2006-09-23-MA-FEA-71-UNIT CONDO AND RELATED IMPROVEMENTS AT LOT H-1 AND WATERLINE EXT IN COUNTY ROW VOL 2

SEP 23 2006

Final Environmental Assessment

PROPOSED 71-UNIT CONDOMINIUM AND RELATED IMPROVEMENTS AT LOT H-1 AND WATERLINE EXTENSION IN COUNTY RIGHT-OF-WAY

(Volume II of II)

Appendices

Prepared for:

Keaka, LLC

September 2006

MUNEKIYO & HIRAGA, INC.

Final

Environmental Assessment

PROPOSED 71-UNIT CONDOMINIUM AND RELATED IMPROVEMENTS AT LOT H-1 AND WATERLINE EXTENSION IN COUNTY RIGHT-OF-WAY

(Volume II of II)

Appendices

Prepared for:

Keaka, LLC

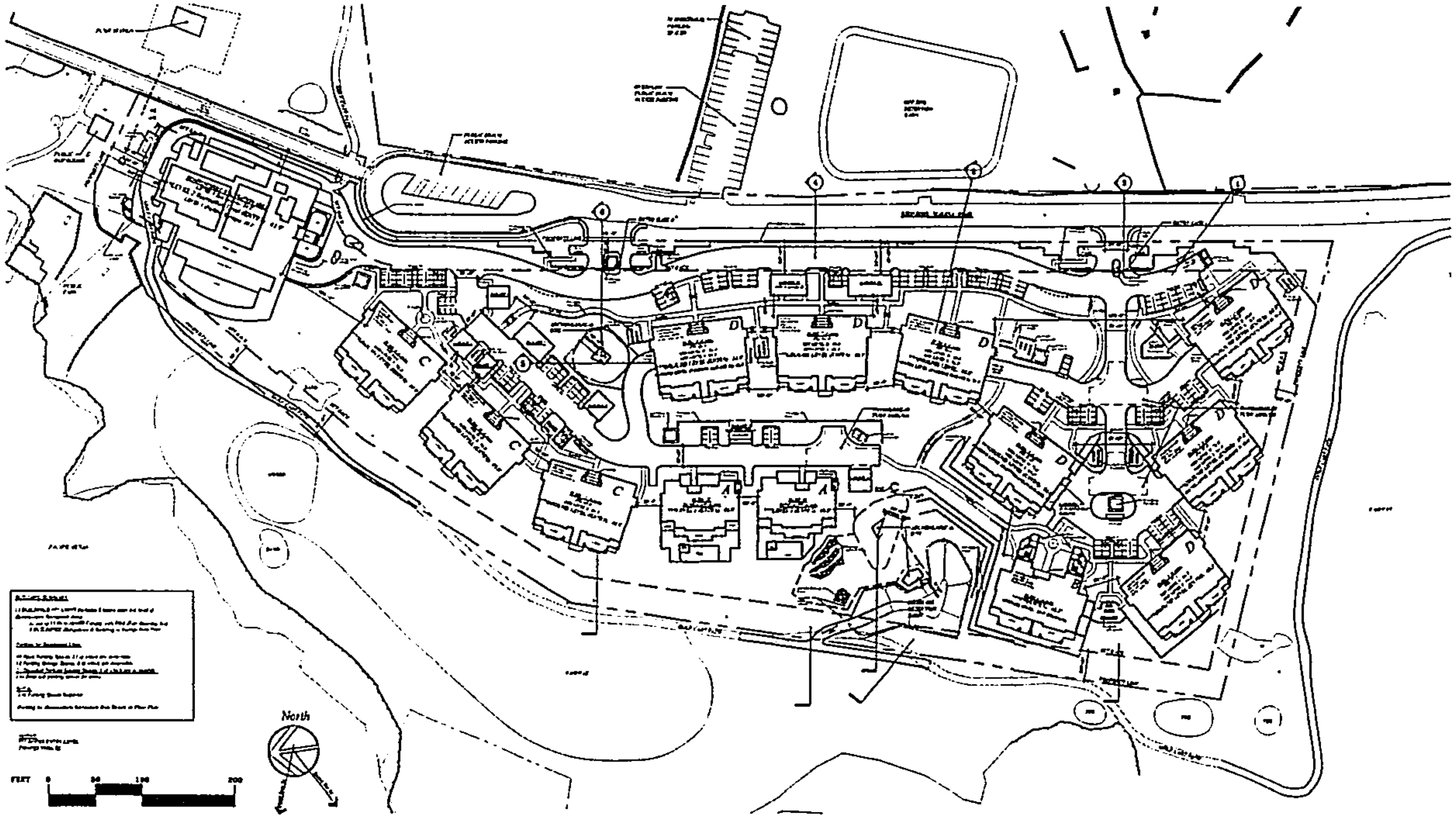
September 2006

MUNEKIYO & HIRAGA, INC.

Appendices

Appendix A

Project Development Plans



RIECKE SUNNLAND KONO

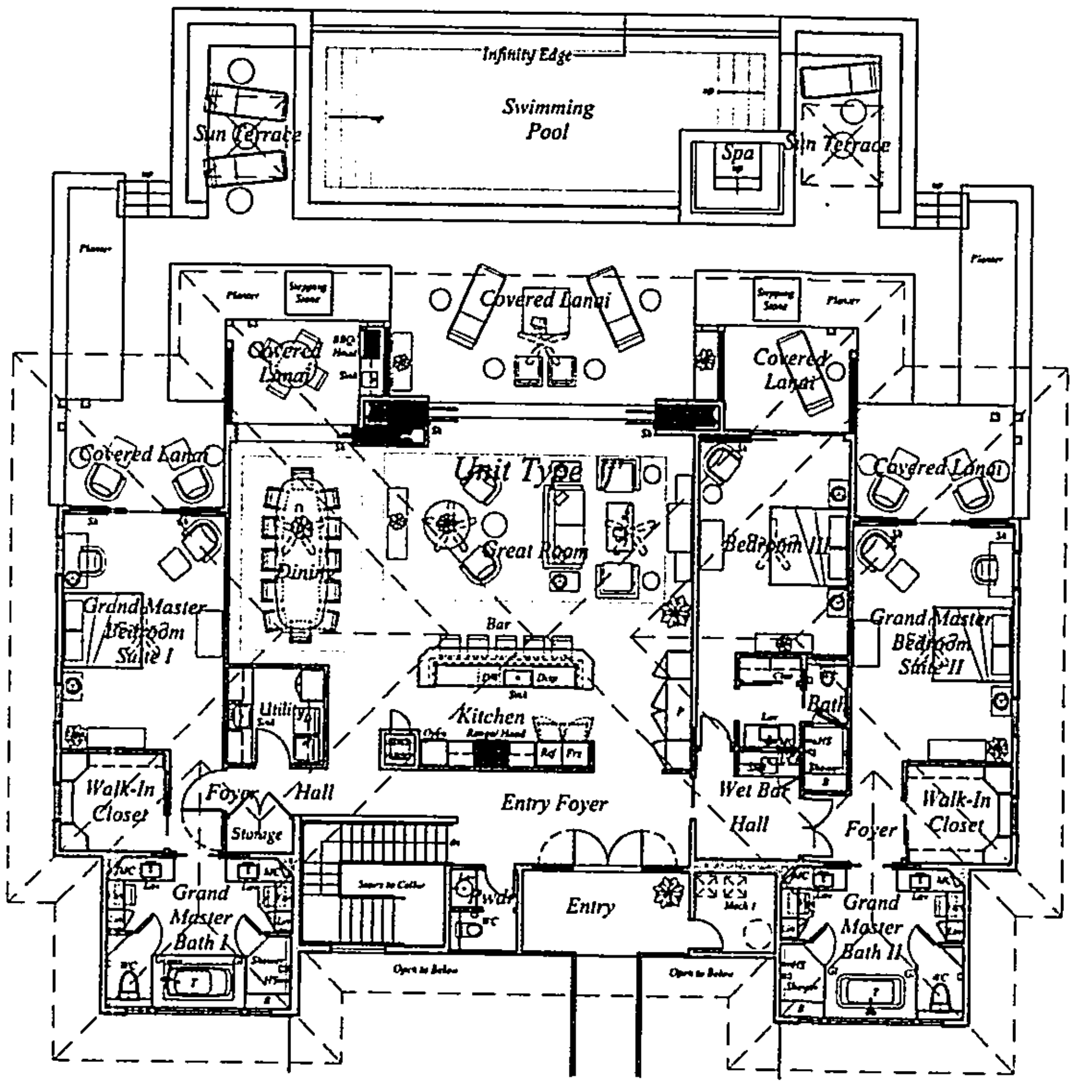
20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

Site Plan

KEAKA LLC



Abbreviations

B	Bench
Clst	Closet
D	Dryer
Disp	Disposal
DW	Dishwasher
Frz	Freezer
GP	Glass Partition
HS	Hand Shower
Lin	Linen Closet
Lav	Lavatory
MC	Medicine Cabinet
Sh	Shower
T	Tub
UCR	Under-counter Refrigerator
Van	Vanity
W	Washer
WB	Wet Basket
WC	Water Closet

Bungalow - Unit Type 'f'
3 Bedroom Unit

2 Grand Master Bedroom
1 Bedroom
1 Media
3-1/2Bath

	Gross	Net
Enclosed Living:	3,657 sq. ft.	3,503 sq. ft.
Covered Area:	783 sq. ft.	
Deck Area:	2,179 sq. ft.	

Cellar	Gross	Net
Enclosed Living:	1,196 sq. ft.	1,008 sq. ft.

FEET 0 2 4 8 16

RIECKE SUNNLAND KONO

20 April 2006

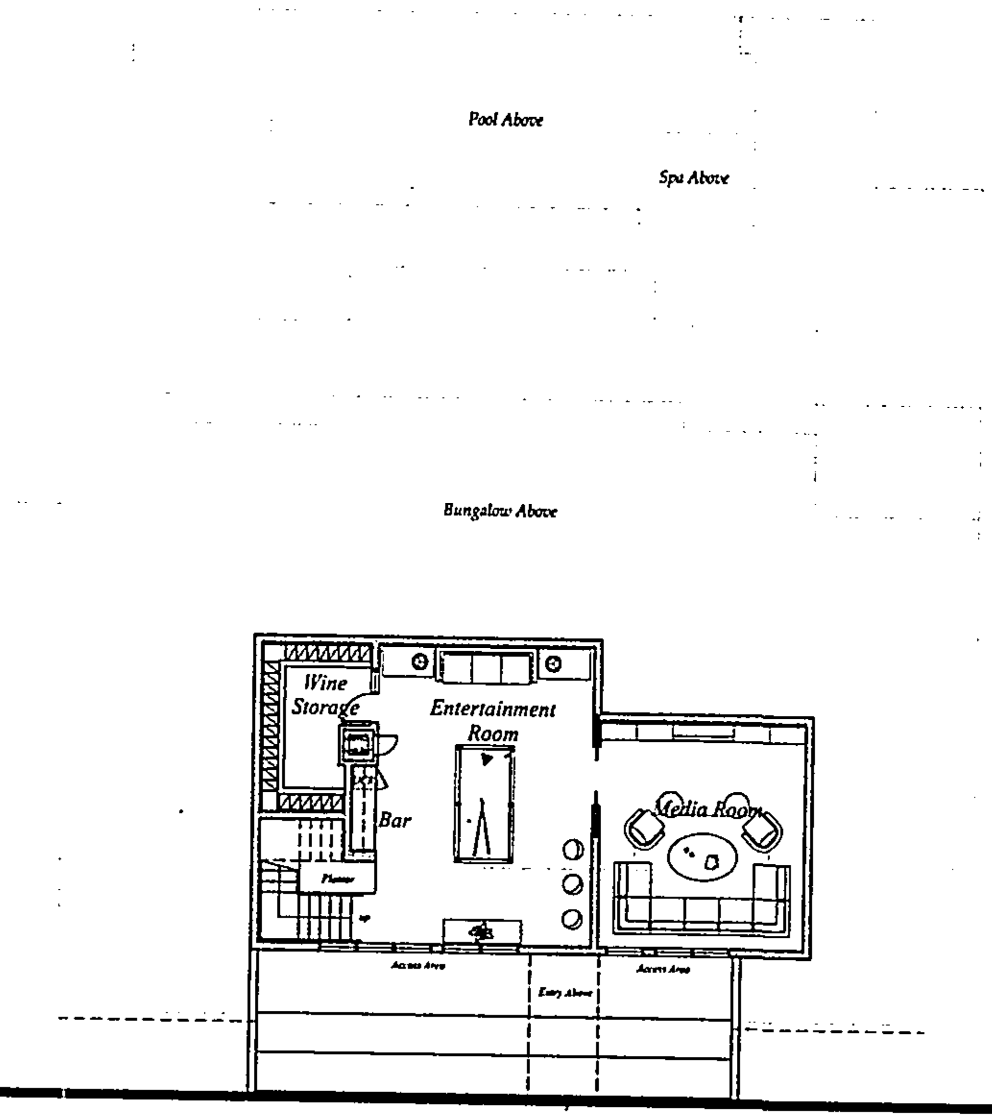
Parcel H-1

Makena Resort, Maui, Hawaii

Building Type A

Building 12

KEAKA LLC



Abbreviations

B	Bench
Clo	Closet
D	Dryer
Disp	Disposal
DW	Dishwasher
Frz	Freezer
Gl	Glass Partition
HS	Hand Shower
Lin	Linen Closet
Lav	Lavatory
MC	Medicine Cabinet
Sh	Shutters
T	Tub
UCR	Under-counter Refrigerator
Van	Vanity
W	Washer
WB	Wire Basket
WC	Water Closet

Bungalow - Unit Type 'f'
Cellar Option

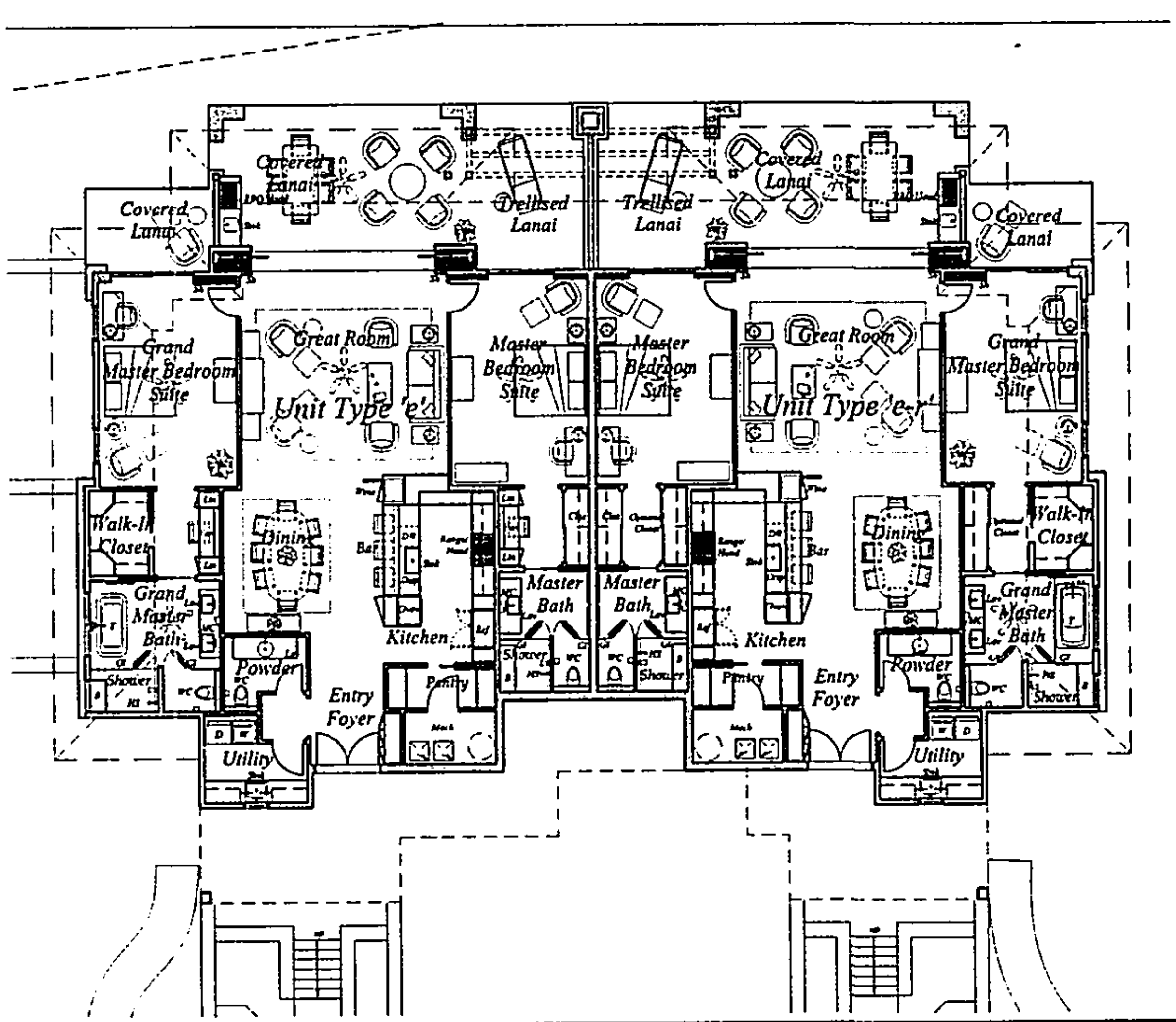
1 Entertainment
1 Media

RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

Building Type A
Building 12

KEAKA LLC



Abbreviations

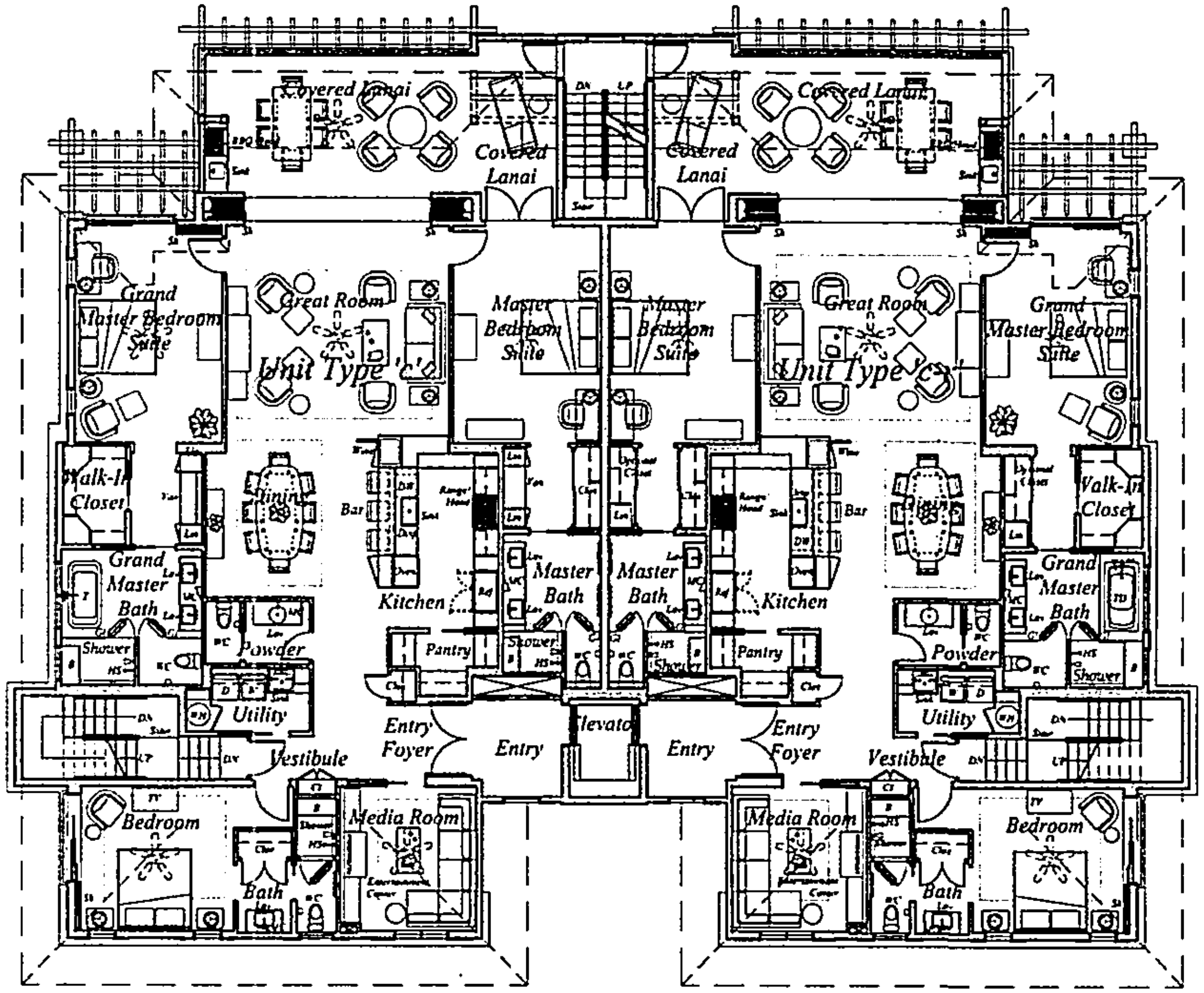
Ground Level
Unit Type 'e' and 'e-r'
2 Bedrm Unit

1 Grand Master Bedroom
1 Master Bedroom
2 ½ Bath

Gross Enclosed Living: 2,238 s.f./unit
Gross Covered: 680 s.f./unit

Net Enclosed Living: 2,126 s.f./unit
Net Lanai: 579 s.f./unit

RIECKE SUNNLAND KONO 20 April 2006	Parcel H-1 Makena Resort, Maui, Hawaii	Building Type B	KEAKA LLC



Abbreviations

B	Bench
Clos	Closet
D	Dryer
Disp	Disposal
DW	Dishwasher
Frz	Freezer
GP	Glass Partition
HS	Hand Shower
Lnc	Linen Closet
Lav	Lavatory
MC	Medicine Cabinet
Sh	Shelves
T	Tub
TD	Tub Deck
UCR	Under-counter Refrigerator
Van	Vanity
W	Washer
WB	Wire Basket
WC	Water Closet
WH	Water Heater

Mid Level II
Unit Type 'c' and 'c-r'
3 Bedroom Unit

1 Grand Master Bedroom
1 Master Bedroom
1 Bedroom
1 Media Room
3 ½ Bath

Gross Enclosed Living:	2,964 s.f./unit
Gross Covered:	295 s.f./unit
Net Enclosed Living:	2,568 s.f./unit
Net Lanai:	428 s.f./unit

FEET 0 2 4 8 16

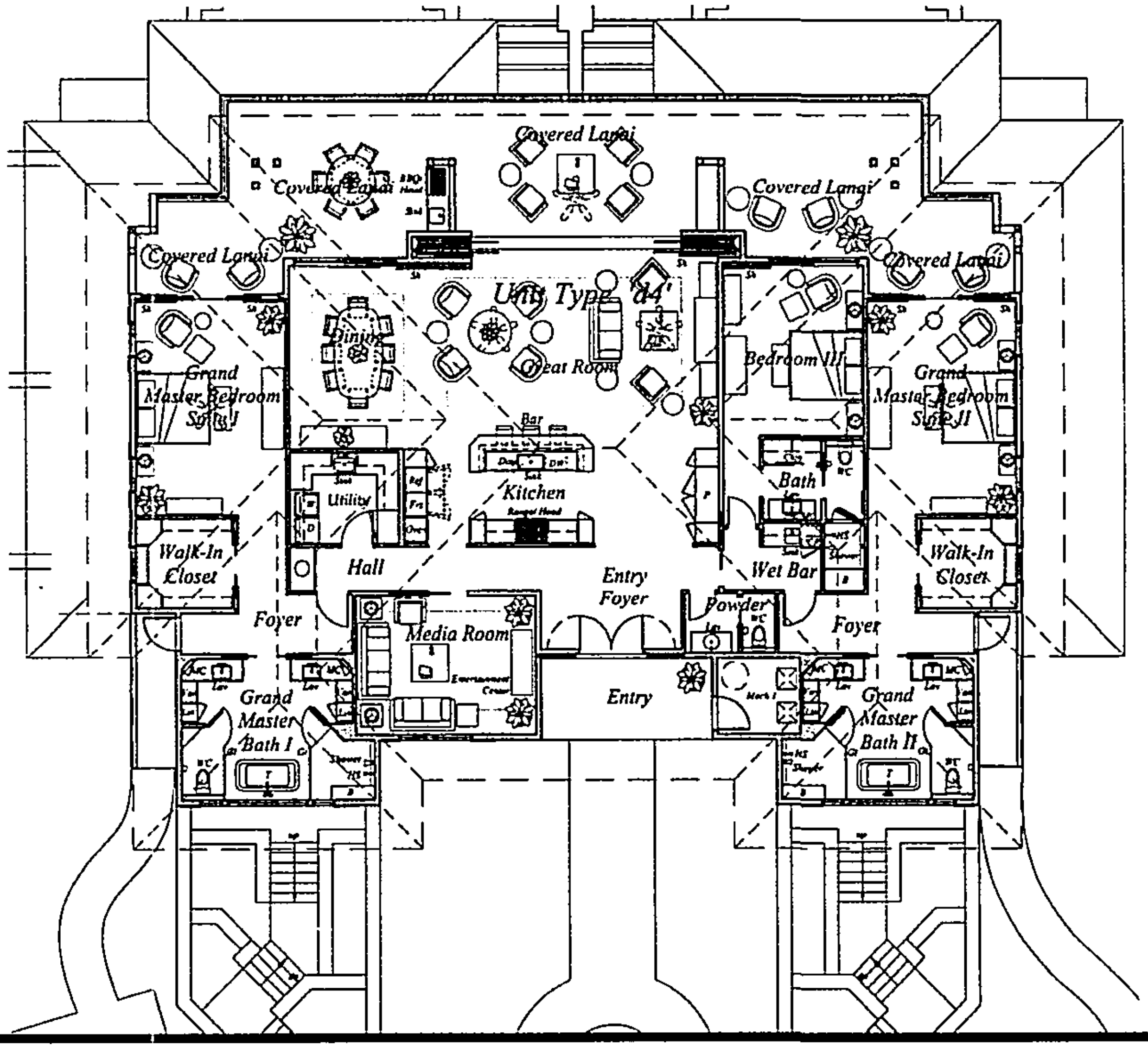
RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

Building Type D

KEAKA LLC



Abbreviations

B	Bench
Clo	Closet
D	Dryer
Disp	Disposal
DW	Dishwasher
Frz	Freezer
GP	Glass Partition
HS	Hand Shower
Lin	Linen Closet
Lav	Lavatory
MC	Medicine Cabinet
Sh	Shutters
T	Tub
UCR	Under-counter Refrigerator
Van	Vanity
W	Washer
WB	Wire Basket
WC	Water Closet

Penthouse Level
Unit Type 'd4'
3 Bedroom Unit

2 Grand Master Bedroom
1 Bedroom
3 ½ Bath

Gross Enclosed Living:	3,724 s.f.
Gross Covered:	748 s.f.
Net Enclosed Living:	3,575 s.f.
Net Lanai:	1,068 s.f.

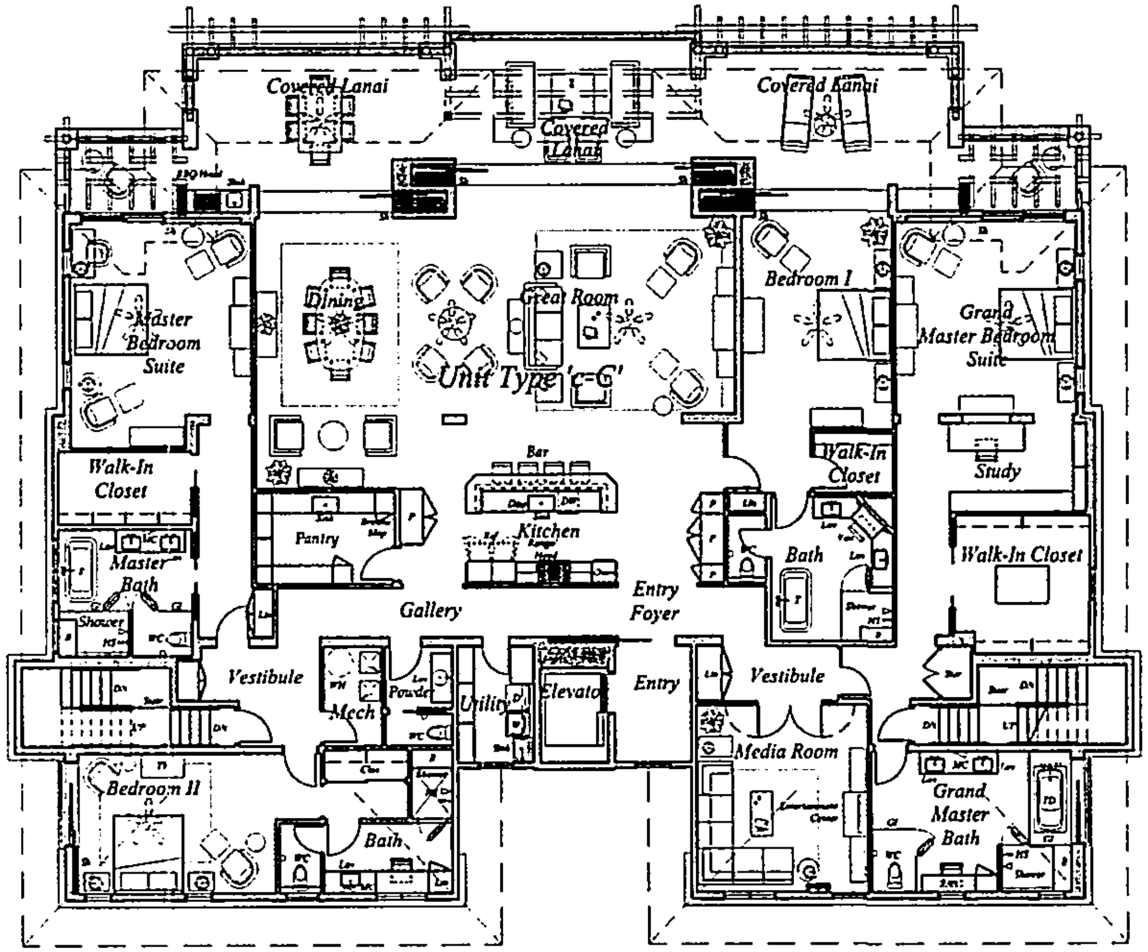
FEET 0 2 4 8 16

RIECKE SUNNLAND ARCHITECTS KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

Building Type B

KEAKA LLC

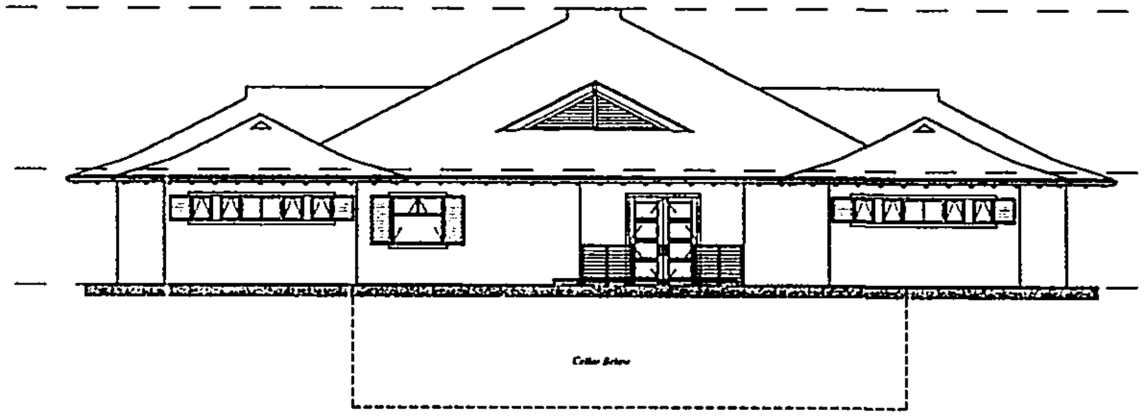


Mid Level Combo Option
Unit Type 'c-C'
4 Bedroom Unit
(replaces Unit Type 'b' or 'c')

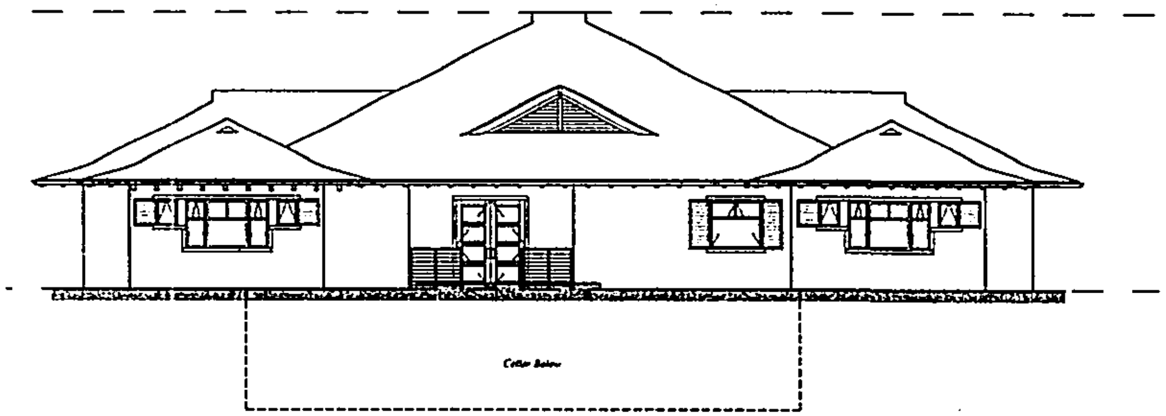
1 Grand Master Bedroom
1 Master Bedroom
2 Bedrooms
1 Media Room
4 ½ Bath

Gross Enclosed Living:	5,977 s.f./unit
Gross Covered:	1,109 s.f./unit
Net Enclosed Living:	5,291 s.f./unit
Net Lanai:	1,060 s.f./unit

RIECKE SUNNLAND KONO 20 April 2006	Parcel H-1 Makena Resort, Maui, Hawaii	Optional Plan	KEAKA LLC

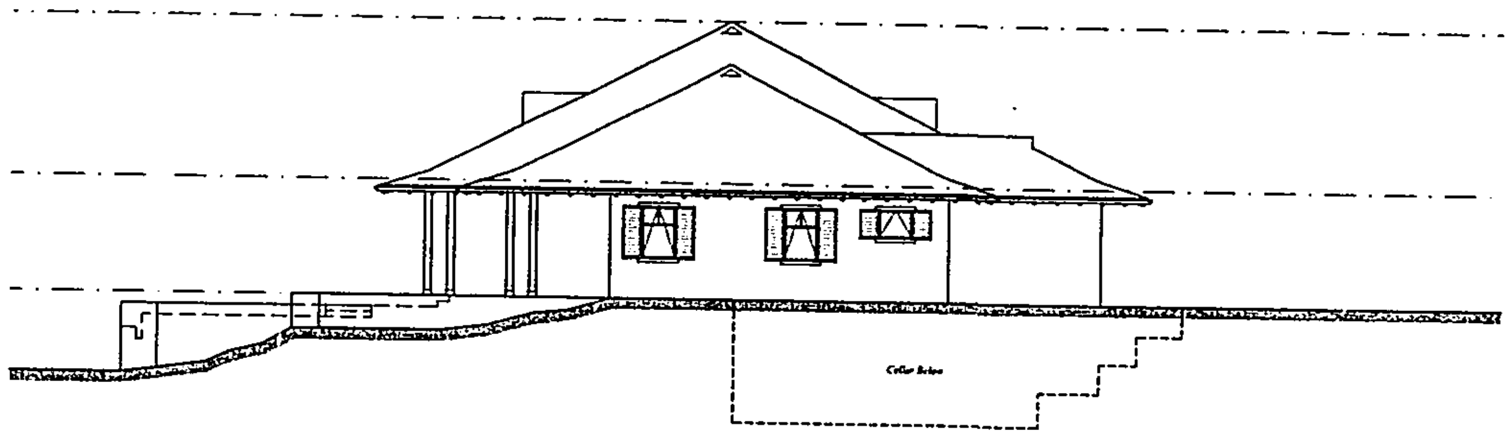


Entry Elevation
Buildings 12

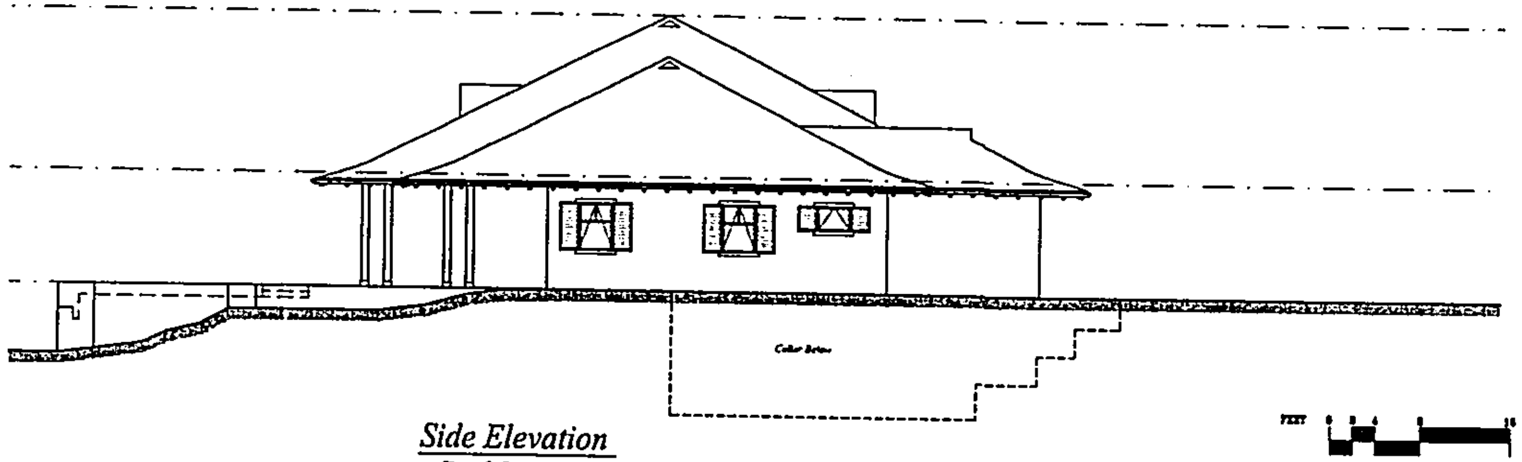


Entry Elevation
Buildings 13

RIECKE SUNNLAND KONO 20 April 2006	*Parcel H-1* *Makena Resort, Maui, Hawaii*	Building Type A Buildings 12 & 13	KEAKA LLC



Side Elevation
Building 12



Side Elevation
Building 13

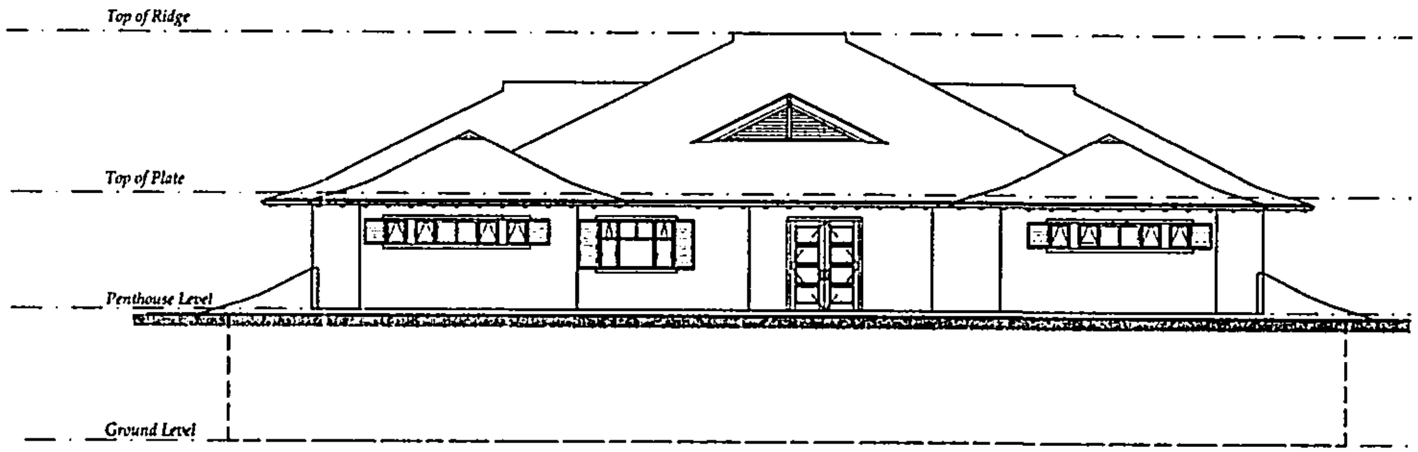
RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

Building Type A
Buildings 12 & 13

KEAKA LLC



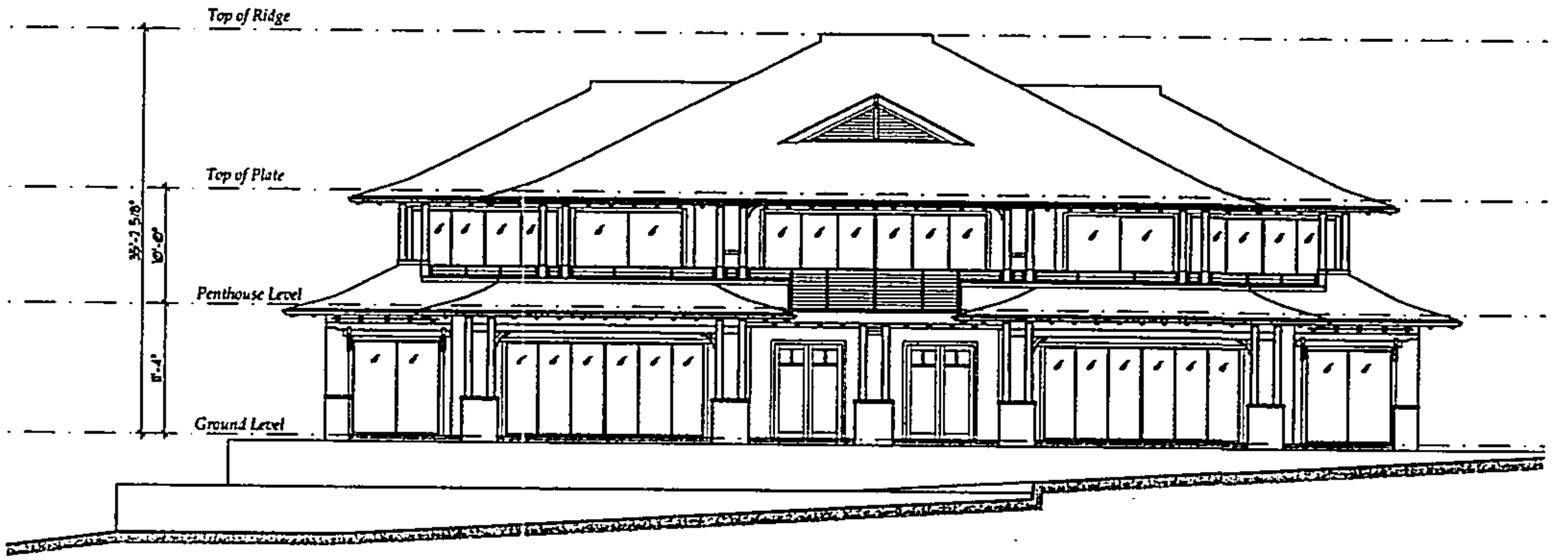
Entry Elevation
Building 4

RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

Building Type B
Building 4

KEAKA LLC



Lanai Elevation
Building 4

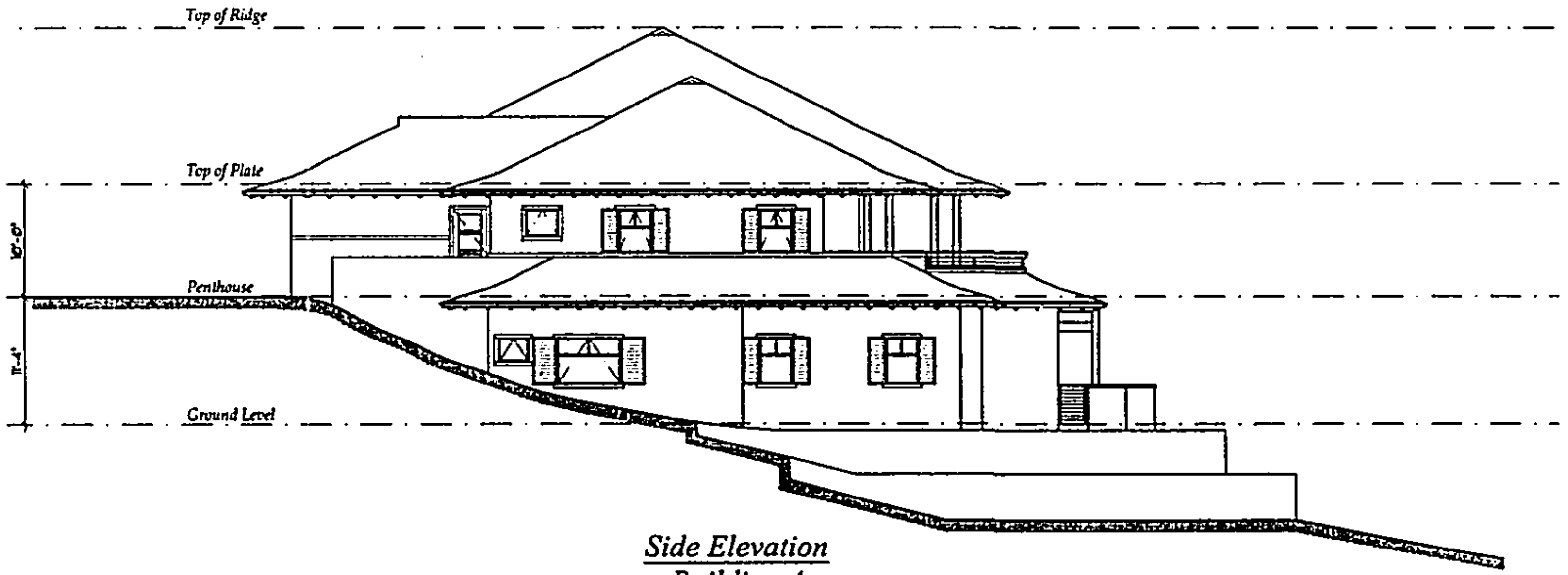
FEET 0 2 4 8 16

RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

Building Type B
Building 4

KEAKA LLC



Side Elevation
Building 4

RIECKE SUNNLAND KONO

20 April 2006

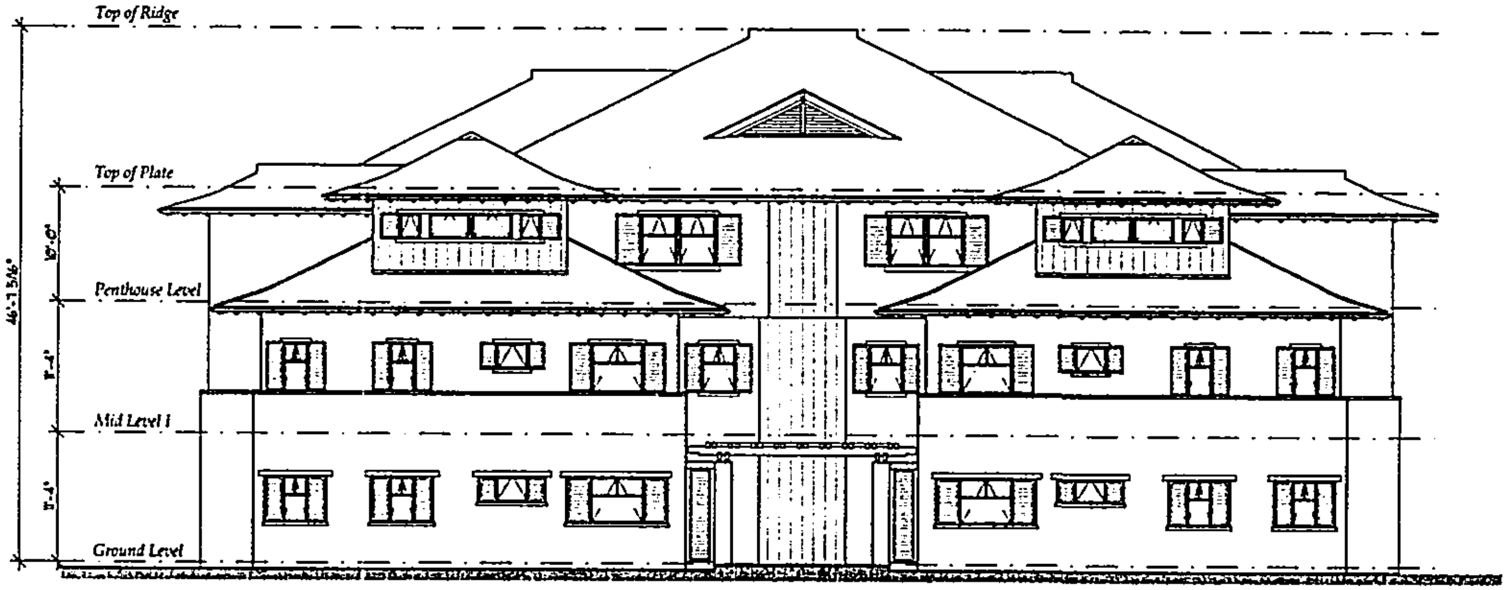
Parcel H-1

Makena Resort, Maui, Hawaii

Building Type B

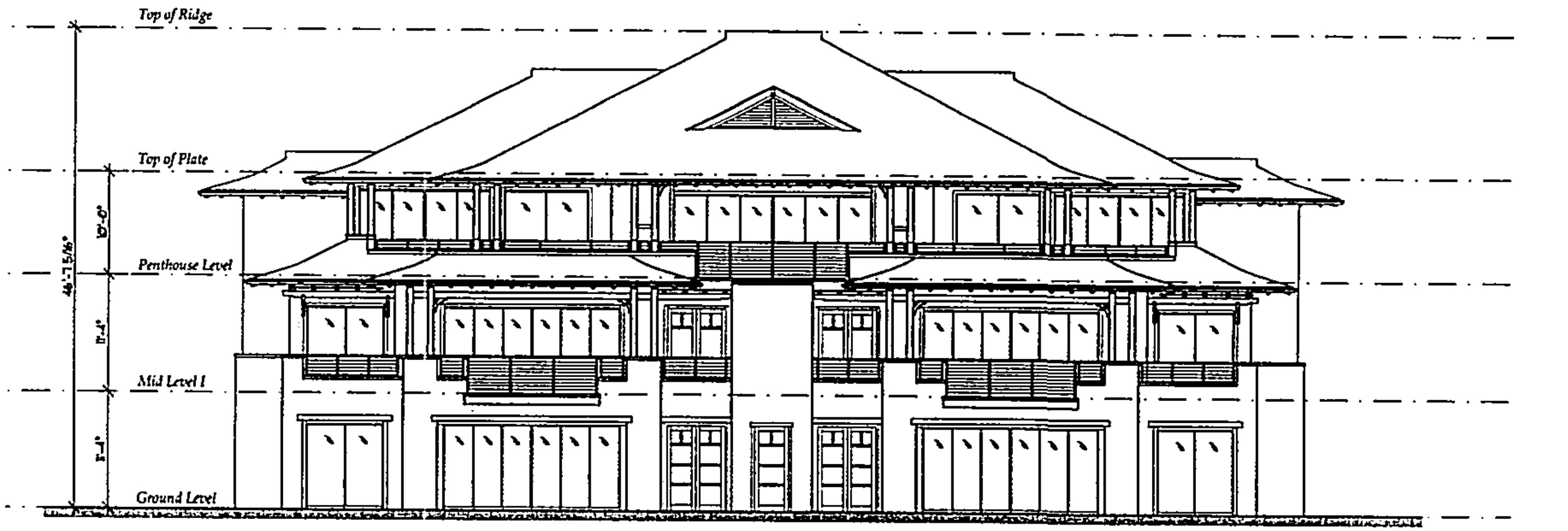
Building 4

KEAKA LLC



Entry Elevation
Building 9, 10 & 11

RIECKE SUNNLAND KONO 20 April 2006	*Parcel H-1* *Makena Resort, Maui, Hawaii*	Building Type C Building 9, 10 & 11	KEAKA LLC



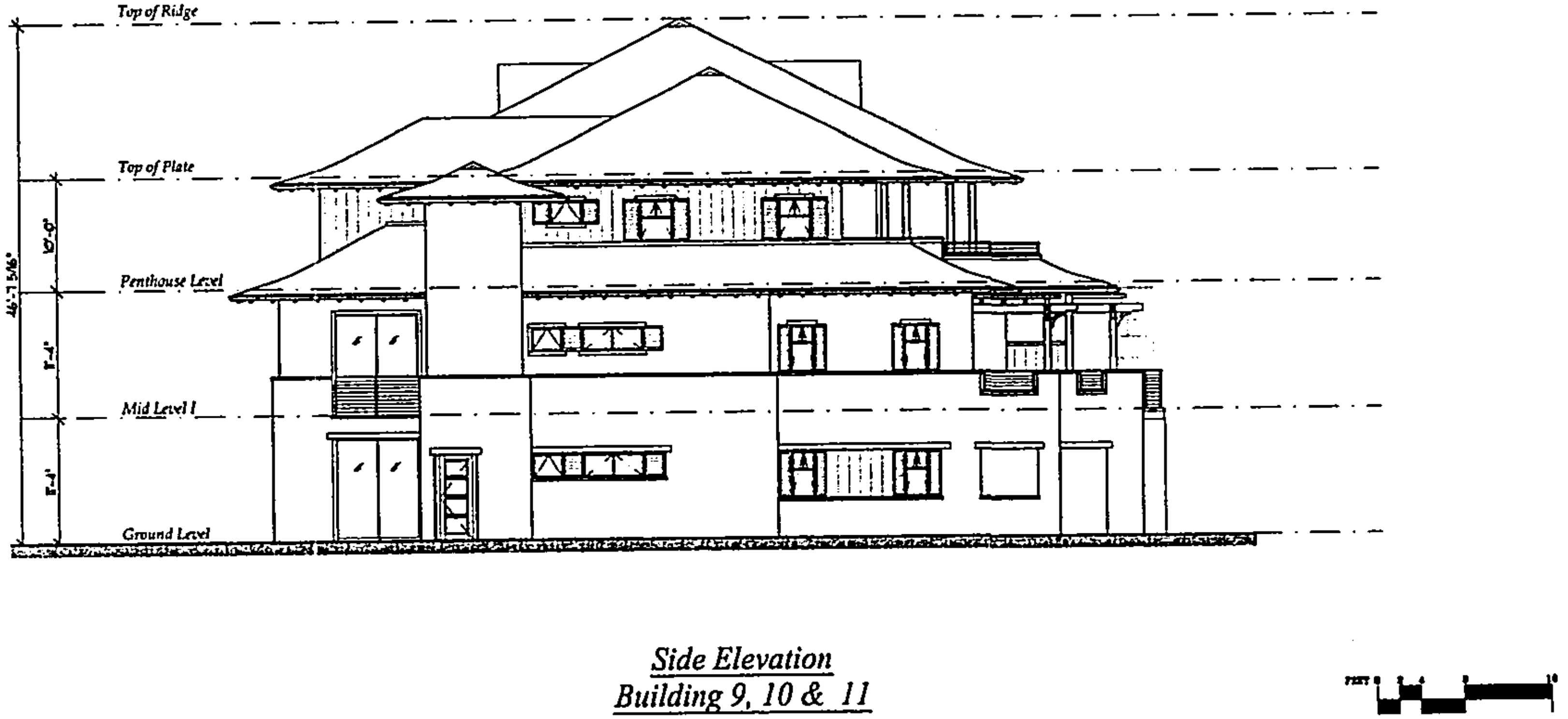
Lanai Elevation
Building 9, 10 & 11

RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

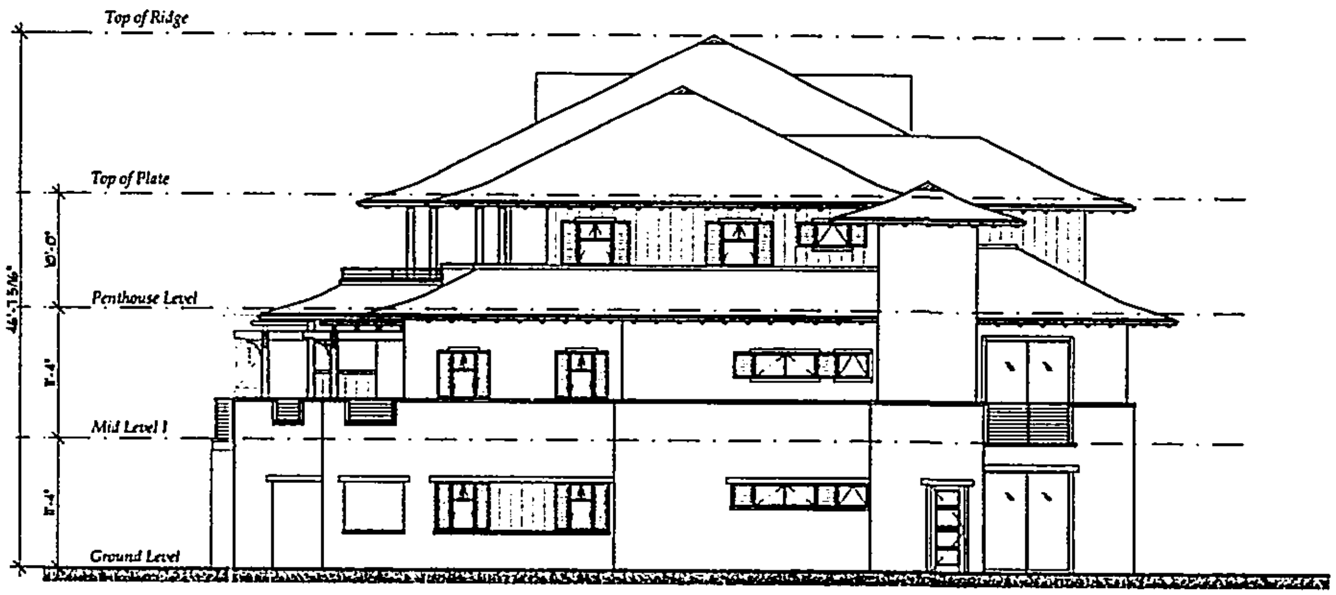
Building Type C
Building 9, 10 & 11

KEAKA LLC



Side Elevation
Building 9, 10 & 11

RIECKE SUNNLAND KONO 20 April 2006	*Parcel H-1* *Makena Resort, Maui, Hawaii*	Building Type C Building 9, 10 & 11	KEAKA LLC



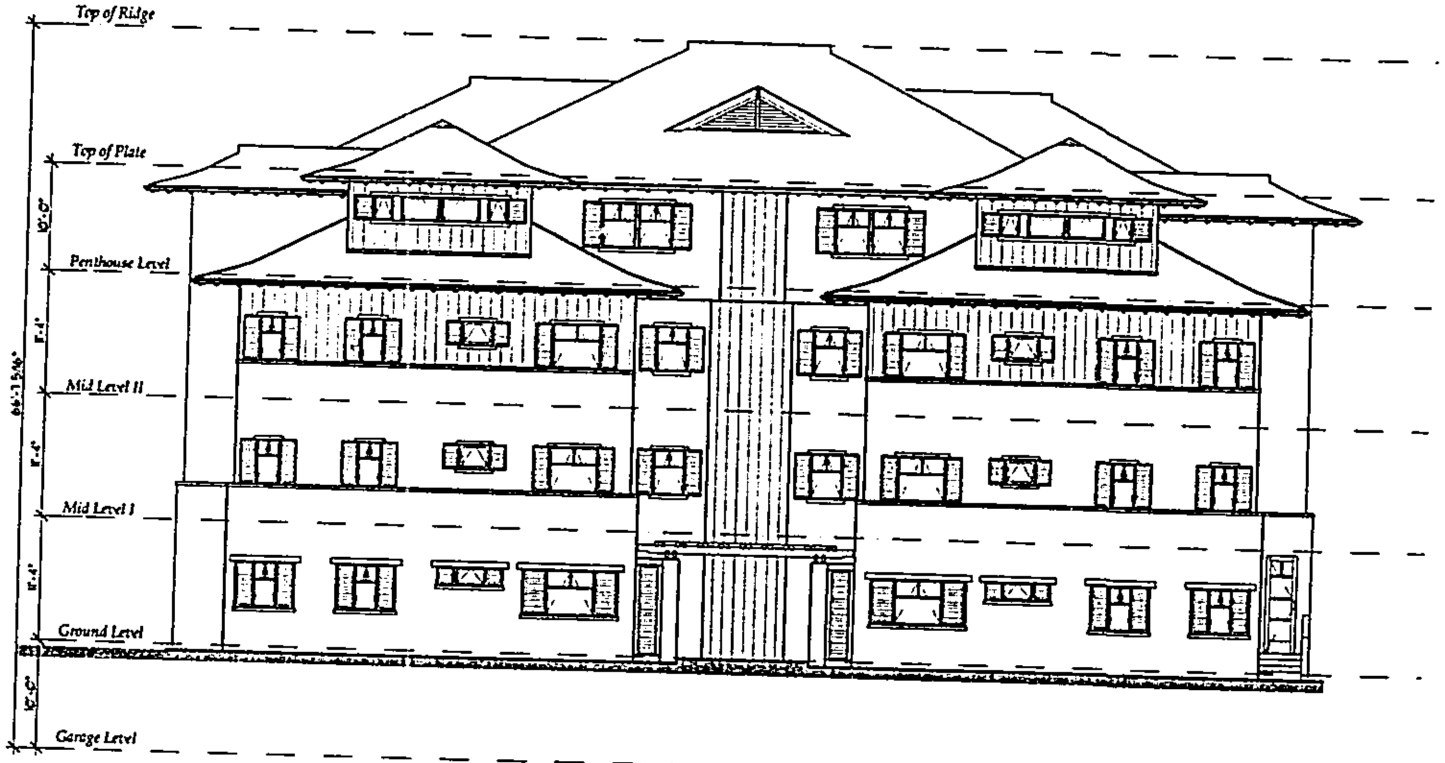
Side Elevation
Building 9, 10 & 11

REICKE SUNNLAND KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

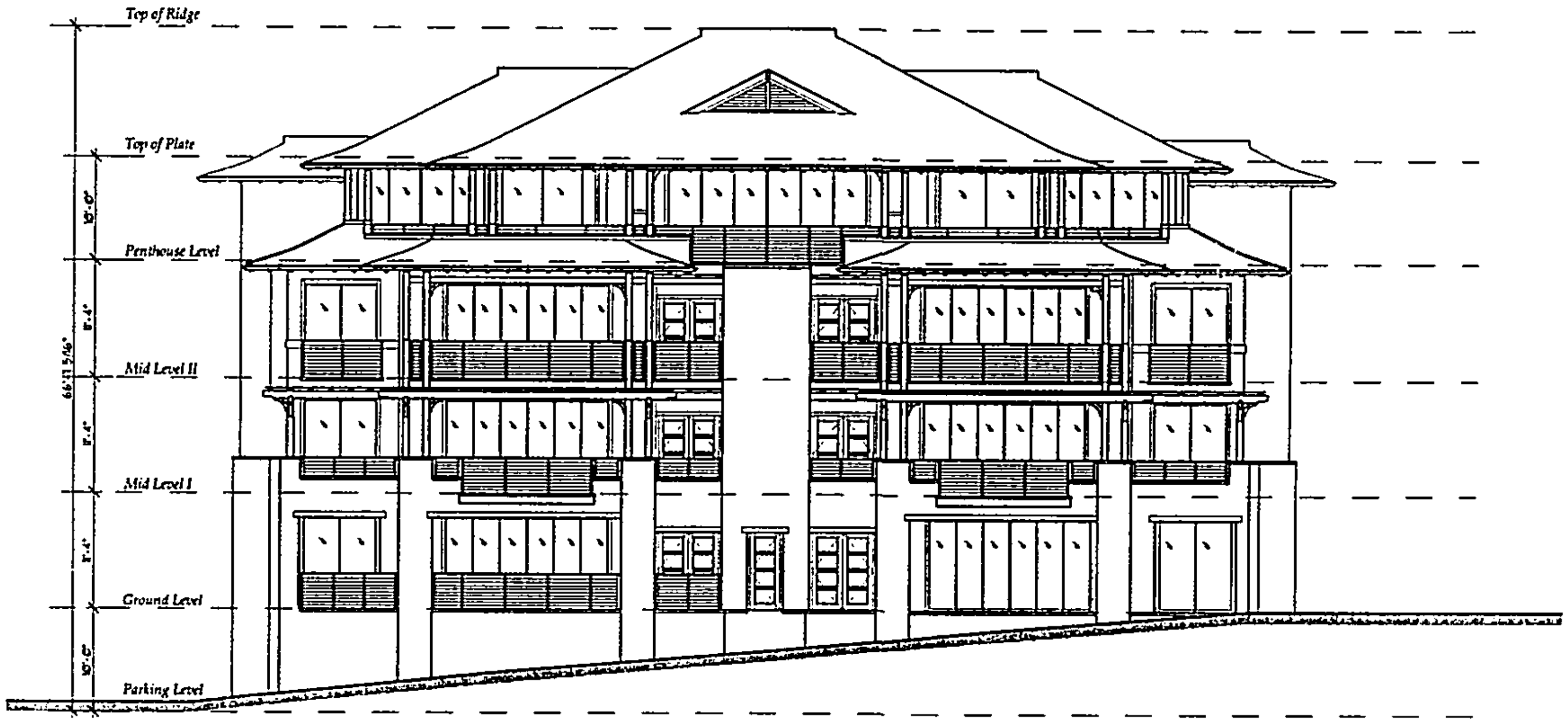
Building Type C
Building 9, 10 & 11

KEAKA LLC



Entry Elevation

RIECKE SUNNLAND KONO 20 April 2006	Parcel H-1 Makena Resort, Maui, Hawaii	Building Type D Building 1, 8 & 6 (opposite)	KEAKA LLC



Lanai Elevation

RIECKE SUNNLAND KONO

20 April 2006

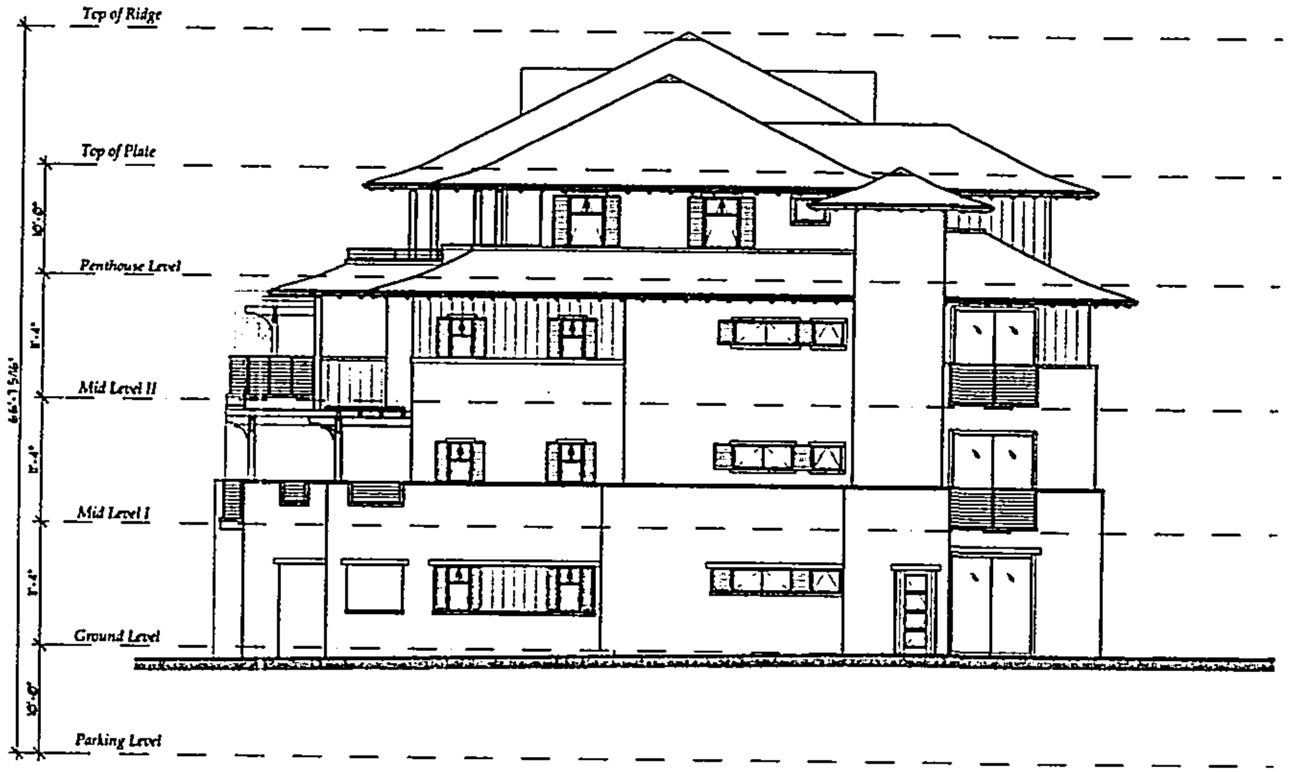
Parcel H-1

Makena Resort, Maui, Hawaii

Building Type D

Building 1, 8 & 6 (similar)

KEAKA LLC



Side Elevation

RIECKE SUNNLAND KONO

20 April 2006

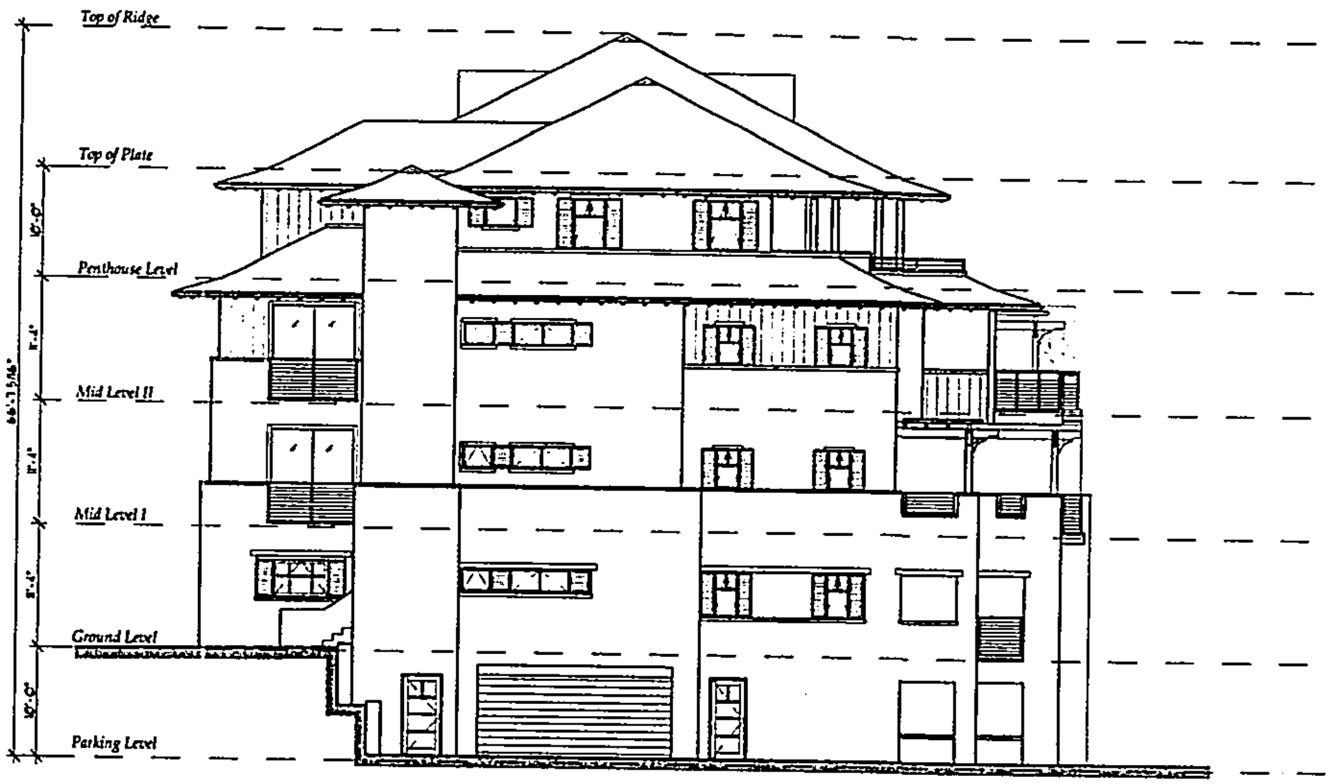
Parcel H-1

Makena Resort, Maui, Hawaii

Building Type D

Building 1, 8 & 6 (opposite)

KEAKA LLC



Side Elevation

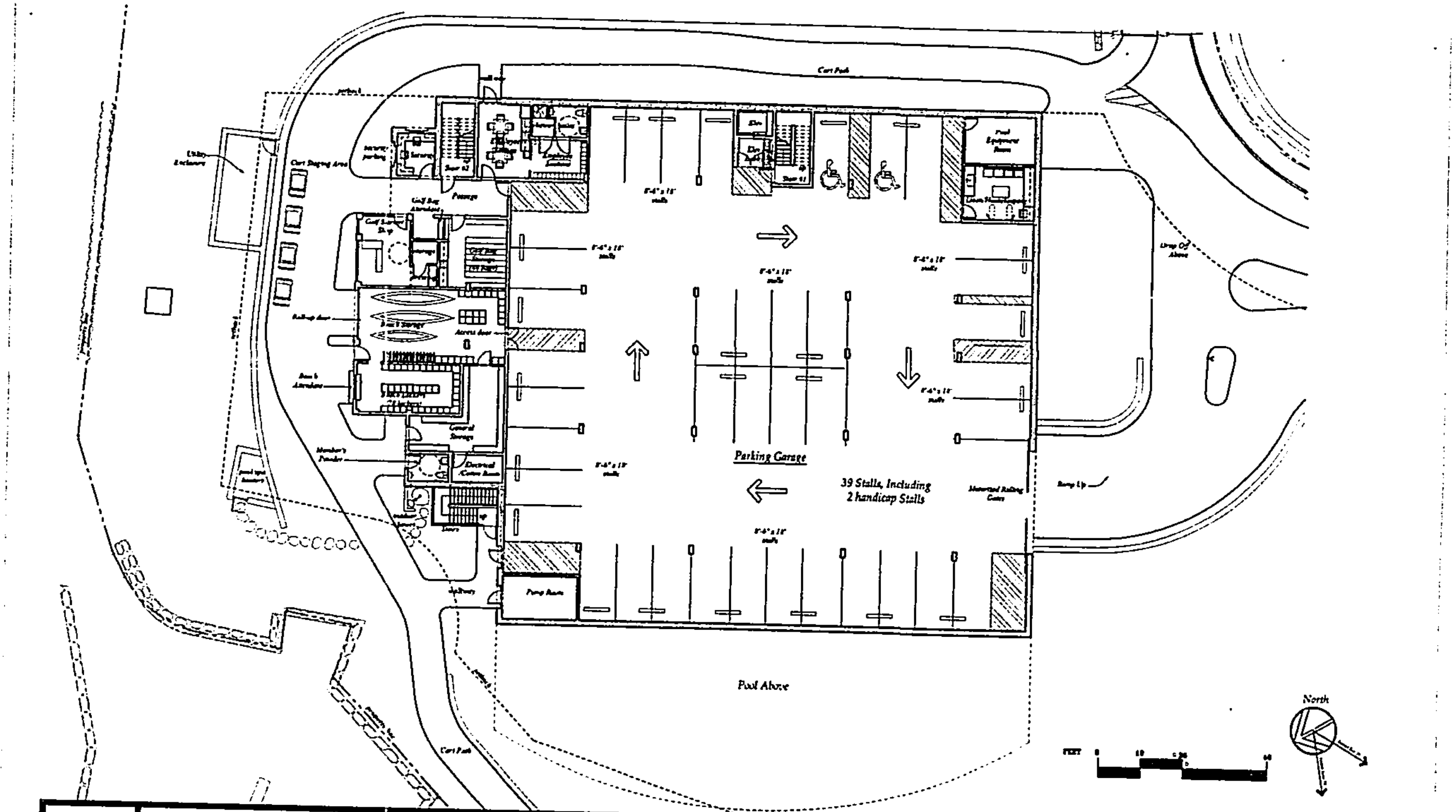
RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

Building Type D
Building 1, 8 & 6 (similar)

KEAKA LLC



RIECKE SUNNLAND KONO

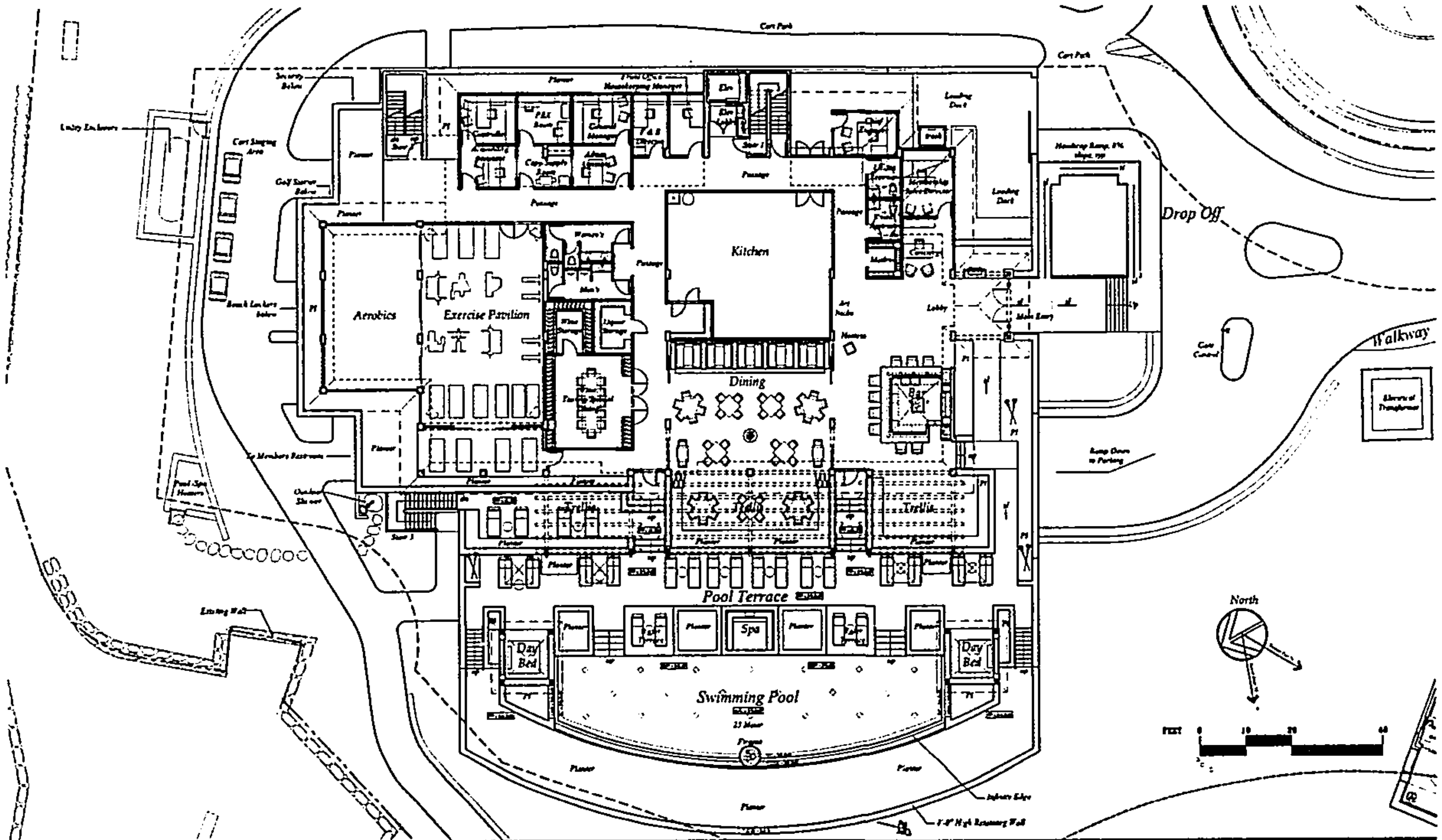
20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

Homeowners' Recreation Building
Level 1 Parking Garage

KEAKA LLC



RIECKE SUNNLAND KONO

20 April 2006

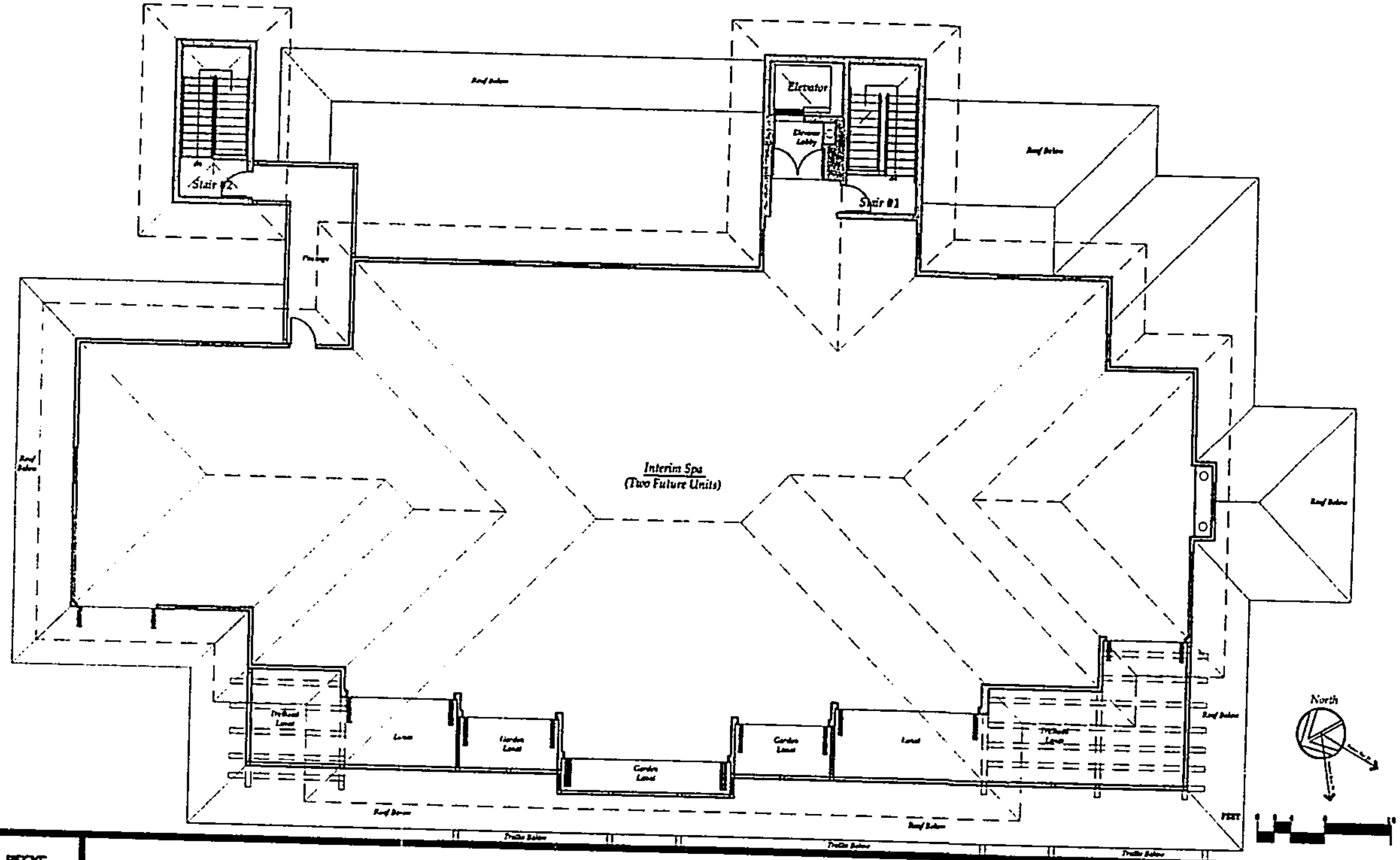
Parcel H-1

Makena Resort, Maui, Hawaii

Homeowners' Recreation Building

Level 2

KEAKA LLC



RIECKE SUNNLAND KONO

20 April 2006

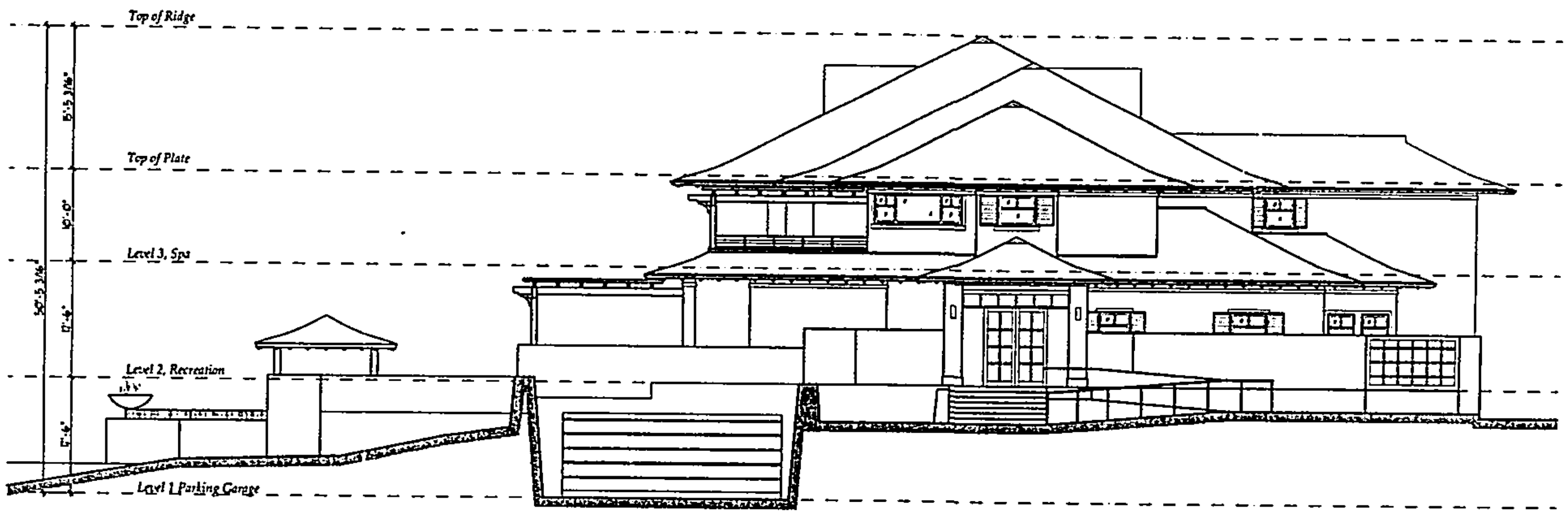
Parcel H-1

Makena Resort, Maui, Hawaii

Homeowners' Recreation Building

Level 3

KEAKA LLC



Entry Elevation
Homeowners' Recreation
Building

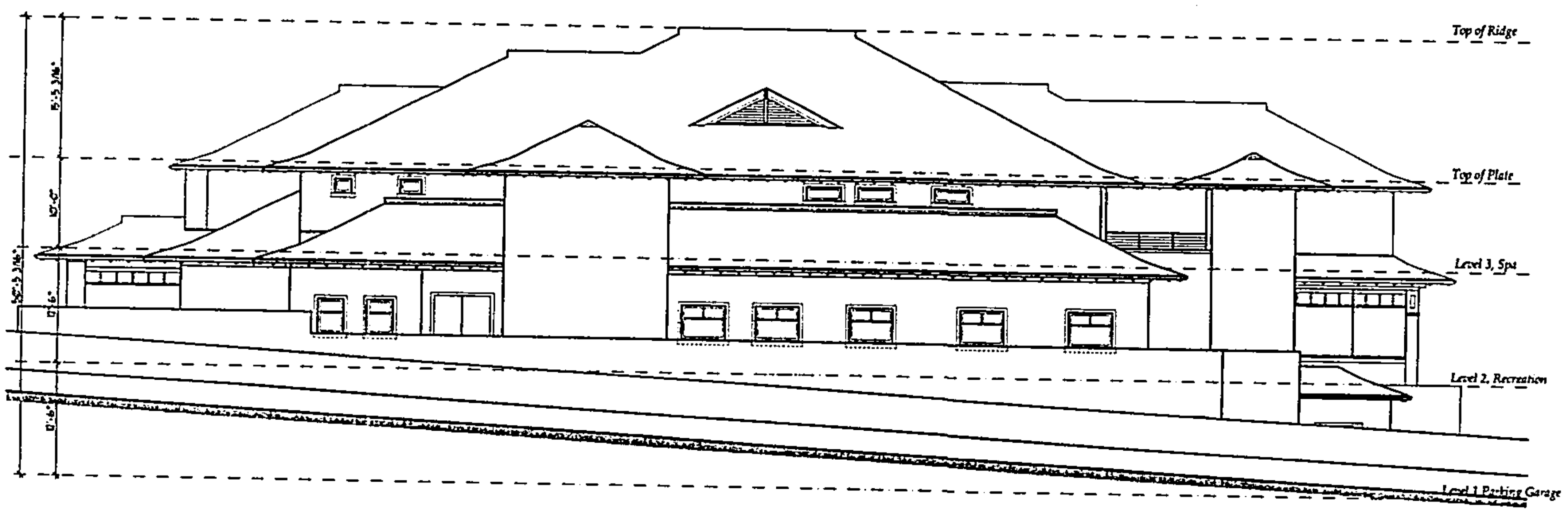
RIECKE SUNNLAND KONO

20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

KEAKA LLC



Mauka Elevation
Homeowners' Recreation Building

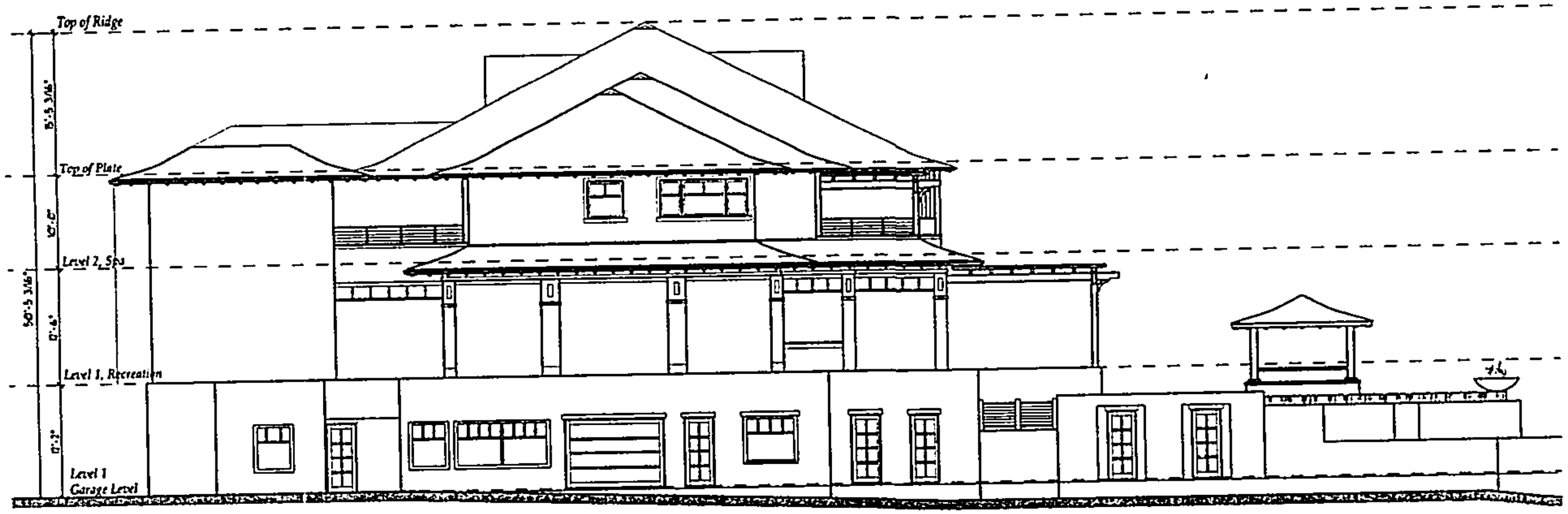
RIECKE SUNNLAND KONO

20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

KEAKA LLC



Side Elevation
Homeowners' Recreation Building

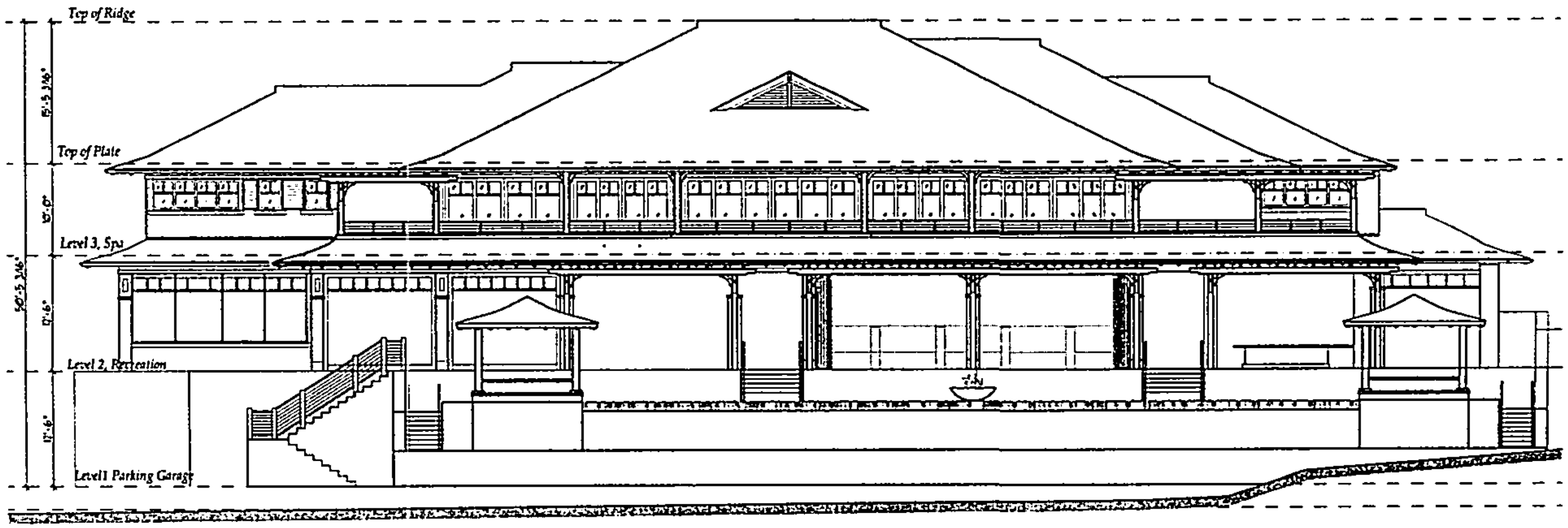
RECKE SUNNLAND KONO

20 April 2006

Parcel H-1

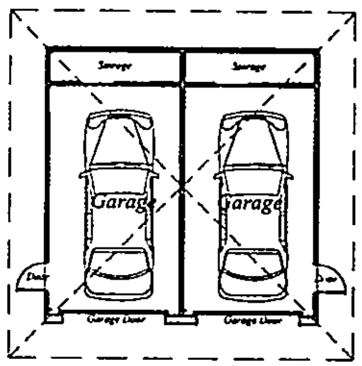
Makena Resort, Maui, Hawaii

KEAKA LLC

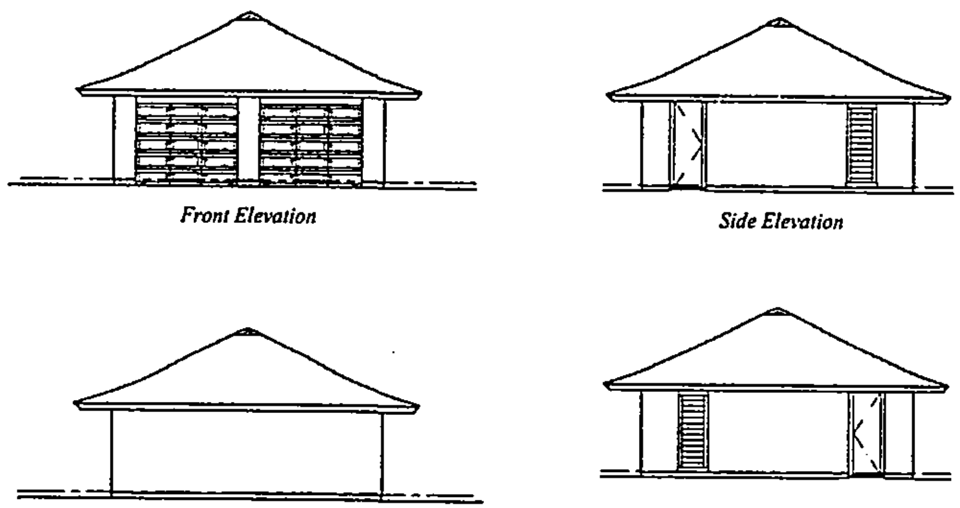


Makai Elevation
Homeowners' Recreation Building

RIECKE SUNNLAND KONO 20 April 2006	Parcel H-1 Makena Resort, Maui, Hawaii	KEAKA LLC



Garage 1
Floor Plan
2 Garages
2 Storage Closets
Gross Building: 560 s.f.



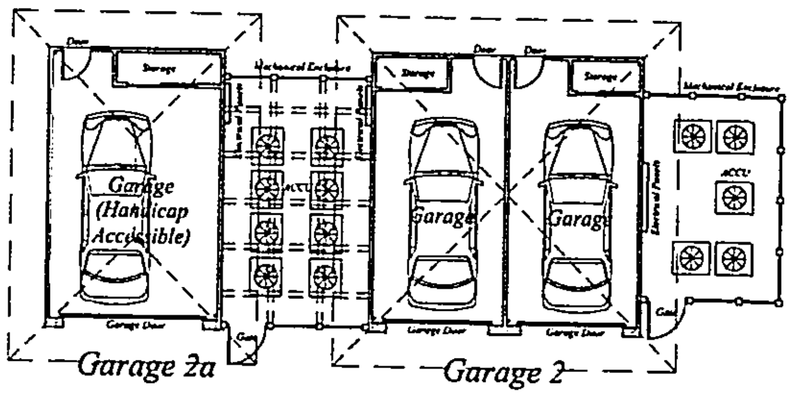
Garage 1
Exterior Elevations

RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1
Makena Resort, Maui, Hawaii

Garage 1

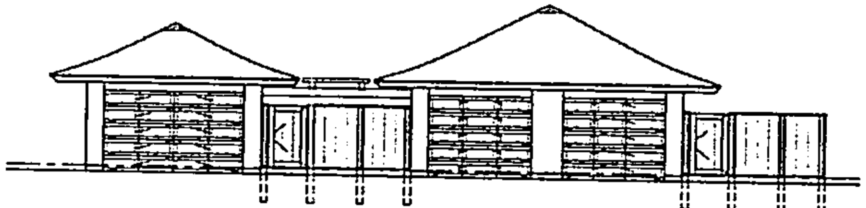
KEAKA LLC



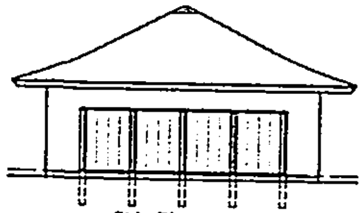
Garages 2 & 2a
Floor Plans

3 Garage
3 Storage Closets
2 Mechanical Enclosures

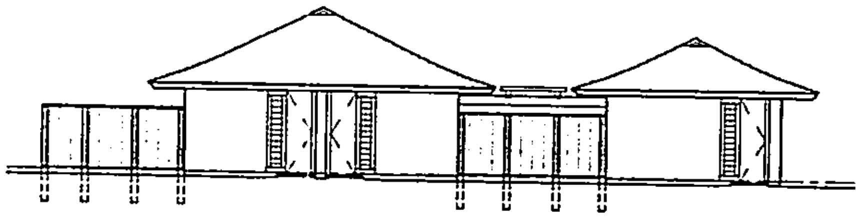
Gross Building (accessible): 359 s.f.
Gross Building: 560 s.f.
Total Enclosed: 919 s.f.



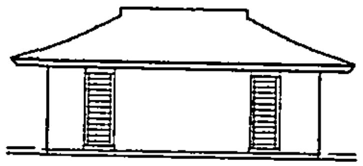
Front Elevation



Side Elevation



Rear Elevation

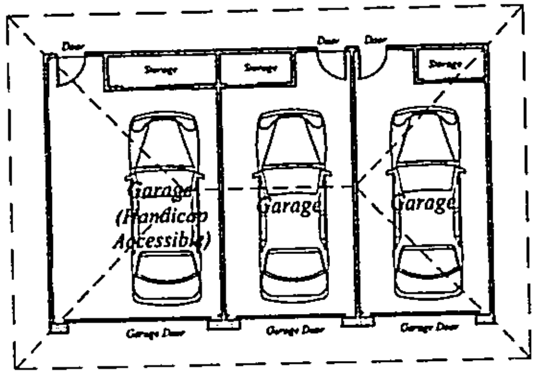


Side Elevation

Garages 2 & 2a
Exterior Elevations

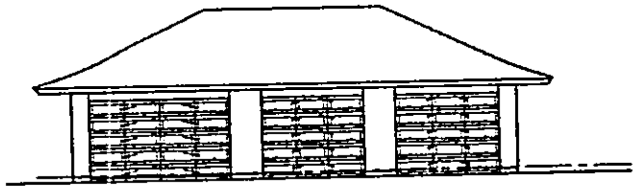
FEET

RIECKE SUNNLAND KONO 20 April 2006	Parcel H-1 Makena Resort, Maui, Hawaii	Garages 2 & 2a	KEAKA LLC

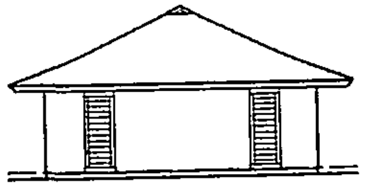


Garage 3 & 11
Floor Plan

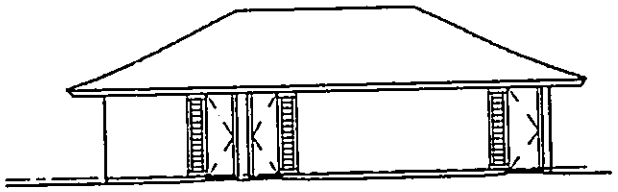
3 Garages
3 Storage Closets
Enclosed Building: 912 s.f.



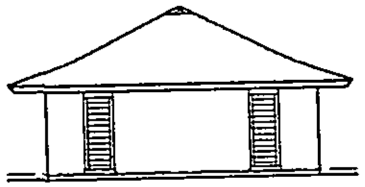
Front Elevation



Side Elevation



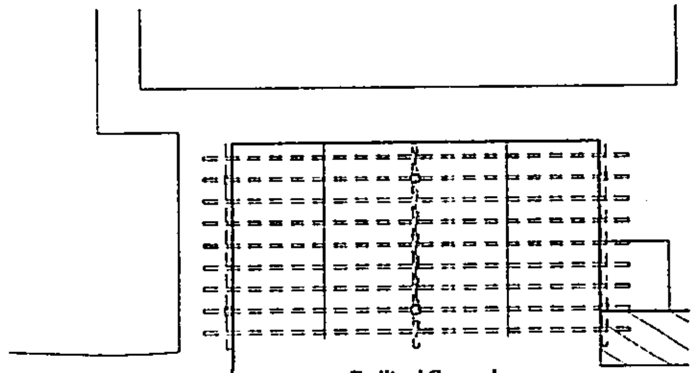
Rear Elevation



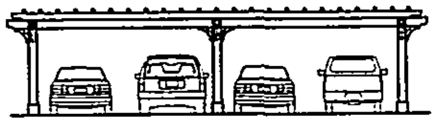
Side Elevation

Garage 3 & 11
Exterior Elevations

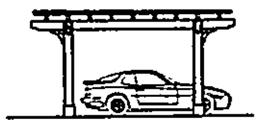
RIECKE SUNNLAND KONO 20 April 2006	Parcel H-1 *Makena Resort, Maui, Hawaii*	Garage 3 & 11	KEAKA LLC



Covered Trellis
Parking, typical



Front Elevation



Side Elevation

Covered Trellis
Exterior Elevations

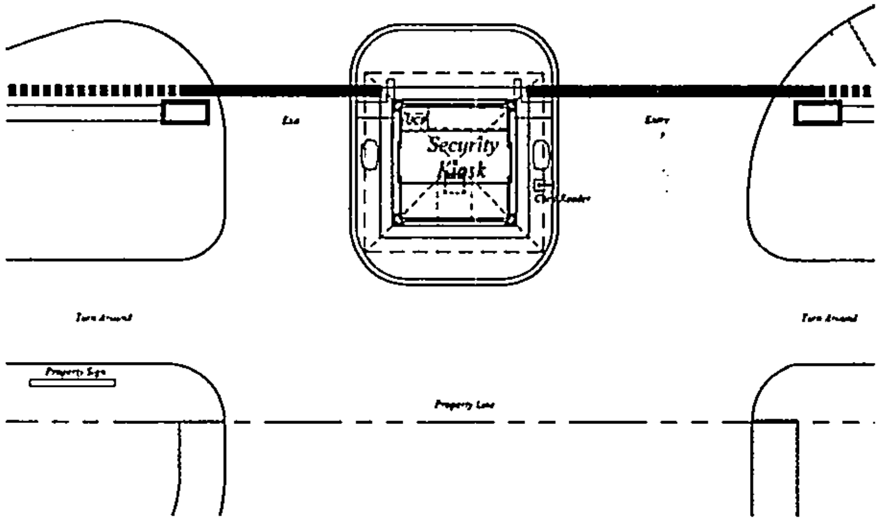
RIECKE SUNNLAND KONO
20 April 2006

Parcel H-1

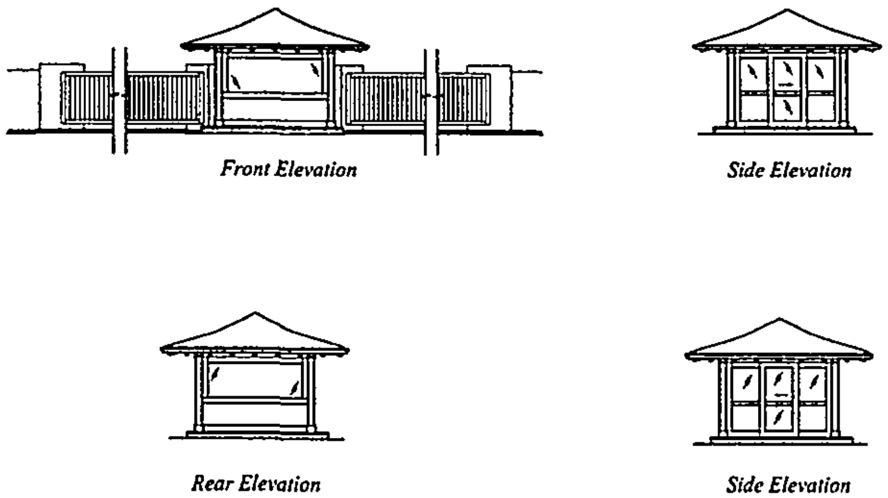
Makena Resort, Maui, Hawaii

Typical Covered
Trellis Parking

KEAKA LLC

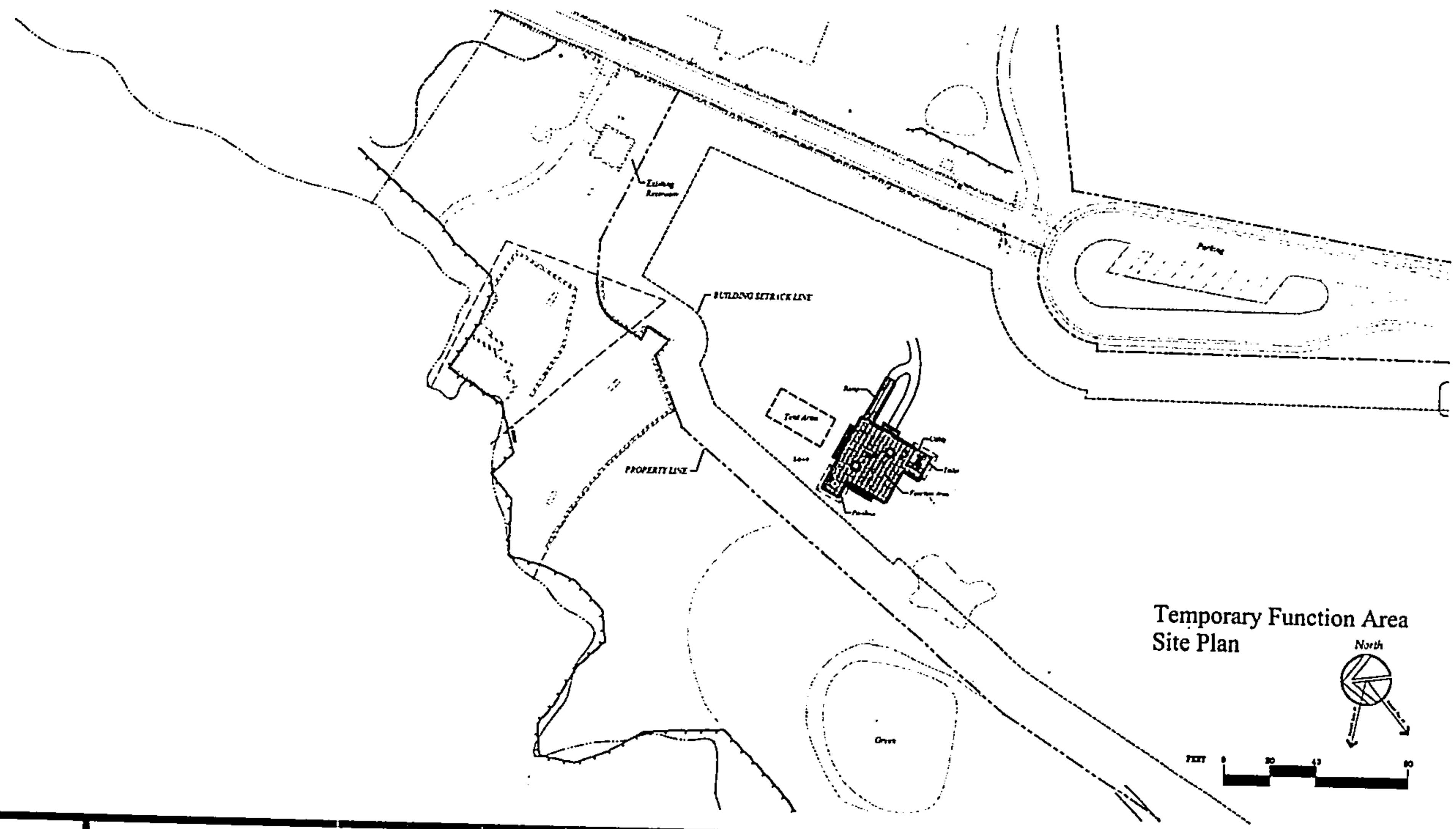


Security Kiosk
Floor Plan
Gross Building: 105 s.f.



Security Kiosk
Exterior Elevations

RIECKE SUNNLAND KONO 20 April 2006	*Parcel H-1* *Makena Resort, Maui, Hawaii*	Security Kiosk	KEAKA LLC



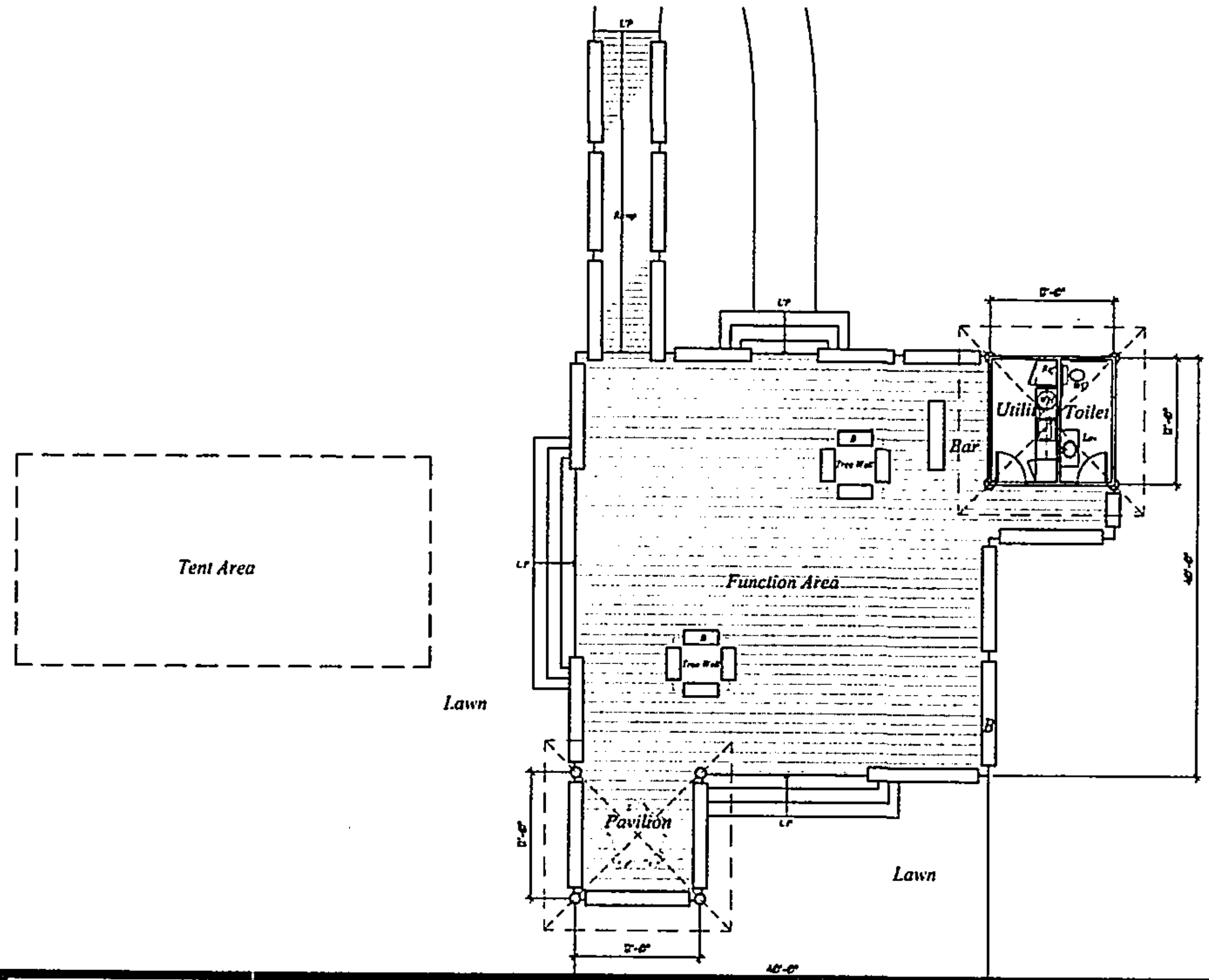
RIECKE SUNNLAND KONO

20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

KEAKA LLC



Temporary Function Area
Floor Plan

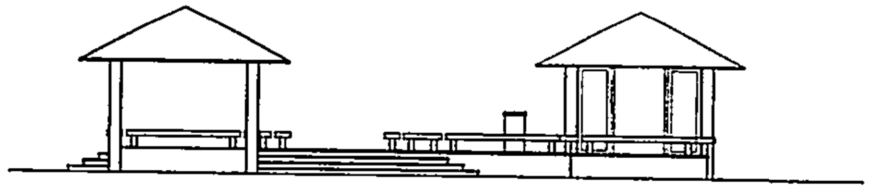
Parcel H-1

Makena Resort, Maui, Hawaii

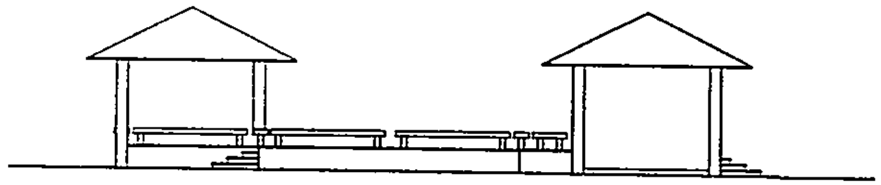
RIECKE SUNNLAND KONO

20 April 2006

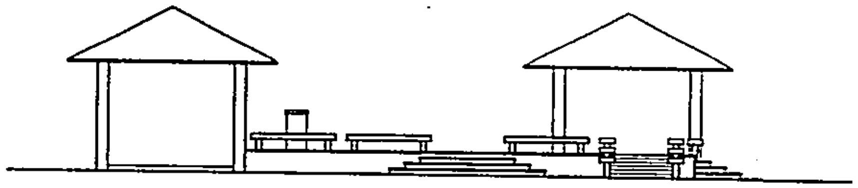
KEAKA LLC



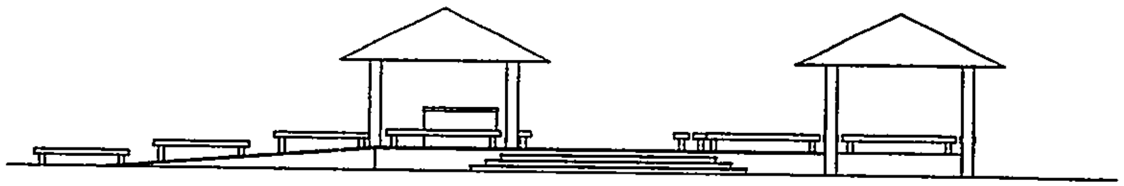
Makai Elevation



West Elevation



Mauka Elevation



East Elevation

TemporaryFunction Area
Exterior Elevations

RIECKE SUNNLAND KONO

20 April 2006

Parcel H-1

Makena Resort, Maui, Hawaii

KEAKA LLC

Appendix A-1

Preliminary Landscape Plan

Note: All permanently planted landscaped areas to be irrigated via automatically-controlled sprinkler systems.

LEGEND

Large Canopy Tree - Field Specimen (16' ht., 12' sp., 6" ca.)
- Monkeypod (Samanea saman)
- Banyan (Ficus benjamina)

Street Tree/Shade Tree - 65 gal. (12' ht., 8' sp., 3" ca.)
- Milo (Thespesia populnea)
- Rainbow Shower (Cassia nealiae)
- Kou (Cordia subcordata)

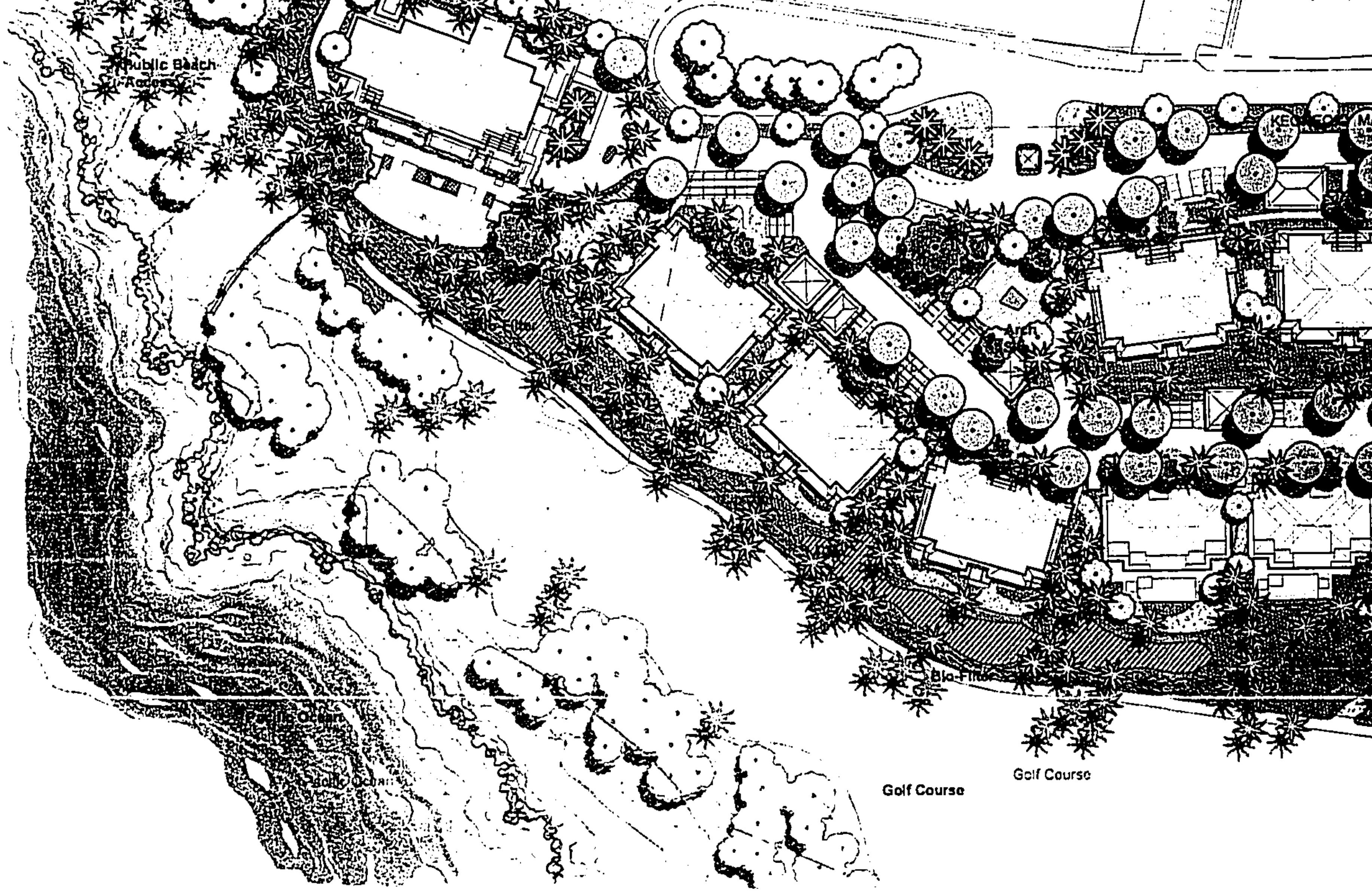
Accent or Flowering Tree - 45 gal. (10' ht., 6' sp., 3" ca.)
- Singapore Plumeria (Plumeria obtusa)
- Kukui (Aleurites mollucana)
- Hong Kong Orchid Tree (Bauhina blakeana)
- Beach Heliotrope (Messerschmidia argentea)
- Hala (Pandanus odoratissimus)

Single-Trunked Palm - Field Spec
- Coconut (Cocos nucifera)
- Joannis Palm (Veitchia joannis

Formal Palms - Field Specimen, n
- Royal Palm (Roystonea regia)
- Queen Palm (Arecastrum rom

Accent Palm
- Fiji Fan Palm (Pritchardia pac
- Foxtail Palm (Wodyetia bifurca

Screen/Buffer Planting
- Seagrape (Coccoloba uvifera)
- Variegated Hau (Hibiscus t. va
- Beach Naupaka (Scaevola fru
- Hibiscus (Hibiscus hybrids)



PRELIMINARY LANDSCAPE PLAN

SCALE: 1"=50'

RIECKE SUNNLAND KONO ARCHITECTS LTD

24 Feb 2006

miyabara associates

Landscape Architecture and Land Planning

TEL (808) 531-1300
FAX (808) 533-6049
928 NUUANU AVE. SUITE 401
HONOLULU, HAWAII 96817

Parcel H-1

Makena Resort, Maui, Hawaii

ngle-Trunked Palm - Field Specimen (15' trunk)
Coconut (Cocos nucifera)
Joannis Palm (Veitchia joannis)

rmal Palms - Field Specimen, matching (15' trunk)
Royal Palm (Roystonea regia)
Queen Palm (Arecastrum romanzoffianum)

cent Palm
Fiji Fan Palm (Pritchardia pacifica)
Foxtail Palm (Wodyetia bifurcata)

reen/Buffer Planting
Seagrape (Coccoloba uvifera)
Variegated Hau (Hibiscus t. variegata)
Beach Naupaka (Scaevola frutescens var. sericea)
Hibiscus (Hibiscus hybrids)

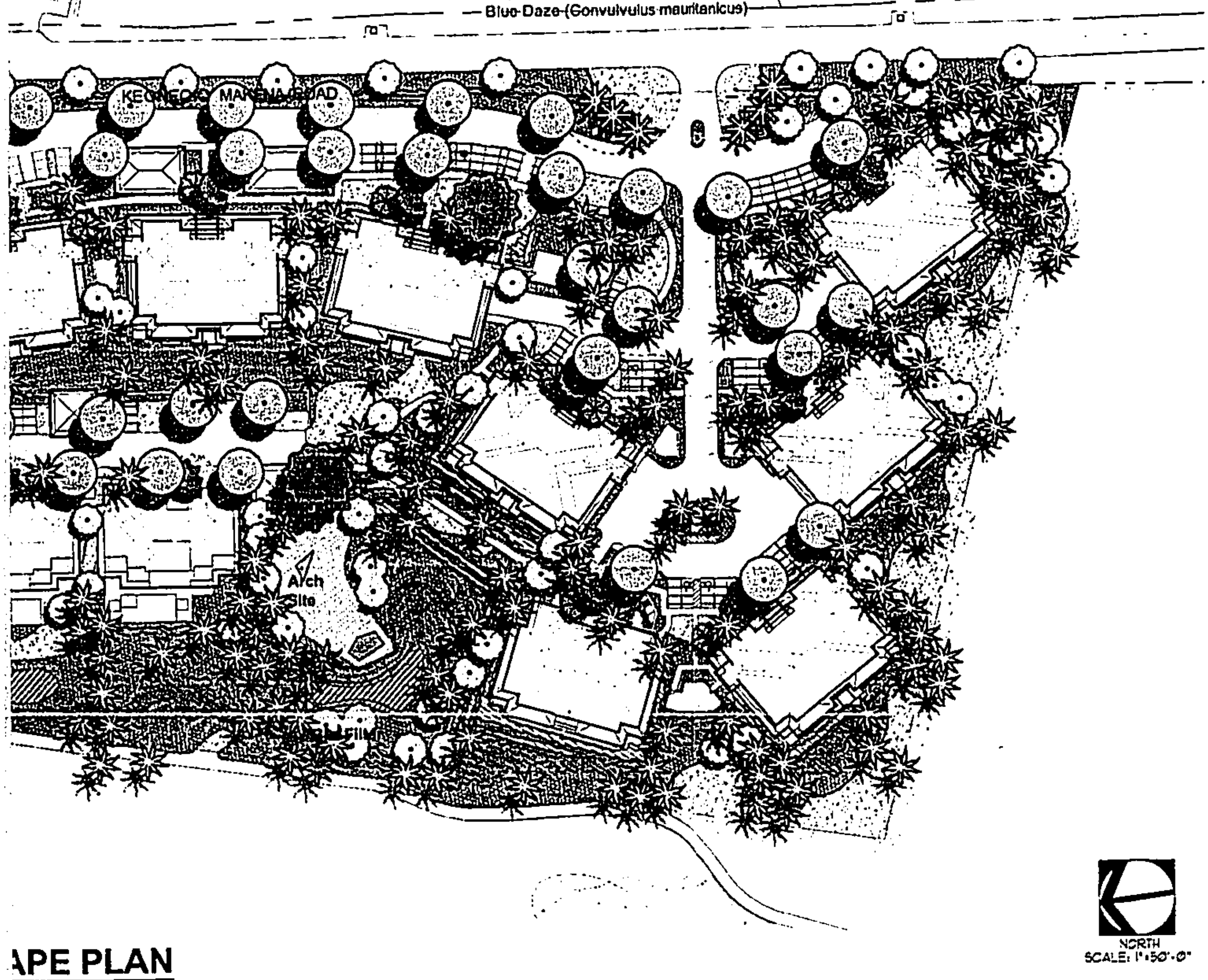
Shrubs and Ground Covers

Shrubs - 1 & 3 Gal.
Tiare Gardenia (Gardenia taitensis)
Spider Lily (Crinum asiaticum)
Ti (Cordyline terminalis)
Beach Naupaka (Scaevola f. var. sericea)
Hibiscus (Hibiscus - various colors)
Red Ginger (Alpinia purpurata)
Bird of Paradise (Strelitzia regia)

Groundcovers - Rtd. Ctgs., 4" pots, Qts.
Laua'e Fern (Microsorium scolopendria)
Kupukupu Fern (Nephrolepis sp.)
'Akia (Wikstroemia uva-ursi)
Pohinahina (Vitex rotundifolia)
Walking Iris (Neomarica sp.)
Iceplant (Carpobrotus edulis)
Blue Daze (Convulvulus mauritanicus)

Grass - Seed or sprigs
Hybrid Bermuda (Cynodon hbd. '419' or '323') - Full Sun
St. Augustine Grass (Stenotaphrum secundatum) - For Shade

Bio-Filter
Beach Naupaka (Scaevola f. var. sericea)
'Ae'ae (Bacopa monnieri)
Makaloa (Cyperus laevigatus)



APE PLAN

I-1

ui, Hawaii

Preliminary Landscape Plan

KEAKA LLC

Appendix B

Green Building Services Letter, Dated July 24, 2006

Green Building Services GBS

MEMORANDUM

July 24, 2006

To: Keaka', LLC
Re: Response to Maui Tomorrow Foundation, Inc. Comments

This memo is in response to the Maui Tomorrow Foundation, Inc. comments to the Maui Planning Commission on the Keaka, LLC Draft Environmental Assessment. Below we have outlined detail responses to the comments raised in the letter.

Historic Structures
Currently the overall project site plan shows that two historic structures (burial site and historic shrine) will be preserved as a part of this project. Archeological documentation has been prepared for the entire site and detailed documentation will be provided for Wall 5795. Keaka', LLC will work with stakeholder groups to provide interpretive displays and documentation related to historic features of the site and illustrate features through educational signage and artifacts on adjacent park land.

Water Supply
Keaka', LLC is very concerned about the preservation of the Iao Aquifer and is actively working to significantly reduce the use of potable water throughout this project. While the Iao is a concern, this project will rely on other water sources that are and will be available to supply water to the site, including:

- Kupaa Well - The well pump has been installed. Pipe line installation will be contracted in the near future.
- Waiale Surface Water Treatment Plant – Which is anticipated to be on-line and operational in 2008.
- Maui Lani Wells –Well drilling is in progress or should be commencing by the last quarter of 2006.

The buildings included in this project are currently designed to use the most advanced water-saving fixtures to reduce water consumption by at least 24%, bringing about a savings of approximately 377,000 gallons of water annually. Landscape irrigation will be reduced by a minimum of 56% based on the use of drought tolerant/native plants and a high-efficiency water-saving irrigation system. This measure will result in a total savings of at least 325,000 gallons of water annually. Currently the waste water treatment plant is under-subscribed, so there is not enough effluent to distribute from the facility. Once the plant increases subscription and adds capacity, this project will tap into the available effluent and eliminate the use of potable water for irrigation completely, saving approximately 580,000 gallons of water annually.

Adjacent Parkland
Cultural assessment was performed and showed that parking is never used to full capacity.

Water Quality and Ecosystem Impacts Related to Runoff
Keaka', LLC is concerned about impacts to water quality and the potential issues related to irrigation and stormwater runoff. The design of this project specifically addresses those

concerns through a comprehensive site stormwater management plan, landscape and irrigation design, an organic landscape maintenance program and an integrated pest management program.

- Stormwater Management: the site design for this project will include variety of stormwater management features that will work effectively to collect, contain, filter and infiltrate stormwater throughout the site, rather than in concentrated areas. All water collected of parking areas and drive isles will be collected and filtered through scientifically tested and certified stormwater filters specifically designed to remove contaminants and turbidity from surface stormwater and gradually allow the stormwater to infiltrate into the ground. The goal of the project is to have no net impact to surface and groundwater when compared to the existing conditions of the site.
- Landscape and Irrigation Design: through the use of native and drought-tolerant plants and a reduction in the area of turf, the landscape design effectively reduces the need for significant amounts of irrigation (56% reduction), thereby reducing the potential for runoff from over-watering the landscape.
- Organic Landscape Maintenance: Keaka', LLC has adopted an Organic Landscape Maintenance Plan. By using only organic fertilizers, pesticides and herbicides, this project will eliminate runoff containing harsh chemical contaminants typically associated with similar development projects. Through the development of a healthy and diverse landscape including native and adapted species, this project will avoid the need for the use of commercial chemical landscape maintenance products in favor of organic and natural methods. Stormwater that runs over and through this landscape will be cleansed through the filtering effects of stormwater bio-swales, infiltration basins and soakage trenches (see attached plan).
- Integrated Pest Management Program: Keaka', LLC has adopted an Integrated Pest Management Program. By implementing a systematic pest management program, this project will reduce or eliminate the regular use of chemical pest treatment and implement a targeted program for the management of pests around the site (see attached plan).

The Makena Golf Course is currently monitoring the groundwater under and adjacent to their property, which can provide a good baseline for the groundwater for this project. Once this project is under way, Keaka', LLC will implement the use of monitoring wells to verify efficacy of stormwater management plan and organic landscape maintenance program.

Green Building: LEED Certification

Keaka', LLC is demonstrating a significant commitment to environmental leadership by pursuing LEED Certification for all of the buildings they are developing for this project. The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a green building standard developed by the U.S. Green Building Council (www.usgbc.org) that is currently being used world-wide. With this standard, the project team is working to reduce environmental impacts from the project in five areas of building design and construction: Site, Water, Energy, Materials and Indoor Environmental Quality. This project is seeking a LEED Silver certification.

Through the LEED Certification process, this project will document the following efforts:

- Providing at least 25% more open space compared to code requirements
- Demonstrating no net increase in stormwater runoff
- A significant reduction in heat-island causing impervious surfaces and light pollution
- A 56% reduction in the use of potable water for landscape irrigation

- A 24% reduction in potable water used in buildings
- An 18% reduction in total energy use
- Diversion of at least 50% of construction waste from the landfill
- Overall recycled content of building materials of at least 10%
- At least 10% of materials extracted and manufactured locally
- A minimum of 50% of the wood in the project will be sustainable harvested FSC certified wood
- Finish materials used in the building will be low or zero-VOC (volatile organic compounds)
- The project will demonstrate green building products and techniques for visitors and residents to learn about the benefits of green building

There are numerous additional requirements that will be incorporated into the design and construction of this project through the innovative practices of the project team and the requirements of LEED certification.

Keaka', LLC has taken a holistic approach to this project in order to reduce environmental impacts and provide high-quality site and building design that will be view as an exemplar of green development for the Maui. Once completed, this project will be held up as a model for future projects because of the innovative practices that are demonstrate by the design and construction of this project.

Sincerely,

Ralph DiNola
Principal

Appendix C

Biological Resources Survey

BIOLOGICAL RESOURCES SURVEY

for the

PARCEL H – 1 PROJECT

MAKENA, MAUI, HAWAII

by

ROBERT W. HOBDY
ENVIRONMENTAL CONSULTANT
Kokomo, Maui
January 2005

Prepared for: KEAKA LLC.

PARCEL H-1 PROJECT,
MAKENA, MAUI

INTRODUCTION

The Parcel H-1 Project lies on approximately 11 acres of land including two parcels (TMK 2-1-06:37) and (TMK 2-1-06:56) of undeveloped land along the Makena – Keoneoio Road in South Makena. Adjacent to it across the road is an additional 2 acre parcel (TMK 2-1-05:84) of undeveloped land that will be included in this survey and assessment. The 11 acre parcel is bounded on three sides by fairways of the Makena South Golf Course, while the 2 acre parcel is bounded on the north by a parking lot and on the east and south by undeveloped brushlands.

SITE DESCRIPTION

The terrain within the project area is gently to moderately sloping and is bisected by one small gully. Elevations above sea level range from 74 feet at the top to 40 feet at the lowest point along the fairway. The area could be characterized as a semi-desert forest. Rainfall averages only 18-20 inches per year with long hot summers (Armstrong,1983). Soils are of the Makena Loam Stony Complex, slightly alkaline and about 40 inches deep with many surface and subsurface stones (Foote, et al. 1972).

BIOLOGICAL HISTORY

In pre-contact times this area would have supported a diverse dry forest/grassland with many species of native trees, shrubs, vines and grasses and a few seasonal herbs and ferns, as well as a complement of native birds and insects. We can still observe fragments of this diversity in relictual pockets of native vegetation in a few places between Kihei and Makena. This diversity of native species was drastically reduced by over a century of browsing and grazing by feral and domesticated herbivores and their replacement by aggressive non-native plant species. The project area now contains only some of the commoner native species that have proven to be stronger competitors and more resistant to disturbance.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna survey of the proposed

Parcel H-1 Project which was conducted during the rainy season in January 2005. The objectives of the survey were to:

1. Document what plant, bird and mammal species occur on the property or may likely occur in the existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the flora and fauna in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey method was used following a route to ensure complete coverage of the area. Areas most likely to harbor native or rare plants such as gulches or rocky outcroppings were more intensively examined. Notes were made on plant species, distribution and abundance as well as terrain and substrate.

DESCRIPTION OF THE VEGETATION

The vegetation on the 11 acre parcel is a dense kiawe (*Prosopis pallida*) forest with an understory of cactus (*Opuntia ficus-indica*), ʻilima (*Sida fallax*) and Guinea grass (*Panicum maximum*) with a mixture of other herbaceous species especially on the forest margins near the fairways.

The 2 acre parcel contains a few scattered kiawe trees over a dense brushland of koa haole (*Leucaena leucocephala*), cactus and ʻilima.

A total of 41 plant species were recorded during the survey. Only 2 of these ʻilima and ʻuhaloa (*Waltheria indica*) are native. Both of these species are indigenous to Hawaii as well as a number of other Pacific islands, and both are quite common throughout Hawaii. The other 39 species are all non-native and most of these are weeds.

DISCUSSION AND RECOMMENDATIONS

The vegetation throughout the project area is totally dominated by non-native species. Only two very widespread and common native species occur here. No officially listed threatened or endangered plants (U.S. Fish and Wildlife Service 1999) are found on the site, nor do any plants proposed as candidate for such status occur on the property.

No wetlands occur on the site. Nothing remotely approaching the three essential criteria that define a Federally recognized wetland, namely 1) hydrophytic vegetation 2) hydric soils and 3) wetland hydrology occur within this dry project area.

Because the vegetation on the site is dominated primarily by non-native plants and because there are no rare or protected native species within the project area, there is little of botanical concern and the proposed project is not expected to have a significant negative impact on the botanical resources.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999).

For each species, the following information is provided:

1. Scientific name with author citation
2. Common English or Hawaiian name.
3. Bio-geographic status. The following symbols are used:
   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.
4. Abundance of each species within the project area:
   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
MONOCOTS			
AGAVACEAE (Agave Family)			
Furcraea foetida (L.) Haw.	Mauritius hemp	non-native	rare
POACEAE (Grass Family)			

Cenchrus ciliaris L.	buffelgrass	non-native	uncommon
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	rare
Cynodon dactylon (L.) Pers.	*manienie*	non-native	rare
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	rare
Eragrostis tenella (L.) P.Beauv. Ex Roem. & Schutt	------------	non-native	rare
Panicum maximum Jacq.	guinea grass	non-native	abundant

DICOTS

ACANTHACEAE (Acanthus Family)			
Asystasia gangetica (L.) T. Anderson	coromandel	non-native	rare
AMARANTHACEAE (Amaranth Family)			
Alternanthera pungens Kunth	khaki weed	non-native	rare
APOCYNACEAE (Dogbane Family)			
Cascabela thevetia (L.) Lippold	be-still tree	non-native	uncommon
ARALIACEAE (Ginseng Family)			
Shefflera actinophylla (Endl.) Harms	octopus tree	non-native	rare
ASTERACEAE (Sunflower Family)			
Ageratum conyzoides L.	*maile hohono*	non-native	rare
Conyza bonariensis (L.) Cronq.	hairy horseweed	non-native	rare
Pluchea indica (L.) Less.	Indian fleabane	non-native	rare
Tridax procumbens L.	coat buttons	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Verbesina encelioides (Can) Benth. & Hook.	golden crown beard	non-native	uncommon
BRASSICACEAE (Mustard Family)			
Coronopus didymus (L.) Sm.	swinecress	non-native	rare
CACTACEAE (Cactus Family)			
Opuntia ficus-indica (L.) Mill	panini	non-native	abundant

CHENOPODIACEAE (Goosefoot Family)			
Chenopodium carinatum R.Br.	----------------	non-native	uncommon
Chenopodium murale L.	*aheahea*	non-native	rare
FABACEAE (Pea Family)			
Crotalaria pallida Aiton	smooth rattlepod	non-native	rare
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	uncommon
Indigofera suffruticosa Mill.	*'iniko*	non-native	uncommon
Leucaena leucocephala (Lam.) deWit	*koa haole*	non-native	common
Prosopis pallida (Humb.&Bonpl.Ex.Willd.) Kunth	*kiawe*	non-native	abundant
Samanea saman (Jacq.) Merr.	monkeypod	non-native	rare
LAMIACEAE (Mint Family)			
Leonotis nepetifolia (L.) R.Br.	lion's ear	non-native	uncommon
Ocimum basilicum L.	basil	non-native	uncommon
MALVACEAE (Mallow Family)			
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	non-native	common
Malva parviflora L.	cheeseweed	non-native	rare
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	uncommon
Sida fallax walp.	*'ilima*	indigenous	abundant
Sida rhombifolia L.	-------------	non-native	uncommon
NYCTAGINACEAE (Four - O'clock Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Boerhavia coccinea Mill.	----------------------	non-native	uncommon
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	rare
Portulaca pilosa L.	------------	non-native	rare
SOLANACEAE (Nightshade Family)			

Nicotiana glauca R.C. Graham	tree tobacco	non-native	rare
Solanum lycopersicum L.	tomato	non-native	rare
Solanum seaforthianum Andr.	-------------	non-native	uncommon
STERCULIACEAE (Cacao Family)			
Waltheria indica L.	*'uhaloa*	indigenous	rare
VERBENACEAE (Verbena Family)			
Lantana camara L.	lantana	non-native	uncommon

FAUNA SURVEY REPORT

SURVEY METHODS

A walk-through survey method was conducted in conjunction with the botanical survey. All parts of the project area were covered. Field observations were made with the aid of binoculars and by listening to vocalizations. Notes were made on species abundance, activities and location as well as observations of trails, tracks scat and signs of feeding. In addition an evening visit was made to the area to record crepuscular activities and vocalizations and to see if there was any evidence of occurrence of the Hawaiian hoary bat (*Lasiurus cinereus semotus*) in the area.

RESULTS

MAMMALS

Three species of feral mammal were observed in the project area during two site visits . Taxonomy and nomenclature follow Tomich (1986).

Axis deer (*Axis axis*) - While no deer were observed during the course of this survey their periodic presence in this area is obvious. These animals are nocturnally active, mobilizing around dusk to feed within this area and likely within surrounding fairways and lush landscaped areas under cover of darkness. Numerous trails, tracks and scat were evident throughout the area as well as significant sign of feeding, all attesting to the frequent use of the area.

Domestic cat (*Felis Domesticus*) – Two wild cats were seen during the evening portion of the survey. They were congregating at a cat colony feeding station that had been set up near the road.

Mongoose (*Herpestes auropunctatus*) – One mongoose was seen in the forest margin. Mongoose feed on rodents and birds in such brushy areas.

Dense vegetation prevented good visibility of other ground dwelling animals, but a significant population of rats and mice would be expected. Mice and rats were not seen but their presence is virtually guaranteed by the abundant food supply in the form of grass seed and herbaceous vegetation.

A special effort was made to look for the native Hawaiian hoary bat by making an evening survey of the area. When present in an area these bats can be easily identified as they forage for insects, their distinctive flight patterns clearly visible in the glow of twilight. No evidence of such activity was observed though visibility was excellent and plenty of flying insects were seen. This area does not represent ideal bat habitat and there have been no reports of bat sightings in the vicinity.

BIRDS

There was moderate birdlife diversity in this normally dry area. An ample supply of grass and herbaceous plant seeds were available following a good winter wet season. Seven species of non-native birds and one migratory bird species were seen, most taking advantage of this seasonal food supply. Taxonomy and nomenclature follow American Ornithologist's Union (1988), Berger (1981), Pratt et al.(1987) and Hawaii Audubon Society (1989).

American cardinal (*cardinalis cardinalis*) – Both sexes of this species were seen individually or in pairs throughout the area. Their bright color and distinctive calls are unmistakable.

Barred dove (*Geopelia striata*) – Many barred doves were seen and heard in the kiawe trees. Their smaller size, striated body and white flashing tails feathers when taking flight distinguish this species from the spotted dove.

Japanese white-eye (*Zosterops japonica*) – Many white-eyes were seen feeding in the kiawe and their high pitched calls were frequently heard.

Gray francolin (*Francolinus pondicerianus*) – A few gray francolins were seen in ground openings and in kiawe trees, but their loud and distinctive calls were heard frequently throughout the area indicating a larger population than seen.

Common mynah (*Acridotheres tristis*) – A few pairs of mynahs were seen throughout the area, feeding in the kiawe trees or transiting the area high above the trees. They are confident and assertive birds.

Cattle egret (*Bubulcus ibis*) – A few egrets were seen transiting over the property to their roosting areas for the night. This project area is not feeding or nesting habitat for egrets.

House finch (*Carpodacus mexicanus*) – A few pairs of these moderately-sized, light brown finches were seen in the kiawe trees.

Kolea or golden plover (*Pluvialis dominica fulva*) – A few plover were seen feeding on grassy areas on forest margins during the late afternoon.

Other bird species I could possibly expect to see in this area but which were not present include the house sparrow (*Passer domesticus*) and the spotted dove (*streptopelia chinensis*). No endemic bird species were seen.

INSECTS

While insects in general were not tallied, they were abundant throughout the area and fueled the elevated bird activity observed. Although not found on the project site one native Sphingid moth, Blackburn's sphinx moth (*Manduca blackburni*), has been put on the Federal Endangered species list and this designation requires special focus (USFWS 2000). Blackburn's sphinx moth occurs on Maui although it has not been found in this area. Its native host plants are species of 'Aiea (*Nothocestrum*) and a non-native alternative host plant is tree tobacco (*Nicotiana glauca*). There are no 'aiea on or near the project area but about six tree tobacco plants were seen. Each of these plants was carefully examined but no Blackburn's sphinx moth or their larvae were observed.

CONCLUSIONS

Fauna surveys are seldom comprehensive due to the short window of observation, the seasonal nature of animal activities and the unpredictable nature of their daily movements. This survey, however, should be considered fairly representative due to the abundance of food resources present throughout the area and the resulting level of animal use. While ideal for many types of non-native animals the habitat is not suitable in its present state for most native animals, and is far removed from remnant populations. No endangered mammal, bird or insect species (US FWS,1999) were observed in the project area during the course of the survey. No unique or special habitats were found on the property. The proposed changes in land use should have no significant impact on the fauna in this part of Maui.

RECOMMENDATIONS

Some seabirds such as the Endangered dark rumped petrel (*Pterodroma phaeopygia sandwichensis)* and the commoner wedge-tailed shearwater (*Puffinus pacificus chlororhynchus*), nesting on the summit of Haleakala and the coastal sites of Wailea Point and Molokini respectively, leave their burrows before dawn and return after sunset. These birds can become attracted to and confused by bright lights, crash and be killed by vehicles or cats and dogs that find them. Young birds are especially vulnerable when they fledge in late fall and take their first tentative flights. It is recommended that all significant outdoor lighting in the development be hooded to direct the light downward.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Mammals and Birds. For each species the following information is provided:

1. Common name
2. Scientific name
3. Bio-geographical status. The following symbols are used:
   - endemic = native only to Hawaii; not naturally occurring anywhere else in the world.
   - indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   - non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.
   - migratory = spending a portion of the year in Hawaii and a portion elsewhere. In Hawaii the migratory birds are usually in the

overwintering/non-breeding phase of their life cycle.

4. Abundance of each species within the project area:
   abundant = many flocks or individuals seen throughout the area at all times of day.
   common = a few flocks or well scattered individuals throughout the area.
   uncommon = only one flock or several individuals seen within the project area.
   rare = only one or two seen within the project area.

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
MAMMALS			
Axis deer	*Axis axis*	non-native	common
Domestic cat	*Felis domesticus*	non-native	uncommon
Mongoose	*Herpestes auropunctatus*	non-native	rare
BIRDS			
American cardinal	*Cardinalis cardinalis*	non-native	abundant
Barred dove	*Geopelia striata*	non-native	common
Japanese white-eye	*Zosterops japonica*	non-native	common

Gray francolin	*Francolinus pondicerianus*	non-native	uncommon
Common mynah	*Acridotheres tristis*	non-native	uncommon
Cattle egret	*Bubulcus ibis*	non-native	rare
House finch	*Carpodacus mexicanus*	non-native	rare
Golden plover / Kolea	*Pluvialis dominica fulva*	indigenous/migratory	rare

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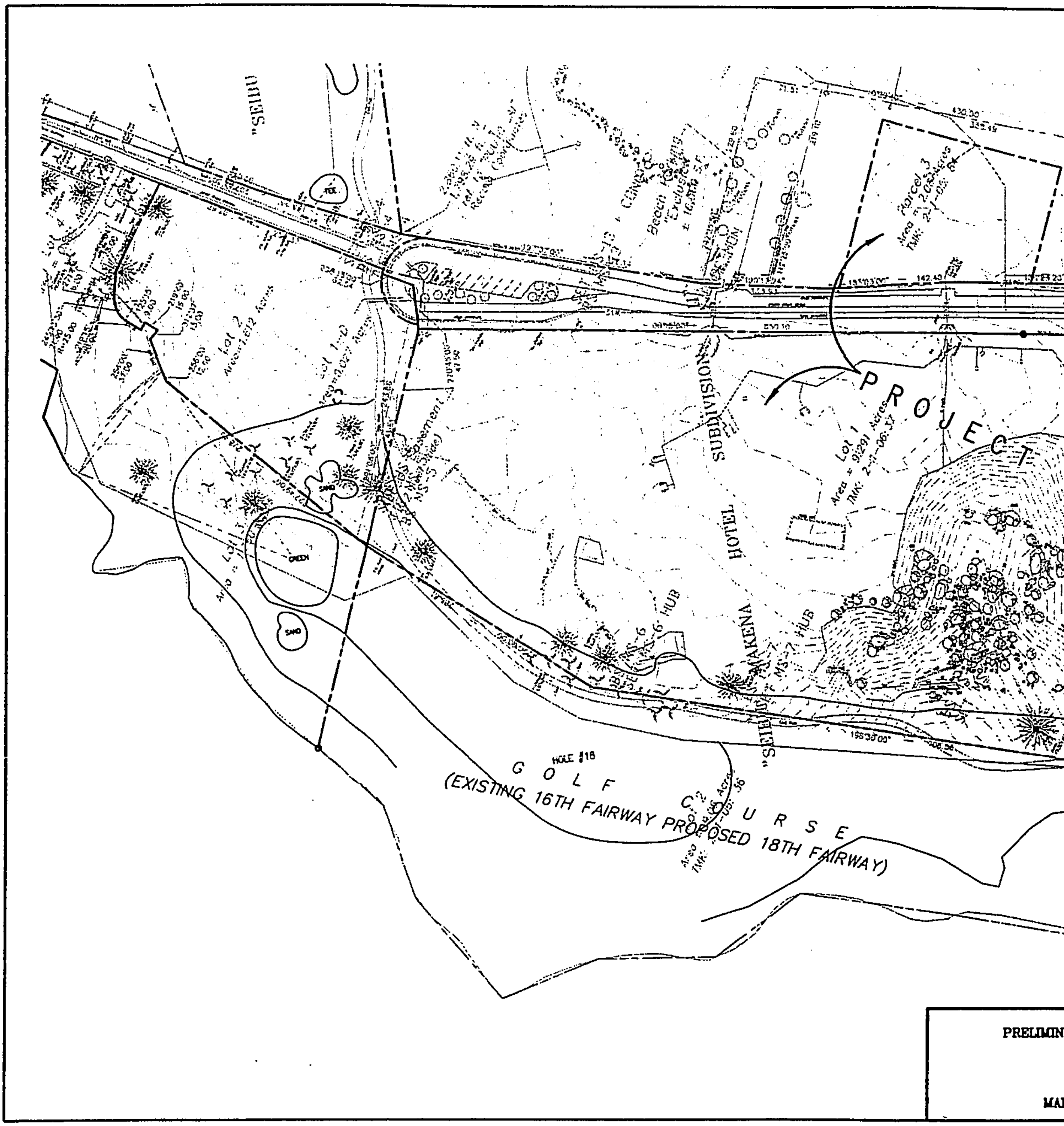

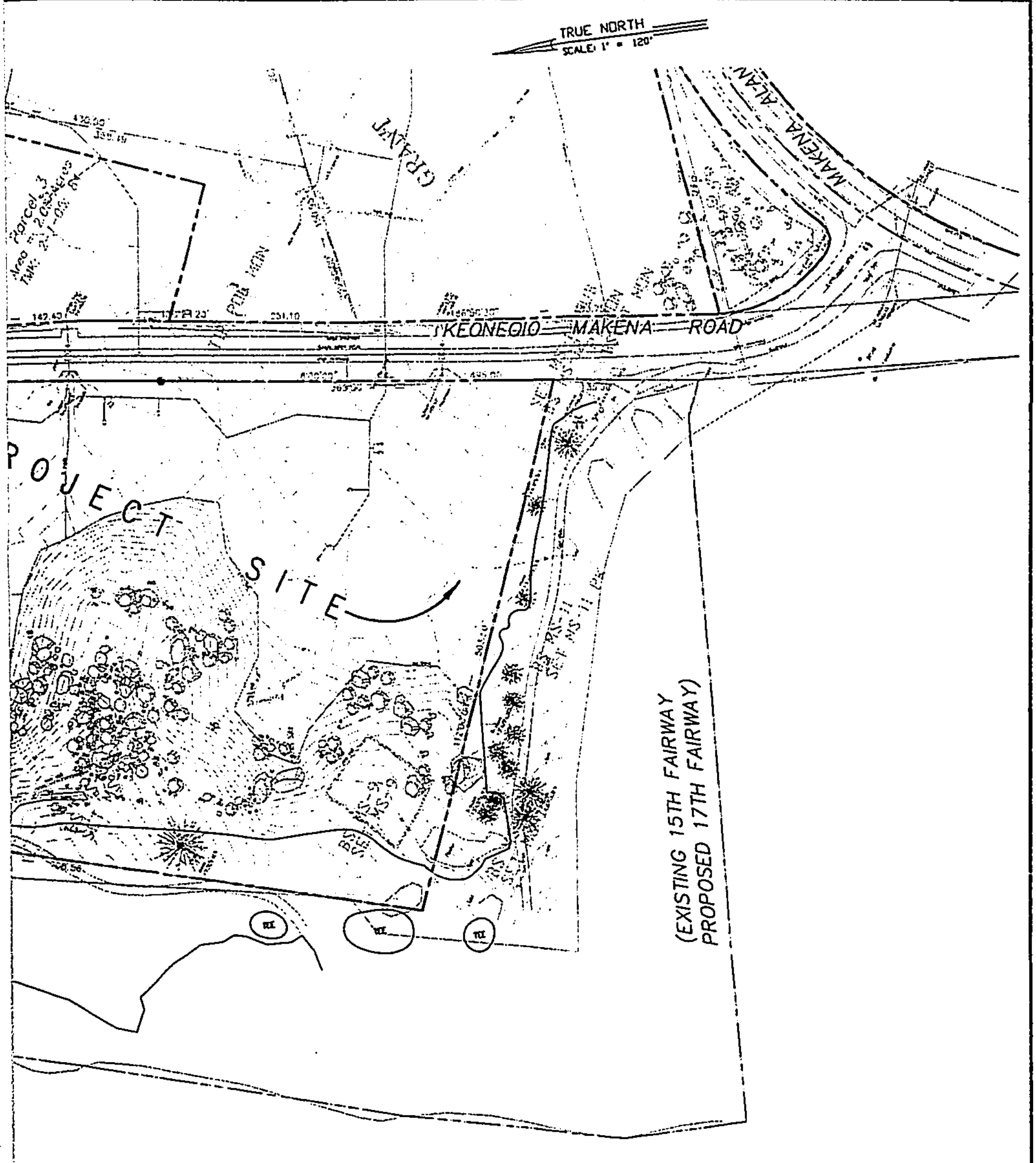

PRELIMINARY ENGINEERING REPORT

PARCEL H-1

MAKENA, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PROJECT SITE PLAN

EXHIBIT

Appendix D

Archaeological Inventory Survey Report

ARCHAEOLOGICAL INVENTORY SURVEY REPORT FOR THE DEVELOPMENT OF CONDOMINIUMS AND ASSOCIATED RETENTION BASIN LOCATED AT PARCEL H-1, AT TMK: 2-1-06: 37 & 56 and 2-1-5: 84 KA'EO *AHUPUA'A;* MAKAWAO DISTRICT; ISLAND OF MAUI

FOR: Keaka LLC

BY: Lisa J. Rotunno-Hazuka,
Jeffrey Pantaleo (MA)

MARCH 2005

ARCHAEOLOGICAL SERVICES HAWAII, LLC.
16 S. Market St. Suite G
Wailuku, HI 96793

"Protecting, Preserving, Interpreting the Past, While Planning the Future"

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MANAGEMENT SUMMARY

At the request of Keaka LLC, of Wailuku, Archaeological Services Hawaii, LLC., of Wailuku, in association with Aki Sinoto of Honolulu, conducted a surface reassessment and inventory survey on lands proposed for condominium development and associated retention basin in Mākena, Makawao District, Island of Maui (TMK 2-1-06:37, 56 and TMK 2-1-5: 84).

In the course of the current undertaking, three of the temporary sites underwent testing where the results were unfortunately minimal and no data to support any new interpretations or to refute hypotheses of site function and chronology was generated. Temporary Sites 21, 22 and 25 are no longer significant and require no further work beyond construction monitoring. Feature 5 of Site 1007, the Mākena School Complex, was recommended for *in situ* preservation in the past. Sites 233, 234 TS18, 25 and 26 are significant for their information content and are recommended for data recovery procedures. Temporary Site (TS) 21 is significant for site type and information content, yet no further work is recommended for this site. TS 26 mostly likely will be recommended for *in situ* preservation (pending data recovery results) and this site will likely be incorporated into the proposed development plans.

INTRODUCTION

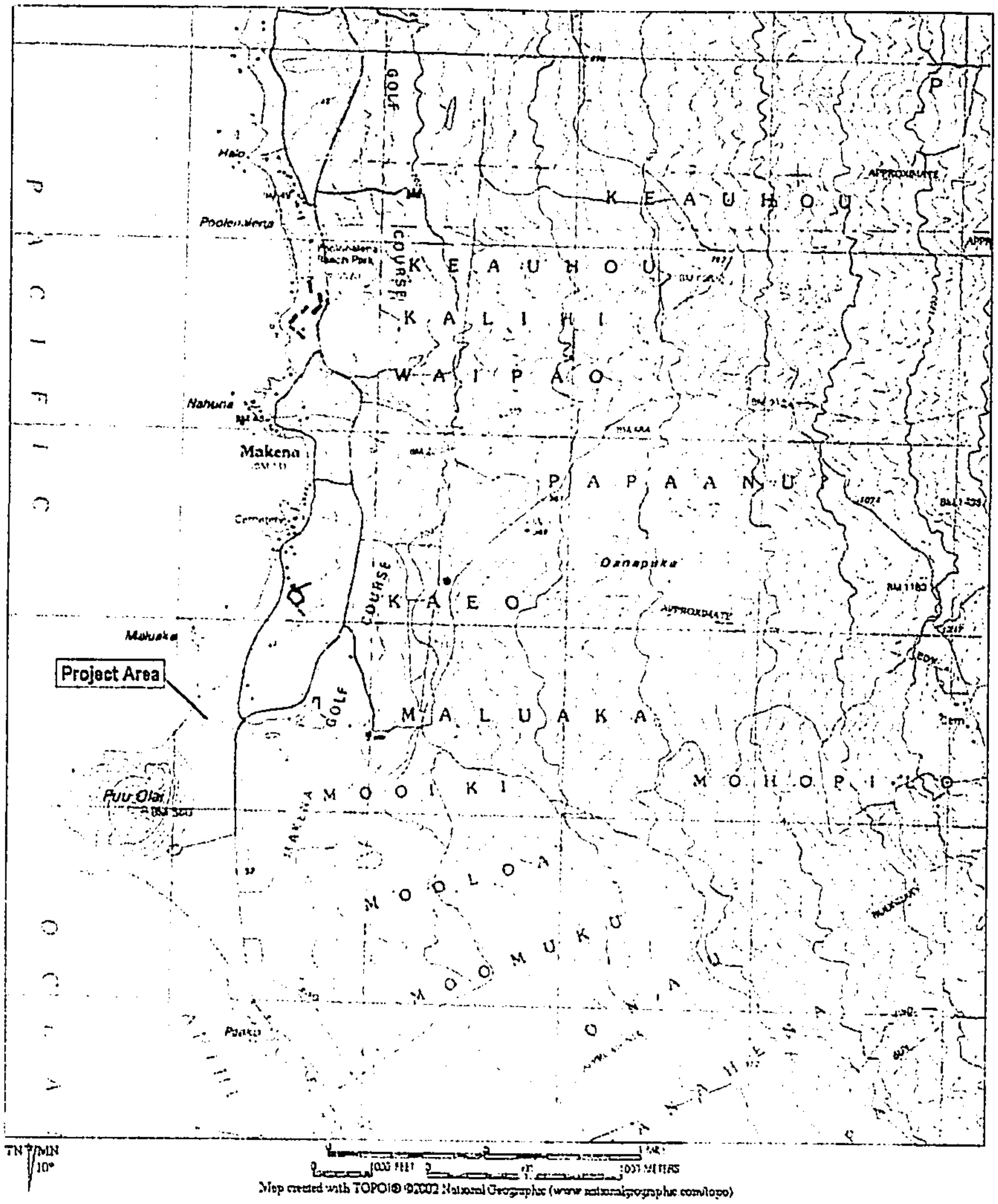
At the request of Keaka LLC, of Wailuku, Archaeological Services Hawaii, LLC., of Wailuku, in association with Aki Sinoto Consulting of Honolulu, conducted a surface reassessment and inventory survey, on lands previously surveyed in the 1970s and 80s. These lands are proposed for condominium development at (TMK 2-1-06:37, 56 and a retention basin at 2-1-5: 84), Honua`ula Moku, Makawao Modern District, Maui (Figures 1 and 2). The two-fold objective of the current undertaking was to compile pertinent data from all archaeological studies completed to date in the area and to augment these studies with additional documentation and subsurface testing. The reassessment identified six new features (TS 18, 20-22, 25 and 26), and relocated two previously recorded enclosure sites (50-Ma-B8-233 and 234), and the Mākena School Complex 50-50-14-1007.

PROJECT AREA

The project area is located along the lower southwestern slopes of Haleakalā in the Mākena region; Ka`eo, Mohopilo, and Maluaka *Ahupua'a*; Makawao District (traditional district of Honua`ula), Maui Island. Honua`ula, one of twelve ancient districts on Maui Island, was incorporated into the Makawao District during the modern era. The project site, located *makai* of Mākena Alanui, occurs approximately 300m south of the Maui Prince Hotel. It is bounded on the north, west, and portions of the south, respectively by the 15, 16 and 17th fairways of the South Course, and on the east by Mākena-Keoneoio Road and an undeveloped portion of land TMK 2-1-05: 3 and 38. A public beach parking lot is located to the north of 2-1-05: 84 and east of 2-1-06: 37. The project area is relatively flat except for a steep draw located in the southern ¼ of the project area.

ENVIRONMENT

The environment of Mākena is similar to that of arid leeward regions of the other Hawaiian Islands. The project area receives approximately 20 inches of annual rainfall, and the elevation of the project area ranges from 20 to 40 feet above mean-sea-level with the topography varying from gently-sloping coastal areas to dissected rocky inland areas with exposed bedrock outcrops, dry gulches, and old `a`ā flows (Armstrong 1973). Soil in the project area consists of Makena loam stony complex (MXC) and may contain some windblown beach sand (BS) along the western fringes. The Makena series are well-drained soils developed in volcanic ash with moderately rapid permeability, slow to medium runoff, and slight to moderate erosion hazard (Foote et al. 1972:91).



Map created with TOPO!® ©2002 National Geographic (www.nationalgeographic.com/topo)

Figure 1. Location of Project Area on USGS Map

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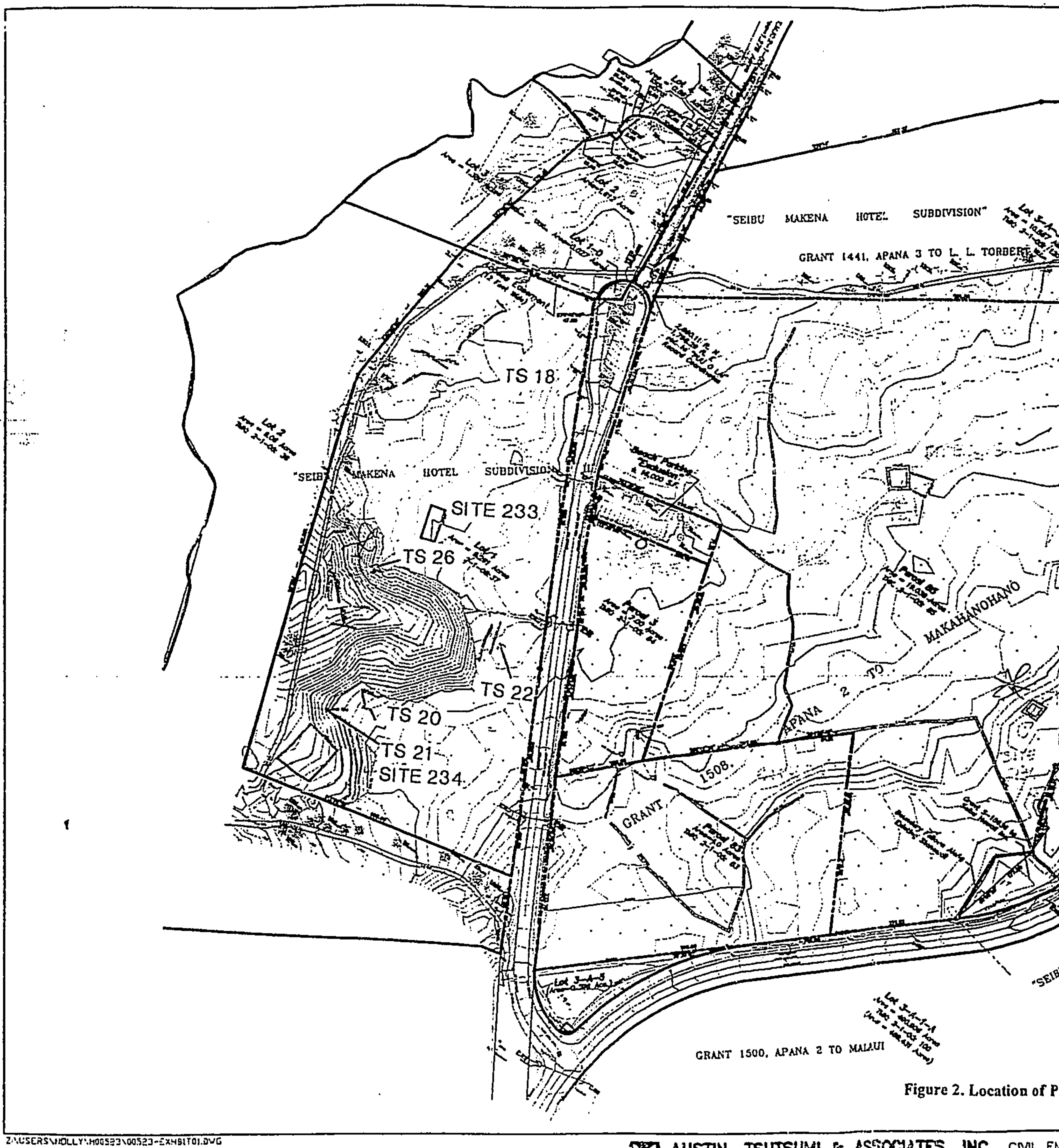

Figure 2. Location of P

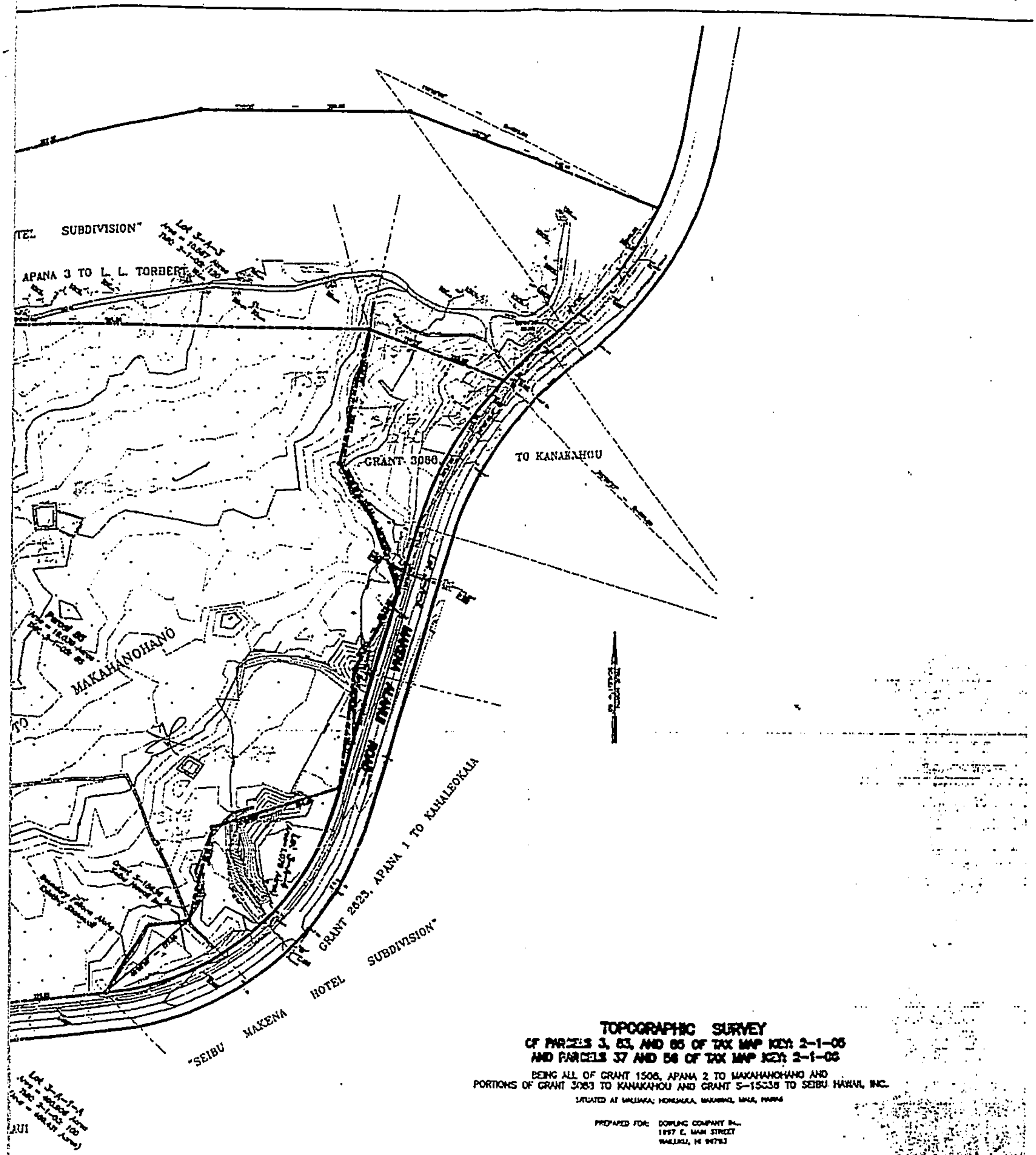

Figure 2. Location of Project Area and Archaeological Sites onTax Map Key

The project area flora is made up of lowland shrubs (Armstrong 1973:64). The majority of the vegetation is xerophytic and consists of common exotics such as *kiawe* (*Prosopis pallida*) as the dominant cover with *koa haole* (*Leucaena leucocephala*) with intermittent, isolated stands of endemic *wiliwili* (*Erythrina sandwichensis*) trees. Common ground cover includes a variety of endemic *'ilima* (*Sida fallax*) and *naupaka kahakai* (*Scaevola sericea*) along the shoreline, exotics such as basil (*Ocimum basilicum*), lantana (*Lantana camara*), the ubiquitous beggar's tick (*Bidens pilosa*), castor bean (*Ricinus communis*), and various dry grasses. Another notable flora is the introduced prickly pear or *panini* cactus (*Opuntia megacantha*). Golden crown-beard (*Verbsina enceliodes*) with its yellow, daisy-like flowers predominates as secondary ground cover in areas that have been previously cleared of primary growth.

HISTORICAL BACKGROUND

Historical background data regarding the Wailea/Mākena region has been summarized in Barrere (1974), Clark and Kelly (1985), Cordy and Athens (1988), Schilt (1988), Gosser et al. (1993 & 1996), and McIntosh et al. (1997). The reader is referred to these studies for detailed information. Thus, this section will be limited to a brief historical summary.

The earliest prehistoric settlement on Maui Island is postulated to have occurred between A.D. 300-600 along the windward regions where abundant rainfall and fertile soil supported cultivation and human populations (Kirch 1985, Cordy and Athens 1988, Gosser et al. 1996). Population expansion into the drier, leeward areas of Kihei, Wailea, and Mākena, likely took place by A.D. 1000-1200 (Cordy 1974, Kirch 1985). Seasonal settlements occurred along the coastal areas to exploit marine resources, while permanent settlements occupied the upland areas to utilize forest products and cultivate agricultural resources. Between these settlements was a dry area used for cultivating sweet potatoes and during transit on *mauka-makai* trails. Upland populations exchanged taro, bananas, and sweet potatoes with the coastal populations for ocean resources (Handy 1940).

The inhabitants of Honua'ula subsisted mainly on fish and sweet potatoes, a common diet of those who lived in the leeward area of Maui (Barrere 1975:41). The early French navigator La Perouse noted, while anchored at Keoneoio Bay that "this part of the coast was altogether destitute of running water. The inhabitants had no drinking water but a brackish water obtained from shallow wells (1798:350)."

Due to the lack of running water, agricultural production on the leeward side of Maui Island was limited to dryland taro in the upland areas in pockets of moist soil where rainfall was greater, while sweet potatoes were grown at the lower elevations (Handy 1940:113-114). Irish potatoes became an important cash crop in East Maui, for provisioning whaling ships and supplying the west coast of North America during the Gold Rush of 1848. By 1846, the cultivation of Irish Potatoes had spread from Kula to Honua'ula. Sweet potatoes were also grown for export, and sugarcane was being cultivated by 1841. M.J. Nowlein and S.D. Burrows leased lands from Kamehameha III at Ulupalakua to grow sugarcane and Irish potatoes. In 1845, Nowlein and Burrows transferred their lease and interests to Linton L. Torbert, who extended sugarcane cultivation to adjoining lands and started cattle ranching. In 1856, Captain James Makee bought the Torbert Plantation and it was later referred to as the "Rose Ranch." By 1862, sugarcane was being extensively cultivated, and a steam mill was built for processing sugar. A severe drought in 1878 forced the end of sugarcane production, and cattle ranching became the dominant commercial enterprise of Honua'ula. By the 1880s, 'Ulupalakua Plantation was basically a cattle ranch utilizing the road and landing at Mākena in Papa'anui. Ranching continued to be practiced into the 1970s. However, the dominant economic and land-use theme since then has focused on tourism. The past three decades have seen the intensification of golf course, resort, and luxury residence developments in the Wailea and Mākena regions.

Land Tenure during the Historic Period

During the Mahele in 1848, lands of Hawaii were divided among the royalty, government, and commoners. Applications for land titles were considered by the Board of Commissioners to Quiet Land Titles. When a claim was validated, a Land Claim Award (L.C.A.) was awarded. Following payment of this claim, a Royal Patent (R.P.) was issued. Eleven individuals were awarded such lands in Ka'eo and Mohopilo. Eight of the awards included parcels used for sweet potato cultivation and house lots located in the coastal, intermediate (Mohopilo), and inland (Ulupalakua) zones. One of these also included a parcel used for the cultivation of Irish Potatoes. Three consisted only of single house lots. Table I presents pertinent data regarding the 11 awards. Portions of government lands were also sold as Grants. Grant 1508, Apana 1 and 2, and portion of Grant 3088, were awarded in the project area. Both Grants are located in Maluaka *Ahupua'a*, Honua'ula District. Grant 1508, Apana 1 (7.66 acres) and 2 (23.20 acres), was awarded to Makahanohano for $32.72 by Kamehameha III in 1854. Grant 3088 was awarded to Kanakahou for $64.46 by Kamehameha IV in 1871.

Table I. List of LCA in Ka`eo *ahupua`a*

Name	LCA #	Locality	Acres	Apana	Landuse
Hiapo	8071/2579	Mohopilo	9.76	2	Sweet potato & houselot
Hualii	2581	"	10:16	2	"
Kahaleokaia	4157	Ka`eo	22.10	3	"
Kaihe	2395	"	.20	1	houselot
Kaili	2395-B	"	.25	1	"
Kalama	4292-B	(Ulupalakua)	7.70	4	sweet potato & houselot
Kalili	2399	Mohopilo	10.17	2	"
Kiniakua	2658	"	7.10	2	"
Kohilae	2401	(Ulupalakua)	23.87	3	"
Meaweiki	3676	Ka`eo	0.324	1	houselot
Nawaiki	5402-B	"	6.81	1	Irish, sweet potato & house

PREVIOUS ARCHAEOLOGY

Winslow M. Walker with his fieldwork during 1929-30, provided the first modern archaeological descriptions of prominent surface remains, mainly *heiau*, on the island of Maui. However, much of the remains of daily life, the house-sites and other small associated features were not documented until several decades later, especially in the remote Mākena region.

Since the 1970s, the aforementioned intensification of land-altering activities associated with the expanding influx of tourism and in-migration of new residents has ironically provided the means for archaeological study of the region. Many archaeological studies have been conducted in Mākena, both within and in the neighboring vicinity of the current project area. Again, interested readers are referred to some of the previously completed reports (Gosser et al. 1993 &1996) that contain comprehensive summaries and reviews of past investigations in the region. For the purposes of the current report, those previous investigations completed wholly within or incorporating portions of the current project area will primarily be discussed. In addition, a few of the most recent work undertaken in the neighboring areas will also be briefly summarized.

Recent Studies in the Neighboring Area

One of the more recent projects located closest to the subject area was undertaken in two adjoining parcels (TMK 2-1-07:34 & 35) situated immediately south of Fairway 15 of the South Course of the Makena Prince Golf Course. An inventory survey was conducted as part of a due diligence, for the prospective purchase of the two parcels for a single-family residential development. Surface features including retaining walls, terraces, mounds (5089 Fe. 2 and 3), enclosures, portions of a fishpond wall, a pre-contact infant burial (5090) a small family historic cemetery enclosure (Fe.1) were present. A surface scatter of historic-period artifactual remains, along with several traditional artifacts was recovered. Test excavations confirmed the presence of multiple historic burials (5091) within an area specified by lineal descendants, apart from the known cemetery (Rotunno-Hazuka et al., 2002). Currently, the project is undergoing monitoring procedures.

Two other projects also occurred in adjoining parcels located immediately north and west of the Mākena Resort Corporation holdings *makai* of Mākena Alanui, near the existing Mākena Surf residential development at the junction of Mākena Alanui and the old Mākena-Keoneoio Road. The triangular lot (TMK 2-1-07:71) defined by the junction is the Cella residence, contained three sites consisting of an overhang shelter (Site 50-50-14-4505), a habitation mound (Site 4506), and a historic-period enclosure (Site 4504). Sites 4504 and 4506 have been preserved *in situ* (Fredericksen). Adjoining the Cella residence lot to the south (TMK 2-1-07:101), a multi-family residential development called Na Hale o Mākena, contained 6 sites composed of 25 features (Sites 3513-3518) representing habitation, agricultural, and marine exploitation activities (Spear et al. 2001). Pohakunahaha (Site 197) heiau occurs in an exclusion adjoining the southern boundary of this parcel. Unfortunately a burial platform associated with the heiau that was previously recorded by Kolb, was not re-identified during the aforementioned work, and due to its close proximity to the boundary line, was bisected during construction activities. This bisected burial as well as another burial located within a cavity of a wall adjoining the Na Hale o Mākena property were inadvertently discovered during recent construction activities. Both sites have been preserved *in situ.*

One additional area is a one-acre parcel (TMK 2-1-01:7 & 98) located on Nahuna Point, south of the other two project areas, along the coast on Mākena-Keoneoio Road. Four archaeological sites

(Sites 4524-4527) were recorded in this private residential property. Site 4524 is a *ko'a* that has been preserved *in situ*, Sites 4525 and 4526 were overhang shelters, and Site 4527 was a historic rock wall.

Numerous projects have been undertaken for the Mākena Resort Corporation. For a detailed summary of past work completed in the Mākena Resort (Seibu) holdings, the reader is referred to Gosser et. al 1996.

Previous Studies In and Adjacent to the Current Project Area

More than a dozen previous investigations, constituting various phases of archaeological research, ranging from surface reconnaissance to inventory surveys, have been performed within or incorporating portions of the current project area. Previous work has resulted in the documentation of 7 sites (Bishop Museum Sites 50-Ma-B9-218, 225, 229, 230, 233, 234 and State Site 50-50-14-1007, the Mākena School Parcel Historic Complex). Each of these investigations will be briefly summarized below and some are located on an overall project area map (Figure 3).

The first attempt at systematic documentation of surface remains on Maui occurred in 1973 during the Statewide Inventory of Historic Places implemented by the State Department of Land and Natural Resources. In that year, a large complex of coastal sites ("Makena Complex," Site 50-50-14-1266) was recorded in the area between Mākena Landing and Pu'u Olai. The five major feature types cited were; walls (numerous, mostly associated with ranching), enclosures (16+), one burial in wall, platforms (3+), and a pit. Although Site 1266 incorporated portions of the current project area, the map and descriptions were too general to correlate the surface remains and their locations to any of the currently extant sites.

In 1974, the Bishop Museum conducted a surface survey in approximately 1000 acres of Mākena properties for the Seibu Corporation (Clark 1974). This reconnaissance addressed Parcels I, II, IIIA, IIIB, and IV; and 120+ sites were recorded (Figures 4 and 5). Parcel I appeared to include portions of the project area, however the descriptions and map were unclear as to what areas constituted Parcel I. A total of 29 sites, consisting of 6 platforms (two house platforms), 17 enclosures, two wall segments, one rock shelter, a possible burial, a well, a small complex of three pens, eight agricultural terraces and a house platform; were recorded in Parcel I. Some of these features were most likely those cited in the Site 1266 complex documented during the Statewide Inventory.

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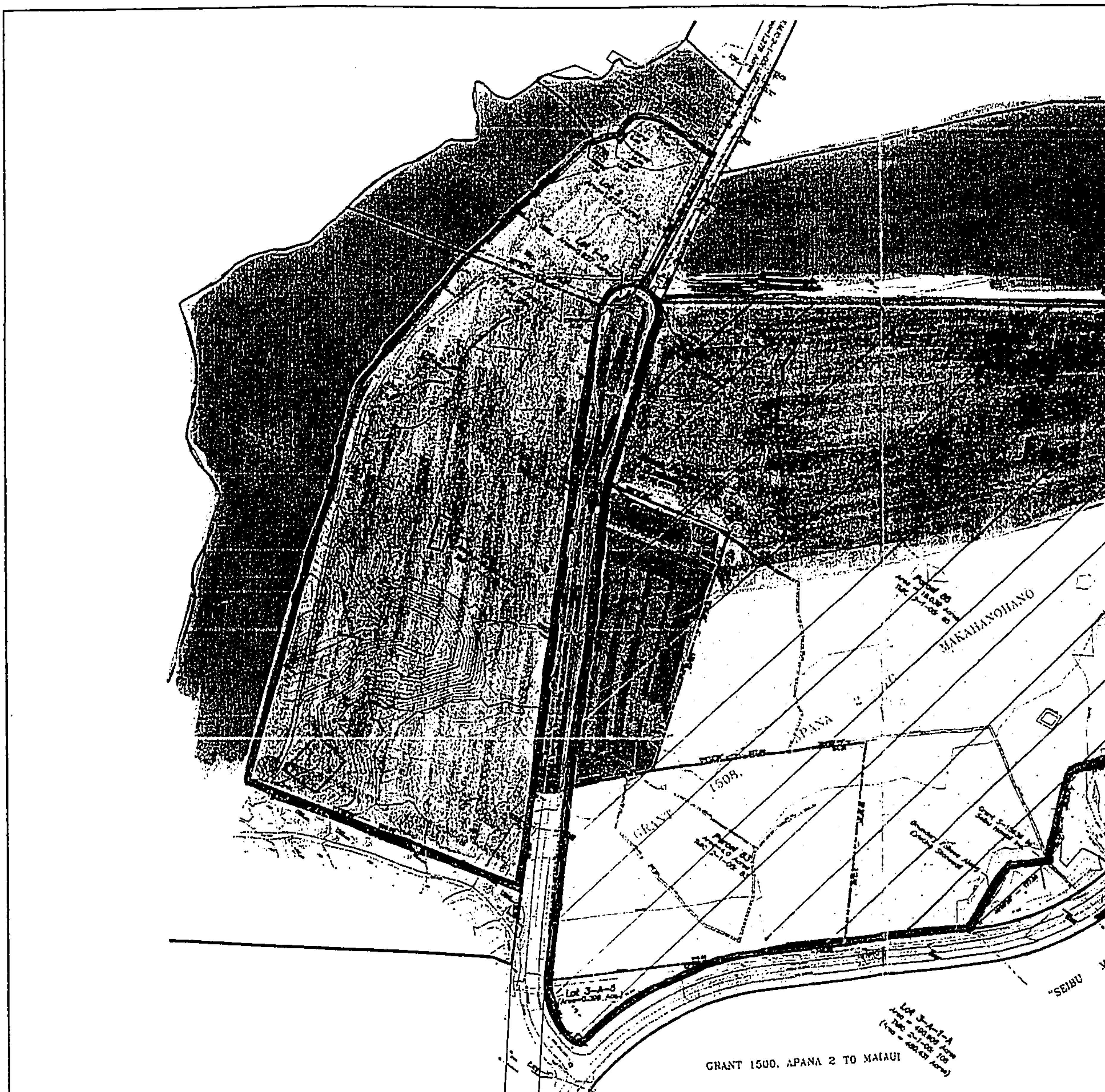

Figure 3. Location Map of Previous Archaeological

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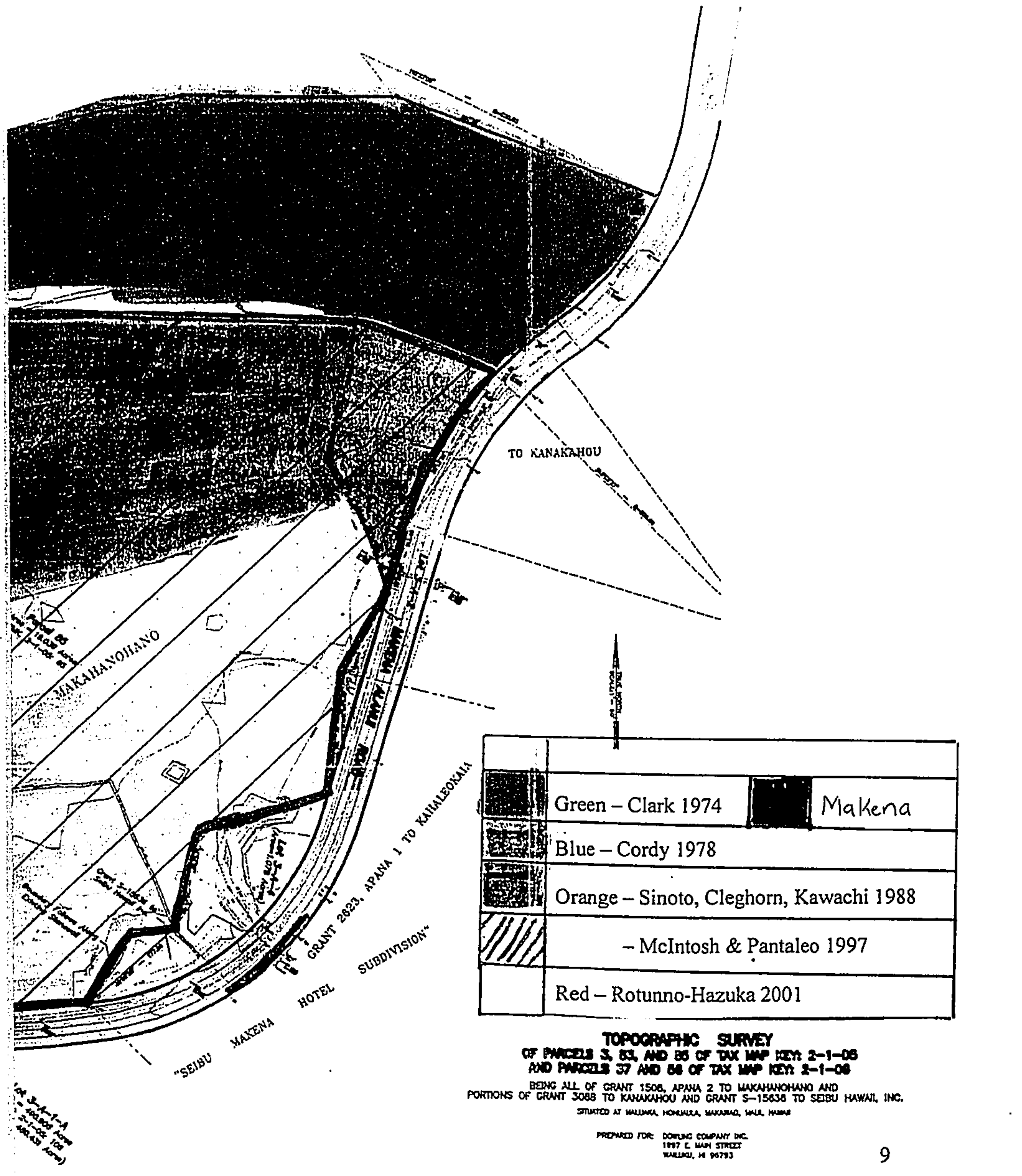

ap of Previous Archaeological Studies in or Adjacent to the Project Area

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In 1977, an archaeological reconnaissance survey undertaken in conjunction with the proposed realignment of the Mākena coast road for the *mauka* alternate route (the current Mākena Alanui), investigated the eastern periphery of the current project area (Figure 6-Davis & Bordner 1977 and EIS 1981). Site 1266, the "Makena Complex," was referenced, but it was located outside of the study area *makai* of the existing *makai* road (Mākena-Keoneoio Road). Site Complex 248, located on both sides of the survey corridor essentially included the sites recorded by Clark in 1974.

In early 1978, increment one of the proposed Seibu Golf Course was investigated by Bishop Museum (Haun 1978) and Site 50-Ma-B8-7 (State Site 50-50-14-1853), a complex of 12 features, was located in the coastal area north of Maluaka Point. Many of these features are believed to have been destroyed during the golf course construction; however, some remnants in the periphery of this complex still exist today.

In mid-1978, a survey of the third increment of the Seibu Golf Course (Fairways 1, 7-10, 17, &18) by the Bishop Museum recorded 76 sites, 7 of which were located in the current project area (Cordy 1978, Figure 7). Bishop Museum site numbers 218, 229-231, 233, 234 and 242 were assigned to these surface remains (Figure 3 and 7). No state numbers have been assigned to these sites. Currently, all 7 sites still exist, however only two in the project area (Sites 233, and 234) will be described in the following RESULTS section.

Site B8-7 recorded by Haun earlier as a 12-feature complex was separated into several discrete sites by Cordy. Haun's Features 2 and 9 were kept as B8-7; Features 1, 3, & 10 became B8-238, the midden scatter became B8-235, Feature 5 became B8-232, Feature 4 became B8-241, and the wooden shack and midden scatter not assigned feature numbers by Haun became B8-236. These sites are all presumed to have been destroyed during golf course construction. Haun's Features 6-8, 11, & 12 were neither re-recorded nor assigned discrete site numbers. Since Cordy's was the first study in which the locations and descriptions of individual sites were specific enough to allow relocation and correlation in the field, the data from this survey became the basis for all subsequent work in the current project area.

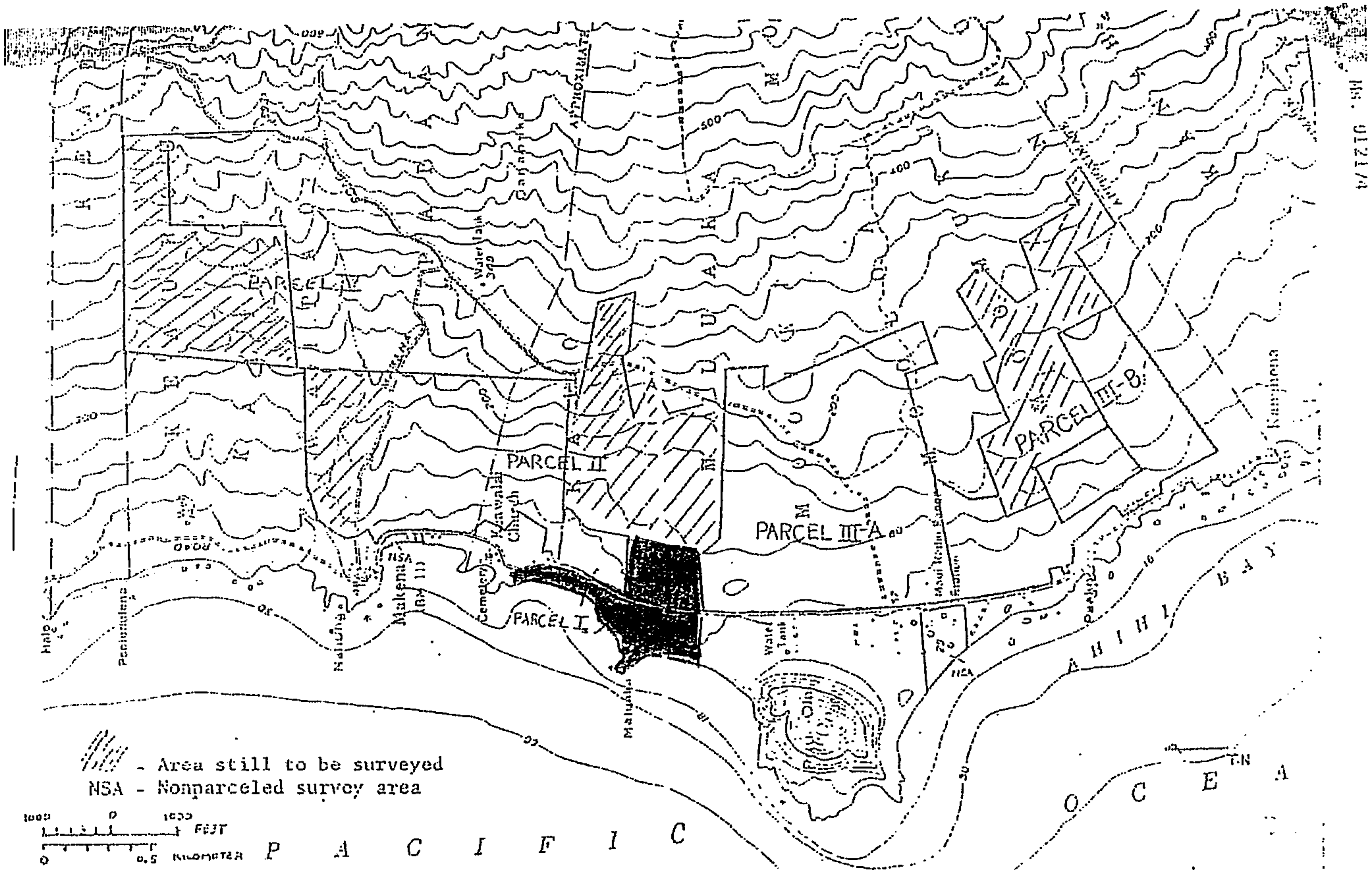


Figure 4. Parcel Location Map from Clark (1974)

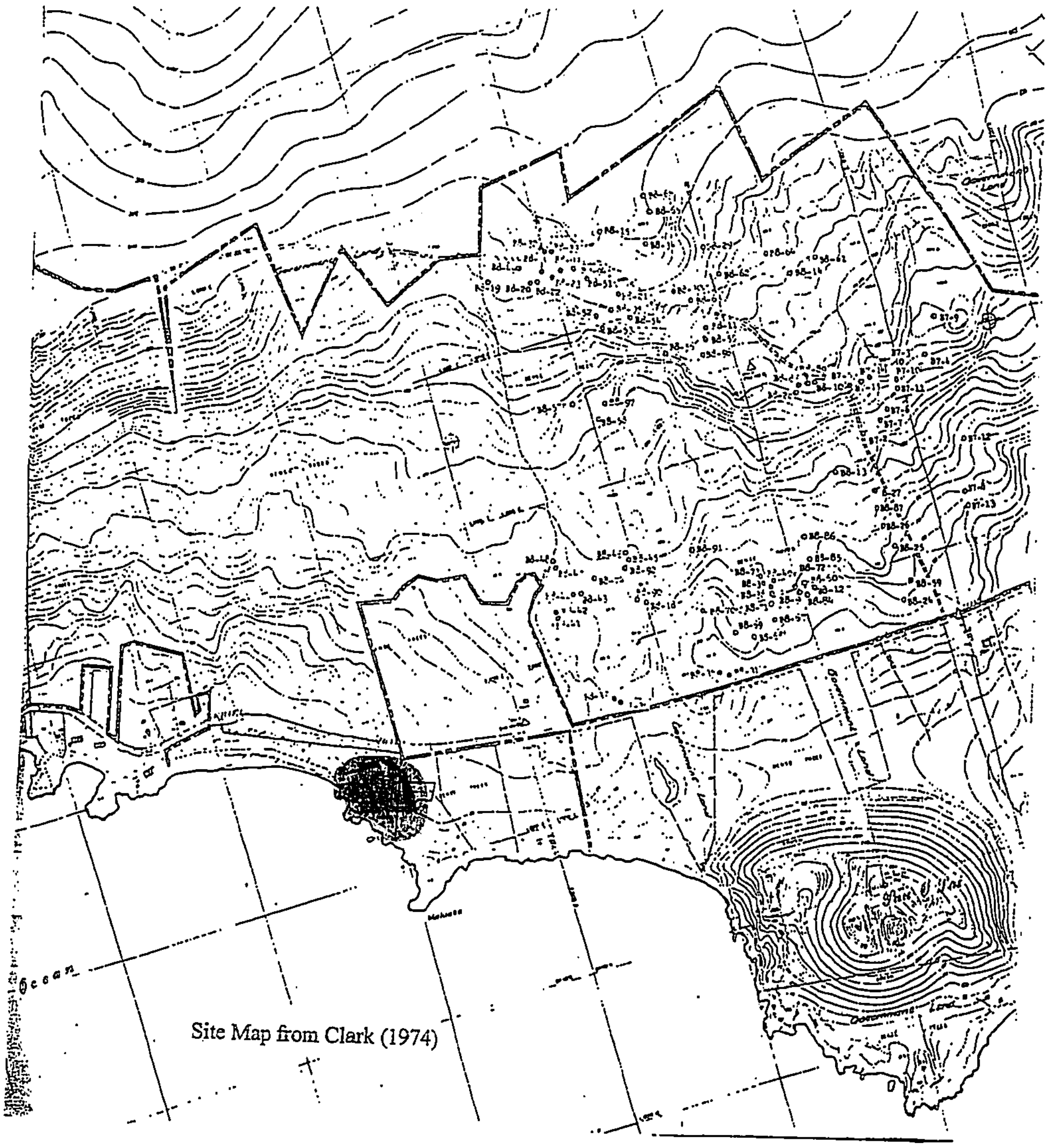


Figure 5. Site Location Map from Clark (1974)

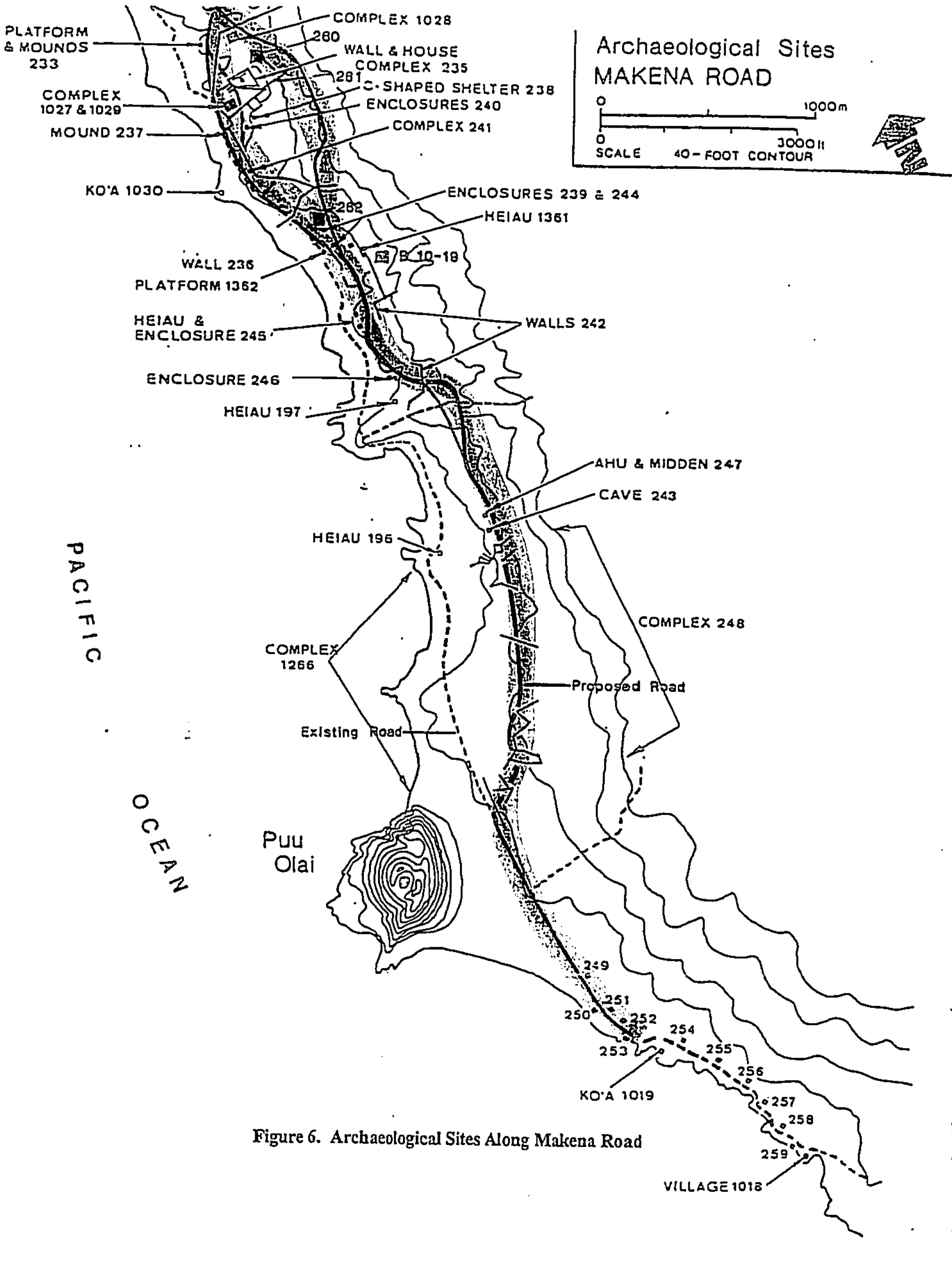
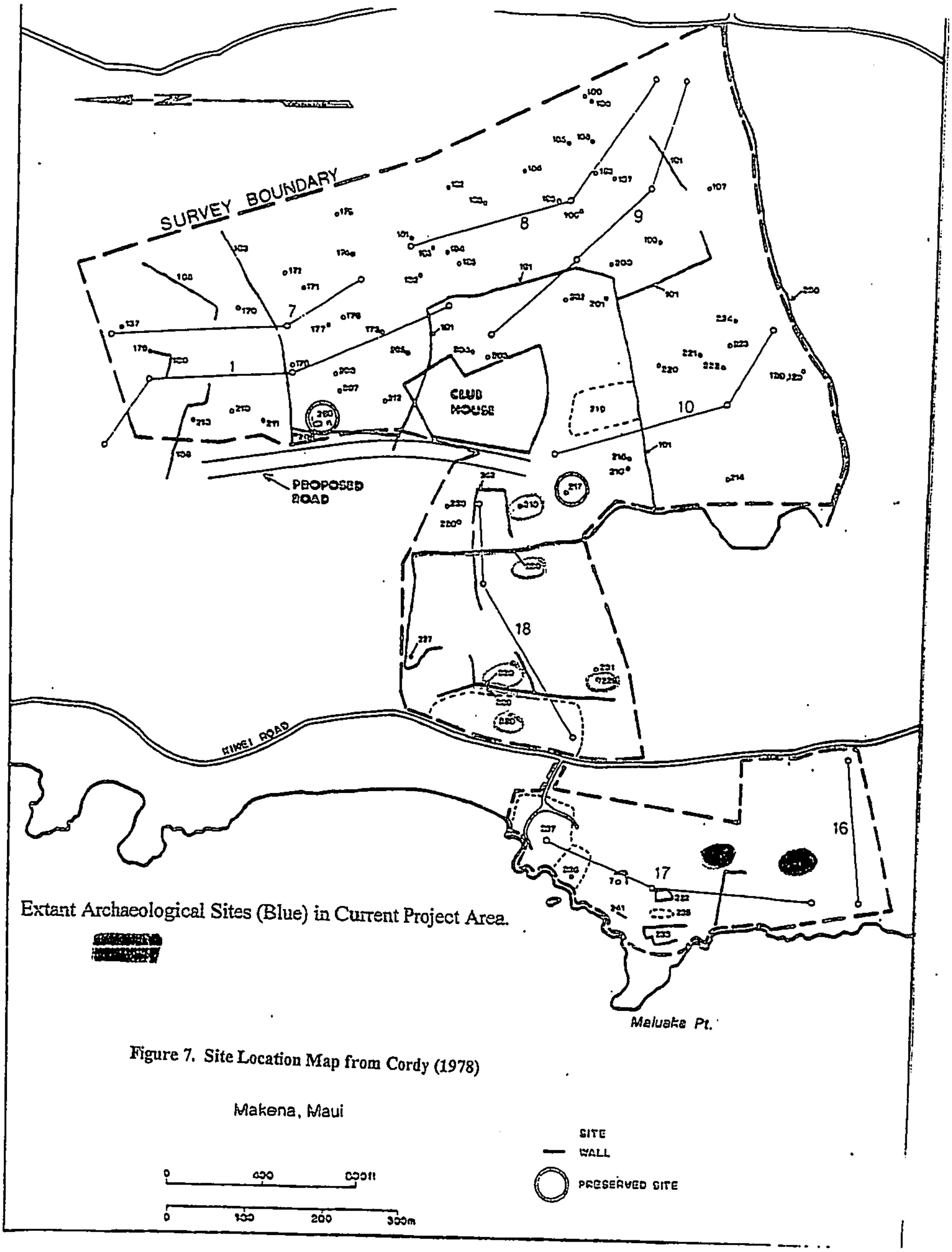


Figure 6. Archaeological Sites Along Makena Road



Extant Archaeological Sites (Blue) in Current Project Area.

Figure 7. Site Location Map from Cordy (1978)

In 1979, two surveys were undertaken in the proposed hotel and residential areas (Denision 1979 and Rogers-Jourdane 1979). Sites B8-111 and B8-112 were located in the current project area. Although the numbers were the same as those assigned by Haun, these were not the same sites. Site 111 was a remnant wall and Site 112 was a semi-circular enclosure. Both sites were tested and produced no subsurface cultural remains. Neither of these sites could be correlated with either Haun's or Cordy's sites based on description or location.

In 1985, intensive data recovery was undertaken at Site 50-Ma-B8-217, a modified outcrop platform originally recorded by Cordy and recommended for preservation. This site was in the path of the proposed Makena Alanui extension and required salvage excavations to be conducted. Minimal remains were recovered from the rock fill of the platform. The interpreted function was a probable sleeping platform (Komori 1985).

In 1988, a survey was conducted for the public beach parking lot (TMK 2-1-05:84) and the south cul-de-sac (TMK 2-1-06:37) for the Mākena-Keoneoio Road (Cleghorn, Kawachi, & Sinoto 1988). A complex of five surface features consisting of two walls (Fe. 1 and 2), two platforms/privies (Fe. 3 and 4), and a cement lined cistern (Fe. 5) with two curvilinear stone alignments around the base were documented and designated Site 50-50-14-1007 (Figures 3 and 8). Eight shovel probes were conducted with negative results. The structural features were thought to be associated with the Old Mākena School, formerly present in that location. Bishop Museum conducted subsequent data recovery at Features 3 and 4. Several historic period artifacts were collected and some internal wooden structural members from the old privies were found, but a formal report was never completed (Hurst, postfield summary letter, 1988). Feature 5, the cistern, was filled and preserved *in situ* in an area adjoining the parking lot to the south. Later, the cul-de-sac area was monitored during construction and installation of landscaping and irrigation. No significant subsurface features were encountered during the construction activities.

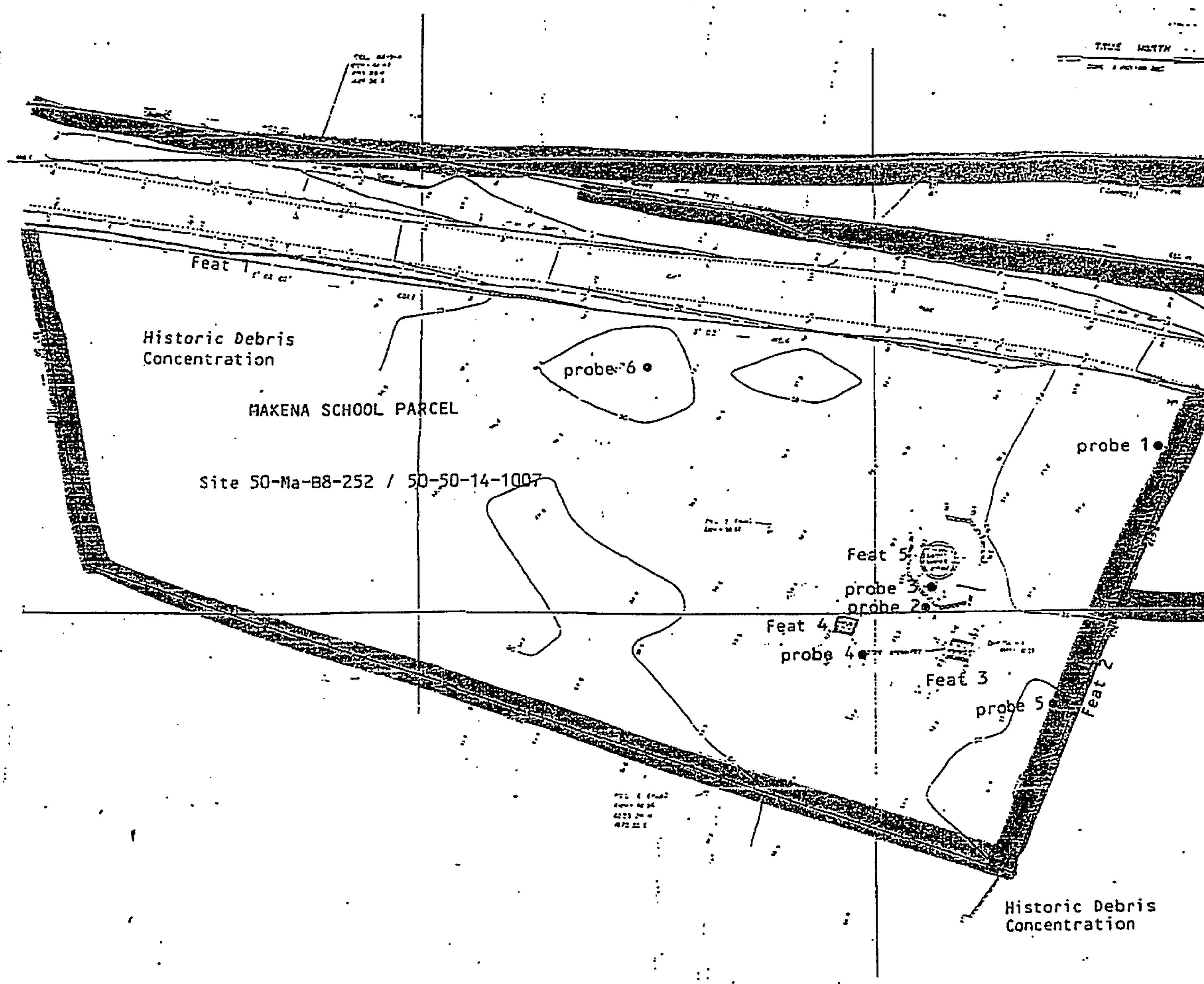


Figure 8. Location Map Showing Site 50-50-11-1007 The O

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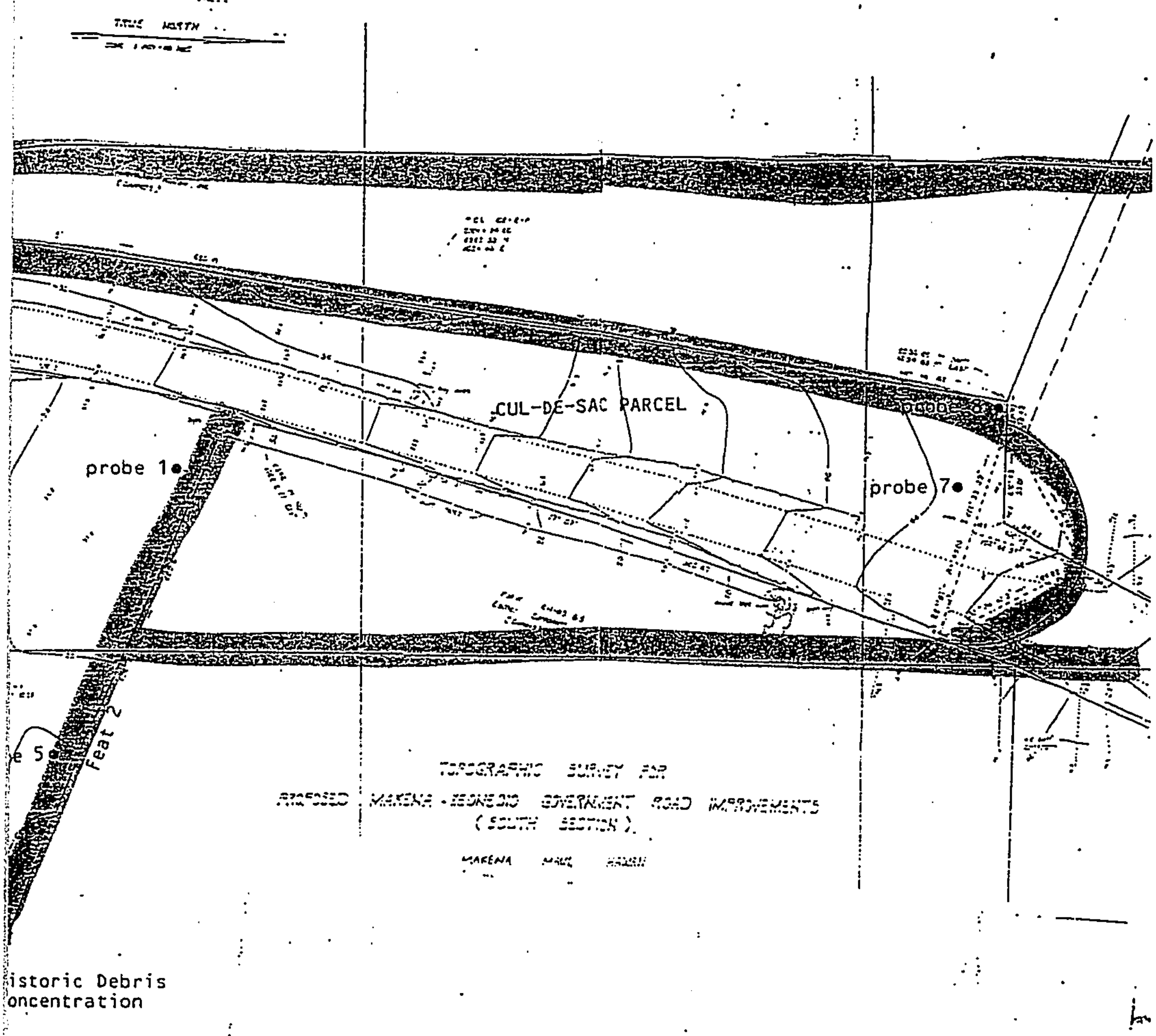


Site 50-50-11-1007 The Old Makena School Complex

In 1997, inventory survey fieldwork for a State Land-use Boundary Amendment petition for six areas, including a portion of the *mauka* section of the current project area as Petition Area 5, was completed (McIntosh and Pantaleo 1998). This undertaking included a review of previously completed work and surface assessments of selected areas and limited subsurface testing where warranted. No further fieldwork, beyond the relocation of previously documented surface features in Petition Area 5, was performed during this assessment (Figure 3 and 9).

On two separate occasions in 1994 and 2000, subsurface testing procedures were implemented at the former Poepoe property (TMK 2-1-05:83) at the request of the family. The objective of these attempts was to locate an infant burial from the 1930s. During the first attempt, Mrs. Cresencia Poepoe from O`ahu was present to oversee the procedures. No remains were found during the first attempt. For the more recent procedure, Mr. Fred Kanoho of Maui, another descendant familiar with the burial location assisted with the search, unfortunately, also with negative results. Several additional areas were investigated with negative results. Based on the age of the individual, absorption of the skeletal remains by the acidic soil was a possibility. However, the absence of any evidence of a burial pit was perplexing. One alternative theory is that, since the interment was at the base of a large mango tree near the house and no remains of that tree could be found, perhaps the burial and pit were displaced when the tree or its stump was removed.

SETTLEMENT PATTERN

The general pattern of extant archaeological remains in the Makena area appears to consist of prehistoric and historic permanent habitation along the coastal areas with isolated pockets of agricultural activity transformed into more extensive clusters of *kula* type features in the inland areas around the 200-foot elevation. Limited permanent and some temporary or seasonal occupation sites occur in the inland areas in association with agricultural complexes. Site densities and complex features are expected to focus around Ka`eo *ahupua`a*.

The variety of available archaeological data as well as historic documentation indicates a traditional subsistence base dependent on marine exploitation and limited dryland cultivation for the Mākena region. The "Makena Agricultural System," as previously defined by Cordy (1978), Haun (1978), Cordy and Athens (1988), and Gosser et al. (1996), is characterized by discontinuous areas of cultivation associated with permanent and temporary habitation features.

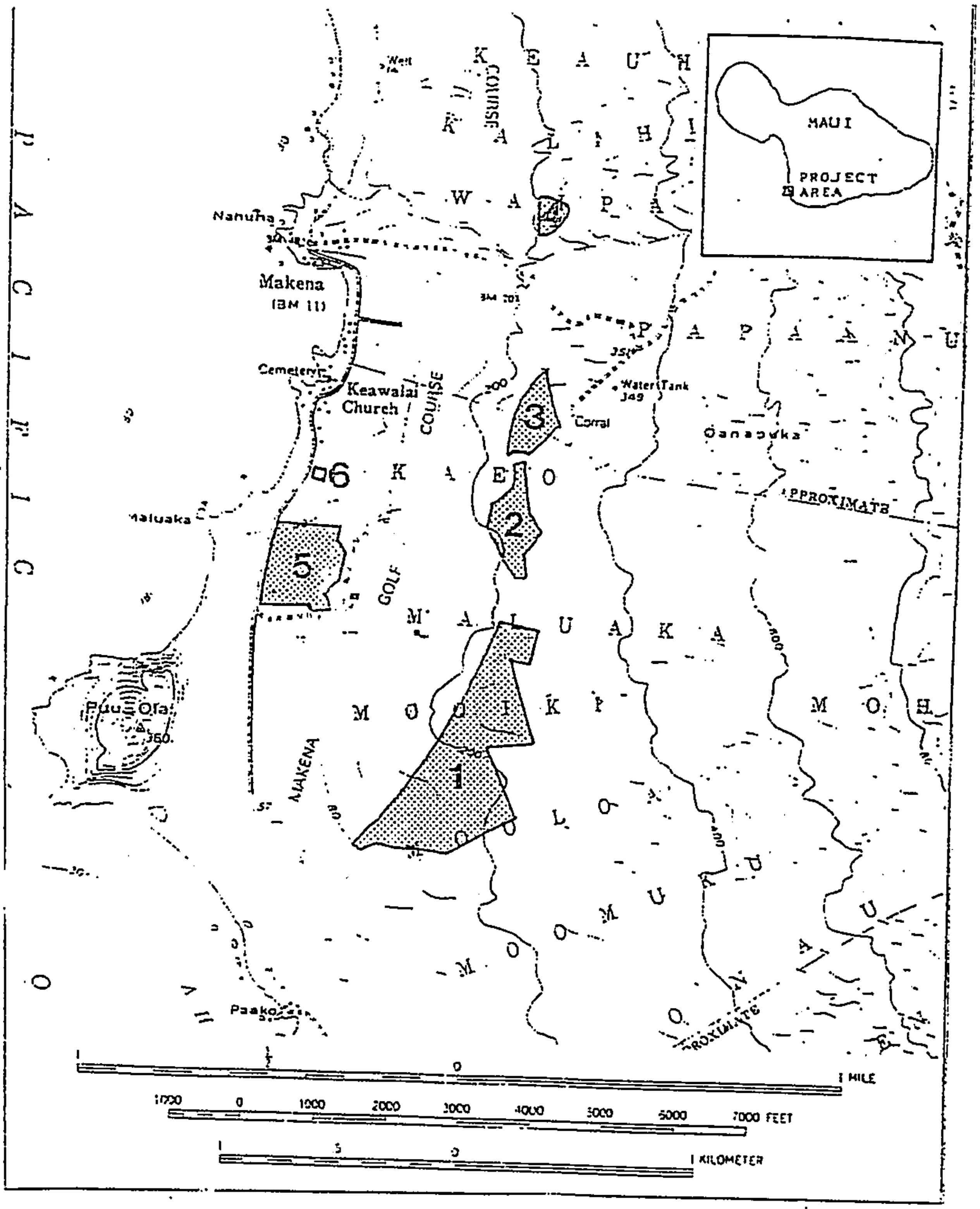


Figure 9. Site Map from McIntosh and Pantaleo (1997)

Gosser suggested that "agricultural pursuits in the Makena region were small-scale and probably on the level of family garden horticulture. The relative abundance of terraces, low retaining walls, mounds, and the absence of formal irrigation features, suggests that most of the farming was restricted to crops such as sweet potato and dry-land taro (Gosser et al. 1996:16)."

Both Gosser (1996) and Titchenal (1996) have pointed out that walled agricultural complexes or *kauhale* occur inland and appear to be situated along fairly uniform elevations. These *kauhale* appear to be unique components of the "Makena Agricultural System" and exhibit fundamental differences from *kauhale* defined in neighboring areas such as Palauea and Wailea. Based on higher site densities, due in part to relatively higher rainfall, Ka`eo *Ahupua`a* has been suggested as the focus of settlement in Mākena (Cordy 1978, Sinoto 1980). Historic period permanent habitation concentrated along the coastal areas as suggested by Jones (1994). Some of the larger walled complexes and structural features in the inland areas have also been attributed to the major efflorescence of commercially-driven agricultural pursuits of the mid-1800s (Titchenal 1966).

SITE EXPECTABLITY

The discussions in the preceding sections indicate the types of sites expected in the current project area. Permanent habitation features, such as walled historic house compounds, other historic structures, enclosures, platforms, *ko`a*, *heiau*, limited agricultural features, and ranch walls and other ranching-related structural remains are expected in the coastal areas of the Mākena region.

METHODOLOGY

To adequately address the scope of the current inventory survey, specific tasks were undertaken in accordance to standard and accepted archaeological practices and techniques during the survey, testing, and laboratory phases of this project. The tasks included:

1. Background documents and literature compilation,
2. Systematic surface survey of project area,
3. Recording of pertinent data, and plan and locational mapping, as warranted,
4. Subsurface testing, as warranted,
5. Laboratory procedures, as required,
6. Synthesis of data,
7. Report write up, editing, and production, and
8. Coordination with the State Historic Preservation Division.

The following subsections present the methods employed during each phase of the current undertaking. Fieldwork was performed by Ms. Jenny Lyn Pickett (B.A.) and Mr. Ian Bassford

(B.A) from July-August 2001, under the overall direction by Ms. Lisa Rotunno-Hazuka (B.A.) and Mr. Jeffrey Pantaleo (M.A.).

Survey Methods

The surface survey consisted of systematic east/west transects using the Mākena-Keoneoio Road and the golf course and shoreline for the *makai* section. Survey transects were spaced at 5-10 meter intervals based on visibility due to vegetation density. Previously unrecorded remains were documented through photographic records, forms, and site maps. Updated condition reports were made for previously recorded sites as warranted. Temporary site designations were assigned to new sites and for previously recorded sites, the existing site numbers in Bishop Museum or State nomenclature, will continue to be used.

Testing Methods

Subsurface testing was undertaken at selected features and included manually excavated, controlled test units as well as a few shovel and trowel probes for expedient stratigraphic comparisons, determination of the nature of deposition, and confirmation of presence/absence of subsurface cultural remains. Controlled test excavations were performed in selected sites and excavated by natural stratigraphic layers, in 10 cm levels in strata greater than 10 cm in thickness. All soil was excavated through nested 1/4 and 1/8 inch mesh screens and midden, artifacts, and other samples were collected and processed at the lab. Profiles were drawn for each unit and soil color and texture determined using the Munsell color system.

Laboratory Methods

All midden, artifacts, and other samples were initially processed by being accessioned, sorted, and cleaned. Then following other pertinent procedures the artifacts were analyzed, catalogued, and photographed; the sorted midden weighed and tabulated, and carbon samples cleaned, dried, and submitted for radiocarbon analyses. All recovered artifacts and samples will be prepared for temporary custodial curation at the Archaeological Services Hawaii laboratory in Wailuku. In addition, all field notes, maps, photographs, and other documentation generated during the course of this project will be curated at the offices of Archaeological Services Hawaii in Wailuku.

State Site Numbers

Permanent State site numbers will not be assigned, at this time, to newly recorded sites or to previously recorded sites with Bishop Museum numbers. The State Historic Preservation Division is currently in the process of clarifying the numbering of sites specifically in the Mākena Resort area (pers. comm. Mr. Aki Sinoto with SHPD-Oahu personnel). Permanent State site numbers shall be assigned when the existing numbering problems have been reconciled.

RESULTS OF FIELDWORK

During the course of the current inventory survey, six (TS18, 20, 21, 22, 25 and 26) newly identified sites were documented and three previously recorded sites (233, 234 and 1007) were relocated within the project areas (See Figure 2). Most sites exhibited disturbances primarily by a bulldozer. Two areas may have contained paving however due to the damage by the dozer, this supposition was inconclusive. Three of the new sites were tested (TS18, 20, 21, 25). The testing demonstrated that generally the Mākena area manifests a three layer stratigraphic sequence, consisting of an A-horizon overlying various strata of natural or cultural layers and the characteristic yellowish-brown Makena loam or solid bedrock as the culturally sterile basal substratum. The generic stratigraphic sequence for the Mākena region is as follows:

> **Layer I:** A-horizon consisting of a dark yellowish-brown (10YR 3/4 - 4/4) to dark grayish-brown (10YR 3/2) and very dark brown (10YR 2/2), very fine to fine-grain, non-sticky, non-plastic, powdery silt loam with abundant roots, rootlets, and rocks.
>
> **Layer II:** Cultural layer consisting of a dark yellowish-brown (10YR 3/4 – 4/4) to very dark grayish-brown (10YR 3/2), brown (10YR 4/3), and black (10YR 2/1), non-sticky, non-plastic, very fine to fine-grain, silt; or Non-cultural layer consisting of a dark yellowish-brown (10 YR 4/4), non-sticky, non-plastic, very fine to fine-grain, silt.
>
> **Layer III:** Basal layer consisting of a dark yellowish-brown (10YR 4/4 – 4/6) to yellowish-brown (10YR 5/6), non-sticky, non-plastic, powdery silt with or without saprolytic rocks; or solid bedrock substratum.

PREVIOUSLY RECORDED SITES

Two of the sites, recorded by Cordy during his 1978 survey, were still found to be present within the current project area (Figure 2). The changes in the golf course that have occurred since 1978 should be noted, since the holes, tees, and fairways are used as references in the site descriptions. Holes 16, 17, and 18 from 1978 are now 6, 7, and 8. One other known site, the Mākena School Parcel Historic Complex, recorded in 1988 was also still extant. Unfortunately, plan maps for these sites could not be retrieved in time from the Bishop Museum archives, to be included in this report.

Site 50-Ma-B8-233

Cordy's description was as follows:

> Enclosure
> This is a large rectangular enclosure near a large coastal gulch at Hole 17. The structure is 17.8 by 8.0 meters (142 sq. m) with a high, wide wall (1.4 to 1.6 meters high, 1.0 meter wide) and no entrances. No midden was present, but historic artifacts were found. One excavation square was dug inside the structure (Cordy 1978:76).

Site 233 is located *makai* of the Mākena-Keoneoio Road just north of a large gulch. This rectangular enclosure was in good condition during this field study (Figure 10). Cordy tested this site and recovered historic artifacts consisting of aqua (1880-1910) and clear (1880-present) glass bottles, wire nails, and a tin canteen cup. Cordy postulated that this site was probably utilized during the 1940s and possibly functioned as a storage site (Cordy 1978:30). No additional testing was undertaken during the current survey.

Discussion

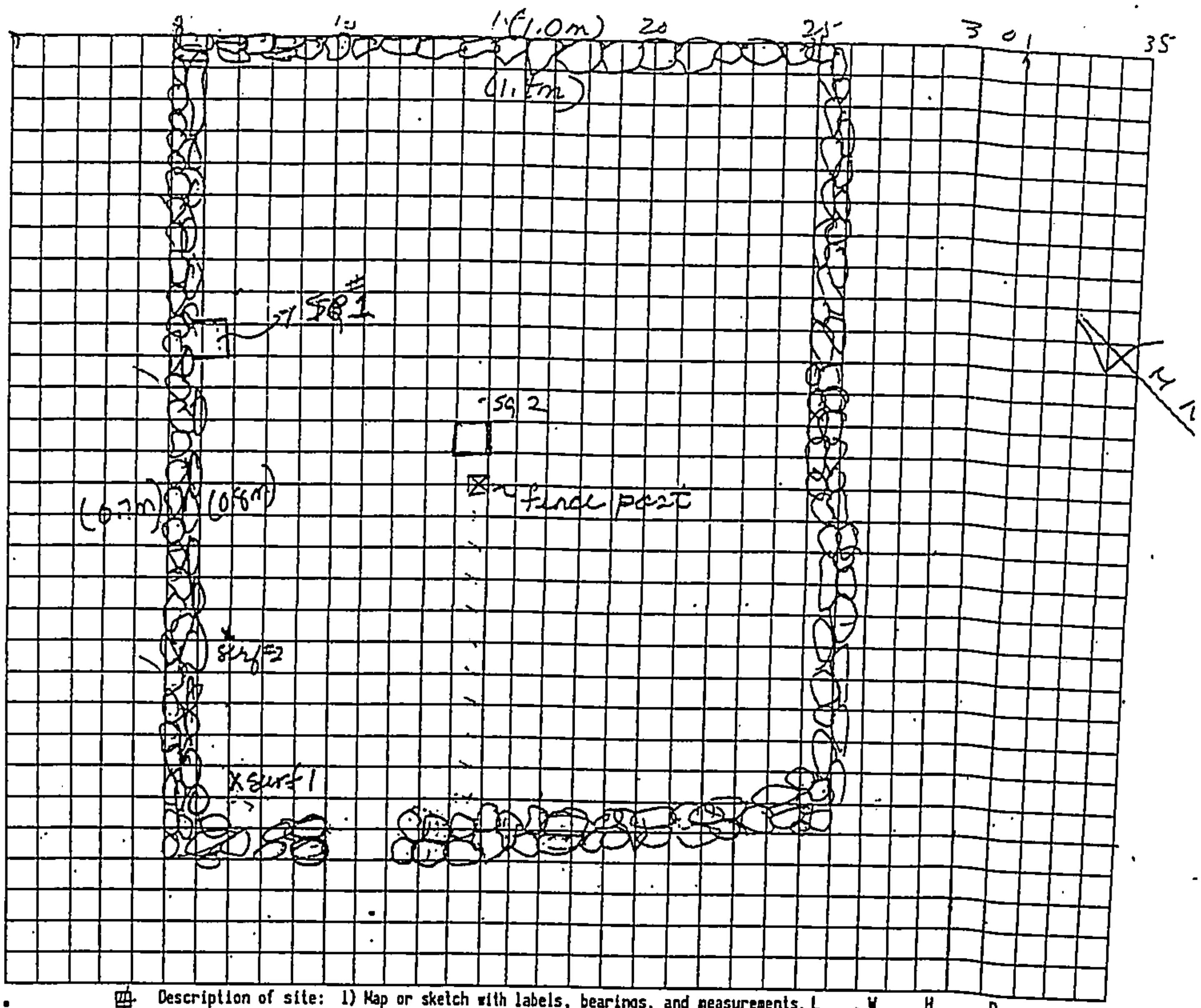
This site will be further analyzed during data recovery procedures.

Site 50-Ma-B8-234

Cordy described this site as:

> Enclosure
> This site is south of the major gulch at hole 17. It is 20.3 by 26.8 meters (544 sq. m) with an opening in the south wall. Walls are 0.7 to 0.8 meter high and 0.5 to 0.8 meter wide. A wood post with square nails is in the center of the structure. No midden was visible. Two excavation squares were dug, and a soil sample was taken (Cordy 1978:77).

This site, also located in the *makai* section, is south of the gulch near the southwestern corner of the project area. This is another large square enclosure with an opening in the south wall and a wooden post located in the center of the structure (Figure 11). The site measures 26.8 (e/w) by 20.3 (n/s) with walls that are .7-.8 meters high and .5-.8 meters wide (Figure 12). Cordy conducted test excavations totaling 2.0 sq. meters, but recovered only bottle glass fragments that appear to date from the 1880s and concluded that this site probably functioned as an animal pen during the early to mid 1900s (Cordy 1978:30). No additional testing was undertaken at this site. Site 234 will also undergo data recovery procedures.



Description of site: 1) Map or sketch with labels, bearings, and measurements, L___, W___, H___, D___; 2) Scale, orientation, local setting, aids to relocation, reference to near-by sites; 3) Construction technique and material (kinds, size, etc.); 4) Features: fireplaces, postholes, cysts, etc.; 5) Cultural deposit (midden, artifacts).

20.3 X 26.8 = 544 m²

Walls = 0.50 to 0.8 m wide — 5 to 8 courses high

Surf 1 = glass bottle

Anthro Dept Record
Grp 6, Box 51

Figure 10. Plan View of Site 233 (From Bishop Museum Records)

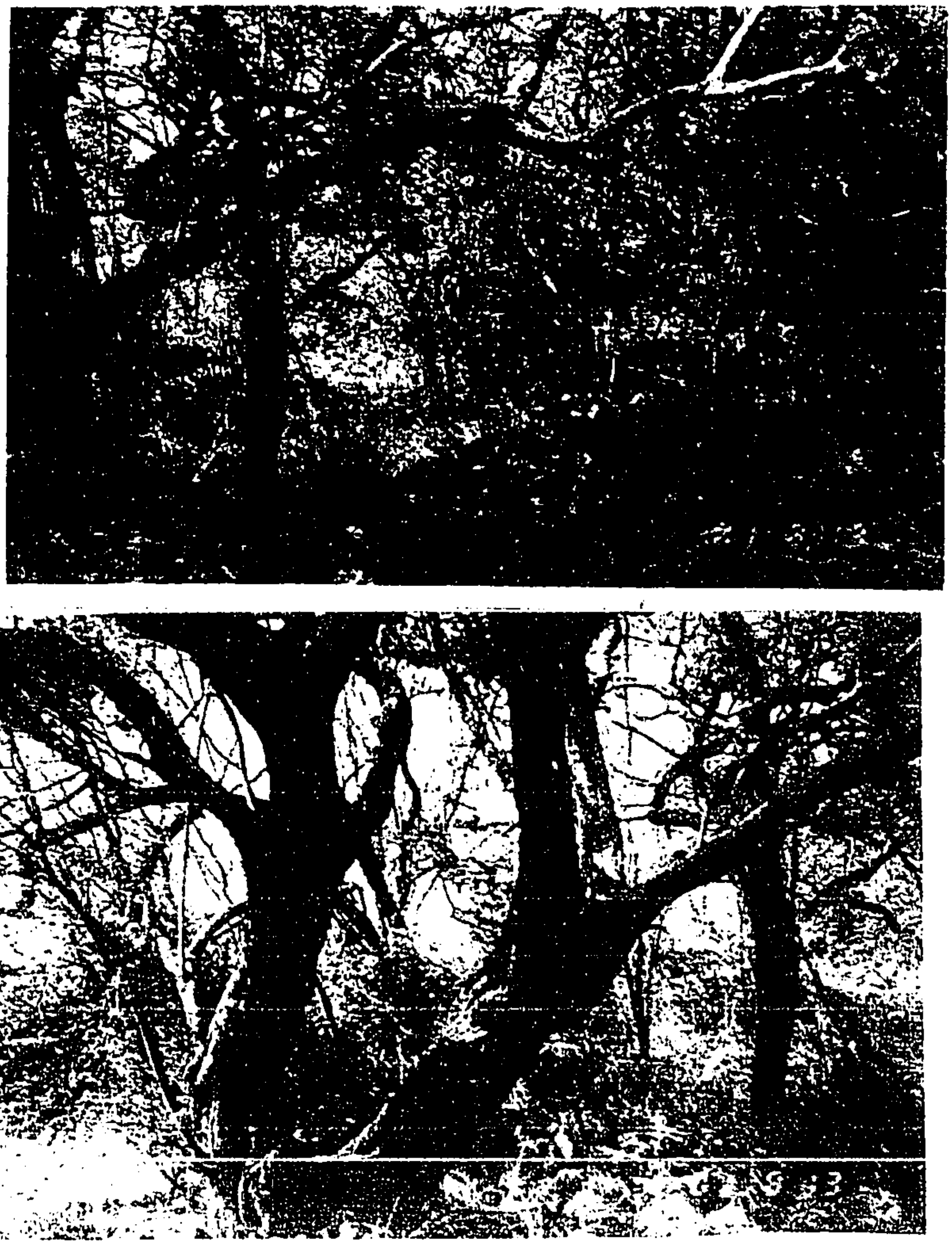
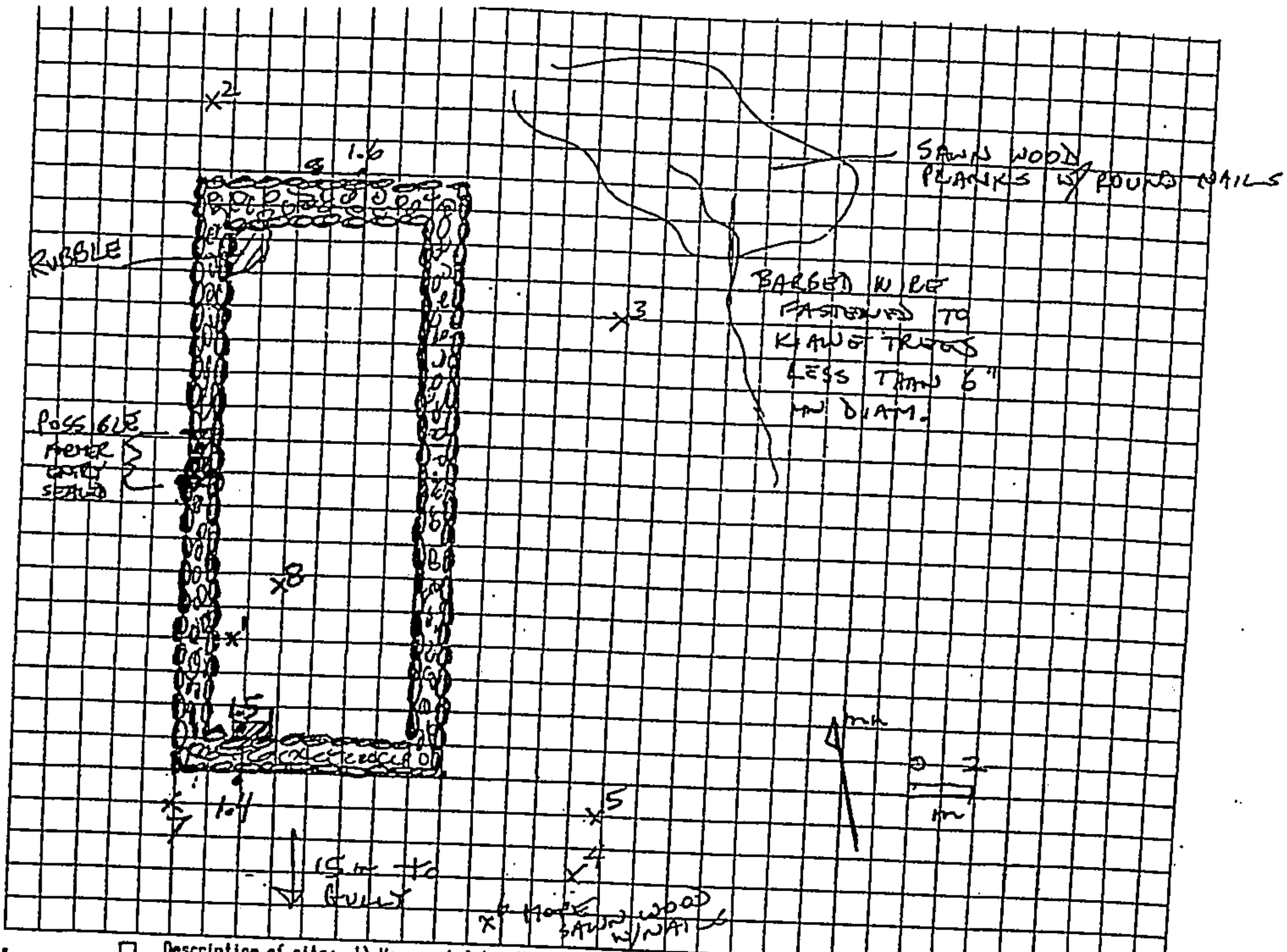


Figure 16. Overview of Site 234-Enclosure



Description of site: 1) Map or sketch with labels, bearings, and measurements, L___, W___, H___, D___; 2) Scale, orientation, local setting, aids to relocation, reference to near-by sites; 3) Construction technique and material (kinds, size, etc.); 4) Features: fireplaces, postholes, cysts, etc.; 5) Cultural deposit (midden, artifacts).

17.8
8.0

17-2 ENCLOSURE

17.8 x 8.0

Anthro Dept. Record
Grp 6, Box 51

EXCAV.

9-10 cm TOTAL DEPTH

I = humus — 3 cm
II = orange-ish brown + outcrop rock

Wall rests on II

SURFACE ARTIFACTS

1 METAL BAND
✓ 2 BARBED WIRE
✓ 3 METAL HOOK
✓ 4 MESS TIN
✓ 5 COCA COLA
✓ 6 GLASS
✓ 7 REEL
8 METAL + GLOVE

Figure 12. Plan View Map of Site 234 (From BPBM records)

Site 50-50-14-1007

This site, the Mākena School Parcel Historic Complex with five features, was previously described as:

> 1. A crude stacked wall roughly 80 meters long, 0.8 meter wide, and 0.5 meter high parallels the Makena road and forms the western boundary of the southern half of the parcel. The utilization of waterworn stones suggests modern origins. Also extensive past disturbance is indicated. According to a Territorial Survey Map (CSF No. 2809), this wall was in existence in 1936 and extended along the entire length of the western boundary of the parcel.
>
> 2. A core filled, double faced wall approximately 0.8 meter wide, and ranging from 0.4 to 1.0 meter in height defines the northern boundary of this parcel. The northern parcel boundary is roughly 76 meters, however, the wall continues eastward beyond the limits of the parcel. The more diagnostic construction of this wall contrasts markedly with that of the Feature 1 wall and suggests a traditional land boundary.
>
> 3. A roughly square (3.0 by 2.7 meters) platform constructed of a single course of basalt boulders is 0.27 meter high along the western side and flush with the ground surface along the eastern side. A two by eight length of lumber is centrally incorporated into the structure, dividing it into east and west halves. The western half is boulder filled and the eastern half is a depression. Several square nails, 8 centimeters in length protrude from the lumber.
>
> 4. Another platform almost identical in construction with Feature 3 measures 3.3 by 3 meters. This structure also incorporates a depression and a length of lumber.
>
> 5. A large cement-lined cistern, 4.5 meters in diameter and 3 meters deep is located west of the two platforms. Two irregular stone alignments appear to partially encircle the cistern. The Mākena loam material resulting from the excavation of the cistern appears to be contained within the encircling alignment. At the top edge if the cistern is six slots that probably held a wooden cover (Cleghorn, Kawachi, and Sinoto 1988:5 & 7).

Currently, all of the features, except for Feature 5 were destroyed when the parking lot was constructed. Data recovery was undertaken at the two platforms, which were interpreted to be privies associated with the school, by Bishop Museum. A post-field summary letter is available, but a formal final report appears never to have been produced. The cistern was recommended for *in situ* preservation. It has been filled in to ground level and preserved in place. No additional work was undertaken at this site during the current survey.

NEWLY RECORDED SITES

Six previously undocumented sites assigned temporary site (TS) 18, 20-22, 25 and 26 were recorded during the current inventory survey. They consisted of various wall segments, modified outcrops (TS 20, 21, 22 and 25) and structures (TS 18 and 26). Three of these sites (TS 20-22) were tested with negative results. The description of these sites and testing results is presented below.

Temporary Site 18

This site is located within the northern half of the project area. It is a low-walled C-shaped structure that opens to the east (Figure 13). The feature is generally disturbed but maintains some integrity along the north wall and bounds a rocky soil. It is constructed of piled angular and saprolitic basalt forming a C-shape. This feature measures 5.8 by 3.7 m (240 degrees) and the walls range in height from .10 to .24 m and are approximately 2.0 meters wide

Testing

No midden, artifacts, or manuports were observed on the surface in or around this site. A .25 sq. m test unit (TU1) was centrally placed on the interior floor to determine presence/absence of subsurface cultural materials. TU1 revealed three stratigraphic layers similar to that generally found in the project area (Figure 14).

> **Layer I** (0-5 cmbs), dark yellowish brown (10YR 3.4), non-sticky, non-plastic silty loam associated with decaying leaf and twig matter.
>
> **Layer II** (5-26 cmbs), dark yellowish brown (7.5 YR 5/8), non-sticky, non-plastic silt with some angular cobble inclusions. Layer II terminates on uneven bedrock and pockets of Layer III.
>
> **Layer III** (18-35 cmbs), dark yellowish brown (10YR 4/6), non-sticky, non-plastic silty clay with bedrock and a few rootlets.

Discussion

This feature type may be utilized for either temporary or permanent activities. As a temporary feature it could be utilized for shelter during marine exploitation, or when part of a permanent complex, the morphology of this structure is typical for a specific activity (i.e. food preparation, storage, work shop for fishing and building implements). Due to the negative findings, and that this site was partially destroyed, it will not be recommended for preservation and incorporated into future development plans. However, it is recommended that additional testing be performed on this feature during the data recovery phase in an attempt to ascertain its function and chronology.

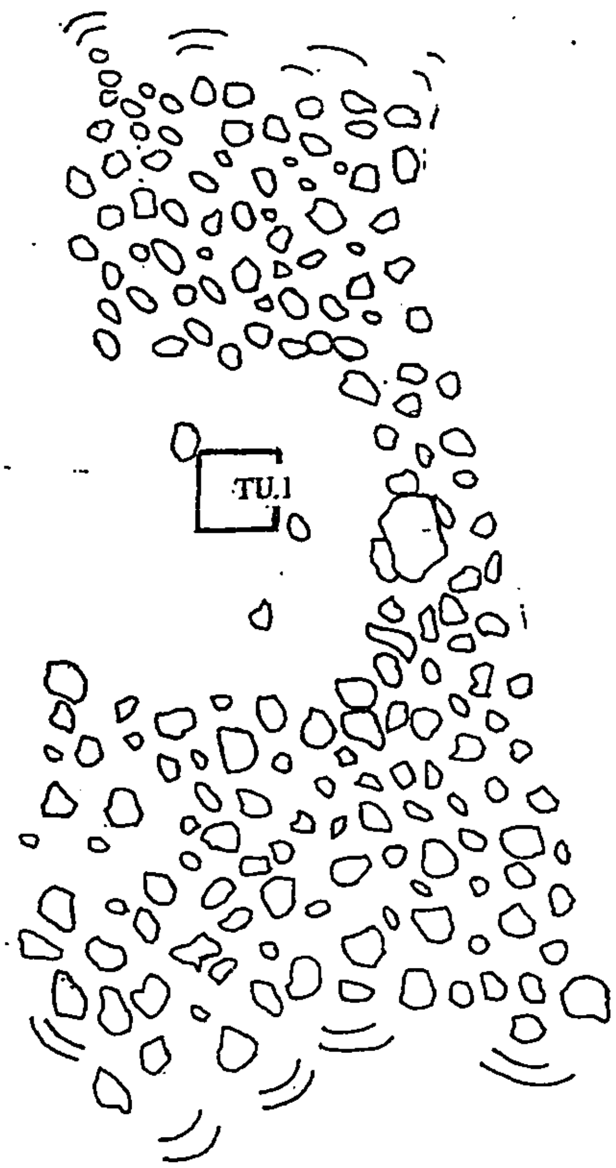


Figure 13. Plan View Map of TS 18

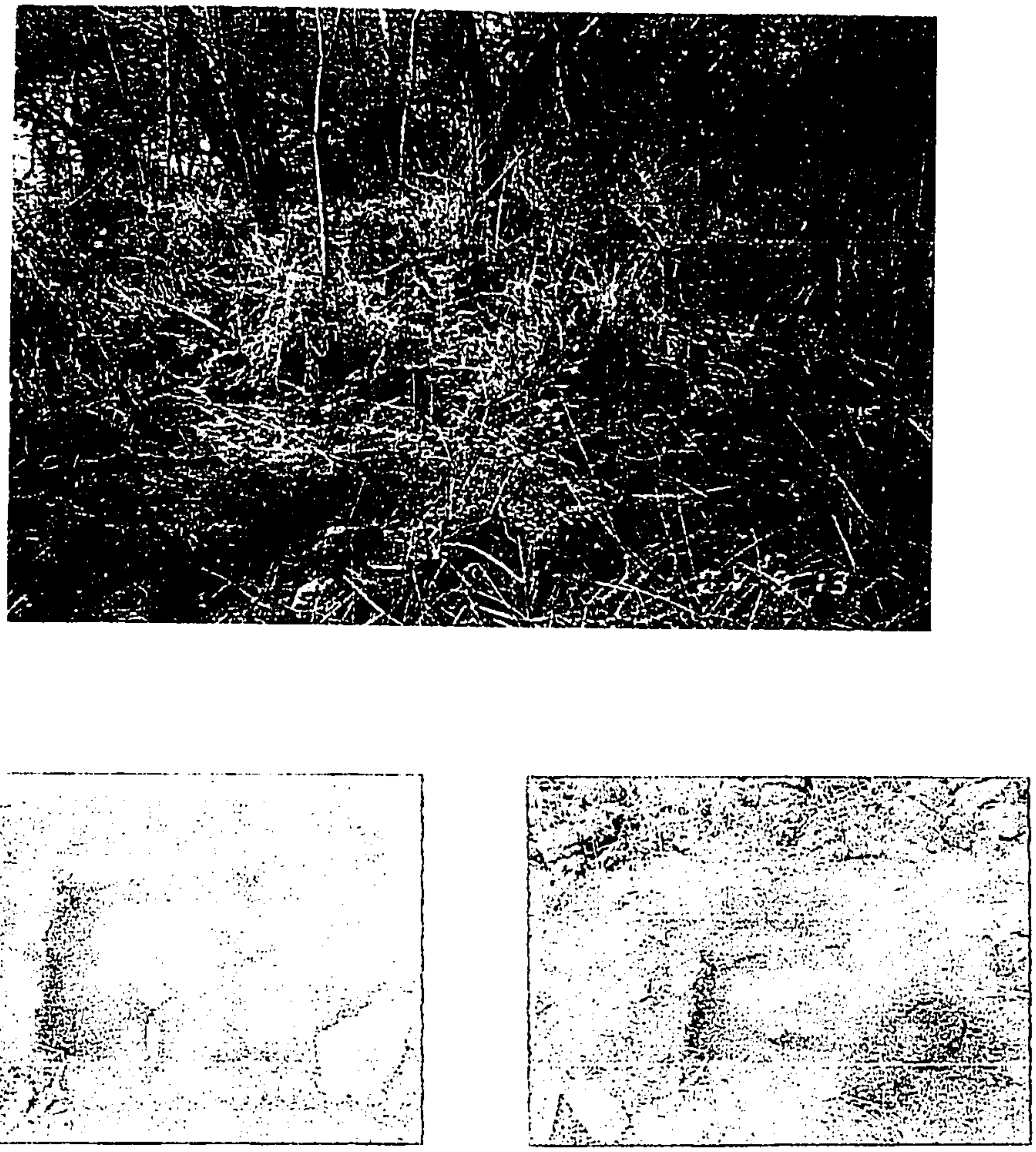


Figure 14. Top: TS 18, View to North, Bottom: Excavations of TU. 1-TS-18

Temporary Site 20

This site is a rectangular modified outcrop located along the top of a ridge in the southwestern portion of the project area. It is constructed of stacked and piled basalt cobbles and boulders on an outcrop and measures 7.7 by 7.2 m (Figure 15 and 16). It is oriented northeast-southwest along its long axis. The southern and southeastern sides exhibit remains of a facing, while the remainder of the feature is tumbled due to disturbances by previous bulldozing activities. The southern side is constructed of stacked, 2 courses high, and aligned basalt cobbles and boulders measuring 0.2 to 0.5 m high.

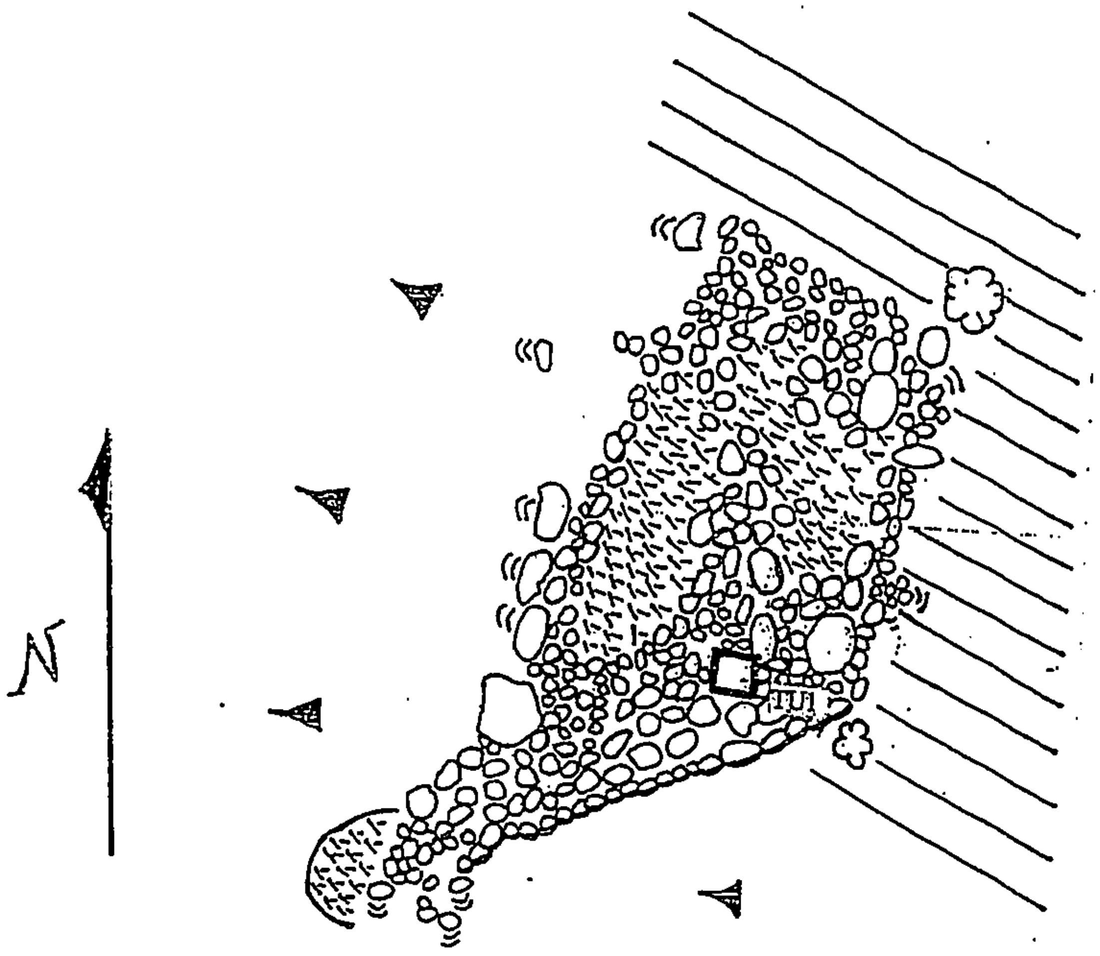
Testing

One 0.25 sq. m test unit (TU1) was excavated in the interior area to determine presence/absence of subsurface cultural remains and function. The surface structural component, designated as Layer I, was initially removed to expose the underlying soil. Two stratigraphic layers (Layers II and III) were revealed during excavation (Figure 17). No cultural material was recovered, and excavation was terminated in Layer III at 35 cmbs.

> **Layer I** is a pavement composed of angular large cobbles and decaying organic leaf matter. This layer was approximately .10 m in thickness.
>
> **Layer II** (10-21 cmbs), dark yellowish-brown (10YR 4/4), non-sticky, non-plastic, very fine-grain, powdery silt loam with abundant roots, rootlets, and rocks (similar to Layer I in the other test units).
>
> **Layer III** (21-35 cmbs), dark yellowish-brown (10YR 3/4), non-sticky, non-plastic, fine-grain, powdery silt with abundant rocks.

Discussion

This feature was badly disturbed obscuring its original construction. However, based on the extent structural components, this feature probably had an agricultural function. No more work is recommended for this feature beyond archaeological monitoring during construction.



EGEND	
	WALL TUMBLE
	DEPRESSION
	FACED WALL
	CORAL
///	BULLDOZER DISTURBANCE
	SLOPE

Figure 15. Plan View Map of TS 20

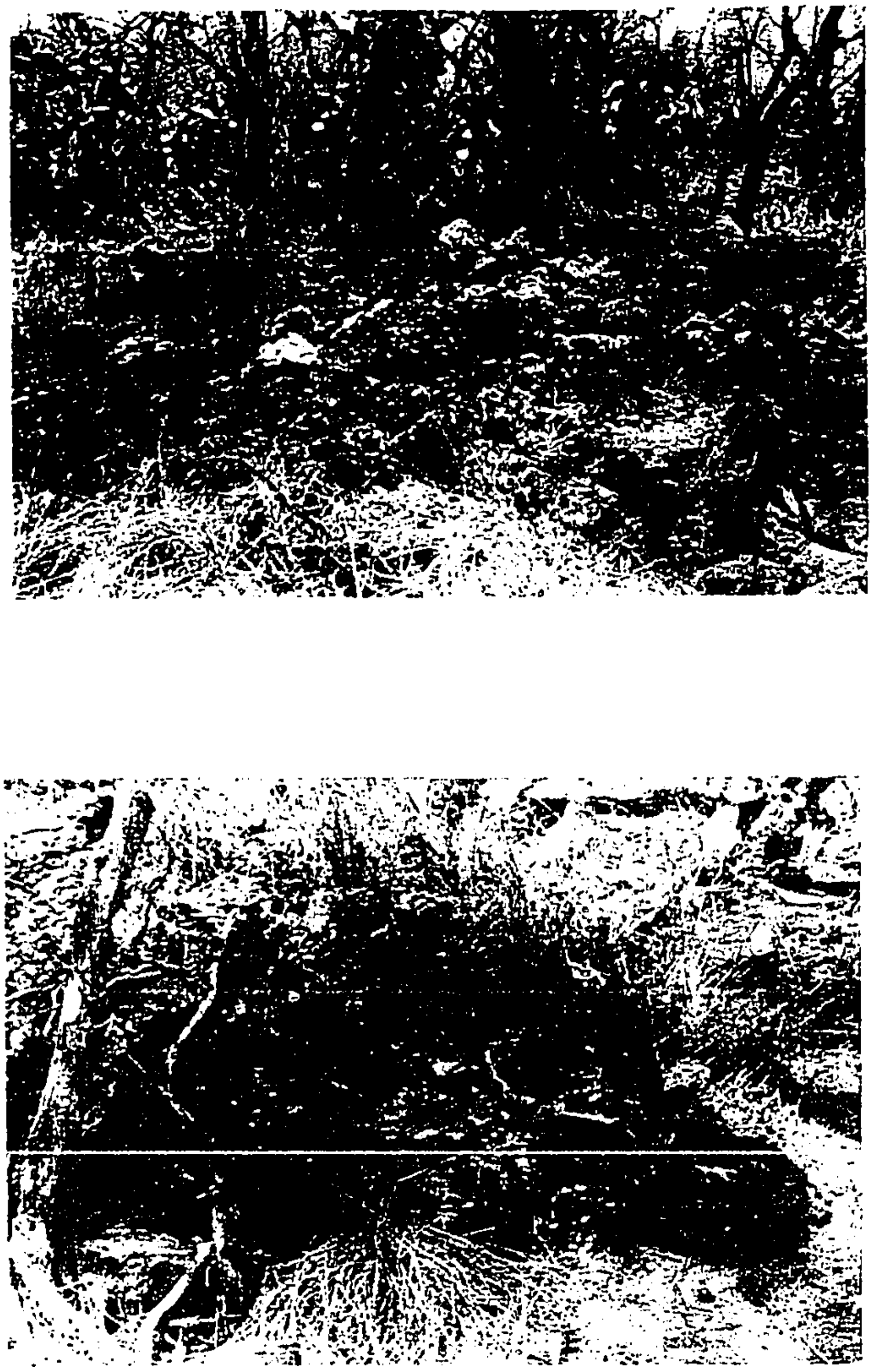
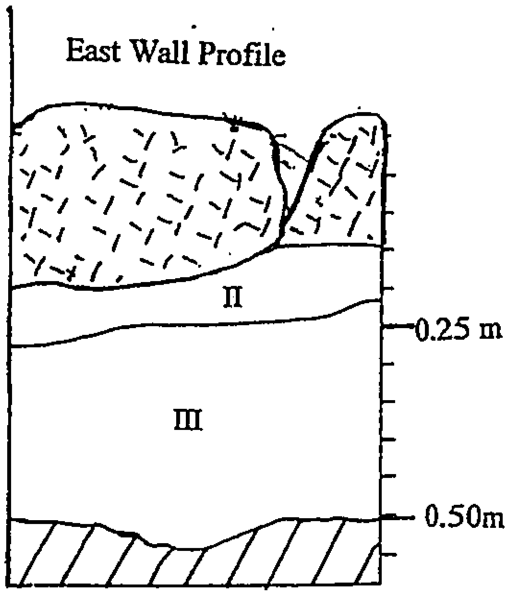


Figure 16. (Top) Overview of Site 26, View to South, (Bottom) Note Faced Boulders and Cobbles View to Northeast



Layer I is a pavement composed of angular large cobbles and decaying organic leaf matter. This layer was approximately .10 m in thickness.

Layer II (10-21 cmbs), dark yellowish-brown (10YR 4/4), non-sticky, non-plastic, very fine-grain, powdery silt loam with abundant roots, rootlets, and rocks (similar to Layer I in the other test units).

Layer III (21-35 cmbs), dark yellowish-brown (10YR 3/4), non-sticky, non-plastic, fine-grain, powdery silt with abundant rocks.

Figure 17. Stratigraphic Profile of Test Unit 1 at TS 20

Temporary Site 21

This site is a modified outcrop, located at the edge of a ridge in the southwestern corner of the *makai* section of project area overlooking Site 50-Ma-B8-234. It consists of a semi-circular wall, built against the edge of a basalt outcrop, measures approximately 1.25 in diameter, which forms a small circular enclosure (Figure 18). The wall is constructed of stacked basalt cobbles and boulders, 2-4 courses high, and retains soil. The wall encloses the southern side and outcrop defines the rest of this feature. The wall measures about 2 m in total length, .50 m wide and .60 m in height on the exterior and .30 m on the interior side. The outcrop measures .80 m high on the eastern and western sides and 1.0 m high on the northern side (Figure 19). The walls and outcrop bounds a fairly level soil area.

Testing

A 0.25 sq. m test unit (TU1) was excavated in the interior soil area to determine presence/absence of subsurface cultural remains and function. Three stratigraphic layers (Layers I-III) were revealed during the excavations and sparse amounts of cultural material including marine shell (*Cypraeidae cyprea* sp.) and porites coral fragments (see Midden) were recovered from Layer II (See Figure 19). Excavations were terminated in Layer III at 44 cmbs.

> **Layer I** (0-3 cmbs), dark yellowish-brown (10YR 4/4), non-sticky, non-plastic, fine-grain, powdery, silt loam with abundant roots, rootlets, and rocks.
>
> Layer II (4-27 cmbs), dark yellowish-brown (10YR 3/4), non-sticky, non-plastic, very fine-grain, powdery silt with 1 piece of coral, 1 shell fragment, and moderate amounts of land snails.
>
> **Layer III** (28-44 cmbs) is a dark yellowish-brown (10YR 4/4), non-sticky, non-plastic, very fine-grain, powdery silt.

Discussion

This site's function could have been two fold, either as a sheltered planting feature, common to the region, or as a storage area. The presence of soil within this feature appears to support an agricultural function.

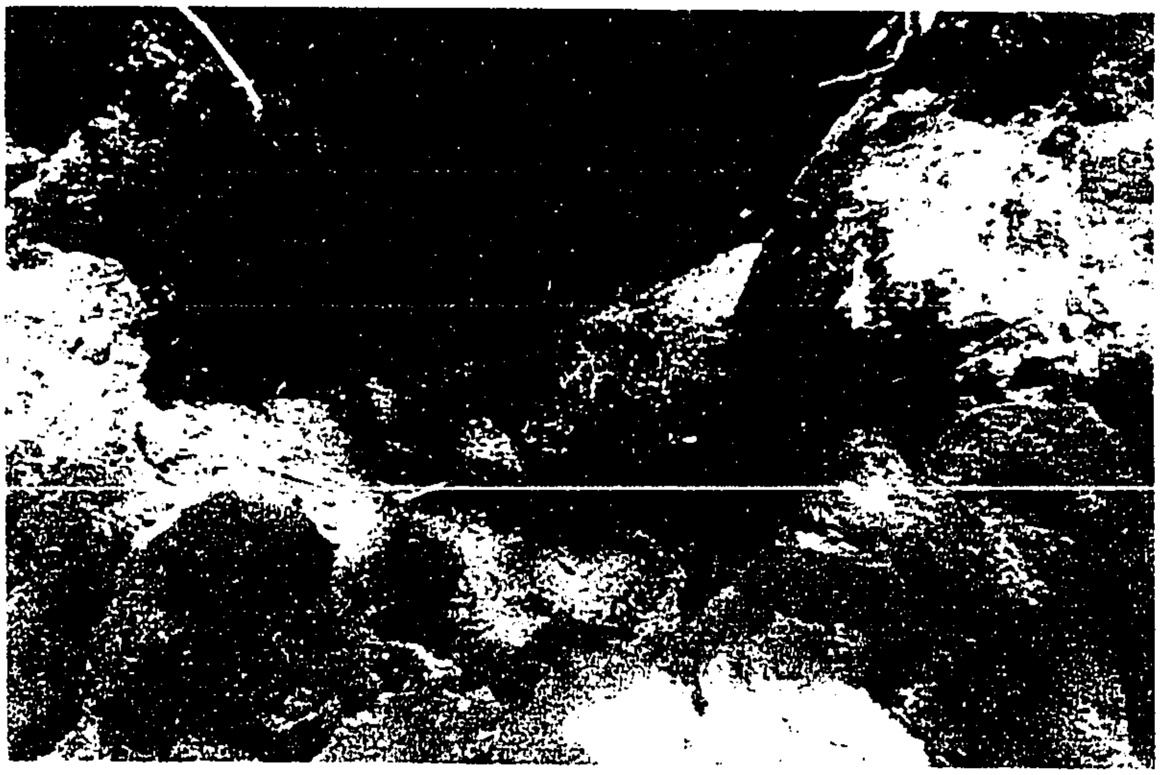
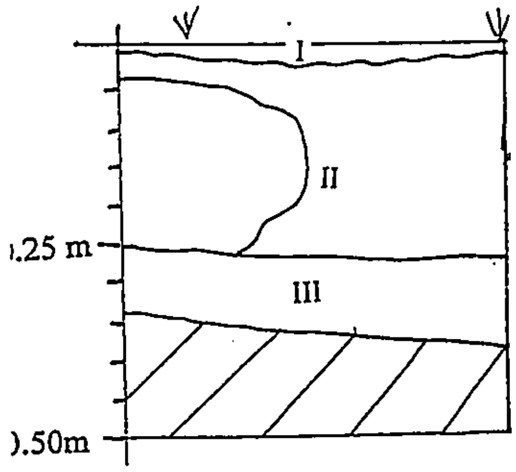


Figure 18. (Top) Overview of Site To North (Bottom) Showing Interior Soil Area

North Wall Profile



Layer I (0-3 cmbs), dark yellowish-brown (10YR 4/4), non-sticky, non-plastic, fine-grain, powdery, silt loam with abundant roots, rootlets, and rocks.

Layer II (4-27 cmbs), dark yellowish-brown (10YR 3/4), non-sticky, non-plastic, ver fine-grain, powdery silt with 1 piece of coral, 1 shell fragment, and moderate amount land snails.

Layer III (28-44 cmbs) is a dark yellowish-brown (10YR 4/4), non-sticky, non-plasti very fine-grain, powdery silt.

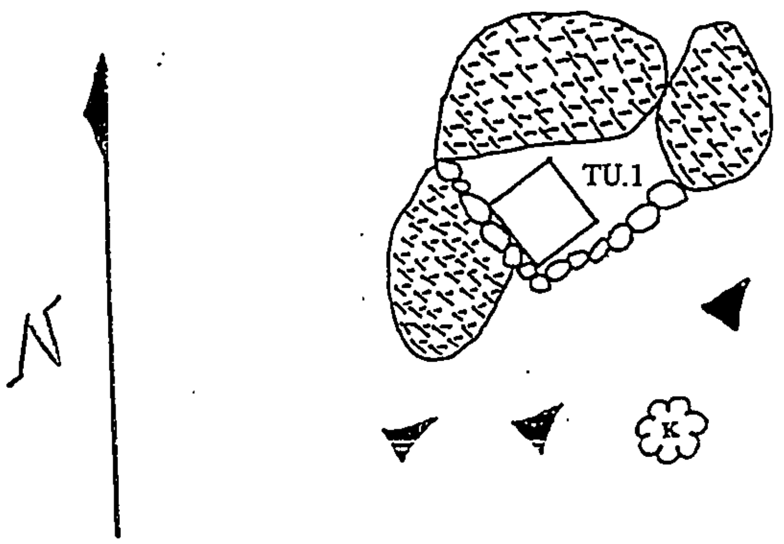


Figure 19. Plan View Map of Site TS 21 and Stratigraphy of TU1

Temporary Site 22

This site is situated adjacent to Mākena-Keoneoio Road in southern portion of the project area just east of the steep draw. It consists of two parallel wall features which are freestanding and oriented roughly north-south. The first segment, oriented at 180 degrees, measures 10.0 meters long by .5 meters wide. The second leg is oriented at 220 degrees and measures 20.0 meters long. This wall is also measures approximately .5 m wide (Figure 20). The walls are constructed of angular basalt cobbles and boulders that area stacked and freestanding. The walls and surrounding area have been bulldozed such that the original length of the wall is inconclusive.

Discussion

This site, based on the arrangement of the segments, must have function as a cattle road to divert cattle into a certain direction. No further work is recommended for this feature.

Temporary Site 25

This feature is a relaxed L-shaped freestanding wall remnant located adjacent to the Mākena-Keoneoio road. The wall opens to the northwest and the longer leg measures approximately 10.5 meters long and curves to the north for an additional 10.0 + meters (Figure 21). The location of this disturbed feature indicates that it may be the remains of either of two previously recorded sites, 50-Ma-B8-111 or 112 (Rogers-Jourdane 1979:18 & 19). However, the descriptions in the report are not specific enough to permit a confirmation.

Discussion

This feature has been adequately documented and needs no further work beyond construction monitoring during construction.

Temporary Site 26

This site consists of a single feature which appears as a rectangular platform; however the presence of an interior faced wall lends support to a badly disturbed enclosure. The site is located along the northern edge of the large gulch, *makai* of the large animal pen Site 233. It is constructed of primarily angular basalt boulders but contains some rounded, water-worn basalt boulders and incorporates bedrock outcrops in its construction. The exterior walls are faced and stacked and the east-wall may have been double-faced and core-filled, however the only faced wall remaining is along the interior NE corner. Feature 1 measures 13.3 by 3.4 m and ranges in height from .30 -.80 m (exterior) and .13 m in the interior (Figure 20). Branch and *porite* coral as well as shell midden were present throughout the site area.

Discussion

No excavations were performed during this survey as this site may be preserved *in situ*. Test excavations will be executed during the implementation of the data recovery phase.

Figure 20. Photograph of TS 22 (Note Second Wall in Background)

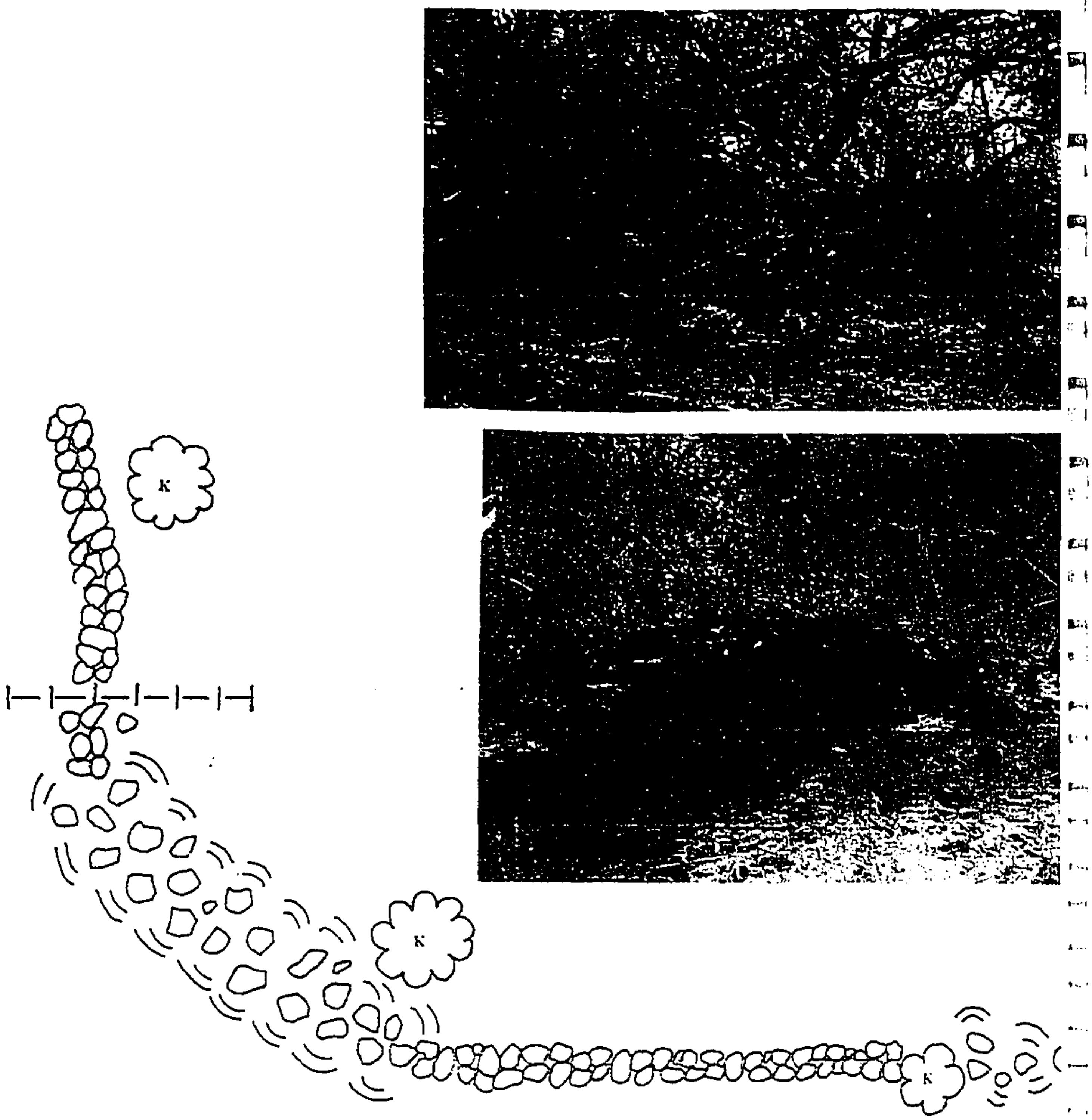


Figure 21. Plan View Map and Photographs of TS 25

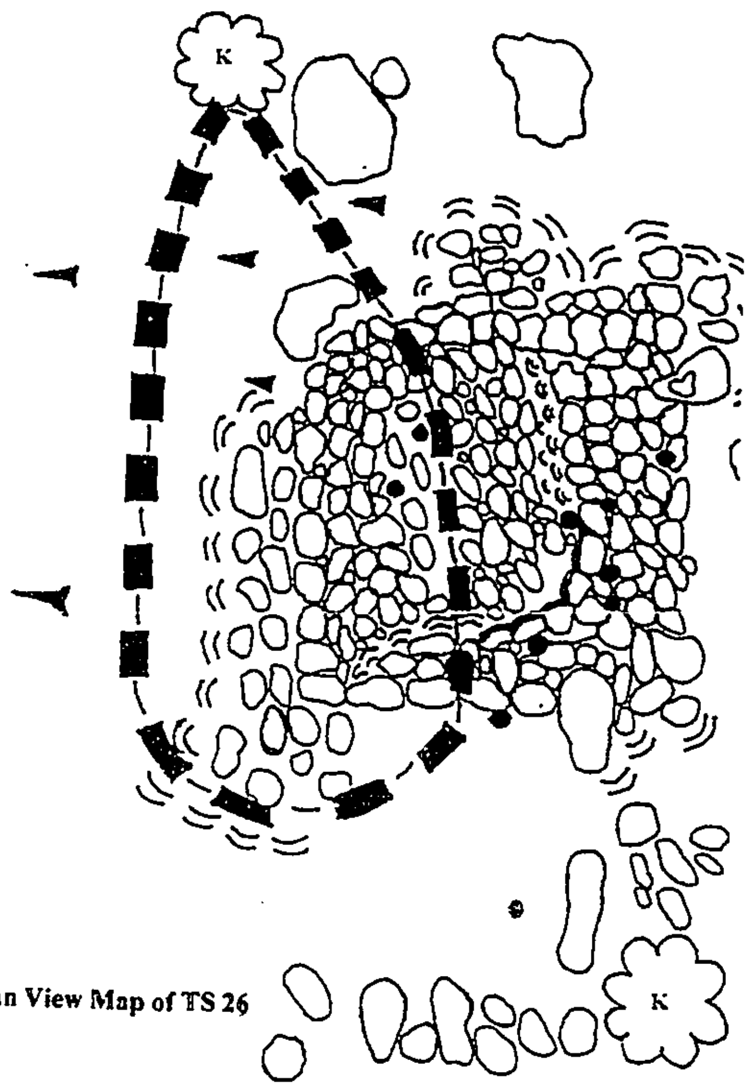


Figure 22. Photograph and Plan View Map of TS 26

ARTIFACT AND MIDDEN SECTION

The only artifact collected from this survey was a bread loaf sinker identified on the surface of a disturbed area. The bread loaf sinker was located on a push pile near the western periphery of the project area and has no context. The sinker is in good condition and is composed of a dark grey, medium grained with white prism-shaped inclusions. Vesicles or minute pits are also present on the surface and may be from use or former pockets which contained the crystal inclusions. The sinker measures 6. 7 by 3.7 by 3.5 cm and is photographed in Figure 21.

The only cultural materials recovered from test excavations were recovered from TS 21. They include a total of .4 grams of Cyprae species and 1.2 g porites coral.

DISCUSSION

A total of eight sites were re-visited and investigated during the current inventory survey. Three were previously recorded sites and six were newly recorded. The previously recorded ranching enclosures (233 and 234), as well as Feature 5, the filled in cistern for the Mākena School Complex, were still existent and in good condition. Although more than a dozen projects have taken place either within or incorporating portions of the current project area over the past three decades, a few small portions of the project area were not previously covered. The majority of newly recorded sites consisted of marginal structural remnants such as modified outcrops, wall remnants and a disturbed C-shape. However, one relatively significant site (TS 26) was found near the drainage in the southern section of the project area.

Temporary Site 26, located in the southwestern portion of the parcel is a partially deteriorated enclosure that may represent the remains of a *ko`a*, or shrine. Its construction, morphology, presence of water worn cobbles and coral, as well as its location suggest the possibility of this site being a shrine associated with marine exploitation activities. The site is also considered to be one of the sites for further study and or preservation.

Most of the remaining sites recorded appear to be related to agricultural (TS 20, 21) and ranching (233, 234, 22, 25) pursuits. Only two features may be representative of a pre-contact settlement, TS 18, the C-shape remnant and TS 26 the religious shrine. The lack of surface structural remains from traditional times for this project area is partially due to the altered terrain from mechanical equipment and the ranching era. This area would have supported a permanent coastal habitation settlement during traditional times and this settlement would have thrived through fishing and exploitation of the coastal reef fringes. Repair and maintenance of the local fishponds at Apunakea, the unnamed fishpond at the Bak South property or other fishponds mentioned in Keoneoio would have been tasks that this coastal settlement could undertake. Unfortunately, little surface evidence and or subsurface data was generated from this project area to support this proposition.

Thus, additional testing in the form data recovery procedures, which are guided by a well-crafted plan, appears to be warranted. The sites recommended for further data collection area presented below.

INITIAL SIGNIFICANCE ASSESSMENTS

All historic properties are evaluated according to significance assessments. Significant properties must possess integrity of location, design, setting, materials, workmanship, feeling and association and shall meet one of the following:

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

Below Table III presents the initial significance evaluations for all eight sites and future mitigation recommendations.

Table II INITIAL SIGNIFICANCE TABLE

SITE NUMBER	DESCRIPTION	TENTATIVE FUNCTION	SIGNIFICANCE	DATA REC.	AGE
50-Ma-B8-233	Large Enclosure	Ranching	D	YES	1945-1950
50-Ma-B8-234	Large Enclosure	Ranching	D	YES	1920-Present
50-50-14-1007	Makena School	Specific Use	A, D, E	NO	Historic
TS 18	C-shape	Habitation	D	YES	Prehistoric
TS 20	Modified Outcrop	Agriculture	D-NLS*	YES	?
TS 21	Walled Pit	Agriculture	C, D	NO	?
TS 22	Parallel Walls	Ranching	D-NLS*	NO	Historic
TS 25	Wall Remnant	Ranching	D-NLS*	NO	Historic
TS 26	Square Enclosure	Religious	D, E	YES	Prehistoric

***NLS=No Longer Significant**

RECOMMENDATIONS

Temporary Sites 21, 2: and 25 are no longer significant and require no further work beyond construction monitoring. Fe. 5 of Site 1007, the Makena School Complex, was recommended for *in situ* preservation in the past, however, at present it is an isolated feature with no cultural context and this recommendation may need to be revisited as development plans for these mauka parcels become available. Perhaps with future development plans, a bronze plaque may be placed in this vicinity recognizing this historic school site. Sites 233, 234 TS18, 25 and 26 are significant for their information content and are recommended for data recovery procedures. TS 21 is significant for site type and information content, yet no further work is recommended for this site. TS 26 mostly likely will be recommended for *in situ* preservation (pending data recovery results) and this site will likely be incorporated into the proposed development plans. Any historic wall features or portions of the walls that can be utilized in the current development plan are also recommended. Pursuant to comments from SHPD for this document, a data recovery plan will be formulated and submitted for SHPD review and approval.

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Appendix D-1

Archaeological Inventory Survey of Development Parcel H-1 (TMK: (2)2-1-05:84 and 2-1-06:37 and 56), Maluaka and Ka`eo Ahupua`a, Honua`ula, Maui)

DRAFT

ARCHAEOLOGICAL INVENTORY SURVEY OF DEVELOPMENT PARCEL H-1 (TMK: [2] 2-1-05: 84; and 2-1-06: 37 & 56), MALUAKA and KA'EO AHUPUA'A, HONUA'ULA, MAUI

Prepared for

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Akahele Archaeology
and
ARCHAEOLOGICAL SERVICES HAWAII, L.L.C.

Theresa K. Donham
April 2006

DRAFT

ARCHAEOLOGICAL INVENTORY SURVEY OF DEVELOPMENT PARCEL H-1 (TMK: [2] 2-1-05: 84; and 2-1-06: 37 & 56), MALUAKA and KA'EO AHUPUA'A, HONUA'ULA, MAUI

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Management Summary

An archaeological inventory survey was conducted October 2005 - March 2006 of a 12.21-acre parcel located at TMK 2-1-05: 84 and 2-1-06: 37 and 56. The survey was conducted at the request of Keaka LLC, in connection with the development of condominiums and associated drainage control improvements. Fifteen historic properties comprising 80 component features were identified within the project area. Eleven of the sites (with 22 component features) were previously identified during prior archaeological studies of the area. Subsurface testing was conducted at 31 features located at 11 of the 15 identified sites. Subsurface midden materials were collected at 20 of the tested features, with individual feature collections ranging from single pieces of shell to 1,313 specimens. Forty-three traditional artifacts were collected at ten features, and 6,492 historic artifacts were collected from six features. Five charcoal samples were collected from four habitation features and submitted for radiocarbon analysis; dated samples range in age from AD 1400-1440 to AD 1680-1740.

Traditional functional categories represented among the identified features include agriculture (clearing piles, mounds, filled depressions, terraces, enclosures), habitation (enclosure, C-shaped wall, midden deposit, pavement), burial (platform), ceremonial (platform, terraces), and indeterminate (walls). Historic era activities represented include agriculture (clearing, terrace), boundary demarcation (walls), education (school site), habitation (structural remains), livestock management (walls, trough, enclosure), refuse disposal (mound, privy, cesspool, pits), transportation (road, trail), and indeterminate (walls, mound). The density and distribution of the historic era features indicates that the project area was intensively used during the twentieth century; this use has most likely resulted in the removal of pre-contact surface architecture and has contributed to the erosion of subsurface cultural deposits.

Among the fifteen sites located within the project area, eleven contain features that are significant under criterion "d"; two sites (5706, 5711) contain features that are significant under criteria "d" and "e"; one site (1007) contains features significant under criteria "a" and "d"; and one site (5795) is significant under criteria "c" and "d". Due to the rather extensive level of data collection conducted during this survey, no further work is recommended to mitigate adverse effects to sites or features significant under criterion "d". The recommended mitigation For Site 5706 Feature 11 and Site 5711 Features 1-3, 5, 6 and 8, significant under criteria "e", is preservation in place. Recommended mitigation of adverse effects for the Mākena School (Site 1007), significant under criterion "a", is further ethnographic work for the recovery of oral history information, and completion of an outstanding data recovery report. For Site 5795, significant under criterion "c", preservation is recommended if possible; or consultation with the SHPD Architectural Branch and Archaeological Branch is recommended to determine an appropriate level of documentation.

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1. INTRODUCTION

Project Background and Description

An archaeological inventory survey was conducted of a 12.21-acre project area located at Maluaka, Honua'ula, Maui (*Figures 1.1 and 1.2*). The survey was conducted by Akahele Archaeology and Archaeological Services Hawai'i, at the request of the property owner, Keaka L.L.C., in preparation for a Maui County Special Management Area Permit Application. The owner proposes to develop condominiums and an associated retention basin within the project area. Survey field work was conducted between October 3 and December 8, 2005 and February 27-March 14, 2006.

Fifteen historic properties comprising 80 component features were identified within the project area. Twenty-two of these features at eleven of the sites were previously identified prior to the current survey. The remaining 58 features and four sites are newly identified. Details regarding the previously recorded SIHP (State Inventory of Historic Places) site numbers and their re-assignment during the current survey is provided in Chapter 3 (see Site Documentation). In addition to recording verbal descriptions of all identified features, scaled plan maps were completed for all features, and subsurface testing was conducted at 31 features located at eleven different sites. Testing included excavation of 38 controlled 0.5-1.0 by 1.0-1.5 meter units and eight 0.5 by 0.5 meter shovel tests. Materials collected include five charcoal samples that were submitted for radiocarbon dating, 43 traditional Hawaiian artifacts from ten different features at six sites, 6,492 historic/modern era artifacts from seven features at six sites, and 9,880.10 grams of midden and other portable materials from 28 of the test units.

The project area consists of three separate parcels; the largest of which (TMK 2-1-06:37) consists of 9.2 acres (*Figure 1.1*). This parcel is located along the west side of the Mākena-Keone'ō'io Road and is bordered on the west by the Makena south golf course. The second parcel (TMK 2-1-06: 56) is adjacent to the north side of parcel 37, and consists of 1.01 acre. This parcel is bordered on the east by a public access walkway to Maluaka Beach, on the north by the Maluaka Beach public picnic area, and on the west by the golf course. The third parcel (TMK 2-1-05: 84) is located along the east side of Mākena-Keone'ō'io Road and consists of 2 acres. It is bordered on the north by the Maui Prince Hotel base yard, and on the east and south by undeveloped land. A paved public parking lot is present at the north end of parcel 84. The proposed retention basin is to be located within this parcel, with the condominiums to be located across Mākena Road on parcels 37 and 56.

With the exception of the parking lot in parcel 84, the three parcels are currently vacant; however, a (modern) private residence was present on parcel 56, and portions of at least one home site was present in parcel 84 prior to resort development in the area. All three parcels have been subjected to varied amounts of grubbing and grading, which occurred in connection with ranch activities, road improvements, and ressort construction. These impacts are discussed in greater detail in Chapter 2.

Scope of Work

The archaeological survey reported here conforms with the requirements for an inventory survey as defined in Hawai'i Administrative Rules (HAR) Title 13, Subtitle 13, Chapter 276. As stated in §13-276-4, the purpose of the inventory survey is to "...determine whether archaeological historic properties are present, and if so, to present their description, interpretation and location." HAR requires that "The entire surface of the project area shall be visually inspected, and any proposed deviations from this level of inspection shall be approved by SHPD prior to implementation."

Inventory survey includes a) evaluation of areas which have no visible historic properties, and b) test excavations at historic properties that have alternative functions, in order to help resolve the question of function. A number of features were identified that had no clearly identifiable function. Test excavations were conducted at these features in order to better define age and function. Full recordation of excavations and analysis of recovered materials is included in the report, as required in §13-276. A detailed outline of information that is required to be included in an inventory survey report is found in §13-276-5.

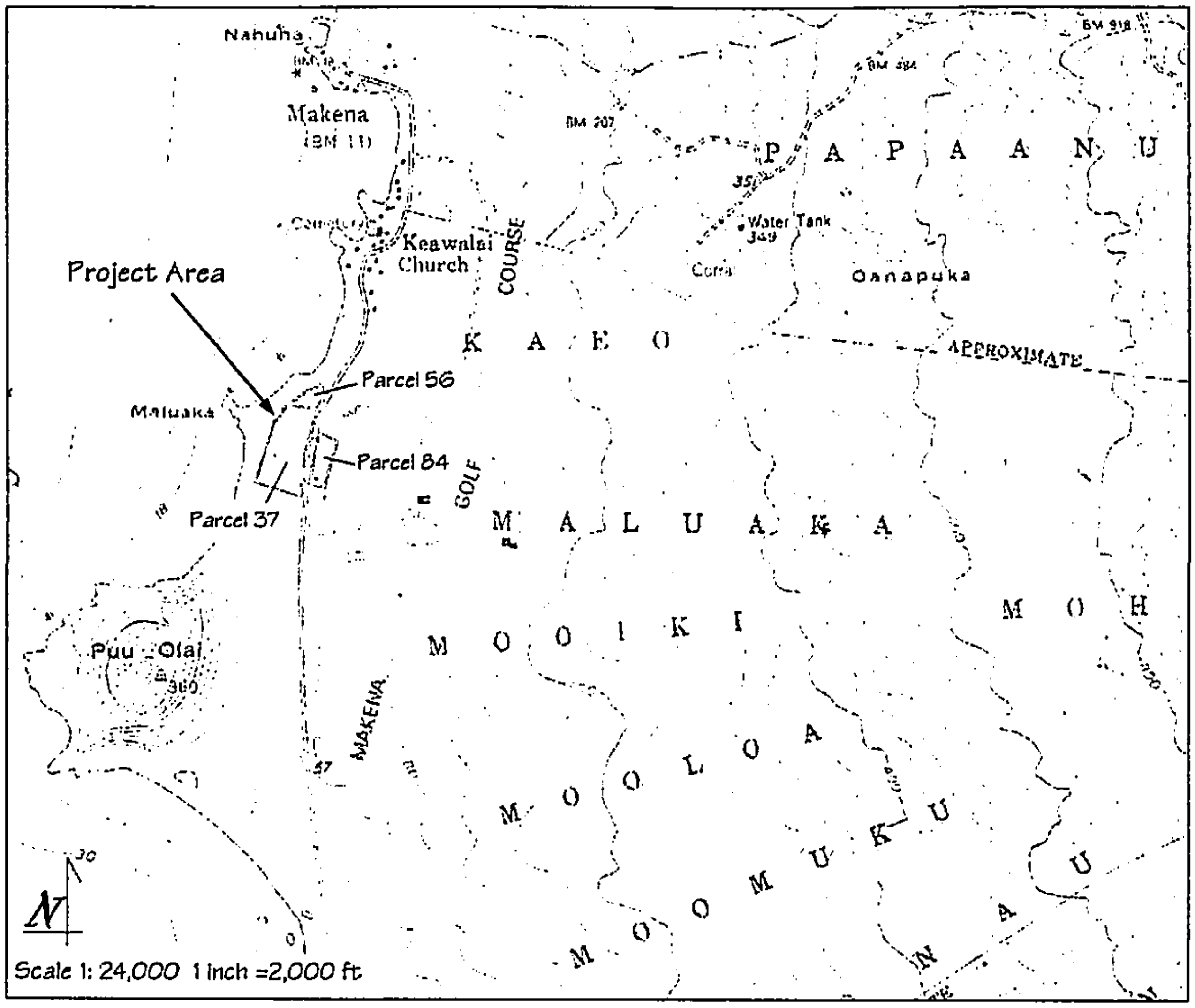


Figure 1.1 A portion of the Makena 7.5 Minute USGS Quadrangle map showing location of project area

Local Environment

Parcels 37 and 56 of the project area comprise a somewhat narrow strip that parallels the shoreline between One'uli Beach and Maluaka Beach. The northwestern edge of the project area is within 90 feet (27.4 meters) of the shoreline at the southern end of Maluaka Beach. The shoreline in this immediate area consisted of a cobble beach prior to construction of a concrete pad overlook area. The relatively narrow strip of land between the shoreline and the project area has been graded and landscaped for a golf course, and much of the original topography in this area is now gone.

General surface elevation within the project area ranges from 20 feet AMSL at the northwestern end of parcel 56 to 70 feet at the southeastern end of parcels 37 and 84. An amphitheater-shaped gulch is present in the south portion of parcel 37. This east-west gulch ranges from 10 feet AMSL at the west end to 60 feet at the eastern bank top. The portion the gulch to the west of the project area was filled during golf course construction, and fill over six feet in height is apparent in the gulch along the western edge of the project area. With the exception of the gulch and a low-lying area in the southwestern corner of parcel 37, the remainder of the project area is relatively level, with a mild gradient toward the west.

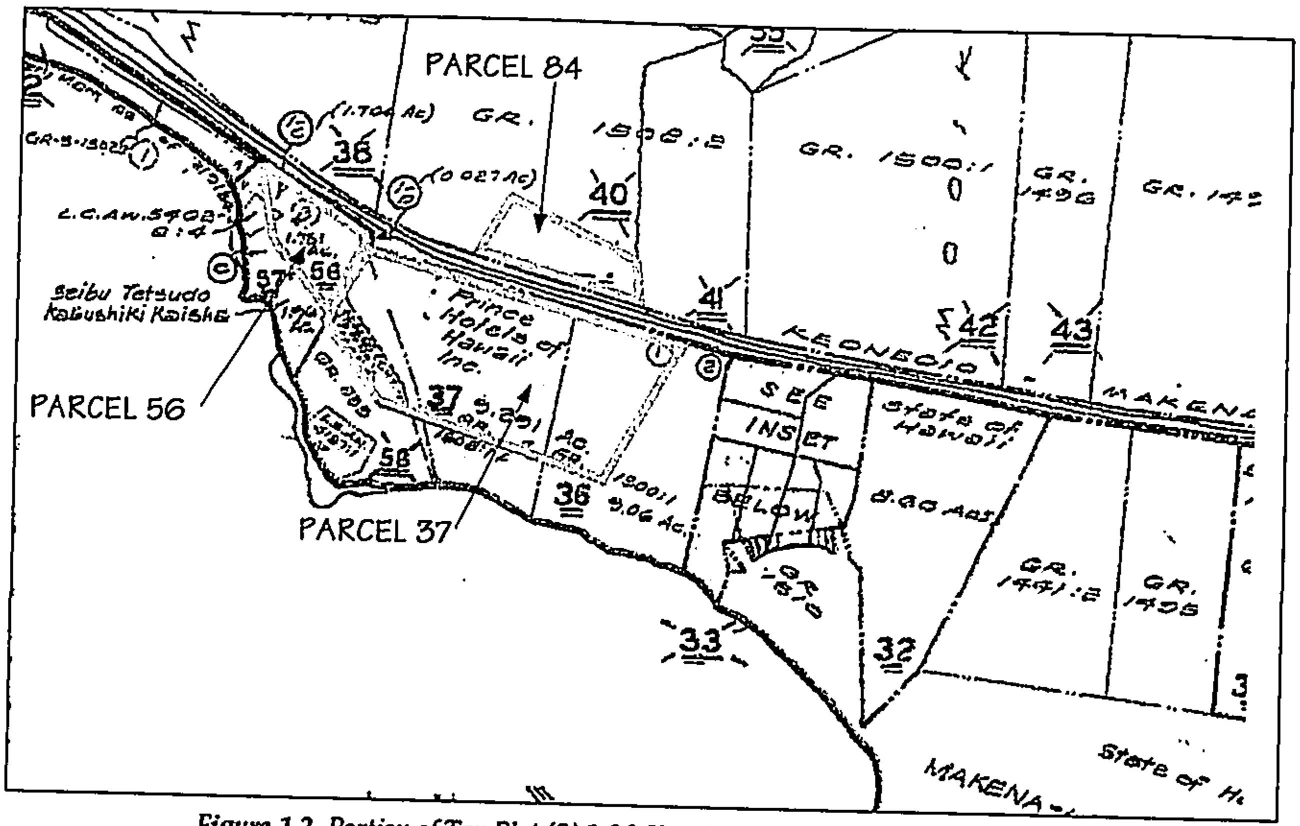


Figure 1.2 Portion of Tax Plat (2) 1-06 Showing Parcels within the Project Area

Minor topographic variation in the form of exposed *pahoehoe* ridges and outcrops are present throughout the project area. These are most apparent in the northern portion of Parcel 37. The central and southern portions of this parcel show exposed bedrock, however, the features are less abrupt in these areas. Areas of soil within the project area conform to the Makena loam, stony complex, as identified and described by the U. S. Department of Agriculture. This soil complex occurs on the lower leeward slopes of Haleakalā, between Mākena and Kama`ole (Foote et al. 1972:91). Stony land occurs on low lava ridges and comprises 30 to 60 per cent of the complex. Representative profiles of this soil exhibit a surface layer of very dark brown loam about 4 inches thick overlying dark grayish brown to dark yellowish brown silt loam subsoil. The substratum is dark yellowish brown cobbly silt loam (Foote et al. 1972:91). The subsoil and substratum soils generally developed in volcanic ash.

Most of the soil profiles within the project area exhibited a shallower surface layer of around 2 inches, over the dark yellowish brown silt loam subsoil. The substratum soil was encountered in relatively shallow contexts throughout most of the project area, and it is absent in some places where the subsoil is directly over solid bedrock. The percentage of stone within the three soil layers varies considerably within the project area, from 70% to less than 10%. Some of the soil deposits within site areas have been augmented by the removal of the cobble inclusions, which are found in piles on adjacent bedrock outcrops. A small area at the northern end of parcel 37, and the area of Site 1007 in parcel 84 includes a surface veneer of aeolian sand that has been transported inland from the coastal beaches. No sand dune formations are present within the project area.

Rainfall data for East Maui compiled by the University of Hawaii (1983) indicates that coastal Mākena receives 15 to 20 inches of rain annually. Lower annual averages of 10 inches or less occur in the coastal Kīhei area to the north (UH 1983:62). Analysis of monthly rainfall rates by Gosser et al. (1996) indicate that coastal Makena receives 25% more rainfall than coastal Kīhei or Wailea (Gosser et al. 1996:13). Their analysis also showed that Mākena exhibits no months of zero rainfall, whereas Kīhei and Wailea have at least two months (June, July) of little to no rain. Stearns and Macdonald (1942) have cautioned that "More rain may fall on the leeward coast during a single kona storm than during the rest of the year." (1942:32). They also indicate that rainfall varies widely from year to year. Rainfall in the upper elevations of Honua`ula (c. 2,000 ft AMSL) are generally double the coastal averages. Rainfall data for Ulupalakua Ranch indicates an annual rainfall range between 52 inches (1906) and 24 inches (1931), with an overall mean of 36.4 inches. (Stearns and Macdonald 1942:31).

The shoreline just west of the project area is dominated by Maluaka Point, which extends approximately 400 feet (122 meters) west from the northwest corner of parcel 37. This basalt point is comprised of mixed lavas from the post-Pleistocene Hana volcanic series (Macdonald et al. 1983:383, 394). The prominent cinder cone, Pu'u Ōla'i, is located 1,200 feet (366 meters) southwest from parcel 37. This cinder cone and the offshore islet of Molokini both date to the Hana volcanic series, which is the youngest identified series on Maui (Macdonald et al. 1983: 383).

The immediate offshore area along Maluaka and One'uli Beaches is classified as a lava apron reef shelf which extends 600 meters off Maluaka Beach and 400 meters off Maluaka Point. This shelf is comprised of solid rock bottom with areas of mixed limestone outcrops and sand pockets (AECOS 1979:59). Most of the shelf area is at depths of 30 feet or less, which provides a relatively extensive area for littoral zone fish and shellfish species. A number of reef fish inhabit this environment, including *kala* (Acanthuridae), *humuhumu* (Balistidae), *kikakapu* (Chaetodontidae), *`akilolo* (Labridae), *uhu* (Scaridae) and *hapu`u* (Serranidae). *Puhi* (eel) and *he`e* (octopus, squid) are also common in this zone. Coral growth in the area is dominated by cauliflower coral (*Pocillopora meandrina*), which provides a rich habitat for crabs, shrimp, various wrasses, surgeonfish, and echinoderms (Felding and Robinson 1987:21).

Groundwater in coastal Mākena derives from underground sources, as there are no surface perennial streams in Honua`ula. Fresh water outflows (freshlets) are common along the rocky shoreline, and they are directly dependent upon the amount of rainfall in upper elevations and the amount of water that soaks into the ground, as opposed to run off. Traditionally, wells were constructed along the shoreline in coastal Honua`ula to access the freshlets. Two wells are documented near the shoreline in Maluaka, immediately west of the project area (Haun 1978); these would have been available to area residents, in addition to other as yet unknown fresh water sources. A number of nineteenth century maps depict fishponds at three to four locations around the base of Pu'u Ōla'i; one of these was located just south of parcel 37. There are currently no wetlands or wetland vegetation stands within the project area.

Prior to the introduction of foreign plant species, coastal Mākena would have supported a variety of native plant species. The sandy beach areas exposed to salt spray was most likely dominated by one or more of the following plants: *naupaka kahakai (Scaevola sericea), pohuehue (Ipomoea pes-caprae), nanea (Vigna marina), pohinahina (Vitex retundifilia), `aki`aki (Sporobolus virginicus), pa`uohi`iaka (Jacquemontia ovalifolia), `ili`ahialo`e (Santalum ellipticum), `akoko (Chamaesyce skottsbergii), and `aweoweo (Chenopodium oahuense)* (Wagner et al. 1990:54). In the less sandy zones along the coast, *`ilima (Sida fallax)* and *ma`o (Gossypium)* were common plant species. In the more protected areas, shrublands dominated by *hinahina (Heliotropium anamalum* var. *argenteum)* and *kipukai (h. curassavicum)* would have most likely occurred. The inland boundary of the Native strand plant community was often dominated by *hala (Pandanus tectorius)*, with *nehe (Lipochaeta succlenta)* as a common understory plant. *`Akia (Wikstromia), `a`ali`i (Dondonaea visosa), `ulei (Osteomeles amthyllikifolia)* and *`akoko (Chamaesyce calastroides)* were probably also common in this environmental zone (Wagner et al. 1990:71).

The lowland forest zone in Honua`ula was probably a *wiliwili (Erythrina)* forest, with *lama (Diospyros sandwicensis), naio (Myoporum sandwicense), hula pepe (Pleomele), hao (Rauvolfia sandwicensis)* and *ilie`e (Plumbago zeylanica)* as common understory plants. Many of the native plant species that grew naturally in the lowlands of Honua`ula had important economic and medicinal value. Other economically important plants, such as *kukui, wauke, ulu,* coconut palm, and various sweet potato and dry taro species would have survived if watered.

The modern vegetation within the project area is primarily *koa haole (Lucaena leucocephala), kiawe (Prosopia pallida), hau (Hibiscus tiliaceus)*, lantana (*Lantana camara*), false thyme (*Lippia micromera*), and prickly pear cactus or *panini (Opuntia ficus-indica)* (Neal 1965). One of few Native plant species still thriving is *'ilima (Sida Fallax) 'Ilima* plants are quite common in the project area; no *wiliwili* trees were observed in the project area; however they are present in other areas of coastal Honua'ula. The central portion of parcel 37 and most of parcel 84 is covered in a thicket of *panini*. This edible cactus was cultivated in the Mākena area during the middle nineteenth century, as indicated in the testimony of *kulena* claimants.

Previous Archaeological Studies

The first visit by an archaeologist to the Mākena region was in 1916 when J.F.G. Stokes of the Bishop museum conducted a two-week tour of *heiau* sites (Stokes 1918). Stokes began his tour at Keone'ō'io, where he identified three *heiau* sites - the *Ko'a* of Kaulana, Pa'alua, and Hala. One *heiau* was identified in Kanahena, Koula, which he did not see. Three *heiau* were mentioned for the Mākena area, and are described as follows:

> Heiau of (blank) on top of Puu Olai. Not seen.
>
> Heiau of Kalani, land of Kaeo, inland. Not seen. Said to have been a heiau for human sacrifices, and that the drums were heard at night.
>
> Heiau of Nanahu, land of Makena; on the point north of Makena Bay. This was a pavement of ala and coral, level with the surrounding ground and rocks, about 20 feet square. The only information to be gathered was that is was "a heiau for dead people." It was not a graveyard, and I do not understand nor could the local people explain to me the meaning of their description. (Stokes 1918)

Mākena was revisited in 1929 when Winslow Walker of the Bishop Museum passed through during his island-wide survey of *heiau* sites. Walker's survey results were never published; however, his manuscript is widely used in reference to *heiau* sites that were known to the local residents with whom Walker consulted. Walker also used information from Stokes (1918) prior work and from listed published by Thrum in the *Hawaiian Annual*. In addition to 230 enumerated sites, Walker made notes on fishing *ko'a*, fishponds, burials, village sites and artifacts of interest.

Walker's report included no new information on the *heiau* reported by Stokes atop Pu'u Ola'i, and it is not mentioned. He visited Koula Heiau (195) in Kanahena and Kalani Heiau (196) in Kaeo. Also recorded for the Mākena region was Pohakunahana Heiau (197), which was described as being "back of the store at the bottom of the hill beyond the pig-pen" (Walker 1931:269). Both the Kalani Heiau and the Pohakunahana Heiau are listed in the SIHP and have been subjected to additional studies in connection with modern development.

Regarding fishponds, Walker found that "Makena had a small fishpond, now totally destroyed by the surf" (Walker 1931:299). This description may have applied to the pond just north of Keawala'i Church, at Apuakehau Point.

In his discussion of fishermen's shrines, Walker indicates that he defined Ku'ula *Heiau* or *Ko'a* as the "smallest of the structures of worship, and are dedicated solely to the service of Kuula, the god of fishing" (Walker 1931:100). He states that they can have a variety of forms, but that "Most ko'as are under 20 feet square;" and "Coral is always associated with the true ko'a, the name itself being a contraction of the word <u>ako'ako'a</u>, which means, coral" (Walker 1931:100).

Walker described four *ko'a* the Honua'ula District, including Kaulana Ko'a at Keone'ō'io, a large *ko'a* at Pa'ako in Mo'omuku, and the *ko'a* at Nanahu, which he notes was previously reported (by Stokes) as a *heiau*. Walker's informants stated that this site was "a place to pray to the Fish God", so the earlier report...seems to be an error (Walker 1931:103). The fourth *ko'a* reported by Walker is described by Walker as follows:

> The ko'a at Onouli is located below the school about 100 feet back from the shore. It is a rough platform 13 by 14 feet and 5 feet high at the front. A low wall surrounds it on three sides. Blocks of Aa, iliili, and a few pebbles and coral fragments were found in its construction. (Walker 1931:103).

Assuming that Walker's "Onouli" is actually Oneuli, and that the school he refers to is Mākena School, this would potentially place the site within the south sector of the current project area. Recent surveys conducted *mauka* of Oneuli Beach to the south of the project area reported no feature that matches Walker's description (Rotunno-Hazuka et al. 2002); .likewise, early studies within the project area found no features with similar dimensions. It therefore seems likely that Site 5711, first identified in 2001 (Rotunno-Hazuka et al. 2005) and further studied during the current survey, is the structure described by Walker.

Information regarding the traditional Hawaiian settlement pattern and early twentieth century Hawaiian land use was gathered during the 1930s by Handy and Handy (1972). Their interests were primarily in agricultural practices, however, a good deal of information regarding current conditions in the 1930s, as well as traditional lore is presented in their study. Regarding the Mākena region, they made the following observation:

> On the south coast of East Maui, from Kula to 'Ulupalakua, a consistently dry and lava-strewn country, Makena and Ke'oneo'io were notable for good fishing; this brought many people to live by the shore and inland. There were some patches of upland taro, not irrigated; but this was a notable area for sweet potato, which, combined with the fishing, must have supported a sizable population although it cannot be counted as one of the chief centers. (Handy and Handy 1972:272).

When Handy and Handy visited Keone'ō'io in the 1930s, they observed that, "There are no people living there now. The modern fishing locality is Makena, a few miles beyond Keone'o'io" (Handy and Handy 1972:510).

During the early 1970s, the State of Hawai'i contracted with Bishop Museum to conduct a statewide field survey of previously identified sites as well as new findings of importance. Two inventories were generated - one for traditional Hawaiian sites and one for historic era structures. The two *heiau* previously recorded by Stokes and Walker were listed in the SHIP at this time, along with a large habitation complex referred to as the Makena Complex (SIHP Site 50-50-14-1266). The area of Site 1266 was recorded as rectangular area that encompasses 3,600 feet (1.9 km) of shoreline between the north base of Pu'u Ola'i and the north end of Maluaka Beach, and between the shoreline and Mākena-Keone'ō'io Road. All of parcels 37 and 56 within the project area, as well as additional lands to the north and south are within the boundaries of this complex (*Figure 1.3*). Scaled maps of the complex area were not produced at the time of this survey; rather formal feature types were enumerated as follows: walls (numerous, mostly associated with ranching, enclosures (16+), one burial in a wall, platforms (3+), and a pit.

Historic era sites recorded in the Mākena area during the 1971 SIHP survey by Wright include Kanahena Landing (50-50-14-1581), the John N. Makaiwa House (1582), the Pu'u Ola'i Slaughterhouse (1583), Keawala'i Church (1584), and Makena Landing (1585). The Pu'u Ola'i Slaughterhouse is the nearest to the current project area; it is located on the *mauka* side of Pu'u Ola'i, within the area of Mākena State Park.

The earliest archaeological survey of proposed development lands conducted in the Mākena area was in 1974. This survey of Seibu resort lands was conducted by Bishop Museum and encompassed 1000 acres of a 1300-acre project area that crossed ten *ahupua'a* of central Honua'ula (Clark 1974). During this survey, approximately 264 sites/features were noted, and Bishop Museum sites numbers were assigned to 114 sites.

The current project area is within Parcel I of the 1974 survey area, which consisted of 40 acres on both sides of Mākena-Keone'ō'io Road in Maluaka. Three sites were identified in the *makai* portion of Parcel 1 during the 1974 survey. These included a possible burial (Ma-B8-6), an enclosure and platform (Ma-B8-7), and a well (Ma-B8-8). They were described as follows:

> B8-6 Possible Burial
> An opening in a wall- -1 m in diameter- -exposed - a possible burial. A rib bone and a long bone can be seen from the opening. In addition there are pieces of wood, a rusted can, and shell fragments. This site should be excavated to determine if this is a human burial; if it is, the proper steps should be taken to relocate it.

B8-7 Enclosure and Platform
A platform- -10.5 by 6 and c. 0.2 to 0.4 m high- -is located within an enclosure which measures 31 by 28 m. The enclosure walls are 0.7 to 0.9 m high, 0.5 m wide, and constructed with multiple-stacked aa. The platform is paved with *'ili'ili*; porcelain, coral, and cowrie are also located on the surface. Historic artifacts include iron pots and pans, a lanterns, glass bottles, window glass, plastic, glass, and china dishes, and a snorkel. The site is in fair condition with moderate research potential.

B8-8 Well
A rectangular-shaped well has interior measurements of 3.6 by 1.4 m. The interior height ranges from 0.5 on the *makai* side- -to 1.6 m on the *mauka* side which is faced with basalt rocks. The well is in fair condition. (Clark 1974:11)

Site B8-6 as described by Clark corresponds with the "burial in a wall" that was found the previous year within the Mākena Complex. No records of further work at this site could be located. According to Clark's site map, it was situated near the center of Parcel 54 of the current project area. This parcel has been extensively bulldozed and remnants of a single wall were located during the current project, along the west boundary of the parcel. No evidence of skeletal remains were found within or near this wall remnant, or other walls that were found within Parcel 37.

Site B8-7 as recorded by Clark was located *makai* of the current project area, in the fairway of the 17th hole of the Seibu golf course. The site was mapped and excavated by Haun (1978) prior to its destruction. The Site B8-8 well is located along the shoreline, *makai* of the current project area. This site is close enough to the shore to escape destruction during golf course construction. It is still present, although the well area has been filled with storm-washed coral and basalt cobbles. The site has since been assigned SIHP Site number 50-50-14-1854.

Between March and April 1978, Bishop Museum archaeologists returned to Mākena to conduct the first increment of archaeological mitigation for the Seibu golf course in Mo'oiki and Maluaka (Haun 1978). The project area for this survey and excavation program included the area of the 17th hole along the shoreline at Maluaka Point; although the bulk of the fieldwork was concentrated in Mo'oiki, on the *mauka* side of Mākena-Keone'ō'io Road. Site Ma-B8-7 previously recorded by Clark was included in Haun's study. The 1978 work expanded the area of the site to include not only the habitation platform and enclosure, but ten additional features (seven walls, two enclosures, and a well). Portions of this complex as mapped by Haun extend into Parcel 37 of the current project area; these include Features 5, 6, 7, 8 and possibly 11. This complex was subsequently assigned SIHP Site number 50-50-14-1853. Further details on Haun's 1978 work and current findings at Site 1853 are found in Chapter 4.

In June of 1978, Bishop Museum undertook survey and excavations in the third increment area of the Seibu golf course, which consisted primarily of lands in Kaeo, north of the area examined by Haun (Cordy 1978). The two survey areas overlapped along the shoreline at Maluaka, and the later survey included the west and south portions of Parcel 37 (*Figure 1.3*).

Nine new sites were recorded in June 1978 within the *makai* section of the third increment area, in addition to the previously recorded B8-7. Four features that had been combined with B8-7 by Haun were given Bishop Museum Site numbers, along with two historic era house sites that had been previously mapped but not recorded. The Bishop Museum sites assigned during the June 1978 survey in Maluaka include four enclosures (Ma-B8-232, 233, 234, and 238), a midden scatter (235), remnants of two historic era dwellings (236, 237), and two walls (240, 241). Two of these sites (233 and 234) are entirely within Parcel 37 of the current project area; a portion of one site (240) are also within Parcel 37, and a portion of one site (237) is within Parcel 56. Further details on the 1978 survey of these sites and current findings are presented in Chapter 4.

Additional work was conducted in Parcel 37 in 1979, in connection with proposed hotel and residential areas (Rogers-Jourdane 1979). This survey area also included most of the land between Mākena-Keone'ō'io Road and Makena Alanui Road, from the north end of the current project area northward to Nahuna Point (c. 100 acres). Two wall sites were identified along the west side of Mākena-Keone'ō'io Road within Parcel 37 of the current survey area; these include Ma-B8-111 and 1112. These sites were subsequently assigned SIHP site numbers 590-50-14-1864 and 2272).

Additional fieldwork of the hotel development area was conducted later that same year, when Sites 1864 and 2272 were tested via excavation of single units at each site (Dennison 1979). Both of these sites were relocated during the current survey, and further details on the previous work at the sites is found in Chapter 4.

In 1987, Bishop Museum conducted a survey of a strip of land along the east side of Parcel 37, and all of Parcel 84, in connection with a proposed public parking lot and cul-de-sac along Mākena-Keone'ō'io Road (Cleghorn et al. 1988). No sites were identified in Parcel 37, and one site, the Mākena School Complex, was identified in Parcel 84. Five surface features were identified at this site, which was assigned Bishop Museum Site Ma-B8-252, and SIHP Site 50-50-14-1007. The features include two parcel boundary walls, two stone and wood platforms believed to be privies, and a cement-plastered cistern. Four of the five identified features were relocated within Parcel 84 of the current project area.

Data recovery excavations were conducted at the two identified privy features at Site 1007 in 1991 (Gwen Hurst letter to Roy Figueiroa 5 June 1991). Details on this and other previous work at Site 1077 are presented in Chapter 4.

One additional prior survey that included the current project area was conducted in 2001 by Archaeological Services Hawaii and Aki Sinoto Consulting. This survey included the three current survey parcels, as well as 23 acres immediately *mauka* (TMK .2-1-05: 83 and 85). In 2005, the three current survey parcels were separated from the larger survey area, and a report detailing the findings in these three parcels was prepared in 2005 (Rotunno-Hazuka et al. 2005).

The 2001 survey relocated previously identified Sites B8-233 and 234, and SIHP Site 1007; and six new sites were recorded (50-50-14-5706 through 5711) within Parcel 37 of the current project area. During the current survey, Sites 5706, 5707, 5709 and 5711 were expanded to include additional newly identified features. Sites 5710 and 5708 were reassigned to newly identified sites during the current survey, due to overlapping site areas (5708) and duplicated SIHP site numbers (5710). The specifics of these revisions are outlined in Chapters 3 and 4.

A number of surveys were conducted of Seibu resort lands and other private properties in Mākena during the 1990s and early 2000s, however none of these projects included the current project area. Findings of these surveys are summarized in a regional context in Chapter 2.

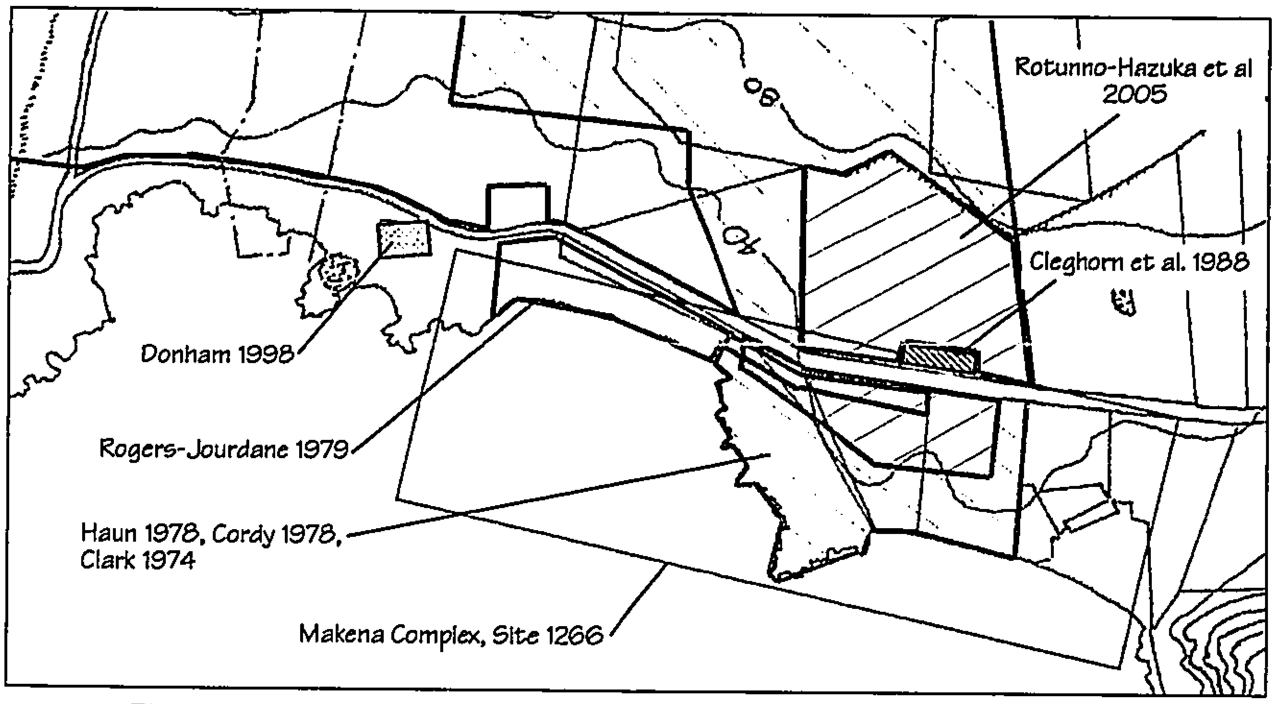


Figure 1.3 Previous Archaeological Studies and Recorded Complexes in Project Area Vicinity

2. SETTELEMENT PATTERN

Early Settlement

Information relating to the earliest settlements along the coast in Honua'ula are obtainable from dated cultural deposits that have been excavated in connection with modern shoreline development. There has been no research-oriented study of coastal Honua'ula designed specifically to identify early settlement. Thus, the available information may not be representative of the actual settlement that occurred in this district. The area of coastal Honua'ula that has a limited number of dated shoreline settlements is between the northern district boundary at Paeahu to the southern boundary of Onau at Kanahena. This area coincides with the Wailea and Mākena resort lands and the area of relatively intense private development.

Currently, there are only a handful of sites in Honua'ula that are documented with radiocarbon samples predating AD 1300-1350. These include three and possibly four shoreline sites, and four sites located short distances inland from the shoreline settlements (*Table 2.1*). The shoreline sites include Palauea Landing in Palauea (Site 2496), Po'olenalena in Keauhou, and Keawakapu in Ka'eo (Site 1584). The inland sites include BPBM Site B12/13, located inland from Wailea Point, Site 260, inland from Palauea Landing, Site 1361, inland from Po'olenalena, and Site 1941, inland from Keawakapu.

A shoreline site near Nahuna Point in Waipio (Site 1820) may also predate AD 1350. A radiocarbon sample recovered from a deeply buried subsurface hearth feature at Site 1820 returned a two sigma calendric range of AD 1104-1664 (Dobyns 1988:112). In discussing this date, Dobyns states that "..a date in the 1600's (near the upper temporal range based on two standard deviations) is a more probable date given other known occupations in Honua'ula" (Dobyns 1988:41). Given what is now known of the distribution of pre-AD 1400 coastal settlement in Houna'ula, it is expected that a habitation site dating to the 1300's or earlier would be present in Waipio. This site and the three sites with definitive early dates are all located at preferred landing sites, most of which were used well into the historic era. These early sites are also distributed in a regular fashion along the coast, with ample space between settlements. The spaces between certain settlements may of course fill in as additional information is gathered.

Based on her translation of oral history, Beckwith (1970) notes that the establishment of formalized land districts and *ahupua'a* on Maui was initiated by Kaka'alaneo, who lived in Lahaina sometime between AD 1420-1538 (based on Fornander's (1969) genealogy). Given this timeframe for the establishment of *ahupua'a*, it appears that these early shoreline settlements pre-dated the establishment of formalized *ahupua'a* boundaries in Honua'ula, and that *ahupua'a* boundaries were most likely established with these existing settlements in consideration.

Comparison of dates from the early sites indicates that the earliest known settlement is currently at the northern end of the district, at Palauea. This pattern, as well as the inferred sequencing of *ahupua'a* organization and settlement, conflicts with the settlement model made popular for Houa'ula by Cordy and Athens (1985), and recently summarized by Gosser as follows:

> The radiocarbon data indicate that coastal South Maui was probably occupied earliest at or near Makena around AD 1200, followed by settlements at Keauhou and Palauea approximately 100 to 150 years later. By AD 1650, there is evidence of increased settlement at Makena, Keauhou, and Palauea, as well as other locations along the coast. At Makena, the clustering of early sites within *ahupua`a* is not as visually apparent as at Keauhou or Palauea, and may be the result of longer and more intense occupation of the Makena area prior to formalized *ahupua`a* development. (Gosser et al. 1996:437)

Current information seems to support the idea that although the Ka'eo/Mākena area was a center of population during the late pre-contact and early historic era, there is currently no available evidence to support the conclusion that it was the first location settled, or that it was the only area settled prior to AD 1350. Furthermore, it appears that there were potentially a number of shoreline settlements (at least four or five) in existence in Houna'ula before political action was taken to subdivide the district into formal *ahupua'a*.

Beta or HRC No.	Site/Feature and Provenience	C-14 Age BP	1 σ Calibrated Calendric Range	Report Reference
39488	Site 2496 Fea. E, TU-1, HF-1, -.80 m	1160+/-80	AD 730-890	Donham 1990: 26
H1273	Site 1941, Fea. 24, Layer II	950+/-80	AD 1014-1199	Gosser et al. 1996:353
86505	Site 2496, Fea. 10, TT2C,X, -1.00 m	750+/-80	AD 1120-1280	Fredericksen et al. 1996
87616	Site 2496, TU 3C/D, X-1, -1.45 m	750+/-60	AD 1140-1260	Fredericksen et al. 1996
111497	Site 1854, TU 56N 3E, -1.20 m	730+/-50	AD 1265-1295	Donham 1998:112
11496	Site 1854, TU 48N4E, -1.45 m	710+/-70	AD 1265-1310	Donham 1998:112
86507	Site 2496, Fea. 8, TU 3A, -1.46 m	690+/-80	AD 1180-1340	Fredericksen et al. 1996
87615	Site 2496, Fea. 17, TU 3D, -1.64 m	660+/-100	AD 1190-1390	Fredericksen et al. 1996*
53920	Site 260, Fea. 2, TU-1, Layer II-4	600+/-120	AD 1280-1420	Rotunno-Hazuka et al. 2000
2463	Site 1820, Fea. 6, TP-11	550+/-140	AD1244-1524	Dobyns 1988:112
H1325	Site 1361, Fea. 1, Unit 1, Layer IV	490+/-70	AD 1298-1344	Gosser et al. 1993
H1463	Site 1362, Fea. D, U20, Layer IV	460+/-80	AD 1280-1520	Gosser et al. 1993
10810	Site B12-12/13, Fea. F, TU-6, -.40 m	380+/-60	AD 1330-1430	Walker et al. 1985: 95

*Note: Not listed here are seven additional radiocarbon dates from Site 2496 that pre-date c. AD 1350; see Fredericksen et al. 1996.

Table 2.1 Summary of Pre-AD 1350 Radiocarbon dates from Honua'ula

The provenience of dated charcoal from the pre-AD 1350 era sites indicates that all of the sites with early dates also show evidence of later occupation, and that the surface architecture at these sites is associated with the later occupations. The later occupations are either superimposed over the buried early deposits, such as at Sites 2496 and 1584, or are in the form of surface features that were built directly on the previous midden deposits, with no additional accumulation of midden. Known cases of stratified sites with intact early deposits preserved beneath sterile sand or later cultural layers are limited in Honua'ula. They include Sites 1820, 1854 and 2496, where aeolian sand has accumulated along the shore. There are currently no known cases of an early deposit predating AD 1350 found beneath later occupations in a cave setting in Honua'ula. Stratified deposits have been found beneath the foundations of walls or platforms, or within walled enclosures, were the soil is protected from erosion and other forms of surface disturbances.

Available radiocarbon dates from Honua'ula show a definite increase in the number of dated sites for the period of AD 1350-1550, and a further increase between AD 1550-1750. Materials analyzed during a recent Seibu property data recovery project in Mākena include 61 wood charcoal samples from 18 sites located in the *ahupua'a* of Keahou, Kalihi, Waipio, Papaanui, and Mo'oiki. The dated features range in elevation from 100 to 480 ft AMSL and are located between 0.5 and one mile from the shoreline (Gosser et al. 1996). Over half (36, 59%) of the assayed charcoal samples returned calendric ranges which post dated AD 1650. The bulk of dates from Palauea and other Wailea *ahupua'a* are also around AD 1650. Eighteen of the 61 calendric ranges for Makena carbon samples were between AD 1400 and 1650 (Gosser et al. 1996:351). The distribution of dated features suggests an inland expansion of habitation and agricultural activities in the Mākena region after AD 1650. Gosser et al. characterize the permanent habitation sites of this period as being discreet complexes enclosed by walls. These complexes are seen to represent traditional *kauhale,* which Gosser infers did not occur in the region until c. AD 1650-1750. Given that the favored habitation areas were re-used and rebuilt rather continuously from AD 1100 and after, it would be difficult to actually date the beginning of walled *kauhale* compounds in Honua'ula. What is currently available for observation are the sites that were not re-occupied and redesigned for subsequent use. Accurate interpretation of the cultural sequence in Honua'ula requires full recognition of the limitations posed by the continued and rather intense land use that has occurred in this region.

Nineteenth Century Land Use

The privatization of land in Honua'ula was accelerated by the leasing of Crown Land for sugar and cattle production; and by the subdivision and fee simple sale of large tracts of Government Land at a relatively early date. A much smaller land area was claimed as *kuleana* and awarded to Native Hawaiians by the Land Commission.

In 1841, Kamehameha III leased approximately 4,073 acres of land in Waipio and Papa'anui to Nowlein and Burrows for sugar cane and livestock production (Thrum 1925 reproduced in Barrere 1975). This lease was subsequently sublet to L. L. Torbert in 1845 for the sum of $800 per year. In 1848, Torbert was appointed by the Minister of Interior to assist John Richardson in surveying lands in Houna'ula. The following year, he was issued Royal Patent 120, which granted him fee simple ownership of a 2,087-acre *mauka* portion of the Kamehameha III lease lands, for the sum of $1,600. In 1850, Torbert and Wilcox secured the remaining 1,986 acres of the original lease through Grant 234, for the sum of $1986 (Waihona 'Aina 2006). He also secured a corridor from "Torbertsville" at the mill site to the shoreline, for purposes of constructing a road and landing. Land Commission testimonies of local residents indicate that disputes over land tenure arose in connection with Torbert's fee simple acquisitions. Testimony indicates that Nawaiki, a local *konohiki,* had claims through descendancy to lands in five different Hounua'ula *ahupua'a,* and eleven different *apana* were described in the Native testimony (*Table 2.1*). As described by Nawaiki:

> I have entered a claim, which has been settled by S.K. Kamakau through witnesses, but when J. Richardson [went] to survey there was much disputing and I relinquished my claim and sold all my rights to Torbert, and I heard from J. Richardson that he was sent to survey by the Minister of the Interior and not by the Board of Land Commissioners. (Foreign Testimony 97v16)

Nawaiki was awarded four *apana* that were not located on Torbert's land, including a .2 acre houselot that is situated adjacent to and overlapping a portion of project area parcel 56 (5402B:4; see *Figure 1.2*). This houselot corresponds with the location of Site Ma-B8-237, which was described by Cordy (1978:9) as a midden scatter and concrete foundation. Site 5708 Feature 3 as identified during the current survey could also be within the boundary of this Land Commission Award.

Nawaiki's houselot and a second .5 acre houselot awarded to Kahaleokaia (5402B:4) are the only LCA shown on historic survey maps within or adjacent to the project area. Kahaleokaia's award is located at Malauaka Point and the awarded land is completely within the golf course area. In his testimony, Kahaleokaia named this location Papakahiula, and stated that four houses were present. Testimony by Hakaloa placed this houselot in Ka'eo. This location corresponds with the location of Site 1853 (Ma-B8-7) as identified by Clark (1974) and later by Haun (1978), and with Site Ma-B8-238 as described by Cordy (1978), which is within the area of Site 1853. The exact extent of the awarded LCA within the Site 1853 complex area is indeterminate at this time; however, given its small size it is not likely that extended as far *mauka* as Feature 5, which is still partially intact and within the project area. On the other hand, the actual area of the claimed houselot was probably over .5 acres, given that four houses were present, and given its size as depicted on Torbert's map (see *Figure* 2.2 below).

LCA within Maluaka include a cluster of six awarded *kuleana* is shown at the 200 to 380 foot elevation range, and a small cluster of four *kuleana* is shown at the 600 to 750 foot elevation range. This latter cluster is at the *mauka* extent of Maluaka as shown on tax maps, and is at the interface between Maluaka and Mohopilo. Records of the two coastal Land Commission awards and the six claims located at the 200-380 foot elevation range (seven awards total) were acquired from the Waihona 'Aina database (2006) for analysis (*Table* 2.2). These claims were made between December 26, 1847 and January 13, 1848). The witness testimonies, as registered in the Native Testimonies, were not recorded until August 9, 1849, and the Royal Patents were issued *circa* 1850.

At least 40 different land parcels were claimed by the seven individuals who testified before the Commission; of these claims, 15 parcels were awarded (*Table 2.2*). Descriptions of claimed lands indicates that all of the claimants utilized parcels that were scattered among two or more *ahupua'a,* with as many as five enumerated. This rather scattered patterning of *apana* is apparent for many of the Honua'ula land claims, and it raises the question as to whether *ahupua'a* boundaries posed any constraints whatsoever on the economic activities of the residents.

Award Claimant	Native Register Claims	Native Testimony 1849	Awarded
2401 Kohilae	Kaeo: 6 sections of grassland	Section 1 - Pasture in Palauea	Relinq..
(Dec 26, 1847)	Palauea: 4 Irish potato patches	Section 2 - Pasture in Keauhou	Relinq.
		Section 3 - Pasture, Ulupalakua, Kaeo	10.91 ac (2)
		Section 4 - Pasture, Ulupala., Mohopilo	12.96
		Section 5 - House lot, Ulupalakua, Kaeo	.
2427 Kanakahou	Mo'oiki: 4 sections of grassland	Sections 1-4, grassland, Mo'oiki	10.13 a. (2)
(Dec. 27, 1847)	Mo'oloa: 1 section of grassland		
	Kaeo: 5 Irish potato patches		
	Palauea: 1 Irish potato patch		
	Maluaka: edible cactus		
	No location specified: houselot, 2 houses		
2524 Moku	Two lots in Puehuehu	Sections 1-3 - pasture, Ulupalakua, Kaeo	Not
(Dec. 25, 1847)		Section 4 - pasture, Maluaka	Awarded
2581 Hualii	Kaeo: three sections of grassland	Section 1 - pasture, Ulupalakua, Kaeo	
(Aug. 9, 1849)	Maluaka: house site	Section 2, pasture, Ulupala., Mohopilo	10.16 a. (2).
2658 Kiniakau	Waipao: moku mau'u (total of 3)	Section 1 - pasture, Palauea	
(Dec. 26, 1847)	Papaanui/Keauhou 2: moku mau'u (2)	Section 2 - pasture, Palauea	
	Keauhou: potato mala (3)	Sections 3 & 5 - pasture, Keauhou	
		Section 4 - pasture, Waipao	7.1 ac. (2)
		Section 6 - pasture, Mohopilo	
		Section 7 - house lot, Waipoa	
4157 Kahaleokaia	Mo'oloa: taro *kihapai*, *'ili* of Paliuli	Sections 1 & 2 - pasture, Kaeo	
(Jan. 13, 1848)	Palauea: bananas, 7 Irish potato patches	Section 3 - taro, Paliuli, Mooloa	10.2 ac,
	Papakahiula: houselot with four houses	Sections 4-6 - pasture, paliuli, Mooiki	11.4 ac
		Section 7 - house lot, Kaeo (apana 1)	0.5 ac.
5402B Nawaiki	Konohiki claims disputed, rights sold to Torbert 1848-49,	Section 1 - pasture, Paipili, Maluaka	
(nd)	Maluaka	Sections 2-5 - Irish potato, Paipili, Keahou	.6 ac.
	Mooiki	Section 6 - taro, I. Potato, Paipili, Maluaka	
	Kaeo	Section 7 - pasture, Laie, Maluaka	
	Makaalua	Section 8-10 - pasture, Mooiki	6.01 (2).
	Laaieiki	Section 11 - house lot, Kaeo	.2 ac.

Note. Number 2 in parentheses behind acreage awarded indicates that two *apana* were awarded and acreage given is total of both. Blank value in awarded column indicates that the section was not awarded

Table 2.2 Summary of Land Commission claims and awards, Malauaka and Ka'eo below 400 feet elevation

Discrepancies between the original land claims and the testimonies provided by witnesses pose some questions as to what the claims were actually used for at the time, or whether there were other fators at work that influenced the Native Testimonies. For example, the Native Register claims list 20 Irish potato patches, as compared to only three noted by witness testimonies. This is odd, given that the production and export of Irish potatoes increased dramatically on Maui between 1848 and 1849, and again in 1850 (Kleiger 1996:42). These data suggest that there should have been an increase in potato patches between 1847 and 1849, not a near disappearance of them. In general, the Native Testimony records tend to indicate a consistent pasture land use pattern, whereas the Native Register indicates a more diverse land use pattern with a range of crops including taro, bananas, and edible cactus as well as a considerable amount of Irish potato cultivation.

The Land Commission records indicate that Maluaka Point was not within the area defined as Maluaka *Ahupua'a*. Both of the awarded houselots at Maluaka Point are described in the Native Testimony as being in Ka'eo, and are within the area of Mahoe's *Ahupua'a* Grant 835, the extent of which is shown on Territorial Survey maps (*Figure* 2.1). The shoreline portion of Maluaka began just south of Mahoe's Grant and included the area behind One'uli Beach to the base of Pu'u Ōla'i. The land grants located along this section of the beach are referred to in grant documents as being within Maluaka Ahupua'a. Torbert's Grant 1441:3, which is located along the *mauka* side of Mākena-Keone'ō'io Road and inland of Maluaka Point, is also referred to in grant documents as being within Maluaka Ahupua'a.

After the *Māhele*, Government Lands within the *ahupua'a* of Maluaka, Mo'oiki, Mo'oloa and Mo'omuku were subdivided into parcels of various sizes and sold to private citizens. Chinen (1993) surmises that these sales were for purposes of offsetting government expense:

> Following the division of the lands into Crown, Government, and Konohiki Lands, from time to time portions of the Government Lands were sold as a means of obtaining revenue to meet the increasing costs of the Government. Purchasers of these lands were issued documents called "Grants" or "Royal Patent Grants". These differed from the Royal Patents issued upon Land Commission Awards. It was not necessary for the recipients of the Royal Patent Grants to obtain an award for their land from the Land Commission. (Chinen 1993: 28, 29)

In January 1853, the East Maui Government land agent John T. Gower was directed by the Interior Department to sell Maluaka, Mo'oiki, Mo'oloa and Mo'omuku Government lands for $1.00 per acre, or at a price that reflected the quality and situation of the land (Klieger 1996:38). In February 1853 L.L. Torbert submitted a survey map of these *ahupua'a* to the Interior Department, and land was opened for sale the following month, on April 3, 1853. During the next 10 years, approximately 72 parcels were sold to 49 different buyers in these *ahupua'a* between the shoreline and 800 feet in elevation. Additional grants were also sold in the upper elevations. Acreage of the parcels sold in the coastal region ranged from 0.97 acre to 69.1 acres. Several buyers purchased more than one parcel in more than one *ahupua'a*; these were designated as *apana* within a single grant.

The most *apana* purchased by a single individual was six, purchased by L.L. Torbert (Grant 1441). Torbert's acquisitions totaled 125.62 acres in the coastal zone (800 ft and below); his largest *apana* was 54.65 acres, and encompassed the crest and upper slopes of Pu'u Ōla'i (*Figure 2.1*). Torbert also bought two parcels between Pu'u Ōla'i and Mākena-Keone'ō'io Road, a shoreline parcel at the north base of the cinder cone, and a triangular parcel of 11.93 acres along the *mauka* side of the Mākena-Keone'ō'io Road and on the north side of Grant 1508 to Makahanohano. These grants, along with Torbert's large ranch holdings to the north, were sold at public auction in 1856, at which time they were acquired by Makee (Hurst 1996:47).

Most of the Crown and Government land in this region was sold as grants, and nearly all of the purchasers were Hawaiians, many of whom also owned Land Commission Awards. For example, Maluaka Point resident Kahaleokaia purchased three side-by-side grants in Maluaka totaling 46.4 acres. These are located just *mauka* of the *aupuni* wall, at an elevation range of 80 to 360 feet elevation (*Figure 2.1*). Kahaleokaia's neighbor Nawaiki purchased two grants in Mo'oiki along the *mauka* side of Mākena-Keone'ō'io Road, totaling 48.57 acres. In addition to Torbert, *haole* purchasers included J. Breman, H.O. Bucklin, S.P. Chapman, J.M. Painter and J. Brown. Torbert was the only *haole* to purchase a substantial amount of land in the coastal zone. Other *haole* purchases near the coast were small and somewhat

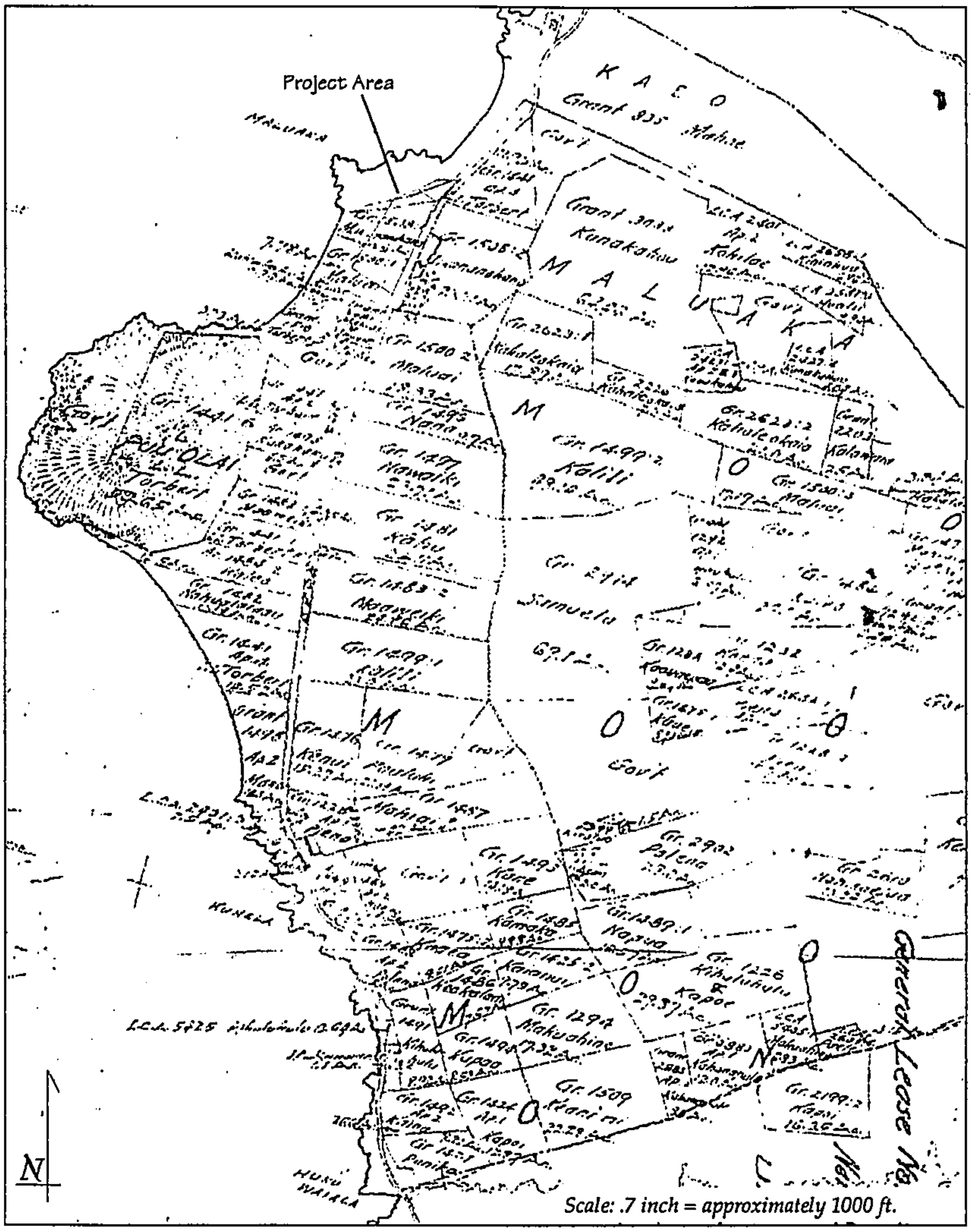


Figure 2.1 Coastal Portion of the Territorial survey map of Grant lands in Honua'ula (Reg. No. 1763), showing LCA and Grants. Approximate location of project area shown in orange.

clustered at the north base of Pu'u Ōla'i, where Andrews, Sinclair, Burns and Brown all had adjacent parcels of one acre or less bordering Torbert's Grant 1510.

Parcel 84 of the current project area was subdivided from Grant 1508:2 to Makahanohano. This original grant was 23.21 acres in area and was bounded on the *makai* side by the Mākena-Keone'ō'io Road and the *mauka* side by the *Aupuni* (government) wall. As a result, the *mauka* boundary of this parcel (and others along the wall) was somewhat irregular as compared to the generally straight sides of other grants. A four-acre parcel (83) was later subdivided from the southern portion of Grant 1508:2. The north boundary of this parcel was defined by the same wall (Site 1007 Feature 7) that defined the southern edge of the Mākena School Lot (parcel 84).

As indicated in Cleghorn et al.'s study, the boundaries of the Mākena School Lot were added to the Territorial Survey Map in 1903. The lot was surveyed in 1917 when it was conveyed to the Territory of Hawai'i (Cleghorn et al. 1989:8). The lot was designated as TMK parcel 39 until the area was re-subdivided for resort planning purposes.

Project area parcel 37 as currently configured encompasses portions of four nineteenth century parcels. The northern edge of the parcel is within the area of Mahoe's Ka'eo *Ahupua'a* Grant 835. Adjacent to south is a strip of land that was retained as Government Land. The shape of this parcel suggests that it was planned as a road corridor to provide access to the shoreline at the south side of Maluaka Point. There is no available information to indicate that a government road was actually located within this corridor, and later tax maps show this corridor as part of Mahoe's Grant 835. The Site 1853 features that are intact within the project area are located within this former government corridor. The bulk of parcel 37 is within the area of Grant 1508:1 to Makahanohano. This was a 7.66 acre parcel that extended to the shoreline from Mākena-Keone'ō'io Road. Across the road was Makahanohano's larger parcel (Grant 1508:2). The southern portion of parcel 37 is within Grant 1500:1 to Maluai. This 7.78 acre parcel also extended to the shoreline; it was one of three parcel purchased by Maluai totaling 43.3 acres.

Project area parcel 56 is only 1.73 acres in area, however, it appears to encompass portions of three former land parcels. These include a corner of Nawaiki's houselot (LCA 5402B: 4), the former Government corridor that follows the southern boundary of Ka'eo, and a sliver of Mahoe's Grant 835. Thus, a small portion of parcel 56 is within Ka'eo *Ahupua'a*.

In addition to the Government survey maps, cartographic records of the nineteenth century include Torbert's Map (Reg. No. 1202), produced *circa* 1848-1856 (*Figure 2.2*). This map has been reproduced in numerous archaeological studies of the area, and in some cases, archaeological sites have been correlated with structures shown on this map. In this case, there are no structures or walls depicted within the current project area. Torbert's map does, however, depict Kahaleokaia's houselot (LCA 4157:1) which correlates with the Maluaka Point Complex (Site 1853). The map shows a walled compound with five structures inside. The area of this compound as depicted on the map appears to be greater than the area that was awarded to Kahaleokaia. The detail of Torbert's map is such that the large enclosure wall cannot be correlated with accuracy to specific walls mapped by Haun; however, it may well be represented by a rather long alignment of three wall sections that were not given feature numbers (see *Figure 4.5* below). The Feature 8 wall segments could conceivably be part of the larger enclosure as well.

The keyhole-shaped fishpond shown on Torbert's map to the south of the project area correlates with Site 5209, recently recorded by Rotunno-Hazuka et al. (2002), and the of cluster of structures adjacent to the fishpond are most likely represented by Site 5210, a rather extensive complex of terraces and interconnecting walls. Included within the Site 5210 complex is "a large clearing enclosed on three sides by freestanding and retaining walls" (Rotunno-Hazuka et al. 2002:57). This feature may correlate with the three-sided enclosure depicted on Torbert's map. This map also depicts the *Aupuni* wall that defined the *mauka* extent of land grants along the *mauka* side of the government road.

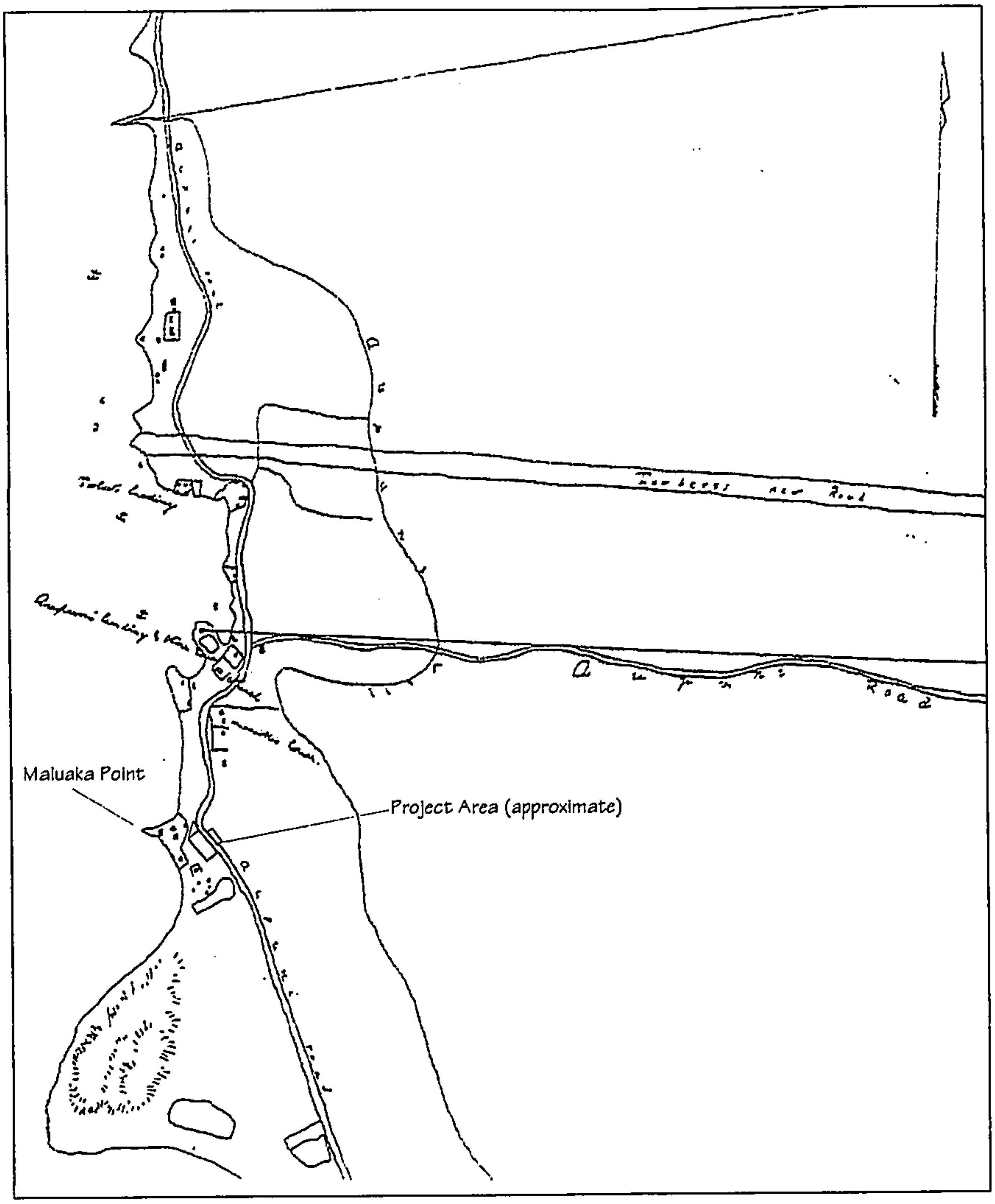


Figure 2.2 A portion of Torbert's Map (Reg. No. 1202); added text is in blue)

Twentieth Century and Current Conditions

At the beginning of the twentieth century, a small population was present in coastal Mākena, with a town center and post office located near Torbert's Landing (now Mākena Landing). The church at Keawakapu was rededicated 1908, following repairs to the church building and installation of a wooden floor (Dodge ms.). Around this same time, the school at Keawakapu was closed and a new school was established at the site of the Mākena School (Site 1007, parcel 84). In 1906, funding for a teacher's cottage at Mākena was included in a wish list for 51 new Department of public Instruction buildings in Maui County by the (Maui News 20 Jan. 1906). No follow-up stories could be found to document whether this cottage was ever constructed.

Published reports of school enrollment across Maui show that Mākena School was usually near the bottom of the list in terms of enrollment numbers. In 1914, Mākena School had 24 students, compared to 146 at Kēōkea, 82 at Kaupo, 71 at Kīhei and 22 at Ulupalakua (Maui News 14 Nov 1914). Ten years later, Mākena School showed 22 students (smallest on Maui), compared to 143 at Kēōkea, 23 at Kula Sanitorium and 79 at Kīhei. The largest single school enrollment at that time was 895 students, at Pā'ia School; ranked second was Pu'unene with 853 students (Maui News 15 Sept. 1926). The next available enrollment report was published in 1930; this report does not list Mākena School. It therefore appears that the school ceased operations some time between 1926 and 1930. Consolidation of school facilities had been a goal of the School Superintendent since 1920, when an article was published explaining that transporting student was cheaper than maintaining all the one-room school houses that were scattered across the island (Maui News 17 Sept 1920).

A number of Hawaiian families lived within or near the project area during the 20th century. These include the Lono, Kailipalauli and Lonokailua families to the south, and Poepoe family to the east (Rotunno-Hazuka et al. 2002). Identified sites 5798 and 5799 are most likely associated with the Poepoe family residence, which was located in parcel 83 to the south of the current project area parcel 84..

Current Conditions

The project area has been impacted to varying degrees by twentieth century activities such as cattle ranching, modern home construction, and resort development. The southeastern corner of parcel 37 has been impacted by grading, with subsequent dumping of construction debris and green waste (*Figure 1.3*). A band of varying width along the west and south boundary of parcel 37, and the west boundary of parcel 56 has been impacted by grading and bulldozer push-piles in connection with golf course development. Strips along Mākena-Keone'ō'io Road and the cul-de-sac have been affected by culvert construction, road widening and other activities. A graded swale was also cut across the southern portion of parcel 37, inland from the road, between two culvert outflow areas. This was probably done to decrease potential sheet wash onto the golf course.

Most of parcel 56 has been grubbed and graded, as evidenced by the presence of linear push piles on the parcel. The only unaffected portions of this parcel were found in a thin strip between the graded area and the edge of the golf course. Finally, the northwestern corner of parcel 84 has been impacted by the construction of a beach access parking lot. Evidence of mechanical activity is indicated in the area of the former school building and in a zone between the former building and Mākena-Keone'ō'io Road.

Expected Findings

Previous archaeological studies of the project area and surrounding lands have found a broad range of sites that span many centuries of intensive land use. It is known that this area was a location for permanent residency, as documented by archaeological deposits, nineteenth century land records, and former residents of twentieth century home sites. Previous surveys of the area have identified evidence of ceremonial use, as indicated by the *Ko'a* (Site 5711) and known cemeteries on the adjacent property to the south. It is therefore expectable that additional ceremonial or burial sites might occur. A number of walls attributable to ranching activities have been identified in parcel adjacent to the project area; these are therefore also expected to occur. As noted above, evidence of the earliest settlements in this area may be rather elusive, due to the extent of land use changes that occurred; however, it is possible that subsurface deposits dating to the period of early settlement (c. AD 1200-1400) may be identified.

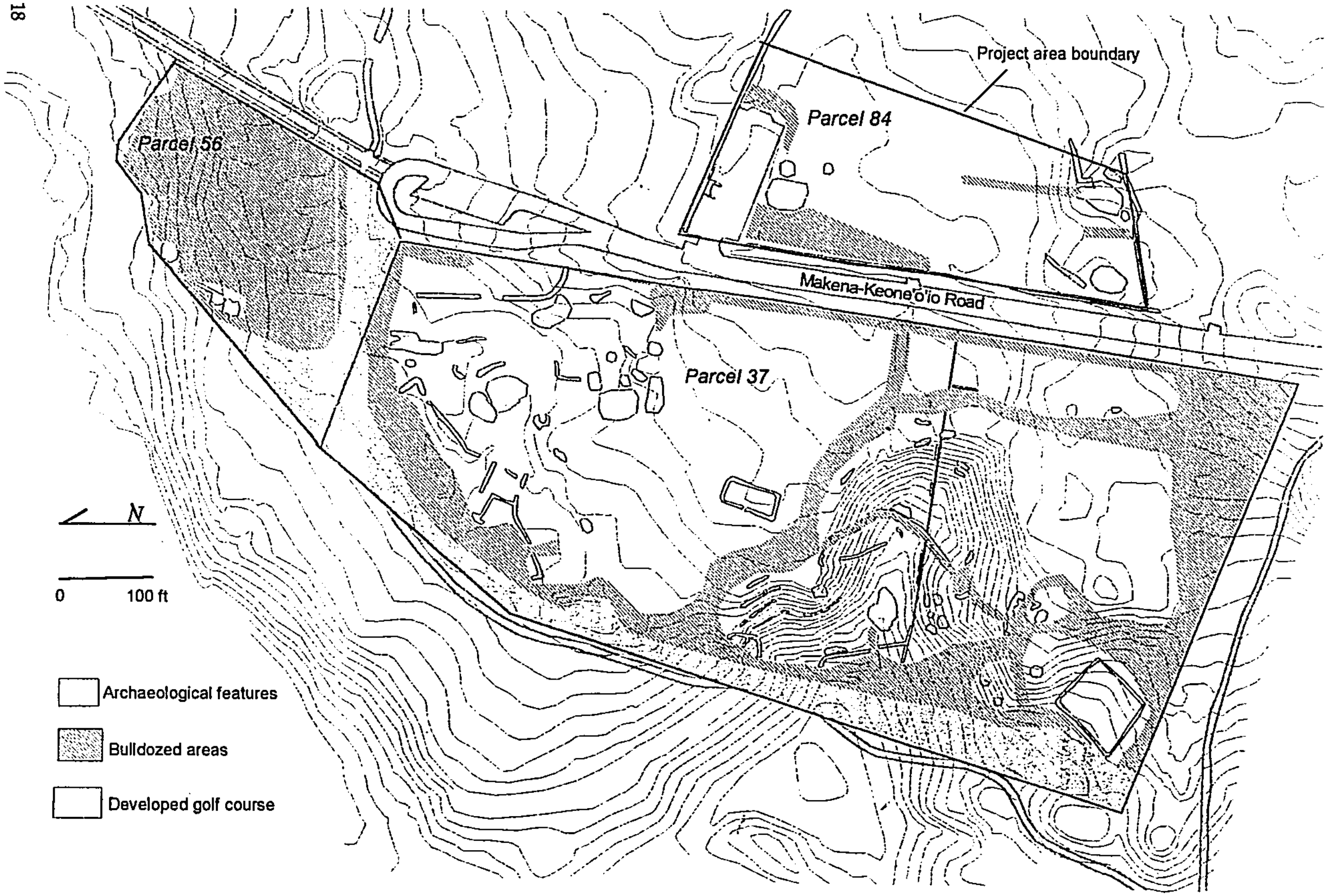


Figure 2.3 Machinery disturbance within the project area

3. FIELD AND LABORATORY PROCEDURES

Pedestrian Survey

A systematic pedestrian survey was conducted of the project area October 3 and 4 by a team of three persons, including the Principal Investigator Theresa K. Donham, and Field Archaeologists Koa Hodgins and Jenny O'Claray. The survey began at the northern end of parcel 37, with transects oriented along the short axis of the parcel, roughly east-west (70-250 degrees Az). Surveyors were spaced at 5-meter or less intervals and the southern edge of the transect was marked with yellow flagging tape. The northern edge of the first transect followed the parcel 37 boundary; each subsequent transect followed the flagged line of the preceding transect. Sixteen transects were completed in parcel 37. The team then proceeded to parcel 56, where transects were oriented roughly north-south, parallel with the western parcel boundary. Four transects were completed in this parcel. Parcel 84 was then surveyed, with transects oriented roughly north-south, parallel with the western parcel boundary. Six transects were completed in this parcel.

All surface features that were determined to be cultural or possibly cultural, regardless of estimated age, were flagged during the pedestrian survey. These features were numbered sequentially, beginning with FN (field number)-1. A total of 88 Field numbers were assigned to surface features, including 73 in Parcel 37 (FN-1 through 72 and 82); five in Parcel 56 (FN-73 through 77); and nine in Parcel 84 (FN-78 through 81 and 83 through 88). The identified surface features were flagged with one or more strips of bright orange flagging tape, marked with the Field Number and date identified.

After the pedestrian survey was completed, a clearing crew consisting of Goodfellow Brothers, Inc. employees was mobilized to clear surface vegetation from all the flagged features. Clearing was accomplished with weed trimmers and chain saws, under the supervision of the principal investigator and field archaeologists. The locations of the identified features were then plotted on a scaled topographic map of the project area (1 inch=100 feet), provided by Austin, Tsutsumi and Associates, Inc.

Site Documentation

Recordation and mapping of cultural features followed the same sequence as the pedestrian survey, with the same team of three archaeologists, along with field archaeologist Tracy Tam-Sing. A feature description record was completed for each of the flagged features. Information recorded included formal type and description, distance and angle to nearest identified feature(s), construction materials and techniques, dimensions, observed portable remains, condition and post-abandonment impacts, natural setting, and inferred function. Color photographs were taken, and a scaled plan map of the feature was drawn. In cases were several small features were in close proximity, these were mapped together. Scales used in field maps ranged from 1 inch=1.0 meter to 1 inch=5.0 meters. During recordation, the feature was assessed to determine if it was over 50 years in age, or potentially over 50 years. Those features determined to be the result of recent golf course construction, drainage improvements, or recent improvements to Mākena Road were identified as such and removed from the list of historic properties. After examination and documentation, eleven features were determined to be less than 50 years old; they are: FN-4, 31, 34, 35, 36, 37, 38, 64, 67, 68, and 72. Other features that appeared to be the result of mechanized earthmoving, but could not with confidence be determined to be less than 50 years in age, are not included in the above list.

Following documentation and mapping, those features determined to potentially be over 50 years in age were grouped into site complexes. Records of previously recorded sites and features were used to determine which features were within or near previously recorded sites. Complex boundaries were then drawn based on these prior surveys, as well as on the spatial association of the identified features.

Features representing ten previously recorded SIHP sites and three previously recorded Bishop Museum sites were identified among the recorded historic features. The ten previously assigned SIHP site numbers include SIHP 50-50-14-1007, 1853, 1864, 2272, and 5706 through 5711. Five new SIHP numbers (50-50-14-5795 through 5799) were requested and assigned to three previously recorded Bishop Museum Sites (Ma-B8-233, 234 and 240) and two previously unrecorded sites in Parcel 84.

The following changes were requested and have been approved by SHPD regarding the previously recorded SIHP sites:

1. Site 1007: originally recorded as Mākena School (Cleghorn et al. 1988), with five component features. Four of the five original features were identified within the project area during this survey and two additional features were added to the complex.
2. Site 1853: originally recorded as 12 features (Haun 1978). Five or possibly six of the previously documented features were identified within the project area, including one previously mapped but undesignated feature that was given a new feature number. One newly identified feature was also added to the complex.
3. Site 1864: originally recorded as a single feature (Rogers-Jourdane 1979). This site was identified within the project area; it was however given two feature designations.
4. Site 2272: originally recorded as a single feature (Rogers-Jourdane 1979). This feature was identified within the project area and three newly identified features were added to the complex.
5. Site 5706: originally recorded as a single feature (Rotunno-Hazuka et al. 2005). This feature was identified within the project area and 16 newly identified features were added to the complex.
6. Site 5707: originally recorded as a single feature (Rotunno-Hazuka et al. 2005). This feature was identified within the project area and three newly identified features were added to the complex. Also added to the complex was a single feature originally recorded as Site 5708.
7. Site 5708: originally recorded as a single feature (Rotunno-Hazuka et al. 2005). This feature was identified within the project area and was combined with Site 5707 due to the close proximity of associated features from Site 5707. The site number was re-assigned to a newly identified complex of three historic/modern era features within the project area.
8. Site 5709: originally recorded as a single feature (Rotunno-Hazuka et al. 2005). This feature was identified within the project area and a nearby newly identified feature was added to the complex.
9. Site 5710: originally assigned to previously recorded SIHP Site 2272. This number was therefore re-assigned to a complex of 13 newly-identified features within the project area.
10. Site 5711: originally recorded as a single feature (Rotunno-Hazuka et al. 2005). This feature was identified within the project area, and seven newly-identified features were added to the complex.

In summary, 23 previously identified features at ten previously recorded SIHP sites within the project area were relocated during the this survey. A possible exception is Site 1853 Feature 11, which is included in this count. Overlays of the prior survey area with the current survey area indicate that portions of this wall should be just inside the west boundary of Parcel 56. Traces of what appeared to be a bulldozed wall were located in the overlaid area of the feature; however, the remnants are currently too partial to verify that it was in fact the same wall mapped by Haun in 1978.

The total overall feature count for the project area is 80, 23 of which were previously recorded. The total number of sites is 15, of which 11 were previously recorded. The four newly-identified sites are 5708, 5710 (numbers reassigned), 5798, and 5799 (newly recorded and newly assigned).

The three previously identified Bishop Museum sites that did not have SIHP Site numbers were assigned new SIHP numbers and expanded as follows:

1. Site Ma-B8-233: originally recorded as a single feature (Cordy 1978). This feature was identified within the project area and assigned a new SIHP Site number, 50-50-14-5795. No newly identified features were added to the site.
2. Site Ma-B8-234: originally recorded as a single feature (Cordy 1978). This feature was identified within the project area and assigned a new SIHP site number, 50-50-14-5796. No new features were added to this site.
3. Site Ma-B8-240: originally recorded as a single feature (Cordy 1978). A portion of this feature was identified within the project area, and three additional features were added to the site; it was assigned a new SIHP site number, 50-50-14-5797.

Finally, two new SIHP site numbers were assigned to two newly-recorded complexes in Parcel 84. These two sites were noted by Cleghorn et al. (1988) but were not recorded. The new sites are as follows:

1. SIHP Site 50-50-14-5798: assigned to a complex of four features, all newly-identified.
2. SIHP Site 50-50-14-5799: assigned to a complex of two newly-identified features.

In total, fifteen historic properties comprising 80 component features were identified within the project area. Eleven of these sites comprising 23 component features were previously identified and recorded as either Bishop Museum or SIHP Sites. Two newly identified sites with six component features, and 51 newly identified features within existing or re-assigned SIHP site complex areas were also recorded. A breakdown of new and previously recorded features by site complex is found in Table 4.1 (below).

Subsurface Testing

Subsurface testing was conducted at 31 features (11 sites) within the project area. Work was conducted by Theresa K. Donham, Koa Hodgins, Jenny O'Claray, Tracy Tam-Sing, and Paul Titchenal. Testing consisted of one or more hand-excavated 1.0 x 1.0 meter square (or larger) test unit; or one or more hand-excavated 0.5 x 0.5 meter round shovel test. Multiple test units (2 to 4) were excavated at eight features, and shovel tests were conducted at four features. The subsurface testing program was designed to augment previous testing that was conducted during prior studies. Prior testing consisted of fourteen test units at six sites/features. A summary table of all prior and current test units is found in Chapter 5.

Decisions regarding the placement and number of test units were made based on the potential for subsurface deposits to provide important information regarding the age and function of the feature. In general, multiple test units were placed at features that were large enough to potentially have considerable spatial variation in the subsurface deposit.

Test units were excavated to various depths, depending upon the depth of bedrock or compacted and sterile subsoil. Excavation was conducted with trowels and followed observed soil layer changes. Stone fill that contained no soil was excavated as such and not given a soil Layer designation. Layers over 0.10 meter in thickness were excavated in 0.10 meter thick levels, which were numbered consecutively within each layer. Vertical control was maintained through use of line levels which were located at a stable point on or above the ground surface near each test unit.

Soil removed during excavation was screened in the field through nested 1/4" and 1/8" screens. In most cases, both the 1/4" and 1/8" size grade materials were separated from general soil matrix in the field. When unusual densities of cultural material were encountered, the unsorted matrix was collected from the screens and transported to the laboratory for sorting. Unsorted 1/4 inch collections were made in one case (Site 5708 Feature 3) , and unsorted 1/8" collections were made in five cases (Site 1853 Feature 8; Site 5706 Features 1, 2, and 5; Site 5707 Feature 2).

Materials collected from screened soil were placed in paper bags or foil which were labeled with the site, feature, and unit designation, layer, level, depth range, excavator, and date. Charcoal encountered during excavation or in the screen was packaged in aluminum foil. Fragile materials such as volcanic glass, small bones and fish scales were packaged in small paper or plastic bags. The charcoal and fragile materials were then placed in the master bag for the level after all screening was completed. Screen collections from each vertical provenience for each test unit was assigned a lot number, which was used to track materials.

As excavation proceeded, volume data was recorded for the excavated matrix prior to screening, and for the naturally occurring rough stones that were removed during screening. These measurements permit quantification of the actual soil volume that contained cultural materials, providing better control for comparisons between various levels and test units collections.

During test unit excavation, notes were maintained for each level, and plan drawings of the unit floor were recorded on graph paper, scaled 1"=20 cm. Profiles of one to two walls of each test unit were recorded after excavation was completed. Photographs were taken prior to and during excavation, and at the completion of the unit. Soil samples were collected from each layer and feature encountered, for purposes of comparison and soil description.

When human skeletal remains were encountered at Site 5706 Feature 11, work ceased immediately and the SHPD office on Maui was contacted. Following consultation with Dr. Melissa Kirkendall of SHPD and Dana Naone Hall of the Maui-Lana'i Islands Burial Council, it was decided that excavation should continue to the extent needed for confirmation of the number and disposition of the individual(s) represented. At that time, excavation was re-initiated, and was again halted after it was determined that the remains represent a single articulated individual in primary burial context.

Potential features identified during excavation of test units were numbered sequentially within the unit, beginning with HF-1. The test units located near areas of heavy pedestrian traffic were backfilled after all photographs and notes were completed. The remaining units will be backfilled after completion of the report, and project review.

Laboratory Procedures

At the completion of fieldwork, each ¼" screen collection was sorted into material categories which were packaged separately in ziplock plastic bags of the appropriate size. The material categories for midden include marine invertebrates, vertebrate fauna, charcoal, coral (weathered, waterworn). Each of these groups were packaged separately and identified with a standardized label which included all the provenience information from the lot bag, as well as the accession number and lot number.

The unsorted 1/8" size grade materials from Sites 1853-8, 5706-5, and 5707-2 were examined in the laboratory for the presence of artifacts such as coral and echinoid spine abraders, fishhook fragments, modified bone items, and volcanic glass or basalt flakes. Charcoal was removed from 1/8" unsorted matrix for dating samples from Sites 5706-5, 5707-2, and 5711-4. Non-diagnostic marine invertebrates and non-diagnostic vertebrate remains were not separated from the unsorted 1/8" matrix form these collections, and these materials are not included in the present analysis.

Each formed traditional artifact was given a unique accession number. The artifacts were grouped by material and form, and detailed information such as measurements, line drawings, and notes on condition and use wear were recorded for each item. The specific types of measurements and descriptive categories used for the artifacts are further discussed in the sections which are devoted to the various types of artifacts. Historic artifacts were given lot numbers by material category (i.e., metal, glass, ceramic, plastic, etc.) and provenience.

Analysis of the marine invertebrates included identification of each specimen to the species if possible, or to the family level. Identification was checked using Kay (1979). Counts and weights for each identified invertebrate group was recorded by provenience lot and tabulated for each test unit. The test unit tables are presented in Chapter 4, and summary data are presented in Chapter 5.

Vertebrate faunal remains were counted and weighed as lots from each collection provenience, and were sorted into the following general groups: fish bones, fish scales, bird/fowl, small mammals (mongoose), medium mammals (pig), and large mammals (bovine, deer). Specific identification of vertebrate remains was not conducted beyond the general groups, primarily because of the small volume of remains and the predominance of either historic/modern assemblages, or non-cultural introductions (deer, mongoose) in the collection.

Stratigraphic information was recorded on excavation record forms, and included standard descriptive categories as used in the USDA Soil Description Manual. Soil samples were collected from each soil layer of every test unit, in order to allow for comparisons of soils between sites, and to provide consistency in soil descriptions. All soil colors, textures and consistence were determined in the laboratory by the author, rather than in the field by five different individuals. Color identifications were made using the Munsell Soil Color Charts, and other descriptive information follows the format and terminology of the USDA National Soil Survey Handbook.

Artifacts and midden samples collected during this project are curated at the facilities of Archaeological Services Hawai'i, 1930A Vineyard Street, Wailuku.

4. SURVEY FINDINGS - SITE DESCRIPTIONS

Fifteen historic properties comprising 80 component features were identified during the current survey (*Tables 4.1 and 4.2; Figure 4.1*). Among the fifteen sites, two are single components (Site 5795 and 5796).; three sites consist of two component features (Site 1864, 5709 and 5799); four sites consist of three to four features (Sites 2272, 5708, 5797 and 5798); four sites consist of five to ten features (Sites 1007, 1853, 5707, and 5711), and two sites contain over 10 features (Sites 5706, 5710). Most of the identified sites (11) are within parcel 37; one is within parcel 56 and three are within parcel 86.

All four of the sites within parcels 56 and 86 are historic to modern in age, and represent either habitation (Sites 5708, 5798, 5799) or a school (Site 1007). Other historic era features located in parcel 37 include walls at Sites 1853, 1864, 5707, and 5797; and enclosures at Sites 5795 and 5796. Three Hawaiian sites (5706, 5707, and 5711) have been dated to the pre-contact era through radiocarbon analysis, and features at Sites 5706 and 5710 are associated with traditional Hawaiian material culture. Some of the landscaping features at these two sites could date to either the pre-contact or the historic era, and are assumed to have been constructed and used by the Hawaiian residents of the area. There are insufficient material remains at many of these features to determine period of construction and use.

As indicated below, the identified sites range from 140 to 2,660 square meters in area. The largest sites (5706 and 5710) are agricultural complexes that contain numerous land clearing features, planting terraces, and/or cleared planting areas. In addition to the Site 5797 fence line, small area sites are the two single-component enclosures (5795, 5796) and a C-shape with associated wall segments (5707).

This section provides descriptive information on the identified features, and the results of subsurface testing. The descriptions follow numeric ordering of the SIHP site number.

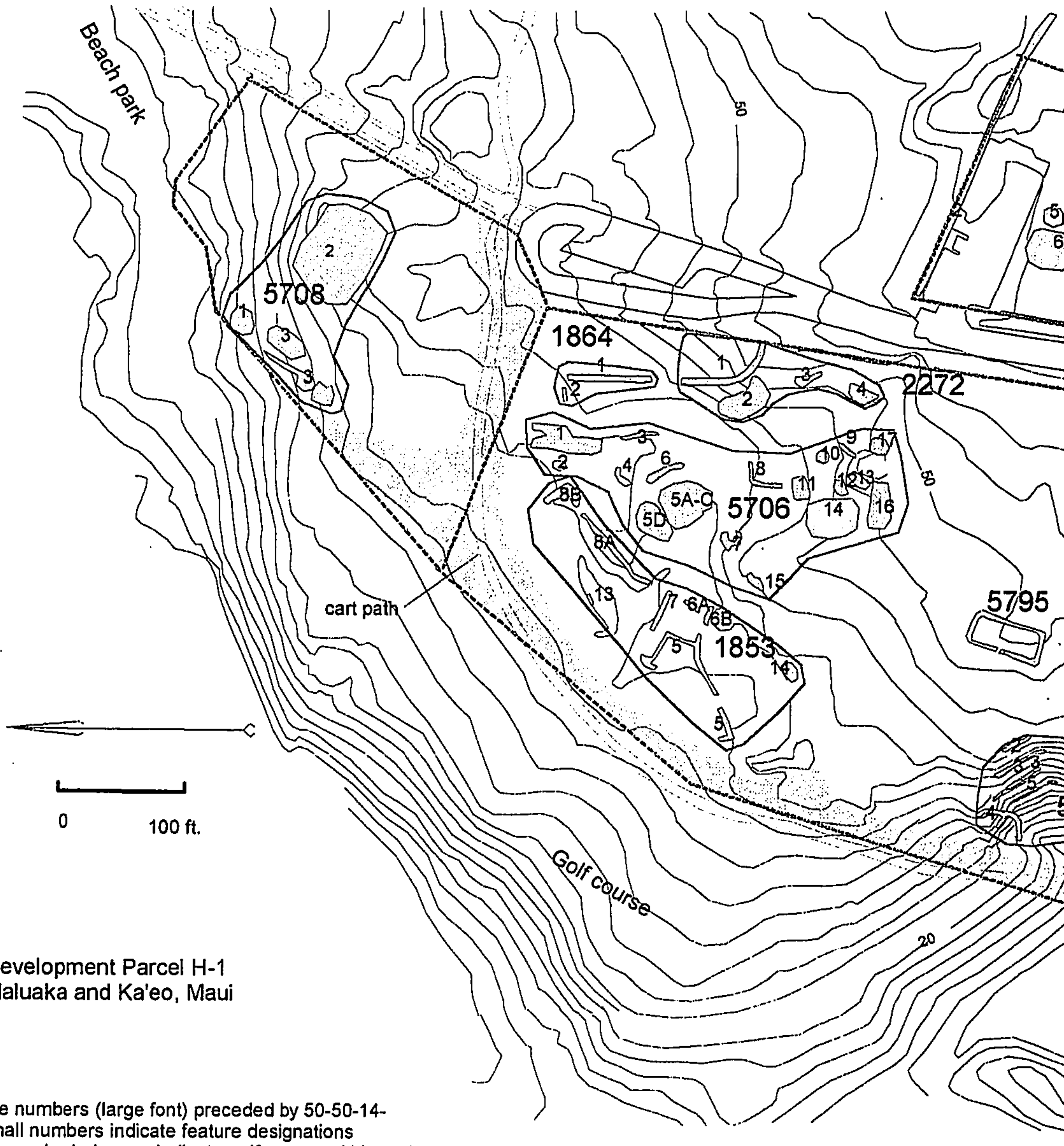
Site No.	Approx. Area*	Features	First Reported*	Parcel No.	COMMENTS
1007	697	6	1988	84	Makena School Site; two features newly identified
1853	2,007	8	1974	37	Maluaka Point complex, two features newly identified
1864	237	2		37	Wall segments along Mākena Road, traditional and modern
2272	1,091	4		37	Wall and landscaping features, three features newly identified
5706	3,350	17	2005a	37	Habitation/agricultural complex, 16 features newly identified
5707	511	5	2005a	37	Habitation site with wall segments, three features newly ident.
5708	1,412	3	2005b	56	Historic/modern home site and historic/modern refuse areas
5709	441	2	2005a	37	Historic/modern land clearing features, machinery indicated
5710	2,660	13	2005b	37	Agricultural complex in gulch, affected by modern dozing
5711	1,420	8	2005a	37	Ceremonial complex in gulch, seven features newly identified
5795	211	1	1974	37	Historic era enclosure, storage/minimal activities indicated
5796	520	1	1974	37	Enclosure, most likely historic (garden/livestock)
5797	140	4	1978	37	Stone wall segments and wire cattle fencing, three features new
5798	446	4	2005b	84	Historic/modern home site with associated wall
5799	334	2	2005b	84	Historic/modern ancillary habitation site, associated wall

*NOTES: Area is given in square meters; First reported dates: 2205a is Rotunno-Hazuka et al.; 2005b is this survey report. See text for other date references

Table 4.1 Summary of Identified Sites

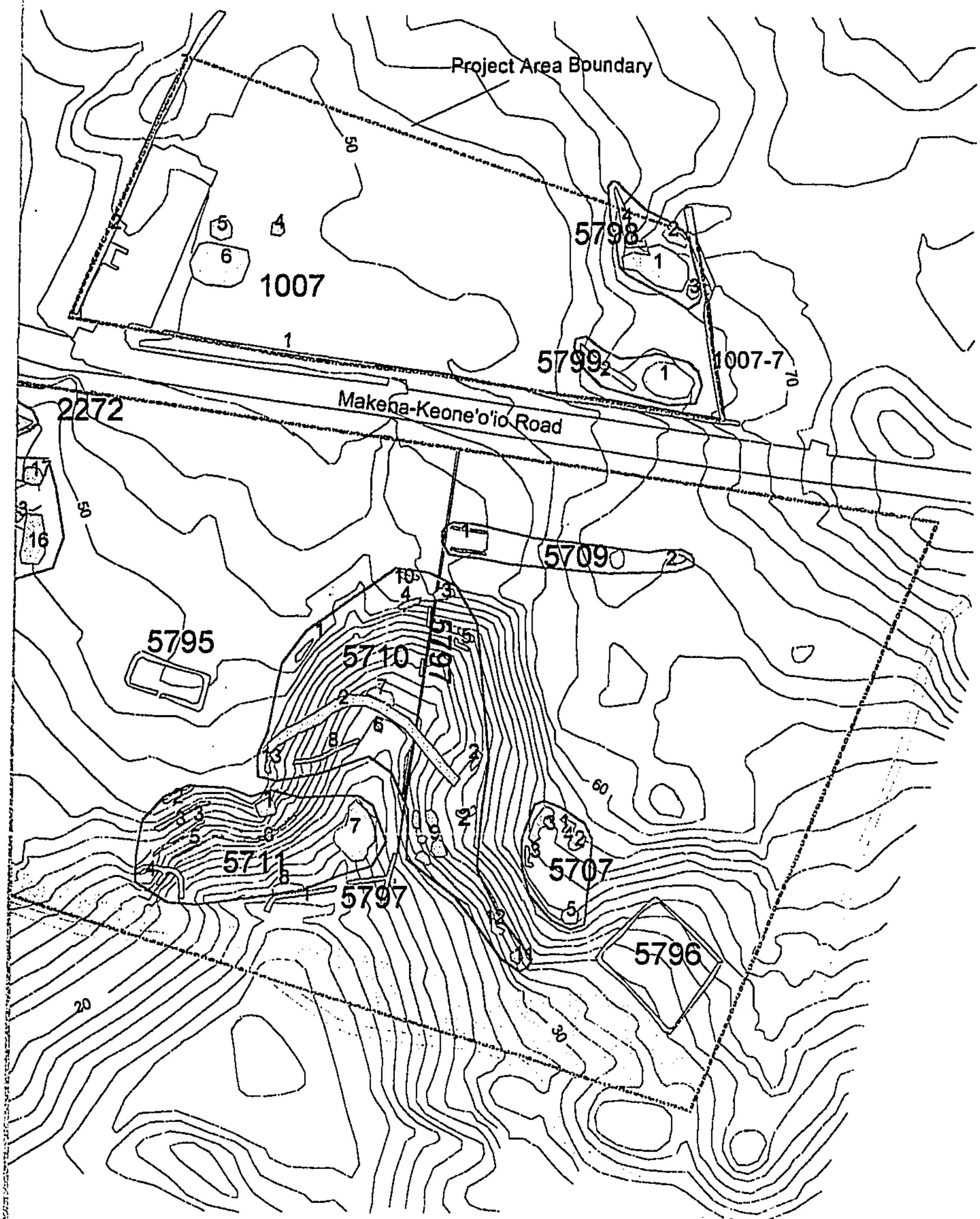
(See inserted map)

Figure 4.1 Project Area Map Showing Site and Feature Locations



Development Parcel H-1
Maluaka and Ka'eo, Maui

Site numbers (large font) preceded by 50-50-14-
Small numbers indicate feature designations
Green shaded areas indicate golf course within project area



Project Area Boundary
50
5798
1007
1007-7
5799
70
Makena-Keone'o'io Road
2272
16
5709
5795
5710
60
5711
5707
5797
5796
20
30

SIHP Site	Fea.	New?	Description	FN	Dimensions	Tested	Function/Age/Affiliation
1007	1	N	Wall along Makena Road, west boundary of Makena School lot	78	1.3 x .50-.80	N	boundary marker; historic
	2	N	Wall along northern boundary of Makena School lot	80	1.1 x .50-1.1	N	boundary marker, historic
	4	N	Square platform with central depression and lumber	83	3.3 x 3.0 x	1989	privy for school, historic
	5	N	Cistern, cement plastered stone construction	79	4.5 m in diam.	N	water storage for school
	6	Y	Remnants of building foundation	79	12.0 x 12.0 x 0.15	Y	Makena school
	7	Y	Stone wall along south boundary of school lot	81	.80 x .50-.80	N	boundary marker, historic
1853	5	N	Enclosure remnant along edge of golf course	29, 30	46.4 x 0.65 x 0.80	Y	indeterminate, too partial
	6A	N	Bifaced, core-filled wall	27	4.6 x 1.0 x 0.80	Y	indeterminate
	6B	N	Unifaced/bifaced wall, a portion abuts pahoehoe ridge	28	10.0 x 1.0 x 0.70	Y	indeterminate
	7	N	Bifaced, core-filled wall, disturbed	14	12.2 x 1.4 x 0.50	Y	possibly historic
	8	N	Bifaced, core-filled wall in two sections, disturbed	3	42.0 x 1.5 x 0.70	N	partial enclosure, historic
	11	N	Unifaced/bifaced wall, a portion abuts bedrock formation, dist.	77	19.0 x 0.80 x 0.5	Y	indeterminate/historic
	13	N	Wooden trough, disturbed	9	3.5 x 0.35 x 0.47	N	livestock/historic
	14	Y	Filled depressions, stone piles abutting pahoehoe ridge	26	12.0 x 6.0 x 0.15	Y	clearing/historic
1864	1	N	Soil terrace with stone retaining wall	6	16.8 x 13.0 x 0.25	Y	agricultural?/Hawaiian
	2	N	Alignment/wall remnant	5	3.0 x 0.6 x 0.25	N	indeterminate/historic?
2272	1	N	Soil terrace with stone retaining wall	12	14.0 x 13.0 x 0.45	Y	agricultural?/Hawaiian
	2	Y	Stones piled on naturally fractured pahoehoe outcrop	16	10.5 x 8.0 x 0.25	N	clearing/Hawaiian
	3	Y	Soil terrace with stone retaining wall and rock filled depression	17	15.0 x 5.0 x 0.20	N	agricultural/Hawaiian
	4	Y	Stone fill placed on naturally fractured pahoehoe outcrop	18	4.3 x 3.5 x 0.40	Y	clearing/Hawaiian

Table 4.2 Summary of Identified Sites and Features within the Project Area

SIHP Site	Fea.	New?	Description	FN	Dimensions	Tested	Function/Age/Affiliation
5706	1	Y	Soil clearing and stone filled area along pahoehoe ridge	1	9.5 x 5.0 x 0.10	Y	habitation/Hawaiian
	2	Y	Pahoehoe excavation and stone-filled area along ridge	2	3.5 x 2.0 x 0.1	Y	agric., habitation/Hawaiian
	3	Y	Soil terrace with stones loosely piled on partially exposed outcrop	7	15.0 x 3.0 x 0.25	N	agriculture/Hawaiian
	4	Y	Soil clearing with adjacent crescent-shaped stone pile	8	2.5 x 1.5 x 0.30	N	agriculture/Hawaiian
	5	Y/N	Paved area, terraces and associated midden scatter	10	24.0 x 17.0 x 0.4	Y	habitation/Hawaiian
	6	Y	Linear stone pile	11	4.4 x 1.7 x 0.20	N	clearing/Hawaiian
	7	Y	Stone mound, alignment, filled depression and filled crevice	13	15.5 x 7.5 x o.30	N	clearing/Hawaiian
	8	Y	L-shaped wall with associated soil clearing	15	11.5 x 4.7 x 0.20	Y	agricultural/Hawaiian
	9	Y	Boulder alignments, loosely piled boulders	19	6.6 x 3.5 x 0.4	N	clearing/Hawaiian
	10	Y	Stone-filled depression at base of pahoehoe outcrop	20	2.0 x 2.0 x 0.3	Y	clearing/Hawaiian
	11	Y	Stone-filled platform	21	5.0 x 3.4 x 0.6	Y	burial/Hawaiian
	12	Y	Stone-filled bedrock depression, boulder alignment	22	3.5 x 2.3 x -0.4	N	clearing/Hawaiian
	13	Y	Stone-filled bedrock area, L-shaped boulder alignment	23	6.0 x 2.4 x 0.30	N	clearing/Hawaiian
	14	Y	Surface midden and artifact scatter	24	18.0 x 16.0	Y	habitation/Hawaiian
	15	Y	Low wall across bedrock outcrop, no soil	25	5.6 x 0.65 x 0.35	N	indeterminate
	16	Y	Soil clearing with associated linear stone piles	32	11.2 x 6.0 x 0.30	N	agriculture/Hawaiian
	17	Y	Stone-filled terrace abutting pahoehoe ridge	33	3.1 x 2.9 x 0.30	Y	clearing/Hawaiian
5707	1	N	Bifaced wall segment (disturbed)	66	9.5 x 4.5 x 0.45	Y	indeterminate
	2	Y	C-shaped enclosure	66	5.2 x 6.0 x 0.64	Y	habitation/Hawaiian
	[illegible]	[illegible]	Bifa[illegible]	66	[illegible] x 4.0 x [illegible]	[illegible]	[illegible]

SIHP Site	Fea.	New?	Description	FN	Dimensions	Tested	Function/Age/Affiliation
5708	1	Y	Stone-filled platform with historic artifacts throughout	75	10.2 x 4.2 x 0.90	Y	habitation/historic-modern
	2	Y	Circular cement cap, push-piles, wooden structural remains	73	4.6 diam. x 0.60	N	habitation/historic-modern
	3	Y	Surface/subsurface historic and modern artifacts	74,76	20.0 x 10.0	Y	habitation/historic-modern
5709	1	N	Parallel rubble walls/mounds	-	20.0 x 10.0	N	livestock/historic/modern
	2	Y	Oval stone mound, adjacent to bulldozed swale	65	3.2 x 2.1 x 0.35	N	clearing/probably historic
5710	1	Y	Stone-filled terrace with small clearing	39	13.0 x 5.0 x 0.60	N	agriculture/Hawaiian
	2	Y	Trail/roadway across gulch, bulldozed	45,61,62	66.0 x 4.2 x 0.20	N	transportation/historic
	3	Y	C-shaped wall at overhang with associated glass jugs	46	2.6 x 2.1 x 0.30	Y	agriculture/Hawaiian/modern.
	4	Y	Soil terrace with stone retaining wall with potting soil	47	6.0 x 3.2 x 0.60	Y	agriculture/Hawaiian/modern
	5	Y	Soil terraces with stone retaining walls	48,49	7.0 x 5.0 x 0.7	Y	agriculture/Hawaiian
	6	Y	Linear stone mound, adjacent to road	51	3.4 x 1.0 x 0.80	N	agricultural /Hawaiian
	7	Y	Four small soil clearings with associated stone terraces	52	13.5 x 9.0 x 0.40	N	agriculture/Hawaiian
	8	Y	Stone wall remnant, probable terrace face	54	10.0 x 1.5 x 0.50	N	agriculture/Hawaiian
	9	Y	Two soil clearings/terraces with three associated mounds	59,60	13.0 x 6.0 x 0.60	N	agriculture/Hawaiian
	10	Y	Collapsed stone terrace with cupboard and stone mound	63	14.0 x3.0 x 0.30	N	agriculture/Hawaiian
	11	Y	Stone terrace wall and stone mound	70	8.0 x 4.0 x 0.5	N	agriculture/Hawaiian
	12	Y	Stone terraces	71	9.5 x 5.0 x 0.50	N	agriculture/Hawaiian
	13	Y	Soil terrace with stone retaining wall	44	6.3 x 5.0 x 0.90	N	agriculture/Hawaiian
5711	1	N	Platform, portion walled	-	6.0 x 5.5 x 1.70	N	ceremonial/Hawaiian
	2	Y	Soil terrace with stone retaining wall, along slope	40	8.0 x 1.7 x 0.36	N	ceremonial/Hawaiian
	3	Y	Soil terrace with stone retaining wall, along slope	41	14.2 x 4.2 x 1.0	Y	habitation, ceremonial/Hawaiian
	4	Y	Partial enclosure with interior terraces and midden scatter	42	19.0 x 7.0 x 0.75	Y	habitation/Hawaiian

Table 4.2 Summary of Identified Sites and Features within the Project Area (Cont.)

SIHP Site	Fea.	New?	Description	FN	Dimensions	Tested	Function/Age
5711	5	Y	Soil terrace with stone retaining wall, along slope	43	12.0 x 2.5 x 0.33	N	habitation, ceremonial/Hawaiian
	6	Y	Soil terrace with stone retaining wall	44	6.3 x 5.0 x 0.26	N	agriculture, ceremonial/Hawaiian
	7	Y	Stone pavement/low platform with terraces	55	24.0 x 11.0 x 0.3	Y	possible ceremonial/Hawaiian
	8	Y	Stone-filled terraces	57	14.0 x 4.7 x 0.45	Y	ceremonial/Hawaiian
5795	-	N	Enclosure (Ma-B8-233)	-	17.8 x 8.0 x 1.0	Y	Habitation/storage/historic
5796	-	N	Enclosure (Ma-B8-234)	-	28.0 x 23.5 x 1.0	Y	garden or livestock enclosure
5797	1	N	Bifaced, core-filled stone wall across gulch (Ma-B8-240)	56,58	46.1 x 0.7 x 0.90	N	poss. habitation enclosure
	2	Y	Stacked stone wall following wire fence line	50	15.0 x 0.6 x 0.35	N	livestock/historic
	3	Y	Stacked stone wall along wire fence line, with associated posts	53	30.5 x 0.6 x 0.45	N	livestock/historic
	4	Y	Two sections of stacked stone wall along wire fence line	46	13.0 x 0.8 x 0.70	N	livestock/historic
5798	1	Y	L-shaped wall, bifaced, core-filled	84	18.5 x 1.10 x 0.8	N	indeterminate/historic
	2	Y	Dimensional lumber structural remains, with round nails	83	2.3. X 2.2. X 0.20	N	habitation/historic
	3	Y	Stone pile with depression - *imu* type stones	85	2.7 x 2.5 x 0.30	N	habitation/historic
	4	Y	Refuse pit	86	1.5 m diameter	N	habitation/historic
5799	1	Y	Dimensional lumber structural remains, with round nails	87	8.0 x 6.0 x 0.40	N	habitation/historic
	2	Y	Stacked stone wall	88	18.0 x 2.0 x 0.30	N	indeterminate/historic

Table 4.2 Summary of Identified Sites and Features within the Project Area (Cont.)

Site 1007

Previous Investigations

Site 50-50-14-1007 was first recorded and listed in the State Inventory in 1988, following a reconnaissance survey of the Mākena Road cul-de-sac and public beach access parking lots (Cleghorn et al. 1988). At the time it was recorded, Site 1007 was named the Mākena School Parcel Historic Complex, and the designated site area encompassed the entire two-acre school parcel (Cleghorn et al. 1988:5). For the purposes of this survey, the school site area has been redefined to include the area of the school structures. Other non-related habitation structures within the school parcel have been given separate SIHP site numbers. The parcel 84 boundary walls recorded by Cleghorn et al. have been kept with the school site.

Five surface features were located within the complex during the 1988 reconnaissance survey. These included 1) a stone wall which follows the western boundary of the parcel; 2) a stone wall which follows the northern boundary of the parcel; 3) a roughly square platform divided in half by structural lumber, with a depression on one side; 4) a second platform similar to Feature 3; and 5) a cement lined cistern (Cleghorn et al. 1988:5, 7). Also noted, but not recorded was a concentration of modern material within the southern third of the parcel (*Figure 4.2*). This area has been recorded during the current survey as SIHP Sites 5798 and 5799.

Cleghorn et al. were not able to find documentation to verify the opening and closing dates of the school. Based on available information, they postulated that the school opened some time around or before 1917, when the parcel was deeded to the Territory of Hawai'i; and it was closed before 1930, when Handy and Handy visited the area (Cleghorn et al. 1988:8). Cleghorn et al.'s report includes a Territorial survey map of the school parcel dated 1936, which depicts a c. 20 foot E-W by 30 foot N-S structure adjacent to the west side of the Feature 5 cistern (*Figure 4.2*). Cleghorn et al. felt that the structure would have overlapped a portion of the cistern, and thus suggested that "...the cistern probably post-dates the abandonment of the school" (Cleghorn et al. 1988: 9). They also suggested that the two platforms (Features 3 and 4) could be remnants of two privies, however they noted that further work would be needed to substantiate their interpretation.

Further archaeological work (data recovery) was recommended for Feature 3, which was located within the area of the proposed parking lot. No further work was recommended for Features 1, 2, 4 and 5, which were not within the proposed construction area. Filling or covering of the cistern was recommended due to safety reasons.

Data recovery excavations were conducted at Features 3 and 4 in 1991 (Hurst 1991). A brief summary report was prepared for Seibu, however, a formal report of findings has not yet been completed.

Current Findings

Four of the five previously identified features (1, 2, 4, and 5) were located during the current survey, and two newly identified features (6 and 7) were added to the complex. Features 1, 2 and 7 are stone walls that define the north, west and south boundaries of the school lot. Features 4, 5 and 6 comprise the remains of the Makena School facility. Feature 3, one of the two postulated privies, is no longer present. We found that the cistern (Feature 5) had been filled, per prior recommendations.

Features 1, 2 & 7

The three stone walls associated with the school site area boundary walls that help define the two-acre parcel that was subdivided from Grant No. 1508:2 and designated as the school lot. The walls are shown on the 1936 Territorial survey map of the School parcel, which shows Features 1 and 2 extending east beyond the eastern boundary of the parcel (*Figure 4.2*). Feature 1, the western boundary wall, also continues south, beyond the juncture with Feature 7. The northern portion of Feature 1 has been impacted by the construction of the public parking lot that is now adjacent to the intact portion of the school site, and by the Prince Hotel landscaper's baseyard. It is therefore possible that Feature 1 extended northward and defined the west boundary of Grant 1508:2. In this case, the walls would have predated construction of the school. Feature 1 continues southward along Mākena Road, beyond the

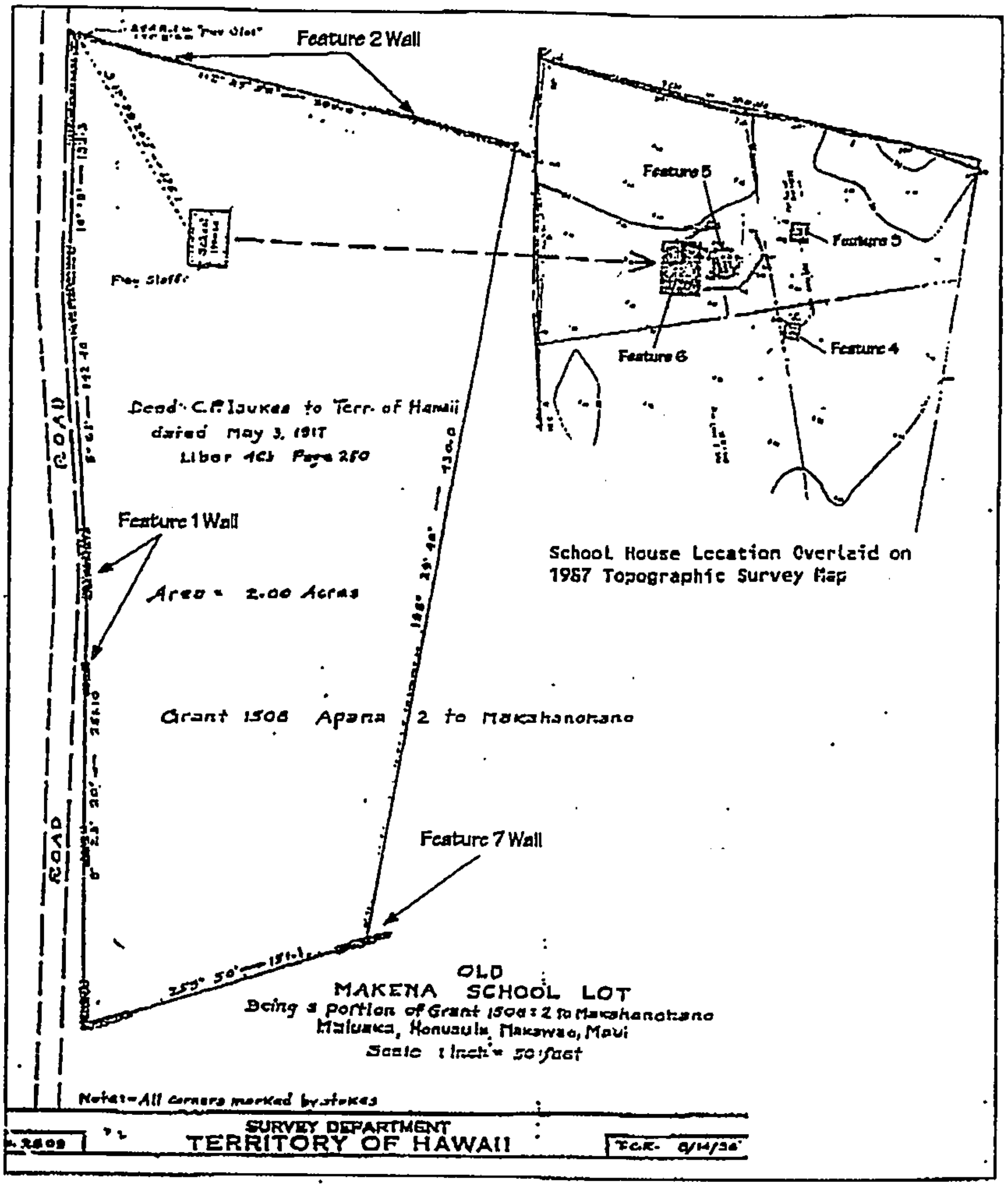


Figure 4.2 Territorial Survey map of the Mākena School lot showing building location and identified archaeological features (map from Cleghorn et al. 1988:6; feature numbers added)

juncture of the southern school lot boundary wall (Feature 7). Feature 2 continues eastward approximately 45 meters beyond the parcel 84 boundary; it then turns south and continues approximately 95 meters to a juncture with the Feature 7 wall. Feature 2 essentially encloses an area slightly under four acres; the western 2 acres comprises the school lot. The Feature 7 wall continues east from the east boundary of parcel 84 boundary for approximately 75 meters, where it junctures with the Feature 2 wall; from there, it continues approximately 105 meters east, then turns south for c. 80 meters and junctures with the Site 230 wall. The Site 230 wall corresponds with the *Aupuni* wall (described in Chapter 1) which also defines the *mauka* boundary of Grant 1508:2. The configuration of these walls beyond the current project area is shown in Rotunno-Hazuka et al. 2005:3).

Structurally, there is considerable variation between and within the three walls, some of which could be attributable to modern impacts and reconstruction work. Feature 1 shows a stacked construction; however, the best-preserved sections of the wall appear to have been rebuilt during the modern era. These sections are just south of the school parcel and are 1.3 m high by 0.5 to 0.8m wide. The west portion of Feature 2 appears to have been rebuilt as well, it is bifaced and core-filled, with neat vertical sides constructed from angular basalt boulders. The most intact portions of the wall are 0.4 meters high and 1.10 meters wide. To the east of the school parcel, this wall is 1.10 meter high and 0.5 to 0.6 meter wide. Feature 7 is in relatively poor condition at the west end, where it was probably affected by rock pillaging. The best-preserved sections are near the east edge of parcel 84, in the area of Site 5798. where the wall is 0.6 meter high and 0.9 to 1.0 meter wide. A section of Feature 7 was knocked out by machinery, apparently to allow installation of a water line. This wall is multiple-stacked, with boulders and cobbles of various sizes used throughout.

Feature 4

This feature was identified as a possible privy by Cleghorn et all (1988), and was mapped in detail and excavated in 1991 during data recovery activities (Hurst 1991). According to Hurst, a 1 by 1 meter unit was excavated to a depth of 1.41 meters at Feature 4. Hurst reported recovering 56 lots of artifacts from the two privies, as well as five fish bone samples. Materials include structural lumber and hardware, (presumably from the privies), slat, slate pencils, buttons, marbles, tin can sherds and soda bottles (Hurst 1991:2). The open excavation from the data recovery work is still visible in the eastern half of the Feature 4. The unexcavated portion of this feature remains in relatively good condition, despite the introduction of modern rubbish into the open excavation. Additional field work was not conducted at Feature 4 during this survey, pending the completion of the data recovery report. If this report is not completed, additional work will be needed to re-document the structure and perhaps excavate the remaining west half of the privy.

Feature 5

Feature 5 is a circular cistern constructed from angular basalt boulders and mortar. The interior and exposed exterior walls of the cistern appears to have been plastered with a fine-grained mortar, and the stones were laid with a coarser mortar. Currently, the feature is filled to just below the rim with soil and stones, and grass is now growing on the fill (*Photo 4.1*). Cleghorn et al. (1988) reported that it was 3.0 meters deep prior to filling. They also note that it is 4.5 meters in diameter; which is the interior diameter. The walls average 0.45-0.50 meter thick, resulting in an exterior diameter of 5.25-5.50 meters. The walls are currently 0.50 to 0.60 meter above ground surface and are generally vertical, with a slightly outward slope in places. This appears to be near the original wall height, as the exterior plaster extends to this current surface.

Imprints of dimensional lumber were observed by Cleghorn et al. along the top of the cistern walls; seven of these are still visible, although the plaster and mortar is beginning to crack and fall away from the stone in many places (*Figure 4.3*). The imprints were made after the surface plaster was applied. Average width of the imprints indicates 4" boards and one 5-6 inch board. All but one of the lumber imprints are 6 inches deep; one is 2 inches deep. The ends of some boards were angled, others were squared. As noted by Cleghorn et al., these most likely represent the notches for a wooden lid.

Two partially buried boulder alignments are present in a curved pattern along the north and south sides of the cistern (*Figure 4.3*). These may represent the edges of the original excavation for the cistern, and were used to stabilize the backfill as the cistern was buried.

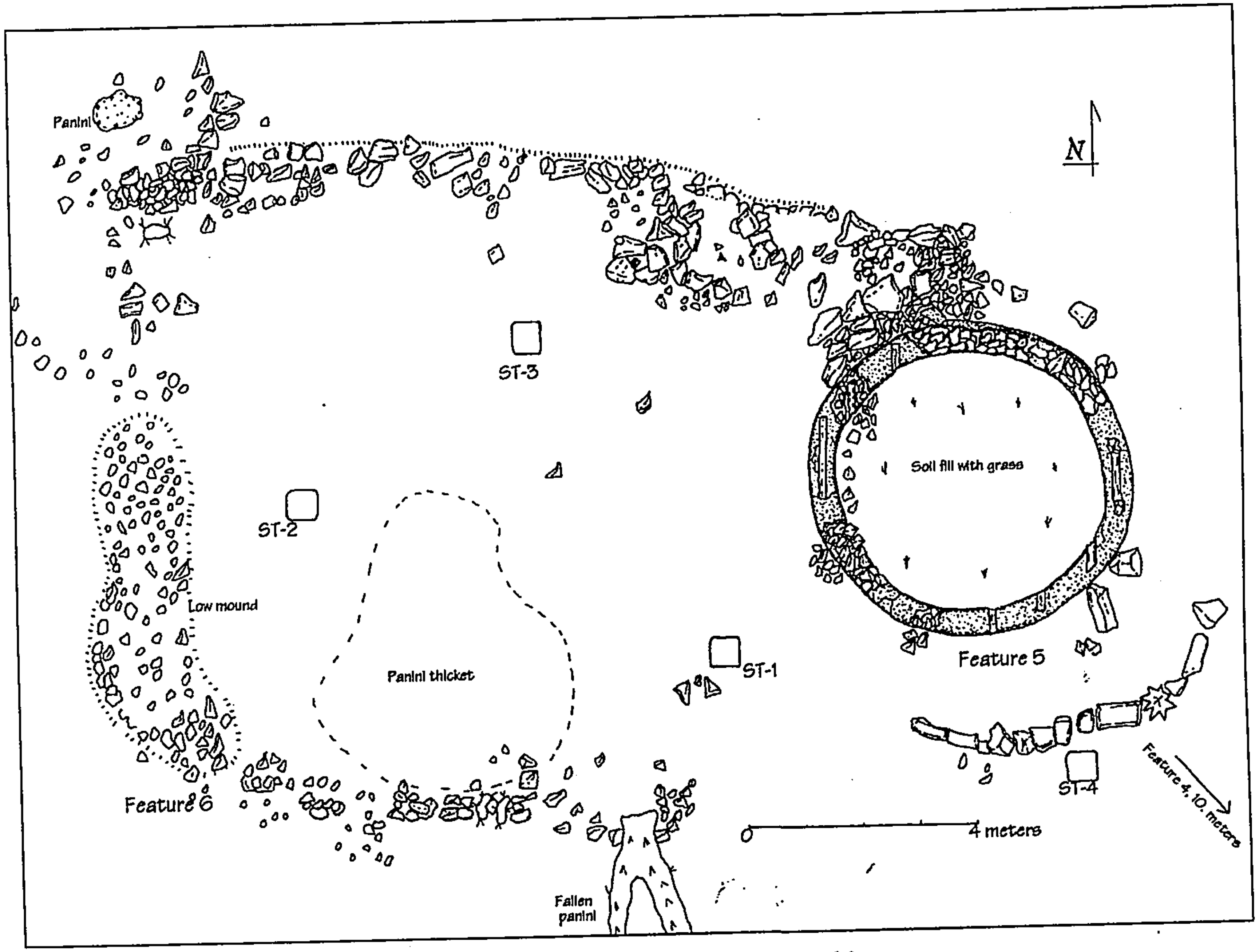


Figure 4.2 Scaled plan map, Site 1007 Features 5 and 6.

Feature 6

Feature 6 is a rectangular pattern of surface rubble and low berms that appear to represent the remnants of the school building foundation. This feature was not recorded by Cleghorn et al.; it is generally diffuse and the stones appear to have been dispersed outward from their original configuration, possibly by machinery. The north and south sides are defined by partially buried aligned boulders and cobbles and a surface scatter of loose stones. These two alignments are parallel and spaced an average of 10 meters apart. The north alignment of 9.8 meters long and the south alignment is 8.0 meters long. The west end of both alignments curve slightly to meet a mounded soil and rock berm that defines the west edge of the feature. The berm averages 0.80 meter wide and is 9.8 meters long. The overall area defined by these alignments and berm is 10.0 meters N-S by 8.0 to 8.5 meters E-W (c. 32 by 26 feet). This is relatively close to the dimensions of the school building as calculated from the territorial survey map; and the location correlates well with the location shown on the survey map.

Four 0.50 by 0.50 meter shovel tests were excavated in the area of Features 5 and 6, in order to determine the extent of disturbance to the immediate area of the structure, and to determine whether deposits predating the school might be present. Shovel Test (ST) 1 was located along the eastern perimeter of Feature 6; ST 2 and 3 were located inside the Feature 6 area, and ST 4 was located just outside the boulder alignment, to the south of Feature 5 (*Figure 4.3, Photos 4.3, 4.3*). All four of the tests showed a consistent soil stratigraphy consisting of three layers. Layer I is fine dark brown to strong brown loose loamy sand with *kiawe* duff; it varies from 0.04 to 0.10 meter in thickness (*Figure 4.4*). Layer II is loose, fine yellowish brown aeolian sand that varies in thickness from 0.10 to 0.15 meters. Layer III is yellowish brown very stony compact silty clay loam. This layer was encountered at 0.16 to 0.25 meter below surface and grades to an *in situ 'a'a* flow. Cultural materials were encountered in Layer I at all four shovel test locations. Layer II contained cultural material in all tests except ST-3, and Layer III was sterile in all units, with the exception of one piece of glass recovered from Layer III of ST-1 (*Table 4.3*).

A total of 397 artifacts were recovered during shovel testing. Of this total, nearly all (381, 96%) are associated with the school building and school activities, and are consistent with materials reported by Hurst from Feature 4. Among these items are 217 pieces of flat (window) glass, 100 pieces of painted and unpainted glaze (from windows), 20 small pieces of chalk, 11 nails (five square), 10 pieces of No. 2 pencil lead, 10 pieces of slate chalk board, six slate pencil fragments, and two metal eraser holders with portions of wooden No. 2 pencils.

Sixteen artifacts are modern and were introduced to the site after the school was closed. These include nine fragments of a single plastic CD and six beverage bottle sherds (one clear, four green). These items were confined to the relatively thin Layer I deposit at ST-1 and 4.

Overall, it appears that the subsurface deposits at the site accurately reflect the time frame of the school operation; although some degree of horizontal movement of materials is expected, given the condition of the foundation.

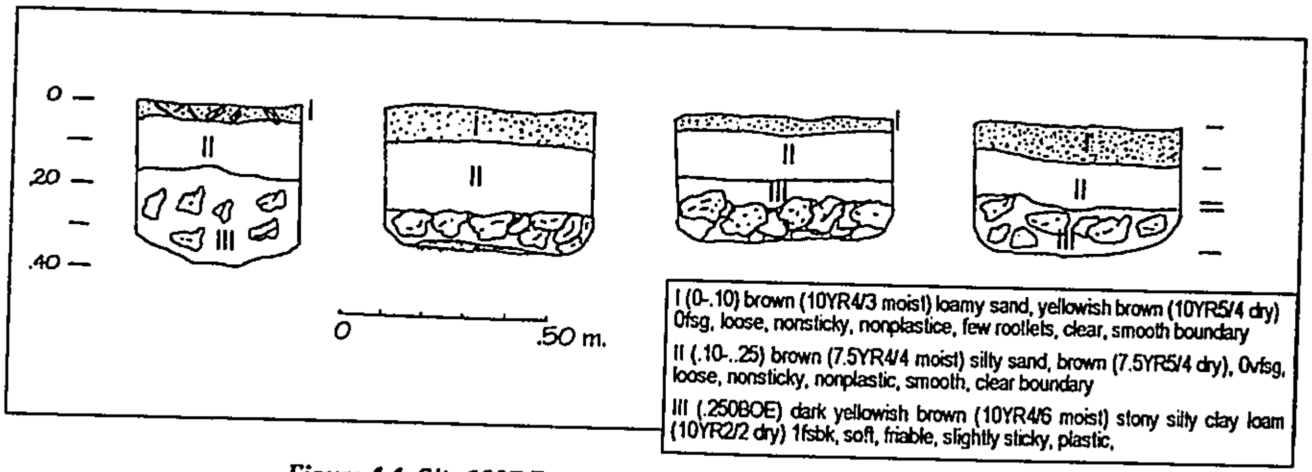


Figure 4.4 Site 1007 Features 5 and 6 Shovel Tests 1-4, Profiles

Absent from the artifact list is structural lumber, which would have been present if the building was demolished or left to crumble in place. The artifact assemblage suggests that the building may have been moved from the site, or all the lumber was carefully salvaged and removed with little or no breakage. The correct scenario can most likely be confirmed through oral interviews.

Midden was recovered from two shovel tests (ST-1 and 4), both of which are on the east side of Feature 6 (*Table 4.3*). The most concentrated occurrence of marine shell was found in Layer II at ST-4, and included one *Nerita picea*, two Echinoderm fragments, one *Patellidae (oiphi)* fragment, and four pieces of *Cypraeidae* shell. Six midden items were recovered from ST-1, including three small fish bones, two pieces of chicken egg shell, and one *Cypraeidae* shell fragment. All of the midden occurred with artifacts from the school activities and are assumed to be contemporaneous with the school.

Preliminary findings from the shovel tests suggest that artifacts and midden are more concentrated in the school yard area just outside the building on the east side, and just south of the cistern. This follows the pattern for expected material densities, given the presence of a post and pier wood frame structure with wood floors. It should be noted that the yard area to the north of the building is not available for testing, due to the presence of a paved parking area.

No surface or subsurface evidence of a later occupation was found at this site, and no information was recovered that supports Cleghorn et al's. conclusion that the cistern post-dates the school. In fact, the location of the cistern and the artifact deposit adjacent to the cistern supports the conclusion that the cistern was built for the school and used during the time the school was in use. The formal characteristics of this feature are consistent with early twentieth century design and construction.

SITE 1007 Fea. 6, ST-1	I	II	III	Total	ST-2	I	II	Total	ST-3	I	ST-4	I	II	Total	Site Total
Depth in cm BS	0-.04/5	.04/5-.16	.16-.30			0-.08	.08-.25			0-.05		0-.06/.10	.06/.10-.20		
CHALK	14	3		17		1	1	2					1	1	20
GLASS															
CLEAR															
Flat	130	44	2	176		13	4	17		2		2	20	22	217
Beverage bottle	1			1									1	1	2
BLUE - indeterminate	1			1											
GREEN - beverage												1	3	4	4
GLAZE															
PAINTED	23	2		25											25
UNPAINTED	59	15		74									1	1	75
LEAD															
NO. 2 PENCIL	6	2		8								1	1	2	10
METAL															
SCHOOL SUPPLIES															
Pencil eraser	1			1									1	1	2
TIN - can fragment												1		1	1
NAILS															
Round	5			5								1		1	6
Square	1			1		1		1		3 (1)					5
MORTAR	3	1		4								1		1	5
SLATE															
Chalk board	4	3		7									3	3	10
Slate pencil		4		4								1	1	2	6
PLASTIC															
CD	9			9											9
TOTAL ARTIFACTS	243	71	2	316		15	5	20		5		8	32	40	397
PORTABLE MATERIAL															
Coral													1	1	1
Waterworn basalt	1			1									1	1	2
Waterworn shell	1	1		2											2
MIDDEN															
Eggshell	2			2											2
Fishbone	2	1		3											3
Marine shell		1		1								1	8	9	10
SUBTOTAL	6	3		9								1	10	11	20
Total	249	74	2	325		15	5	20		5		9	42	49	417

Table 4.3 Recovered artifacts and midden, Site 1077 Feature 6, Shovel Tests 1-4

Site 1853 (Ma-B8-7)

Previous Investigations

Site 1853 was identified during Clark's 1,300-acre reconnaissance survey of Seibu lands, and was initially recorded as Bishop Museum Site 50-Ma B8-7. At that time, the site was identified as a 10.5 by 6.0 meter by .40 meter high rectangular paved platform inside a 31.0 by 28.0 meter enclosure (Clark 1974: 11). During subsequent survey and excavation field work (Haun 1978), the site area was expanded to include 17 mapped features, 12 of which were assigned feature numbers (*Figure 4.5*). Identified features included three enclosures (Features 1, 5 and 9), seven walls (Features 3, 4, 6-8, 11,12), a well (Feature 10) and a platform (Feature 2). Artifacts and midden were observed only on the Feature 2 platform and within the Feature 9 enclosure, which surrounded the platform (Haun 1978: 14). Features 2 and 9 as recorded by Haun correspond with the original Site 1853 as recorded by Clark.

Haun described the Feature 2 platform as being 7.8 by 5.5 meter by .40 meter high, with a thick pavement consisting of waterworn cobbles and boulders and pieces of coral. He also noted a stairway in the center of the *mauka* wall leading to the top of the structure. Haun (1978) excavated four one-by-one meter units within and adjacent to the platform, and concluded the following:

> The artifact assemblage yielded is almost completely historic -- nails, glass, ceramic fragments, pieces of slate, a Jew's harp, and a variety of metal objects. One piece of basaltic glass was the only possible evidence of prehistoric occupation, although this was associated with the historic materials. (Haun 1978:25)

At the time of Haun's visit (March/April 1978), portions of the Feature 9 enclosure had been broken through by bulldozers. No additional information was provided by Haun regarding the other mapped features within this complex, and only Feature 2 was excavated as part of the data recovery program.

In June of 1978, Bishop Museum staff revisited the complex during the third increment golf course survey, and assigned new Bishop Museum site numbers to two of the enclosures within the complex. The enclosure designated by Haun as Feature 5 of Site B8-7 was assigned BPBM Site B8-232; and Haun's Feature 1 was assigned B8-238 (Cordy 1978). In his discussion of findings, Cordy interpreted the Site B8-7 enclosed platform and the Site B8-238 enclosure as permanent historic era habitation sites. The Site B8-232 enclosure was interpreted as a historic era livestock-related enclosure (Cordy 1978:54).

The SIHP site number 50-50-14-1853 was subsequently assigned to the Site B8-7 complex as described by Haun (1978). SIHP numbers were not assigned to the Bishop Museum site numbers assigned by Cordy within the complex area. Therefore, the SIHP number (1853) applied to the B8-7 complex as described by Haun is used here.

Current Findings

Six of the twelve features enumerated by Haun within Site 1853 were removed during construction of the Seibu golf course (*Figure 4.5*). Portions of one enclosure (Feature 5) and three walls (Features 6-8), are within the current project area. A wooden trough that is shown on Haun's site map, but not enumerated in his report, is also present within the project area; it was recorded for this project as Feature 13. It is also possible that the remnants of the Feature 11 wall are within the project area. This wall is shown to the west of the project area when properties are overlaid, however, when measurements are taken from known features, the wall falls within parcel 56 (discussed below).

The Feature 12 wall and the Site B8-8 (SIHP Site 1854) well that is shown on Haun's site map are still present, however, they are outside the current project area. The wall was impacted by golf course construction, and is currently covered with landscaping vegetation. The Site B8-8 well has been impacted by high surf and is currently filled in with beach pebbles. The stairway and vertical wall facing around the well are still visible and conform with the description provided by Haun.

The features that were located and re-identified within the project area are described below, followed by a new feature (14) that was added to the complex due to its close proximity to previously recorded features.

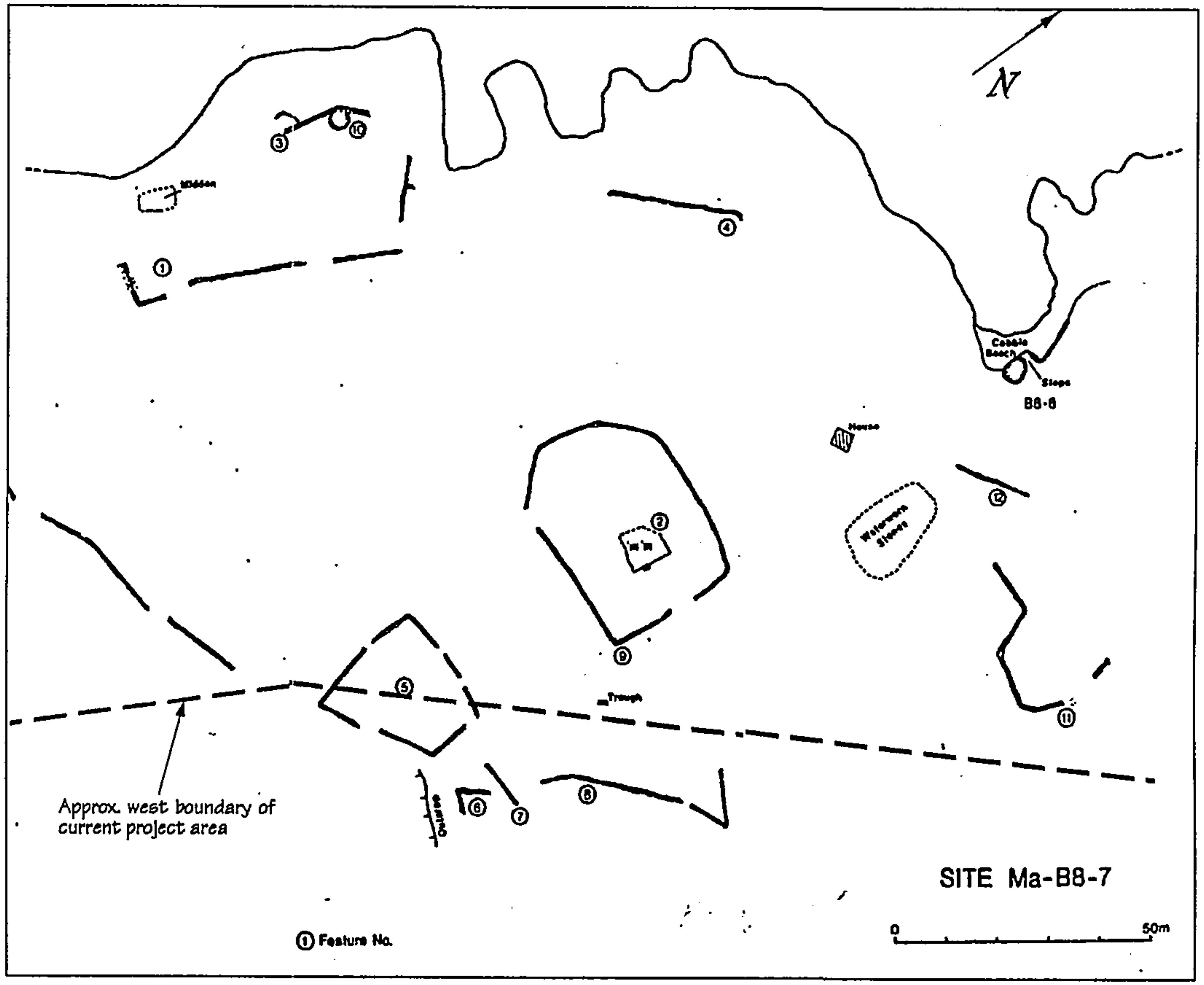


Figure 4.5 Site 1853 Plan Map from Haun 1978:21 (current project area boundaries added)

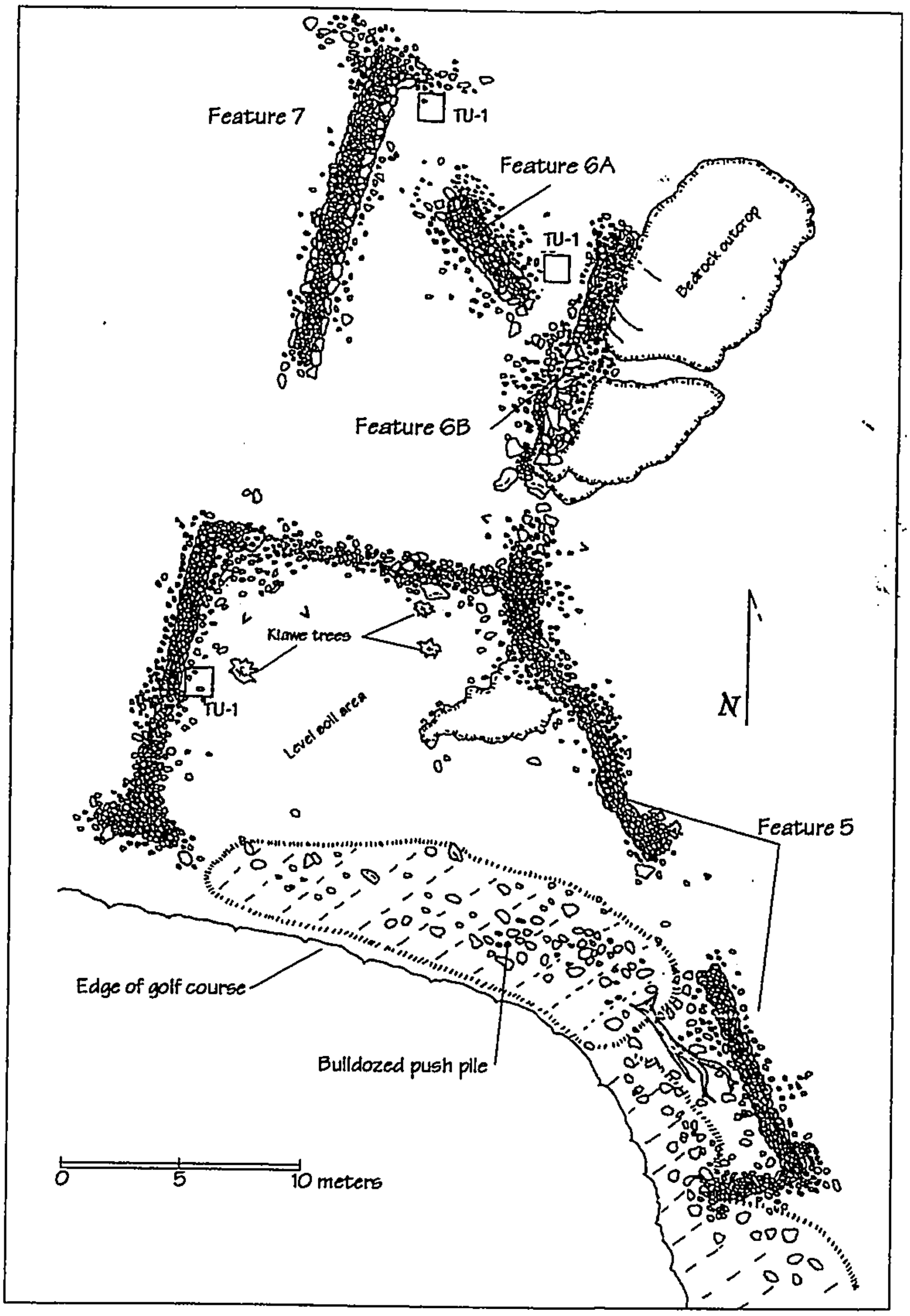


Figure 4.6 Scaled Plan Map, Site 1853 Features 5, 6 and 7

Site 1853 Feature 5 (50-Ma-B8-232)

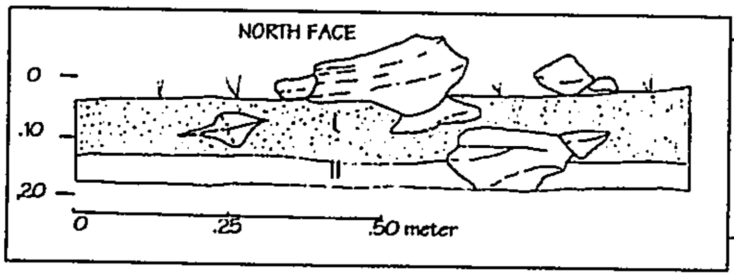
Feature 5 was mapped by Haun (1978), and described as an historic era enclosure (1978: 14). Dimensions of the enclosure were recorded as 24.2 by 22.4 meters, with a total area of 542 square meters. As depicted by Haun, the enclosure was four-sided, with sides measuring approximately as follows: north wall, 24 meters, west wall, 24 meters; south wall, 22 meters; and east wall, 12 meters. Five openings were mapped, including two in the north wall, one in the west wall, one in the south wall and one in the east wall, at the northern corner.

Cordy revisited the enclosure in 1978 and assigned it Bishop Museum site number 50-Ma-B8-232. He described it as being roughly rectangular with one long side, and measuring 22 by 24 meters, with a total exterior area of 528 square meters. Cordy noted two of the openings in the enclosure, both of which "seemed to be knocked down by bulldozers" (Cordy 1978:76). Cordy excavated a 1.0 by 1.0 meter test unit within the enclosure and identified a 0.05 to 0.10 meter thick cultural deposit (Cordy 1978:20). One sea urchin spine abrader was recovered from the surface of the feature (Cordy 1978:16). Twenty pieces of shellfish midden (15.2 grams) were recovered from the test unit. Varieties recovered included *Cellana exaratus* (2), Cypraeidae (13), *Drupa ricinus* (1), *E. mammillatus* (2), and *Nerita picea* (2). Cordy interpreted Feature 5 (Site 232) as being entirely historic in age (1978: 27), although no artifacts were recovered to provide an absolute historic date for the cultural layer (Cordy 1978: 30). Assigned function was as a livestock enclosure (1978: 48, 53).

During the current survey, a portion of Feature 5 was identified along the western boundary of the project area, adjacent to the edge of the golf course and a bulldozed push pile (*Figure 4.6*). Field numbers 29 and 30 were assigned to two identified wall sections; these were subsequently determined to be portions of the Feature 5 enclosure. The portion of the enclosure still remaining includes the eastern half (12.0 meters) of the north wall; the entire east wall (12.0 meters), the entire south wall (24 meters), and a small portion of the west wall (4.0 meters). One opening 4.5 meters wide was observed in the south wall. This opening corresponds with Haun's 1978 map; no opening was seen in the east wall, as indicated on Haun's map.

The Feature 5 wall shows a consistent construction technique of multiple-stacked subangular basalt cobbles and boulders (*Photo 4.4*). The intact portions of the wall are five to seven courses in height (0.45 to 1.00 meter), with disturbed sections at one to two courses (0.10 to 0.45 meter). Width ranges from 0.60 to 1.10 meter, with an average of 0.80 meter. The surface inside the enclosure remnant is flat to irregular, with kiawe, *koa haole*, *'ilima*, and grass present. An exposed *pahohoe* outcrop is present near the center along the south wall. A short wall (2.6 meters) extends east from the southeast exterior corner of the enclosure and abuts a second *pahoehoe* outcrop that is part of Feature 6. No artifacts, midden, or other portable materials (except golf balls) were observed within or adjacent to the enclosure remnant.

A 1.0 by 1.0 meter square test was excavated adjacent to the interior side of the north wall, near the center of the intact portion (*Figure 4.6*). Two soil layers were encountered; these include a very dark brown surface layer (I) of fine sandy loam to a depth of 0.12 meter below surface, and a subsoil layer (II) of dark brown compact silty clay loam from 0.12 to 0.17 meter below surface (*Figure 4.7*). A total of 270 liters of matrix was screened; both soil layers contained 50% small cobbles and pebbles by volume. No artifacts, midden, or other portable remains were recovered during excavation or soil screening. The cultural layer briefly described by Cordy for Feature 5 was not encountered in the test unit, and no new information was obtained to indicate former uses or period of construction.



I: (0-.12 m) very dark brown (10YR2/2 moist) sandy loam, (10YR2/2) dry, 0vfcr, loose, very friable, nonsticky, non-plastic, rootlets common, clear, wavy boundary

II: (.12-.17) dark brown (10YR3/4 moist and dry) silty clay loam, 2fsbk, hard, friable, slightly sticky, slightly plastic

Figure 4.7 Site 1853 Feature 5, TU-1 Profile

Site 1853 Feature 6

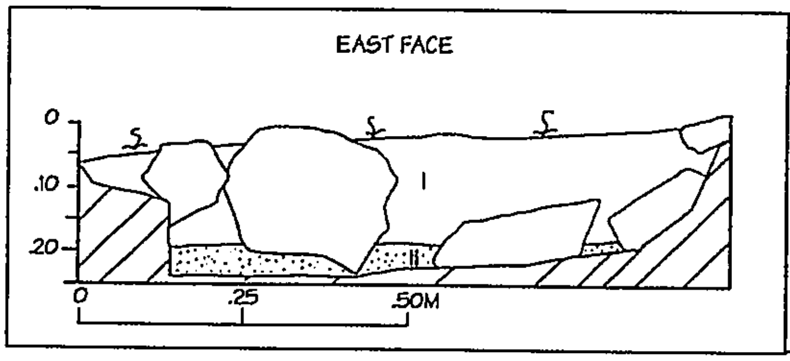
Feature 6 was mapped and described by Haun (1978:14) as an historic era wall. It is depicted as an L-shaped structure 10.5 meters long by 0.6 meter wide, located approximately 8.0 meters east from the Feature 5 enclosure. Current investigations indicate that Feature 6 is actually two discontinuous wall sections that are oriented at an oblique angle (*Figure 4.6*). The two sections have been designated as Features 6A and 6B. The southwestern end of Feature 6A is 2.00 meters northeast from the center of Feature 6B and the northeastern end of Feature 6A is 6.2 meters east from the south end of Feature 7 (*Figure 4.6*).

Feature 6A is a free-standing bifaced, core-filled wall constructed from basalt boulders and cobbles, with small cobbles and pebbles as fill (*Photo 4.5*). The wall is 4.60 meters long and oriented northeast-southwest. Portions of the wall are collapsed, however, there is no indication of extensive machinery or animal impacts. Height of the wall averages 0.65 meters, and width is consistent at 1.00 meter. The collapsed portion is 0.20 meter high and 1.3 meter wide. The wall was constructed on level ground with a soil deposit present.

Feature 6B is a unifaced core-filled wall constructed against the north face of an exposed *pahoehoe* outcrop (*Photo 4.6*). The wall is constructed with basalt boulders stacked two to four courses high, and smaller cobbles and pebbles that were used to fill between the stacked boulders and the outcrop. The western end of the wall consists of a single course of stacked boulders with no fill in place. This section appears to be either unfinished or partially dismantled. Overall length of Feature 6B is 10.0 meters; width is 1.00 meter and height varies from 0.50 to 0.90 meter. The western end of Feature 6B is in a collapsed condition; however, it appears that this wall section once abutted the southeast corner of the Feature 5 enclosure. Vegetation in the vicinity of Feature 6 consists of *koa haole*, kiawe, *'ilima*, and scattered grasses. No artifacts, midden or other portable remains were observed on the surface around these two wall sections.

A 1.0 by 1.0 meter test unit was excavated in a level soil area midway between the two Feature 6 wall sections (*Figure 4.6*). Two soil layers were encountered; the surface layer (I) consists of dark brown sandy loam with roots and some organic duff materials. The underlying subsoil (Layer II) consists of compact dark yellowish brown silty clay loam (*Figure 4.8*). Layer I extended to a maximum depth of 0.15 meter below surface and contained scattered boulders from wall fall as well as *in situ* cobbles. Layer II was excavated to 0.20 meter below surface. The test unit was terminated in sterile Layer II subsoil. Layer I soil contained roughly 16% stones by volume (15 liters stone in 95 liters screened matrix). No artifacts, midden, or other portable remains were found in the screened matrix. Layer II contained roughly 25% stones; no artifacts, midden or other portable remains were recovered from screened matrix.

Subsurface testing in the area of Feature 6 did not provide any new information to assist in determining the age of function of these wall sections. The positioning of Feature 6B indicates that it most likely post-dates the Feature 5 enclosure.



I: (0-.15) very dark brown (10YR2/2 moist) sandy loam (10YR3/3 dry), 0vfcr, loose, very friable, nonsticky, nonplastic, very fine roots common, clear, smooth boundary

II: (.15-.25) very dark brown (10YR2/2 moist) gravelly silty clay loam (10YR4/3 dry), 1fsbk, soft, friable, slightly sticky, slightly plastic, few fine roots and few coarse roots

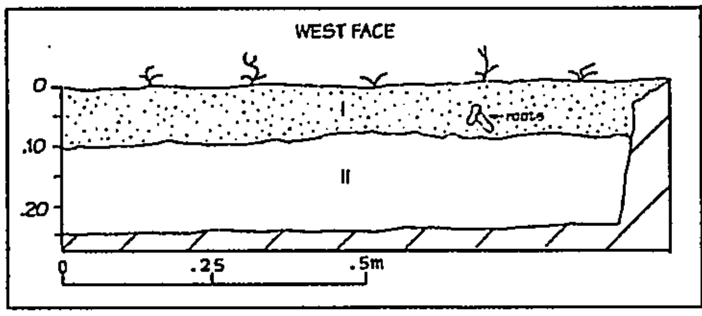
Figure 4.8 Site 1853 Feature 6 Test Unit 1 Profile.

Site 1853 Feature 7

Feature 7 was mapped and described by Haun (1978: 14) as an historic era wall measuring 9.8 meters long by 0.70 meter wide, located between wall Features 6 and 8. The current survey identified the feature as a bifaced, core-filled wall that was impacted on the east end and possibly on the west end as well. the intact section of this wall is 12.2 meters long and 1.4 meter wide, with height ranging from 0.25 to 0.80 meter. The wall is constructed from large stacked boulders on the exterior sides and filled with small to medium cobbles (*Photo 4.7*). The sides are well-faced and the wall is generally wider than the nearby Feature 5 enclosure and Feature 6 and 8 walls. The western portion of the wall is lower than the eastern half, and it appears that stones were removed from this feature and perhaps used in construction of the adjacent walls. No artifacts or portable remains were observed on the surface in the near vicinity.

A 1.0 by 1.0 meter test unit was excavated on the south side of the wall, near the eastern end (*Figure 4.6*). Two soil layers were encountered; Layer I is the surface layer consisting of dark brown fine sandy loam, and Layer II is dark yellowish brown compact subsoil (*Figure 4.9, Photo 4.8*). Layer I averaged 0.10 meter in thickness and contained 10% stones by volume. Portable remains recovered from screened Layer I soil include 1 piece of a Cypraeidae shell (13.4 grams) and five small pieces of weathered coral (9.3 grams total). Layer II was excavated to a base depth of 0.28 meter below surface and contained 14% stones by volume. No artifacts, midden or other portable remains were observed in screened Layer II matrix.

Materials recovered from Test Unit 1 indicate a low level of activity in the area; however, it should be noted that the remains are heavily weathered, suggesting that they have been exposed to disturbances and surface erosion. Layer I at this location is interpreted as primarily a topsoil matrix that may be either a disturbed cultural layer, or may contain materials from a former cultural layer that has eroded away.



I: (0-.10) very dark brown (10YR2/2 moist) sandy loam (10YR3/3 dry), 0vfcr, loose, very friable, nonsticky, nonplastic, very fine roots common, clear, smooth boundary.

II: (.10-.28) very dark brown (10YR2/2 moist) gravelly silty clay loam (10YR4/3 dry), 1fsbk, soft, friable, slightly sticky, slightly plastic, few fine roots and few coarse roots.

Figure 4.9 Site 1853 Feature 7, Test Unit 1 Profile

Site 1853 Feature 8

Feature 8 was mapped by Haun (1978: 14) and described as an historic era wall with an overall length of 47.4 meters and a width of 0.7 meter. Haun's site map depicts the wall as two sections; these were easily identified in the field during the current survey and designated as Feature 8A and 8B (*Photos 4.9 and 10*).

Feature 8A is a 28.0 meter-long straight to slightly curved wall oriented roughly northeast-southwest (40-220 degrees Az.). The southwestern end of this segment is 5.7 meter west from the Feature 7 wall; and the northeastern end is 1.8 meter from the end of Feature 8B (*Figure 4.10*). Feature 8A is constructed with basalt boulders and cobbles of various sizes. The intact portions show a bifaced, core-filled design, with an average width of 1.0 meter. Height of the intact portions range from 0.40 meter to 0.90 meter, with the highest face along the north side of the wall where three courses of exterior boulders are still intact. Three broken-down sections are present along the wall; these appear to be areas that were affected by animals. The north end of the wall is currently 1.8 meter south from the end of the Feature 8B wall. The break between these two wall sections may have been caused by animals; however, it is also possible that there was an original opening in the wall at this location. The southern end of the Feature 8A wall may have been impacted by bulldozing.

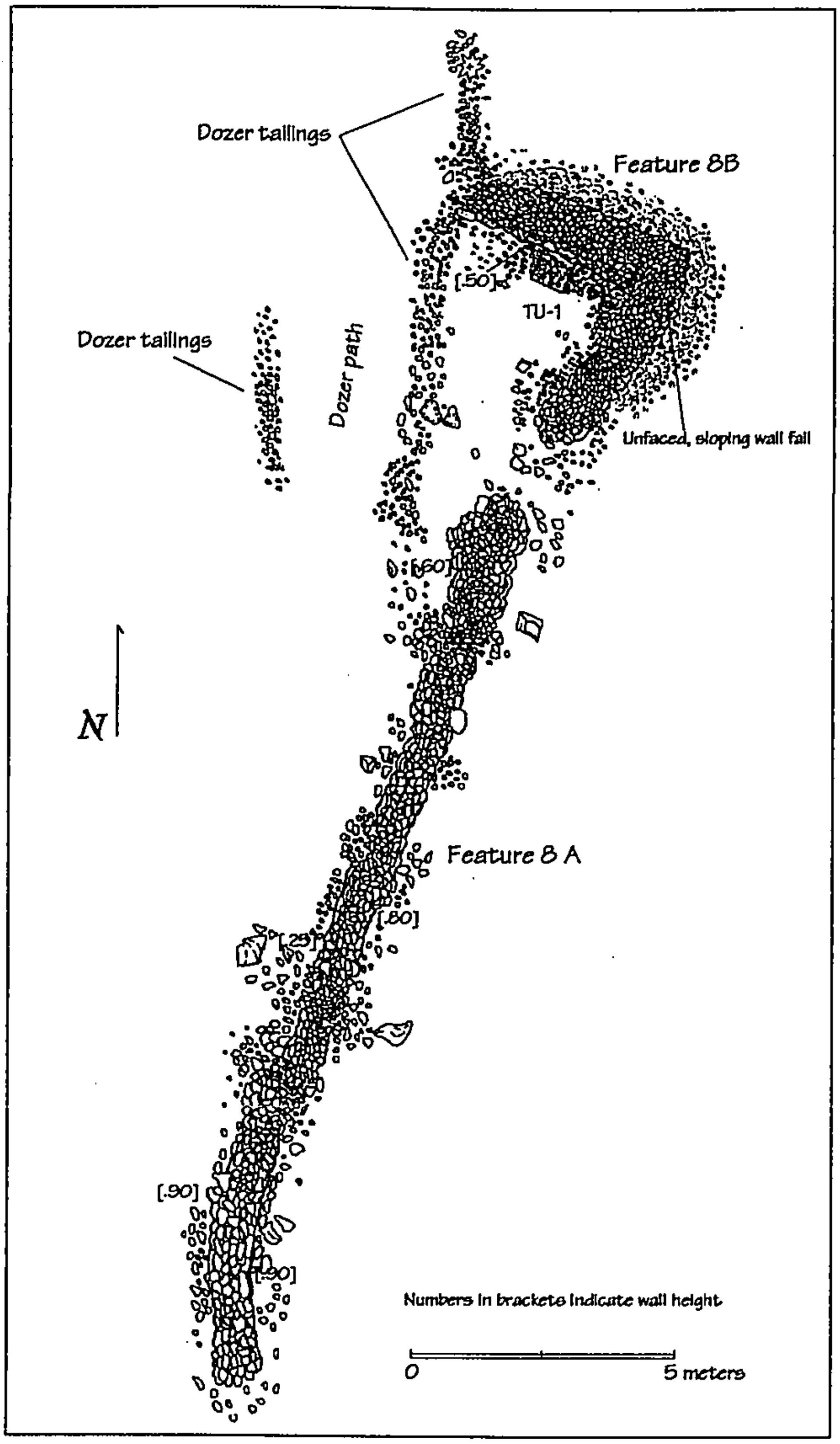


Figure 4.10 Site 1853 Feature 8, Plan Map

The wall follows along the crest of a low ridge formation that is surrounded by lower, flat terrain on the east and west sides; overall condition is fair to poor. No artifacts or portable remains were observed on the Feature 8A wall or on the surface in the near vicinity of the wall. Surface midden associated with Site 5606 feature 5 is present 5.0 meters east from the wall.

Feature 8B is a roughly V-shaped wall segment located 1.8 meter north from the north end of Feature 8A. This segment has an overall length of 14.0 meters, with each half at 7.0 meters. Width along the top, where discernible, is 1.4 to 1.8 meters, and height averages from 0.4 to 0.6 meters, with a maximum interior height of 0.90 meters. Currently, the Feature 8B segment shows facing only along the interior (west) side; the exterior side slopes outward, resulting in a base that is 0.80 to 1.00 meter wider than the top. A linear bulldozer tailing of boulders and cobbles is present to the north and south of the west end of this wall, indicating that it was directly impacted by machinery. This occurred prior to 1978, as the current wall segment correlates with Haun's (1978) map.

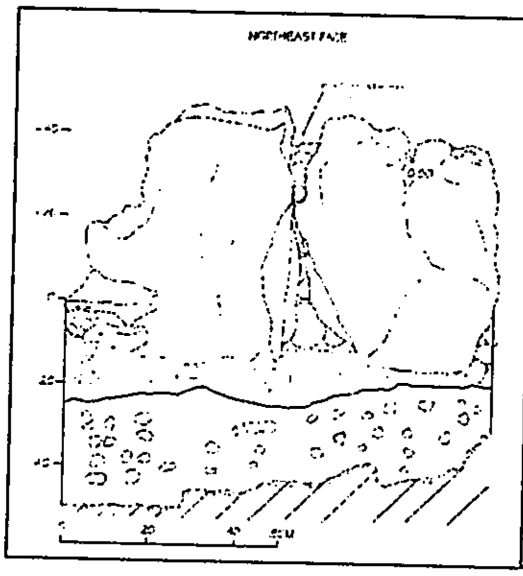
Portable materials observed on and near Feature 8B include a piece of weathered coral (0.07 m in diameter) on the wall, and a piece of weathered branch coral (0.15 by 0.13 by 0.07 m) on the ground surface inside the wall (*Figure 4.10*).

A 1.0 by 1.0 meter test unit was excavated along the inside of the northern portion of the wall, at the location of two upright boulders that formed the interior facing. The excavation encountered a surface layer of wall fall (140 liters) that averaged 0.10 meter in thickness, with a maximum of 0.25 meter near the wall. The uppermost soil layer (I) was 0.10 meter thick and consists of loose, dark brown silty loam with rootlets and *koa haole* duff (*Figure 4.11*). Layer I at this location is quite stony, with pebble to small cobble-sized stones representing 64% of the screened matrix by volume (66 of 103 liters).

A formed sandstone artifact fragment was recovered from Layer I, at 0.06 meter below soil surface. This item appears to be portion of a pestle handle or the stem of a large sinker (see Chapter 5). A piece of weathered branch coral was also found on the surface of Layer I, beneath the wall fall. Screened Layer I soil contained 9 pieces of marine shell, 27 small fragments of weathered coral, and one waterworn basalt pebble (*Table 4.4*). By volume, the density of marine shell in Layer I was 0.04 grams per liter of screen soil (1.40 grams/37 liters).

Layer II consisted of compact subsoil and tightly packed *in situ 'a'ā* clinkers. Stones comprised 60% of the matrix by volume (103 of 176 liters). A weathered irregular bedrock surface was encountered 0.20 meter below surface at the northeastern corner of the unit and at 0.32 meter below surface at the southwestern corner. Portable remains consisting of five pieces of Cypraeidae shell (4.40 grams) and 11 small pieces of weathered coral (4.70 grams) were recovered from the upper 0.05 meter of the layer. The base of the layer was sterile (*Photo 4.11*).

Findings from Test Unit 1 indicate that Layer I soil was in place at the time the wall was constructed at this location. The stones appears to have been set on the surface with little to no impacts to Layer I. It is therefore likely that the portable remains in Layers I and II were deposited prior to the construction of the wall.



I: (0-.10) very dark brown (10YR2/2 moist) loam (10YR3/3 dry), 1fcr, loose, friable, nonsticky, nonplastic, very fine roots common, clear smooth boundary.

II: (.10-.32) yvery dark brown (10YR2/2 moist) gravelly silty clay loam (10YR3/4 dry). 1fsbk, slightly hard, firm, slightly sitcky, plastic, few fine to coarse roots.

Figure 4.11 Site 1853 Feature 8B, Test Unit 1 Profile

Site 1853 Feature 11

As described and mapped by Haun (1978:14), Feature 11 consisted of 41.0 meter long by 0.9 meter wide historic era stone wall. The wall is depicted as having a general east-west orientation, with three bends. The eastern section of the wall is 20.0 meters long and is oriented generally north-south. A gap approximately 7.0 meters wide is shown in this section of the wall on Haun's map.

SITE 1853 Feature 8						
TU-1	I-1		II-1		Total	
Depth	.50-.60		.60-.70			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Cypraeidae	1	0.90	5	4.40	6	5.30
Hipponix imbricatus	1	0.05			1	0.05
Patellidae	2	0.20			2	0.20
Bivalves						
Isognomonidae	5	0.25			5	0.25
TOTAL SHELL	**9**	**1.40**	**5**	**4.40**	**14**	**5.80**
Coral						
Weathered Frags.	27	25.50	11	4.70	38	30.20
Basalt						
Waterworn pebbles	1	5.20			1	5.20
TOTAL	**37**	**32.10**	**16**	**9.10**	**53**	**41.20**

Table 4.4 Recovered Materials, Site 1853 Feature 8B

The location of this wall in relation to the current project area was interpolated by measuring the angle and distances of Feature 11 from the corner point of Feature 8 on Haun's map and plotting this location on the project area topographic map. It was checked by measuring the distance from the Site Ma-B8-8 well, which is plotted on Haun's map and is still present along the shoreline.

A surface feature was located at the projected location of Feature 11. The feature is situated adjacent to the edge of the golf course in an area that was affected by bulldozing. It consists of a 4.0 meter long section of intact wall oriented north-south, and an 8.0 meters long section of what appears to be a bulldozed wall or similar type of feature. A 7.0 meter long *pahoehoe* rock face is located between the two wall sections, resulting in a 19.0 meter long wall-like formation. The intact wall section is 1.0 to 0.80 meter wide and 1.0 to 0.5 meter high. Bulldozer disturbance has affected the southern portion of this wall section, and all areas to the west of the wall. A swale has been created along the west side of the remainder of this feature.

If the subject feature is in fact Feature 11, we must assume that the gap shown on Haun's map was not an opening, but a section of natural bedrock. Normally, when these types of formations are incorporated into a wall, the feature is depicted as being continuous. Thus, there is a degree of uncertainty as to whether this wall segment is in fact the same wall mapped by Haun.

Subsurface testing along the west side of the wall uncovered an historic/modern era refuse deposit that appears to be associated with the adjacent historic/modern era Site 5708. A number of surface artifacts consisting of bottles, cans and modern camping debris is also present. It was therefore determined that the cultural deposit should be part of Site 5708, with the understanding that the disturbed possible wall could be the Site 1853 wall. The intact wall segment and the disturbed stone feature are depicted on the Site 5708 Feature 3 map (*Figure 4.49*).

Site 1853 Feature 13

This newly assigned feature was depicted on Haun's (1978) map of Site 1853 as a trough, located approximately 14.0 meters west from the Feature 8 wall. The feature was relocated in the same general location, approximately 10.0 meters west from the Feature 8 wall. It was overturned and partially buried under bulldozer push. It appears to have been moved eastward approximately 2-4 meters.

The trough is constructed from milled lumber planks, 2 inches thick. The base is a single 2x16 inch plank and the sides are single 2x18 inch planks. Hardware consists of round (c. 20d) nails and metal bands on the ends (*Photo 4.12*). Short Kiawe posts are located nearby and on top of the trough; these were probably used to secure the trough to the ground.

The condition and materials used in the feature indicate a likely twentieth century construction, *circa* 1920-1940..

Site 1853 Feature 14

This newly identified feature was located 18.0 meters southeast from the Feature 5 enclosure remnant. It consists of three filled depressions (components A-C) and a low stone alignment (component D) along the base of an exposed *pahoehoe* outcrop (*Figure 4.12*). The modifications are within an area of 13.0 meters northwest-southeast by 6.0 meters northeast by southwest. The filled depressions are 1.0 to 1.5 meter in diameter and consist of small to large subangular basalt cobbles that were placed in natural depressions along the base of the outcrop. The surfaces of the deposits are generally level to slightly above surrounding ground surface.

The alignment is located 5.0 meters east from the filled depressions and is constructed from loosely piled (unfaced) basalt cobbles, one to three coursed high. It appears to have functioned as an informal terrace face, as the height varies from 0.10 meter on the upslope side to 0.25 meter on the downslope side. The alignment is 2.5 meter long by 0.55 meter wide and oriented east-west.

One surface artifact consisting of a broken modern glass bottle was observed on the surface, adjacent to Feature 14A. A thin soil deposit is present in areas outside the filled depressions, which contain no soil. Vegetation is sparse and includes *panini* cactus, lantana, *'ilima*, and grass.

A 1.0 by 1.0 meter test unit was excavated over the largest of the three filled depressions (14A) in order to aid in determining the function and age of the feature. The surface of the test unit consisted of informally placed angular cobbles against the west face of a 1.15 meter high *pahoehoe* face. The stones (340 total count) were removed to expose a former duff-covered surface. This surface consisted of naturally fractured *in situ pahoehoe* and a natural crevice 0.20 meter long by 0.09 meter wide. The sloping surface beneath the stone fill varied from 0.02 meter below surface at the southeast corner to 0.52 meter below surface at the center along the north wall of the unit. This was the deepest excavated point within the crevice, which appeared to continue slightly deeper.

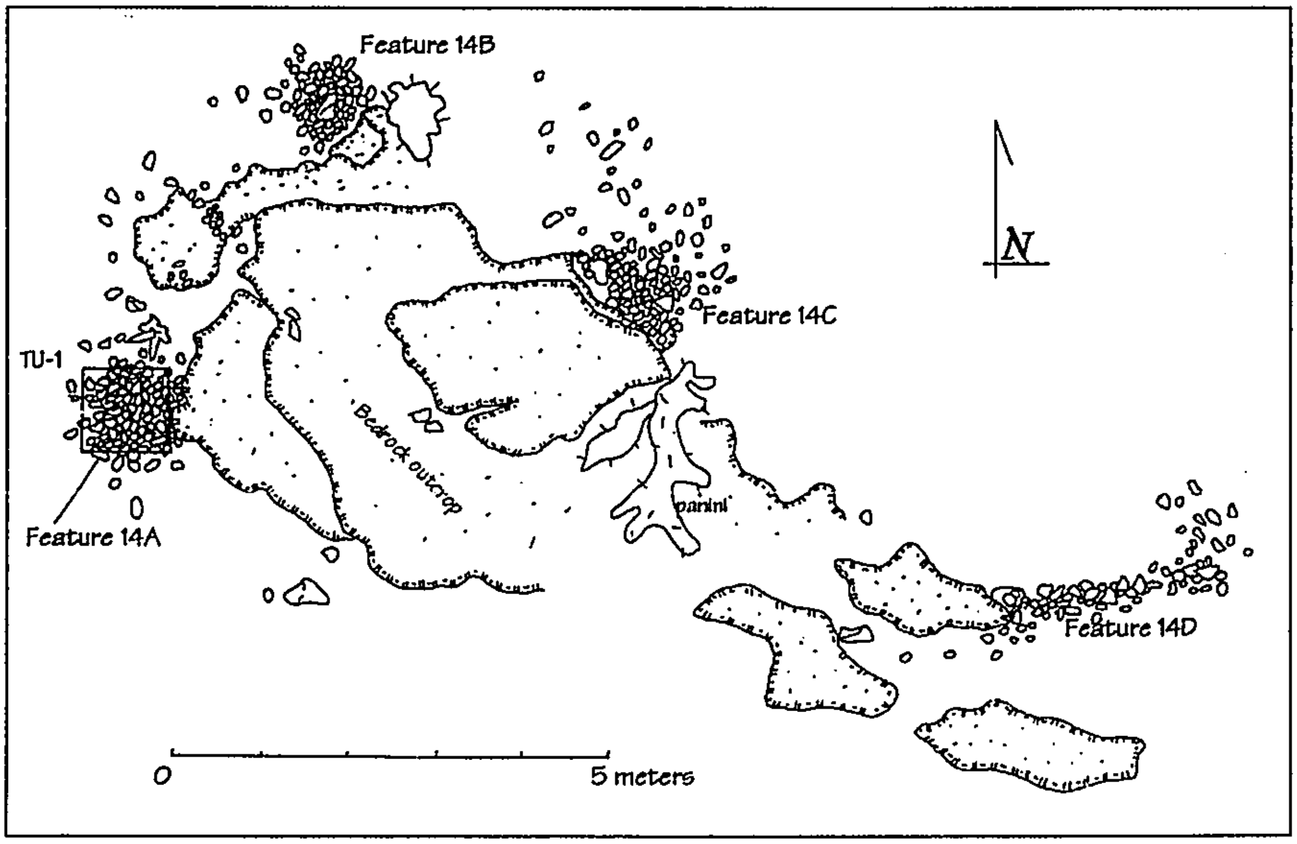
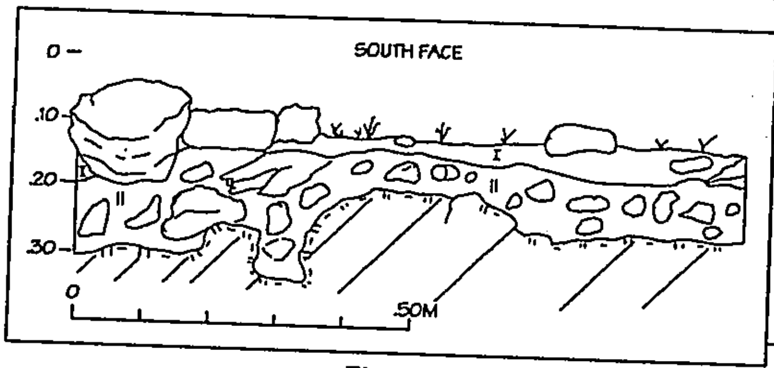


Figure 4.12 Site 1853 Feature 14, Plan Map

A small amount of soil was recovered from the Layer I deposit found beneath the rock fill. This thin deposit consisted of loose, dark brown sandy loam with rootlets and duff (*Figure 4.13*). One small piece of weathered coral was found on the surface, beneath the stone fill. No additional portable remains were found in the screened Layer I soil.

Layer II consisted of naturally fractured bedrock with soil that had filtered down from the surface. This was excavated to expose a very irregular bedrock base. The soil in this layer was similar in color and texture to Layer I. Two small pieces of decayed metal were found in soil near the base of Layer II. No other portable remains were recovered from the screened Layer II matrix. Overall, the excavation contained only 40% soil by volume (38 of 91 liters).

Subsurface findings suggest that the stone fill was tossed into an existing opening in the *pahoehoe* surface for purposes of sealing the underlying crevice. The crevice was not particularly large, however, it would have posed a trip hazard to cattle. The presence of metal near the base of excavation suggests that this material filtered down into the crevice prior to the time it was sealed. The stone fill would therefore be historic in age. The two other filled depressions at Feature 14 are also most likely contemporaneous with Feature 14A and are assumed to have served a similar function.



I: (0-.05) very dark brown (10YR2/2 moist) sandy loam (10YR3/3 dry), 0vfcr, loose, very firable, nonsticky, nonplastic, fine to very fine roots common, smooth, wavy boundary

II: (.05-.35) very dark gray (10YR3/1 moist) stony silt loam, 2msbk, slightly hard, very friable, nonsticky, nonplastic, fine to coarse roots common.

Figure 4.13 Site 1853 Feature 14, Test Unit 1 Profile

Site 1864 (50-Ma-B8-111)

Previous Investigations

Site Ma-B8-111 was initially recorded in March 1979 during a Bishop Museum reconnaissance and partial Phase I survey of the proposed Seibu resort area (Rogers-Jourdane 1979: 18). Parcel 37 of the current project area was included in the survey, along with an additional 91 acres on the *makai* side of Makena Alanui Road. Sites 111 and 112 (discussed below) were the only two sites identified in Parcel 37 during the 1979 reconnaissance survey. SHIP Site number 1864 was subsequently assigned to the site in the early 1990's by SHPD.

Site 1864 was described by Rogers-Jourdane as follows:

> This site is a discontinuous L-shaped wall. The main wall is 9.3 meter long, running in a N-S direction. The shorter wall segment starts c. 1.0 meter W of the main wall and extends for c. 3.5 meters in an E-W direction. Both wall segments are low-lying, averaging 0.3 meter in height and constructed of stacked aa. Wall widths average 0.40 meter in the shorter wall segment and 0.65 meter in the main wall. Site function is undetermined, but the site appears to be a remnant enclosure or wall. (Rogers-Jourdane 1979:18)

In June of 1979, Bishop Museum staff returned to the proposed Seibu resort for "Phase II salvage" of identified sites (Denison 1979). At that time, the feature was described as "...at most a low rubble wall, and probably not a wall at all" (Denison 1979:18). Denison surmised that the linear rubble line was the result of recent activity in the area, although he was not able to verify this based on the surrounding terrain. Denison noted that the short section of the feature "...does in fact appear to be a constructed feature" (Denison 1979:18).

A test unit was excavated at site 1864, and two soil layers were encountered; these were described by Denison as being "essentially identical" to the soil deposits at the nearby Site 2272. No midden or artifacts were recovered during the excavation. A specific age or function was not offered for this site, and no further work was recommended (Denison 1979:21).

Current Findings

Site 1864 was relocated in the field using Denison's site map and his verbal description. As noted by Denison, Site 1864 is located "very near Site B8-112", which is described below. It appeared that Site 1864 has undergone little to no changes since 1979. The site is located 17.0 meters west from the sidewalk that borders the east edge of Parcel 37. The long section of the wall remnant (Feature 1) is currently 16.8 meters long, oriented N-S (*Figure 4.14*). The north and south ends of this wall remnant consist of a single layer of disturbed stones; a 6.0 meter-long section in the center is still loosely stacked up to three courses high, with a maximum height of 0.35 meters. The entire feature is in a disturbed state, and possible dozer paths were noted at both ends. The location of the wall remnant in relation to surrounding topography indicates that it served as a retaining wall for soil. The surface on the west side is level and averages 0.30 to 0.40 meters above the ground surface to the east side of the wall. In addition, the location and orientation of this remnant in relation to the nearby Site 2272 wall suggests that they were once connected to form a single large enclosure. Currently, the north end of the Site 2272 wall is 6.0 meters south from the end of Site 1864; the area between these walls contains scattered stones and may have been impacted by bulldozing in the past. These impacts to the walls predated the 1979 survey.

The shorter E-W segment of this site (Feature 2) is located 4.3 meters north from the relatively intact section of the wall, although scattered stones are present in the area between the two sections. As noted by Denison, this section is in better condition and appears to have been constructed more recently, and probably after the bulldozer disturbance. It is 3.2 meters long and 0.5 to 0.7 meters wide; height ranges from 0.15 to 0.35 meter, with and average of 0.25 meter. It is suspected that this section is not functionally or temporally related to the longer section. A modern beverage bottle is located adjacent to the east end of this section (*Photo 4.13*).

Surface materials observed on the soil flat near the long section of the wall include pieces of unfinished mortar and a modern beverage bottle, near the sidewalk. Also found and collected was a ground cobble tool comprised of dense igneous stone (possibly Hawaiite). This item was partially buried, with the rounded side visible from the surface (see Chapter 5).

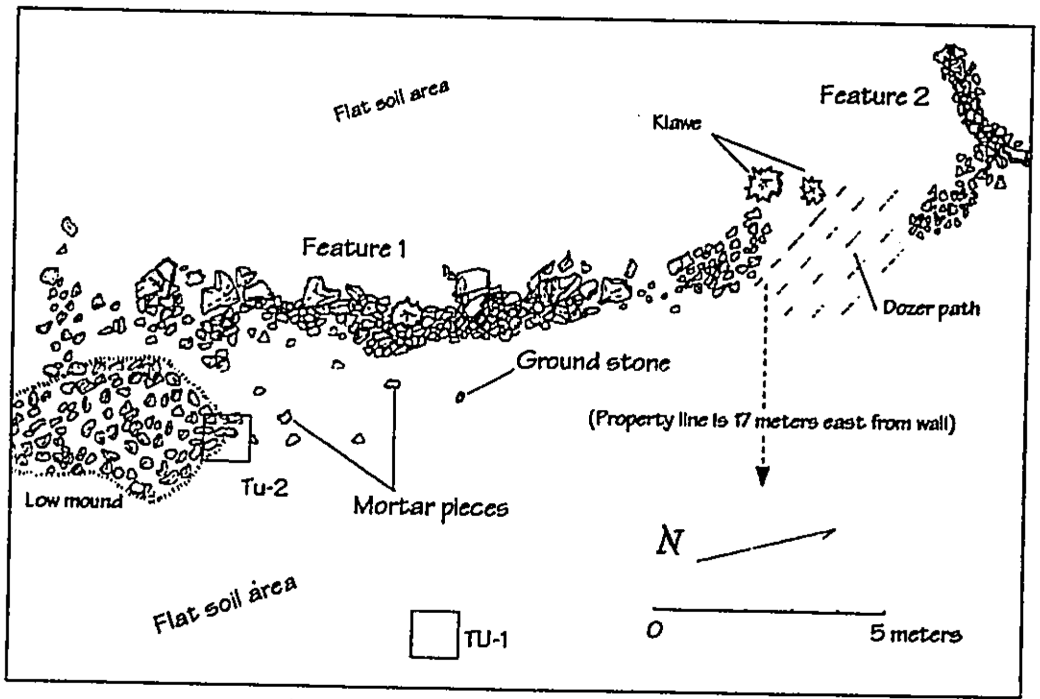


Figure 4.14 Scaled Plan Map, Site 1864

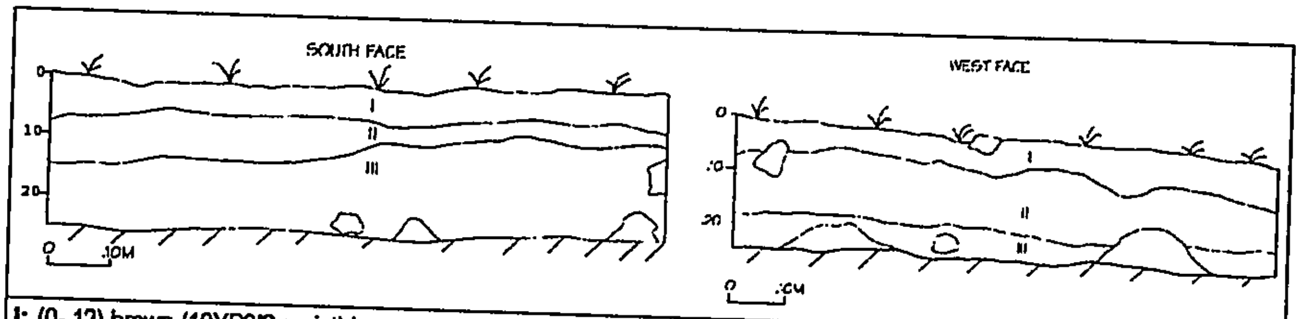
Two 1.0 by 1.0 meter test units were excavated at Site 1864; Test Unit 1 was located near the center of the level soil flat and Test Unit 2 was located over a low stone-filled rise near the southern end of the wall (*Figure 4.14*). The origin of this rise was indeterminate based on surface examination; possible functions included an eroded platform or an eroded machinery push pile. Both units were excavated to a base depth of 0.25 meter below surface, and the soil stratigraphy encountered in both test units was similar.

In Test Unit 1, Layer I was 0.08 meter thick and consisted of very loose brown (moist and dry) loamy sand with *kiawe* duff and very few stones (*Figure 4.15*). Layer II was 0.07 meter thick and consisted of loose brown (7.5YR5/4) loamy sand with less than 1% stones by volume. Layer III was 0.10 to 0.15 meter thick to the base of excavation and consisted of compact dark yellowish brown (10YR4/4) silty clay loam with 7% stones by volume. No artifacts, midden or other portable remains were located in screened matrix from Test Unit 1 (*Photo 4.14*).

Layer I in Test Unit 2 consisted of brown loamy sand with duff and small cobble-sized stones (25% by volume). Layer II was 0.10 meter thick and consisted of loose dark yellowish brown sand with 14% stones by volume (*Figure 4.15*). Layer III averaged 0.05 meter thick and consisted of loose dark brown silty clay loam with 55% stones by volume. This layer rested on an irregular surface of decomposing bedrock. No artifacts, midden or other portable remains were located in screened matrix from Test Unit 2.

The negative findings of subsurface testing during the current survey are consistent with the 1979 testing results. Given the poor condition of the wall and its partial nature, it is difficult to determine the age or use of the site. If it was part of an enclosure and connected with Site 2272, the western portion was destroyed in the early twentieth century when Mākena Road was first improved. Additional impacts occurred when the cul-de-sac and sidewalk were built in the early 1980s.

Subsurface testing did indicate that the area within the former enclosure contained a relatively deep deposit of loose sandy soil, which is not common elsewhere in the project area. The presence of relatively deep loose sandy soil with few rocks suggests a former use as a garden enclosure. This would collaborate with the traditional artifact that was found on the site surface. If the area had been used as a cattle enclosure, we would expect a more eroded and deflated soil deposit, with more loose stones scattered in the soil layers.



I: (0-.12) brown (10YR3/2 moist) loamy sand (10YR5/3-4/2 dry), structureless, fine, single grain, loose, nonsticky, nonplastic, very fine to fine roots common, clear, smooth boundary.

II: (.12-.25) dark yellowish brown (10YR4/4 moist) sand (10YR6/4 dry), structureless, fine, single grain, loose, nonsticky, nonplastice, few fine to coasrse roots, clear, smooth boundary.

III: (.25-.30) dark brown (7.5YR3/4 moist) gravelly silty clay loam (7.5YR4/6 dry), moderate, fine, granular, soft, friable, slightly sticky, slightly plastic, grades to aa flow, few coarse roots.

Figure 4.15 Site 1864, Test Units 1 and 2 Profiles

Site 2272 (50-Ma-B8-112)

Previous Investigations

This site was recorded by Bishop Museum in 1979, in conjunction with Site B8-111. It was described by Rogers-Jourdane as follows:

> This site is a semi-circular wall with a total length of c. 32 meters. Construction is multiple-stacked aa, except for a 9.0 meter-log section near the E terminus, which appeared to have been double-faced originally. Much of the wall in this section has been extensively disturbed and only aa-boulder basal uprights still remain intact. Wall widths range from 0.46 to 1.0 meter and heights from 0.10 to 0.5 meter. (Rogers-Jourdane 1979:19).

Subsurface testing (a 1.0 by 1.0 meter unit) was conducted at Site B8-112 in 1979, and no evidence of artifacts or midden were observed (Denison 1979:19). Denison noted at the time that, "This wall functioned partially as a retaining wall, as indicated by the fact that the ground surface is substantially higher on its E side" (1979:19). No specific function or estimated age was indicated for the site, and no further work was recommended. SIHP site number 2272 was later assigned to the site by SHPD.

Current Findings

The Site 2272 wall was relocated in the field through use of Denison's site location map and Rogers-Jourdane's description. This wall and soil terrace was designated as Feature 1; three additional features were added to the site complex, due to their proximity to the wall and apparent functional/temporal similarities. These include two clearing piles (Features 2 and 4) and a soil terrace with associated clearing pile (Feature 3).

Site 2272 Feature 1

Feature 1 is described here as a soil terrace with a retaining wall (*Figure 4.16, Photo 4.15*). The overall length of the wall has been reduced from 32.0 meters as noted in 1979, to 24.8 meters, due to the removal of the southeastern end of the wall during construction of the Mākena Road cul-de-sac and sidewalk. The southern end of the wall is currently adjacent to the sidewalk that runs along the eastern boundary of Parcel 37. The northern end of the wall is 13.8 meters west from the sidewalk and as noted above, is 6.0 meters south from the south end of the Site 1864 wall, which continues along the same topographic contour in line with this wall. These two wall segments would have been designated as features within the same site if they did not already have separate SIHP site numbers.

As noted in the prior studies, the wall is not core-filled; however, much of the base is constructed from parallel boulders that were set on edge and filled with smaller cobbles. The upper courses of the wall are multiple stacked, with two to five coursed intact. Height ranges from 0.20 to 0.90 meter, with an average of 0.45 meter. The soil deposit behind the wall along the east side is continuous with the soil flat behind the Site 1984 wall. Surface artifacts observed at Site 2272 were limited to modern rubbish (plastic bags, clear bottle glass) that was thrown into the area from the sidewalk.

Two 1.0 by 1.0 meter test units were excavated at Feature 1. Test Unit 1 was located adjacent to the east (uphill) side of the wall, and was excavated to determine the base depth of the wall as well as to recover information regarding the age and function of the feature. This excavation encountered a 0.05 meter thick layer (I) of surface duff mixed with loose very pale brown and brown loamy sand. Layer I contained basalt cobble wall fall (40% by volume), which was concentrated in the west half of the unit, against the wall (*Figure 4.17*).

Layer II was 0.10 to 0.15 meter thick and consisted of very pale brown sand with 11% stone content by volume. The base of the Feature 1 wall was encountered at the base of this layer, and stones present were large pebble-size pieces of decomposing bedrock. Layer III consisted of thin pockets of dark brown (dry) silty clay loam that occurred in natural bedrock crevice. Only 40 liters of this layer was collected from Test Unit 1, and most of the matrix (88%) was comprised of *in situ* cobbles and pieces of decomposing bedrock. Solid *pahoehoe* bedrock was encountered at a depth range of 0.30 to 0.55 meter below surface. No artifacts, midden, or other portable remains were encountered in Test Unit 1.

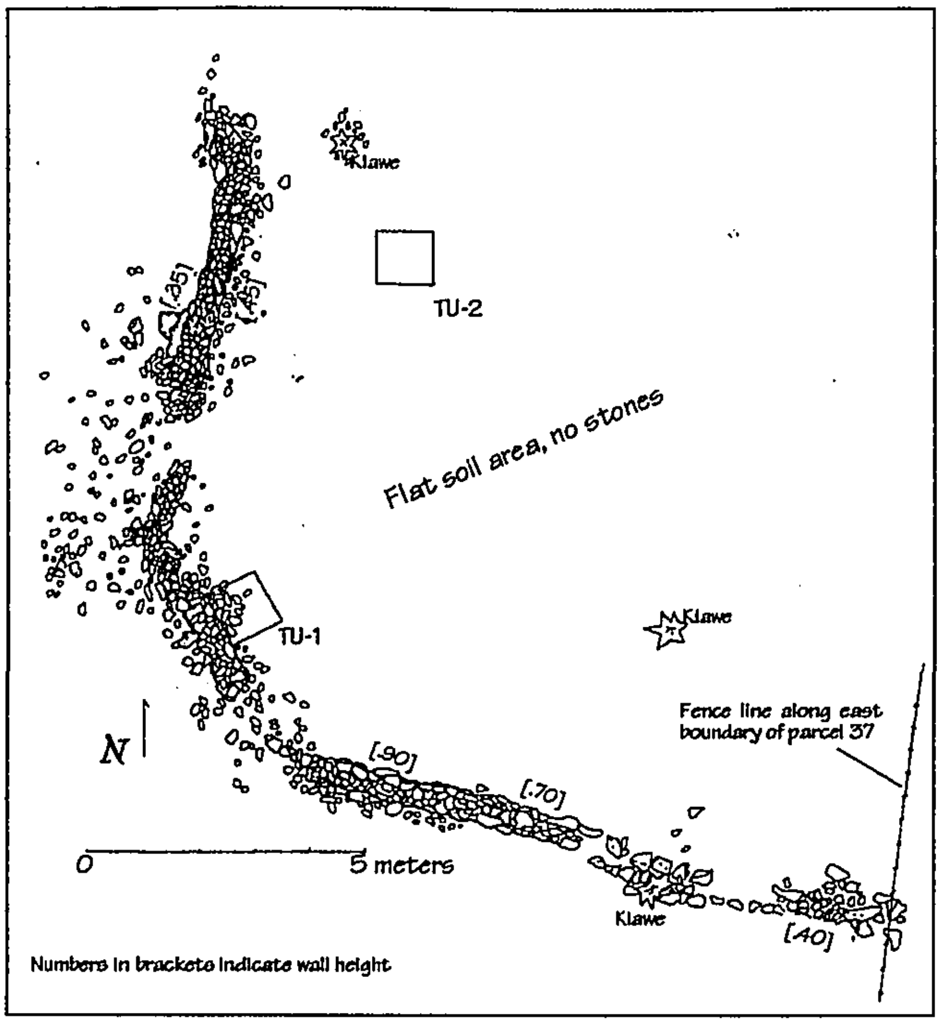
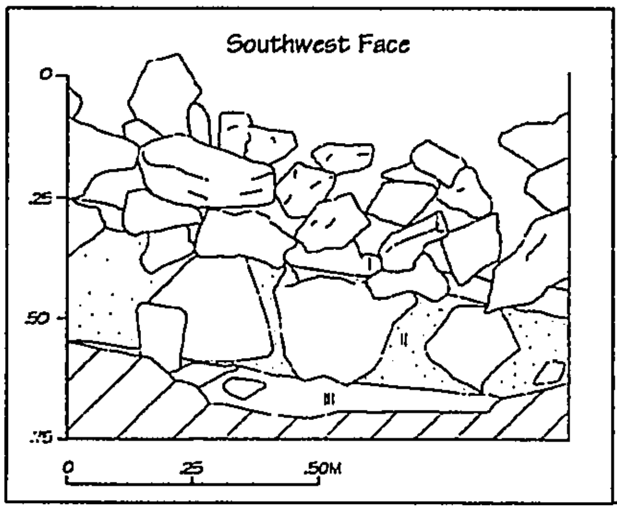


Figure 4.16 Scaled Plan Map, Site 2272 Feature 1



I: (0-.05) pale brown and very dark brown (10YR6/3 and 2/2 moist and dry) loamy sand with duff, structureless, very fine, single grain, loose, nonsticky, nonplastic, fine roots common, diffuse, broken boundary.

II: (.05-.20) very pale brown (10YR7/3 moist and dry) sand, structureless, very fine, single grain, loose, nonsticky, nonplastic, few coarse roots, clear, smooth boundary

III: (.20-.25) very dark grayish brown (7.5YR3/2 moist) stony silty clay loam (7.5YR3/4 dry), moderate, medium, subangular blocky, slightly hard, firm, slightly sticky, nonplastic, few coarse roots, grades to aa flow

Figure 4.17 Site 2272 Feature 1, Test Unit 1 Profile

Test Unit 2 was located 2.5 meters east from the Feature 1 wall, near the northern end of the feature. It was located in a level, soil-filled area of the site with no surface stones present. Two soil layers were encountered in this excavation, which was terminated at solid bedrock 0.10 to 0.15 meter below surface (*Photo 4.16*). The surface layer (I) was a thin (0.03 meter) deposit of organic duff with very pale brown sand (*Figure 4.18*). Layer II averaged 10 cm in thickness and consisted of very pale brown sand over an irregular bedrock surface. Excavated Layer II soil contained 6% stones by volume (5 of 80 liters screened). No artifacts, midden, or other portable remains were recovered from screened soil at this test unit.

The subsurface testing results at Feature 1 are consistent with the 1979 testing results, which also found no cultural materials. The findings are also consistent with the Site 1864 results, which showed sandy soil deposits with relatively few stones. Testing along the base of the wall indicates that most of the soil accumulated after the wall was in place, or the wall was built in a shallow trench that was dug to the solid bedrock surface.

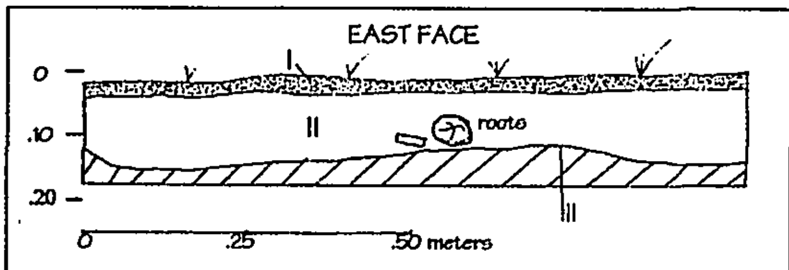


Figure 4.18 Site 2272 Feature 1, Test Unit 2 Profile

I: (0-.03) pale brown and very dark brown (10YR6/3 & 2/2 moist and dry) sand with duff, 0vfsg, loose, nonsticky, nonplastic, vf roots common, smooth, clear soundary.

II: (.03-.13) very pale brown (10YR7/3 moist and dry) sand, 0vfsg, loose, nonsticky, nonplastic, coarse roots common, clear, wavy boundary.

III: (.13-.15) very dark grayish brown (7.5YR3/2) silty clay loam (7.5YR3/4 dry), 2msbk, slightly hard, firm, slightly sticky, nonplastic, grades to aa flow.

Site 2272 Features 2 and 3

Feature 2 is located 2.2 meters southwest from the western bend in the Feature 1 wall. It consists of an informal concentration of loose stones that were placed on an exposed knoll-like *pahoehoe* outcrop (*Figure 4.19*). The stones are primarily medium to small cobbles that are scattered among naturally fractured *pahoehoe* blocks, and set into natural crevices in the *pahoehoe*. Overall area of the concentration is 10.5 meters N-S by 8.0 meters E-W. The height of the outcrop area ranges from 0.15 to 0.55 meters above surrounding ground surface. The cobbles are generally one layer thick, and there is no indication of a formally constructed feature. The concentration appears to be the result of clearing, possibly of the adjacent Feature 1 terrace. No soil deposits or surface materials were observed on Feature 2.

Feature 3 is located 5.6 meters south from Feature 2, along the same contour and bedrock outcrop formation. It consists of a small soil terrace with a stone-filled face and two informal stone concentrations (*Figure 4.19*). The stone-filled terrace face is 3.9 meters N-S by 0.80 to 1.50 meter wide. The informally arranged (not stacked) face slopes toward the east and has a maximum height of 0.60 meters. A small soil flat 3.0 by 2.5 meters occurs on the east side of the face. A concentration of small to medium cobbles is located 2.5 meters north from the small terrace. This surface feature is 2.8 meters N-S by 4.4 meters E-W and is raised 0.15 meter above surrounding ground surface, which is the average thickness of a single course of stones. This concentration appears to have resulted from ground clearing in the immediate area. Also associated with Features 2 and 3 is a small concentration of large to medium cobbles that was placed against the east side of a *pahoehoe* outcrop, 3.0 meters south from the Feature 2 area. This informal stone pile is 1.7 meters NE-SW by 0.90 meter NW-SE and three courses high in the center.

Features 2 and 3 are interpreted as reflecting agricultural activities, specifically the clearing of stones from soil area in order to plant. They are assumed to be temporally and functionally related to the larger planting enclosure represented by Site 1864 and Site 2272 Feature 1.

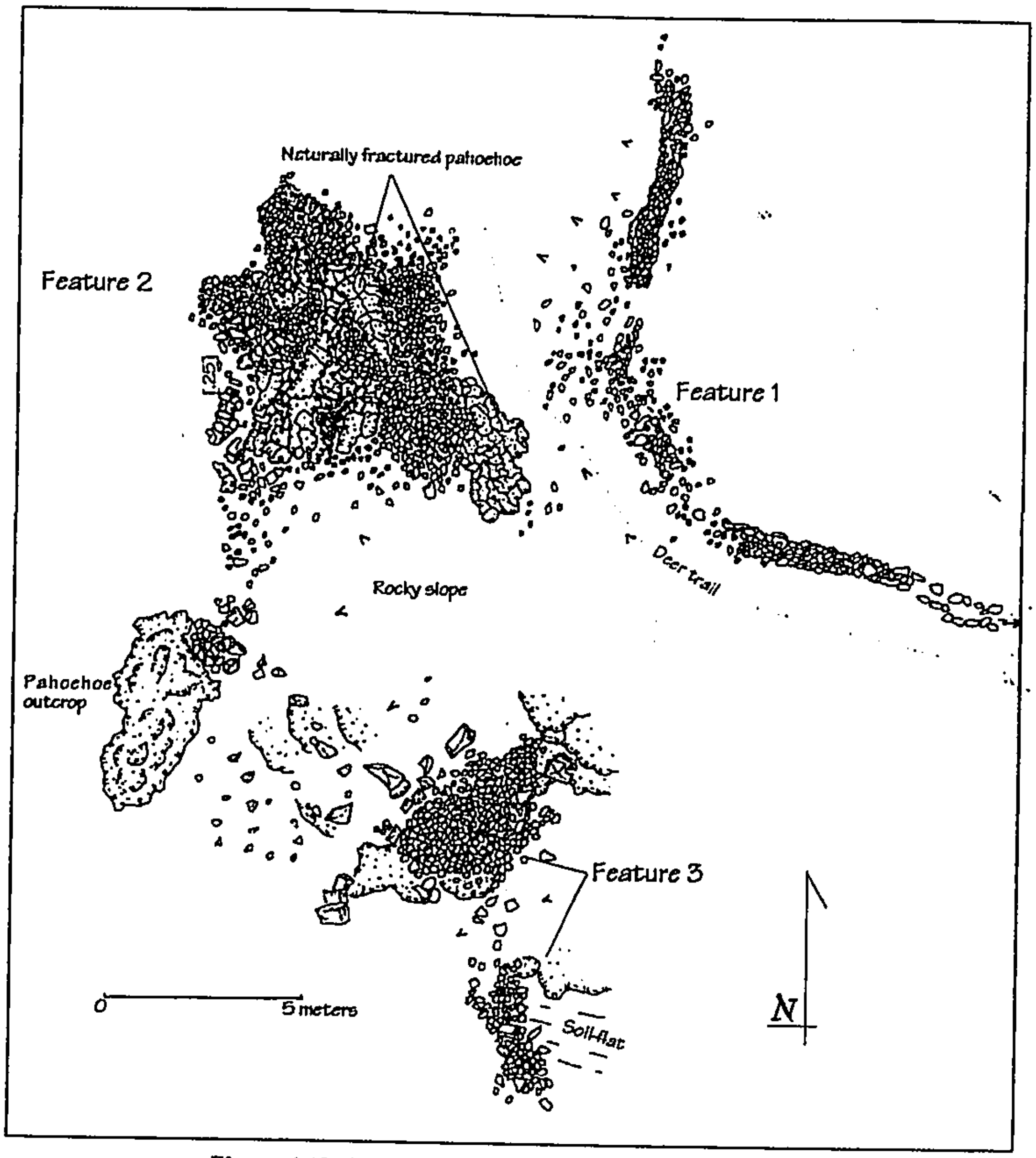


Figure 4.19 Scaled Plan Map, Site 2272 Features 2 and 3

Site 2272 Feature 4

This newly-identified feature is an unpaved stone-filled terrace constructed on a natural bedrock outcrop (*Figure 4.20*). It is located 5.3 meters south from Feature 3, along the same bedrock ridge formation. The terrace is constructed with medium to large angular cobbles and small boulders that were loosely piled against a natural outcrop. The edge of the feature is not formally faced; however, it is distinct due to the natural formation. The interior area is flat to slightly depressed. Overall dimensions are 4.3 meters N-S by 3.5 meters E-W. Heights along the west (downhill) edge range from 0.25 to 0.50 meter. The uphill (east) side of the terrace is defined by a 0.50 meter high bedrock face. No artifacts or other portable remains were observed on the surface of the terrace. Evidence of ground disturbance is present 3.0 meters to the east of this feature, however it appears to be undisturbed and in fair to good condition.

Due to the uncertainty of its function, a 1.0 by 1.0 meter test unit was excavated at the center of the filled area at Feature 4. Test Unit 1 encountered a 0.20 meter-thick layer of stone fill at the surface (*Figure 4.21, Photo 4.17*). The fill consisted of medium to small cobbles loosely placed over and between larger cobbles. The larger cobbles were *in situ* pieces of the naturally fracture bedrock outcrop, whereas the smaller stones were introduced. No soil was present in this fill layer, however some duff was encountered in the air pockets between the stones. Layer I was encountered at 0.20 meter below surface and consisted of very stony sandy loam that had accumulated primarily in natural crevices in the bedrock. This soil contained 50% stones by volume and no cultural materials. The base of Layer I was solid, sloping bedrock at 0.37 to 0.62 meter below surface. The deeper areas of soil in crevices overlaid Layer II, which was a dark brown compact gravelly and stony silty clay loam, with 50% stones by volume. This subsoil was also culturally sterile.

Subsurface testing at Feature 4 verified that it was a predominantly natural bedrock terrace upon which stones had been tossed, most likely during soil clearing.

A cleared soil area is present immediately to the west of this feature. The absence of any artifacts, midden, or other cultural materials indicates little to no other activities at this location.

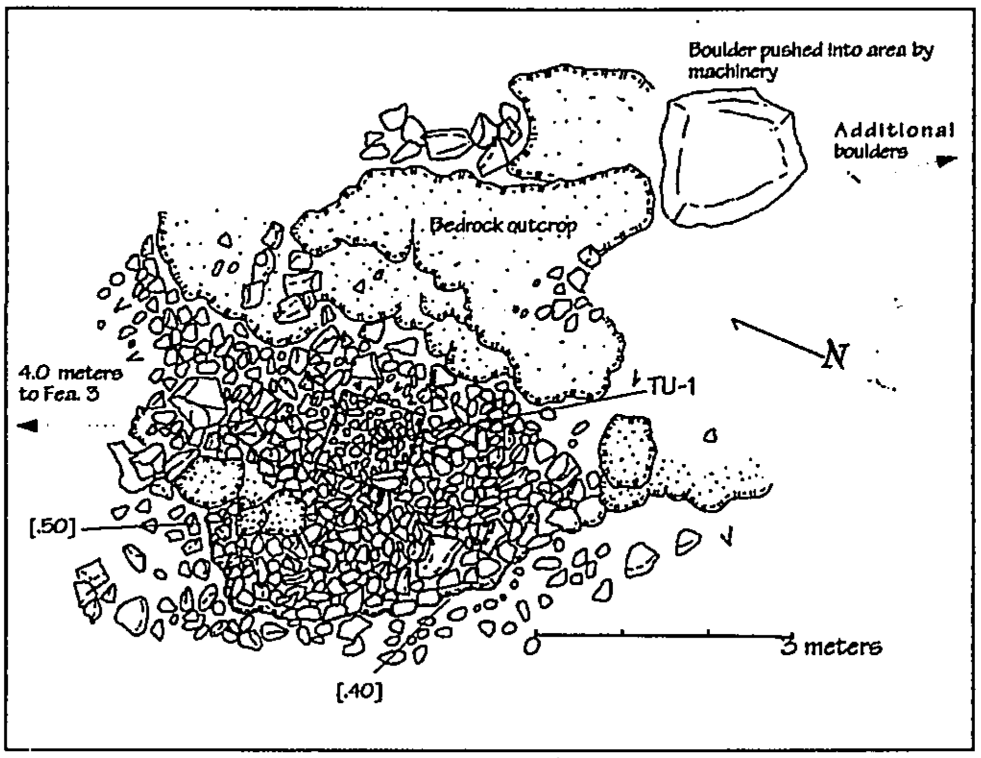


Figure 4.20 Scaled Plan Map, Site 2272 Feature 4

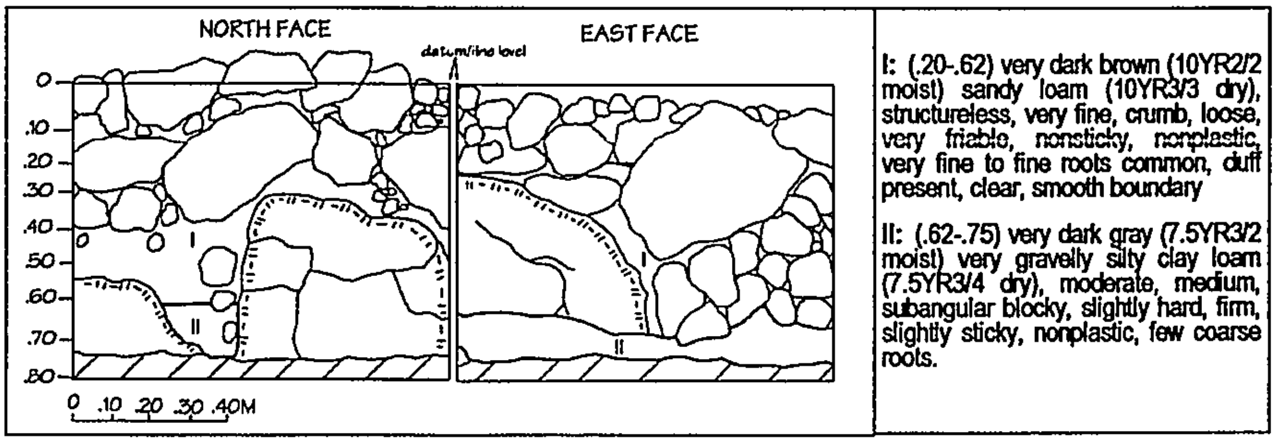


Figure 4.21 Site 2272 Feature 4, Test Unit 1 Profiles

SITE 5706

Previous Investigations

Site 5706 was identified in 2001 and first reported as a single feature consisting of a low-walled C-shape. The structure was reported to be in a disturbed state, with possible functions as a temporary shelter or as a special use area within a larger permanent complex (Rotunno-Hazuka et al. 2005:31). A 0.50 by 0.50 meter test unit was excavated in the interior of the C-shape in 2001; no cultural materials were found in screened soil (Rotunno-Hazuka et al. 2005:31). Additional details on this feature are included below in the discussion of Feature 5.

Current Findings

The feature identified in 2001 as Site 5706 was relocated with certainty through use of project area maps and on-site evidence of prior testing. The site was found to be in close proximity to a number of other features, some of which were directly associated through shared walls or surface midden scatter. Due to this close proximity, it seemed that all the features should be within a single complex; since an SIHP number had been assigned to one feature, it was decided to use this number and expand the site boundaries to include the additional features. The previously identified C-shape was incorporated into the Feature 5 area.

Site 5706 as currently defined is a multiple use (habitation/burial/agricultural) complex comprised of 17 features, within an area approximately 100 meters N-S by 33.5 meters E-W (3,350 sq. meters). The site perimeters are defined by developed/disturbed land on the north; by previously recorded sites 1864 and 2272 on the east; and by previously recorded Site 1853 on the west. The southern perimeter is defined by an absence of identified cultural features. The identified features are numbered in a generally north-south order, following the order of assigned field numbers.

Site 5706 Feature 1

Feature 1 is a newly-identified feature located adjacent to bulldozer push piles along the northern boundary of Parcel 37. It most likely represents the remnant of a larger feature that was impacted during golf course construction. Currently, the feature consists of a low stone-filled pavement with an associated clearing. Formally, the feature is similar to the original Site 5706 C-shape that was identified in 2001. However, there is no evidence at either of these features that they were built as actual C-shaped walls. Rather, they appear to be clearings in what were natural scatters of broken *pahoehoe* bedrock. The low pavement-like area at Feature 1 abuts the east side of an exposed *pahoehoe* lava ridge, and is comprised predominantly of naturally occurring stone with a discontinuous layer of loose imported stones, a few pieces of coral and a few waterworn basalt cobbles (*Figure 4.22*). The northern edges of the feature have been impacted by golf course grading; the remainder of the feature appears to be in good to fair preservation, with the exception of a deer path that cuts through the southern end of the filled area. Feature 2 is located 3.5 meters to the west of Feature 1, along the opposite side of the same exposed *pahoehoe* lava ridge. Feature 7, a similar type of rock-filled area, is located 6.0 meters to the south.

Overall area of Feature 1 is 26.72 sq meters; the major axes are 9.5 meters N-S by 5.0 meters E-W. The cleared area is within a U-shaped opening in the rock fill; it is located a the north end of the filled area, and is 2.0 meters N-S by 2.6 meters E-W. The location of the clearing raises suspicions as to whether it was made by machines. However, testing did indicate the presence of a midden deposit at this location. The edges of the fill around this clearing are 0.30 to 0.12 meters high. Other edges of the rock fill vary from 0.50 to 0.10 meter. The edges of the exposed bedrock outcrop that forms the west edge of the fill range from 0.80 to 0.13 meters in height.

A shallow circular depression is located at the south end of the filled area, against the exposed rock outcrop. This depression is most likely natural' it has a maximum depth of 0.20 meter below surrounding fill surface, and is 1.2 meters is diameter. Two weathered fragments of branch coral were located on the surface inside this depression. An additional piece of a weathered coral cobble is located near the center of the rock fill, to the south of the cleared area. In addition to three pieces of weathered coral, surface remains include modern beverage bottles and bottle glass sherds. No surface midden was observed.

A 1.0 by-1.0 meter test unit was excavated in the cleared area of the feature, in order to help ascertain feature function and age. Three soil layers were encountered at this location. The surface layer (I) consisted of very dark brown sandy loam with decomposing organics and duff; it ranged from 0.08 to 0.12 meter thick and contained 54% stones by volume. A discontinuous lens of loose light gray sandy loam with concentrated amounts of midden was present at the base of Layer I. This lens was rather thin (.05 meter) where it occurred and contained the same stone and midden volume as did Layer I. Layer II was a compact layer of dark yellowish brown (dry) gravelly silty clay loam 0.14 to 0.20 meter thick over decomposing and *in situ* *'a'ā* *(Figure 4.23, Photo 4.18)*.

Marine shell midden representing six varieties of gastropods, one bivalve family (*Isognomonidae*), and *Echinoidea* was recovered from screened soil (*Table 4.5*). Gastropods were predominantly *Cypraiedae* (42.8 grams), *N. picea* (7.62 grams) and *Conidae* (4.8 grams). Most of the remains were found in Layer II, which appears to be an intact remnant of a cultural layer. Nine small pieces of weathered coral were recovered; three from each of the three layers. Small water worn basalt pebbles were also found in all three layers.

It appears that Feature 1 is associated with a habitation site; however, due to the disturbed nature of the feature, its specific function is not certain. The rock-fill that was placed over the naturally fractured outcrop area would have allowed for safer and easier passage over the lava flow, and would also allow for a variety of functional uses of the area.

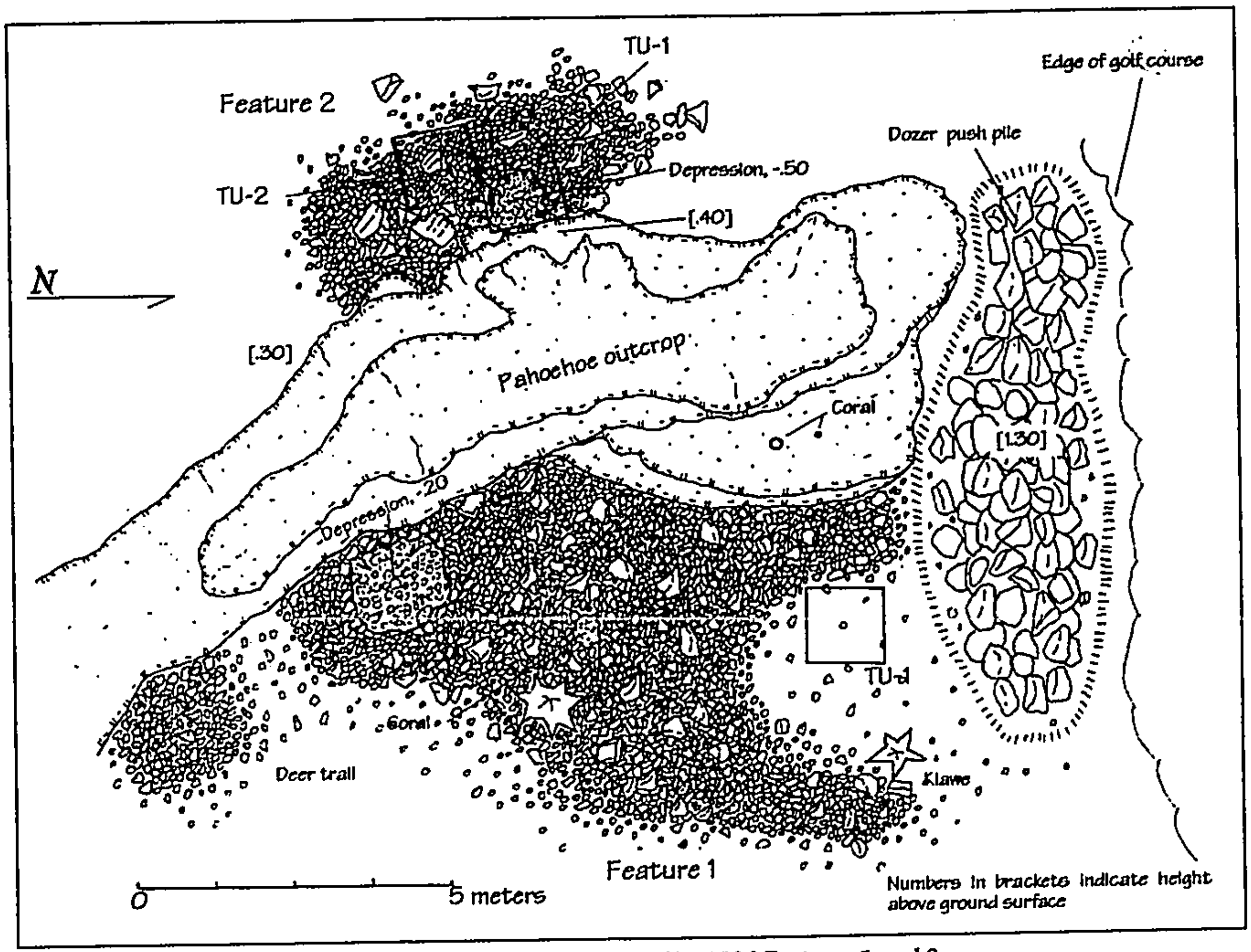
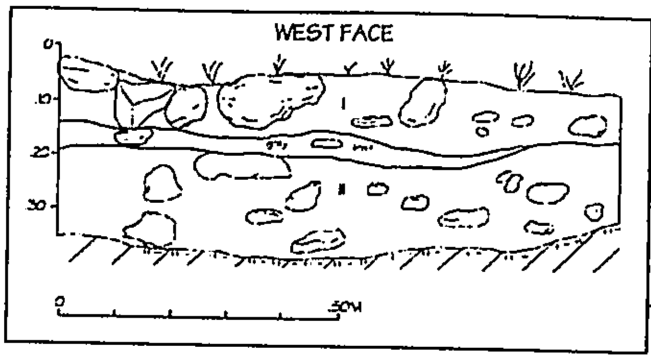


Figure 4.22 Scaled Plan Map, Site 5706 Features 1 and 2



I: (0-.12) very dark brown (10YR2/2 moist and dry) sandy loam, weak very fine, single grain and crumb, loose, very friable, nonsticky, nonplastic, very fine roots common, clear, smooth boundary; introduced stones, midden.

II: (.12-.35) very dark grayish brown (7.5YR3/2 moist) gravelly silty clay loam (10YR4/6 dry), strong, medium, subangular blocky, hard, firm, slightly sticky, slightly plastic, fine to coarse roots common, grades to aa flow

Figure 4.23 Site 5706 Feature 1, Test Unit 1 Profile

Site 5706 Feature 2

This newly-identified feature is a filled *pahoehoe* excavation and an associated rock filled area. It is located along the west side of the exposed *pahoehoe* lava ridge that was modified at Feature 1 (*Figure 4.22*). The corner of the Site 1853 Feature 8 wall is located 4.5 meters to the west. The excavation appeared from the surface as a roughly circular opening (0.80 by 1.0 meter) against the rock face of the outcrop, which rises 0.90 meter above the feature at this location (*Photo 4.19*). The opening had been filled to within 0.50 to 0.20 meters from the top surface with fill material consisting of small angular cobble and pebbles, and some weather *'a'a* cobbles and pebbles. The perimeters of the opening were defined by larger angular *pahoehoe* cobbles, of the type that would have been removed in order to excavate the hole. The area surrounding the excavation was filled with angular to weathered lava cobbles and pebbles. The filled area is 4.5 meters NW-SE by 1.50 to 2.00 meters NE-SW. The long axis of the fill follows the orientation of the exposed lava outcrop. Some of the stones in the filled area appeared to have been removed from the excavation (due to inconsistent exposure discoloration).

SITE 5706 Feature 1								
TU-1	I-1		II-1		III-1		Total	
Depth	4/15-12/20		16/24-23/29		23/29-35/42			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae			3	4.80			3	4.80
Cypraeidae	13	14.00	20	23.10	9	5.70	42	42.80
Litorina Pintado			1	0.25			1	0.25
Nerita picea	7	1.05	28	5.10	11	1.50	44	7.65
Patellidae			2	1.05			2	1.05
Thaididae			1	2.40	2	0.50	3	2.90
Unidentifiable			4	0.60	2	0.05	6	0.85
Bivalves								
Isognomonidae			4	1.35			4	1.35
Echinoidea								
Mouth					2	0.15	2	0.15
Shell			3	0.30	8	0.50	11	0.80
Spine					3	0.25	3	0.25
Total Shellfish	20	15.05	84	38.95	37	[illegible].15	121	63.15
Vertebrates								
Rodent			1	0.15			1	0.15
Coral								
Waterworn								
Weathered Frags.	3	3.70	3	4.50	3	0.45	9	8.65
Other								
Pummice			5	0.30	7	0.10	12	0.40
Waterworn basalt	2	22.00	7	24.00	1	2.80	10	48.80
Waterworn shell								
TOTAL	25	40.75	80	67.90	48	12.50	153	121.15

Table 4.5 Site 5706 Feature 1, Recovered Materials

No surface remains were observed on or near the Feature 2 area. Two one-by-one meter test units were excavated at Feature 2, in order to better determine the age and function of the feature. Test Unit 1 was placed over the lava excavation, and Test Unit 2 was placed over the filled area, adjacent to the excavation. In Test Unit 1, the upper 0.13 meter of fill within the excavation was comprised of large pebbles and small cobbles, with no soil present. Portable remains found in this rock fill included a waterworn basalt pebble and four pebble-size pieces of weathered coral. No midden was encountered. Loose Layer I soil with duff was encountered at 0.12 to 0.13 meter below the surrounding surface. This very dark brown sandy loam appeared to have blown into the hole after it was filled, as it was sparingly scattered among the rock fill and filtered downward as stones were removed. Only two liters of Layer I soil was recovered after removing 127 liters of stones.

The *in situ* soil layer (Layer II) was encountered at 0.43 to 0.48 meter below surrounding surface. This layer is comprised of dark yellowish brown (dry) silty clay loam with *'a'a* pebbles and cobbles. This soil appeared to be previously disturbed, as it was quite loose. Portable remains found in this layer appear to include materials that had filtered down from the surface, such as a small bird bone, a rat or mouse bone, and a deer incisor. A few pieces of marine shell midden, including *Cypraeidae* and *Neritidae*, and additional pebble-sized pieces of weathered coral were also found in this layer (*Table 4.6*).

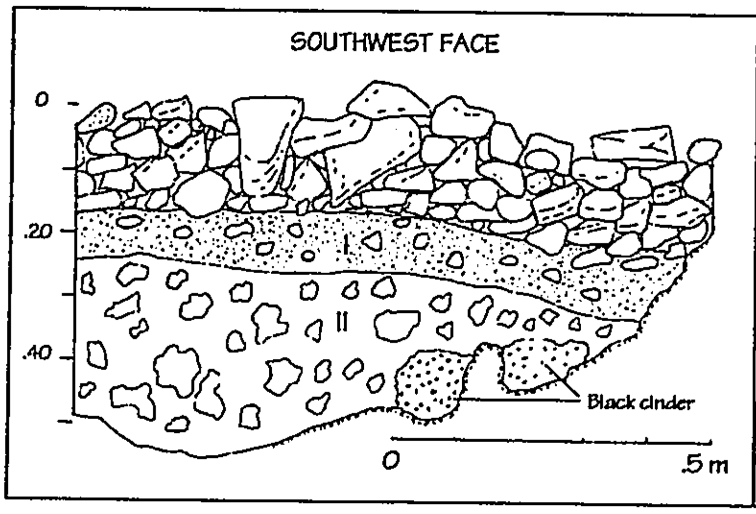
Evidence of prior breaks in the bedrock surface were detected at or just below the top of Layer III (.55 to .60 meter below surface). These appeared to be from human agency, although it might be possible that a tree could have also caused this type of disturbance. The base of the original excavation was probably at or near this point. If the excavation was made in order to plant something, it is possible that a tree was planted that subsequently caused further breakage of the lava substrate. Broken pieces of mixed lava with intermixed Layer III soil were removed to a final base depth of 0.40 to 0.60 meter below surrounding surface (*Photo 4.20*).

Test Unit 2 was excavated in order to follow out the full extent of the excavation and to ensure that it did not represent a burial feature. The unit was located adjacent to the south side of Test Unit 1, over the remainder of the former excavation and the rock fill area. A 0.16 to 0.20 meter-thick layer of stone fill was encountered from the surface of the excavation. The fill was comprised of small to medium sized weathered cobbles that had been placed on the former soil surface (Layer I). The stone fill contained several portable items, including eight small pieces of weathered coral, one weathered coral cobble and a Cypraeidae shell fragment (6.2 grams). No soil was present in this stone layer.

Layer I in Test Unit 2 was a former topsoil layer that had been sealed beneath the stone fill. The layer was 0.10 meter thick and consisted of loose dark brown very stony sandy loam with lenses of black sand. The soil contained 83% stones by volume (99 of 119 liters screened). A small but highly varied collection of marine midden was collected from the 20 liters of soil that was screened as Layer I. These included six shellfish families, *Echinoidea*, and fish bone (*Table 4.6*). Also recovered from this layer were 48 waterworn basalt pebbles, five waterworn coral pebbles and two waterworn shells, all of which are components in *'ili'ili* paving. Nine small fragments of weathered coral were also recovered from Layer I.

Layer II in Test Unit 2 consisted of a very stony yellowish brown silty loam with 67% stones by volume. Two levels were excavated in this layer, which overlaid an irregular bedrock surface (*Figure 4.24*). The uppermost level of screened Layer II soil (17 liters) contained a highly varied but rather small collection of marine midden, with eight shellfish families and Echinoidea represented in the 2.73 grams of recovered remains (*Table 4.6*). Waterworn basalt pebbles were also present, at roughly half the quantity found in Layer I. The second level of Layer II showed a substantial decrease in midden, with 0.86 grams of shellfish and six waterworn basalt pebbles recovered from the 10 liters of screened soil.

Results of testing at feature 2 indicate that the *pahoehoe* excavation and associated fill area post-dated a habitation deposit that may represent the periphery area of a permanent house site. Due to the lack of midden and *'ili'ili* in the stone fill layer, and the higher densities of these materials in a former surface soil layer, it appears that these materials were deposited prior to deposition of the stone fill. The specific function of the excavation was not determined. Possible purposes may have been for lithic material mining, or for planting. The pre-existing habitation component is rather sparse compared to the deposit at Feature 1; midden density for Layers I and II-1 at Feature 2 is 0.25 grams per liter screened soil, compared to 1.9 grams for Layer II at feature 1. This may be partly attributed to disturbances resulting from the later excavation, or due to the fact that the Feature 2 area was peripheral to a more intensively used habitation site that was within the golf course area.



I: (.20-.35) same as described in Figure 4.23.
II: (.35-.55) same as described in Figure 4.23.

Figure 4.24 Site 5706 Feature 2, Test Unit 2 Profile

SITE 5706 Feature 2

TU-1	I-1		II-1		III-1		TU-1 Total		TU-2	I-1		II-1		III-1		III-2		TU-2 Total		Grand Total	
Depth	50/72-78/83		78/83-90/95		90/95-110					.40-.50		.50-.60		.60-.70		.70-.80					
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.		Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Columbellidae														1	0.02			1	0.02	1	0.02
Conidae			3	2.20			3	2.20						2	0.30			2	0.30	5	2.50
Cypraeidae			2	0.60			2	0.60		1	6.20	6	1.10	2	0.75			9	8.05	11	8.65
Nerita picea			2	0.20			2	0.20				3	0.15	8	0.65			11	0.80	13	1.00
Patellidae												2	6.70	2	0.05	2	0.85	6	7.60	6	7.60
Planaxis labiosa														1	0.02			1	0.02	1	0.02
Thaididae			1	0.40			1	0.40				1	0.15					1	0.15	2	0.55
Strombidae												1	0.05					1	0.05	1	0.05
Unidentifiable			6	0.10	1	0.10	7	0.20				4	0.25	4	0.30			8	0.55	15	0.75
Bivalves																					
Isognomonidae												6	0.05					6	0.05	6	0.05
Mytilledae														1	0.02			1	0.02	1	0.02
Spondylidae			1	1.40			1	1.40						1	0.05			1	0.05	2	1.45
Echinoidea																					
Shell												4	0.05	1	0.05	1	0.01	6	0.11	6	0.11
Spine														2	0.50			2	0.50	2	0.50
Total Shellfish			15	4.90	1	0.10	16	5.00		1	6.20	27	8.50	25	2.61	3	0.86	56	18.17	72	23.17
Vertebrates																					
Fish												1	0.05					1	0.05	1	0.05
Large mammal			1	3.40			1	3.40												1	3.40
Small mammal			2	3.10	1	0.60	3	3.70						1	0.10			1	0.10	4	3.80
Rodent			1	0.05			1	0.05				1	tr.	1	0.02			2	0.02	3	0.07
Total Vertebrates			4	6.55	1	0.60	5	7.15				2	0.05	2	0.12			4	0.17	9	7.32
Coral																					
Waterworn	2	146.50	3	1.60			5	148.10		2	13.80	5	15.00					7	28.80	12	176.90
Weathered Frags.	1	2.10	2	23.40	1	1.10	4	26.60		7	218.50	9	3.50	1	0.40			17	222.40	21	249.00
Other																					
Waterworn basalt	1	16.20	2	12.40			3	28.60				48	165.80	25	155.20	6	10.50	79	331.50	82	360.10
Waterworn shell												2	13.00					2	13.00	2	13.00
TOTAL	4	164.80	26	48.85	3	1.80	33	215.45		10	238.50	93	205.85	53	158.33	9	11.36	155	614.04	188	945.54

Table 4.4 Site 5706 Feature 2, Recovered Materials from Test Units 1 and 2.

Site 5706 Features 3, 4 and 6

These newly-identified features are located 5.5 meters south from Feature 1 and 2, with Feature 3 situated along the base of the same *pahoehoe* outcrop. The features border a cleared soil area that measures 18.0 meters N-S by 8.0 meters E-W (*Figure 4.25*).

Feature 3 is a linear clearing pile located along the surface of an exposed bedrock outcrop. The natural outcrop has a terrace-like appearance, which has been enhanced by the deposition of small to medium-sized cobbles along the fractured bedrock surface. The feature has an overall length of 16.0 meters N-S, and is 0.80 meters wide at the two ends. A 8.0 meter-long section in the center is 3.0 meters wide; this area is predominantly natural bedrock that has fractured *in situ*. The loosely piles stones are two to three courses thick and show an average height of 0.20 meters along the east (downhill) side. No artifacts, midden or other portable remains were observed on the surface at or near Feature 3.

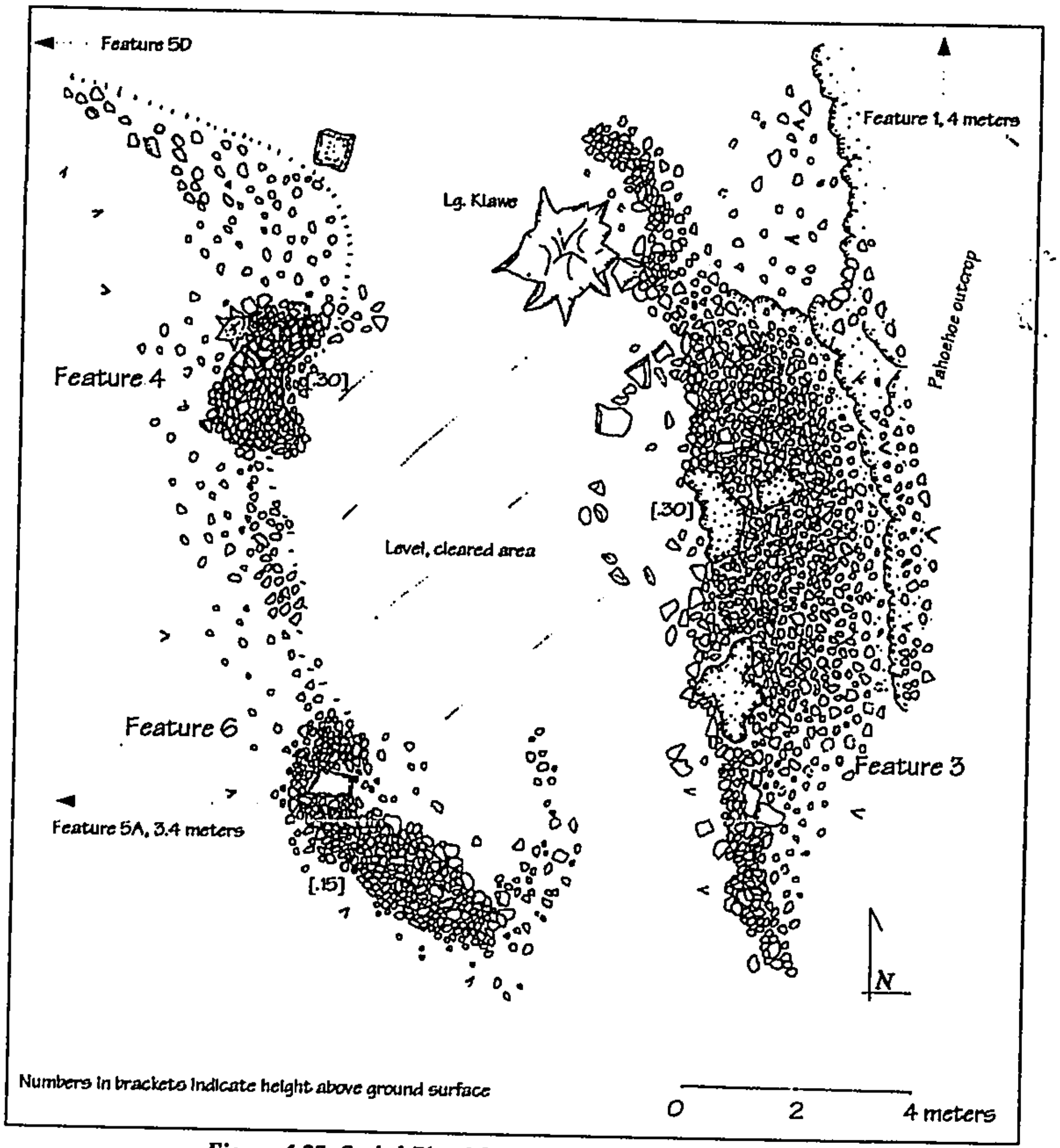


Figure 4.25 Scaled Plan Map, Site 5706 Features 3, 4 and 6

Feature 4 is a crescent-shaped clearing pile located 6.0 meters west from the north end of Feature 3. The pile is 2.5 meters N-S by 1.45 meters E-W and has a maximum height of 0.30 meters. The pile is loosely constructed from weathered *'a'a* cobbles and angular pieces of weathered *pahoehoe* that were probably cleared from the adjacent soil flat. No faced edges are present, and the ground surface is visible through the center of the pile. One waterworn basalt cobble was noted among the piled stones.

Feature 6 is a linear clearing pile located 2.5 meters south from Feature 4, along the same contour elevation. The northern edge of the Feature 10A pavement is 3.4 meters to the southwest and upslope from Feature 6. This pile is similar to Feature 3 in that it is situated on top of an exposed naturally fractured bedrock outcrop. It is 4.7 meters long and 0.80 to 1.7 meters wide; height averages 0.15 meter above ground surface. This loose pile is one to three courses of small to large basalt cobbles, with no artifacts or other cultural remains observed.

All three of these features are assumed to be contemporaneous and functionally related to agricultural activities within the Site 5706 area. They are also assumed to be contemporaneous with Features 1, 2, 5, and other features to the south, within the Site 5706 complex area.

Site 5706 Feature 5

Feature 5 is comprised of four components, including an informal cobble pavement (5A), two informal terraces (5B, 5C) and an a surface midden scatter (5D). One of the terraces (5B) includes the area of the previously recorded Site 5706. Current investigations determined that this previously recorded feature is not a C-shape shelter; rather it is a portion of a natural bedrock terrace that has been modified with the addition of stones. The four components are within an overall area of 26.0 m N-S by 12.0 meters E-W (*Figure 4.26*). The principal component, Feature 5A is situated on the crest of a low knoll; Features B and C are located around the base of the knoll, and Feature D is on a flat area to the north side of the knoll.

Feature 5A is situated over a partially exposed bedrock outcrop that has been augmented with large to small *'a'a* cobbles and some boulders to form a bi-leveled rough pavement. The overall surface area of the pavement is 8.0 meters N-S by 5.0 to 6.5 meters E-W. The perimeter is generally irregular with scattered boulders present, but no faced or formally set alignments. The surface is generally level, but is rough and is not paved with small cobbles and pebbles. The upper level area of the pavement comprises the eastern half of the structure and is 3.0 to 5.0 meters N-S by 6.5 meters E-W. This area is raised an average of 0.20 meter above surrounding ground surface. The lower level is 3.5 meter N-S by 5.0 meters E-W and is raised an average of 0.10 meter above ground surface. Feature 5B abuts the western side of this lower pavement (*Photo 4.21*).

One traditional artifact was observed on the surface of Feature 5A. A complete breadloaf sinker made from red siltstone was found next to a natural bedrock boulder near the center of the pavement, along the western edge of the upper level (see Chapter 5). No midden or other portable remains were observed on the surface of the rough pavement. A 1.0 by 1.0 meter test unit (TU-2) was excavated into the pavement at the location of the surface find. The excavation encountered a surface layer of loosely placed cobbles intermixed with naturally fractured bedrock. This layer was 0.45 to 0.47 meter thick and included a sparse amount of filtered humus and duff. No cultural material was recovered from among the stones. Layer I was 0.02 to 0.05 meter thick and consisted of very dark brown sandy loam topsoil that occurred between *in situ* bedrock boulders (*Figure 4.27*). No cultural material were found in the 11 liters of Layer I soil that was screened. Layer II had a thickness of 0.15 meter and consisted of dark yellowish brown (dry) very stony silty clay loam with 60% stones by volume. No cultural material was found in the 40 liters of soil screened from this natural subsoil layer. It overlaid a very stony and compact layer of decomposing bedrock (Layer III) with yellowish brown (dry) silty clay. Layer III was excavated to a base depth of 0.67 meters, and contained no cultural material.

A second 1.0 by 1.0 meter test unit (TU-4) was excavated in north-central portion of the lower level of the pavement, 1.6 meter west from Test Unit 2. This unit encountered the same stratigraphy noted in Test Unit 2. A 0.40 to 0.50 meter thick layer of stone fill with no soil was encountered overlying a former topsoil layer (I), which was 0.03 to 0.04 meter thick. The thin topsoil overlaid dark yellowish brown silty loam subsoil (Layer II) that averaged 0.20 to 0.25 meter thick. The naturally decomposing bedrock (Layer III) with yellowish brown silty clay was encountered 0.70 to 0.75 meter below surface (*Figure 4.27, Photo 4.22*).

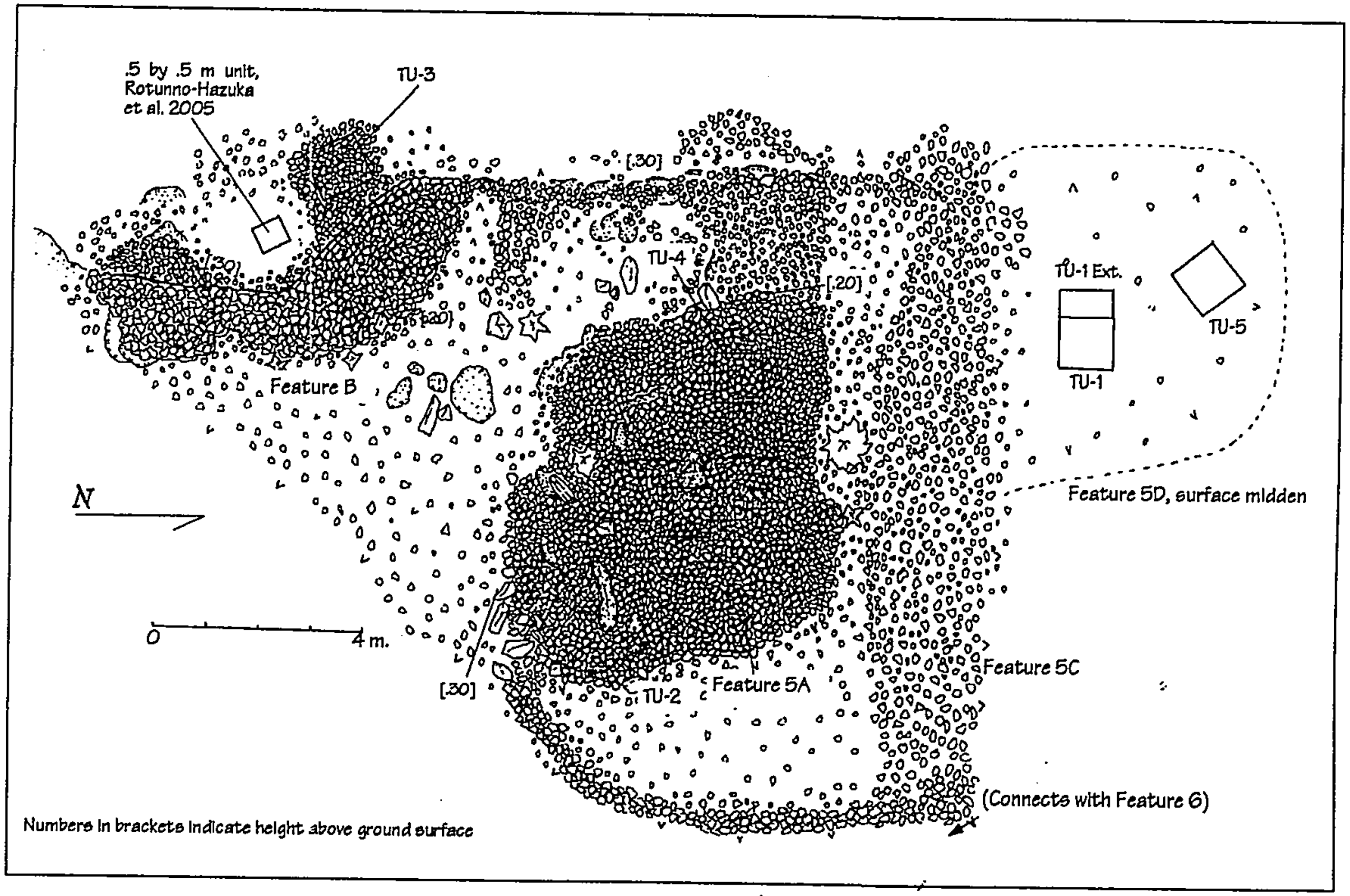
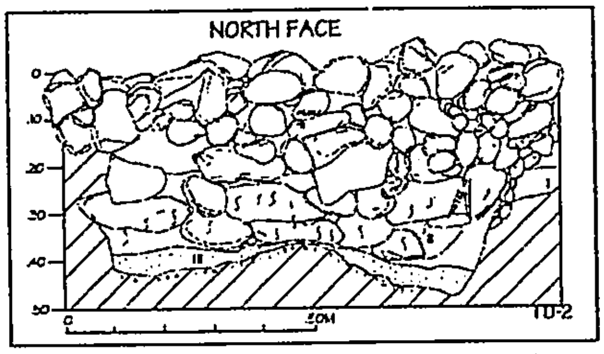


Figure 4.26 Scaled Plan Map, Site 5706 Feature 5

Sparse amounts of marine shell midden were recovered from Layers I and II, with a total of nine pieces (2.4 grams) representing three shellfish families (Cypraeidae, Neritidae, Patellidae). Also recovered were two waterworn basalt pebbles and 2.90 grams of charcoal. The charcoal was found to consist primarily of charred *panini* roots (*Table 4.7*).



I: (.45-.50) very dark brown (10YR2/2 moist and dry) sandy loam, 1vfcrlsg, loose, very friable, nonsticky, nonplastic, vf roots common, diffuse, broken boundary.

II: (.50-.65) very dark brown (10YR2/2 moist) silty loam (10YR3.4 dry), 1fsbk, soft, friable, nonsticky, nonplastic, fine roots common, gradual, wavy boundary.

III: (.65-.68) dark yellowish brown (10YR3/4 moist) gravelly silty loam (10YR5/4 dry), 1vfcr, soft, friable, nonsticky, nonplastic, few medium to coarse roots.

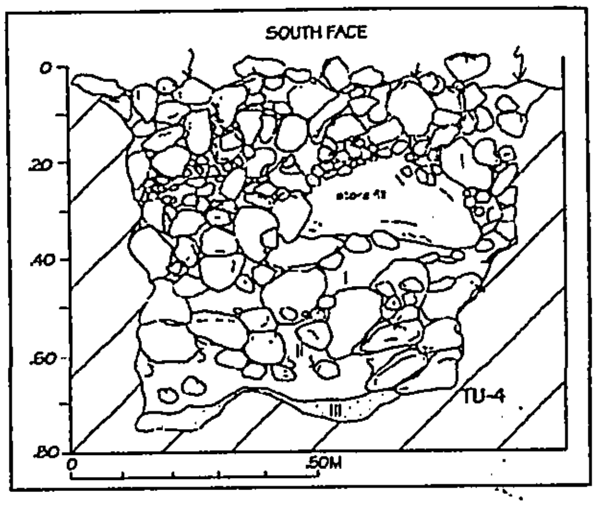


Figure 4.27 Site 5706 Feature 5A, Test Unit 2 and 4 Profiles

SITE 5706 Feature 5																
TU-3			TU-4	II-1		III-1		TU-5	I-1		II-1		II-2		TU-5 TOTAL	
Depth	.24 In situ			.33/.43-.36/.45		.36/.45-.55			.03/.12-.08/.14		0.8/.14-.20		.20-.30			
Gastropods	Cnt.	Wt.		Cnt.	Wt.	Cnt.	Wt.		Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae									8	8.20	3	2.10			11	10.30
Cypraeidae				2	0.40	3	0.50		44	37.20	40	14.00	1	0.01	85	51.21
Litorina Pintado									4	1.00	4	0.45			8	1.45
Nerita picea						3	0.50		20	6.10	30	5.20	1	0.04	51	11.34
Patellidae						3	1.40		1	0.20					1	0.20
Planaxis labiosa									1	0.15			2	0.15	3	0.30
Strombidae											2	0.20			2	0.20
Thaididae																
Morula uva									18	11.70	14	6.60	2	0.05	34	18.35
Drupa morum									1	6.90	2	3.30			3	10.20
Unidentifiable									1	0.01	1	0.05			2	0.06
Bivalves																
Isognomonidae									1	0.30					1	0.30
Echinoidea																
Mouth											2	0.05	1	0.05	3	0.10
Shell											18	0.40	2	0.10	20	0.50
Total Shellfish				2	0.40	9	2.40		99	71.76	116	32.35	9	0.40	224	104.51
Vertebrates																
Rodent													1	0.10	1	0.10
Fowl									1	0.10					1	0.10
Lg. Mammal	1	5.20														
Coral																
Unweathered branch																
Waterworn																
Weathered Frags.									10	16.45	15	5.15			25	21.60
Other																
Charcoal							2.90					0.10	trace			3.90
Kukui nut shell									1	0.50					1	0.50
Waterworn basalt				1	4.15	1	1.30		2	5.25	1	0.60			3	5.75
Waterworn shell																
TOTAL	1	5.20		3	4.55	10	6.60		113	94.06	132	38.20	10	0.50	225	132.76

Table 4.7 Midden and Portable Materials, Site 5706 Feature 5, Test Units 3, 4 and 5

Subsurface testing results for Feature 5A did not provide substantive information regarding its age and function. Recovery of sparse amounts of midden beneath the lower level of the pavement might indicate limited use of the feature for habitation, with perhaps separate uses for the two levels. For example, the upper level may have been used as a sleeping area while the lower level served a more general purpose. In general, the pavement is much courser and more irregular than what is normally indicated for a sleeping *hale*. This functional interpretation is therefore not fully satisfactory. Structurally, the feature most resembles the Feature 11 burial platform. This raises the possibility that although no burials were found during testing, they could be present beneath the stone fill.

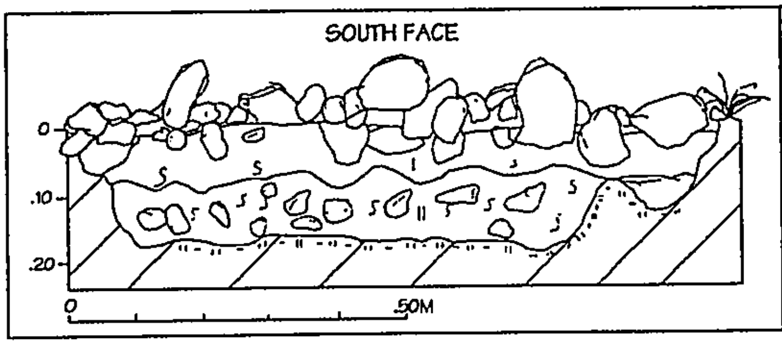
Feature 5B is a partially exposed natural bedrock formation that has been augmented with cobble fill. The linear feature has a terrace-like appearance, and it serves to define the western base of the knoll on which Feature 5A is located. The feature is oriented N-S and has an overall length of 14.50 meters; width varies from 1.5 to 2.5 meters. Average height along the western (downslope) side is 0.30 meter; height along the uphill side averages 0.10 meter. The terrace is generally straight, except at the south end, where it curves around a 2.50 by 2.00 meter clearing. The clearing is defined on the south and west sides by the terrace, and on the north side by a 1.8 by 1.5 meter area of stone fill (*Figure 4.26*). This clearing was identified in 2001 as a C-shape shelter and was tested by excavation of a 0.5 by 0.5 meter test unit. No cultural material was found in the prior test unit excavated in the cleared area (Rotunno-Hazuka et al. 2005:31).

During the current survey, an additional 1.0 by 1.0 meter test unit (TU-3) was excavated in the area of stone fill that defines the north boundary of the clearing. The purpose of the excavation was to assist in determining the function and age of the terrace.

Test Unit 3 encountered a thin surface layer of stones comprised of small cobbles and large pebbles, one to two courses thick. Layer I soil was encountered beneath the first course of stone fill and was intermixed with the lower course. The layer was 0.06 to 0.08 meter thick and consisted of very stony dark brown (dry) sandy loam with organic debris and duff (*Figure 4.28*). A fragment of large mammal bone (deer) was recovered from Layer I, 0.04 meter below the top of the layer. No midden or other cultural material was recovered. Layer II consisted of very stony dark brown (dry) gravelly silt loam with 50% stones by volume. This layer was excavated to a base depth of 0.40 meter below surface; no cultural material was recovered (*Photo 4.23*).

Results of subsurface testing at Feature 5B indicate that it most likely served as an area of stone accumulation in connection with the clearing of adjacent soil areas. The roughly rectangular stone fill area tested may well have resulted from the clearing of the area immediately to the south, which was tested in 2001 and found to contain no cultural material. Thus, both the clearing and the linear rock-filled area appear to have agricultural functions.

Feature 5C is a linear formation of surface stones oriented E-W and located 1.5 meter north from Feature 5A. This component defines the south edge of The Feature 5D surface midden scatter. Feature 5C is situated along the base and gradual slope of the Feature 5 knoll; the east end of the surface stones nearly connects with Feature 6, as described above. This component has an overall length of 11.0 meters and varies in width from 2.0 to 3.0 meters, with the widest portion in the center. No indications of formal construction were observed; however, the extent of prior disturbances to this feature are indeterminate. Minimally, there have been impacts from cattle and deer.



I (.02-.10) black (10YR2/1 moist) sandy loam (10YR3/3 dry), weak, fine, crumb, loose, nonsticky, nonplastic, very fine roots common, clear, wavy boundary

II: very dark grayish brown (10YR3/2 moist) silt loam (10YR3/4 dry), moderate, medium subangular blocky, slightly hard, firm, slightly sticky, nonplastic, few fine to coarse roots, grades to aa flow

Figure 4.28 Site 5706 Feature 5B, Test Unit 3 Profile

In it current state Feature 5C appears to be an area where stones were tossed during soil clearing. Cleared soil is present to the north of this rocky area.

Feature 5D is an area of surface midden scatter which was observed in the cleared soil area to the north of Feature 5C. The surface midden area is 7.0 meters N-S by 7.5 meters E-W. The northern edge of the scatter is within 5.0 meters of the Site 1853 Feature 8 wall. Shellfish families observed on the surface within the Feature 5D area include *Cypraeidae, Neritidae, Patellidae,* and *Thaididae*. Also observed were waterworn pebbles and weathered coral fragments.

Two 1.0 by 1.0 meter test units (TU-1 and TU-5) were excavated near the center of the midden scatter in order to determine the integrity and age of the cultural deposit (*Figure 4.26*). A 0.5 by 0.5 meter extension unit was also added to the west side of TU-1 in order to better determine whether *in situ* cultural features might be present. Three soil layers were encountered in the excavations, all of which were predominated by naturally occurring stone (*Figure 4.29*). Layer I was a 0.02 to 0.08 meter-thick very dark brown (dry) sandy loam topsoil with organic debris and duff. Average thickness was 0.05 meter. Only 15 liters of soil was screened from this Layer, in Test Unit 1, however, 66 pieces (47.3 grams) of shellfish representing five families were recovered, along with seven pieces of weathered coral and a waterworn basalt pebble (*Table 4. 8*). In Test Unit 5, a greater variation of shellfish was recovered, with eight families represented among the 99 shell specimens (*Table 4.7*).

Layer II in TU-1 was a very stony very dark brown (dry) silt loam deposit with significant *kiawe* root intrusion and 57% stones by volume. This layer showed a quantitative increase in cultural material, although the actual density per volume of screened soil decreased from 3.1 grams per liter for Layer I to 1.9 grams per liter for Layer II. The combined shell midden density for both layers in TU-1 is 2.3 grams per liter. Eight shellfish families and Echinoidea remains are represented in the Layer II midden collection for TU-1. Test Unit 5 shows a similar decrease in shell density per volume of excavated soil as compared to Layer I. Vertebrates recovered from Layer II include one fish scale and a deer bone from TU-1, and one bird bone fragment from TU-5. Layer II in TU-1 exhibited patches of darker mottling and sandy lenses; none of these soil features could be attributed to cultural features due to the extensive disturbance caused by *kiawe* roots. This type of mottling was not observed in TU-5 or in the TU-1 extension. Cultural materials continued into Layer III, although the decrease was significant and material was limited to the upper portion of the layer.

Layer III consisted of yellowish brown (dry) very stony silt loam with decomposing bedrock. The base of this layer was not encountered in the excavations, although it became increasingly stonier as depth increased. Thirty-one shellfish pieces (10.5 grams) representing four families were recovered from the upper level of Layer III in TU-1; no cultural materials were recovered from Layer II in TU-5. Also recovered from TU-1 was one piece of waterworn coral. These materials are presumed to have been introduced into Layer III by natural processes, as the Layer is natural subsoil and bedrock.

Results of testing at Feature 5D indicate that the surface scatter reflects a subsurface deposit reflecting habitation activities. No artifacts were recovered in this test unit to aid in determining specific activities conducted. Shellfish midden density is higher at this location than any other tested areas within the

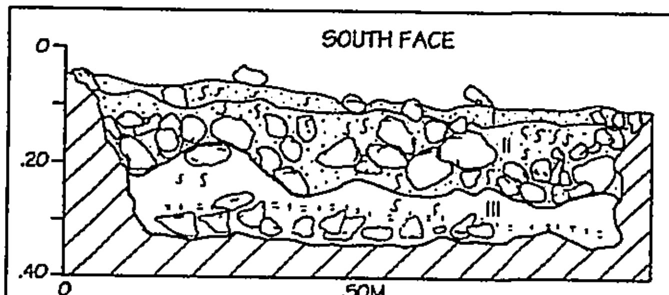


Figure 4.29 Site 5706 Feature 5D, Test Unit 1 Profile

I (0-.08) black (10YR2/1 moist) sandy loam (10YR3/3 dry), weak, fine, crumb, loose, nonsticky, nonplastic, very fine roots common, clear, wavy boundary

II: (.08-.25) very dark grayish brown (10YR3/2 moist) very stony silt loam (10YR3/4 dry) with dark yellowish brown (10YR4/6) sand lenses and black (10YR2/2) mottling, moderate, medium subangular blocky, slightly hard, firm, slightly sticky, nonplastic, many fine to coarse roots, diffuse, wavy boundary

III: (.35-.40) brown (10YR3/4 moist) very stony silty loam (10YR5/4 dry), weak, fine, crumb, soft, very friable, nonsticky, nonplastic, fine to coarse roots common, grades to aa flow project area. No charcoal was present in the area of Test Unit 1, so we were not able to obtain materials for age determination.

The Feature 5 area is interpreted as a habitation and agricultural location; however, the current surface features do no have characteristics of permanent habitation structures. The paved area (Feature 5A) is generally too rough and lacks the *'ili'ili* or *ala* pavement found at habitation sites. The predominant activity indicated by surface features is stone clearing, presumably for planting purposes.

SITE 6706 Feature 5																			
TU-1	I-1		II-1		III-1		TU-1 Total		TU-1	I-1		II-1		II-2		EXT. TOTAL		FINAL TOTAL	
Depth	.05-.13		.09/.13-.19/.28		.19/.28-.30				ext.	03/06-07/.10		.07/13-.20/.23		.20/.30-.33/.40					
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt	Wt.		Cnt	Wt.	Cnt	Wt.	Cnt.	Wt.	Cnt	Wt.	Cnt.	Wt.
Conidae			2	0.45			2	0.45		2	1.40					2	1.40	4	1.85
Cypraeidae	18	25.40	39	30.80	2	3.00	59	59.20		34	37.70	4	1.10	1	0.20	39	39.00	98	98.20
Littorina Pintado	5	1.30	20	6.20	3	0.60	28	8.10	-	14	4.30	1	0.10			15	4.40	43	12.50
Nerita picea	34	9.10	192	54.90	23	5.10	249	69.10		149	44.20	21	6.20	5	0.30	175	50.70	424	119.80
Patellidae	2	1.10	7	5.40			9	6.50		3	0.50	1	0.20			4	0.70	13	7.20
Thaididae	7	10.40	10	15.00	2	1.60	19	27.00		9	4.00			2	1.50	11	5.50	30	32.50
Drupa rubusidaeus			12	9.05	1	0.20	13	9.25		1	0.70					1	0.70	14	9.95
Neothais harpa			1	0.30			1	0.30		1	0.50	1	0.80			2	1.30	3	1.60
Trochidae			1	0.40			1	0.40										1	0.48
Unidentifiable			3	0.30			3	0.30										3	0.30
Bivalves																			
Brachiodontes c.										1	0.10					1	0.10	1	0.10
Isognomonidae			2	0.40			2	0.40		1	0.10	2	0.85			3	0.95	6	1.35
Echinoidea																			
Mouth			4	0.30			4	0.30		1	0.20			7	0.40	8	0.60	12	0.90
Shell			7	1.20			7	1.20		5	0.65	3	0.30	4	0.20	12	1.15	19	2.35
Total Shellfish	66	47.30	300	122.80	31	10.60	397	182.50		221	94.35	33	9.55	19	2.60	273	106.50	670	289.00
Vertebrates																			
Fish (scale)			1	tr.			1	tr.										1	tr.
Lg. Mammal	1	1.65					1	1.65										1	1.66
Coral																			
Unweathered branch										1	7.80					1	7.80	1	7.80
Waterworn					1	1.90	1	1.90		1	0.50					1	0.50	2	2.40
Weathered Frags.	7	8.60	17	49.00			24	57.60		3	3.40	1	1.10			4	4.50	28	62.10
Other																			
Waterworn basalt	1	11.80					1	11.80										1	11.80
Waterworn shell	1	2.30					1	2.30		4	3.50	2	1.50			6	5.00	7	7.30
TOTAL	76	71.65	318	171.80	32	12.40	426	257.75		230	109.65	36	12.15	19	2.60	286	124.30	711	382.05

Table 4.8 Midden and Portable Materials, Site 5706 Feature 5D, Test Unit 1 and Extension

Site 5706 Feature 7

This newly identified feature is located 3.4 meters southwest from Feature 5B, along the north-facing edge of an exposed *pahoehoe* outcrop. The feature consists of three stone mounds and two areas of stone fill, within an overall area of 10.0 meters N-S by 14.0 meters E-W (*Figure 4.30*).

Feature 7A is an oval mound constructed primarily from angular *pahoehoe* boulders and large cobbles. It is 4.8 meters N-S by 2.3 meters E-W at the center and ranges in height from 0.30 meters along the west (uphill) side to 0.76 meters along the east side. The mound shows no evidence of formal facing along the edges and is irregular on the surface. It is generally of loose construction, suggesting that it was put together during land clearing.

Feature 7B is a linear wall-like stone mound located to the west of Feature 7A. It is oriented roughly E-W along the slope of the outcrop. The mound is 5.2 meters long by 0.8 to 1.2 meters wide and 0.15 to 0.30 meters high. No indications of faced sides are present. The mound forms the south boundary of a small (3.0 by 2.0 meters) soil clearing at the base of the outcrop. It appears that these stones were probably moved from the area that is now cleared.

Feature 7C is a roughly triangular area of loose stone fill on a naturally fractured *pahoehoe* outcrop area. It measures 3.0 meters N-S by 4.0 meters E-W and ranges from 0.20 to 0.45 meters in height. Stones in this area are angular *pahoehoe* cobbles that were loosely placed on similar naturally-occurring materials. This pile also appears to have originated from adjacent cleared soil.

Feature 7D is a filled and leveled area against two exposed outcrop faces. This roughly oval area is 2.7 meters N-S by 3.3 meters E-W; the surface is below surrounding bedrock surfaces on all sides except the north, where it is 0.2 to 0.3 meters above the surrounding soil surface. Stones in this area are generally medium to small cobbles.

Feature 7E is a stone-filled bedrock crevice located just north of Feature 5D. It is 2.2 meter N-S by 0.7 meter E-W. The fill is below surrounding bedrock surfaces on two sides; it is level with the ground surface on the east side and 0.20 meters above ground surface on the north side. It is also presumed to be the result of land clearing.

Feature 7 is interpreted as an agricultural feature with a specific function of land clearing. The informal attributes of these stone piles do not warrant testing or further examination, as the natural land and bedrock surface below the mounds is visible through the loosely piled stones.

Site 5706 Feature 8

This newly-identified feature is an L-shaped wall remnant located near the center of Site 5706. The long axis of the wall is oriented N-S and is 11.0 meters long; the short axis is at the north end of the long section and is 6.0 meters long (*Figure 4.33*). The wall is constructed from various-sized basalt cobbles and

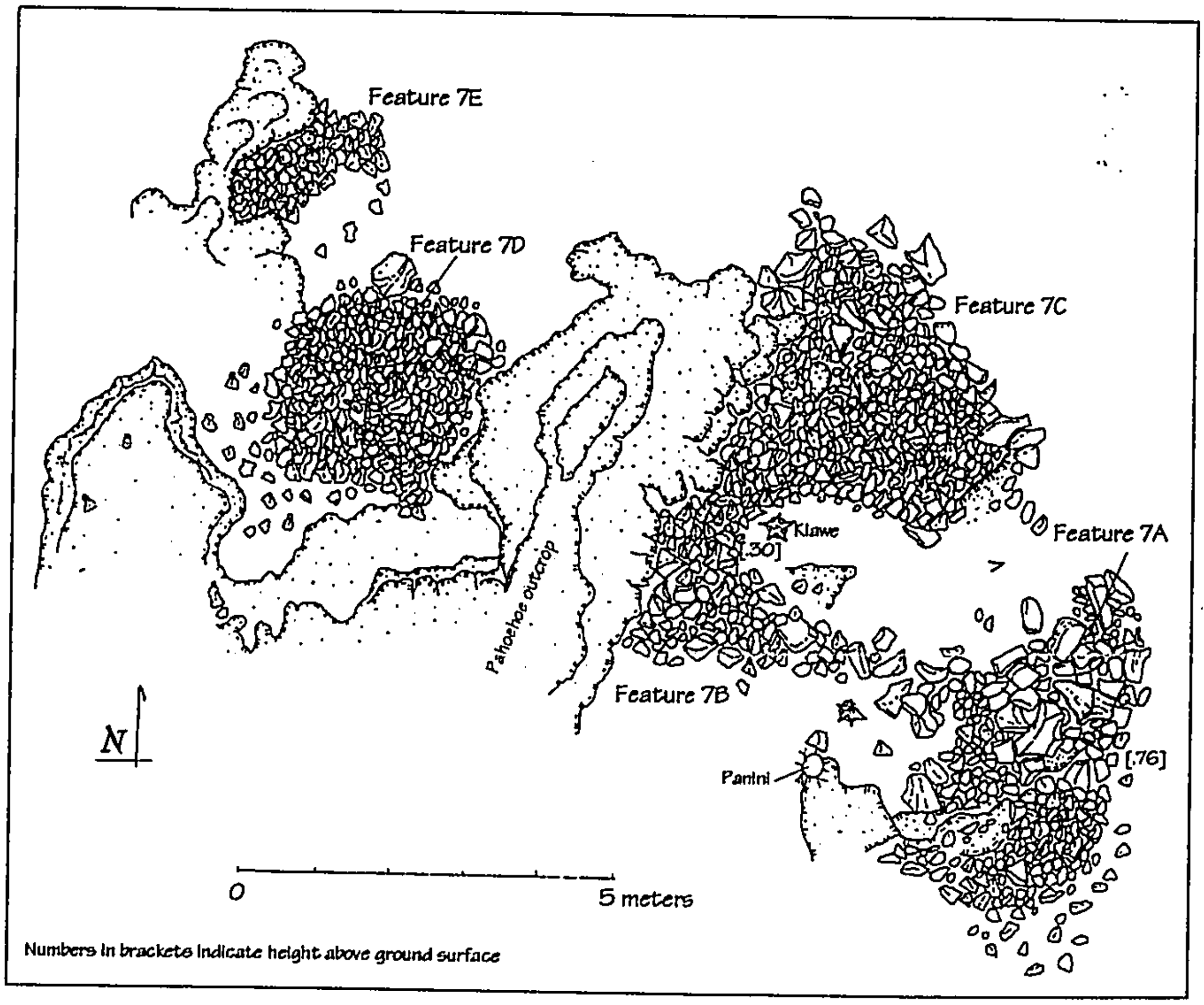


Figure 4.30 Scaled Plan Map, Site 5706 Feature 7

boulders that are multiple-stacked up to two courses high. Currently, the wall has a maximum height of 0.35 meter, with an average of 0.20 meter. The wall is in poor condition and it appears that much of the structural materials have been removed for use elsewhere. The area surrounding the wall is generally level soil that is clear of surface stones; the surface to the east side sloped slightly from east to west. One piece of weathered coral was observed on the surface 1.4 meters east from the wall (*Figure 4.31*).

A 1.0 by 1.0 meter test unit was excavated inside the corner of the wall, in order to determine the presence or absence of an associated cultural deposit. Two soil layers were encountered in the excavation, both of which were culturally sterile.

Layer I was 0.05 meter thick and consisted of loose dark brown (dry) sandy loam with organic duff and 50% stones by volume (*Figure 4.32*).

Layer II was 0.15 meter thick and consisted of dark yellowish brown (dry) gravelly silty clay loam intermixed with decomposing bedrock and *in situ* boulders.

Total volume of screened soil from Test Unit 1 was 150 liters. No artifacts, midden, or other portable remains were recovered. The soil deposit was found to be rather thin in this area as compared to other locations that showed indications of stone clearing. A specific function or age could not be determined for this feature. It could be placed in the pre-contact era by association with surrounding features, and a nearby dated feature (11). However, the absence of subsurface cultural material and the superficial nature of the feature could also indicate more recent construction, or possibly machinery activity in this area.

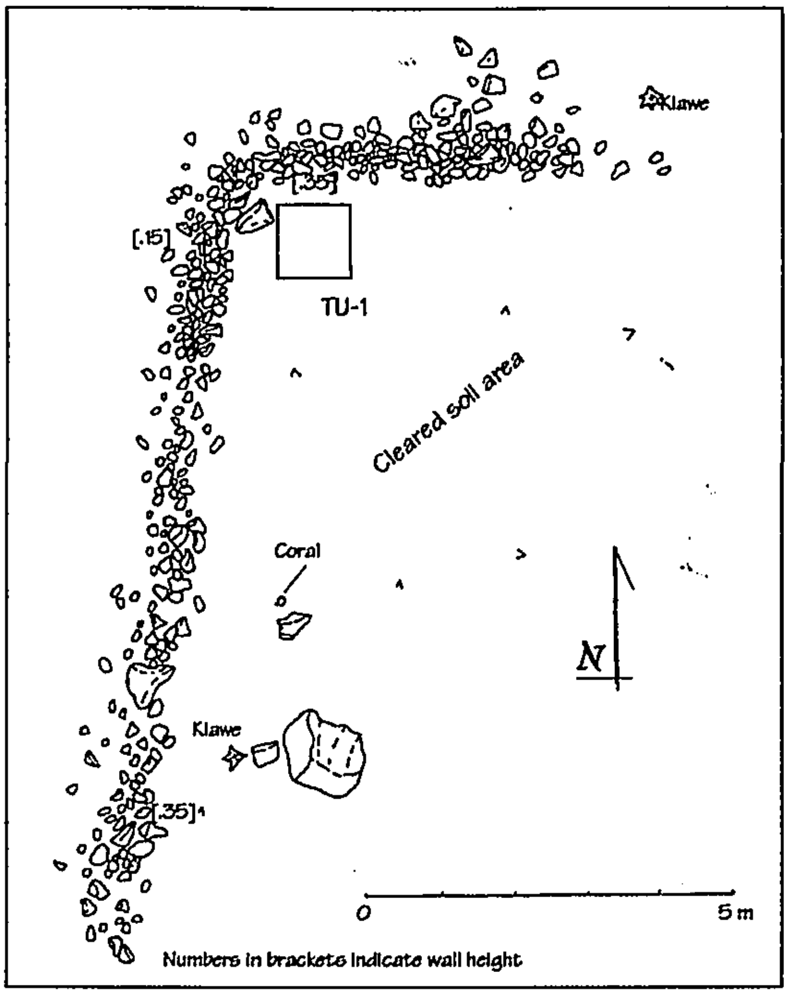


Figure 4.31 Scaled Plan Map, Site 5706 Feature 8

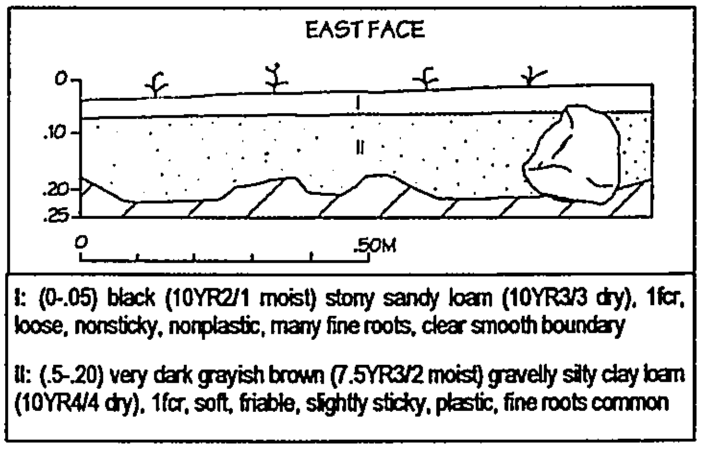


Figure 4.32 Site 5706 Feature 8 Test Unit 1 Profile

Site 5706 Feature 9

This newly-identified feature consists of two boulder alignments that are located along the base and east slope of a prominent *pahoehoe* ridge. Several other features (10, 12, 13, 15, 16 and 17) were also found at various locations along this ridge formation (*Figure 4.33, Photo 4.24*). Feature 9A is an alignment of large boulders 3.8 meters long, oriented N-S on exposed bedrock. The alignment is a single course of angular boulders with an average height of 0.30 meter. One small piece of weathered coral was observed at the southern end of the alignment, where it abuts with Feature 9B, a linear pile of boulders. The linear pile is oriented E-W and is 2.4 meters long by 0.8 meter wide by 0.50 meter high. Boulders in this pile are loosely stacked two courses high on exposed bedrock. The feature appears to be the result of land clearing.

Site 5706 Feature 10

Feature 10 is located 11.0 meters north from Feature 9, at the base of the same *pahoehoe* ridge formation. Feature 11, which was found to contain a human burial, is located 4.0 meters to the north. This newly-identified feature is a circular stone-filled depression measuring 2.0 meters in diameter. The fill consists of generally uniform-sized medium to small cobbles that are smaller than stones observed in nearby features. At least three layers of cobbles were observed beneath the level surface of this feature, which is 0.30 meter below the bedrock surface that defines the southern edge of the depression. One piece of weathered sandstone was found on the surface of the stone fill. No artifacts or other portable remains were observed on or near the feature.

A 1.0 by 1.0 meter test unit was excavated in the center of Feature 10 in order to better determine its function and age. The excavation encountered a 0.30 meter-thick layer of stone fill with no soil, over a 0.10 meter-thick layer (I) of dark yellowish brown (dry) stony silt loam (*Figure 4.34*). Layer I contained 50% stones by volume and four small fragments of weathered coral (0.55 grams total). Also recovered from screened Layer I soil were three small mammal bones believed to represent a mongoose (*Table 4.9*).

Layer II was encountered at 0.50 meter below surface and consisted of dark yellowish brown (dry) silty clay loam with 50% stones by volume. This natural subsoil was excavated to a base depth of 0.56 meter below surface, or 1.06 meter below the bedrock surface along the south side of the excavation. No portable remains were recovered from screened Layer II soil. The underlying bedrock surface was highly irregular and it appeared that the fill was placed in a natural rather than artificially created depression.

The function of Feature 10 appears to be similar to that of Site 1853 Feature 14, although the age of these two filled depressions may not be consistent. Feature 10 at Site 5706 is among pre-contact era features and may be of a similar age. The filled depression at Site 1853 contained metal fragments at a fairly deep provenience, suggesting an historic period date for that feature.

SITE 5706 Feature 10				
TU-1	Surface		I-1	
Depth	0		30-40	
Vertebrates	Cnt.	Wt.	Cnt.	Wt.
Small mammal			3	0.40
Coral				
Weathered Frags.			4	0.56
Sandstone				
Weathered Frags.	1	12.20		
TOTAL	1	12.20	7	0.95

Table 4.9 Recovered Materials, Site 5706 Feature 10

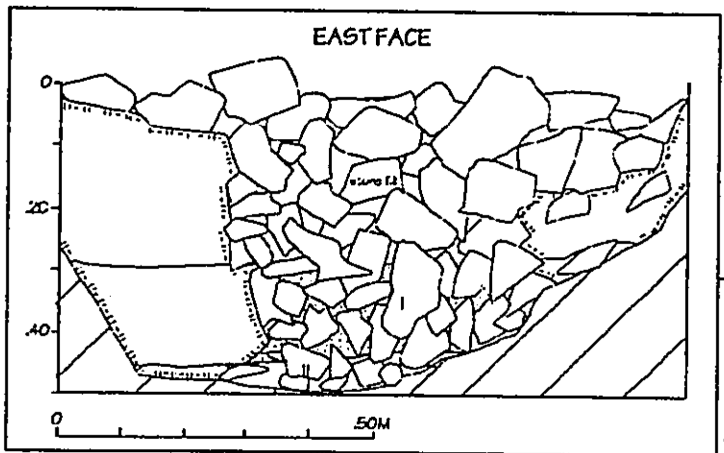


Figure 4.34 Site 5706 Feature 10, Test Unit 1 Profile

I: (.30-.40) dark brown (10YR3/3 moist) stony silt loam (10YR3/4 dry), weak, fine, crumb, soft, firable, nonsticky, nonplastic, many fine to very fine roots, diffuse, broken boundary

II: (.40-.56) dark yellowish brown (10YR3/4 moist) very stony silty clay loam (10YR4/6 dry), moderate, fine, crumb, slightly hard, firm, slightly sticky, slightly plastic, few coarse roots, grades to bedrock

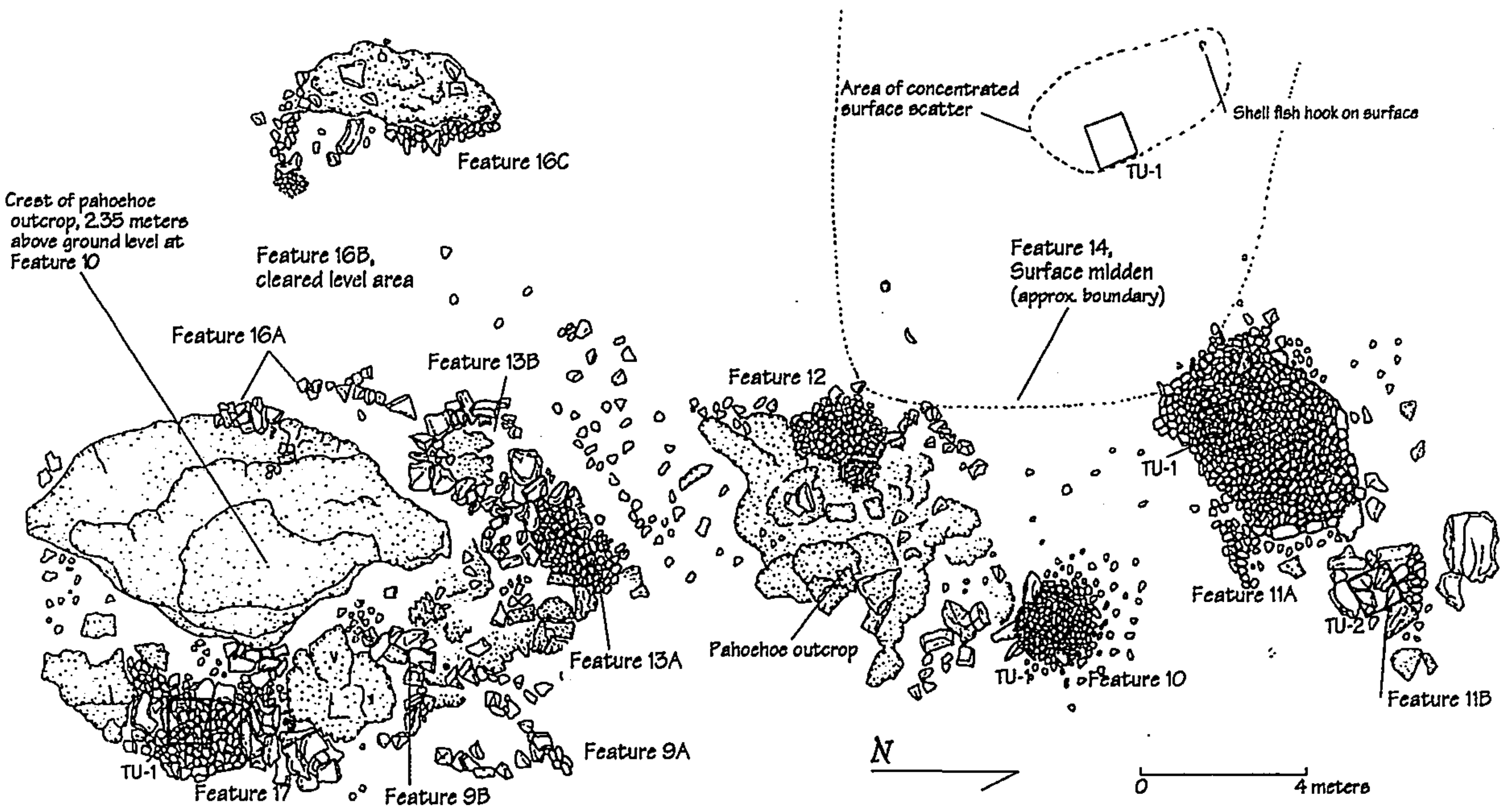


Figure 4.33 Scaled Plan Map, Site 5706 Features 9 through 14, 16 and 17

Site 5706 Feature 11

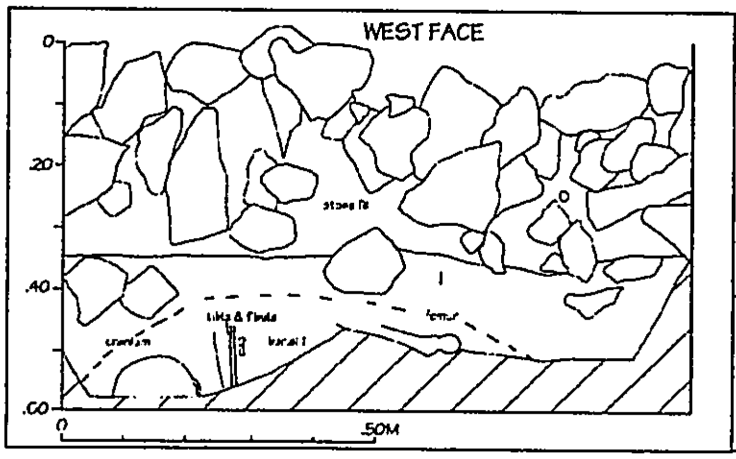
This newly-identified feature is located 2.7 meters south from the south end of the Feature 8 wall and is adjacent to the east end of the Feature 14 surface midden scatter. As noted above, Feature 10 is 4.0 meters to the south (*Figure 4.33*). Feature 11 is an informal stone-filled platform that is roughly rectangular in plan, although the corners are not fully square (*Photo 4.25*). Major axis of the platform is 5.0 meters NE (25 degrees Az) and minor axis is 3.4 meters in the center. The east end is 2.4 meters wide and the west end is 3.0 meters wide. Height above surrounding ground surface is 0.20 to 0.30 meter. The surrounding surface is generally cleared soil, with one area of exposed bedrock at the northeast corner of the platform. The feature is constructed with subangular cobbles and small boulders, with some areas of naturally occurring bedrock exposed in the fill. The edges are well-defined, with boulders aligned along portions of the perimeter, and bedrock used to define the edges in some places. There are indications of disturbance along the southern perimeter, where stones have been moved or kicked away form the feature, most likely by animals. The surface of the platform is generally level, except that the western half is slightly higher than the east half. There is no formal separation of the two portions of the platform; the surface area exhibits a gradual slope from west to east. There is no evidence of a formal paving, such as pebbles or *'ili'ili* on the surface of the platform. One weathered coral cobble was observed on the surface of the platform, in the west half. A stoneware crockery rim sherd from a bowl was found at the west edge of the platform. As noted above, a surface midden scatter is also present to the west of the platform; no midden was seen on the platform or along the other three sides.

A 1.0 by 1.0 meter test unit was excavated in the west portion of the feature, in order to help determine age and function of this feature. The excavation encountered a 0.35 meter-thick layer of stone fill that contained no soil or other portable materials (*Figure 4.35*). Very dark grayish brown (dry) silt loam was encountered near the base of the stone fill, intermixed with introduced stones. The upper level of this soil (0.35 to 0.45 meter below surface) contained 70% stone fill by volume. Level 1 also contained 10 pieces of marine shell (2.95 grams) and six weathered coral fragments (*Table 4.10*). Shellfish families represented include *Cypraeidae, Neritidae* and *Isognomonidae.*

Level 2 of the soil deposit showed an increase in midden, with 79 shellfish pieces (28.75 grams) recovered from 40 liters of screened soil. Also recovered from level 2 were 20 pieces of weathered coral and 17.8 grams of charcoal. The charcoal was submitted to Beta Analytic Laboratory for radiocarbon dating, and returned a conventional radiocarbon age of 290+/-40 BP (AD 1660 +/-40). This date was calibrated to a range of AD1490 - 1660, with an intercept of AD 1640 (Beta-212865; see Chapter 5 for more information).

Portions of an *in situ* human burial were encountered during excavation of level-2. The proximal epiphysis of a left femur was uncovered near the west wall of the unit at 0.48 meter below platform surface. The articular dish of the left acetabulum and a portion of the pubis was found just beneath the surface near the femur. The cranium was encountered at 0.54 meter below platform surface near the southwest corner of the unit.

After consultation with SHPD and the Maui-Lana'i Islands Burial Council representatives, additional excavation was conducted to verify the number of individuals represented and whether or not the burial was in a primary context.



I (pit fill): (.35-.56) very dark brown (10YR2/2 moist) gravelly silt loam (10YR3/2 dry), weak, very fine, crumb, soft, very friable, nonsticky, nonplastic, very fine to fine roots common, no boundary encountered.

Figure 4.35 Site 5706 Feature 11, Test Unit 1 Profile

Additional excavation partially exposed an articulated left tibia and fibula and left foot bones (*Figure 4.36*). Articulated hand bones were found near the cranium, and additional foot bones were found near the hip. Excavation was stopped when it was determined that all of the remains were from a single articulated individual. Some disturbance of extremities was noted; this was attributed to root disturbance and minor disturbance during excavation.

The individual was determined to be positioned on the right side, facing north to northeast. The left hip is tightly flexed with the leg oriented outward from the torso, with the left foot near the chest area. Bone morphology indicates a young, gracile adult, possibly a female. Diagnostic elements such as the mandible and pubic symphysis were not fully exposed for purposes of determining sex. The extent of epiphesial suture closure noted on the femur indicates adult age (over 20 years, Bass 1971:166).

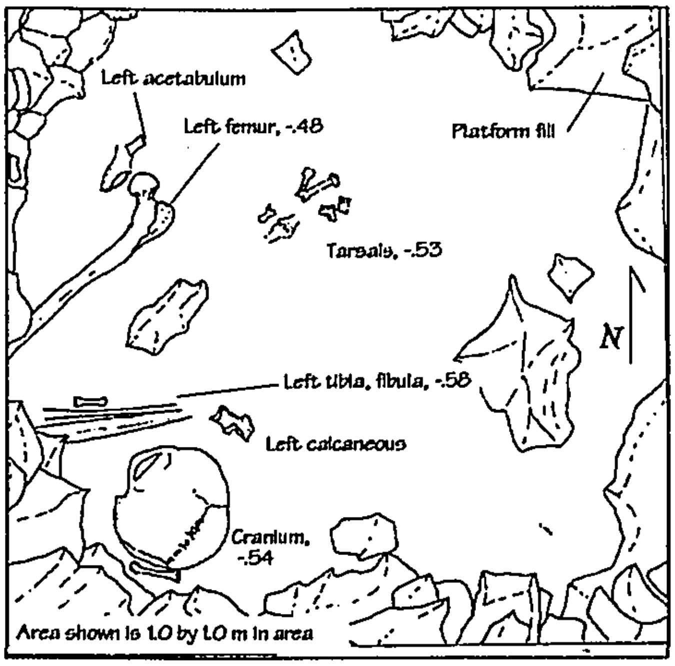


Figure 4.36 Site 5706 Feature 11, Burial Plan View

During excavation to determine the disposition of the burial, three skeletal elements were found in screened soil. These include the right navicular, a proximal foot phalanx, and minute fragments from the pelvis. These pieces were turned over to Leslie Kululoio of the Maui-Lana'i Islands Burial Council for wrapping, and they were reburied by Council representatives Leslie Kululoio and Dana Naone Hall with the articulated remains. The platform was reconstructed over the burial to ensure its preservation during the interim between discovery and approval of a burial preservation plan.

The overall composition and thickness of the soil beneath the platform indicates that it is not a natural soil layer. As indicated in all other test units within the project area, Layer I rarely exceeds 0.15 meter in thickness. At Feature 11, there was no evidence of a Layer I topsoil with duff and organic material; at this location, the soil appears to be disturbed pit fill, associated directly with the *in situ* burial. The burial pit was apparently excavated into a pre-existing cultural deposit that was contiguous with the deposit observed at Feature 14. Due to the location of the test unit in relation to the burial, all soil removed from the unit was from within the burial pit; no edges of the pit were discernible in the unit floor.

SITE 5706 Feature 11						
TU-1	Pit Fill-1		Pit Fill-2		Total	
Depth	.35-.45		.45-.55			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Cypraeidae	4	2.30	28	23.70	32	26.00
Nerita Picea	5	0.50	18	1.50	23	2.00
Patellidae			3	0.30	3	0.30
Planaxis labiosa			11	0.50	11	0.50
Thaididae			2	0.95	2	0.95
Unidentifiable			7	0.40	7	0.40
Bivalves						
Isognomonidae	1	0.15	3	0.25	4	0.40
Echinoidea						
Spines			7	1.15	7	1.15
TOTAL INVERTS.	10	2.95	79	28.75	89	31.70
Coral						
Weathered Frags.	6	2.95	20	35.80	26	38.75
Other						
Charcoal				17.80		17.80
TOTAL	16	5.90	99	82.35	115	88.25

Table 4. 10 Recovered material, Site 5706 Feature 11

Currently available information from the Feature 11 testing suggests that the cultural deposit dated to *circa* AD 1640 was in place prior to the placement of the burial and the platform, which was most likely constructed as a burial monument/marker. The specific time frame for the burial is therefore sometime after the estimated time range for the cultural deposit. It is not known whether the stoneware sherd found at Feature 11 is associated with the burial; however, it is possible that the burial was known during the timeframe indicated by the sherd, which is late 19th to early twentieth century.

The size of the platform suggests that at least one additional burial may be present at this location.

A second test unit was excavated in a bedrock outcrop located immediately east of the Feature 11 platform, in order to verify the presence or absence of additional burials at this location (*Figure 4.33*). The test unit was located in center of the outcrop, where several boulders had been loosely piled in a depression between *in situ* boulders. The loosely piled boulders were removed to expose a thin (0.04-0.06 meter) Layer I topsoil of dark brown (dry) gravelly sandy loam with organic duff (*Figure 4.37*). This topsoil overlaid a compact stony dark grayish brown (dry) silty clay loam with decomposing bedrock and *in situ* boulders. Solid bedrock was reached at 0.15-0.18 meter below surface. No cultural material was recovered from the 80 liters of soil screened form Layers I and II. Testing confirmed that there was no subsurface feature beneath the boulder pile. This would indicate a probable function as a clearing pile.

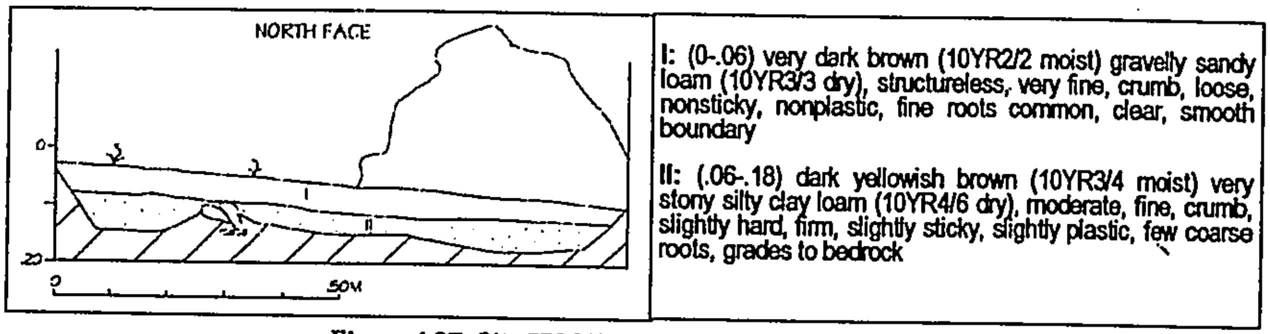


Figure 4.37 Site 5706 Feature 11, Test Unit 2 Profile

Site 5706 Feature 12 and 13

These newly-identified features are located along the western base of the prominent *pahoehoe* ridge associated with Features 9 and 10. Feature 12 is 6.0 meters south from Feature 11, and Feature 13 is 5.5 meters south from Feature 12. A surface midden scatter (Feature 14) is within 2.0 meters west from Feature 12. Both of these features (12 and 13) are stone-filled depressions, similar in form to Feature 10 (*Figure 4.33*). They are interpreted as having functioned as clearing piles, and are most likely associated with the Feature 14 area immediately to the west.

Feature 12 consists of angular boulders and cobbles that are loosely piled on naturally fractured bedrock at the base of the outcrop. The filled area is 3.5 meters N-S by 2.3 meters E-W; the surface is level and is 0.4 meter below the top of the bedrock face along the eastern side. A small square hole in the bedrock is present along the east side of the filled area. This hole has been partially filled with small cobbles. An informal alignment of boulders is present to the west of the filled area. This appears to have been a fortuitous result of animal traffic; a deer skeleton is present on the surface adjacent to these boulders. No cultural material is present in the immediate area of Feature 12; surface midden associated with Feature 14 is within 2.0 meters of the this feature.

Feature 13A is a filled depression and small circular clearing, located along the northwestern slope of the *pahoehoe* outcrop. The filled area consists of angular cobbles and boulders that are loosely placed on naturally fractured bedrock. The filled area is 3.0 meters NE-SW by 2.3 meters. The fill is 0.2 to 0.3 meters above surrounding bedrock on the downhill side and level with the surface on the uphill side. The southwestern perimeter of the filled area is defined by several naturally up-thrusted boulders, which were incorporated into a roughly circular enclosure wall (13B). A coral cobble (.0.2 by 0.2 meter) was located on the surface among scattered stones immediately upslope from the filled area.

Feature 13B is a loosely constructed L-shaped wall that abuts natural boulders to form a small enclosure. It is located adjacent to the southwest side of Feature 13A and is situated along the slope of the *pahoehoe* ridge. The long section of the wall is 2.4 meters and the short section is 1.3 meters. The wall is constructed from angular boulders, some of which are single course and set on end. Smaller cobbles have been used to fill gaps between the boulders along the inside of the wall. Height ranges from 0.25 to 0.40 meters. The small enclosed area is 1.8 meter E-W by 1.4 meter N-S and has sloping rock surface. No soil or portable remains were found inside the small area. It may have been used for temporary storage.

Site 5706 Feature 14

Feature 14 is a surface midden and artifact scatter that occurs in an area of stone-free soil immediately west of Features 11, 12, and 13. Feature 16, a third clearing pile feature, is present on the east and west sides of the scatter. Overall surface area is 16.0 meters N-S by 18.0 meters E-W. The edges of the surface midden correspond with the edges of cleared soil and are defined by either natural bedrock outcrops or constructed clearing piles. The cleared area has become a well-worn deer access route, and surface erosion is apparent. Shellfish varieties observed on the surface include *Cypraeidae, Neritidae, Thaididae,* and *Spondylidae*. Densities noted were not particularly high, however, more remains were visible in the deer trail. An area of relative concentration along the trail showed roughly two to three shell pieces per square meter of surface area. Also found in the concentrated area was the fragment of a shell fishhook (*Figure* 4.33).

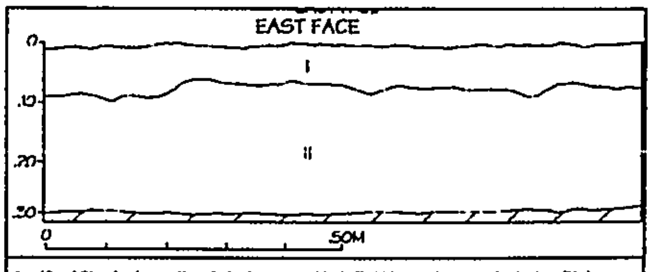
A 1.0 by 1.0 meter test unit was excavated within the area of relatively concentrated midden. Two soil layers were encountered, both of which contained cultural material. Layer I was 0.06 to 0.09 meters thick and consisted of very loose dark yellowish brown (dry and moist) silt loam with a small amount (5%) of *kiawe* duff intermixed (*Figure 4.38*). An intact topsoil/duff surface was not present at this location. A few loose cobbles were present on the surface, however, no additional stone were encountered during excavation of Layer I. A total of 39 shell fragments (18.85 grams) was recovered from screened Layer I soil, with four shellfish families represented (*Cypraeidea, Conidae, Neritidae* and *Thaididea*). All of the shell pieces were heavily weathered and in poor preservation. The shell density value for Layer I is 0.25 grams per liter of screened soil (*Table* 4.11). Also recovered from Layer I was an unmodified sandstone (beach conglomerate) cobble.

Layer II consisted of compact yellowish brown (dry) silty clay loam with less than .5% stones per volume in level 1, and no stones in level 2 (.5 liter per 100.5 liter excavated in level 1). Cultural material was found only in the upper level of Layer II, to a base depth of 0.20 meter below surface. A slight decrease in shell count was found, with 22 fragments (15.9 grams) and three identifiable shellfish families represented. Density for this level was markedly lower (0.15 gram per liter), due to the higher volume of screened soil (100 liters). Also recovered from Layer II-1 were two basalt flakes. The second level of Layer II showed an increase in compaction, but no change in soil color or texture. No cultural material was recovered from this level and the excavation was terminated at 0.30 meter below surface.

The cultural deposit represented at Feature 14 appears to have been severely affected by erosion, most of which was probably brought about by recent deer traffic. Prior activities may have also affected the deposit, which is now in a disturbed and secondary state. Although it is clear that activities related to habitation took place at this location, the specifics of these activities are not clear. Due to the fact that Feature 14 is adjacent to Feature 11, it is safe to assume that the cultural layer found beneath the platform and disturbed by the burial pit is contemporaneous with the disturbed deposit at Feature 14. Thus, the date of *circa* AD 1640 is likely for this Feature. The artifacts found at this feature, including a shell fishhook fragment and basalt flakes collaborate with this date.

SITE 5706 Feature 14						
TU-1	I-1		II-1		Total	
Depth	0/.06/.10		.06/.10-.20			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
~~Cassididae~~			1	7.00	1	7.00
Conidae	1	0.60			1	0.60
Cypraeidae	17	12.00	8	6.40	25	18.40
Nerita picea	7	1.85	1	1.50	8	3.35
Thaididae	3	0.65			3	0.65
Unidentifiable	11	3.75	12	1.00	23	4.75
Total Shellfish	39	18.85	22	15.90	61	34.75
Other						
Beach Congolm.	1	222.60			1	222.60
TOTAL	40	241.45	22	15.90	62	257.35

Table 4.11 Recovered Materials, Site 5706 Feature 14



I: (0-.18) dark yellowish brown (10YR4/6 moist and dry) silt loam, 1vfcr, loose, nonsticky, nopnplastic, gradual, wavy boundary

II: (.18-.30) dark yellowish brown (10YR3/6 moist) silty clay loam (10YR5/8 dry), 1msbk, slightly hard, firm, slightly sticky, plastic, few fine to medium roots

Figure 4.38 Site 5706 Feature 14, Test Unit 1 Profile

Site 5706 Features 15 and 16
These two newly –identified features are located in the vicinity of the aforementioned Features 7, 9, 10, 12, and 13. Feature 15 is located 10.5 meters west from Feature 7, on the same outcrop area. Feature 16 is located to the south and west of Feature 13 (*Figure 4.35*).

Feature 15 is a low stacked wall constructed from angular basalt boulders and large cobbles. It is situated along the top of a low *pahoehoe* ridge, oriented perpendicular to the major axis of the ridge. The wall is 5.6 meter long by 0.65 meter wide and ranges in height from 0..2 to 0.45 meter. Construction is generally loose, with no formally faced sides (*Figure 4.39*). No portable remains were observed near the wall or in the vicinity. There is no soil deposit associated with this feature, and its specific function is indeterminate.

Feature 16 consists of three stone clearing piles and an associated soil clearing. Two of the piles are linear in form and consist of loosely piles angular bounders and cobbles. set along the east and west sides of the soil area. The third pile is concentrated against the east face of a low *pahoehoe* outcrop, at the west side of the clearing (*Figure 4.33*).

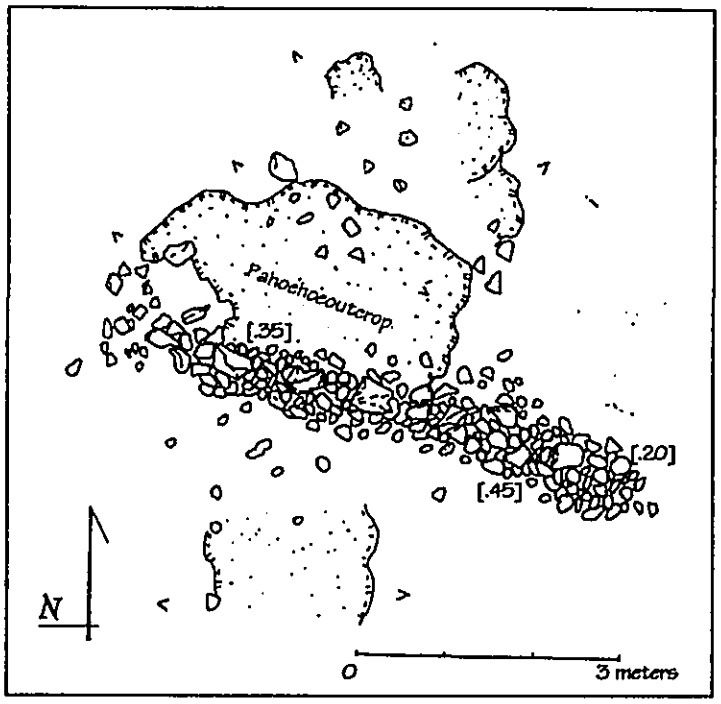


Figure 4.39 Scaled Plan Map, Site 5706 Feature 15

The soil clearing is 4.0 meters N-S by 5.0 meters E-W. The northern end of this soil clearing is adjacent to the southern-most extent of Feature 14. No portable remains or cultural materials were observed on the surface within this cleared area.

The stone pile along the east side of the clearing is 4.0 meters long (N-S) and consists of a linear string of single boulders. The linear pile along the southwest side of the clearing is 3.0 meters long and oriented N-S. The third more compact pile is at the west edge of the clearing and is 2.8 meters N-S by 0.8 meter W-E. This pile is comprised primarily of cobbles and is over one course in thickness. No portable remains were found in association with the clearing piles. They are assumed to be contemporaneous with the other clearing features located nearby.

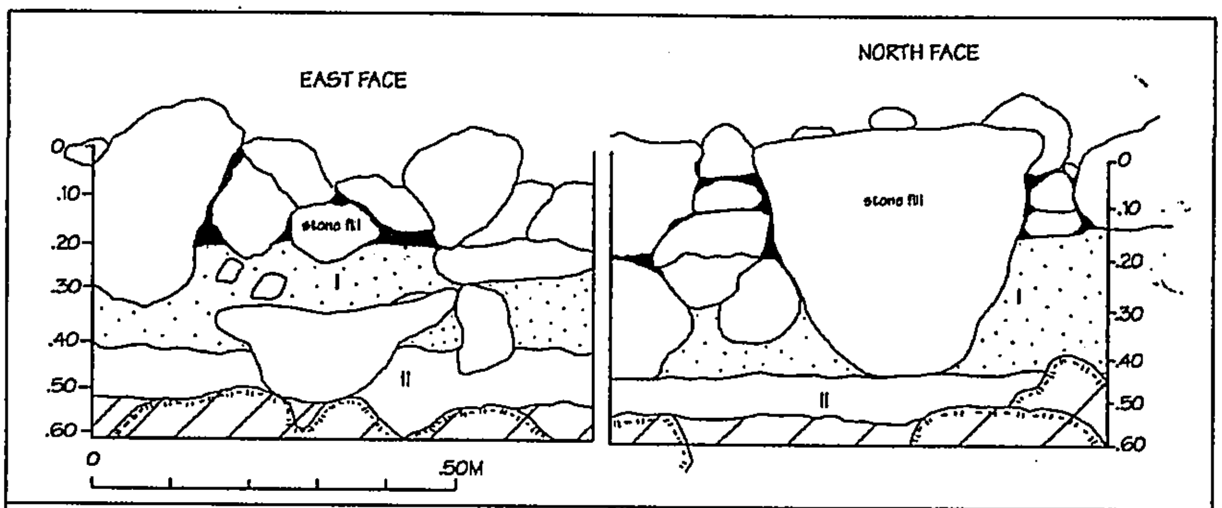
Site 5706 Feature 17
This newly-identified feature is an area of stone fill atop a natural *pahoehoe* terrace. It is located 2.5 meters south from Feature 9, along the east-facing slope of the major *pahoehoe* ridge formation (*Figure 4.33*). The feature appeared to be distinct from the nearby clearing piles, due to the more formal appearance and the presence of four coral cobbles and one coral pebble on the surface of the stone fill. The filled surface area measures 3.1 meters N-S by 2.9 meters E-w, and it has a roughly D-shape in plan view. The height of the filled surface is 0.20 to 0.40 meter along the east face. Along the west side, the bedrock face rises 0.90 meter above the filled surface. Materials used include angular boulders and cobbles; there is no formal paving of smaller stones; however, the surface is generally level.

A 1.0 by 1.0 meter test unit was excavated in the center of the terrace in order to help determine age and function. A 0.20 meter-thick layer of stone fill with no soil was encountered overlying a very stony layer of loose dark brown sandy loam with organic duff and 65% stones by volume (*Figure 4.42, Photo 4.26*). A single piece of *Cypraeidae* shell (0.2 grams) was recovered from the 25 liters of screened Layer I, level 1 soil. Also recovered from the screen for Layer I-1 were five small fragments of weathered coral.

No portable remains were recovered from the second level of Layer I, which extended from 0.30 to 0.40 meter below surface.

Layer II was encountered at 0.40 meter below surface and consisted of dark yellowish brown (dry) silty loam that had accumulated in crevices between *in situ* bedrock boulders. This sterile subsoil layer continued to 0.52 meter below surface, which is where the unit was terminated. Small pockets of the soil continued in crevices beyond this depth. No cultural materials or portable remains were recovered from Layer II soil.

Results of the testing indicated that the feature was a relatively thin veneer of stone fill that had been placed over a natural bedrock formation. A concentration of coral was found on the surface at this feature; it consisted of weathered brain coral cobbles and pebbles, none of which was branch coral. It is therefore difficult to assign a ceremonial function to this modified outcrop terrace, although the possibility should not be ruled out.



I: (.20-.40) black (10YR2/1 moist) stony sandy loam (10YR3/3 dry), 1fcr, loose, nonsticky, nonplastic, fine roots common, gradual broken boundary
II: (.40-.60) dark brown (7.5YR3/2 moist) silt loam (10YR3/4 dry), 1fcr, soft, friable, nonsticky, nonplastic, few fine roots, grades to bedrock

Figure 4.40 Site 5706 Feature 17, Test Unit 1 Profiles

In summary, investigations at Site 5706 found that probably most of the features in this complex are pre-contact in age and includes indicators of habitation, gardening or farming, and burial. At this time, it is assumed that the habitation features (5, 11, and 14) are contemporaneous and date to *circa* AD 1640. The agricultural features are closely associated with the habitation features, and there was no evidence found that these are historic in age. However, this should not rule out the possibility that some of the agricultural features could date to the historic period, when several families were living directly *makai* of this site. It is therefore assumed that the agricultural features represent landscaping connected with farming or gardening that could have occurred any time that folks were living in the area. The burial is traditional Hawaiian and could have been placed at the site anytime in the late seventeenth through eighteenth centuries.

The fact that Site 5706 is bounded on the north, east and west by either the golf course or by sites that are probably later, indicates that what we recorded may not represent the original full extent of the site. Midden deposits found in soil beneath the Site 1853 Feature 8 wall and Site 5706 Features 1 and 2 may reflect activities contemporaneous with one of the earlier occupations of the Site 5706 area, rather than with the surface structures or stone formations.

Site 5707

Previous Investigations

Site 5707 was identified and recorded in 2001 during a survey of the 35-acre Four Seasons Hotel project area. At that time, a single feature was identified as a modified outcrop constructed of stacked and piled basalt cobbles and boulders. The feature was mapped as being roughly D-shaped in plan and measuring 7.7 by 7.2 meters (Rotunno-Hazuka et al. 2005:34). A 0.5 by 0.5 meter test unit was excavated into the feature, and two soil layers were encountered beneath a 0.10 meter-thick layer of stones. No cultural materials were encountered. The site was summarized as follows:

> Due to the extent of disturbances of this site and the paucity of subsurface remains, function and age are difficult to determine; however due to the presence of one faced wall, it was probably a bulldozed ranch wall. No further work is recommended for this feature beyond construction monitoring during grading activities. (Rotunno-Hazuka et al. 2005:34)

Current Findings

Site 5707 was relocated through use of project area maps and the presence of the former test unit. Upon site relocation, it was determined that additional features were present, and the site area was expanded to include four additional features (*Figure 4.41*). These include a C-shaped enclosure (Feature 2), a bifaced wall remnant (Feature 3), a stone alignment and soil terrace (Feature 4), and a small planting enclosure that could be modern (Feature 5). This last feature was previously recorded as Site 5708; however, due to its proximity to the newly identified features, it was decided to include this feature with the Site 5707 complex. Previous work at Feature 5 is discussed below. The Site 5707 area was found to be in an extremely disturbed state; clearly identified bulldozer trails were observed which affected all of the features except Feature 5 (*Figure 4.41*).

Site 5707 Feature 1

Feature 1 was previously recorded as a modified outcrop, and interpreted as a probable bulldozed ranch wall. Vegetation clearing and additional investigations determined that this feature is the remnant of a bifaced core-filled wall that has been truncated at both ends by bulldozers. The current length of the wall is 8.6 meters and it is oriented NE-SW. Width of the wall ranges from 1.6 to 1.8 meters, and height along the east side averages 0.45 meter. The base of the wall is constructed from large subangular to rounded boulders set in parallel rows and filled with smaller cobbles. Portions of the wall base incorporate *in situ* bedrock boulders. Parallel single courses of the base stones remain along most of the wall, with some remnants of a second course present. A linear pile of pushed stones is present against the west face of the wall. This material was pushed in at an oblique angle to the wall, resulting in a V-shaped configuration. The previous test unit was excavated into the pushed material, against the west face of the wall. It appears that the northern end of Feature 1 probably continued north and connected with the Feature 3 wall. Both walls are of similar construction technique, although the base of Feature 1 is somewhat wider than that of Feature 3. The extent of Feature 1 to the south is indeterminate; it may have continued to connect with Feature 2; however, there is no clear indication that the area between these two features was impacted by machinery.

Site 5707 Feature 2

This newly identified feature is located 4.0 meters south from the south end of the Feature 1 wall. It consists of a substantially constructed C-shaped enclosure with the opening oriented toward the west. The front (west) side of the enclosure was impacted by machinery and the west ends of both walls were taken out to the base level. Pushed stones occur along the front of the north wall and the entrance. The eastern (back) wall of the enclosure appears to be relatively undisturbed (*Photo 4.27*).

Overall area of the enclosure wall from the exterior sides is 5.0 meters N-S by 6.0 meters E-W. The intact portion of the south wall is 1.2 meters wide and shows a bifaced core-filled construction. The east (back) wall is 2.8 meters wide and shows a stacked boulder face on the west (interior) side. The exterior side is currently stacked and slopes downward from the west to east. Maximum height of the east wall is 0.75 meter above surrounding ground surface. The faced wall height along the interior is 0.64 meter. The entrance of the shelter has been disturbed; estimated original width is 1.0 to 1.1 meters. A small

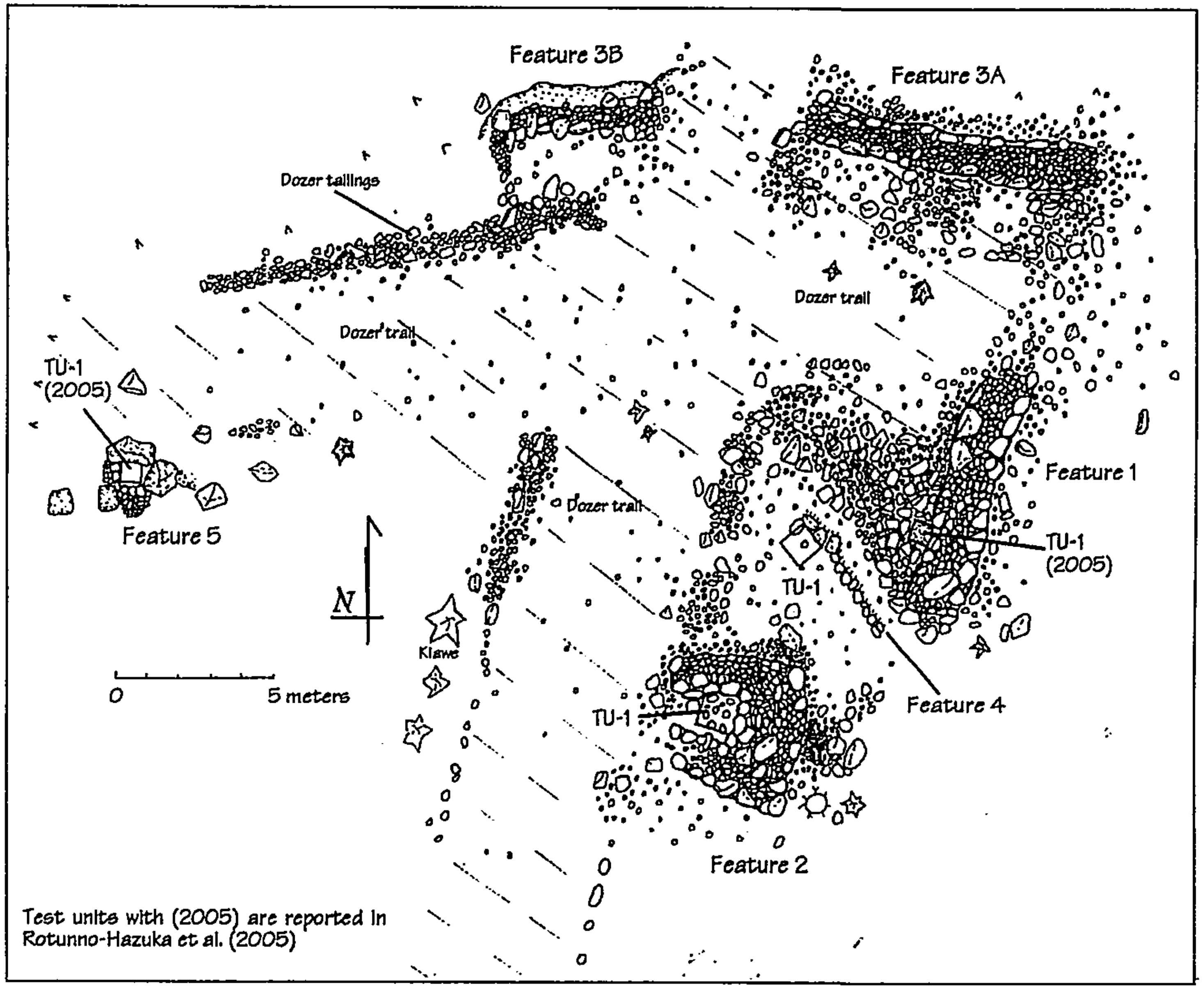


Figure 4.41 Scaled Plan Map, Site 5707

weathered coral pebble was observed on the west end of the southern wall, and a waterworn basalt cobble was observed among the disturbed stones at the entrance. Also observed on the surface was a single piece of *Cypraeidae* shell.

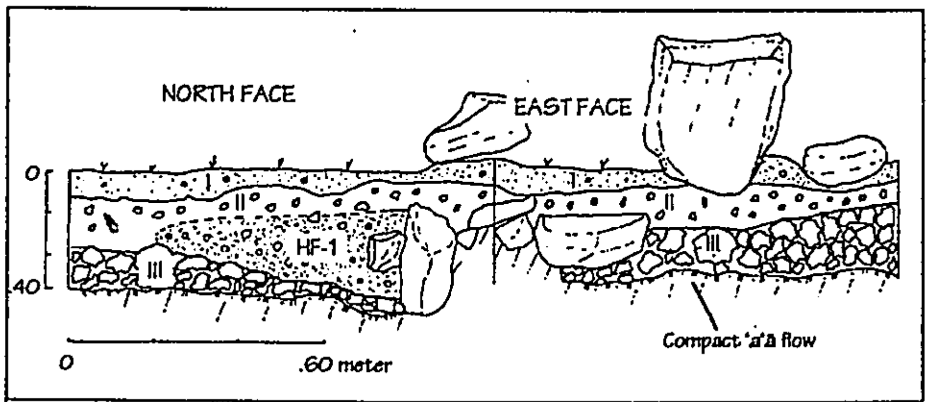
The interior area of Feature 2 is square in plan, at 1.5 by 1.5 meters. The interior surface is level and contains a soil deposit; several stones that fell from the walls were also present inside the enclosure. A large *Panini* was growing in the center of this feature at the time of the current investigations. This cactus had to be removed in order to access the feature for subsurface testing. The root system of the cactus caused a considerable amount of disturbance to the soil deposits inside the structure.

A 1.0 by 1.0 meter test unit was excavated in the interior of the shelter in order to help determine age and function of the feature. This unit was subsequently expanded to 1.3 meters N-S by 1.0 meter E-W in order to examine a possible hearth area and obtain additional charcoal for a dating sample. The expanded unit removed the bulk of the soil deposit that was present inside the shelter (*Photo 4.28*).

Three soil layers were encountered during excavation, and one possible hearth area was observed (*Figure 4.42*). Layer I was a thin (0.08 meter) deposit of very loose dark brown sandy loam with pebble and small cobble sized stones throughout (32% by volume). Cactus roots, most of which were rotten, occurred throughout this topsoil layer. A total of 28 shell pieces (15.95 grams) were recovered from screened soil, with four shellfish families represented (*Table 4.12*). Also recovered from Layer I were seven waterworn coral pebbles, four weathered coral pieces, and a rectangular piece of cut shell.

Layer II was .012 to 0.36 meter thick and was excavated in two levels. This layer consisted of very stony dark brown silty loam with 50% stones by volume. The layer showed considerable root disturbance throughout the unit. This soil feature was in a severely disturbed state due to cactus root intrusion, and had no clearly definable edges; further examination by expansion of the unit indicated that it was possibly a hearth remnant that contained sufficient charcoal for a dating sample. Layer II showed an increase in shell midden weight density, from .40 grams per liter in Layer I to .78 grams per liter in Layer II-1. The actual shell count did not change significantly, however. Most of the difference was due to one large piece of unidentifiable shell recovered from Layer II-1 (*Table 4.12*). Artifacts recovered from Layer II-1 includes a coral abrader, two basalt flakes, two volcanic glass flakes, and a fragment of a square nail. Twelve charcoal fragments (0.30 grams) were recovered from this level, most of which were from charred cactus root.

A second level of Layer II was present in the northern half of the test unit, where the remnant of a subsurface feature was discernible in the north wall of the original excavation (*Figure 4.42*). When the unit was expanded to the north, the northern portion of a circular ash deposit was observed at 0.33 meter below surface, at the interface of Layers II and III. The feature (HF-1) was located in the northeastern corner of the interior, and consisted of fine gray to dark gray ashy silt mixed with decayed material from cactus roots. All of the midden and artifacts recovered from Layer II-2 were within the area of HF-1. Artifacts include two basalt flakes and seven volcanic glass flakes. A 6.2 gram sample of non-cactus charcoal from HF-1 was submitted to Beta Analytic Laboratory for radiocarbon dating. The sample returned a conventional radiocarbon age of 240+/-60 BP, which was calibrated to three alternative ranges at two sigma (AD 1500-1690; AD 1730-1810; and AD1920-1950). The intercept of the conventional age with the calibration curve is AD 1660. At one sigma, the calibrated range corresponding with this intercept is AD 1640-1670.



I: (0-.08) dark brown (10YR3/3) sandy loam with duff, 0vfsg, loose, nonsticky, nonplastic, clear smooth bound.
II: (.08-.36) very dark brown silty loam (10YR2/2 moist) silt loam (10YR3/3 dry), 1msbk, soft, very friable, nonsticky, nonplastic, clear, smooth boundary; HF-1 is dark grayish brown ashy cultural feature.
III: (.36-.45) dark yellowish brown (10YR3/4 moist) gravelly silty clay loam (10YR5.6 dry), 1msbk, hard, firm, slightly sticky, plastic, grades to aa flow

Figure 4.42 Site 5707 Feature 2, Test Unit 1 Profile

SITE 5707 Feature 2										
TU-1	I-1		II-1		HF-1		III-1		Total	
Depth	.05/.11-.14/.17		.14/.17-.24/.27		.24/.27-.36/.38		.24/.27-.34/.40			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae										
Cypraeidae	4	3.80	8	7.10	2	1.70	1	2.60	15	15.20
Nerita picea	8	7.50	16	1.90	1	0.10			25	9.60
Patellidae	5	1.20	1	6.00	3	0.10	1	0.06	10	7.35
Thaididae	2	9.60	2	9.40			1	1.00	5	19.90
Unidentifiable	9	0.80	4	38.45	1	0.70			14	39.95
Total Shellfish	28	16.96	31	62.85	7	2.80	3	3.66	69	81.90
Vertebrates										
Large Mammal	2	2.50							2	2.50
Medium Mammal	1	1.20							1	1.20
Indeterminate			2	0.20					1	0.10
Coral										
Waterworn	7	109.35	13	120.30	2	20.30			22	249.95
Weathered Frags.	4	34.90	32	338.10	17	32.00	5	66.50	32	367.50
Other										
Charcoal			12	0.30		6.2			12	0.30
Firecracked Basalt			1	12.06					1	12.06
TOTAL	42	147.96	91	633.36	28	61.70	8	70.16	139	726.80

Table 4.12 Midden and Portable Material, Site 5707 Feature 2

Layer III was encountered at a varied depth of 0.10 to 0.37 meter below surface, with the deepest surface located beneath HF-1. This layer was a very stony dark yellowish brown silty clay loam subsoil with 70% stones by volume. Three pieces of marine shell were recovered from the 31 liters of screened soil. Also recovered were five pieces of weathered coral and a spall from a ground cobble. These materials are presumed to be intrusive from the upper Layer, as Layer III is essentially sterile subsoil.

Results of testing at Feature 2 indicated that the Layer I soil deposit post-dates the wall, which was constructed into the surface of Layer II. Thus, cultural material present in Layer I probably got there due to roots or other types of natural perturbation. The dated charcoal from HF-1 suggests a construction and use date that is roughly contemporaneous with the cultural deposit at Site 5706. Later uses of Feature 2 or the Site 5707 area are suggested by the presence of a single square nail fragment that was found inside the C-shape. The relatively small size of this shelter (2.25 square meters) precludes its use for long-term habitation; it most likely functioned as a short-term activity area that would not have been suitable for sleeping. It is possible that Feature 2 was a component of a larger habitation compound; however, the relationship of this C-shape with the nearby wall remnants is very unclear due to modern machinery disturbances.

Site 5707 Feature 3

Feature 3 is the remains of a bifaced core-filled wall that was oriented E-W along the south edge of the Parcel 37 gulch. Two sections of the wall were identified, these are separated by a 3.6-4.0 meter wide bulldozer path. The eastern section (Feature 3A) is the longest and best preserved; it is 9.0 meters long and 1.2 to 1.6 meters wide. Height of the wall ranges from 0.48 to 0.30 meter, with the highest section along the north side. The wall is constructed with subangular boulders set in parallel rows and filled with smaller cobbles and pebbles. In general, only one course of the wall is still intact, and both ends have been truncated by bulldozers. Three piles of stones are pushed against the south side of the wall; these stone could have originated from either the Feature 1 or Feature 3 wall. There is no remnant of a corner at the east end of this longer section, so it cannot be determined if the wall turned to connect with Feature 1.

The western wall section (Feature 3B) is aligned with the eastern section, and it is presumed that these sections were once continuous. This section is 6.6 meters long and 0.8 to 1.2 meter wide. The southern row of base stones is present, however most of the stones from the northern side have been displaced or removed. Only a single course remains of the wall section, with heights ranging from 0.50 to 0.76 meter for single basal boulders. A linear tailing of stones is spread westward from the wall segment for 13.0 meters; these stones most likely originated from the wall. Additional tailing lines occur to the west, down the hill toward the golf course. No artifacts or portable remains were observed on the surface in the area of Feature 3.

Site 5707 Feature 4

This newly-identified feature is a partially buried boulder alignment that forms a low terrace. It is located between Feature 1 and 2 and is oriented NW-SE, roughly parallel with the disturbed portion of Feature 1 (*Figure 4.41*). The alignment is comprised of 14 boulders and is 4.4 meters long. The stones are buried to roughly half their height, and protrude an average of 0.35 meters above ground surface. The west end of the alignment is marked by a single boulder that is turned perpendicular to the other stones. The ground on the south side of the alignment is raised 0.20 above the level to the north side. This forms a terrace-like area that continues southward for 4.0 meters to the Feature 2 C-shape. It appears as though machinery has driven over Feature 4, however, a distinct trail could not be discerned.

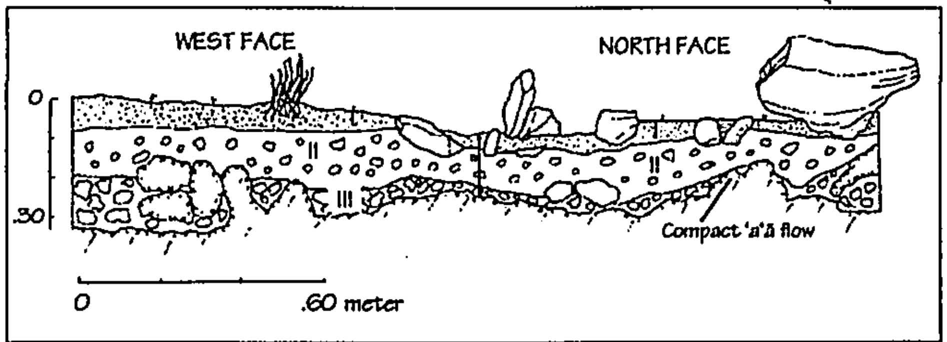
A 1.0 by 1.0 meter test unit was excavated at the west end of the alignment, on the south (raised) side in order to help determine function and age. Three soil layers were encountered, including a thin (0.02-0.05 meter-thick topsoil consisting of dark brown loose sandy loam with deer scat and duff (*Figure 4.43, Photo 4.29*). No artifacts or cultural material was recovered frcm Layer I soil.

Site 5707 Fea. 4	II-1		II-2		TOTAL	
Depth	0.8/.18-.20/.28		.20/.28-.34/.40			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae	2	0.70			2	0.70
Cypraeidae	5	13.20			5	13.20
Total Shellfish	7	13.90			7	13.90
Coral						
Weathered Frags.	10	39.20	2	1.80	12	41.00
Other						
Charcoal	nd	0.75	nd	0.20	nd	0.95
TOTAL	17	53.85	2	1.82	19	55.67

Table 4.13 Midden and Portable Materials, Site 5707 Feature 4

Layer II was excavated in two levels and consisted of very dark brown stony silty clay loam with pockets of windblown beach sand. Seven shell fragments (*Conidae* and *Cypraeidae*) were recovered from level 1, as well as 10 small pieces of weathered coral, one small volcanic glass flake, and 0.75 grams of charcoal (*Table 4.13*). The second level of Layer II contained no shellfish remains; 12 small coral fragments, one small volcanic glass flake, and 0.20 grams of charcoal were, however recovered.

Layer III consisted of a yellowish brown (dry) gravelly silty clay loam. No artifacts, midden, or other portable remains were found in this subsoil layer. Results of testing at Feature 4 suggested that the feature was part of a larger habitation complex that probably included Feature 2 and *possibly* was inside an enclosure (Feature 1 and 3). The rather sparse midden deposit at Feature 4 may be attributed to post-abandonment disturbances and erosion.



I: (0-.10) dark brown (10YR3/3 moist and dry) sandy loam, 1vfsbk, friable, non-sticky, non-plastic, many fine roots, clear smooth boundary
II: (.10-.25) very dark brown (10YR2/2 moist) gravelly silt loam (10YR4/4 dry), 2fskb, friable, slightly sitcky, slightly plastic, fine to coarse roots common, diffuse wavy boundary.
III: (25-.33) dark yellowish brown (10YR3/4 moist) gravelly silty clay loam (10YR5.6 dry), 2msbk, hard, firm, slightly sticky, plastic, few coarse roots, grades to aa flow

Figure 4.43 Site 5707 Feature 4, Test Unit 1 Profile

Site 5707 Feature 5

This previously identified feature was recorded as Site 5708 in 2001, and was described as follows:

> It consists of a semi-circular wall, built against the edge of a basalt outcrop, measuring 1.25 [meter] in diameter, forming a small circular enclosure which bounds a level soil area. The wall is constructed of stacked basalt cobbles and boulders, 2-4 courses high, and retains soil. The wall encloses the southern side and the outcrop defines the rest of this feature. The wall measures about 2 m in total length, .50 m wide and .50 m in height on the exterior and .30 m on the interior side. The outcrop measures .80 m high on the eastern and western sides and 1.0 m high on the northern side. (Rotunno-Hazuka et al. 2005:38)

A 0.50 by 0.50 meter test unit was excavated inside the small enclosure in 2001, and three soil layers were encountered. One piece of Cypraeidae shell (0.4 gram) and one piece of weathered coral (1.2 grams) was recovered from screened Layer II soil The feature was interpreted as a planting shelter or possibly a storage area, with no age determinable. Further examination of the structure suggests that it could be relatively recent, based on the construction technique and the very good condition of the stacked wall in relation to the surrounding bulldozer-disturbed area (*Photo 4.30*).

The prior excavation removed essentially all of the soil deposit within the small feature, so it was not possible to conduct further testing. It would appear that the shell and coral fragments were in the soil deposit prior to construction of the narrow wall. This feature is similar in style to other obviously modern planting areas that were identified in the gulch adjacent to Site 5707. The modern features are intermixed with what appear to be older pre-contact features and may represent re-use of existing features (see discussion for Site 5710).

Features 1 and 3 at Site 5707 are assumed to be contemporaneous and may have been connected at one time. Features 2 and 4 appear to be contemporaneous and reflect habitation activities at the site during the middle seventeenth century. It was not possible to clearly associate the two wall features with Features 2 and 4, due to extensive machinery disturbance of the site. It does appear, however, that the bulldozing that disturbed the site was conducted prior to golf course construction and is associated with a graded road (Site 5710 Feature 2) that enters and crosses the gulch in this area. This road is assumed to be from ranching activities, and may be connected with use of the Site 5795 enclosure across the gulch. Thus, it appears that the Feature 1 and 3 walls were not functional ranch walls at that time the road was made (early-middle twentieth century). There is a possibility that the walls are contemporaneous with and functionally associated with the C-shape enclosure and terrace. Their construction technique is consistent with traditional Hawaiian wall design.

Site 5708

As noted above, this site number was originally assigned to what is now Feature 5 of Site 5707. The number has been re-assigned to a historic/modern era habitation site located in Parcel 56. The site consists of three features - a stone-filled platform (Feature 1), a house site (Feature 2), and a surface artifact/midden scatter with an associated subsurface refuse concentration (Feature 3). The overall site area is 41.5 meters N-S by 49.0 meters E-W.

Feature 1

This newly-identified feature is located along the northwestern boundary of Parcel 56, immediately south of a modern retaining wall that defines the public beach park. The feature has been impacted by earthmoving in connection with the wall construction and with grading in the Parcel 56 area. The east and west ends of the platform are disturbed, and it appears that a retaining wall may have extended west from the original platform (*Figure 4.44*). Currently the structural remnants are 10.2 meters E-W by 4.2 meters N-S. The platform area is oriented NE-SW with a major axis of 5.0 meters and minor axis of 2.8 meters. The north side of the platform shows a faced edge of stacked boulders, to a height of 0.90 meter. The south side is 0.42 meter high and also shows remnants of a formerly faced perimeter wall. The surface of the platform is level and paved with small cobbles and pebbles of weathered *'a'a*. Artifacts observed on the surface of the platform include historic/modern structural debris and rubbish, including metal water pipes, rusted iron fragments, broken bottle glass, iron stove parts, earthenware flower pots, copper flashing, and whiteware dish sherds. Also observed on the surface was one fragment of branch coral.

A 1.0 by 1.0 meter test unit was excavated in the center of the platform to verify its age and function. The excavation encountered a 0.15 meter-thick layer of stone fill that contained no soil or portable remains. Beneath this layer were seven 0.10 meter-thick levels of stone and soil fill (*Figure 4.45, Photo 4.31*). The soil consisted of dark brown gravelly loamy sand with ash mottling and relatively high amounts of charcoal.

Historic/modern debris (933 items) was found throughout the platform fill, with the highest concentration in the uppermost level of the soil mix (level 1). Fourteen ceramic sherds were recovered, including seven earthenware flower pot fragments and seven porcelain fragments, all of which are less than 50 years in age. Most of the 125 recovered glass sherd are clear (118) and include beverage bottles, condiment bottles, medicine bottles, kitchenware and flat glass. Sixty-four pieces of leather, including 63 fragments of a leather boot were recovered; the boot was located at the base of the platform. A total of 705 pieces of metal were recovered, with nearly all of this material in levels 1-3. Also recovered were 22 pieces of brick or mortar and five pieces of plastic, including comb fragments, buttons and plastic wrapping material. A more in-depth discussion and itemized listing of the artifacts is found in Chapter 5. All of the recovered artifacts appear to be from the twentieth century, *circa* 1940-1980.

Food remains consisting of shellfish and vertebrate bones were found throughout the platform fill; these materials included six varieties of shellfish and Echinoidea (135 items total), 87 fish bones and 71 bones representing various mammals, including cow and pig (*Table 4.14*). Most of the large and medium animal bones showed evidence of butchering with a fine-toothed saw. Also recovered from the fill was 1,022.60 grams of charred wood pieces, many of which were from milled lumber.

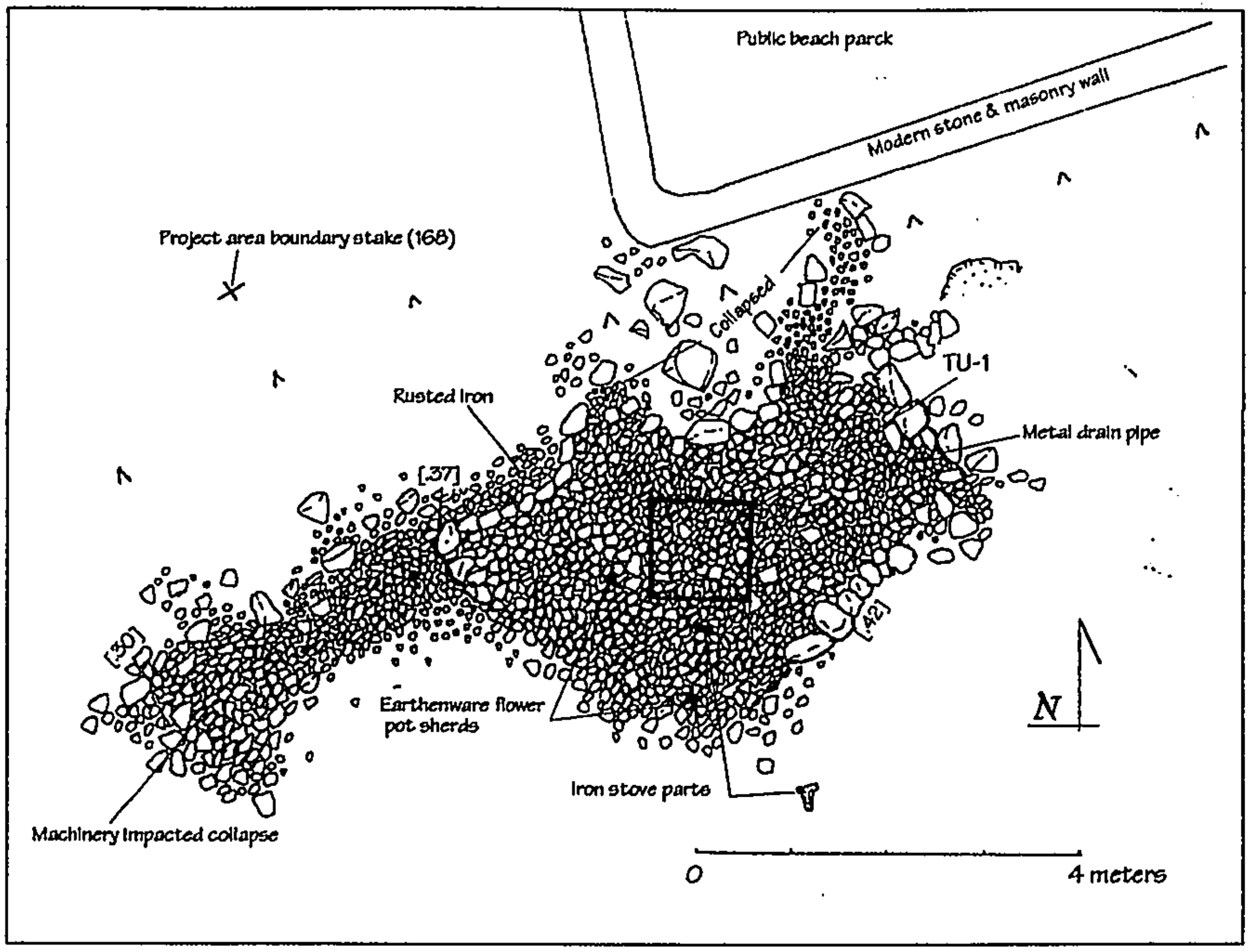
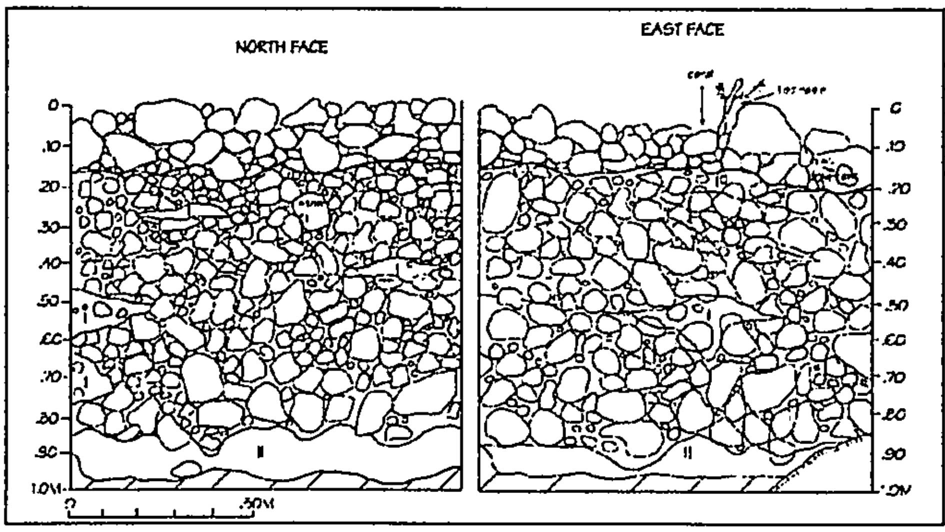


Figure 4.44 Scaled Plan Map, Site 5708 Feature 1



I: (.15-.85) dark brown (10YR 3/3 moist) gravelly loamy sand (10YR6/3-5/3 dry), 0vfsg, loose, nonsticky, nonplastic, few fine to coarse roots, diffuse, broken boundary; pockets of light brownish gray (10YR6/2) ash throughout.

II: (.85-1.00) dark brown (10YR3/3 moist) silty loam (10YR4/4 dry), 3msbk, hard, friable, nonsticky, nonplastic, few coarse roots, grades into aa flow

Figure 4.45 Site 5708 Feature 1, Test Unit 1 Profiles

SITE 5708 Feature 1																
TU-1	Level 1		Level 2		Level 3		Level 4		Level 5		Level 6		Level 7		Total	
Depth	.15-.25		.25-.35		.35-.45		.45-.55		.55-.65		.65-.75		.75-.85			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae	4	18.50			2	2.80					2	3.00			8	24.10
Cypraeidae	5	3.65	3	3.80	5	5.50			4	7.70	1	2.70	2	2.30	20	25.65
Nerita picea	2	1.10	4	1.50	4	1.00	9	2.80	11	3.10	1	0.30	1	0.20	32	10.00
Patellidae	1	2.50													1	2.50
Unidentifiable	1	0.10							2	0.30					3	0.40
Bivalves																
Spondylidae									2	0.50					2	0.50
Tellinidae			1	0.70											1	0.70
Echinoidea																
Mouth									1	0.10					1	0.10
Spine							1	0.20							1	0.20
Shell	60	7.30	2	0.20			1	0.10							63	7.60
Crustacea									3	0.60					3	0.80
Total Shellfish	73	33.15	10	6.20	11	9.10	11	3.10	23	12.50	4	6.00	3	2.50	135	72.65
Vertebrates																
Fish	17	1.30	10	0.40	3	0.05	19	2.32	19	0.60	13	1.10	6	0.70	87	6.47
Rodent											1	0.10			1	0.10
Indet. Mammal	14	1.10	5	7.75			3	0.20							22	9.05
Small Mammal											1	0.10			1	0.10
Med. Mammal	12	6.90	1	0.70											13	7.60
Lg. Mammal	28	44.50	1	1.30	1	8.30	3	2.50			2	1.90			35	58.50
Total Vertebrates	71	63.80	17	10.15	4	8.35	25	5.02	19	0.60	17	3.20	6	0.70	159	81.82
Coral																
Waterworn	3	8.30													3	8.30
Weathered Frags.	1	8.90													1	8.90
Other																
Waterworn basalt	7	42.80			1	1.60									8	44.40
Waterworn shell			1	7.50											1	7.50
TOTAL	155	146.95	28	23.85	16	19.05	36	8.12	42	13.10	21	9.20	9	3.20	307	223.47
Charcoal		517.70		153.00		161.30		83.40		45.50		20.20		41.50		1022.60

Table 4.14 Midden and Portable Materials, Site 5708 Feature 1, Test Unit 1

Modern artifacts and debris was present through all levels of the platform fill, which terminated on sterile silty clay loam subsoil. This feature was therefore determined to be modern in construction and use and appears to represent a rubbish burning/disposal area that was located away from the house (Feature 2) area. The residents apparently built the platform up as the rubbish accumulated, resulting in a nicely contained disposal area.

Site 5708 Feature 2

Feature 2 is a former dwelling site that was razed, most likely during development of the Prince Hotel and beach park. The Feature consists of two linear push-piles (Features 2A and B), a pile of structural lumber, and a circular concrete-capped cesspool (Feature 2C; *Figure 4.46*). Overall area of the feature is 36.0 meters E-W by 12.0 metes N-S. The two push-piles are located to the west of the cesspool, and may correspond with locations of former retaining walls that served as a base for the dwelling foundation. The piles consist of various-sized boulders and cobbles with waterworn cobbles and pebbles intermixed (*Photo 4.32*). Pieces of rusted iron, hog wire fencing, copper flashing, window screen, and cookware are intermixed with the pushed stones. The structural lumber is located immediately north of the cesspool cap; it is mixed with pieces of window screen and round wire nails. This appears to represent a small out- building or shed.

The cesspool cap is 4.6 meters in diameter and is currently 0.60 meter above surrounding ground surface (*Photo 4.33*). A mound of broken stone and soil is present adjacent to the east sides of the concrete structure. This appears to be material that was removed during excavation for the cesspool. Construction material, structural remains and artifacts observed at Feature 2 are consistent with the modern age associated with Feature 1. It is likely that this house was built *circa* 1940-50 and was occupied until the early to middle 1980s. This home had piped-in water, as indicated by a surface metal water line that is still present along the west side of Mākena-Keoneʻōʻio Road.

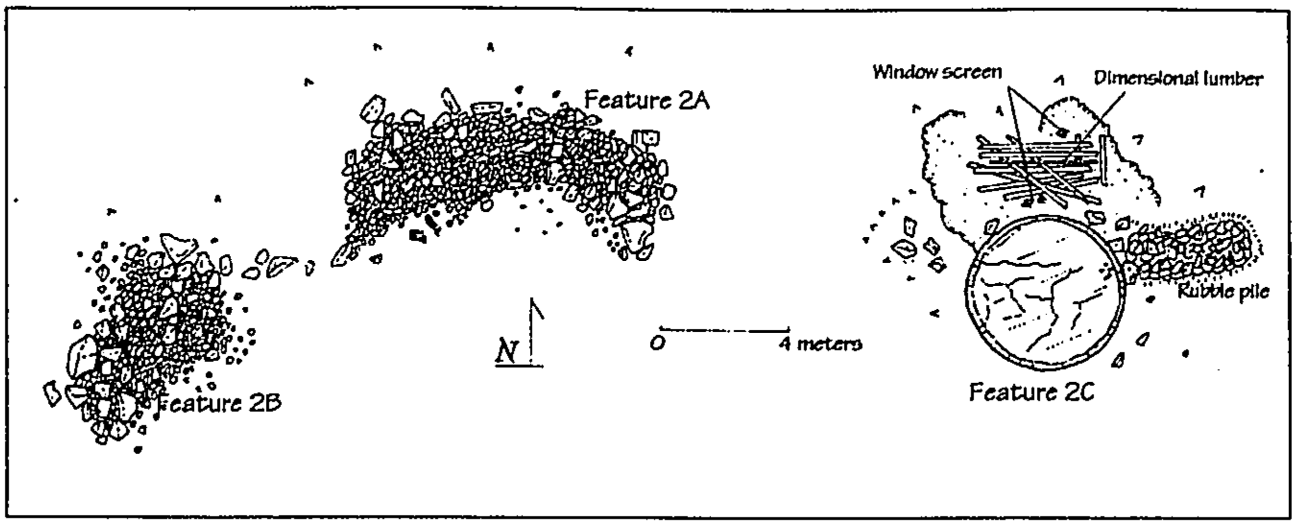


Figure 4.46 Scaled Plan Map, Site 5708 Feature 2

Site 5708 Feature 3

This artifact and midden concentration is located 12.0 meters west from Feature 1, and is situated along the western edge of Parcel 56. The area of the feature has been impacted by bulldozing and grading associated with golf course construction. The disturbed remains of what may be a former wall are located within the area of this feature, which is 21.0 meters N-S by 8.0 meters E-W (*Figure 4.47*).

The surface within the feature area is littered with broken bottle glass sherds, metal artifacts such as metal water pipes and window screen, and plastic and cloth items from recent camping episodes. One area of interest within the feature appeared to be a natural overhang shelter with a soil deposit (*Photo 4.34*). This area is located along the west face of a tall boulder outcrop formation that was incorporated into the wall. A small area roughly 2.0 meters in diameter was present between the edge of pushed boulders and the outcrop face, and a small section of this area was beneath a small rock ledge. The sheltered area showed evidence of recent camping and the surface was scattered with plastic bags, and clothing (adult female and child). Also present was a hair dryer, several small bottles of shampoo and lotion, cassette tapes and two gym bags. This material was cleared from the surface and a 1.0 by 1.0 meter unit was excavated to determine whether the sheltered area had evidence of prior use. The southern 0.5 to 0.25 meter of the test unit was located beneath the rock overhang and the remainder of the unit was in open air.

The ground surface prior to excavation was level black loamy topsoil that showed no evidence of prior disturbance. This appearance proved to be quite deceiving; as the excavation proceeded, it became clear that a highly concentrated secondary deposit of rubbish was present. Three soil layers were discernible, however, the upper two levels did not correlate with changes in portable remains (*Figure 4.48*).

Layer I was 0.10 meter thick and consisted of very dark brown loamy sand with a high concentration of historic/modern rubbish and midden. Two levels of this soil layer were excavated, both of which exhibited high concentrations of material. A total of 1,146 items, including 450 pieces of glass, 647 pieces of metal, mortar, plastic, rubber, wood and shell were recovered from the upper 0.10 meter-thick level of Layer I. In addition, 242.85 grams of marine shellfish, 120.50 grams of vertebrate bones and 1,170.4 grams of waterworn basalt pebbles were collected (*Table 4.15*). Level 2 showed similar quantities of all materials, except metal, which increased in frequency. A total of 1,481 items were recovered from this 0.10 meter-thick level. Most of this material (74%) is metal, of which 769 items were complete or partial food cans. These included tall (No. 303) cans as well as tuna, sardine, and Spam cans. Intermixed with the twentieth century debris were a few hand-stamped ceramic sherds and bone buttons which could date to the nineteenth century.

Layer II soil consisted of compact black stony sandy loam with ash mottling and an increased amount of charcoal. The predominant charred material in in this and all other excavations levels consisted of

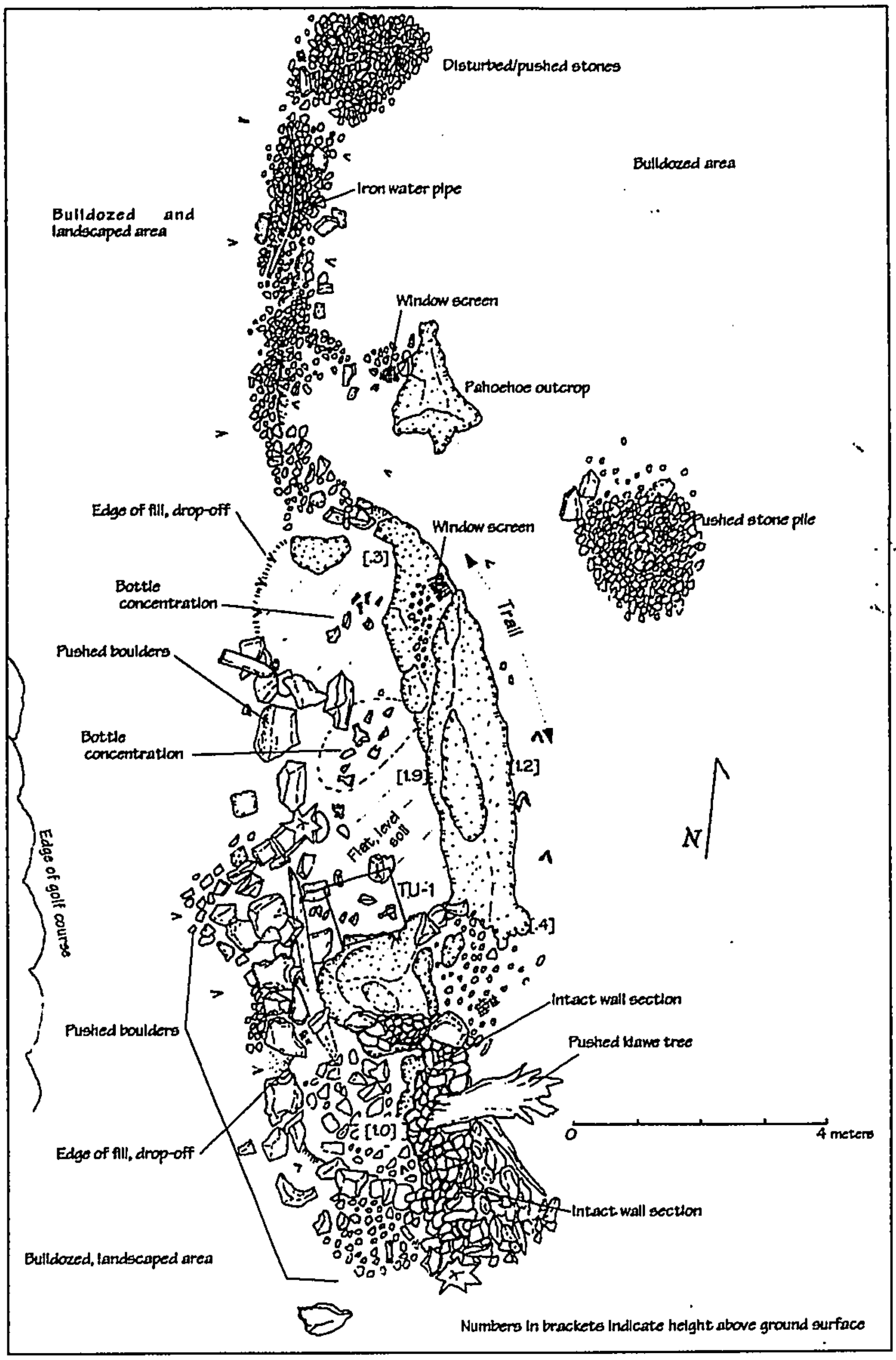


Figure 4.47 Scaled Plan Map, Site 5708 Feature 3

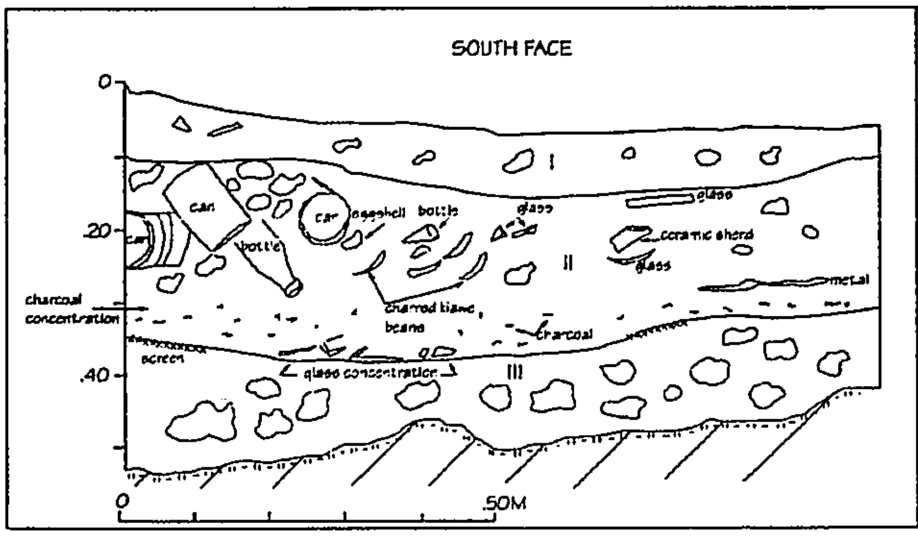
kiawe beans. These items were not retained for weighing, and the charcoal weights reported here reflect charred wood. Two levels of Layer II were excavated; the first level showed frequencies of modern debris similar to I-2, while the lower level showed a decrease in all material categories except ceramics and mortar. A total of 2,284 items were collected from Layer II, most of which (63%) occurred in II-1. Midden frequencies were similar for both of the Layer II levels, which showed a decrease from the Layer I concentrations (*Table 4.15*).

The base of the debris deposit was at the base of Layer II, and was defined by a metal window screen that had been placed over the former surface at this location. Layer III soil below the screen was brown (dry) gravelly silty loam with a sparse amount of marine midden and no artifacts (*Photo 4.35*).

The window screen is identical to other pieces that are laying about on the surface at Feature 3, which were probably set at this location in the 1970's of 80's. The screen appears to be the only subsurface artifact that was in a primary context. All the other material was apparently either pushed into the overhang from the golf course area, or tossed in over the rock face from the east side. The presence of the high bedrock face along the east side of the deposit would have prohibited it being pushed by machinery from the Feature 1 area. The compacted and mixed nature of the deposit tends to support an interpretation that the material was pushed from the west side. Thus, it could have originated from Site Ma-B8-237, one of two historic/modern house sites that were extant in the golf course area in 1978 (Haun 1978, Cordy 1978). The location of Feature 3 is also near the inland extent of Nawaiki's houselot (LCA 5402B:4).

Results of testing indicated that the artifact and midden deposit at Feature 3 is secondary and mixed. In addition to the historic/modern materials, traditional Hawaiian artifacts including two volcanic glass flakes, a ground stone fragment and a basalt flake were recovered from Layer I. The presence of these items, as well as the nineteenth century artifacts in Layer I suggests a reverse stratigraphy which would have resulted if materials were pushed into the feature area rather than deposited or accumulated gradually over time.

The Feature 3 deposit appears to be mostly contemporaneous with the deposits at Feature 1 and 2; however, it appears that the Feature 3 originated from a different habitation area. For example, the Feature 1 artifact collection included no shell or bone buttons, whereas the Feature 3 collection included 15 shell buttons and two bone buttons. Also, Feature 3 contained 154 crown bottle caps, whereas Feature 1 had only eight. No whiteware was found at Feature 1, while nine whiteware sherds were recovered from Feature 3. It also appears that the Feature 3 artifact collection contains some twentieth century items that pre-date 1940. There are also differences between the faunal collections from Features 1 and 3; these are discussed in Chapter 5.



I: (0-.15) pale brown and very dark brown (10YR6/3, 2/2 moist and dry) loamy sand, 0vfsg, loose, nonsticky, nonplastic, fine roots common, diffuse, broken boundary.

II: (.15-.43) black (10YR2/1 moist) sandy loam (10YR2/2 dry), 0vfsg, loose, nonsticky, nonplastic, few coarse roots, clear, smooth boundary.

III: (.43-.55) very dark brown (10YR2/2 moist) gravelly silt loam (10YR4/3 dry), 1fsg/cr, soft, very firable, nonsticky, nonplastic, grades into aa flow.

Figure 4.48 Site 5708 Feature 3, Test Unit 1 Profile

SITE 5708 Feature 3

TU-1	I-1		I-2		II-1		II-2		III-1		Total	
Depth	0/.08-.15		.15-.20/.23		.20/.23-.30		.30-.40/.43		.40-.43/.55			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae	1	2.40	2	1.10	4	1.80	3	6.40			10	11.70
Cypraeidae	104	83.10	40	33.40	45	54.60	31	22.80	6	1.20	226	195.10
Euplica turturina	1	0.40	1	0.30							2	0.70
Litorina pintado	1	0.10	3	1.40							4	1.50
Nerita picea	324	108.30	209	59.80	78	23.20	38	10.60	1	0.2	650	202.10
Patellidae	96	40.80	55	21.40	44	8.60	37	8.40			232	79.20
Planaxis labiosa	3	0.10									3	0.10
Thaididae			1	0.20	3	10.60	8	13.40	1	0.3	13	24.50
Drupa morum	1	3.70			2	5.20					3	8.90
Drupa rubusidaeus	2	2.80									2	2.80
Morula granulata	1	1.30									1	1.30
Neothais harpa					1	0.50					1	0.50
Unidentifiable	2	0.35					1	0.40			3	0.75
Bivalves			1	0.20							1	0.20
Isognominidae	2	0.40	3	0.20			1	0.30	1	0.20	7	1.10
Echinoidea												
Mouth			1	0.30							1	0.30
Spine	2	0.40	3	0.50	6	1.20	8	3.25			19	5.35
Shell	3	0.40	30	1.80	1	0.20	2	1.50			36	3.90
Crustacea					2	0.60					2	0.60
Total Shellfish	**543**	**242.85**	**349**	**120.60**	**106**	**106.50**	**129**	**67.05**	**9**	**1.90**	**1216**	**540.60**
Vertebrates												
Fish	7	0.50	11	1.30	9	1.80	4	0.10			31	3.70
Fowl			7	1.00	2	0.30	6	0.90			15	2.20
Fowl-eggshell	3	0.10	2	0.10	7	0.25	12	0.50	1	0.10	25	1.06
Indet. Mammal	6	1.60									6	1.60
Small Mammal	2	1.20									2	1.20
Med. Mammal	30	10.10	42	12.50	49	18.00	42	13.30			163	53.90
Lg. Mammal	36	107.00	35	72.30	12	11.20	27	122.60	2	4.90	112	318.00
Total Vertebrates	**84**	**120.50**	**97**	**87.10**	**79**	**31.55**	**91**	**137.40**	**3**	**5.00**	**354**	**381.66**
Coral												
Burned	3	2.30									3	2.30
Waterworn	8	40.00	7	7.30	7	10.50	3	0.80			25	58.60
Weathered Frags.	6	37.20			6	8.00	8	6.80			20	52.00
Other												
Charcoal	15	7.50		47.20		32.60		39.80		2.00		129.10
Kukui Nut - unburned	1	0.40									1	0.40
Waterworn basalt	224	1170.40	72	240.00	68	182.00	40	127.00	7	33.50	411	1752.90
Waterworn shell	4	1.60	5	4.80	8	17.40	9	7.10			26	30.90
TOTAL	**892**	**1622.75**	**530**	**507.00**	**274**	**388.55**	**280**	**385.95**	**19**	**42.40**	**2056**	**2948.48**

Table 4.15 Midden and Portable Materials, Site 5708 Feature 3

Site 5709

Site 5709 was recorded in 2001 and was identified as a set of two parallel wall features that "..have been bulldozed such that the original length of these walls (*sic*) segments is inconclusive" (Rotunno-Hazuka et al. 2005:41). The area of Site 5709 was re-examined and four additional stone features were identified along a bulldozed swale that had apparently been constructed as part of drainage improvements for Makena-Keone'ō'io Road. The path of the swale is shown in Figure 2.3. The two wall segments originally identified as Site 5709 are situated along opposite banks of the swale, which is 4.6 to 5.0 meters wide at this feature, which has been designated as Feature 1 (*Figure 4.49*). Two linear rock piles are situated along the east side of the swale and were found to be bulldozer tailings. One oval mound situated above and to the west of the swale may predate the swale construction. It is described here as Feature 2.

Feature 1 represents the remnants of some type of stone construction that was directly impacted by machinery (*Photo 4.36*). The two wall-like features are possibly remnants of a larger structure that was cut through the center, pushing boulders and cobbles to both sides in a linear formation. Presently, the western formation is 9.6 meters long, 0.60 to 1.10 meter wide, and 0.3 to 0.55 meter high. The eastern formation is 8.5 meters long, 0.7 to 1.2 meters wide, and 0.35 to 0.40 meter high. The remnants of a wire fence line and downed fencepost are present in the swale at the north edge of Feature 1. This fence line is part of Site 5797, which runs E-W from across Parcel 37. The wire and post fence runs along the entire length of Site 5797, and portions of the fence line are defined by stone walls. It is possible that a stone wall was present in this area of Site 5797 and was pushed aside as the swale was cut. Remnants of a wall are present along the fence line to the northeast of the eastern formation. Portable remains observed on the surface include broken clear bottle glass.

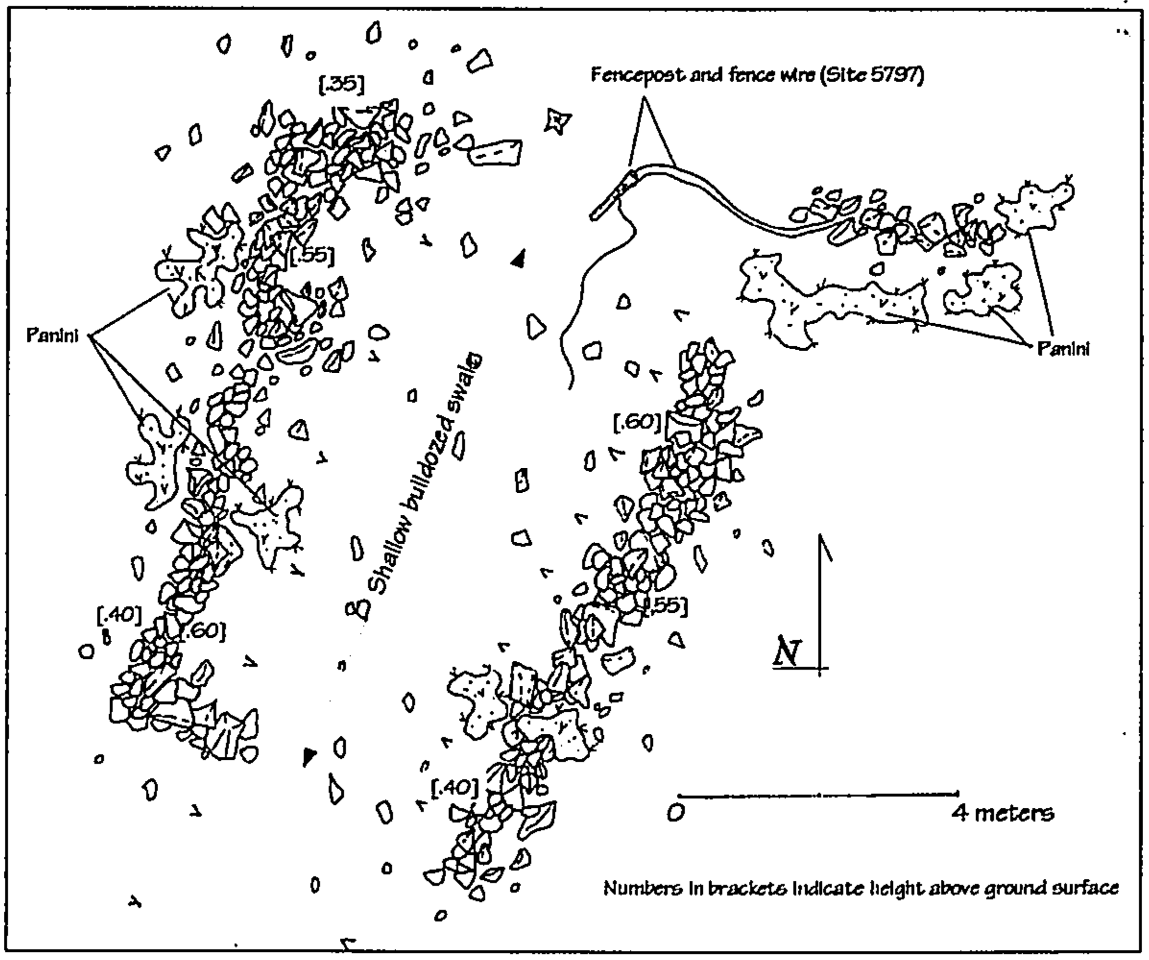


Figure 4.49 Scaled Plan Map, Site 5709 Feature 1

Site 5709 Feature 2

This newly identified oval stone mound is located 42.0 meters south from Feature 1 and 3.0 meters south from the east bank of the bulldozed drainage swale that bisects Feature 1. This mound appears to have been constructed by hand; however, it is within the area that was impacted by the swale construction. A linear stone mound that is an obvious bulldozer tailing is 16.0 meters to the northeast, at the same elevation contour.

Feature 2 is situated on a low bedrock knoll and is surrounded by generally rocky terrain with little to no soil accumulation indicated. It was constructed from loosely stacked and piled boulders and cobbles, with no formal perimeter definition or facing (*Figure 4.50*). The mound is 3.2 meter NE-SW by 2.1 meters NW-SE and has a maximum height of 0.46 meter in the center, where it is a maximum of three courses high. The sides of the mound show one to two courses of boulders or cobbles. There is no indication of soil or subsurface deposits beneath the mound. No portable remains or artifacts were observed on the surface near this feature.

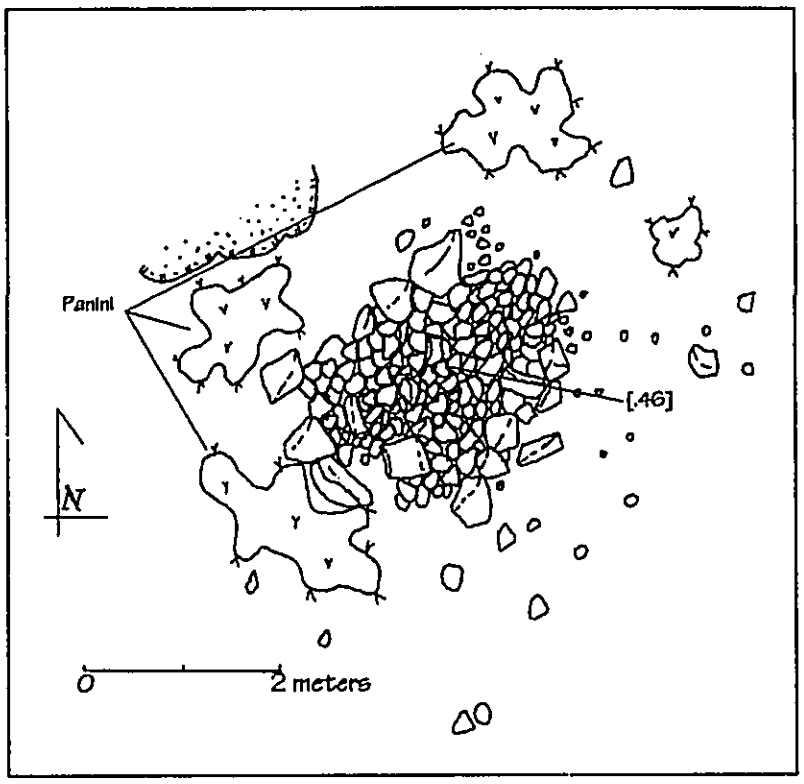


Figure 4.50 Scaled Plan Map, Site 5709 Feature 2

A general functional interpretation would be that Feature 2 is the byproduct of land clearing. In this case, the clearing could have been in connection with ranching or the drainage swale construction. Agricultural clearing is less likely for this location, due to the paucity of soil in the area of the mound, and the absence of other agricultural clearing mounds.

Age is likely to be either historic, if associated with ranching; or modern, if associated with swale construction. It is not likely that subsurface testing will result in new information; the natural bedrock surface is visible beneath the mound.

Site 5710

This site number was originally assigned to the Site 2272 Feature 1 wall (Rotunno-Hazuka et al. 2005). During the current survey, the number was re-assigned to an agricultural complex located within the Parcel 37 gulch (*Figure 4.1*). This complex is comprised of 13 features, all of which are newly-identified. The overall area of Site 5710 is 91.0 meters NE-SW by 64.0 meters NW-SE. Much of the site area consists of relatively steep gulch slopes (*Figure 4.1*).

Feature 1 is a stone-filled terrace located along the top of the south-facing gulch bank, 13.0 meters east from the north end of Feature 2. It is constructed along a narrow natural flat area formed by exposed bedrock (*Figure 4.51*). The upper (north) side of the terrace is a natural vertical face, against which small to large cobbles were collected. The western end of the cobble area exhibits a U-shaped clearing with exposed soil. Overall length of the filled area is 13.0 meters NW-SE by 1.0 to 3.0 meters. The clearing is 2.0 meters NE-SW by 1.4 meters. The vertical face along the uphill side of the terrace is 1.0 meters high at the east end and 0.40 meter high at the west end. The surface of the filled area drops off 0.50-0.80 meter along the downhill side.

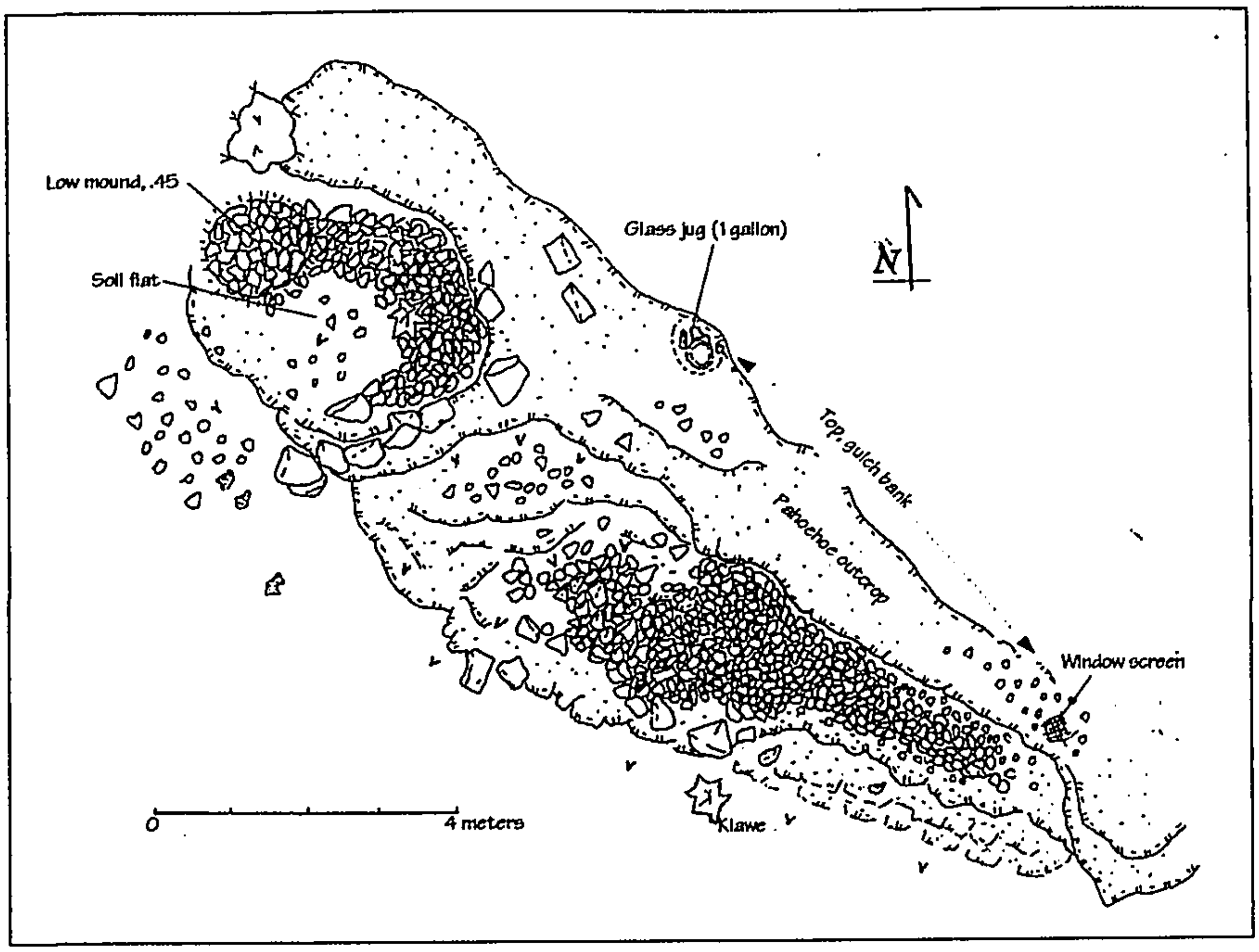


Figure 4.51 Scaled Plan Map, Site 5710 Feature 1

Three weathered coral fragments were observed on the surface immediately downslope from the cleared soil area. Other artifacts found on the surface include a broken clear glass jar along the uphill side, a piece of metal window screen at the east end of the terrace, and a piece of saw-cut wood near the broken jar. These latter items probably represent limited use of the area by modern planters.

Site 5710 Feature 2 is a field road that crosses the gulch in a generally N-S direction (*Photo 4.37*). The south end of the road is discernible at the Site 5707 area, where evidence of bulldozing is apparent. The north end is apparent at the upper edge of the gulch, where it connects with a larger bulldozed area along the top of the gulch bank. The section of the road that has associated stone piles and tailings in the gulch is 66.0 meters long and has a surface width of 2.0 to 2.6 meters. Average width of the trail from the outer edges of pushed rubble is 4.2 meters. The edges are defined by loosely piled boulders and cobbles which have been pushed to the sides by machinery. The road is slightly elevated (filled) across the lowest points in the gulch, and indications of bulldozing outside the road corridor are present in this area (*Figure 4. 52*). The surface is currently eroded, as is it being rather intensively used by deer. The overall structure of the road suggests that it was cut by a relatively small dozer, rather than the type commonly used for modern mass grading projects such as the golf course. It is therefore possible that this feature was built by the ranch and could be over 50 years in age.

Site 5710 Feature 3 is located along the upper slope, at the eastern end of the gulch, 2.0 meters south from the Site 5797 fence line. It consists of a small enclosure that was formed by construction of a curved wall against a bedrock face and shallow overhang (*Figure 4. 53, Photo 4.38*). The wall has an overall length of 4.8 meters and it encloses an area 1.6 meters in diameter, with the eastern 0.35 meters located beneath a 0.85 meter-high overhang. The wall averages 0.45 meter wide and height ranges from 0.10 to

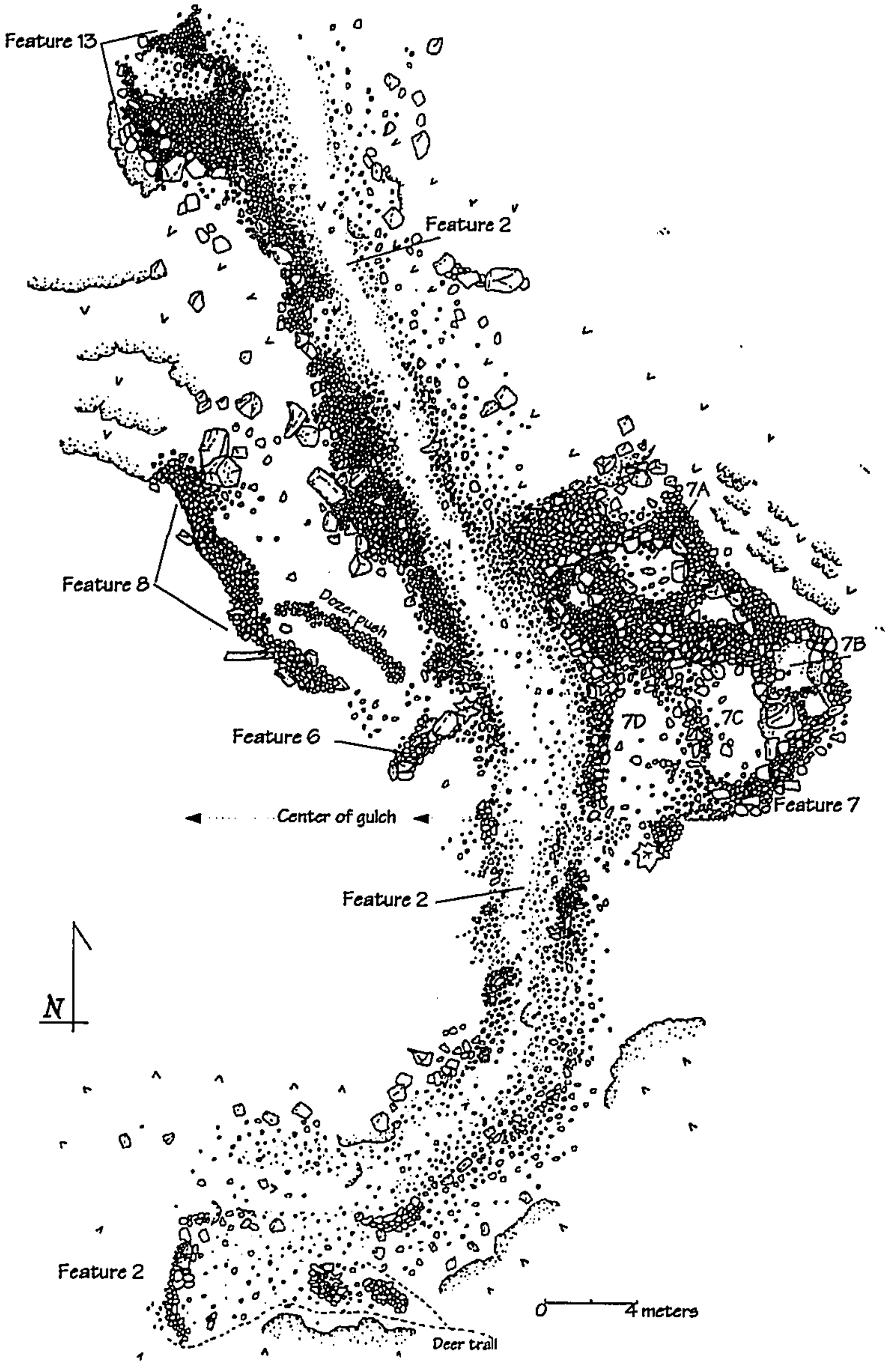


Figure 4.52 Scaled Plan Map, Site 5710 Features 2, 6-8, and 13

0.55 meter. Construction is simple stacking, with subangular boulders and cobbles stacked one to three courses high and one to two stones wide. The interior area is level and has a soil surface. A rusted tin can was observed on the surface inside the wall, and two broken clear glass gallon jugs are present just outside the wall to the west.

A 1.0 by 1.0 meter test unit was excavated inside the enclosure in order to better determine its age and function. One thin soil layer was present, which extended to a varied depth of 0.06 to 0.09 meters below surface. This soil was dark brown (10YR3/3) loam with organic duff and rootlets, over the solid bedrock surface. Artifacts recovered during testing include 156 pieces of a single tin can (3 lb coffee can) that were scattered on the surface and in Layer I soil. Other portable materials include a single *Nerita picea* shell, one unidentifiable shell, two waterworn coral pebbles and one tiny piece (0.15 gram) of weathered coral.

The artifacts associated with Feature 3 indicate its use during the modern era, most likely for specialized planting. The wall construction and condition is such that it too could be modern. The portable remains were probably present in the soil prior to the construction of the wall. The soil may well have been imported to this location, as it does not conform with the naturally occurring Layer II stony silty clay loam that generally overlies bedrock in this area. A possible source is the bag of potting soil at Feature 4.

Site 5710 Feature 4

This soil-filled terrace is located 7.0 meters north from Feature 3, at the same elevation contour along the upper slope of the gulch. The terrace is defined along the eastern (upslope) side by the vertical face of an exposed bedrock ledge. The west side is defined by a modified bedrock ledge that forms a retaining wall for the soil. Overall area of the terrace is 6.0 meters N-S by 3.2 meters E-W; the level soil deposit is 4.0 meters N-S by 2.0 meters E-W. The constructed portion of the retaining wall is 6.0 meters long (N-S) and 0.8 to 1.5 meters wide. The interior side of the wall is 0.15 meter high to level with the terrace surface; the exterior side is 0.90 to 1.30 meters high. A large plastic bag containing potting soil is located on the soil flat, inside the retaining wall.

A 0.5 by 0.5 meter shovel test was excavated in the soil deposit of Feature 4 in order to better determine age and function (*Figure 4.53*). Two soil layers were encountered - Layer I consisted of dark brown (moist and dry) silty loam with few stones, and Layer II consisted of dark yellowish brown (dry) silty clay loam over solid bedrock. Two levels were excavated in Layer I, which extended to 0.18 meter below surface. One *Patellidae* shell fragment was found in Layer I-2, and charcoal fragments were found in both levels (*Table 4. 16*). No portable remains were found in Layer II, which was 0.10 meter thick.

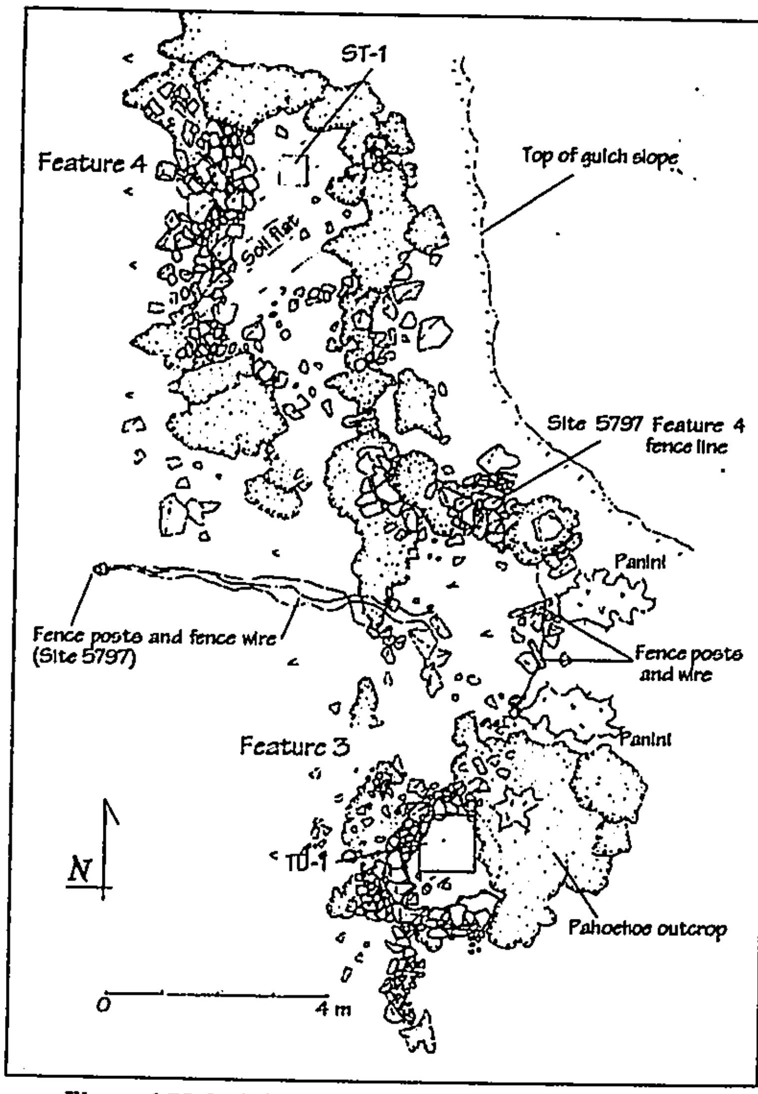


Figure 4.53 Scaled Plan Map, Site 5710 Features 3 and 4

The soil deposit at Feature 4 appeared to have developed *in situ*, and although evidence of use during the modern era is apparent, there is no overwhelming indication that this terrace was recently constructed. It may therefore represent a case of reuse.

SITE 5710 Feature 4				
ST-1	I-1		I-2	
Depth	0-.10		.10-.18	
Gastropods	Cnt.	Wt.	Cnt.	Wt.
Patellidae			1	1.90
Other				
Charcoal	16	1.60	48	3.00
TOTAL	16	1.60	49	4.90

Table 4.16 Portable material, Site 5710 Feature 4, Shovel Test 1

Site 5710 Feature 5

Feature 5 is located roughly midway along the southeastern slope of the gulch, downhill from Features 3 and 4, and 2.0 meters south of the Site 5797 fence line and a stone wall section. Two soil terraces (5A and 5B) with stone retaining walls are present at this location (*Figure 4. 54*). Feature 5A is located just upslope from Feature 5B. It consists of a terrace wall constructed from stacked basalt cobbles and boulders that incorporates an existing natural bedrock step. The wall is 5.2 meters long, oriented NE-SW, and 1.8 meters wide. Two to three courses of stones are stacked to a maximum height of 1.10 meter along the downhill side of the wall, and 0.15 meter along the uphill side. A level soil area is present behind the wall on the uphill side; it is 3.8 meters long and has a maximum width of 2.0 meters. No portable remains were observed on or near this terrace.

Feature 5B is located 1.6 to 3.0 meters west of 5A, downslope. It is a soil terrace with a stone retaining wall along one (west) side. The wall is 5.2 meters long by 0.65 to 1.0 meter wide. Height along the downslope side is 0.50 to 0.70 meters, and along the uphill side is 0.15 to 0.30 meter. The wall is constructed from two to three courses angular boulders, and cobbles, with smaller cobbles along the top of the wall. No portable remains were observed on or near this terrace.

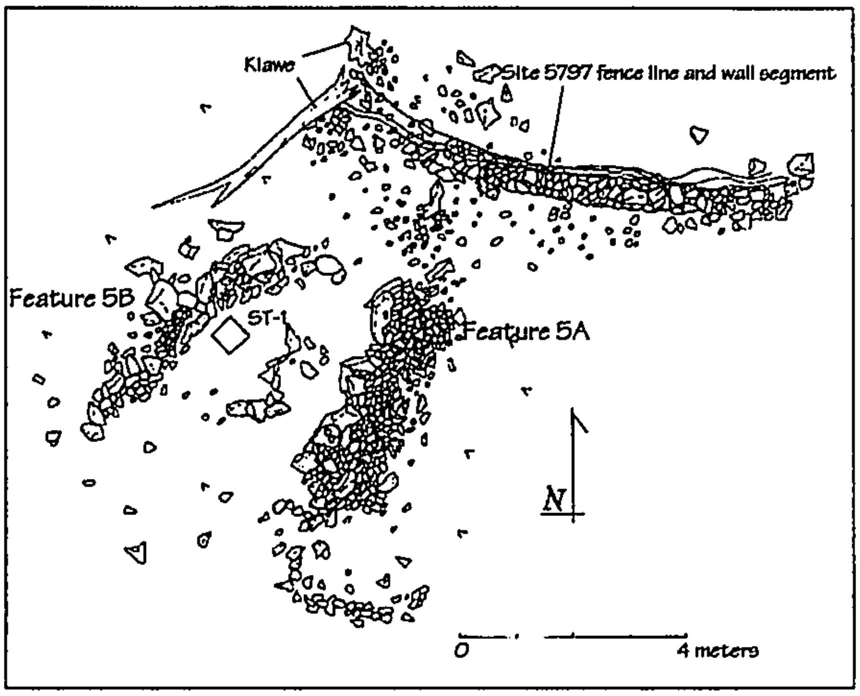


Figure 4.54 Scaled Plan Map, Site 5710 Feature 5

A 0.50 by 0.50 meter shovel test was excavated in the soil at Feature 5B. One layer of dark brown (10YR3/3) silty loam was encountered to a depth of 0.15 meter. No portable remains were recovered from the screened soil. Layer I rested on solid bedrock, and the shovel test was terminated at 0.15 meter below surface.

Both of the terraces at Feature 5 are agricultural in function. No clear evidence indicating age was found at the feature, which could represent traditional Hawaiian or more recent specialized planting activities.

Site 5710 Feature 6

This linear mound feature is located in the center of the gulch, adjacent to the west side of the Feature 2 trail (*Figure 4.52, Photo 4.39*). It is constructed against a bedrock boulder and consists of loosely stacked subangular boulders and cobbles. The perimeters of the mound are informal, and there are no indication of former faced sides. It is oriented NE-SW and is 3.5 meter long by 1.0 meter wide. Maximum height in the center is 0.88 meter. A large *kiawe* tree is located at the eastern end of the mound and has somewhat affected its general configuration. Evidence of bulldozer activity is apparent to the east (Feature 2) and to the north of the mound, where a linear tailing formation occurs. It is uncertain whether Feature 6 was affected by machinery; however, given its location, it is likely that it was affected.

An isolated weathered coral cobble is present 1.0 meter south of the mound; no additional portable remains were observed on the surface.

Feature 6 is probably associated functionally with Feature 7, located immediately across the Feature 2 trail/road. The road may have removed additional features that were located between these two areas. General function of Features 6 and 7 is agricultural, most likely traditional Hawaiian.

Site 5710 Feature 7

Feature 7 is an area of modified bedrock outcrops and small clearings located in the center of the gulch, adjacent to the east side of Feature 2 (*Figure 4.52, Photo 4.40*). Three informal terraces are stair-stepped from north to south, and each has a small cleared planting area. Overall area of the feature is 16.0 meters NW-SE by 10.0 meters.

Feature 7A, the uppermost terrace, is primarily a natural ledge that has been modified along the front with aligned to stacked boulders. The northwestern end of the terrace abuts the Feature 2 trail and was probably impacted during trail construction. It is presently in poor condition and much of the front retaining wall has collapsed. Exterior dimensions are 6.2 meters NW-SE by 4.2 meters. The interior area is 5.0 by 2.0 meter. Maximum height of the front face is currently 0.45 meter, with an average of 0.25 meter. Much of the stone material on this terrace is naturally fractured bedrock. The soil clearing is situated against the back, which is formed by a bedrock ledge averaging 0.50 meter high. The clearing is roughly circular, at 2.0 to 1.8 meters in diameter. No portable remains were observed on this terrace.

Feature 7B is adjacent to the south end of Feature 7A, with the front facing west. It is of similar construction, with informal modification of existing bedrock formations. The overall terrace area is 4.3 meters N-S by 3.0 meters E-W, and the interior area is 4.0 meters by 1.0 meter. The soil clearing in the center of the terrace is 2.0 meters N-S by 1.0 meter. The front face consists of a single course of small boulders and has a maximum height of 0.37 meters. This terrace is also in a collapsed state, and no portable remains were observed on the surface.

Feature 7C is immediately downslope and adjacent to the west side of Feature 7B. It is a poorly defined soil clearing on a natural bedrock ledge that is defined by cleared stones that are informally placed along the edges. The southern edge is defined by a natural bedrock formation. Overall area is 5.5 meters N-S by 3.0 meters E-W, and the interior is 4.0 by 2.0 meters. The front is presently collapsed and is currently one course high, with an average of 0.35 meter. No portable remains were observed on the surface of this terrace.

Feature 7D is immediately downslope and adjacent to the west side of Feature 7C. It also abuts the south side of Feature 7A, which forms the upslope perimeter of this terrace. The western edge of Feature 7D was impacted by the Feature 2 trail, and the edge of the trail currently defines the west side of this terrace. Overall area is 10.0 meters N-S by 3.8 meters E-W, and the interior area is 8.5 meters N-S by 1.5-2.0 meters. The south side of this terrace is very ill defined, and it was probably also impacted by the trail. No portable remains were observed on the surface.

All of the terraces at Feature 7 are in poor condition, suggesting that they are not of recent construction.

Site 5710 Feature 8

Feature 8 is a disturbed and poorly-preserved wall located along the lower north slope of the gulch, 4.0 to 5.0 meters west from the Feature 2 trail (*Figure 4. 52*). Overall length of the wall is 10.0 meters NW-SE, and the undisturbed portion at the north end is 3.5 meters long. Apparently, this wall once functioned as a terrace face; the undisturbed portion is 1.0 meter wide and it retains an area of stone fill 2.0 meters wide on the east (uphill) side. The base course of the wall at the north end is on a bedrock outcrop, where it is three courses (0.50 meter) high. A soil clearing is present to the north and west, which was probably the source area for the stone fill behind the wall.

Large boulders that were pushed from the trail corridor are adjacent to the north end of the wall, and a linear bulldozer tailing pile is parallel to the south portion. The south end of the disturbed wall section is 3.2 meters north from Feature 6, and the area between the two features is scattered with loose surface cobbles.

The original configuration of this wall is indeterminate, although it may have followed an alignment similar to its current position. No portable materials were observed on or near the feature. General function is believed to be agricultural, and it is most likely a traditional Hawaiian construction.

Site 5710 Feature 9

The Feature 9 area encompasses three small mounds and two informal terraces. It is located along the lower south slope of the gulch, adjacent to the north side of the Feature 2 road (*Figure 4.55, Photo 4.41*). Overall area of the feature is 14.0 meters E-W by 7.0 meters N-S. The components of this feature are in poor preservation and have been impacted by road construction, cattle, and deer.

Feature 9A is a stone mound located at the western end of the Feature 9 area. The mound is of loose construction and is situated on an exposed bedrock surface. It is comprised of small to large cobbles and pebbles, with no formal perimeter edges of faced sides. It measures 2.5 meters E-W by 1.1 meter and has a maximum height of 0.56 meter. No portable remains were observed on or around this mound.

Feature 9B is a terrace located at the eastern end of the feature area, adjacent to the Feature 2 trail. The front face of the terrace is constructed with aligned large cobbles and the back is defined by an exposed bedrock outcrop. The western half of the terrace was impacted by bulldozing during construction of Feature 2. Currently it is 4.1 meters E-W by 2.2 meters N-S overall , with an interior area of 2.8 by 1.1 meters. Maximum height along the front is 0.77 meter, with an average height of 0.45 meter. No soil clearing is present at this time; much of the stones inside the terrace appear to have been disturbed.

Feature 9C is a small stone mound located 1.0 meter downslope from Feature 9A. It is similar in construction to Feature 9A, with small to medium cobbles and pebbles informally piled on an exposed rock surface. The mound measures 1.6 meters E-W by 0.90 meter N-S and has a maximum height of 0.70 meter in the center. The south side is supported by a bedrock face. No portable remains were observed in the area of this mound.

Feature 9D is a small linear mound located 2.0 meters west of Feature 9C and slightly uphill. It is loosely constructed from cobbles and pebbles, and sits on an expose rock surface. It measures 1.5 meters E-W by 0.60 meter N-S and has a maximum height of 0.39 meter. Most of the mound is in a collapsed state and it appears to have been impacted by deer traffic. No portable remains were observed in the immediate area.

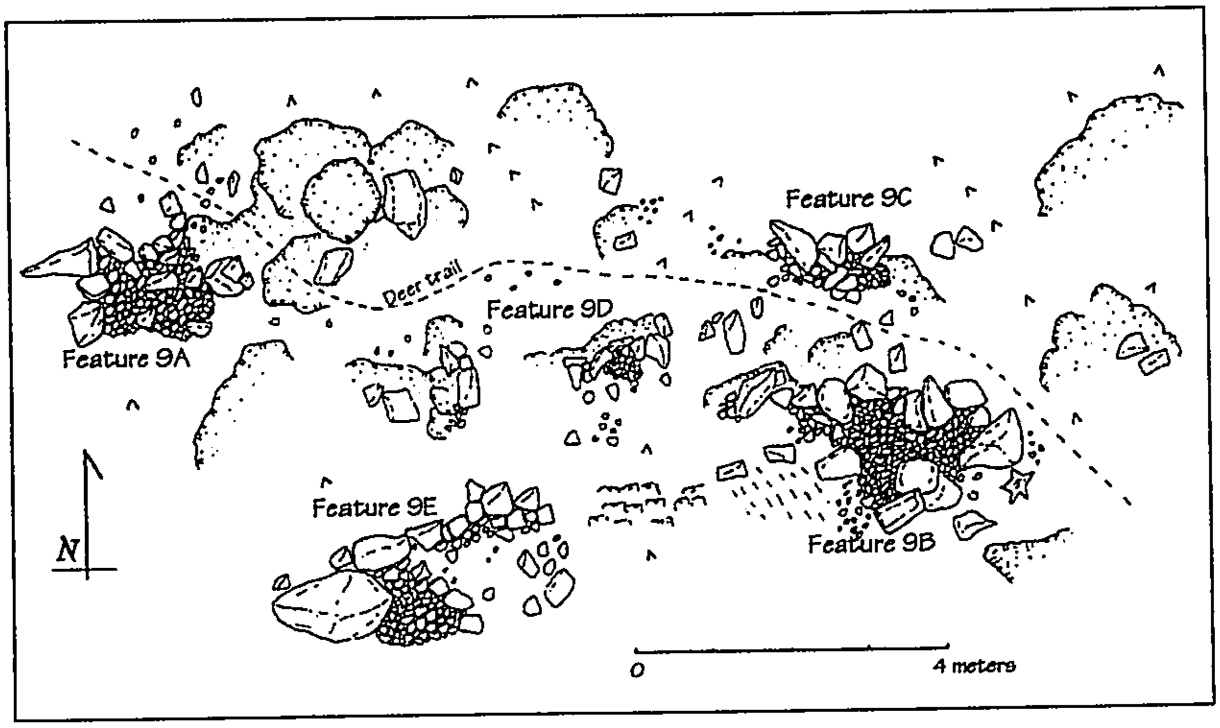


Figure 4.55 Scaled Plan Map, Site 5710 Feature 9

Feature 9E is an informal terrace located 1.6 meter south uphill from Feature 9D. It is defined by an alignment of small boulders along the front and an exposed bedrock face along the back. The surface of the terrace is generally cleared of stones, which have been concentrated to the west side of the clearing. Overall area is 2.6 meters E-W by 1.6 meters, and the interior area is 2.0 by 1.1 meter. The front facing is 0.55 to 0.40 meters high along the outside of the alignment. No portable remains were observed on or around this terrace.

Site 5710 Feature 10

Feature 10 is located at the top of the gulch along the back (east-facing) side, 11.0 meters upslope from Feature 3. It consists of a small cupboard, a terrace and a mound, within an overall area of 10.0 meters NE-SW by 4.0 meters (*Figure 4.56, Photo 4.42*).

Feature 10A, a small cupboard, is located at the eastern end of the feature area. It consists of a natural opening in a 1.5 meter-high bedrock face across which cobbles have been stacked two courses high to form a closed *puka*. The stacked cobbles are 0.37 meter high and 0.55 meter wide. The resulting cupboard is 0.60 meter square and 0.56 meter deep. A shallow soil deposit is present inside the cupboard, which is in relatively good condition. No portable materials were observed in or around the cupboard.

Feature 10B is a terrace constructed against the vertical face of an exposed bedrock outcrop. The front of the terrace is defined by aligned and stacked boulders and cobbles; it is 6.5 meter E/W by 1.3 meter wide, and the front has a maximum height of 0.56 meter, with an average of 0.35 meter. The front of the terrace is partially toppled, and no portable remains were observed on or around the feature.

Feature 10C is a small stone mound located at the eastern end of the Feature 10B terrace. The mound consists of various-sized cobbles that were informally set on and around naturally occurring bedrock boulders; it is 1.3 by 1.0 meter at the base and has a maximum height of 0.70 meter. It is probably associated with clearing and construction of the terrace.

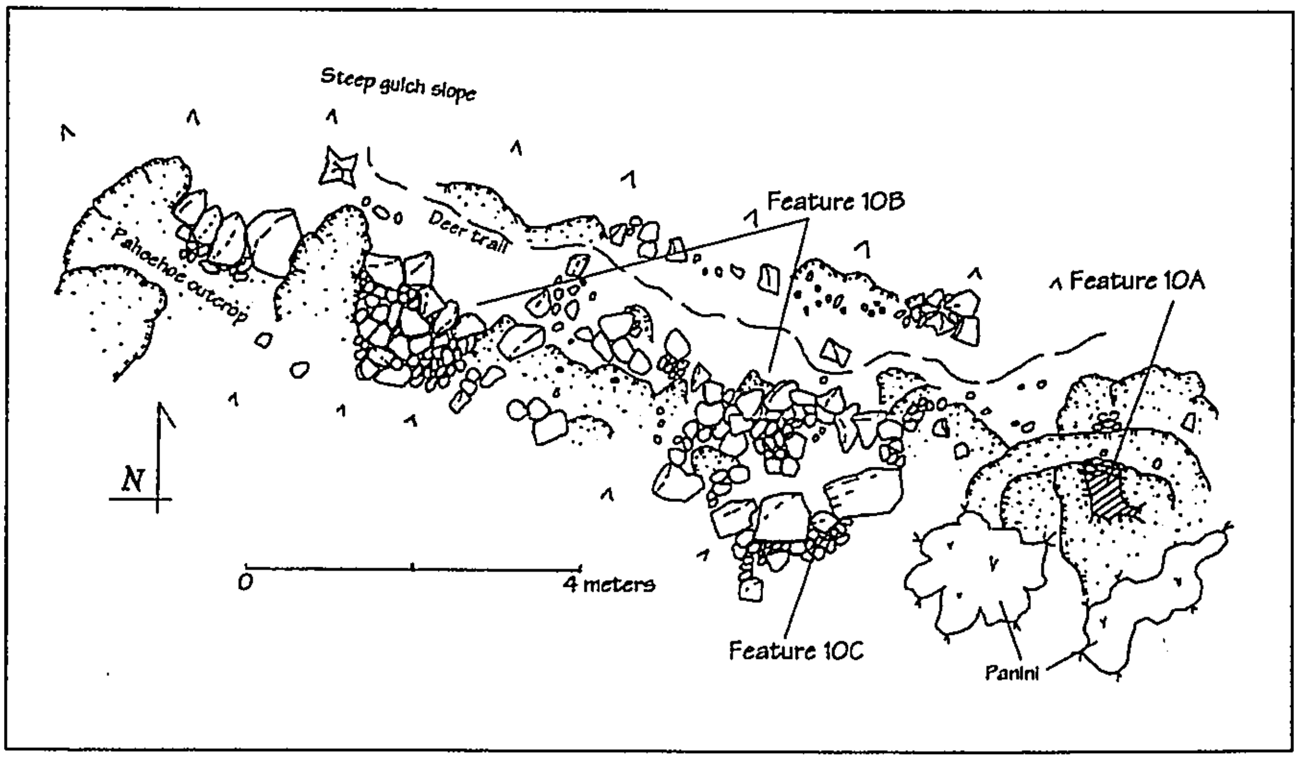


Figure 4.56 Scaled Plan Map, Site 5710, Feature 10

Site 5710 Features 11 and 12

Features 11 and 12 are located along the lower south slope of the gulch, within 8.0 meters of the edge of graded golf course area. Feature 11 is closest to the golf course and has probably been affected by bulldozing. A discernible bulldozer path runs downslope adjacent to Feature 11B (*Figure 4.57*).

Feature 11A is a low stone filled terrace formed by modification of an existing bedrock formation. The front of the terrace is defined by an alignment of large cobbles and the surface is filled with small pebbles. The front alignment faces north and has an average height of 0.40 meters. The terrace is 4.2 meters E-W by 1.5 meter wide overall, with an interior area of 3.5 by 1.0 meters. One waterworn coral cobble is present on the terrace, at the western end. This feature has been impacted by deer traffic; a well-worn trail crosses over the west and south sides (*Photo 4.43*).

Feature 11B is a stone mound located 1.2 meters west from Feature 11A. The mound is informal in construction, with medium to small cobbles loosely placed on an exposed bedrock surface. It measures 2.7 meters E-W by 1.0 meter N-S and has a maximum height of 0.64 meter in the center. Most of the mound is only two coursed high. No portable materials were observed on or near the mound.

Feature 12A is a stone-filled terrace located 6.0 meters north and downslope from Feature 11A. It is formed by modification of a natural outcrop ledge with a front retaining alignment of boulders and large cobbles. Small cobbles and pebbles were placed behind the retaining wall, resulting in a level filled surface. The terrace is 8.5 meters NW-SE by 2.2 meters, with an interior area of 6.5 by 1.2 meters. Maximum height along the outside (north side) of the aligned retaining wall is 0.47 meters. The terrace has been impacted by deer traffic; no portable remains were identified on the surface (*Photo 4.44*).

Feature 12 B is a small terrace located immediately south and upslope from Feature 12 A. It was formed by construction of a boulder alignment across a natural dip, and placement of cobble fill behind the alignment. No exposed bedrock surface were used or modified for this particular terrace. It is 3.0 meters E-W by 1.0 meter N-S, with an interior area of 2.2 by 0.60 meters. The front of the retaining alignment is 0.56 meter high on the north side. The feature is in a generally eroded state, and no portable remains were observed on the surface.

Site 5710 Feature 13

This soil and stone terrace is located along the upper north slope of the gulch, adjacent to the north end of the Feature 2 trail (*Figure 4.52, Photo 4.45*). It is a mostly natural formation that has been augmented by the re-arrangement of stones to expose a soil flat. The terrace is 6.3 meter N-S by 5.0 meters N-S; the interior soil area is 3.0 meters N-S by 2.0 meters E-W. A single piece of branch coral was observed outside the terrace to the north. This item may be associated with Site 5711 Feature 1, located nearby. The soil deposit was probed and found to by quite shallow.

In summary, the Site 5710 complex is viewed as an agricultural area that encompasses most of the gulch within Parcel 37. It is likely that additional terraces and clearing mounds were once present along the slopes of the gulch.

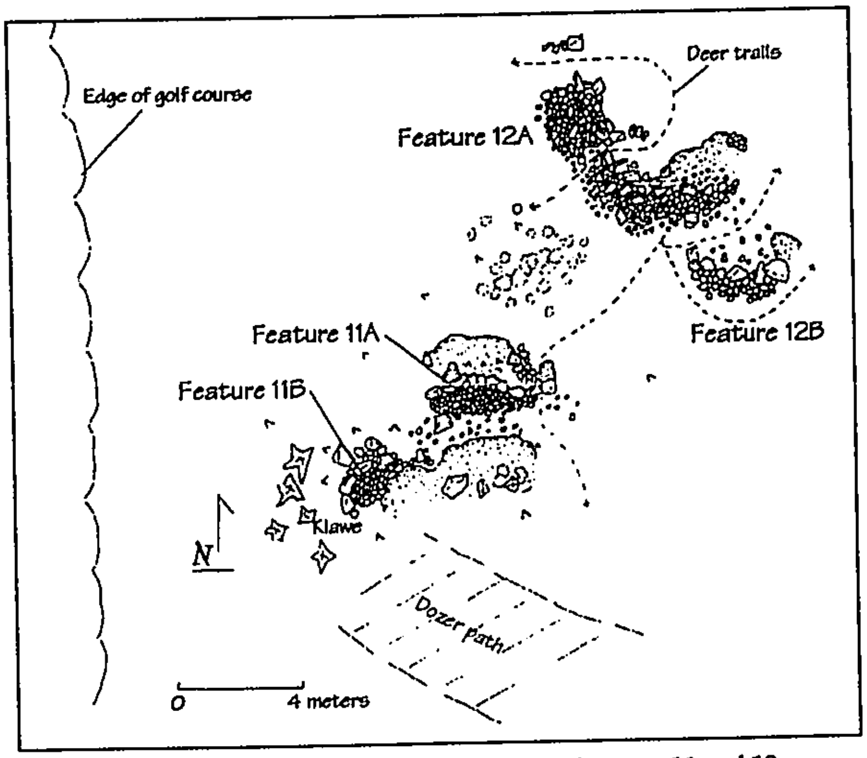


Figure 4.57 Scaled Plan Map, Site 5710 Features 11 and 12

Recent impacts from machinery and animals are evident at many of the identified features and have no doubt caused the removal of others. The historic/modern road that was cut by machines across the gulch probably caused the most impacts to the complex. This road post-dates the features in the gulch, as they show evidence of post-abandonment alteration caused by the machinery. Three of the agricultural features (1, 3, and 4) have portable remains indicative of use during modern times; however, only one of these has formal attributes suggestive of recent construction. All other agricultural features appear to be traditional and may be contemporaneous with the terraces or the Feature 4 enclosure at Site 5711.

Site 5711

Site 5711 was recorded in 2001 as a single feature consisting of a rectangular platform or a badly disturbed enclosure (Rotunno-Hazuka et al. 2005: 41). The structure was mapped and interpreted as a possible fishing shrine or *ko'a*, based on the presence of branch coral and the shape of the structure. The site was recommended for preservation.

The Site 5711 structure was easily relocated during the current survey using project area maps, and due to the unique aspects of the platform. This structure was designated as Feature 1, and seven additional features were identified in proximity to the platform that were added to the complex. The overall site area is 58.0 meters N-S by 27.5 meters E-W. The complex encompasses the west-facing slope along the north side of the gulch, and the center of the gulch at the west edge of the project area (*Figure 4.1*). Much of the site area was essentially buried beneath fallen *kiawe* trees and branches, and was only accessible for recording after extensive clearing with chain-saws.

Site 5711 Feature 1

Feature 1 was remapped and re-measured during the current survey, after it was cleared of large *kiawe* branches. The structure was found to be a partially enclosed platform situated on the top and upper west-facing slope of the gulch. The platform is currently somewhat D-shaped in plan, and may have been rectangular prior to erosion and wall-fall. It is constructed from weathered basalt boulders and cobbles, with some large coral cobbles incorporated (*Figure 4.57, Photo 4.46*). It is formally faced and raised on all sides, with the wall heights varied according to the slope of the land. The surface area is 6.0 meters N-S by 5.5 meters E-W. Wall heights are 0.70 to 0.80 meter along the east side, which is at the top of the slope. The north and south sides range from 0.75 to 1.05 meters in height along the slope, and the west wall is 1.70 meters high from ground surface in front of the platform. The corners along the west wall and the western portion of the platform are in a partially collapsed state, as are other sections along the outer walls of the platform. The top of the platform (where intact) is level and paved with smaller cobbles and pebbles.

Remnants of an enclosure wall are present on top of the platform, along the north , east and south sides. The wall is broken down along the north side and along a portion of the south side. It is currently 0.30 to 0.55 meter high and 1.60 meters wide. An area 1.5 by 1.0 meters inside the wall has a noticeable concentration of *ala* pavement pebbles and branch coral.

At least 14 pieces of unweathered branch coral were observed on the surface of the platform, and additional pieces were seen mixed with collapsed stones from wall fall. Branch coral (3-4 pieces) was also found on the ground surface to the south and west of the platform. This area has been subjected to surface erosion due to the presence of a deer trail.

A small terrace alignment is present along the slope, 1.0 to 2.0 meters from the southeast corner of the platform. The alignment abuts existing bedrock outcrops and apparently served to help stabilize the slope around the platform base. It is 2.2 meters long and 0.25 to 0.50 meter high along the downslope side. Three large terraces (Features 2, 3 and 5) are located c. 15.0 meters to the west of the platform, and a fifth terrace (Feature 6) is located downslope from the platform, 7.3 meters west from the western wall. These nearby terraces all show surface scatters of midden and weathered coral, and are believed to be functionally and temporally related to the platform.

Current findings and background research confirm the prior interpretation that Feature 1 is a *ko'a* or *heiau*. The extent of the overall complex associated with this feature suggests that the term *heiau* might be more appropriate.

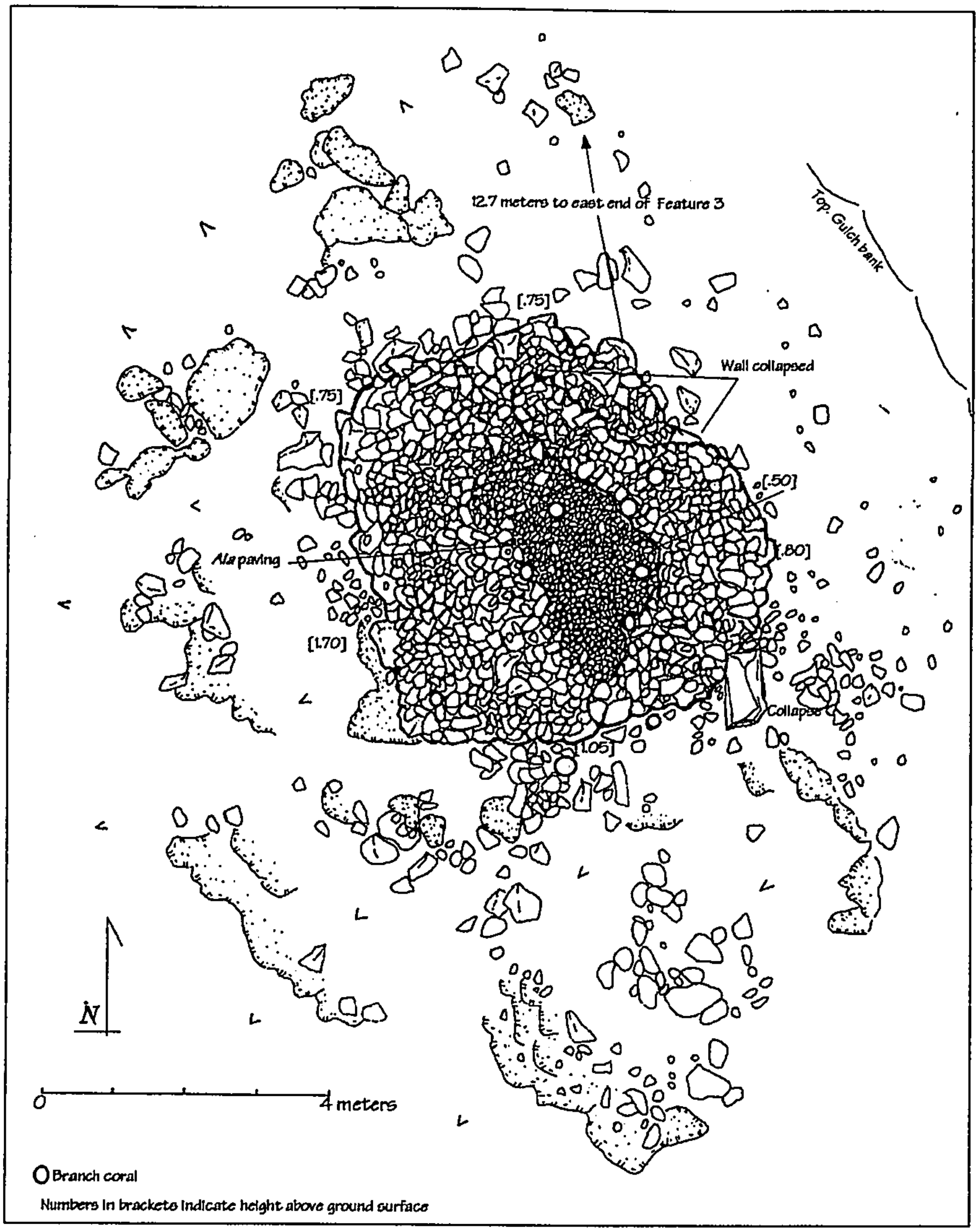


Figure 4. 59 Scaled Plan Map, Site 5711, Feature 1

Site 5711 Feature 2

Feature 2 is located 15.0 meters north from Feature 1 and is the uppermost and smallest of four stepped terraces that follow contours along the west-facing slope of the gulch (*Figure 4.60*). It is constructed with aligned and stacked boulders and large cobbles that augment an exposed natural bedrock ledge. The terrace is oriented NE-SW along the top edge of the gulch. Overall length is 8.0 meters by 1.70 meters wide; the interior area is 7.6 by 1.3 meters. Average height of the front face is currently 0.35 meters. The retaining wall is in poor preservation and many of the set boulders have fallen out of place. Some of the collapse is due to deer traffic up and down the gulch slope. The interior surface of the terrace is relatively level soil with scattered small cobbles. Portable materials observed on the surface of the terrace include two pieces of weathered coral and a *Cypraeidae* shell fragment.

Site 5711 Feature 3

This terrace is located immediately downslope of Feature 2, and is oriented along the contour, parallel to the upper terrace (*Figure 4.59, Photo 4.47*) It is of similar construction, with boulders and large cobbles stacked or aligned along a natural outcrop ledge. The retaining wall for Feature 3 is in slightly better preservation, an has an overall length of 14.2 meters. The terrace is 4.2 meters wide overall, with an interior width of 2.2 meters. The level soil area within the terrace ranges in width from 1.0 to 1.8 meters, and is currently being used as a deer trail. The retaining wall has a maximum height of 1.0 meter, and an average height of 0.60 meter where the face has not collapsed. Portable remains observed on the terrace include a weathered coral fragment and two pieces of *Cypraeidae* shell.

A 1.0 by 1.0 meter test unit was excavated in the soil flat in order to better determine the age and function of this terrace. Two soil layers were encountered, both of which contained cultural materials (*Figure 4. 60*). Layer I extended from the generally bare, eroded surface to a depth of 0.38 meter below surface; it consisted of fine dark brown loam with 30-40% stones by volume.

Four levels were excavated in Layer I, and level 3 (0.20-0.30 meter) showed the highest frequency of midden remains and artifacts (*Table 4.17*). A total of 131 shellfish fragments (97.95 grams) representing six shellfish families and Echinoidea were recovered, along with four fish bones, 2.5 grams of charcoal, weathered coral fragments and four volcanic glass flakes. A total of 219.72 grams of shellfish was recovered form all four levels of Layer I, which translates to a density value of 1.9 grams per liter of screened soil. Other artifacts recovered from Layer I include four volcanic glass flakes from level 2 and one volcanic glass flake from level 1.

Charcoal collected from Layer I-3 and I-4 was combined and submitted to Beta Analytic Laboratories for radiocarbon age determination. The sample (Beta 212867) returned a conventional radiocarbon age of AD 1440+/-60 BP.

TU-1	I-1		I-2		I-3		I-4		II-1		Total	
Depth	0-.10		.10-.20		.20-.30		.30-.38		.38-.48			
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae	4	3.20	2	1.80	5	2.50	3	1.20			14	8.70
Cypraeidae	49	51.15	38	30.00	51	76.60	4	6.95			142	164.70
Litorina Pinlado					7	1.10	1	0.15	1	0.35	9	1.60
Lucinidae					1	0.10					1	0.10
Nerita picea	11	0.60	10	0.40	12	1.35	10	1.80	3	0.20	46	4.35
Planaxis labiosa			1	0.01			1	0.10			2	0.11
Terebridae	2	1.50									2	1.50
Thaididae	3	0.50	5	6.00	9	9.60	5	2.50	1	0.40	23	19.00
Drupa rubusidaeus			5	0.60	2	0.60					7	1.20
Neothais harpa	1	0.85	1	1.20							2	2.05
Unidentifiable	23	2.40	31	2.80	27	3.60	7	0.55			88	9.35
Bivalves												
Isognomonidae			1	0.01							1	0.01
Echinoidea												
Mouth					2	0.20	1	0.05			3	0.25
Shell	2	0.20	1	0.10	1	0.30					4	0.60
Spine			18	5.10	14	2.00	1	0.05			33	7.15
Total Shellfish	95	60.40	113	48.02	131	97.95	33	13.35	5	0.95	377	220.67
Vertebrates												
Fish			3	1.00	4	0.95	5	0.80			12	2.75
Large Mammal	1	1.00			1	11.40					2	12.40
Coral												
Weathered Frags.	7	2.10	16	5.70	9	4.00	2	0.50			34	12.30
Other												
Beach Conglom.	2	7.40	1	0.70	2	0.20	1	0.50			6	8.80
Charcoal					55	2.50	32	0.90	5	0.30	92	3.70
Unburned kukui nut			1	4.60	1	1.10						
Waterworn basalt												
Waterworn shell	2	7.60									2	7.60
TOTAL	107	76.70	134	60.02	203	118.10	73	16.05	10	1.25	625	269.42

Table 4.17 Midden and Portable Materials, Site 5711 Feature 3, Test Unit 1

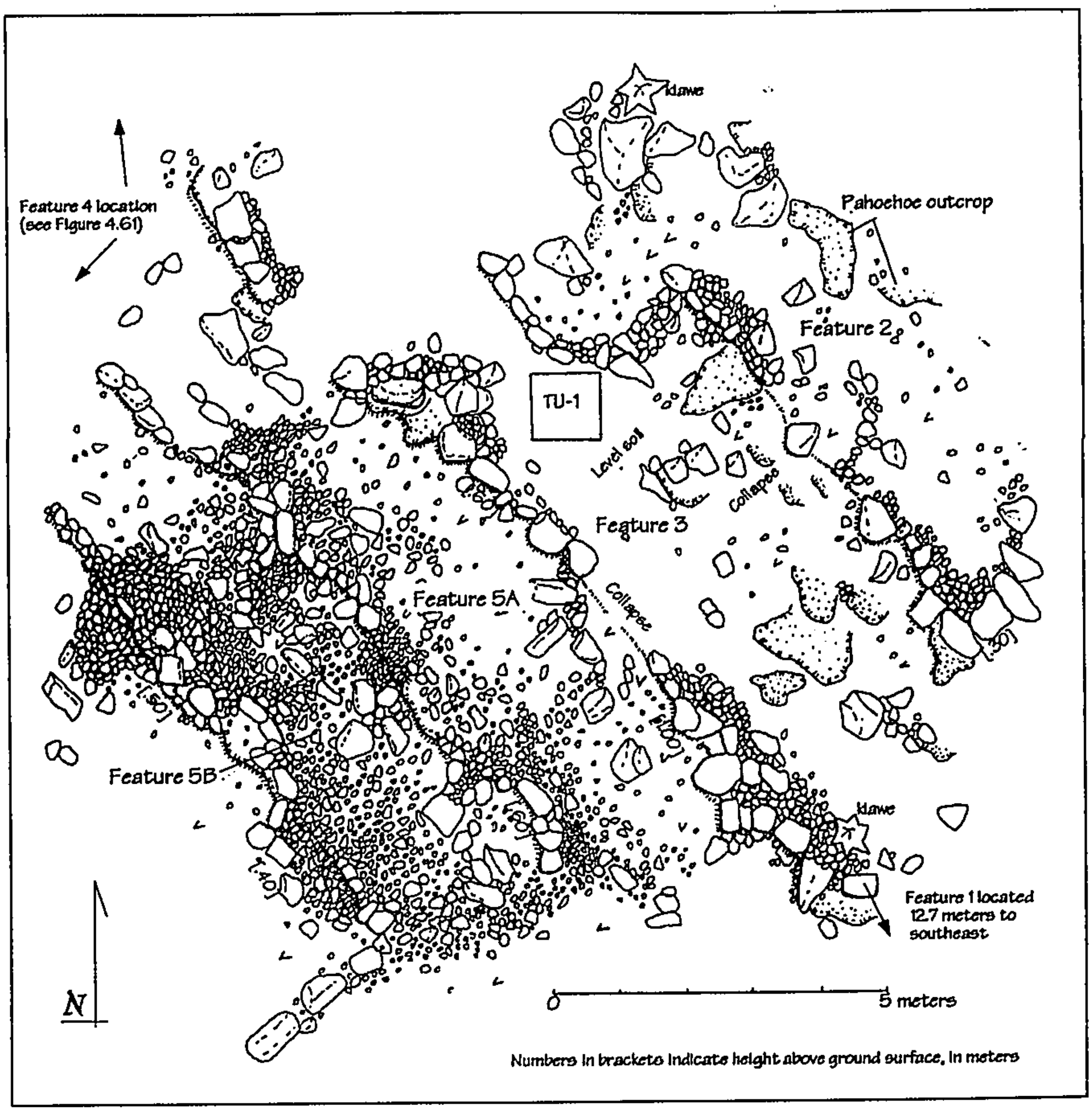
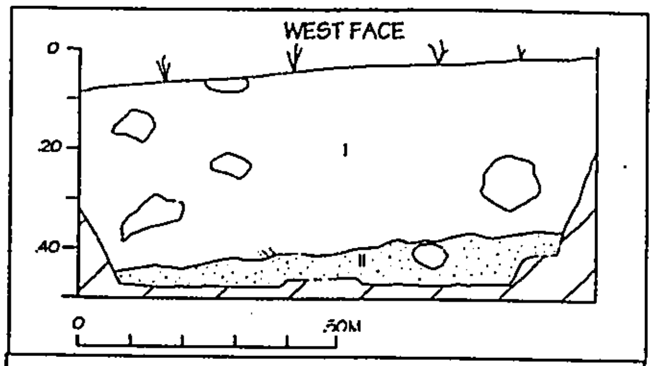


Figure 4.59 Scaled Plan Map, Site 5711 Features 2, 3 and 5

The calibrated calendric range at two sigma is AD 1310 to 1370 and AD 1380 to 1470. The intercept of the calibration curve with the conventional age is AD 1420, and the 1 sigma calibrated range is AD 1400 to 1440. This date suggests that the Site 5711 terraces predate other dated habitation sites in the project area by at least two centuries.



I: (0-.38) black (10YR2/1 moist) loam (10YR3/1 dry) 1fcr, soft, very friable, nonsticky, nonplastic, fine to coarse roots common, clear, smooth boundary.

II: (.38-.48) dark brown (7.5YR3/2 moist) gravelly silty clay loam (10YR4/6 dry), 2msbk, hard, friable, slightly sticky, slightly plastic.

Figure 4.60 Site 5711 Feature 3, Test Unit 1 Profile

Layer II at Feature 3 consisted of dark yellowish brown (10YR3/4) compact silty clay loam with 60% stones by volume. Decomposing bedrock with sterile soil was encountered at 0.48 meter below surface, and excavation was terminated at the base of a single level. Layer II contained only five shell fragments and a few pieces of charcoal (*Table 4.14*) in the upper portions. This material is assumed to have filtered down from Layer I, as Layer II was essentially sterile.

The high midden density at feature 3 is interesting, as this feature was assumed to be agricultural in function, and is too narrow to be considered a habitation area. It is wide enough for short-term, specialized use, possibly of a ceremonial nature.

Site 5711 Feature 4

Feature 4 is located adjacent to the west side of the Feature 2, 3, and 5 terraces, along the same southwest-facing slope of the gulch. It consists of three enclosed terraces that have been directly impacted by grading and filling for the golf course (*Figure 4.61, Photo 4.48*). Overall area of the feature is 18.0 meters NE-SW by 6.0 meters in the center. The intact enclosure wall currently includes a portion of the upper E-W wall, the entire east side, and a portion of the lower wall. It is not possible to estimate the original width (E-W axis) of the enclosure, given current conditions.

The wall defining the east side of the enclosure is constructed from stacked boulders and large cobbles, and incorporates several large *in situ* bedrock boulders. The constructed portions of the wall are bifaced and have an average height of 1.0 meter along the exterior side. The interior sides are lower, due to terrace leveling inside, and range from 0.15 to 0.70 meters. The interior areas of the three terraces are predominantly soil; however, exposed bedrock outcrops are present in some areas, especially in the uppermost terrace.

The upper level terrace (Feature 4A) has a current interior area of 5.5 meters N-S by 4.0 meters E-W and exhibits a slightly sloping surface. The retaining wall defining the south side of this terrace is constructed from boulders and cobbles stacked between exposed bedrock faces that are up to 1.10 meter high from the downhill side. The original size and configuration of this upper terrace is indeterminate. Several surface boulders are also present inside this feature; these are from golf course bulldozing activity, although they may have originated from the western walls of the enclosure.

A shovel test consisting of 0.50 by 0.50 meter was excavated at Feature 4A in order to aid in determining function and age. Shovel test (ST) 1 was located on the soil flat where probing indicated the greatest soil depth. The excavation encountered two soil Layers overlying a decomposing bedrock substrate. Layer I occurred from the surface to 0.18 meter below surface. This layer consisted of black silty loam with ash mottling and a relatively large quantity of charcoal (6.3 grams). Also recovered were three pieces of weathered coral and minute traces of marine shell (*Table 4. 18*). Layer II at ST-1 consisted of dark yellowish brown (dry) stony silty clay loam intermixed with decomposing bedrock. This layer was sterile.

Findings of ST-1 at Feature 4A indicated that additional excavation was warranted to better determine the nature of the subsurface ash deposit and to obtain additional charcoal for dating purposes. Test Unit 1, a .50 by 1.5-meter unit, was therefore situated over the area of ST-1, and extended north along the eastern portion of the terrace.

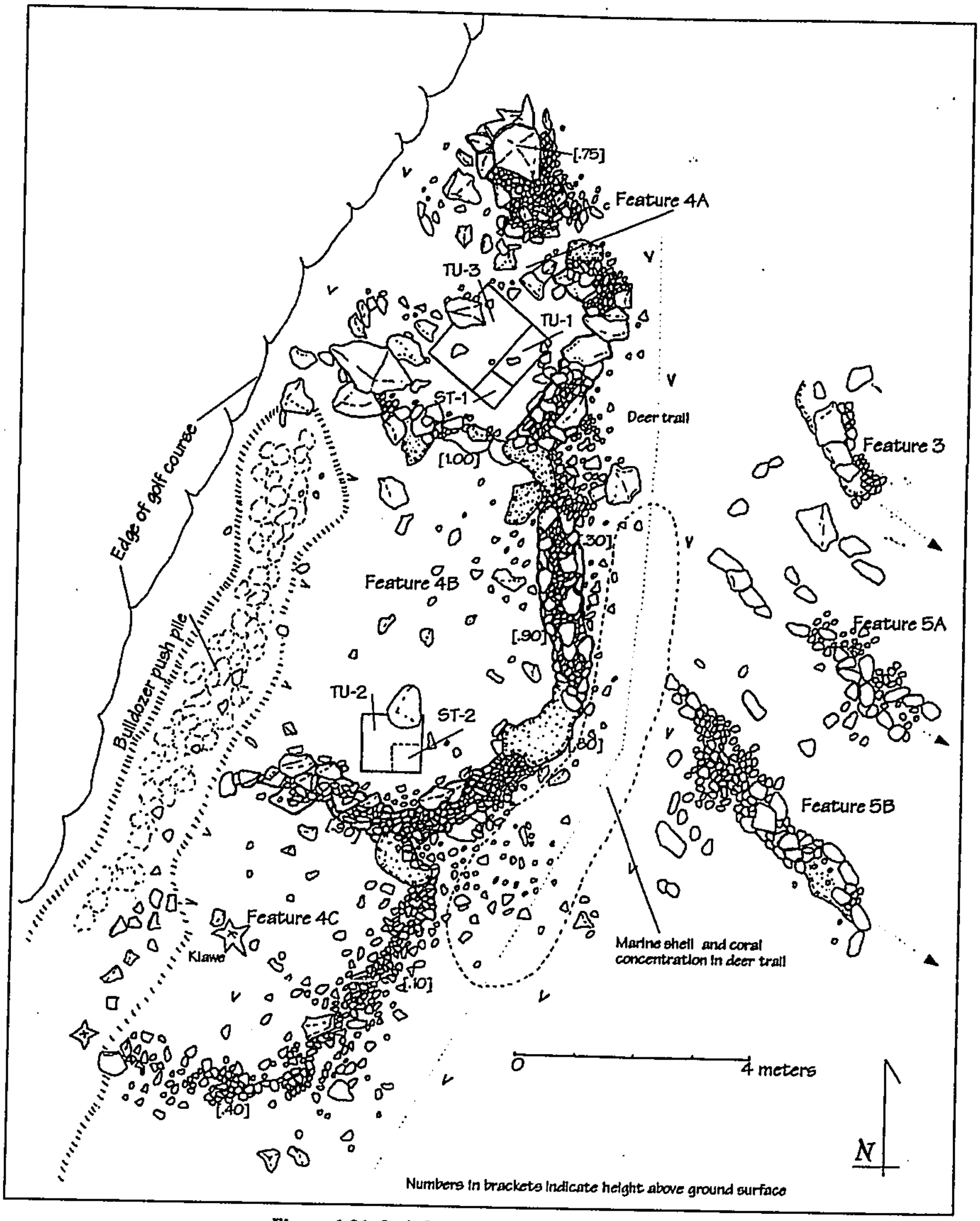


Figure 4.61 Scaled Plan Map, Site 5711 Feature 4

A relatively deep and unstratified cultural deposit was encountered in TU-1. This deposit (Layer I) began at the surface and continued to 0.55 meter below surface. Six excavation levels were screened, and cultural material was found in all levels (*Table 4.19*). Shellfish remains were concentrated in levels 1 and 2, where 508 specimens (322.02 grams) were collected from the 1/4 inch screen. Thirteen shellfish families, as well as *Echinoidea* and *Crustacea* were recovered from these two levels. The remaining levels showed a gradual decrease in shellfish to 20 specimens for level 6.

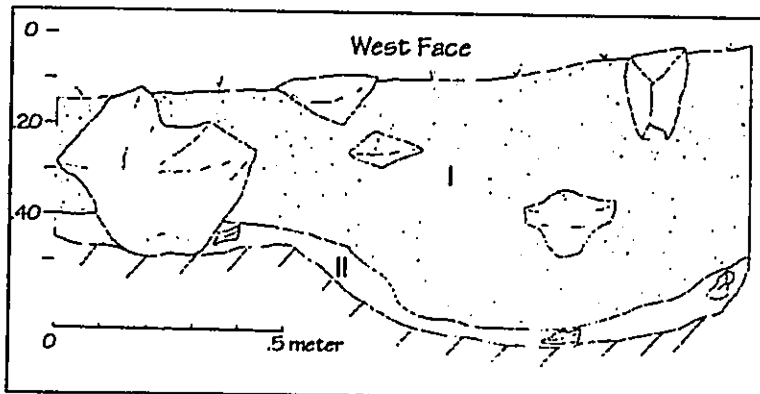
SITE 5711 Feature 4							
ST-1	I-1		ST-2	I-1		Total	
Depth	0-.18			0-.13			
	Cnt	Wt.		Cnt.	Wt.		
Coral							
Weathered frags	3	0.50		27	8.70	30	9.20
Other							
Beach conglom.				3	2.20	3	2.20
Charcoal		6.30			0.50		
TOTAL	3	6.80		30	11.40	33	18.20

Table 4.18 Portable Materials, Site 5711 Feature 4 Shovel Tests 1 and 2

Charcoal densities indicated in ST-1 continued in Test Unit 1, where total of 195.46 grams of charcoal was recovered from the six excavation levels. Charcoal was most dense in level 3, where 60.75 grams were recovered from the 1/4 and 1/8 inch screens. Charcoal from level 3 and the combined charcoal from levels 5 and 6 (47.9 grams) was submitted as two samples to Beta Analytic Laboratory for age determination (Beta-215909 and 215910). The results of the analysis were less than absolute, and indicate likely contamination with modern charcoal. The sample from level 3 (Beta 215909) returned a conventional radiocarbon age of 20-+/-60 BP, and three alternative calibrated calendric ranges: AD 1680 to 1730; AD 1810 to 1930; and AD 1950 to beyond 1960. The sample from levels 5 and 6 (Beta 215910) returned a conventional radiocarbon age of 90+/-70 BP, and three alternative calibrated calendric ranges: AD 1680-1740; AD 1800 to 1930; and AD 1950 to 1950. The similarities between these two samples indicates that they are from essentially the same charcoal deposit. The earliest range for both samples is AD 1680-1740, which is most consistent with the midden and artifact deposit from Feature 4, although it should be noted that no artifacts were recovered from Test Unit 1.

The relatively thick and unstratified nature of the cultural deposit observed in Test Unit 1 suggests that it might be pit fill, or a secondary deposit that was moved into the feature during golf course construction (*Figure 4.62, Photo 4.49*). In the latter case, the materials most likely originated from the western portion of the enclosure, which was destroyed during golf course construction. This would explain the homogenous nature of the soil and the cultural material. A second test unit (TU-3) was excavated adjacent to the west side of TU-1, in order to better determine the nature of the deposit. This unit confirmed that the surface boulders within Feature 4A were deposited by bulldozers. The 1.0 by 1.5-meter unit was not able to define an edge to the subsurface deposit that would indicate pit fill. This finding, together with the rather uncertain dates from charcoal, tend to suggest some type of disturbance or mixing of this deposit.

Feature 4B is the largest of the three enclosed terrace remnants; it is 6.8 meters N-S by 5.0 meters and its retaining wall on the south side is 0.90 meter high along the outside. The surface inside this terrace is mostly soil and is generally level to slightly sloping. A concentration of surface midden was observed in a deer trail along the slope, just outside the eastern perimeter wall of this terrace. The scatter includes *Conidae, Cypraeidae,* and *Patellidae* shell fragments, as well as weathered coral fragments.



I: (0-.55) black (10YR2/1 moist and dry) silty loam, moderate, fine, subangular blocky, slightly hard, friable, slightly sticky, slightly plastic, many five roots, clear, wavy boundary

II: (.55-.65) dark brown (7.5YR3/2 moist) very stony silty clay loam, moderate, medium, subangular blocky, hard, friable, slightly sticky, slightly plastic, fine to coarse roots common, grades to bedrock.

Figure 4.62 Site 5711 Feature 4A, Test Unit 1 Profile

SITE 5711 Feature 4	TU-1															
	Surf.		I-1		I-2		I-3		I-4		I-5		I-6		TU-1 Total	
Depth			0-10		10-20		20-30		30-40		40-50		50-55			
Gastropoda	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae	5	6.75	22	38.30	1	0.95					2	2.70			30	48.70
Cypraeidae	12	31.00	120	103.50	148	109.20	20	17.00	18	11.80	9	18.10	12	6.45	339	298.05
Litorina pintado			5	1.00	4	1.10	1	0.20							10	2.30
Nerita picea	2	0.60	47	13.95	35	10.10	7	2.40	5	1.55	4	1.20	5	2.00	106	32.00
Nerita polita					2	2.20									2	2.20
Theodoxus cariosus			1	0.35											1	0.35
Marginellidae			1	0.35											1	0.35
Patellidae	1	0.10	1	0.20			1	0.15	1	0.10					4	0.55
Planaxis labiosa																
Thaididae			6	6.62	5	4.20	5	3.30	3	1.30	2	3.25			21	18.67
Morula granulata			2	1.78	5	2.00									7	3.78
Neothais harpa					1	0.80									1	0.80
Trochus intextus					1	0.55									1	0.55
Unidentifiable			5	3.42	3	2.25					4	10.70			12	16.37
Bivalves																
Isognomonidae			1	0.30			1	0.40					1	0.10	3	0.80
B. crebistriatus					6	0.35	4	0.45			2	0.15			12	0.95
Spondylidae					4	3.60									4	3.60
Echinoidea																
Mouth			1	0.35	1	0.40									2	0.75
Spine			7	2.00	5	0.90	2	1.40			1	1.40	1	0.30	16	6.00
Shell			16	1.70	47	6.50	4	0.50	4	0.85	1	0.15			72	8.70
Crustacea			1	0.60	4	5.80							1	0.40	6	6.80
Total Shellfish	20	38.65	236	172.12	272	149.90	45	25.80	31	15.60	25	37.65	20	8.25	649	447.67
Vertebrates																
Fish			1	0.25			1	0.15	1	0.30					3	0.70
Indet. Mammal			1	0.30	4	0.70									5	1.00
Medium Mammal							3	0.95							3	0.95
Total Vertebrates			2	0.55	4	0.70	4	1.10	1	0.30					11	2.65
Coral																
Burned							1	0.30	4	1.80					5	2.10
Waterworn	1	4.20			2	10.75									3	14.95
Unweathered brain					1	218.40									1	218.40
Weathered Frags.	3	69.45	8	5.10	8	3.30									19	77.85
Other																
Charcoal		0.05		21.10		30.06		60.70		35.65		33.60		14.10		195.46
Kukui nut - burned					3	0.73									3	0.73
Sandstone																
Waterworn basalt	1	4.30	5	17.65											6	21.95
Waterworn shell			1	1.50	3	18.90	1	0.70					1	0.50	6	21.60
TOTAL	25	116.65	252	218.02	293	432.31	61	88.60	35	53.35	25	71.45	21	22.85	703	1003.66

SITE 5711 Feature 4	TU-2										TU-3						Feature 4	
	I-1		I-2		I-3		II-1		TU-2 Total		I-1		II-2		TU-3 Total		Total	
Depth	0-10		10-20		20-25		25-40				0-10		10-20					
Gastropoda	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Conidae	4	23.50	10	33.00	5	25.00	2	10.20	21	71.70	9	7.40	6	3.30	15	10.70	66	129.10
Cypraeidae	38	30.50	30	22.20	16	49.80	15	26.70	99	129.20	163	121.60	63	34.90	226	156.50	664	581.75
Litorina pintado			1	0.05	1	0.20	1	0.05	3	0.30	2	0.35	2	0.50	4	0.85	17	3.45
Nerita picea	4	1.20	7	2.10	5	1.45	3	0.40	19	5.15	43	12.10	22	5.55	65	17.65	189	54.80
Nerita polita																	2	2.20
Theodoxus cariosus																	1	0.35
Marginellidae											4	0.70	1	0.05	5	0.75	6	1.10
Patellidae	1	0.40	2	1.30	1	0.10			4	1.80	1	1.35	1	0.20	2	1.55	10	3.90
Planaxis labiosa			1	0.25					1	0.25							1	0.25
Thaididae	4	1.80	4	6.10			2	0.20	10	8.10	11	5.80	12	6.75	23	12.55	54	39.32
Morula granulata																	7	3.78
Neothais harpa																	1	0.80
Trochus intextus			1	0.90					1	0.90							2	1.45
Unidentifiable	3	0.60			4	1.40			7	2.00	7	1.20			7	1.20	26	19.57
Bivalves																		
Isognomonidae					1	0.20			1	0.20	1	0.50	2	0.40	3	0.90	7	1.90
B. crebistriatus											1	0.10	1	0.02	2	0.12	14	1.07
Spondylidae																	4	3.60
Echinoidea																		
Mouth	1	0.10			1	0.40			2	0.50	5	1.20	4	0.70	9	1.90	13	3.15
Spine	2	0.15	2	0.35	4	0.65			10	1.15	9	1.90	2	0.20	11	2.10	37	9.25
Shell	8	1.00	5	0.75	2	0.15	2	0.30	17	2.20	47	7.50	17	3.20	64	10.70	153	21.60
Crustacea											4	4.90	4	0.90	8	5.80	14	12.60
Total Shellfish	63	59.25	83	67.00	42	79.35	25	37.85	193	243.45	307	166.60	137	56.67	444	223.27	1286	914.69
Vertebrates																		
Fish					1	0.25			1	0.25	8	0.80	1	0.15	9	0.95	13	1.90
Indet. Mammal																	5	1.00
Medium Mammal											4	1.60	2	0.80	6	2.40	9	3.35
Total Vertebrates					1	0.25			1	0.25	12	2.40	3	0.95	15	3.35	26	6.25
Coral																		
Burned											1	3.00			1	3.00	6	5.10
Waterworn																	3	14.95
Unweathered brain																	1	218.40
Weathered Frags.	6	4.50	6	10.70	5	21.20	5	5.00	22	41.40	11	12.00	7	6.80	18	18.80	59	138.05
Other																		
Charcoal		1.70		0.90		1.20				3.80		18.70		18.90		37.60		236.86
Kukui nut - burned																	3	0.73
Sandstone	2	42.90	1	1.20	1	0.45			4	44.60	2	3.70			2	3.70	6	48.30
Waterworn basalt																	6	21.95
Waterworn shell													1	1.75	1	1.75	7	23.35
TOTAL	71	108.35	70	79.80	49	102.45	30	42.85	220	333.50	333	206.40	148	87.02	481	293.42	1402	1607.63

Table 4.19 Midden and Portable Material, Site 5711 Feature 4, Test Units 1-3

A 0.50 by 0.50 meter shovel test unit (ST-2) was excavated at the south end of Feature 4B, in an area of maximum soil thickness. Two soil layers were encountered which showed the same characteristics as the Layers found in ST-1. This area showed a higher concentration of weathered coral, with 27 pieces recovered from Layer I, and a lesser amount of charcoal. Also recovered were three pieces of beach conglomerate sandstone and six pieces of volcanic glass. This is the highest concentration of volcanic glass recovered within the project area.

A 1.0 by 1.0-meter test unit (TU-2) was placed over the area of ST-2, and excavated to a maximum depth of 0.40 meter. The cultural deposit (Layer I) was 0.25 meter thick at this location, and it exhibited a slightly lower density of shellfish midden, and considerably less charcoal as compared to TU-1 (*Table 4.19*). One additional volcanic glass flake and four additional pieces of unmodified sandstone were recovered from Layer I at TU-2. In addition, 22 pieces of weather coral were recovered.

The upper portion of Layer II in TU-2 contained a small amount of cultural material consisting of marine shell and weathered coral fragments. This Layer, which consisted of dark yellowish brown very stony silty loam, occurred between 0.25 and 0.40 meter below surface, where the excavation was terminated.

Feature 4C is the lower level terrace; it is 5.7 meters N-S by 3.7 meters, and exhibits wall heights of 0.05 to 0.40 meters. This lower terrace and its walls are in poorer condition than the two terraces upslope. The upper half of the interior here is relatively level, whereas the lower half slopes from north to south. Soil deposits are generally thin across this terrace, and no subsurface testing was conducted in this section of Feature 4.

Subsurface findings indicate that there was some sort of spatial differentiation in activities within this feature. Feature 4A contained a thick unstratified charcoal and midden deposit, with no artifacts. No evidence of *in situ* burning was found at Feature 4A, and the nature of the deposit suggests that it may be secondary, and/or mixed with materials moved into this area from the destroyed portion of the enclosure. Feature 4B contained a relatively high number of volcanic glass flakes and pieces of unmodified sandstone. These later items could represent waste material from the production of a formed sandstone artifact. They do not occur naturally at this location and were brought to the site for some purpose. The original full size of this enclosure is unknown, it was not recorded by Bishop Museum staff during any of the three surveys that included the area. It is possible that the site was covered by the dense *kiawe* forest that also covered the nearby terraces and the rather large Feature 1 platform.

Site 5711 Feature 5

This bi-leveled terrace is located immediately downslope from Feature 3, near the base of the gulch slope (*Figure 4.59*). The construction materials and methods for this feature are the same as indicated for Features 2 and 3, and it appears that all four of these terraces were constructed at the same time. They are constructed with aligned to stacked boulders and large cobles as retaining walls, behind which are level to nearly level terraces. The retaining walls for the Feature 5 terraces incorporate a few exposed bedrock shelves into the walls, but not to the extent indicated for the upper terraces; as a result, these two lower level terraces are in somewhat poorer condition that the features upslope.

The upper level of Feature 5 is 12.0 meters long and 2.5 meters wide, with a maximum width of 0.38 meter along the front (west side). Most of the front of the terrace is collapsed, and the original height of the retaining wall is indeterminate. The interior flat portion of the upper level is 8.0 meters long by 2.0 meter wide. The northern end of this terrace is within 2.0 meters of the Feature 4 enclosure wall, and it appears that the retaining walls of both levels once abutted the Feature 4 enclosure wall.

The lower level of Feature 5 differs from the other terraces in that the interior area is uneven and covered with stones, rather than being level with a soil flat. This terrace is 8.5 meters long by 3.0 meters wide, with a maximum height of 1.1 meter along the retaining wall. The interior area is 8.0 by 2.2 meters and the average height of the retaining wall is 0.40 meter.

Portable remains observed on both levels of Feature 5 include *Conidae* and *Cypraeidae* shell fragments, and one small waterworn pebble on the upper level. The upper level exhibits a slightly higher concentration of shells, with about ten pieces observed, compared to around five pieces for the lower level.

Portable remains observed on both levels of Feature 5 include *Conidae* and *Cypraeidae* shell fragments, and one small waterworn pebble on the upper level. The upper level exhibits a slightly higher concentration of shells, with about ten pieces observed, compared to around five pieces for the lower level.

Site 5711 Feature 6

Feature 6 is a natural outcrop face that has been augmented with boulders and cobbles to form a terrace wall along the lower edge of the gulch slope. It is located 7.3 meters downslope from the southeastern corner of the Feature 1 platform, and approximately 4.0 meters east from Feature 5. This terrace is along the same slope contour as Feature 5 and it is likely that the two sections once connected. The area between the intact wall portions has been impacted by large *kiawe* trees.

Feature 6 has an overall length of 14.0 meters and the constructed portions are 1.0 meter wide. The height of the outcrop face from the west (downhill) side is 1.20 to 1.90 meters along the south portion and 0.7 to 0.80 meter along the north portion. The constructed sections are 0.70 to 0.80 meters high. The surface immediately behind the terrace face is mostly exposed bedrock, with small soil pockets in crevice areas only. A trail of large cobbles and boulders is evident along the slope between the platform and the terrace; these stones originated from the Feature 1 platform.

The largest constructed section of this terrace is at the south end, and is 2.5 meters long. A deer trail defines the south end of this wall, so it is possible that it once extended further south. A narrow soil ledge is present along the slope at the base of the terrace face. Material observed along this trail includes *Cypraeidae* shell fragments, three pieces of weathered coral, and a piece of beach conglomerate sandstone.

Site 5711 Feature 7

Feature 7 is a roughly rectangular cobble pavement and associated terraces located in the center of the gulch, against the south base of the slope, 7.3 meters south and downslope from the Feature 6 terrace (*Figure 4.63, Photo 4.50*). The water flow channel through the gulch forms the north perimeter of the pavement and a bedrock shelf along the lower south slope forms the south perimeter. The east perimeter is defined by a bedrock shelf that has been augmented with cobbles to form two terrace-like retaining walls that are oriented at right angles to form the northeast corner. The terrace that defines the north side of this corner is stepped along the north gulch slope. The west perimeter of the pavement was impacted by machinery, and it is not certain if it was faced or informal. Intact portions of the west perimeter are currently informal and show one to two courses of cobbles or small boulders that were used as fill.

Overall area of Feature 7 is 24.0 meters NW-SE by 11.0 meters NE-SW. The pavement measures 10.0 meters NW-SE by 5.5 to 7.5 meters NE-SW, with the wider section at the west end. Average height is 0.10 to 0.20 meter along the outer edge, which represents a single course of cobbles. The terrace that defines the east side of the pavement is 8.0 meters NE-SW by 1.5 to 2.0 meters wide and 0.20 to 0.30 meters high. It is constructed from stacked cobbles that were set between exposed bedrock boulders. The slope at this location is along the center of the gulch, east to west. The terrace forming the northeastern corner of the pavement is 3.0 meters NW-SE by 0.9 meter wide and 0.40 meter high. A low step 4.0 meter long and 0.25 meter high is present parallel to and just below this terrace, providing further definition to the edge of the pavement.

The southwest corner of the pavement contains a low raised area that shows a uniform paving of small cobbles and pebbles. This area is 4.0 meters square and is the only section of the pavement that exhibits a somewhat formal paved surface. This area is raised 0.20 meter above the surrounding pavement surface.

No portable materials were observed on the pavement surface; one piece of weathered coral was found on the upper level terrace above the northeastern corner of the pavement. A 1.0 by 1.0 meter unit was excavated in the area of formal pavement in order to better determine function and age of the feature. Two stone fill layers were identified over two to three soil layers and a solid but irregular bedrock surface which was encountered at 0.26 to 0.80 meter below surface. The upper stone fill layer was comprised of uniformly-sized large to medium weathered *'a'ā* pebbles with a few small cobbles and recent leaf litter. This layer extended to a maximum depth of 0.20 meter below surface, with an average depth of 0.12 meter. The smaller fill was directly over an irregular surface of larger cobble fill that was consistent with the larger pavement area. This cobble fill was an average of two courses thick, with three courses in some areas. Filtered duff was scattered between the fill stones, however no soil was present (*Figure 4.64*).

A dense basalt hammerstone was located beneath the small pavement stones, on the surface of the cobble fill layer, 0.10 to 0.20 meter below surface. The hammerstone shows evidence of use for a variety of purposes, with pecking, grinding and battering indicated. Its location within the stone fill, beneath the smaller pavement suggests that it was either left at the location of its use prior to the introduction of the smaller pavement; or it was used as fill and is in a secondary context rather than left at the location of use.

Layer I was encountered 0.35 to 0.40 meter below surface and was defined by a fairly level old surface duff deposit over a very stony silty loam, 0.10 to 0.18 meter thick. A single waterworn basalt pebble was present on the surface of the soil deposit, and one small *Isognomonidae* shell fragment was found in the

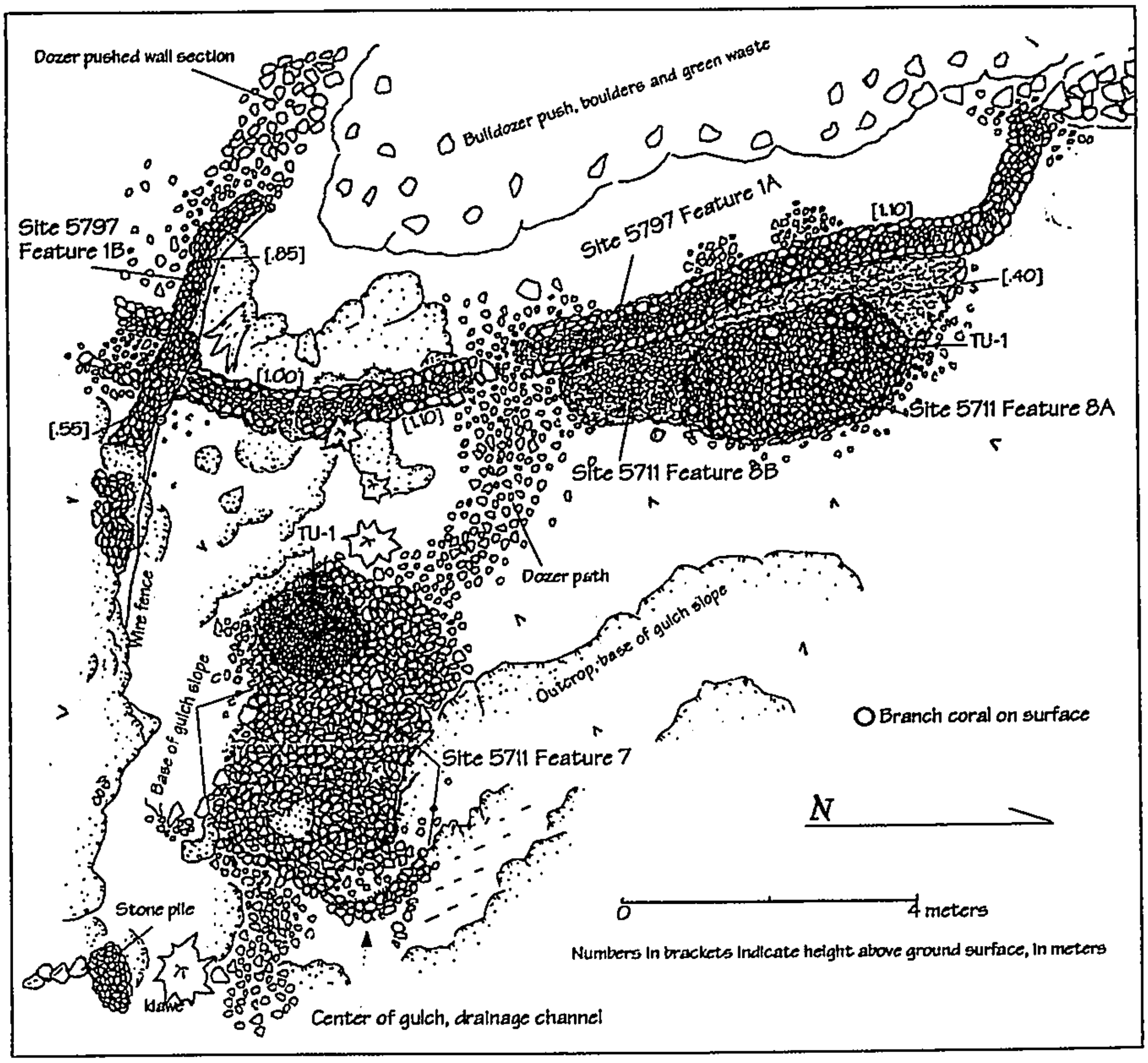
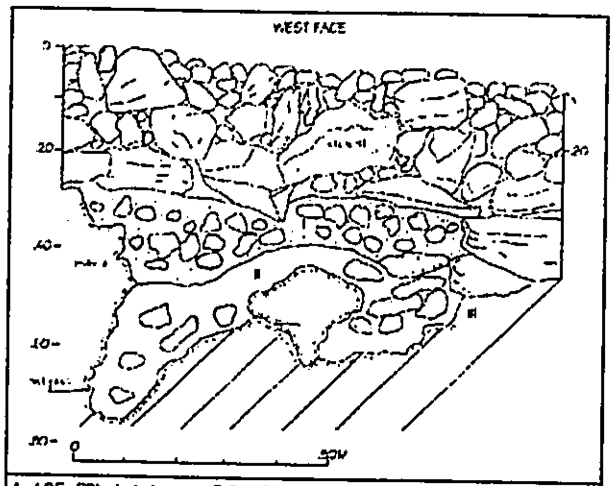


Figure 4.63 Scaled Plan Map, Site 5711 Features 7 and 8, and Site 5797 Feature 1



I: (.35-.53) dark brown (7.5YR3/2 moist and dry) very stony silty loam, 2fsbk, soft, friable, sticky, nonplastic, fine roots common, wavy boundary

II: (.53-.75) dark brown (7.5YR3/2 moist) very stony silty clay loam, 2msbk, hard, friable, slightly sticky, slightly plastic, few coarse roots.

Figure 6.64 Site 5711 Feature 7, Test Unit 1 Profile

duff just below the Layer I surface. No other portable remains were found in screened Layer I soil.

Layer II consisted of dark yellowish brown (dry) silty clay loam subsoil intermixed with decomposing bedrock boulders and cobbles. This layer averaged 0.22 meter thick, with one deeper area that showed evidence of root intrusion. The soil in the root cast was looser and less compact than surrounding Layer II soil, and it contained two small pieces of *Cypraeidea* shell. No other portable remains were recovered from screened Layer II soil. Layer II was situated directly on bedrock throughout most of the test unit; however, pockets of Layer III soil were present beneath movable decomposing bedrock stones. This subsoil consisted of very compact yellowish brown silty clay; less than one liter was recovered for screening and the layer was culturally sterile (*Photo 4.51*).

The absence of a distinct cultural deposit at Feature 7 and the general lack of artifacts suggests that this pavement was not used for general habitation purposes. It is possible that the pavement once formed the base for a soil terrace, which has since washed away; or that it helped channel surface water; or that it had some specialized purpose in connection with the nearby Feature 8.

Site 5711 Feature 8

This feature consists of two stone-filled terraces located in the center of the gulch, 10.0 meters northwest from Feature 7. The west perimeter of the Feature 8 area is defined by the Site 5797 wall, which post-dates this feature (*Figure 4.63*). Feature 8A is the larger of the two terraces; it is D-shaped in plan and oriented with the major axis at 6.5 meters N-S by 4.0 meters E-W. It is constructed from subangular basalt boulders and cobbles, and coral boulders, with faced perimeters along the north, west and south sides (*Photo 4.52*). The east side is defined by a natural outcrop ledge that has been augmented with aligned or stacked cobbles and boulders. This edge is 0.50 meter above the terrace surface. The faced sides of the terrace are 0.30 to 0.40 meters high, with two to three courses of stones indicated. The perimeter stones do not exceed the height of the terrace surface. The surface is informally paved with cobble-sized stones and coral cobbles, resulting in an uneven interior area. Several pieces of unweathered branch coral were observed on the surface of the terrace. In addition, relatively large weathered coral cobbles were incorporated into the terrace surface.

The Site 5797 wall runs parallel to the west side of the terrace, within 0.50 meter of the southwestern corner. It is uncertain whether this wall construction actually affected the terrace. If stones were removed to construct the wall, care was taken to leave the remaining portions intact and to reface the perimeter.

A 1.0 by 1.0 meter test unit was excavated in the northwest portion of the terrace in order to better determine its age and function. The test unit was adjacent to a large coral cobble paving stone, and two surface pieces of unweathered branch coral. The stone fill layer was 0.15-0.25 meter thick and consisted of mixed basalt boulders, cobbles and pebbles, with no soil. Portable items found within the fill layer included six pieces of unweathered branch coral (234.6 grams) and one waterworn siltstone cobble (*Table 4.20*).

Layer I was encountered 0.30-0.45 meter below the terrace surface and consisted of very fine dark brown gravelly silty loam with organic duff and a high percentage of angular basalt cobbles that were introduced as terrace fill. This layer was 0.18-0.23 meter thick and followed a natural east-west slope. Recovered portable material included two gastropod shell fragments (0.7 grams), three pieces of unweathered branch coral (147.7 grams), 14 weathered coral pieces (38.3 grams) and a waterworn basalt cobble. Also observed and left *in situ* was a large piece of unweathered branch coral. This item extended into the north wall of the unit at the interface of Layers I and II (*Figure 4.65, Photo 4.53*).

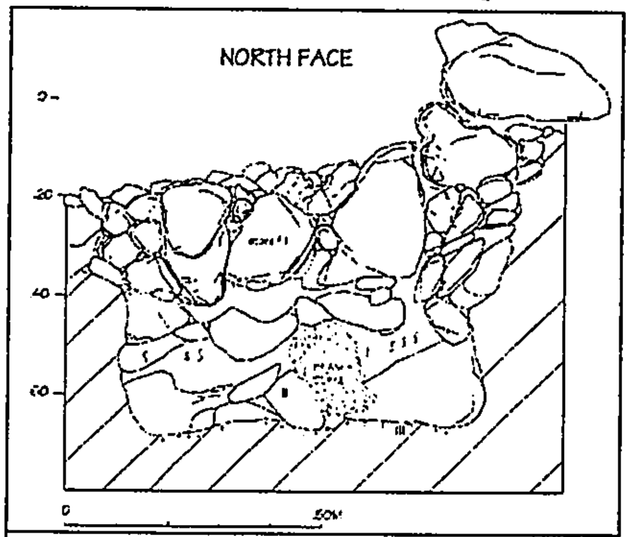
Layer II consisted of dark yellowish brown (dry) very stony silty clay loam with naturally occurring gravel, stones, and decomposing bedrock fragments. One piece of unweathered branch coral was recovered from screened Layer II soil. Layer II was situated on solid bedrock throughout most of the unit; with Layer III soil present only in bedrock crevices. This culturally sterile subsoil was not excavated for screening, as the overlying Layer II was found to be essentially sterile.

Subsurface findings at Feature 8A verified that the primary function of this terrace was ceremonial, based on the high frequency of unweathered branch coral throughout the stone fill and soil layers, and on the absence of artifacts or midden that would indicate other uses. Material present on the surface of the terrace support this interpretation as well. It is notable that Feature 8 is directly downslope from the Feature 1 platform and aligns with the orientation of the platform. Due to this association, it was determined that both features are components of a single large ceremonial complex.

SITE 5711 Feature 8								
TU-1	Stone Fill		I-1		II-1		Total	
Depth	.06-.21		.21-.48					
Gastropods	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
Cypraeidae			1	0.20			1	0.20
Patellidae			1	0.50			1	0.50
Coral								
Branch-unweathered	6	234.60	3	147.40	1	7.70	10	389.70
Waterworn								
Weathered Frags.			14	38.30			14	38.30
Other								
Waterorn basalt	1	305.40	1	514.90			2	820.30
TOTAL	7	540.00	20	701.30	1	7.70	28	1249.00

Table 4.20 Midden and Portable Material, Site 5711 Feature 8

Feature 8B is a second lower terrace located adjacent to the south side of Feature 8A. It is constructed in a similar fashion, with large cobbles and some boulders used as fill material. No surface paving is present, and the surface is somewhat irregular. This terrace was impacted by the construction of the Site 5797 wall, and the western perimeter is currently defined by the wall. It is likely that some stones were removed from this the interior of this structure as well during wall construction. The current configuration of the terrace is D-shaped, with the major axis at 4.5 meters N-S by 2.5-3.5 meters. The terrace is slightly raised 0.10 meter along the south side only. Along the north side, the Feature 8A terrace perimeter is 0.30 meter above the surface of this terrace, and along the east side, the natural outcrop ledge is 0.25 to 0.40 meters above the terrace surface. It is possible that Feature 8B is the remnant of a larger terrace upon which Feature 8A was built. Remnants of this larger terrace are indicated to the northwest side of Feature 8A, where stone fill is present between the terrace and the wall.



I: (.30-.53) dark brown (7.5YR3/2 moist and dry) gravelly silty loam, 2fsbk, soft, friable, slightly sticky, nonplastic, many very fine to fine roots, diffuse, broken boundary.

II: (.53-.70) dark brown (7.5YR3/2 moist) very stony silty clay loam (10YR3/6 dry), 1fcr, soft, friable, slightly sticky, plastic, clear boundary.

III: (.70-.75) dark brown (7.5YR3/2 moist) very stony silty clay loam (10yr 3/6 dry), 2fsbk, hard, firm, slightly sticky, plastic, grades into bedrock

Figure 4.65 Site 5711 Feature 8, Test unit 1 Profile

Due to the disturbances indicated from the wall, it is not possible to determine the former extent of Feature 8B. At this time, it is interpreted as an integral component of Feature 8.

In summary, Site 5711 is interpreted as primarily a ceremonial complex, with Feature 1 as the major structure and Feature 8 as an ancillary structure. The temporal relationship between these two structures and the adjacent terraces is not verified; however, their close association would indicate that their purpose was to enhance the appearance and grandeur of the complex, particularly when viewed from the ocean and shoreline. The terraces are dated to AD 1400-1440, which is not an unreasonable date to expect for the construction of Feature 1 and 8. The relationship of Feature 7 to these structures is uncertain; it exhibits no outward signs of ceremonial use, if it was a landscaping feature, this would tie it into the complex by virtue of spatial association only. Feature 4 appears to post-date the earliest use of the complex, but its presence indicates a likely continuation of activities at this site. This feature is not ceremonial *per se*, however, it could have certainly provided temporary shelter for persons conducting ceremonial activities, or maintenance of the site.

Site 5795 (Ma-B8-233)

Previous Investigations

Site 5795 is one of four sites within the current project area that was recorded and described in 1978 during a Bishop Museum survey of the Seibu golf course third increment (Cordy 1978). The details of this survey are discussed in Chapter 3. Cordy's description of this site is as follows:

> This is a large rectangular enclosure near a large coastal gulch at hole 17. The structure is 17.8 by 8.0 meters ($142m^2$) with a high, wide wall (1.4 to 1.6 meters high, 1.0 meter wide) and no entrances. No midden was present, but historic artifacts were found. One excavation square was dug inside the structure. (Cordy 1978:76)

Cordy's field map of the enclosure indicates a "possible former entry, sealed" in the center of the west wall. This possible entry was apparently opened during the 1978 survey for access to the interior of the enclosure, and it was found in an open condition during a subsequent 2005 survey (*Figure 4.67*). The excavation square described by Cordy was located against the south wall, near the southwest corner, and was 1.5 meters E-W by 0.5 meter N-S. The excavation encountered a 0.03 meter-thick layer of humus over a brown Layer II soil and a rock outcrop (Cordy field notes 1978). The excavation was terminated at 0.09-0.10 meter below surface.

Cordy's notes do not indicate that midden was observed or collected; however, he listed this site (233) as having a cultural layer (II) at 0.05-0.10 meter below surface (Cordy 1978:20). This was apparently determined on the basis of soil color and texture, rather than on the presence or absence of cultural material (Cordy 1978:20). There is no record in the report or in field notes that indicates the recovery of midden at this site during the 1978 field work.

Nine historic/modern artifacts were collected from the surface of the site area in 1978; these items included a Coca Cola bottle, a glass bottle sherd, a leather glove, a metal hoop, a metal meat hook, a tin mess cup (1940s military issue, Carter in Cordy 1978:101), a metal spool, round wire nail(s), and unidentified metal fragments (Cordy 1978:17). Also noted in the field were pieces of barbed wire and sawn wood planks with round nails. The metal hoop, the glove and unidentified metal fragments were found inside the enclosure. All other items were found outside, with a concentration of material 5.0 meters southeast from the southeast corner of the enclosure. The barbed wire was found fastened to *kiawe* trees in a pattern suggesting that a fence may have surrounded the enclosure at one time. The lumber was found with the above concentration and in an area approximately 5.0 meters northeast from the northeast corner of the enclosure. The time frame indicated by surface artifacts was 1945-1950 (Cordy 1978:30), and the structure was interpreted as being "entirely historic" (Cordy 1978:27). Suggested site function was as a storage facility (Cordy 1978:48).

Additional field work was conducted at Site 5795 in August 2005 and reported in Rotunno-Hazuka et al. 2005. At that time, a scaled plan map was completed and three additional test units were excavated. Two 1.0 by 1.0 meter units were located inside the enclosure, and one 2.0 by 1.0 meter unit was excavated through the west wall. Just north of the possible former entry that was opened in 1978.

Test Unit 1 was located in the center of the south half of the enclosure at was excavated to a base depth of 0.27 meter below surface (*Figure 4.66*). Two soil layers were identified, including a thin very dark grayish brown (10YR2/2) humic layer (I) over dark yellowish brown (10YR3/6) stony silty clay loam. One glass marble fragment was found at the base of Layer I, 0.05 meter below surface. This item is generally contemporaneous with the mid-twentieth century artifacts recovered by Cordy. No midden or other portable materials were recovered at this location.

Test Unit 2 was located inside the east wall, near the southeast corner of the enclosure. The unit was excavated to a base depth of 0.30 meter below surface, and revealed the same soil stratigraphy indicated in Test Unit 1. The excavation indicated that the wall foundation base was only 0.05 meter below current ground surface, and that the thin Layer I soil was also present beneath the core fill of the wall. No artifacts, midden or other portable materials were recovered from Test Unit 2.

Test Unit 3 was excavated through the west wall, which was 1.40 meter wide at the location. The excavation confirmed that the wall base was quite shallow and was situated on natural bedrock outcrops in places. The wall also appeared to have been built in one episode, with well-faced stacked sides and smaller core filling. The larger base stones along the sides appeared to penetrate through the Layer I soil, however the smaller core filling was situated on top of a relatively undisturbed Layer I deposit (*Figure 4.66*). No artifacts, midden or other portable materials were recovered from Test Unit 3.

The findings of the August 2005 testing found no new information that would alter or revise Cordy's interpretation of the enclosure as a storage facility related to ranching. The height of the walls and the relatively narrow entrance were referenced as indicators of a storage area as opposed to some type of animal enclosure. The period of construction as historic era was maintained, given the relatively good preservation of the walls, construction technique, and the presence of historic era artifacts.

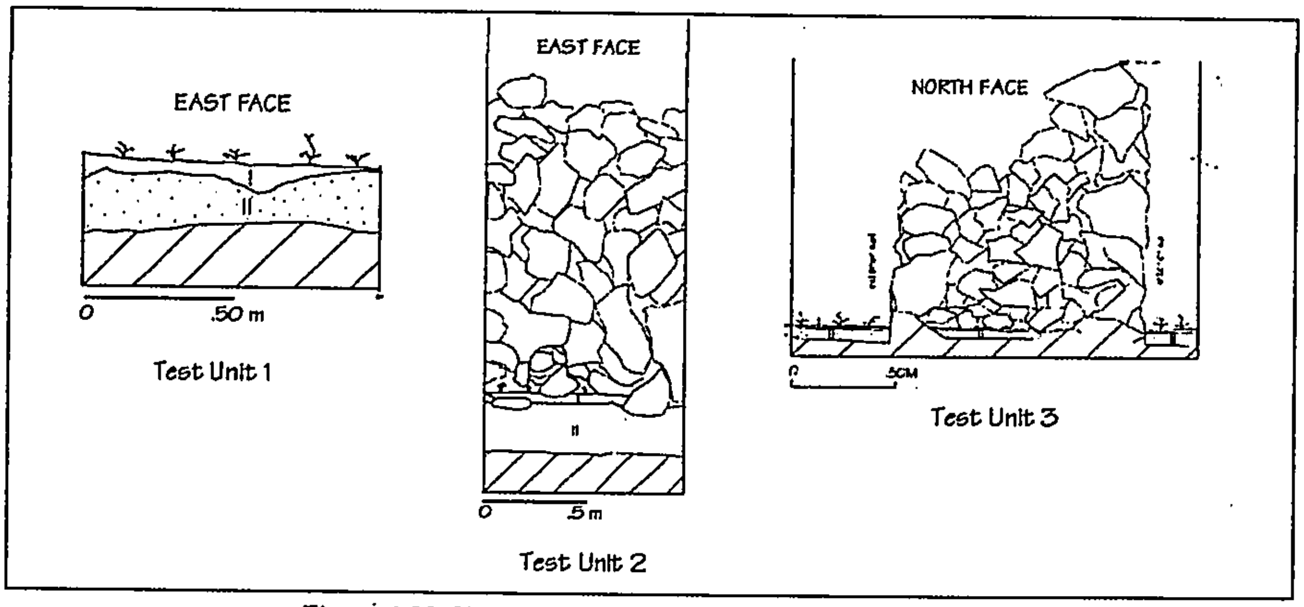


Figure 4.66 Site 5795, Test Units 1-3 (August 2005) Profiles

Current Findings

During the current survey, the SIHP site number was assigned to this site, and two additional test units were excavated inside the Site 5795 enclosure (*Figure 4.68, Photo 4.54*). Test Unit 4 was located in the center of the enclosure, across from the entrance. Two soil layers were encountered in the excavation, which terminated at 0.25 meter below surface at the interface of Layers II and III. Layer I at Test Unit 4 was 0.06 meter thick and consisted of loose brown silty loam with duff and roughly 50% stones by volume (*Figure 4.67*). Two pieces of marine shell were recovered from screened Layer I soil, including a *Cypraeidae* shell fragment (1.2 grams) and a *Muricodrupa funiculus* fragment (0.1 gram). Layer II at Test Unit 4 was yellowish brown silty clay loam with a minimal amount of stone. No midden or artifacts were recovered from this layer.

Test Unit 5 was located at the north end of the enclosure, near the center. This excavation encountered a 0.08 meter-thick deposit of Layer I soil atop solid *pahoehoe* bedrock. Further probing in the vicinity indicated that the northern 1/3 of the enclosure floor was solid bedrock. No artifacts, midden or other portable materials were recovered from the 18 liters of soil that was screened from this test unit.

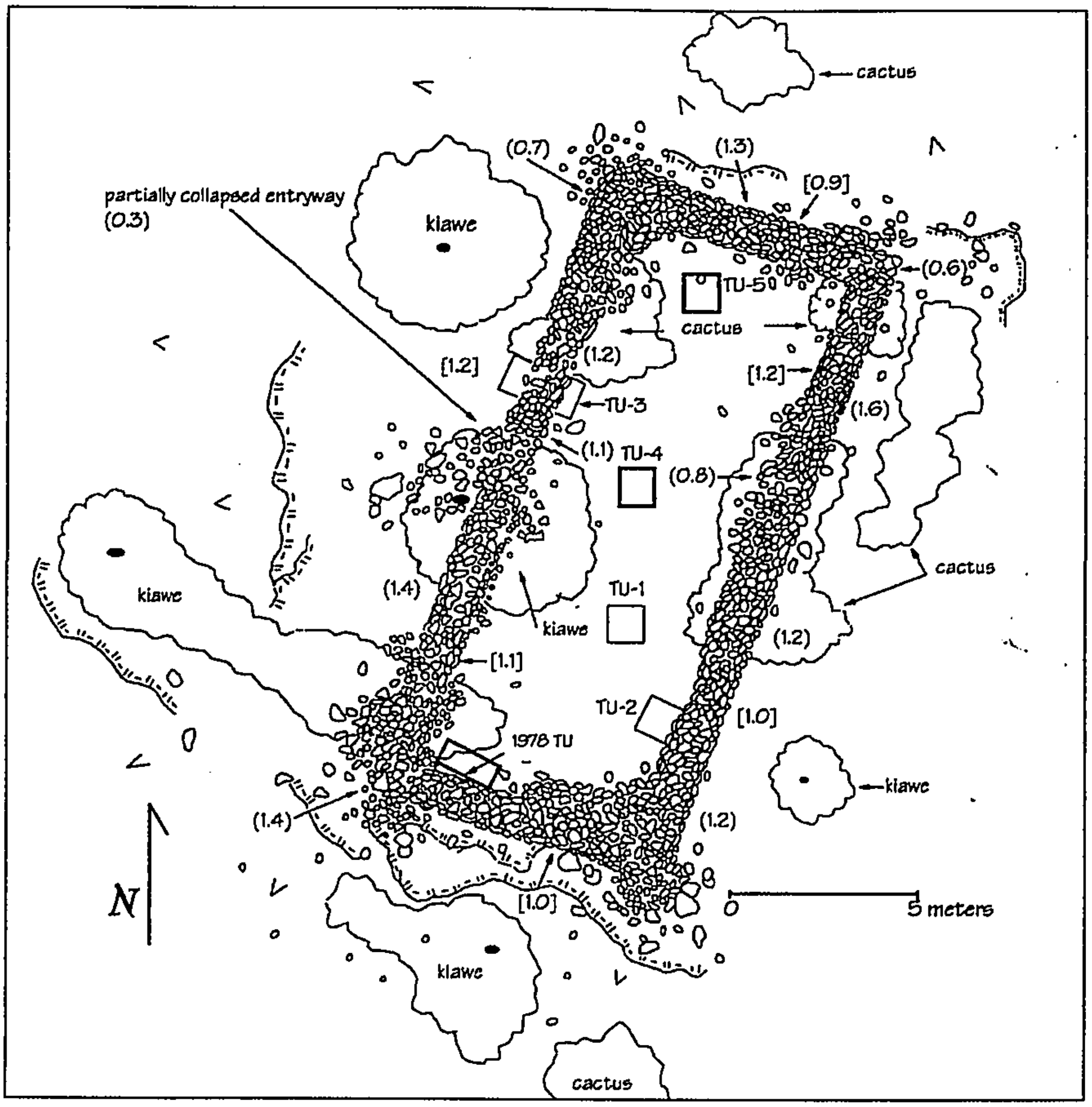


Figure 4.67 Scaled Plan Map of Site 5795, completed in August 2005 (with recent test units (4 and 5) added)

In summary, recent testing inside the Site 5795 enclosure further substantiated prior findings that this enclosure is of historic construction and was most likely used for storage. The findings of a rock surface in the northern portion further supports use for non-habitation activities, as this surface would have been somewhat irregular and in need of paving if the enclosure was a habitation area. The shallow soil deposits elsewhere preclude its use for purposes that would have required subsurface excavation.

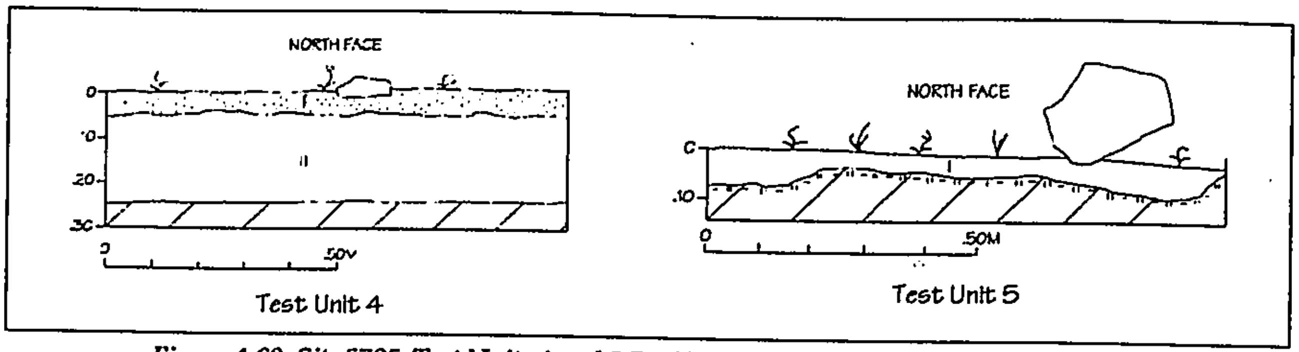


Figure 4.68 Site 5795, Test Units 4 and 5 Profiles (Note: soil layers same as Figure 4.67)

Site 5796 (Ma-B8-234)

Previous Investigations

Site 5796 was first recorded during the Bishop Museum survey of the Seibu golf course third increment (Cordy 1978), at which time it was described as follows:

> This site is south of the major gulch at hole 17. It is 20.3 by 26.8 meters (544m^2) with an opening in the south wall. Walls are 0.7 to 0.8 meter high and 0.5 to 0.8 meter wide. A wood post with square nails is in the center of the structure. No midden was visible. Two excavation squares were dug, and a soil sample was taken. (Cordy 1978: 77)

Two 1.0 by 1.0 meter test units were excavated at Site 5796 during the 1978 survey, and two categories of midden - bird bone and Cypraeidae shell - were reported as being recovered (Cordy 1978:24). No cultural layer was identified at this site (Cordy 1978:20), and field notes provide no information on the soil stratigraphy, base depth of excavations, or specific recovered materials . One beverage bottle with a crown type closure was recovered from the surface inside the enclosure; this item was dated to 1920-present (Carter in Cordy 1978:100). The 1978 survey report identifies Site 5796 as being "entirely historic" and it is interpreted as a livestock enclosure (Cordy 1978:27, 48). That was utilized during the early to middle twentieth century.

Site 5796 was revisited in August of 2005, when a scaled plan map was completed and three additional test units were excavated (*Figure 4.69*). This field work resulted in revised dimensions for the enclosure:

> The enclosure site measures 28.0 (e/w) by 23.5 (n/s) with intact walls ranging in height from .8-1.4 meters and .7-1.0 meters in width. The interior floor area measuring 25.5 meters long by 21.5 meters wide is level and is comprised of soil areas and scattered cobbles. The interior floor slopes gently west to east towards a steep hillside. (Rotunno-Hazuka et al. 2005:24)

Test Unit 1 was a 1.0 by 1.0 meter unit located in the south-central portion of the enclosure, in an area of soil with loose surface cobbles. Two soil layers were encountered, including a thin (0.05 meter) Layer I very dark grayish brown loose humic loam with duff and 10% stones by volume. Layer II consisted of dark yellowish brown silty clay which extended to the base of excavation at 0.27 meter below surface. Three small fragments of *Cypraeidae* shell were recovered from screened Layer II soil, between 0.05 and 0.10 meter below surface.

Test Unit 2 was a 1.0 by 1.0 meter unit located against the interior side of the northeast wall; excavation here encountered the same two soil layers, and no midden or artifacts. The base of the wall was found to be rather shallow, resting on or just beneath the this Layer I topsoil (*Figure 4.70*).

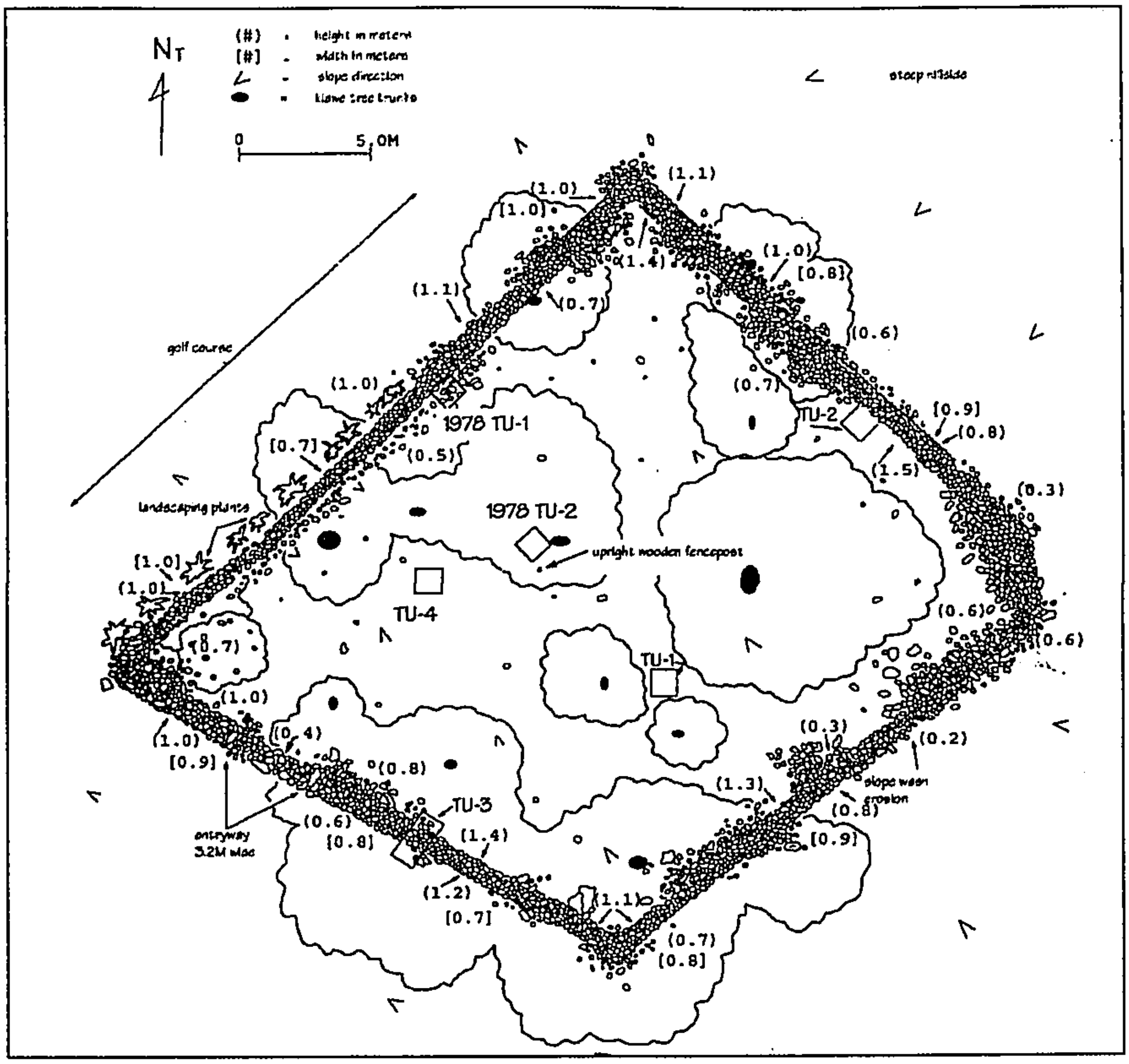


Figure 4.69 Scaled Plan Map, Site 5796, completed August 2005 (recent and 1978 test units added)

Test Unit 3 was a 1.0 by 2.0 meter unit excavated through the southwestern wall of the enclosure. Clear bottle glass fragments were present on the surface against the inside wall at this location, and two pieces were recovered from the surface inside the test unit. Layers I and II were found to be the same as indicated in Test Units 1 and 2. One piece of marine shell and four small pieces of weathered coral were recovered from the upper portion of Layer II, between 0.05 and 0.10 meter below surface.

Additional work at Site 5797 found no new information to revise or alter the 1978 interpretation of this enclosure was a cattle pen:

> A large collapsed or closed off entryway was noted in the south wall, and due to the width of this entrance coupled with the presence of a wooden post in the center, as well as the enclosure shape and size, this feature probably was utilized as a holding pen for cattle either being imported or exported. (Rotunno-Hazuka et al. 2005:25)

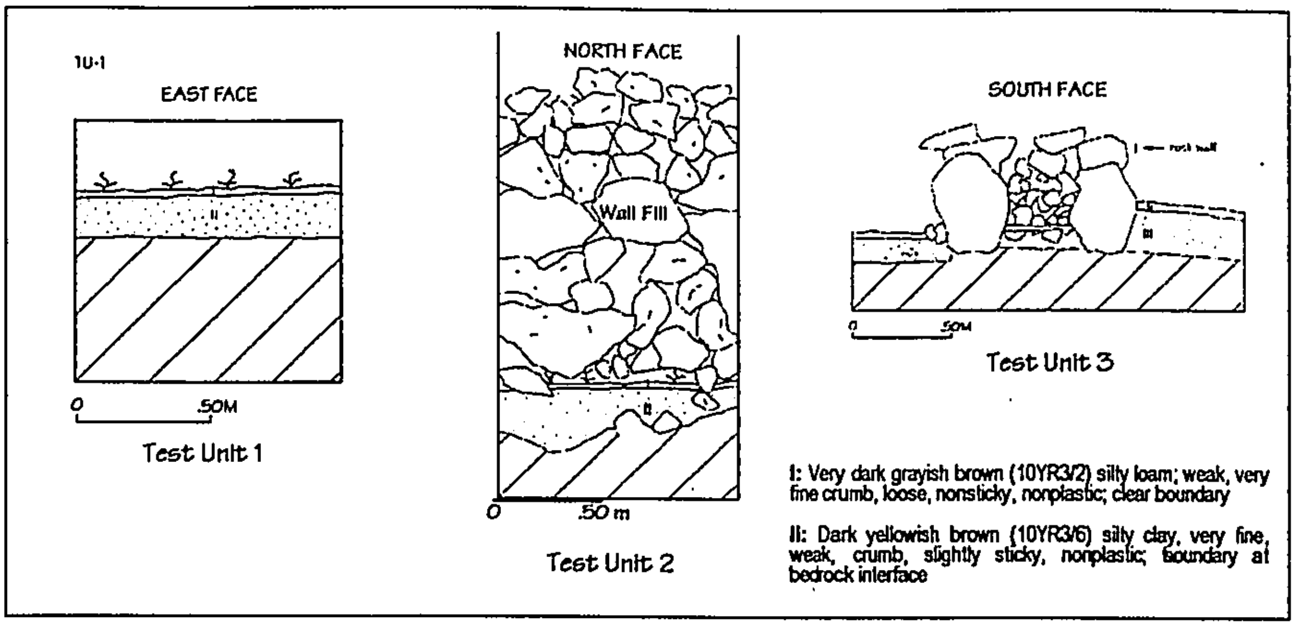


Figure 4.70 Site 5796, Test Unit 1-3 Profiles (August 2005)

Current Findings

During the current survey, one additional test unit (TU-4) was excavated inside the enclosure, and the SIHP site number was assigned. The location of the unit was determined by conducting soil probes across the interior soil deposits and locating an area of relatively deep soil, or where surface midden was observed. The unit was placed in the western quarter of the enclosure, where soil deposits were found to be 0.25 meter thick over bedrock (*Figures 4.69 and 4.71, Photo 4.55*). Layer I at this location was 0.06 to 0.09 meter thick and consisted of the same dark grayish brown silty loam as described above. One waterworn fragment of a *Conidae* shell (6.3 grams) was recovered from screened Layer I soil, along with two pieces of weathered coral (15.4 grams).

Layer II consisted of gravely silty clay loam subsoil that showed some mottling indicative of prior disturbance. No midden, artifact, or other materials were recovered from the 65 liters of soil screened from Layer II. The unit was terminated at very compact subsoil with decomposing bedrock.

Results from subsurface testing during three different surveys showed a very sparse occurrence of marine shell and weathered coral fragments. These materials may represent the remnants of a deposit that pre-dated the enclosure. No new information was recovered during the current survey that would cause the age of the enclosure to be questioned. An alternative function as a garden enclosure, as opposed to animal enclosure, is however feasible. In general, the ground level inside the enclosure is above the ground level on the outside, and the wall heights along the interior sides are lower than the exterior sides. In some cases, the interior wall height of intact sections is 0.5 meter or less, which would not appear to be the ideal height for a cattle enclosure. The exterior sides of the walls are 0.90 meters and greater along intact sections. This would suggest that the walls could have functioned to keep cattle out. A third possibility is that the enclosure was built as a garden area and later converted to a cattle pen.

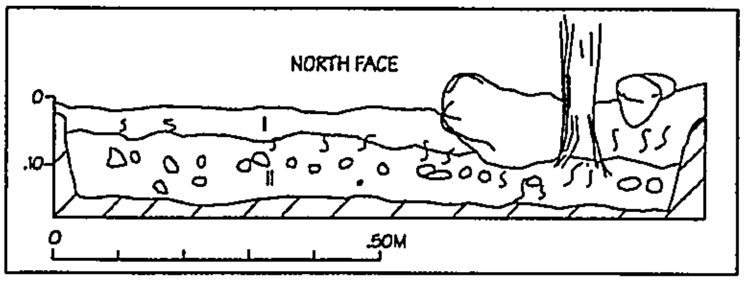


Figure 4.71 Site 5796, Test Unit 4 Profile (soils same as Fig. 4.70)

If the enclosure was used as a garden area, the midden and coral could date to that period of use, which would have been during the cattle era (hence the need for walls).

Site 5797 (Ma-B8-240)

Previous Investigations

This wall was first recorded during the 1978 Bishop museum survey of the Seibu golf course third increment (Cordy 1978). The full description of the site as found in the 1978 report is as follows:

> This site bounds an area within the coastal end of the major gulch at hole 17. It runs on both sides of the gulch and crosses it near the beach and Site 233. The wall is 0.5 to 0.7 meter wide and 1.0 meter high. No excavation was done. (Cordy 1978:77)

The site map published in this report depicts Site 5797 as an L-shaped wall (Cordy 1978:9), however, it is described as occurring on both sides of the gulch, and on the map of historic era sites, parallel walls are shown extending along the gulch *mauka* of Site 233 (Cordy 1978:53). The site was interpreted as an historic era livestock enclosure.

Current Findings

Remnants of Site 5797 were identified at the western end of the gulch, adjacent to the edge of the golf course impact zone. This is the location "near Site 233" where the wall crosses the gulch and continued *makai* toward the beach along both side of the gulch (*Figure 4.63*). This portion of the wall was designated Feature 1. Additional wall sections (Features 2-4) were observed along a straight alignment extending *mauka* from the southern corner of Feature 1. These wall sections were associated with wooden fence posts and heavy gauge straight fence wire that continued eastward through the gulch to Mākena-Keoneʻōʻio Road (*Figure 4.1*).

Site 5797 Feature 1 is comprised of two construction components, the largest of which includes the remnant wall section that crosses the gulch (Feature 1A). This wall segment is 35.5 meters long and oriented generally N-S, with gradual bends at 5.0 meters from the existing ends of the wall (*Photo 4.56*). It is constructed from subangular boulders and cobbles with a bifaced core-filled design. Smaller cobbles and pebbles are used to fill the center of the wall area between two aligned rows of stacked boulders and large cobbles. Width of the wall ranges from 0.60 to 1.10 meters, with the wider portions along the northern half of the segment. Heights of the wall are greater on the west (downhill) side and range from 0.50 to 1.10 meters, with an average of 1.0 meter where the wall is intact. On the east side, heights range from 0.50 to 1.10 meter, with an average of 0. 70 meter. A 2.5 meter-wide section of the wall has been breached by machinery; this section is in the center of the gulch.

The northern end of the wall is at a berm of pushed fill and boulders from the golf course. The southern end of the wall abuts Feature 1B, which is oriented E-W along the base of the gulch slope. Feature 1A forms the western perimeter of Site 5706 Feature 8B. Some of the stones from this terrace may have been used in the wall construction, and two pieces of branch coral are present atop the wall adjacent to the terrace. Other portable remains observed in the immediate area include marine shell fragments and pieces of weathered coral, all of which were seen in bulldozer disturbed areas to the west of the wall and in the wall breach.

Feature 1B extends to the east and west of its corner with Feature 1A. This wall segment shows a distinctly different construction design; it is narrower, lower, and of multiple-stacked rather than bifaced construction. A 16.0 meter-long section of the wall is still intact. The eastern end has been impacted by golf course construction and the western end abuts a vertical bedrock face, where the wall temporarily terminates. A heavy gauge straight wire fence with posts runs along the north side of the wall, and continues east, beyond the end of the stone construction. This wall segment is 0.60 to 0.80 meter wide and shows varying heights along the north and south sides. The north (downhill) side ranges from 0.50 to 1.10 meter, with an average of 0.70 meter; the south side ranges from 0.40 to 0.80 meter, with an average of 0.50 meter. This wall section utilizes bedrock ledges in its construction and consists primarily of large to medium cobble-sized stones with no core fill.

Remnants of what appear to be a bifaced wall extend southward approximately 3.0 meters from the juncture of Features 1A and 1B. It is possible that the Feature 1A section originally continued south up the south slope of the gulch, and was truncated in order readjust the wall configuration. Feature 1B could have been constructed when the fence posts were installed. Based on the 1978 survey, it can be assumed that these two walls formed an enclosure that extended westward nearly to the beach.

Site 5797 Features 2-4

Three additional constructed wall segments were identified along the fence line that continued eastward from Feature 1. This line does not follow the top of the gulch; rather it is oriented in a straight line that runs along the base of the south slope and up the east (back) slope (*Figure 4.1*). The fence line and constructed wall sections are near or intersect with a number of the Site 5706 features, and with Site 5709 Feature 1.

Feature 2 is located 12.0 meters east from the east end of Feature 1B. It is a 30.5 meter-long section of constructed stone wall that is aligned along a wire fence line. This wall section ends at the Site 5706 Feature 2 trail, which appears to have taken out a portion of this fence line and wall. This wall section is situated along the lower south slope of the gulch, just above the base, and is at a higher elevation than Feature 1. It consists of single to multiple-stacked cobbles and boulders, two to four courses high and one to three courses wide. Height of this section ranges from 0.15 to 0.60 meter and width ranges from 0.50 to 0.65 meter. This feature is in a poor condition due to slope erosion and probable animal traffic (*Photo 4.57*).

Feature 3 is located 18.2 meters east from the east end of Feature 2, along the same straight fence line. This wall section is 15.0 meters long and shows the same construction technique as Feature 2, with simple to multiple-stacked boulders and cobbles, two to four courses high. Widths here range from 0.60 to 1.00 meter and heights from 0.25 to 0.40 meter. This section shows upright and fallen fence posts with up to three strands of heavy gauge straight wire attached.

Feature 4 is located 7.6 meters east from the east end of Feature 3. This wall section is 4.5 meters long and incorporates exposed bedrock. This section is 1.0 meter wide and 0.9 to 1.65 meter high, with the higher sections being at natural rock faces. Feature 4 extends between Site 5710 Features 3 and 4, although it does not appear to have impacted these features (*Figure 4.53*). This location is along the upper east slope of the gulch, just below the top of the bank. The fence line continues east from this location and crosses Site 5709 Feature 1, where a fourth wall remnant was identified.

It appears that Features 1B through 4 are contemporaneous, and clearly associated with livestock management. Feature 1A is most likely an earlier component that was altered for use in conjunction with the later wall. The original configuration of Feature 1A is indeterminate, and it cannot be stated with certainty that this wall was originally intended as a cattle enclosure. It does appear to post-date Site 5711 Feature 8, which potentially dates to the 15th century. Feature 1A could have been part of the large enclosure that was present around Kahaleokaia's houselot (LCA 5147:7) that is depicted on Torbert's map (see Chapter 2).

Site 5798

This historic/modern habitation site is located in the southeastern corner of Parcel 84, the Mākena School lot. It was briefly noted in Bishop Museum's reconnaissance survey report of the Mākena School Site, where it was referred to as one of two "concentrations of modern material, ...one located just beyond the northeastern corner of the parcel and the other located within the southern third of the parcel" Cleghorn et al. 1988:7). Cleghorn et al. assigned SIHP Site number 1007 to the entire two-acre school lot parcel; however, this site and Site 5799 are functionally and temporally distinct from the school, and it seems that separate site numbers are warranted.

Four features were identified at this site during the current survey, including an L-shaped stone wall (Feature 1), wooden structural remnants (Feature 2), a concentration of *imu* stones (Feature 3), and a refuse pit (Feature 4). Overall area of the site is 30.0 meters E-W by 19.0 meters N-S (*Figure 4.72*). The site is situated on a low knoll, and the southern perimeter is defined by the Site 1007 Feature 7 boundary wall, which is also the project area boundary.

Feature 1 is an L-shaped wall that appears to have been part of a larger boundary or enclosure wall (*Photo 4.58*). The long axis is 14.0 meters long and oriented NE-SW, at a slight angle to the Parcel 84 south boundary wall. The corner is at the west end of the long section, with the short section turning to the south; this section is 4.5 meters long. The eastern end of the wall shows evidence that it continued eastward, beyond the eastern boundary of Parcel 84. Rubble remnants are apparent for at least another

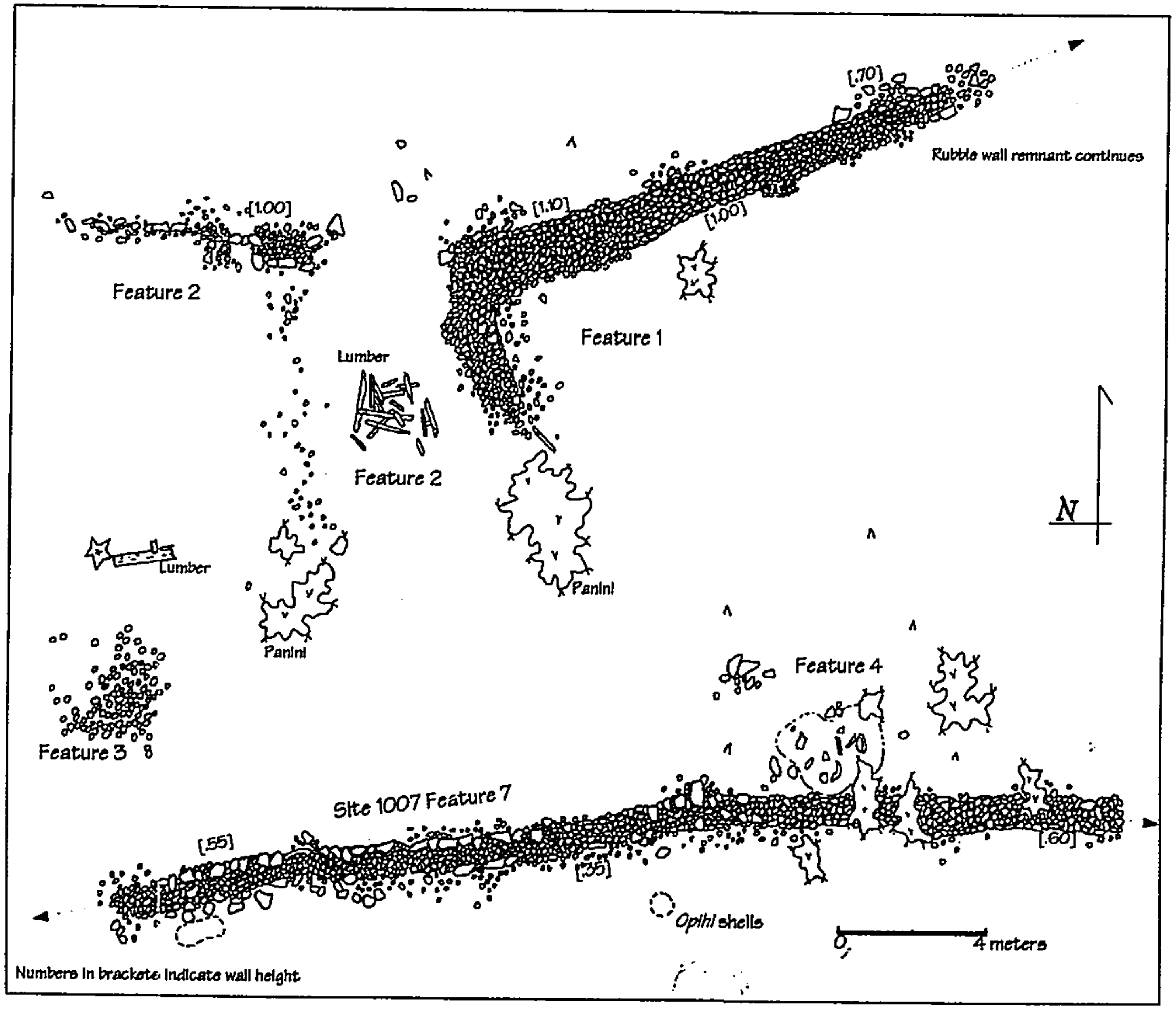


Figure 4.72 Scaled Plan Map, Site 5798 Features 1-4

30.0 meters. Likewise, the west end of the wall was truncated, and an unknown length was removed, although there are no remains to suggest the extent of the wall toward the south. The wall is bifaced and core-filled, with the outer side defined by large stacked boulders and the interior filled with small cobbles and pebbles. Width of the wall ranges from 0.90 to 1.30 meters, and heights of intact portions range from 0.65 to 1.10 meters. The relationship between this wall section and the dwelling is uncertain, although it appears that the dwelling was uphill and to the south of the wall, which may have pre-dated the house.

Fragments of glass and metal are scattered on the ground along both sides of the wall, and on top of the wall. These materials are generally middle 20th century in age.

Site 5798 Feature 2

This feature includes two areas of structural lumber and remnants of a stone retaining wall, adjacent to the west side of Feature 1 (*Photo 4.59*). Overall area of the feature is 10.0 by 10.0 meters. The primary lumber concentration is 1.0 meter west of the Feature 1 wall. It consists of a concentration of dimensional lumber with round (16D) nails in place. The lumber is within an area 2.2 by 2.3 meters and appears to represent a structural item that rotted in place, rather than a pile of relocated materials. The longest board present is 1.6 meters (5 feet) and dimensions are 1 by 6 inches. The size and amount of lumber present suggests a structure similar to a chicken coup or small animal shelter, or a platform of some sort.

A second area of lumber is located 6.0 meters to the southwest. Two heavy dimensional lumber planks and a concrete block are present at the base of a *kiawe* tree trunk. These items appear to be in secondary context. Remnants of a stone retaining wall are present 3.0 meters west of Feature 1 and 3.0 meters north of the lumber concentration. This wall remnant is 7.0 meters long, with approximately 2.0 meters still intact at the eastern end. It is 1.0 meter wide where intact; height along the north (downhill) side is 1.0 meter, and height along the uphill side is 0.34 meter. The wall may have originally been bifaced; however, it is now generally rubble with one faced side at the east end. Broken glass and metal fragments are scattered on the ground in the general area of this feature; it appears that the area was impacted by machinery.

Site 5798 Feature 3

Feature 3 is located at the western edge of the Feature 2 area and 3.8 meters north from the Site 1007 south boundary wall. It consists of a concentration of rounded vesicular basalt cobbles, of the classic *imu* type, surrounding a depression in the ground that resembles an *imu*, or earth oven. The overall area of the concentration is 2.7 meters N-S by 2.5 meters E-W, and individual cobbles range in size from 0.10 to 0.25 meter in diameter. The stones are loosely piles one to three high in a roughly oval formation around a shallow depression in the soil that looks like an *imu* pit. The terrain at this feature is generally level, with a very gently slope to the northwest. No artifacts or portable remains other than the stones were observed in the immediate area of this feature.

Site 5798 Feature 4

Feature 4 is located at the southeastern corner of the site, against the north side of the Site 1007 south boundary wall (Feature 7). It consists of an excavated pit that contains modern era household refuse, including enamelware dishes and kettles, glass bottles, glass kitchenware, tin cans, porcelain tableware, and miscellaneous metal items. The refuse pit is 1.5 meters in diameter, and is filled to within 0.30 meters below surrounding ground surface. Refuse material is scattered from the pit to the north and east, down a gentle natural slope. There are indications that someone searched through the pit in the not too distant past; perhaps the Bishop Museum staff took a look at the material in 1988, or a bottle hunter did some digging. All observed items date to the modern era, *circa* 1940-1970.

The nature and distribution of structural remains and artifacts at Site 5798 suggests that the main dwelling may have been located to the south side of the parcel boundary wall, and outside of the project area. This location conforms with the location of a structure shown on the 1956 and 1983 USGS Makena Quadrangle maps, and with the home of the Poepoe family.

Site 5799

This site is located along the western boundary wall of the Mākena School parcel, 23.5 meters northeast from the southwestern corner of the school parcel. It consists of two features, a concentration of structural lumber (Feature 1) and stone wall remnant (Feature 2). The overall site area is 24.0 meters NE-SW by 14.0 meters (*Figure 4.73, Photo 4.60*).

Feature 1 consists of a roughly rectangular (8.0 by 6.0 meters) area of dimensional lumber and in place wire nails of various sizes. The structural remains appear to have deteriorated *in situ*, and they appear to represent a small shack. (c. 8 by 10 feet). No electrical components or plumbing was observed in the immediate area. Artifacts observed include clear bottle glass and ceramic sherds dating to the middle twentieth century (*circa* 1940-1970).

Feature 2 is located 3.6 meters west from Feature 1 and within 3.0 meters east of the Site 1007 Feature 1 west boundary wall. It includes a bulldozed section and an intact section of a stone retaining wall. The overall length indicated is 18.0 meters NE-SW, with the southern 8.0 meters in a disturbed condition. This southern portion includes a 3.0 meter-wide break and a 5.0 meter-long section of stones that were pushed onto the existing wall. This pushed section of the wall is 3.0 meters wide and mounded up to 0.62 meter high.

The 9.0 meter-long intact section of the wall is 0.50 to 0.70 meter wide and ranges in height from 0.35 to 0.42 meters along the north (downhill) side. The south side of the wall is generally level with to just above ground surface. There are indications that this wall may have turned to the southeast, based on a linear pattern of boulders and cobbles. If so, it may have connected with the remnant retaining wall at Feature 2, Site 5798.

In addition to bottles and dishes, surface material observed in the vicinity of the feature include 55 gallon oil drums and metal debris.

Artifacts and structural remains found at Site 5799 indicate that it is contemporaneous with Site 5798, and was most likely utilized by the same family. One informant indicated that the shack at Site 5799 was used primarily by men for recreational activities.

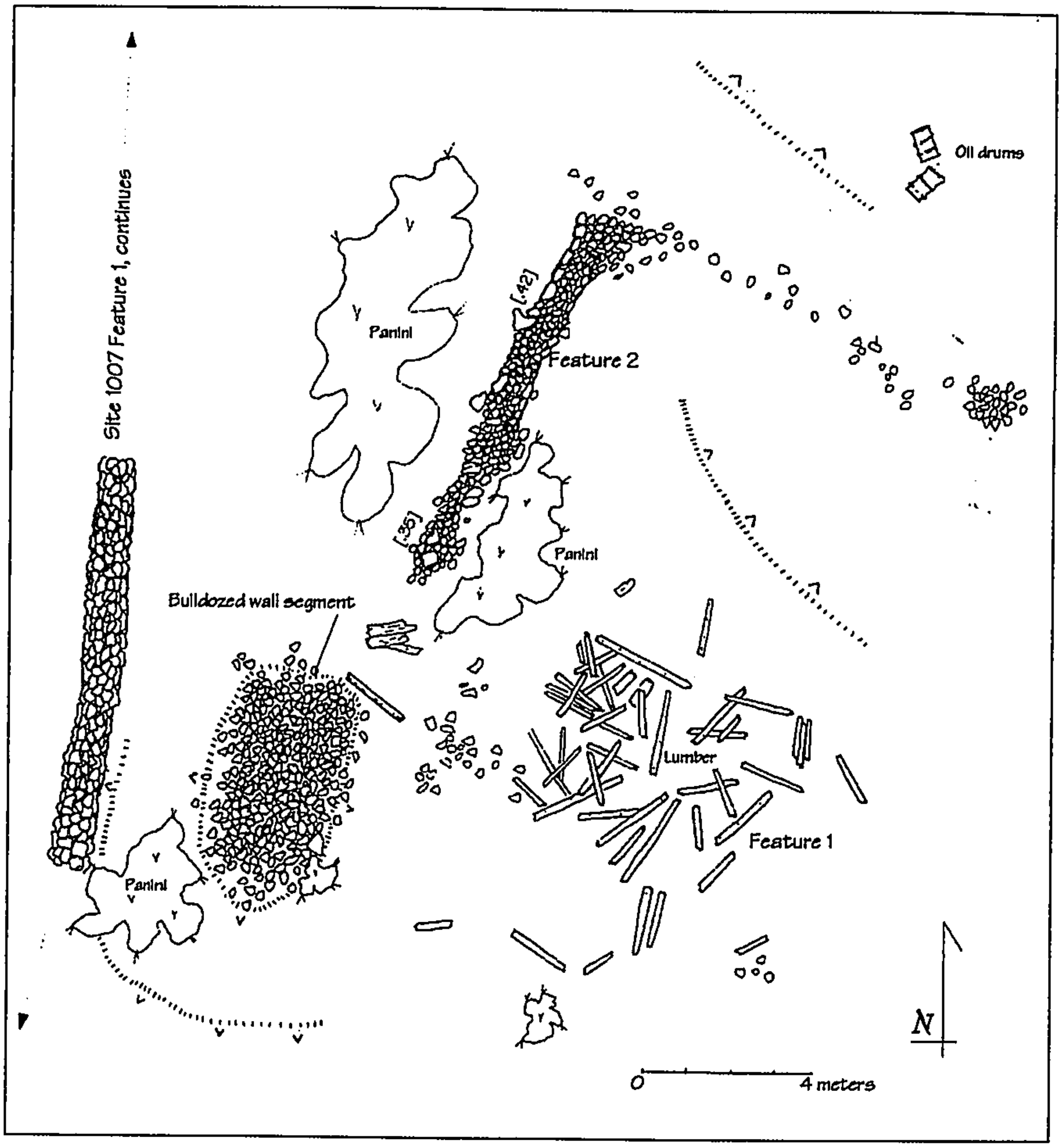


Figure 4.73 Scaled Plan Map, Site 5799

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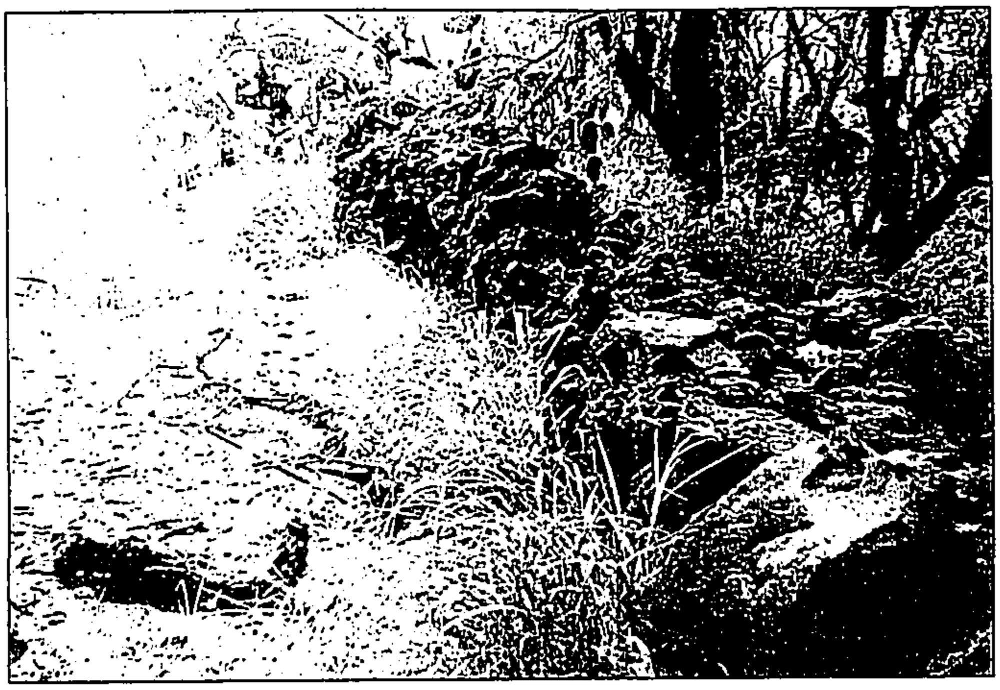

Photo 4.1 Site 1007 Feature 1, view to east

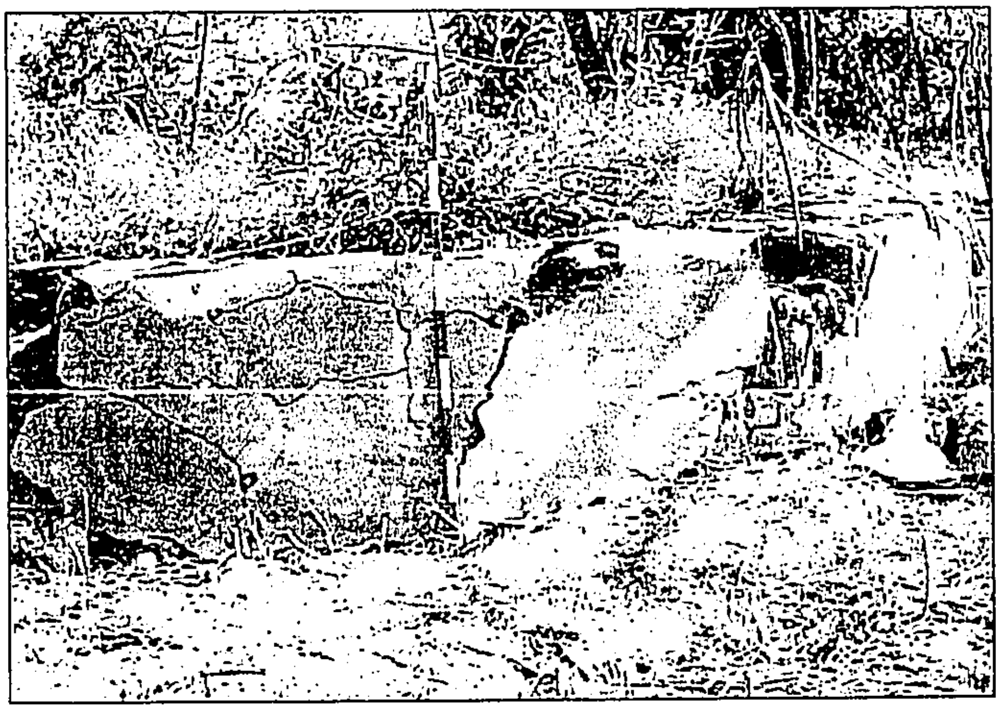

Photo 4.2 Site 1007 Feature 5 Cistern, view to northeast

Photo 4.4 Site 1853 Feature 5, view to east

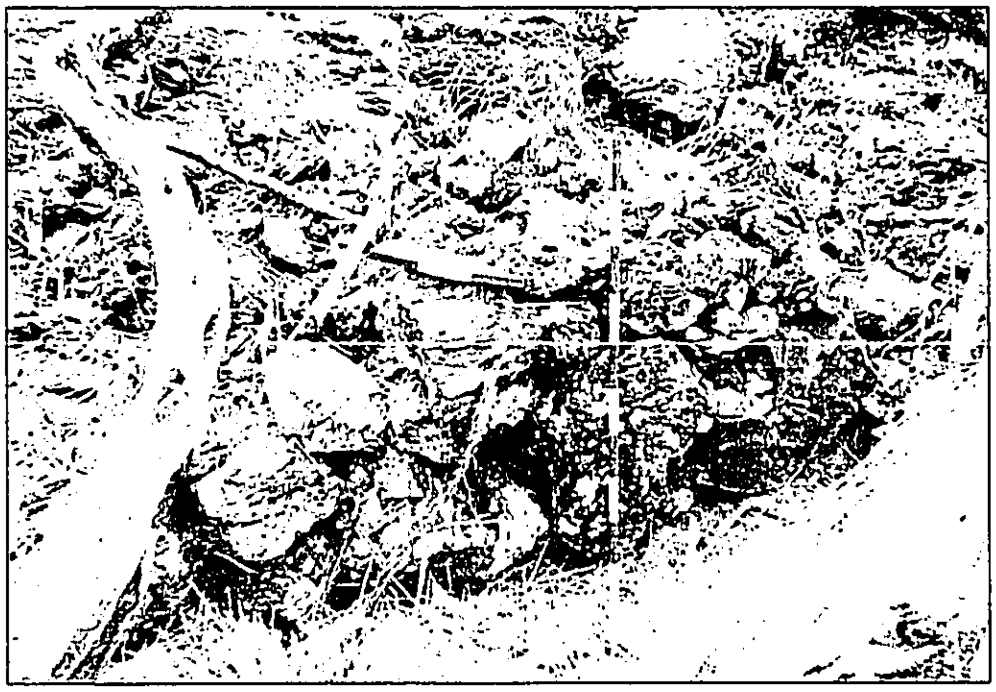

Photo 4.5 Site 1853 Feature 6B, view to southwest

Photo 4.7 Site 1853 Feature 7, view to north

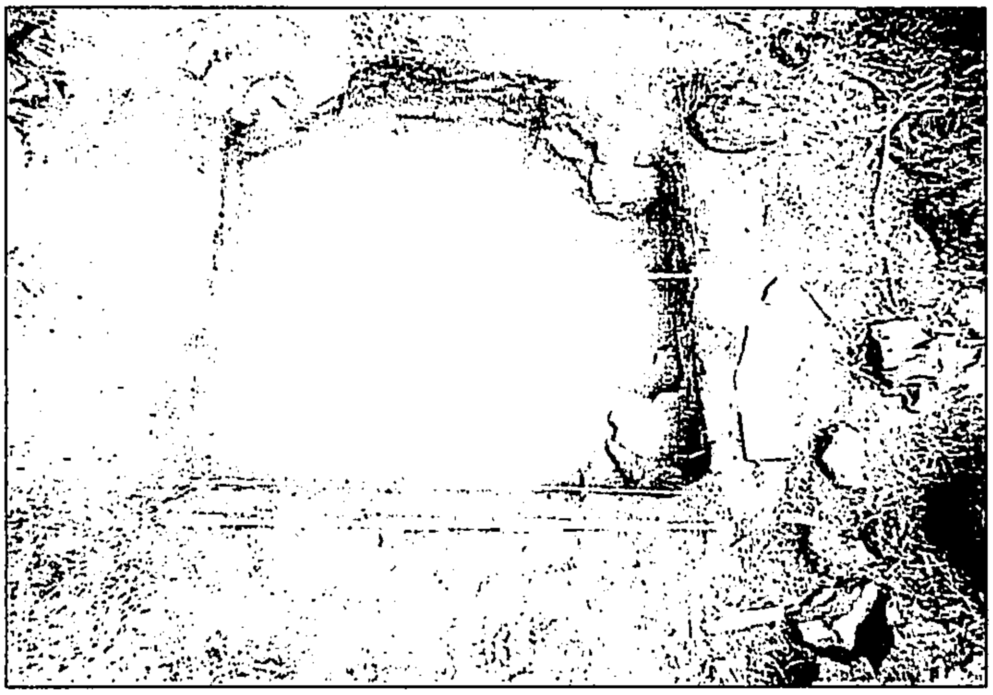

Photo 4.8 Site 1853 Feature 7, Test Unit 1, base of excavation

Photo 4.9 Site 1853 Feature 8A, view to east

Photo 4.10 Site 1853 Feature 8B, view to east

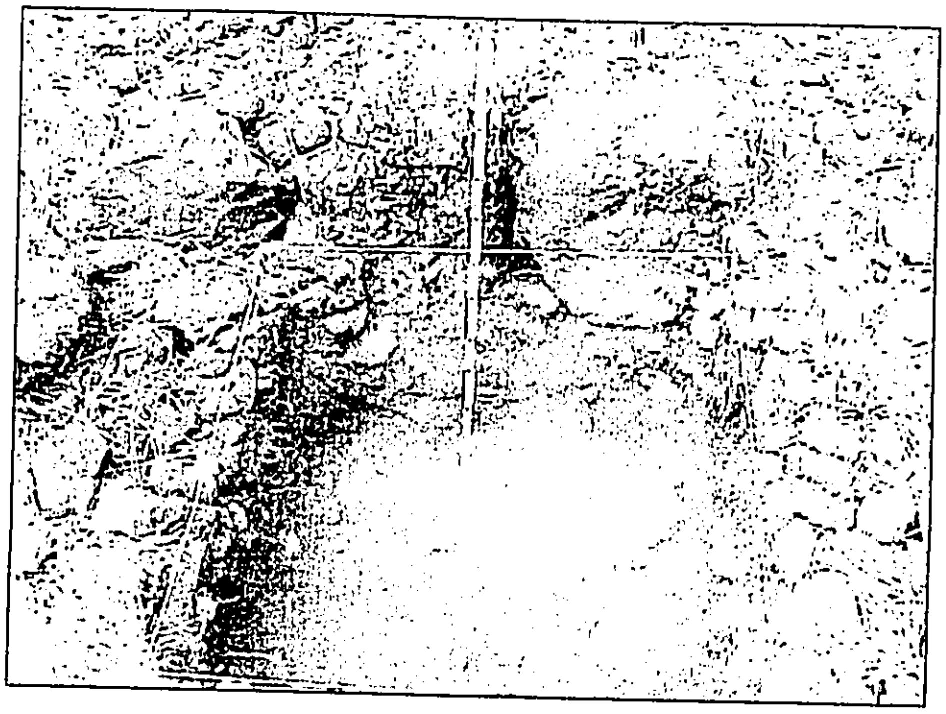

Photo 4.11 Site 1853 Feature 8B, Test Unit 1, base of excavation, east face

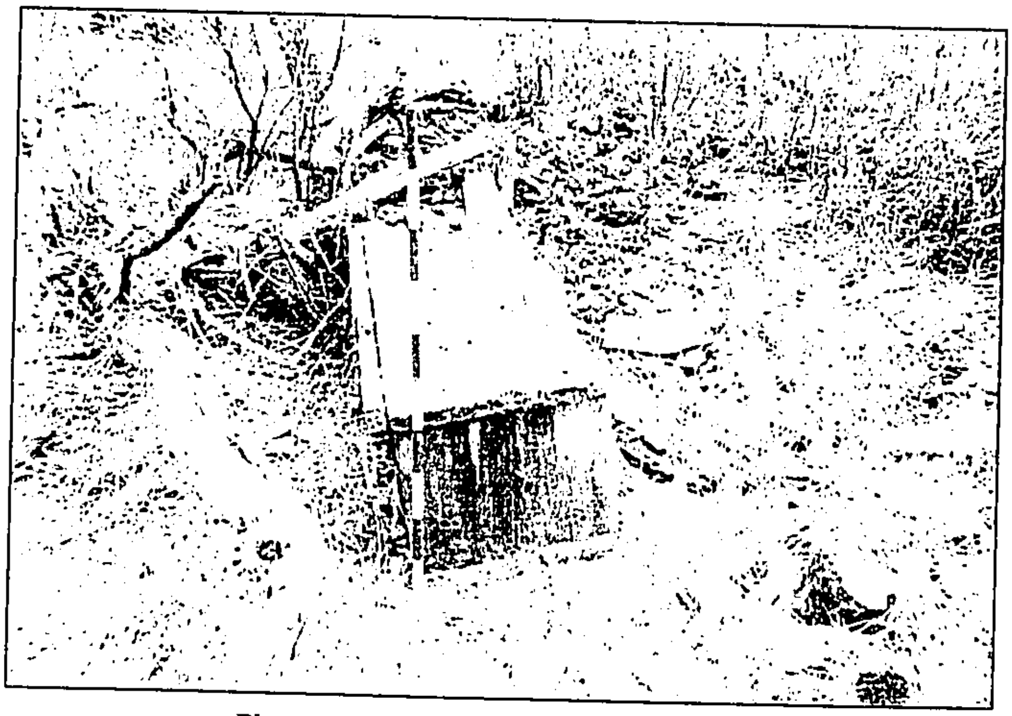

Photo 4. 12 Site 1853 Feature 13, view to west

Photo 4.13 Site 1864 Feature 2, view to north

Photo 4.14 Site 1864 Feature 1, Test Unit 1, base of excavation

Photo 4.15 *Site 2272 Feature 1, view to north*

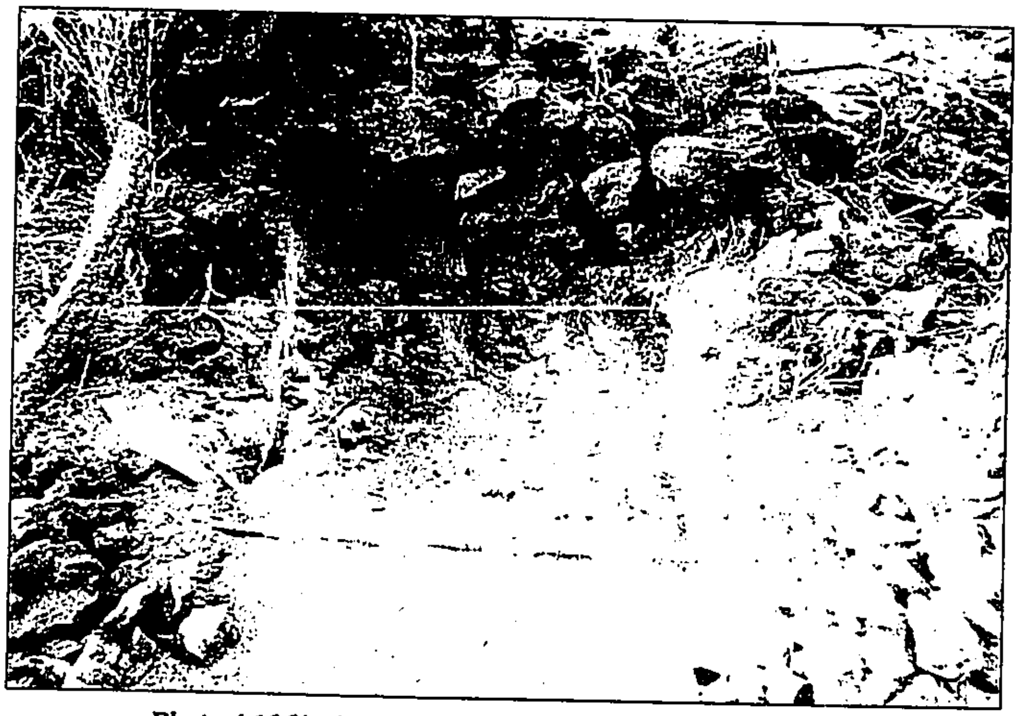

Photo 4.16 *Site 2272 Feature 1, Test Unit 2, base of excavation*

Photo 4.17 Site 2272 Feature 4, Test Unit 1, base of excavation

Photo 4.18 Site 5706 Feature 1, Test Unit 1, base of excavation, north face

Figure 4.19 Site 5706 Feature 2, view to east

Photo 4.20 Site 5706 Feature 2, Test Unit 2, base of excavation, east view

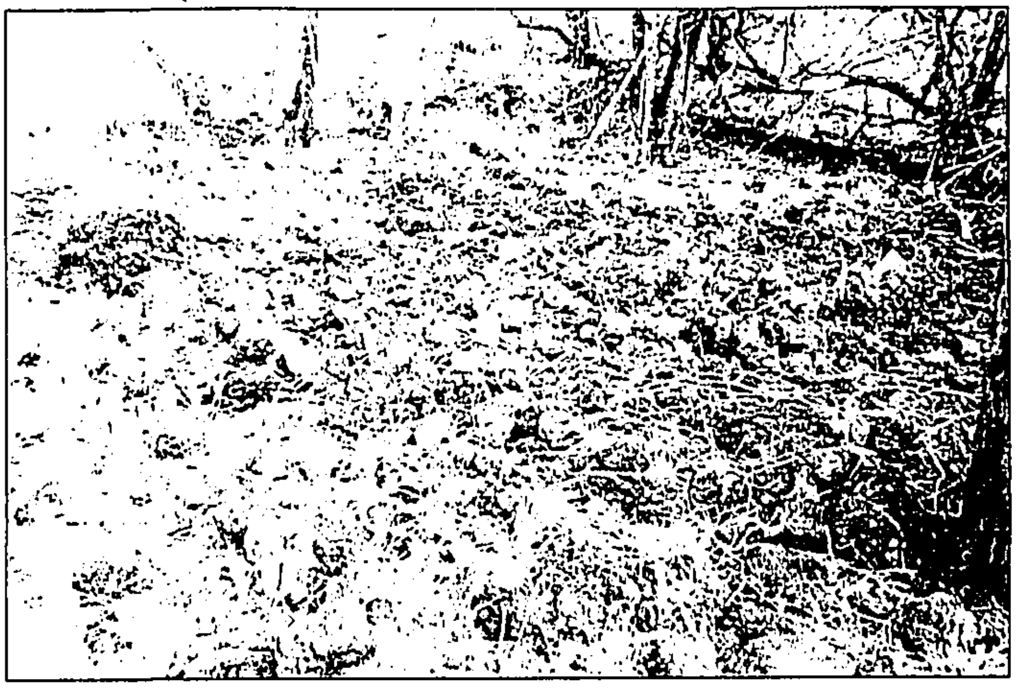

Photo 4.21 Site 5706 Feature 5A, view to northeast

Photo 4.22 Site 5706 Feature 5A, Test Unit 2, base of excavation

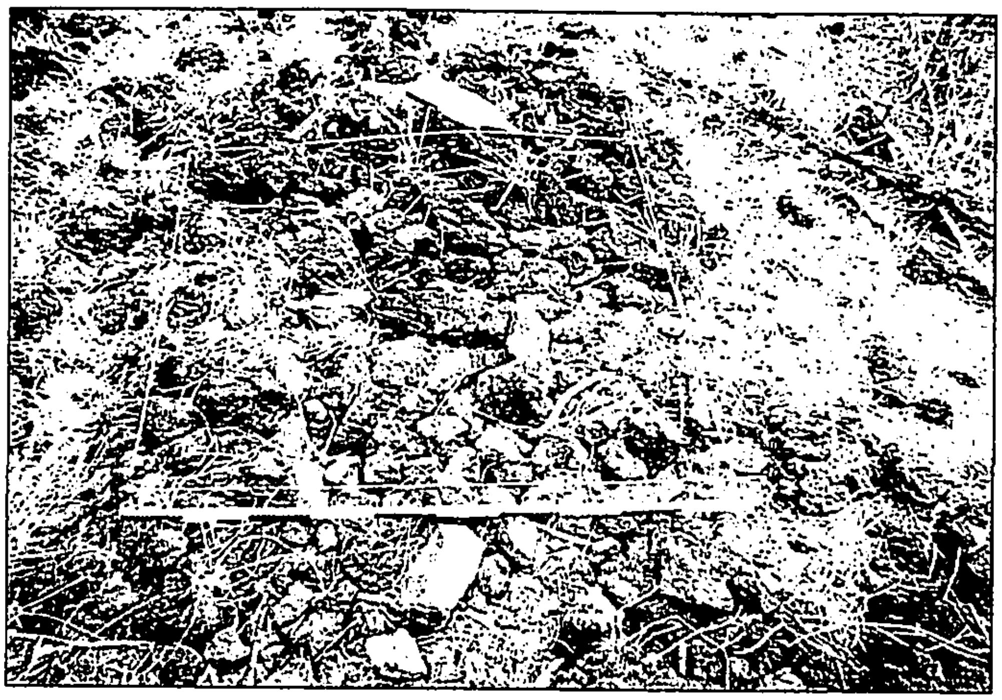

Photo 4.23 Site 5706 Feature 5B, Test Unit 3 prior to excavation

Photo 4.24 Site 5706, outcrop area with Features 9-14, view to south

Photo 4.25 Site 5706 Feature 11, view to north

Photo 4.26 Site 5706 Feature 17, Test Unit 1, base of excavation

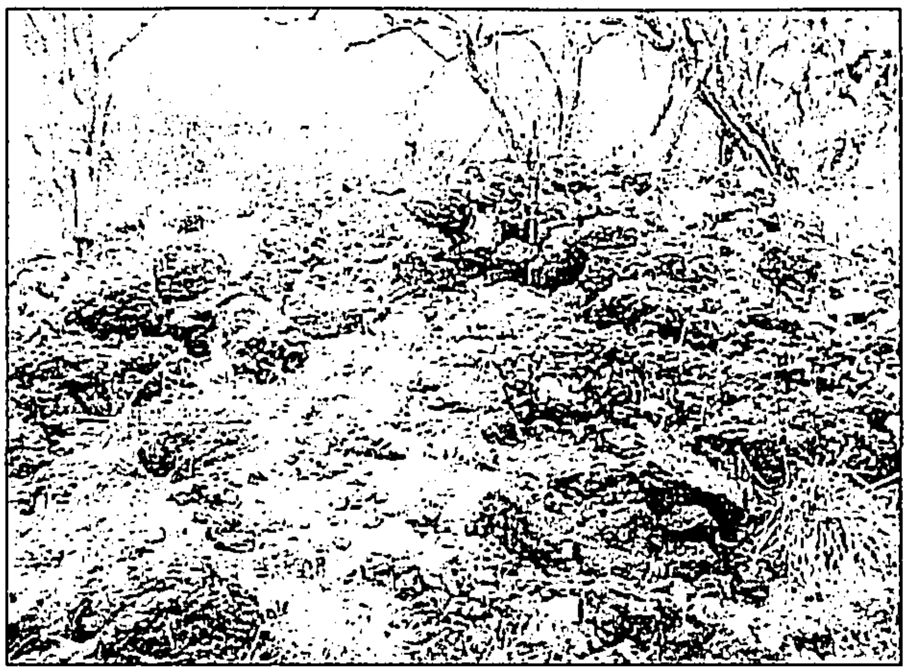

Photo 4.27 Site 5707 Feature 2, view to northeast

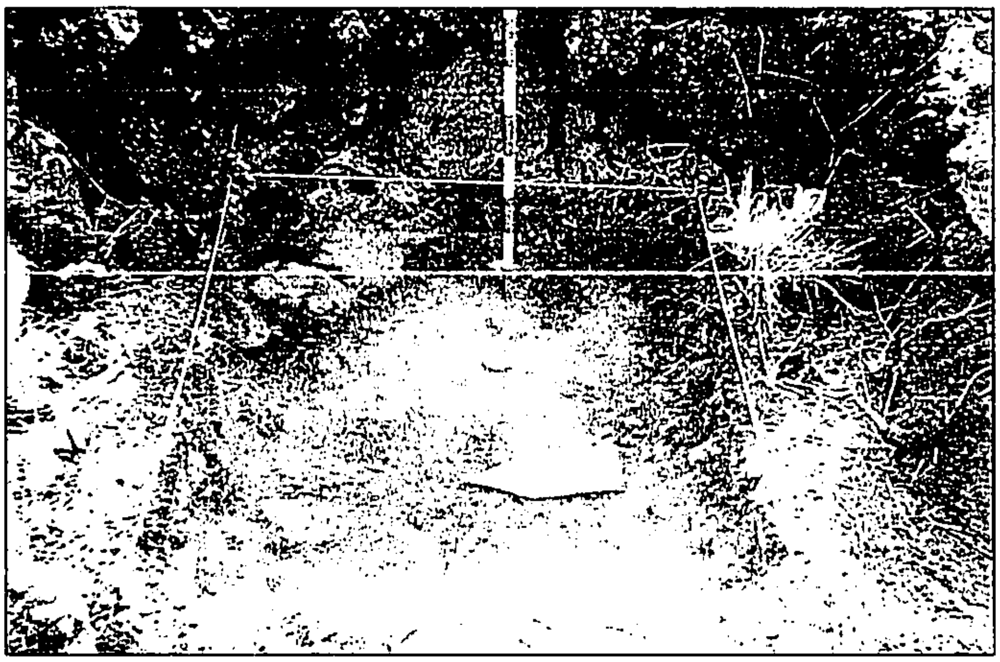

Photo 4.28 Site 5707 Feature 2, Test Unit 1, base of excavation (prior to expansion)

Photo 4.29 Site 5707 Feature 4, Test Unit 1, base of excavation, view to north

Photo 5.30 Site 5707 Feature 5, view to west

Photo 4.31a Site 5708 Feature 1, Test Unit 1, prior to excavation

Photo 4.31b Site 5708 Feature 1, Test Unit 1, base of excavation

Photo 4.32 Site 5708 Feature 2A, view to northeast

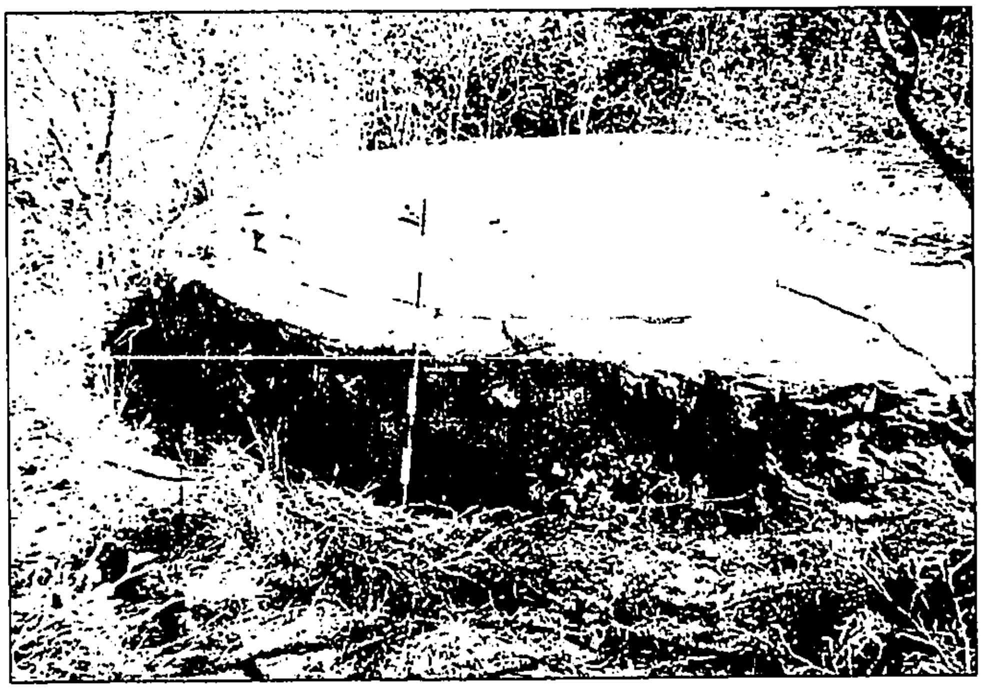

Photo 4.33 Site 5708 Feature 2C, view to north

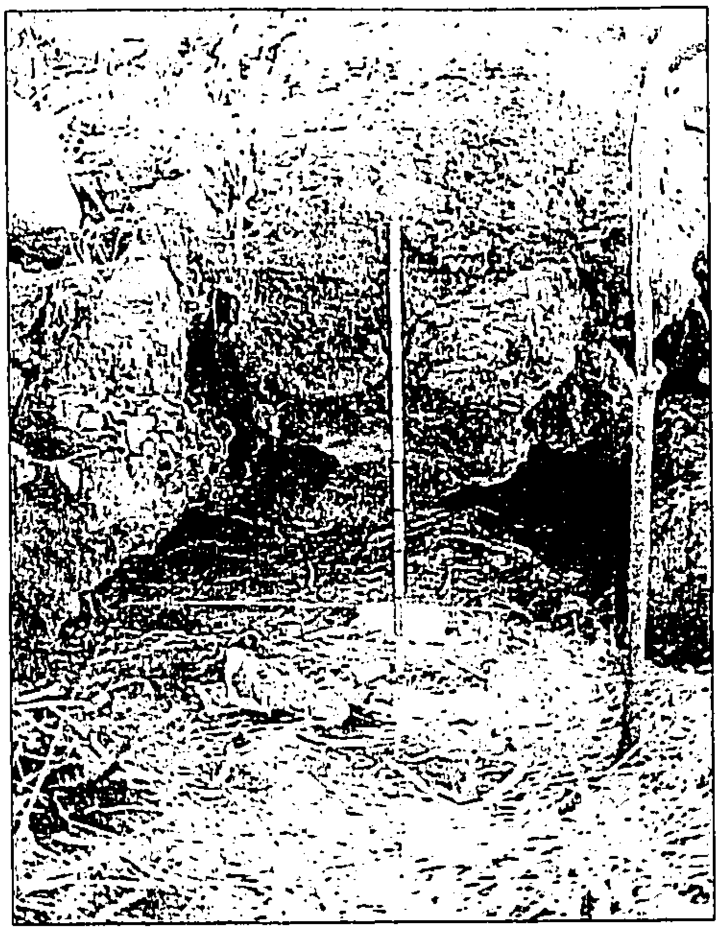

Photo 4.34 Site 5708 Feature 3 overhang prior to excavation

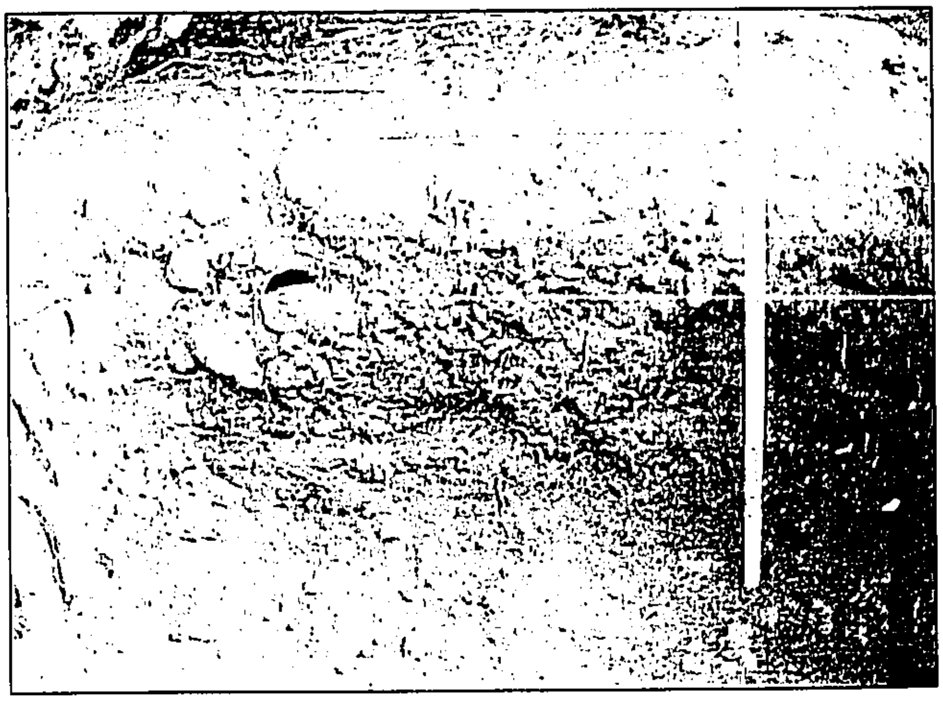

Photo 4.35 Site 5708 Feature 3, Test Unit 1, base of excavation, south face

Photo 4.36 Site 5709 Feature 1, view to east

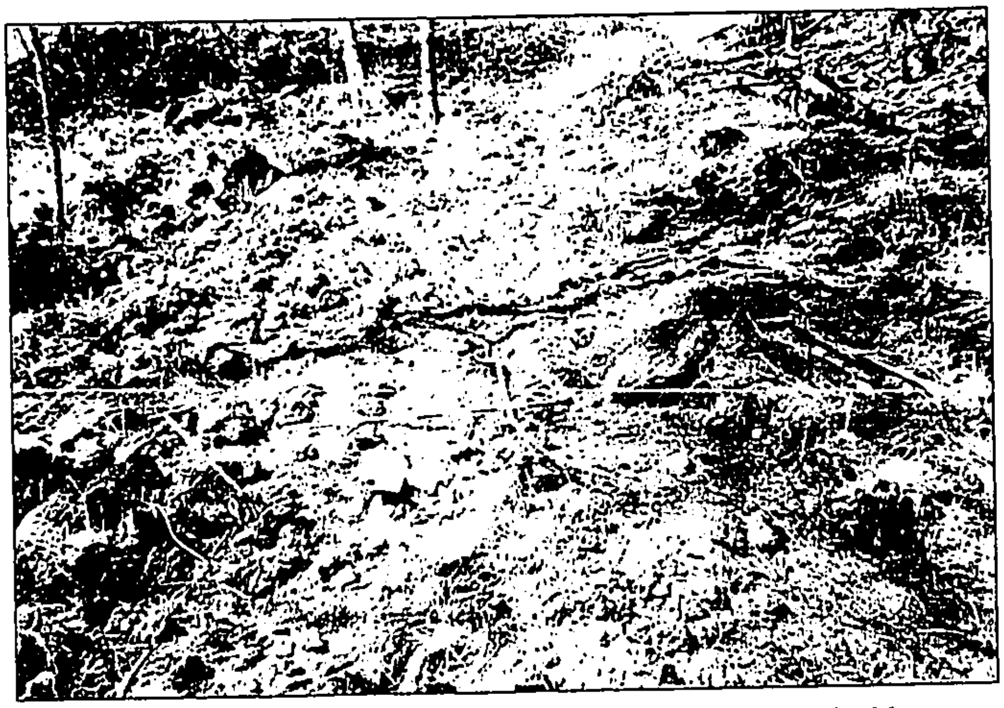

Photo 3.37 Site 5710 Feature 2, view to north from south side of gulch

Photo 4.38 Site 5710 Feature 3

Photo 4.39 Site 5710 Feature 6, view to south

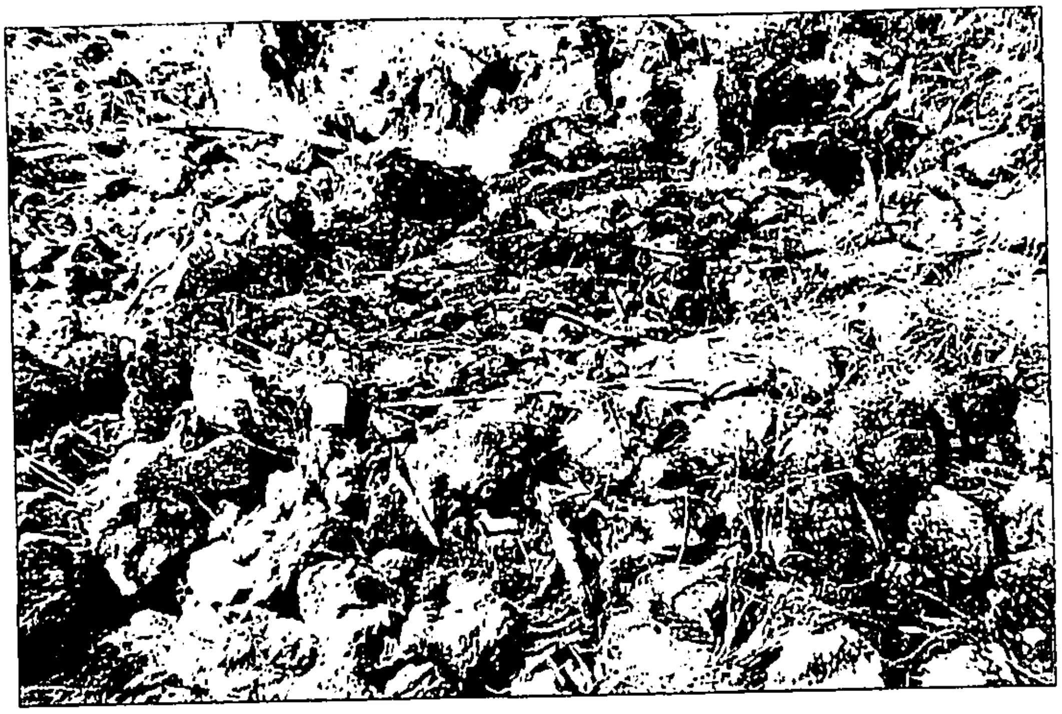

Photo 4.40 Site 5710 Feature 7A, view to north

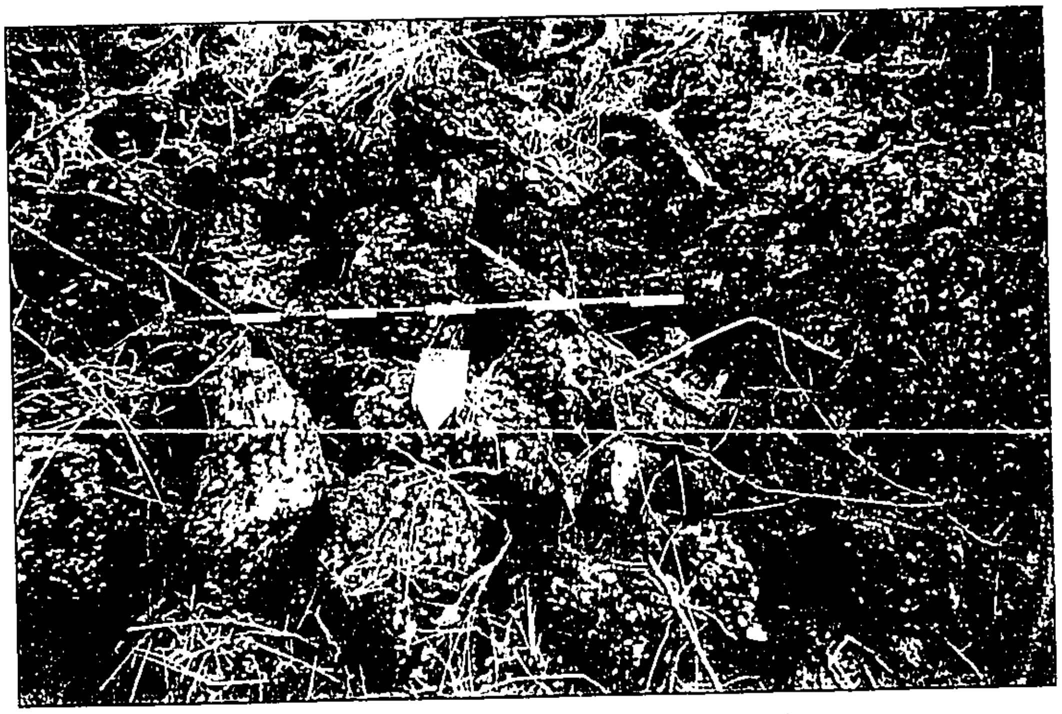

Photo 4.41 Site 5710 Feature 9, view to south

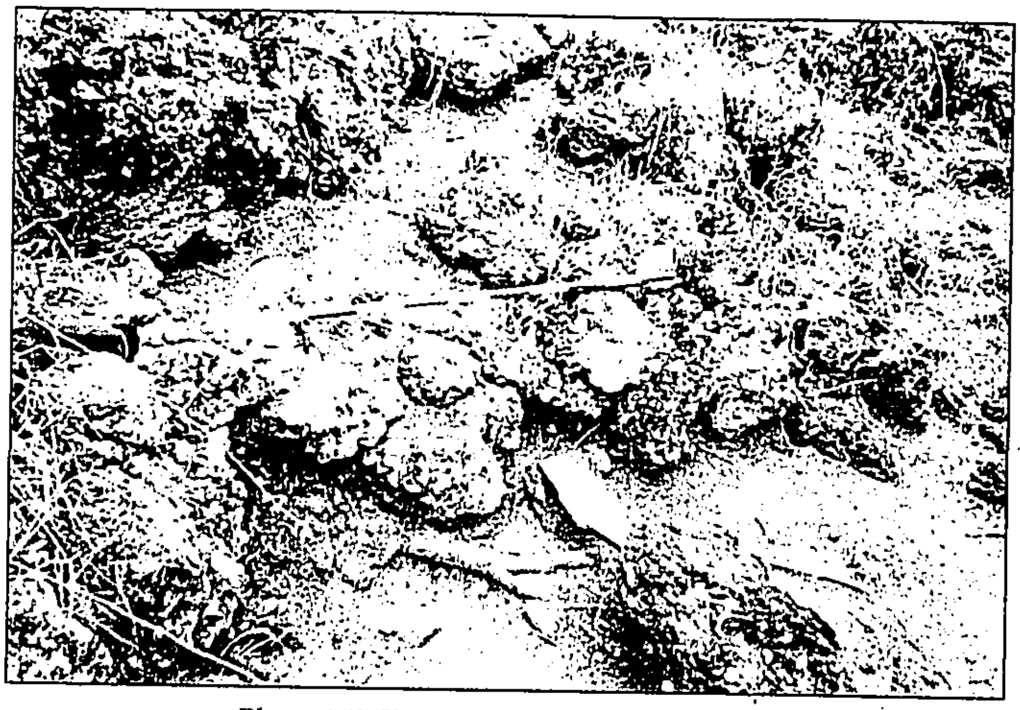

Photo 4.42 Site 5710 Feature 10, view to south

Photo 4.43 Site 5710 Feature 11, view to south

Photo 4.44 Site 5710 Feature 12A, view to south

Photo 4.45 Site 5710 Feature 13, view to north

Photo 4.46 Site 5711 Feature 1, south portion of platform with wall remnant, view to west

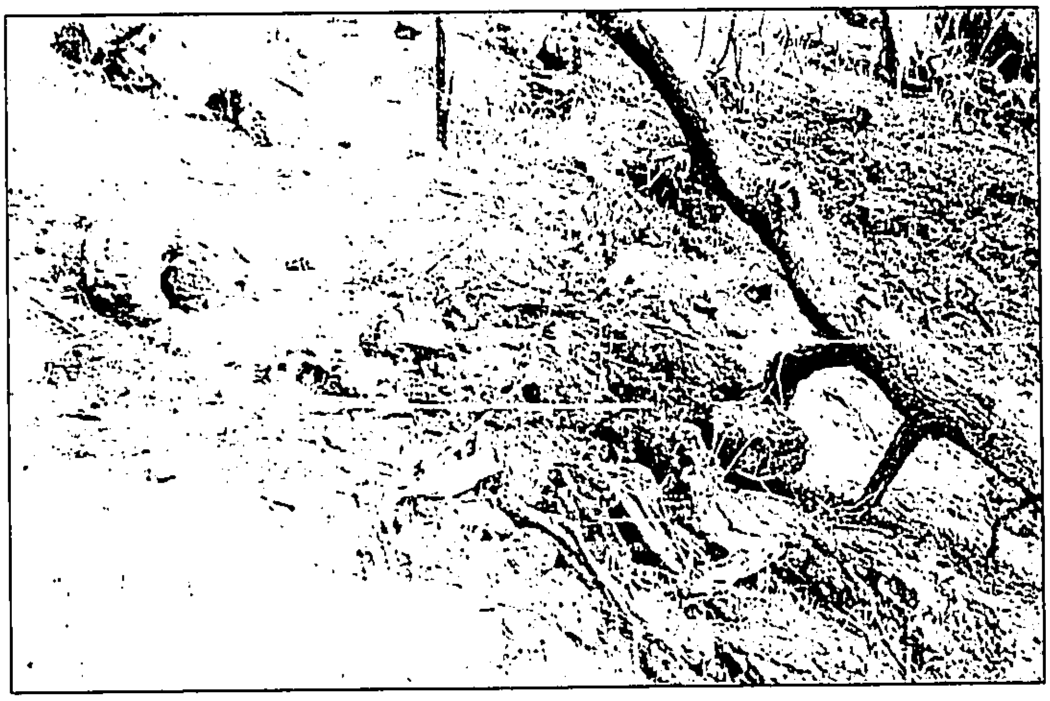

Photo 4.47 Site 5711 Feature 3, view to east

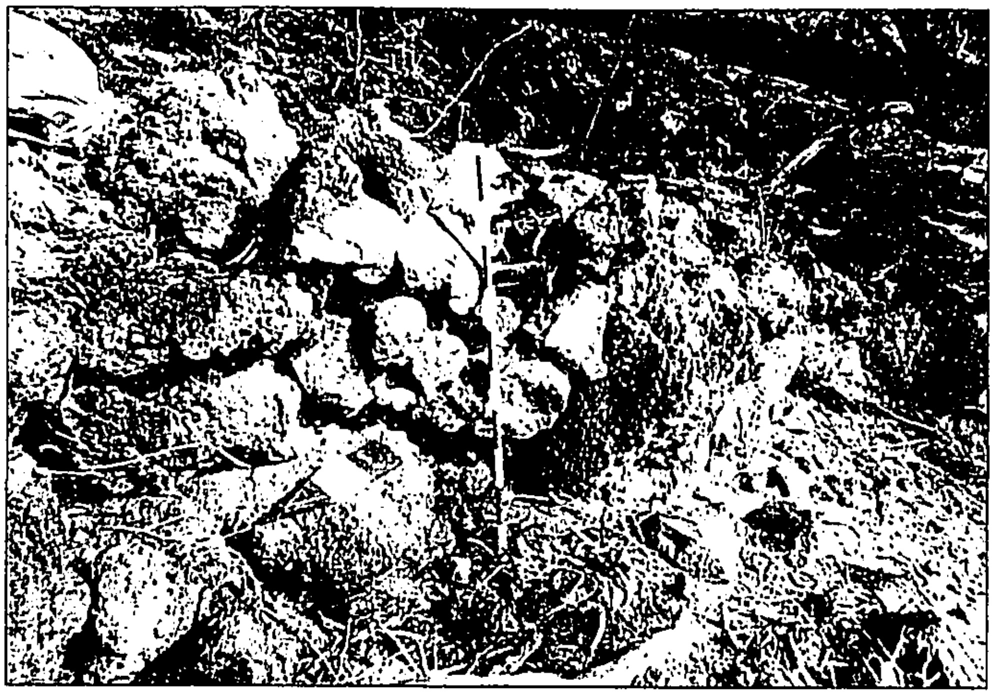

Photo 4.48 Site 5711 Feature 4, close-up of east wall from interior, view to southeast

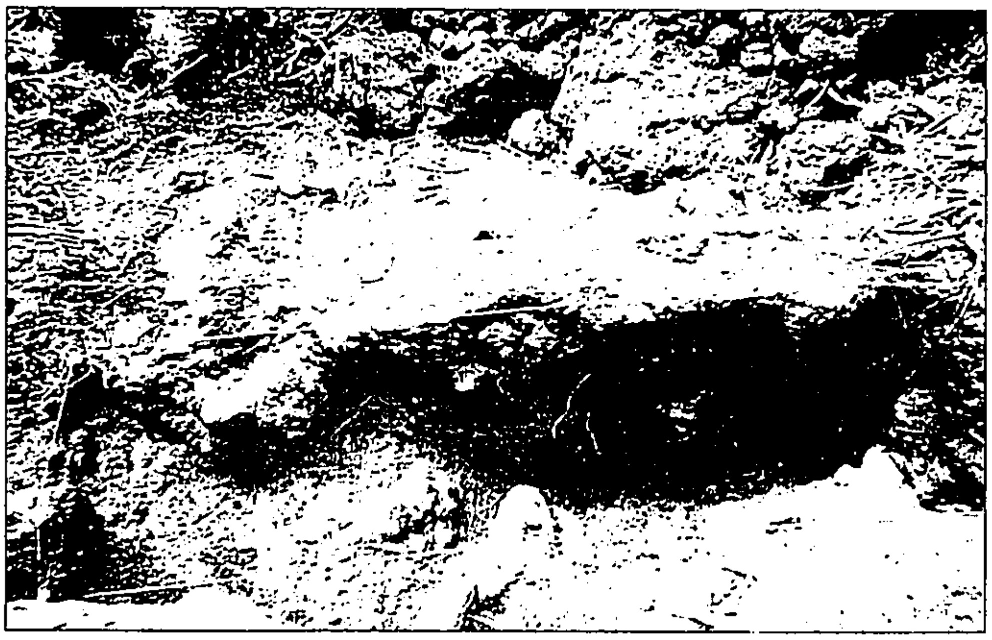

Photo 4.49 Site 5711 Feature 4, Test Unit 1, base of excavation, west face

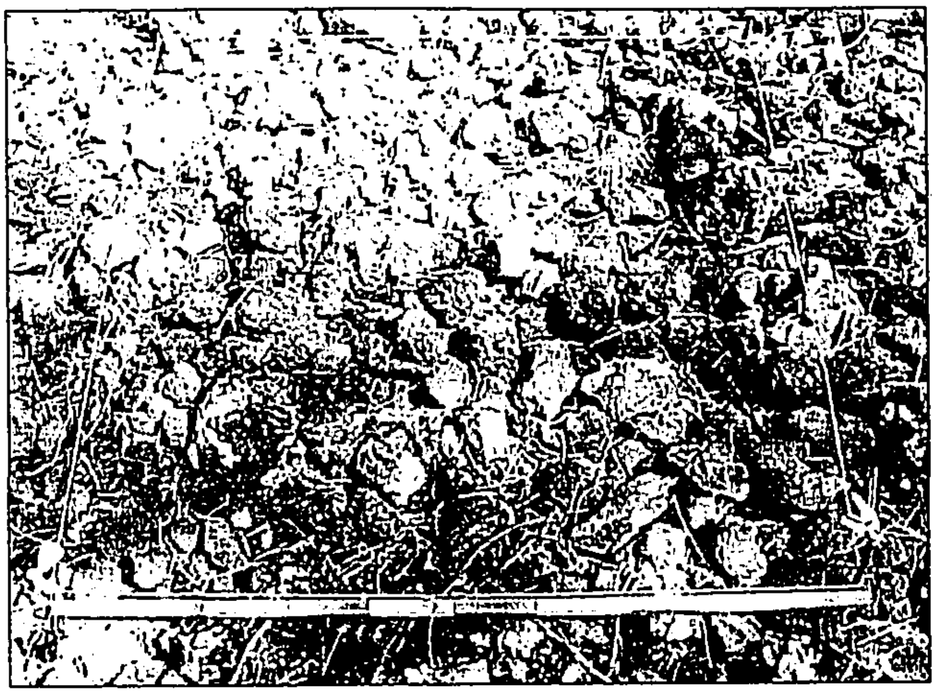

Photo 4.50 Site 5711 Feature 7 paved are prior to excavation

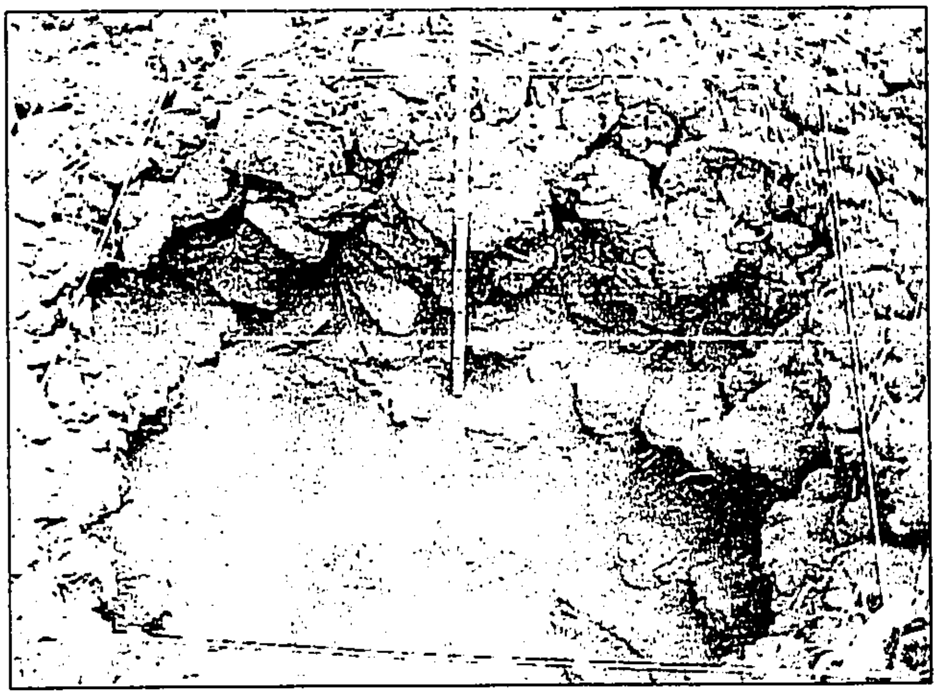

Photo 4.51 Site 5711 Feature 7, Test Unit 1, base of excavation, north face

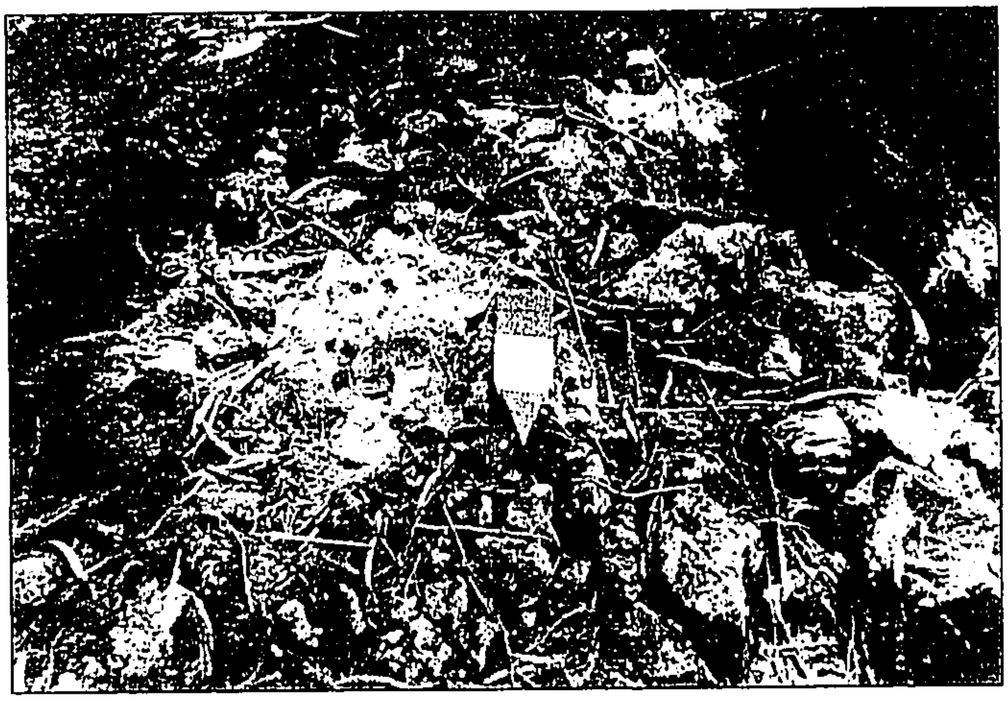

Photo 4.52 Site 5711 Feature 8A, close-up of coral in terrace fill, view to south

Photo 4.53 Site 5711, Feature 8A, Test Unit 1, base of excavation, west face

Photo 4.54 Site 5795, northeastern corner of enclosure, view to southwest

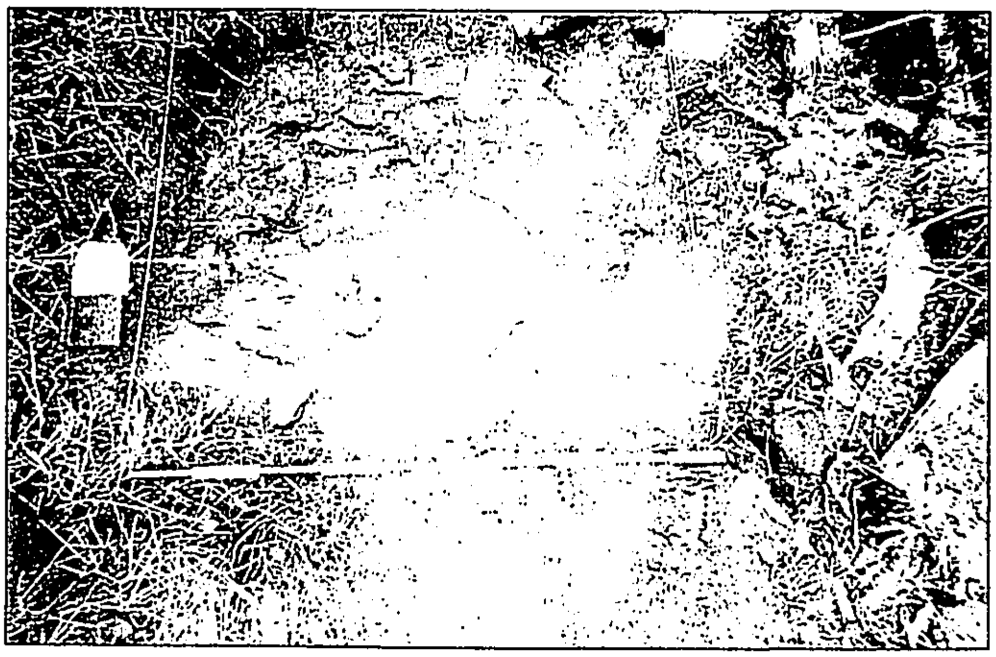

Photo 4.55 Site 5795 Test Unit 5, base of excavation at bedrock surface

Photo 4.56 Site 5796, north wall from inside enclosure, view to west

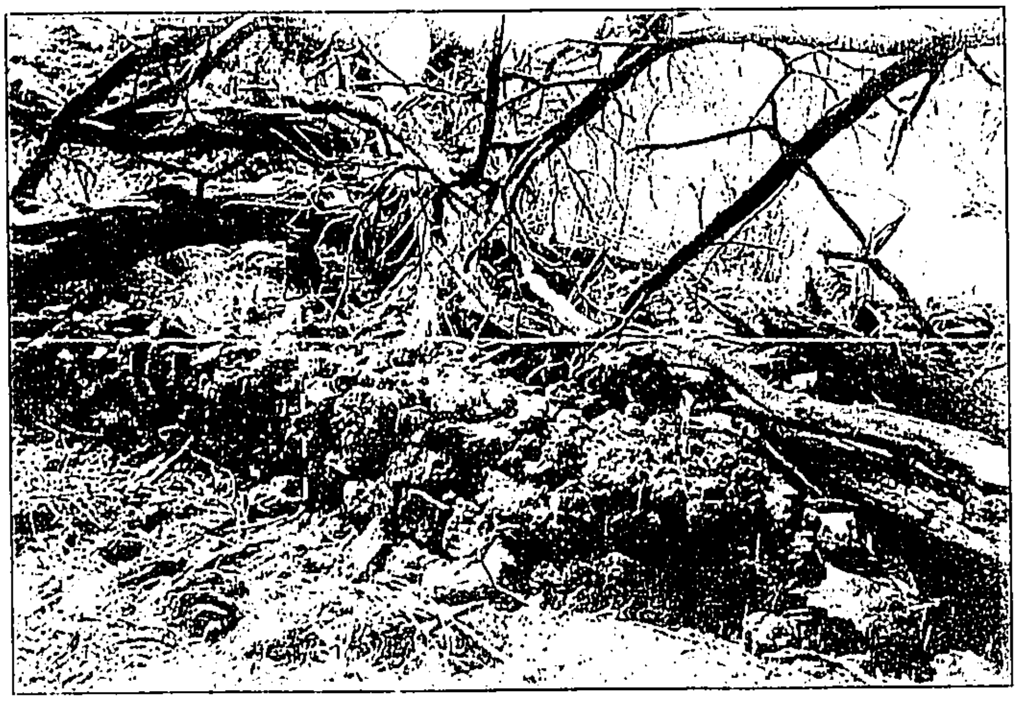

Photo 4.57 Site 5797 Feature 1A, view to southwest

Photo 4.58 Site 5797 Feature 2, view to east

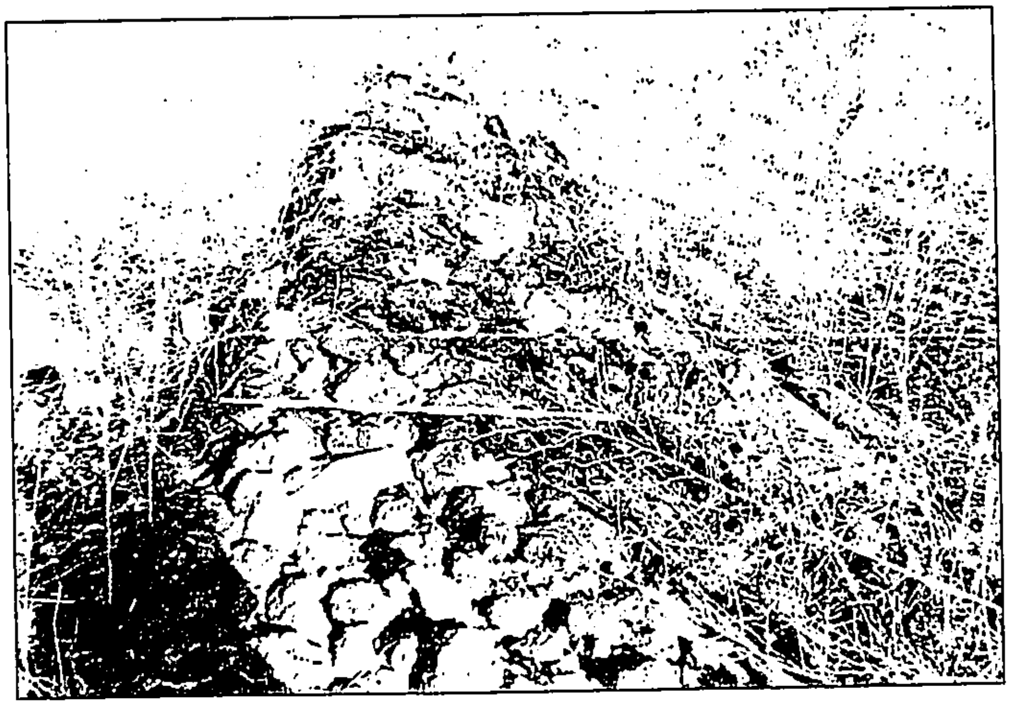

Photo 4.59 Site 5798 Feature 1, view to east

Photo 4.60 Site 5798 Feature 3, view to north

Photo 4.61 Site 5799 Feature 1, view to north

5. MATERIAL ANALYSIS

Summary of Recovered Materials

Materials recovered during survey and testing include 43 traditional artifacts, 6,492 historic/modern artifacts, 5,256 shellfish specimens (3,142.63 grams), 549 vertebrate specimens (498.46 grams), 363 pieces of weathered coral, 65 pieces of waterworn coral, 524 waterworn basalt pebbles, 17 pieces of unmodified beach conglomerate sandstone, and 1,432.01 .grams of charcoal. All of these materials, with the exception of four artifacts, were collected during subsurface testing. Four artifacts were recovered from surface contexts at two sites within the project area. These include two formed ground stone items (Site 1864 and 5706-5), a shell fishhook fragment (Site 5706-14) and a crockery sherd (Site 5706-11).

The subsurface materials were recovered from 25 of the 38 test units excavated during this project, and from six of the eight shovel tests. Shellfish collections were recovered from 23 of the 38 excavation units; artifacts were recovered from 10 test units, and other types of portable remains were recovered from 24 test units and three shovel tests (*Table 5.1*). No materials whatsoever were collected from eleven test units and two shovel tests.

During previous subsurface testing within the project area, materials were collected from six units at three sites (5705, 5795 and 5796). Previously recovered artifacts include a glass marble fragment from Site 5795 and bottle sherds from Site 5796 (Rotunno-Hazuka et al. 2005). Midden was collected from one prior excavation at Site 5707 Feature 5 (formerly 5708) and four prior excavations at Site 5795 (Cordy 1978, Rotunno-Hazuka et al. 2005); and coral was collected from excavations at Sites 5707 and 5796 (Rotunno-Hazuka et al. 2005). Prior excavations at Sites 1864, 2272, 5706, 5707, 5795 and 5796 (eight units) resulted in no collected materials (Cordy 1978; Denison 1979; Rotunno-Hazuka et al. 2005).

Prior excavations conducted in 1978, 1979, 2001 and 2005 are listed by site in Table 5.1. Units indicated as "Prior-1" in the table were excavated in August 2005; those excavated in 1978, 1979, and 2001 are indicated by the respective years.

Subsurface soil deposits identifiable as cultural layers were found in 17 excavations at eleven features within the project area (*Table 5.1*). These deposits were defined primarily on the basis of the presence of cultural material, rather than on any intrinsic qualities of the soil deposit. With the exception of the deposits at Sites 5706-5, 5706-11, 5707-2, Site 5708, and 5711-4 cultural deposits are not distinct from the naturally occurring soil layers. In other words, with the exception of the above cases, soil stratigraphy throughout the project area follows natural layers, some of which contain cultural material.

Two intact subsurface features were encountered at two sites within the project area. At Site 5706-11, the excavation encountered an *in situ* burial feature that contained cultural material in the re-deposited burial pit fill. At Site 5707-2, a possible hearth area was encountered in an area of extreme root disturbance. Two areas of secondary refuse deposition were also encountered during testing. These were both at Site 5708 (Features 1 and 3); they consisted of secondary refuse deposits that overlaid natural, sterile soil.

In all cases where cultural material was present in test units, it occurred either in a single layer (usually I), or as a continuous deposit (I/II), with no sterile zones between cultural layers. It was therefore not possible to identify temporally discreet cultural deposits within individual test units. This condition is believed to be the result of post-use disturbances at most of the sites. The primary disturbances include cattle and deer trampling, machinery, *panini* thickets and wind erosion, all of which cause mixing of vertical soil units and contribute to surface deflation. Continued use of the area by local residents throughout the historic and modern eras has also contributed to vertical mixing of deposits and surface deflation.

Due to the lack of stratigraphic differentiation, and given the generally low volume of recovered materials at most sites, vertical provenience collections are combined here, and occurrences of cultural material between features and sites are compared, rather than comparing layers or arbitrary levels within test units. Detailed tables on the vertical distribution of recovered materials are provided for each test unit in Chapter 4.

Site	Fea.	Unit	Size (m)	B.O.E.	Cult. Layer	Shell Midden	Artifacts	Other
1853	5	TU-1	1 x 1	0.25 m	-	-	-	-
	6	TU-1	1 x 1	0.20 m	-	-	-	-
	7	TU-1	1 x 1	0.28 m	I (disturbed)	1 shell frag.	-	weathered coral
	8	TU-1	1 x 1	0.35 m	I	1.4 grams	1 ground stone	weathered coral
	14	TU-1	1 x 1	0.56 m	-	-	decayed metal	
1864	1	TU-1	1 x 1	0.25 m	-	-	-	-
	1	TU-2	1 x 1	0.25 m	-	-	-	-
	1	(1979)	1 x 1	0.25 m	-	-	-	-
2272	1	TU-1	1 x 1	0.55 m	-	-	-	-
	1	TU-2	1 x 1	0.72 m	-	-	-	-
	1	(1979)	1 x 1	0.25 m	-	-	-	-
	4	TU-1	1 x 1	0.72 m	-	-	-	-
5706	1	TU-1	1 x 1	0.35 m	II	63.15 grams	-	weathered coral
	2	TU-1	1 x 1	1.10 m	-	5.00 grams	-	coral, 'ili'ili
	2	TU-2	1 x 1	0.80 m	I/II	23.17 grams		coral, 'ili'ili
	5D	TU-1	1.5 x 1	0.38 m	I/II	182.5 grams		coral, 'ili'ili
	5A	TU-2	1 x 1	0.67	-	-	sinker (surface)-	-
	5B	TU-3	1 x 1	0.40	-	-	-	-
	5A	TU-4	1 x 1	0.75	I/II	2.40 grams	-	'ili'ili
	5D	TU-5	1 x 1	0.40	I	104.71 grams		weathered coral
	5B	(2001)	.50 x .50	0.35	-	-	-	-
	8	TU-1	1 x 1	0.20	-	-	-	-
	10	TU-1	1 x 1	0.50 m	-	-	-	weathered coral
	11	TU-1	1 x 1	0.58 m	Burial pit fill	31.7 grams	-	coral, charcoal
	11	TU-2	1 x 1	0.14 m	-	-	-	-
	14	TU-1	1 x 1	0.30 m	I/II	34.75 grams	2 basalt flakes	sandstone
	17	TU-1	1 x 1	0.52 m	-	1 shell frag.	-	weathered coral
5707	1	prior	.50 x .50	0.35 m	-	-	-	-
	2	TU-1	1.3 x 1	0.44 m	I/II	91.9 grams	vol. glass, other	coral, charcoal
	4	TU-1	1 x 1	0.40 m	II-1	13.9 grams	-	weathered coral
	5	prior	.50 x .50	0.44	-	1 shell frag.	-	weathered coral
5708	1	TU-1	1 x 1	0.97 m	fill	72.55 grams	modern refuse	coral, vertebrates
	3	TU-1	1 x 1	0.55 m	I/II	540.60 grams	hist/mod refuse	coral, 'ili'ili, verts.
5710	3	TU-1	1 x 1	0.12 m	-	0.30	-	weathered coral
	4	ST-1	.50 x .50	0.28 m	-	-	-	-
	5	ST-1	.50 x .50	0.15 m	-	-	-	-

Table 5.1 Summary of Subsurface Testing

Site	Fea.	Unit	Size	B.O.E.	Cultural Layer	Midden	Artifacts	Other
5711	3	TU-1	1 x 1	0.48 m	I	220.67 grams	9 volcanic glass	coral, charcoal
	4	ST-1	.50 x .50	0.27 m	I	-	-	coral, charcoal
	4	ST-2	.50 x .50	0.23 m	I	-	6 volcanic glass	coral, charcoal
	4	TU-1	1.50 x .50	0.67	I	450.62 grams	-	coral, charcoal
	4	TU-2	1 x 1	0.40	I	243.70 grams	1 volcanic glass	coral, charcoal
	4	TU-3	1.50 x 1	0.30	I	226.62 grams		coral, charcoal
	7	TU-1	1 x 1	0.80 m	-	1.70 grams	hammerstone	
	8	TU-1	1 x 1	0.73	-	0.70 gram	-	branch coral
5795	-	TU-4	1 x 1	0.25 m	-	1.3 grams	-	-
		TU-5	1 x 1	0.15 m	-	-	-	-
		Prior-1	1 x 1	0.27 m	-	-	glass marble frag.	-
		Prior-2	1 x 1	0.30 m	-	-	-	-
		Prior-3	2 x 1	0.15 m	-	-	-	-
		(1978)	1.5 x .5	0.10 m	0.05-0.10 m	-	-	-
5796	-	TU-4	1 x 1	0.25 m	-	1 waterworn frag.	-	2 coral pcs.
		Prior-1	1 x1	0.20 m	-	3 shell fragments	-	-
		Prior-2	1 x 1	0.27 m	-	-	-	-
		Prior-3	1 x 2	0.25 m	-	1 shell fragment	glass bottle sherds	4 coral pcs.
		1978-1	1 x 1	ND	-	Bird bone (?)	-	-
		1978-2	1 x 1	ND	-	Cypraeidae (?)	-	-
1007	6	ST-1	.50 x .50	0.35 m	I/II	eggshell, fishbone	structural, slate	
		ST-2	.50 x .50	0.30	I/II	-	flat glass, nails	
		ST-3	.50 x .50	0.30	I	-	flat glass, nails	
		ST-4	.50 x .50	0.30	I/II	-	structural, slate	coral, basalt

Table 5.1. Summary of Subsurface Testing (cont.)

Faunal Remains

Faunal remains representing either marine shellfish or vertebrates were recovered from 20 features at eight sites within the project area (*Table 5.2*). Marine shellfish collections range from one to 1,261 specimens at nineteen features, for a total of 2,329 specimens (1,230.45 grams). Vertebrate collections range from one to 354 specimens at eight features, with a total of 547 specimens (498.26 grams). Both of these faunal assemblages are dominated by the collection from Site 5708-3, which accounts for 52% of the marine shellfish (44% by weight) and 65% of the vertebrates (77% by weight). This collection, together with the collection from 5708-1, stand out as having high counts for both invertebrates and vertebrates, reflecting both the nature and time frame of these two collections, which are from areas of permanent historic/modern habitation. The vertebrate collections from the two features at Site 5708 reflect cultural behavior and represent dietary components such as pork (medium mammal), beef (large mammal) and chicken (fowl and eggshell). In comparing these two collections, we find a greater amount of fish remains at Feature 1, with no chicken and markedly lower relative frequencies of pork and beef as compared to the Feature 3 collection. These differences support the hypothesis that these collections derived from different households.

In contrast, the vertebrate collections from the other six features within the project area are predominantly non-cultural introductions such as deer, rodents, and mongoose. The largest vertebrate

Site-Feature	1853-7 Ct.	1853-7 Wt.	1853-8 Ct.	1853-8 Wt.	5700-1 Ct.	5700-1 Wt.	5706-2 Ct.	5706-2 Wt.	5706-6 Ct.	5706-6 Wt.	5706-10 Ct.	5706-10 Wt.
Gastropoda												
Cassidae												
Columbellidae							1	0.02				
Conidae					3	4.60	5	2.50	15	11.85		
Cypraeidae	1	13.40	6	5.30	42	42.80	11	8.65	183	149.41		
Euplica turturina												
Hipponix imbricatus			1	0.05								
Ulorina pintado					1	0.25			51	13.95		
Lucinidae												
Nerita picea					44	7.65	13	1.00	475	131.14		
Nerita polita												
Theodoxis cariosus												
Marginellidae												
Patellidae			2	0.20	2	1.05	6	7.60	14	7.40		
Planaxis labiosa							1	0.02	3	0.30		
Terebridae												
Thaididae					3	2.90	2	0.55	30	32.50		
Drupa morum									3	10.20		
Drupa rubusidaeus									14	9.95		
Morula granulata												
Morula uva									34	18.35		
Neothais harpa									3	1.60		
Strombidae							1	0.05	2	0.20		
Trochidae									1	0.40		
Unidentifiable					6	0.65	18	0.79	5	0.30		
Bivalves												
Isognomonidae			5	0.25	4	1.35	6	0.05	6	1.05		
Mytilidae							1	0.02	1	0.10		
Spondylidae							2	1.45				
Tellinidae												
Unidentifiable												
Echinoidea												
Mouth					2	0.15			13	1.05		
Shell					11	0.90	8	0.11	39	2.85		
Spine					3	0.25	2	0.50				
Crustacea												
Total Shellfish	1	13.40	14	5.80	121	63.18	72	23.17	194	393.21	0	0.00
Vertebrates												
Fish							1	0.03				
Fish scale									1	tr.		
Fowl									1	0.10		
Fowl-eggshell												
Small Mammal							4	3.80			3	0.40
Med. Mammal												
Lg. Mammal							1	3.40	2	6.85		
Rodent					1	0.15	3	0.04	1	0.10		
Indet. Mammal												
Total Vertebrates	0	0.00	0	0.00	1	0.15	9	7.29	5	7.05	3	0.40
Total Faunal	1	13.40	14	5.80	122	63.30	81	30.46	199	400.26	3	0.40

Site-Feature	5706-11 Ct.	5706-11 Wt.	5706-14 Ct.	5706-14 Wt.	5706-17 Ct.	5706-17 Wt.	5707-2 Ct.	5707-2 Wt.	5707-4 Ct.	5707-4 Wt.	5709-1 Ct.	5709-1 Wt.
Gastropoda												
Cassidae			1	7.00								
Columbellidae												
Conidae			1	0.60					2	0.70	8	24.10
Cypraeidae	32	26.00	25	18.40	1	0.20	15	15.20	5	13.20	20	25.65
Euplica turturina												
Hipponix imbricatus												
Ulorina pintado												
Lucinidae												
Nerita picea	23	2.00	6	3.35			25	9.50			32	10.00
Nerita polita												
Theodoxis cariosus												
Marginellidae												
Patellidae	3	0.30					10	7.35			1	2.50
Planaxis labiosa	11	0.50										
Terebridae												
Thaididae	2	0.85	3	0.65			5	13.90				
Drupa morum												
Drupa rubusidaeus												
Morula granulata												
Morula uva												
Neothais harpa												
Strombidae												
Trochidae												
Unidentifiable	7	0.40	23	4.75			14	38.95			3	0.60
Bivalves												
Isognomonidae	4	0.40										
Mytilidae												
Spondylidae											2	0.30
Tellinidae											1	0.70
Unidentifiable												
Echinoidea												
Mouth											1	0.10
Shell											53	7.60
Spine	7	1.15									1	0.20
Crustacea											3	0.80
Total Shellfish	69	31.70	61	322.60	1	0.20	69	91.80	7	13.90	135	72.55
Vertebrates												
Fish											97	6.47
Fish scale												
Fowl												
Fowl-eggshell												
Small Mammal											1	0.10
Med. Mammal							1	1.20			13	7.90
Lg. Mammal							2	2.50			39	58.50
Rodent											1	0.10
Indet. Mammal							1	0.10			22	9.05
Total Vertebrates	0	0.00	0	0.00	0	0.00	4	3.80	0	0.00	189	81.82
Total Faunal	69	31.70	61	322.60	1	0.20	73	95.70	7	13.90	294	154.37

Site-Feature	5709-3 Ct.	5709-3 Wt.	5710-3 Ct.	5710-3 Wt.	5711-3 Ct.	5711-3 Wt.	5711-4 Ct.	5711-4 Wt.	5711-7 Ct.	5711-7 Wt.	5711-8 Ct.	5711-8 Wt.	5795 Ct.	5795 Wt.	5796 Ct.	5796 Wt.	TOTAL Ct.	TOTAL Wt.
Gastropoda																		
Cassidae																	1	7.00
Columbellidae																	1	0.02
Conidae	10	11.70			14	8.70	65	123.10							1	6.30	112	189.93
Cypraeidae	225	155.10			142	154.70	654	581.75	2	1.70	1	0.20	1	1.20			1258	1173.55
Euplica turturina	2	0.70															2	0.70
Hipponix imbricatus																	1	0.05
Ulorina pintado	4	1.50			9	1.50	17	3.45									82	20.75
Lucinidae					1	0.10											1	0.10
Nerita picea	650	202.10	1	0.20	46	4.35	189	54.60									1506	347.84
Nerita polita							2	2.20									2	2.20
Theodoxis cariosus							1	0.35									1	0.35
Marginellidae							6	1.10									6	1.10
Patellidae	232	79.20	1	1.90			10	3.50			1	0.50					50	107.41
Planaxis labiosa	3	0.10			2	0.11	1	0.25									21	1.28
Terebridae					2	1.50											2	1.50
Thaididae	13	24.50			23	19.00	54	38.32									116	140.17
Drupa morum	3	8.90															6	19.10
Drupa rubusidaeus	2	2.80			7	1.20											23	13.95
Morula granulata	1	1.30					7	3.78									8	5.08
Morula uva																	34	18.35
Neothais harpa	1	0.50			2	2.05	1	0.80									7	4.95
Strombidae																	3	0.25
Trochidae							2	1.45									3	1.85
Unidentifiable	3	0.75	1	0.10	68	9.35	26	18.57									190	77.03
Bivalves																		
Isognomonidae	7	1.10			1	0.01	7	1.90									40	6.71
Mytilidae							14	1.07									16	1.02
Spondylidae							4	3.60									8	5.55
Tellinidae																	1	0.70
Unidentifiable	1	0.20															1	0.20
Echinoidea																		
Mouth	1	0.30			3	0.25	13	3.15									35	4.95
Shell	36	3.80			4	0.60	153	21.60									212	37.46
Spine	18	5.35			33	7.15	37	9.25									102	23.85
Crustacea	2	0.80					14	12.50									19	14.00
Total Shellfish	1216	548.60	3	2.20	377	220.67	1286	814.69	2	1.70	2	0.70	2	1.30	1	6.30	5956	3142.63
Vertebrates																		
Fish	31	3.70			12	2.75	13	1.92									131	12.97
Fish scale																	1	tr.
Fowl	15	2.20															16	2.30
Fowl-eggshell	25	1.05															25	1.00
Small Mammal	2	1.20															10	6.40
Med. Mammal	163	53.90					8	3.35									177	62.70
Lg. Mammal	112	318.00			2	12.40											154	401.65
Rodent																	6	0.69
Indet. Mammal	6	1.00					5	1.00									29	10.75
Total Vertebrates	354	381.66	0	0.00	14	15.15	27	6.28	0	0.00	0	0.00	0	0.00	0	0.00	849	498.46
Total Faunal	1670	932.26	2	0.30	391	235.82	1313	820.94	2	1.70	2	0.70	2	1.30	1	6.30	6806	3640.83

Table 5.2 Summary of Recovered Faunal Remains

collection among these six is from Site 5711-3, which shows 14 specimens at 15.15 grams. Two of the specimens from this collection (82% of the total weight at 12.40 grams) are deer bones that were introduced to the deposit by natural processes. The 12 fish bones found at 5711-3 do, however, reflect cultural behavior, and this fish bone collection is the largest (both in count and in size of fish represented) among the six traditional Hawaiian vertebrate collections (*Table 5.2*). The second-largest vertebrate collection from a traditional component (5706-2), includes rodent, deer and mongoose remains, all of which are non-cultural introductions. The only vertebrate element from this feature that reflects cultural behavior is the single fish bone.

Traditional vertebrate collections that reflect cultural behavior include fish specimens from 5606-2, 5706-5, 5711-4, and 5711-3. In comparing these four collections, it is clear that the two Site 5711 features show a markedly higher occurrence rate of fish remains, as compared to the Site 5706 features. This may reflect its use in relationship to the nearby *ko'a*, as a place where fish and other food items were left as offerings. Preservation is also a factor; the area of Site 5711 appears to have been less impacted by reuse. In comparing the invertebrate collections, it is apparent that the Site 5708-3 collection is both the largest and has the greatest variety, with 13 identifiable families or species represented. Species that occur only in this collection include *Euplica turturina*, *Drupa morum*, and *Morula granulata*. The occurrence of the two *Thaididae* species may be a reflection of better preservation, which allowed recognition of these specimens.

The other historic era invertebrate collection from 5708-1 contrasts with the Feature 3 collection in both its relatively small numbers and very low variety. Only six shellfish families are represented at 5708-1, which is less than five of the fifteen non-historic collections. Again, this points to dietary differences between the two feature collections from Site 5708. One trait held in common to both collections is a small amount of *Crustacea* shell, which was found only in these two historic/modern collections.

The invertebrate collection from Site 5711 Feature 4 is the largest by count among the traditional components, with 1,286 specimens (914.69 grams) representing 17 shellfish families or species, and *Echinoidea*. Other relatively large collections were obtained from Site 5706 Feature 5D and 5711 Feature 3. The latter collection consists of 377 specimens (220.67 grams) representing 11 species or families and Echinoidea, and the Site 5706 Feature 5D collection shows 894 specimens at 393.21 grams. A comparison of the shellfish densities per liter of screened soil shows a higher density for 5706-5D (2.3 grams per liter) as opposed to 5711-3 (1.9 grams per liter).

In comparing the shellfish collections, we find clear differences in the frequencies of key shellfish, such as *Nerita picea*, which shows 475 specimens at 5706-5D (53%), as compared to 46 specimens (12%) at 5711-3, and 189 (15%) at Site 5711 Feature 4. Likewise, *Litorina pintado* shows 51 specimens (6%) at 5706-5D compared to 9 (2%) at 5711-3 and 17 (1%) at 5711-4. *Cypraeidae* show 183 specimens (20%) at 5706-5D, compared to 142 (38%) at 5711-3 and 664 (52%) at 5711-4. Both of the Site 5711 collections also shows considerably more *Echinoidea* than does the 5706-5D collection. These differences may well reflect both temporal and functional distinctions between the two sites. The 5711-3 collection dates to AD 1400-1440; whereas the 5706-5D and 5711-4 collections could date to the middle seventeenth century. Functionally, Feature 5706-5D is a habitation component represented by a midden scatter with no clearly associated surface structure. The features at Site 5711 include a terrace and partial enclosure that are believed to have some level of ceremonial function, due to the size of the terrace (it is too small for a habitation area) and association with the Site 5711-1 *ko'a* platform and the 5711-8 *ko'a* terrace.

The fourth and only other traditional faunal collection to contain over 100 specimens is from Site 5706 Feature 1, located at the northern edge of Parcel 37. This collection includes 121 shellfish specimens (63.15 grams) and no vertebrate remains that reflect cultural behavior. This collection is predominantly *Cypraeidae* (42) and *Nerita picea* (44), with the remaining 42% represented by five shellfish families and *Echinoidea*. *Cypraeidea* predominates in both count and/or weight across 11 the remaining 13 traditional era shellfish collections. The only two collections that contained shellfish, but no *Cypraeidea*, were recovered from Site 5710 (Features 3 and 4). Three collections consist of only *Cypraeidea* (one or two specimens) these occur at 1853-7, 5706-17, and 5711-7. By weight, this family is the most common across the project area, and it accounts for 48% of all invertebrates collected. None of the *Cypraeidea* specimens collected were complete, and none were of sufficient size or preservation to determine species. By count, *Nerita picea* is the most frequently occurring species, with 594 specimens collected (26% of total). Nearly all of these specimens represent a complete shell or a single individual.

Site-Feature	Basalt Flakes	Coral	Ground Stone	Sandstone (formed)	Shell	Volcanic Glass	TOTAL
1853-8				1 knob			1
1864-1			1 cobble				1
5706-5A			1 sinker				1
5706-14	2				1 hook frag.		3
5707-2	6	1 abrader	1 fragment		1 cut blank	7	16
5707-4						2	2
5708-3	1		1 fragment			2	4
5711-3						9	9
5711-4						5	5
5711-7			1 hammerstone				1
Total	9	1	5	1	2	25	43

Table 5.3 Summary of Recovered Traditional Artifacts

Artifacts

A total of 43 traditional artifacts were recovered from ten features at six sites during the current survey, including four items from the surface and 34 from subsurface contexts. Material categories represented include coral (1), shell (2), ground stone (5), fine-grained basalt (9), beach conglomerate sandstone (1) and volcanic glass (25). Nearly half (4) of the features with traditional artifacts show a single item recovered. In two of these cases, the artifacts are of ground stone and were recovered from the surface (1864 and 5706-5A), and in two cases the artifacts were of ground stone found in stone fill (5711-7) or on a former surface beneath wall fall (1853-8). The largest traditional artifact collection is from Site 5707 Feature 2, which has 16 items in five different material categories (*Table 5.3*). The second-ranked collection size (nine items) is from Site 5711-3; all of these artifacts are volcanic glass flakes. The artifacts are described here by material category

Basalt Flakes

All seven of the recovered basalt flakes are tertiary reduction flakes that show no remnants of the original stone cortex. They are all complete or nearly complete, and they show no evidence of use modification or wear. Two general size groups are represented; two large flakes (13.8 and 13.3 grams) were recovered from Sites 5707 and 5708; and five small flakes (0.5 to 0.9 grams) were recovered from sites 5706 (2) and 5707 (3). The basalt is dark gray (10YR4/1), with the Site 5708 specimen a very dark gray (10YR3/1). No vesicles or inclusions were seen in any of these flakes. The Site 5708 specimen shows a finer grain than do the other six specimens.

Coral

The single coral artifact was recovered from the north wall of Test Unit 1 at Site 5707 Feature 2. The artifact was situated within Layer II-1, at 0.20 meter below surface. It appears to be relatively complete, although it is weathered. Overall shape is file-like, with one utilized filing edge along the length of the item (*Photo 5.1*). It is asymmetric in cross-section, with one broad lateral edge and one thin lateral edge. The tip exhibits a blunt point. The abrader is 30.28 mm long by 12.28 mm wide at the proximal end and 6.00 mm at the distal end. Maximum thickness is along the dorsal (unused) edge, at 6.30 mm; the sawing or filing edge is 2.00 mm thick or less. Weight is 2.3 grams.

Shell

Two shell items were recovered, including a fishhook fragment from the surface at Site 5706 Feature 14 and a piece of cut shell from Site 5707 Feature 2 The fishhook fragment represents approximately 25% of a one-piece jabbing type hook, with the tip of the hook and the shank missing (*Photo 5.2*). The item measures 12.4 mm from the two broken ends to the base, and has a maximum width of 16.8 mm at the broken ends. Thickness is 4. 2 mm and weight is 1.1 gram. The artifact was found in a deer trail on the surface of a midden scatter feature; structural features are not immediately associated with the scatter; however Feature 5706-11, a stone platform with at least one *in situ* burial is nearby.

The second shell artifact was recovered during excavation of the test unit at Site 5707 Feature 2, from Layer II-1 (0.20 meter below surface). This is a roughly rectangular piece of shell that exhibits cut edges along the two short sides (*Photo 5.2*). The item is 18.4 to 20. 3 mm long by 10.2 to 12.6 mm wide and 1.9 to 3.6 mm thick. Weight is 1.4 grams. The item is beveled along the major axis, however it is too weathered to determine if this is the result of use or natural causes. Both long edges show flaking and wear that reflect natural weathering. The surfaces of both sides are also quite weathered and there is no natural sheen left on the dorsal side of the piece. This item may have been either a hook tab or a shell scraper.

Ground Stone

Two complete formed ground stone artifacts were recovered from surface contexts during the survey. These include a breadloaf sinker and a unifacially ground cobble. The sinker was found on the surface of the Site 5706 Feature 5A pavement, near the center of the structure (*Photo 5.3*). It is made from red (7.5R4/6) siltstone that has black (7.5R2.5/0) and yellow (10YR7/6) inclusions. No crystalline inclusions are present, however, the stone show numerous vesicles where other inclusions have fallen out. It is a relatively soft stone and it shows evidence of battering on the dorsal and lateral sides. The item is 62.4 mm long by 33.1 mm wide at the dorsal side and 25.9 mm wide at the ventral side. Thickness is 35.5 mm a the center and 24.8 at the ends. The is one continuous groove around the sinker, 9.2 mm from the ventral side; this groove is 3.4 to 4.4 mm wide and 1.8 mm deep. A second groove is present down the center of the ventral side; this groove is 4.3 mm wide and 1.5 to 1.8 mm deep. The sinker weighs 99.3 grams.

This sinker is relatively small in comparison to a sample of 10 breadloaf sinkers recovered form an underwater site offshore from Maluaka Point at a depth of 85 feet (Donham and Severns 1994). The size range within that collection was 256.0 to 632.7 grams. Among a total of 38 sinkers of various forms recovered from underwater contexts in Mākena Bay, the smallest weighed 163 grams (Donham and Severns 1994:6). A significant correlation was found between the size and weight of these sinkers and the depth of water where they used and later found; thus there is some basis for inferring that the small sinker found at site 5706 was most likely used in waters less than 80 feet deep.

The second ground stone specimen was recovered from the surface at Site 1864 Feature 1. This item is composed of dense andesitic stone (Hawaiite or Mugearite) with medium to small olivine crystal inclusions. The stone is dark reddish brown (5YR3/20 with small pinkish gray (5YR7/2) inclusions and crystalline glittering throughout (*Photo 5.4*). One face of the stone (the ventral side) has been ground flat; the remaining faces are smoothly rounded, probably from grinding. There is evidence of pecking in the center of the dorsal side, and to a limited extent on the lateral sides. The stone is 99.6 mm long by 70.0 mm wide and 58.6 mm thick in the center. The ground surface has the same length and width as the overall stone dimensions. Weight of the item is 795.4 grams. The very hard and rather gritty texture of this stone would have served well for purposes of smoothing materials such as wood. The stone apparently also served in some capacity as a hammering tool. Oddly, no other artifacts or midden materials were found at Site 1864.

One complete unformed ground stone tool was recovered from the project area. This item is a basalt cobble that exhibits one ground face in addition to numerous pounding and pecking scars. This item was found in the stone fill layer of the Site 5711 Feature 7 pavement (*Photo 5.5*). The cobble is 110.6 by 82.0 by 77.8 mm and weighs 989.4 grams. The ground surface is on a lateral side and is 65.0 mm in diameter and has a maximum depression in the center of 1.0 mm. There are three large flake scars at corner points on the stone; these appear to be the result of striking a sharp item with force. The dorsal surface of the stone is heavily scared with pecking marks, and there are two other small localizations of pecking scars along margins. Overall, the stone shows evidence of varied use, either extensively over time or intensively within a short time period. The tool was found in a secondary context, among other stones that were introduced into the feature from (probably) the surrounding areas. No other artifacts and only traces of midden were found at Feature 7.

Two fragments of ground stone tools were recovered; the largest is a flake from a dense fine-grained dark gray (10YR4/1) basalt stone that shows a flat ground surface and a ground margin. The flake was recovered from the upper level of Layer I at Site 5708 Feature 3, within a concentration of historic and modern debris. The flake has been exposed to heating with metallic debris, and some of this material adheres to the ground surface. Overall dimensions are 59.0 by 31.6 by 8.3 mm. Weight is 14.1 grams. The original size and shape of this item is difficult to estimate; the arc of the ground margin suggests that the stone was at least as large as the complete item found at Site 1864. This artifact was clearly in a secondary context, as were all the other artifacts recovered at this refuse concentration.

The second fragmentary ground stone was recovered from Layer III-1 at Site 5707 Feature 2. It is the fragment of a black (2.5YR2.5/0) vesicular basalt stone that shows olivine and light reddish brown (2.5YR4/8) hematite inclusions. The item shows evidence of use after it was broken from a larger stone. It is multifaceted, with dimensions of 19.8 by 18.9 by 12.9 mm, and weighs 5.05 grams. Three facets on the original break edge show evidence of grinding. The largest of these areas in roughly oval (14.0 by 12.0 mm) and the smallest is triangular (10.0 by 10.0 mm). These surfaces are flat to slightly concave. The tool appears to have been used for specialized grinding or polishing of small items. It was found in a primary context with a number of other traditional artifacts, including basalt flakes, a coral abrader, cut shell and volcanic glass flakes.

Sandstone

A single formed sandstone artifact was recovered from the surface of Layer I-1 at Site 1853 Feature 8B. This item is made from black and white (10YR 2/1 and 8/1) beach conglomerate sandstone with small olivine crystal inclusions (*Photo 5.6*). This item appears to be the knob end of a grinding pestle or the knob of a large plummet-type sinker. It is round in cross section and concave-sided in profile, with a length of 37.0 mm. The top end is nearly complete and is convex, with a diameter of 26.0 mm. The stem constricts to a diameter of 22.0 mm, and the broken end expands to a diameter of 26.9 mm. Weight is 40.1 grams. The exterior surface of the item is rough due to exfoliation of sand particles.

This stone is relatively soft, and if it was used for grinding, it would have been applied to soft materials, such as *noni*, *awa* root , charcoal, or *kukui* nut meat. The likely form would have been relatively long and narrow, with a gradually expanding diameter. Several such pestles with knobs similar to this artifact are depicted in Brigham's compendium of artifacts from the Bishop Museum (Brigham 1902: 361-363, Plates XLI, XLII). According to Brigham, at the turn of the century, this type of pestle was referred to as a "*noni* pounder" (Brigham 1902:362).

Knob-type tyeing ends also occur on plummet type sinkers, however, in most cases the knob has a much shorter axis and a marked expansion at the top, so as the keep a line secure (Brigham 1902:406). The item found here does not exhibit these traits.

Volcanic Glass

A total of 25 volcanic glass flakes were recovered from five locations within the project area (*Table 5.3*), with the largest single collection (9 flakes) from Site 5711 Feature 3. These nine items were recovered from three levels within Layer I of Test Unit 1. A single flake in level 1, and four pieces were found in each of levels 2 and 3. One of the items in this collection, from I-2, is a natural glass nodule (1.35 grams) with weathered facets that has no evidence of use or flaking. Two items are primary core reduction chunks that exhibit cortex on the entire dorsal surface as well as on lateral sides. These items weigh 4.0 and 1.3 grams and were recovered from I-1 and I-3 respectively. Three of the items are primary core reduction flakes, with entire dorsal surfaces of cortex; they range from 0.25 to 0.9 grams in weight. Two of the items are secondary reduction flakes, at 0.3 and 0.5 grams each; and there is one complete tertiary flake at 0.5 grams. Also recovered from Site 5711 (Feature 4, Layer I) were five volcanic glass items, including one primary core reduction chunk (0.8 grams) one tertiary chunk with a mineral inclusion (0.1 gram) and three minute tertiary flakes at less than 0.1 gram each.

The volcanic glass collection from Site 5707 Feature 2 has the second-highest count with seven items. These include one relatively large (4.0 grams) primary core reduction chunk and four tertiary flakes (0.1 to 0.4 grams). The core reduction chunk is predominantly cortex, and the minute tertiary flakes show no evidence of use. Also recovered from Site 5707 (Feature 4) were two small tertiary flakes (0.1 gram each) from Layer II-1 of the test unit. Naturally formed volcanic glass crystals were present in the soil at this feature as well, with eight crystals recovered from 1/8 inch screened soil.

The final volcanic glass item was recovered from Site 5708 Feature 3, Layer I-1 and consists of a secondary reduction flake (0.45 grams) with no evidence of use. None of the 22 volcanic glass items show evidence of use modification or use wear. These artifacts have not, however, been subjected to microscopic examination to determine whether minute wear scars are present.

Historic/Modern Artifacts

Artifacts dating to the nineteenth and twentieth centuries were recovered from six sites within the project area - 1007, 1853, 5706, 5707, 5708 and 5710. The collection from two features at Site 5708 is comprised of 6,090 items; the Site 1007 collection (from four shovel tests) consists of 397 items; and the other four collections consist of single lots or single items only. These smaller collections will be discussed first.

Two small pieces of decomposed metal were recovered from the base of a stone fill deposit at Site 1853 Feature 14. These small flake-like pieces could not be further identified.

One historic artifact was recovered from the surface at Site 5706 Feature 11. This is the rim section of a stoneware crockery bowl (*Photo 5.7*). The paste is quite hard and shows no granular inclusions; the glaze is lead on the exterior with clear salt glaze on the top of the rim and clear salt glaze over white paste on the interior. The execution of the glaze, overall form and paste quality suggests twentieth century factory production.

The historic artifact recovered from Site 5707 consists of the mid-shaft portion of a square nail, in five pieces. The item was recovered from Layer II-1 of the test unit at Feature 2.

A metal item represented by 156 fragments was recovered from the upper level of the excavation unit at Site 5710 Feature 3. This item was partially buried and visible from the surface prior to excavation; it appears to be a 3-pound size coffee can. It is likely that this item was brought into the site along with other planting paraphernalia such as potting soil that was seen in the general area. The artifact is taken to reflect modern reuse of the site for planting.

The historic/modern collection from Site 5708 Feature 1 consists of 933 items, most of which (710, 76%) are pieces of metal. All of the metal items appear to be modern is age and most appear to date from the 1960s or 1970s. These include such items as paint cans, crown bottle caps, food cans, window and hardware screen, tarp grommets, and pieces of barbed wire (*Table 5.4*). Glass is the second highest in frequency, with 125 items collected. Clear glass is the most common, representing 95% of the glass collection. All items in this category also appear to be modern and most likely date to c. 1960 or later. The brown beverage bottles are crown cap disposable "stubby" beer bottles, of the style common in the 1960s and 70s. The bottles are embossed with "no deposit no return" and "not to be refilled".

Ceramic items recovered from Site 5708 Feature 1 include seven sherds from an unglazed modern earthenware flower pot and seven porcelain sherds, four of which represent an single saucer. The porcelain sherds are all white glazed with no decoration present. Other recovered items include the remnants of a leather boot, found at the base of the deposit, and 5 plastic items, including two buttons, a piece of a comb, and two fragments of plastic food (i.e., Saran) wrap. All of the materials recovered from Feature 1 are most likely less than 50 years in age, although some items could date to the 1940s or 1950s.

The artifact collection from Site 5708 Feature 3 is considerably larger than the Feature 1 collection, with at total of 5,157 items collected (*Table 5.5*). As with Feature 1, the predominant material category is metal, with 3,092 items (60%). Over half of the metal items at Feature 3 are tin food cans and pieces (62%), compared to 22% at Feature 1. These cans are middle to late twentieth century manufacture. Shapes include flat cans normally used for sardines and other fish products, rectangular cans normally used for meats, such as *Spam*, and round cans normally used for fruits and vegetables. Also recovered were metal keys used to open sardine cans. Metal from Feature 3 also showed the presence of at least one large container, as did Feature 1. These items were most likely 55 gallon drums that were used to burn trash. The pieces of this container at feature 3 had been exposed to heat, and several are adhering to melted glass or other materials.

SITE 5708 FEA 1, TU-1	II-1	II-2	II-3	II-4	II-5	II-6	II-7	TOTAL
Depth in cm BD	15-25	25-35	35-45	45-55	55-65	65-75	75-85	
CERAMIC								
EARTHENWARE	7							7
PORCELAIN	4 (1)	1	1		1			7
TOTAL CERAMIC	11	1	1	0	1	0	0	14
GLASS								
CLEAR								
Bottle, beverage	11							11
Bottle, condiment	7							7
Jar, food	13 (1)							13
Medicinal bottle/vial	17 (2)							17
Curved (bottle/jar)	7			2				9
Kitchenware	28							28
Light bulb				1				1
Flat glass	41	4						45
SUBTOTAL CLEAR	111	4	0	3	0	0	0	118
BROWN, bottle, beverage	5 (2)							5
GREEN, bottle/jar	2							2
TOTAL GLASS	118	4	0	3	0	0	0	126
LEATHER								
Belt/strap	1							1
Shoe/boot					5	24	34	63
METAL								
TIN/STEEL								
Band							5	5
Bolt	1							1
Can, food		9	3		33	113		166
Can, paint			76					76
Cap, crown	6		1		1			8
Chain			1			10	21	37
Fishhook						2		2
Flat steel, large container	173	48						221
Gear, small	1							1
Grommet	1	2						3
Hoe						3		3
Horseshoe						1		1
Key, can opener	11							11
Nail, wire	43	31	22		6	4	5	111
Plumbing	1							1
Screen, hardware cl.	4							4
Screen, filter plate	2							2
Screw	1							1
Snap	1							1
Spike			2			4		6
Staple (fencing)	2	2						4
Utensil					1			1
Wing Nut			1					1
Wire, smooth	1	1				1		3
Wire, barbed	1							1
Wire, braided	1	1	5		1			8
Indeterminate	12	12	7					31
SUBTOTAL TIN/STEEL	262	106	118	0	39	144	31	700
COPPER								
Indeterminate	1							1
ALUMINUM								
Cannister top	1							1
LEAD								
Window sealant	1							1
Molten drop	1							1
MIXED MATERIALS								
Battery, D-cell	1							1
SUBTOTAL OTHER METAL	5							5
TOTAL METAL	267	106	118	6	0	8	0	710
MORTAR								
Brick	1							1
Unfinished	17	1	3					21
TOTAL MORTAR	18	1	3					22
PLASTIC								
Button	1		1					2
Comb						1		1
Sheet/wrap				2				2
TOTAL PLASTIC	1	0	1	2	0	1	0	5
GRAND TOTAL	414	112	123	5	45	169	65	933

Table 5.4 Summary of Recovered Artifacts, Site 5708 Feature 1, Test Unit 1

SITE 5708 FEA 3, TU-1	I-1	I-2	II-1	II-2	III-1	TOTAL
Depth in cm BD	0/8-10/15	10/15-20/23	20/23-30	30-40/43	40/43-55	
BONE						
Button	1	1				2
CERAMIC						
EARTHENWARE				2		2
WHITEWARE						
Bowl	1	1				2
Handle (chamber pot)	1					1
Plate/saucer	1		1			2
TRANSFER PRINT	1	2		1		4
STAMPED/PAINTED		2				2
PORCELAIN	1	1		2		4
TOTAL CERAMIC	6	7	1	4	0	17
FILM						
Cellophane, film			1	1		2
GLASS						
CLEAR						
Bottle, beverage	18	15	1	54 (6)		88
Bottle, condiment		1	8	12 (3)		21
Clock face				1		1
Eyeglass lens			1			1
Glass, beverage				10 (3)		10
Ink bottle				1 (1)		1
Jar, food	46	20 (1)	38	21		125
Medicinal bottle/vial	1	1	2	1		5
Medicinal bottle/panel		3				3
Curved (bottle/jar)	225	134	22	118		499
Kitchenware	7		3	1		11
Lamp chimney		18	43	36		97
Light bulb	3	8	11	4		26
Flat glass	2		2	4		8
Melted glob	2	1	7	1		11
SUBTOTAL CLEAR	304	201	138	263		905
AMBER-bottle/jar		1				1
BLACK-button		1				1
BROWN						
Bottle, beverage	124	125	344 (16)	279 (21)		872
Bottle, bleach			12 (1)			12
GREEN-bottle/jar	5	2	26 (3)			33
LIGHT GREEN-bottle			7	8 (1)		15
BLUE-Indeterminate	1	1				2
AQUA-bottle/jar	2	1	7 (1)	8 (2)		18
AQUA-coke bottle				9 (1)		9
OLIVE			1	2		3
WHITE						
Button	1	1				2
Houseware	3		1	1		5
SUBTOTAL OTHER GLASS	136	132	398	307	0	973
MIXED MELTDOWN	10					10
TOTAL GLASS	450	332	537	570	0	1888

***Table 5.5** Summary of Recovered Artifacts, Site 5708 Feature 3, Test Unit 1*

SITE 5708 FEA 3, TU-1	I-1	I-2	II-1	II-2	III-1	TOTAL
Depth in cm BD	0/0-10/15	10/15-20/23	20/23-30	30-40/43	40/43-55	
LEATHER						
Strap or belt fragment	2					2
METAL						
TIN/STEEL						
Band				6		6
Bolt			1			1
Buckle	4 (1)		1			5
Button	1	3	1			5
Cable, automotive		3				3
Can, food	41	769	571	486	2	1869
Cap, crown	45	48	25	36		154
Chain	1					1
Disc				1		1
Fastener			3	4		7
Fencing, barbed wire		1		13		14
Fencing, chicken wire	71	39	95	124		329
File			1			1
Flat steel (large container)	297	67	81	27		472
Eyelett (boot lace)	1	4	2	1		8
Handle, drawer		1		1		2
Harness ring	7	2				9
Hinge	1					1
Horse shoe				1		1
Key, can opener	2	1				3
Nail, wire	109	115	61	148		432
Plumbing	1					1
Screen, hardware cl.	2		3	15		20
Screw		1	1	2		4
Scissors				1		1
Snap	1	3	1	2		7
Spike	1		1			2
Staple (fencing)	5	2	1	3		11
Spur	2 (1)					2
Tack			3			3
Toy, car wheel		1				1
Utensil, serving spoon		1				1
Window shade hardware		2				2
Wire, smooth	3	6	3	1		13
Indeterminate	24	5	12	20		61
SUBTOTAL TIN/STEEL	618	1074	867	452	2	3013
COPPER						
Flashing	2	1	1	2		6
Household hardware		1				1
Light bulb base			2			2
Pipe			1			1
Wire, insulated	6	3		3		12
Wire, uninsulated	1		3			4
Tube				1		1
BRASS						
Button or stud		1				1
Casing-ammunition	3					3
Household hardware		1				1
Injector plug-deisel	2					3
Pencil eraser band		1				1
Stud, saddle/harness		5				5
Tack-roofing	4		1			5
ALUMINUM						
Crown cap liner	2	1				3
Foil	6	8	5	2		21
Opener strip (bottle)	1					1
LEAD						
Molten drop	1			2		3
MIXED MATERIALS						
Battery, D Cell	1					1
SUBTOTAL OTHER METAL	29	27	13	10		79
TOTAL METAL	647	1101	880	462	2	3092

***Table 5.5** Summary of Recovered Artifacts, Site 5708 Feature 3, Test Unit 1 (Cont.)*

SITE 5708 FEA 3, TU-1	I-1	I-2	II-1	II-2	III-1	TOTAL
Depth in cm BD	0/8-10/15	10/15-20/23	20/23-30	30-40/43	40/43-55	
CALKING-window		1	3	1		6
MICA-thin sheet			5			6
MORTAR						
Finished surface	3	9	4	12		28
Unfinished	8	32	9	24		73
Painted				2		2
TOTAL MORTAR	11	41	13	38		103
PLASTIC						
Bag	1					1
Bottle	2					2
Cap-screw type			1	1		2
Case	3					3
Comb-tooth			2			2
Sheet/wrap	7	1				8
Indeterminate			1			1
TOTAL PLASTIC	13	1	4	1		19
ROOFING-Mineral Surface		1				1
RUBBER						
Machinery belt			3			3
Button	1	2 (1)				3
Washer	1					1
SHELL						
Button	1	1	8 (5)	5		15
WOOD						
Round post cap						1
GRAND TOTAL	1132	1480	1464	1083	2	5167

Table 5.5 Summary of Recovered Artifacts, Site 5708 Feature 3 (Cont.)

The Feature 3 metal collection contained a greater proportion of copper, brass, and aluminum items as compared to Feature 1. A variety of items are represented in these categories, including household hardware and plumbing, personal possessions, clothing, automotive, and outdoor activities (ammunition, animal harness hardware). Items such as D-cell batteries, pieces of aluminum foil, and electric light bulb bases are clearly modern in age, and it is likely that most of the metal materials are less than 50 years in age; however, the presence of a few historic era glass and ceramic items suggests that some of the metal items could also be historic in age.

Ceramics recovered from Feature 3 include whiteware and porcelain. Among the whiteware items are six decorated body sherds from flatware items, and five undecorated sherds representing a bowl, a plate, a handle (chamber pot) and two flatware items. The decorated whiteware is transfer print, stamped (possibly sponge), and painted (*Photo 5.8*). These decorated ceramic sherds are generally assigned a manufacturer's date range of c. 1850-1920, which places them in an earlier time frame than most of the Feature 3 artifacts. The sherds could represent heirloom kitchenware that was present in a modern home, or could reflect evidence of mixing with an earlier historic era component that was probably just west of the Feature 3 location (i.e., Site Ma-B8-237).

Other artifacts that could represent an earlier component include two bone buttons, some of the 15 shell buttons that were recovered (*Photo 5.9*), a fragmentary metal spur, a horseshoe, and two olive bottle glass sherds. As indicated in the feature description, the deposit at Feature 3 was mixed and appeared to be re-deposited at the feature from a prior refuse dump location. It therefore seems likely that both the artifacts and midden deposit could represent more than one temporal component; however, the composition and design of the vast majority of the Feature 3 artifacts are modern and post-date *circa* 1940. A broad spectrum of domestic and outdoor activities, reflecting one or more permanent home sites, are represented among the over 5,000 items that were collected from a single test unit at Feature 3.

The final historic artifact collection was recovered from Site 1007 Feature 6, which is the site of the Mākena School building. A total of 397 artifacts were recovered from four shovel test units within and adjacent to the postulated footprint of the former building. These items are tabulated and discussed in Chapter 4. As indicated above, the bulk of recovered artifacts are structural in nature, representing window glass (217 items) and window glaze material (100 pieces). Less frequent are nails (6 round and 5 square) and pieces of structural lumber (none). Artifacts that reflect the specialized nature of the site include pieces of slate chalk board (10), six slate pencil fragments, 20 fragments of chalk, 10 pieces of no. 2 pencil lead, and two metal pencil eraser bands with portions of a wood pencil (*Photo 5.10*). The composition of the artifact collection from Site 1007 indicates that there has not been substantial subsurface disturbance of the deposit that dates to the time of school use. There is some modern rubbish on the site surface, however, this material is rather sparse to absent in subsurface contexts.

Portable Materials

Portable materials described here include unmodified pieces of coral, unmodified water worn basalt pebbles or small cobbles, and unmodified pieces of beach conglomerate sandstone. A total of 931 such items were recovered at 18 locations within the project area. These include 354 pieces of coral, 519 waterworn basalt pebbles, 34 waterworn marine shells, 11 pieces of unmodified sandstone, 12 pieces of pumice, and one piece of fire-cracked basalt (*Table 5.6*).

Site-Feature	Weathered Coral		Waterworn Coral		Branch Coral		Waterworn Basalt		Unmodified Sandstone		Other*	
	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.	Cnt.	Wt.
1007-6	1	1.0					2	6.0			2	1.0
1853-7	5	9.3										
1853-8	38	30.2					1	5.2				
5706-1	9	8.6					10	48.8			12	0.4
5706-2	21	249.0	12	176.9			82	360.1			2	0.5
5706-5	24	57.6	1	1.9			3	17.3			1	2.3
5706-10	4	0.6							1	12.2		
5706-11	26	38.7										
5706-14									1	222.6		
5706-17	5	9.0										
5707-2	32	367.8	22	250.0							1	12.1
5707-4	12	41.0										
5708-1	1	8.9	3	8.3			8	44.4			1	7.5
5708-3	20	52.0	25	58.6			411	1752.9			26	30.9
5710-3	1	0.2	2	9.5								
5711-3	34	12.3							6	8.8	2	7.8
5711-4	30	9.2							3	2.2		
5711-8	14	38.3			10	389.7	2	820.3				
5796	2	15.4										

*Other: 5706-1, pumice; 5707-2, fire-cracked basalt; all others, waterworn shell

Table 5.6 Summary of Recovered Portable Materials

Coral

Three types of unmodified coral are present within the project area; waterworn coral, weathered coral, and unweathered branch coral. Items classified as waterworn coral are rounded, pebble-sized pieces that exhibit a glossy, hard surface. These pieces are often found within *'ili'ili* pavement. Weathered coral is also waterworn, however it is has a rough exfoliated surface and is soft and friable; it can be broken with pressure between the fingers. Some of these items may represent remnants of former tools; however, their presence at some locations is not readily explainable. Unweathered branch coral is material that was removed live or recently dead from the ocean and taken to a designated location. These items are assumed to be offerings, and they were collected at only one tested location within the project area - Site 5711-8 - which is interpreted to be a *ko'a*. The branch coral and other portable materials collected from Site 5711 Feature 8 will be returned to its original location, as this feature will be preserved in place.

Basalt and Sandstone

Waterworn basalt pebbles and cobbles were recovered from subsurface contexts at eight features within the project area. Nearly all of the recovered items are small pebbles, of the size range found in *'ili'ili* paving. A few larger pebbles or cobbles were recovered; these items showed no indications of use; however, limited use for rubbing or similar purposes would not necessarily leave traces of the use. Significant amounts of these stones (over 50) were recovered from two locations, Site 5706 Feature 2 and Site 5708 Feature 3. At Site 5706 Feature 2, the pebbles were intermixed with *'a'a* pebbles and cobbles that were used to fill a natural lava depression. They could represent a former pavement layer that got disturbed and displaced during subsequent activities at this location. The basalt pebbles at Site 5708 Feature 3 were clearly in a secondary context, as they were intermixed with a high concentration of mostly modern rubbish that had been deposited at the site along with the *'ili'ili* stones, some traditional artifacts, and a considerable amount of midden.

Unmodified sandstone was recovered from four features at two sites (5706 and 5711) within the project area. This material would have been transported to the site areas from the beach, and was apparently used for a number of utilitarian purposes, as well as for the manufacture of specific types of tools. All of the recovered pieces show a consistent grain and quality, which is the same as found in the formed knob item shown in photo 5.6. It appears that there was a good source area for this material nearby, as it is somewhat unique to find this type of lithic material at various sites within a given area. The presence of a formed sandstone item at Site 1853 indicates that the material was being formed into artifacts within the project area.

Charcoal and Dating Samples

Charcoal was collected from test units at nine features (four sites) within the project area (*Table 5.7*). Relatively large collections were recovered from the two historic/modern refuse features (5708-1 and 3). Charred material at both of these features included wood charcoal with melted glass and fabric, as well as burned metal and other materials. Due to the clear association of the charcoal with modern artifacts, and the presence of large amounts of charred *kiawe* beans in Feature 3, it was determined that radiocarbon dating is not necessary to verify the age of the charcoal and the deposits.

An unusually large amount of charcoal (243.66 grams) was also recovered from excavations at Site 5711 Feature 4. This feature did not exhibit clear evidence of subsurface disturbance, however, it was located adjacent to the golf course and is in an area that could have been impacted by modern burning. Unfortunately, there was not sufficient time to submit samples of this charcoal for species identification prior to submittal for age determination. The results (see below) suggest that mixing of various-aged woods probably occurred.

A total of 43.45 grams of charcoal was recovered from the six remaining features that contained charcoal. In only one case, 5706-11, was the amount greater than 10 grams. Samples recovered from Sites 5706-5A and 5710-4 were determined to be highly susceptible to contamination by modern or historically burned roots. In these cases, intact pieces of *panini* rootlets were observed in the charcoal. These roots were also seen in the charcoal from 5707-2; however, a substantial amount of other woody material was present after the removal of the cactus rootlets.

Site-Feature	Charcoal (grams)	Beta Analytic Sample No.
5706-5A	2.9	
5706-11	17.8	212865
5707-2	6.5	212866
5707-4	0.95	
5708-1	1,022.6	
5708-3	129.1	
5710-4	4.8	
5711-3	3.7	212867
5711-4	243.66	215909, 215910

Table 5.7 Summary of Recovered Charcoal

Sufficient amounts of uncontaminated charcoal for dating was collected from three test units at three sites (5706-11, 5707-2, and 5711-3) within the project area. Two additional samples were prepared from the Site 5711 Feature 4 collection, even though the integrity of the samples was unsure. Specific information on the context of the samples and the dating results are presented below. Detailed reports on each sample and on Beta Analytic's processing procedures are presented in the Appendix.

Beta 212865: Measured radiocarbon age: 220+/-40 BP; conventional radiocarbon age: 290+/-40 BP; 2 Sigma calibration result: AD 1490 to 1660; intercept of radiocarbon age with calibration curve: AD 1640; 1 Sigma calibrated results: AD 1520 to 1580 and AD 1630 to 1650. Selected calibrated calendric range, AD 1630 to 1650, which brackets the intercept.

This sample was collected from the second excavation level of burial pit backfill, beneath the a layer of loose stone platform fill at Site 5706 Feature 11(*0.45-0.55 meter below platform surface*). The charcoal was scattered throughout a cultural deposit that had been disturbed during the excavation of a shallow pit for the Feature 11 burial. There was no indication of natural or cultural soil layers within the area of the test unit, as all of the excavated soil was from within the area of the burial pit. It is assumed that the cultural deposit found beneath this platform was continuous with the deposit found on the surface and subsurface at Feature 14, which is adjacent to the west side of Feature 11. The sample was collected from screened soil and placed in foil in the field. It was later examined in the laboratory and found to contain no intrusive cactus roots. The collection was weighed, and the entire amount was sent to Beta Analytic Laboratories, where it was processed using the standard radiocarbon dating analysis.

Beta 212866: Measured radiocarbon age: 240+/-60 BP; conventional radiocarbon age: 240+/-60 BP; 2 Sigma calibrated results: AD 1500 to 1690; AD 1730 to 1810 and AD 1920 to 1950; intercept of radiocarbon age with calibration curve: AD 1660; 1 Sigma calibrated results: AD 1640 to 1670, AD 1770 to 1800 and AD 1940 to 1950. Selected calibrated calendric range, AD 1640 to 1670, which brackets the intercept.

This sample (6.2 grams) was collected from Layer II, level 2 of the test unit extension at Site 5707 Feature 2 (0.24 to 0.33 meter below surface datum). The test unit extension was a 0.30 meter by 1.0 meter area to the north of test unit 1, and was located over a possible hearth area (HF-1). During excavation of the extension, it was determined that HF-1 was a hearth that had been disturbed by cactus and other roots; however, the boundaries of the feature were still discernible. The charcoal was determined to be from within this disturbed hearth area; it was collected from 1/4 inch screened soil in the field and from a bulk sample of feature matrix that was sorted in the laboratory. An additional .3 gram of charcoal was recovered from Layer II-1, however this was not combined with the charcoal from HF-1 in hopes of maintaining sample integrity. Some pieces of charred cactus root were removed from the collected charcoal prior to weighing and shipping to Beta Analytic.

Beta 212867: Measured radiocarbon age: 510+/-60 BP; 2 Sigma calibrated results: AD 1310 to 1370 and AD 1380 to 1470; intercept of radiocarbon age with calibration curve: AD 1420; 1 Sigma calibrated results: AD 1400 to 1440. Selected calibrated calendric range: AD 1400 to 1440, which brackets the intercept.

This sample was recovered from Layer I, levels 3 and 4 (0.20-0.38 meter below surface) at Test Unit 1, Site 5711 Feature 3. It consisted of 3.4 grams of charcoal that was collected in the filed from 1/4 inch and 1/8 inch screened soil. The charred material was placed in foil in the field and repackaged in foil following preliminary cleaning and weighing in the laboratory. After further cleaning at the Beta Analytic Laboratory, the sample size was such that extended counting was recommended and implemented.

Beta 215909: Measured radiocarbon age: 30+/-60 BP; conventional radiocarbon age: 20+/-60 BP; 2 Sigma calibrated results: AD 1680 to 1730 and AD 1810 to 1930 and AD 1950 to beyond 1960; intercept of radiocarbon age with calibration curve: AD 1950; 1 Sigma calibrated results: AD 1950 to beyond 1960.

Beta 215910: Measured radiocarbon age: 10+/-70 BP; conventional radiocarbon age: 90+/-70 BP; 2 Sigma calibrated results: AD 1660 to beyond 1960; intercepts of radiocarbon age with calibration curve: AD 1890, AD 1910, AD 1950; 1 Sigma calibrated results: AD 1680 to 1740 and AD 1800 to 1930 and AD 1950 to 1950.

The above two samples were recovered from Test Unit 2 at Site 5711 Feature 4. Beta 215909 was recovered from Layer I, level 3 (0.20 to 0.30 meters below surface) and weighed 60.7 grams. Beta 215910 was collected from Layer I, levels 5 and 6 (0.40 to 0.55 meters below surface) and weighed 47.9 grams. Nearly all of the charcoal comprising these samples was collected from the 1/8 inch screen material, which was collected as bulk unsorted material in the field and sorted in the laboratory. Charcoal was collected through floatation recovery and allowed to dry in a controlled environment for two days. The dating results are mixed, and probably signify mixing of charred wood material from various time periods. Both samples produced alternate ranges at 2 Sigma that bracket **AD 1680 to 1740**, which is the timeframe selected to reflect the earliest occupation phase of the site. This date is accepted with the caveat that the samples are not particularly reliable. Species identification analysis of the remaining charcoal from this feature would clarify whether the samples were in fact contaminated with exotic wood.

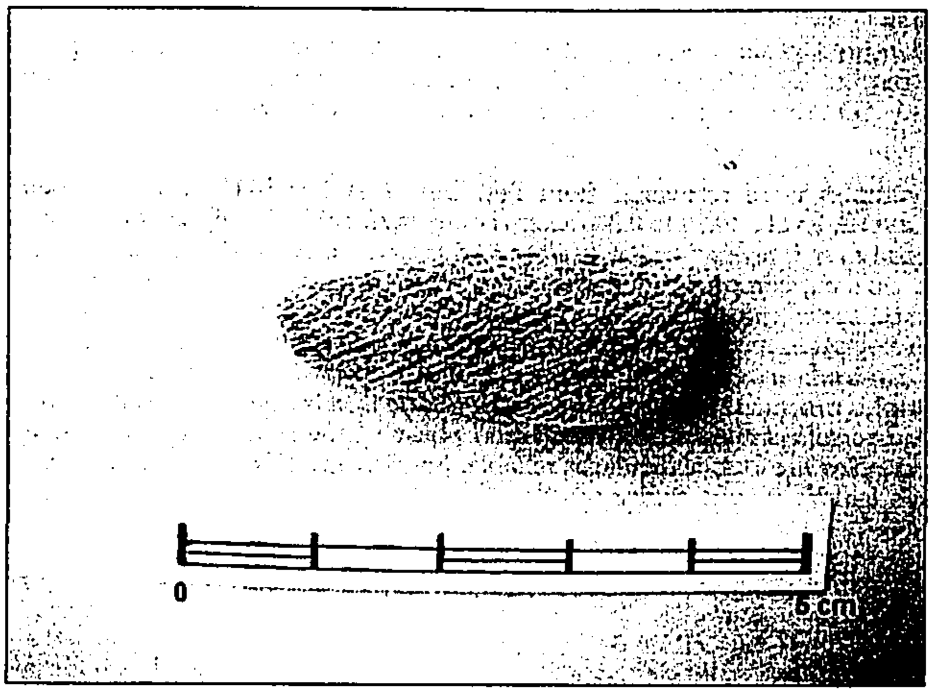

Photo 5.1 Coral abrader, Site 5707 Feature 2, TU-1

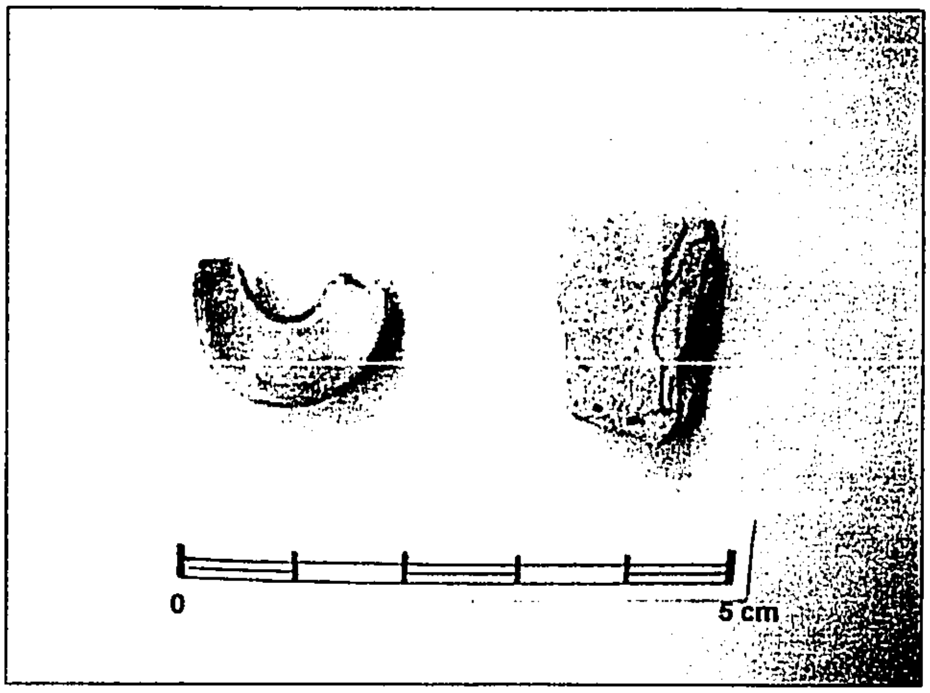

Photo 5.2 a) Shell fishhook, Site 5706 Feature 14, surface
b) Cut shell, Site 5707 Feature 2, TU- 1

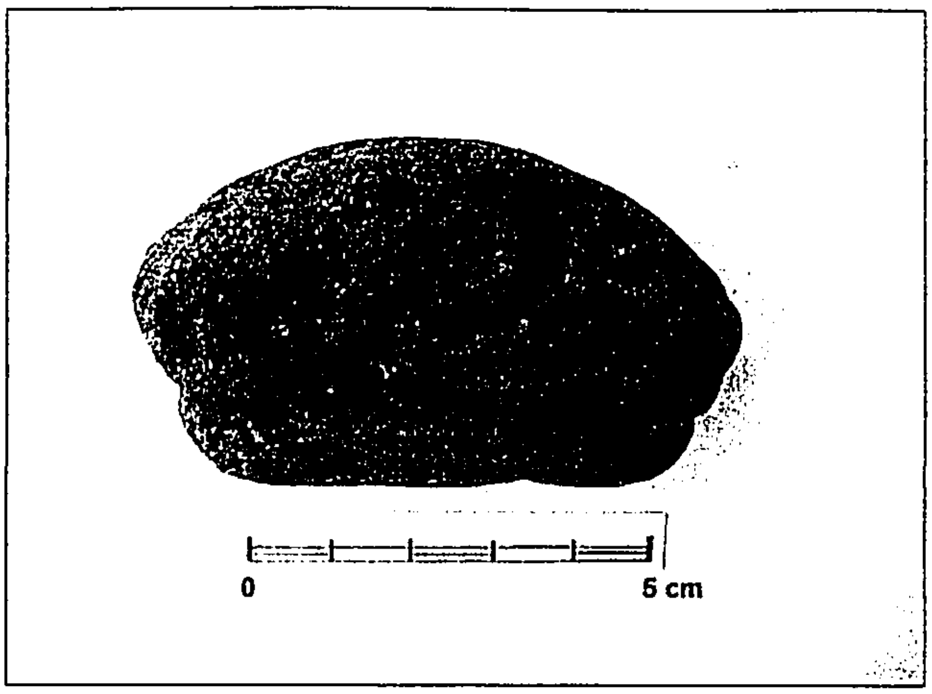

Photo 5.3 Breadloaf sinker, Site 5706 Feature 5A, surface

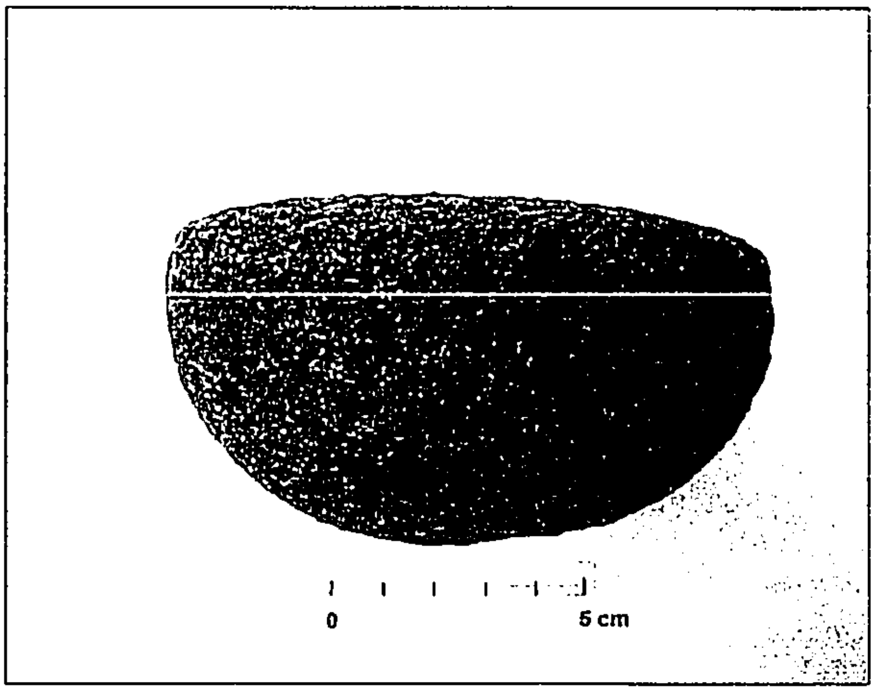

Photo 5.4 Groundstone cobble tool, Site 1864 Feature 1, surface

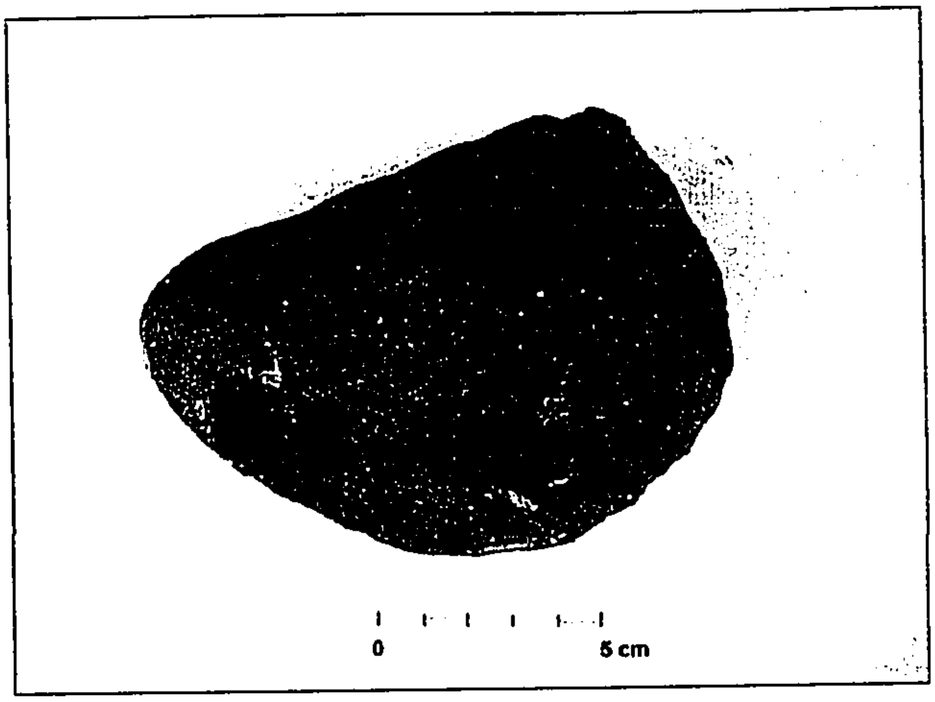

Photo 5.5 Basalt Hammerstone, Site 5711 Feature 7, TU-1

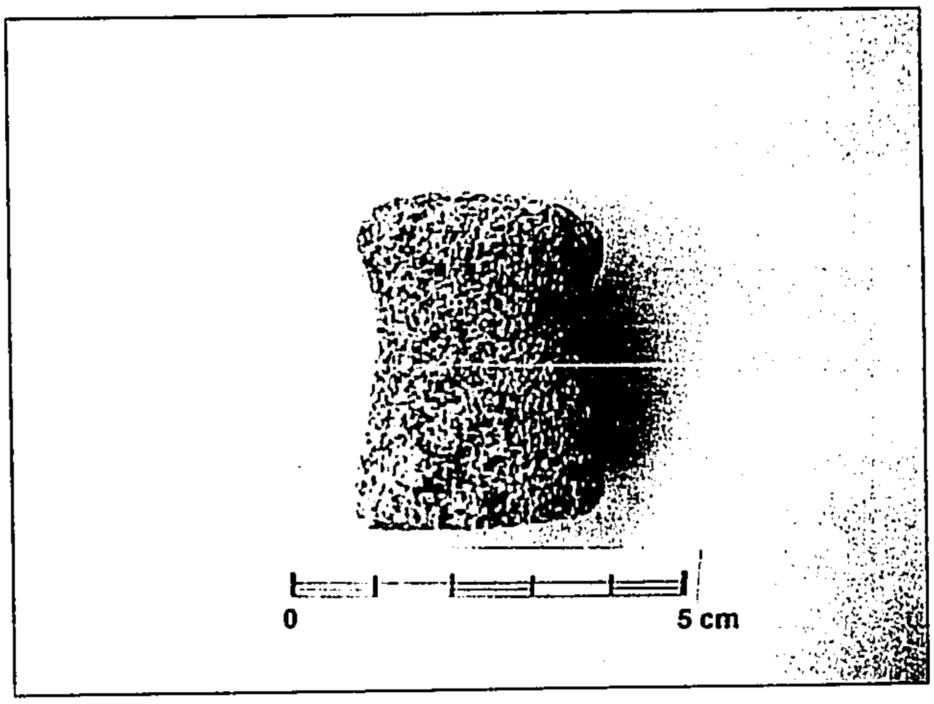

Photo 5.6 Formed sandstone knob, Site 1853 Feature 8, TU-1

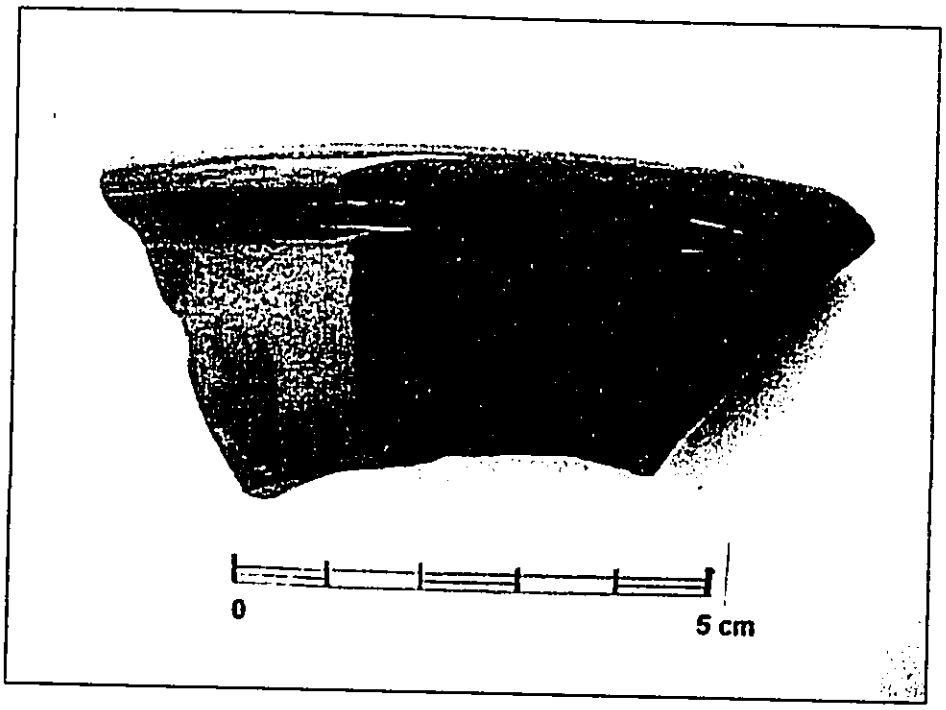

Photo 5.7 Stoneware rim sherd, Site 5706 Feature 11, surface

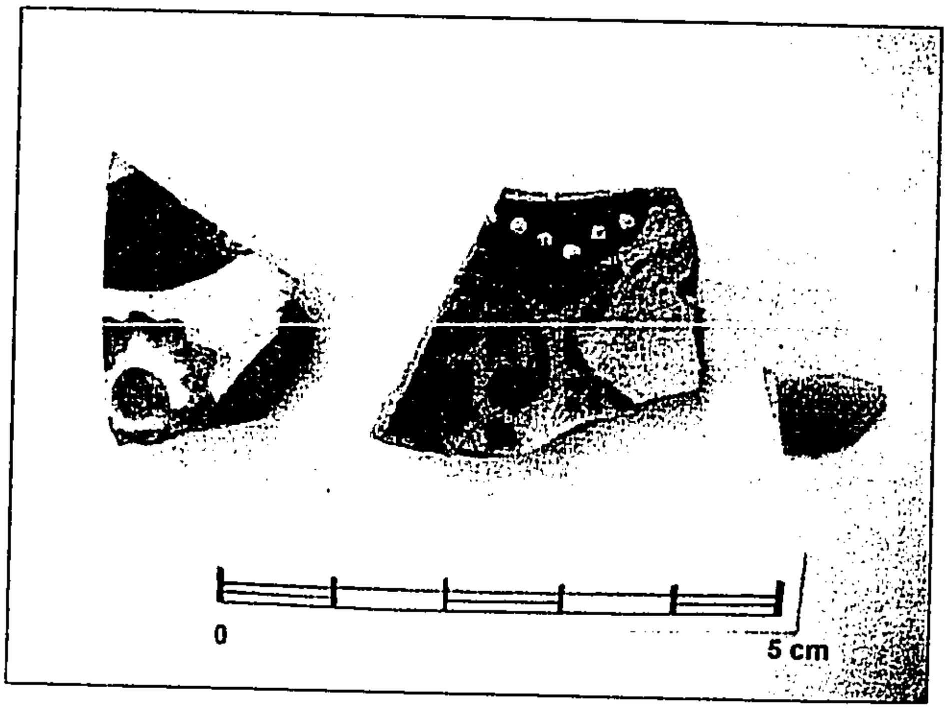

Photo 5.8 Decorated whiteware sherds, Site 5708 Feature 3, Test Unit 1

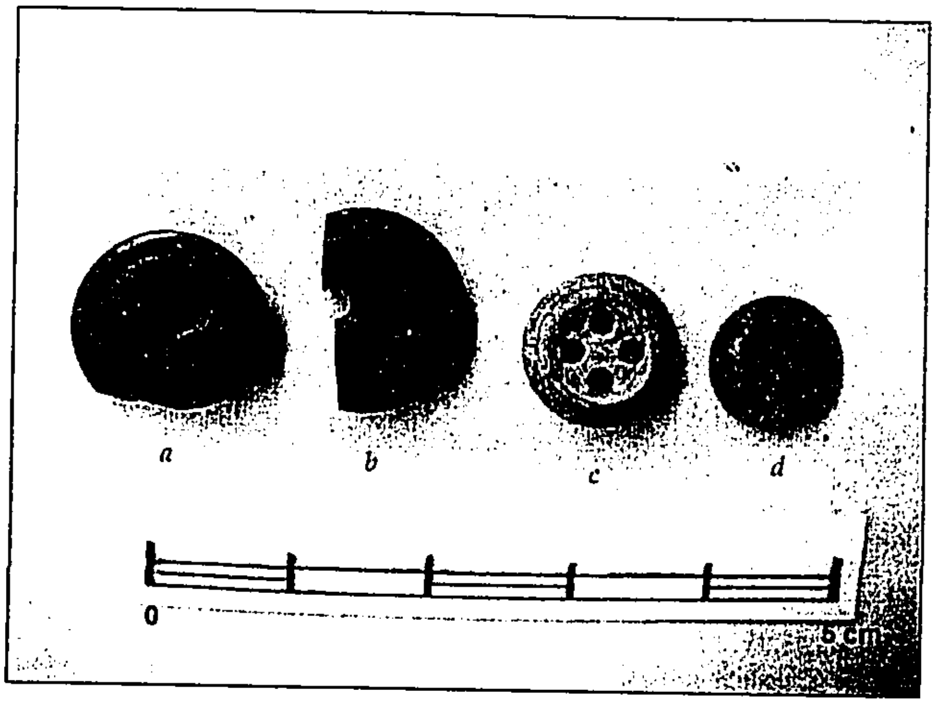

Photo 5.9 Bone (a, b) and shell (c, d) buttons, Site 5708 Feature 3, TU-1

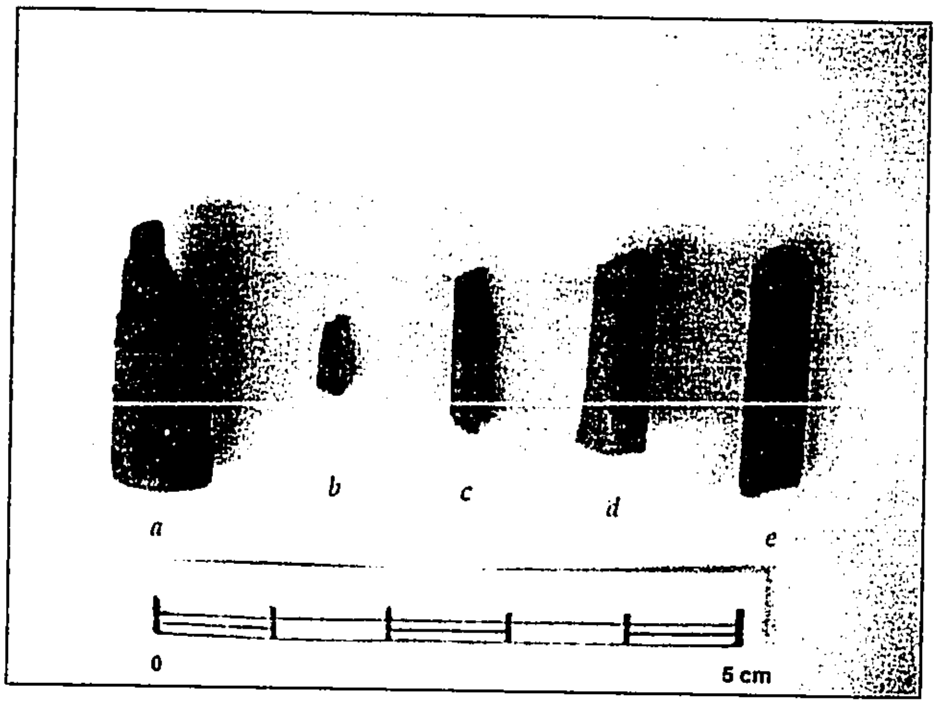

Photo 5.10 Lead pencil parts (a-c) and slate pencils (d, e), Site 1007 Feature 6

6. CONCLUSION

Discussion

A relatively broad range of functional categories are represented among the 80 identified features within the project area. The traditional features represent five general functional groups, and the identified historic/modern era features represent nine general functional groups. Subdivisions within the functional groups are apparent, based on the formal characteristics of the features. These subgroups are taken to represent functional differences within the overall category. For example, traditional habitation features are subdivided into surface midden, paving, enclosure, and C-shape shelter. Each of these formal variants reflects functional differences between the habitation features in terms of permanence, number of occupants, and types of activities conducted.

The functional groups and formal subgroups for the traditional sites are as follows:

Agriculture-loose stone clearing pile on outcrop: 2272-2, 2272-4, 5706-3, 5706-4, 5706-5B&C, 5706-6, 5706-7, 5706-9, 5706-12, 5706-16, 5706-17, 5710-11, 5710-12
Agriculture-stone clearing mound: 5706-13, 5706-16, 5710-6, 5710-9, 5710-10, 5710-11
Agriculture-stone-filled depression: 5706-2, 5706-10, 5706-13
Agriculture-modified outcrop with soil flat: , 5710-7, 5700-9
Agriculture-soil terrace with stone retaining wall: 1864-1, 2272-1, 2272-3, 5710-1, 5710-3, 5710-4, 5710-5, 5710-10
Agriculture-soil flat with wall: 5706-8
Agriculture-garden enclosure: 5796
Burial-platform: 5706-11
Ceremonial-platform or terrace: 5711-1, 5711-8
Ceremonial and agricultural-terrace: 5711-2, 5711-3, 5711-5, 5711-6
Habitation-enclosure: 5711-4
Habitation-walled C-shape shelter: 5707-2
Habitation-pavement: 5706-5A (tentative)
Habitation-midden deposit: 1853-8, 5706-1, 5706-2, 5706-5D, 5706-14
Indeterminate-wall: 1853-7, 5706-15, 5707-1, 5707-3, 5710-8
Water management?-fill & terraces: 5711-7

Among the historic/modern era features, the functional categories and formal subcategories, and their occurrences are as follows:

Agriculture-modified outcrop with soil flat: 5707-5
Agriculture-soil terrace with stone retaining wall: 5710-3, 5710-4
Boundary demarcation-wall: 1007-1, 1007-2, 1007-7
Livestock management-enclosure: 1853-5 (?), 5796
Livestock management-wall: 5709-1 (tentative) 5797-1, 5797-2, 5797-3, 5797-4
Livestock management-filled depression: 1853-14
Livestock management-trough: 1853-13
Education/school site: 1007-6
Habitation-houselot perimeter wall: 1853-8, 5797-1 (tentative)
Habitation-*Imu:* 5798-3
Habitation-structural lumber: 5708-2, 5798-2, 5799-1
Indeterminate-mound: 5709-2
Indeterminate-wall: 1853-6, 1864-2, 5707-1, 5798-1, 5799-2
Refuse disposal-pit: 5708-1, 5708-3, 5798-4
Refuse disposal-privy: 1007-4
Refuse disposal-cesspool: 5708-2
Storage-enclosure: 5795
Transportation-road: 5710-2
Water management-cistern: 1007-5

Certain features are listed above under more than one functional category, indicating alternative uses or multiple uses over time. It should be noted that the traditional agricultural sites are not assumed to be strictly pre-contact in age. The age of many agricultural features is not determinable due to a lack of diagnostic artifacts and dating materials. Given the fact that the area was intensively occupied by Hawaiians from at least AD 1400 through the late twentieth century, there is no basis for assuming that all agricultural activities in the area are pre-contact. Some of the agricultural features reflect both traditional Hawaiian construction and modern reuse, and it is possible/probable that some, if not most, of the extant agricultural features were constructed during the nineteenth or early twentieth century. These features are included in the "traditional" list because they show no evidence of modern/historic building materials and they contained no diagnostically historic or modern artifacts. For the purposes of this study, "historic" refers to artifacts or structures that are over 50 years in age. "Modern" refers to artifacts or structures that post-date 1940. Thus, modern sites are "historic" when they date to 1940-1955. The modern habitation sites and other components within the project area generally span a period of c. 1940-1980, which means that they include historic materials and structures.

Agricultural Features: The largest formal/functional category within the agricultural group is the loose stone clearing pile on an exposed outcrop. Fourteen of these features were identified at three sites - 2272, 5706 and 5710 - with most of them (10) located at Site 5706. Sites 2272 and 5706 are located adjacent to one another and reflect a single general agricultural zone. This section of the project area is characterized by soil pockets between *pahoehoe* ridges that run in a generally north-south orientation. Most of the *pahoehoe* ridges in this area show evidence of *in situ* fracturing of the surface rock layer, and in some locations, these fractured chunks are gathered up into piles, or set in alignments or informal mounds. Other loose piles appear to be stones that were cleared from adjacent soil areas and generally tossed onto the rock surface. The purpose of the clearing the stones would be to provide soil areas for garden plots that were associated with the dwellings at Maluaka Point.

The second most common agricultural feature is the soil terrace with stone retaining wall. Eight of these features were identified at three sites (1864, 2272, and 5710), with most (5) found at Site 5710. This occurrence pattern reflects the topographic setting of Site 5710, which is along the relatively steep slopes of a gulch. The soil terraces at Sites 1864 and 2272 may have been connected at one time, and are interpreted as agricultural due to the absence of midden and artifacts that normally signal former habitation sites.

Habitation features: The five habitation features included in the traditional list include three that are known to be pre-contact in age, based on radiocarbon dating results. These include the C-shape enclosure (Feature 2) at Site 5707, the midden scatter (Features 11/14) at Site 5706, and the enclosure (Feature 4) at Site 5711. The C-shape shelter reflects a specialized use area that was occupied during the middle to late seventeenth century (AD 1640-1670), and possibly again in the nineteenth century. This shelter is too small for any form of permanent occupation; however, it is part of a larger complex that is now mostly destroyed. The age of the two partial walls and a partially buried alignment/terrace have not been verified, although the alignment/terrace is very likely contemporaneous with Feature 2.

The midden scatter at Site 5706 has been severely impacted by erosion, but more intact portions of the feature beneath Feature 11 reflect the former presence of a possible permanent dwelling in the immediate vicinity, *circa* AD 1630-1650. Structural remains of a former dwelling are no longer identifiable, and the site now shows a later phase of use as a garden area, with special use for burial. The burial post-dates the mid-seventeenth century habitation deposit, and it may predate some or all of the nearby agricultural/landscaping features. A second nearby habitation feature (5) at Site 5706 is probably contemporaneous with Features 11/14; this traditional pavement and midden scatter showed no indications of historic era use, although such use should not be ruled out based solely on an absence of historic artifacts. The final habitation enclosure (Site 5711 Feature 4) has been severely compromised by golf course construction; remnant deposits suggest somewhat intensive and specialized use (possibly in connection with the *Ko'a* complex) during a limited time period *circa* AD 1680-1740.

The four habitation features listed as historic/modern are distinguished on the basis of clearly modern/historic artifacts and building materials; or in the case of the *imu*, association with features that are clearly modern. All of the habitation and agricultural sites are assumed to be Hawaiian, based on available information and oral histories provided by the local residents of the area. The livestock management features and historic era enclosures are also assumed to be constructed primarily by Hawaiians who were employed by Ulupalakua Ranch.

Ceremonial Features: This category includes the rather impressive One'uli *Ko'a* and associated lower level terrace/platform. The *Ko'a* is in an eroded condition, but its original size and height are nevertheless determinable. This platform is situated so as to command a broad visual seascape, and it is situated so as to be visible from the offshore area along the north side of Pu'u Ōla'i. The platform exhibits all the classic traits of a fishing *ko'a*. A unique aspect of this site is the associated structures, which essentially create a relatively large complex area that apparently was devoted to Ku'ula Kai, a widely recognized fishing deity. According to Beckwith, Ku'ula Kai supplies reproductive energy to all things of the sea; his worship is associated with various specialized fishing techniques, as well as the construction of Ku'ula shrines, as taught throughout Hawai'i by 'Aiai, son of the human Ku'ula (Beckwith 1971: 20). According to Beckwith

> It is the old fishing technique, still practised, both in its practical and its religious aspect, which is referring to Kuula's teachings. All the places named in the legend of Aiai remain as authentic fishing grounds and stations for fisherman in island waters. Nor is the old practice of offering fish from the first catch to the god upon the fish altar entirely forgotten (Beckwith 1971:20).

According to oral histories recorded by Thrum, Aiai constructed a *ko'a* in Honua'ula during his travels around the archipelago. This particular *ko'a* was however reportedly covered by lava. The *Ko'a* at One'uli was not covered by lava, but it was certainly covered by massive *kiawe* trees, leaving it essentially undetectable from land or water. It appears that the site was undetectable at least 30 years ago when Bishop Museum surveys were being conducted in the immediate area.

Significance Assessments and Recommendations

Initial significance assessment of the identified historic properties follows the procedures and guidelines stipulated in Hawai'i Administrative Rule §13-284-6, as stated:

> Evaluation of significance. (a) Once a historic property is identified, then an assessment of significance shall occur. The person shall make this initial assessment or delegate this assessment, in writing, to the SHPD. This information shall be submitted concurrently with the survey report it historic properties were found in the survey.
>
> (b) To be significant, a historic property shall possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following criterion:
>
> (1) Criterion "a". Be associated with events that have made an important contribution to the broad patterns of our history;
> (2) Criterion "b". Be associated with the lives of persons important in our past;
> (3) Criterion "c". Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
> (4) Criterion "d". Have yielded, or is likely to yield, information important for research on prehistory or history; or
> (5) Criterion "e". Have an important value to the native Hawaiian people or to another ethnic group of the state due to association with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts- -these associations being important to the group's history and cultural identity. (HAR §13-284-6)

Initial significance evaluations and recommended further work for each of the 80 identified features is presented in Table 6.1. Summaries of these recommendations are provided in the following site-specific discussions.

Site 1007
The Mākena School complex consists of seven features, including three walls and the remains of a privy, a cistern, and a disturbed area where the school building once stood. Subsurface testing was conducted in the area in 1989, and data recovery excavations were conducted at two privies in 1991. One of the privies has since been destroyed by a parking lot. Available documentary information obtained from Bishop Museum and SHPD indicates that a data recovery report was never submitted to SHPD for review and approval. Thus, the data recovery that was recommended for this site in 1989 was never completed. A summary report of the data recovery work is available; however, it does not provide information on recovered artifacts, and it does not include reference to information obtained from local residents and/or family members of those who attended the school. Limited historic data was collected during this survey to provide a general timeframe for the school operation (c. 1900-1929), however, the exact dates of opening and closure could not be determined.

The Mākena School site is significant for its information relating to the early twentieth century in Mākena and South Maui. The significant archaeological information has been recovered, however, the recovered information has not been reported. In addition, significant historical information regarding the school and activities conducted at the site has not been collected from local residents knowledgeable about the site. Recommended mitigation does not involve additional archaeological work; it does, however involve a resolution of the incomplete data recovery report and conducting interviews of knowledgeable informants. The oral history information could be combined with the data recovery report.

Site 1853
This site was recorded in 1978 as an historic period habitation complex with associated ranch-related walls and enclosures. Data recovery was conducted at the primary habitation (Feature 2), and its period of occupation was estimated at the late 1700s to middle 1800s (Haun 1978:78). Six of twelve features enumerated for Site 1853 were removed during construction of the Seibu golf course. Portions of one enclosure (Feature 5), three wall features (6, 7, 8) and possibly portions of a fourth wall (Feature 11) are within the current project area, along with a wooden trough (Feature 13) and a newly-identified filled depression (Feature 14). Testing was conducted at Features 5, 6, 7, 8, and 14 during the current project. Excavations at Features 5, 6 and 7 provided no information to assist in determining the age and function of these features. Excavation at Feature 14 indicated that it probably dates to the historic era, given the presence of metal at the base of the filled depression.

Information collected at Feature 8 indicates that this wall post-dates a pre-existing midden deposit that represents a diffuse artifact/midden scatter similar to that found at the adjacent Site 5706. Given the lack of associated habitation deposits at these walls, a functional interpretation at this time is tentative. Possibilities include its use as a portion of the main enclosure wall around Kahaleokaia's houselot at Maluaka Point, or livestock management. The partial condition of the features at this site limit their interpretive and educational value, and there does not appear to be additional information in subsurface contexts associated with these features. No further work is recommended at this site.

Site 1864
This site was recorded in 1979, and after testing was assessed as requiring no further archeological work (Denison 1979). Additional testing was conducted at the site during the current survey, and one traditional Hawaiian artifact was found on the site surface. No information was obtained from subsurface contexts. The formal characteristics of this site suggest that it was an enclosed agricultural terrace, and was probably contiguous with Site 2272 Feature 1. It is currently in a partial state and as such has limited interpretive or educational value. Testing indicates that there is little to no potential for new information to occur in subsurface contexts. No further work is recommended at this site.

Site 2272
The primary feature at this site was recorded and tested in 1979, at which time it was determined that no further archaeological work was warranted (Denison 1979). An age and function were not determined at that time, and additional testing at Feature 1 resulted in no cultural material to assist in this endeavor. The formal attributes of this feature, together with its association with Site 1864, suggest that it was an

SITE	FEA.	Function/Age	Significance Criterion	Mitigation Completed	Mitigation Recommended
1007	1, 2	Boundary wall, historic	d	Documented*	No further work
	4	Privy, Mākena School	d	Data recovered, documented	Complete DR report
	5	Cistern, Mākena School	d	Documented	No further work
	6	School building site	a, d	Tested#, documented	Oral interviews
	7	Boundary wall, historic	d	Documented	No further work
1853	5	Enclosure, historic likely.	d	Tested, documented	No further work
	6A	Wall, indeterminate	d	Tested, documented	No further work
	6B	Wall, historic likely	d	Tested, documented	No further work
	7	Wall, possibly traditional	d	Tested, documented	No further work
	8	Wall, possibly historic	d	Tested, documented	No further work
	11	Wall remnant, indeterm.	d	Documented	No further work
	13	Wooden trough	d	Documented	No further work
	14	Clearing, historic	d	Tested, documented	No further work
1864	1	Agricultural	d	Tested, documented	No further work
	2	Wall, historic/modern	d	Documented	No further work
2272	1	Agricultural	d	Tested, documented	No further work
	2, 3	Agricultural	d	Documented	No further work
	4	Agricultural	d	Tested, documented	No further work
5706	1	Habitation, traditional	d	Tested, documented	No further work
	2	Clearing	d	Tested, documented	No further work
	3, 4	Agricultural	d	Documented	No further work
	5	Habitation, traditional	d	Tested, documented	No further work
	6, 7	Clearing	d	Documented	No further work
	8	Agricultural	d	Tested, documented	No further work
	9	Clearing	d	Documented	No further work
	10	Clearing	d	Data recovered, documented	No further work
	11	Burial, Hawaiian	e	Tested, documented	Preserve in place
	12, 13	Clearing	d	Documented	No further work
	14	Habitation, pre-contact	d	Tested, documented	No further work
	15	Clearing	d	Documented	No further work
	16	Agricultural	d	Documented	No further work
	17	Clearing	d	Tested, documented	No further work

*Documentation includes recorded verbal description, scaled plan map, location on project map, photographs
#Testing consists of subsurface testing to determine extent and nature of deposits
"Data recovered" as used here means that all significant subsurface deposits have been excavated

Table 6.1 Summary of Significance Evaluations and Recommended Further Work

SITE	FEA.	Function/Age	Significance Criterion	Mitigation Completed	Mitigation Recommended
5707	1	Wall segment, indeterminate	d	Tested#, documented*	No further work
	2	Habitation, pre-contact	d	Data recovered#, documented	No further work
	3	Wall segment, indeterminate	d	Documented	No further work
	4	Habitation, pre-contact	d	Tested, Documented	No further work
	5	Agriculture, modern	d	Data recovered, documented	No further work
5708	1	Habitation, modern	d	Tested, documented	No further work
	2	Habitation, modern	d	Documented	No further work
	3	Habitation, historic/modern	d	Tested, documented	No further work
5709	1	Livestock, clearing, modern	d	Documented	No further work
	2	Clearing, indeterminate	d	Documented	No further work
5710	1	Agriculture	d	Documented	No further work
	2	Transportation, historic/mod.	d	Documented	No further work
	3	Agriculture, possibly <50 yrs.	d	Tested, documented	No further work
	4	Agriculture, possibly <50 yrs	d	Tested, documented	No further work
	5	Agriculture	d	Tested, documented	No further work
	6-13	Agriculture	d	Documented	No further work
5711	1	Ceremonial (*Ko'a*), pre-contact	d, e	Documented	**Preserve in place**
	2	Ceremonial, pre-contact	d, e	Documented	**Preserve in place**
	3	Ceremonial, pre-contact	d, e	Tested, documented	**Preserve in place**
	4	Habitation, pre-contact (partial enclosure)	d, e	Tested, documented	**Preserve in place or data recovery**
	5, 6	Ceremonial, pre-contact	d, e	Documented	**Preserve in place**
	7	Water control	d	Documented	No further work
	8	Ceremonial (*Ko'a*), pre-contact	d, e	Tested, documented	**Preserve in place**
5795	-	Storage enclosure, historic	c, d	Tested, documented	**Preserve or architectural documentation**
5796	-	Enclosure, Hawaiian/historic	d	Tested, documented	No further work
5797	1-4	Livestock wall/fence, historic	d	Documented	No further work
5798	1	Livestock wall, historic	d	Documented	No further work
	2-4	Habitation, historic/modern	d	Documented	No further work
5799	1	Habitation, historic/modern	d	Documented	No further work
	2	Wall, historic	d	Documented	No further work

***Documentation includes recorded verbal description, scaled plan map, location on project map, photographs**
#Testing consists of subsurface testing to determine extent and nature of deposits
"Data recovery" as used here means that all significant subsurface deposits have been excavated

***Table 6.1** Summary of Significance Evaluations and Recommended Further Work (Cont.)*

agricultural terrace. Three additional features were documented at Site 2272 during the current survey, and one of these (Feature 4) was tested. All thee of the newly identified features were confirmed to be informal stone clearing piles situated atop naturally fractured bedrock outcrops. The clearing piles are probably associated with the cleared terrace of Feature 1. Testing at this site indicates that there is little to no potential for new information to occur in subsurface contexts. The site has been impacted by improvements to Mākena-Keone'ō'io Road and it is therefore of limited value in an interpretive or educational sense. No further work is recommended at this site.

Site 5706

This site is a multiple-use complex with 17 features reflecting habitation (3), agriculture (13), and burial (1). Among the 13 agricultural features are nine clearing piles or filled depressions, and four soil areas with associated clearing piles. Three of the clearing features were tested (Features 2, 10, and 17), and one of these (Feature 10) was completely excavated. These features showed sparse amounts of marine shell and portable materials that had filtered down through the stone fill, presumably after the stones were in place. The presence of this material suggests that the clearing piles were traditional Hawaiian in origin, although the time frame of construction is uncertain. One of the agricultural soil clearings (Feature 8) was tested and found to be devoid of cultural material.

All three of the habitation features (1, 5D and 14) were tested, and were found to contain sparse to moderately dense subsurface deposits of marine shell midden. These three features were definable prior to testing based on the presence of marine shell midden on the surface. In two cases, (Features 5D and 14) traditional artifacts were also found on the surface (one at each feature). Subsurface artifacts, consisting of two basalt flakes, were found only at Feature 14. No evidence of subsurface features or intact cultural layers were observed during testing at Features 1 and 14. It appears that the focal area of Feature 1 was previously impacted by golf course construction and the remaining feature area shows sparse midden in an undifferentiated natural soil layer. It does not appear likely that additional excavation would yield new information at this feature.

The Feature 5 area includes a stone pavement, stone-filled outcrop slopes, and a surface midden scatter. A total of five test units were excavated within the feature area, including one unit excavated during a prior survey (Rotunno-Hazuka et al. 2005). Three of the five test units found no cultural material, one found very sparse amounts of shell midden, and one unit (Test Unit 1) found relatively high amounts of shell midden (highest weigh per liter of soil within the project area). No subsurface artifacts or features were found during the testing at Feature 5. The lack of midden and artifacts within the paved area at Feature 5A suggest that it may have served some sort of special purpose, however, the pavement is too irregular for use as a sleeping house (*hale moe*) or similar type of specialized structure. It is not certain whether additional excavation would be able to clarify the function of this feature; however, current testing has sampled roughly 4% of the surface area of this structure (2 sq. meters of 48 square meters).

The excavation at Feature 5D encountered a somewhat disturbed cultural layer in Layer I topsoil and Layer II soil. Two test units and one expansion unit were excavated in this are to ensure that sufficient information was obtained to assess its integrity. The deposit appears to be traditional Hawaiian, however, it is lacking in diagnostic artifacts. Marine midden and vertebrate remains are also very common at historic era sites. On the other hand, this deposit could predate the surface features at Site 5706. Unfortunately, no charcoal suitable for dating was recovered from excavations; in general the midden materials are weathered and bleached, indicative of a disturbed and secondary deposit. Given the interpretive limitations of the deposit at Feature 5D, no further work is recommended at this time.

The third habitation feature at Site 5706 (Feature 14) is a midden scatter that was found to be generally deflated and eroded, with the bulk of the cultural material within and just beneath the present ground surface. This features has been exposed to intensive deer traffic in the recent past and present, and no doubt to cattle in the past. It does not appear likely that intact cultural layers or features are present, or that new information detailing specific uses or period of use is present at this feature. Due to its proximity to and continuity with Feature 11, the Feature 14 midden scatter is believed to be contemporaneous with the dated cultural material found in the burial pit fill beneath the platform at Feature 11. No further work is recommended at Feature 14. A portion of the Feature 14 midden deposit is within the setback buffer zone for Feature 11, and will be preserved in place along with the platform.

Feature 11 at Site 5706 was found to contain an *in situ* human burial that was placed in a shallow pit beneath an informal stone platform/pavement. The burial pit fill that was screened prior to discovery of human remains was found to contain marine shell midden and sufficient charcoal to provide a radiocarbon date of AD 1490-1660 (two sigma). The burial was determined to be Native Hawaiian based on the method of interment, the structural attributes of the burial feature, and context of the burial feature within a Native Hawaiian habitation/agricultural complex. The burial feature has been stabilized pending a determination by the Maui/Lana'i Islands Burial Council. A plan to preserve the burial feature in place will be prepared and submitted to the Burial Council for approval.

Site 5707

This site consists of five features, four of which (Features 1-4) have been directly impacted by machinery. The wall features (1 and 3) were severely impacted to the extent that their original configuration and relationship is indeterminate. The walls were breached at several locations and the disturbed stones were then pushed against the sides of the walls, further affecting the soil deposits in the immediate vicinity. Testing was conducted at Feature 1 during a prior study, and no cultural material to aid in determining the age of the wall was recovered. Feature 2 at this site represents the most intact traditional Hawaiian habitation feature identified, as well as the largest and most varied traditional artifact collection from a single feature (16 items from 5 material categories). This small C-shaped enclosure was impacted by machinery along the west (open) end, but otherwise survived intact. The interior deposit was protected by the walls; however, it was adversely affected by a large *panini* plant that covered the interior floor area. Remnants of what appeared to be a small hearth in the corner of the shelter were found during excavation, and the test unit was expanded to collect all the material from this subsurface feature. Sufficient charcoal was collected to provide a radiocarbon date of AD 1500-1690 (two sigma).

Due to the small size of this feature, the testing that was conducted removed over 75% of the entire interior area and 100% of the north portion, which showed greater depth and a much higher concentration of materials than the south portion. If the interior of this structure were larger, further work in the form of data recovery would be recommended; however, in this case, it is fairly certain that adequate data recovery has been completed, and no further work is warranted at this feature.

Feature 4, a partially buried stone alignment, may have been functionally related to Feature 2, however, it is presently in a deteriorated state and subsurface deposits have been compromised. It appears that machinery drove over this alignment, scraping soil away at the time. A small amount of midden is present, however, there does not appear to be much potential for intact cultural deposits or features.

Prior testing at Feature 5, which could be a modern planting feature, removed nearly 100% of the interior area of the feature, precluding the need to conduct further work. This feature contained only one piece of marine shell, which was probably in the soil prior to construction of the small walled planting area. No further work is warranted at this feature.

Site 5708

Sufficient information has been collected at Site 5708-1 to determine that it represents a modern habitation site. The location of the dwelling at this site is shown on the USGS Makena Quadrangle map dated 1956, and it is not shown on the 1983 map. Thus, the dwelling was present in 1956, which would make it at least 50 years in age. Feature 1 represents a refuse disposal and reduction area where rubbish was burned. A large sample of metal, glass, plastic and other materials was recovered at this feature; all materials appear to date to *circa.* 1940-1980, with the bulk of material being less than 50 years in age.

Feature 2 identifies the location of a former structure. The site has been bulldozed and all structural remains have been pushed into linear piles. The intact cap over what appears to be a cesspool is present at this modern feature. It has been documented and no further work is recommended.

Feature 3 represents a secondary deposit of refuse from both historic and modern eras. This feature is located adjacent to the edge of the golf course, against the west face of a high natural bedrock face. After testing the location, it was determined that debris was pushed against this rock face from a nearby location within the golf course area. The deposit is extremely concentrated metal and glass rubbish, some of which has been burned. Materials found that appear to date to the late nineteenth/early twentieth century include decorated whiteware sherds, bottle glass, and possibly shell and bone buttons.

Some of the metal items, such as a spur and horse shoe, could also date to the historic era. Traditional Hawaiian artifacts, including basalt flakes, ground stone, and volcanic glass were also found within the deposit. There are indications of reverse stratigraphy within the deposit, with the earlier items at upper levels. This would be expected if materials were pushed in episodes. The historic materials are believed to have originated from the Site Ma-B8-237, identified by Cordy (1978) as a midden scatter and a concrete foundation. The modern materials could have originated from the Site 5708 Feature 2 area, or from Site Ma-B8-237. No further work appears warranted at this feature.

Site 5709

This site, previously identified as a set of parallel walls, was reexamined and found to most likely be the result of heavy machinery. The two linear rubble piles are situated along the sides of an artificial swale that was cut across the project area in conjunction with drainage improvements along Mākena Road. The original disposition of the stone at this location is not known; however, they could have originated from the area of Site 5797, which is a wall and fence that runs through the project area in an east-west orientation. This feature, and a second stone pile along the same swale, have been documented, and no further work is recommended.

Site 5710

Site 5710 is a traditional agricultural complex consisting of twelve features, and one intrusive historic/ modern road or trail. The features are located along the top edges, slopes, and bottom of a large gulch. Most of the features consist of small soil clearings with associated stone constructions such as informal retaining walls or stone-filled outcrop areas. Three of the larger terraces were tested and found to contain sparse amounts of marine shell and weathered coral. In general, the features are in poor preservation, having been impacted by slope-wash erosion, cattle, and recently by deer. Two of the features show evidence of possible reconstruction and reuse during the modern era; these are in the best condition. Most of the features along the central slope and bottom of the gulch were impacted during bulldozing of a road that entered and crossed the gulch. The age of this road is uncertain; however, it does not appear to be related to recent golf course construction. Given the relatively poor condition of this complex, it would have interpretive potential only after extensive reconstruction and stabilization. The terraces at Site 5711 to the west are in better condition, and if preserved would provide a good representation of the extent of landscaping that was once present in this gulch. No further work is recommended at Site 5710.

Site 5711

This site includes what is thought to be the *Ko'a* at *One'uli* previously described by Walker (1930), as well as six or seven additional features that appear to have ceremonial functions. Principal among these is Feature 8, a stone and coral-filled terrace located at the bottom of the gulch, in line with the *ko'a* at the top of the gulch. Testing at Feature 8 confirmed its function as a second *ko'a*. Along the slope between these two *ko'a* are a series of four stepped terraces that show surface scatters of coral, branch coral, and marine midden. A test unit at one of the terraces (Feature 3) recovered nine pieces of volcanic glass, 220.67 grams of marine shell midden, and fish remains. Charcoal from this excavation was dated to AD 1044-1440, which is the earliest date obtained within the project area. Preservation is recommended for Features 1, 2, 3, 5 and 8.

Feature 4 is a terraced enclosure located immediately west of the terraces. This partial enclosure has been impacted by the golf course; however, test units within the enclosure indicate that it contains cultural deposits rich in midden, and that it has the potential to contain in tact subsurface features. Due to its proximity to the ceremonial features, and its possible ceremonial function, preservation of this feature is also recommended. Given that a ceremonial function cannot be verified for Feature 4 at this time, data recovery is recommended if preservation is not selected as the preferred mitigation measure.

The final feature within Site 5711 is a stone pavement at the bottom of the gulch, to the east of Feature 8. No surface remains were observed at this cobble-filled area to indicate its use in a ceremonial context, and testing resulted in no findings that would support this interpretation. At this time, the most feasible functional use of this feature is that it served to channel stream flow toward the north side of the gulch. Current information does not support its inclusion with the ceremonial components of the site. Therefore, it cannot be recommended for preservation on that basis. No further work is recommended for Feature 7 at this time.

Site 5795

This historic era enclosure was recorded as Site Ma-B8-233 in 1978, when it was interpreted as an historic era storage structure. It was re-examined twice, and a total of six test units have been excavated within the enclosure. No new information has been recovered that conflicts with the 1978 interpretation as a storage structure. All artifacts recovered from this site are historic or modern in age, and include glass, metal and leather materials. An associated fence line found around the outside of the structure supports the idea that this structure housed materials that were used in ranch operations, and the fence served to keep cattle out of the structure. Only trace amounts of midden (2 pieces of shell) were recovered from one of the six excavations, further suggesting a lack of human domestic activities within the enclosure. Testing also indicates that he southern half of the floor area was solid rock, a preferred attribute of storage areas. It appears that there is not likely to be new information present in subsurface deposits at this site, and no further excavation is recommended.

The Site 5795 enclosure is in good condition, with minor areas of wall fall at the corners and along the west wall. Architecturally, it is a good example of dry-laid stone work. The walls are tall and straight; in fact, the walls may be the tallest recorded for any enclosure in the region. Data from 40 enclosures recorded by Cordy in 1978 within, *makai* and *mauka* of the project area show that six enclosures had walls over 1.0 meter in height, but no enclosure except Site 5795 had walls heights of 1.6 meter. This points to the site as a somewhat unique architectural feature, in addition to being a good example of a ranching era special use structure. It is therefore assessed as being significant under criteria "c" and "d". The impacts to the information value of the site have been mitigated; however, excavation does not mitigate criterion "c" value. Preservation is recommended here as the preferred mitigation measure. If this is not feasible, then architectural mitigation should be conducted, following recommendations from the SHPD Architecture Branch.

Site 5796

This enclosure was recorded as Ma-B8-234 in 1978 and interpreted as a cattle pen. Six units have been excavated at the site since 1978, and no information has been recovered that conflicts with this interpretation. Recent investigations have, however suggested that it could have served as a garden enclosure as well, given the relatively low height of walls from the interior. Only sparse amounts of marine shell and no traditional artifacts were recovered during any of the testing procedures. This enclosure is not particularly well-preserved, and it is not unique relative to a number of other enclosures that have been documented in the region. Testing by three different archaeologists has indicated that there is little to no potential for subsurface deposits to be present at this site. Therefore, no further work is recommended.

Site 5797

This wall and fence line was first recorded in 1978 as Site Ma-B8-240, when it was interpreted as a ranch wall. Most of the wall recorded in 1978 is now gone, with only the eastern portion remaining. Examination of this portion indicates that there were two building sequences, the first of which could have been for non-ranching purposes. This early component is presently too fragmented to determine original function; however, it may have been part of a large houselot enclosure that was present at Maluaka Point. The added wall sections include an east-west fence line with associated stone wall segments. This fence and wall continued west into the golf course area, and east at least to Mākena Road. The fence is currently in a broken down and non-functional state. Its condition indicates an age of at least 50 years or more. The wall and fence have been sufficiently documented and no further work is recommended at the site.

Site 5798

This historic/modern habitation site is located at the southern edge of Parcel 84, and it includes a wall (Feature 1) that most likely pre-dates the dwelling, a concentration of structural lumber (Feature 2), an *imu* pit (Feature 3) and a refuse pit (Feature 4). The primary dwelling may have been located to the south side of the Parcel 84 boundary wall, at a location shown on the 1956 and 1983 USGS Makena Quadrangle maps. The site is the former home of the Poepoe family. A sufficient level of documentation has been completed at this site, and no further work is recommended.

Site 5799

This site is interpreted as an accessory structure to the Site 5798 habitation complex. It consists of the wooden remains of a small shack and modern artifacts (Feature 1). Also associated is a retaining wall segment (Feature 2) that appears to predate the structure. The location of this site conforms with the mapped location of a structure shown on the 1956 and 1983 USGS Makena Quadrangle maps. The site has been documented to a sufficient level and no further work is recommended.

Summary

Among the fifteen sites located within the project area, 11 contain features that are significant solely under criterion "d", which refers to the information value of the site in furthering the understanding of history or prehistory. Sites in this group include 1853, 1864, 2272, 5707, 5708, 5709, 5710, 5796, 5797, 5798 and 5799. No further work is recommended at these sites.

Two sites contain features that are significant under criteria "d" and "e". These include Site 5706 and 5711. At Site 5706, one feature (11) significant under criterion "e" and 16 features significant under criterion "d". Preservation in place is recommended for Site 5706 Feature 11, due to its cultural significance as a burial location. At Site 5711, seven of eight features are assessed as significant under criteria "d" and "e". Preservation in place is recommended for six of these features (1, 2, 3, 5, 6, and 8), and either preservation in place or data recovery is recommended for one feature (4).

Site 1007 has a feature (6) that is assessed as significant under criteria "a" and "d", and five features assessed as significant under criterion "d". Data recovery excavations have been completed at these latter features, however the report has not been completed. Thus, recommended mitigation for these features is completion of the data recovery report. If the materials and information is no longer available to complete this report, then additional data recovery field should be conducted at the intact portion of Feature 4. In addition, the full significance of Feature 6 has not been mitigated through archaeological field work. Additional mitigation in the form of oral history compilation, is recommended for the Mākena School Site. This information could be included in the data recovery report, or could be conducted as a separate study. It is recommended that the oral history study be completed by an individual who is formally trained in conducting oral interviews.

Finally, one site (5795) is assessed as significant under criteria "c" and "d". Preservation is recommended for this site; if preservation is not possible, consultation with the SHPD Architectural Branch for a determination of architectural mitigation is recommended.

In addition to the above site-specific recommendations, it is recommended that initial grading and grubbing of the project area be monitored by a qualified archaeologist, in order to ensure that a) the preserve areas as designated by approved preservation plans are marked and maintained during earthmoving, and that b) inadvertent discoveries are identified, documented and protected.

Implementation of the mitigation measures as recommended here will require preparation of a burial preservation plan for Site 5706-11, with review and approval by the SHPD and the Maui-Lana'i Islands Burial Council. A preservation plan for Site 5711 and possibly 5795 will be needed, with review and approval by SHPD. If Site 5795 is not preserved, documentation of the site per architectural recommendations will be needed. Completion of the data recovery report and a new oral history study for Site 1007 will also be needed. Finally, a monitoring plan will also be prepared and submitted to SHPD for review and approval, to ensure fulfillment of preservation plans and protect inadvertent discoveries.

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8. APPENDIX

Beta Analytic Inc.
Radiocarbon analysis and calibration reports

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MR. DARDEN HOOD
Director

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

January 17, 2006

Ms. Theresa K. Donham
Akahele Archaeology
30 Laumaewa Loop
Kihei, HI 96753
USA

RE: Radiocarbon Dating Results For Samples C-0601, C-0602, C-0603

Dear Ms. Donham:

Enclosed are the radiocarbon dating results for three samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses went normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the VISA card provided. A receipt is enclosed. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

BETA

BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

UNIVERSITY BRANCH
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305/667-5167 FAX: 305/663-0964
E-MAIL: beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Ms. Theresa K. Donham

Akahele Archaeology

Report Date: 1/17/2006

Material Received: 1/9/2006

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 212865 SAMPLE : C-0601 ANALYSIS : Radiometric-Priority delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1490 to 1660 (Cal BP 460 to 290)	220 +/- 40 BP	-21.0 o/oo	290 +/- 40 BP
Beta - 212866 SAMPLE : C-0602 ANALYSIS : Radiometric-Priority delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1500 to 1690 (Cal BP 450 to 260) AND Cal AD 1730 to 1810 (Cal BP 220 to 140) Cal AD 1920 to 1950 (Cal BP 30 to 0)	240 +/- 60 BP	-24.8 o/oo	240 +/- 60 BP
Beta - 212867 SAMPLE : C-0603 ANALYSIS : Radiometric-Priority delivery (with extended counting) MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1310 to 1370 (Cal BP 640 to 580) AND Cal AD 1380 to 1470 (Cal BP 570 to 480)	290 +/- 60 BP	-11.5 o/oo	510 +/- 60 BP

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By international convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

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Deputy Directors

April 4, 2006

Ms. Theresa K. Donham
Akahele Archaeology
30 Laumaewa Loop
Kihei, HI 96753
USA

RE: Radiocarbon Dating Results For Samples C0604, C0605

Dear Ms. Donham:

Enclosed are the radiocarbon dating results for two samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses went normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

The cost of the analysis was charged to the VISA card provided. A receipt is enclosed. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood

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BETA ANALYTIC INC.

DR. M.A. TAMERS and MR. D.G. HOOD

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REPORT OF RADIOCARBON DATING ANALYSES

Ms. Theresa K. Donham

Report Date: 4/4/2006

Akahele Archaeology

Material Received: 3/28/2006

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 215909	30 +/- 60 BP	-26.0 o/oo	20 +/- 60 BP

SAMPLE : C0604
ANALYSIS : Radiometric-Priority delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1680 to 1730 (Cal BP 260 to 220) AND Cal AD 1810 to 1930 (Cal BP 140 to 20)
Cal AD 1950 to beyond 1960 (Cal BP 0 to 0)

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 215910	10 +/- 70 BP	-20.3 o/oo	90 +/- 70 BP

SAMPLE : C0605
ANALYSIS : Radiometric-Priority delivery
MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 1660 to beyond 1960 (Cal BP 290 to 0)

Dates are reported as RCYBP (radiocarbon years before present, "present" = 1950A.D.). By International convention, the modern reference standard was 95% of the C14 content of the National Bureau of Standards' Oxalic Acid & calculated using the Libby C14 half life (5568 years). Quoted errors represent 1 standard deviation statistics (68% probability) & are based on combined measurements of the sample, background, and modern reference standards.

Measured C13/C12 ratios were calculated relative to the PDB-1 international standard and the RCYBP ages were normalized to -25 per mil. If the ratio and age are accompanied by an (*), then the C13/C12 value was estimated, based on values typical of the material type. The quoted results are NOT calibrated to calendar years. Calibration to calendar years should be calculated using the Conventional C14 age.

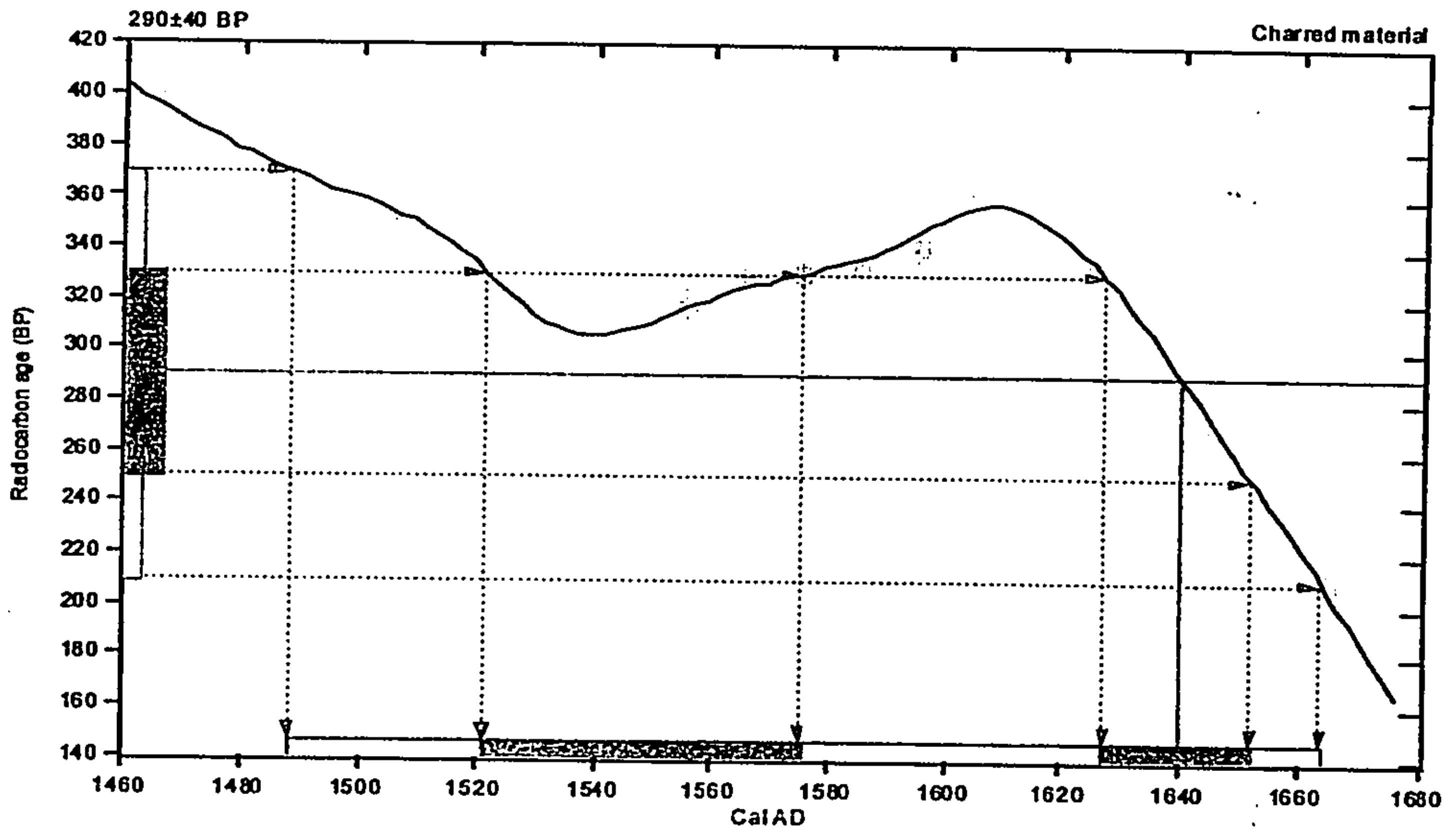
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21:lab. mult=1)

Laboratory number:	**Beta-212865**
Conventional radiocarbon age:	**290±40 BP**
2 Sigma calibrated result: (95% probability)	**Cal AD 1490 to 1660 (Cal BP 460 to 290)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal AD 1640 (Cal BP 310)
1 Sigma calibrated results: (68% probability)	Cal AD 1520 to 1580 (Cal BP 430 to 380) and Cal AD 1630 to 1650 (Cal BP 320 to 300)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.8:lab. mult=1)

Laboratory number: **Beta-212866**

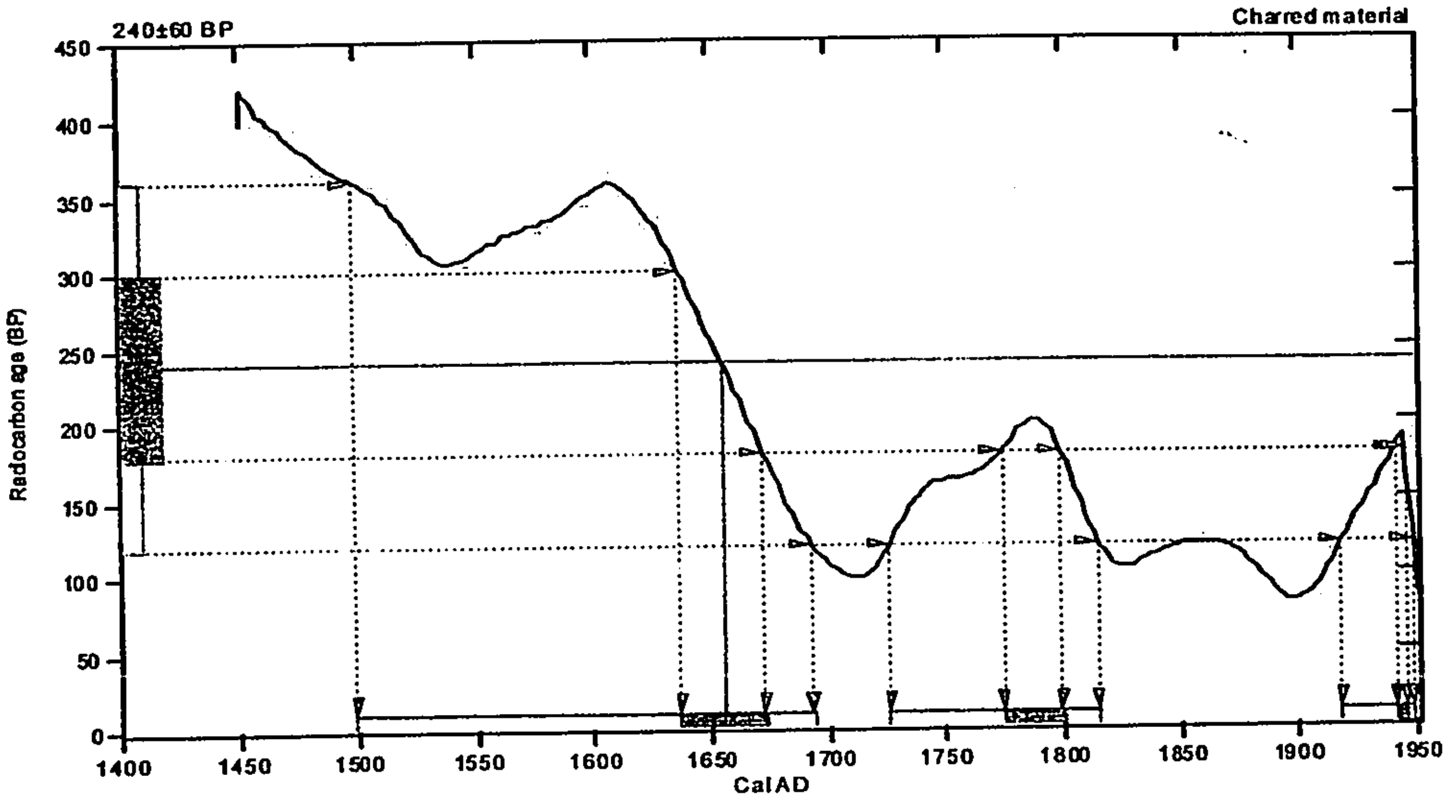
Conventional radiocarbon age: **240±60 BP**

2 Sigma calibrated results: **Cal AD 1500 to 1690 (Cal BP 450 to 260) and**
(95% probability) **Cal AD 1730 to 1810 (Cal BP 220 to 140) and**
Cal AD 1920 to 1950 (Cal BP 30 to 0)

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1660 (Cal BP 290)

1 Sigma calibrated results: Cal AD 1640 to 1670 (Cal BP 310 to 280) and
(68% probability) Cal AD 1770 to 1800 (Cal BP 180 to 150) and
Cal AD 1940 to 1950 (Cal BP 10 to 0)



References:
Database used
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Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-11.5:lab. mult=1)

Laboratory number: **Beta-212867**

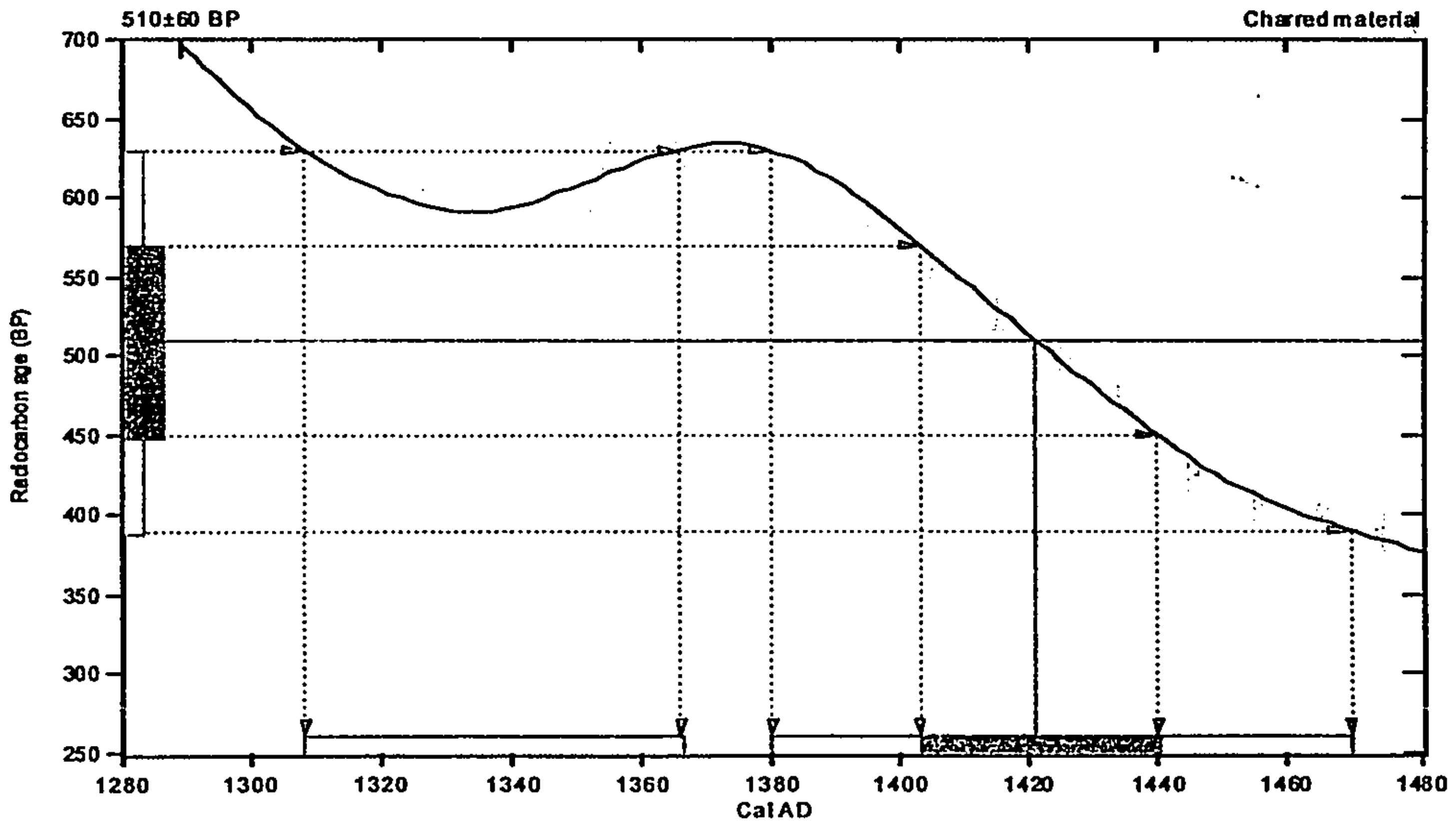
Conventional radiocarbon age: **510±60 BP**

2 Sigma calibrated results: **Cal AD 1310 to 1370 (Cal BP 640 to 580) and**
(95% probability) **Cal AD 1380 to 1470 (Cal BP 570 to 480)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1420 (Cal BP 530)

1 Sigma calibrated result: Cal AD 1400 to 1440 (Cal BP 550 to 510)
(68% probability)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
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A Simplified Approach to Calibrating C14 Dates
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-26:lab. mult=1)

Laboratory number: **Beta-215909**

Conventional radiocarbon age: **20±60 BP**

2 Sigma calibrated results[2]: **Cal AD 1680 to 1730 (Cal BP 260 to 220) and**
(95% probability) **Cal AD 1810 to 1930 (Cal BP 140 to 20) and**
Cal AD 1950 to beyond 1960 (Cal BP 0 to 0)

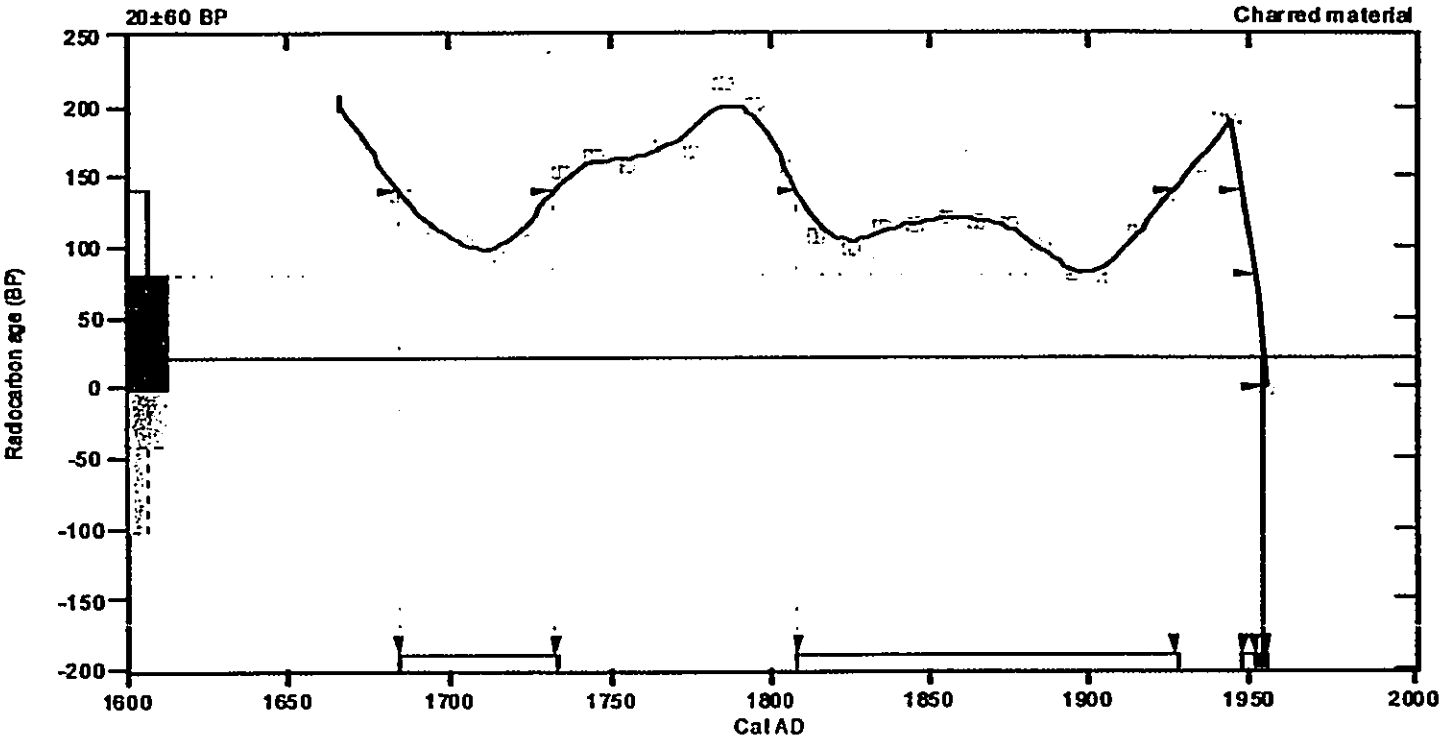
[2] 2 Sigma range being quoted is the maximum antiquity based on the minus 2 Sigma range

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 1950 (Cal BP 0)

1 Sigma calibrated result[3]: Cal AD 1950 to beyond 1960 (Cal BP 0 to 0)
(68% probability)

[3] 1 Sigma range being quoted is the maximum antiquity based on the minus 1 Sigma range



References:
Database used
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-20.3:lab. mult=1)

Laboratory number: Beta-215910

Conventional radiocarbon age: 90±70 BP

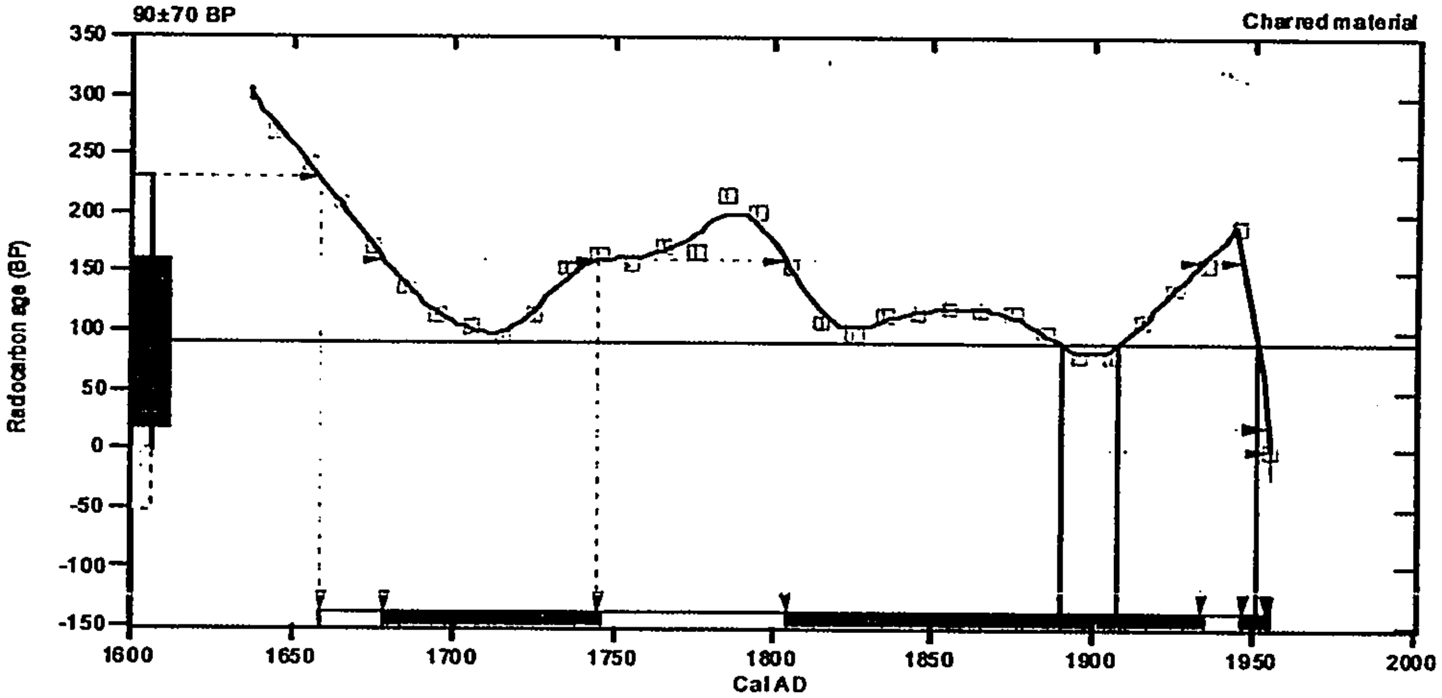
2 Sigma calibrated result[2]: Cal AD 1660 to beyond 1960 (Cal BP 290 to 0)
(95% probability)

[2] 2 Sigma range being quoted is the maximum antiquity based on the minus 2 Sigma range

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal AD 1890 (Cal BP 60) and
Cal AD 1910 (Cal BP 40) and
Cal AD 1950 (Cal BP 0)

1 Sigma calibrated results: Cal AD 1680 to 1740 (Cal BP 270 to 200) and
(68% probability) Cal AD 1800 to 1930 (Cal BP 150 to 20) and
Cal AD 1950 to 1950 (Cal BP 0 to 0)



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Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
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Www.radiocarbon.com

Mr. Darden Hood
Director

Mr. Ronald Hatfield
Mr. Christopher Patrick
Deputy Directors

Final Report

The final report package includes the final date report, a statement outlining our analytical procedures, a glossary of pretreatment terms, calendar calibration information, billing documents (containing balance/credit information and the number of samples submitted within the yearly discount period), and peripheral items to use with future submittals. The final report includes the individual analysis method, the delivery basis, the material type and the individual pretreatments applied. The final report has been sent by mail and e-mail (where available).

Pretreatment

Pretreatment methods are reported along with each result. All necessary chemical and mechanical pretreatments of the submitted material were applied at the laboratory to isolate the carbon which may best represent the time event of interest. When interpreting the results, it is important to consider the pretreatments. Some samples cannot be fully pretreated, making their ^{14}C ages more subjective than samples which can be fully pretreated. Some materials receive no pretreatments. Please look at the pretreatment indicated for each sample and read the pretreatment glossary to understand the implications.

Analysis

Materials measured by the radiometric technique were analyzed by synthesizing sample carbon to benzene (92% C), measuring for ^{14}C content in one of 53 scintillation spectrometers, and then calculating for radiocarbon age. If the Extended Counting Service was used, the ^{14}C content was measured for a greatly extended period of time. AMS results were derived from reduction of sample carbon to graphite (100% C), along with standards and backgrounds. The graphite was then detected for ^{14}C content in one of 9 accelerator-mass-spectrometers (AMS) .

The Radiocarbon Age and Calendar Calibration

The "Conventional ^{14}C Age (*)" is the result after applying $^{13}C/^{12}C$ corrections to the measured age and is the most appropriate radiocarbon age. If an "*" is attached to this date, it means the $^{13}C/^{12}C$ was estimated rather than measured (The ratio is an option for radiometric analysis, but included on all AMS analyses.) Ages are reported with the units "BP" (Before Present). "Present" is defined as AD 1950 for the purposes of radiocarbon dating.

Results for samples containing more ^{14}C than the modem reference standard are reported as "percent modem carbon" (pMC). These results indicate the material was respiring carbon after the advent of thermo-nuclear weapons testing (and is less than ~ 50 years old).

Applicable calendar calibrations are included for materials between about 100 and 19,000 BP. If calibrations are not included with a report, those results were either too young, too old, or inappropriate for calibration. Please read the enclosed page discussing calibration.

PRETREATMENT GLOSSARY
Standard Pretreatment Protocols at Beta Analytic

Unless otherwise requested by a submitter or discussed in a final date report, the following procedures apply to pretreatment of samples submitted for analysis. This glossary defines the pretreatment methods applied to each result listed on the date report form (e.g. you will see the designation "acid/alkali/acid" listed along with the result for a charcoal sample receiving such pretreatment).

Pretreatment of submitted materials is required to eliminate secondary carbon components. These components, if not eliminated, could result in a radiocarbon date, which is too young or too old. Pretreatment does not ensure that the radiocarbon date will represent the time event of interest. This is determined by the sample integrity. Effects such as the old wood effect, burned intrusive roots, bioturbation, secondary deposition, secondary biogenic activity incorporating recent carbon (bacteria) and the analysis of multiple components of differing age are just some examples of potential problems. The pretreatment philosophy is to reduce the sample to a single component, where possible, to minimize the added subjectivity associated with these types of problems. If you suspect your sample requires special pretreatment considerations be sure to tell the laboratory prior to analysis.

"acid/alkali/acid"

The sample was first gently crushed/dispersed in deionized water. It was then given hot HCl acid washes to eliminate carbonates and alkali washes (NaOH) to remove secondary organic acids. The alkali washes were followed by a final acid rinse to neutralize the solution prior to drying. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of the sample. Each chemical solution was neutralized prior to application of the next. During these serial rinses, mechanical contaminants such as associated sediments and rootlets were eliminated. This type of pretreatment is considered a "full pretreatment". On occasion the report will list the pretreatment as "acid/alkali/acid - insolubles" to specify which fraction of the sample was analyzed. This is done on occasion with sediments (See "acid/alkali/acid - solubles"

Typically applied to: charcoal, wood, some peats, some sediments, and textiles "acid/alkali/acid - solubles"

On occasion the alkali soluble fraction will be analyzed. This is a special case where soil conditions imply That the soluble fraction will provide a more accurate date. It is also used on some occasions to verify the present/absence or degree of contamination present from secondary organic acids. The sample was first pretreated with acid to remove any carbonates and to weaken organic bonds. After the alkali washes (as discussed above) are used, the solution containing the alkali soluble fraction is isolated/filtered and combined with acid. The soluble fraction, which precipitates, is rinsed and dried prior to combustion.

"acid/alkali/acid/cellulose extraction"

Following full acid/alkali/acid pretreatments, the sample is bathed in (sodium chlorite) $NaClO_2$ under very controlled conditions (Ph = 3, temperature = 70 degrees C). This eliminates all components except wood cellulose. It is useful for woods that are either very old or highly contaminated.

Applied to: wood

"acid washes"

Surface area was increased as much a possible. Solid chunks were crushed, fibrous materials were shredded, and sediments were dispersed. Acid (HCl) was applied repeatedly to ensure the absence of carbonates. Chemical concentrations, temperatures, exposure times, and number of repetitions, were applied accordingly with the uniqueness of each sample. The sample was not be subjected to alkali washes to ensure the absence of secondary organic acids for intentional reasons. The most common reason is that the primary carbon is soluble in the alkali. Dating results reflect the total organic content of the analyzed material. Their accuracy depends on the researcher's ability to subjectively eliminate potential contaminants based on contextual facts.

Typically applied to: organic sediments, some peats, small wood or charcoal, special cases

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Calendar Calibration at Beta Analytic

Calibrations of radiocarbon age determinations are applied to convert BP results to calendar years. The short-term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer-term differences.

The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to about 10,000 BP. Calibration using tree-rings to about 12,000 BP is still being researched and provides somewhat less precise correlation. Beyond that, up to about 20,000 BP, correlation using a modeled curve determined from U/Th measurements on corals is used. This data is still highly subjective. Calibrations are provided up to about 19,000 years BP using the most recent calibration data available.

The Pretoria Calibration Procedure (Radiocarbon, Vol 35, No.1, 1993, pg 317) program has been chosen for these calendar calibrations. It uses splines through the tree-ring data as calibration curves, which eliminates a large part of the statistical scatter of the actual data points. The spline calibration allows adjustment of the average curve by a quantified closeness-of-fit parameter to the measured data points. A single spline is used for the precise correlation data available back to 9900 BP for terrestrial samples and about 6900 BP for marine samples. Beyond that, splines are taken on the error limits of the correlation curve to account for the lack of precision in the data points.

In describing our calibration curves, the solid bars represent one sigma statistics (68% probability) and the hollow bars represent two sigma statistics (95% probability). Marine carbonate samples that have been corrected for $^{13}C/^{12}C$, have also been corrected for both global and local geographic reservoir effects (as published in Radiocarbon, Volume 35, Number 1, 1993) prior to the calibration. Marine carbonates that have not been corrected for $^{13}C/^{12}C$ are adjusted by an assumed value of 0 %0 in addition to the reservoir corrections. Reservoir corrections for fresh water carbonates are usually unknown and are generally not accounted for in those calibrations. In the absence of measured $^{13}C/^{12}C$ ratios, a typical value of -5 %0 is assumed for freshwater carbonates.

(Caveat: the correlation curve for organic materials assume that the material dated was living for exactly ten years (e.g. a collection of 10 individual tree rings taken from the outer portion of a tree that was cut down to produce the sample in the feature dated). For other materials, the maximum and minimum calibrated age ranges given by the computer program are uncertain. The possibility of an "old wood effect" must also be considered, as well as the potential inclusion of younger or older material in matrix samples. Since these factors are indeterminant error in most cases, these calendar calibration results should be used only for illustrative purposes. In the case of carbonates, reservoir correction is theoretical and the local variations are real, highly variable and dependent on provenience. Since imprecision in the correlation data beyond 10,000 years is high, calibrations in this range are likely to change in the future with refinement in the correlation curve. The age ranges and especially the intercept ages generated by the program must be considered as approximations.)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

Variables used in the calculation of age calibration → (Variables: est. C13/C12=-25:lab. mult=1)

Laboratory number: Beta-123456

Conventional radiocarbon age[1]: 2400±60 BP ← The uncalibrated Conventional Radiocarbon Age (± 1 sigma)

The calendar age range in both calendar years (AD or BC) and in Radiocarbon Years (BP) → 2 Sigma calibrated result: (95% probability) Cal BC 770 to 380 (Cal BP 2720 to 2330)

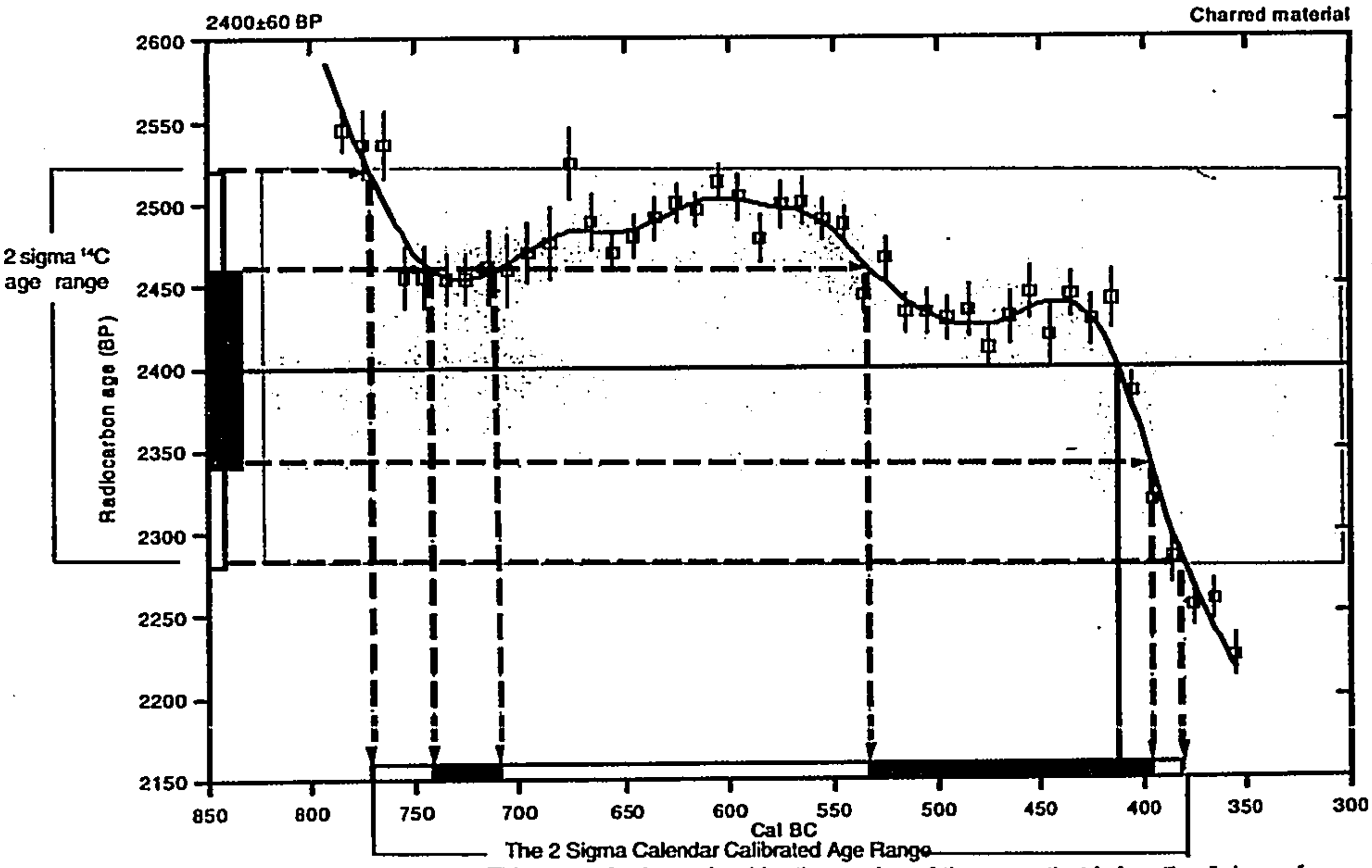
[1] C13/C12 ratio estimated

Intercept data

The intercept between the average radiocarbon age and the calibrated curve time scale. This value is illustrative and should not be used by itself.

Intercept of radiocarbon age with calibration curve: Cal BC 410 (Cal BP 2360)

1 Sigma calibrated result: (68% probability) Cal BC 740 to 710 (Cal BP 2690 to 2660) and Cal BC 535 to 395 (Cal BP 2485 to 2345)



The 2 Sigma Calendar Calibrated Age Range

This range is determined by the portion of the curve that is in a "box" drawn from the 2 sigma limits on the radiocarbon age. If a section of the curve goes outside of the "box", multiple ranges will occur as shown by the two 1 sigma ranges which occur from sections going outside of a similar "box" which would be drawn at the 1 sigma limits.

References:

Database used
Intcal 98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
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Mathematics
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← References for the calibration data and the mathematics applied to the data. These references, as well as the Conventional Radiocarbon Age and the 13C/12C ratio used should be included in your papers.

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Appendix D-2

Na Kupuna O Maui Letter, Dated May 2, 2006

Na Kapuna O Maui
320 Kaeo Place, Lahaina, Maui, Hawaii 96761 (808) 281-1567

May 2, 2006

Ms. Melissa Kirkendall
State of Hawaii
Department of Land and Natural Resources
State Historic Preservation Division
150 Mahalani Street
Wailuku, Hawai'i, 96793

RE: **Parcel H-1 Archaeological Inventory Survey**
TMK: (2) 2-01-05: 84; and (2) 2-01-06: 37 & 56

Dear Ms. Kirkendall,

Na Kupuna O Maui, the designated curator for cultural sites within Makena, had the opportunity to review the Archaeological Inventory Survey for Parcel H-1, dated April, 2006. We offer the following comments:

1. We feel that feature 4 of site 5711 should be preserved rather than just performing data recovery. The site has been classified as d and e, where e means that it has important cultural value. Feature 4 is located near to the ko'a features 1 and 8 and could be culturally related to them.

2. Site 5795 is described as a storage structure that was used in ranch operations for the area. According to the report, this site has been studied and tested since 1978 and that it is not likely that anything new will be discovered. It is classified as c and d, which means that although the site may be historically important it does not have the same cultural value as the other sites that were recommended for preservation. Due to these reasons we feel that site 5795 does not need to be preserved however, we support doing the architectural mitigation as mentioned in the report.

We agree with the other recommendations listed in the study in table 6.1 except for the items listed above. Thank you for this opportunity to comment on this project. Please call me at (808) 281-1567 if you have any questions.

Sincerely,

Patricia Nishiyama

Patricia Nishiyama
President

Kimokeo Kapahulehua

Kimokeo Kapahulehua
South Maui Representative

Appendix E

Traffic Impact Assessment Report

TRAFFIC IMPACT ASSESSMENT REPORT FOR

PARCEL H-1

IN MAKENA, MAUI, HAWAII

FINAL REPORT

Prepared For
Keaka, LLC

Phillip Rowell and Associates
47-273 'D' Hui Iwa Street
Kaneohe, Hawai'I 96744
Tel: 808-239-8206 Fax: 808-239-4175
Email: prowell@gte.net

March 15, 2005
Revised March 16, 2005

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1. INTRODUCTION

Phillip Rowell and Associates has been retained to prepare the following Traffic Impact Assessment Report (TIAR) for a proposed luxury condominium development in the Makena area of Maui. The purpose of this study is to identify the traffic impacts of the proposed project and to provide supporting documentation for the SMA Permit Application. This introductory chapter discusses the location of the project, the proposed development, and the study methodology.

Project Location and Description

The proposed project is a located south of the Maui Prince Hotel in the Makena area of South Maui. The site is bordered by Makena Keoneoio Road on the east, the Makena Golf Course on the south and west and the Maui Prince Hotel on the north. The general location on Maui is shown in Figure 1.

The project will consist of 72 luxury condominium units. The two existing parking lots used by the park users will be maintained.

The main access to the project will be Makena Keoneoio Road, an existing roadway serving the park.

Figure 2 is a schematic site plan.

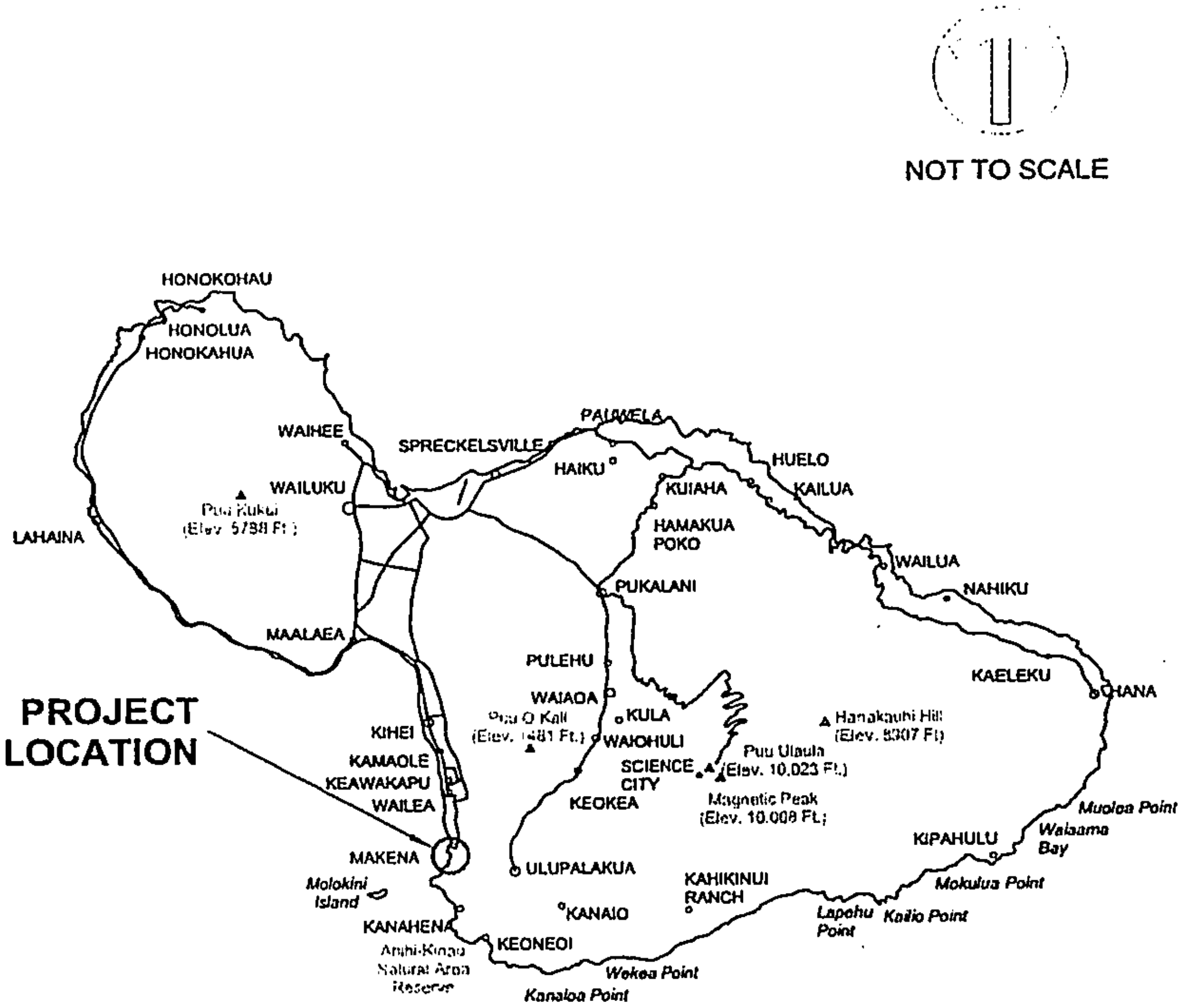
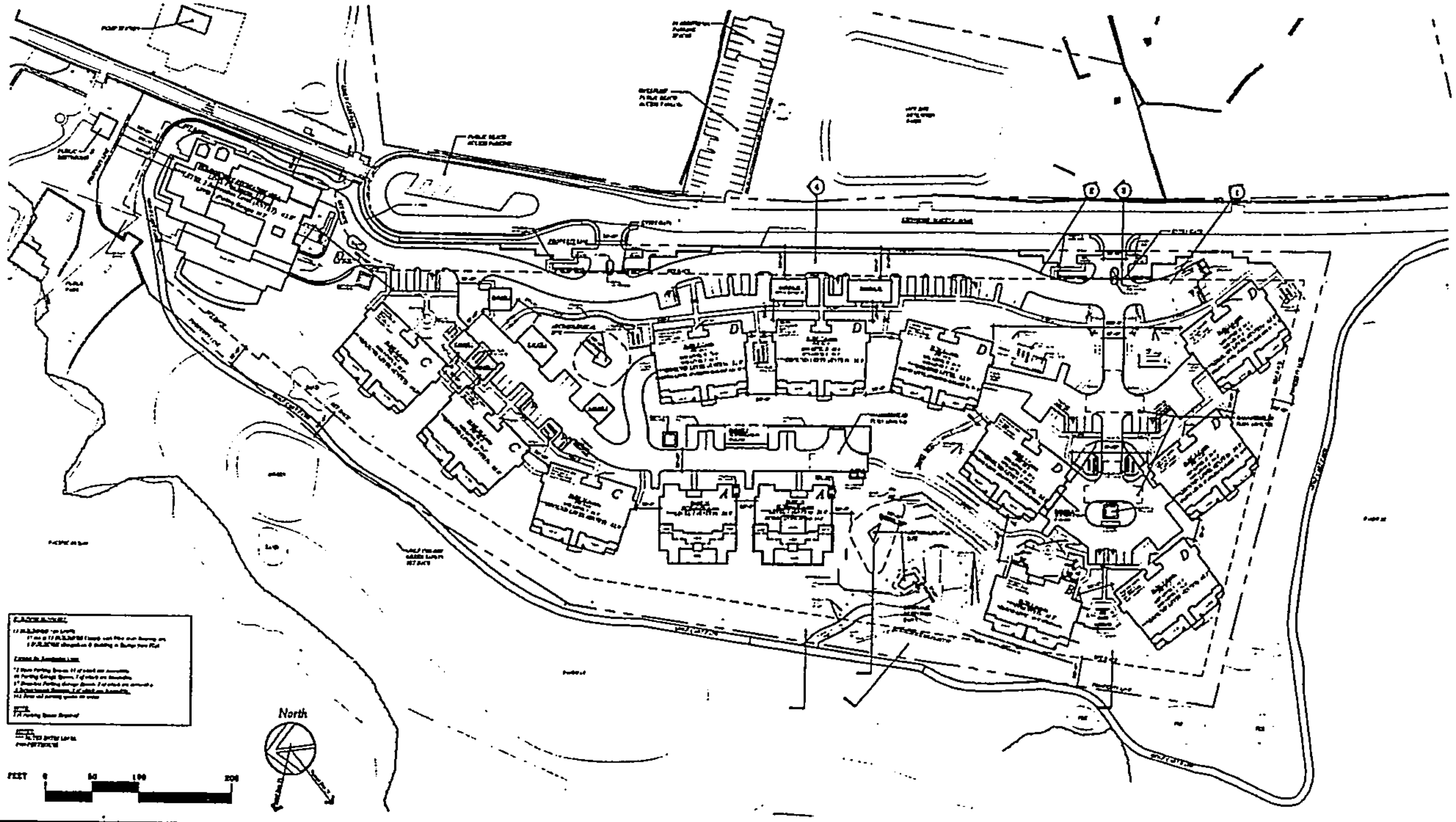


Figure 1
PROJECT LOCATION MAP



RIECKE SUNNLAND KONO 16 Dec 2005	**Parcel H-1** *Makena Resort, Maui, Hawaii*	Site Plan	KEAKA LLC

Study Area

The project is included in the Makena Resort Master Plan. The study area for the Makena Resort Master Plan included all existing and proposed intersections within the resort, Waialea Alanui Drive, Piilani Highway between Wailea Iki Drive and Mokulele Highway and South Kihei Road between Okolani Drive and Kilohana Drive.

Therefore, the study area for this project is limited to the immediate vicinity of the project. The traffic Impacts on locations north of and south of the intersection of Makena Alanui at Makena Keoneoio Road are identified and mitigated as part of the impact analysis for the Makena Resort Master Plan.

Purpose and Objective

The traffic impacts outside the immediate area of the project have been identified in the *TIAR for the Makena Resort Master Plan.*[1] Therefore, the purpose and objective of this study is to assess the impacts of the proposed development at the intersection of Makena Alanui at Makena Keoneoio Road, which provides access to and egress from the project. As long as the estimated traffic generated by the proposed development for this site is equal to or less than the estimated traffic used in the *TIAR for the Makena Resort Master Plan*, the traffic impacts outside the study area are addressed by the *TIAR for Makena Resort Master Plan.*

Study Methodology and Order of Presentation

1. *Analysis of Existing Traffic Conditions*

Existing traffic volumes at the study intersections were determined from traffic counts performed during January 2005. Intersection configurations and traffic control information were also collected in the field at the time of the traffic counts. Other data collected included speed limits and right-of-way controls.

Using the data collected, existing traffic operating conditions in the vicinity of the project were determined. The methodology for unsignalized intersections described in the 2000 *Highway Capacity Manual* (HCM)[2] was used to determine the level-of-service (LOS) at the intersection Makena Alanui at Makena Keoneoio.

Existing traffic conditions, the LOS concept and the results of the LOS analysis for existing conditions are presented in Chapter 2.

2. *Determination of Background Traffic Projections*

Background traffic conditions are defined as future traffic conditions during the design year <u>without</u> the proposed project. The year 2010 was used as the design year. This design year is consistent with the target completion year for Increment 1 of the Makena Resort Master Plan.

A description of the process used to estimate 2010 background traffic volumes and the resulting background traffic projections is presented in Chapter 3.

---

[1] The Traffic Management Consultant, *Traffic Impact Analysis Report For the Proposed Makena Resort Master Plan*, May 8, 2000

[2] *Highway Capacity Manual*, Institute of Transportation Engineers, Washington, D.C., 1997

3. *Analysis of Project-Related Traffic Impacts*

The next step in the traffic analysis was to estimate the peak-hour traffic that would be generated by the proposed project. This was done using standard trip generation procedures outlined in *Trip Generation*[3] and the *Trip Generation Handbook*[4]. The procedure is described in Chapter 4.

These trips were distributed based on the available approach and departure routes. The project-related traffic was then superimposed on 2010 background traffic volumes at the study intersections. The HCM methodology was used again to conduct a LOS analysis for background plus project conditions. The results of this analysis were compared to 2010 background conditions to determine the incremental impacts of this project. The analysis of the project-related impacts and the conclusions of the analyses are presented in Chapter 5.

[3] *Trip Generation*, Institute of Transportation Engineers, Washington, D.C., 1997

[4] Trip Generation Handbook, Institute of Transportation Engineers, Washington, D.C., 1998

2. ANALYSIS OF EXISTING CONDITIONS

This chapter presents the existing traffic conditions on the roadways adjacent to the proposed project. The level-of-service (LOS) concept and the results of the LOS analysis for existing conditions are also presented. The purpose of this analysis is to establish the base conditions for the determination of the impacts of the project which are described in a subsequent chapter.

Existing Roadway and Traffic Conditions

Makena Alanui

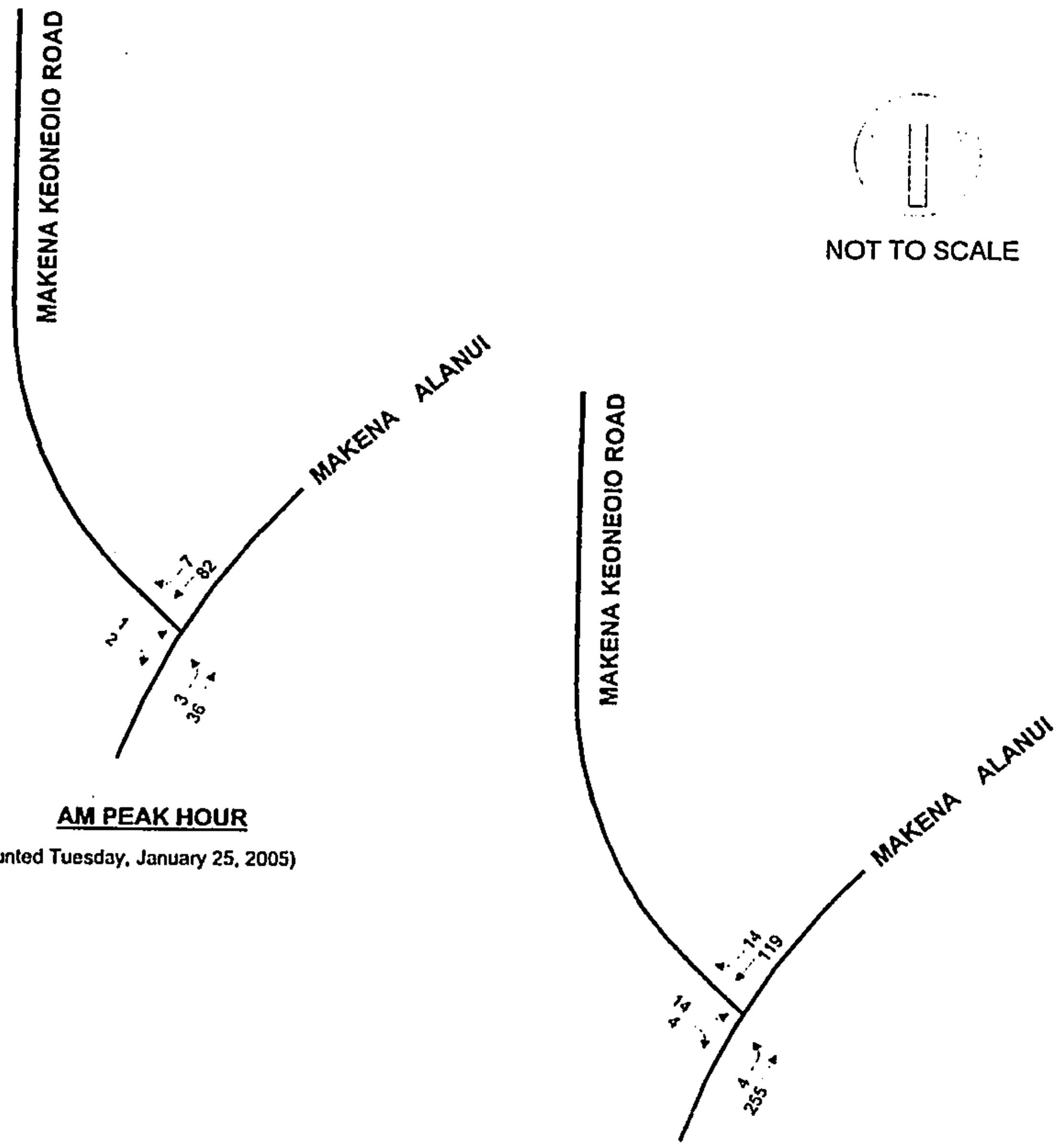
Access to the project will be via Makena Alanui. Makena Alanui is a two-lane, two-way roadway. The posted speed limit adjacent to the project is 30 miles per hour (mph). North of the project, Makena Alanui has bike lanes along both sides and a sidewalk along the southbound side of the roadway.

Makena Keoneoio Road

Makena Keoneoio Road is a two-lane, two-way roadway. There is a "limited sight distance" sign and an advisory speed limit sign for 20 mph immediately after the turn from Makena Alanui. The intersection of the Makena Keoneoio Road with Makena Alanui is "STOP" sign controlled. There are no separate turn lanes.

A turn-around is at the north end of the Makena Keoneoio. Within the turn-around, there are two handicap parking spaces and 7 standard parking spaces. There is an adjacent parking lot with 1 handicap parking spaces and 28 standard parking spaces.

AM and PM peak hour traffic volumes at the intersection of Makena Alanui at Makena Keoneoio Road are shown in Figure 3. The traffic volumes include large trucks, buses and motorcycles. They do not include mopeds or bicycles. The counts for these volumes were performed during January, 2005.



AM PEAK HOUR
(Counted Tuesday, January 25, 2005)

PM PEAK HOUR
(Counted Monday, January 24, 2005)

Figure 3
EXISTING (2005) PEAK HOUR TRAFFIC VOLUMES

Level-of-Service Concept

The methodology described in the *2000 Highway Capacity Manual* (HCM) was used to analyze the operating efficiency of the study intersection. This method involves the calculation of the average vehicle delay along the controlled movements which is related to a level-of-service.

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (LOS) is a qualitative measure of the effect of a number of factors which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worse, respectively. The characteristics of traffic operations for each level-of-service are summarized in Table 1. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. Level-of-service D is typically considered acceptable for peak hour conditions in urban areas.

Table 1 Level-of-Service Definitions for Unsignalized Intersections[1]

Level-of-Service	Expected Delay to Minor Street Traffic	Delay (Seconds)
A	Little or no delay	> 10
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	See note (2) below	>50.0

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.

Level-of-Service Analysis of Existing Conditions

The results of the Level-of-Service analysis for the intersection of Makena Alanui at Makena Keoneoio Road are shown in Table 2. Shown in the table are the average vehicle delays and the Levels-of-Service. Pedestrian activity was minimal during the traffic counts.

Table 2 Existing Levels-of-Service [1]

Intersection and Movement	AM Peak Hour		PM Peak Hour	
	Average Vehicle Delay [1]	LOS [2]	Average Vehicle Delay [1]	LOS [2]
Makena Alanui at Makena Keoneoio				
Northbound Left	7.4	A	7.5	A
Eastbound Left & Right	9.0	A	11.1	B

NOTES:
(1) Delay in seconds per vehicle.
(2) LOS denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. Level-of-Service is based on delay.

The conclusion of this analysis is that the existing intersection operates at a high level of service (Level-of-Service A or B) and delays are minimal. These conclusions are consistent with field observations during the traffic counts.

3. FUTURE BACKGROUND TRAFFIC CONDITIONS

The purpose of this chapter is to discuss the assumptions and data used to estimate 2010 background traffic conditions. Background traffic conditions are defined as future traffic volumes without the proposed project.

For this project, 2020 traffic projections were obtained from the *TIAR for the Makena Resort Master Plan.* [5] These projections represent build-out of Makena Resort and other developments that are anticipated to be completed between 2005 and 2020.

2010 traffic projections were the calculated by interpolating between the traffic counts performed in January 2005 and 2020.

The resulting 2010 background peak hour traffic projections are shown in Figure 4.

[5] The Traffic Management Consultant, *Traffic Impact Analysis Report For the Proposed Makena Resort Master Plan*, May 8, 2000

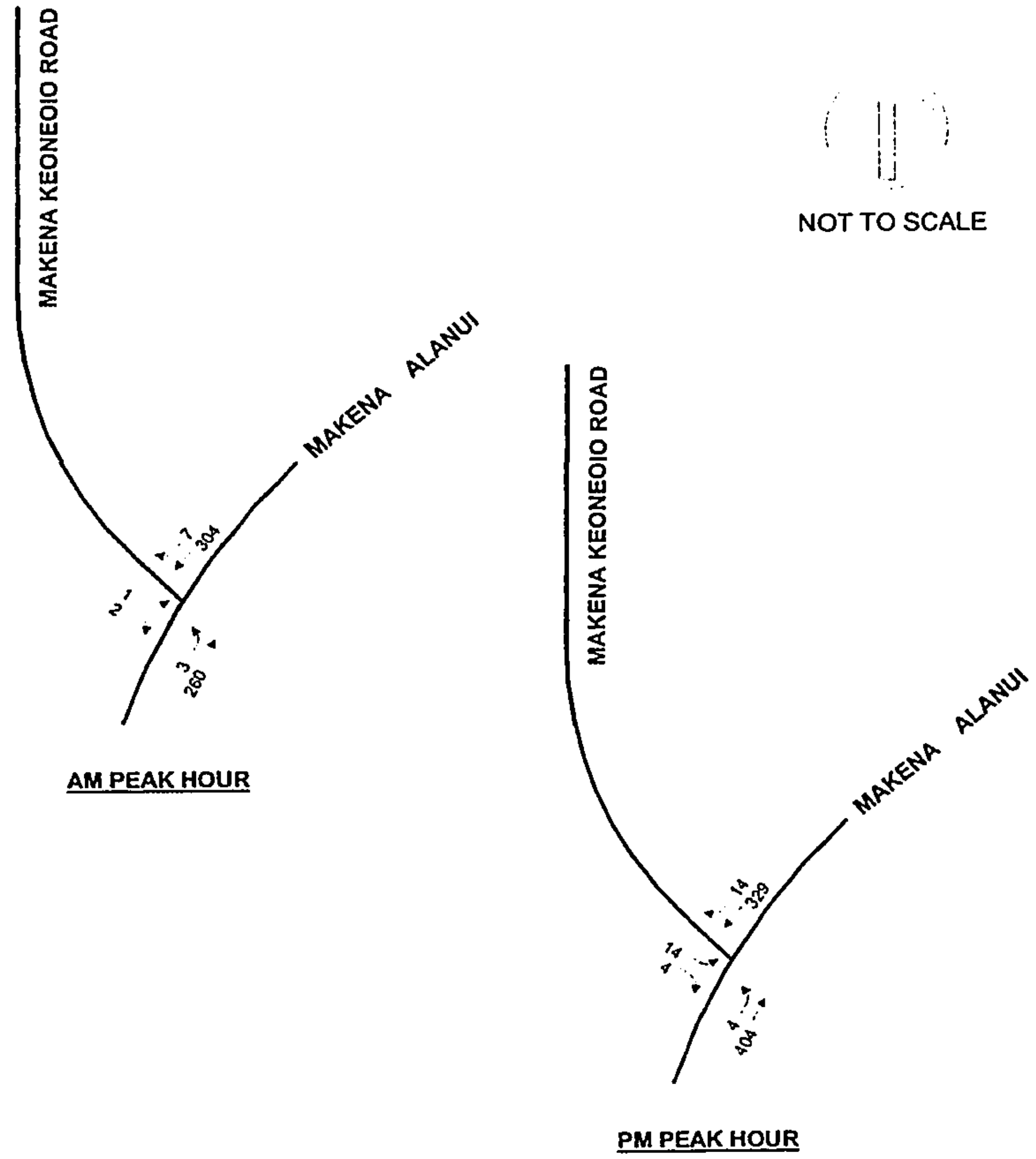


Figure 4
2010 BACKGROUND TRAFFIC PROJECTIONS

4. PROJECT-RELATED TRAFFIC CONDITIONS

This chapter discusses the methodology used to identify the traffic-related impacts of the proposed project. Generally, the process involves the determination of weekday peak-hour trips that would be generated by the proposed project, distribution and assignment of these trips along the approach and departure routes, and finally, determination of the levels-of-service at affected intersections and driveways subsequent to implementation of the project. This chapter presents the generation, distribution and assignment of project generated traffic and the background plus project traffic projections. The results of the level-of-service analysis of background plus project conditions are presented in the following chapter.

Project Trip Generation

Future traffic volumes generated by a project are typically estimated using the procedures described in the *Trip Generation Handbook*,[6] published by the Institute of Transportation Engineers. This method uses trip generation rates to estimate the number of trips that a proposed project will generate during the peak hours.

The trip generation analysis was performed using the following assumptions:.

1. The project will consist of 72 luxury condominium units.

2. The traffic characteristics of the project will be consistent with those described for luxury condominium in *Trip Generation*.[7]

---

[6] Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 1998, p. 7-12

[7] Institute of Transportation Engineers, *Trip Generation, 7th Edition*, Washington, D.C., 2003

The trip rates and the estimated number of AM and PM peak hour trips that the proposed development will generate are shown in Table 3. The trips shown are the peak hourly trips generated by the project, which typically coincide with the peak hour of the adjacent street.

Table 3 Trip Generation Analysis for Residences

		Luxury Condos (LU Code 233)		
Time Period	Direction	Rate or % [1]	Units	Trips
AM Peak Hour	Total Trips per Unit	0.65	72	47
	% Inbound	32%		15
	% Outbound	68%		32
PM Peak Hour	Total Trips per Unit	0.65		47
	% Inbound	60%		28
	% Outbound	40%		19

NOTES:
(1) ITE, *Trip Generation*, Washington, D.C., 1997, pages 409-413.

As shown the proposed project will generate 15 inbound and 32 outbound trips during the morning peak hour. During the afternoon peak hour, the project will generate 28 inbound and 19 outbound trips.

The Institute of Transportation Engineers recommends that a traffic impact study should be performed if, in lieu of another locally preferred criterion, development generates an additional 100 vehicle trips in the peak direction (inbound or outbound) during the site's peak hour.[8] Based on this criterion, a traffic impact study is not warranted since the project will generate only 47 vehicles per hour during the peak hour.

There was a previous plan to construct 500 hotel rooms in the vicinity of this project. A 500-room resort hotel will generate approximately 205 trips during the morning peak hour and 255 during the afternoon peak hour. The proposed project will generate 22% and 18% of the trips that a 500-room resort hotel will generate during the morning and afternoon peak hours, respectively.

2010 Background Plus Project Projections

The project-related trips were distributed and assigned using the following assumptions;

1. The approach and departure distribution of project generated traffic will be comparable to the approach and departure patterns of existing traffic at the study intersection.

2. The peak hour of project generated traffic will coincide with the peak hour of the adjacent street. Therefore, the impact analysis will assess a worse-case condition.

2010 background plus project traffic projections were estimated by superimposing the peak hourly traffic generated by the proposed project on the 2010 background peak hour traffic volumes presented in Chapter 3. The project trip assignments are shown on Figure 5 and the traffic projections for 2010 background plus project conditions are shown on Figure 6.

[8] Institute of Transportation, *Traffic Access and Impact Studies for Site Development, A Recommended Practice*, 1991, page 5.

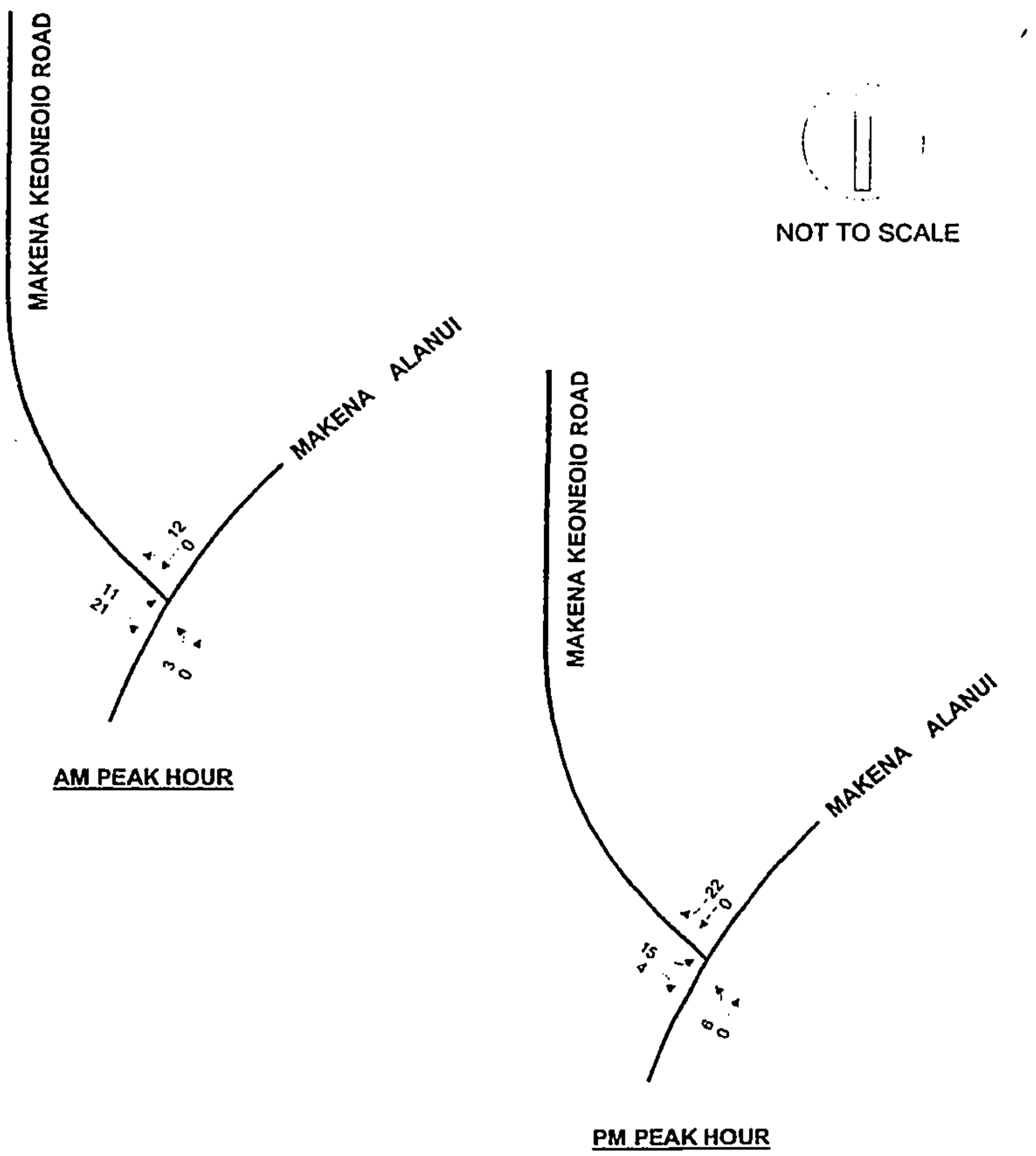


Figure 5
PROJECT TRIP ASSIGNMENTS

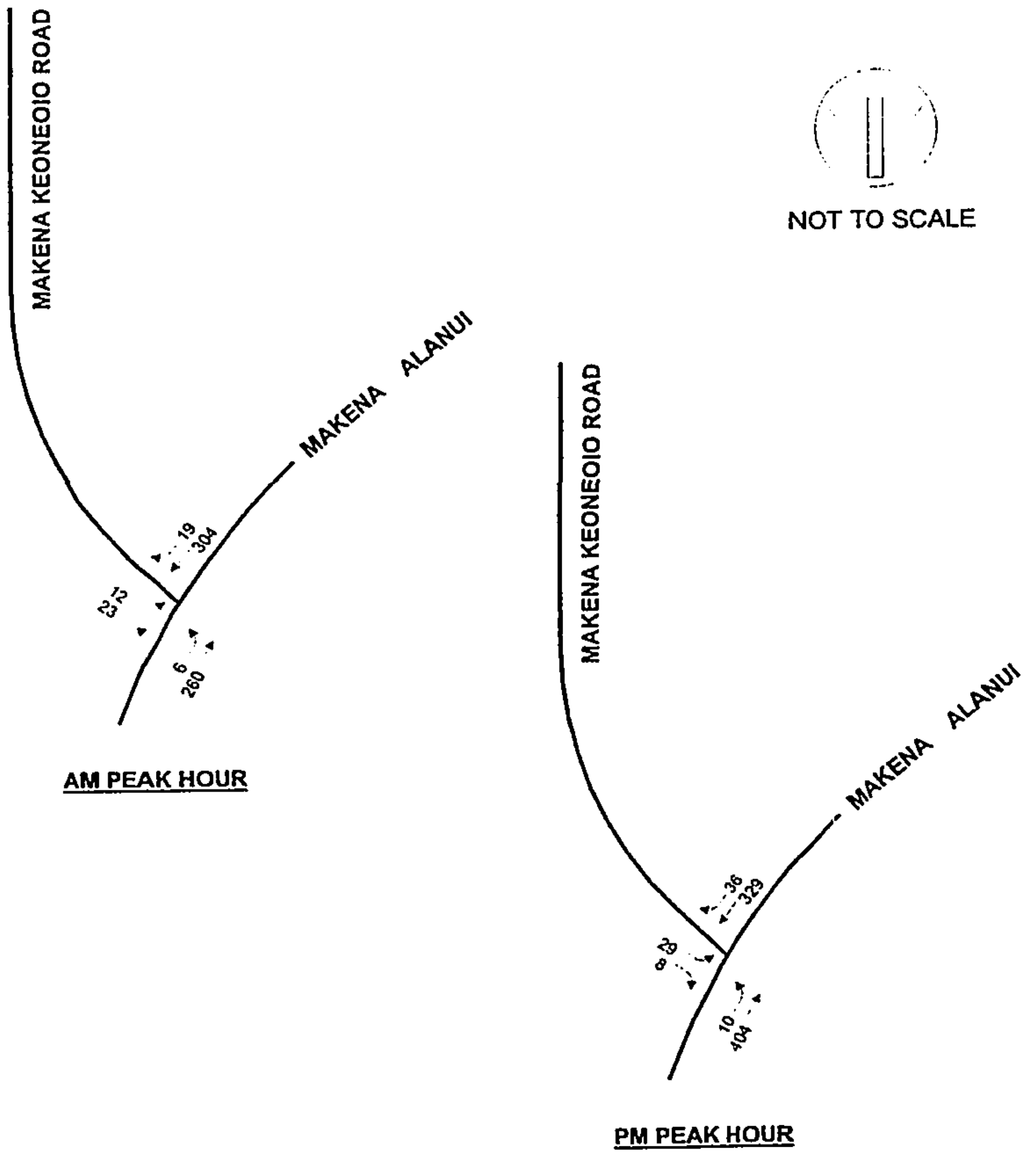


Figure 6
2010 BACKGROUND PLUS PROJECT PEAK HOUR TRAFFIC PROJECTIONS

5. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to summarize the results of the level-of-service analysis, which identifies the project-related impacts. In addition, any mitigation measures necessary and feasible are identified and other access, egress and circulation issues are discussed.

Project Related Traffic Impacts

The traffic impact of the proposed project was assessed by analyzing the changes in traffic volumes and Levels-of-Service. The change in traffic volumes along the roadway links serving the project is summarized in Table 4.

Table 4 Traffic Volume Changes Along Study Streets

Roadway	Location and Direction		AM Peak Hour				PM Peak Hour			
			Without Project	With Project	Change	Percent Change	Without Project	With Project	Change	Percent Change
Makena Alanui	North of Project	NB	261	272	11	4.21%	418	433	15	3.59%
		SB	310	323	13	4.19%	343	365	22	6.41%
	South of Project	NB	263	266	3	1.14%	408	414	6	1.47%
		SB	306	327	21	6.86%	333	337	4	1.20%

The Level-of-Service analysis was performed assuming that the lane configuration of the intersection of Makena Alanui at Makena Keoneoio Road is unchanged.

The results of the Level-of-Service analysis for the study intersections are shown in Table 5. Shown in the table are the average vehicle delays and the Levels-of-Service. The finding of the level-of-service analysis is that all traffic movements will operate at Level-of-Service C or better. This compares to a minimum acceptable Level-of-Service of D.

Table 5 Level-of-Service Analysis for 2010 Peak Hour Conditions[1]

Intersection and Movement	AM Peak Hour					PM Peak Hour				
	Without Project		With Project		Change	Without Project		With Project		Change
	Delay [1]	LOS [2]	Delay	LOS	Delay	Delay	LOS	Delay	LOS	Delay
Makena Alanui at Makena Keoneoio										
Northbound Left	8.0	A	8.1	A	0.1	8.1	A	8.2	A	0.1
Eastbound Left & Right	11.6	B	12.3	B	0.7	15.7	C	17.0	C	1.3

NOTES:
(1) Delay is in seconds per vehicle.
(2) denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual.*

Left Turn Storage Lane Analysis

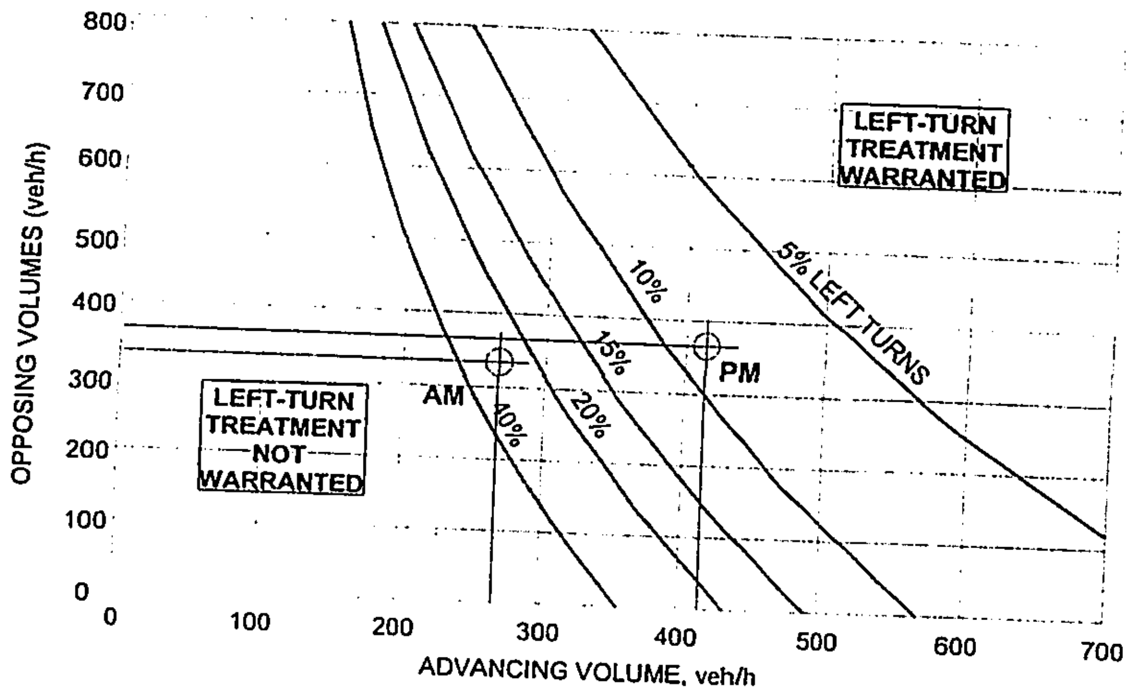
The need for a separate left turn lane for northbound to westbound traffic was assessed using criteria established by the Transportation Research Board. This warrant is shown as Figure 7. As shown, the warrant for a separate left turn lane is not satisfied.

Additionally, a separate left turn storage lanes would not improve the level-of-service, as the level-of-service for background plus project conditions is already at A, which is the highest level-of-service.

Sight Distance and Traffic Calming

Sight distance along Makena Keoneoio is limited by the vertical alignment of the roadway. The County has posted a "Limited Sight Distance" sign and an advisory speed limit sign for 20 mph. Simple adjusted to the vertical alignment is not feasible because of the adjacent cart path for the golf course. It is recommended that the project civil engineer examine alternative to maximize the sight distance.

In addition, traffic calming measures should be incorporated in the site plan for Makena Keoneoio. This roadway has a straight alignment which encourages drivers to speed between the top of the crest and the parking lots. As the adjacent property is developed, vehicular and pedestrian safety will be compromised unless traffic calming measures are implemented.



Source: NCHRP Report 457
Evaluating Intersection Improvements: An Engineering Study Guide
2001, page 22

	AM	PM
Advancing Volume	266	414
Opposing Volume	323	365
Percent Left Turns	2.3%	2.4%

GUIDELINES FOR DETERMINING THE NEED FOR A MAJOR ROAD LEFT-TURN BAY AT A TWO-WAY STOP CONTROLLED INTERSECTION

TWO-LANE ROAD - 60 km/hr (40 mph)

Figure 7
LEFT TURN LANE WARRANT ASSESSMENT

Conclusions and Recommendations

The conclusions of the traffic impact analysis for 2010 background plus project conditions are:

1. The proposed project is a 72-unit luxury condominium development south of the Maui Prince Hotel in the Makena area of South Maui. The project is within the study area of the *TIAR for Makena Resort Master Plan*.

2. The proposed project will generate 47 trips during the morning peak hour and 47 trips during the afternoon peak hour.

3. The proposed project will have a negligible impact on the average vehicle delays and levels-of-service at the intersection of Makena Alanui at Makena Keoneoio Road. All traffic movements will operate at Level-of-Service C or better during the peak hours.

4. A separate left turn storage lane for traffic turning into the project is not warranted based on the findings of a warrant analysis and the level of service analysis.

5. *The roadway cross-section of Makena Alanui adjacent* to the *Maui Prince Hotel* north of the project should be extended along the frontage of the project. This includes the sidewalk along the makai side and bike lanes along both sides of Makena Alanui.

6. Traffic calming measures should be incorporated in the site plan for Makena Keonoeoio.

Appendix F

Makena Wastewater Corp. Letter, Dated July 19, 2006

MAKENA WASTEWATER CORP.

5415 Makena Ala Nui, Kihei, HI 96753

July 19, 2006

Keaka, LLC
2005 E. Main Street
Wailuku, HI 96793
Attention: Everett Dowling

SUBJECT: Response to questions

Mr. Dowling,

The following information is provided in response to your request to Makena Resort Corp. regarding Maui Tomorrow's request for information.

a. **"The design capacity, current monthly average and daily maximum flows of waste water treated by the Makena Resort Treatment Plan, if the plant is currently operational, and if not, predicted annual flows based upon present and anticipated treatment agreements with this and other potential users of the facility."**

Makena Wastewater Corp. (MWC) Response:

Design Capacity:	720,000 gallons per day
Monthly Average:	80,700 gallons per day (June 2006)
Daily Maximum Flows:	105,000 gallons

b. **"A description of the ultimate disposal of discharged waste waters and reclaimed waters (injection, irrigation, etc.)**

Makena Wastewater Corp. Response:

100% of the treated effluent is recycled per the State of Hawaii, Department of Health, Hawaii Administrative Rules, Chapter 11-62, Wastewater Systems. Usage includes golf course irrigation, wastewater facility landscape irrigation and wastewater facility uses, i.e. Washdown, dilution water, etc.

c. **"If the plant is operational, a summary of plant compliance history including any reported violations, spills or releases, and cited deficiencies or formal enforcement actions."**

Makena Wastewater Corp. Response:

The Makena Wastewater Corp. wastewater facility has been in compliance with all Federal, State and county regulations. No violations, spills or releases, cited deficiencies or formal enforcement actions have occurred to date.

d. **"If the plant is not yet operational, a discussion of the prospective start-up date, and a report of predicted competing users, and their anticipated usages,"**

Makena Wastewater Corp. Response:

The facility has been in full operation since October 2, 2002.

e. **"A discussion of the potential for collection system spills or bypasses to reach sensitive area ecosystems."**

Makena Wastewater Corp. Response:

The Makena Wastewater Corp. facilities are equipped with modern alarm systems for emergency notification and response. Preventive maintenance programs are utilized for equipment and collection systems and are consistent with industry practices.

If you have any questions, please contact me at (808) 357-2807.

Yours Truly,

John Oka, Vice President Operations, MWC

JO:

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME LEINAALA FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
EMD / WB
51083

October 26, 2005

Mr. John Oka
Vice President and Acting Plant Manager
South Kohala Wastewater Corporation
5415 Makena Alanui
Kihei, Hawaii 96753

Dear Mr. Oka:

Subject: Makena Wastewater Reclamation Facility
Operation and Maintenance Inspection

Department of Health staff conducted an operation and maintenance inspection of the subject facility on October 19, 2005. The inspection covered the time period from October 22, 2004 through October 19, 2005. The facility was determined to be satisfactorily maintained and operated and is given a general rating of "ACCEPTABLE."

If you have any questions, please call Steven Sato of our branch at our direct toll-free no. 984-2400, extension 64294. Recycled water questions may be directed to Lance Manabe at the same extension number.

Sincerely,

HAROLD K. YEE, P.E.
Chief, Wastewater Branch

SS:mt

Appendix G

Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT

FOR

PARCEL H-1

MAKENA, MAUI, HAWAII
TMK: (2) 2-1-06: 37, 56
(2) 2-1-05: 84

DEVELOPER: KEAKA, LLC

APRIL 2006
FEBRUARY 2006
DECEMBER 2005 (REVISED)
SEPTEMBER 2005 (REVISED)
APRIL 2005

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS • SURVEYORS
HONOLULU • WAILUKU, HAWAII

PRELIMINARY ENGINEERING REPORT

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AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS • SURVEYORS
HONOLULU • WAILUKU, HAWAII

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APPENDICES

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

KENNETH K. KUROKAWA, PE
LAMBERT J. YAMASHITA, PE
DONOHUE M. FUJII, PE
STANLEY T. WATANABE
TERRANCE S. ARASHIRO, PE

KEN K. KUROKAWA, PE
President &
Maui Branch Office Manager

PRELIMINARY ENGINEERING REPORT
FOR
PARCEL H-1
MAKENA, MAUI, HAWAII

I. INTRODUCTION

The purpose of this report is to provide an overview of the preliminary engineering design of Parcel H-1 project in Makena, Maui. This report evaluates the existing site conditions and defines requirements for grading, drainage, sewer, and water utilities, along with other miscellaneous site improvements.

II. PROPOSED PROJECT

A. Location

The proposed project is located within the Makena Resort Development, TMK: (2) 2-1-06:37 and 56. The project site is bounded by Maluaka Beach Park to the north, Keoneoio Makena Road to the east, the Makena Golf Course 15th fairway to the south, and the Makena Golf Course 16th fairway to the west. Keoneoio Makena Road, an existing public road with two parking areas provides public access to the beach. The current landowner is Keaka, LLC. Refer to Exhibit 1 for Location and Vicinity Map.

B. Project Description

The proposed project consists of the construction of 13 condominium buildings (69 units), a recreational facility building and parking area. The project site encompasses a total land area of approximately 10.90 acres. The main access to the proposed project site will be provided through Keoneoio Makena Road. Refer to Exhibit 2 for Preliminary Site Plan.

REPLY TO:
1871 WILI PA LOOP, SUITE A • WAILUKU MAUI, HAWAII 96793
PHONE (808) 244-8044 • FAX (808) 242-9163 • EMAIL: atamaui@atahawaii.com

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII

PRELIMINARY ENGINEERING REPORT
FOR
PARCEL H-1
MAKENA, MAUI, HAWAII

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B. Project Description

The proposed project consists of the construction of 13 condominium buildings (69 units), a recreational facility building and parking area. The project site encompasses a total land area of approximately 10.90 acres. The main access to the proposed project site will be provided through Keoneoio Makena Road. Refer to Exhibit 2 for Preliminary Site Plan.

On-site improvements include clearing and grubbing of the site, excavation and embankment for construction of interior roadways/parking area and building, retaining walls, construction and installation of waterlines, sewer system, storm drain lines, retention basins, underground electrical and telephone lines, and walkways.

Off-site work improvements include resurfacing of Keoneoio Makena Road with asphalt concrete, installation of a 12-inch water main and fire hydrants within Keoneoio Makena Road, utility service connections to existing utilities and a retention basin on TMK: (2) 2-1-05: 84. All infrastructure work will conform to the "Standard Specifications" and "Standard Details" of the Department of Public Works, County of Maui.

III. EXISTING CONDITIONS

A. Topography and Soil Conditions

The site, exclusive of the Keoneoio Makena Road and beach parking, is undeveloped. Existing vegetation in the area consists of overgrown brush, weeds, kiawe trees, and a widely spread outcrop of cactus. Currently, the site is vacant of any structures and usage.

A majority of the site slopes toward the northwest. The remaining portion of the site slopes in a northerly direction. The average slopes of the site ranges are 4 to 8 percent. Elevations at the site range from 78 to 10 feet Mean Sea Level (msl).

Soil on the site is mainly Makena loam, stony complex (MXC). MXC soil is typically found on 3 to 15 percent slopes, on the lower leeward slopes of Haleakala in the Makena and Kamaole region. This complex is a mixture of Makena loam and stony land. Type MXC soil is part of the Makena soil series and characterized as well drained, having moderately rapid permeability, and slow to medium runoff with a slight erosion hazard. Classifications are based on the USDA Soil Conservation Service's publication, "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai and Lanai", State of Hawaii, dated August 1972.

B. Infrastructure

1. Water

The County of Maui, Department of Water Supply (DWS), provides water service within the vicinity of the project. An existing 16-inch ductile iron and two 2-inch Drisco pipe waterlines are located within Makena Alanui Road. There are no existing fire hydrants within the vicinity of the project site. There are currently no existing water services to the project site.

2. Sewer

The site currently generates no wastewater flow. An existing privately owned and operated sewerage pump station is located north of the subject project servicing Maui Prince Hotel. There are no existing sewer collection systems within Makena Alanui Road or Keoneoio Makena Road.

3. Drainage

On-site storm water runoff generally flows in a westerly direction through the property and onto the golf course.

Off-site storm runoff generated by Keoneoio Makena Road and lots mauka of the road is conveyed/intercepted into Keoneoio Road's existing drain system and eventually discharges through the project site. The existing drainage system within Keoneoio Makena Road consists of three grated drain inlets with 24-inch culverts.

Pre-development on-site runoff is estimated to be approximately 13.7 cubic feet per second (cfs). Pre-development off-site runoff, passing through the site, is calculated to be approximately 8.1 cfs. Hydrology calculations are based on a 50 year – 1 hour storm recurrence interval. Refer to Appendix A for Preliminary Hydrology Computations.

4. Roadway

The proposed project is situated along Keoneoio Makena Road. Keoneoio Makena Road is a public road (right-of-way width varies) which provides access to the existing beach parking lot. Existing improvements within Keoneoio Makena Road include a 24 feet wide asphalt concrete paved road, grated drain inlets, culvert crossings, parking stalls and a 30-stall parking lot mauka of Keoneoio Makena Road.

C. Flood Zone

The majority of the project site sits in a designated flood zone "C", with areas of minimal flooding. A small portion of the site, approximately 0.11 acres, lies in flood zone designation "A4" which are areas prone to 100-year floods with a base flood elevation of 9 feet. Flood zone information is obtained from the Federal Emergency Management Agency, Flood Insurance Rate Map (FIRM), Panel No. 150003 0330 B and 150003 0340 B, dated June 1, 1981.

IV. PROPOSED INFRASTRUCTURE IMPROVEMENTS

A. Grading and Drainage Plan

The project will require excavation and embankment to provide relatively flat terraced buildable areas for the proposed structures and recreational facilities. The site will be graded to maintain the existing westerly drainage pattern. Retaining walls, ranging from an exposed face of 2-feet to 6-feet, will be required in order to achieve the desired floor elevations.

The Rational Method is used to determine the storm water runoff quantities for drainage area less than 100 acres. Hydrology calculations are based on a 50 year – 1 hour storm recurrence interval. Refer to Appendix A for preliminary computations for onsite and offsite runoff.

Off-site runoff from the currently undeveloped property mauka of the project site will be intercepted and retained by the proposed off-site drainage system. This offsite drainage system will include drain inlets, manholes, underground drainlines, swales and a retention basin located on TMK: (2) 2-1-05:84. The entire offsite peak flow of 8.1 cfs will be retained in the offsite retention basin.

As part of this project, Keoneoio Makena Road will be resurfaced with asphalt concrete pavement and clearing and re-grading of the existing roadside swale. Resurfacing of the existing pavement will not increase the impervious surfaces, thus there will be no increase in runoff entering the site.

Onsite proposed drainage system improvements will include grated drain inlets, catch basins, manholes, underground drainlines, bioretention basins, a standard retention basin and several subsurface retention systems. On-site post-development flow from the project site is calculated at approximately 29.8 cfs, which is an increase of 16.1 cfs. This increase in runoff will be collected and conveyed (via underground drainage systems) into proposed retention systems located throughout the site. The proposed onsite runoff will be reduced from 29.8 cfs to 9.8 cfs.

Summary of 50-Year Runoff:

Pre-Development Offsite Runoff	8.1 cfs
Pre-Development Keoneoio Makena Rd	3.6 cfs
Pre-Development Onsite Runoff	13.7 cfs
Total Pre-Development Runoff	**25.4 cfs**
Post-Development Offsite Runoff	8.1 cfs
Post-Development Keoneoio Makena Rd	3.6 cfs
Post-Development Onsite Runoff	29.8 cfs
Total Post Development Runoff	**41.5 cfs**
Proposed Offsite Runoff	0.0 cfs
Proposed Keoneoio Makena Rd	3.6 cfs
Proposed Onsite Runoff	9.8 cfs
Total Runoff Under Proposed Design	**13.4 cfs**

The overall proposed runoff from the project site will be 13.4 cfs, which is a reduction of 12.0 cfs or 47 percent over pre-development conditions. The reduction is made possible by the implementation of retention systems in offsite and onsite areas that are sized to retain runoff from the 50-year, 1-hour storm.

Several methods of water quality treatment are utilized on the project site including bioretention basins, subsurface retention/ infiltration beds, and underground filtering units. The various systems are located throughout the site to provide a minimum of first flush treatment of all storm drain runoff. First flush treatment is commonly defined as the first inch of runoff and represents 90 percent of total annual runoff volume.

Seven (7) shallow bioretention basins are located on the makai side and north side of the site. The bioretention systems retain stormwater runoff and allow it to filter through vegetation and 18-24 inches of organic soil. The basins will provide removal of stormwater pollutants such as phosphorous, nitrogen, total suspended solids (TSS) and petroleum-oils and lubricants (POL).

The subsurface retention/ infiltration beds are proposed throughout the site to provide water quality treatment through extended detention of stormwater runoff. Slow release rates will ensure detention times of approximately 24 hours. Additionally, the underground chambers will allow stormwater to infiltrate into the surrounding soils, thereby providing groundwater recharge.

The underground filtering units are employed generally as a pretreatment prior to the bioretention systems and the subsurface retention/ infiltration systems. The filtering units remove sediment (TSS) and free floating oil and debris.

B. Water System

There are currently no water utilities existing on the site. Water service to the project site will be provided via installation of a new 12-inch ductile iron waterline within the Keoneoio Makena Road right-of-way. This proposed 12-inch waterline will connect to an existing 16-inch ductile iron waterline running within Makena Alanui Road and extend to the parking lot turnaround at Keoneoio Makena Road.

On-site water system improvements will include a domestic water system, fire line system, and an irrigation system. The domestic water system consists of a water meter and 4-inch and 6-inch ductile iron waterlines. The fire line system consists of a double check detector check assembly, fire hydrants and 8-inch and 12-inch ductile iron fire lines. The irrigation system consists of a landscape water meter and irrigation lines. Refer to Exhibit 4 for Preliminary Water System Improvements.

Preliminary water demand estimates require approximately 59,340 gallons per day (gpd), which is the average daily demand for domestic use. Landscape irrigation demand is calculated to be 39,007 gpd. The landscape irrigation, system will be converted to use R-1 quality, reclaimed water when available. Refer to Appendix B for Preliminary Water Demand Calculations. Fire flows within the project site require 2,500 gallons per minute (gpm) for a duration of 2 hours with fire hydrants installed at 250 feet maximum interval.

C. **Sewer System**

An on-site sewerage collection system will be installed to provide sewer service to all the units. The proposed gravity sewer line/pump station/force main system will be connected to the existing sewerage pump station located north of the subject project and southeast corner of the existing Maui Prince Hotel. The existing sewerage pump station will convey the sewerage flows via an existing force main to an existing pump station located northeast of the project site. Refer to Exhibit 5 for Preliminary Sewer System Improvement Plan. Preliminary wastewater contributions are calculated at approximately 34,795 gpd (average daily demand). Refer to Appendix C for Preliminary Wastewater Computations.

D. **Roadway Improvements**

Access to the project will be provided through the existing Keoneoio Makena Road which is designated in the County of Maui, Kihei-Makena Community Plan as rural road, therefore improvements to Keoneoio Makena Road will be limited to resurfacing the existing pavement width with asphalt concrete pavement and grading of the existing roadside swales to direct roadway drainage flow to the grated inlets. Refer to Exhibit 8 for typical roadway section. The existing public overflow parking area located on TMK: (2) 2-1-05:84 will be expanded to provide for an additional ten (10) parking stalls.

Onsite roadways and driveways consist of 22 feet wide asphalt concrete pavement. Aisle widths for parking areas will be a minimum of 24 feet wide.

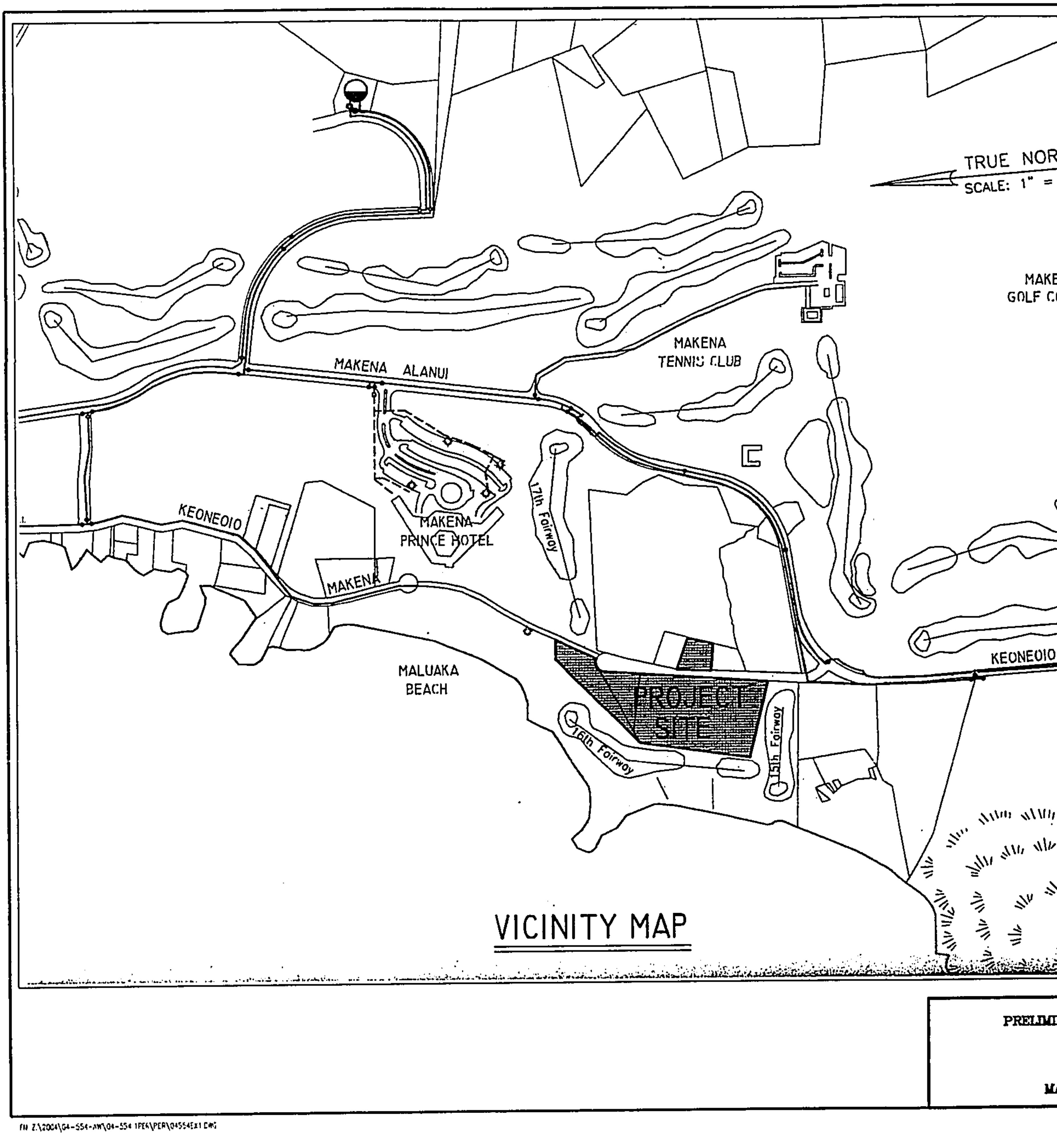
V. CONCLUSION

The proposed improvements for this project will be designed in accordance with the applicable rules and regulations of the County of Maui and will have no adverse effects to the existing facilities and to the surrounding environment.

Z:\2004\04-554.1\Parcel H-1 @ Makena Resorts\Reports\PER 04-2006\PER Parcel H-1 051806.doc

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

EXHIBITS



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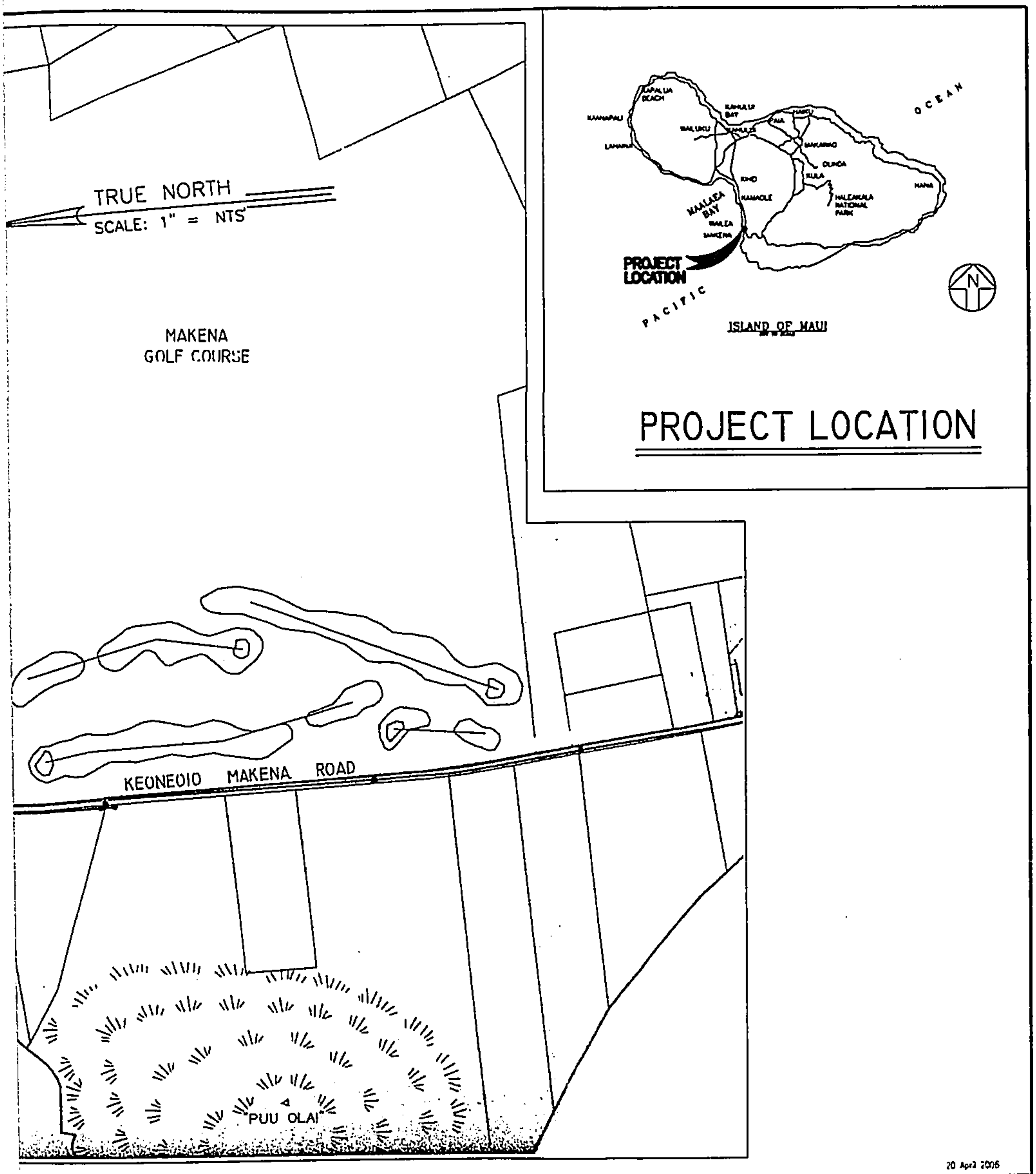
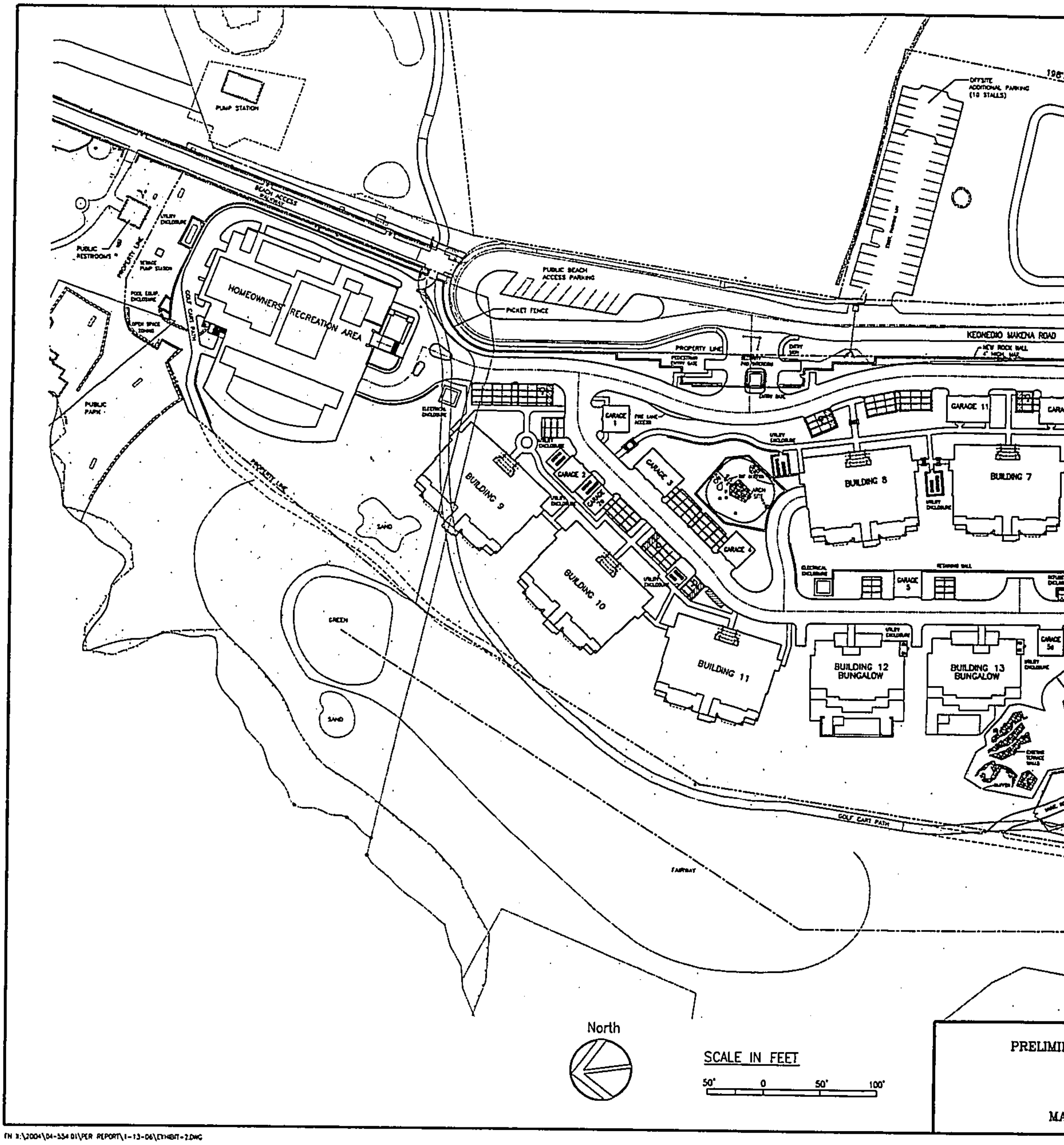


20 April 2006

PRELIMINARY ENGINEERING REPORT **PARCEL H-1** MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII **PROJECT LOCATION AND VICINITY MAP**	**EXHIBIT** 1



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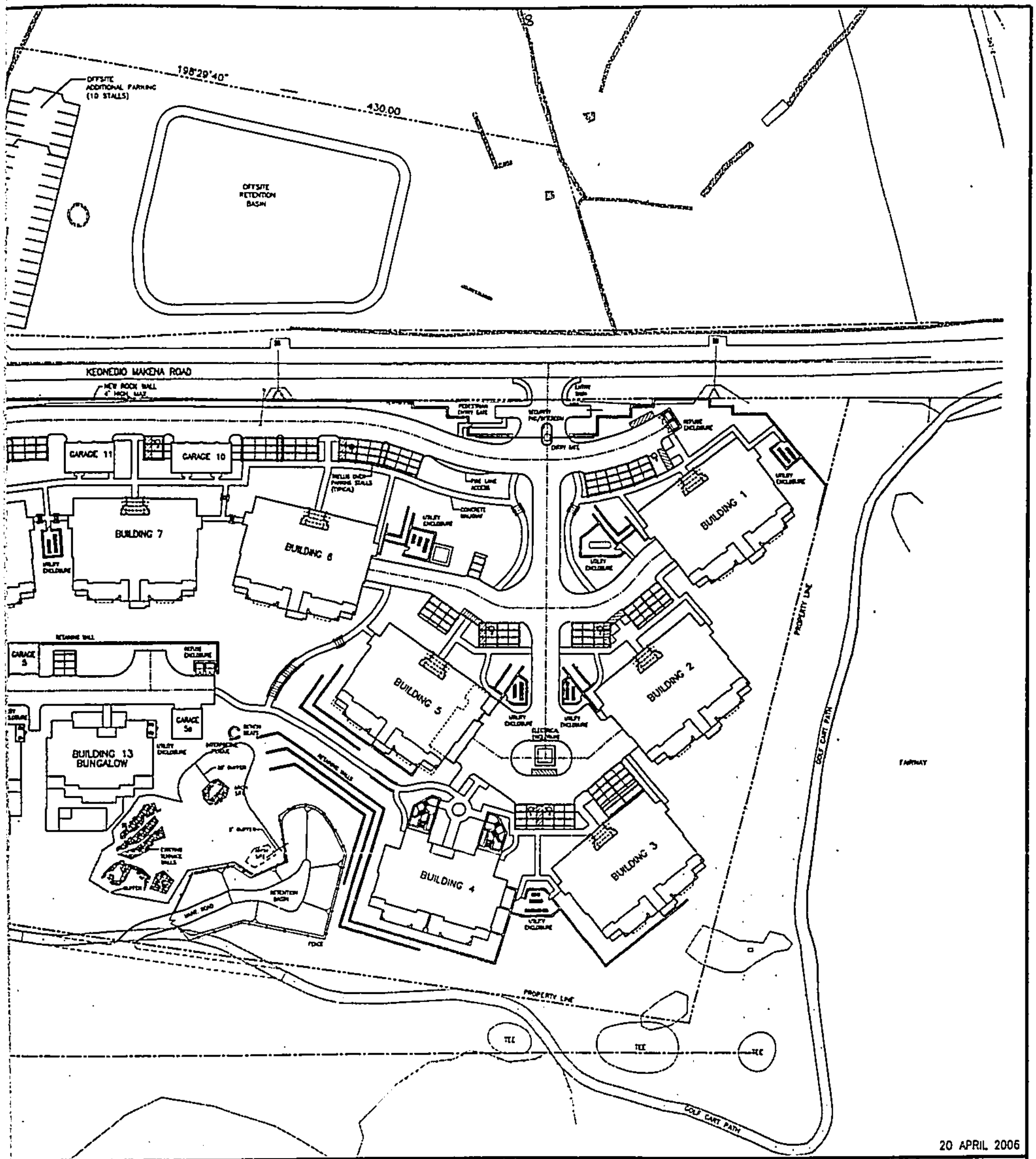


PRELIMINARY ENGINEERING REPORT

PARCEL H-1

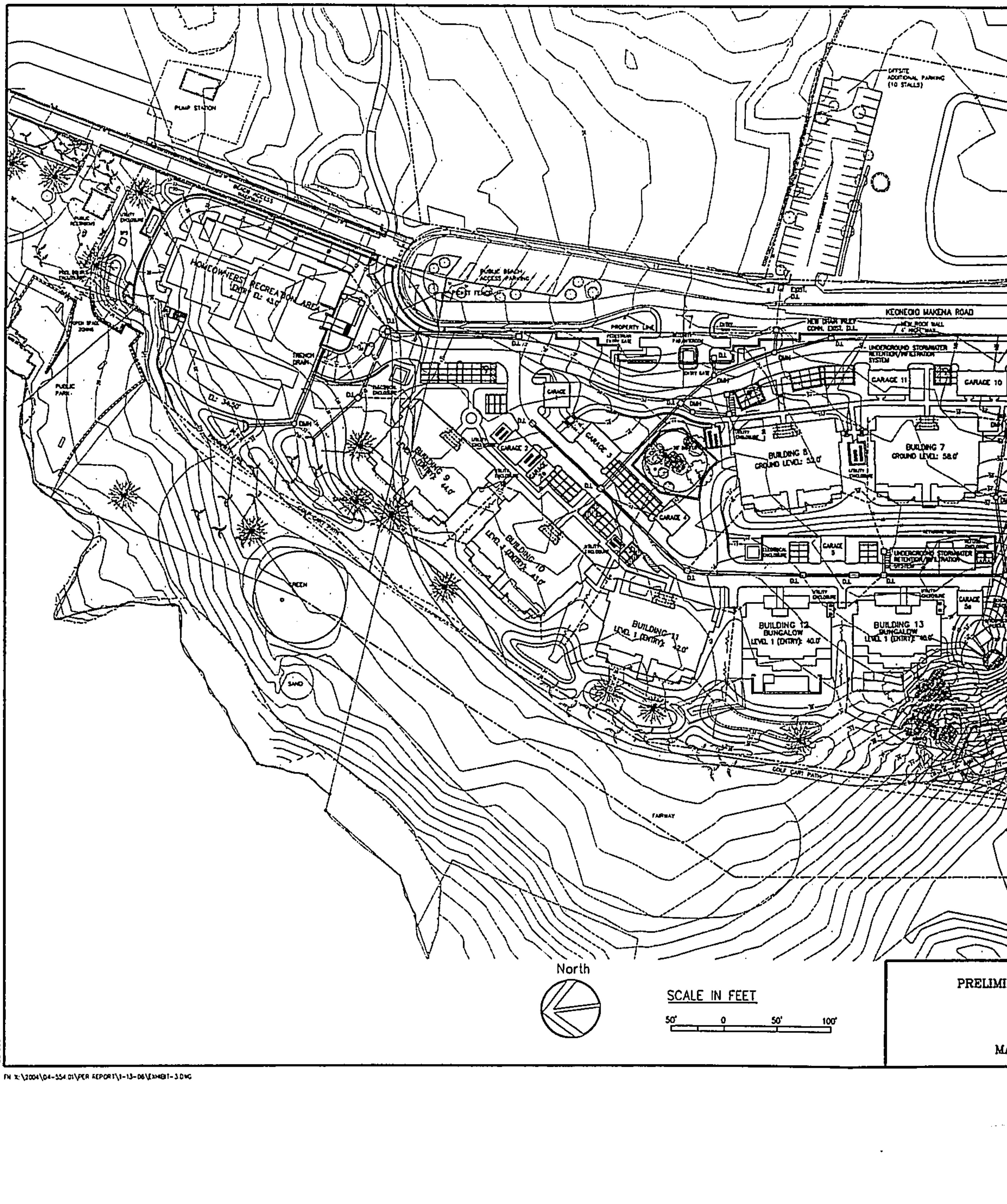
MAKENA, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII

PRELIMINARY SITE PLAN

EXHIBIT

2



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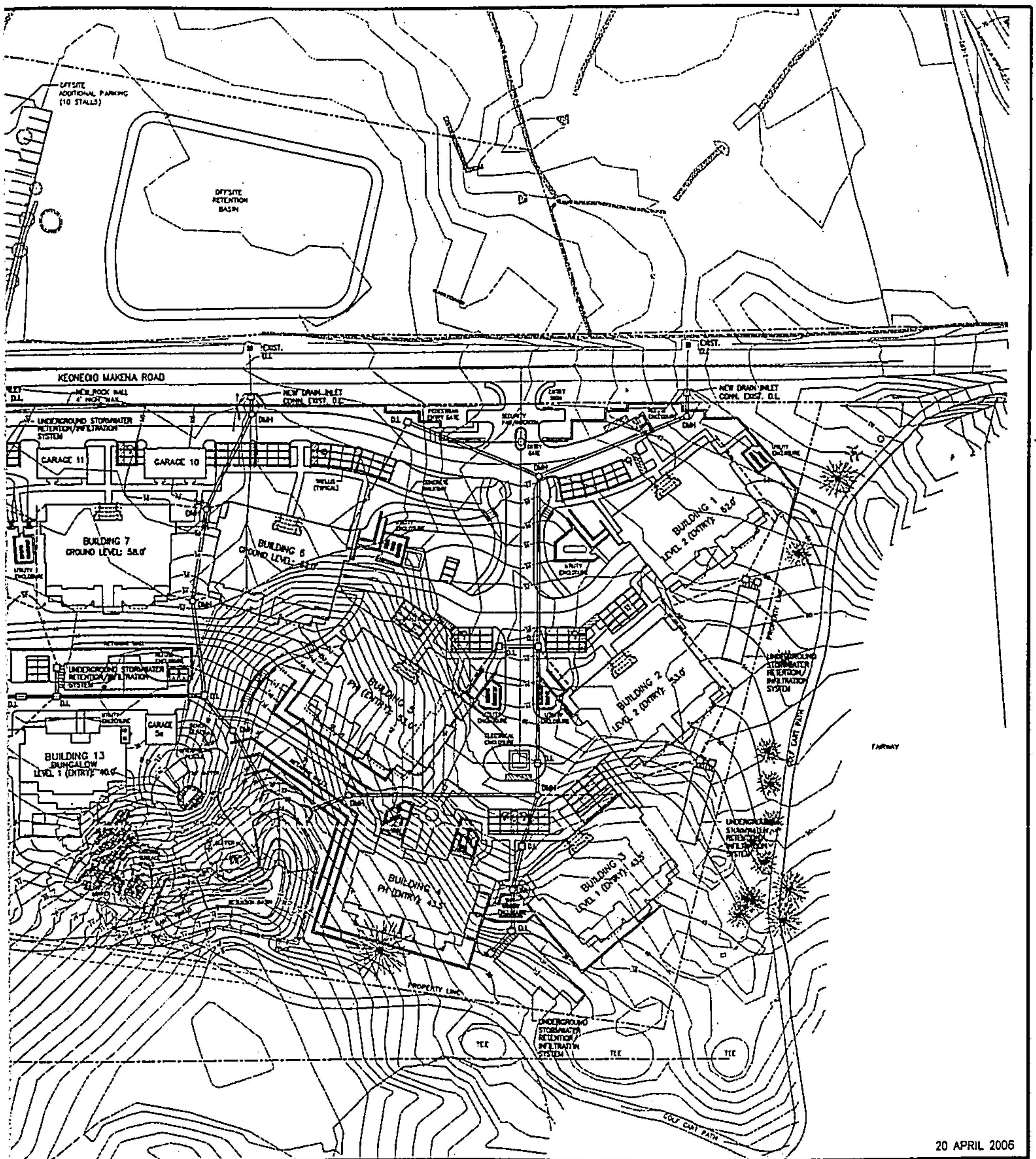
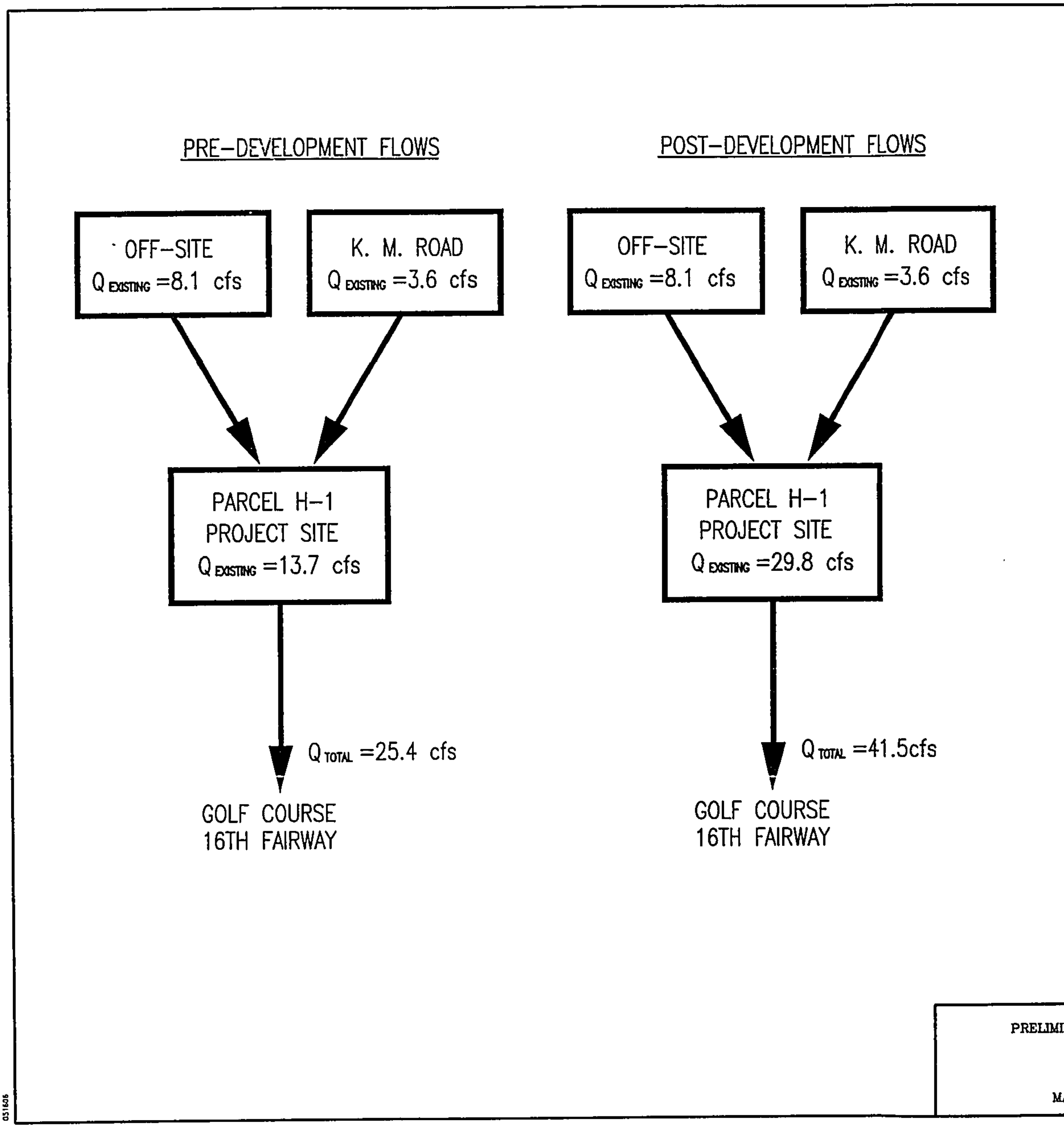
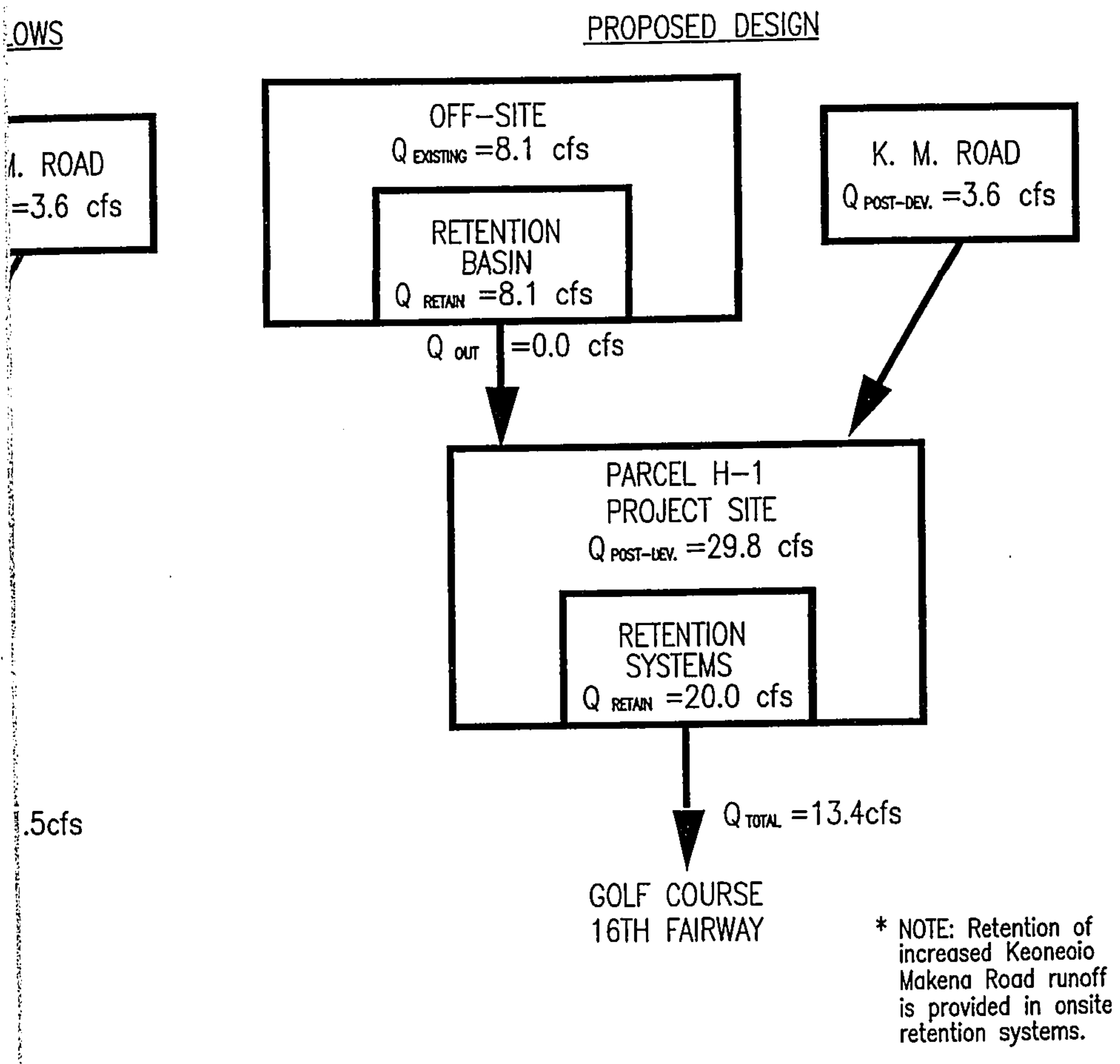
DOCUMENT CAPTURED AS RECEIVED



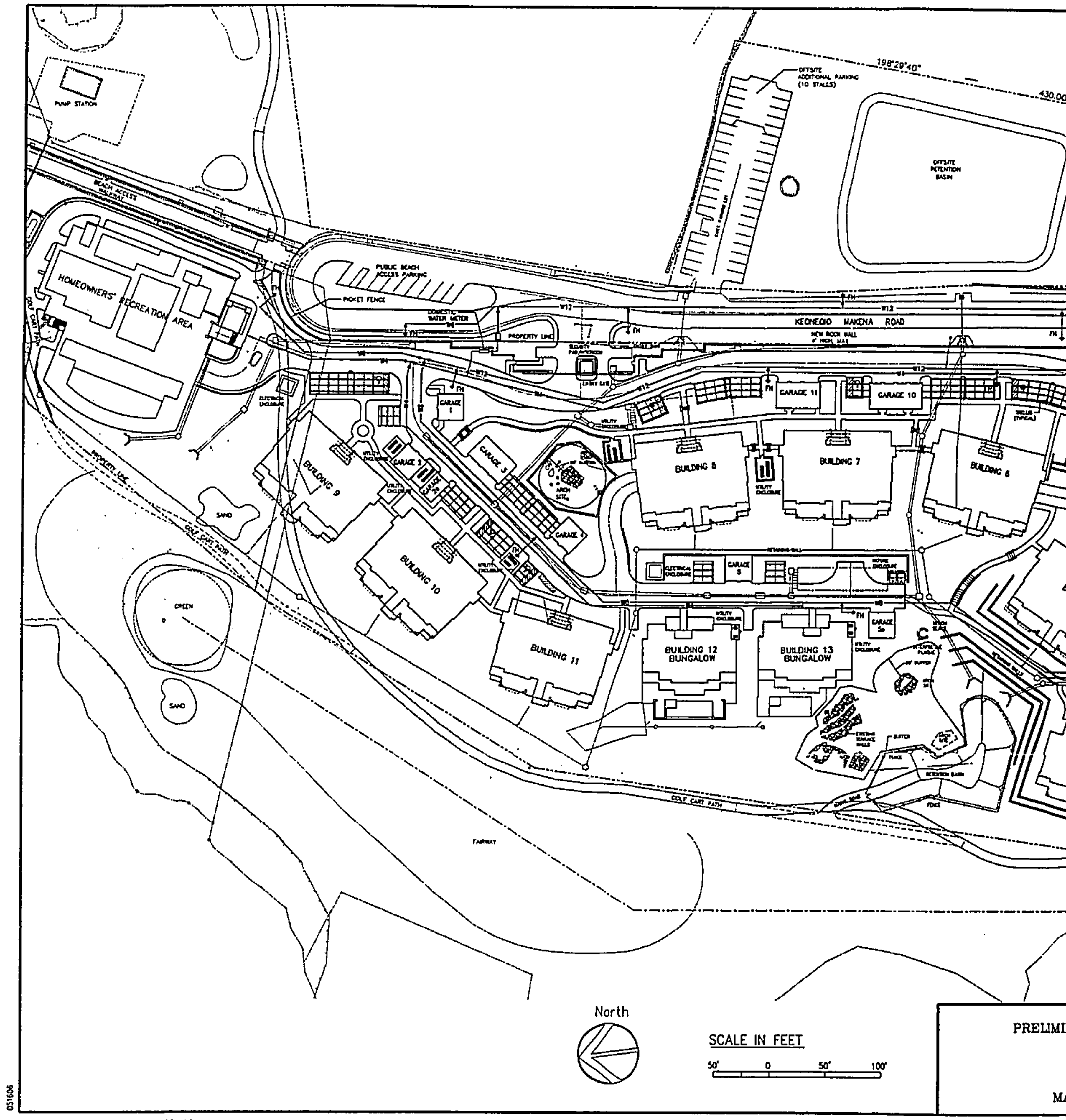
PRELIMINARY ENGINEERING REPORT PARCEL H-1 MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII PRELIMINARY GRADING AND DRAINAGE PLAN	EXHIBIT 3


PRE-DEVELOPMENT FLOWS
OFF-SITE
Q EXISTING =8.1 cfs
K. M. ROAD
Q EXISTING =3.6 cfs
PARCEL H-1
PROJECT SITE
Q EXISTING =13.7 cfs
Q TOTAL =25.4 cfs
GOLF COURSE
16TH FAIRWAY
POST-DEVELOPMENT FLOWS
OFF-SITE
Q EXISTING =8.1 cfs
K. M. ROAD
Q EXISTING =3.6 cfs
PARCEL H-1
PROJECT SITE
Q EXISTING =29.8 cfs
Q TOTAL =41.5cfs
GOLF COURSE
16TH FAIRWAY
PRELIMI
M.



20 APRIL 2006

PRELIMINARY ENGINEERING REPORT PARCEL H–1 MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII PRELIMINARY DRAINAGE FLOW CHART	EXHIBIT 3A



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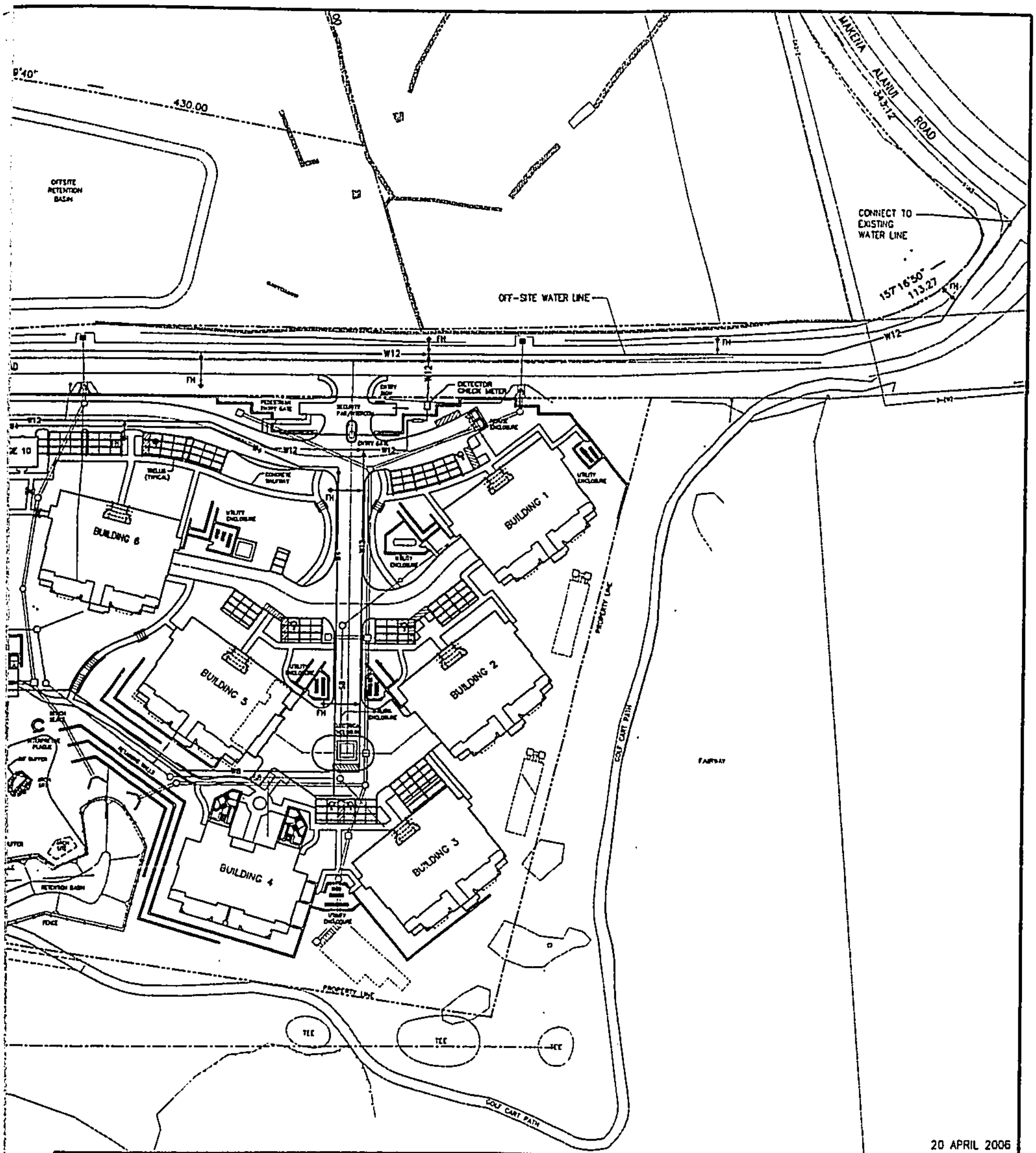
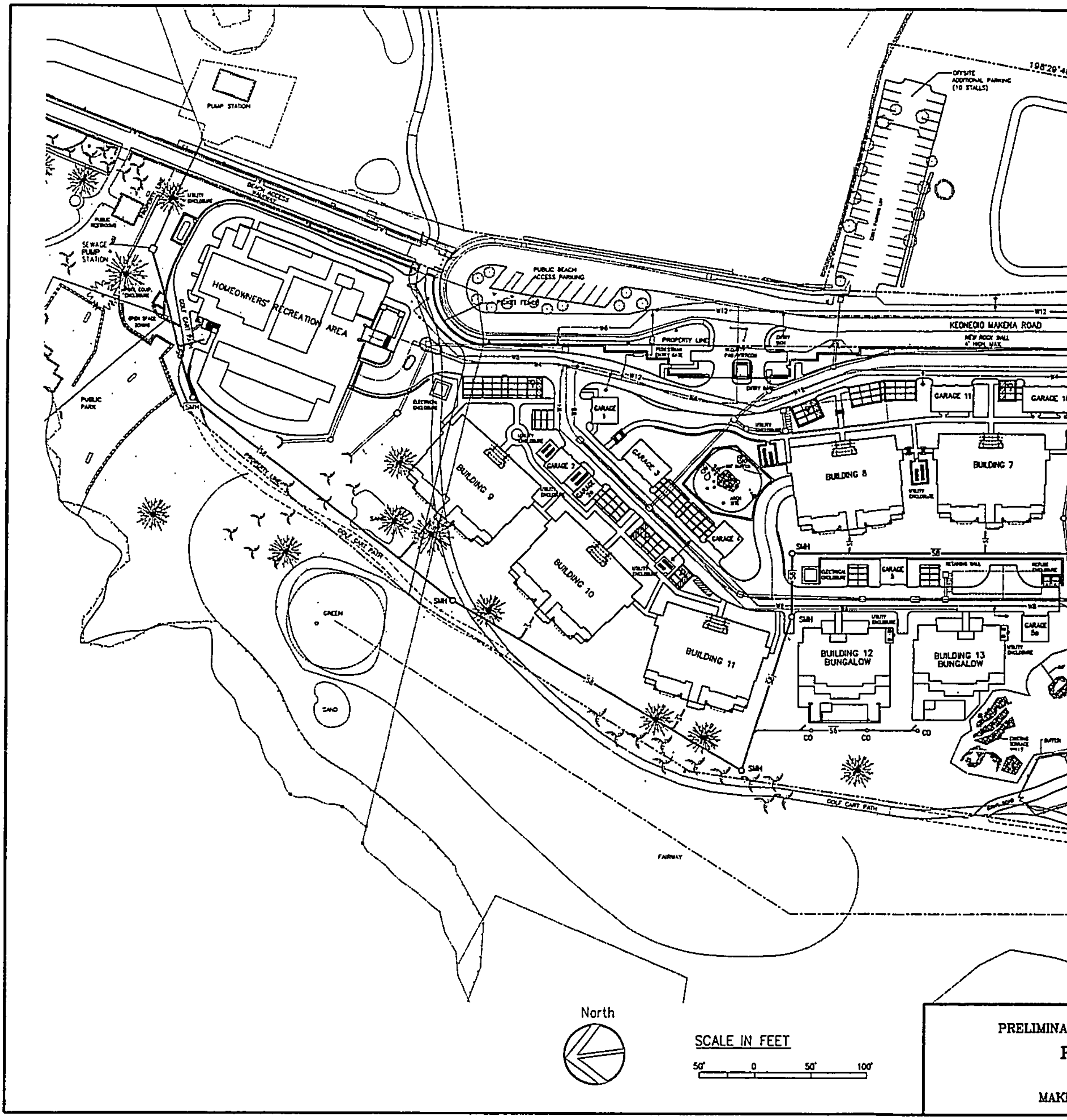


20 APRIL 2006

PRELIMINARY ENGINEERING REPORT **PARCEL H-1** MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII **PRELIMINARY WATER SYSTEM IMPROVEMENTS**	EXHIBIT 4



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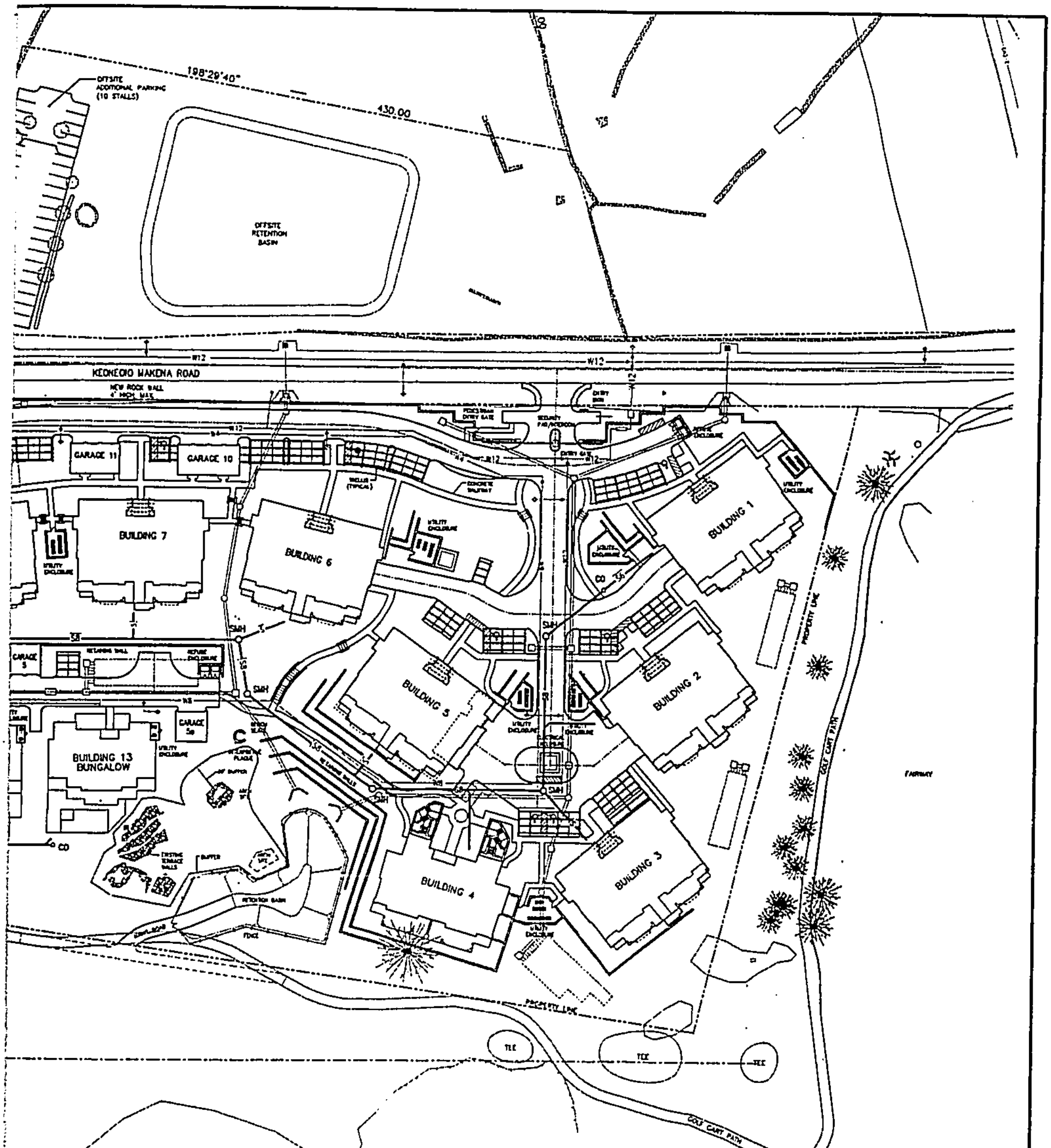
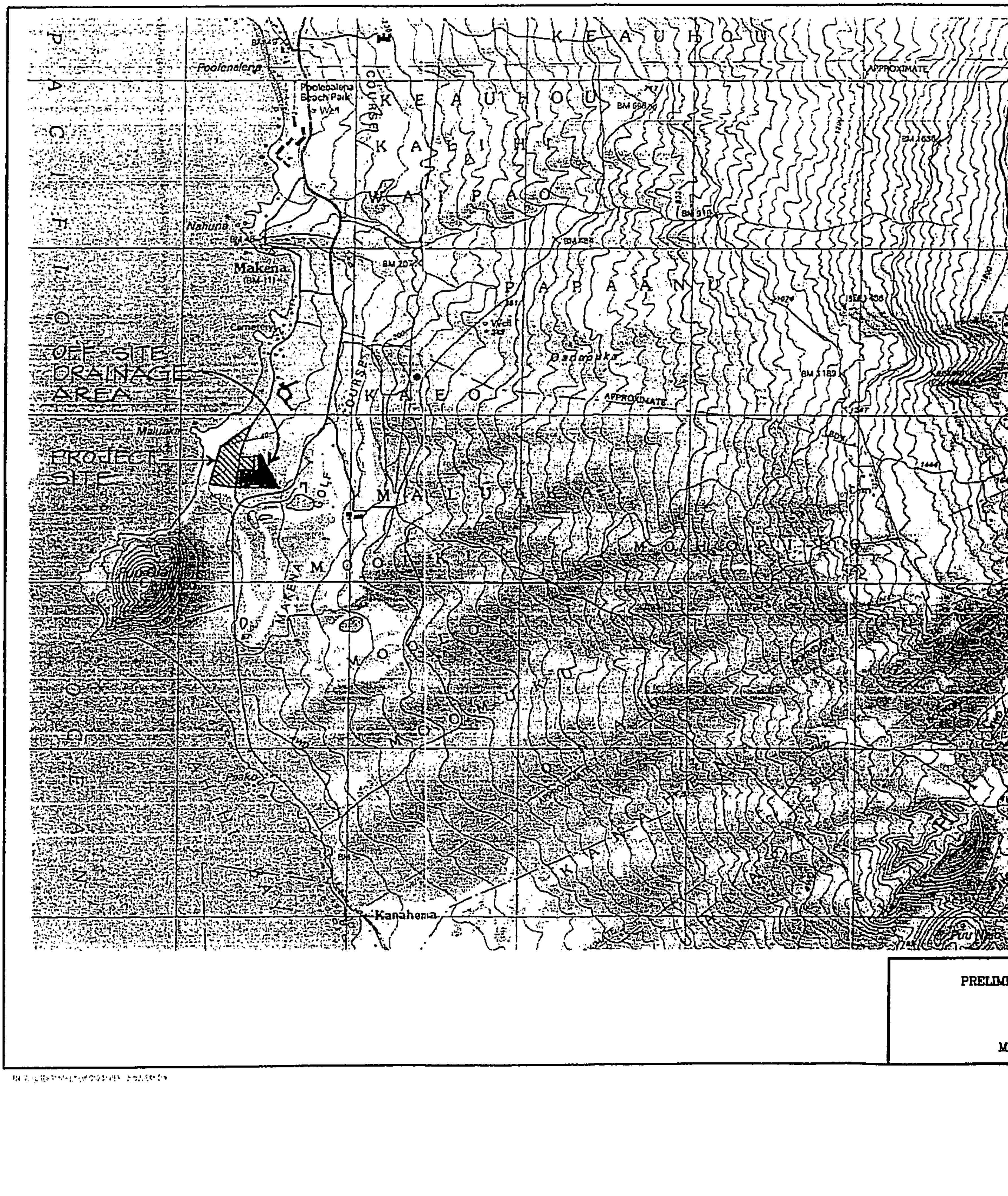


20 APRIL 2006

PRELIMINARY ENGINEERING REPORT **PARCEL H-1** MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII **PRELIMINARY ON-SITE SEWER SYSTEM IMPROVEMENTS**	EXHIBIT 5

DOCUMENT CAPTURED AS RECEIVED



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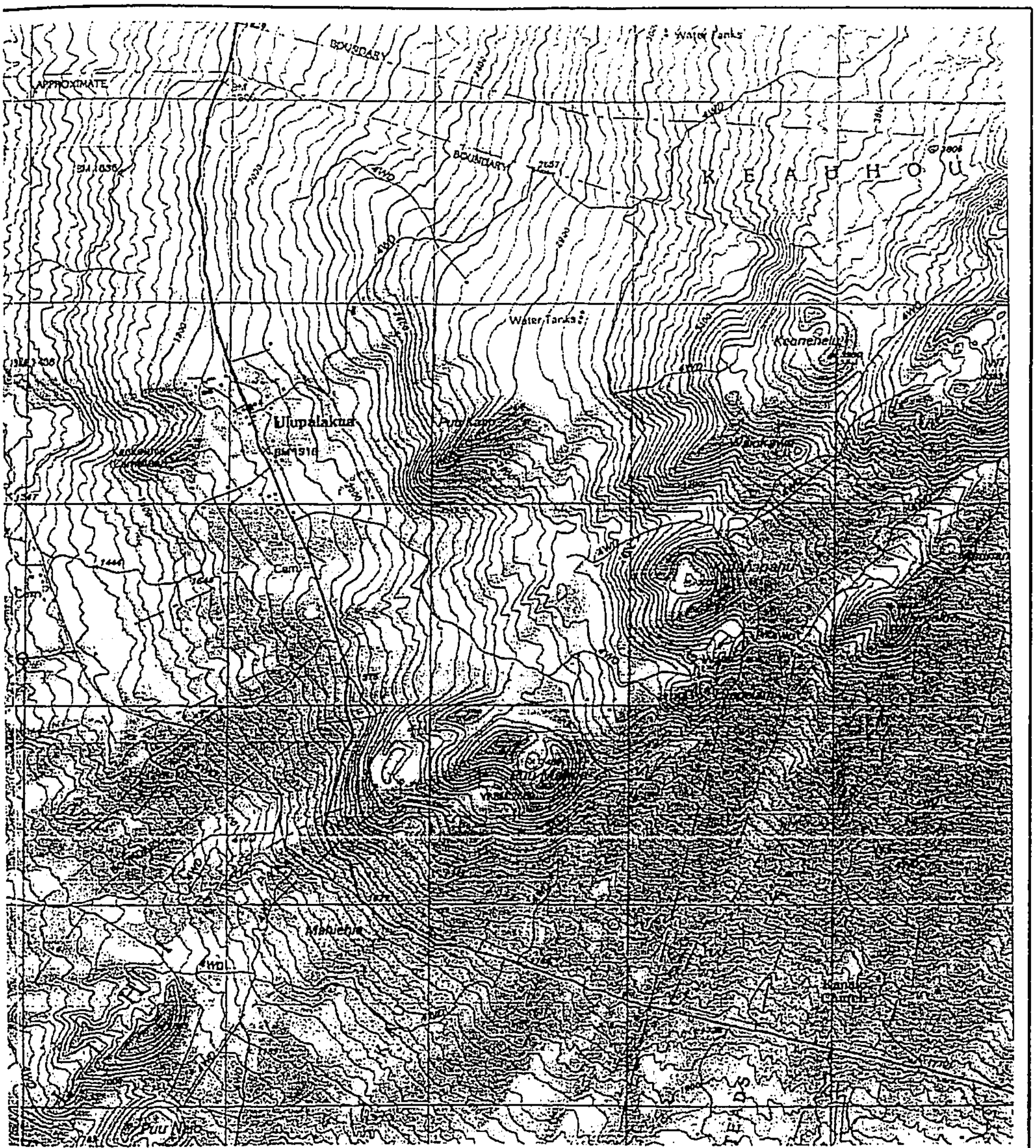
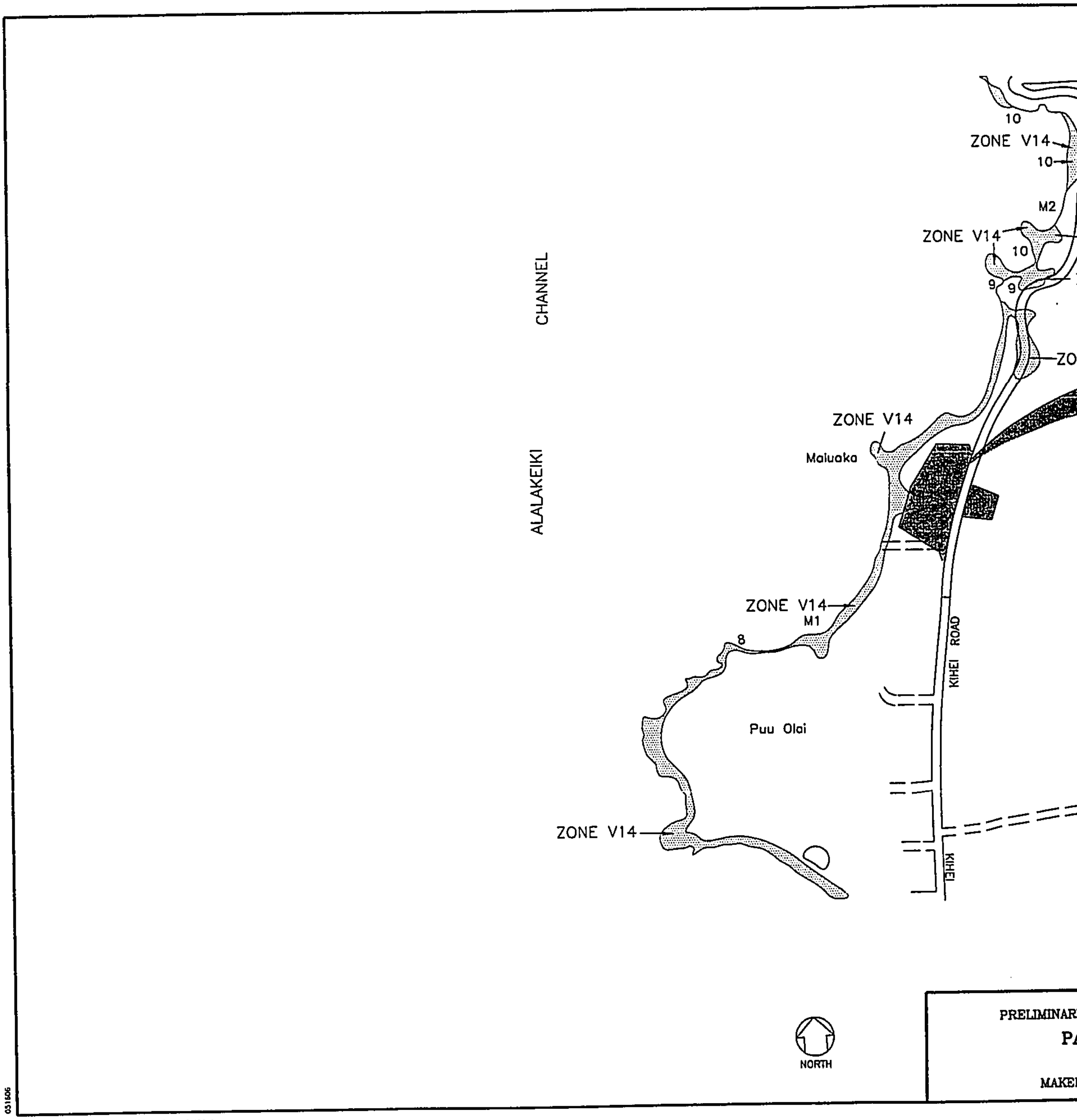


PRELIMINARY ENGINEERING REPORT PARCEL H-1 MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII OFFSITE DRAINAGE MAP	EXHIBIT 6



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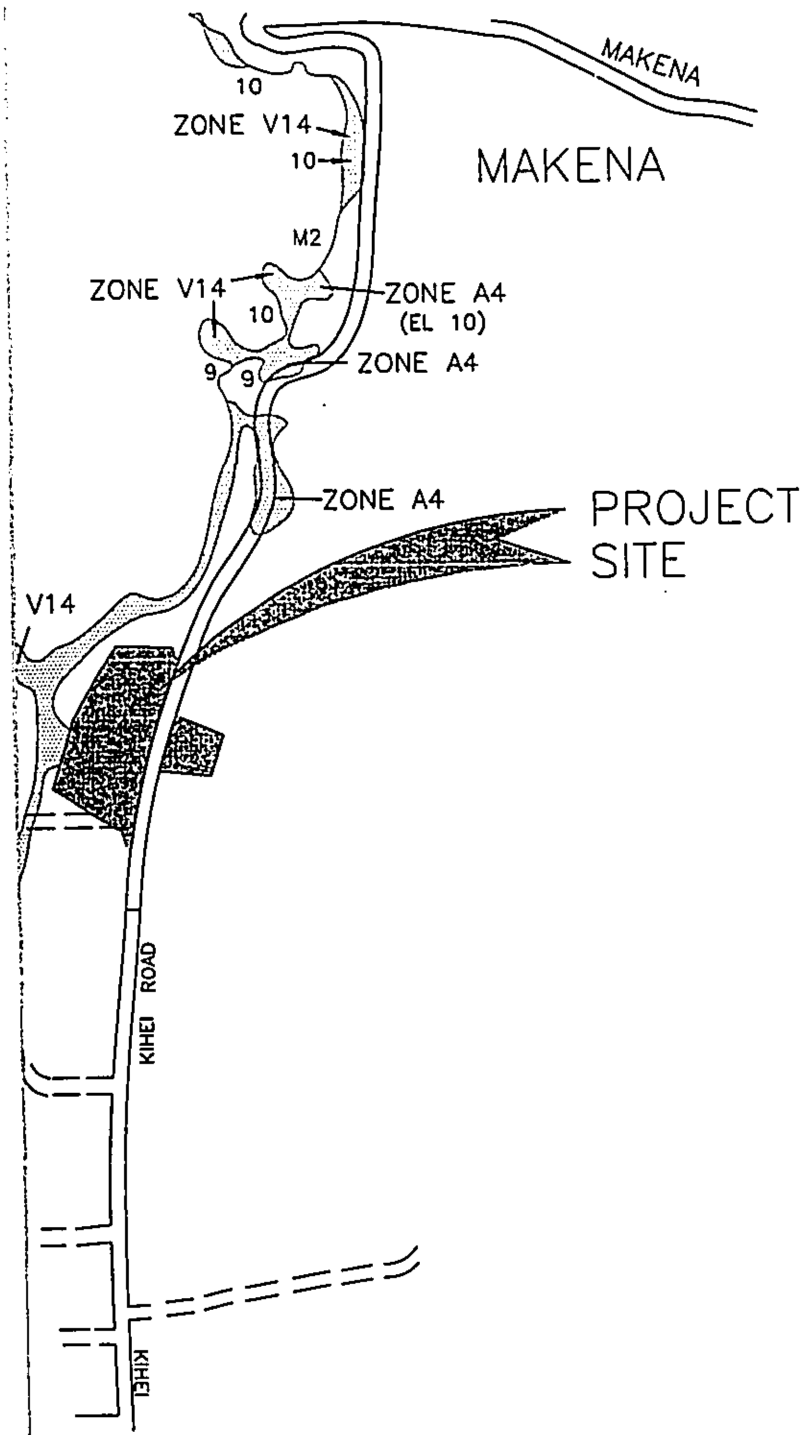
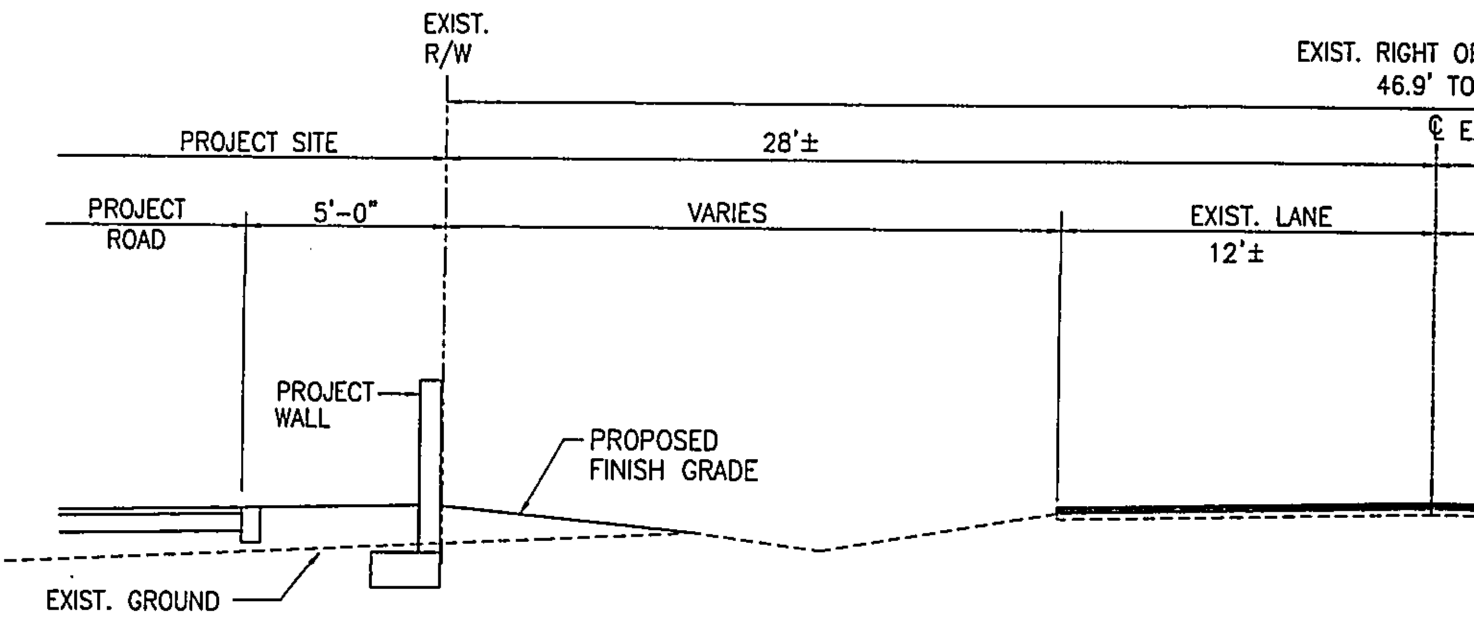


20 APRIL 2006

PRELIMINARY ENGINEERING REPORT **PARCEL H-1** MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII **FLOOD ZONE**	EXHIBIT 7



TYPICAL ROAD SECTION – KEONEOIO

NOT TO SCALE

PRELIM

031606

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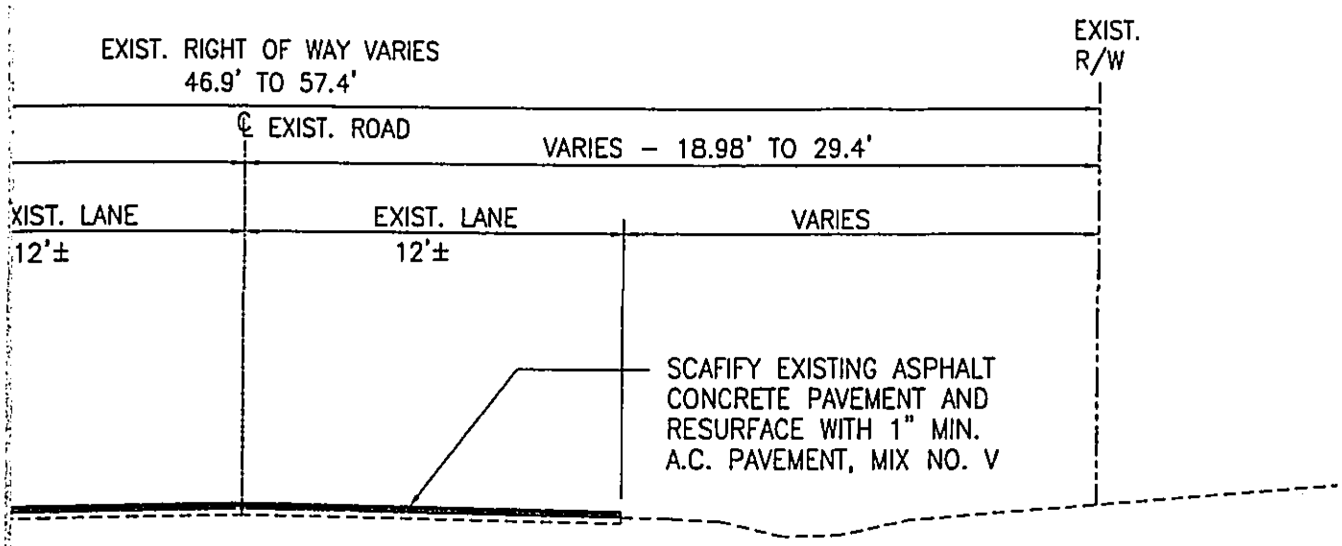
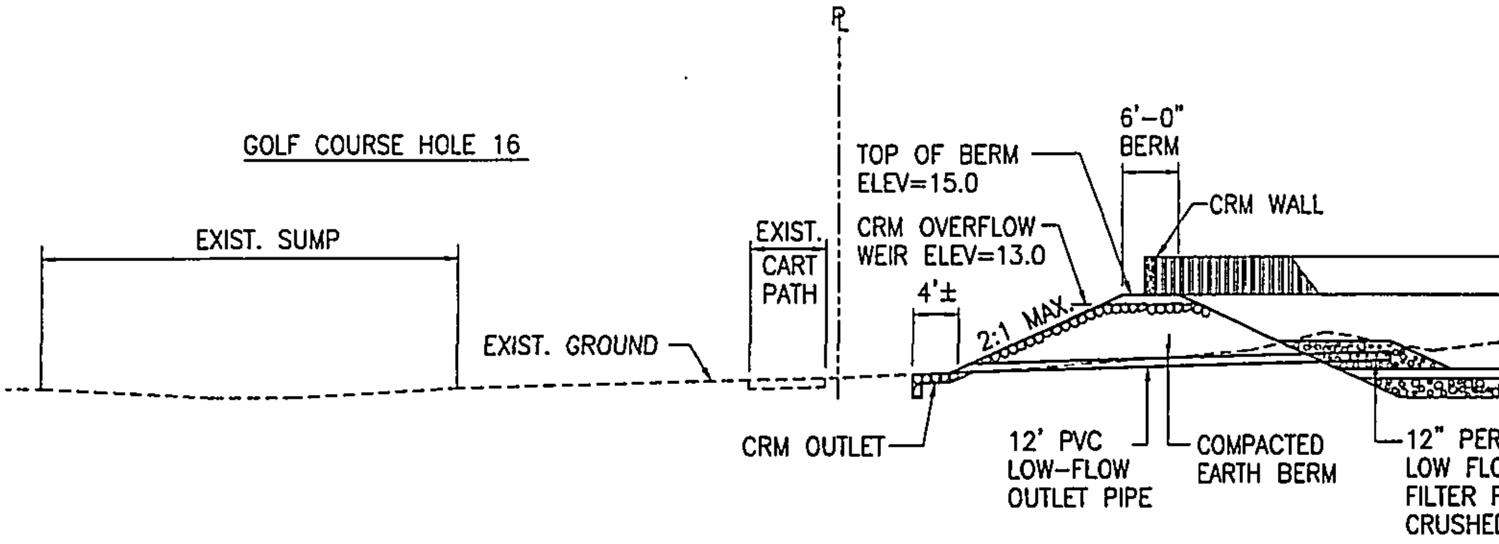


- KEONEOIO MAKENA ROAD

20 APRIL 2006

PRELIMINARY ENGINEERING REPORT PARCEL H-1 MAKENA, MAUI, HAWAII	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU, WAILUKU, HAWAII TYPICAL ROAD SECTION KEONEOIO MAKENA ROAD	EXHIBIT 8



TYPICAL SECTION – RETENTION BASIN

NOT TO SCALE

PRE

031606

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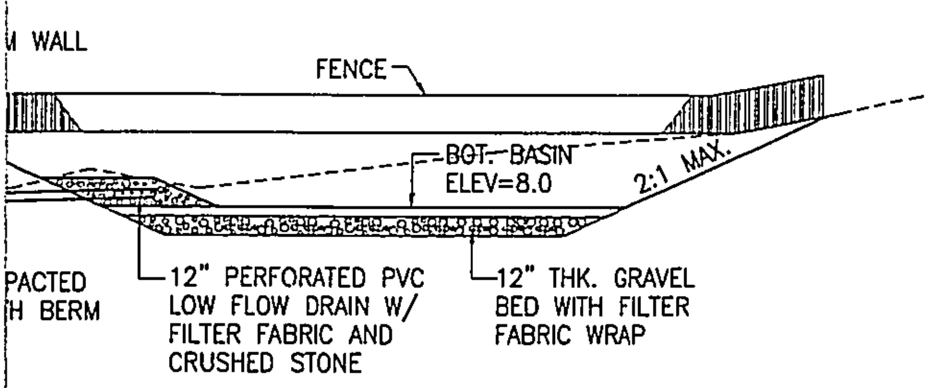

N BASIN

20 APRIL 2006

PRELIMINARY ENGINEERING REPORT PARCEL H–1 MAKENA, MAUI, HAWAII	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, WAILUKU, HAWAII TYPICAL SECTION RETENTION BASIN	EXHIBIT 9

APPENDICES

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX A
PRELIMINARY HYDROLOGY CALCULATIONS

EXISTING KEONEOIO MAKENA ROAD HYDROLOGY CALCULATIONS
(50 Year Storm)

Area (A)

Length of Road:	815 feet
Width of ROW:	56 feet
Width of Pavement:	24 feet

A = (815 feet) (56 feet) = 45,640 ft^2 = **1.05 acres**

Impervious Area = (815 feet) (24 feet) = 19,560 ft^2 = 0.45 acres
Pervious Area = 1.05 – 0.45 = 0.60 acres

Runoff Coefficient (C)

Impervious areas:	C = 0.95
Pervious areas:	C = 0.22

$$C = \frac{0.95\,(0.45 \text{ acres}) + 0.22\,(0.60 \text{ acres})}{1.05 \text{ acres}} = 0.53$$

Rainfall Intensity (I)

Average site slope:	2.0%
Longest reach length:	approx 50 feet
Time of concentration (T_c):	5 minutes
50 Year- 1 hour Rainfall:	2.5 inches

I_{50} = 6.4 inches/hour

Runoff (Q)

Q = C I A

Q = discharge in cubic feet per second (cfs)

C = runoff coefficient

I = rainfall intensity (inches per hour)

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A = watershed area (acres)

$Q_{50} = (0.53)\,(6.4 \text{ inches/ hour})\,(1.05 \text{ acres})$

$= \mathbf{3.56\ cfs}$

Reference: Drainage Standards for County of Maui, Department of Public Works and Waste Management, County of Maui, 1995

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EXISTING OFF-SITE HYDROLOGY CALCULATIONS (50 Year Storm)

Area (A)

A = 6.05 acres

Runoff Coefficient (C)

Site Description: Heavy brush and cactus overgrowth, rocky outcrop surrounding Makena Golf Course fairways.

C = 0.35

Rainfall Intensity (I)

Average site slope:	3.0%
Longest reach length:	approx. 1,300 feet
Time of concentration (T_c):	26 minutes
50 Year- 1 hour Rainfall:	2.5 inches

I_{50} = 3.8 inches/hour

Runoff (Q)

Q = C I A

Q = discharge in cubic feet per second (cfs)

C = runoff coefficient

I = rainfall intensity (inches per hour)

A = watershed area (acres)

Q_{50} = (0.35) (3.8 inches/ hour) (6.05 acres)

= 8.05 cfs

Reference: Drainage Standards for County of Maui, Department of Public Works and Waste Management, County of Maui, 1995

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EXISTING OFF-SITE HYDROLOGY CALCULATIONS (50 Year Storm)

Area (A)

A = 6.05 acres

Runoff Coefficient (C)

Site Description: Heavy brush and cactus overgrowth, rocky outcrop surrounding Makena Golf Course fairways.

C = 0.35

Rainfall Intensity (I)

Average site slope:	3.0%
Longest reach length:	approx. 1,300 feet
Time of concentration (T_c):	26 minutes
50 Year- 1 hour Rainfall:	2.5 inches

I_{50} = 3.8 inches/hour

Runoff (Q)

Q = C I A

Q = discharge in cubic feet per second (cfs)

C = runoff coefficient

I = rainfall intensity (inches per hour)

A = watershed area (acres)

Q_{50} = (0.35) (3.8 inches/ hour) (6.05 acres)

= 8.05 cfs

Reference: Drainage Standards for County of Maui, Department of Public Works and Waste Management, County of Maui, 1995

Project: Parcel H-1
Makena, Maui, Hawaii
TMK: (2) 2-1-06: 37, 56 and 2-1-05: 84

Job No: M-04-554.4
Computed by: RE
Date: 12/13/05

EXISTING ON-SITE HYDROLOGY CALCULATIONS (50 Year Storm)

Area (A)

A = 10.90 acres

Runoff Coefficient (C)

Site Description: Heavy brush and cactus overgrowth, rocky outcrop. No onsite improvements.

C = 0.30

Rainfall Intensity (I)

Average site slope: 6.0%

Longest reach length: approx. 500 feet

Time of concentration (T_c): 19 minutes

50 Year- 1 hour Rainfall: 2.5 inches

I_{50} = 4.2 inches/hour

Runoff (Q)

Q = C I A

Q = discharge in cubic feet per second (cfs)

C = runoff coefficient

I = rainfall intensity (inches per hour)

A = watershed area (acres)

Q_{50} = (0.30) (4.2 inches/ hour) (10.90 acres)

= 13.73 cfs

Reference: Drainage Standards for County of Maui, Department of Public Works and Waste Management, County of Maui, 1995

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POST-DEVELOPMENT ONSITE HYDROLOGY CALCULATIONS (50 Year Storm)

Area (A)

Condominium Buildings:	2.48 acres
Recreation Facility:	0.47 acres
Roadways/ Walkway/ Cartpath:	2.24 acres
Total Impervious areas:	5.19 acres
Landscape areas:	5.71 acres
A = Total site area =	**10.90 acres**

Runoff Coefficient (C)

Impervious areas: C = 0.95
Pervious areas: C = 0.22

$$C = \frac{0.95\,(5.19\text{ acres}) + 0.22\,(5.71\text{ acres})}{10.90\text{ acres}} = 0.57$$

Rainfall Intensity (I)

Average site slope:	3.0%
Longest reach length:	approx 850 feet
Time of concentration (T_c):	12 minutes
50 Year- 1 hour Rainfall:	2.5 inches

I_{50} = 4.8 inches/hour

Runoff (Q)

Q = C I A

Q = discharge in cubic feet per second (cfs)

C = runoff coefficient

I = rainfall intensity (inches per hour)

A = watershed area (acres)

$$Q_{50} = (0.57)\ (4.8 \text{ inches/ hour})\ (10.90 \text{ acres})$$

$$= \mathbf{29.82\ cfs}$$

Reference: Drainage Standards for County of Maui, Department of Public Works and Waste Management, County of Maui, 1995

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APPENDIX B
PRELIMINARY WATER DEMAND CALCULATIONS

PRELIMINARY WATER DEMAND CALCULATIONS

Project Site Description

Total Project Area = 10.90 acres

69 – Condominium (Multi Family Low Rise)
1 – Recreational Facility Building (48,000 sf Gross Area)
1 – Landscape (248,730 sf)

Average Daily Demand

(Table 15, Water System Standards)

Multi Family Low Rise Units	560 gallons / unit
Recreational Facility	120 gallons / person/day

Maximum Daily Demand (Estimated)

Landscape (Condominium Area)	31,517 gallons per day
Landscape (Recreation Facility)	7,490 gallons per day
Total Landscape Demand (Max Daily)	39,007 gpd

Water Demand Calculation

Water Demand Computation

Condominium Units

69 units [560 gallons/ unit/ day] = 38,640 gallons per day (gpd)

Recreational Facility

Assume: 2.5 person/ unit x 69 units x 120 gal/ person = 20,700 gpd

Preliminary Water Demand

38,640 gpd + 20,700 gpd = **59,340 gpd**

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Maximum Daily Water Demand

(59,340 gpd)*1.5 + 39,007 gpd = 128,017 gpd

Total = 128,000 gpd

Reference: Water System Standards
Department of Water Supply, County of Maui, 2002 and as amended

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CIVIL ENGINEERS • SURVEYORS

APPENDIX C

PRELIMINARY WASTEWATER CONTRIBUTION COMPUTATIONS

PRELIMINARY WASTEWATER CONTRIBUTION CALCULATIONS

Project Site Description:

69 – Condominium Units
1 – Recreational Facility (48,000 sf Gross Area)

Wastewater Contribution Standards:

Condominium Units	255 gallons / day / unit
Recreational Facility	100 gallons / person / day

Assumptions:

In Recreational Facility area, assume 2.5 persons/ unit x 69 units = 172.5 person

Wastewater Contribution Calculation:

Condominium Units Contribution

Total number of units: 69 units

69 units [255 gallons/ unit/ day] = 17,595 gallons per day (gpd)

Recreational Facility Units Contribution

172.5 persons x [100 gallons/ person/ day] = 17,250 gpd

Average Daily Wastewater Contribution:

17,595 + 17,200 = 34,795 gpd

Reference: Wastewater Flow Standards
Wastewater Reclamation Division, County of Maui, 1993

Project: Parcel H-1
Makena, Maui, Hawaii
TMK: (2) 2-1-06: 37, 56 and 2-1-05:084

Job No: M-04-554.4
Computed by: AW
Date: 02/24/06 [1 of 1]

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Appendix H

Austin, Tsutsumi & Associates, Inc. Letter, Dated July 28, 2006

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

KENNETH K. KUROKAWA, P.E.
LAMBERT J. YAMASHITA, P.E.
DONOHUE M. FUJII, P.E.
STANLEY T. WATANABE
TERRANCE S. ARASHIRO, P.E.

#04-554.1
July 28, 2006

Mr. Don Fujimoto
Keaka LLC
2005 Main Street
Wailuku, Hawaii 96793

Dear Mr. Fujimoto:

Subject: 71 Unit Condominium
Draft Environmental Assessment
Response to Comments

This memo is in response to the Maui Planning Commission comments on the Keaka, LLC Draft Environmental Assessment. Based upon our review of the comment we offer the following responses:

Item No. 2 ***"Identify the source of fill material."***

The project will require approximately 20,000 CY of fill material, which will be 4000 CY will be from the large off-site retention basin located on the Mauka side of Keoneoio Makena Road. At this time the location of additional fill material required is not known, and will be the responsibility of the Contractor awarded the construction contract to determine where to obtain the material, but is presumed it would be from the nearest available source.

Item No. 3c ***"Provide a discussion as to how the project will monitor the effectiveness of the mitigative measures post development."***

During construction the project will implement a Best Management Plan approved by DOH under an NPDES permit. Visual inspection of the site will be conducted immediately after a storm event to determine the effectiveness of the mitigative measures implemented. If no silt buildup is visible the mitigative measures are deemed to be effective. Excessive buildup of silt indicate that a large amount of sediment is transported by the storm water and possible remediation work to the drainage structures, landscape planting or landscape irrigation system may be required. The cause of the excessive silt buildup will be determined and corrective action to the landscape and drainage system will be immediately undertaken.

REPLY TO:
501 SUMNER STREET, SUITE 521 • HONOLULU, HAWAII 96817-5031
PHONE (808) 533-3646 • FAX (808) 526-1267 • EMAIL: atahnl@atahawaii.com

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII

Mr. Don Fujimoto
Keaka LLC

July 28, 2006

Item No. 7 ***"On Page 55 of the Draft EA, indicates the landscape irrigation system will be converted to R-1 quality when available. Provide further explanation.***

The source of effluent re-use water is generated by the Makena WWTP, but with the limited number of raw sewerage connection, i.e. only the Maui Prince Hotel and the Makena Golf Club House are currently connected to the WWTP, the WWTP generates an adequate supply of re-use water until there is an increase in raw sewerage flows to the WWTP.

The projects landscape irrigation system will be designed as a separate system that can be disconnected from the potable water main and reconnected to the effluent re-use line, requiring no changes to the on-site landscape irrigation system.

Item No. 8 ***"Discuss where the Applicant intends to find potable water for the project."***

Currently the DWS has three (3) water sources that will increase the availability of potable water that will supplement the Iao Aquifer. The three sources are:

1. Kupaa Well - The well pump has been installed. Pipe line installation will be contracted in the near future.

2. Waiale Surface Water Treatment Plant – Which is anticipated to be on-line and operational in 2008.

3. Maui Lani Wells –Well drilling is in progress or should be commencing by the last quarter of 2006.

The applicant is aware of the DWS regulation that issuance of water meter is dependent on the availability of water at the time of water meter application.

Should you have any questions or require further information, please call me at (808) 533-3646.

Sincerely,

AUSTIN, TSUTSUMI & ASSOCIATES, INC.

By STANLEY T. WATANABE
Vice President & Senior Designer

STW:mt

cc: A. Wong – ATA Maui

Z:\2004\04-554.1\Correspondence\Response to Comments-Maui Planning Comm 072806.doc

Appendix I

Cultural Impact Assessment

MALUAKA

(Fish Shelter)

Photo of project site

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium
& TMK 2-1-05:84, 2 acres for a retention basin, Maluaka
(Mäkena) Honua'ula, Makawao, Maui, Hawai'i

Mitigating Measures

"Preservation in place of native Hawaiian burial"
"Preservation in place of Ceremonial Hawaiian Ko'a"
"10-Stall expansion of public parking lot on Parcel 84"
"Archaeological monitoring during initial grading"

FINAL REPORT

Prepared for:
KEAKA L.L.C.
2005 Main Street
Wailuku, Hawai'i

Prepared by:
CKM Cultural Resources, L.L.C.
C. K. Maxwell Sr.
157 Alea Place
Pukalani, Hawai'i

MALUAKA
(Fish Shelter)

TITLE PAGE

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium & **TMK 2-1-05:84**, 2 acres for a retention basin, Maluaka (Mäkena) Honua'ula, Makawao, Maui, Hawai'i

Mitigating Measures
"Preservation in place of native Hawaiian burial"
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F I N A L   R E P O R T

February 2005

Prepared for:
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MALUAKA

(Fish Shelter)

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium & **TMK 2-1-05:84**, 2 acres for a retention basin, Maluaka (Mäkena) Honua'ula, Makawao, Maui, Hawai'I

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MALUAKA

(Fish Shelter)

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium & **TMK 2-1-05:84**, 2 acres for a retention basin, Maluaka (Mäkena) Honua'ula, Makawao, Maui, Hawai'i

ABSTRACT

This study is in accordance with the Office Of Environmental Quality Control, which describes resources having Hawaiian Cultural Value. It will describe potential impacts from further development, along with measures that could possibly be employed to mitigate those impacts. If any historic and/or prehistoric resources are identified during an archaeological survey, the study will evaluate the resources and assist in the development of a general preservation plan. It will also address the requirements of the Office of Hawaiian Affairs, in regards to cultural impacts. Specifically, the document will address potential effects on the Hawaiian Cultural and Traditional Customary Rights, as described in the legislation known as Act 50, Sessions Laws of Hawai'i, 2002, and meet the requirement of the HRS Chapter 343, which also requires an environmental assessment of cultural resources, in determining the significance of a proposed project. Also, Articles IX and XII of the State Constitution, other state laws, and the courts of the state, require government agencies to promote and preserve cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups. Furthermore, this study will address whether the development will impede access to any cultural or spiritual sites, and how they could be mitigated if found.

A Hawaiian cultural resource evaluation revealed the location of the project area as follows: The site (named Maluaka - meaning *Fish Shelter*) is located in the Honua'ula[1] Ahupua'a[2], between the Maui Prince Hotel, which is positioned on the right side, and Pu'uöla'i[3] Hill which is

[1] Honua'ula - Land division in Mäkena.
[2] Ahupua'a - Land division usually extending from the uplands to the sea.
[3] Pu'uöla'i - Hill (360 feet) in Mäkena.

positioned on the left. According to the aerial photo placed on the cover page, the Mäkena[4] golf course fairway #15 borders the project on the Pu'uöla'i hillside, while the fairway #16 runs on the entire front area of the project site. Kalaeloa Point[5] and Naupaka[6] Beach is located on the south side area of the project. Maluaka Park provides an access from a public right of way located on the northwest side of the parcel and the old Mäkena Alanui Highway. Access to the beach can be made from the 17th fairway of the Mäkena Golf Course.

There are archaeological sites on this property (refer to Archaeological Inventory Survey (March 2005) submitted by the projects archaeologist, Lisa Rotunno-Hazuka of Archaeological Services of Hawai'I and a supplemental Archaeological Inventory Survey (April 2006) prepared at the request of the applicant by Theresa K. Donham of Akehele *Archaeology*). *Information on the sites and buffer zone will* be available in the archaeological information of this report.

Through research and the information gathered from the informants, there is no evidence of religious or cultural practices that took place in ancient times. However, according to project archaeologist, Lisa Rotunno-Hazuka, a foundation was found and may have possibly been used for

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[4] Mäkena - District in South Maui.
[5] Kalaeloa - Long Shoreline, located front of Maluaka, Mäkena.
[6] Naupaka - Kind of shrub named after the Native species (Scavola) found growing on the coast of Mäkena.

religious purposes, such as a *ku'ula*[7] (fishing shrine), due to its close proximity to the ocean. Archaeological work will not be necessary, as the site and related features will be preserved in place with the proper buffer zones for protection. It is evident that this place was very important to the Hawaiian people who had occupied this area in the past, and should be preserved in perpetuity. As well, a Native Hawaiian burial should also be preserved in place to protect this site.

The place name and the surrounding areas illustrate this site was well used in ancient times. From all indications, the most important part of this development is to ensure that the access of the Native Hawaiians and general public will not be impeded by this project, as the ocean and its natural resources are used by many for subsistence gathering and enjoyment.

It is strongly suggested that well defined paths be built first from the mauka side of the parking area to Maluaka Park located on the Wailuku end of this project, and special care be taken that the Homeowners Recreation Building not "intrude" the privacy of the park users. Both residents and users have to "respect" each others space. This fact was strongly indicated by several informants when they were interviewed, which will appear in the Informants Interviews section of this report.

Note: As much as possible, throughout this report, the spellings of Hawaiian vocabulary and place names have been standardized to present orthography.

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[7] Ku'ula - Any stone god used to attract fish, whether tiny or enormous, carved or natural; named for the god of fishermen Ku'ula; Heiau (temple) near the sea for worship of fish gods; hut where fish gear was kept with *ku'ula* images usually inland and very taboo. I have seen numerous *ku'ula* and every one stood on platforms similar to the one on this property- C. Maxwell

MALUAKA

(Fish Shelter)

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium & TMK 2-1-05:84, 2 acres for a retention basin, Maluaka (Mākena) Honuaÿula, Makawao, Maui, Hawaiÿi

OUTLINE

I. Introduction

  a. Scope

II. Specific Area of Research

  a. Maluaka (Mākena)
  b. Clarification of area
  c. Honua'ula ahupua'a and surrounding ÿili

III. Maluaka: The Historical and the Cultural Context

  a. Native vegetation and habitat
    (1) Native flora, fauna
    (2) Wildlife

IV. Conclusion

V. Bibliography

MALUAKA

(Fish Shelter)

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium & TMK 2-1-05:84, 2 acres for a retention basin, Maluaka (Mäkena) Honua'ula, Makawao, Maui, Hawai'i

INTRODUCTION

Scope

The scope of this report will be to compile various historical, cultural and topographical accounts and facts of the 'ili[1], Maluaka and its adjacent 'ili and ahupua'a Honua'ula. The following description of the project area is derived from topographical, cultural and usage descriptions of the more general areas of Maluaka and its ahupua'a, Honua'ula.

(1) In accordance with O.E.Q.C. guidelines, the study will describe resources having cultural value, and will describe potential impacts from further development along with measures that could be employed to mitigate those impacts. The contractor will coordinate with the archaeologist characterizing the site to evaluate the cultural significance of historic and prehistoric resources identified during an archaeological inventory, and will assist in the development of a general preservation plan for those resources.

(2) It will also include a Traditional Practices Assessment that will meet the assessment requirements of O.E.Q.C. and O.H.A. for cultural impacts. Specifically, the document will address potential effects on Hawai'i's culture, and traditional and customary rights, as described in the legislation known as Act 50, 2000.

Today, its shores are of impeccable beauty and serene splendor. Through information from informants who grew up in this area and the location of this project being built, Maluaka draws a great number of visitors and Native Hawaiians to Maluaka Park and the ocean for subsistence purposes.

[1] 'ili- Land section within a specific land division.

Specific Area of Research

This project site shall be identified as: (1) TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, to include a 71 Unit Condominium and (2) TMK 2-1-05:84, with 2 acres for a retention basin. These project areas are located in Maluaka of the Honua'ula ahupua'a and the 'ili of Makawao.

Ahupua'a and 'ili

The name of the ahupua'a is Honua'ula. In historical times, this landmass was a section all unto its own. However, the Territorial Session Laws of 1909 placed Honua'ula in the district of Makawao:

> (1) Hämäkua Loa[2], Hämäkua Poko[3], Kula, and Honua'ula, the western boundary starting from Kapukaulua[4] and running along the bottom of the gulch to the peak of "Pu'uokai'a[5]," to be styled the Makawao District.[6]

While this specific zoning, revised in 1932 to enlarge this particular zone, continues to be used as modular guidelines for land zones today, it is furthest from what was used in the established land tenure system.

Its customary boundaries extended from Paeahu[7], Honua'ula (currently where Kama'ole beaches are located in Kïhei) to Pöhaku Manamana (the area below Kanaio) and its highest peak extends to Pöhaku Palaha, the edge of the cliffs of Haleakalä.

The area being examined in this report is Maluaka.

Maluaka is situated on the northwestern end of the Honua'ula ahupua'a. Several definitions of Maluaka exists. Studies on the shoreline, land terrain features, and anthropological happenings prior to western contact found that Maluaka was a part of a large fishing community.

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[2] Hämäkua Loa - Former district and land division, Ha'ikü, Maui.
[3] Hämakua Poko - Former district and land division, Ha'ikü, Maui.
[4] Kapukaulua - Coastal area, Pä'ia, point in Häna, Maui.
[5] Pu'uokai'a - land section, Pä'ia, Maui; Lit., hill of the fish.
[6] Territory of Hawai'i Session Laws of 1909
[7] Paeahu - Large land section in Honua'ula, Mäkena, Maui. Lit., row [of] heaps.

The name Maluaka is formed using two Hawaiian words: "malu" and "aka." "Malu" is defined as shade, shelter, protection, peace, control and/or strength and "aka" is defined as newly hatched fish. Although "aka" has several definitions, this definition is chosen because Maluaka was part of a large fishing community.

Its shoreline may possibly have been spawning sites for the various fish that occupy Maluaka's oceanfront.

Several individuals created a definition to be a formation of clouds providing a "shelter" to Maluaka, however, what is historically factual is the accumulation of clouds in the area. The Näulu clouds, which is also the name of the rain in this particular region, would gather in a special formation and occasionally amass into *ke ao panopano* or thick luminous clouds. These clouds would then move on to Kaho'olawe and drench the island with rain. Prior to its military use, Kaho'olawe was laden with thick green vegetation.

The Näulu clouds are famous for its legendary battles with the Ukiukiu clouds over Haleakalä. A. Von Tempski recounts a story she was told in her book *Born in Paradise*:

> Näulu and Ukiukiu - trade wind-driven clouds split by the height and mass of Haleakalä into two long arms. Näulu traveled along the southern flank of the mountain, Ukiukiu along the northern flank and they battled forever to possess the summit. Usually Ukiukiu was victorious, but occasionally Näulu pushed him back. Sometimes both cloud warriors called a truce and withdrew to rest, leaving a clear space between the heaped white masses of vapor looming against the blue of the sky. The space Makali'i told me, was called Ala nui o Lani - The Highway to Heaven.

Honua'ula has various 'ili all with its own historical significance. Much of this vast land was home to large fishing villages. However, in the research process not much was found on Maluaka, alone. Therefore the compilation of these historical facts will include those 'ili in close proximity to Maluaka as well as Honua'ula in general.

A chant of Honua'ula printed in an 1865 copy of Ke Au Oko'a, one of the daily newspapers in the 1860's.

Ua kaulana i ka nani o ke one
Ke one kaulana 'o Honua'ula
Honua'ula, e paluku 'ia ana nä kihipo'ohiwi e nä ale o ka Moa'e

'Tis famous, the beauty of the sand
The famous sand of Honua'ula
Honua'ula, whose shoulders are pummeled by the Moa'e winds (local trade winds).

Honua'ula and Maluaka were famous for being pummeled by the trade winds, while today, locals enjoy its cool breezes. The trade winds are at times forceful but its path of travel has been consistent. The trade winds always breeze from the northwest to the southeast.

Other areas of Honua'ula that may be mentioned in this compilation and reside near the area of Maluaka is Mäkena, 'Äpuakëhau, Pa'ako, Mo'o'iki, Papa'anui. These 'ili surround the Maluaka 'ili of the Honua'ula ahupua'a.

Historical and Cultural References

While there are seldom direct references to Maluaka, much of its historical and cultural references will be determined by those 'ili in close proximity and the ahupua'a in general.

Maluaka is famous for a pu'u or a hill in its 'ili. This hill is called Pu'uöla'i or "hill of earthquakes." This area was said to have showed volcanic activity last as A. Von Tempski recalls in her book *Born in Paradise*:

> The coast below us was covered with a dense growth of kiawe trees waving their lacy branches in the wind, and here and there coconut groves lifted their glittering green into the sunshine. A purple cone, like a boil, jutted into the sea at the southern end of Haleakalä. "That's Pu'uöla'i, the Hill of Earthquakes, where the last activity of the mountain took place," Daddy told me.

In this particular region of Pu'uöla'i, a heiau was located at the base of this hill. A. Von Tempski again recalls a journey that she encountered.

> After we'd eaten, Makali'i saddled our two horses and took me to see an old *heiau*, temple, at the base of the Hill of Earthquakes, just beyond the point where Pili had speared the *ulua* the day before. Reverently we inspected the square heap of black stones. "In this temple *kahunas(sic)* prayed and offered sacrifices in old times," Makali'i said in Hawaiian [language]. "This was the temple of the Shark God where fisherman made offerings before putting out to sea."

Maluaka is also culturally significant because it is home to the 'ili'ili[8], Onouli. Onouli is where 'Aikanaka, a fierce ruler of Maui, transitioned his earthly life to the beyond. Noted Hawaiian historian David Malo sites the following in his book *Hawaiian Antiquities*:

> [']Aikanaka was a chief born at Holonokiu, Mu'ole'a, Häna, Maui. He died at Onouli, Pu'uöla'i, Honua'ula, and his bones were laid to rest at 'Iao.

This area was kapu or taboo while his body was being prepared for its final resting place. Many mourned the death of 'Aikanaka and until this day, Onouli is held in high regards because the passing of 'Aikanaka.

The surrounding shoreline of Maluaka and its' 'ili were fishing villages. Upon encountering this magnificent area, it is not difficult to recognize that this area was home to a fishing village.

Mäkena is an 'ili in Honua'ula which continues to be famous for its gorgeous shoreline and abundance of fish. In W.M. Walker's *Archaeology of Maui* points out one particular happening in the Mäkena area:

> Ponds for entrapping and keeping fish alive are to be seen at five places on Maui: Keone'o'io, Mäkena, Kalepolepo and Lahaina.

This was a common tactic in harvesting fish for the many people that lived in various areas. This is a way to assume that a great deal of families lived in these area.

[8] 'ili'ili - Smaller land sections in an 'Ili.

One account in the *Ke Au Oko'a*, in a 1873 edition of this Hawaiian language newspaper says the following:

> Aia i ke kai uli
> i ke kai loa
> Ua aka nä i'a i Mäkena
> i ka lihi o ke kai
>
> There in the dark sea[9]
> In the vast sea
> The fish spawn at Mäkena
> There at the edge of the ocean

This particular reference speaks to the many types of fish that spawn in these areas. Mäkena and Maluaka both had shorelines that were great fishing zones. These areas were so pristine that the State of Hawai'i has codified it as a Natural Area Reserve Sanctuary of 'Ähihi-Kïna'u.

Along with the everyday lives of those that inhabited Honua'ula, territorial wars were also part of that history. Samuel Mänaiakalani Kamakau remarks in his book, *Ruling Chiefs of Hawai'i:*

> In the year 1776 Kalani'öpu'u and the chiefs returned to war on Maui and in the battle with Kahekili's forces at Wailuku were completely overthrown. The army landed at Keone'o'io, their double canoes extending to Mäkena at Honua'ula. There they ravaged the countryside and many of the people of Honua'ula fled to the bush.

This excerpt of Kamakau lends an important view of history and the lifestyle in this area.

What can be seen from these excerpts is that the area of Maluaka and its subsequent 'ili was part of a fishing village. It is obvious that great care, conservation and preservation for this coastline are, without question, a must.

Native Flora, Fauna

[9] The dark sea is in reference to the amount of fish in the ocean, it was cluttered with fish hence the "dark sea."

The topographical landscape of this particular region is dry and arid. Very few plants could have made its' home here.

There is evidence of a water source as highlighted in the history of Honua'ula. Local lore claims that Kane and Kanaloa landed at Pu'u o Kanaloa (Hill of Kanaloa) a small hill just north of Keone'o'io when they first came from Kahiki (Tahiti). They dug a water hole by the beach and found brackish water. So they went about 200 yards inland and dug another hole. This is the spring called Ka-wai-a-ka-la'o, which still contains fresh water in it. They then went on to Nu'u and dug another spring.

One crop that was highly cultivated was the sweet potato (Ipomoea batatas) or known in Hawaiian as 'uala. These grew in extremely arid conditions and provided a great starch for those of the Honua'ula district.

In the lore of this area, it is said that a local farmer noticed that his 'uala were being stolen. He would plant crop after crop and just as it was about to be harvested, the potatoes would be stolen. When the farmer caught the thief, it was none other than a hog, Kamapua'a[10].

One essential plant used to construct thatched homes was the tanglehead or twisted beargrass (Heteropogon contortus) or known in Hawaiian as pili grass. This grass was also quite common in these areas because of the arid climate conditions near the Kahului coastline. Pili also grows in dusty conditions. This grass was useful to the Hawaiians by bunching dried clumps of grass to create a waterproof house.

Much of the ground cover near the coastal line was Pä'ü o Hi'iaka (Jacquemontia ovalifolia). This was a ground-covering vine with abundant tubular flowers that range in color from light blue, purple, to white. This plant did not need much water, which in turn made the coastal lines and its surrounding areas a perfect place of growth for this plant.

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[10] Kamapua'a is a demi-god whose physical formation spans natures beauty. He is often known as a boar wrestling with the forestry, wherever he may be. His *kinolau* or physical earthly embodiment is the *Kukui* tree or Candlenut tree. Kamapua'a's ocean form is the current State fish, the Humuhumunukunukuäpua'a.

While Hawaiians of the past used Pä'ü o Hi'iaka to cure the keiki (children) of ea (thrush, a mouth disease), this plant is better known for the mo'olelo, or story, that explains its name. Long ago, Pele, the volcano goddess, took her youngest sister, Hi'iaka, to the ocean. As Pele was out amongst the waves fishing, or some say surfing, the sun climbed higher and hotter in the sky. Meanwhile, Hi'iaka waited patiently on the shoreline for her sister. A plant near Hi'iaka, seeing that the sun's merciless rays were burning the keiki tender young skin, took pity upon Hi'iaka and extended its branches to shield her. In gratitude, Pele gave the plant its name, Pä'ü (skirt) o Hi'iaka (of Hi'iaka, my baby sister).

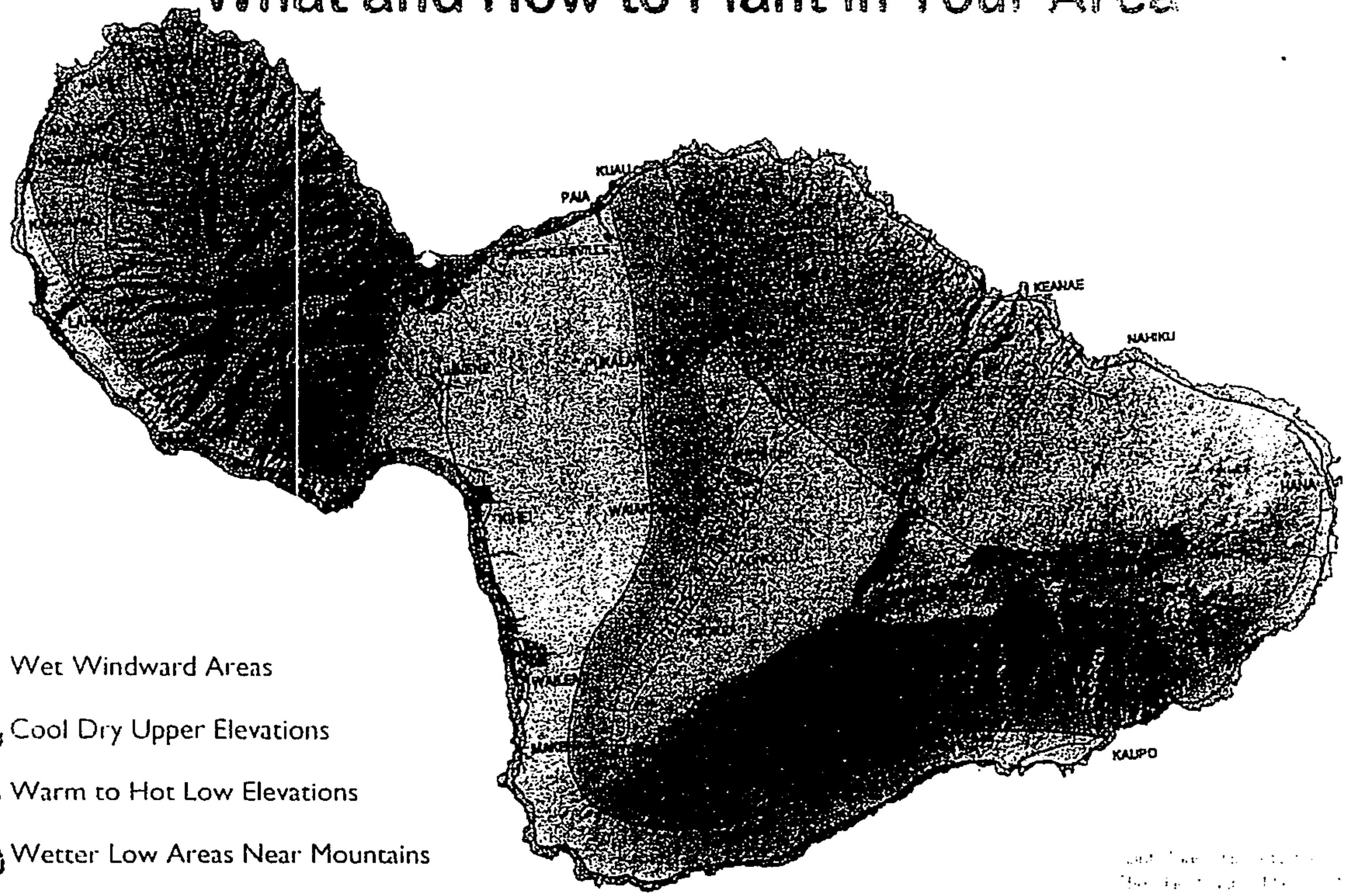
Another blossoming plant that may have resided in this area is the hopseed bush (Dodonaea viscosa) or known in Hawaiian as 'a'ali'i. This hard wood native shrub is indigenous to the islands. This plant also grows well in dryer climates. Ranging in heights of one to thirty feet, this shrub to tree is found growing in elevations up to 8,000 feet and wind swept open country. Today, 'a'ali'i is being used to reforest the island of Kaho'olawe. In the late 1960's and 1970's, the U.S. government used Kaho'olawe for missile testing. This caused the island's water plate to crack in half and thus not being able to retain water. However, the 'a'ali'i is doing well in growing and flourishing on the island.

Another plant that grew in the area is called huehue or 'inalua (Cocculus trilobus). This plant produced an extremely purple berry, which when collected and smashed would be used to dye kapa (bark cloth made from the wauke tree- Broussonetia papyrifera) with colors ranging from a deep dark purple hue to a light periwinkle.

DOCUMENT CAPTURED AS RECEIVED

Saving Water in The Yard

What and How to Plant in Your Area



1 Wet Windward Areas

2 Cool Dry Upper Elevations

3 Warm to Hot Low Elevations

4 Wetter Low Areas Near Mountains

5 Windward Coastal Salt Spray Zones

Tips From The Maui County Department of Water Supply

By Water All Things Find Life

ZONES

The Maui County Planting Plan has compiled a system of 5 zones of plant growth for Maui County. The descriptions of zones and maps for these zones are as follows:

Zone 1:

Wet areas on the windward side of the island. More than 40 inches of rain per year. Higher than 3,000 feet.

Zone 2:

Cool, dry areas in higher elevations (above 1,000 feet). 20 to 40 inches of rain per year.

Zone 3:

Low, drier areas, warm to hot. Less than 20 inches of rain per year. Sea level to 1,000 feet.

Zone 4:

Lower elevations which are wetter due to proximity of mountains. 1,000 to 3,000 feet.

Zone 5:

Salt spray zones in coastal areas on the windward side.

These zones are to be used as a general guide to planting for Maui County. In addition to looking at the maps, read the descriptions of the zones and decide which zone best fits your area. Plants can be listed in more than one zone and can be planted in a variety of conditions. For best results, take notes on the rainfall, wind, sun and salt conditions of your site. Use the zones as a general guide for selection and read about the plants to decide which best fits your needs as far as care and or function.

Plant Zone Map of Maui

Explanation of Plant Zone Map

PLACES TO BUY NATIVES ON:

Maui:

1.	**Hoolawa Farms** P O Box 731 Haiku HI 96708 The largest and best collection of natives in the state. They will deliver, but it's worth the drive to go and see! Will propagate upon request	575-5099
2.	**Kula True Value Nursery** Many natives in stock Get most of their plants from Hoolawa Farms They take special requests	878-2551
3.	**Kihei Garden and Landscape**	244-3804
4.	**Kihana Nursery, Kihei**	879-1165
5.	**The Hawaiian Collection** Specialize in Sandalwood propagation Will propagate special requests	878-1701

Zone-specific Native and Polynesian plants for Maui County

Zone 3

TYPE: F Fern G Grass Gr Ground Cover Sh Shrub P Palm S Sedge Tr Tree V Vine

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req
F	Psilotum nudum	moa, moa kula	1'	1'	sea to 3,000'	Dry to Wet
G	Colubrina asiatica	'anapanapa	3'	10'	sea to 1,000'	Dry to Wet
G	Eragrostis monticola	kalamalo	1'	2'	sea to 3,000'	Dry to Medium
G	Eragrostis variabilis	'emo-loa	1'	2'	sea to 3,000'	Dry to Medium
G	Fimbristylis cymosa ssp. spathacea	mau'u'aki'aki fimbristyls	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Boerhavia repens	alena	0.5'	4'	sea to 1,000'	Dry to Medium
Gr	Chamaesyce celastroides var. laehiensis	'akoko	2'	3'	sea to 1,000'	Dry to Medium
Gr	Cressa truxillensis	cressa	0.5'	1'	sea to 1,000'	Dry to Medium
Gr	Heliotropium anomalum var. argenteum	hinahina ku kahakai	1'	2'	sea to 1,000'	Dry to Medium
Gr	Ipomoea tuboides	Hawaiian moon flower, 'uala	1'	10'	sea to 3,000'	Dry to Medium
Gr	Jacquemontia ovalifolia ssp. sandwicensis	pa'u o hi'iaka	0.5'	6'	sea to 1,000'	Dry to Medium
Gr	Lipochaeta integrifolia	nehe	1'	0'	sea to 1,00'	Dry to Medium
Gr	Peperomia leptostachya	ala'ala-wai-nui	1'	1'	sea to 3,000'	Dry to Medium
Gr	Plumbago zeylanica	ilie'e	1'			
Gr	Sesuvium portulacastrum	'akulikuli, sea-purslane	0.5'	2'	sea to 1,000'	Dry to Wet
Gr	Sida fallax	'ilima	0.5'	3'	sea to 1,000'	Dry to Medium
Gr	Tephrosia purpurea var. purpurea	'auhuhu	2'	2'	sea to 1,000'	Dry to Medium
Gr - Sh	Hibiscus calyphyllus	ma'o hau hele, Rock's hibiscus	3'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta rockii	nehe	2'	2'	sea to 3,000'	Dry to Medium
Gr - Sh	Lipochaeta succulenta	nehe	2'	5'	sea to 1,000'	Dry to Wet
Gr - Sh	Lycium sandwicense	'ohelo-kai, 'ae'ae	2'	2'	sea to 1,000'	Dry to Medium
P	Cocos nucifera	coconut, niu	100'	30'	sea to 1,000'	Dry to Wet
P	Pritchardia hillebrandii	lo'ulu, fan palm	25'	15'	sea to 1,000'	Dry to Wet
S	Mariscus javanicus	marsh cypress, 'ahu'awa	0.5'	0.5'	sea to 1,000'	Dry to Medium

Zone 3

Zone-specific Native and Polynesian plants for Maui County

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Sh	Argemone glauca var. decipiens	pua kala	3'	2'	sea to 3,000'	Dry to Medium
Sh	Bidens molokaiensis	ko'oko'olau	1'	3'	sea to 1,000'	Dry to Medium
Sh	Bidens menziesii ssp. menziesii	ko'oko'olau	1'	3'		
Sh	Bidens micrantha ssp. micrantha	ko'oko'olau	1'	3'		
Sh	Chenopodium oahuense	'aheahea, 'aweoweo	6'		sea to higher	Dry to Medium
Sh	Dianella sandwicensis	'uki	2'	2'	1,000' to higher	Dry to Medium
Sh	Gossypium tomentosum	ma'o, Hawaiian cotton	5'	8'	sea to 1,000'	Dry to Medium
Sh	Hedyotis spp.	au, pilo	3'	2'	1,000' to 3,000'	Dry to Wet
Sh	Lipochaeta lavarum	nehe	3'	3'	sea to 3,000'	Dry to Medium
Sh	Osteomeles anthyllidifolia	'ulei, eluehe	4'	6'	sea to 3,000'	Dry to Medium
Sh	Scaevola sericea	naupaka, naupaka-kahakai	6'	6'	sea to 1,000'	Dry to Medium
Sh	Senna gaudichaudii	kolomona	5'	5'	sea to 3,000'	Dry to Medium
Sh	Solanum nelsonii	'akia, beach solanum	3'	3'	sea to 1,00'	Dry to Medium
Sh	Styphelia tameiameiae	pukiawe	6'	6'	1,000' to higher	Dry to Medium
Sh	Vitex rotundifolia	pohinahina	3'	4'	sea to 1,000'	Dry to Medium
Sh	Wikstroemia uva-ursi kauaiensis kauaiensis	'akia, Molokai osmanthus				
Sh - Tr	Broussonetia papyrifera	wauke, paper mulberry	8'	6'	sea to 1,000'	Dry to Medium
Sh - Tr	Myoporum sandwicense	naio, false sandalwood	10'	10'	sea to higher	Dry to Medium
Sh - Tr	Nototrichium sandwicense	kulu'i	8'	8'	sea to 3,000'	Dry to Medium
Sh-Tr	Dodonaea viscosa	'a'ali'i	6'	8'	sea to higher	Dry to Medium
Tr	Aleurites moluccana	candlenut, kukui	50'	50'	sea to 3,000'	Medium to Wet
Tr	Calophyllum inophyllum	kamani, alexandrian laurel	60'	40'	sea to 3,000'	Medium to Wet
Tr	Canthium odoratum	Alaha'e, 'ohe'e, walahe'e	12'	8'	sea to 3,000'	Dry to Medium
Tr	Cordia subcordata	kou	30'	25'	sea to 1,000'	Dry to Wet
Tr	Diospyros sandwicensis	lama	12'	15'	sea to 3,000'	Dry to Medium
Tr	Erythrina sandwicensis	wiliwili	20'	20'	sea to 1,000'	Dry
Tr	Metrosideros polymorpha var. macrophylla	ohi'a lehua	25'	25'	sea to 1,000'	Dry to Wet

Zone 3

Zone-specific Native and Polynesian plants for Maui County

Type	Scientific Name	Common Name	Height	Spread	Elevation	Water req.
Tr	Morinda citrifolia	Indian mulberry, noni	20'	15'	sea to 1,000'	Dry to Wet
Tr	Nesoluma polynesicum	keahi	15'	15'	sea to 3,00'	Dry
Tr	Nestegis sandwicensis	olopua	15'	15'	1,000' to 3,000'	Dry to Medium
Tr	Pandanus tectorius	hala, puhala (HALEUST)	35'	25'	sea to 1,000'	Dry to Wet
Tr	Pleomele auwahiensis	halapepe	20'			
Tr	Rauvolfia sandwicensis	hao	20'	15'	sea to 3,000'	Dry to Medium
Tr	Reynoldsia sandwicensis	'ohe makai	20'	20'	1,000' to 3,000'	Dry
Tr	Santalum ellipticum	coastal sandalwood, 'iliahi	8'	8'	sea to 3,000'	Dry to Medium
Tr	Thespesia populnea	milo	30'	30'	sea to 3,000'	Dry to Wet

Wildlife

Today, the area is rampant with wild deer. On many neighbor islands including many ʻili on Maui, the axis deer has uprooted many of the indigenous plants of the area. These deer contribute to the degradation of both the physical topographical features of the land as well as cause an environmental risk to the native habitat.

The wild boar has also caused its share in degrading the physical topographical features of the Maluaka ʻili and Honuaʻula ahupuaʻa in general. The wild boar and the axis deer have caused an increase in human traffic as both are prized hunting game. Many hunters ignore much of the natural vegetation and often times trample or destroy the native plants to access the game or to create markers for trails.

INTERVIEWS OF INFORMANTS

STATEMENT OF:
Pat A. Borge, Adult
Owner – Mākena Stables
Mākena Road, Mākena, Maui

Interviewed by telephone on January 17, 2005, at 7:45 p.m. He related that it would be difficult to contact him in person but, would give a statement by phone. He stated that he is familiar of the project area and has been to the ocean fronting the project on many *occasions*. He did not know the history of the area, but he insisted that even though a development is to take place on the site, access to the ocean for the public is very important. There are too many projects that are being built or already exist in Mākena that does not give the general public access to the ocean.

STATEMENT OF:
Robert "Bobby" K. Lu'uwai, Adult
Radar Tech. - U.S. Government
301 Kulalani Drive, Kula, Maui 96790

Interviewed by telephone on January 19, 2005, at 9:30 a.m. He related that he had been ill and would rather give an interview on the phone. He stated that he was born and raised in the Mākena area and could remember him and his parents spending time at Maluaka and Naupaka Beach. He also stated that he had no idea about cultural or spiritual customs taking place on this property. When he was a child, he recalls his parents telling him to be careful and not to play with stones from the area, and also not to listen to any voices because they would be harmed if they tried to find out where the voices were coming from. He understands that the project will not block access to the ocean because it is separated by the golf course and access to the ocean exists.

<u>**STATEMENT OF:**</u>

Mr. Edward Y. Chang Jr., Adult
Retired
4800 Mākena Alanui Road, Mākena, Maui
(Property fronts Maluaka and Kalaeloa Point)

<u>Interviewed at the Kukahiko Estate in Mākena on January 19, 2005, at 10:30 a.m.</u>

He related that he was born in Wailuku in 1932 and his family moved to Mākena in 1937 and, has lived there ever since. He stated that his ancestors had lived in Mākena for hundreds of years. He attended ʻUlupalakua School until the eighth grade, and then attended Lahainaluna High School. He went into the service and returned to Mākena where he started his family. He also states that he remembers Maluaka and Kalaeloa Point, as he and his family spent a lot of time there fishing over the years. This was one of the places where he had learned from his father how to live off the ocean. This area was noted for its bountiful schools of fish, and the name Maluaka depicts the translation of the area. He concluded that there were many types of Hawaiian cultural sites and burials. These were located on the former Lono-Buck property of the Puʻuōlaʻi side and mauka of this property which was formally owned by the Poepoe Family. There is also a pond or wet-land feature on the Lono-Buck property. He knew of the archaeological sites on the property but does not really know what it was used for with the exception of the platform that could have easily housed a kuʻula.

STATEMENT OF:
Dana Naone Hall, Adult
Cultural Practitioner
2087 Wells Street, Wailuku, HI 96793

Interviewed at her office on January 21, 2005, at 1:05 p.m. She related that she is very familiar with the area of study as she had on many occasions visited this parcel and knows exactly where it is. (She was also shown a picture of the study area). She had great concern about the Homeowners Recreation Building because of the fact that it is right next to a small, well-used park and it would encroach on the use of the park by Native Hawaiians and the public. The experience of Native Hawaiians and other current park users will be adversely affected by the height and overall size of the recreation building with its second story pools and open lanai angled toward the park. The only building in or near the park at present is a modest restroom facility for park users. The park is set within and bordered by the sand dune, the 19 foot-wide public access trail, park landscaping, kiawe trees, beach, rocky shoreline and the ocean. She is also concerned about the number of new residents and guests of the proposed luxury development, who would be competing for the limited shoreline resources. She feels that the size of the park should be increased and the Homeowners Recreation Building moved further away from the park. In addition, the current parking areas for the park and shoreline access should be increased. In her view these measures should be accommodated by the project in order to prevent displacing Native Hawaiians and other users from this important shoreline area. She also feels that while the project does not adjoin the shoreline that the new residents will use the coastal resources so that the developer should obtain the cooperation of the Mākena Resort in providing access to and along the shoreline in favor of Native Hawaiians and the public from the park to Onouli Beach. She recommended that the lone archaeological site on the property be preserved in place. She concluded that archaeological monitoring should occur during ground disturbing construction because this project is surrounded by significant archaeological sites.

STATEMENT OF:
Lisa Rotunno-Hazuka, Adult
Archaeologist – Archaeological Service of Hawaii
16 Market Street, Suite G, Wailuku, HI 96793

Interviewed at a job site on Ka'ahumanu Ave January 26, 2005, at 10:15 a.m.
She related that she is the archaeologist for this project and that she found some stone enclosures, but she strongly feels that it was constructed in the historical period by ranching ventures. She recommended that these sites be data-recovered and the information noted of its existence. Site #TS26 is a religious platform and she recommends that buffer zones be set and the site be preserved and protected. The area was most likely used for the worship of the fish god, *Ku'ula,* however, nothing was found on the platform. She will submit a report on her findings of this property.

STATEMENT OF:
Leslie Kuloloio, Adult
Self-Employed – Hawaiian Practitioner
469 Maalo Street, Kahului, HI 96732

Interviewed at the Hannibal Tavares Community Center in Pukalani on February 4, 2005 at 4:00 p.m. He related that he is well aware of the project and have grown up in the area of Mākena. His ancestors originated from this area. The name Maluaka is named for the sand beach that fronts the Maui Prince Hotel. The north side (Kahului side) of Pu'uōla'i, the beach and area is called Onouli, in front of this project is called Kalaeloa which fronts this project. He does not want to see this project to be built but the zoning was in for a long time and nothing can be done. He would like to see this project follow the mitigation measures agreed upon by himself, Dana and Isaac Hall to lessen the impact on the fishermen, park users and Native Hawaiians who use the area for sustenance. He also would like to see that when this project is built, lights will not be shone on the beach or the ocean because the fish needs night time environment to survive. He also said that lateral access to the ocean be kept open 24 hours a day for cultural and religious purposes of the Native Hawaiian people.

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements
(using State of Hawaii O.E.Q.C. methods)
Blessings, Weddings, Lectures
and Ho'oponopono

[illegible]
Seeking the knowledge to push us forward

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Makuka

PERSON INTERVIEWED: Pat A. Borge

DATE & TIME OF INTERVIEW: 1/19/05 – 7:46 pm.

INTERVIEWER: **CKM CULTURAL RESOURCE L.L.C. -** C. K. Maxwell

PURPOSE OF INTERVIEWE: **CULTURAL IMPACT ASSESSMENT**

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Pat A. Borge
Signature: Interview by Phone
Date: 1/19/05

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

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and Ho'oponopono

[illegible]
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Maluaka

PERSON INTERVIEWED: Robert "Bobby" K. Luuwai

DATE & TIME OF INTERVIEW: 1/17/04 3:55pm

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER. UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Robert L "Bobbie" K Luuwai
Signature: By Phone
Date: 1/17/04 3:65pm.

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

CKM CULTURAL RESOURCES. L.L.C.

Specializing in Cultural Impact Statements (using State of Hawaii O.E.Q.C. methods), Blessings, Weddings, Lectures and Ho'oponopono

[illegible]
(Seeking the knowledge to push us forward)

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Maluoka

PERSON INTERVIEWED: Edward Y Chang Jr.

DATE & TIME OF INTERVIEW: 9 Am 1/19/05

INTERVIEWER: **CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell**

PURPOSE OF INTERVIEWE: **CULTURAL IMPACT ASSESSMENT**

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS.

Person Interviewed Print name: Ed Y Cheng Jr.
Signature: Edward Y Chang Jr.
Date: 1/19/05

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place · Pukalani, Maui, HI 96768
Phone: (808) 572-8038 · Fax: (808) 572-0602 · Cell: 870-3345
Email: kale@moolelo.com · Website: www.moolelo.com

CKM CULTURAL RESOURCES, L.L.C.

Specializing in Cultural Impact Statements (using State of Hawaii O.E.Q.C. methods). Blessings, Weddings, Lectures and Ho'oponopono

INTERVIEW SUMMARY AND CONSENT FORM

JOB NAME: Makuaka

PERSON INTERVIEWED: Dana Naone Hall

DATE & TIME OF INTERVIEW: ____________

INTERVIEWER: CKM CULTURAL RESOURCE L.L.C. - C. K. Maxwell

PURPOSE OF INTERVIEWE: CULTURAL IMPACT ASSESSMENT

I HEREBY GIVE PERMISSION TO CKM CULTURAL RESOURCES L.L.C., TO USE, THE INFORMATION FROMTHIS INTERVIEW IN PREPARING A CULTURAL IMPACT ASSESSESMENT REPORT FOR THE SUBJECT PROJECT. I FURTHER UNDERSTAND THAT I WILL BE GIVEN A COPY OF MY COMMENTS, subject to review by the signatory and approval

Person Interviewed Print name: ____________
Signature: Dana Naone Hall
Date: 1:21 pm 1:05 pm.

Kahu Charles Kauluwehi Maxwell, Sr.
157 Alea Place - Pukalani, Maui, HI 96768
Phone: (808) 572-8038 - Fax: (808) 572-0602 - Cell: 870-3345
Email: kale@moolelo.com - Website: www.moolelo.com

Maluaka
(Fish Shelter)

TMK 2-1-06:37 & 56, Parcel H-1 10.9 acres, 71 Unit Condominium & TMK 2-1-05:84, 2 acres for a retention basin, Maluaka (Mäkena) Honua'ula, Makawao, Maui, Hawai'i

CONCLUSION

This prestigious and serene landscape of Honua'ula's coastline proves to have every sense of the tropical paradise individuals may seek. There is, however, a great need of care for an area like this which demands much needed attention. Due to many historical and cultural findings, Maluaka and its surrounding 'ili combined, created a great fishing village. So much that the State of Hawai'i has sought to codify the area as a conservatory for the fishes of the area, designating it as The 'Ähihi-Kïna'u Natural Area Reserve.

Based on the translation of Maluaka, it indeed would be a great move to preserve the fish in this particular area, primarily because it is where fish spawn and create new generations of fishes.

Its topographical features are rough and hard, however, it is amongst a water source. This land that is pummeled by the Moa`e winds is indeed a special place.

There are two significant archaeological sites found on this project which have been given the site numbers 5706 and 5711. Site 5706 is a Native Hawaiian burial and has the significance assessment of Criterion "E" and Site 5711 is a ceremonial Ku'ula (Ko'a) and related features including a minor platform and terrace and has the significance assessment of Criterion "D" and "E". Criterion "D", means it has yielded, or is likely to yield, information important for research on prehistory or history, and Criterion "E", means having an important value to the Native Hawaiian people of the State of Hawaii due to associations with traditional beliefs, events or oral accounts. These associations are important to the group's history and cultural identity. The sites are also believed to be prehistoric.

MITIGATING MEASURES

KEAKA L.L.C. has addressed the comments made by informants Dana Hall and Leslie Kuloloio and addressed their concerns on the impact of this project on the Maluaka area. Refer to Item #3, mitigating measures. All seven points of concern have been completed.

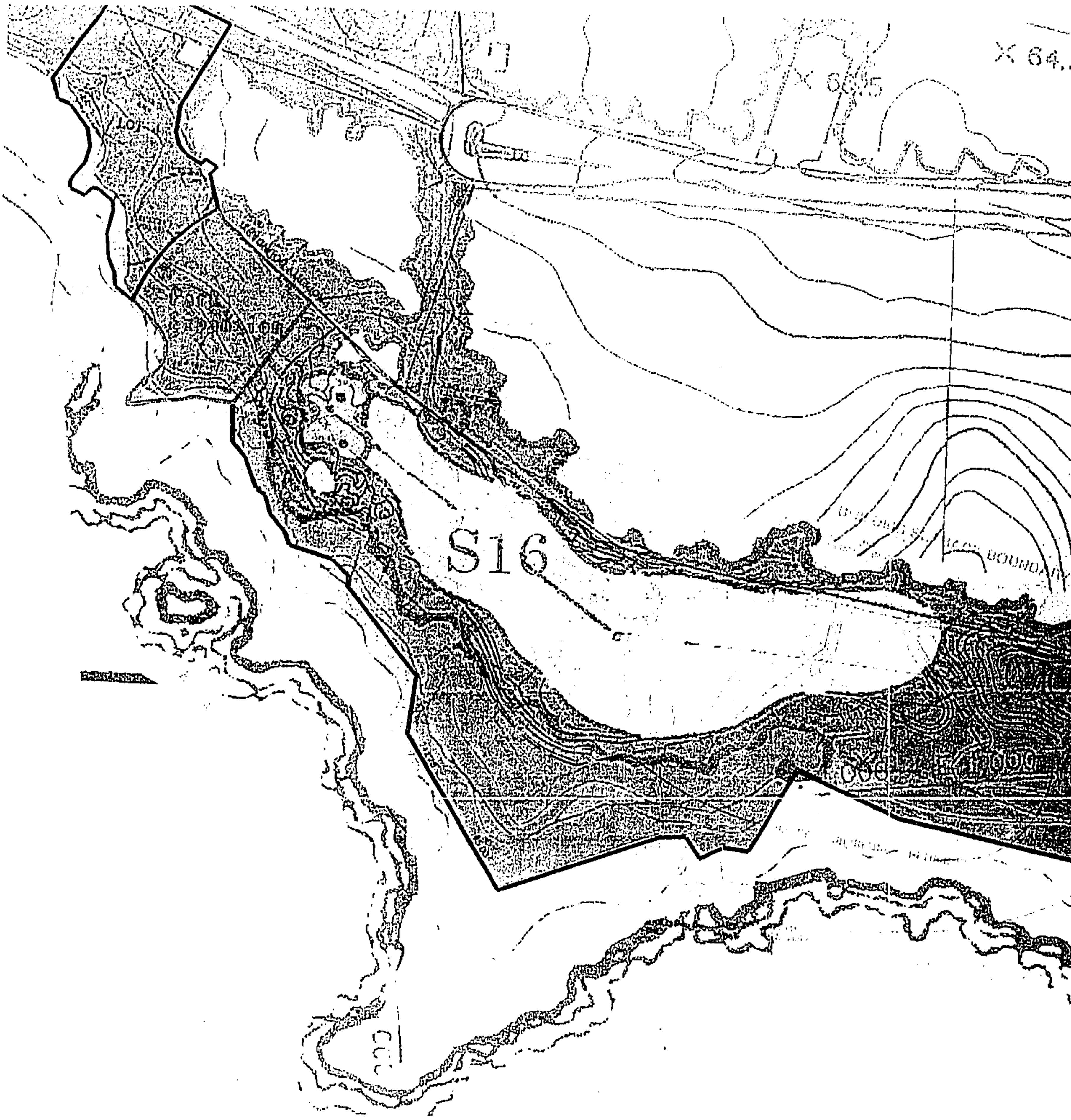
Refer to Map #1 which shows the Maluaka Park expansion and the lateral shoreline access along the beach of this project.

Refer to Map #2 which shows additional parking stalls for people accessing Maluaka Beach.

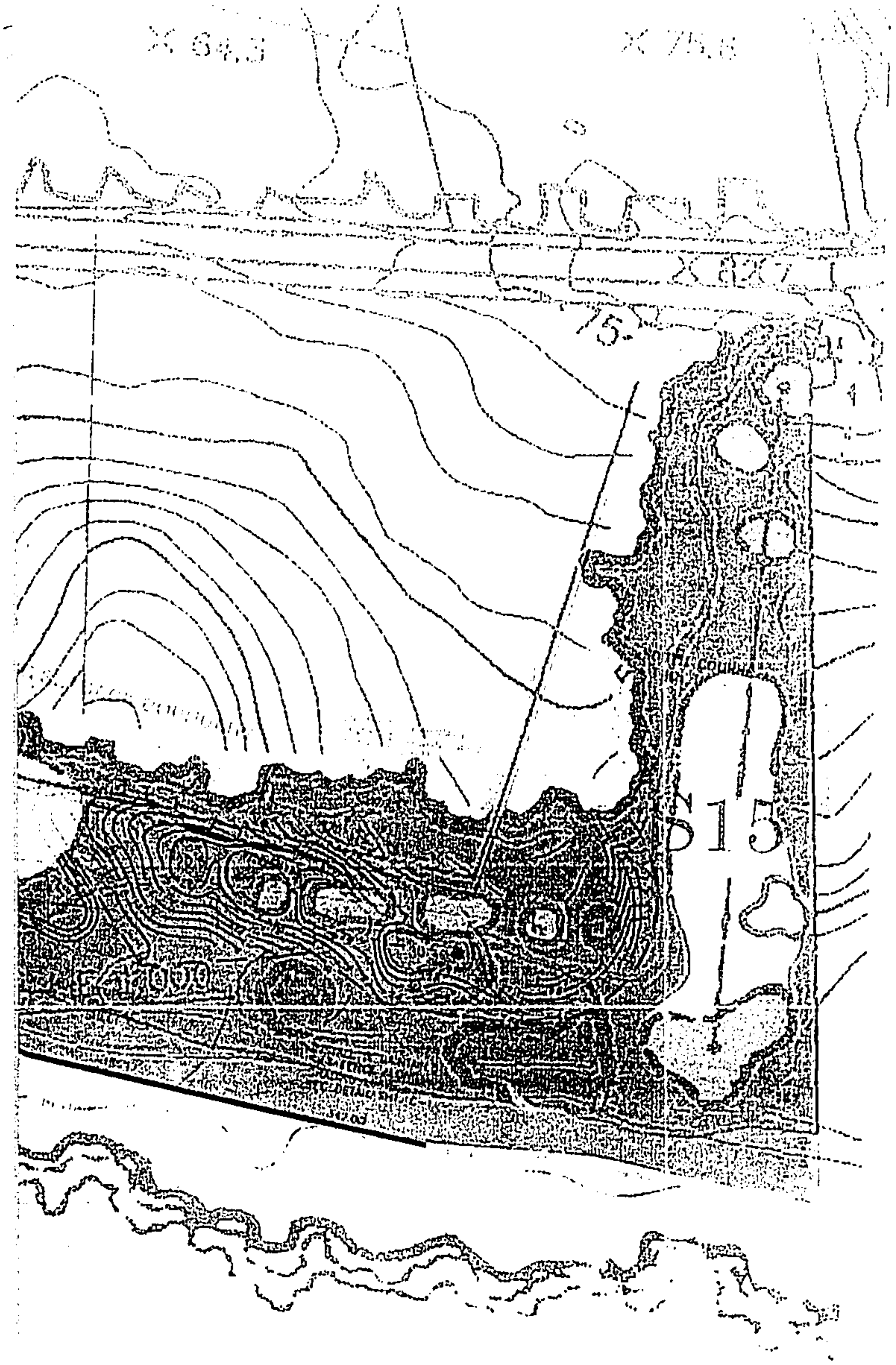
KEAKA L.L.C has also preserved in place the Native Hawaiian burial site and ceremonial Ku`ula and related features. Refer to the ``Project Site Plan which shows the Burial Preservation Site and the in place preservation of the ceremonial site and related features.

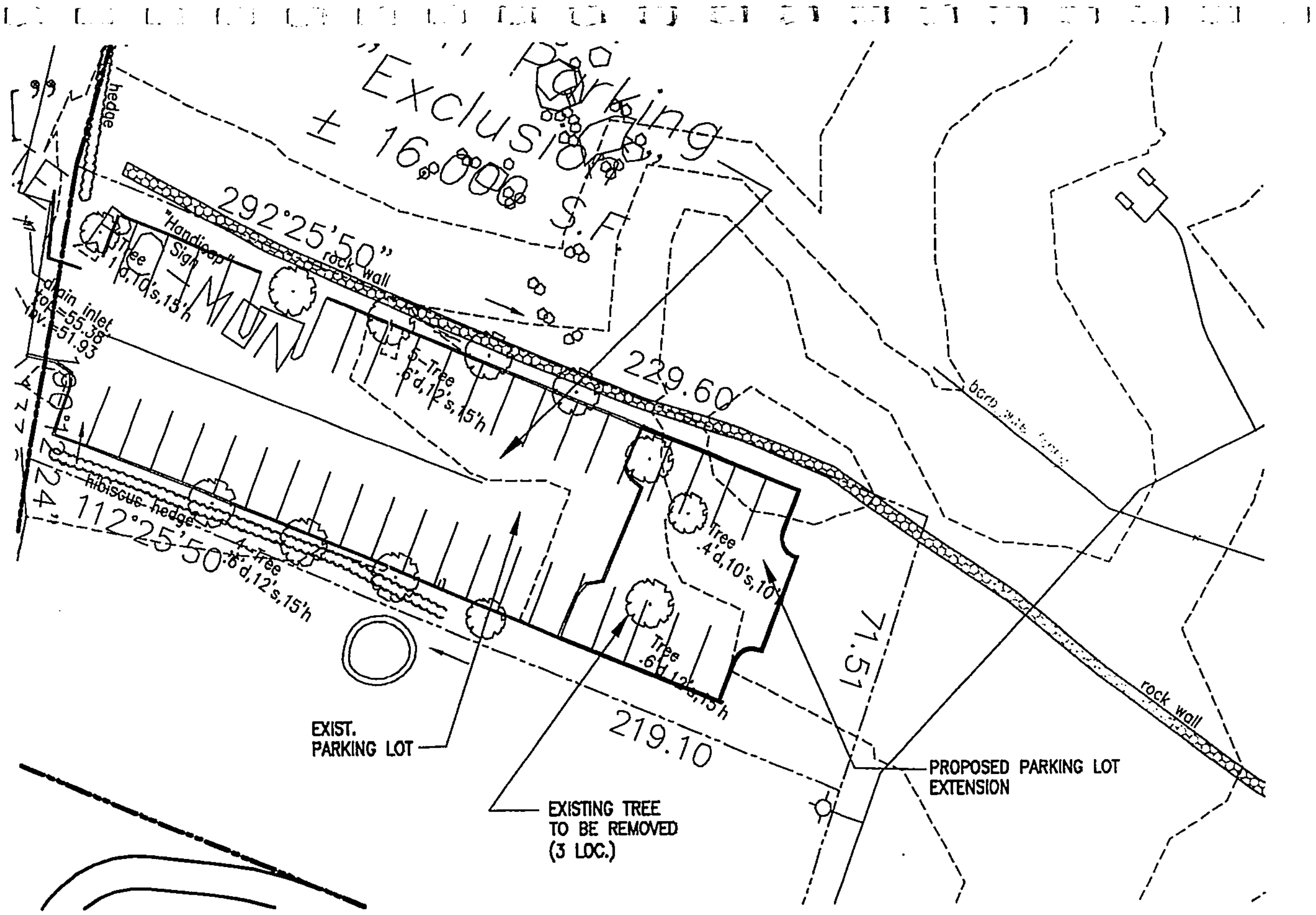
Item #3 Mitigating Measures

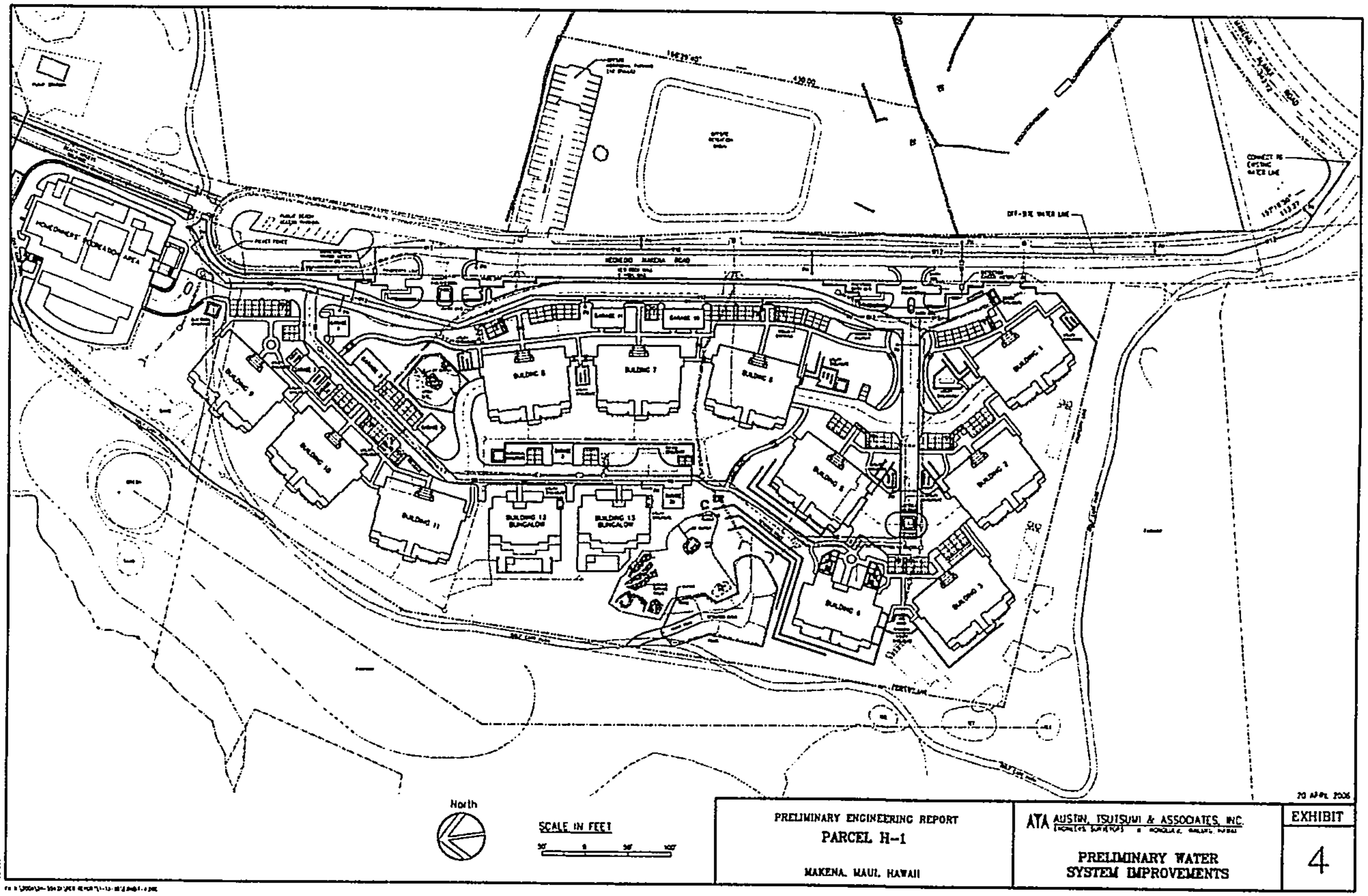
- To redesign the pool and pool deck in order to more than double the distance between the park boundary and the recreation building.
- To provide a landscape easement in the area between the golf cart path along the north side of the recreation building and the park boundary.
- To relocate the golf cart path further away from the park.
- To add 10 parking stalls to the existing 30 stall beach parking lot.
- Encourage and work with Seibu to create a pedestrian easement from the existing park to the beach to the south of the park.
- To preserve in place the Native Hawaiian burial site and ceremonial site and related features.
- To hire an archaeologist to monitor the site work construction.


S16

DOCUMENT CAPTURED AS RECEIVED



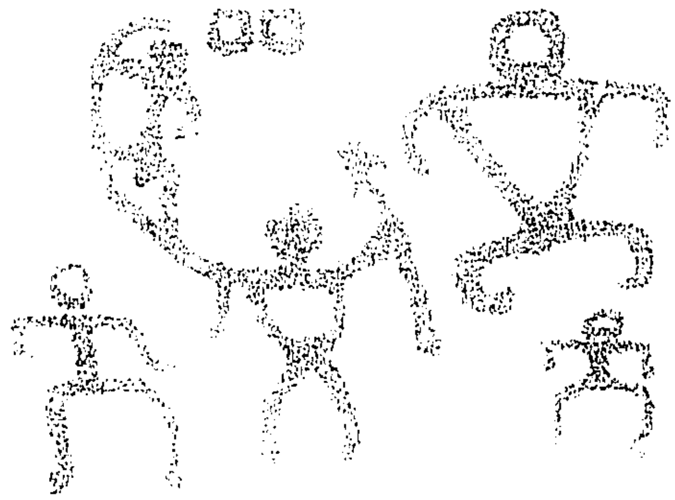

"Exclusive Parking"
± 16,000 S.F.
292°25'50"
rock wall
hedge
"Handicap" Sign
Tree
229.60
5-Tree .6'd,12's,15'h
Tree .4'd,10's,10'h
Tree .6'd,12's,15'h
4-Tree .6'd,12's,15'h
hibiscus hedge
112°25'50"
71.51
219.10
rock wall
drain inlet
EXIST. PARKING LOT
EXISTING TREE TO BE REMOVED (3 LOC.)
PROPOSED PARKING LOT EXTENSION



HOMEOWNERS' RECREATION AREA
MAKENA ROAD
OFF-SITE WATER LINE
CONNECT TO EXISTING WATER LINE
BUILDING 1
BUILDING 2
BUILDING 3
BUILDING 4
BUILDING 5
BUILDING 6
BUILDING 7
BUILDING 8
BUILDING 9
BUILDING 10
BUILDING 11
BUILDING 12 BUNGALOW
BUILDING 13 BUNGALOW
North
SCALE IN FEET
20 APRIL 2006
PRELIMINARY ENGINEERING REPORT
PARCEL H-1
MAKENA, MAUI, HAWAII
ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
PRELIMINARY WATER
SYSTEM IMPROVEMENTS
EXHIBIT
4

State Historic Preservation Division

PROTECTING N
ATIVE HAWAIIAN BURIALS



For at least two thousand years, native Hawaiians have placed the earthly remains and spirits of their "kupuna," or ancestors, within the landscapes of Hawai'i.

When a departing kupuna was laid to rest there was never a doubt that their remains would empower their descendants until they themselves were reduced to earth. Some kupuna were covered by stacked stones while others were buried with no surface markers at all, frequently in sand dunes.

Remains of high chiefs or those kupuna of high honor often were interred at night to conceal their location from jealous rivals who might steal and degrade or otherwise use the spiritual power of the remains for personal gain.

Because of these cultural practices, ancestral bones can be found almost anywhere in Hawai'i today. Burial sites are often accidentally disturbed either by nature (high surf or erosion) or by human activity through projects that involve excavation.

If you discover a burial site: stop activity in the immediate area; leave remains in place; contact the State Department of Land and Natural Resources, Historic Preservation Division and your County Police Department. Reporting a burial site disturbance is required by law (Hawai'i Revised Statutes, Chapter 6E) and severe penalties could result when SHPD is not notified of such disturbance.

Let us all continue to give these ancestors the dignity and respect they deserve.

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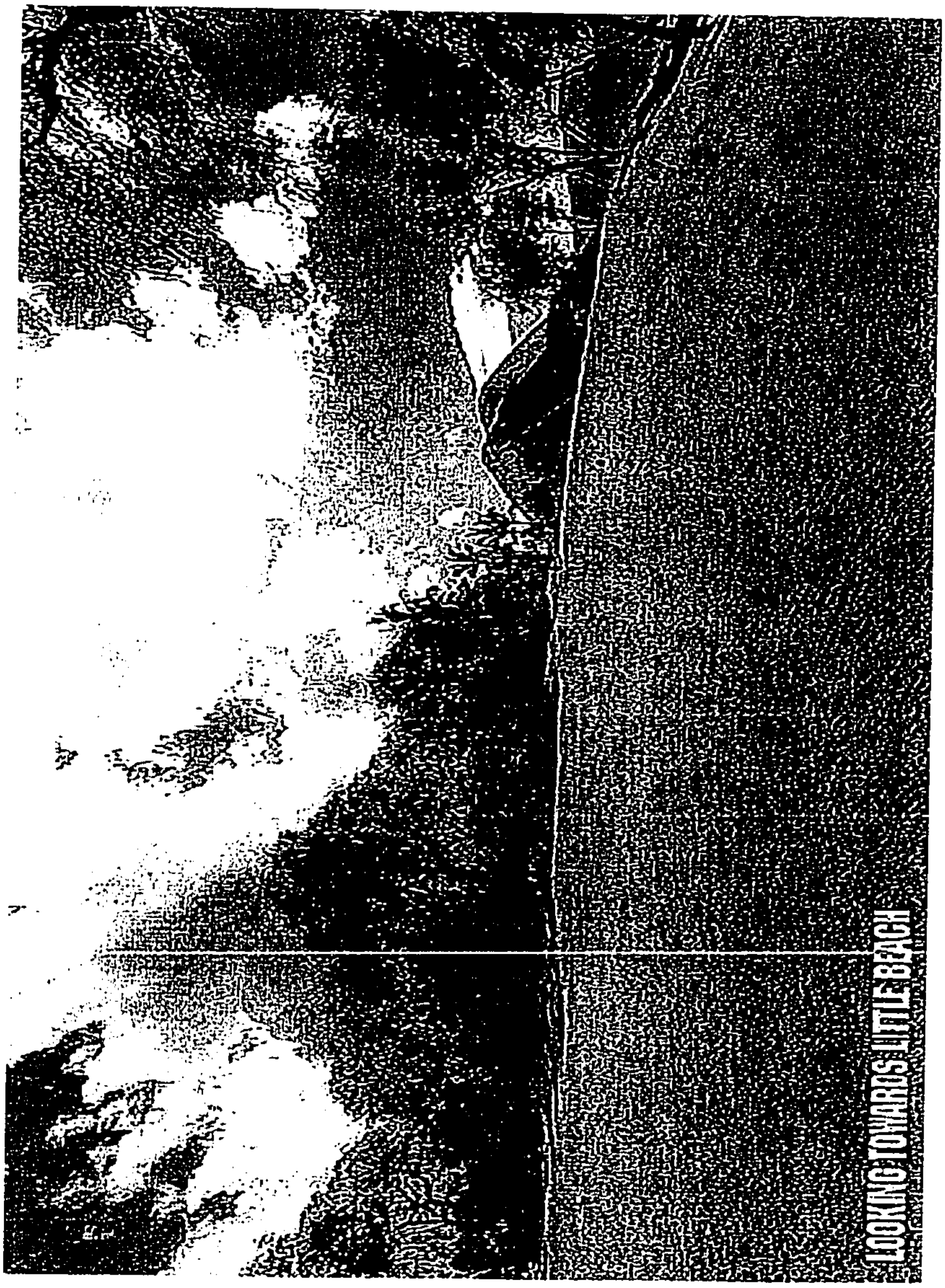
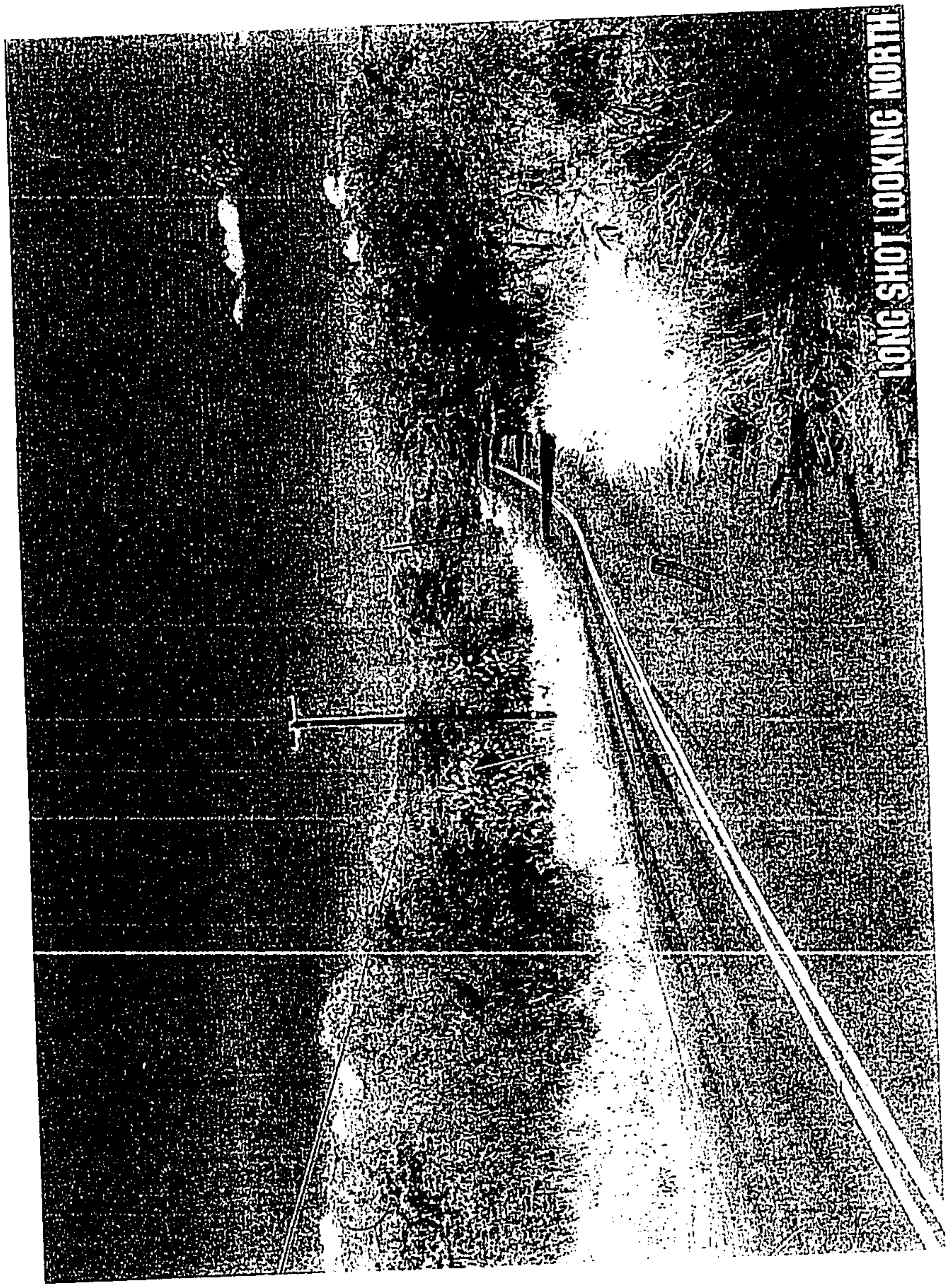
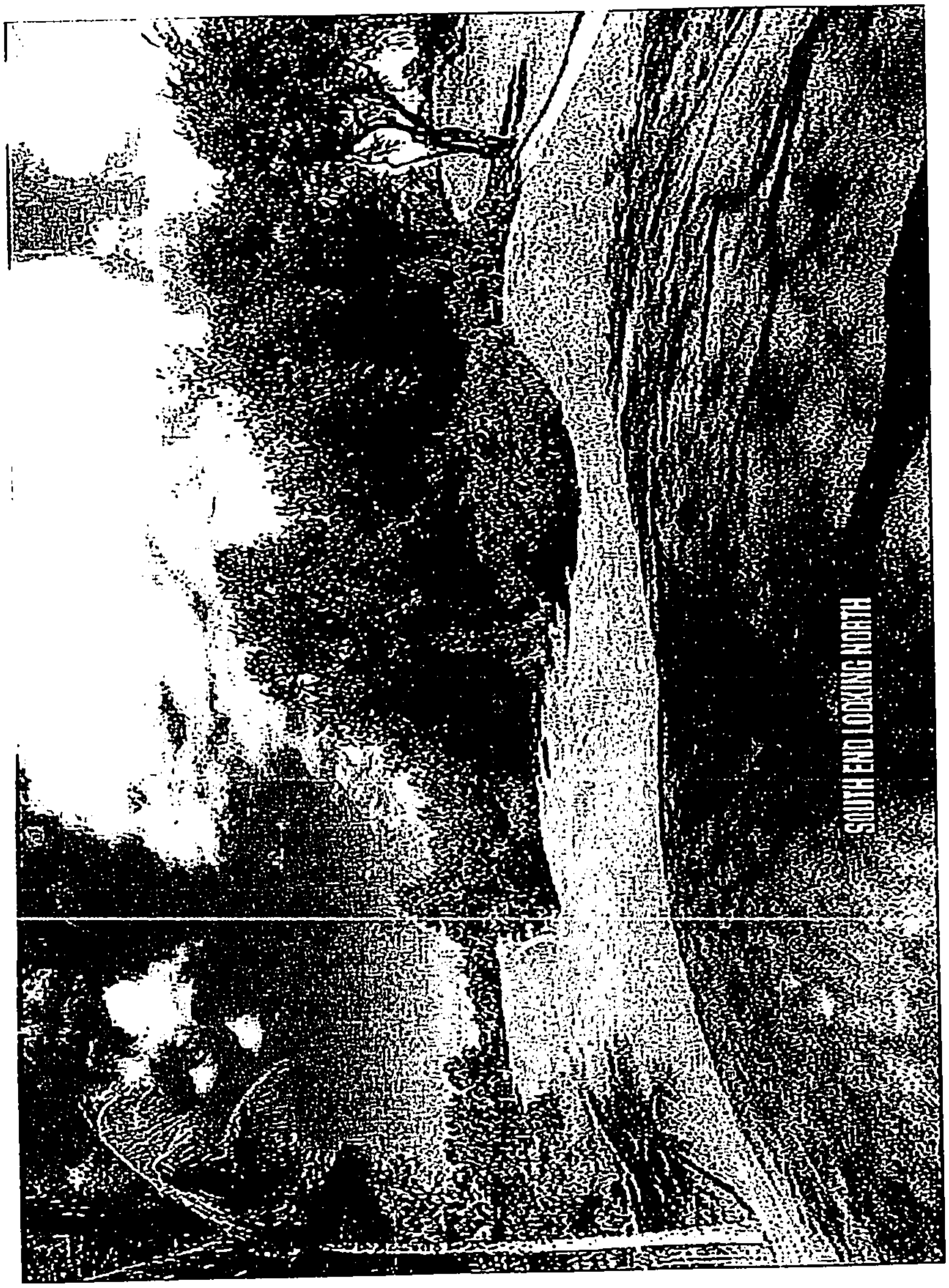
Ke Au Okoʻa, April 1865 – March 1873

Ka Hoku O Hawaiʻi, May 1906 – 1948


LOOKING TOWARDS LITTLE BEACH


LONG SHOT LOOKING NORTH


SOUTH END LOOKING NORTH

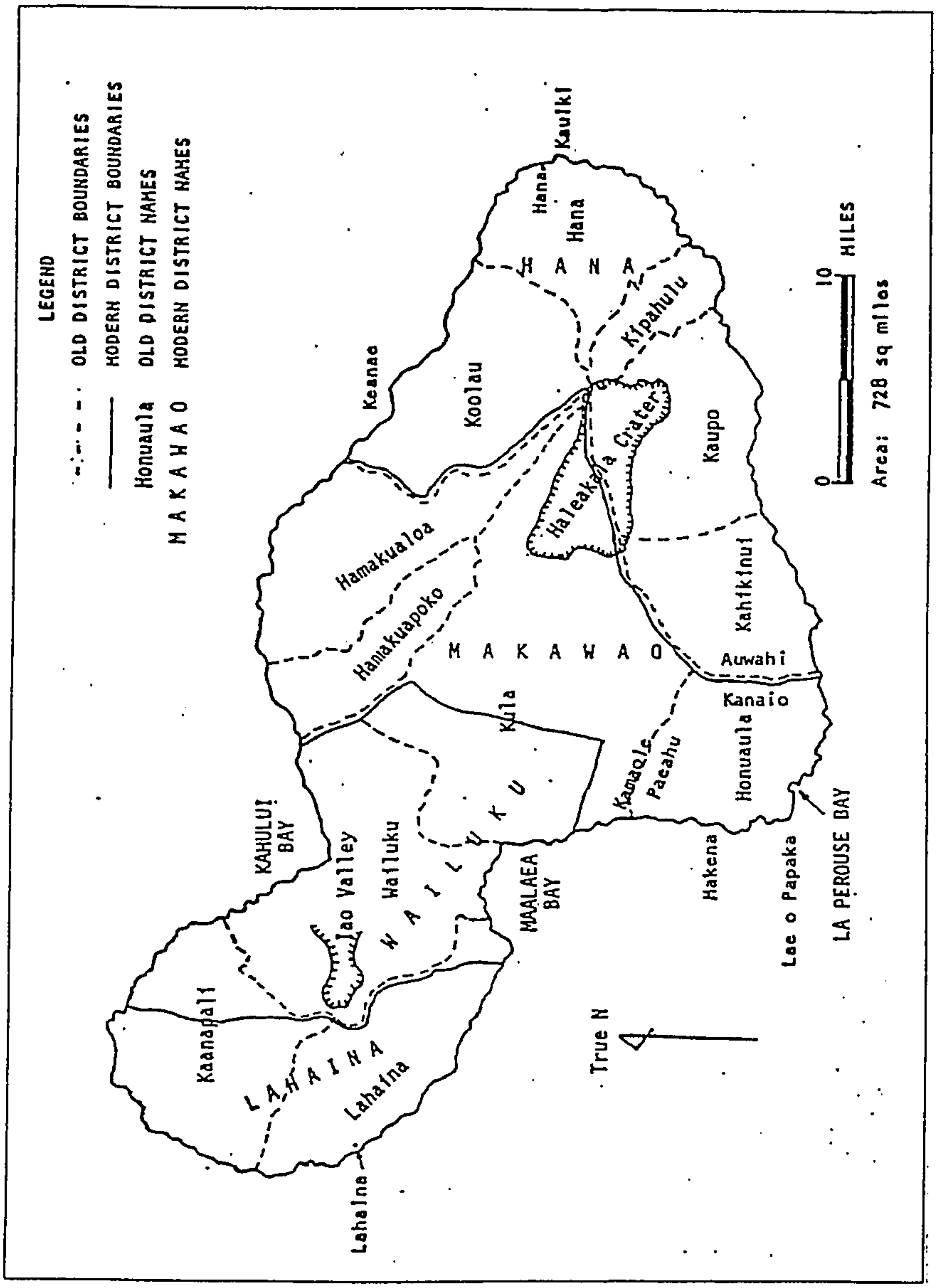
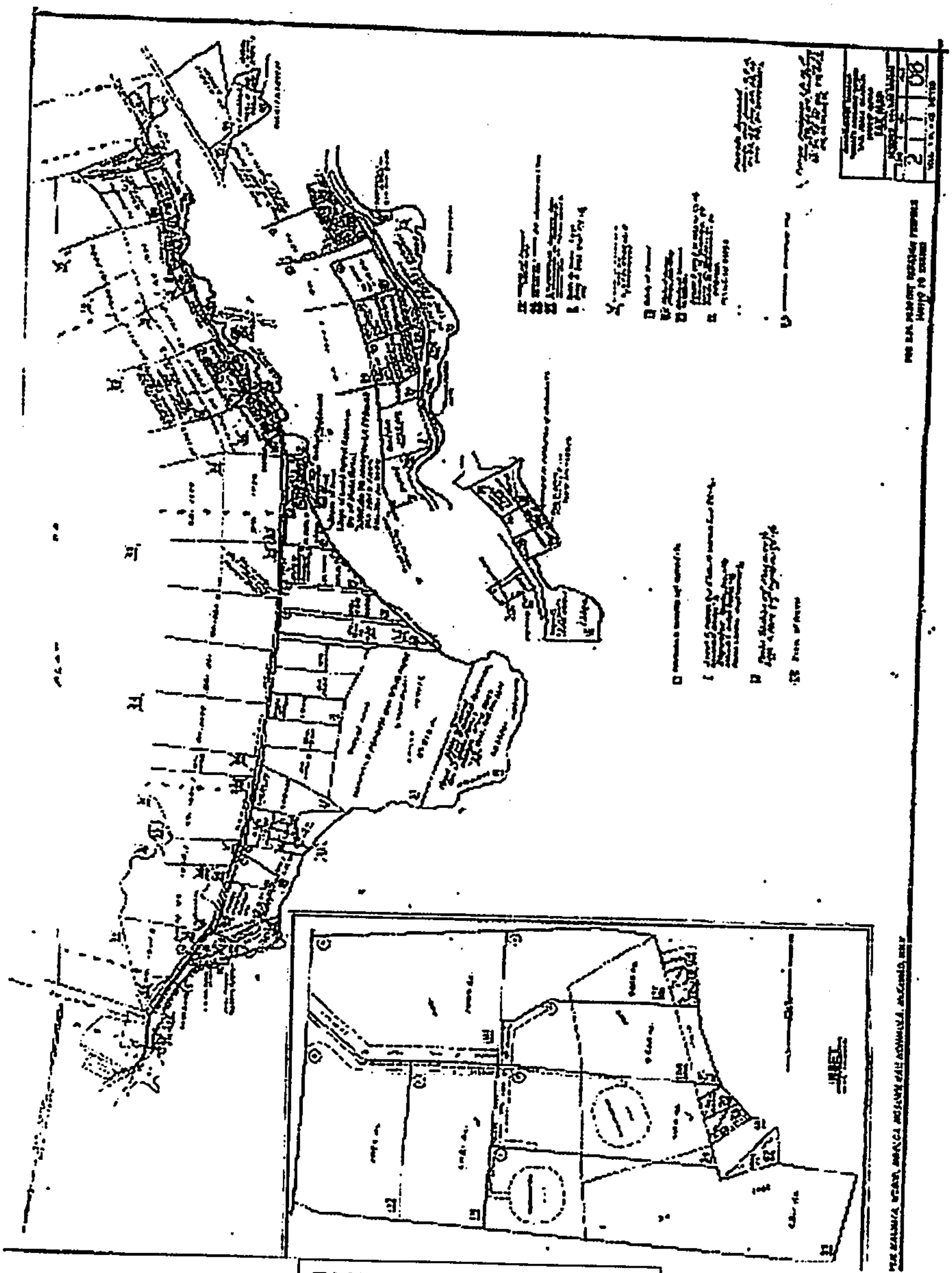


Figure B-1. Ancient and Modern Districts of Maui (from Barrere 1975)

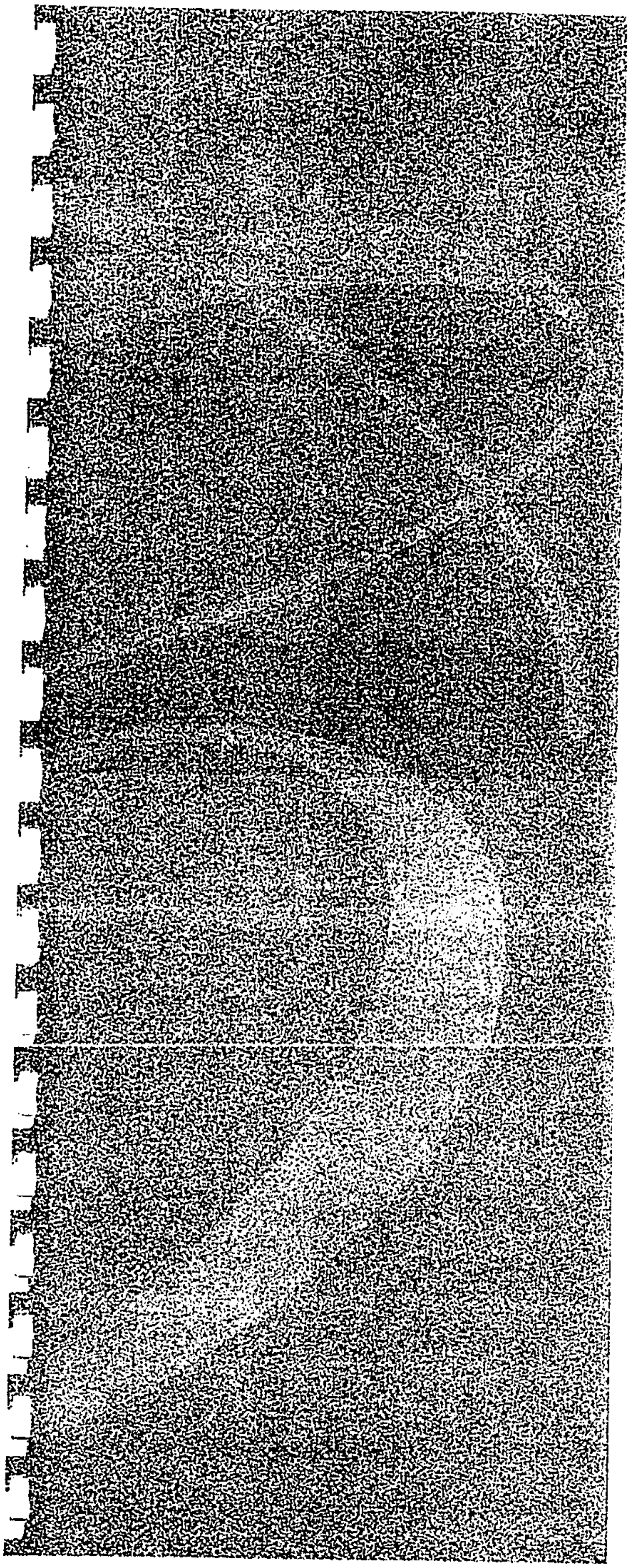
Ancient and Modern Districts of Maui



T.M.K. 2-1-06:37 & 56, 2-1-05:84

Appendix J

Economic and Fiscal Impacts Study



Report to

Dowling Company, Inc.

Covering the

KEAKA CONDOMINIUM ECONOMIC AND FISCAL IMPACTS

As of July 2006

JOHN CHILD & COMPANY
APPRAISERS & CONSULTANTS

JOHN CHILD & COMPANY
APPRAISERS & CONSULTANTS

July 24, 2006

Karen Char, MAI, CRE
Paul D. Cool, MAI, CRE
Shelly H. Tanaka
Elie E. Kato
Tammy Walther

Mr. Don Fujimoto
Dowling Company, Inc.
2005 Main Street
Wailuku, Hawaii 96793

Dear Don,

Re: Keaka Impact Assessment

At your request, John Child & Company has completed an economic and fiscal impact assessment for the proposed Keaka condominium project. This letter and the accompanying analysis and exhibits summarize our findings. Supporting documentation is available in our workfiles.

SITE AND PROJECT DESCRIPTION

Dowling Company, Inc. (DCI) owns the fee simple interest in a 10.903-acre site on the westerly (makai) side of the Keoneoio-Makena Road in the Makena Resort (tax map key 2-1-06:37 and 56 of the Second Taxation Division). The site is separated from the ocean by the 15th and 16th fairways of the Makena Resort South Course. The site is designated for hotel use on the Kihei-Makena Community Plan and zoned H-M, Hotel District.

DCI, through its affiliate Keaka LLC, propose to develop a luxury condominium development to be known as Keaka. The proposed Keaka development will include 71-unit luxury condominium distributed over 13 one to five-story buildings. The proposed unit mix is shown as follows:

Bedrooms	Total
2	2
3	68
Interim spa	1
Total	71

Keaka is projected to be marketed and sold over a one- to two-year period.

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DCI is in the process of securing the necessary County approvals for the development. As a part of this process, you have asked us to assist you by completing an analysis of the economic and fiscal impacts associated with the proposed development.

STUDY OBJECTIVES AND PURPOSE

The objectives of our assistance are to assess the economic and fiscal impacts of the proposed Keaka condominium development, including the effects on expenditures, household income and employment, and government revenues and expenditures.

The purpose of our assistance is to provide economic and fiscal impact assessments for internal use and decision-making by Dowling Company, Inc.

As a result, this report is intended for the sole and exclusive use of Dowling Company, Inc. In accepting this report, the client specifically agrees that our assistance is not intended for any other purpose or users and is not to be relied upon by any third parties for any purpose, whatsoever.

EFFECTIVE DATE OF REPORT

The effective date of this report is July 17, 2006.

OVERVIEW OF POPULATION AND HOUSING CHARACTERISTICS

The Keaka project site is in the resort area of Makena/Wailea. The Makena/Wailea area consists of a portion of Census Tract 303.02, as shown in Exhibit A.

The population and housing characteristics for this area are unique and vary significantly from other Maui residential neighborhoods. The Makena/Wailea population is generally older, with smaller average household size and proportionately fewer school aged children per household than the rest of Maui County. The Makena/Wailea community is also a transient community with a large percentage of housing used for seasonal, recreational, or occasional use.

The demographics for the County of Maui and Makena/Wailea are discussed under the following subheadings.

Population, Age, and Households

In 2000, the population of Maui County totaled 128,094. The Makena/Wailea area comprised about 0.9% of the population or 1,141 residents. In 2005, the estimated resident population of Maui County totaled 140,050. [1] A 2006 population estimate for Makena/Wailea was not available.

Based on the 2004 State of Hawaii Databook, the de facto population for Maui County, which includes island visitors, is estimated to be 168,439 in 2000 and 184,922 in 2006.

Makena/Wailea residents are typically older than Maui County residents. The median age in the Makena/Wailea area is about 49, about twelve years older than the median age for Maui County.

In 2000, the number of households within Maui County totaled 43,507. At that time the Makena/Wailea area comprised 1.3% of the households in Maui County or 566 households.

The average household size in Makena/Wailea is generally smaller than the rest of Maui County. In 2000, households in the Makena/Wailea area average about 1.2 persons, while the average household size for Maui County is about 3.0 persons.

Children

According to the 2000 U.S. Census, the percentage of Maui County households with children is about 39%. In contrast, the percentage of Makena/Wailea households with children is about 11%. About 75% of the children are school aged (between the age of 5 and 17). The average number of school aged children per household for Maui County and Makena/Wailea is 1.4.

A comparison of Maui County and Makena/Wailea demographics is shown as follows:

Demographic	Maui County	Makena/ Wailea
Population	128,094	1,141
Median age	37	49
Households	43,507	566
Average household size	3.0	1.2
Percent of households with children	39%	11%

[1] Socio-Economic Forecast The Economic Projections for the Maui County General Plan 2030, County of Maui, Planning Department, Long Range Division, June 2006.

Housing Characteristics

According to the 2000 U.S. Census, there are approximately 1,861 housing units in Makena/Wailea and 56,377 units in Maui County. The vacancy rate for Makena/Wailea is 70% compared to 23% for Maui County, shown as follows:

Occupancy and vacancy rates for Makena/Wailea and Maui County

	Makena/Wailea		Maui County	
	Total	Percent	Total	Percent
Occupied	566	30%	43,507	77%
Vacant	1,295	70	12,870	23
Total	1,861	100%	56,377	100%

The majority vacant units are used for seasonal, recreational, or occasional purposes. In Makena/Wailea, 94% of all vacant units are used for such purposes.

ECONOMIC IMPACTS

This section describes the expected direct, indirect, and induced impacts of the Keaka condominium project in terms of construction expenditures, employment, and additional household income. [1]

CONSTRUCTION EXPENDITURES

The Keaka condominium project will generate direct, indirect, and induced expenditures in Hawaii as a result of the construction.

[1] The economic impacts associated with the proposed Keaka condominium project are based on the 2002 Input-Output (I-O) study prepared by the State of Hawaii, Department of Business, Economic Development and Tourism (DBEDT).

Direct Construction Expenditures

The direct impact of the proposed Keaka project is measured by the total construction expenditures injected directly into the State's economy during the build out and marketing phases. The construction period is projected at about 48 months. The annual construction expenditures are projected to range from about $6.1 million to $98.6 million and total about $220.2 million, shown as follows:

Projected Construction Expenditures

Construction period (years)	Costs Hard	Soft	Total
1	$29,000	$6,100,000	$6,129,000
2	3,000	22,900,000	22,903,000
3	76,400,000	16,200,000	92,600,000
4	77,000,000	21,600,000	98,600,000
Total	153,432,000	66,800,000	220,232,000

Indirect and Induced Expenditures

The direct construction expenditures will create additional expenditures in other industries. These expenditures are an indirect effect. Based on multipliers reported by DBEDT, every $1 in construction spending generates another $0.44 of indirect expenditures in other industries. Therefore the total $220.2 million in direct construction expenditures is projected to create another $97.6 million in sales in other industries.

A change in direct and indirect expenditures induces changes in household spending or personal consumption expenditures. The induced effects are calculated based on the multipliers also reported by DBEDT. The induced expenditures are projected to total about $117.6 million over the construction period.

Total Construction Expenditures

As a result, the direct, indirect and induced expenditures created by the Keaka condominium project is projected to total about $435.4 million, as shown as follows:

Direct	$220,200,000
Indirect	97,600,000
Induced	117,600,000
Total	$435,400,000

LONG-TERM EXPENDITURES

The proposed Keaka condominium project will generate long-term expenditures for the maintenance of the building and grounds and the service of owners and guests. Based on similar condominium projects, the annual expenditures for Keaka are projected at about $1.5 million annually. The $1.5 million in direct expenditures are projected to generate about $1.4 million in indirect and induced expenditures.

TOTAL EXPENDITURES

The construction of the Keaka condominium project will generate about $435.4 million in direct, indirect, and induced expenditures. The long-term expenditures created from the maintenance and servicing of the project will generate about $2.9 million in direct and indirect expenditures annually, shown as follows:

Projected Expenditures from the Keaka Condominium Project

	Employment tenure	
	Construction	Long-term (annually)
Projected output (expenditures)		
Direct	$220,200,000	$1,500,000
Indirect and induced	215,200,000	1,400,000
Total	$435,400,000	$2,900,000

EMPLOYMENT IMPACTS

The DBEDT I-O Study projects the number of full-time, part-time, and self-proprietor jobs created from a $1.0 million change in output.

The Keaka condominium project will create short-term employment during the construction of the project and create long-term employment opportunities for the maintenance of the project and service of the owners and guests.

Construction Employment

The impact of the construction of the Keaka condominium project is summarized under the following subheadings:

Direct Construction Employment

Direct construction employment includes construction workers as well as professional, managerial, sales and clerical workers who may be employed elsewhere in the State.

The DBEDT I-O study show the direct effect of a $1 million of multi-family construction spending dollars creates 7.2 full-time and part-time construction related jobs. Based on the estimated construction expenditures, a total of about 1,575 full-time and part-time jobs are created during the three year construction period.

Indirect and Induced Employment

According to the DBEDT I-O study, an additional 7.7 jobs would be created in other industries as a result of every $1.0 million in construction. Based on these indirect and induced multiplier effects, about 1,615 jobs would be created during the construction period.

Total Employment Impacts During the Construction Period

Based on the projected construction expenditures and multiplier effects applicable to the construction industry, a total of about 3,190 direct, indirect and induced jobs will be created during the construction period.

Long-Term Employment Impacts

The Keaka condominium project would create permanent or long-term employment opportunities in building maintenance and management, outdoor landscaping and administrative fields. The long-term employment projections are based on projected costs at comparable Wailea condominium projects and the DBEDT I-O Study. Fourteen long-term employment positions are projected to be generated from the Keaka condominium project.

Based on DBEDT multipliers, the indirect and induced employment from the Keaka condominium project is projected at about nine jobs annually.

Total Employment Impacts

The projected employment from the construction is projected at about 3,190 new jobs. The long-term jobs created by Keaka are projected to total about 23 jobs annually, shown as follows:

Employment Impacts from the Keaka Condominium Project

	Employment tenure	
	Construction	Long-term (annually)
Projected new jobs		
Direct	1,575	14
Indirect and induced	1,615	9
Total	3,190	23

HOUSEHOLD INCOME

Income impacts from the Keaka condominium project measure the effect of the development on household income consisting of wages, salaries, and self-employment income.

Income impacts directly affect the State income tax revenue base and indirectly affect the State's general excise tax base as an increase in household income generally results in an increase in consumption.

Construction Income

The income impacts from the Keaka construction are estimated as follows:

Direct Income Impact

Household income associated with the construction industry is projected to represent about $0.29 of every dollar of construction expenditures. Based on the projected construction budget, the direct household income from the project is projected to total about $63.4 million.

Indirect and Induced Income

Indirect and induced income impacts represent the household income change in other sectors of the economy resulting from the Keaka condominium construction. Based on multipliers reported by DBEDT, an additional $66.8 million in indirect and induced income effects are projected.

Total Construction Employment Income

The projected construction employment would create $63.4 million in direct household income. The total effect on income from the Keaka Condominium construction is projected to total $130.2 million.

Long-Term Employment Income

The income impacts from the construction period would cease after the development is completed; however, additional income impacts would result from the long-term maintenance of the condominium project. The direct household income impact from the Keaka project could generate about $430,000 annually.

Based on multipliers reported by DBEDT, the indirect and induced effects would result in an additional $390,000 employment income. The total annual long-term employment impact is about $820,000.

Total Income Impacts

The total impact of the Keaka condominium project on household income is projected to be about $130,200,000 for the construction period. The long-term income impact is projected at about $820,000 annually, as shown as follows:

Impact of Keaka on Employment Income

	Employment tenure	
	Construction	Long-term (annually)
Direct	$63,400,000	$430,000
Indirect and induced	66,800,000	390,000
Total	$130,200,000	$820,000

PROJECTED ECONOMIC IMPACTS

Development of Keaka condominium project is projected to produce the following direct, indirect, and induced economic impacts in the State of Hawaii:

	Employment tenure: Construction	Employment tenure: Long-term (annually)
Projected output (expenditures)		
Direct	$220,200,000	$1,500,000
Indirect and induced	215,200,000	1,400,000
Total	435,400,000	2,900,000
Projected new jobs		
Direct	1,575	14
Indirect and induced	1,615	9
Total	3,190	23
Projected employment income		
Direct	$63,400,000	$430,000
Indirect and induced	66,800,000	390,000
Total	$130,200,000	$820,000

FISCAL IMPACTS

This section evaluates the fiscal impacts of the proposed Keaka condominium project by comparing tax revenues and expenditures to the State of Hawaii and the County of Maui.

The fiscal impacts in terms of revenue and expenditures to the State and County of Maui are summarized in the following table:

Fiscal Impacts to the State and County of Maui

	State of Hawaii	County of Maui
Revenues	General excise tax State income taxes	Real property tax
Expenditures	Schools Roadway maintenance	Police protection Fire protection Roadway maintenance Parks and recreation

PROJECTED POPULATION

Keaka is a luxury condominium project in the resort area of Makena/Wailea. Occupancy at Keaka is expected from full and part-time owners. The projected occupancy at Keaka is based on the following assumptions:

- 30% of units are occupied year round.
- The average seasonal or occasional use owner uses their unit about 21% of the year.
- The average household size for a 3-bedroom unit is about 1.6.
- About 11% of the households have children. These households have about 1.4 school aged children.

Based on the above characteristics, an average annual occupancy at Keaka is projected at about 32 households totaling 48 persons including three school aged children.

FISCAL IMPACTS TO THE STATE OF HAWAII

The estimated fiscal impacts to the State of Hawaii are discussed in terms of the following revenues and expenditures.

State Revenue Sources

Revenues to the State of Hawaii would be generated from state taxes including general excise taxes, personal income taxes, corporate income tax, state fuel, alcohol, other indirect business taxes and transient accommodations tax.

State Tax Revenues

The revenue from state taxes are projected based on the DBEDT I-O study and state tax multipliers. The model projects the direct, indirect and induced tax revenue from construction spending and long-term maintenance of Keaka.

State Expenditures

Projected State expenditures are based, in part, on the following:

- Based on the size and projected residents and guests at Keaka, no new roads or schools will be generated as a direct result from this project.

- The cost to repair and maintain State roadways on Maui (excluding administrative and other ancillary costs) is about $47 per capita.

- The cost to educate a child is about $9,338 per pupil.

Total Impacts to the State of Hawaii

The State tax revenue from the construction period is expected to total about $22.3 million. The annual long-term revenue is about $172,000 with costs totaling $30,000. The long-term net impact to the state is a surplus of about $142,000, shown as follows:

Revenue and Expenditures to the State of Hawaii

	Total
Construction period	
Revenue	
State taxes	$22,300,000
Expenditures	0
Net impact from the Keaka condominium construction	22,300,000
Long-term	
Revenue	
State taxes	$172,000
Expenditures	
Schools	28,000
Roadway maintenance	2,000
Total	30,000
Net long-term impact from the Keaka condominium project, rounded	$142,000

FISCAL IMPACTS TO THE COUNTY OF MAUI

The estimated fiscal impacts to the County of Maui are discussed in terms of the following revenues and expenditures.

Revenue Sources

Revenues to the County of Maui would be generated from increase in real property tax values.

Real Property Tax

The 2006 assessed value for the unimproved Keaka condominium site totals about $21.2 million. The projected assessed value of the Keaka condominium projects is about $291.1 million. The increased assessed values would generate about $2.24 million in additional revenue annually.

County of Maui Expenditures

The expenditures for the County of Maui include roadways and park maintenance and police and fire protection. The cost to the County of Maui is based on the statement of revenues and expenditures for the following departments or divisions:

- Department of Police
- Department of Fire & Public Safety
- Department of Parks & Recreation
- Department of Public Works & Environmental Management, Highways Division

The costs of each county service per capita were calculated by dividing the total expenditures for each department by the projected de facto population. The costs per capita for each department are shown as follows:

Department	Costs per capita
Public Works, Highways division	$203
Police	201
Parks & Recreation	173
Fire & Public Safety	119

Total Fiscal Impacts to the County of Maui

The net long-term fiscal impacts to the County of Maui are revenues of about $2.24 million and expenditures of about $34,500. The net impact to the County of Maui is a surplus of about $2.2 million, shown as follows:

Annual Revenue and Expenditures to the County of Maui

Long-term	
Revenue	
Increase in real property tax	$2,240,000
Expenditures	
Roadway maintenance	10,000
Police	10,000
Parks and recreation	8,500
Fire	6,000
Total	34,500
Net long-term impact from the Keaka condominium project, rounded	$2,205,500

FISCAL IMPACT TO THE STATE AND COUNTY OF MAUI

The construction period will generate about $22.3 million in State taxes. The long-term State tax revenue generated from Keaka is projected at about $2.4 million while expenditures total about $64,500 annually. The net fiscal impact from the Keaka project is projected at a surplus of about $2.3 million annually, shown as follows:

Construction period	Total
Revenue	
State taxes	$22,300,000
Expenditures	0
Net impact from the Keaka condominium construction	22,300,000
Long-term impacts	
Revenue	
Increase in real property tax	$2,240,000
State taxes	172,000
Total annual revenue	$2,412,000
Expenditures	
Schools	28,000
Roadway maintenance	12,000
Police	10,000
Fire	6,000
Parks and recreation	8,500
Total annual expenditures	64,500
Net annual fiscal impact from the Keaka condominium project	$2,347,500

* * * * *

We appreciate having the opportunity to assist you on this interesting assignment. Please call us if you have any questions.

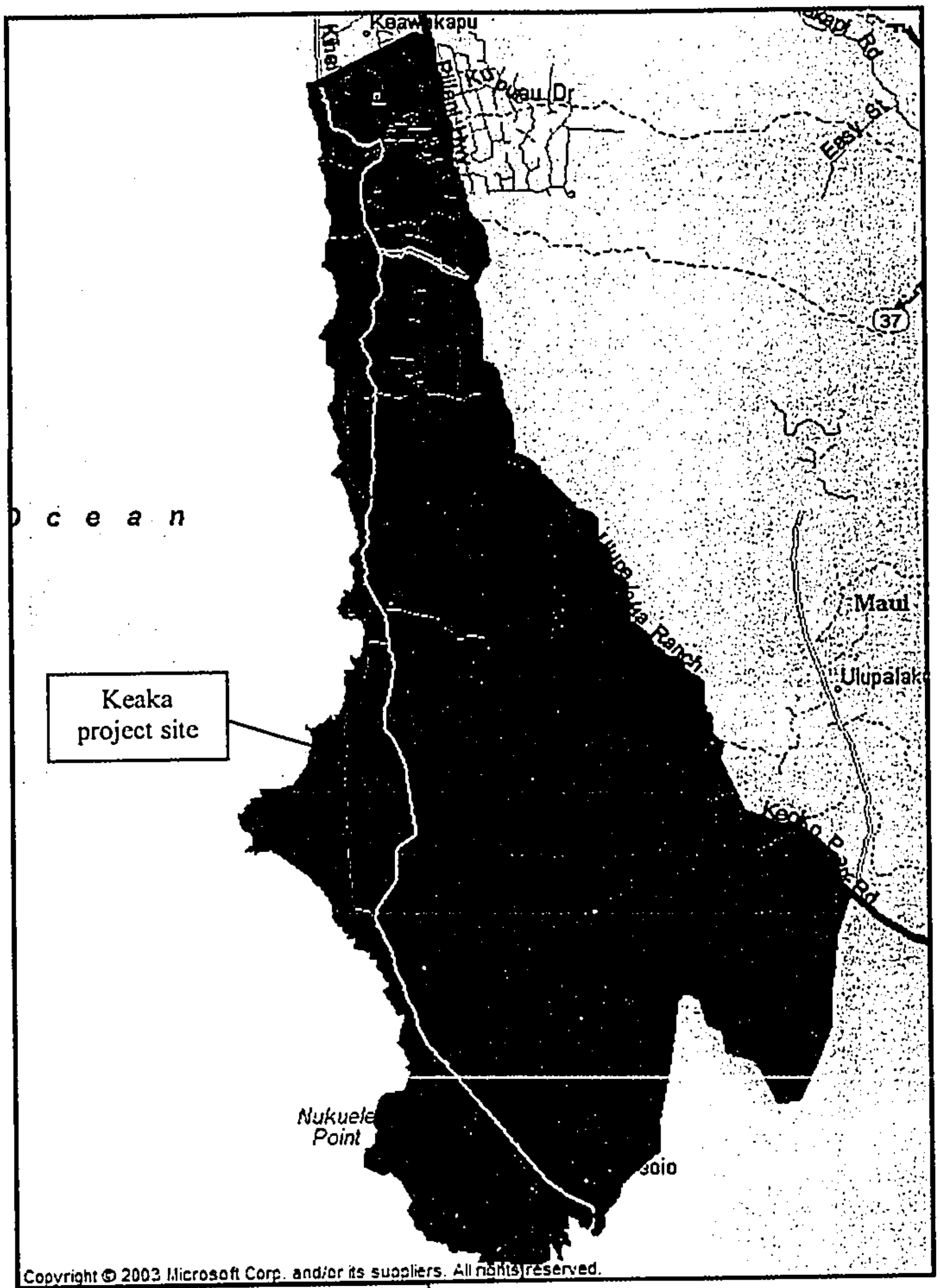
Sincerely,

JOHN CHILD & COMPANY, INC.

Paul D. Cool, MAI, CRE
Vice President

Elie E. Kato
Analyst

CENSUS BLOCKS COMPOSING THE MAKENA/WAILEA MARKET AREA



Key

Makena/Wailea census blocks

Source: John Child & Company based on the United States Department of Commerce, U.S. Census Bureau, Census 2000, and Microsoft MapPoint 2004.

STUDY CONDITIONS

The study conditions that are the basis of the analyses, opinions, and conclusions of this report are as follows:

Report Purpose and Intended User

The purpose of our assistance is to provide economic and fiscal impact assessments for internal use and decision-making by Dowling Company, Inc. As a result, this report is intended for the sole and exclusive use of Dowling Company, Inc. In accepting this report, the client specifically agrees that our assistance is not intended for any other purpose or users and is not to be relied upon by any third parties for any purpose, whatsoever.

Consulting Assistance

This assignment is a consulting service as described in the "Uniform Standards of Professional Appraisal Practice."

Basis of Analyses, Opinions, and Conclusions

The analyses, opinions, and conclusions of this report rely on data and information provided by others. The information is believed to be reliable; however, no responsibility is assumed for the accuracy of information provided by others.

The analyses, opinions, and conclusions assume:

1. No hidden or unapparent surface or subsurface conditions of the property, structures, soils, subsoils, geological formations, ground water, or drainage conditions exist that would render the property more or less valuable.
2. Existing improvements comply with all applicable public and private zoning codes, regulations and covenants, unless stated otherwise.
3. The client has provided us with all significant, relevant information covering the subject of this report.

No responsibility is assumed for matters legal in nature affecting the property or its title, which is assumed to be good and merchantable.

Properties in Hawaii typically include a reservation in favor of the State of Hawaii of all mineral and metallic mines. Our analyses, opinions, and conclusions assume these reservations do not have an impact on the value or use of the property.

Any drawings, maps, photographs, and similar exhibits accompanying this report are included to assist the reader in visualizing the property. No responsibility is assumed for the accuracy of these exhibits.

Hazardous Substances

The existence of hazardous substances (actual, alleged or threatened discharge, disposal, seepage, migration, release, growth, infestation, spread or escape of mold(s), mildew(s), fungi and/or spores or any materials, goods or products containing, harboring or nurturing these substances) that could be present on the property, or other environmental conditions that could impact the property, were not brought to the attention of the appraisers nor observed during the site visit.

The appraisers are not trained or qualified to detect hazardous substances or conditions even if these hazards, or evidence of potential presence of these hazards, are visible on the property.

This report assumes no hazardous substance or condition exists that would impact the analyses, opinions or conclusions. If a hazardous substance or condition exists, it could have a negative effect on the value of the property.

Native Hawaiian Rights

The legality of the traditional gathering rights of native Hawaiians that could be exercised on the property, or other native Hawaiian rights that could impact the property, was not considered in this report. This report assumes that the "traditional gathering rights" or any other "rights of native Hawaiians" would not be exercised on the property or properties that are the subject of this report and on any comparable properties that are included in this report. If native Hawaiian rights exist on the property and not the comparable properties, it could have a negative effect on the value of the property.

Archaeological or Historically Significant Conditions

The existence of archaeological or historically significant conditions that could be present on the property were not identified nor observed during the site visit. The appraisers are not trained or qualified to recognize archaeological or historically significant conditions, even if these conditions are visible on the property.

This report assumes no archaeological or historically significant condition exists that would impact the analyses, opinions or conclusions. If an archeological or historically significant condition exists, it could impact the value of the property.

Endangered Species

The presence of flora and/or fauna on the property qualified for protection under the Endangered Species Act of 1973 was not identified. The appraisers are not trained or qualified to recognize endangered flora or fauna, even if visible on the property.

This report assumes no endangered species are present on the property. The presence of endangered species could impact the value of the property.

Americans With Disabilities Act (ADA)

The Americans with Disabilities Act (ADA) became effective January 26, 1992. This report was not based on any specific compliance survey and analysis of this property to determine whether or not it is in conformity with the various detailed requirements of the ADA. A survey of the property together with a detailed analysis of the requirements of the ADA could reveal that the property is not in compliance with one or more of the requirements of the ADA. If so, it could have a negative effect on the value of the property.

Terms of Assignment

We have no obligation to update our report because of events and transactions occurring subsequent to the effective date of the report.

Neither our fees nor payment were contingent upon the results of the report.

Use of Report

This report is valid only if presented in whole, with original photographs and exhibits, if any, and the official seal of John Child & Company embossed on the letter of transmittal and certification.

This report or any portion of this report may not be reproduced or published without the prior written consent of John Child & Company, and then only with proper qualification.

The contents of this report or portions of this report, the identity of the appraisers or any reference to John Child & Company, the Appraisal Institute, the Counselors of Real Estate, or the American Society of Appraisers, or to their respective designations may not be disseminated to the public through advertising media, public relations media, news media, sales media, or any other public means of communication.

Limitation on Liability

John Child & Company shall not be liable to Client or to any third party (including without limitation lenders and other persons to whom Client may show this report for the purposes of obtaining credit, insurance or any other benefit or promise) in the event that the use or value of the subject property is or becomes different from the use or value estimates, analyses, opinions or conclusions in this report unless it is established by clear and convincing evidence that John Child & Company acted in bad faith or willfully and recklessly failed to exercise an appropriate standard of care in the community while performing this assignment. In any event, John Child & Company's liability to Client or to any third party shall be limited to the amount of the fees to complete this assignment.

This report may not be shown to any third party without our consent and without receiving a written acknowledgement from any person to whom it is shown that such person has read, understands and agrees to be bound by the limitation of liability in this paragraph.

CERTIFICATION

We certify, to the best of our knowledge and belief:

- Reported statements of fact are true and correct.
- Reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions and are our unbiased professional analyses, opinions and conclusions.
- We have no present or prospective interest in the property that is the subject of this report, and we have no personal interest or bias with respect to the parties involved.
- Our engagement was not contingent upon developing or reporting predetermined results.
- Our compensation is not contingent on the reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value estimate, the attainment of a stipulated result, or the occurrence of a subsequent event and is not contingent on an action or event resulting from the analyses, opinions or conclusions in, or use of, this report.
- The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Appraisal Institute's Code of Professional Ethics and Standards of Professional Appraisal Practice, which include the Uniform Standards of Professional Appraisal Practice.
- The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives. It is also subject to the same review by the Counselors of Real Estate and the American Society of Appraisers.
- The State of Hawaii has a Real Estate Appraiser Certification program. As of the date of this report, Paul D. Cool, MAI, CRE (CGA-71) is a certified general appraiser by the State of Hawaii.
- Paul D. Cool and Elie E. Kato made a personal visit to the real estate that is the subject of this report.

JOHN CHILD & COMPANY, INC.

Paul D. Cool

Paul D. Cool, MAI, CRE
Vice President

Elie E. Kato
Analyst

Date signed: July 24, 2006

SCOPE OF PROFESSIONAL SERVICES

Background

John Child & Company is a professional corporation that specializes in real estate consulting, appraisal, and business valuation. Since 1937, it has continued to revolutionize the field with innovative ways of ensuring and expanding the growth of its clients.

The Company provides a critical knowledge of local market conditions and trends, gained from analysis and interpretation of the community and economy of Hawaii. As a result, clients receive sound alternatives and progressive solutions backed by experience and insight.

Its professional team members have held local, regional and national leadership positions in their professional organizations, helping to establish and promote the highest standards of professional practice and ethics for the industry.

The strength of the Company is based on its commitment to quality and timeliness, expressed in the accountability through which it has achieved its growth and earned the trust and confidence of its clients for nearly 70 years.

Real Estate Consulting and Appraisal

The Company's real estate consulting and appraisal practice includes a range of specialized services covering real estate in Hawaii and the Pacific area. Professional services include:

- Valuation of real estate
- Litigation support
- Market and financial feasibility analyses
- Highest and best use studies
- Economic and fiscal impact assessments
- Valuation of fractional interests in real estate
- Arbitration.

Prior assignments involve a variety of real estate interests including fee simple, leasehold, leased fee and other partial rights and fractional interests. These assignments cover a variety of land uses and property types such as:

- Agricultural, conservation and vacant land
- Golf courses
- Healthcare facilities
- Hotels and resort properties
- Industrial property
- Master planned and mixed-use projects
- Office buildings and commercial property
- Residential developments (single-family, multi-family and condominium)

- Redevelopment projects
- Shopping centers and retail facilities
- Special-purpose property
- Timeshare intervals.

Business Valuation

The Company's business valuation practice includes the valuation of closely-held businesses, including controlling and minority interests in corporations, partnerships, limited liability companies (LLCs) and limited liability partnerships (LLPs). Its business valuation practice provides assistance in:

- Analysis of minority interest and marketability discounts
- ESOP valuation
- Estate planning, estate and gift tax reporting
- Litigation support
- Lost earnings
- Marital dissolution
- Mergers and acquisitions
- Stock transfers and redemptions.

REPRESENTATIVE ASSIGNMENTS

The Company has prepared real estate consulting and appraisal assignments and business valuations for nearly 70 years. Recent assignments that are representative of its current real estate consulting and business valuation practices are briefly described.

Real Estate Consulting and Appraisal

The Company's real estate appraisal and consulting practice covers a variety of properties and property interests. Real estate interests include fee simple, leasehold, leased fee and other partial rights and fractional interests. Representative projects are listed by development type as follows:

Redevelopment

Aloha Tower	Kakaako Redevelopment Plan	Pawaa Redevelopment Masterplan
Honolulu Waterfront Master Development Plan	Kakaako Waterfront Park	Kapalama Development Complex

Resorts

Hualalai	Mauna Kea	Hawaiian Rivera (proposed)
Kaanapali North Beach	Princeville	Kaupulehu (proposed)
Kauai Lagoons	Waikoloa Beach Resort	Manini'owali (proposed)
Ko Olina	Wailea Resort	Regents International (proposed)
Kuilima		

Hotels

- Ala Moana Hotel
- Coco Palms
- Embassy Suites Kaanapali
- Hilton Hawaiian Village
- Hotel Hana Maui
- Hyatt Regency Waikiki
- Hyatt Regency Maui
- Kahala Hilton
- Kea Lani Hotel
- Keauhou Beach Hotel
- King Kamehameha Kona Beach Hotel
- Kona Village
- Maui Marriott
- Maui Wailea Inter-Continental Hotel
- Pacific Beach Hotel
- Princeville Hotel
- Sheraton Poipu Beach
- Wailea Beach Resort
- Waikiki Circle Hotel
- Waikiki Beachcomber
- Waikiki Resort Hotel

Shopping Centers

- Ala Moana
- Coconut Grove
- Enchanted Lakes
- Ewa Pointe Marketplace
- Hawaii Kai
- Hawaii Kai Towne Center
- Keauhou Shopping Center
- Koko Marina
- Koolau Center
- Lanihau Center
- Mililani
- Pearl City
- Prince Kuhio Mall
- Princeville
- Royal Hawaiian
- Wailea Shopping Village
- Windward City
- Windward Mall

Golf Courses

- Asahi Kanko Olomana Course
- Dunes at Maui Lani (proposed)
- Hawaii Country Club
- Hawaii Kai
- Kaanapali
- Kauai Lagoons (Kiele and Lagoons)
- Ko Olina
- Mid-Pac Country Club
- Pearl Country Club
- Princeville (Makai and Prince)
- Sandalwood Golf Course
- Silversword Golf Course
- Waikapu Country Club
- Waikele
- Waikoloa (Kings)
- Waikoloa Village (two proposed)
- Wailea (Blue, Emerald, Gold)

Office Buildings

- 1164 Bishop
- Ala Moana Building
- Ala Moana Pacific Center
- Amfac Towers
- ANA Kalakaua Center
- Commerce Tower
- Davies Pacific Center
- Financial Plaza of the Pacific
- Grosvenor Center
- Harbor Court
- Hawaiian Life Building
- Hawaii National Bank
- HMSA Building
- Pan Am Building
- Waialae Building
- Waikiki Bank of Hawaii Building
- Waikiki Trade Center

Industrial Properties

- Airport Trade Center
- Bougainville Commercial Center
- Halawa Center
- Hawaii Business Center
- Lihue Industrial Park
- Panasonic/Technics Center
- Robinson Industrial Tract

Residential

- Ewa by Gentry
- Harbor Court
- Honolulu Park Place
- Imperial Plaza
- Kalele Kai
- Kamaole Heights
- Kamehame Ridge
- Ko Olina Fairways
- Makakilo
- Mawaena Kai
- Mililani
- Nauru Tower
- One Archer Lane
- Royal Capitol Plaza
- Uplands at Maunakea
- Victoria Tower
- Wailea Golf Vistas
- Wailea Pualani Estate

Healthcare

Arcadia Retirement Residence
Kauai Care Center (skilled nursing facility)
Regency at Hualalai (assisted living)
Straub Hospital & Clinic

Special Purpose

Cemeteries/Memorial Parks
Chinese Cultural Plaza
Condominium Lease to Fee Conversion
Hawaii Newspaper Agency Building
Hawaiian Home Land Claims
Kanepuu Conservation Easement
Kapaa Land Fill
Kaumalapau Harbor
Kealia Pond
NAS Barbers Point Electrical Distribution System
Palmyra Atoll
Residential Lease to Fee Conversation
State of Hawaii Airports
Telecommunications Sites
Visitor Attractions

Business Valuation

The Company's business valuation practice focuses on closely-held businesses in Hawaii. Business valuation assignments typically estimate the market value of a closely-held corporation or partnership and the value of minority interests in the business.

These assignments are prepared to assist in estate planning and estate and gift tax reporting to the Internal Revenue Service. Business valuations are also used to assist in litigation, mergers and acquisitions covering controlling and minority interests in the closely-held businesses.

Recent valuations of closely-held businesses include:

Corporations

Aala Produce, Inc. - supplier of provisions to vessels
Finance Investment, Ltd. - real estate developer, investor and provider of diversified financial services
Gay & Robinson, Inc. - sugar grower
Industrial Investors, Inc. - real estate investor and manager
Jas W. Glover Holding Company, Ltd. - construction contractor
K. Inouye Properties, Inc. - real estate investor and manager
Loyalty Development Company, Inc. - real estate developer, investor and manager
Loyalty Enterprises, Ltd. – property management and insurance agency
Palani Ranch Company, Inc. - cattle rancher
Sen Plex Corporation - plumbing and air conditioning contractor, real estate manager
SSFM Engineers - professional engineering services

Limited Partnerships and Limited Liability Companies

Aaron Properties Partners of Hilo - Hilo Burger King
Caroline J. Robinson LLC - real estate investor
CGB Partners - real estate investor
J.L.P. Robinson LLC – real estate investor
K.J.L. Associates - real estate investor and manager
KVH Partners - real estate investor
Lanihau Partners - real estate developer and manager

Leong Brothers - real estate investor and manager
Loyalty Investments - real estate investor
Taihook Associates - real estate investor and manager
Taira Family Limited Partnership – real estate investor

CLIENTS

The Company provides professional services to a range of clients representing private, non-profit and public interests. Selected clients in private industry, non-profit organizations and public agencies are listed.

PRIVATE INDUSTRY

Attorneys/Accountants

Alston Hunt Floyd & Ing
Ashford & Wriston
Cades Schutte
Carlsmith Ball
Case & Lynch
Chun Kerr Dodd Beaman & Wong
Goodsill, Anderson, Quinn & Stifel
Hong Iwai & Hulbert
Imanaka Kudo & Fujimoto
Ing Horikawa Jorgensen & Endo
Kobayashi, Sugita & Goda
KPMG Peat Marwick
McCorriston Miller Mukai McKinnon
Milberg Weiss Bershad Hynes & Lerach
Oshima Chun Fong & Chung
Paul Johnson Park & Niles
Price Okamoto Himeno & Lum
Rush Moore Craven Sutton Morry & Beh
Tom & Petrus
Torkildson Katz Jossem Fonseca Jaffe Moore & Hetherington
White & Tom

Architects/Planners

AM Partners, Inc.
Belt Collins & Associates
C.H. Guernsey & Company
Helber, Hastert & Fee Planners
Kober/Hanssen/Mitchell Architects
Leo H. Daley/Alfred A. Yee Division
Parsons Brinckerhoff Quade & Douglas, Inc.
PBR Hawaii
RM Towill Corp.
Townscape, Inc.

Banks/Lenders

American Savings Bank
Bank of America
Bank of Hawaii
Central Pacific Bank
Chemical Bank
Citibank, N.A.
City Bank
Continental Bank, Chicago
First Federal Savings and Loan Association
First Hawaiian Bank
Fukuoka City Bank
GE Capital Hawaii, Inc.
GE Capital Real Estate
GMAC Commercial Mortgage
Hawaii National Bank
Key Commercial Mortgage
Liberty Bank, Connecticut
Nippon Credit Bank
Orix Corporation
Sanwa Bank, Ltd.
The Bank of Tokyo-Mitsubishi, Ltd.
The Chuo Mitsui Trust & Banking Co., Ltd.
The Daiwa Bank, Ltd.
The Industrial Bank of Japan, Ltd.

The Kyowa-Saitama Bank
The Long-Term Credit Bank of Japan, Ltd.
Wells Fargo Bank

Builders

Armstrong Builders, Ltd.
Charles Pankow Builders
Pacific Construction Co., Ltd.
Tokyu Construction Co., Ltd.

Closely Held Corporations/Limited Partnerships/Family Trusts

Akala Partners (Twigg-Smith family)
Gay & Robinson (Selwyn Robinson family)
Jas. W. Glover Holding Company, Ltd. (Van Orden family)
J.L.P. Robinson LLC (James L.P. Robinson family)
KJL Associates (Luke family)
KVH Partners and CGB Partners (Knudsen Trust beneficiaries)
Lanihau Partners, LP
Leong Brothers
Loyalty Development, Loyalty Investments (Ching family)
MAR Trusts (Mark A. Robinson, Sr. Family)
Palani Trust (Greenwell family)
Sen Plex Corp. (Sen family)
Taihook Associates

Developers/Landowners

A&B Properties, Inc.
Aloha Towers Associates
Bedford Properties, Inc. (fka Kaiser National Housing Corporation Development Company)
Bradley Holdings
Central Pacific Realty
Chiyoda Hawaii Corporation
Dowling Company, Inc.
Finance Realty
Gentry Companies
Hana Ranch Partners
Hanalei Land Company
Haseko (Hawaii), Inc.
Hemmeter/Tokyu Waterfront Joint Venture
Kaneohe Ranch
McCormack Properties
Nansay Hawaii
Niu Pia Farms
O. G. Hawaii Corporation
Pahio Development
Pauahi Management Corp.
Stone Companies
Tesoro Hawaii Corporation
The Estate of James Campbell
The Myers Corporation
The Queen Emma Foundation
Toyo Real Estate Co., Ltd.
Violet Hee Lum Properties, Inc.

Diversified Corporations

Amfac/JMB Hawaii, Inc.
- Amfac Property Development Co.

Azabu USA Corporation
Dole Foods (fka Castle & Cooke, Inc.)
- Castle & Cooke Retail
- Mililani Town, Inc.

Oceanic Properties, Inc.
Kitano Indo Gaisa Co., Ltd.
Kokusai-Motorcars Co., Ltd.
Nissho Iwai Corporation
Shimizu Corporation
Shinwa Golf Kabushiki Kaisha

Investors/Investment Bankers/Insurance Companies

IDG Realty, Ltd.
ITOCHU Corporation (C. Itoh & Co., Ltd.)
MassMutual
Meridian Pacific
The Equitable Life Assurance Society of the United States of American

Resort Operators/Owners

- Alpha U.S.A., Inc.
- Kapalua Land Company, Ltd.
- Princeville Development Company
- Wailea Resort Company, Inc.
- Shinwa International

Retailers

- City Mill Co., Ltd.
- J.C. Penney Company, Inc.
- Kyotaru International
- Louis Vuitton Hawaii, Inc.
- McDonald's Restaurants of Hawaii

Trust Companies and Trusts

- First Hawaiian Trust
- Hawaiian Trust Co., Ltd.
- Knudsen Trusts
- Queen Liliuokalani Trust

NON-PROFIT ORGANIZATIONS

- Chaminade College
- Hawaii Pacific Health
- Kamehameha Schools
- KCAA Pre-Schools of Hawaii
- Nature Conservancy
- *Punahou School*
- St. Francis Healthcare Systems of Hawaii
- Young Women's Christian Association (YWCA)
- Trust for Public Land

PUBLIC AGENCIES

Bank Regulatory Agencies

- Federal Depository Insurance Corporation (FDIC)
- Federal Home Loan Bank Board (FHLBB)

City & County of Honolulu

- Honolulu Public Transit Authority
- Dept. of Housing and Community Development
- Department of Public Works
- Department of the Corporation Counsel

County of Hawaii

- Department of Finance

County of Kauai

- Department of Water

Federal Agencies

- Internal Revenue Service
- U.S. Attorney General
- U.S. Department of the Army
- U.S. Department of the Navy
- U.S. Dept. of Interior, Fish & Wildlife Service

Public Utilities

- Citizens Utilities Company - Kauai Electric
- GTE Hawaiian Telephone Co.
- Hawaiian Electric Industries (HEI, Inc.)
- Pacific Resources, Inc.

State of Hawaii

- Attorney General
- Department of Hawaiian Home Lands
- Department of Land & Natural Resources
- Department of Transportation
- Hawaii Community Development Authority
- Housing and Community Development Corporation of Hawaii

PROFESSIONAL TEAM QUALIFICATIONS

The Company's professional team has a wide range of real estate experience gained through a range of field experience, professional accomplishments, training and education. Team members have earned their reputation for quality work and professional service.

Professional Designations

Team members hold designations earned from the major professional organizations. Team members have earned the MAI (Members Appraisal Institute) designation from the Appraisal Institute, the CRE (Counselor of Real Estate) from The Counselors of Real Estate (formerly the American Society of Real Estate Counselors) and ASA (Senior Member) from the American Society of Appraisers.

State Certification

Members of the professional team are Certified General Appraisers under the State of Hawaii license and certification program and are qualified to prepare appraisal reports for mortgage financing purposes for federally insured lending institutions.

Other Qualifications and Training

Professional team members are qualified as expert witnesses in the courts of Hawaii; actively participate in various business and professional organizations; serve as review appraisers and arbitrators; and continue to attend courses, seminars, and workshops to strengthen their own specialized appraisal skills and education.

Professional Team Members

Professional team members include:

- Karen Char, MAI, CRE, ASA, President
- Shelly H. Tanaka, Appraiser
- Tammy M. Walther, Analyst
- Paul D. Cool, MAI, CRE, Vice President
- Elie E. Kato, Analyst

The education and professional experiences of team members are outlined in their accompanying resumes.

PAUL D. COOL, MAI, CRE
Vice President

Paul joined John Child & Company in 1972. He has appraised property on all the major islands in Hawaii. He was recently involved in an assignment on the island of Diego Garcia in the Indian Ocean; he has also valued properties on the U.S. Mainland and on Guam.

Paul has extensive knowledge about Hawaii's resort properties. Over the past 10 years, Paul has appraised over $10 billion in hotel and resort properties.

Paul serves in leadership positions in NAIOP Hawaii (the Hawaii Chapter of the National Association of Industrial and Office Properties), the Hawaii Chapter of the Counselors of Real Estate, and the Appraisal Institute.

Education

- Bachelor of Business Administration, Business Economics and Quantitative Methods, University of Hawaii, 1980

- Successfully completed various courses, workshops, and seminars sponsored by the Appraisal Institute, including:
  - Appraisal Institute, Standards of Professional Practice Part C, 2004
  - Appraisal Institute, Scope of Work, 2002
  - Appraisal Institute, Specialized Appraisal Issues, 2002
  - Appraisal Institute, Real Estate Disclosure, 2001
  - Appraisal Institute, Real Estate Fraud, 2001
  - Appraisal Institute, Conservation Easements, 2001
  - Appraisal Institute, Standards of Professional Practice Part C, 1999
  - Appraisal Institute, The Appraiser as an Expert Witness, 1999
  - Appraisal Institute, Detrimental Conditions in Hawaii, 1997
  - Appraisal Institute, Standards of Professional Practice Part A, 1996
  - Appraisal Institute, Environmental Risk and the Real Estate Appraisal Process, 1995

Professional Associations

- Member, Appraisal Institute (MAI designation)
  - President, Hawaii Chapter, 2001
  - Member, Regional Ethics Panel, 1998
  - Chair, Hawaii Chapter Membership Development & Retention, 2004 - 2006
  - Chair, Hawaii Chapter Admissions Committee, 1997
  - Chair, Hawaii Chapter External Affairs Committee, 1996
  - Chair, Hawaii Chapter Candidate Guidance Committee, 1994 - 1995
  - Member, Young Advisory Council, 1996.

- Member, The Counselors of Real Estate (formerly the American Society of Real Estate Counselors, CRE designation)
  - Chairperson, Hawaii Chapter, 2001
  - Alternate Chief Delegate, 20th Pan Pacific Congress - Auckland, New Zealand, 2000
  - Alternate Chief Delegate, 19th Pan Pacific Congress - Singapore, 1998

Other Real Estate Associations

- Member, Hawaii Chapter of the National Association of Office and Industrial Properties (NAIOP Hawaii)
  - President, Hawaii Chapter, 2002
  - Chair, Kukulu Hale Awards of Excellence, 2004 - 2005
  - Chair, Public Relations Committee, 2000 - 2006
  - Chair, Membership Committee, 1998 - 1999
  - Chair, Government Affairs Committee, 1997

Professional Experience

- Vice President, John Child & Company, Inc. (1972 to present)

Professional Certification

- The Appraisal Institute conducts a voluntary program of continuing education for its designated members. Members who meet the minimum standards of this program are awarded periodic educational certification. Paul D. Cool, MAI is certified under this program.

State Certification

- Certified General Appraiser, State of Hawaii, License Number CGA-71, expiring December 31, 2007.

Court Testimony

- Qualified as an expert witness in the valuation of real property in the Courts of the State of Hawaii.

ELIE E. KATO
Analyst

Elie analyzes market trends, prepares market studies, and estimates real estate values for a wide variety of properties in Hawaii. Elie recently prepared market and socio-economic impact studies for the Navy rental housing redevelopment and a luxury condominium project on Maui.

His valuation assignments have covered agricultural and conservation lands, development sites, existing hotels, existing and planned luxury condominium projects, and industrial and commercial properties. Elie has also valued conservation easements, properties containing fishponds, and zoned property with limited development potential. These properties are on Kauai, Oahu, Maui, and the Big Island.

The properties include fee simple and leased fee interests that were valued for use by attorneys, lenders, developers, buyers, and sellers in lease rent negotiations, tax planning and reporting, and internal decision making.

In addition to his market studies and valuation assignments, Elie has a range of other real estate experience in Hawaii. He has developed financial models to evaluate the investment potential of apartment complexes and vacant land purchases, and he has evaluated investment opportunities, and assisted in developing and renting property on Maui. He has also prepared rezoning applications and appeared before the Maui Planning Commission.

Education

- Master of Business Administration, Finance; University of California Irvine, 2002
- Ph.D. and MS, Genetics and Molecular Biology; Bachelor of Arts, Biology, University of Hawaii at Manoa, 1998, 1994 and 1991
- Baldwin High School, 1986
- Successfully completed courses, workshops and seminars including:
  - International Real Estate Feasibility and Assessment
  - Real Estate Sales License
  - Essentials of Real Estate Financing
  - Essentials of the Deposit Receipt Offer Acceptance

Professional Experience

- Analyst, John Child and Company (2003 to present)

Licenses

- Hawaii Real Estate Sales License # RS 61235

Appendix K

Draft Affordable Housing Agreement

LAND COURT | REGULAR SYSTEM

Return By Mail [ ] Pick-Up [X] To:

CARLSMITH BALL LLP
One Main Plaza, Suite 400
2200 Main Street, P.O. Box 1086
Wailuku, Maui, Hawaii 96793-1086

Attention: B. Martin Luna
Telephone: (808) 242-4535

TITLE OF DOCUMENT:

AGREEMENT REGARDING AFFORDABLE HOUSING

PARTIES TO DOCUMENT:

KEAKA: KEAKA, LLC

COUNTY: COUNTY OF MAUI
200 South High Street
Wailuku, Maui, Hawaii 96793

TAX MAP KEY(S): (2) 2-1-06:37 and 56 (por.) (This document consists of ___ pages.)

4829-0311-9360.4.058920-00001

AGREEMENT REGARDING AFFORDABLE HOUSING

Makena, Lot H-1

THIS AGREEMENT REGARDING AFFORDABLE HOUSING ("AGREEMENT") is made and entered into as of______________________, 2006, by KEAKA, LLC ("KEAKA") a limited liability company authorized to do business in the State of Hawaii, whose mailing address is 2005 Main Street, Wailuku, Maui, Hawaii 96793, and the COUNTY OF MAUI, a political subdivision of the State of Hawaii ("COUNTY"), the address of which is 200 South High Street, Wailuku, Maui, Hawaii 96793.

RECITALS:

A. By this Agreement, KEAKA and the COUNTY desire to memorialize and implement their understanding regarding the satisfaction of KEAKA's affordable housing requirements imposed on or affecting the development of certain lands which are owned by KEAKA, more particularly described as that certain parcel of land comprising approximately 11 acres and identified as Tax Map Key No. (2) 2-1-06: 37 and 56 (por.), Makena, Maui, Hawaii, which parcels constitute a proposed 71-unit residential development (the "Project"), known as ________________________, located approximately as shown on the map attached as Exhibit "A" to this Agreement.

B. On April 29, 2005, KEAKA filed an application for a Special Management Area ("SMA") Use Permit with the County Department of Planning (the "Department") for the Project. Said SMA Use Permit application is pending action by the Maui Planning Commission (the "Commission").

C. The Department of Housing and Human Concerns ("DHHC") is recommending that KEAKA provide a monetary contribution of $720,000 ($40,000 X 18 units) toward the development of affordable housing.

D. The Maui Planning Commission (The "Commission") may through the SMA process, mitigate impacts of the project, including the need for affordable housing in the Kihei-Makena region, and the Commission at its meeting of________________, 2006, imposed a condition on the project, as represented by KEAKA, requiring KEAKA to make a voluntary contribution of $720,000 to Maui Economic Concerns of the Community, Inc.

E. KEAKA agrees that it will satisfy its affordable housing obligation by making a monetary contribution of $720,000.00 to Maui Economic Concerns of the Community, Inc. ("MECC"), a 501(c)3 nonprofit corporation for MECC's South Maui Resource Center project, which will be in Kihei, Maui. KEAKA shall pay MECC the monetary contribution within thirty (30) days after receipt of a written Decision and Order (SMA approval letter) approving the Project's SMA Use Permit application.

AGREEMENT

In consideration of the Recitals, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, KEAKA and the COUNTY hereby agree as follows:

1. This Agreement fully satisfies the affordable housing requirements for the Project. The COUNTY shall not impose the Affordable Housing Guidelines or any other or further affordable housing obligations as a condition to or in connection with the Project. It is the specific intent of this Agreement that no future covenant or condition requiring the construction, development, inclusion, allowance for or contribution to or in lieu of affordable housing or employee housing shall be imposed on the Project unless the number of units in the Project is increased by KEAKA. In such event, the only revision to this Agreement would be an increase in the total amount of the monetary contribution referenced in Paragraph D and E of this Agreement.

2. Full compliance of the affordable housing requirements specified in this Agreement shall occur when KEAKA makes its monetary contribution of $720,000.00 to MECC for its South Maui Resource Center project.

3. The COUNTY hereby represents and confirms that KEAKA's monetary contribution to MECC for its South Maui Resource Center Project as specified in this Agreement is not inconsistent with any existing rules, regulations, and ordinances of the COUNTY and the DHHC pertaining to affordable housing.

4. The terms, agreements, covenants and conditions set forth in this Agreement shall be binding upon and inure to the benefit of the parties hereto, and their respective successors, successors-in-title, and assigns.

5. In the event of any dispute arising from or relating to this Agreement, the parties shall bear their own costs and expenses resulting therefrom, including attorneys' fees and litigation costs.

6. This Agreement may be executed in one or more counterparts. It shall be fully executed when each party whose signature is required has signed at least one counterpart even though no one counterpart contains the signature of all the parties. Each executed counterpart shall be deemed an original, but all of which together shall constitute one and the same Agreement.

7. If any term, provision, covenant or condition of this Agreement should be held by a court of competent jurisdiction to be invalid, void or unenforceable, the remainder of this Agreement shall continue in full force and effect and shall in no way be affected, impaired or invalidated thereby.

KEAKA and the COUNTY have executed this Agreement as of the date first referenced above.

KEAKA, LLC, a Hawaii limited liability company

By ______________________________
Name:
Title:
"KEAKA"

COUNTY OF MAUI

By ______________________________
Name: ALAN M. ARAKAWA
Title: Mayor
"COUNTY"

APPROVAL RECOMMENDED:

____
Alice L. Lee, Director
Department of Housing and Human Concerns

APPROVED AS TO FORM AND LEGALITY:

____

Deputy Corporation Counsel
County of Maui

STATE OF HAWAII)
: SS.
COUNTY OF MAUI)

On this ________ day of ____________________, 2006, before me personally appeared ________________________________, to me personally known, who, being by me duly sworn or affirmed, did say that he is the ______________________ of KEAKA, LLC, and that such person executed the foregoing instrument as the free act and deed of such person, and if applicable in the capacity shown, having been duly authorized to execute such instrument in such capacity.

____

Notary Public, State of Hawaii

My commission expires: ____________

STATE OF HAWAII)
: SS.
COUNTY OF MAUI)

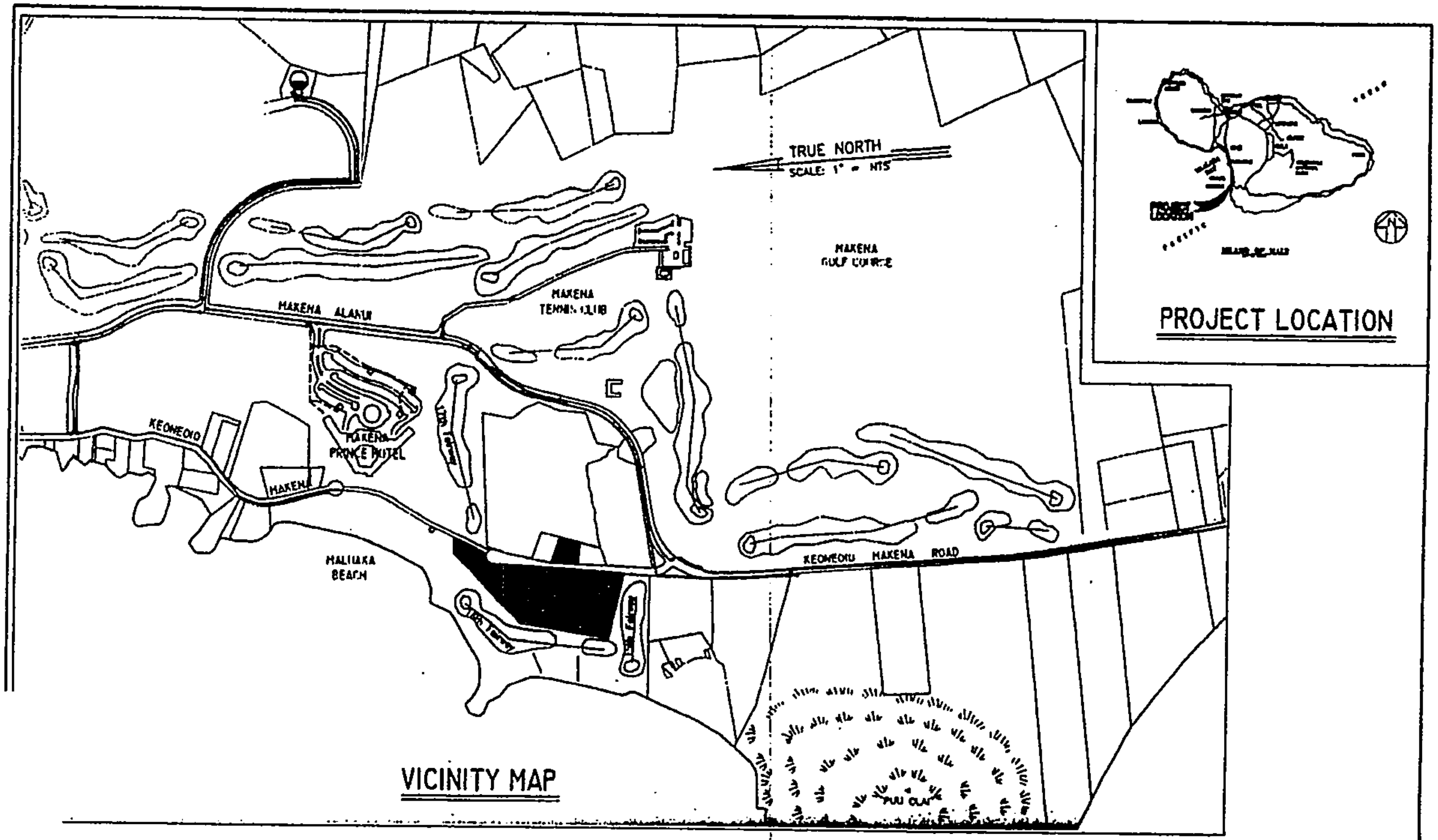
On this ________ day of ______________________, 2006, before me appeared ALAN M. ARAKAWA, to me personally known, who being by me duly sworn did say that he is the Mayor of the County of Maui, a political subdivision of the State of Hawaii, and that the seal affixed to the foregoing instument is the lawful seal of the said County of Maui, and that the said instrument was signed and sealed on behalf of said County of Maui pursuant to Section 9-18 of the Charter of the County of Maui; and the said ALAN M. ARAKAWA acknowledged the said instrument to be the free act and deed of said County of Maui.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal.

____

Notary Public, State of Hawaii

My commission expires: __________



PRELIMINARY ENGINEERING REPORT
PARCEL H-1
MAKENA, MAUI, HAWAII

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.

PROJECT LOCATION AND VICINITY MAP

EXHIBIT 1

Appendix L

Austin, Tsutsumi & Associates, Inc. Letter Dated July 27, 2006

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

KENNETH K. KUROKAWA, PE
LAMBERT J. YAMASHITA, PE
DONOHUE M. FUJII, P.E.
STANLEY T. WATANABE
TERRANCE S. ARASHIRO, PE

#04-554.1
July 27, 2006

Mr. Don Fujimoto
Keaka LLC
2005 Main Street
Wailuku, Hawaii 96793

Dear Mr. Fujimoto:

Subject: 71 Unit Condominium
Draft Environmental Assessment
Response to Comments

This memo is in response to the Maui Tomorrow Foundation, Inc. comments to the Maui Planning Commission on the Keaka, LLC Draft Environmental Assessment. Based upon our review of the comment we offer the following responses:

Page 2: ***"Need to specify a source of water to meet Project demand..."***

RESPONSE:
Currently the Department of Water Supply (DWS) has three (3) water sources that will increase the availability of potable water that will supplement the Iao Aquifer. The three sources are:

1. Kupaa Well – The well pump has been installed. Pipe line installation will be contracted in the near future.

2. Waiale Surface Water Treatment Plant – Which is anticipated to be on-line and operational in 2008.

3. Maui Lani Wells – Well drilling is in progress or should be commencing by the last quarter of 2006.

The applicant is aware of the DWS regulation that issuance of water meter is dependent on the availability of water at the time of water meter application.

Page 2: ***"The proposed project has a maximum daily water demand..."***

RESPONSE:
The 128,000 gallons per day (gpd) is the sum of the maximum daily domestic consumption plus the average daily landscape irrigation demand. The maximum domestic consumption is calculated as 1.5 times the average daily demand which is 59,304 gpd. The text of the DEA notes that the average daily consumption is 98,340

REPLY TO:
501 SUMNER STREET, SUITE 521 • HONOLULU, HAWAII 96817-5031
PHONE (808) 533-3646 • FAX (808) 526-1267 • EMAIL: atahnl@atahawaii.com

OFFICES IN:
HONOLULU, HAWAII
WAILUKU, MAUI, HAWAII

gpd which is the sum of the average daily domestic consumption plus landscape irrigation demand (59,340 + 39,000 = 98,304 gpd).

The original SMA indicated 28, 000 gpd vs. DEA of 59,340 gpd. This difference is a result of reclassifying the project as a multi-family residential with a daily consumption guideline of 560 gals per unit, while the SMA water demand calculation is based on "Hotel" consumption guideline of 340 gals per unit. This revision was deemed appropriate since the applicant is has committed this project to be for residential use only.

Keaka LLC is commitment to build "green" which is reflected in updated landscape planting plan and irrigation system to reduce the preliminary landscape irrigation demands by 75% over the typical low-water use landscape planting and irrigation system. This will be accomplished by use of climate adaptive plants and high efficiency innovative irrigation system and reduction in lawn area. Thus the proposed average daily domestic plus landscape irrigation water demand has been reduced to approximately 68,700 gpd.

The project incorporates water conservation measures in the current design that will reduce the total domestic water demand by 24% when compared to Maui County minimum plumbing standards. Landscape water demand is reduced by 56% by using water efficient irrigation systems and planting of draught tolerant native plant species. The landscape irrigation system will be designed to be readily converted to a reclaimed water system when the Makena Wastewater Treatment Plant is capable of supplying the project with reclaimed water. The projects water conservation efforts will use less water than that allowed by the current land use zoning thus limiting the demand to the public water source.

Page 3: ***"The Keaka LLC DEA does not address the issue of extremely limited..."***

RESPONSE:
Keaka LLC acknowledges the availability of water to other projects. The project will use water efficient design elements throughout the project, thus the impact from the project to other project is minimized. The applicant is aware of the DWS policy that the DWS will not commit to the availability of water service to the project until the application for water meter request is submitted.

Page 4: ***"Past information provided by the applicant alleged several potential sources of water..."***

RESPONSE:
DWS has three (3) water sources that will increase the availability of potable water that will supplement the Iao Aquifer. The three sources are:

1. Kupaa Well - The well pump has been installed. Pipe line installation will be contracted in the near future.

2. Waiale Surface Water Treatment Plant – Which is anticipated to be on-line and operational in 2008.

3. Maui Lani Wells – Well drilling is in progress or should be commencing by the last quarter of 2006.

Page 5: ***"The DEA fails to address the impact of several years of construction traffic..."***

RESPONSE:
Construction traffic will be controlled by use of appropriate traffic control measure based on traffic control plans approved by the Department of Public Work and Environmental Management Division (DPWEM). Additionally, construction work will be done during the weekdays when traffic by park users is the lowest; the construction work will have minimal impact to the driving public.

Page 5: ***"The DEA also fails to acknowledge the net loss of de facto parking..."***

RESPONSE:
The applicant proposes to improve Keoneoio Makena Road to conform to the Kihei-Makena community plan. The proposed improvements as discussed with the DPWEM is a 28-foot paved road, two (2) 12-foot travel lanes with 2 feet shoulders on each side. Parking within the county right-of-way is under the jurisdiction of the County of Maui.

Page 6: ***"However, the 47% reduction in the existing storm water..."***

RESPONSE:
Current County storm water design standards allow discharge of post development storm water flows equal to the existing storm water runoff rate. The 47% reduction in the total storm water flows is a significant reduction in the runoff leaving the project site. This reduction in total runoff, along with the storm water quality measures to be implemented will have minimal impact to downstream properties.

The project storm water design meets County of Maui drainage standards for a 50-year 1-hour storm and also the Department of Health NPDES and LEED requirements for retention of a 2-year 24-hour storm event.

The initial runoff (first flush) of any storm contains 90% of potential pollutants load, which include total suspended solids (TSS), phosphates and nutrients as well as petroleum products from road and parking areas. Therefore, containment and filtration of the first flush storm water by natural and mechanical Storm Water Best Management Practices (BMP) is essential to reducing pollutant loads. The project will incorporate both natural and mechanical devices to control storm water quality associated with the project site.

The debris and sediments accumulated within the storm water filtration and retention system will be removed during regular scheduled maintenance and disposed at an approved County disposal site.

Page 6:

RESPONSE:
Surface runoff enters catch basins and field inlets with filtering devices installed to capture large debris and initial filtration of storm water, the storm water is then transported by underground piping system to mechanical filtering devises located within drainage manholes for pre-treatment prior to entering into underground retention chambers. Storm events greater than the 50-year, 1-hour storm will overflow via an underground piping system to the next downstream retention system then to the open retention basin with an emergency overflow weir. The overflow will be discharged onto the low lying area of the existing golf course fairway which currently retains the existing runoff.

Debris from the catch basins and drain inlets will be removed and disposed of in an approved landfill, silt and debris accumulated within the mechanical filtering manhole/vaults will be removed and disposed of at an approved disposal site. The underground retention system will vacuumed out and filter replaced at manufacture's recommended intervals and is disposed of in an appropriate disposal site.

The storm water system design incorporates the acceptable practices for LEED certification and EPA recommended storm water quality control. The Storm Water Best Management Plan incorporates the following to maintain pre-developed storm water quality.

Grass Swales and Landscape Areas

1. The surface runoff of storm water from road and parking areas will be directed to grass/landscape areas to reduce flow velocity and allow percolation into the surrounding soil.

Catch Basin and Drain Inlet Filters

1. Basket screen with absorbent material are installed within the catch basin/drain inlets that captures large debris and absorbed pollutants as storm water moves through the basin.

2. Manufactures data indicate these filter are effective in the removal of large trash debris and Petroleum, oil and lubricants.

Mechanical Filtering System

1. The mechanical filter systems are off-line vaults with separation chambers that capture large particles and pollutants. There are several manufactures of mechanical storm water filtering devices which are rated for removal of 80-90 % of the total suspended solids. The filtering system also contains drop-in filters cartridges that capture nutrients.

2. The high efficiency filtering systems are cartridge-type with different medias that remove specific pollutants as the storm water passes through the manhole/vault.

Underground Retention System

1. Underground retention system will retain the design storm event within the drainage distribution area. The treated storm water effluent will be retained and allowed to percolate through the surrounding soil.

2. LEED design guidelines classify percolation as 100% effective in removal of pollutants.

Bio- Swales and Bio- retention Basins

1. The bio-swales are similar to the grass swales are generally planted with native planting to absorb the nutrients. These swales and basins will detain the storm water flows to allow time for the suspended pollutants to settle out from the storm water.

Open Retention Basin

1. Storm water will enter the open Basin via underground drainage system; storm water will be retained and allowed to slowly pass thought a crush rock filter blanket surrounding a perforated low-flow pipe that will be sized to release storm water at 53% of the pre-developed rate. If the rain event intensifies, the water level within the pond would gradually rise to the over flow level.

The above Method of storm water quality control measures are accepted by LEED and EPA as storm water measures and devices that reduce the pollutant level associated with storm water. Thus pollutant load generated by the project should not increase. Additionally the off-site storm water retained within the off retention basin reduces the total storm water flow and will reduce pollutant load generated from Makena Alanui Road and Keoneoio Makena Road.

Should you have any questions or require further information, please call me at (808) 533-3646.

Sincerely,

AUSTIN, TSUTSUMI & ASSOCIATES, INC.

By STANLEY T. WATANABE
Vice President & Senior Designer

STW:mt

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Appendix M

Sustainable Landscape Management Plan

miyabara*associates*
Landscape Architects and Planners

July 26, 2006

MAKENA BAY CLUB
Makena, Hawaii

SUSTAINABLE LANDSCAPE MANAGEMENT PLAN

The goal of the sustainable landscape management plan for the Makena Bay Club development is to insure the long-term viability of the landscape and to minimize any environmental impacts to the site and surrounding areas.

The following are the key elements of the plan:

LANDSCAPE DESIGN CONCEPTS

1. Use of native Hawaiian and Polynesian-introduced plants.
    a. Appropriate native plants that are site adaptive to the region enhance the sense of place.
    b. Native plants require less fertilization and watering.
    c. A minimum of 50% of non-turf planting areas shall be native plants.

2. Reduce amount of turf area.
    a. Reducing turf areas reduce irrigation requirements.
    b. Conventional landscape design results in turf area of approximately 51% (118,500 SF) of the total landscape area (230,500 SF).
    c. Proposed landscape design has turf area of approximately 26% (59,000 SF) or a reduction of turf area by nearly one half.

3. Efficient irrigation design.
    a. Reduce watering via use of efficient equipment.
    b. Incorporate devices such as rain and moisture sensors.
    c. Incorporate drip irrigation wherever possible.
    d. Use mulch to retain moisture and reduce loss.
    e. Use of non-potable water as available.

4. Select and locate low maintenance plant material.
    a. Use plants that require minimal trimming, pruning, and litter removal.
    b. Use plants that are pest and disease resistant.
    c. Use drought-tolerant plants.
    d. Locate and space plants to allow for natural growth and form.

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miyabara*associates*
Landscape Architects and Planners

CONSTRUCTION AND MAINTENANCE CONSIDERATIONS

1. Topsoil.
   a. Stockpile existing soil and re-use after grading operations.
   b. Use organic, biodegradable soil amendments such as decomposed wood products and compost, to improve the nutrient levels of the planting areas.

2. Fertilizers and Amendments.
   a. Perform soil testing on a regular basis to determine actual soil composition and amendment requirements.
   b. Use non-chemical fertilizers such as compost, decomposed manure, and other organic materials exclusively.
   c. Products shall contain no synthetic chemicals, animal components or sewage sludge and shall be produced in accordance with the National Organic Standards Board guidelines.

3. Lawn Care and Landscape Maintenance Program.
   a. Promote healthy lawns to prevent weeds and pests.
   b. Deep-water lawns weekly to promote healthy root growth.
   c. Mow lawn at a height to preserve shade at ground level to discourage weed seed germination. Recommended minimum height is 1-1/2 inch.
   d. Put green waste, e.g. grass clippings, back on lawns in addition to composting.
   e. Aerate the soil on a regular basis to promote healthy lawn growth.
   f. Use mulches and compost for shrub and ground cover areas to retain moisture and nutrients, promote micro-organism activity, and discourage weeds.

4. Integrated Pest Management (IPM). See attached policy.
   a. Use IPM to control pests and disease.
   b. Requires diligent monitoring of the plants to detect infestation and identify the cause.
   c. Use organic and biodegradable products exclusively.

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Appendix N

Integrated Pest Management Program

MAKENA BAY CLUB
July 12, 2006

Integrated Pest Management Policy - Low Environmental Impact

Conventional pest control techniques have relied extensively on the use of spray-applied chemicals that contribute to ground and surface water contamination and create the potential for exposure to building occupants and visitors. The Integrated Pest Management (IPM) system seeks to minimize the spray application of pesticides by focusing on long-term, mechanical and administrative measures to control pests, thereby reducing the use of pesticides and their environmental impact. Makena Bay Club has formally adopted this policy to implement IPM systems in the maintenance of its building and grounds. This policy applies to all employees and contractors working for Makena Bay Club.

Goals of the IPM system:
- Prevent pest situations before they occur through cultural and mechanical changes
- Reduce and eliminate where feasible the use of chemical pesticides. Pesticides classified as Group A (known) and Group B (likely) carcinogens are prohibited for use and exposure within and around the building.
- Reduce long-term expenditures by focusing on proactive preventive measures rather than on reactive pesticide applications

IPM system includes:
- Detailed information and data sheets on all chemical products submitted to building manager for approval before use
- Contractors to follow the rules and regulations set forth by the federal EPA, when handling and disposing of hazardous waste material
- Alter the pest's environment
- Use of alternative methods to catch pests
- Minimal use of herbicides and pesticides

Roles and Responsibilities
- Building Management
  - To serve as a liaison between the building occupants and the service contractor regarding pest complaints/concerns
  - To ensure that the pest control contractor is following the IPM program
  - Is responsible for implementing the recommendations regarding structural change sanitation, and other areas for which the pest control contractor is not responsible
  - The Manager is ultimately responsible for deciding which course of action is taken

- Pest Control Contractor
  - To provide assessment of the applicable area, evaluation; monitoring and pest control services
  - To evaluate the building area to identify the presence of existing pest populations
  - When appropriate, the contractor will recommend necessary control strategies including preventative maintenance and sanitation measures
  - Responsible for application of pesticides according to the label (Transport, handling, storage, and use of all pesticides shall be in strict accordance with the pesticide product label and all applicable Federal and State laws and regulations)
  - Will supply trained personnel to educate staff on the most effective means to achieve pest control in and around their workplace in accordance with established IPM techniques

- Landscape Contractor
  - Will explore alternative vegetation controls utilizing native and fire resistant plants
  - Will develop alternatives to using herbicides based on recommendations below

- Building Occupants
  - Cooperate with the objectives to the IPM system
  - Communicate with the pest-control contractor and building manager about conditions regarding a pest problem
  - To follow recommendations made by the pest-control contractor and building manager

Implementation of IPM system

- **General Requirements:** No routinely scheduled (e.g., seasonal, monthly or weekly) pesticide applications will be made. No pesticide fogging or space spraying will be done. Insecticides will be used only in containerized baits, or for spot treatments targeted to insect nests or problem areas where a minimal amount of material is used. No highly acute toxic (e.g., Toxicity Category I or Group A) pesticides will be used. No high volatility formulations will be used. No restricted use pesticides will be used. Pesticides will not be used if there is credible evidence that they cause cancer in humans or laboratory animals, or that they are reproductive toxins, endocrine disrupters, neurotoxins, or cause immune system dysfunction. No pesticide product will be used unless the district has received information from the manufacturer identifying the "inert" ingredients.

  All pesticide applications will be done by certified pesticide applicators only. Pesticides will be applied only when no building occupants are present. All pesticide use will be subject to advance approval by Building Management.

- **Education:** the proper education of occupants and building management staff is critical for the success of the IPM system. Areas of influence include:
  - Common Areas/Kitchens
    - All food stored in closed and completely sealed containers. Thin plastic bags will not keep out hungry rodents. Do not leave food out on desks, cabinets, tables, etc.
    - Clean up any crumbs or drinks that may have spilled.
    - Poor liquids down sinks before discarding
  - Recycling
    - Rinse all cans and bottles and discard excess water before placing in the recycling container
    - Place clean items in recycle containers; do not store them in your office
  - Interior Plants
    - Avoid over watering plants
    - Keep pots and surrounding areas clean of leaves and seedpods
    - Do not keep plants that produce seeds or fruit
  - Exterior Landscape
    - Avoid planting non-native plants or plants not suitable for the area
    - Avoid pruning native plants and other plants except where the intent is to produce a formal clipped hedge per the landscape architect's plan
    - Cut lawn to a min. of 3" to reduce the chance of creating 'bare' spots. Exceptions include sports courts where the lawn is required to be no more than 1 ½" high
    - Mulch areas beneath plants at 2" minimum depth
    - Deep water lawns
    - Leave grass clippings on lawns. If thatch builds up, rake the area with a heavy rake
    - Aerate lawn as needed

- Reseed lawn once a year or as needed
- Apply compost to lawn twice per year or apply organic fertilizer as needed
- Spot spray for weeds only if manually pulling weeds fails to work

- General rules to adhere to
  - Report leaks immediately to building management
  - If you see a pest, report it immediately
  - Keep work areas neat and organized

Key Components

- Samples of pests should be obtained whenever possible. This helps in the identification process and in identifying the treatment
- Pest type and problem can be influenced by:
  - Location of building: Urban, suburban, or country
  - Exterior landscape: Type and proximity to building
  - Interior plantscaping: Plant types and maintenance
  - Level of sanitation: Food and nonfood areas
  - Personal pest problems: In the homes of occupants, maintenance staff, and visitors
- Monitoring and record keeping – make sure that the service contractor is keeping a log with the following information:
  - The name of the target pest
  - The type and quantity of any pesticide used – along with the MSDS sheet
  - The site of the application
  - The date of the application
  - The name of the pesticide applicator
- Action threshold – determine when the pest problem is likely to become serious enough to warrant some action
- Provide notice to the building principal of use not less than 72 hours before intended application of pesticide (non-toxic, less toxic and toxic) or herbicide
- In case where rodent or similar infestation creates an imminent risk of danger to students and staff, the principal shall notify the school community by notice and posting within 24 hours of application

Pest Treatments

- Cultural – reduce pests by making their environment less favorable. Proper disposal of garbage, clearing up cluttered offices, removing weeds in gardens, etc.
- Physical – keep pests from areas where they are not wanted
  - Barriers (window screens) will help exclude flies, mosquitoes, and aphids
  - Traps can be used to catch cockroaches, ants, and mice
- Mechanical – direct measures to eradicate the pest or make the environment unsuitable for entry or survival
  - Cultivation or tillage, thereby exposing soil insects to drying out or being eaten by predatory insects
  - Hand picking of snails, slugs, caterpillars, etc.
  - A strong water spray to dislodge aphids and mites from plants
- Biological – this using the natural enemies of pests, including predators and parasites
  - Predators such as ladybugs and lacewings feed on aphids, caterpillars, and beetle larvae
  - Parasites such as mini-wasps and flies are important in the fight against aphids, scale insects and whiteflies
- Botanical and Mineral – using the least toxic substances such as plant derivatives, oils and soaps

- Insecticidal soaps - kill soft-bodied insects such as aphids, scales, and mites by penetrating their outer coat or entering the respiratory system and causing cell damage or disruption
- Pyrethrum/Pyrethrins/Pyrethroids - These are broad-spectrum insecticides. These materials disrupt the nervous system of insects and cause paralysis. They are fast-acting and often used for their "knock-down" effects to quickly reduce large insect pest populations

- Chemical – chemicals should be used as a last resort and only the least toxic ones. If they are used make sure to read the instruction and wear protective equipment and clothing
  - Use only when less toxic treatments have failed
  - Use only for spot treatments
  - Apply only when the pest is present
  - Work with the HOA to develop a list of approved chemicals that are permitted
  - **NOTIFICATION:** Provide at least 48 hours notice to all residents prior to any application of chemicals. Include the date, time, location and purpose of the application. Provide access to the product MSDS upon request.

Appendix O

Makena Resort Marine Water Quality Reports

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801-3378

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD / CWB

February 10, 2006

02044MWO.06

Mr. Roy Figueiroa, Vice President
Makena Resort Corporation
5415 Makena Alanui
Kihei, Maui, Hawaii 96753

Dear Mr. Figueiroa:

Subject: **Acceptance of Reports dated June 1, 2004, January 11, 2005, and August 4, 2005, in compliance with Condition No. 10 of the State Land Use Commission Decision and Order LUC Docket No. A97-721**

We have reviewed and accepted your reports and are utilizing the information in the reports for our 2006 integrated 303d/305b report to the U.S. EPA.

We thank you for the opportunity to review your reports.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

WTO:rg

MARINE WATER QUALITY MONITORING

MAKENA RESORT, MAKENA, MAUI

WATER CHEMISTRY

REPORT I-2005

Prepared for

Makena Resort Corp.

5415 Makena Alanui Drive

Makena, Kihei, Maui, Hawaii 96753-9599

By

Marine Research Consultants

1039 Waakaua Pl.

Honolulu, Hawaii 96822

August 4, 2005

I. PURPOSE

Makena Resort Corp. has constructed two 18-hole golf courses (North and South Courses) within the boundaries of the Makena Resort Development. The study area off the Makena site fronts approximately 5.4 miles of coastline. The area is bounded by Papanui Stream (Nahuna Point) on the north and Pu`u Olai (Ahihi Bay) on the south. No part of the project involves direct alteration of the shoreline or nearshore marine environments.

Evaluations of other golf courses and other forms of resort development located near the ocean in the Hawaiian Islands reveal that while there is detectable input to the coastal ocean of materials used for fertilization of turfgrass and landscaping, there are few, if any, effects that can be considered detrimental to the marine ecosystem (Dollar and Atkinson 1992). Thus, there is no *a priori* reason to suspect that the construction and responsible operation of the golf courses at Makena will cause any harmful changes to the marine environment. Nevertheless, in the interest of assuring maintenance of environmental quality, and as a means of ensuring that proper procedures are set forth, a condition of the Land Use Commission District Boundary Amendment for the project was the implementation of an ongoing marine monitoring program off the Makena Resort Development. The primary goals of the program are twofold: 1) to assess the degree that materials used on the Resort property to enhance turf growth and landscaping leach to groundwater and subsequently reach the ocean, and 2) to determine the fate of these materials within the nearshore zone. In terms of determining fate, the question that is addressed is if the materials that originate from Resort activities disperse with little or no effect, or do they cause changes in water quality sufficient to alter marine biological community structure?

The rationale of the monitoring program is to conduct repetitive evaluations of water chemistry at the same locations at regular time intervals (twice per year). This strategy allows for determination of variations in effects from the Resort in both space (at different locations along the shoreline) and time. These studies also fulfill condition No. 10, Declaration of Conditions pertaining to the Amendment of the District Boundary, as required by the Land Use Commission, dated April 17, 1998. The following report presents the results of the fifteenth increment in the monitoring program, and contains data from water chemistry sampling conducted on June 19, 2005.

II. ANALYTICAL METHODS

Three survey sites directly downslope from the Makena Golf Course site have been selected as sampling locations. A fourth site, located offshore of an area with minimal land-based development, particularly golf course operations, was selected as a control. Figure 1 is a map showing the shoreline and topographical features of the Makena area, and the location of the North and South Golf Courses. The four survey sites are depicted as transects perpendicular to the shoreline extending from the shoreline out to what is considered open coastal ocean (i.e., beyond the effects of activities on land). Survey Site 1 is located near the northern boundary of the project site off Nahuna Point; Survey Site 2 bisects Makena Bay near Makena Landing, which is directly downslope of the Makena. Site 3 bisects the middle of the South course on the north side of Maluaka Point. Site 4, which is considered the Control site, is located at the northern boundary of the 'Ahihi-Kina`u natural area reserve offshore of the 1790 lava flow and approximately 1-2 miles south of the existing Makena Golf courses (Figure 1). In 2003, Site 3 was relocated from a location at the southern boundary of the project offshore of Oneloa Beach to the location directly off the golf course described above. Site 3 was relocated because the original location consistently showed virtually no input of groundwater to the ocean, hence offered little potential for evaluating effects from the project. The new location of Site 3 is directly downslope from both the portion of the golf course nearest to the ocean, as well as newly constructed residences. As a result, the new location represents an area that reflects the maximum influence of several land uses on nearshore water quality. Several private residences are also located near the shoreline in the vicinity of Control Site 4, while land use upslope of this survey site consists primarily of cattle grazing.

All fieldwork was conducted on June 19, 2005 using a small boat. Environmental conditions during sample collection consisted of calm seas, mild winds (10-15 knots) and sunny skies. Water samples were collected at stations along transects that extend from the highest wash of waves to approximately 125-200 meters (m) offshore at each site. Such a sampling scheme was designed to span the greatest range of salinity with respect to freshwater efflux at the shoreline. Sampling was more concentrated in the nearshore zone because this area is most likely to show the effects of shoreline modification. With the exception of the two stations closest to the shoreline (0 and 2 m offshore), samples were collected at two depths; a surface sample was collected within approximately 10 centimeters (cm) of the sea surface, and a bottom sample was collected within one m of the sea floor.

Water samples beyond 10 meters (m) from the shoreline were collected using a 1.8-liter Niskin-type oceanographic sampling bottle. This bottle was lowered to the desired depth in an open position where spring-loaded endcaps were triggered to close by a messenger released from the surface. Upon recovery, each sample was transferred into a 1-liter polyethylene bottle until further processing. For nearshore samples within 10 m of the shoreline, water samples were collected in 1-liter polyethylene bottles by divers swimming from the shoreline.

Water samples were also collected from seven golf course irrigation wells (No's 1, 2, 3, 4, 5, 6, and 10) and two irrigation lakes on June 29, 2005.

Subsamples for nutrient analyses from all water sources were immediately placed in 125-milliliter (ml) acid- washed triple rinsed, polyethylene bottles and stored on ice until returned to Honolulu. Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis.

Water quality parameters evaluated included the 10 specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (Open Coastal waters) of the Water Quality Standards, Department of Health, *State of Hawaii. These criteria include:* total nitrogen (TN) which is defined as dissolved inorganic nitrogen plus dissolved organic nitrogen, nitrate + nitrite nitrogen ($NO_3^- + NO_2^-$), ammonium (NH_4^+), total phosphorus (TP) which is defined as dissolved inorganic phosphorus plus dissolved organic phosphorus, chlorophyll a (Chl *a*), turbidity, temperature, pH and salinity. In addition, orthophosphate phosphorus (PO_4^{3-}) and silica (Si) were reported because these constituents are sensitive indicators of biological activity and the degree of groundwater mixing, respectively.

Analyses for NH_4^+, PO_4^{3-}, and $NO_3^- + NO_2^-$ (hereafter termed NO_3^-) were performed using a Technicon autoanalyzer according to standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion following digestion. Dissolved organic nitrogen (TON) and dissolved organic phosphorus (TOP) were calculated as the difference between TN and inorganic N, and TP and inorganic P, respectively. Limits of detection for the dissolved nutrients are 0.01 µM (0.14 µg/L) for NO_3^- and NH_4^+, 0.01 µM (0.31 µg/L) for PO_4^{3-}, 0.1 µM (1.4 µg/L) for TN and 0.1 µM (3.1 µg/L) for TP.

Chl *a* was measured by filtering 300 ml of water through glass fiber filters; pigments on filters were extracted in 90% acetone in the dark at -5°C for 12-24 hours, and the fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer (level of detection 0.01 µg/L). Salinity was determined using an AGE Model 2100 laboratory salinometer with a precision of 0.0003‰.

In situ field measurements included water temperature, pH, dissolved oxygen and salinity which were acquired using an RBR Model XR-420 CTD calibrated to factory specifications. The CTD was a readability of 0.001°C, 0.001pH units, 0.001% oxygen saturation, and 0.001 parts per thousand (‰) salinity.

Nutrient, turbidity, Chl *a* and salinity analyses were conducted by Marine Analytical Specialists located in Honolulu, Hawaii. This laboratory possess the appropriate acceptability ratings from the State of Hawaii Dept. of Health, and the U.S. EPA

III. RESULTS

A. Horizontal Stratification

Table 1 shows results of all marine water chemical analyses for samples collected off Makena on June 19, 2005 reported in micromolar units (µM). Table 2 shows similar results presented in units of micrograms per liter (µg/L). Tables 3 and 4 show geometric means of ocean samples collected at the same sampling stations during the fifteen surveys to date from August 1995 to June 2005. *Table 5* shows water chemistry measurements (in units of µM and µg/L) for samples collected from irrigation wells located on the Makena Resort Golf Courses. Concentrations of twelve chemical constituents in surface and deep-water samples from the June 2005 sampling are plotted as functions of distance from the shoreline in Figures 2 and 3. Mean concentrations (±standard error) of twelve chemical constituents in surface and deep water samples from the entire sampling program at Makena Resort, as well as data from the most recent sampling, are plotted as functions of distance from the shoreline in Figures 4-15.

On all four sampling transects concentrations of dissolved Si, NO_3^-, and TN were elevated by one to two orders of magnitude across the sampling regime. Values of salinity show the mirror image with low values within the nearshore zone (Figures 2-3, 4-9, Tables 1 and 2). The horizontal gradients were steepest on Transects 1 and 4, where the peak value of NO_3^- (44.08 and 17.5 µM, respectively) at the shoreline was more than two orders of magnitude higher than the concentration 150 m from shore (~0.1µM). Salinity at the shoreline of both Transects 1 and 4 was about 5‰ lower than the offshore values (Table 1). On Transects 2 and 3, horizontal gradients of Si, NO_3^- and salinity were also evident, but of a generally smaller magnitude than on Transects 1 and 4 (Tables 1 and 2).

Phosphate phosphorus (PO_4^{3-}) exhibited relatively small horizontal gradients with highest values generally nearest to the shoreline (Figure 2, Tables 1 and 2). The horizontal gradients of PO_4^{3-}, however, were small compared to Si and NO_3^-.

The pattern of elevated Si, NO_3^- and TN with a corresponding reduced salinity is indicative of groundwater entering the ocean near the shoreline. Low salinity groundwater, which contains high concentrations of Si, NO_3^-, TN and PO_4^{3-} (see values for well waters in Table 5), often percolates to the ocean near the shoreline, resulting in a distinct zone of mixing in the nearshore region. In the Kihei-Makena area, the zone of mixing generally extends to about 100 m of the shoreline, although in June 2005, elevated concentrations of Si, NO_3^- and TN were evident along the entire length of Transect 1(Tables 1 and 2).

Dissolved nutrient constituents that are not associated with groundwater input (NH_4^+, TP, TON, TOP) did not show any distinct patterns with respect to distance from the shoreline (Figure 2). Concentrations of TON, TP and TOP were essentially constant along the entire length of each transect (Figure 2). Concentrations of NH_4^+ were high near the shoreline and in a zone between 50 m and 150 m of the shoreline at Site 4 (Figure 2). Surface concentrations of turbidity and Chl *a* were highest near the shoreline and decreased with increasing distance offshore at all four sites (Table 1, Figure 3).

Among the four transect sites; values for turbidity were highest on Transect 2, which is the typical pattern seen on previous survey dates (Table 1, Figure 3). Transect 2 bisects Makena Bay, which is semi-enclosed embayment with a silt/sand bottom rather than the predominantly "hard" reef bottoms that occur at the three other transect sites. In addition, it has been observed that during flash floods originating in the ranch lands upslope of the Makena Resort terrigenous sediment flows to the ocean in Makena Bay. As a result of wave-induced resuspension of the naturally occurring silt/sand substratum, as well as terrigenous runoff which may be partially retained within the embayment, turbidity has been typically elevated at Transect 2 relative to the other transect sites. It is important to note that in surveys conducted since July 2002, water clarity in Makena Bay has improved greatly compared to preceding surveys in 2001 which reflected conditions following substantial input of terrigenous materials from a flash-flood that occurred in October 1999.

Surface water temperature measured beyond 10 m of the shoreline ranged between 25.7°C and 25.8°C during the June 2005 survey (Tables 1 and 2). Owing to the length of time between collection and return to the shoreline, temperature was not measured in the samples collected by divers.

B. Vertical Stratification

In many areas of the Hawaiian Islands, input of low salinity groundwater to the nearshore ocean creates a distinct buoyant surface lens that can persist for some distance offshore. Buoyant surface layers are generally found in areas where turbulent processes (primarily wave action) are insufficient to completely mix the water column in the nearshore zone. Figures 2 -15 and Tables 1 and 2 show concentrations of water chemistry constituents with respect to vertical stratification. During the June 2005 survey, vertical stratification was evident for Si, NO_3^-, TN and salinity over the entire length of the transects at Sites 1, 2 and 3. At Site 4, breaking surf of 1-2 m near the shoreline resulted in a relatively unstratified water column during the June 2005 survey.

With respect to the other constituents measured, there were variations between surface and deep samples, however, the differences were generally small and no apparent trend with distance offshore was evident (Figures 2-15). One exception was the distinctly higher concentration of Chl *a* in the surface waters compared to the deeper water at Site 1 (Figures 3 and 4).

C. Temporal Comparison of Monitoring Results

Figures 4-15 show mean concentrations (±standard error) of water chemistry constituents from surface and deep samples at all four sites during the fifteen monitoring surveys conducted from 1995 to 2005. In addition, the results of the most recent survey also shown.

Examination of the plots in Figures 4-15 show results of the most recent survey in comparison with the overall trend from the entire monitoring program. The only constituent that shows a consistent excursion above the mean values on all four transects is temperature. The water temperature of ~25.8°C at all stations in June 2005 was substantially higher than the mean values for the fifteen surveys to date.

Other instances where present survey results vary from the mean values are evident. At Sites 1, 3 and 4, Chl *a* concentrations from the present survey were above the mean value measured at all points along the transects (Figures 6, 12 and 15). The elevated concentrations of Chl *a* cannot be considered a response to input from the Makena Resort, as Site 2, which is closest to the golf course did not exhibit an elevated trend. In addition, Site 4, which is considered the Control beyond the influence of the golf course showed distinctly elevated concentrations in the June 2005 survey relative to the mean values. Measurements of NH_4^+ during June 2005 at Site 4 also exceeded the mean value at three of the seven sampling stations (Figure 13).

The dissolved nutrient in nearshore waters that is most liable to originate from leaching of golf course fertilizers is NO_3^-. During the June 2005 survey, concentrations of NO_3^- and TN in the nearshore area of Site 3 were well above the mean value (Figures 10 and 11). Site 3 is directly downslope of the portion of the golf course nearest to the ocean. It is also the site of active housing construction during the past six months. Continued monitoring will indicate whether or not operation of the golf course has resulted in incremental additions of nutrients to the composition of groundwater in this area. At the other transect sites, NO_3^- levels measured during this survey were of the same magnitude as the 10-year mean values.

D. Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material input from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. Comparison of the curves produced by such plots with conservative mixing lines provides an indication of the origin and fate of the material in question (Officer 1979, Dollar and Atkinson 1992, Smith and Atkinson 1993).

Figure 16 shows plots of concentrations of four chemical constituents (Si, NO_3^-, PO_4^{3-}, NH_4^+) as functions of salinity for samples collected in June 2005. Figures 17 and 18 show the same type of plot with data grouped by transect site for the composite of all past surveys, as well as for the most recent survey. Each graph also shows two conservative mixing lines that are constructed by connecting the end member concentrations of open ocean water with two sources of groundwater: 1) irrigation well No. 4 located on the North Course of the Makena Resort and 2) the irrigation lake that was fed by irrigation wells 2, 3 and 4. If the parameter in question displays purely conservative behavior (no input or removal from any process other than physical mixing), data points should fall on, or very near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as uptake by biotic metabolic processes, data points will fall below the mixing line.

Dissolved Si represents a check on the model as this material is present in high concentration in groundwater, but is not a major component of fertilizer. In addition, Si is not utilized rapidly within the nearshore environment by biological processes. It can be seen in Figure 16 that when concentrations of Si are plotted as functions of salinity, data points from each of the sampling sites prescribe distinct linear arrays. Data points from Transect Sites 1and 2 lie on the irrigation lake water mixing line. Most of the data points for showing concentrations of Si from Transect Site 4 fall on the conservative mixing line created from water collected from an irrigation well. Data points from Site 3 prescribe a linear array above both mixing lines. Such a pattern suggests that the groundwater mixing with ocean water at the shoreline has slightly different composition between Sites 1-2, 3 and 4. These differences are likely a result of irrigation of the golf courses upslope from Transect Sites 1-2 with water from the irrigation lakes, while naturally occurring groundwater is mixing with ocean water off Transect Site 4. Even with these subtle differences between sampling locations, it appears that the groundwater endmembers from well No. 4 provides a valid representation of the effects of golf course operation on unaltered groundwater that enters the ocean following flow through the golf courses. Over the course of monitoring since 1995, the relationship between salinity and Si has remained nearly constant (Figure 17).

NO_3^- is the form of nitrogen most common in fertilizer mixes that are used for enhancing turf growth. As is the case for Si, there is a distinct difference in the mixing lines created for NO_3^- by connecting endpoint concentrations of open ocean water with well water and irrigation lake water (Figure 16). These differences are likely a result of uptake of NO_3^- by plants in the irrigation lake that results is substantially lower concentrations than in the irrigation well.

As with Si, the plots of NO_3^- versus salinity show that data points from each transect lie in a distinct linear array. Data points from Transect 4, which is considered the control site with no influence from the golf course, lie close to the irrigation lake mixing line. Such a position indicates that the source of NO_3^- entering the ocean at Transect 4 contains no subsidies from activities on land. Conversely, all of the data points from Transect 1and 3 lie above all of the mixing lines, indicating a subsidy of NO_3^- to the ocean from sources on land. In addition, the slopes of the lines created from the data points from Transects 1 and 3 are distinctly different, indicating different sources of NO_3^- at the two sites. Such is not the case at Site 2 where all of the concentrations of NO_3^- in the ocean samples are a result of mixing of natural groundwater (i.e., well water) and ocean water (Figure 16).

Site 1 is located directly downslope from the boundary between the Makena and Wailea Golf Courses, while Site 3 is located downslope from the area of the South course that is closest to the ocean. It is possible that the apparent subsidy of NO_3^- is a result of leaching of golf course fertilizers to the groundwater lens. In addition to the nearby golf courses, however, there are also newly constructed house lots with landscaping and lawns near the shoreline at Site 1. An old cesspool also remains from a house recently torn down that was directly inshore of Site 3. New construction of a multi-unit housing complex has been on-going at Site 3 for the past 6 months. As the mixing model reveals that the subsidies of NO_3^- in nearshore waters at Sites 1 and 3 are qualitatively different, the input at Site 3 may be associated with leaching of sewage nutrients from these residential features as well as leaching of golf course nutrients.

Linear regression of NO_3^- concentrations as a function of salinity for the present survey has a Y-intercept (concentration at a salinity equal to that of well water) of 313 µM at Site 1, 129 µM at Site 2, 734 µM at Site 3, and 120 µM at Site 4. Compared to the averaged concentration of NO_3^- measured in four irrigation wells for this survey (161 µM), there appears to be a subsidy to groundwater of at least 151 µM at Site 1, and 573 µM at Site 3. Thus, the concentration of NO_3^- in undiluted groundwater entering the ocean at Sites 1 and 3 are increased by about 2-fold and 4-fold, respectively over background concentrations in groundwater. These values are slightly lower at Site 1 and slightly higher at Site 3 than the subsidies calculated from the sample concentrations from the previous surveys in March and November 2004. Hence, these subsidies may be slightly increasing with time at this location, while decreasing at Site 1. It is also apparent in Figure 17 that the slope of the NO_3^- data points as functions of salinity at Site 3 are the steepest that have been measured during the course of monitoring since 1995. Mixing analyses also indicate that groundwater from Sites 2 and 4 has not shown a significant increase in the concentration of NO_3^- compared to naturally occurring groundwater over the course of monitoring (Figure 17).

While the regression calculations reported above indicate substantial subsidies of NO_3^- to groundwater, it is important to note that with respect to potential environmental effects, it is nutrient availability in the water column that is of primary importance. While projected elevated concentrations of NO_3^- in groundwater reaching the shoreline may be the result of activities on land, the actual concentration of NO_3^- in nearshore waters at Site 3 does not differ greatly from areas with no subsidy. The average concentration of NO_3^- of samples collected within 50 m of the shoreline at Site 3 is 7.7 µM compared to 5.4 µM at Control Site 4.

Site 1 has also been used as a monitoring station for a similar evaluation of the effects of the Wailea Golf Courses on water chemistry since 1989. The lowest concentrations of NO_3^- relative to salinity at Site 1 occurred during the initial two years of study, with subsequent higher concentrations from 1992 through the last survey in 2001. Hence, there appears to have been an increase of NO_3^- in nearshore waters that was not occurring in 1989-1991.

Completion of the Wailea Gold Course occurred in December 1993, while completion of the Makena North Course occurred in November 1993. As the southern region of the Wailea Course and the northern part of the Makena Course overlap in the makai-mauka direction landward of ocean sampling Site 1, the increased concentrations of NO_3^- may be a result of leaching of fertilizer materials from the combined golf courses to groundwater that enters the ocean in the sampling area.

Similarly, the new location of sampling Site 3 is adjacent to the portion of the Makena Course extends to within approximately 50 m of the shoreline. This section of the course was recently grassed with new turf. In order to expedite rapid grow-in of the turn, maximal rates of fertilization are temporarily employed. Such rates of fertilizer application may be the source of the high levels of NO_3^- detected in offshore waters adjacent to the golf course. This site has only been investigated since August 2002 with similar results showing high levels of NO_3^- in the nearshore zone. Future time-series surveys will reveal if there is a downward trend in NO_3^- concentration with the decrease in fertilizer application on the golf holes adjacent to sampling Site 3.

While the data reveal a long-term subsidy to the concentration of NO_3^- in groundwater at Sites 1 and 3, it does not appear that there has been any adverse effect to the biota offshore of this area. Because of the linear relationship of the concentrations of NO_3^- as functions of salinity, there is no indication of uptake of this material in the marine environment. Such lack of uptake indicates that the nutrients are not being removed from the water column by metabolic reactions that could change the composition of the marine environment. Rather, the nutrients entering the ocean through groundwater efflux appear to be dispersed solely by physical mixing processes. As a result, it does not appear that the increased nutrients are causing any alteration in biological community composition or function.

Similar situations have also been observed in other locales in the Hawaiian islands where nutrient subsidies from golf course leaching result in excess NO_3^- in the nearshore zone. At Keauhou Bay on the Big Island, it was shown that owing to the distinct vertical stratification in the nearshore zone, the excess nutrients never come into contact with benthic communities, thereby limiting the potential for increased uptake by benthic algae. In addition, the residence time of the high nutrient water was short enough within the embayment to preclude phytoplankton blooms. As a result, while NO_3^- concentrations doubled as a result of golf course leaching for a period of at least several years, there was no detectable negative effect to the marine environment (Dollar and Atkinson 1992). Owing to the unrestricted nature of circulation and mixing off the Makena project (no confined embayment) it is reasonable to assume that the excess NO_3^- subsidies that are apparent in the present study will not result in alteration to biological communities.

Inspection of the offshore area reveals an apparently healthy coral reef that does not appear to exhibit any negative effects from nutrient loading. There are no areas where excessive algal growth is presently occurring. The mean concentration of Chl *a* in surface waters within 50 m of the shoreline off of Site 3 (0.65 µg/L), was the lowest of any of the four transects, and was nearly one-third the values that occurred off Control Site 4 (1.76 µg/L), which displayed no subsidy of NO_3^-. The lower values of Chl *a* indicate that plankton biomass is not elevated in the areas of highest nutrient subsidy to groundwater. Continued monitoring will indicate if this trend continues.

It is also important to note that there is no subsidy of NO_3^- at Site 2 (Makena Landing) that was impacted by the flash flood in 1999. While turbidity in this area was affected on a sustained basis (at least for a year following the flood), there is no increase in the form of nitrogen associated with golf course fertilization.

The other form of dissolved inorganic nitrogen, NH_4^+, does not show a linear pattern of distribution with respect to salinity for either the June 2005 survey (Figure 16) or the entire monitoring program (Figure 18). Many of the samples with near oceanic salinity also displayed the highest concentrations of NH_4^+. The lack of a correlation between salinity and concentration of NH_4^+ suggests that this form of nitrogen is not present in the marine environment as a result of mixing from groundwater sources. Rather, NH_4^+ is generated by natural biotic activity in the ocean waters off Makena. It is also interesting to note that the conservative mixing line for NH_4^+ constructed from the endpoint concentration from irrigation lake 10, composed of well water and sewage effluent, has a substantially steeper slope than the mixing line constructed from water from irrigation Well 4.

PO_4^{3-} is also a major component of fertilizer, but is usually not found to leach to groundwater to the extent of NO_3^-, owing to a high absorptive affinity of phosphorus in soils. Data points for PO_4^{3-} from the June 2005 survey do not show a distinct linear trend with respect to salinity at any of the sites. Some of the highest concentrations of PO_4^{3-} occurred at the Control Site (Figure 16). The elevated NO_3^- at Sites 1 and 3, which appear to be influenced by golf course and residential landscaping, is not reflected in similar subsidies of PO_4^{3-}. Examination of the entire data set indicates that the highest concentrations of PO_4^{3-} occur at Control Site 4, which is deemed beyond the influence of the golf course. Over the entire monitoring program, the data set shows the same consistent trend (Figure 18).

D. Compliance with DOH Standards

Tables 1 and 2 also show samples that exceed DOH water quality standards for open coastal waters under "wet" and "dry" conditions. These criteria are applied depending upon whether the area is likely to receive less than (dry) or greater than (wet) 3 million gallons of groundwater input per mile per day. As it is not readily possible to accurately estimate groundwater and surface water discharge, both wet and dry standards are considered. DOH standards include specific criteria for three situations; criteria that are not to be exceeded during either 10% or 2% of the time, and criteria that are not to be exceeded by the geometric mean of samples. With only fifteen samples collected to date from each sampling station, comparison of the 10% or 2% of the time criteria for any sample is not statistically meaningful. However, comparing sample concentrations to these criteria provide an indication of whether water quality is near the stated specific criteria.

Boxed values in Tables 1 and 2 show instances where measurements exceed the DOH standards under dry conditions, while boxed and shaded values show instances where measurements exceed DOH standards under wet conditions. During the June 2005 survey, concentrations of NO_3^- in samples collected within 10 m of the shoreline on all four transects, including Control Site 4, exceeded the 10% "wet" standards. Concentrations of NO_3^- also exceeded the wet standards along the remainder of Transect 1 and to 50 m offshore at Station 3 (Table 1). From the preceding discussion of conservative mixing, it is apparent that natural input of groundwater to the nearshore zone can substantially raise the concentrations of NO_3^- to values exceeding DOH standards without anthropogenic subsidies. While there is no statistically significant increase of NO_3^- over natural groundwater input at Sites 2 and 4, a few samples from both these areas exceed the DOH limits. This is especially important at Control Site 4, where there is no influence from the golf courses. Thus, it appears that input of natural groundwater (and possible non-Resort activity) can result in ocean water quality measurements that can be interpreted to exceed DOH standards.

In addition, results from the June 2005 survey indicated that eight measurements of NH_4^+, sixteen measurements of TN, four measurements of turbidity and all but nineteen measurements of Chl *a* exceeded the 10% DOH criteria under dry conditions. No measurements of TP exceeded the 10% dry standards during June 2005. When compared under wet conditions, only three measurements of NH_4^+, nine measurements of TN and fifteen measurements of Chl *a* were exceeded.

Tables 3 and 4 show geometric means of samples collected at the same locations during the fifteen increments of the monitoring program at all four sites. Also shown in these tables are the samples that exceed the DOH geometric mean limits for open coastal waters under "dry" (boxed) and "wet" (boxed and shaded) conditions. For NO_3^-, NH_4^+, and TN numerous dry and wet standards were exceeded. Five samples of TP, eighteen samples of turbidity exceeded the dry standards. All samples exceed the geometric mean standards for Chl *a*.

Site 4 is considered a control transect, in that it is not located offshore of a golf course. However, it can be seen in Tables 3 and 4 that the number of samples that exceed geometric mean criteria at Site 4 are comparable to the other three sites, all of which are located downslope from the Makena Resort. Hence, it appears that the Resort activities, including golf courses cannot be attributed as the sole (or even major) factor causing water quality to exceed geometric mean standards.

IV. SUMMARY

- The fifteenth phase of water chemistry monitoring of the nearshore ocean off the Makena Resort was carried out on June 19, 2005. Fifty ocean water samples were collected on three transects spaced along the project ocean frontage. One transect was located outside of the Makena Resort area in order to serve as a control site. Site 1 was located at the northern boundary of the project, Site 2 was located near the central part of the Makena North Golf Course in the center of Makena Bay, Site 3 was downslope from the part of Makena South Golf Course that comes closest to the shoreline, and Control Site 4 was located to the south of Makena Resort off the 'Ahihi-Kina'u Natural Area Reserve. Sampling transects extended from the shoreline out to the open coastal ocean. Water samples were analyzed for chemical criteria specified by DOH water quality standards, as well as several additional criteria. In addition, water samples were collected from seven irrigation wells and two irrigation lakes located on the Makena Golf Courses.
- Water chemistry constituents that occur in high concentration in groundwater (Si, NO_3^- and PO_4^{3-}) displayed distinct horizontal gradients with high concentrations nearest to shore and decreasing concentrations moving seaward. Based on salinity, groundwater input was greatest at Sites 1, 3 and 4, and to a lesser extent at Site 2. As Site 4 was not located in the vicinity of the Makena Resort, it is apparent that groundwater input is not solely a response to land usage.
- Slight vertical stratification of the water column was evident beyond 10 m of the shoreline at Sites 1, 2 and 3, but not at Site 4. Vertical and horizontal patterns of distribution indicate that physical mixing processes

generated by wind, waves and currents were not sufficient for complete mixing of the water column at these sites.

- Turbidity and Chl *a* were elevated near the shoreline at all four sites, as has been the case in all previous surveys. Site 2 is located at the point where sediment-laden storm water runoff entered the ocean following a flash flood in October 1999. While the highly turbid conditions associated with the runoff event are no longer evident, normal processes of circulation (tidal exchange, wave mixing) and the silt/sand bottom result in slightly more turbid conditions in Makena Bay (Site 2) compared to the other sampling sites that occur in areas with predominantly hard reef substrata.

- Most water chemistry constituents that do not occur in high concentrations in groundwater did not display any recognizable horizontal or vertical trends.

- Scaling nutrient concentrations to salinity indicates that there were measurable subsidies of NO_3^- to the groundwater that enters the nearshore ocean at Sites 1 and Site 3. The subsidy substantially increases the concentration of NO_3^- with respect to salinity in groundwater flowing to the ocean compared to natural groundwater. The area shoreward of Site 1 includes an overlap of the southern part of the Wailea Gold Course and the northern part of the Makena North Course, as well as residential development. Site 3 is directly downslope from the Makena South Course in an area that was recently planted with new turf, which requires maximal fertilization to expedite growth. In addition, a cesspool remains from a house that was recently torn down lies directly inshore from Site 3. Hence, the subsidies of NO_3^- noted at Sites 1 and 3 may result from a combination of sources. While the scaling of nutrient concentration to salinity indicates that the projected concentration of NO_3^- in undiluted groundwater is subsidized by inputs from land uses, the actual concentrations of NO_3^- in the ocean at Site 3 are only slightly elevated over the control site.

- Similar subsidies of NO_3^- were not evident at Site 2, off the Makena North Course (Makena Bay). Thus, other sources besides golf course fertilizers may be contributing to the nutrient subsidies. If the subsidy of NO_3^- is a result of construction and operation of the existing golf courses, future monitoring surveys should indicate if the leaching of NO_3^- to the ocean is a temporary phenomenon that decreases with time, or is a continuing pattern.

- There is no subsidy of PO_4^{3-} corresponding to the subsidy of NO_3^- at Site 1. However, the highest concentrations of PO_4^{3-} were measured in nearshore samples at Site 4. As Site 4 is a control, the slightly elevated concentrations of PO_4^{3-} are originating from sources not associated with the Makena Resort.

- Comparing water chemistry parameters to DOH standards revealed that numerous measurements of NO_3^-, a few measurements of NH_4^+, TN, and turbidity and nearly all measurements of Chl *a* exceeded the DOH "not to exceed more than 10% of the time" criteria for dry and wet conditions of open coastal waters. No measurements of TP exceeded the DOH standards during this survey. It is apparent that the concentrations of NO_3^- in nearshore marine waters that contains a mixture of seawater and natural groundwater may exceed DOH criteria with no subsidies from human activities on land. Numerous values of NO_3^-, NH_4^+, TP, TN, turbidity and all measurements of Chl *a* exceeded specified limits for geometric means. Such exceedances occurred at all survey sites, including the control site that was far from any golf course influence.

- As in past surveys, there appears to be a definite input of nutrients (NO_3^-) to groundwater that enters the nearshore ocean at sampling sites downslope from parts of the Makena Resort, as well as other residential properties. However, this input has not increased substantially relative to previous surveys, and does not appear to be detrimental to marine community structure.

- The next phase of the Makena Resort monitoring program is scheduled for the second half of 2005.

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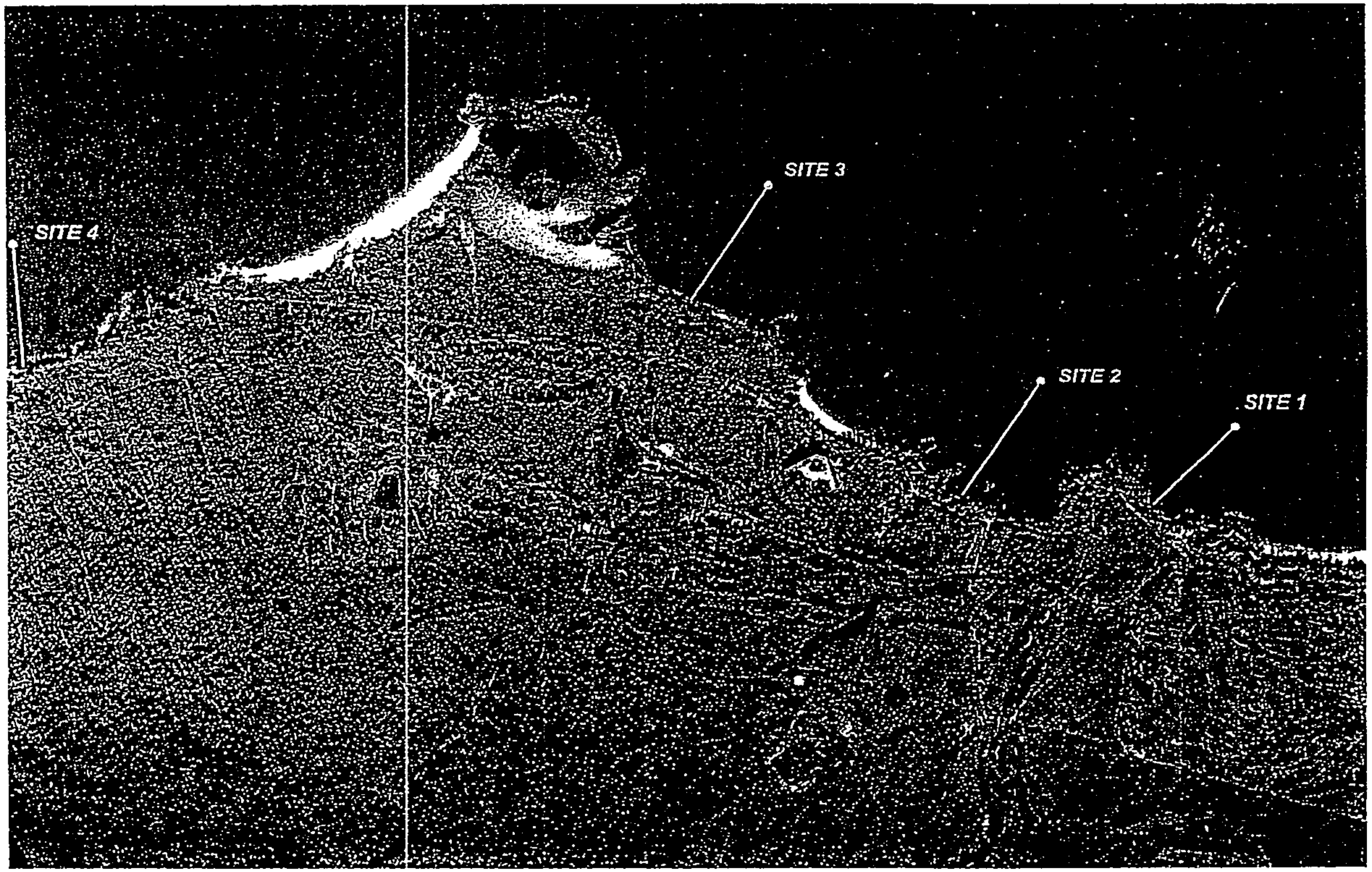

FIGURE 1. Aerial photograph of Makena Golf Courses on Southwest coastline of Maui showing locations of four ocean water sampling sites.

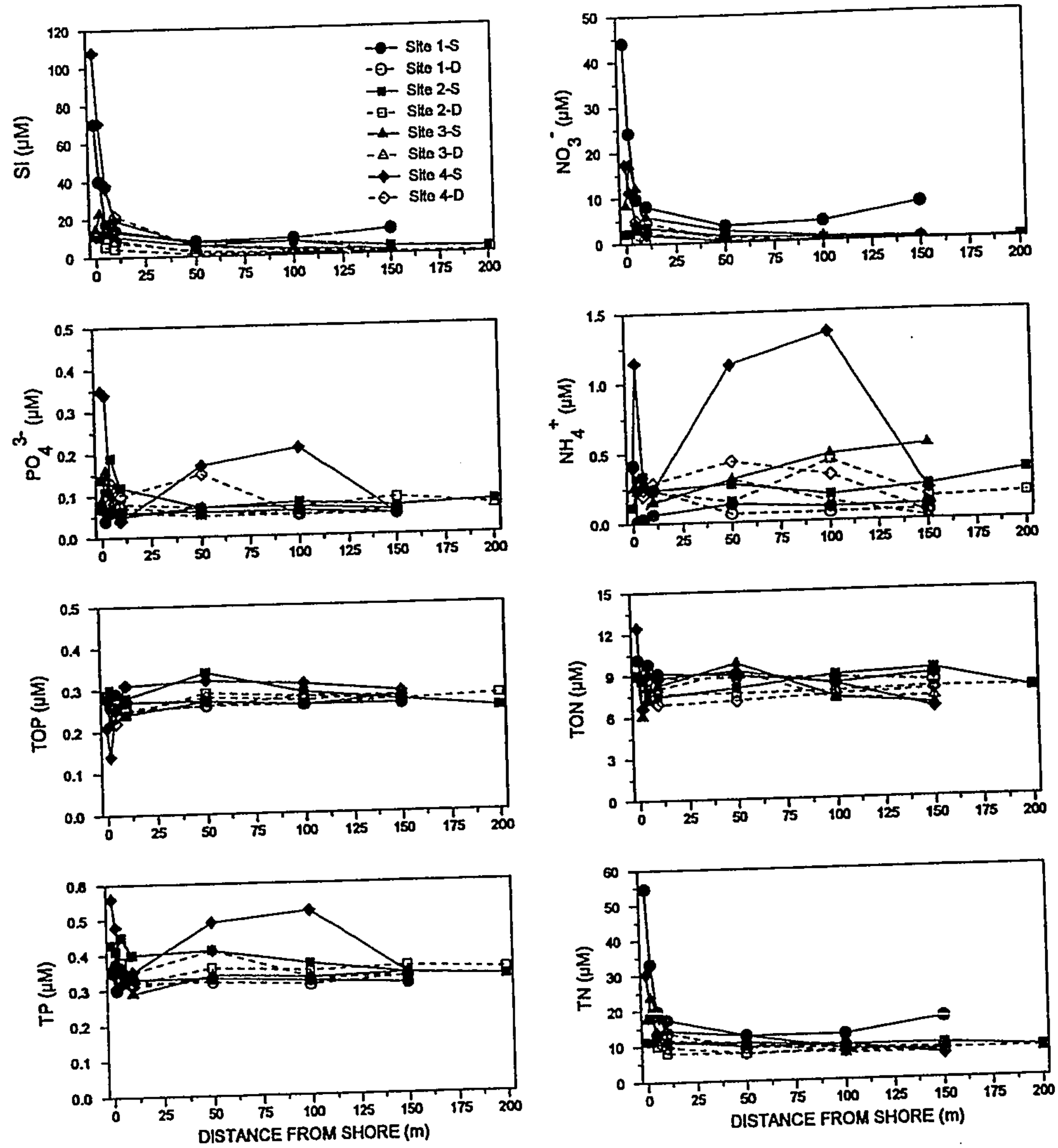

FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected on June 19, 2005 as a function of distance from the shoreline in the vicinity of Makena Resort. For site locations, see Figure 1.

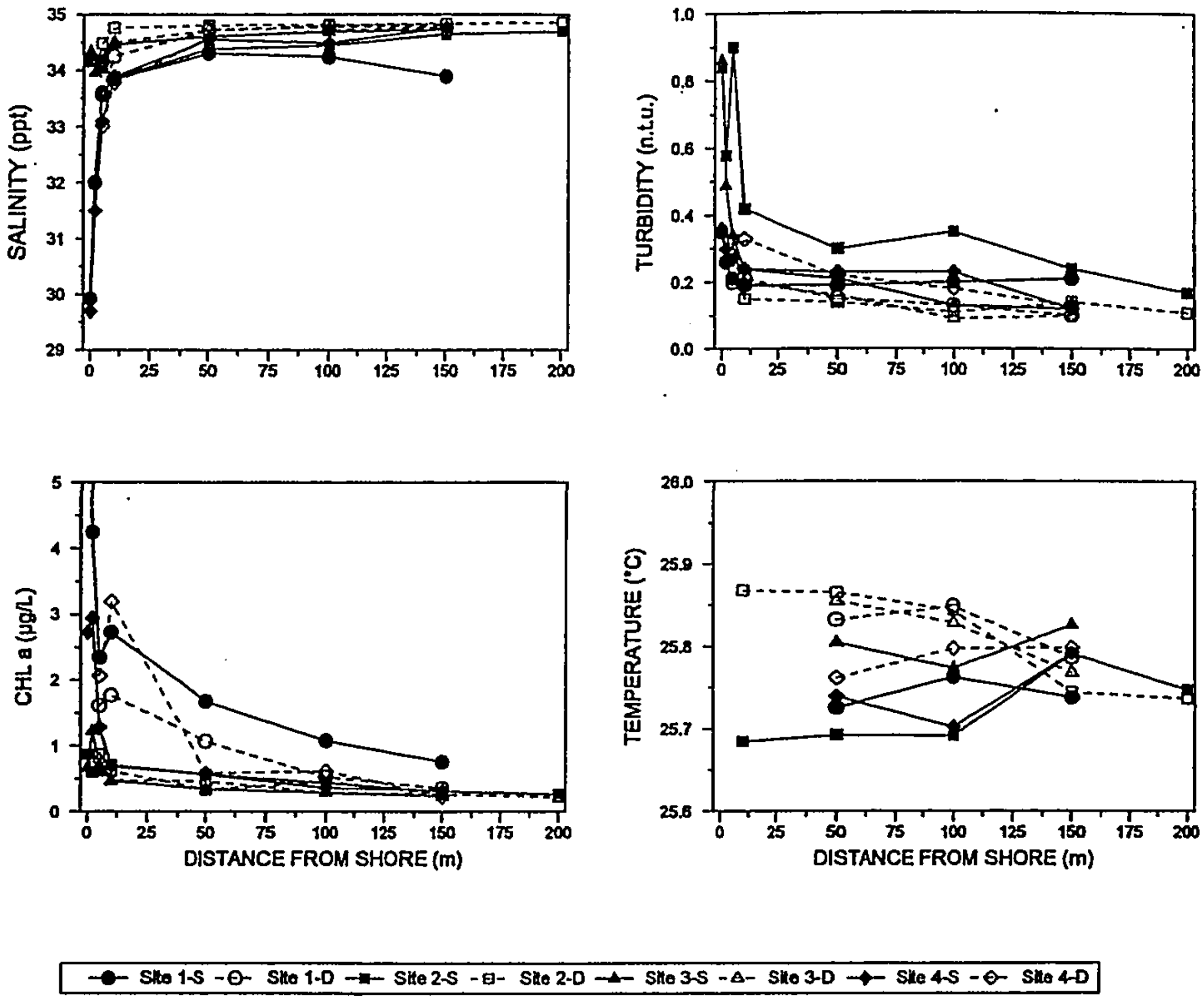

FIGURE 3. Plots of water chemistry constituents in surface (S) and deep (D) samples collected on June 19, 2005 as a function of distance from the shoreline in the vicinity of Makena Resort. Note: temperature data was not recorded for nearshore samples at Sites 1, 3 and 4. For site locations, see Figure 1.

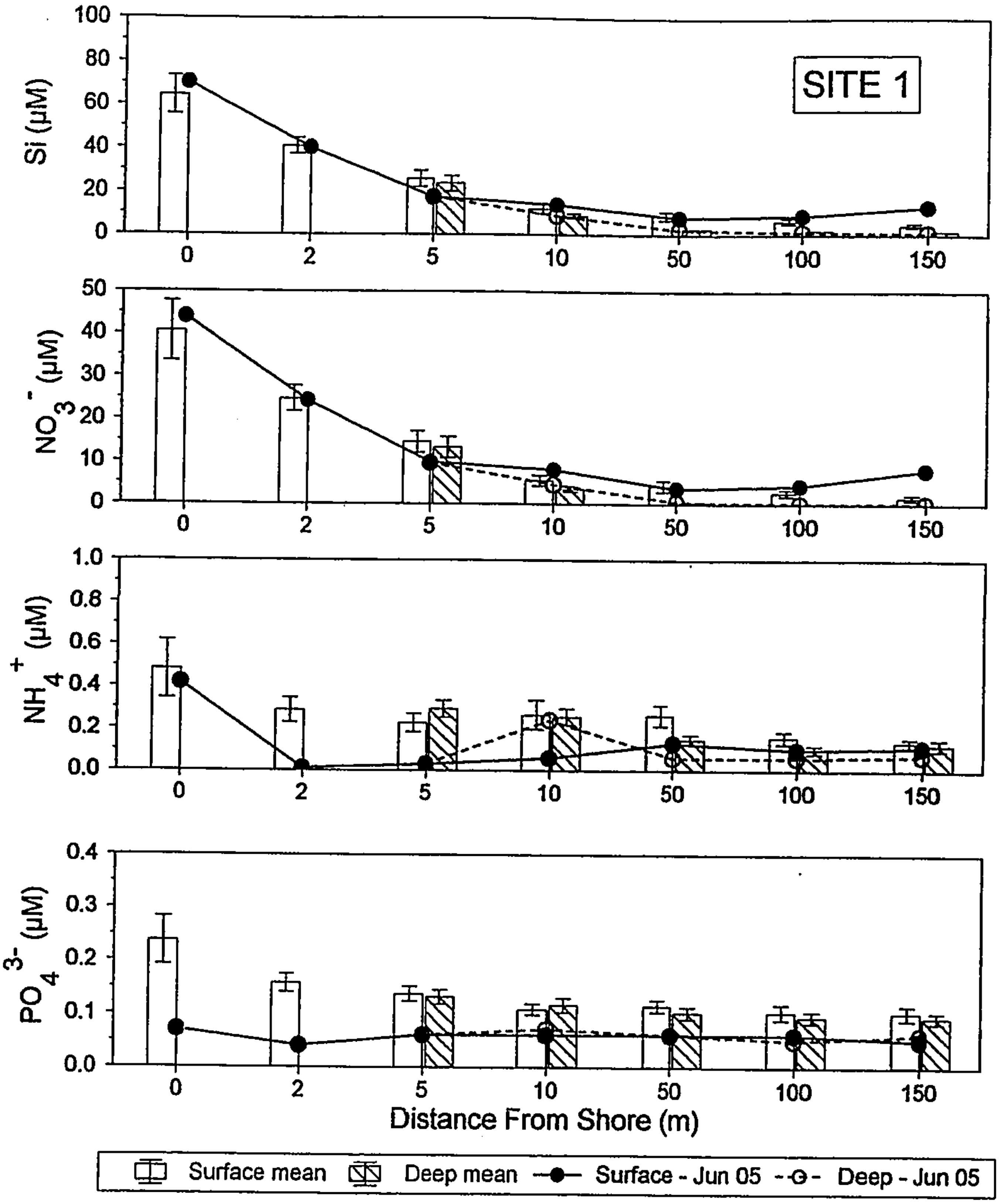

FIGURE 4. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 1, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

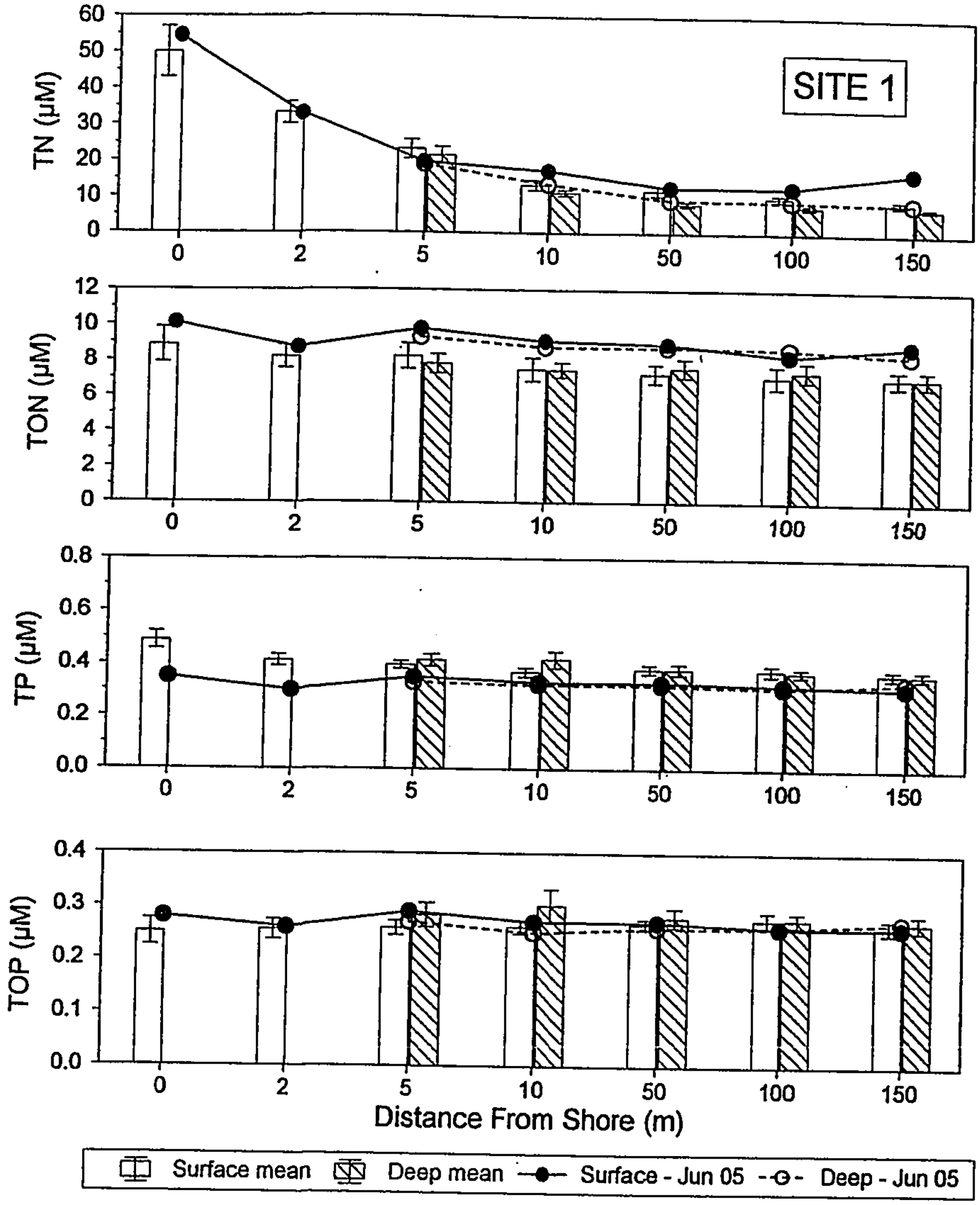

FIGURE 5. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 1, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

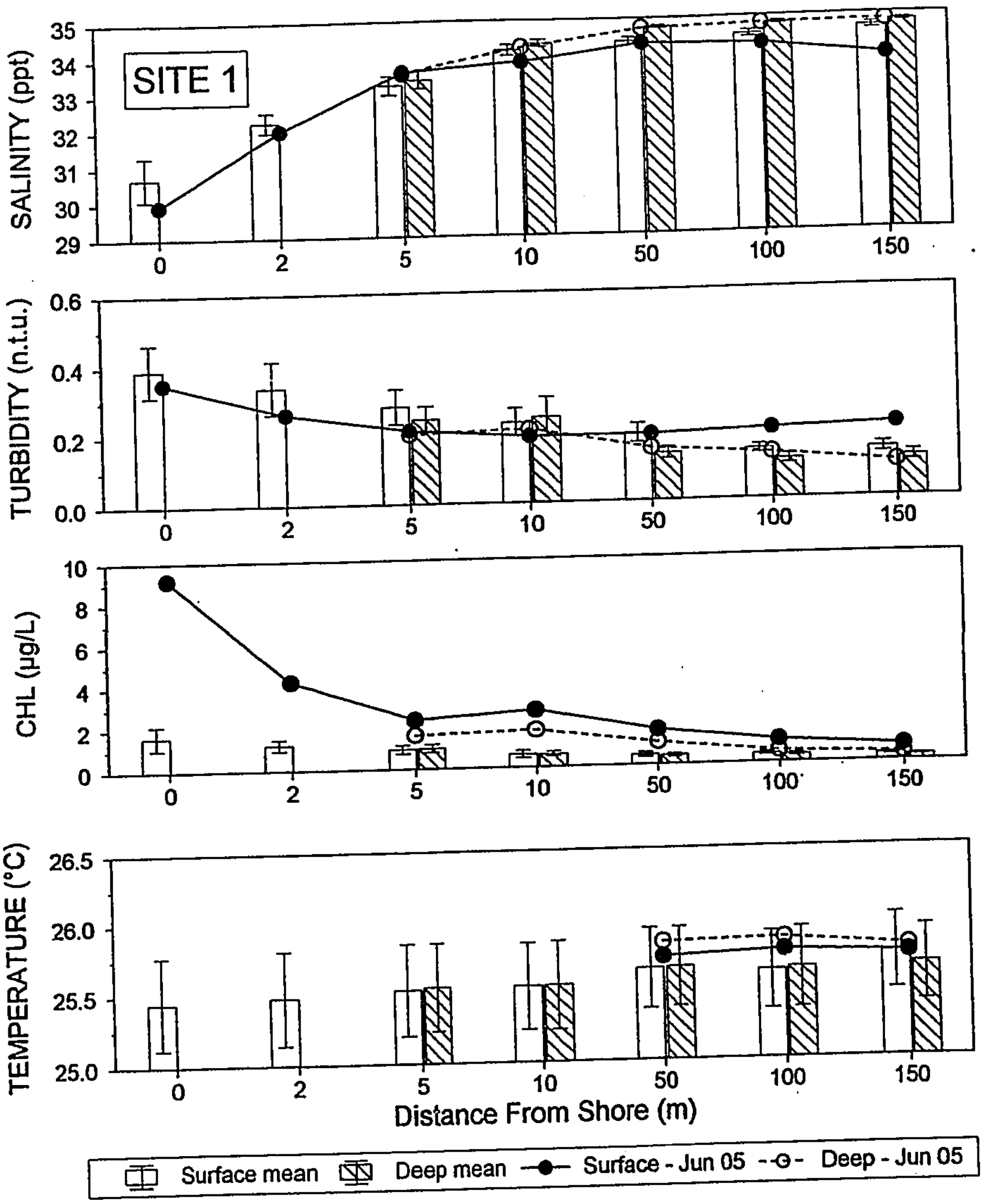

FIGURE 6. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 1, offshore of the Makena Resort. Data points and connected lines from samples collected during the most survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

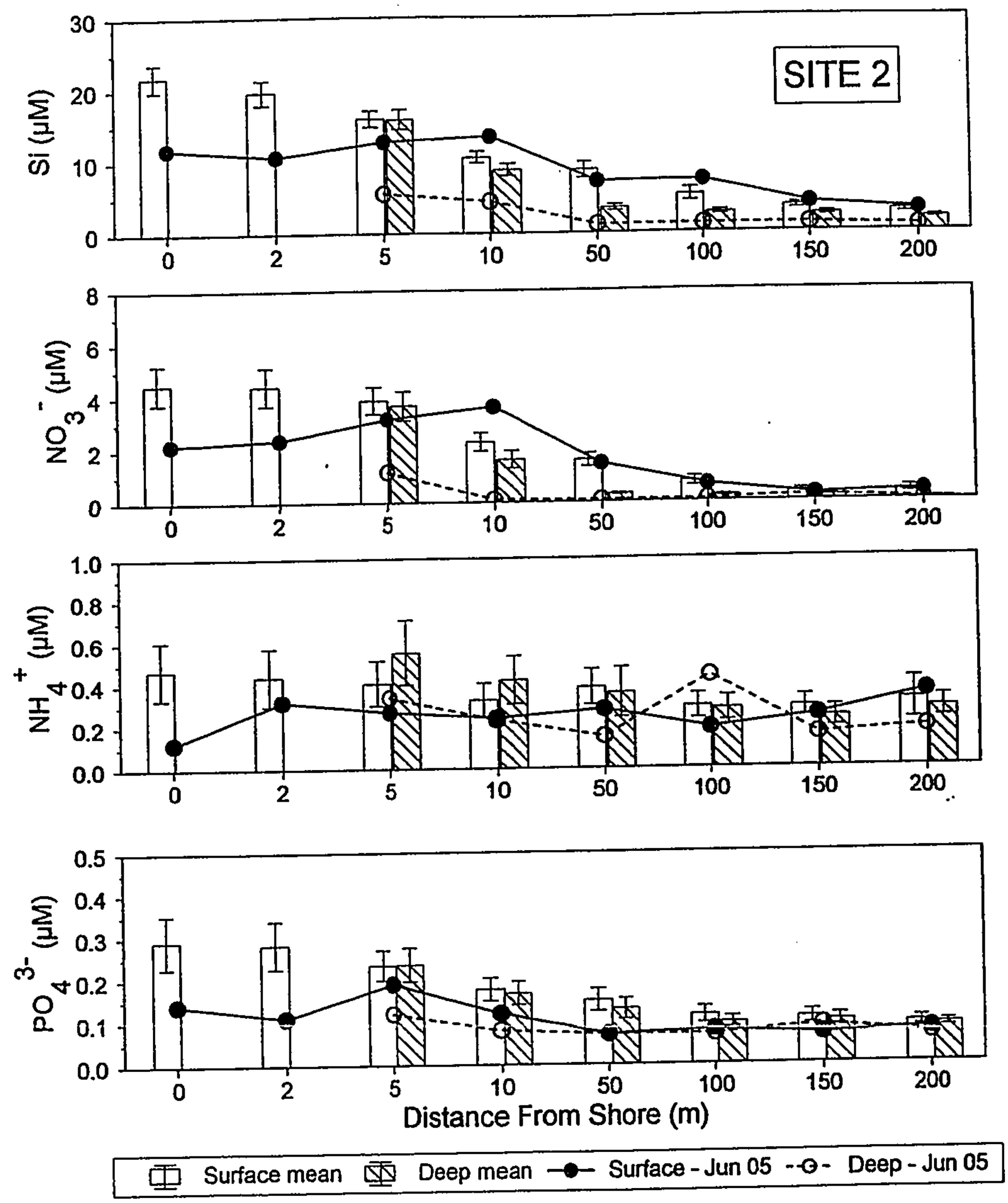

FIGURE 7. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 2, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

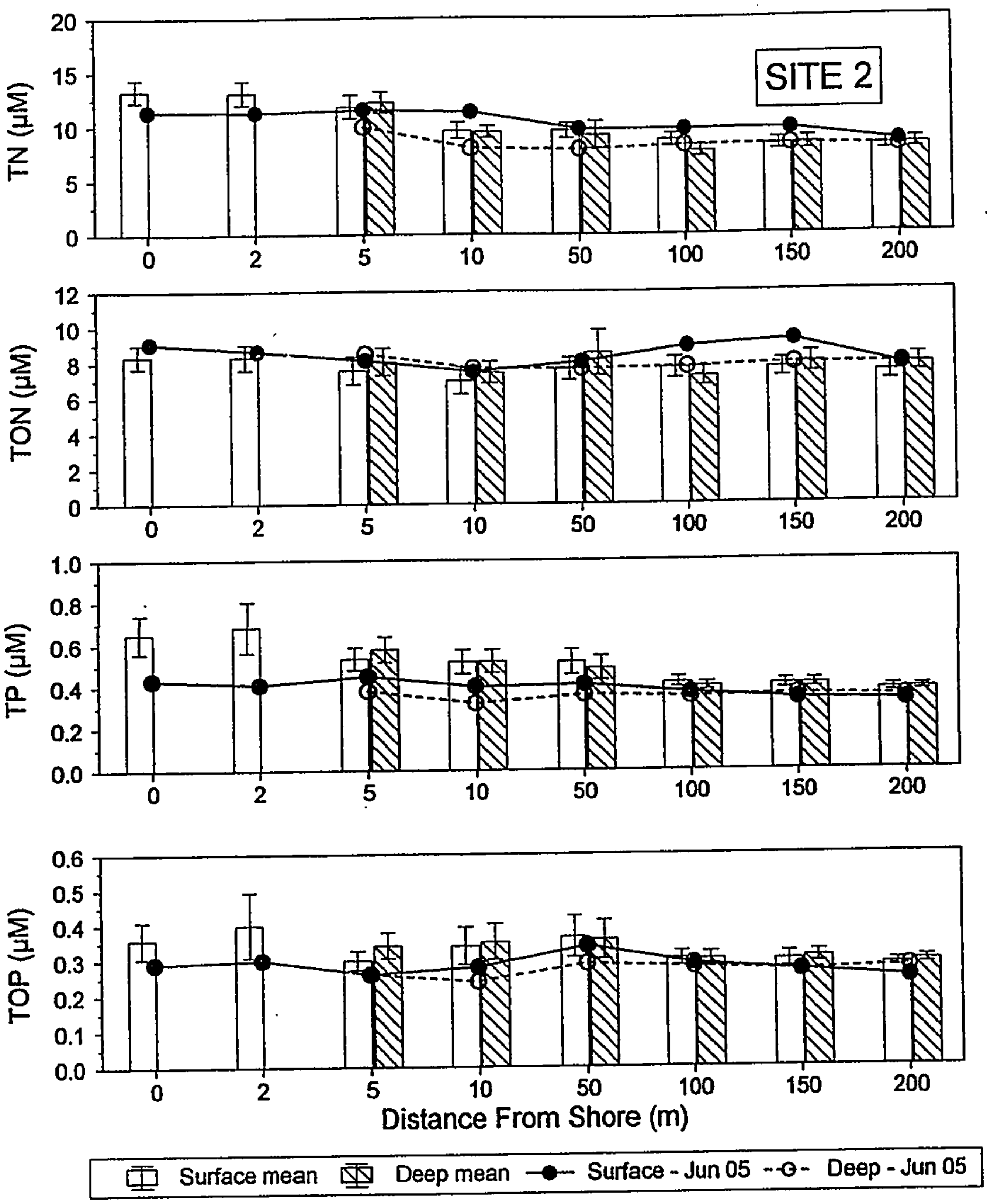

FIGURE 8. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 2, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

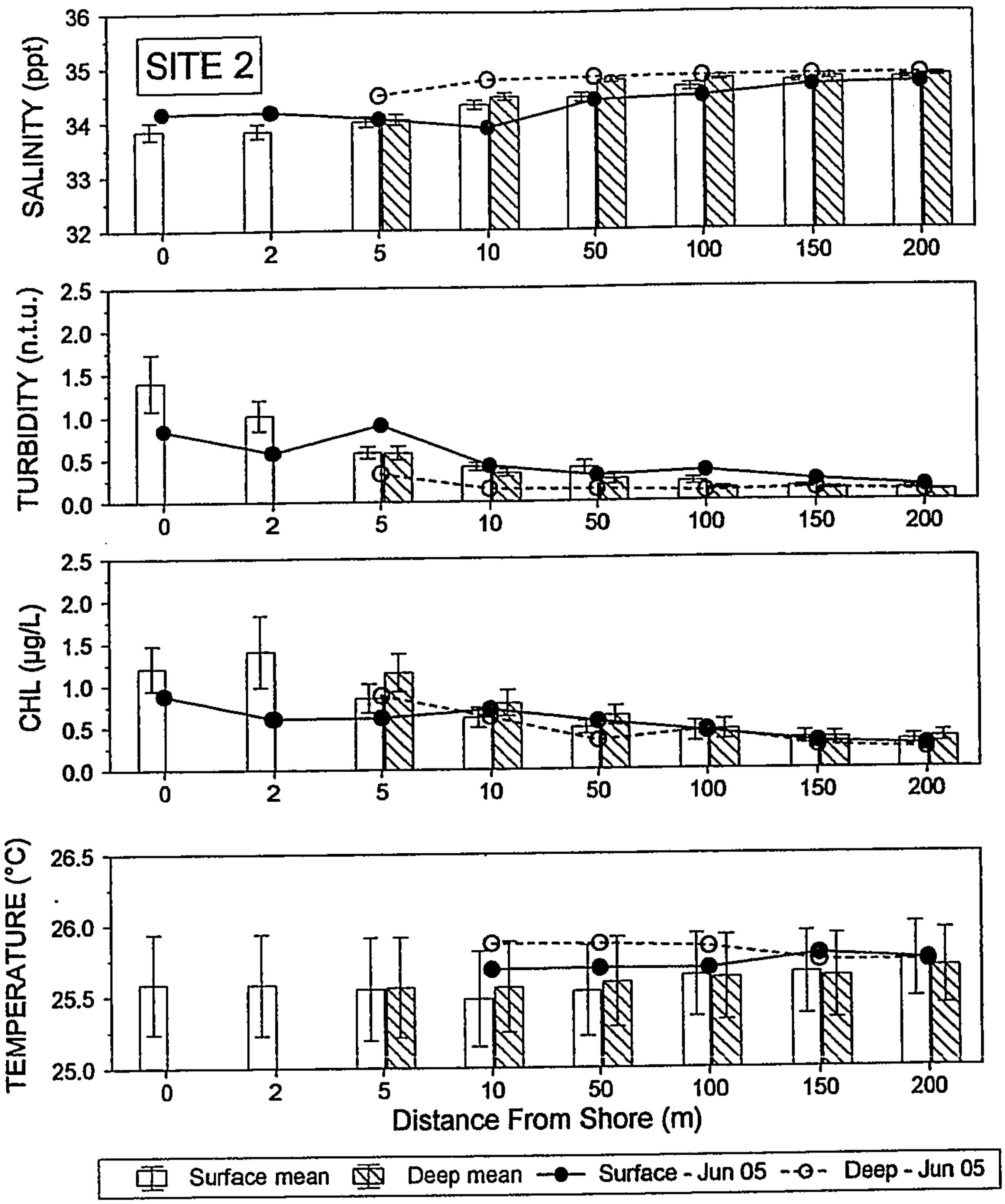

FIGURE 9. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 2, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey,bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

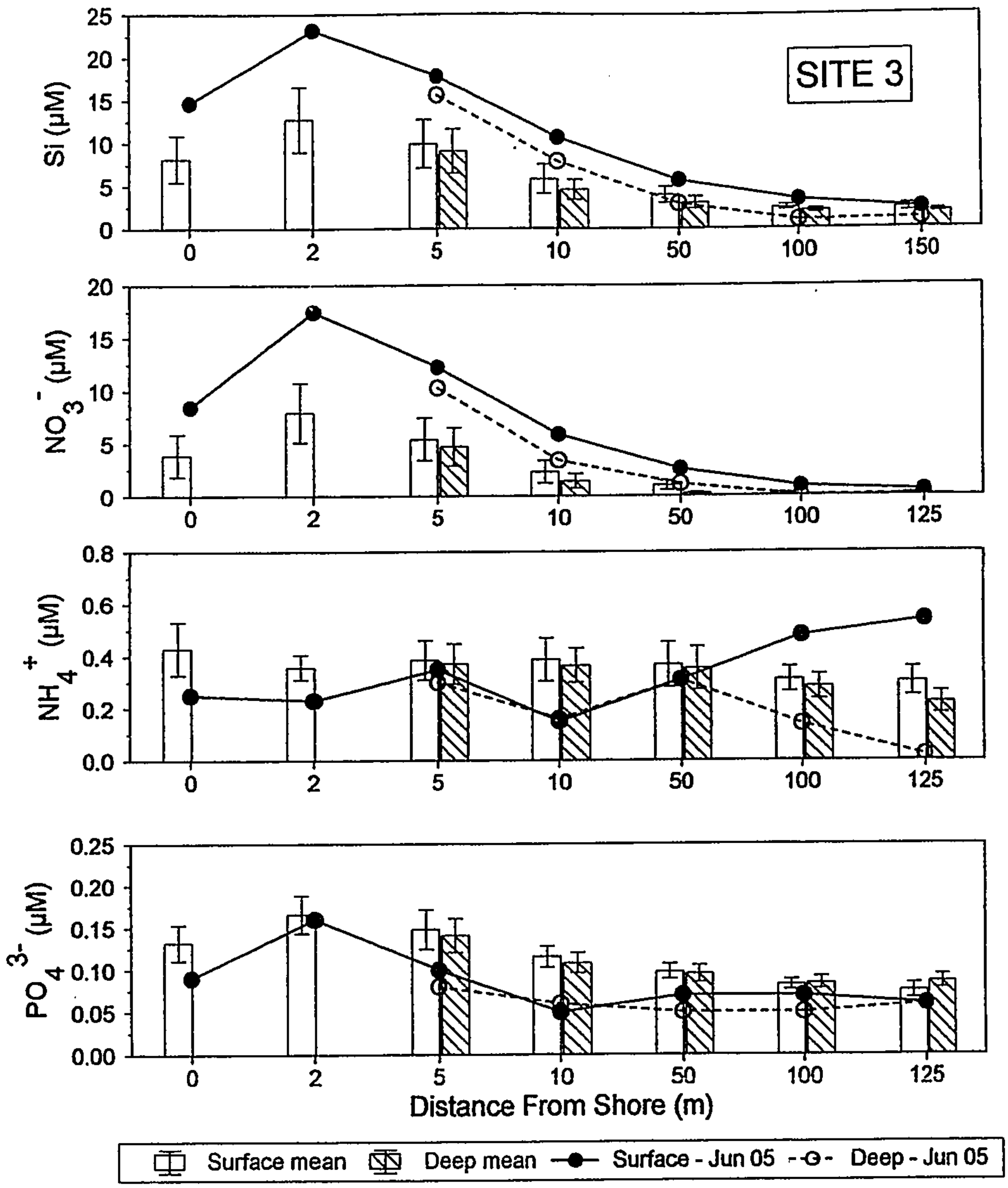

FIGURE 10. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

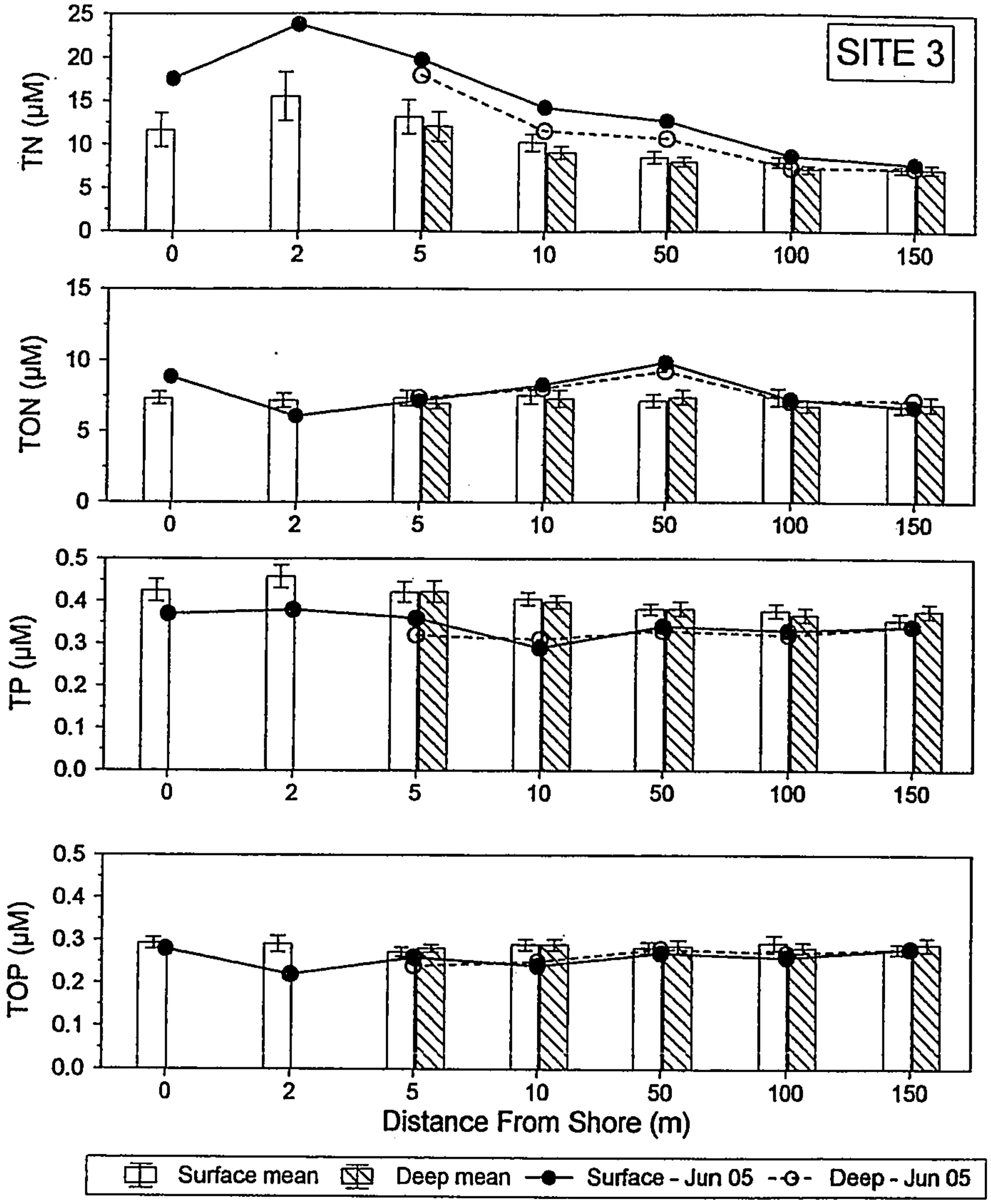

FIGURE 11. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

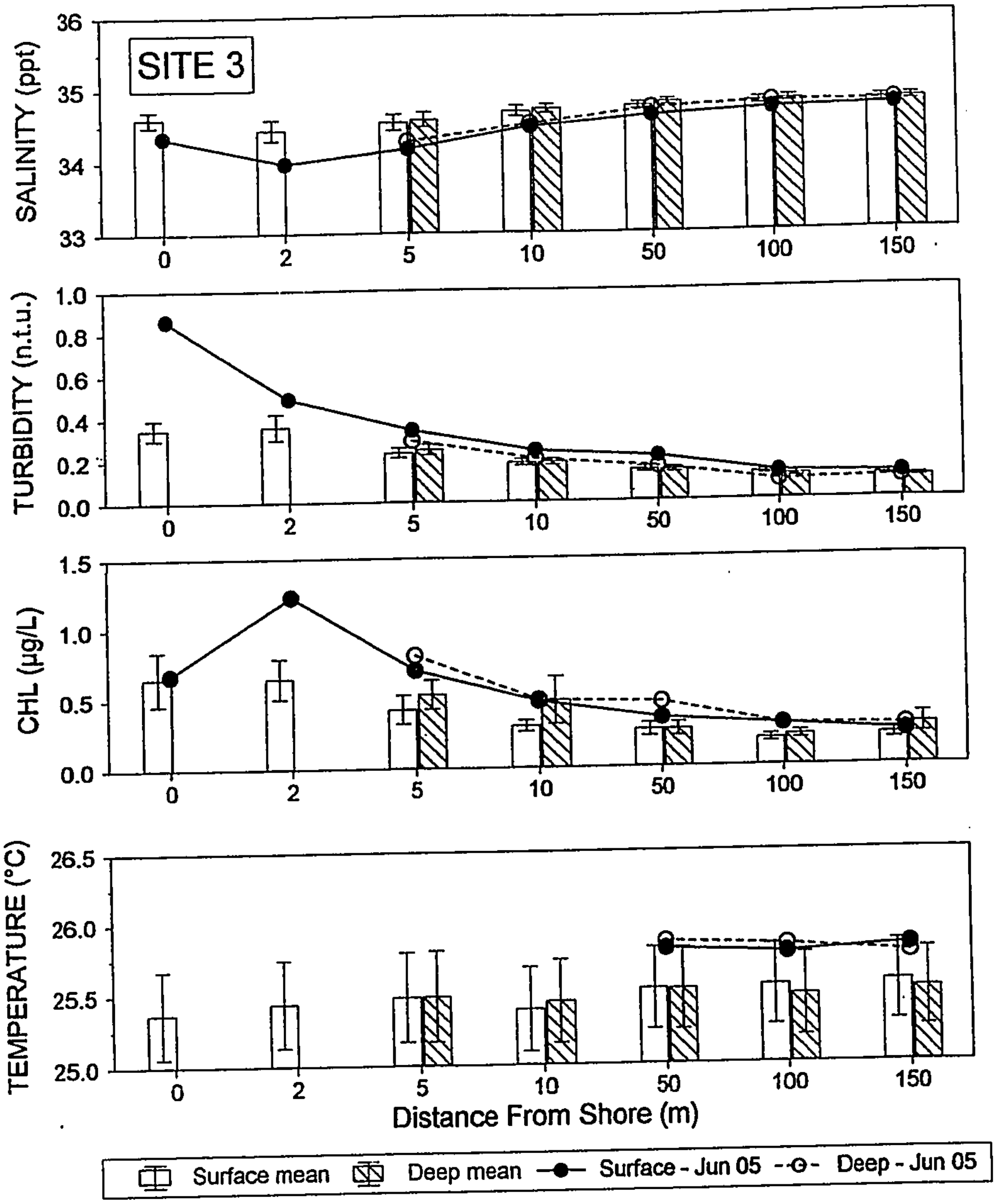

FIGURE 12. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

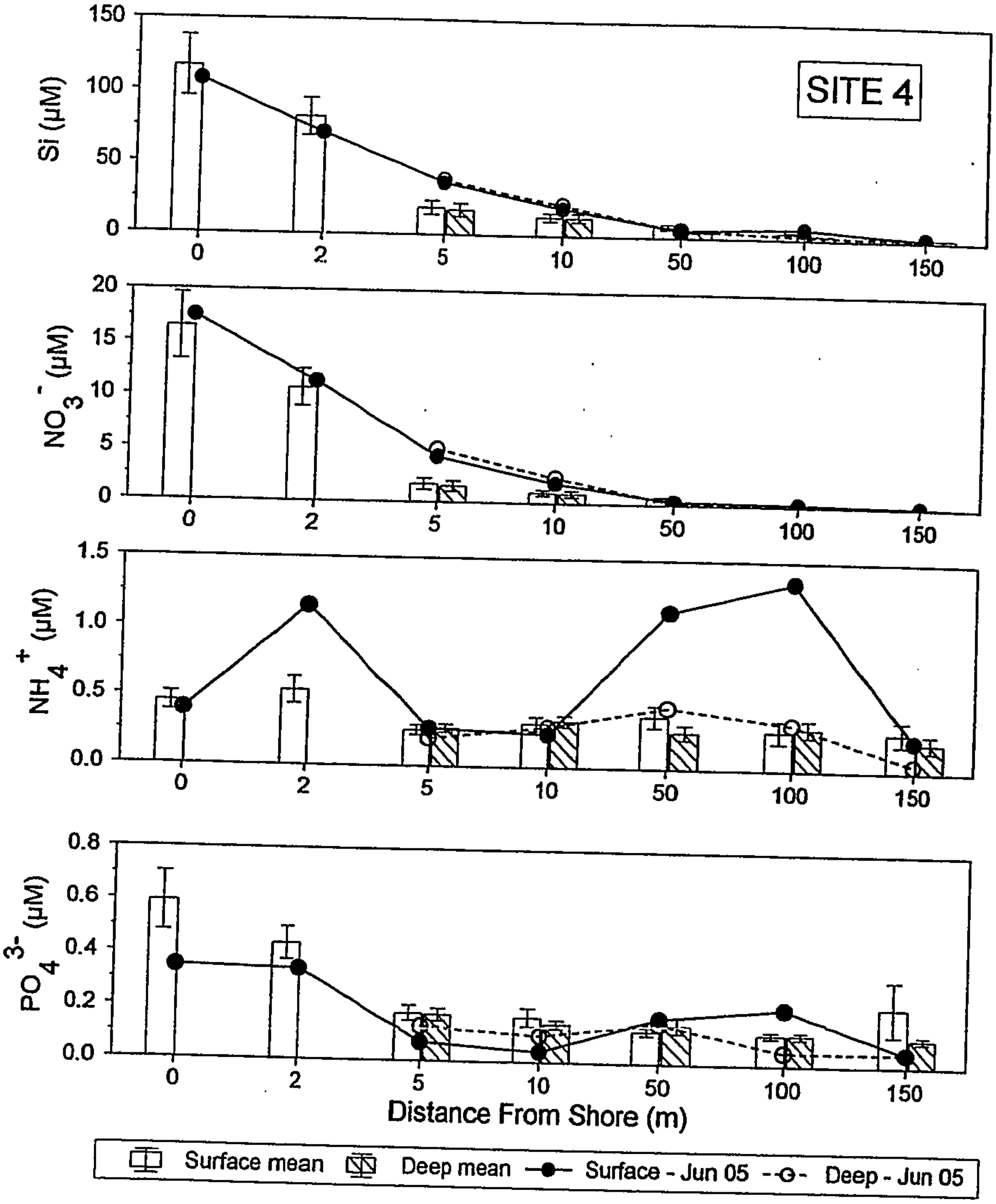

FIGURE 13. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 4, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. Note Y-axis scale break for Si and NO3. For site location, see Figure 1.

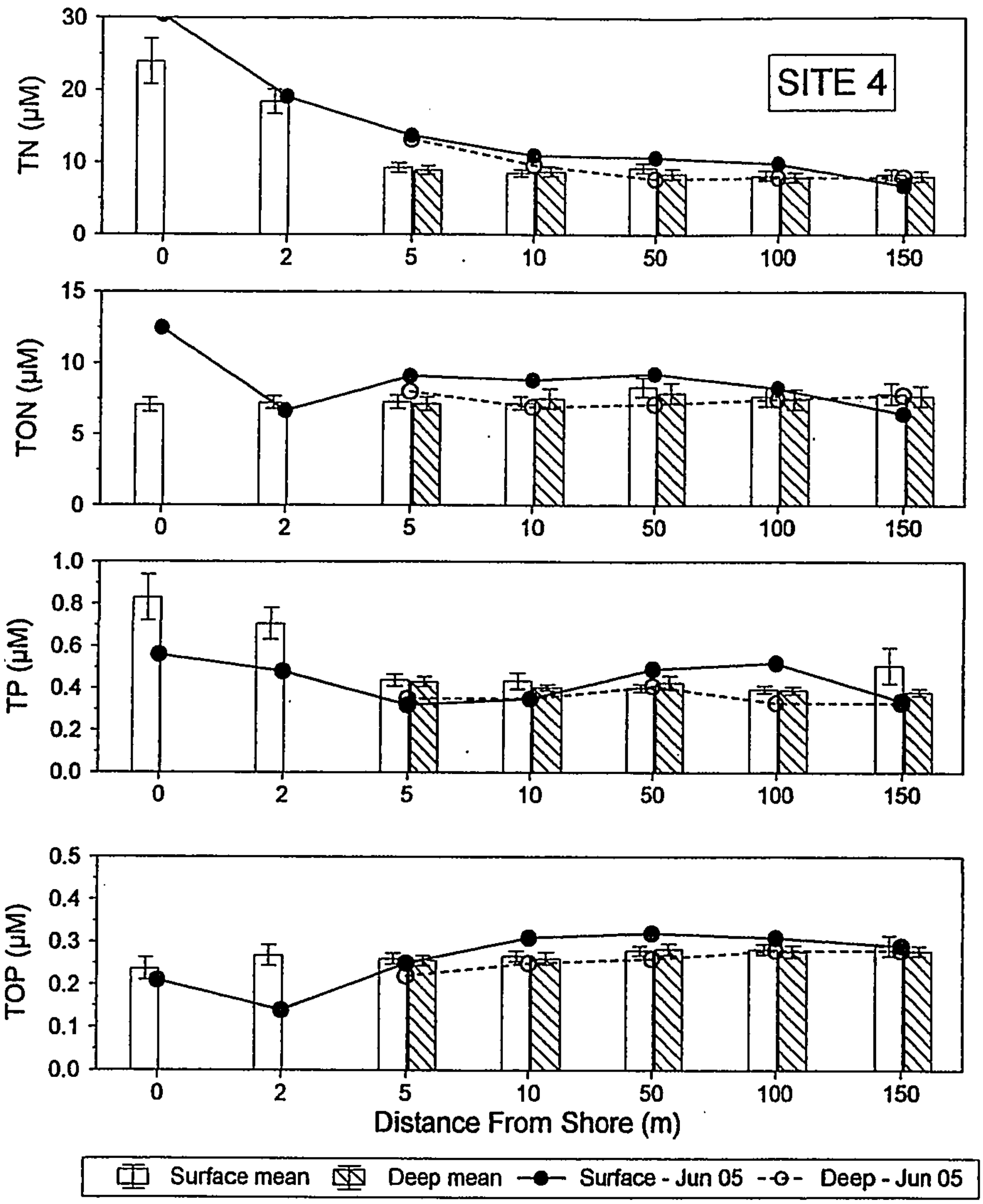

FIGURE 14. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 4, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

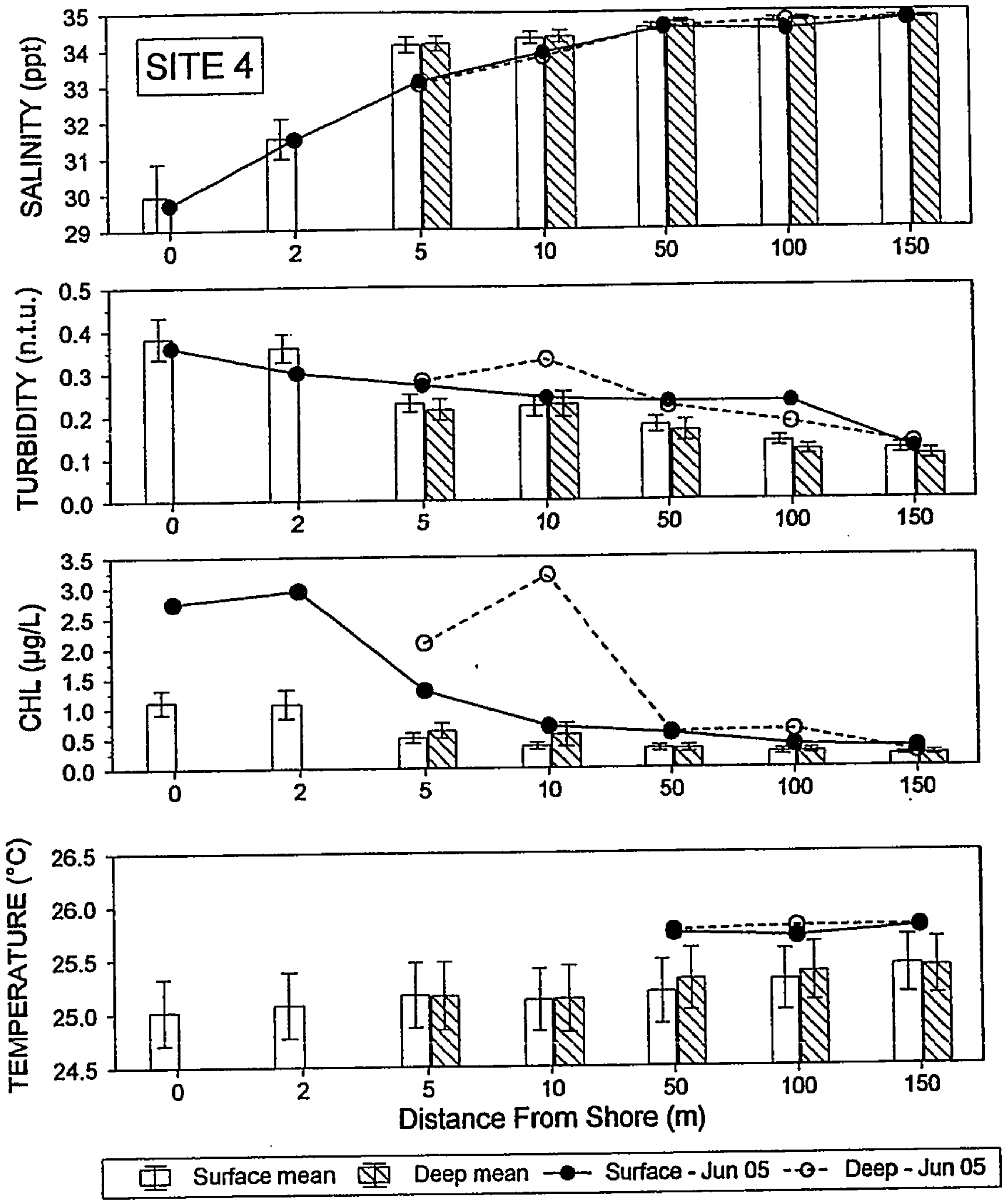

FIGURE 15. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 4, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=15). Error bars represent standard error of the mean. For site location, see Figure 1.

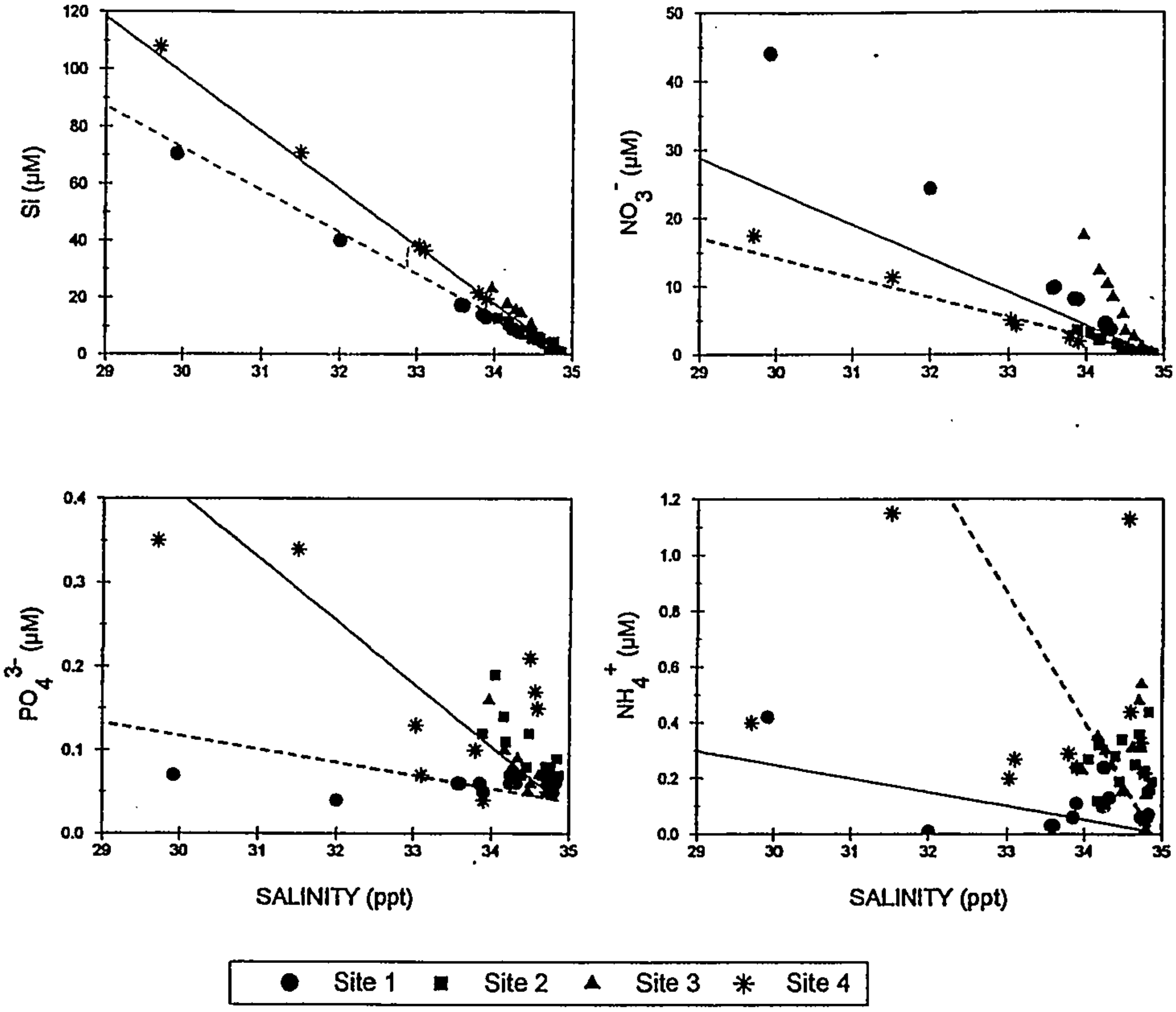

FIGURE 16. Mixing diagram showing concentration of dissolved nutrients from samples collected offshore of the Makena Resort on June 19, 2005 as functions of salinity. Solid red line in each plot is conservative mixing line constructed by connecting the concentrations in open coastal water with water from a golf course irrigation well. Dotted black line is mixing line constructed from open coastal water with water from irrigation lake 10 used to feed both North and South golf courses. For sampling site locations, see Figure 1.

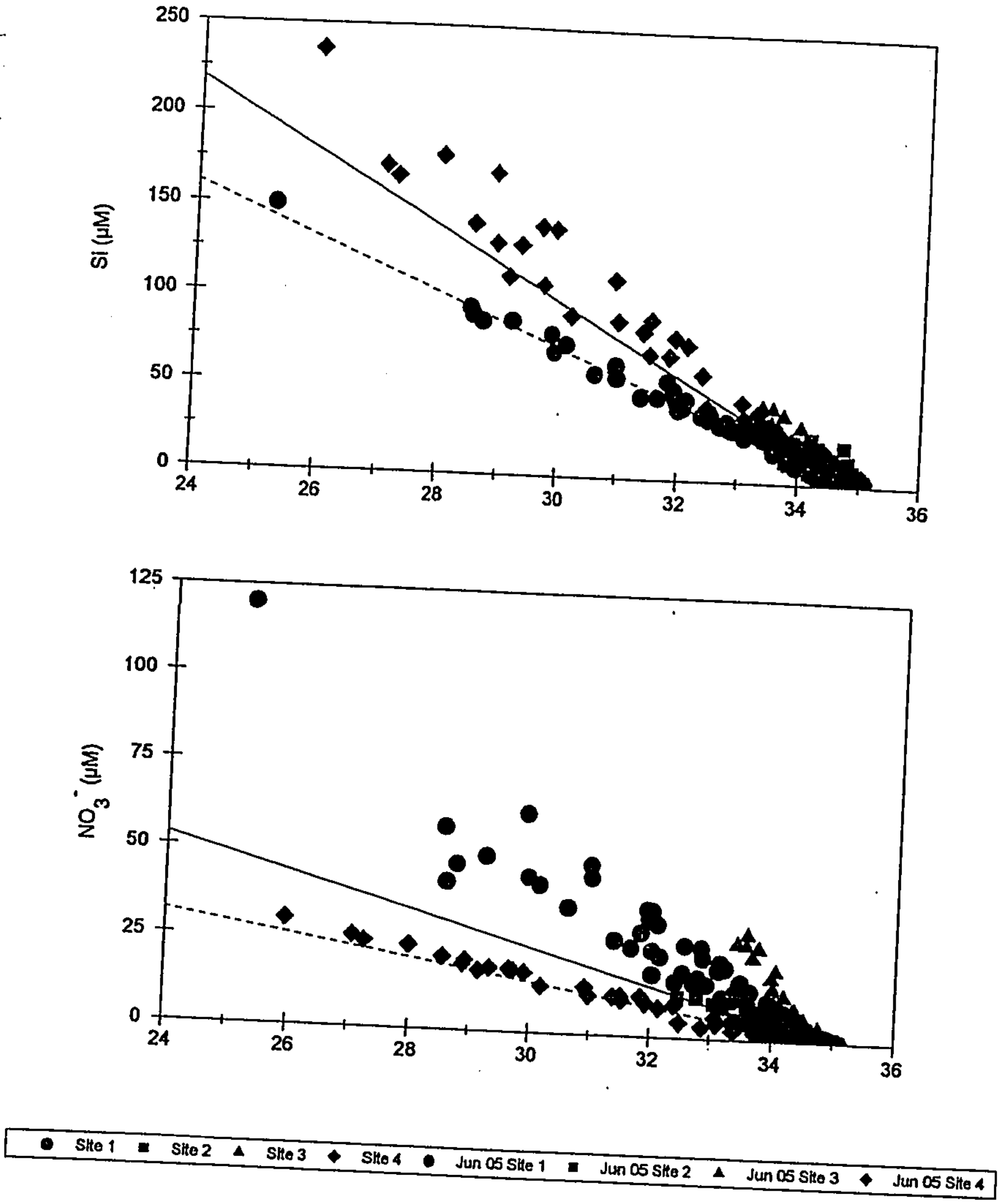

FIGURE 17. Silicate and nitrate, plotted as a function of salinity for surface samples collected since August 1995 at four sites offshore of the Makena Golf Course. Black symbols represent combined data from surveys conducted between August 1995 and June 2005. Red symbols are data from June 2005 survey. Solid red line in each plot is conservative mixing line constructed by connecting the concentrations in open coastal water with water from a golf course irrigation well. Dotted black line is mixing line constructed from open coastal water with water from irrigation lake 10 used to feed both North and South golf courses. For sampling site locations, see Figure 1.

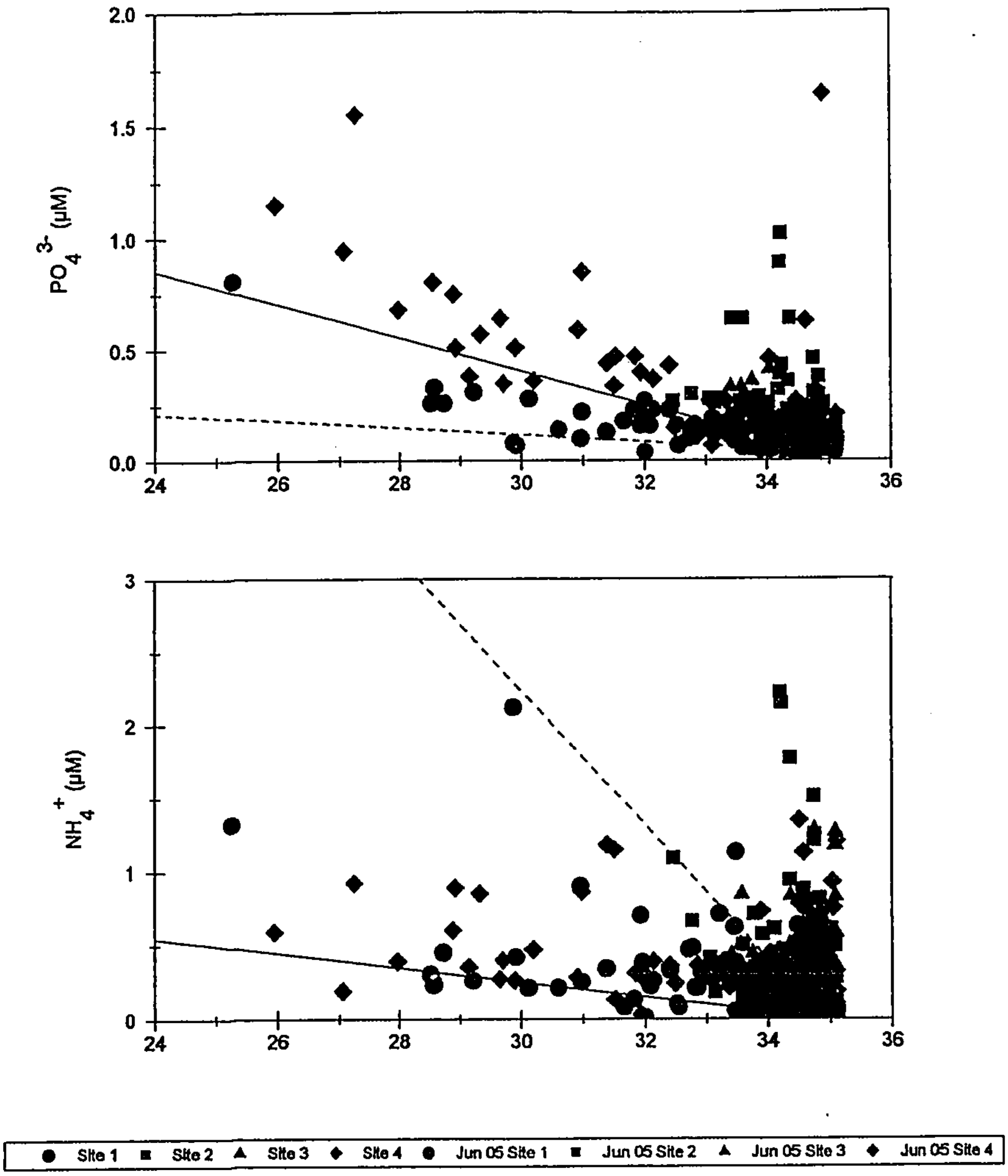

FIGURE 18. Phosphate and ammonium, plotted as a function of salinity for surface samples collected since August 1995 at four sites offshore of the Makena Golf Course. Black symbols represent combined data from surveys conducted between August 1995 and June 2005. Red symbols are data during the June 2005 survey. Solid red line in each plot is conservative mixing line constructed by connecting the concentrations in open coastal water with water from a golf course irrigation well. Dotted black line is mixing line constructed from open coastal water with water from irrigation lake 10 used to feed both North and South golf courses. For sampling site locations, see Figure 1.

TABLE 1. Water chemistry measurements from ocean water samples collected in the vicinity of the Makena Resort on June 19, 2005. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep, NA=data not available. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH 10% "dry" standards; boxed and shaded values exceed DOH 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (μM)	NO3 (μM)	NH4 (μM)	Si (μM)	TOP (μM)	TON (μM)	TP (μM)	TN (μM)	TURB (NTU)	SALINITY (ppt)	CHL a (μg/L)	TEMP (deg.C)	pH (std.units)	O2 % Sat
MAKENA 1	0 S	0.1	0.07	[illegible]	0.42	70.42	0.28	10.13	0.35	[illegible]	0.35	29.921	[illegible]	NA	8.23	NA
	2 S	0.1	0.04	[illegible]	0.01	40.18	0.26	8.74	0.30	[illegible]	0.26	32.003	[illegible]	NA	8.23	NA
	5 S	0.1	0.06	[illegible]	0.03	17.17	0.29	9.79	0.35	[illegible]	0.21	33.599	[illegible]	NA	8.21	NA
	5 D	2.5	0.06	[illegible]	0.03	17.38	0.27	9.32	0.33	[illegible]	0.20	33.569	[illegible]	NA	8.21	NA
	10 S	0.1	0.06	[illegible]	0.06	13.91	0.27	9.12	0.33	17.32	0.19	33.850	[illegible]	NA	8.20	NA
	10 D	3.0	0.07	[illegible]	0.24	8.89	0.25	8.78	0.32	13.61	0.21	34.252	[illegible]	NA	8.19	NA
	50 S	0.1	0.06	[illegible]	0.13	7.90	0.27	8.95	0.33	12.71	0.19	34.313	[illegible]	25.73	8.20	97.25
	50 D	4.1	0.06	0.49	0.06	2.23	0.26	8.78	0.32	9.33	0.15	34.728	[illegible]	25.83	8.21	97.43
	100 S	0.1	0.06	[illegible]	0.10	8.83	0.26	8.29	0.32	12.74	0.20	34.243	1.08	25.76	8.20	98.14
	100 D	6.4	0.05	0.14	0.06	1.32	0.26	8.69	0.31	8.89	0.13	34.790	0.52	25.85	8.22	98.08
	150 S	0.1	0.05	8.07	0.11	13.01	0.26	8.86	0.31	17.04	0.21	33.894	0.76	25.74	8.20	96.46
	150 D	10.5	0.06	0.17	0.07	0.89	0.27	8.35	0.33	8.59	0.10	34.820	0.36	25.79	8.21	96.09
MAKENA 2	0 S	0.1	0.14	2.20	0.12	11.79	0.29	9.06	0.43	11.38	0.84	34.169	0.88	NA	8.20	NA
	2 S	0.1	0.11	2.38	0.32	10.72	0.30	8.64	0.41	11.34	0.58	34.188	0.61	NA	8.20	NA
	5 S	0.1	0.19	[illegible]	0.27	12.76	0.26	8.12	0.45	11.56	0.90	34.054	0.62	NA	8.19	NA
	5 D	1.5	0.12	[illegible]	0.34	5.54	0.26	8.50	0.38	10.00	0.33	34.484	0.88	NA	8.20	NA
	10 S	0.1	0.12	3.62	0.24	13.47	0.28	7.48	0.40	11.34	0.42	33.888	0.71	25.68	8.18	97.05
	10 D	2.4	0.08	0.10	0.23	4.40	0.24	7.66	0.32	7.99	0.15	34.767	0.62	25.87	8.21	95.80
	50 S	0.1	0.07	[illegible]	0.28	7.19	0.34	8.03	0.41	9.77	0.30	34.388	0.57	25.69	8.18	93.67
	50 D	3.8	0.07	0.08	0.15	1.15	0.29	7.65	0.36	7.88	0.14	34.808	0.34	25.87	8.21	96.00
	100 S	0.1	0.08	0.64	0.19	7.28	0.29	8.91	0.37	9.74	0.35	34.452	0.44	25.69	8.18	95.57
	100 D	4.7	0.07	0.08	0.44	1.14	0.28	7.73	0.35	8.25	0.11	34.825	0.46	25.84	8.21	95.79
	150 S	0.1	0.07	0.25	0.25	4.03	0.27	9.24	0.34	9.74	0.24	34.657	0.31	25.79	8.19	95.41
	150 D	9.5	0.09	0.21	0.16	1.14	0.27	7.91	0.36	8.28	0.14	34.846	0.27	25.74	8.21	94.38
	200 S	0.1	0.08	0.36	0.36	3.00	0.25	7.79	0.33	8.51	0.17	34.705	0.27	25.75	8.20	95.65
	200 D	13.4	0.07	0.04	0.19	0.78	0.28	7.87	0.35	8.10	0.11	34.866	0.23	25.74	8.21	95.57
MAKENA 3	0 S	0.1	0.09	[illegible]	0.25	14.64	0.28	8.86	0.37	17.57	0.86	34.338	0.67	NA	8.15	NA
	2 S	0.1	0.16	[illegible]	0.23	23.19	0.22	6.08	0.38	[illegible]	0.49	33.970	[illegible]	NA	8.14	NA
	5 S	0.1	0.10	[illegible]	0.35	17.80	0.26	7.16	0.36	[illegible]	0.34	34.170	0.70	NA	8.13	NA
	5 D	3.0	0.08	[illegible]	0.30	15.63	0.24	7.36	0.32	[illegible]	0.29	34.271	0.81	NA	8.13	NA
	10 S	0.1	0.05	[illegible]	0.15	10.64	0.24	8.28	0.29	14.32	0.24	34.470	0.47	NA	8.13	NA
	10 D	4.5	0.06	[illegible]	0.16	7.85	0.25	8.05	0.31	11.62	0.20	34.503	0.48	NA	8.13	NA
	50 S	0.1	0.07	[illegible]	0.31	5.65	0.27	9.84	0.34	12.74	0.21	34.616	0.35	25.81	8.13	90.24
	50 D	3.5	0.05	[illegible]	0.31	2.91	0.28	9.24	0.33	10.71	0.16	34.720	0.46	25.86	8.16	87.37
	100 S	0.1	0.07	0.94	0.48	3.39	0.26	7.26	0.33	8.68	0.13	34.699	0.29	25.77	8.18	92.23
	100 D	6.2	0.05	0.02	0.14	0.98	0.27	7.13	0.32	7.29	0.09	34.784	0.29	25.83	8.20	93.33
	150 S	0.1	0.06	0.53	0.54	2.37	0.28	6.71	0.34	7.78	0.12	34.732	0.24	25.83	8.20	94.90
	150 D	8.2	0.06	0.09	0.02	1.14	0.28	7.20	0.34	7.31	0.10	34.783	0.28	25.77	8.21	96.23
MAKENA 4	0 S	0.1	0.35	[illegible]	0.40	108.07	0.21	12.47	0.56	[illegible]	0.36	29.704	[illegible]	NA	8.15	NA
	2 S	0.1	0.34	[illegible]	[illegible]	70.85	0.14	6.65	0.48	[illegible]	0.30	31.503	[illegible]	NA	8.14	NA
	5 S	0.1	0.07	[illegible]	0.27	36.80	0.25	9.09	0.32	13.70	0.27	33.098	[illegible]	NA	8.16	NA
	5 D	1.5	0.13	[illegible]	0.20	38.26	0.22	8.00	0.35	13.25	0.28	33.025	2.08	NA	8.16	NA
	10 S	0.1	0.04	[illegible]	0.24	19.60	0.31	8.82	0.35	10.98	0.24	33.896	0.69	NA	8.16	NA
	10 D	2.5	0.10	[illegible]	0.29	21.77	0.25	6.92	0.35	9.65	0.33	33.789	3.20	NA	8.16	NA
	50 S	0.1	0.17	0.33	[illegible]	5.53	0.32	9.25	0.49	10.71	0.23	34.561	0.57	25.74	8.15	94.19
	50 D	5.9	0.15	0.18	0.44	5.40	0.26	7.12	0.41	7.74	0.22	34.591	0.59	25.76	8.15	92.88
	100 S	0.1	0.21	0.25	[illegible]	7.38	0.31	8.25	0.52	9.85	0.23	34.494	0.37	25.70	8.14	92.93
	100 D	6.0	0.05	0.12	0.33	2.32	0.28	7.47	0.33	7.92	0.18	34.720	0.62	25.80	8.17	88.63
	150 S	0.1	0.05	0.11	0.22	1.24	0.29	6.44	0.34	6.77	0.12	34.772	0.33	25.79	8.19	92.50
	150 D	7.4	0.05	0.08	0.05	1.59	0.28	7.75	0.33	7.88	0.13	34.778	0.24	25.80	8.19	90.60
DOH WQS		DRY	10%	0.71	0.36				0.96	12.86	0.50	*	0.50	**	***	
			2%	1.43	0.64				1.45	17.86	1.00		1.00			
		WET	10%	1.00	0.61				1.29	17.85	1.25	*	0.90	**	***	
			2%	1.78	1.07				1.93	25.00	2.00		1.75			

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 1. Water chemistry measurements from ocean water samples collected in the vicinity of the Makena Resort on June 19, 2005. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep, NA=data not available. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH 10% "dry" standards; boxed and shaded values exceed DOH 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH (std.units)	O2 % Sat
MAKENA 1	0 S	0.1	0.07	[illegible]	0.42	70.42	0.28	10.13	0.35	[illegible]	0.35	29.921	[illegible]	NA	8.23	NA
	2 S	0.1	0.04	[illegible]	0.01	40.18	0.26	8.74	0.30	[illegible]	0.26	32.003	[illegible]	NA	8.23	NA
	5 S	0.1	0.06	[illegible]	0.03	17.17	0.29	9.79	0.35	[illegible]	0.21	33.599	[illegible]	NA	8.21	NA
	5 D	2.5	0.06	[illegible]	0.03	17.38	0.27	9.32	0.33	[illegible]	0.20	33.569	[illegible]	NA	8.21	NA
	10 S	0.1	0.06	[illegible]	0.06	13.91	0.27	9.12	0.33	17.32	0.19	33.850	[illegible]	NA	8.20	NA
	10 D	3.0	0.07	[illegible]	0.24	8.89	0.25	8.78	0.32	13.61	0.21	34.252	[illegible]	NA	8.19	NA
	50 S	0.1	0.06	[illegible]	0.13	7.90	0.27	8.95	0.33	12.71	0.19	34.313	[illegible]	25.73	8.20	97.25
	50 D	4.1	0.06	0.49	0.06	2.23	0.26	8.78	0.32	9.33	0.15	34.728	[illegible]	25.83	8.21	97.43
	100 S	0.1	0.06	[illegible]	0.10	8.83	0.26	8.29	0.32	12.74	0.20	34.243	[illegible]	25.76	8.20	98.14
	100 D	6.4	0.05	0.14	0.06	1.32	0.26	8.69	0.31	8.89	0.13	34.790	0.52	25.85	8.22	98.08
	150 S	0.1	0.05	[illegible]	0.11	13.01	0.26	8.86	0.31	17.04	0.21	33.894	0.76	25.74	8.20	96.46
	150 D	10.5	0.06	0.17	0.07	0.89	0.27	8.35	0.33	8.59	0.10	34.820	0.36	25.79	8.21	96.09
MAKENA 2	0 S	0.1	0.14	[illegible]	0.12	11.79	0.29	9.06	0.43	11.38	0.84	34.169	0.88	NA	8.20	NA
	2 S	0.1	0.11	[illegible]	0.32	10.72	0.30	8.64	0.41	11.34	0.58	34.188	0.61	NA	8.20	NA
	5 S	0.1	0.19	[illegible]	0.27	12.76	0.26	8.12	0.45	11.56	0.90	34.054	0.62	NA	8.19	NA
	5 D	1.5	0.12	[illegible]	0.34	5.54	0.26	8.50	0.38	10.00	0.33	34.484	0.88	NA	8.20	NA
	10 S	0.1	0.12	[illegible]	0.24	13.47	0.28	7.48	0.40	11.34	0.42	33.888	0.71	25.68	8.18	97.05
	10 D	2.4	0.08	0.10	0.23	4.40	0.24	7.66	0.32	7.99	0.15	34.767	0.62	25.87	8.21	95.80
	50 S	0.1	0.07	[illegible]	0.28	7.19	0.34	8.03	0.41	9.77	0.30	34.388	0.57	25.69	8.18	93.67
	50 D	3.8	0.07	0.08	0.15	1.15	0.29	7.65	0.36	7.88	0.14	34.808	0.34	25.87	8.21	96.00
	100 S	0.1	0.08	0.64	0.19	7.28	0.29	8.91	0.37	9.74	0.35	34.452	0.44	25.69	8.18	95.57
	100 D	4.7	0.07	0.08	0.44	1.14	0.28	7.73	0.35	8.25	0.11	34.825	0.46	25.84	8.21	95.79
	150 S	0.1	0.07	0.25	0.25	4.03	0.27	9.24	0.34	9.74	0.24	34.657	0.31	25.79	8.19	95.41
	150 D	9.5	0.09	0.21	0.16	1.14	0.27	7.91	0.36	8.28	0.14	34.846	0.27	25.74	8.21	94.38
	200 S	0.1	0.08	0.36	0.36	3.00	0.25	7.79	0.33	8.51	0.17	34.705	0.27	25.75	8.20	95.65
	200 D	13.4	0.07	0.04	0.19	0.78	0.28	7.87	0.35	8.10	0.11	34.866	0.23	25.74	8.21	95.57
MAKENA 3	0 S	0.1	0.09	[illegible]	0.25	14.64	0.28	8.86	0.37	17.57	0.86	34.338	0.67	NA	8.15	NA
	2 S	0.1	0.16	[illegible]	0.23	23.19	0.22	6.08	0.38	[illegible]	0.49	33.970	[illegible]	NA	8.14	NA
	5 S	0.1	0.10	[illegible]	0.35	17.80	0.26	7.16	0.36	[illegible]	0.34	34.170	0.70	NA	8.13	NA
	5 D	3.0	0.08	[illegible]	0.30	15.63	0.24	7.36	0.32	[illegible]	0.29	34.271	0.81	NA	8.13	NA
	10 S	0.1	0.05	[illegible]	0.15	10.64	0.24	8.28	0.29	14.32	0.24	34.470	0.47	NA	8.13	NA
	10 D	4.5	0.06	[illegible]	0.16	7.85	0.25	8.05	0.31	11.62	0.20	34.503	0.48	NA	8.13	NA
	50 S	0.1	0.07	[illegible]	0.31	5.65	0.27	9.84	0.34	12.74	0.21	34.616	0.35	25.81	8.13	90.24
	50 D	3.5	0.05	[illegible]	0.31	2.91	0.28	9.24	0.33	10.71	0.16	34.720	0.46	25.86	8.16	87.37
	100 S	0.1	0.07	0.94	0.48	3.39	0.26	7.26	0.33	8.68	0.13	34.699	0.29	25.77	8.18	92.23
	100 D	6.2	0.05	0.02	0.14	0.98	0.27	7.13	0.32	7.29	0.09	34.784	0.29	25.83	8.20	93.33
	150 S	0.1	0.06	0.53	0.54	2.37	0.28	6.71	0.34	7.78	0.12	34.732	0.24	25.83	8.20	94.90
	150 D	8.2	0.06	0.09	0.02	1.14	0.28	7.20	0.34	7.31	0.10	34.783	0.28	25.77	8.21	96.23
MAKENA 4	0 S	0.1	0.35	[illegible]	0.40	108.07	0.21	12.47	0.56	[illegible]	0.36	29.704	[illegible]	NA	8.15	NA
	2 S	0.1	0.34	[illegible]	[illegible]	70.85	0.14	6.65	0.48	[illegible]	0.30	31.503	[illegible]	NA	8.14	NA
	5 S	0.1	0.07	[illegible]	0.27	36.80	0.25	9.09	0.32	13.70	0.27	33.098	[illegible]	NA	8.16	NA
	5 D	1.5	0.13	[illegible]	0.20	38.26	0.22	8.00	0.35	13.25	0.28	33.025	[illegible]	NA	8.16	NA
	10 S	0.1	0.04	[illegible]	0.24	19.60	0.31	8.82	0.35	10.98	0.24	33.896	0.69	NA	8.16	NA
	10 D	2.5	0.10	[illegible]	0.29	21.77	0.25	6.92	0.35	9.65	0.33	33.789	[illegible]	NA	8.16	NA
	50 S	0.1	0.17	0.33	[illegible]	5.53	0.32	9.25	0.49	10.71	0.23	34.561	0.57	25.74	8.15	94.19
	50 D	5.9	0.15	0.18	0.44	5.40	0.26	7.12	0.41	7.74	0.22	34.591	0.59	25.76	8.15	92.88
	100 S	0.1	0.21	0.25	[illegible]	7.38	0.31	8.25	0.52	9.85	0.23	34.494	0.37	25.70	8.14	92.93
	100 D	6.0	0.05	0.12	0.33	2.32	0.28	7.47	0.33	7.92	0.18	34.720	0.62	25.80	8.17	88.63
	150 S	0.1	0.05	0.11	0.22	1.24	0.29	6.44	0.34	6.77	0.12	34.772	0.33	25.79	8.19	92.50
	150 D	7.4	0.05	0.08	0.05	1.59	0.28	7.75	0.33	7.88	0.13	34.778	0.24	25.80	8.19	90.60
DOH WQS		DRY	10%	0.71	0.36				0.96	12.86	0.50	*	0.50	**	***	
			2%	1.43	0.64				1.45	17.86	1.00		1.00			
		WET	10%	1.00	0.61				1.29	17.85	1.25	*	0.90	**	***	
			2%	1.78	1.07				1.93	25.00	2.00		1.75			

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 2. Water chemistry measurements from ocean water samples (in µg/L) collected in the vicinity of the Makena Resort on June 19, 2005. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep, NA=data not available. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH 10% "dry" standards; boxed and shaded values exceed DOH 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	SI (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH (std.units)	O2 % Sat
MAKENA 1	0 S	0.1	2.17	617.12	5.88	1,978.80	8.68	141.82	10.85	764.82	0.35	29.921	9.19	NA	8.23	NA
	2 S	0.1	1.24	340.76	0.14	1,129.06	8.06	122.36	9.30	463.28	0.26	32.003	4.25	NA	8.23	NA
	5 S	0.1	1.86	138.48	0.42	482.48	8.99	137.06	10.85	275.94	0.21	33.599	2.35	NA	8.21	NA
	5 D	2.5	1.86	135.52	0.42	488.38	8.37	130.48	10.23	266.42	0.20	33.569	1.62	NA	8.21	NA
	10 S	0.1	1.86	110.96	0.84	390.87	8.37	127.68	10.23	242.48	0.19	33.850	2.73	NA	8.20	NA
	10 D	3.0	2.17	76.76	3.36	249.81	7.75	122.92	9.92	190.54	0.21	34.252	1.77	NA	8.19	NA
	50 S	0.1	1.86	50.82	1.82	221.99	8.37	125.30	10.23	177.94	0.19	34.313	1.68	25.73	8.20	97.25
	50 D	4.1	1.86	6.86	0.84	62.66	8.06	122.92	9.92	130.62	0.15	34.728	1.07	25.83	8.21	97.43
	100 S	0.1	1.86	60.90	1.40	248.12	8.06	116.06	9.92	178.36	0.20	34.243	1.08	25.76	8.20	98.14
	100 D	6.4	1.55	1.96	0.84	37.09	8.06	121.66	9.61	124.46	0.13	34.790	0.52	25.85	8.22	98.08
	150 S	0.1	1.55	112.38	1.54	365.58	8.06	124.04	9.61	238.56	0.21	33.894	0.76	25.74	8.20	96.46
	150 D	10.5	1.86	2.38	0.98	25.01	8.37	116.90	10.23	120.26	0.10	34.820	0.36	25.79	8.21	96.09
MAKENA 2	0 S	0.1	4.34	90.80	1.68	331.30	8.99	126.84	13.33	159.32	0.84	34.169	0.88	NA	8.20	NA
	2 S	0.1	3.41	38.92	4.48	301.23	9.30	120.96	12.71	158.76	0.58	34.188	0.61	NA	8.20	NA
	5 S	0.1	5.89	[illegible]	3.78	358.56	8.06	113.68	13.95	161.84	0.90	34.054	0.62	NA	8.19	NA
	5 D	1.5	3.72	18.24	4.76	155.67	8.06	119.00	11.78	140.00	0.33	34.484	0.88	NA	8.20	NA
	10 S	0.1	3.72	46.68	3.36	378.51	8.68	104.72	12.40	158.76	0.42	33.888	0.71	25.68	8.18	97.05
	10 D	2.4	2.48	1.40	3.22	123.64	7.44	107.24	9.92	111.86	0.15	34.767	0.62	25.87	8.21	95.80
	50 S	0.1	2.17	29.74	3.92	202.04	10.54	112.42	12.71	136.78	0.30	34.388	0.57	25.69	8.18	93.67
	50 D	3.8	2.17	1.12	2.10	32.32	8.99	107.10	11.16	110.32	0.14	34.808	0.34	25.87	8.21	96.00
	100 S	0.1	2.48	8.96	2.66	204.57	8.99	124.74	11.47	136.36	0.35	34.452	0.44	25.69	8.18	95.57
	100 D	4.7	2.17	1.12	6.16	32.03	8.68	108.22	10.85	115.50	0.11	34.825	0.46	25.84	8.21	95.79
	150 S	0.1	2.17	3.50	3.50	113.24	8.37	129.36	10.54	136.36	0.24	34.657	0.31	25.79	8.19	95.41
	150 D	9.5	2.79	2.94	2.24	32.03	8.37	110.74	11.16	115.92	0.14	34.846	0.27	25.74	8.21	94.38
	200 S	0.1	2.48	5.04	5.00	84.30	7.75	109.06	10.23	119.14	0.17	34.705	0.27	25.75	8.20	95.65
	200 D	13.4	2.17	0.56	2.66	21.92	8.68	110.18	10.85	113.40	0.11	34.866	0.23	25.74	8.21	95.57
MAKENA 3	0 S	0.1	2.79	118.48	3.50	411.38	8.68	124.04	11.47	245.98	0.86	34.338	0.67	NA	8.15	NA
	2 S	0.1	4.96	244.72	3.22	651.64	6.82	85.12	11.78	333.06	0.49	33.970	1.23	NA	8.14	NA
	5 S	0.1	3.10	171.64	4.90	500.18	8.06	100.24	11.16	276.78	0.34	34.170	0.70	NA	8.13	NA
	5 D	3.0	2.48	144.20	4.20	439.20	7.44	103.04	9.92	251.44	0.29	34.271	0.81	NA	8.13	NA
	10 S	0.1	1.55	82.46	2.10	298.98	7.44	115.92	8.99	200.48	0.24	34.470	0.47	NA	8.13	NA
	10 D	4.5	1.86	47.76	2.24	220.51	7.74	112.75	9.60	162.75	0.20	34.503	0.48	NA	8.13	NA
	50 S	0.1	2.17	36.26	4.34	158.77	8.37	137.76	10.54	178.36	0.21	34.616	0.35	25.81	8.13	90.24
	50 D	3.5	1.55	16.24	4.34	81.77	8.68	129.36	10.23	149.94	0.16	34.720	0.46	25.86	8.16	87.37
	100 S	0.1	2.17	13.16	6.72	95.26	8.06	101.64	10.23	121.52	0.13	34.699	0.29	25.77	8.18	92.23
	100 D	6.2	1.55	0.28	1.96	27.54	8.37	99.82	9.92	102.06	0.09	34.784	0.29	25.83	8.20	93.33
	150 S	0.1	1.86	7.42	7.56	66.60	8.68	93.94	10.54	108.92	0.12	34.732	0.24	25.83	8.20	94.90
	150 D	8.2	1.86	1.26	0.28	32.03	8.68	100.80	10.54	102.34	0.10	34.783	0.28	25.77	8.21	96.23
MAKENA 4	0 S	0.1	10.85	245.28	5.60	3,036.77	6.51	174.58	17.36	426.46	0.36	29.704	2.74	NA	8.15	NA
	2 S	0.1	10.54	159.04	[illegible]	1,990.89	4.34	93.10	14.88	288.24	0.30	31.503	2.95	NA	8.14	NA
	5 S	0.1	2.17	60.78	3.78	1,034.08	7.75	127.26	9.92	191.80	0.27	33.098	[illegible]	NA	8.16	NA
	5 D	1.5	4.03	[illegible]	2.80	1,075.11	6.82	112.00	10.85	185.50	0.28	33.025	[illegible]	NA	8.16	NA
	10 S	0.1	1.24	26.88	3.36	550.76	9.61	123.48	10.85	153.72	0.24	33.896	0.69	NA	8.16	NA
	10 D	2.5	3.10	34.16	4.06	611.74	7.75	96.88	10.85	135.10	0.33	33.789	5.20	NA	8.16	NA
	50 S	0.1	5.27	4.62	16.85	155.39	9.92	129.50	15.19	149.94	0.23	34.561	0.57	25.74	8.15	94.19
	50 D	5.9	4.65	2.52	6.16	151.74	8.06	99.68	12.71	108.36	0.22	34.591	0.59	25.76	8.15	92.88
	100 S	0.1	6.51	3.50	[illegible]	207.38	9.61	115.50	16.12	137.90	0.23	34.494	0.37	25.70	8.14	92.93
	100 D	6.0	1.55	1.68	4.62	65.19	8.68	104.58	10.23	110.88	0.18	34.720	0.62	25.80	8.17	88.63
	150 S	0.1	1.55	1.54	3.08	34.84	8.99	90.16	10.54	94.78	0.12	34.772	0.33	25.79	8.19	92.50
	150 D	7.4	1.55	1.12	0.70	44.68	8.68	108.50	10.23	110.32	0.13	34.778	0.24	25.80	8.19	90.60
DOH WQS		DRY	10%	10.00	5.00				30.00	180.00	0.50	*	0.50	**	***	
			2%	20.00	9.00				45.00	250.00	1.00		1.00			
		WET	10%	14.00	8.50				40.00	250.00	1.25	*	0.90	**	***	
			2%	25.00	15.00				60.00	350.00	2.00		1.75			

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.

** Temperature shall not vary by more than one degree C. from ambient conditions.

***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 3. Geometric mean data from water chemistry measurements (in μM) off the Makena Resort collected since August 1995 (N=15). For geometric mean calculations, detection limits were used in cases where sample was below detection limit. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep. Also shown are State of Hawaii, Department of Health (DOH) geometric mean water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH GM 10% "dry" standards; boxed and shaded values exceed DOH GM 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH
MAKENA 1	0 S	0.1	0.19	33.55	0.33	56.48	0.22	8.11	0.47	44.40	0.33	30.609	1.03	25.41	8.16
	2 S	0.1	0.14	22.91	0.20	38.84	0.24	7.81	0.40	31.46	0.27	32.235	0.93	25.44	8.18
	5 S	0.1	0.12	10.86	0.16	20.82	0.25	7.85	0.39	20.90	0.23	33.238	0.71	25.49	8.18
	5 D	2.5	0.12	9.07	0.24	18.95	0.27	7.57	0.40	19.37	0.21	33.385	0.80	25.51	8.17
	10 S	0.1	0.10	3.92	0.16	9.95	0.25	7.08	0.36	12.36	0.19	34.180	0.46	25.51	8.17
	10 D	3.0	0.10	2.91	0.21	7.85	0.28	7.34	0.40	11.03	0.19	34.361	0.49	25.51	8.17
	50 S	0.1	0.10	2.76	0.19	7.34	0.26	7.02	0.37	11.04	0.17	34.367	0.36	25.62	8.15
	50 D	4.1	0.09	0.39	0.12	2.73	0.27	7.35	0.37	8.03	0.12	34.759	0.32	25.63	8.15
	100 S	0.1	0.09	0.99	0.12	4.81	0.26	6.52	0.37	9.58	0.13	34.512	0.32	25.59	8.15
	100 D	6.4	0.08	0.10	0.07	1.95	0.27	7.10	0.36	7.38	0.09	34.796	0.27	25.61	8.17
	150 S	0.1	0.09	0.36	0.11	3.35	0.25	6.87	0.35	8.40	0.12	34.655	0.23	25.72	8.15
	150 D	10.5	0.08	0.08	0.08	1.71	0.26	6.80	0.35	7.06	0.10	34.804	0.20	25.64	8.17
MAKENA 2	0 S	0.1	0.22	[illegible]	0.30	20.65	0.32	7.98	0.58	12.75	1.02	33.851	0.92	25.55	8.15
	2 S	0.1	0.22	[illegible]	0.29	18.75	0.33	7.91	0.59	12.60	0.83	33.840	[illegible]	25.54	8.15
	5 S	0.1	0.20	[illegible]	0.26	15.49	0.28	6.85	0.50	[illegible]	0.62	34.012	0.68	25.51	8.16
	5 D	1.5	0.20	[illegible]	[illegible]	14.95	0.32	7.17	0.54	[illegible]	0.50	34.051	[illegible]	25.53	8.15
	10 S	0.1	0.15	[illegible]	0.20	10.18	0.31	4.68	0.48	9.23	0.37	34.316	[illegible]	25.45	8.16
	10 D	2.4	0.14	[illegible]	0.25	8.25	0.32	7.14	0.49	9.35	0.30	34.461	0.59	25.53	8.16
	50 S	0.1	0.12	[illegible]	0.28	7.58	0.33	7.32	0.48	9.35	0.31	34.441	[illegible]	25.51	8.14
	50 D	3.8	0.10	0.27	0.19	3.13	0.32	7.57	0.45	8.24	0.20	34.755	0.52	25.57	8.16
	100 S	0.1	0.10	[illegible]	0.19	4.22	0.29	7.39	0.40	8.48	0.18	34.622	0.33	25.62	8.15
	100 D	4.7	0.08	0.19	0.19	2.44	0.29	6.98	0.39	7.49	0.13	34.775	0.34	25.60	8.16
	150 S	0.1	0.09	0.27	0.23	3.13	0.28	7.43	0.40	8.05	0.14	34.729	0.28	25.63	8.16
	150 D	9.5	0.08	0.13	0.16	2.18	0.30	7.68	0.40	8.10	0.12	34.793	0.28	25.61	8.17
	200 S	0.1	0.08	0.22	0.19	2.52	0.28	7.21	0.37	7.93	0.12	34.789	0.26	25.72	8.17
	200 D	13.4	0.08	0.06	0.20	1.72	0.29	7.69	0.38	8.06	0.10	34.834	0.30	25.68	8.18
MAKENA 3	0 S	0.1	0.10	0.84	0.30	4.91	0.28	7.16	0.41	10.32	0.31	34.595	0.44	25.34	8.18
	2 S	0.1	0.14	1.42	0.31	6.60	0.28	6.99	0.44	12.59	0.30	34.435	0.44	25.41	8.16
	5 S	0.1	0.12	1.03	0.27	5.66	0.27	7.13	0.41	11.45	0.22	34.537	0.32	25.45	8.16
	5 D	3.0	0.12	0.87	0.29	5.28	0.28	6.89	0.41	10.78	0.23	34.571	0.39	25.45	8.16
	10 S	0.1	0.10	0.55	0.29	3.72	0.28	7.29	0.40	9.73	0.17	34.685	0.25	25.36	8.16
	10 D	4.5	0.09	0.42	0.24	3.36	0.28	7.08	0.39	8.83	0.17	34.719	0.30	25.41	8.16
	50 S	0.1	0.09	0.30	0.25	2.94	0.27	6.99	0.37	8.26	0.14	34.749	0.22	25.50	8.14
	50 D	3.5	0.08	0.19	0.24	2.48	0.28	7.16	0.37	7.83	0.13	34.799	0.21	25.50	8.16
	100 S	0.1	0.07	0.13	0.22	2.25	0.28	7.15	0.37	7.74	0.12	34.791	0.16	25.52	8.15
	100 D	6.2	0.07	0.07	0.20	1.90	0.27	6.65	0.36	7.05	0.10	34.815	0.19	25.45	8.16
	150 S	0.1	0.06	0.08	0.20	2.00	0.27	6.56	0.34	7.07	0.10	34.797	0.17	25.54	8.17
	150 D	8.2	0.08	0.05	0.14	1.83	0.28	6.67	0.37	6.99	0.09	34.806	0.21	25.50	8.18
MAKENA 4	0 S	0.1	0.43	[illegible]	[illegible]	74.66	0.21	6.88	0.73	20.58	0.34	29.727	0.85	24.98	8.04
	2 S	0.1	0.35	[illegible]	[illegible]	56.52	0.25	7.07	0.65	[illegible]	0.33	31.470	0.78	25.04	8.04
	5 S	0.1	0.15	[illegible]	0.20	13.43	0.25	7.05	0.42	9.00	0.21	34.111	[illegible]	25.14	8.07
	5 D	1.5	0.15	[illegible]	0.25	12.27	0.25	6.91	0.42	8.74	0.20	34.151	[illegible]	25.13	8.08
	10 S	0.1	0.13	[illegible]	0.25	10.34	0.26	6.96	0.42	8.35	0.20	34.306	0.30	25.09	8.09
	10 D	2.5	0.13	[illegible]	[illegible]	9.41	0.25	7.14	0.40	8.51	0.20	34.340	[illegible]	25.10	8.09
	50 S	0.1	0.11	[illegible]	[illegible]	5.96	0.27	8.00	0.39	9.00	0.16	34.569	0.27	25.16	8.09
	50 D	5.9	0.12	0.22	0.21	4.14	0.27	7.45	0.41	8.02	0.14	34.738	0.26	25.28	8.11
	100 S	0.1	0.10	0.23	0.19	4.29	0.27	7.30	0.39	7.88	0.12	34.731	0.20	25.27	8.12
	100 D	6.0	0.10	0.19	0.20	2.99	0.27	7.01	0.38	7.62	0.10	34.779	0.21	25.35	8.13
	150 S	0.1	0.11	0.12	0.14	2.39	0.24	7.44	0.45	7.92	0.10	34.804	0.17	25.41	8.15
	150 D	7.4	0.09	0.12	0.13	2.05	0.27	7.35	0.37	7.73	0.08	34.817	0.17	25.40	8.16
DOH WQS GEOMETRIC MEAN	DRY			0.25	0.14				0.52	7.86	0.20	*	0.15	**	***
	WET			0.36	0.25				0.64	10.71	0.50		0.30		

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 4. Geometric mean data (in µg/L) from water chemistry measurements (in µM) off the Makena Resort collected since August 1995 (N=15). For geometric mean calculations, detection limits were used in cases where sample was below detection limit. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep. Also shown are State of Hawaii, Department of Health (DOH) geometric mean water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH GM 10% "dry" standards; boxed and shaded values exceed DOH GM 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH
MAKENA 1	0 S	0.1	5.80	[illegible]	[illegible]	1,586.52	6.80	113.50	14.50	[illegible]	0.33	30.609	[illegible]	25.41	8.16
	2 S	0.1	4.30	[illegible]	2.80	1,091.02	7.40	109.30	12.30	[illegible]	0.27	32.235	[illegible]	25.44	8.18
	5 S	0.1	3.70	[illegible]	2.20	584.83	7.70	109.90	12.00	[illegible]	0.23	33.238	[illegible]	25.49	8.18
	5 D	2.5	3.70	[illegible]	3.30	532.31	8.30	106.00	12.30	[illegible]	0.21	33.385	0.80	25.51	8.17
	10 S	0.1	3.00	54.70	2.20	279.50	7.70	99.10	11.10	173.10	0.19	34.180	0.46	25.51	8.17
	10 D	3.0	3.00	40.70	2.90	220.51	8.60	102.80	12.30	154.40	0.19	34.361	0.49	25.51	8.17
	50 S	0.1	3.00	38.60	2.60	206.18	8.00	98.30	11.40	154.60	0.17	34.367	0.36	25.62	8.15
	50 D	4.1	2.70	5.40	1.60	76.69	8.30	102.90	11.40	112.40	0.12	34.759	0.32	25.63	8.15
	100 S	0.1	2.70	13.80	1.60	135.11	8.00	91.30	11.40	134.10	0.13	34.512	0.32	25.59	8.15
	100 D	6.4	2.40	1.40	0.90	54.78	8.30	99.40	11.10	103.30	0.09	34.796	0.27	25.61	8.17
	150 S	0.1	2.70	5.00	1.50	94.10	7.70	96.20	10.80	117.60	0.12	34.655	0.23	25.72	8.15
	150 D	10.5	2.40	1.10	1.10	48.03	8.00	95.20	10.80	98.80	0.10	34.804	0.20	25.64	8.17
MAKENA 2	0 S	0.1	6.80	[illegible]	[illegible]	580.06	9.90	111.70	17.90	178.50	1.02	33.851	0.92	25.55	8.15
	2 S	0.1	6.80	[illegible]	[illegible]	526.69	10.20	110.70	18.20	176.40	0.83	33.840	0.97	25.54	8.15
	5 S	0.1	6.10	[illegible]	[illegible]	435.11	8.60	95.90	15.40	158.80	0.52	34.012	0.68	25.51	8.16
	5 D	1.5	6.10	[illegible]	[illegible]	419.95	9.90	100.40	16.70	[illegible]	0.50	34.051	[illegible]	25.53	8.15
	10 S	0.1	4.60	[illegible]	2.80	285.96	9.60	65.50	14.80	129.20	0.37	34.316	[illegible]	25.45	8.16
	10 D	2.4	4.30	[illegible]	3.50	231.74	9.90	100.00	15.10	130.90	0.30	34.461	[illegible]	25.53	8.16
	50 S	0.1	3.70	[illegible]	[illegible]	212.92	10.20	102.50	14.80	130.90	0.31	34.441	[illegible]	25.51	8.14
	50 D	3.8	3.00	3.70	2.60	87.92	9.90	106.00	13.90	115.40	0.20	34.755	[illegible]	25.57	8.16
	100 S	0.1	3.00	[illegible]	2.60	118.54	8.90	103.50	12.30	118.70	0.18	34.622	[illegible]	25.62	8.15
	100 D	4.7	2.40	2.60	2.60	68.54	8.90	97.70	12.00	104.90	0.13	34.775	[illegible]	25.60	8.16
	150 S	0.1	2.70	3.70	3.20	87.92	8.60	104.00	12.30	112.70	0.14	34.729	0.28	25.63	8.16
	150 D	9.5	2.40	1.80	2.20	61.24	9.20	107.50	12.30	113.40	0.12	34.793	0.28	25.61	8.17
	200 S	0.1	2.40	3.00	2.60	70.79	8.60	100.90	11.40	111.00	0.12	34.789	0.26	25.72	8.17
	200 D	13.4	2.40	0.80	2.80	48.31	8.90	107.70	11.70	112.80	0.10	34.834	0.30	25.68	8.18
MAKENA 3	0 S	0.1	3.00	[illegible]	[illegible]	137.92	8.60	100.20	12.60	144.50	0.31	34.595	[illegible]	25.34	8.18
	2 S	0.1	4.30	[illegible]	[illegible]	185.39	8.60	97.90	13.60	176.30	0.30	34.435	0.46	25.41	8.16
	5 S	0.1	3.70	[illegible]	[illegible]	158.99	8.30	99.80	12.60	160.30	0.22	34.537	0.32	25.45	8.16
	5 D	3.0	3.70	[illegible]	[illegible]	148.32	8.60	96.50	12.60	150.90	0.23	34.571	[illegible]	25.45	8.16
	10 S	0.1	3.00	[illegible]	[illegible]	104.49	8.60	102.10	12.30	136.20	0.17	34.685	0.25	25.36	8.16
	10 D	4.5	2.70	[illegible]	3.30	94.38	8.60	99.10	12.00	123.60	0.17	34.719	0.30	25.41	8.16
	50 S	0.1	2.70	4.20	3.50	82.58	8.30	97.90	11.40	115.60	0.14	34.749	0.22	25.50	8.14
	50 D	3.5	2.40	2.60	3.30	69.66	8.60	100.20	11.40	109.60	0.13	34.799	0.21	25.50	8.16
	100 S	0.1	2.10	1.80	3.00	63.20	8.60	100.10	11.40	108.40	0.12	34.791	0.16	25.52	8.15
	100 D	6.2	2.10	0.90	2.80	53.37	8.30	93.10	11.10	98.70	0.10	34.815	0.19	25.45	8.16
	150 S	0.1	1.80	1.10	2.80	56.18	8.30	91.80	10.50	99.00	0.10	34.797	0.17	25.54	8.17
	150 D	8.2	2.40	0.70	1.90	51.40	8.60	93.40	11.40	97.90	0.09	34.806	0.21	25.50	8.18
MAKENA 4	0 S	0.1	13.30	[illegible]	[illegible]	2,097.20	6.50	96.30	[illegible]	[illegible]	0.34	29.727	0.85	24.98	8.04
	2 S	0.1	10.80	[illegible]	[illegible]	1,587.65	7.70	99.00	[illegible]	[illegible]	0.33	31.470	0.78	25.04	8.04
	5 S	0.1	4.60	[illegible]	2.80	377.25	7.70	98.70	13.00	126.00	0.21	34.111	[illegible]	25.14	8.07
	5 D	1.5	4.60	[illegible]	3.50	344.66	7.70	96.70	13.00	122.40	0.20	34.151	[illegible]	25.13	8.08
	10 S	0.1	4.00	[illegible]	3.50	290.45	8.00	97.40	13.00	116.90	0.20	34.306	0.30	25.09	8.09
	10 D	2.5	4.00	[illegible]	[illegible]	264.33	7.70	100.00	12.30	119.10	0.20	34.340	[illegible]	25.10	8.09
	50 S	0.1	3.40	[illegible]	[illegible]	167.42	8.30	112.00	12.00	126.00	0.16	34.569	0.27	25.16	8.09
	50 D	5.9	3.70	3.00	2.90	116.29	8.30	104.30	12.60	112.30	0.14	34.738	0.26	25.28	8.11
	100 S	0.1	3.00	3.20	2.60	120.51	8.30	102.20	12.00	110.30	0.12	34.731	0.20	25.27	8.12
	100 D	6.0	3.00	2.60	2.80	83.99	8.30	98.10	11.70	106.70	0.10	34.779	0.21	25.35	8.13
	150 S	0.1	3.40	1.60	1.90	67.14	7.40	104.20	13.90	110.90	0.10	34.804	0.17	25.41	8.15
	150 D	7.4	2.70	1.60	1.80	57.58	8.30	102.90	11.40	108.20	0.08	34.817	0.17	25.40	8.16
DOH WQS GEOMETRIC MEAN		DRY		3.50	2.00				16.00	110.00	0.20	*	0.15	**	***
		WET		5.00	3.50				20.00	150.00	0.50		0.30		

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 5. Water chemistry measurements in µM and µg/L (shaded) from irrigation wells and two irrigation lakes collected in the vicinity of the Makena Resort on June 29, 2005. For sampling site locations, see Figure 1.

WELLS	PO4 (µM)	PO4 (µg/L)	NO3 (µM)	NO3 (µg/L)	NH4 (µM)	NH4 (µg/L)	SI (µM)	SI (µg/L)	TOP (µM)	TOP (µg/L)	TON (µM)	TON (µg/L)	TP (µM)	TP (µg/L)	TN (µM)	TN (µg/L)	SALINITY (ppt)
1	1.12	[illegible]	132.48	1,854.7	2.40	[illegible]	524.0	14,723	0.60	18.60	6.72	94.08	1.72	[illegible]	141.60	1,982	1.288
2	2.52	78.12	164.04	2,296.6	1.20	[illegible]	734.7	20,646	0.68	21.08	2.40	33.6	3.20	[illegible]	167.64	2,347	1.730
3	2.36	[illegible]	155.72	2,180.1	2.28	[illegible]	731.0	20,540	0.44	13.64	1.52	21.28	2.80	[illegible]	159.52	2,233	1.920
4	2.52	[illegible]	162.80	2,279.2	1.64	[illegible]	664.9	[illegible]	0.48	14.88	2.00	28.00	3.00	[illegible]	166.44	2,330	1.794
5	2.12	[illegible]	135.04	1,890.6	1.48	[illegible]	594.2	[illegible]	0.44	13.64	4.84	[illegible]	2.56	[illegible]	141.36	1,979	1.489
6	1.76	[illegible]	180.76	2,530.6	1.52	[illegible]	561.1	[illegible]	0.48	14.88	4.96	[illegible]	2.24	[illegible]	187.24	2,621	1.530
10	2.44	[illegible]	194.84	2,727.8	1.16	[illegible]	653.4	[illegible]	0.48	14.88	0.60	[illegible]	2.92	[illegible]	196.60	2,752	1.976
IL10	0.56	[illegible]	95.80	[illegible]	15.00	[illegible]	484.64	[illegible]	1.16	35.96	30.44	[illegible]	1.72	[illegible]	141.24	[illegible]	2.05
IL-B	49.86	[illegible]	100.60	[illegible]	46.88	[illegible]	582.20	[illegible]	1.58	[illegible]	35.48	[illegible]	51.44	[illegible]	182.96	[illegible]	2.07

LINDA LINGLE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801-3378

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2006
MAKENA RESORT CORP.

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:
EMD / CWB

July 13, 2006

07036MWO.06

Mr. Roy Figueiroa
Vice President
Makena Resort Corporation
5415 Makena Alanui
Kihei, Maui, Hawaii 96753

Dear Mr. Figueiroa:

Subject: **Marine Water Quality Monitoring Report II-2005**
Makena Resort, Makena, Maui

Thank you for your Makena Resort Marine Water Quality Monitoring Report dated March 6, 2006. We find your report very useful and applicable for our 305b Report to the U.S. Environmental Protection Agency.

This letter of acceptance satisfies Condition No. 10 of the State Land Use Commission Decision and Order (LUC Docket No. A97-721).

Sincerely,

DENIS R. LAU, P.E., Chief
Clean Water Branch

WTO:rg

I. PURPOSE

Makena Resort Corp. has constructed two 18-hole golf courses (North and South Courses) within the boundaries of the Makena Resort Development. The study area off the Makena site fronts approximately 5.4 miles of coastline. The area is bounded by Papanui Stream (Nahuna Point) on the north and Pu`u Olai (Ahihi Bay) on the south. No part of the project involves direct alteration of the shoreline or nearshore marine environments.

Evaluations of other golf courses and other forms of resort development located near the ocean in the Hawaiian Islands reveal that while there is detectable input to the coastal ocean of materials used for fertilization of turfgrass and landscaping, there are few, if any, effects that can be considered detrimental to the marine ecosystem (Dollar and Atkinson 1992). Thus, there is no *a priori* reason to suspect that the construction and responsible operation of the golf courses at Makena will cause any harmful changes to the marine environment. Nevertheless, in the interest of assuring maintenance of environmental quality, and as a means of ensuring that proper procedures are set forth, a condition of the Land Use Commission District Boundary Amendment for the project was the implementation of an ongoing marine monitoring program off the Makena Resort Development. The primary goals of the program are twofold: 1) to assess the degree that materials used on the Resort property to enhance turf growth and landscaping leach to groundwater and subsequently reach the ocean, and 2) to determine the fate of these materials within the nearshore zone. In terms of determining fate, the question that is addressed is if the materials that originate from Resort activities disperse with little or no effect, or do they cause changes in water quality sufficient to alter marine biological community structure?

The rationale of the monitoring program is to conduct repetitive evaluations of water chemistry at the same locations at regular time intervals (twice per year). This strategy allows for determination of variations in effects from the Resort in both space (at different locations along the shoreline) and time. These studies also fulfill condition No. 10, Declaration of Conditions pertaining to the Amendment of the District Boundary, as required by the Land Use Commission, dated April 17, 1998. The following report presents the results of the sixteenth increment in the monitoring program, and contains data from water chemistry sampling conducted on December 18, 2005.

II. ANALYTICAL METHODS

Three survey sites directly downslope from the Makena Golf Course site have been selected as sampling locations. A fourth site, located offshore of an area with minimal land-based development, particularly golf course operations, was selected as a control. Figure 1 is a map showing the shoreline and topographical features of the Makena area, and the location of the North and South Golf Courses. The four survey sites are depicted as transects perpendicular to the shoreline extending from the shoreline out to what is considered open coastal ocean (i.e., beyond the effects of activities on land). Survey Site 1 is located near the northern boundary of the project site off Nahuna Point; Survey Site 2 bisects Makena Bay near Makena Landing. Site 3 bisects the middle of the South course on the north side of Maluaka Point. Site 4, which is considered the Control site, is located at the northern boundary of the 'Ahihi-Kina'u natural area reserve offshore of the 1790 lava flow and approximately 1-2 miles south of the existing Makena Golf courses (Figure 1). In 2003, Site 3 was relocated from a location at the southern boundary of the project offshore of Oneloa Beach to the location directly off the golf course described above. Site 3 was relocated because the original location consistently showed virtually no input of groundwater to the ocean, hence offered little potential for evaluating effects from the project. The new location of Site 3 is directly downslope from both the portion of the golf course nearest to the ocean, and newly constructed residences. As a result, the new location represents an area that reflects the maximum influence of several land uses on nearshore water quality. Several private residences are also located near the shoreline in the vicinity of Control Site 4, while land use upslope of this survey site consists primarily of cattle grazing.

All fieldwork was conducted on December 18, 2005 using a small boat. Environmental conditions during sample collection consisted of mild winds (10-15 knots) and sunny skies, and a small southerly swell (2-3 ft.). Water samples were collected at stations along transects that extend from the highest wash of waves to approximately 125-200 meters (m) offshore at each site. Such a sampling scheme was designed to span the greatest range of salinity with respect to freshwater efflux at the shoreline. Sampling was more concentrated in the nearshore zone because this area is most likely to show the effects of shoreline modification. With the exception of the two stations closest to the shoreline (0 and 2 m offshore), samples were collected at two depths; a surface sample was collected within approximately 10 centimeters (cm) of the sea surface, and a bottom sample was collected within one m of the sea floor.

Water samples beyond 10 m from the shoreline were collected using a 1.8-liter Niskin-type oceanographic sampling bottle. This bottle was lowered to the desired depth in an open position where spring-loaded endcaps were triggered to close by a messenger released from the surface. Upon recovery, each sample was transferred into a 1-liter polyethylene bottle until further processing. For nearshore samples within 10 m of the shoreline, water samples were collected in 1-liter polyethylene bottles by divers swimming to the shoreline from the boat.

Water samples were also collected from seven golf course irrigation wells (No's 1, 2, 3, 4, 6, 10 and 11) and one irrigation lakes on the same day as the ocean sampling.

Subsamples for nutrient analyses from all water sources were immediately placed in 125-milliliter (ml) acid-washed triple rinsed, polyethylene bottles and stored on ice until returned to Honolulu. Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis.

Water quality parameters evaluated included the 10 specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (Open Coastal waters) of the State of Hawaii Department of Health Water Quality Standards. These criteria include: total nitrogen (TN) which is defined as dissolved inorganic nitrogen plus dissolved organic nitrogen, nitrate + nitrite nitrogen ($NO_3^- + NO_2^-$), ammonium (NH_4^+), total phosphorus (TP) which is defined as dissolved inorganic phosphorus plus dissolved organic phosphorus, chlorophyll a (Chl *a*), turbidity, temperature, pH and salinity. In addition, orthophosphate phosphorus (PO_4^{3-}) and silica (Si) were reported because these constituents are sensitive indicators of biological activity and the degree of groundwater mixing, respectively.

Analyses for NH_4^+, PO_4^{3-}, and $NO_3^- + NO_2^-$ (hereafter termed NO_3^-) were performed using a Technicon autoanalyzer according to standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion following digestion. Dissolved organic nitrogen (TON) and dissolved organic phosphorus (TOP) were calculated as the difference between TN and inorganic N, and TP and inorganic P, respectively. Limits of detection for the dissolved nutrients are 0.01 µM (0.14 µg/L) for NO_3^- and NH_4^+, 0.01 µM (0.31 µg/L) for PO_4^{3-}, 0.1 µM (1.4 µg/L) for TN and 0.1 µM (3.1 µg/L) for TP.

Chl *a* was measured by filtering 300 ml of water through glass fiber filters; pigments on filters were extracted in 90% acetone in the dark at -5°C for 12-24 hours, and the fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer (level of detection 0.01

µg/L). Salinity was determined using an AGE Model 2100 laboratory salinometer with a precision of 0.0003‰.

In situ field measurements included water temperature, pH, dissolved oxygen and salinity which were acquired using an RBR Model XR-420 CTD calibrated to factory specifications. The CTD was a readability of 0.001°C, 0.001pH units, 0.001% oxygen saturation, and 0.001 parts per thousand (‰) salinity.

Nutrient, turbidity, Chl *a* and salinity analyses were conducted by Marine Analytical Specialists located in Honolulu, Hawaii. This laboratory possesses acceptable ratings from EPA-compliant proficiency and quality control testing.

III. RESULTS

A. Horizontal Stratification

Table 1 shows results of all marine water chemical analyses for samples collected off Makena on December 18, 2005 reported in micromolar units (µM). Table 2 shows similar results presented in units of micrograms per liter (µg/L). Tables 3 and 4 show geometric means of ocean samples collected at the same sampling stations during the sixteen surveys to date from August 1995 to December 2005. Table 5 shows water chemistry measurements (in units of µM and µg/L) for samples collected from irrigation wells located on the Makena Resort Golf Courses. Concentrations of twelve chemical constituents in surface and deep-water samples from the December 2005 sampling are plotted as functions of distance from the shoreline in Figures 2 and 3. Mean concentrations (±standard error) of twelve chemical constituents in surface and deep water samples from the entire sampling program at Makena Resort, as well as data from the most recent sampling, are plotted as functions of distance from the shoreline in Figures 4-15.

In most previous surveys, concentrations of dissolved Si and NO_3^- have generally exhibited elevated concentrations in the samples collected at the shoreline which rapidly decline within 10 m of the shoreline. Correspondingly, salinity is generally lowest at the shoreline and increases rapidly within with distance from shore. During the December 2005 survey, however, such steep horizontal gradients were not evident on any of the sampling transects. Slight horizontal gradients of Si, NO_3^- and salinity were evident on Transects 1 and 2, while on Transects 3 and 4, horizontal gradients of were not evident (Tables 1-2, Figures 2-3).

At the sampling stations located closest to shore, the concentrations of Si ranged from about 2-6 µM compared to a range of geometric means of the entire previous data set of approximately 20-100 µM. Similarly, peak values of NO_3^- on the four transects in December 2005 ranged from 0.18-0.71 µM compared to ranges in geometric means of approximately 5-40 µM for the previous sampling (Figures 2, 4, 7, 10 and 13). While salinity was generally lower near the shoreline with increasing values with distance from shore, the range of values was only about 0.1‰ (Figures 3, 6, 9, 12 and 15, Table 1).

Phosphate phosphorus (PO_4^{3-}) showed no horizontal gradients at any of the sites. With the exception of a distinctly high value in the shoreline sample at Site 2, values were of the same magnitude among the four sites (Figure 2, Tables 1 and 2).

The pattern of elevated Si, NO_3^- and TN with a corresponding reduced salinity is usually indicative of groundwater entering the ocean near the shoreline. Low salinity groundwater, which contains high concentrations of Si, NO_3^-, TN and PO_4^{3-} (see values for well waters in Table 5), often percolates to the ocean near the shoreline, resulting in a distinct zone of mixing in the nearshore region. In the Kihei-Makena area, the zone of mixing generally extends to about 100 m of the shoreline. During the December 2005 survey, the lack of distinct horizontal gradients is likely the result of higher rates of mixing of groundwater with ocean water near the shoreline. Sampling for the Makena monitoring program is generally conducted during a period of low tide, in order to maximize the signal of groundwater in the nearshore zone. The December 2005 sampling was conducted during a period of relatively high, but ebbing tide (+1.3 - +1.0 ft). Based on the data, it is evident that the difference in tidal state, as well as wind and wave mixing during the sampling was sufficient to nearly eliminate the groundwater signal in the nearshore zone.

Dissolved nutrient constituents that are not associated with groundwater input (NH_4^+, TP, TON, TOP) did not show any distinct patterns with respect to distance from the shoreline (Figure 2). For all constituents, except TOP, there was an elevated measurement in the shoreline sample at Site 2 (Figure 2). Surface concentrations of turbidity were highest near the shoreline and decreased with increasing distance offshore at Sites 1, 2 and 4. At Site 3, turbidity remained constant along the transect (Table 1, Figure 3). Patterns in the concentrations of Chl *a* were similar to turbidity for Transects 1, 3 and 4. On Transect 2, concentrations of Chl *a* increased from the shoreline to 10 m offshore, and then decreased along the remaining length of the transect.

Among the four transect sites, values for turbidity were generally highest on Transect 2, which is the typical pattern seen on previous survey dates (Table 1, Figure 3). Transect 2 bisects Makena Bay, which is semi-enclosed embayment with a silt/sand bottom rather than the predominantly "hard" reef bottoms that occur at the three other transect sites. In addition, it has been observed that during flash floods originating in the ranch lands upslope of the Makena Resort terrigenous sediment flows to the ocean in Makena Bay. As a result of wave-induced resuspension of the naturally occurring silt/sand substratum, as well as terrigenous runoff which may be partially retained within the embayment, turbidity has been typically elevated at Transect 2 relative to the other transect sites. It is important to note that in surveys conducted since July 2002, water clarity in Makena Bay has improved greatly compared to preceding surveys in 2001 which reflected conditions following substantial input of terrigenous materials from a flash-flood that occurred in October 1999.

Surface water temperature measured beyond 10 m of the shoreline ranged between 25.3°C and 25.7°C during the December 2005 survey (Tables 1 and 2). Owing to the length of time between collection and return to the shoreline, temperature was not measured in the samples collected by divers.

B. Vertical Stratification

In many areas of the Hawaiian Islands, input of low salinity groundwater to the nearshore ocean creates a distinct buoyant surface lens that can persist for some distance offshore. Buoyant surface layers are generally found in areas where turbulent processes (primarily wave action) are insufficient to completely mix the water column in the nearshore zone. Figures 2 -15 and Tables 1 and 2 show concentrations of water chemistry constituents with respect to vertical stratification. During the December 2005 survey, vertical stratification was not evident for Si, NO_3^-, and TN on any of the four survey transects.

With respect to the other constituents measured, there were variations between surface and deep samples, however, the differences were generally small and no apparent trend with distance offshore was evident (Figures 2-15). One exception was the distinctly higher concentration of Chl *a* in the deep waters compared to the surface water at Site 2 (Figures 3 and 4).

C. Temporal Comparison of Monitoring Results

Figures 4-15 show mean concentrations (±standard error) of water chemistry constituents from surface and deep samples at all four sites during the sixteen monitoring surveys conducted from 1995 to 2005. In addition, the results of the most recent survey in December 2005 are also shown on each plot.

As discussed in the section above on horizontal stratification, comparison of the results of the December 2005 survey do not exhibit the typical trend of elevated nutrient concentrations in the nearshore area (within 10 m of the shoreline). Rather, nutrient concentrations are almost universally "flat" across the entire sampling regime on all four transects (Figures 4-15). The only exception to this pattern is elevated concentrations of PO_4^{3-}, NH_4^+, TN and TP at the shoreline station of Transect 2. The only constituent that shows a consistent excursion above the mean values on all four transects is salinity. In particular, there is no evidence of the reduced salinity at the nearshore stations in Dec 2005 that typified the overall conditions during the monitoring program. The average salinity of ~34.96 ‰ at all stations in December 2005 was slightly higher than the mean values at all sampling stations for the sixteen surveys to date.

Other instances where present survey results vary from the mean values are evident. At Sites 1, 2 and 4 turbidity was higher during the recent survey compared to the mean values, especially in the nearshore area (Figures 6, 9 and 15). At Site 4, which is considered the Control beyond the influence of the golf course, turbidity was distinctly elevated at the two stations closest to shore during the December 2005 survey relative to the mean values. Measurements of NH_4^+ and PO_4^{3-} during December 2005 at Site 2 also exceeded the mean value in the shoreline station (Figure 7).

Nitrate nitrogen (NO_3^-) is the nutrient component of golf course fertilizers that is most likely to leach to nearshore waters. During the December 2005 survey, concentrations of NO_3^- and TN were well below the mean values at all stations (Figures 2-15). The concentrations measured were very low at all sites ranging between below detectable to 0.71 µM. In many past surveys, elevated concentrations of NO_3^- have been routinely detected in the nearshore region of Site 3, located directly offshore of Golf Course Hole 15, which extends almost to the shoreline. In addition, within the past year new housing has been constructed adjacent to the golf course directly inshore of Site 3. During the December 2005 survey, however, there was no indication of elevated NO_3^- in the nearshore region of Site 3.

D. Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material input from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. Comparison of the curves produced by such plots with conservative mixing lines provides an indication of the origin and fate of the material in question (Officer 1979, Dollar and Atkinson 1992, Smith and Atkinson 1993).

Figure 16 shows plots of concentrations of four chemical constituents (Si, NO_3^-, PO_4^{3-}, NH_4^+) as functions of salinity for samples collected in December 2005. Figures 17 and 18 show the same type of plot with data grouped by transect site for the composite of all past surveys, as well as for the most recent survey. Each graph also shows two conservative mixing lines that are constructed by connecting the end member concentrations of open ocean water with two sources of groundwater: 1) irrigation well No. 4 located on the North Course of the Makena Resort (representative of unaltered groundwater), and 2) the irrigation lake that is fed by irrigation wells 2, 3 and 4.

If the parameter in question displays purely conservative behavior (no input or removal from any process other than physical mixing), data points should fall on, or very near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as uptake by biotic metabolic processes, data points will fall below the mixing line.

Dissolved Si represents a check on the model as this material is present in high concentration in groundwater, but is not a major component of fertilizer. In addition, Si is not utilized rapidly within the nearshore environment by biological processes. It can be seen in Figure 16 that when concentrations of Si are plotted as functions of salinity, data points from each of the sampling sites prescribe distinct linear arrays. Data points from Transect Sites 1and 3 lie on the irrigation lake water mixing line while most of the data points for Si from Transect Site 4 prescribe a downward concave curve that is primarily above the two mixing lines. Data points from Site 2 prescribe an upward concave array that rises above both mixing lines. Such a pattern suggests that the groundwater mixing with ocean water at the shoreline has slightly different composition between Sites 1-3, 2 and 4. These differences are likely a result of irrigation of the golf courses upslope from Transect Sites 1 and 3 with water from the irrigation lakes. The elevated levels of Si at Transect 2 suggest some external source of groundwater entering the nearshore area at Makena Landing. At Site 4, the linear array of data points for Si above the mixing line also indicate some alteration in groundwater in this area relative to the groundwater that flows under the golf course. Even with these subtle differences between sampling locations, it appears that the groundwater endmembers from well No. 4 provides a valid representation of the effects of golf course operation on unaltered groundwater that enters the ocean following flow through the golf courses. Over the course of monitoring since 1995, the relationship between salinity and Si has remained nearly constant (Figure 17).

NO_3^- is the form of nitrogen most common in fertilizer mixes that are used for enhancing turf growth. As is the case for Si, there is a distinct difference in the mixing lines created for NO_3^- by connecting endpoint concentrations of open ocean water with well water and irrigation lake water (Figure 16). These differences are likely a result of uptake of NO_3^- by plants in the irrigation lake that results is substantially lower concentrations than in the irrigation well.

As with Si, the plots of NO_3^- versus salinity show that data points from each transect lie in a distinct array. Data points from Transect 4, which is considered the control site with no influence from the golf course, lie mostly on or below the irrigation lake mixing line. However, several data points lie above the mixing line. Nearly all of the data points from Transect 1, and several data points for Transect 3 lie above both mixing lines, indicating a subsidy of NO_3^- to the ocean from sources on land. However, at Site 3, the data points that are above the mixing line do not occur in the samples with the lowest salinities, indicating that the concentrations are not likely a response to groundwater efflux. As with Si at Site 2, the samples collected near the shoreline (lowest salinity) displayed an indication of anomalous subsidy that does not appear to be closely linked to groundwater input water (Figure 16).

Site 1 is located directly downslope from the boundary between the Makena and Wailea Golf Courses, while Site 3 is located downslope from the area of the South course that is closest to the ocean. It is possible that the apparent subsidy of NO_3^- at Sites 1 and 3 are a result of leaching of golf course fertilizers to the groundwater lens. In addition to the golf courses, however, there are also newly constructed house lots with landscaping and lawns near the shoreline at Site 1. An old cesspool may also remain from a house recently torn down that was directly inshore of Site 3. New construction of a multi-unit housing complex has been on-going at Site 3 for the past year. As the mixing model reveals that the subsidies of NO_3^- in nearshore waters at Sites 1 and 3 are qualitatively different, the input at Site 1 in the lowest salinity samples that does not occur at Site 3 may be associated with leaching of sewage nutrients from these residential features rather than from leaching of golf course nutrients.

Site 1 has also been used as a monitoring station for a similar evaluation of the effects of the Wailea Golf Courses on water chemistry since 1989. The lowest concentrations of NO_3^- relative to salinity at Site 1 occurred during the initial two years of study, with subsequent higher concentrations since 1992. Hence, there appears to have been an increase of NO_3^- in nearshore waters that was not occurring in 1989-1991. Completion of the Wailea Gold Course occurred in December 1993, while completion of the Makena North Course occurred in November 1993. As the southern region of the Wailea Course and the northern part of the Makena Course overlap in the makai-mauka direction landward of ocean sampling Site 1, the increased concentrations of NO_3^- may be a result of leaching of fertilizer materials from the combined golf courses to groundwater that enters the ocean in the sampling area.

While the data reveal a long-term subsidy to the concentration of NO_3^- in groundwater at Site 1 and up to the present survey at Site 3, it does not appear that there has been any adverse effect to the biota offshore of this area. In past surveys, the linear relationship of the concentrations of NO_3^- as functions of salinity indicate that there is no detectable uptake of this material in the marine environment. Such lack of uptake indicates that the nutrients are not being removed from the water column by metabolic reactions that could change the composition of the marine environment. During the present survey in December 2005, nutrients entering the ocean through groundwater efflux appear to be dispersed solely by physical mixing processes to a point where there was little detectable subsidy. As a result, it does not appear that the increased nutrients are causing any alteration in biological community composition or function.

Similar situations have also been observed in other locales in the Hawaiian islands where nutrient subsidies from golf course leaching result in excess NO_3^- in the nearshore zone. At Keauhou Bay on the Big Island, it was shown that owing to the distinct vertical stratification in the nearshore zone, the excess nutrients never come into contact with benthic communities, thereby limiting the potential for increased uptake by benthic algae. In addition, the residence time of the high nutrient water was short enough within the embayment to preclude phytoplankton blooms. As a result, while NO_3^- concentrations doubled as a result of golf course leaching for a period of at least several years, there was no detectable negative effect to the marine environment (Dollar and Atkinson 1992). Owing to the unrestricted nature of circulation and mixing off the Makena project (no confined embayment) it is reasonable to assume that the excess NO_3^- subsidies that are apparent in the present study will not result in alteration to biological communities.

Inspection of the offshore area reveals an apparently healthy coral reef that does not appear to exhibit any negative effects from nutrient loading. There are no areas where excessive algal growth is presently occurring. The mean concentration of Chl *a* in surface waters within 50 m of the shoreline off of Site 3 (0.43 µg/L), was of the same magnitude as the other four transects. The similarity in values of Chl *a* indicate that plankton biomass is not elevated in the areas of highest nutrient subsidy to groundwater. Continued monitoring will indicate if this trend continues.

The other form of dissolved inorganic nitrogen, NH_4^+, does not show a linear pattern of distribution with respect to salinity for either the December 2005 survey (Figure 16) or the entire monitoring program (Figure 18). Many of the samples with near oceanic salinity also displayed the highest concentrations of NH_4^+. The lack of a correlation between salinity and concentration of NH_4^+ suggests that this form of nitrogen is not present in the marine environment as a result of mixing from groundwater sources. Rather, NH_4^+ is generated by natural biotic activity in the ocean waters off Makena.

PO_4^{3-} is also a major component of fertilizer, but is usually not found to leach to groundwater to the extent of NO_3^-, owing to a high absorptive affinity of phosphorus in soils. Data points for PO_4^{3-} from the December 2005 survey do not show a distinct linear trend with respect to salinity at any of the sites. The elevated NO_3^- at Site 1, which is likely a result of golf course and residential landscaping, is not reflected in similar subsidies of PO_4^{3-}. Over the entire monitoring program, the data set shows the same consistent trend (Figure 18).

D. Compliance with DOH Standards

Tables 1 and 2 also show samples that exceed DOH water quality standards for open coastal waters under "wet" and "dry" conditions. These criteria are applied depending upon whether the area is likely to receive less than (dry) or greater than (wet) 3 million gallons of groundwater input per mile per day. As it is not readily possible to accurately estimate groundwater and surface water discharge, both wet and dry standards are considered. DOH standards include specific criteria for three situations; criteria that are not to be exceeded during either 10% or 2% of the time, and criteria that are not to be exceeded by the geometric mean of samples. With only sixteen samples collected to date from each sampling station, comparison of the 10% or 2% of the time criteria for any sample is not statistically meaningful. However, comparing sample concentrations to these criteria provide an indication of whether water quality is near the stated specific criteria.

Boxed values in Tables 1 and 2 show instances where measurements exceed the DOH standards under dry conditions, while boxed and shaded values show instances where measurements exceed DOH standards under wet conditions.

Results from the December 2005 survey indicated that one measurement each of NH_4^+ and TN, ten measurements of turbidity and six measurements of Chl *a* exceeded the 10% DOH criteria under dry conditions. No measurements of NO_3^- or TP exceeded the 10% dry standards during December 2005. When compared under wet conditions, only one measurement of NH_4^+ and one measurement of turbidity were exceeded.

Tables 3 and 4 show geometric means of samples collected at the same locations during the sixteen increments of the monitoring program at all four sites. Also shown in these tables are the samples that exceed the DOH geometric mean limits for open coastal waters under "dry" (boxed) and "wet" (boxed and shaded) conditions. For NO_3^-, NH_4^+, and TN numerous dry and wet standards were exceeded. Five samples of TP, nineteen samples of turbidity exceeded the dry standards. All samples exceed the geometric mean standards for Chl *a*.

Site 4 is considered a control transect, in that it is not located offshore of a golf course. However, it can be seen in Table 4 that the number of samples that exceed geometric mean criteria at Site 4 are comparable to the other three sites, all of which are located downslope from the Makena Resort. Hence, it appears that the Resort activities, including golf courses cannot be attributed as the sole (or even major) factor causing water quality to exceed geometric mean standards.

IV. SUMMARY

- The sixteenth phase of water chemistry monitoring of the nearshore ocean off the Makena Resort was carried out on December 18, 2005. Fifty ocean water samples were collected on three transects spaced along the project ocean frontage. Site 1 was located at the northern boundary of the project, Site 2 was located near the central part of the Makena North Golf Course in the center of Makena Bay, Site 3 was downslope from the part of Makena South Golf Course that comes closest to the shoreline, and Control Site 4 was located to the south of Makena Resort off the 'Ahihi-Kina`u Natural Area Reserve. Sampling transects extended from the shoreline out to the open coastal ocean. Water samples were analyzed for chemical criteria specified by DOH water quality standards, as well as several additional criteria. In addition, water samples were collected from seven irrigation wells and one irrigation lakes located on the Makena Golf Courses.

- Water chemistry constituents that occur in high concentration in groundwater (Si, NO_3^- and PO_4^{3-}) displayed very small horizontal gradients with only slightly higher concentrations nearest to shore and decreasing concentrations moving seaward. While small compared to most previous surveys, groundwater input was greatest at Sites 1 and 2, and to a lesser extent at Site 4, and not detectable at Site 3. The relatively small horizontal gradients are a result of sampling during a high tide, which together with wind and wave action, results in near complete mixing of groundwater with ocean water at the shoreline. In contrast, during past surveys, which were conducted during low tidal stands, horizontal gradients of inorganic nutrients and salinity have been considerably more pronounced.

- Vertical stratification of the water column was not evident during December 2005. The lack of strong vertical and horizontal patterns of distribution indicate that physical mixing processes generated by tide, wind, waves and currents were sufficient for near complete mixing of the water column at these sites.

- Turbidity and Chl *a* were elevated near the shoreline at all four sites, as has been the case in all previous surveys. Site 2 is located at the point where sediment-laden storm water runoff entered the ocean following a flash flood in October 1999. While the highly turbid conditions associated with the runoff event are no longer evident, normal processes of circulation (tidal exchange, wave mixing) and the silt/sand bottom result in slightly more turbid conditions in Makena Bay (Site 2) compared to the other sampling sites that occur in areas with predominantly hard reef substrata.

- Most water chemistry constituents that do not occur in high concentrations in groundwater did not display any recognizable horizontal or vertical trends.

- Scaling nutrient concentrations to salinity indicates that there were very slight, but detectable subsidies of NO_3^- to the groundwater that enters the nearshore ocean at Sites 1 and 2. The subsidies increase the concentration of NO_3^- with respect to salinity in groundwater flowing to the ocean compared to natural groundwater. The area shoreward of Site 1 includes an overlap of the southern part of the Wailea Gold Course and the northern part of the Makena North Course, as well as residential development. Site 3 is directly downslope from the Makena South Course, but showed no consistent input of nutrient materials that could be related to the golf course. In addition, a remnant cesspool from a old house may still remain directly inshore from Site 3. Hence, the subsidies of NO_3^- noted at Sites 1 and 3 may result from a combination of sources. While the scaling of nutrient concentration to salinity indicates that the projected concentration of NO_3^- in undiluted groundwater is subsidized by inputs from land uses, the actual concentrations of NO_3^- in the ocean at all sites were only slightly elevated over background conditions.

- Subsidies of NO_3^- were also evident at shoreline samples Site 2 in Makena Bay, which is a well-used recreational area. Thus, other human activities besides golf course fertilizers may be contributing to the nutrient subsidies. If the subsidy of NO_3^- is a result of construction and operation of the existing golf courses, future monitoring surveys should indicate if the leaching of NO_3^- to the ocean is a temporary phenomenon that decreases with time, or is a continuing pattern.

- There is no subsidy of PO_4^{3-} corresponding to the subsidy of NO_3^- at Site 1. However, the highest concentrations of PO_4^{3-} were measured in nearshore samples at Site 2 in Makena Bay.

- Comparing water chemistry parameters to DOH standards revealed that no measurements of NO_3^- or TP exceeded the DOH "not to exceed more than 10% of the time" criteria for dry and wet conditions of open coastal waters. Only a few measurements of NH_4^+, TN, and turbidity and Chl *a* exceeded the DOH standards during this survey. Numerous values of NO_3^-, NH_4^+, TP, TN, turbidity and all measurements of Chl *a* exceeded specified limits for geometric means. Such exceedances occurred at all survey sites, including the control site that was far from any golf course influence.

- As in past surveys, there appears to be a definite input of nutrients (NO_3^-) to groundwater that enters the nearshore ocean at sampling sites downslope from parts of the Makena Resort, as well as other residential properties. However, this input has not increased relative to previous surveys, and does not appear to be detrimental to marine community structure.

- The next phase of the Makena Resort monitoring program is scheduled for the first half of 2006.

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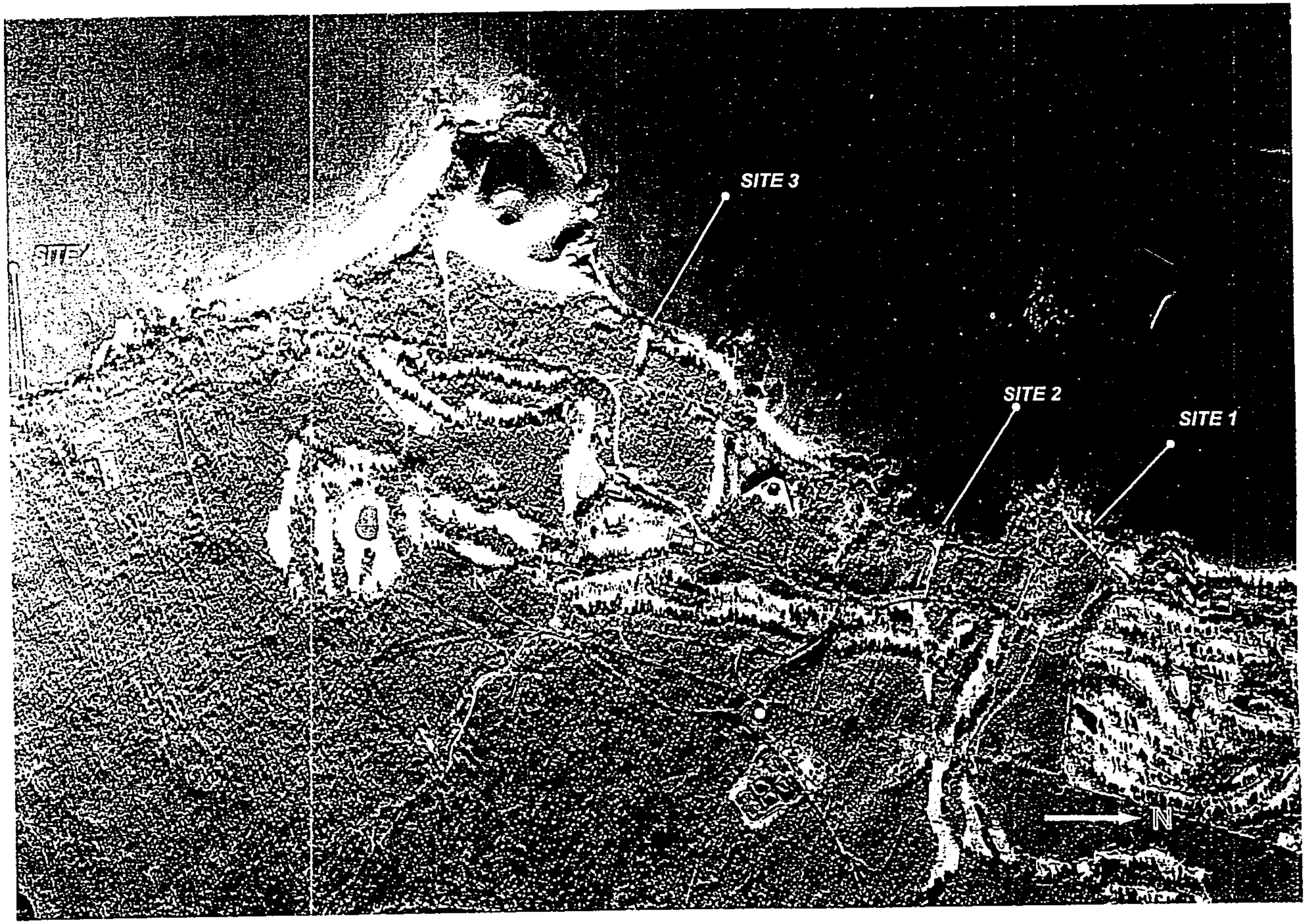


FIGURE 1. Aerial photograph of Makena Golf courses on southwest coastline of Maui. Also shown are locations of four water sampling transects that extend from the shoreline to 150-200 m from shore.

TABLE 1. Water chemistry measurements from ocean water samples collected in the vicinity of the Makena Resort on December 18, 2005. Nutrient concentrations are in micromoles (uM). Abbreviations as follows: DFS=distance from shore; S=surface; D=deep, NA=data not available; BDL=below detection limit. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH 10% "dry" standards; boxed and shaded values exceed DOH 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (μM)	NO3 (μM)	NH4 (μM)	Si (μM)	TOP (μM)	TON (μM)	TP (μM)	TN (μM)	TURB (NTU)	SALINITY (ppt)	CHL a (μg/L)	TEMP (deg.C)	pH (std.units)	O2 % Sat
MAKENA 1	0 S	0.1	0.04	0.56	0.05	2.43	0.30	6.51	0.34	7.12	1.00	34.934	0.72	NA	8.11	NA
	2 S	0.1	0.04	0.71	0.06	2.71	0.31	6.93	0.35	7.70	0.94	34.942	0.51	NA	8.12	NA
	5 S	0.1	0.04	0.22	0.05	1.71	0.33	6.67	0.37	6.94	0.50	34.986	0.46	NA	8.11	NA
	5 D	2.5	0.08	0.21	0.10	1.87	0.28	6.48	0.36	6.79	0.28	34.974	0.48	NA	8.11	NA
	10 S	0.1	0.10	0.28	0.13	1.70	0.30	6.64	0.40	7.05	0.30	34.979	0.44	NA	8.11	NA
	10 D	3.0	0.09	0.21	BDL	1.58	0.29	6.83	0.38	7.04	0.23	34.995	0.47	NA	8.10	NA
	50 S	0.1	0.09	0.28	0.10	1.54	0.28	6.59	0.37	6.97	0.23	35.031	0.34	25.5	8.09	100.4
	50 D	4.3	0.09	0.32	0.15	2.03	0.30	6.44	0.39	6.91	0.22	35.004	0.38	25.5	8.09	95.9
	100 S	0.1	0.10	0.32	0.18	1.99	0.28	6.32	0.38	6.82	0.28	35.018	0.35	25.5	8.09	98.5
	100 D	5.3	0.09	0.27	0.06	2.09	0.30	6.56	0.39	6.89	0.16	34.968	0.34	25.5	8.12	93.6
	150 S	0.1	0.08	0.03	0.15	1.61	0.30	6.46	0.38	6.64	0.08	35.002	0.24	25.7	8.13	98.6
	150 D	7.4	0.07	0.02	0.05	1.44	0.31	6.64	0.38	6.71	0.08	34.999	0.28	25.7	8.13	94.8
MAKENA 2	0 S	0.1	0.58	0.40	[illegible]	6.30	0.30	14.29	0.88	15.96	[illegible]	34.919	0.19	NA	8.09	NA
	2 S	0.1	0.17	0.25	0.02	5.24	0.33	7.21	0.50	7.48	1.08	34.916	0.22	NA	8.10	NA
	5 S	0.1	0.14	0.20	0.12	4.40	0.29	6.73	0.43	7.05	0.59	34.930	0.28	NA	8.10	NA
	5 D	1.5	0.09	0.32	0.12	4.42	0.38	7.70	0.47	8.14	0.64	34.919	0.49	NA	8.10	NA
	10 S	0.1	0.13	0.27	0.07	3.94	0.31	6.96	0.44	7.30	0.55	34.950	0.56	NA	8.10	NA
	10 D	2.4	0.11	0.22	0.08	4.15	0.30	6.38	0.41	6.68	0.56	34.947	0.77	NA	8.10	NA
	50 S	0.1	0.08	0.26	0.10	3.02	0.42	7.80	0.50	8.16	0.26	34.969	0.30	25.4	8.10	95.4
	50 D	2.8	0.09	0.14	0.10	3.07	0.34	7.20	0.43	7.44	0.27	34.910	0.36	25.5	8.10	93.8
	100 S	0.1	0.08	0.14	0.10	2.30	0.32	6.46	0.40	6.70	0.14	34.949	0.31	25.6	8.11	96.0
	100 D	3.8	0.09	0.18	0.17	2.31	0.30	6.47	0.39	6.82	0.18	34.940	0.44	25.5	8.11	93.3
	150 S	0.1	0.09	0.06	0.12	1.88	0.34	7.35	0.43	7.53	0.11	34.989	0.28	25.6	8.12	96.5
	150 D	6.5	0.06	0.11	BDL	2.04	0.32	6.41	0.38	6.52	0.11	34.965	0.28	25.7	8.12	94.8
	200 S	0.1	0.07	0.09	0.04	2.06	0.32	6.54	0.39	6.67	0.11	34.996	0.23	25.6	8.13	96.6
	200 D	12.2	0.06	0.10	0.11	1.89	0.34	7.17	0.40	7.38	0.11	34.980	0.23	25.7	8.12	93.6
MAKENA 3	0 S	0.1	0.03	0.19	0.03	1.96	0.31	6.78	0.34	7.00	0.19	34.970	0.45	NA	8.11	NA
	2 S	0.1	0.03	0.26	0.04	2.08	0.30	6.44	0.33	6.74	0.20	35.014	0.48	NA	8.10	NA
	5 S	0.1	0.04	0.24	0.12	2.05	0.30	6.33	0.34	6.69	0.24	34.981	0.47	NA	8.09	NA
	5 D	3.0	0.02	0.28	0.11	2.06	0.31	6.34	0.33	6.73	0.23	34.957	0.83	NA	8.09	NA
	10 S	0.1	0.02	0.26	0.05	1.94	0.31	6.57	0.33	6.88	0.20	34.949	0.39	NA	8.09	NA
	10 D	4.5	0.05	0.26	0.09	1.98	0.36	7.57	0.41	7.92	0.21	34.969	0.52	NA	8.09	NA
	50 S	0.1	0.07	0.28	0.11	2.07	0.34	8.00	0.41	8.39	0.17	34.942	0.38	25.4	8.09	95.9
	50 D	3.9	0.05	0.28	0.13	2.24	0.38	8.32	0.43	8.73	0.11	34.997	0.28	25.6	8.10	92.0
	100 S	0.1	0.06	0.23	0.14	2.00	0.33	6.22	0.39	6.59	0.11	34.954	0.23	25.5	8.10	94.1
	100 D	6.0	0.06	0.25	0.22	2.50	0.32	5.90	0.38	6.37	0.11	34.953	0.26	25.5	8.09	90.0
	150 S	0.1	0.05	0.05	0.21	1.61	0.32	5.90	0.37	6.16	0.10	35.002	0.20	25.7	8.13	97.1
	150 D	8.1	0.05	0.04	0.14	1.83	0.33	5.96	0.38	6.14	0.09	34.999	0.21	25.7	8.13	94.5
MAKENA 4	0 S	0.1	0.04	0.18	0.18	3.55	0.32	7.22	0.36	7.58	0.60	34.932	0.38	NA	8.04	NA
	2 S	0.1	0.05	0.15	0.16	3.53	0.32	6.44	0.37	6.75	0.72	34.903	0.47	NA	8.04	NA
	5 S	0.1	0.04	0.08	0.12	3.45	0.31	6.70	0.35	6.90	0.28	34.887	0.37	NA	8.03	NA
	5 D	1.5	0.06	0.09	0.11	3.66	0.31	6.44	0.37	6.64	0.20	34.901	0.35	NA	8.03	NA
	10 S	0.1	0.06	0.12	0.14	3.62	0.30	6.48	0.36	6.74	0.14	34.900	0.18	NA	8.03	NA
	10 D	2.5	0.05	0.11	0.10	3.65	0.29	6.04	0.34	6.25	0.15	34.868	0.22	NA	8.03	NA
	50 S	0.1	0.02	0.14	0.17	3.51	0.31	7.25	0.33	7.56	0.12	34.920	0.19	25.3	8.04	91.7
	50 D	2.8	0.02	0.08	0.13	3.26	0.30	5.58	0.32	5.79	0.10	34.958	0.19	25.3	8.06	89.7
	100 S	0.1	0.08	0.20	0.13	1.99	0.36	6.49	0.44	6.82	0.08	35.031	0.17	25.6	8.10	93.2
	100 D	5.0	0.05	0.17	0.16	2.96	0.31	5.85	0.36	6.18	0.10	34.999	0.15	25.5	8.07	88.1
	150 S	0.1	0.04	0.01	0.11	1.29	0.32	6.00	0.36	6.12	0.06	35.030	0.14	25.7	8.13	96.4
	150 D	6.5	0.02	0.03	0.10	1.78	0.33	6.12	0.35	6.25	0.07	35.015	0.16	25.7	8.12	94.3
DOH WQS		DRY	10%	0.71	0.36				0.96	12.86	0.50	*	0.50	**	***	****
			2%	1.43	0.64				1.45	17.86	1.00		1.00			
		WET	10%	1.00	0.61				1.29	17.85	1.25	*	0.90	**	***	****
			2%	1.78	1.07				1.93	25.00	2.00		1.75			

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.
**** Dissolved oxygen saturation should no be below 75%

TABLE 2. Water chemistry measurements from ocean water samples collected in the vicinity of the Makena Resort on December 18, 2005. Nutrient concentrations are shown in units of micrograms per liter (µg/L). Abbreviations as follows: DFS=distance from shore; S=surface; D=deep, NA=data not available; BDL=below detection limit. Also shown are the State of Hawaii, Department of Health (DOH) "not to exceed more than 10% of the time" and "not to exceed more than 2% of the time" water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH 10% "dry" standards; boxed and shaded values exceed DOH 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH (std.units)	O2 % Sat
MAKENA 1	0 S	0.1	1.24	7.84	0.70	68.3	9.30	91.14	10.54	99.68	1.00	34.934	0.72	NA	8.11	NA
	2 S	0.1	1.24	9.94	0.84	76.2	9.61	97.02	10.85	107.80	0.94	34.942	0.51	NA	8.12	NA
	5 S	0.1	1.24	3.08	0.70	48.1	10.23	93.38	11.47	97.16	0.50	34.986	0.46	NA	8.11	NA
	5 D	2.5	2.48	2.94	1.40	52.5	8.68	90.72	11.16	95.06	0.28	34.974	0.48	NA	8.11	NA
	10 S	0.1	3.10	3.92	1.82	47.8	9.30	92.96	12.40	98.70	0.30	34.979	0.44	NA	8.11	NA
	10 D	3.0	2.79	2.94	BDL	44.4	8.99	95.62	11.78	98.56	0.23	34.995	0.47	NA	8.10	NA
	50 S	0.1	2.79	3.92	1.40	43.3	8.68	92.26	11.47	97.58	0.23	35.031	0.34	25.5	8.09	100.4
	50 D	4.3	2.79	4.48	2.10	57.0	9.30	90.16	12.09	96.74	0.22	35.004	0.38	25.5	8.09	95.9
	100 S	0.1	3.10	4.48	2.52	55.9	8.68	88.48	11.78	95.48	0.28	35.018	0.35	25.5	8.09	98.5
	100 D	5.3	2.79	3.78	0.84	58.7	9.30	91.84	12.09	96.46	0.16	34.968	0.34	25.5	8.12	93.6
	150 S	0.1	2.48	0.42	2.10	45.2	9.30	90.44	11.78	92.96	0.08	35.002	0.24	25.7	8.13	98.6
	150 D	7.4	2.17	0.28	0.70	40.5	9.61	92.96	11.78	93.94	0.08	34.999	0.28	25.7	8.13	94.8
MAKENA 2	0 S	0.1	17.98	5.60	[illegible]	177.0	9.30	200.06	27.28	223.44	[illegible]	34.919	0.19	NA	8.09	NA
	2 S	0.1	5.27	3.50	0.28	147.2	10.23	100.94	15.50	104.72	1.08	34.916	0.22	NA	8.10	NA
	5 S	0.1	4.34	2.80	1.68	123.6	8.99	94.22	13.33	98.70	0.59	34.930	0.28	NA	8.10	NA
	5 D	1.5	2.79	4.48	1.68	124.2	11.78	107.80	14.57	113.96	0.64	34.919	0.49	NA	8.10	NA
	10 S	0.1	4.03	3.78	0.98	110.7	9.61	97.44	13.64	102.20	0.55	34.950	0.56	NA	8.10	NA
	10 D	2.4	3.41	3.08	1.12	116.6	9.30	89.32	12.71	93.52	0.56	34.947	0.77	NA	8.10	NA
	50 S	0.1	2.48	3.64	1.40	84.9	13.02	109.20	15.50	114.24	0.26	34.969	0.30	25.4	8.10	95.4
	50 D	2.8	2.79	1.96	1.40	86.3	10.54	100.80	13.33	104.16	0.27	34.910	0.36	25.5	8.10	93.8
	100 S	0.1	2.48	1.96	1.40	64.6	9.92	90.44	12.40	93.80	0.14	34.949	0.31	25.6	8.11	96.0
	100 D	3.8	2.79	2.52	2.38	64.9	9.30	90.58	12.09	95.48	0.18	34.940	0.44	25.5	8.11	93.3
	150 S	0.1	2.79	0.84	1.68	52.8	10.54	102.90	13.33	105.42	0.11	34.989	0.28	25.6	8.12	96.5
	150 D	6.5	1.86	1.54	BDL	57.3	9.92	89.74	11.78	91.28	0.11	34.965	0.28	25.7	8.12	94.8
	200 S	0.1	2.17	1.26	0.50	57.9	9.92	91.56	12.09	93.38	0.11	34.996	0.23	25.6	8.13	96.6
	200 D	12.2	1.86	1.40	1.54	53.1	10.54	100.38	12.40	103.32	0.11	34.980	0.23	25.7	8.12	93.6
MAKENA 3	0 S	0.1	0.93	2.66	0.42	55.1	9.61	94.92	10.54	98.00	0.19	34.970	0.45	NA	8.11	NA
	2 S	0.1	0.93	3.64	0.56	58.4	9.30	90.16	10.23	94.36	0.20	35.014	0.48	NA	8.10	NA
	5 S	0.1	1.24	3.36	1.68	57.6	9.30	88.62	10.54	93.66	0.24	34.981	0.47	NA	8.09	NA
	5 D	3.0	0.62	3.92	1.54	57.9	9.61	88.76	10.23	94.22	0.23	34.957	0.83	NA	8.09	NA
	10 S	0.1	0.62	3.64	0.70	54.5	9.61	91.98	10.23	96.32	0.20	34.949	0.39	NA	8.09	NA
	10 D	4.5	1.55	3.64	1.26	55.6	11.15	106.03	12.70	110.93	0.21	34.969	0.52	NA	8.09	NA
	50 S	0.1	2.17	3.92	1.54	58.2	10.54	112.00	12.71	117.46	0.17	34.942	0.38	25.4	8.09	95.9
	50 D	3.9	1.55	3.92	1.82	62.9	11.78	116.48	13.33	122.22	0.11	34.997	0.28	25.6	8.10	92.0
	100 S	0.1	1.86	3.22	1.96	56.2	10.23	87.08	12.09	92.26	0.11	34.954	0.23	25.5	8.10	94.1
	100 D	6.0	1.86	3.50	3.08	70.3	9.92	82.60	11.78	89.18	0.11	34.953	0.26	25.5	8.09	90.0
	150 S	0.1	1.55	0.70	2.94	45.2	9.92	82.60	11.47	86.24	0.10	35.002	0.20	25.7	8.13	97.1
	150 D	8.1	1.55	0.56	1.96	51.4	10.23	83.44	11.78	85.96	0.09	34.999	0.21	25.7	8.13	94.5
MAKENA 4	0 S	0.1	1.24	2.52	2.52	99.8	9.92	101.08	11.16	106.12	0.60	34.932	0.38	NA	8.04	NA
	2 S	0.1	1.55	2.10	2.24	99.2	9.92	90.16	11.47	94.50	0.72	34.903	0.47	NA	8.04	NA
	5 S	0.1	1.24	1.12	1.68	96.9	9.61	93.80	10.85	96.60	0.28	34.887	0.37	NA	8.03	NA
	5 D	1.5	1.86	1.26	1.54	102.8	9.61	90.16	11.47	92.96	0.20	34.901	0.35	NA	8.03	NA
	10 S	0.1	1.86	1.68	1.96	101.7	9.30	90.72	11.16	94.36	0.14	34.900	0.18	NA	8.03	NA
	10 D	2.5	1.55	1.54	1.40	102.6	8.99	84.56	10.54	87.50	0.15	34.868	0.22	NA	8.03	NA
	50 S	0.1	0.62	1.96	2.38	98.6	9.61	101.50	10.23	105.84	0.12	34.920	0.19	25.3	8.04	91.7
	50 D	2.8	0.62	1.12	1.82	91.6	9.30	78.12	9.92	81.06	0.10	34.958	0.19	25.3	8.06	89.7
	100 S	0.1	2.48	2.80	1.82	55.9	11.16	90.86	13.64	95.48	0.08	35.031	0.17	25.6	8.10	93.2
	100 D	5.0	1.55	2.38	2.24	83.2	9.61	81.90	11.16	86.52	0.10	34.999	0.15	25.5	8.07	88.1
	150 S	0.1	1.24	0.14	1.54	36.2	9.92	84.00	11.16	85.68	0.06	35.030	0.14	25.7	8.13	96.4
	150 D	6.5	0.62	0.42	1.40	50.0	10.23	85.68	10.85	87.50	0.07	35.015	0.16	25.7	8.12	94.3
DOH WQS		DRY	10%	10.00	5.00				30.00	180.00	0.50	•	0.50	••	•••	••••
			2%	20.00	9.00				45.00	250.00	1.00		1.00			
		WET	10%	14.00	8.50				40.00	250.00	1.25	•	0.90	••	•••	••••
			2%	25.00	15.00				60.00	350.00	2.00		1.75			

• Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.

•• Temperature shall not vary by more than one degree C. from ambient conditions.

•••pH shall not deviate more than 0.5 units from a value of 8.1.

•••• Dissolved oxygen saturation should not be less than 75%

TABLE 3. Geometric mean data from water chemistry measurements (nutrient concentrations in μM) off the Makena Resort collected since August 1995 (N=16). For geometric mean calculations, detection limits were used in cases where sample was below detection limit. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep. Also shown are State of Hawaii, Department of Health (DOH) geometric mean water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH GM 10% "dry" standards; boxed and shaded values exceed DOH GM 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DEPTH (m)	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH
MAKENA 1	0 S	0.1	0.18	[illegible]	[illegible]	46.40	0.22	8.00	0.46	[illegible]	0.35	30.863	[illegible]	25.4	8.16
	2 S	0.1	0.13	[illegible]	0.18	32.89	0.24	7.75	0.40	[illegible]	0.29	32.398	[illegible]	25.4	8.17
	5 S	0.1	0.11	[illegible]	0.14	17.81	0.25	7.77	0.39	[illegible]	0.24	33.345	[illegible]	25.5	8.17
	5 D	2.5	0.11	[illegible]	0.22	16.39	0.27	7.49	0.40	[illegible]	0.21	33.482	[illegible]	25.5	8.17
	10 S	0.1	0.10	[illegible]	0.16	8.91	0.25	7.05	0.36	[illegible]	0.20	34.229	[illegible]	25.5	8.17
	10 D	3.0	0.10	[illegible]	0.17	7.10	0.28	7.31	0.40	[illegible]	0.19	34.400	[illegible]	25.5	8.16
	50 S	0.1	0.10	[illegible]	0.18	6.65	0.26	6.99	0.37	[illegible]	0.17	34.408	[illegible]	25.6	8.15
	50 D	4.1	0.09	[illegible]	0.12	2.68	0.27	7.29	0.37	7.95	0.12	34.774	[illegible]	25.6	8.15
	100 S	0.1	0.09	[illegible]	0.13	4.55	0.26	6.51	0.37	9.38	0.14	34.543	[illegible]	25.6	8.14
	100 D	6.4	0.08	0.10	0.07	1.96	0.27	7.06	0.36	7.35	0.10	34.807	0.27	25.6	8.16
	150 S	0.1	0.08	0.31	0.11	3.20	0.26	6.84	0.36	8.28	0.12	34.677	0.23	25.7	8.15
	150 D	10.5	0.08	0.07	0.08	1.69	0.26	6.79	0.35	7.04	0.10	34.816	0.20	25.6	8.17
MAKENA 2	0 S	0.1	0.24	[illegible]	[illegible]	19.17	0.32	8.27	0.60	[illegible]	[illegible]	33.917	[illegible]	25.6	8.14
	2 S	0.1	0.22	[illegible]	0.24	17.32	0.33	7.87	0.58	[illegible]	[illegible]	33.907	[illegible]	25.5	8.14
	5 S	0.1	0.20	[illegible]	[illegible]	14.32	0.28	6.84	0.50	[illegible]	[illegible]	34.068	[illegible]	25.5	8.15
	5 D	1.5	0.19	[illegible]	[illegible]	13.86	0.32	7.20	0.53	[illegible]	[illegible]	34.105	[illegible]	25.5	8.15
	10 S	0.1	0.15	[illegible]	0.19	9.59	0.31	4.79	0.48	9.09	0.38	34.355	[illegible]	25.5	8.16
	10 D	2.4	0.14	[illegible]	0.23	7.90	0.32	7.09	0.48	9.15	0.31	34.491	[illegible]	25.5	8.16
	50 S	0.1	0.12	[illegible]	[illegible]	7.15	0.33	7.35	0.48	9.27	0.31	34.474	[illegible]	25.5	8.14
	50 D	3.8	0.10	0.26	0.18	3.12	0.32	7.54	0.45	8.18	0.21	34.765	[illegible]	25.6	8.15
	100 S	0.1	0.09	[illegible]	0.19	4.06	0.29	7.33	0.40	8.36	0.18	34.642	[illegible]	25.6	8.14
	100 D	4.7	0.08	0.19	0.19	2.43	0.29	6.94	0.39	7.45	0.13	34.785	[illegible]	25.6	8.16
	150 S	0.1	0.09	0.25	0.22	3.03	0.29	7.42	0.40	8.02	0.14	34.745	0.28	25.6	8.15
	150 D	9.5	0.08	0.13	0.14	2.17	0.30	7.60	0.40	7.99	0.12	34.804	0.28	25.6	8.17
	200 S	0.1	0.08	0.20	0.17	2.48	0.28	7.16	0.37	7.83	0.12	34.803	0.26	25.7	8.16
	200 D	13.4	0.08	0.06	0.19	1.73	0.29	7.65	0.38	8.01	0.10	34.844	0.29	25.7	8.18
MAKENA 3	0 S	0.1	0.07	[illegible]	[illegible]	8.00	0.28	7.01	0.38	[illegible]	0.30	34.430	[illegible]	25.4	8.18
	2 S	0.1	0.15	[illegible]	[illegible]	16.79	0.26	6.82	0.45	[illegible]	0.34	34.039	[illegible]	25.7	8.15
	5 S	0.1	0.12	[illegible]	0.22	11.30	0.26	7.45	0.42	[illegible]	0.25	34.291	[illegible]	25.7	8.15
	5 D	3.0	0.10	[illegible]	[illegible]	9.18	0.28	6.55	0.42	[illegible]	0.24	34.370	[illegible]	25.7	8.15
	10 S	0.1	0.08	[illegible]	0.24	5.93	0.28	7.03	0.38	[illegible]	0.18	34.539	[illegible]	25.5	8.15
	10 D	4.5	0.07	[illegible]	0.17	4.81	0.29	6.86	0.38	10.09	0.17	34.617	[illegible]	25.6	8.15
	50 S	0.1	0.09	[illegible]	0.20	4.19	0.27	7.26	0.37	9.48	0.14	34.661	0.25	25.6	8.12
	50 D	3.5	0.06	[illegible]	0.14	2.87	0.28	7.45	0.35	8.16	0.10	34.777	0.23	25.6	8.16
	100 S	0.1	0.06	0.34	0.19	2.45	0.28	7.16	0.36	7.96	0.10	34.769	0.18	25.7	8.15
	100 D	6.2	0.06	0.12	0.16	1.80	0.27	6.32	0.34	6.75	0.08	34.793	0.20	25.7	8.15
	150 S	0.1	0.05	0.14	0.15	2.03	0.28	6.27	0.34	6.89	0.09	34.762	0.17	25.7	8.18
	150 D	8.2	0.06	0.07	0.08	1.72	0.27	6.38	0.34	6.65	0.08	34.796	0.24	25.7	8.19
MAKENA 4	0 S	0.1	0.37	[illegible]	[illegible]	61.71	0.22	6.90	[illegible]	[illegible]	0.35	30.029	[illegible]	25.0	8.04
	2 S	0.1	0.31	[illegible]	[illegible]	47.52	0.25	7.03	0.63	[illegible]	0.35	31.674	[illegible]	25.0	8.04
	5 S	0.1	0.14	[illegible]	0.20	12.34	0.25	7.02	0.42	8.86	0.22	34.159	[illegible]	25.1	8.07
	5 D	1.5	0.14	[illegible]	0.23	11.38	0.25	6.88	0.41	8.59	0.20	34.198	[illegible]	25.1	8.08
	10 S	0.1	0.13	[illegible]	0.24	9.68	0.26	6.93	0.41	8.24	0.20	34.343	0.29	25.1	8.08
	10 D	2.5	0.12	[illegible]	[illegible]	8.87	0.25	7.06	0.39	8.34	0.19	34.372	[illegible]	25.1	8.09
	50 S	0.1	0.09	[illegible]	[illegible]	5.77	0.27	7.95	0.39	8.90	0.16	34.591	0.26	25.2	8.09
	50 D	5.9	0.10	0.21	0.20	4.08	0.27	7.32	0.40	7.86	0.14	34.751	0.25	25.3	8.10
	100 S	0.1	0.10	0.23	0.19	4.09	0.28	7.25	0.39	7.81	0.12	34.750	0.19	25.3	8.12
	100 D	6.0	0.09	0.18	0.20	2.99	0.27	6.93	0.38	7.52	0.10	34.793	0.21	25.4	8.13
	150 S	0.1	0.11	0.10	0.14	2.30	0.24	7.34	0.44	7.79	0.10	34.818	0.16	25.4	8.14
	150 D	7.4	0.08	0.11	0.12	2.03	0.27	7.26	0.37	7.63	0.08	34.829	0.17	25.4	8.15
DOH WQS GEOMETRIC MEAN	DRY			0.25	0.14				0.52	7.86	0.20	*	0.15	**	***
	WET			0.36	0.25				0.64	10.71	0.50		0.30		

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 4. Geometric mean data from water chemistry measurements (nutrient concentrations in µg/L)off the Makena Resort collected since August 1995 (N=16). For geometric mean calculations, detection limits were used in cases where sample was below detection limit. Abbreviations as follows: DFS=distance from shore; S=surface; D=deep. Also shown are State of Hawaii, Department of Health (DOH) geometric mean water quality standards for open coastal waters under "dry" and "wet" conditions. Boxed values exceed DOH GM 10% "dry" standards; boxed and shaded values exceed DOH GM 10% "wet" standards. For sampling site locations, see Figure 1.

TRANSECT SITE	DFS (m)	DH (m)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (NTU)	SALINITY (ppt)	CHL a (µg/L)	TEMP (deg.C)	pH
MAKENA 1	0 S	0.1	5.50	[illegible]	[illegible]	1303.4	6.80	112.00	14.20	[illegible]	0.35	30.863	[illegible]	25.4	8.16
	2 S	0.1	4.00	[illegible]	2.50	923.9	7.40	108.50	12.30	[illegible]	0.29	32.398	[illegible]	25.4	8.17
	5 S	0.1	3.40	[illegible]	1.90	500.3	7.70	108.80	12.00	[illegible]	0.24	33.345	[illegible]	25.5	8.17
	5 D	2.5	3.40	[illegible]	3.00	460.4	8.30	104.90	12.30	[illegible]	0.21	33.482	[illegible]	25.5	8.17
	10 S	0.1	3.00	[illegible]	2.20	250.3	7.70	98.70	11.10	[illegible]	0.20	34.229	[illegible]	25.5	8.17
	10 D	3.0	3.00	[illegible]	2.30	199.4	8.60	102.30	12.30	[illegible]	0.19	34.400	[illegible]	25.5	8.16
	50 S	0.1	3.00	[illegible]	2.50	186.8	8.00	97.90	11.40	[illegible]	0.17	34.408	[illegible]	25.6	8.15
	50 D	4.1	2.70	[illegible]	1.60	75.3	8.30	102.10	11.40	111.30	0.12	34.774	[illegible]	25.6	8.15
	100 S	0.1	2.70	[illegible]	1.80	127.8	8.00	91.10	11.40	131.30	0.14	34.543	[illegible]	25.6	8.14
	100 D	6.4	2.40	1.40	0.90	55.1	8.30	98.80	11.10	102.90	0.10	34.807	0.27	25.6	8.16
	150 S	0.1	2.40	4.30	1.50	89.9	8.00	95.80	11.10	115.90	0.12	34.677	0.23	25.7	8.15
	150 D	10.5	2.40	0.90	1.10	47.5	8.00	95.10	10.80	98.60	0.10	34.816	0.20	25.6	8.17
MAKENA 2	0 S	0.1	7.40	[illegible]	[illegible]	538.5	9.90	115.80	18.50	[illegible]	[illegible]	33.917	[illegible]	25.6	8.14
	2 S	0.1	6.80	[illegible]	3.30	486.5	10.20	110.20	17.90	[illegible]	[illegible]	33.907	[illegible]	25.5	8.14
	5 S	0.1	6.10	[illegible]	[illegible]	402.2	8.60	95.80	15.40	[illegible]	[illegible]	34.068	[illegible]	25.5	8.15
	5 D	1.5	5.80	[illegible]	[illegible]	389.3	9.90	100.80	16.40	[illegible]	[illegible]	34.105	[illegible]	25.5	8.15
	10 S	0.1	4.60	[illegible]	2.60	269.4	9.60	67.00	14.80	127.30	0.38	34.355	[illegible]	25.5	8.16
	10 D	2.4	4.30	[illegible]	3.20	221.9	9.90	99.30	14.80	128.10	0.31	34.491	[illegible]	25.5	8.16
	50 S	0.1	3.70	[illegible]	[illegible]	200.8	10.20	102.90	14.80	129.80	0.31	34.474	[illegible]	25.5	8.14
	50 D	3.8	3.00	3.60	2.50	87.6	9.90	105.60	13.90	114.50	0.21	34.765	0.50	25.6	8.15
	100 S	0.1	2.70	[illegible]	2.60	114.0	8.90	102.60	12.30	117.00	0.18	34.642	0.33	25.6	8.14
	100 D	4.7	2.40	2.60	2.60	68.3	8.90	97.20	12.00	104.30	0.13	34.785	0.35	25.6	8.16
	150 S	0.1	2.70	3.50	3.00	85.1	8.90	103.90	12.30	112.30	0.14	34.745	0.28	25.6	8.15
	150 D	9.5	2.40	1.80	1.90	61.0	9.20	106.40	12.30	111.90	0.12	34.804	0.28	25.6	8.17
	200 S	0.1	2.40	2.80	2.30	69.7	8.60	100.20	11.40	109.60	0.12	34.803	0.26	25.7	8.16
	200 D	13.4	2.40	0.80	2.60	48.6	8.90	107.10	11.70	112.10	0.10	34.844	0.29	25.7	8.18
MAKENA 3	0 S	0.1	2.10	[illegible]	[illegible]	224.7	8.60	98.10	11.70	172.80	0.30	34.430	0.62	25.4	8.18
	2 S	0.1	4.60	[illegible]	[illegible]	471.6	8.00	95.50	13.90	285.80	0.34	34.039	[illegible]	25.7	8.15
	5 S	0.1	3.70	[illegible]	3.00	317.4	8.00	104.30	13.00	234.60	0.25	34.291	0.54	25.7	8.15
	5 D	3.0	3.00	[illegible]	4.00	257.9	8.60	91.70	13.00	[illegible]	0.24	34.370	0.80	25.7	8.15
	10 S	0.1	2.40	[illegible]	3.30	166.6	8.60	98.40	11.70	165.10	0.18	34.539	0.35	25.5	8.15
	10 D	4.5	2.10	20.70	2.30	135.1	8.90	96.00	11.70	141.30	0.17	34.617	0.54	25.6	8.15
	50 S	0.1	2.70	[illegible]	2.80	117.7	8.30	101.60	11.40	132.70	0.14	34.661	0.25	25.6	8.12
	50 D	3.5	1.80	[illegible]	1.90	80.6	8.60	104.30	10.80	114.20	0.10	34.777	0.23	25.6	8.16
	100 S	0.1	1.80	4.70	2.60	68.8	8.60	100.20	11.10	111.40	0.10	34.769	0.18	25.7	8.15
	100 D	6.2	1.80	1.60	2.20	50.6	8.30	88.50	10.50	94.50	0.08	34.793	0.20	25.7	8.15
	150 S	0.1	1.50	1.90	2.10	57.0	8.60	87.80	10.50	96.50	0.09	34.762	0.17	25.7	8.18
	150 D	8.2	1.80	0.90	1.10	48.3	8.30	89.30	10.50	93.10	0.08	34.796	0.24	25.7	8.19
MAKENA 4	0 S	0.1	11.40	[illegible]	[illegible]	1733.4	6.80	96.60	[illegible]	271.90	0.35	30.029	0.81	25.0	8.04
	2 S	0.1	9.60	[illegible]	[illegible]	1334.8	7.70	98.40	19.50	222.00	0.35	31.674	0.76	25.0	8.04
	5 S	0.1	4.30	[illegible]	2.80	346.6	7.70	98.30	13.00	124.00	0.22	34.159	[illegible]	25.1	8.07
	5 D	1.5	4.30	[illegible]	3.20	319.7	7.70	96.30	12.60	120.30	0.20	34.198	0.77	25.1	8.08
	10 S	0.1	4.00	[illegible]	3.30	271.9	8.00	97.00	12.60	115.40	0.20	34.343	0.29	25.1	8.08
	10 D	2.5	3.70	[illegible]	[illegible]	249.2	7.70	98.80	12.00	116.80	0.19	34.372	0.34	25.1	8.09
	50 S	0.1	2.70	25.40	[illegible]	162.1	8.30	111.30	12.00	124.60	0.16	34.591	0.26	25.2	8.09
	50 D	5.9	3.00	2.90	2.80	114.6	8.30	102.50	12.30	110.00	0.14	34.751	0.25	25.3	8.1
	100 S	0.1	3.00	3.20	2.60	114.9	8.60	101.50	12.00	109.30	0.12	34.750	0.19	25.3	8.12
	100 D	6.0	2.70	2.50	2.80	84.0	8.30	97.00	11.70	105.30	0.10	34.793	0.21	25.4	8.13
	150 S	0.1	3.40	1.40	1.90	64.6	7.40	102.80	13.60	109.10	0.10	34.818	0.16	25.4	8.14
	150 D	7.4	2.40	1.50	1.60	57.0	8.30	101.60	11.40	106.80	0.08	34.829	0.17	25.4	8.15
DOH WQS GEOMETRIC MEAN	DRY			3.50	2.00				16.00	110.00	0.20	*	0.15	**	***
	WET			5.00	3.50				20.00	150.00	0.50		0.30		

* Salinity shall not vary more than ten percent form natural or seasonal changes considering hydrologic input and oceanographic conditions.
** Temperature shall not vary by more than one degree C. from ambient conditions.
***pH shall not deviate more than 0.5 units from a value of 8.1.

TABLE 5. Water chemistry measurements in μM and μg/L (shaded) from irrigation wells and two irrigation lakes collected in the vicinity of the Makena Resort on December 18, 2005. For sampling site locations, see Figure 1.

WELLS	PO4 (μM)	PO4 (μg/L)	NO3 (μM)	NO3 (μg/L)	NH4 (μM)	NH4 (μg/L)	Si (μM)	Si (μg/L)	TOP (μM)	TOP (μg/L)	TON (μM)	TON (μg/L)	TP (μM)	TP (μg/L)	TN (μM)	TN (μg/L)	SALINITY (ppt)
1	1.64	50.84	124.72	1,746.1	0.40	5.60	505.7	14211	0.92	28.52	9.04	[illegible]	2.56	79.36	134.16	[illegible]	1.304
2	3.32	102.92	135.60	1,898.4	0.40	5.60	670.7	18847	0.36	11.16	9.80	137.2	3.68	114.08	145.80	2,041	1.847
3	2.72	84.32	129.88	1,818.3	0.76	10.64	668.3	18779	0.40	12.40	9.68	135.5	3.12	96.72	140.32	1,964	1.980
4	3.04	94.24	137.16	1,920.2	0.96	13.44	628.8	17670	0.20	6.20	6.08	[illegible]	3.24	100.44	144.20	[illegible]	1.800
6	2.48	76.88	186.64	2,613.0	1.16	16.24	526.8	14802	0.48	14.88	5.32	74.5	2.96	91.76	193.12	2,704	1.491
10	2.80	86.80	193.36	2,707.0	1.60	22.40	600.4	16870	0.44	13.64	1.68	23.5	3.24	100.44	196.64	[illegible]	1.763
11	2.52	78.12	107.28	1,501.9	1.72	24.08	580.2	16305	0.48	14.88	9.40	[illegible]	3.00	93.00	118.40	[illegible]	2.770
IL10	0.56	17.36	50.08	701.12	3.12	43.68	462.68	13,001.31	1.92	59.52	45.84	641.76	2.48	76.88	99.04	1,386.56	2.02

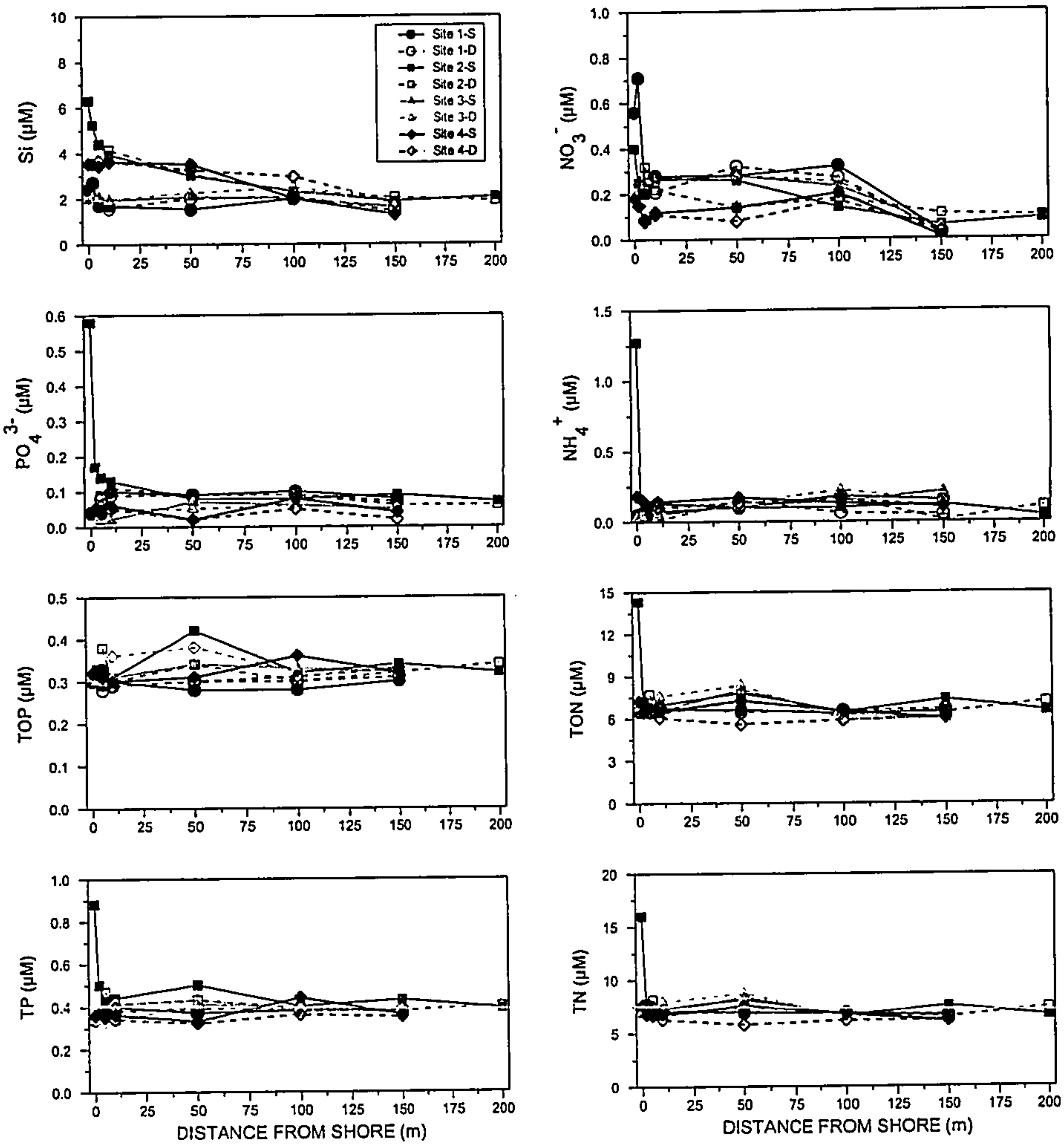


FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected on December 18, 2005 as a function of distance from the shoreline in the vicinity of Makena Resort. For site locations, see Figure 1.

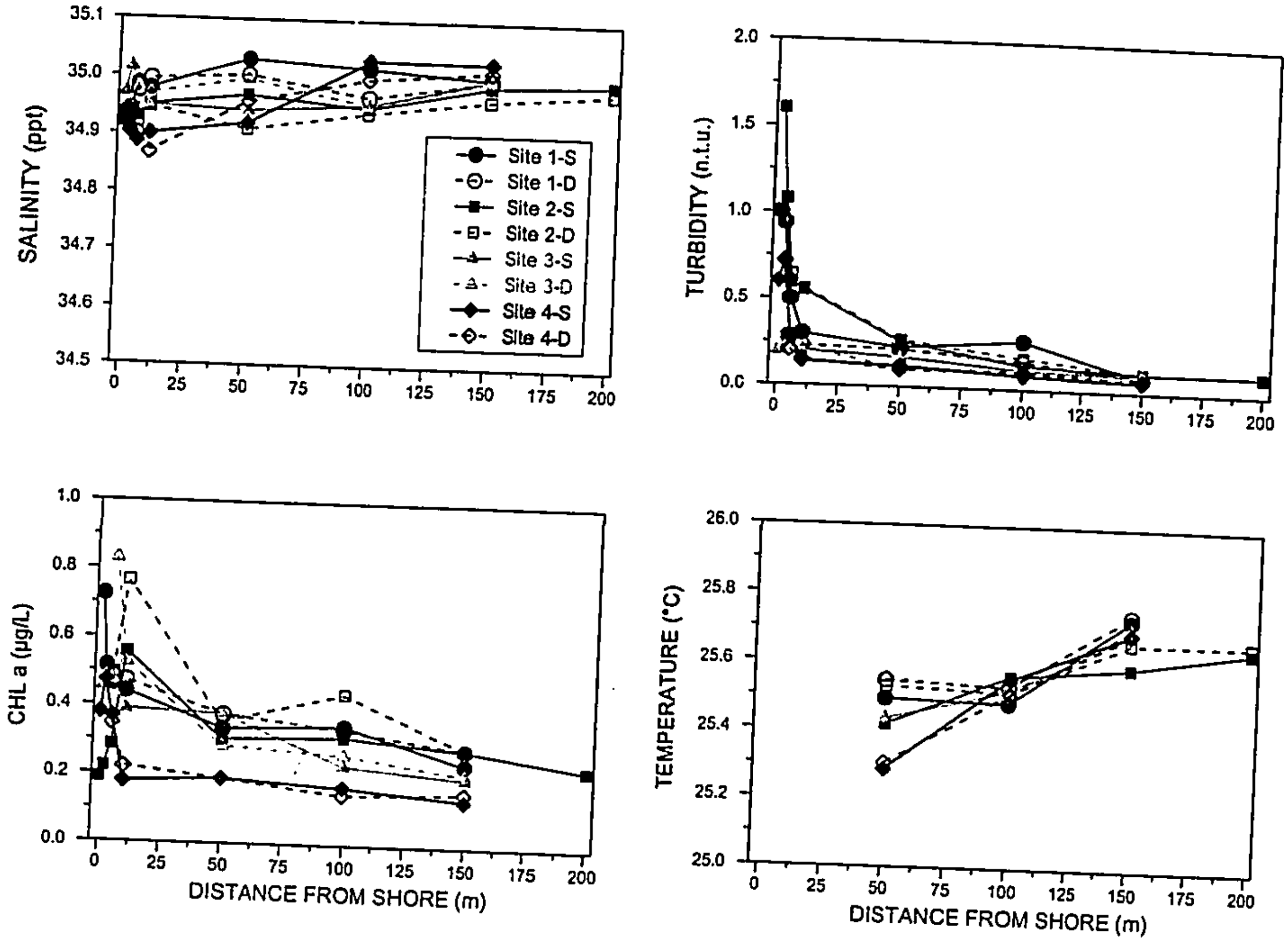


FIGURE 3. Plots of water chemistry constituents in surface (S) and deep (D) samples collected on December 18, 2005 as a function of distance from the shoreline in the vicinity of Makena Resort. Note: temperature data were not recorded for nearshore samples. For site locations, see Figure 1.

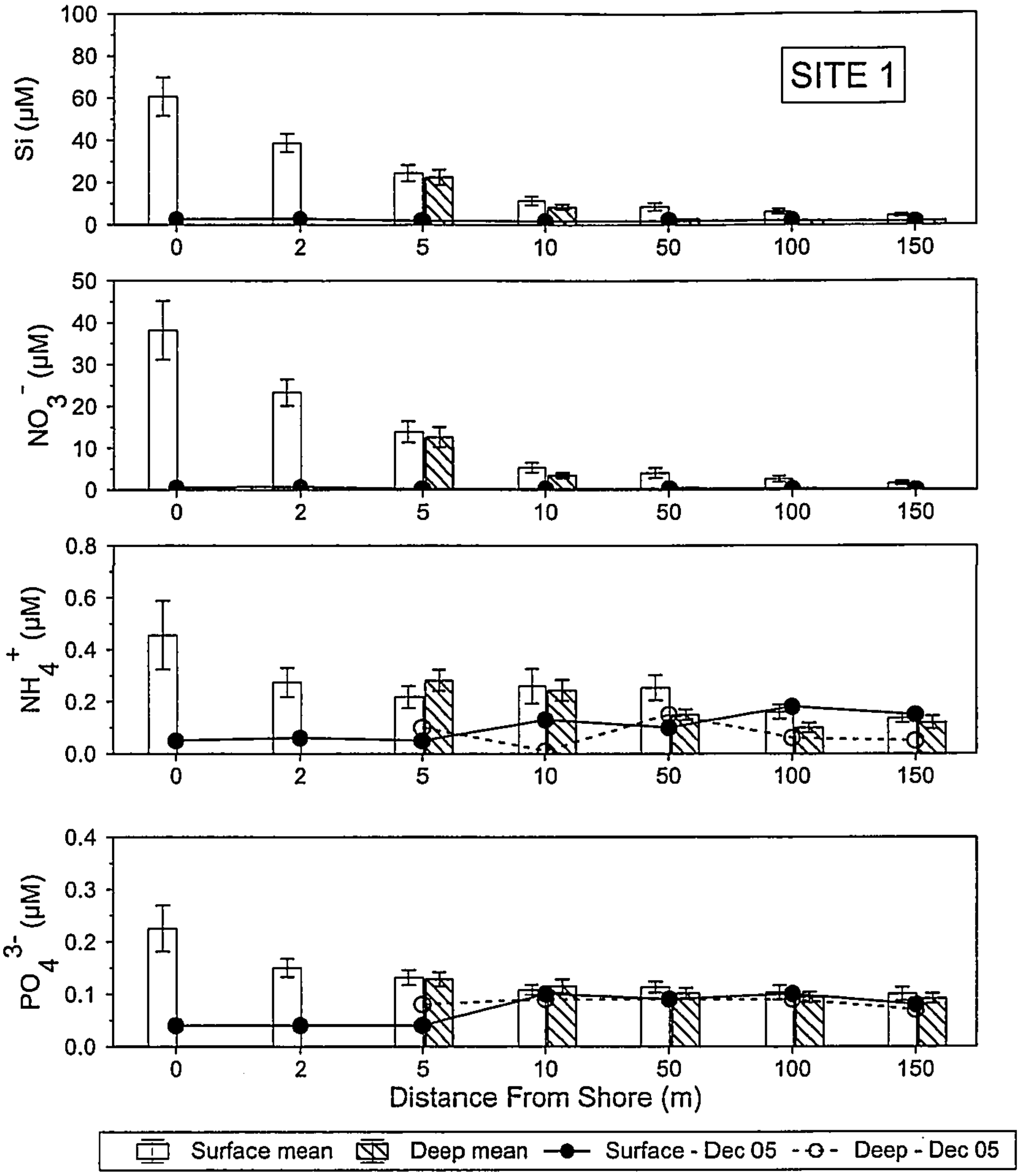


FIGURE 4. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 1, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

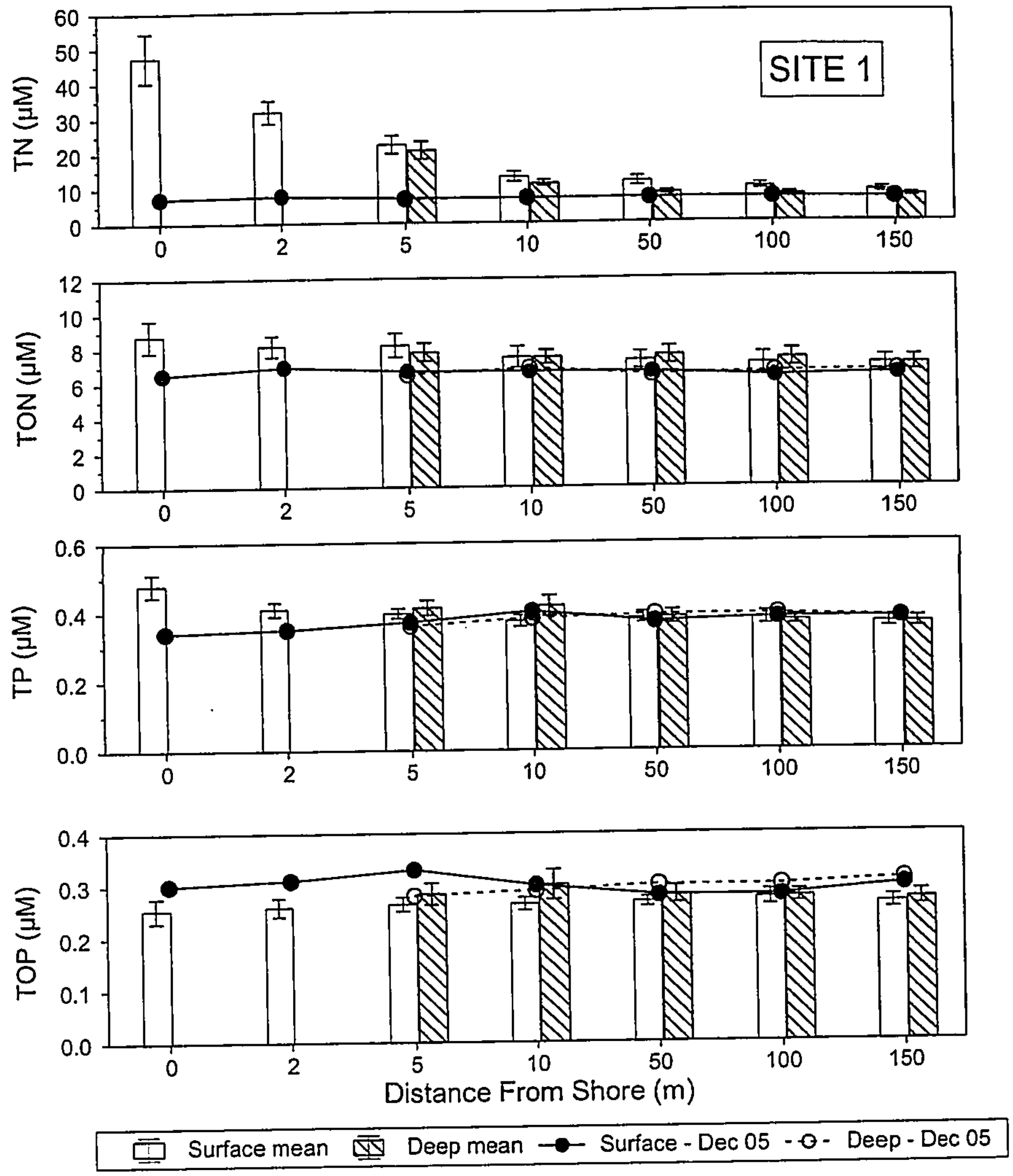


FIGURE 5. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 1, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

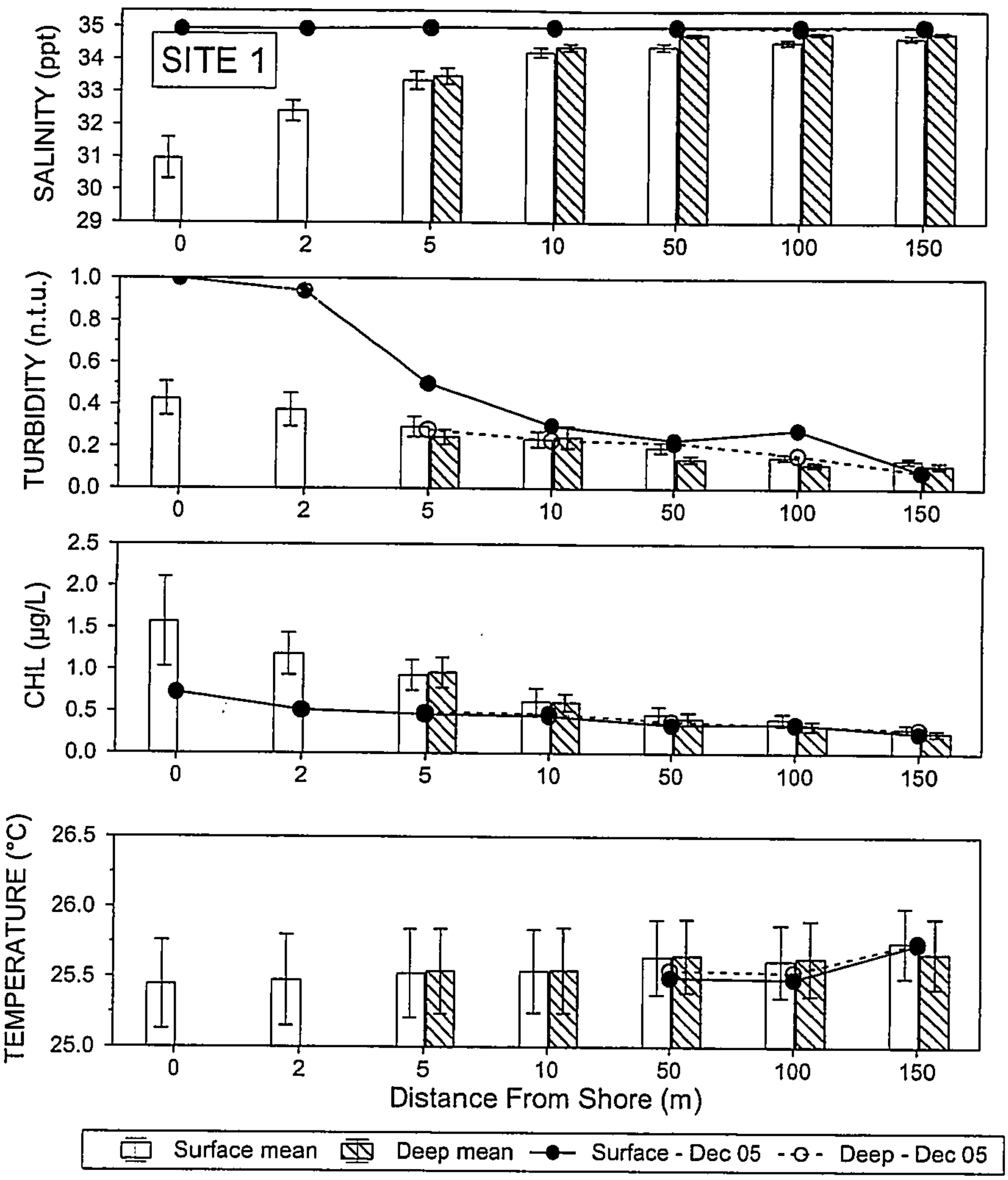


FIGURE 6. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 1, offshore of the Makena Resort. Data points and connected lines from samples collected during the most survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

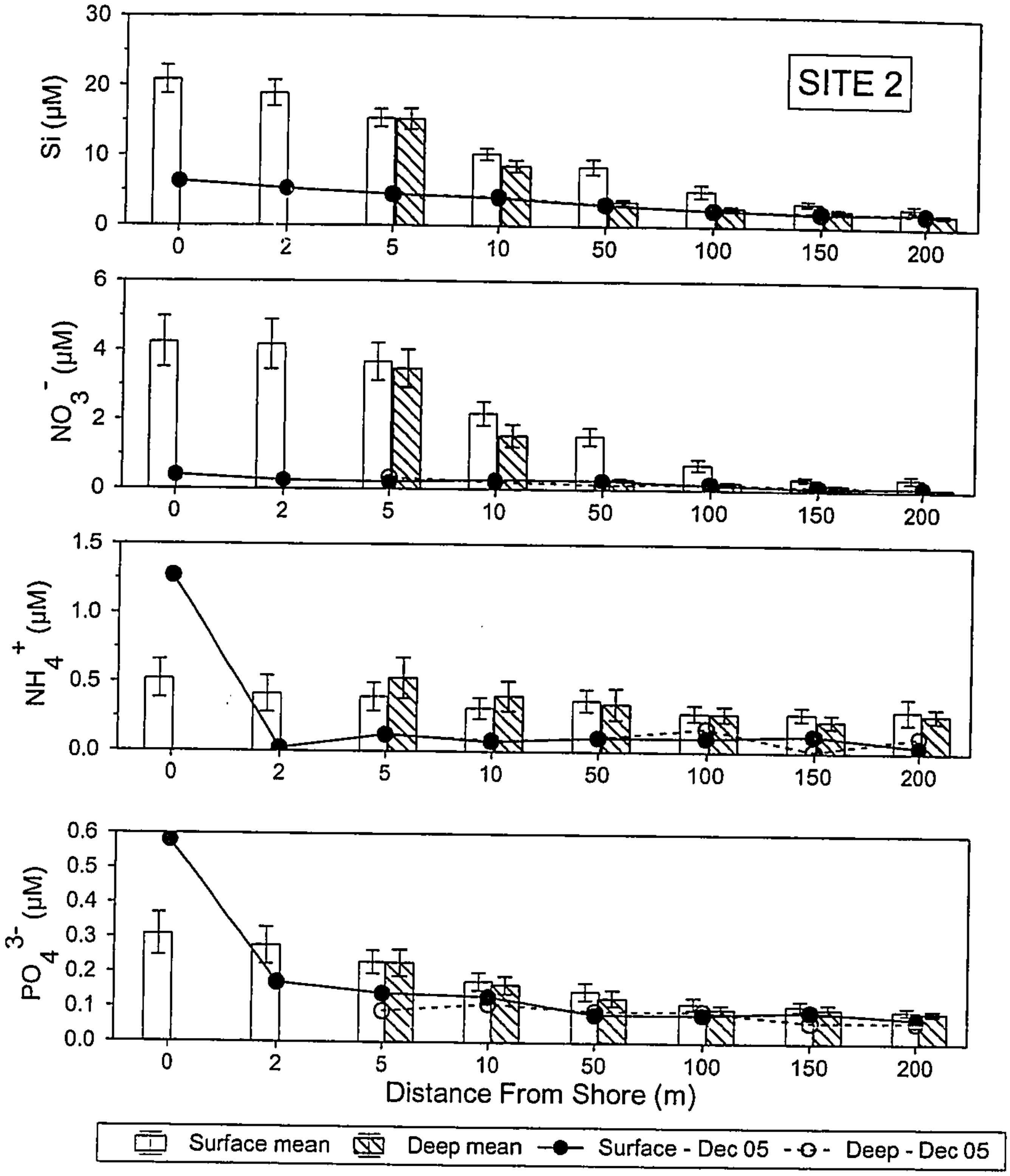


FIGURE 7. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 2, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

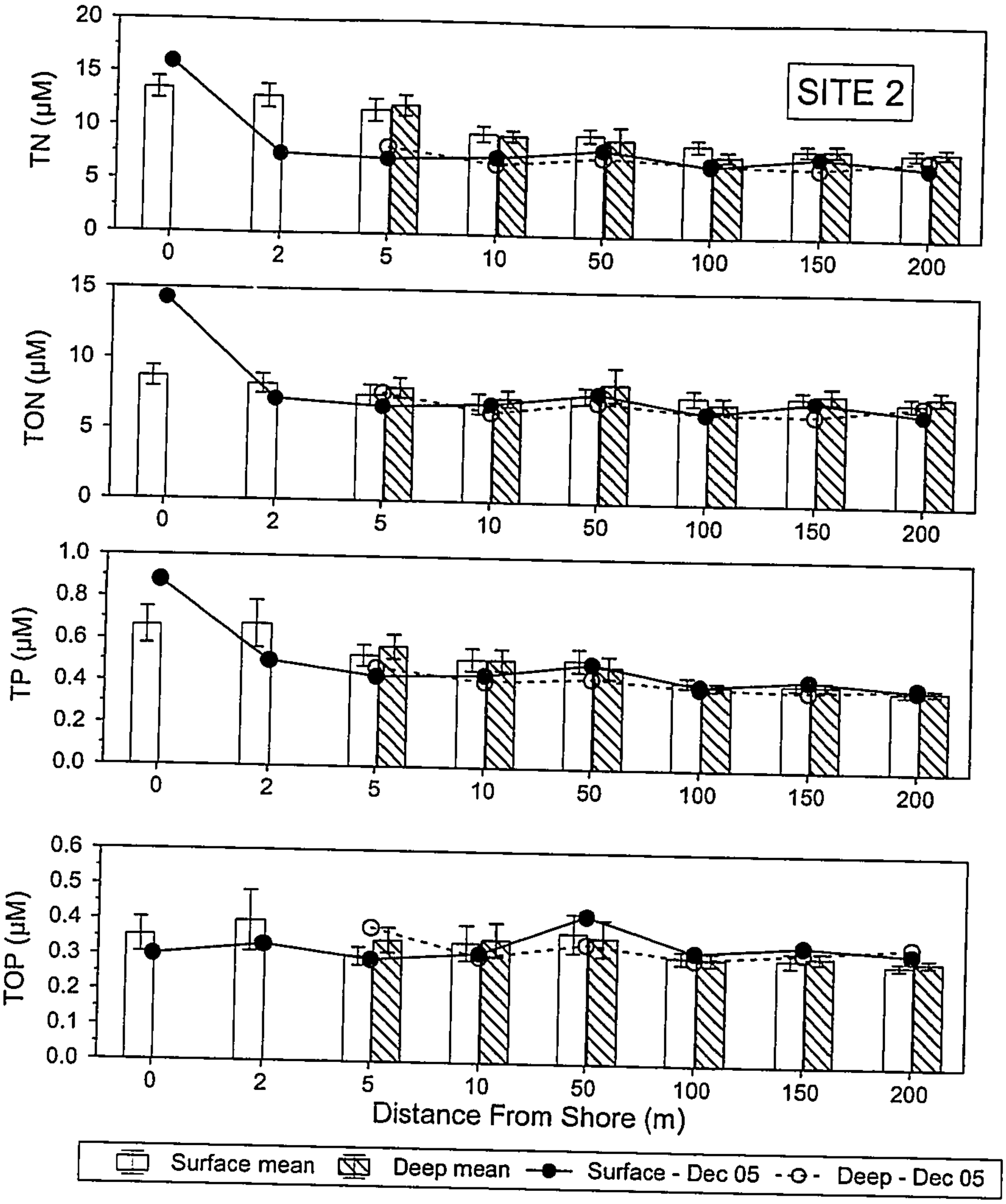


FIGURE 8. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 2, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

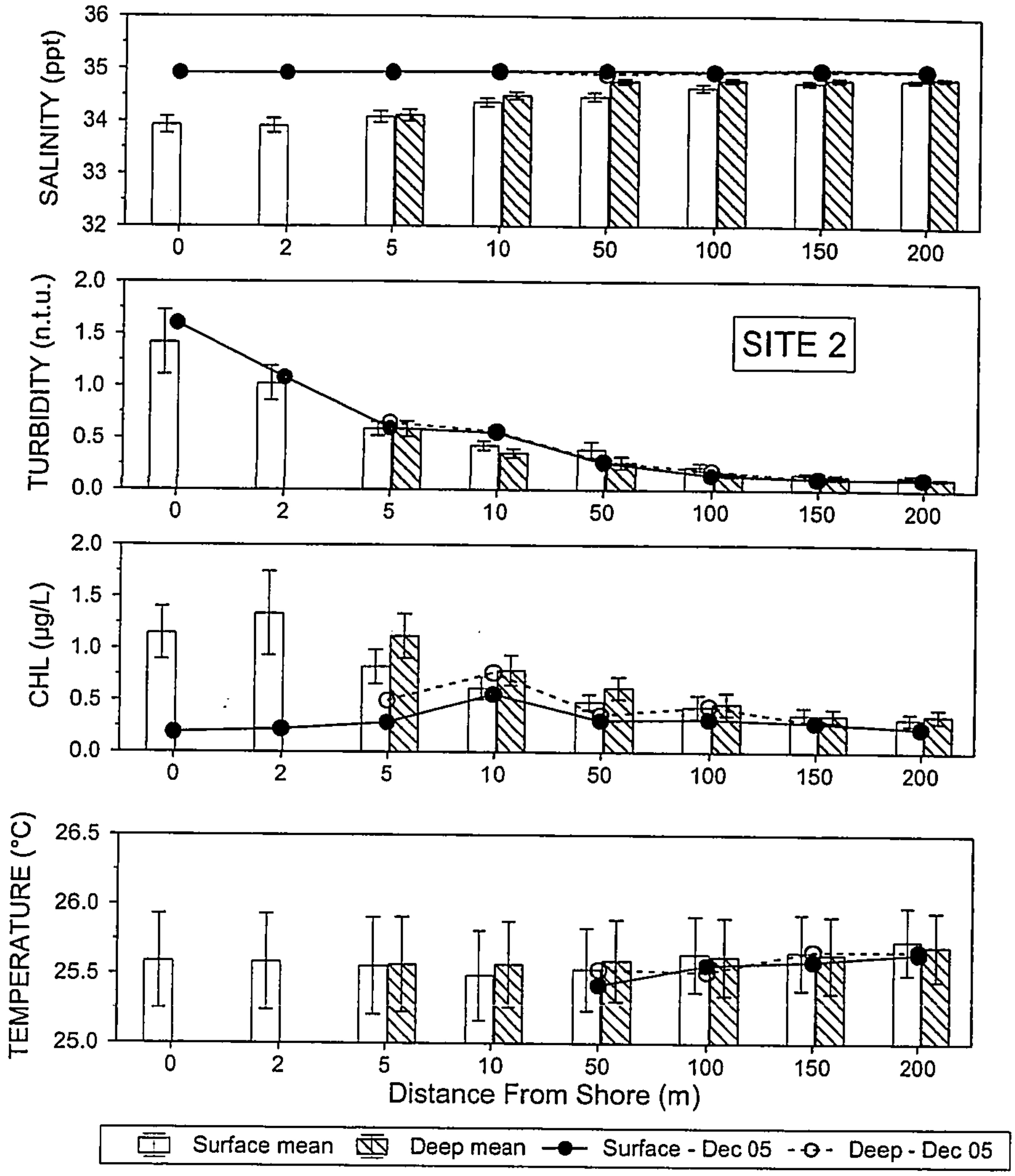


FIGURE 9. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 2, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey,bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

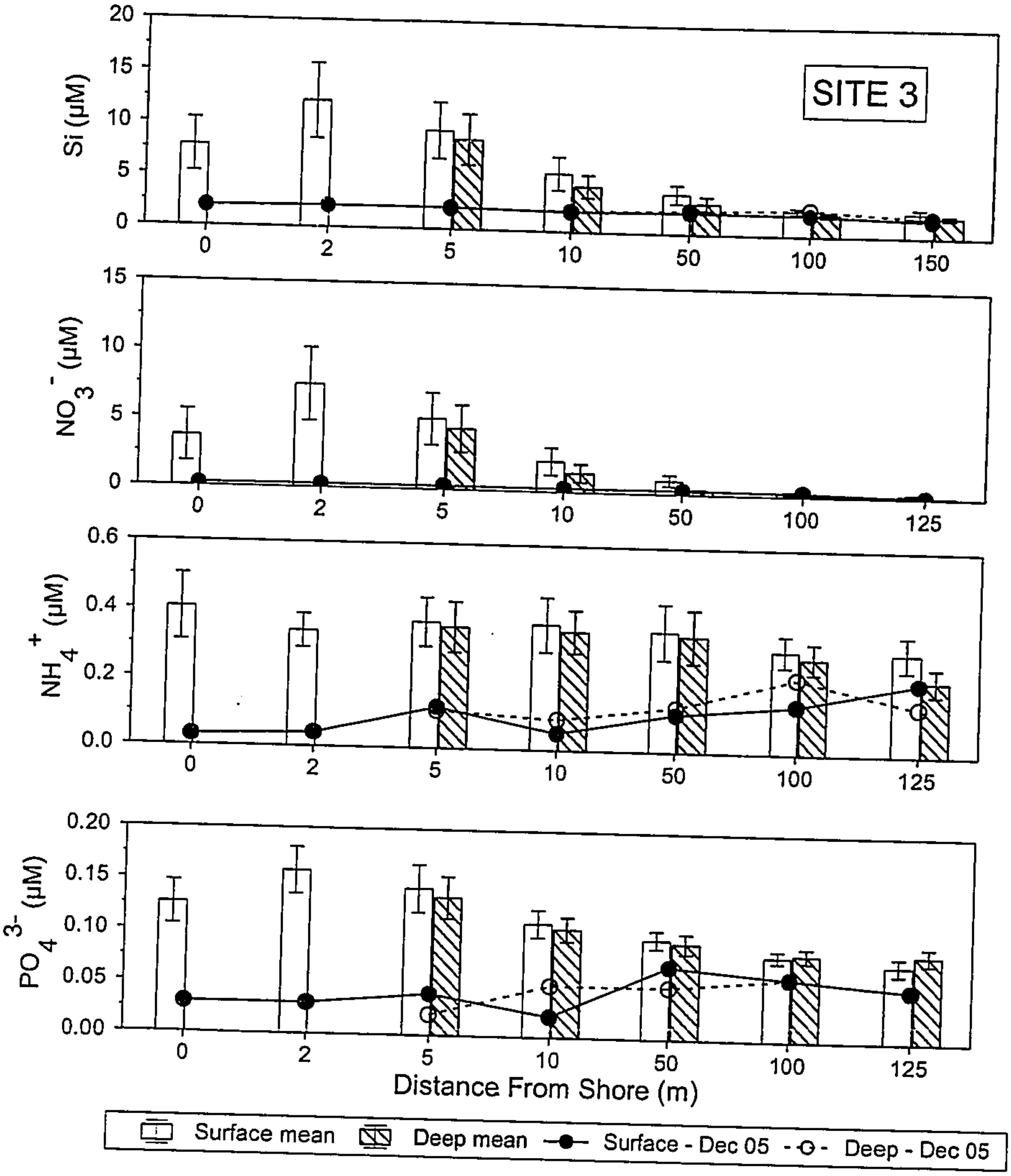


FIGURE 10. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

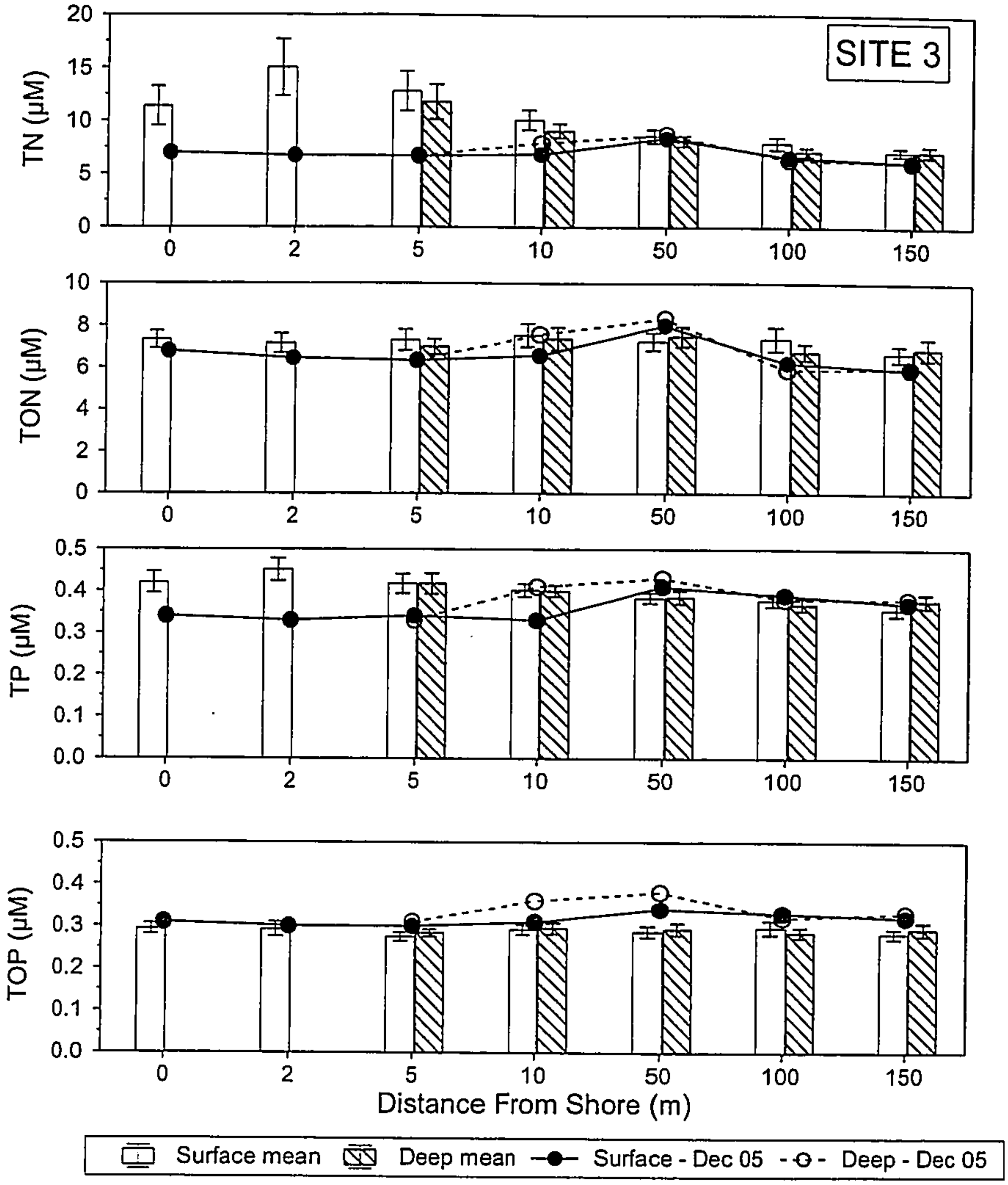


FIGURE 11. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

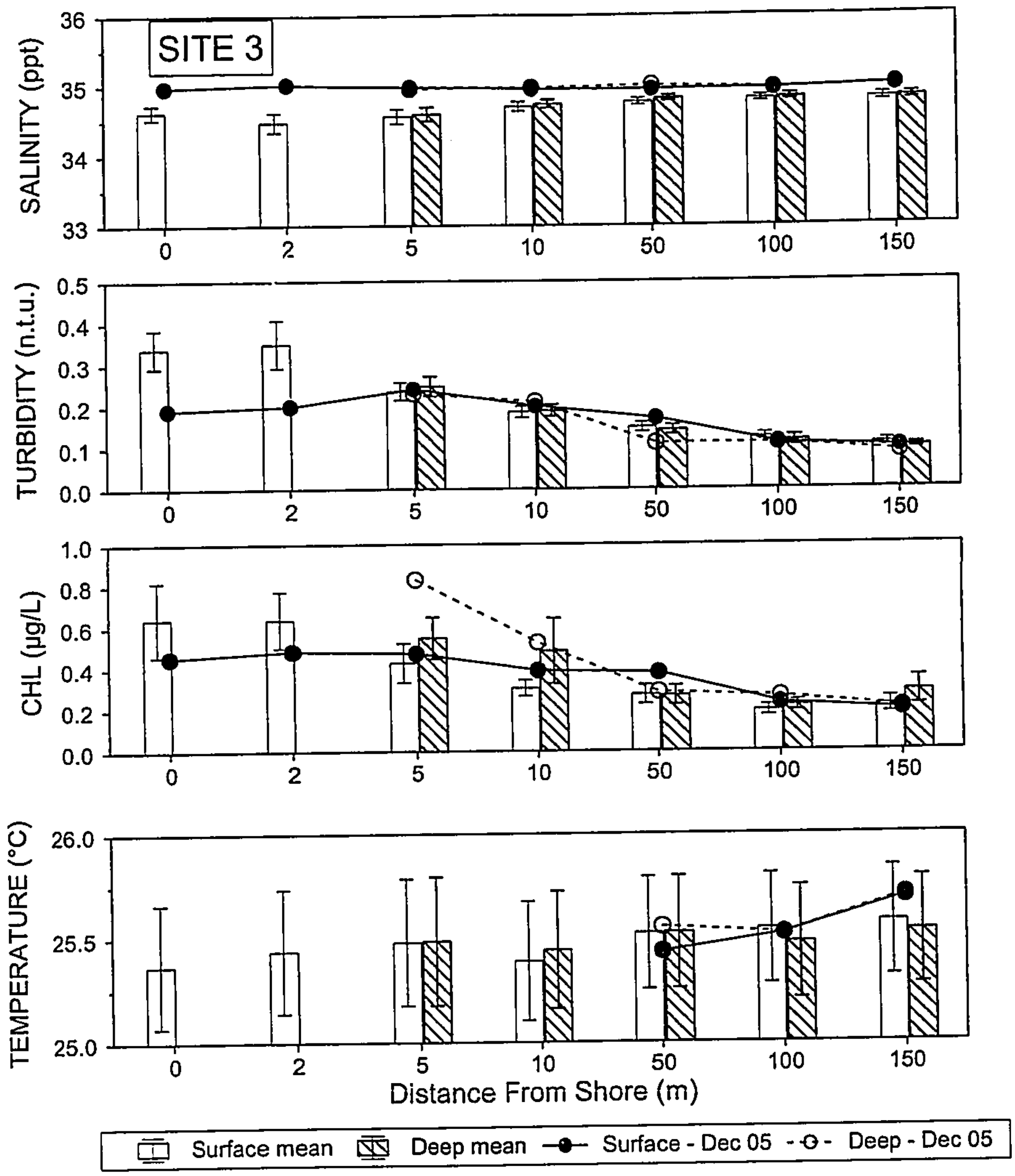


FIGURE 12. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 3, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

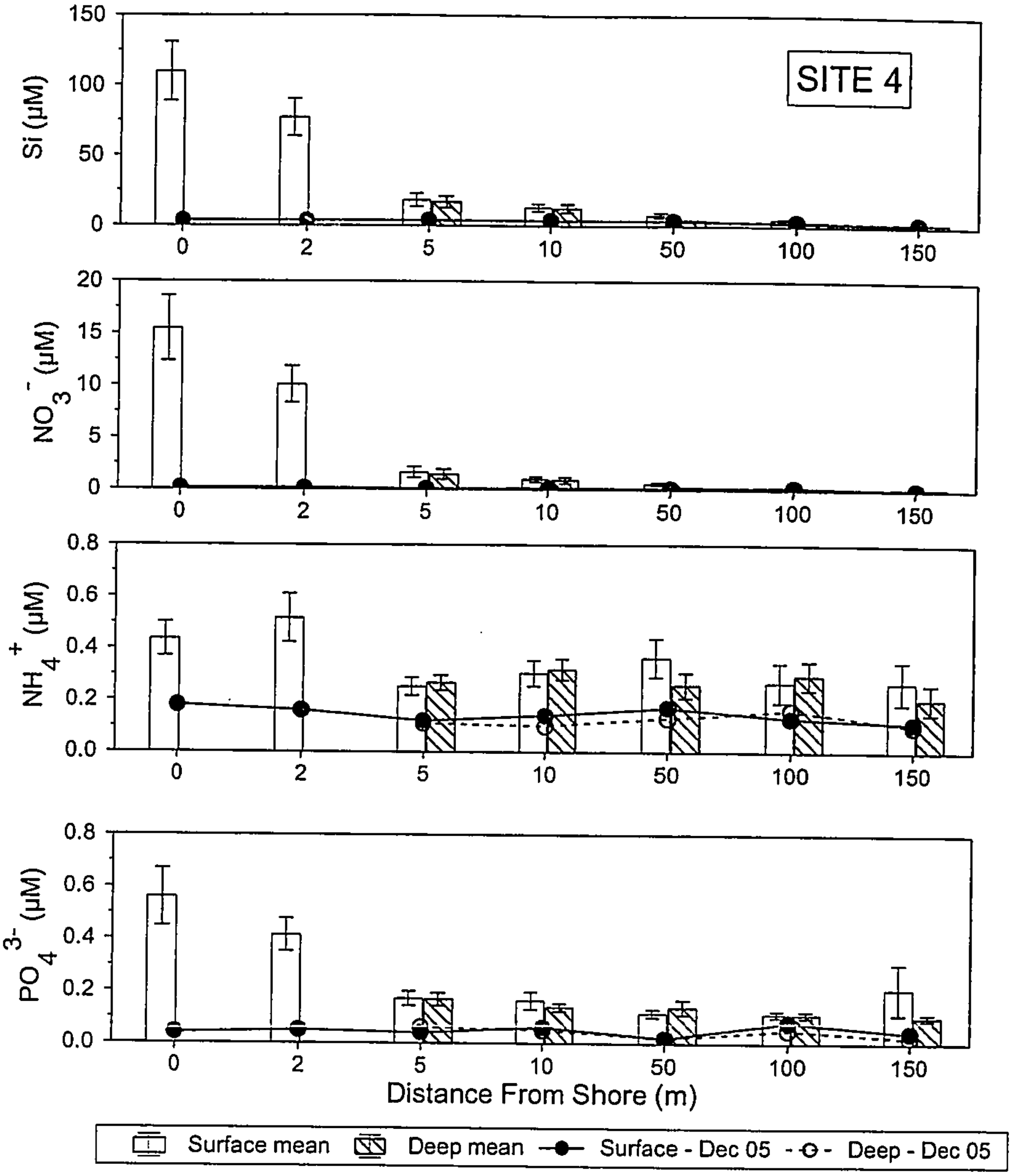


FIGURE 13. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 4, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

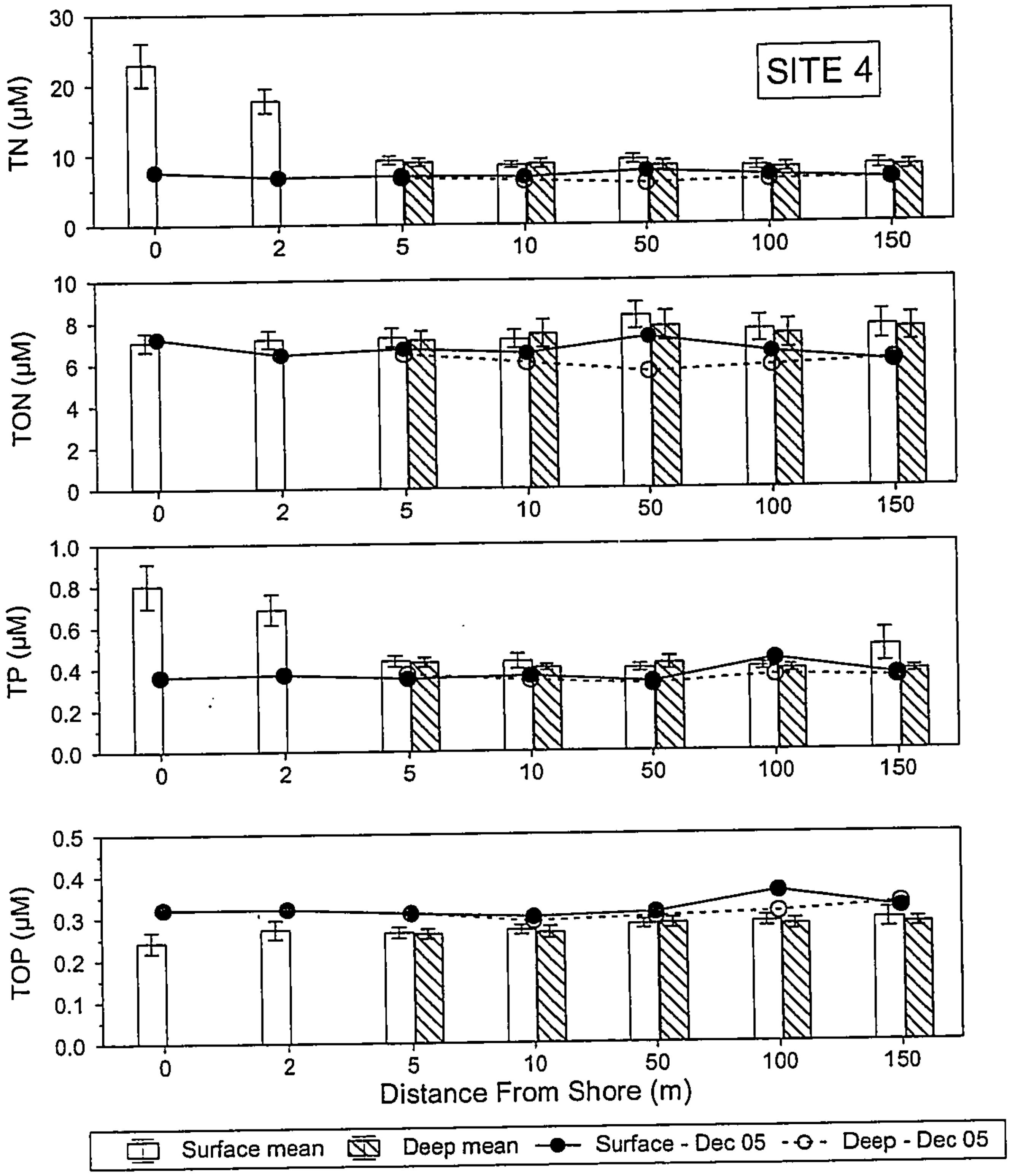


FIGURE 14. Plots of dissolved nutrient constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 4, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

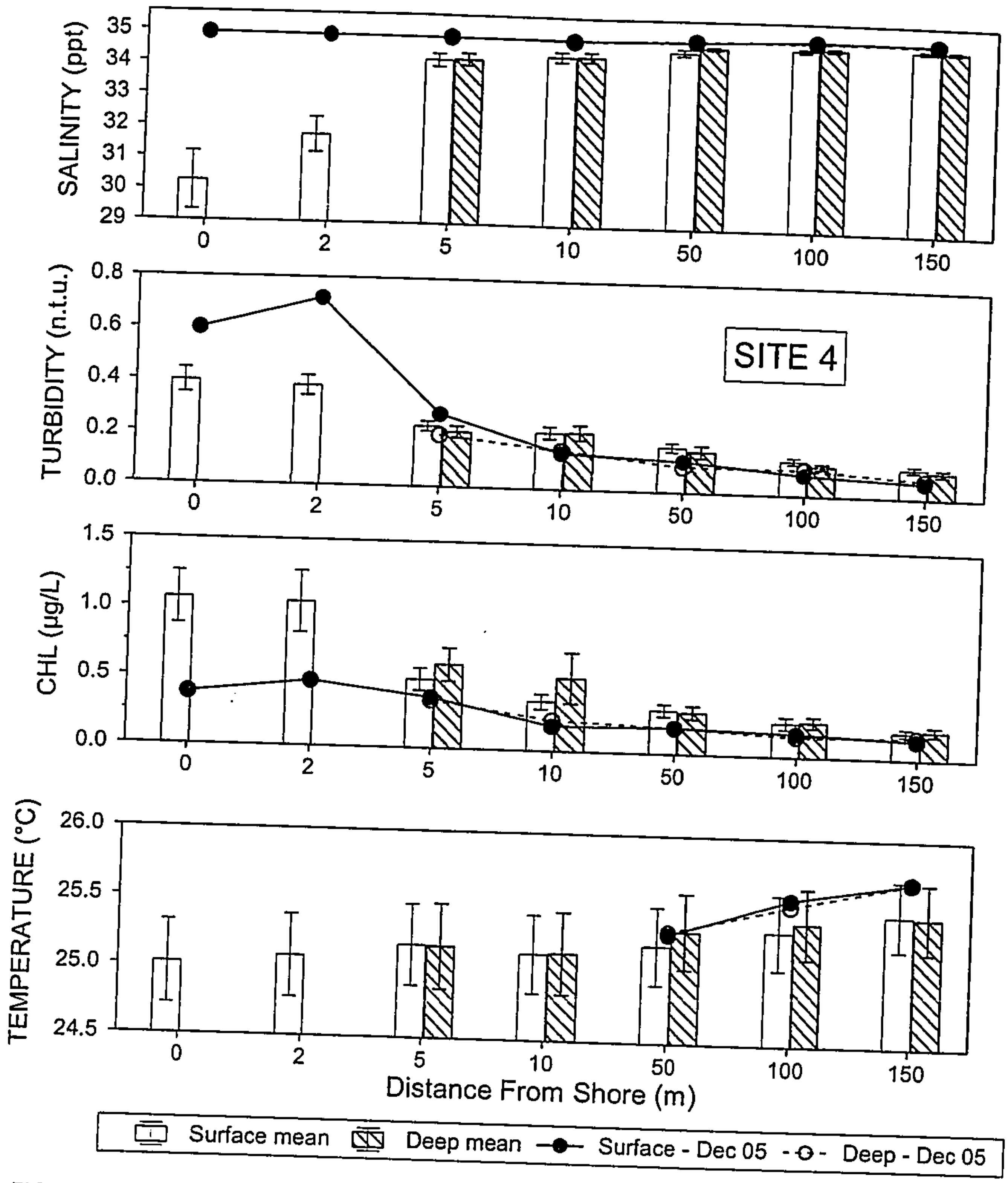


FIGURE 15. Plots of water chemistry constituents measured in surface and deep water samples as a function of distance from the shoreline at Site 4, offshore of the Makena Resort. Data points and connected lines from samples collected during the most recent survey, bar graphs represent mean values at each sampling station for surveys conducted since August 1995 (N=16). Error bars represent standard error of the mean. For site location, see Figure 1.

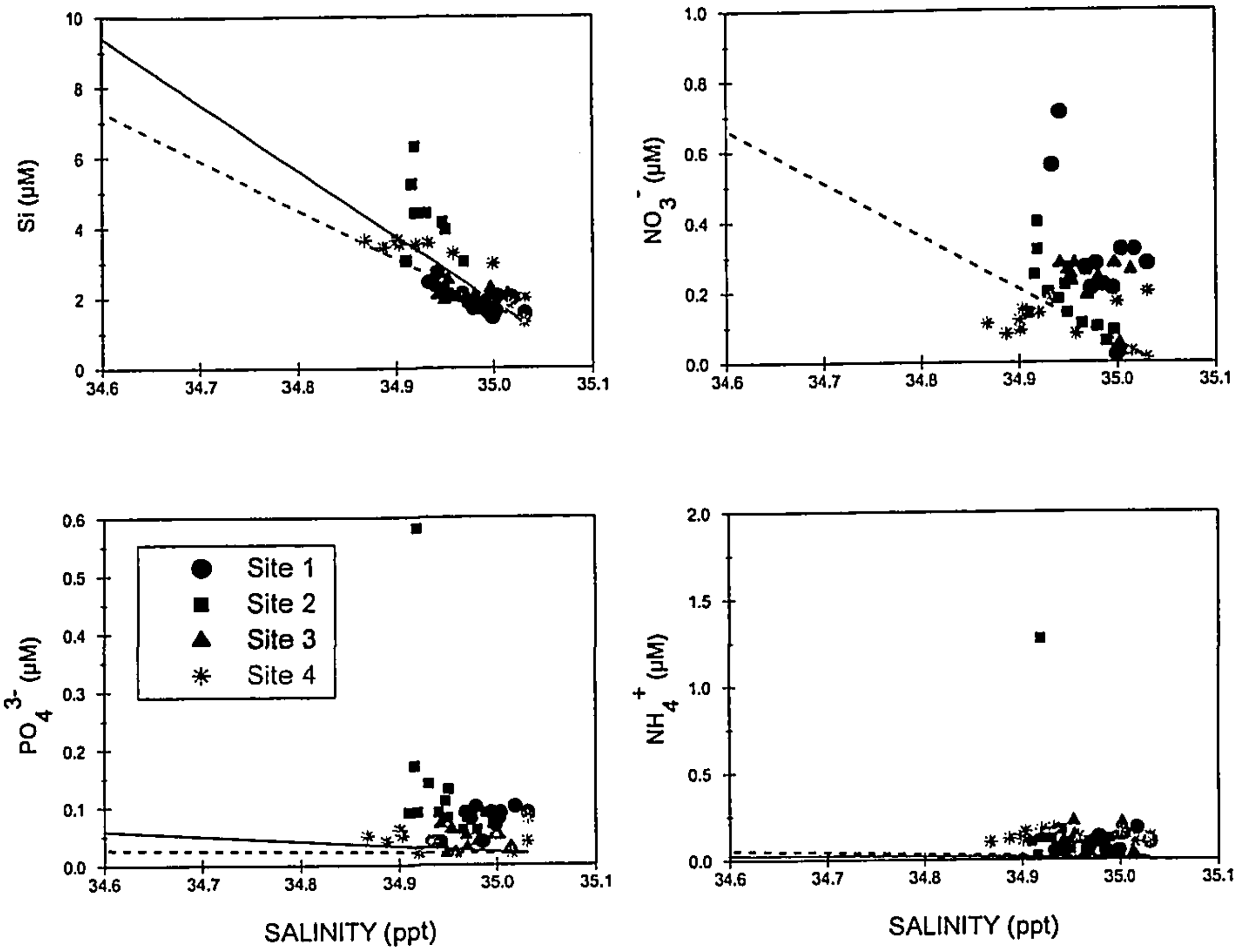


FIGURE 16. Mixing diagram showing concentration of dissolved nutrients from samples collected offshore of the Makena Resort on December 18, 2005 as functions of salinity. Solid red line in each plot is conservative mixing line constructed by connecting the concentrations in open coastal water with water from a irrigation well located above the golf course. Dotted black line is mixing line constructed from open coastal water with water from lake 10 used to irrigate both the North and South golf courses. For sampling site locations, see Figure 1.

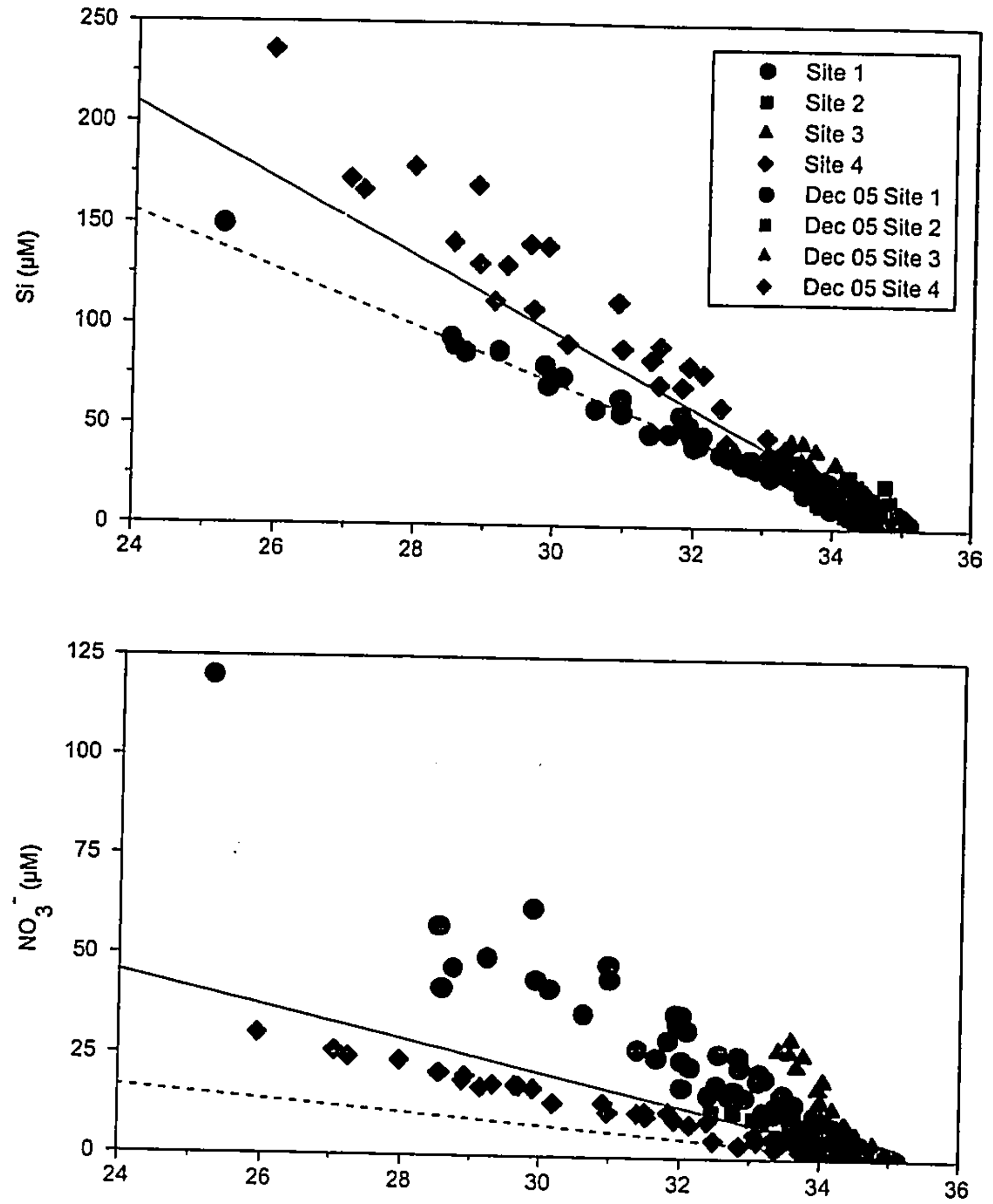
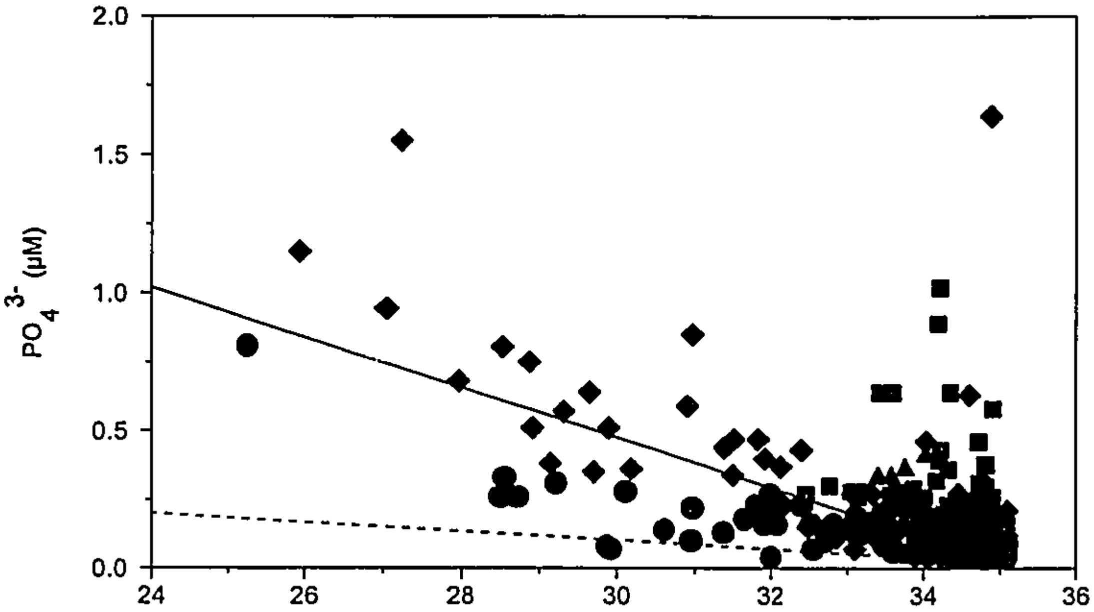


FIGURE 17. Silicate and nitrate, plotted as a function of salinity for surface samples collected since August 1995 at four sites offshore of the Makena Golf Course. Black symbols represent combined data from surveys conducted between August 1995 and December 2005. Red symbols are data from the December 2005 survey. Solid red line in each plot is conservative mixing line constructed by connecting the concentrations in open coastal water with water from a golf course irrigation well. Dotted black line is mixing line constructed from open coastal water with water from lake 10 used to irrigate both the North and South golf courses. For sampling site locations, see Figure 1.



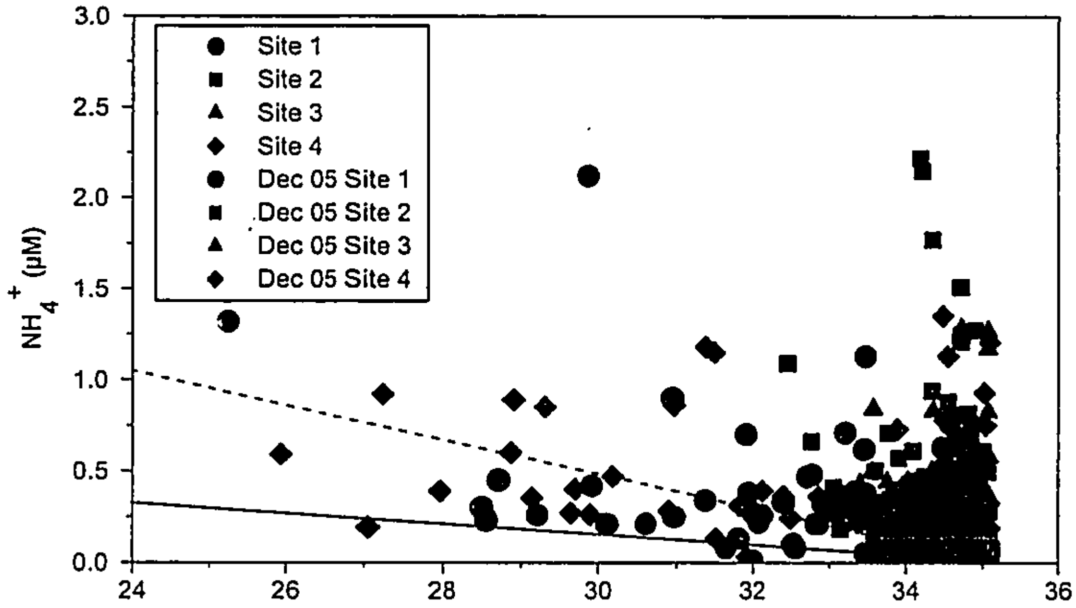


FIGURE 18. Phosphate and ammonium, plotted as a function of salinity for surface samples collected since August 1995 at four sites offshore of the Makena Golf Course. Black symbols represent combined data from surveys conducted between August 1995 and December 2005. Red symbols are data from December 2005 survey. Solid red line in each plot is conservative mixing line constructed by connecting the concentrations in open coastal water with water from a golf course irrigation well. Dotted black line is mixing line constructed from open coastal water with water from lake 10 used to irrigate both the North and South golf courses. For sampling site locations, see Figure 1.

Appendix P

Letters of Support from Adjacent Property Owners

February 28, 2005

Maui Planning Commission
250 South High Street
Maui, Hawaii 96793

Aloha Commission Members,

I am writing to you in support of Keaka LLC's condo project in Makena. The planned project will actually have an overall influence in helping to beautify our area. The utility lines that currently hang above our properties are eyesores to the community and the project will seek to underground these lines. As one of the landowners closest to the project, I welcome this opportunity to enhance the Makena area.

I am also pleased that the development will include less than 75 units so not lead to overcrowding. The project will benefit Makena.

I am hopeful that the commission will approve projects such as this one. .

Sincerely,

Cindy Beattie

Cindy Beattie
Nio, Inc.
Vice President & Secretary

TMK# 2-2-1-06:109

Tuesday, March 1, 2005

Letter of Support
Maui Planning Commission

Dear Chairman and Planning Commission Members,

The proposed Makena condominium project offers many benefits for the people of Maui. I urge you to decide in support of this worthy project.

The project is nicely designed, low density and will be a welcomed addition to our neighborhood. Furthermore, Keaka LLC has committed to putting the existing ugly overhead utility lines underground which will enhance the area.

Pulu Aina Hanau, Inc., owns property across the 15th fairway from the project and believes this project is in its best interest and we hope that you will join us in supporting the project.

Sincerely,

Dan Reisenauer
Pulu Aina Hanau, Inc.
Vice President, Treasurer
TMK# 2-2-1-06:107

March 1, 2005

Director of Planning
Maui Planning Commission
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Director,

Aloha. As a longtime resident of South Maui, I would like to extend my support of Keaka LLC's condominium project as it has been proposed.

Mr. Dowling, the developer for the proposed project recently met with property owners neighboring the site. I was thoroughly impressed with his efforts to inform those who will potentially be affected. The project is well planned with benefits to Maui residents. I greatly appreciate his efforts to brief us about the project.

I am also thoroughly impressed with the plans for the condominium, which offers a very nice architectural design that will serve as a refreshing addition to Makena.

I hope the Commission will recognize the interests of our community by supporting this project.

Sincerely,

Robert Cella
Kai Hi, Inc.
Director
TMK# 2-2-1-06:035

March 3, 2005

Maui Planning Commission
Chairman
250 South High Street
Wailuku, Maui, HI

Dear Chairman,

I would like to express my support for the proposed condominium project in Makena. I attended a recent meeting where the developer presented his plans to those of us who own property closest to the project...

I am assured the condominiums will improve our lovely area. I believe it will only complement our picturesque area. The proposed condominiums are just the right project for the site and as a neighbor the project has my support.

Sincerely yours,

John Zapotocky
Pono Awawa, Inc.
President

TMK# 2-2-1-06:108