FILE COPY

SEP 08 2011

Bernard P. Carvalho, Jr.
Mayor

Gary K. Heu
Managing Director

Larry Dill, P.E.
County Engineer

Lyle Tabata
Deputy County Engineer

DEPARTMENT OF PUBLIC WORKS
County of Kaua'i, State of Hawai'i
4444 Rice Street, Suite 275, Līhu'e, Hawai'i 96766
TEL (808) 241-4992 FAX (808) 241-6604

July 28, 2011

Mr. Gary Hooser, Director
Office of Environmental Quality Control
235 South Beretania Street, Room 702
Honolulu, Hawai'i 96813

'11 AUG 11 P2:05
RECEIVED
OFC. OF ENVIRONMENTAL QUALITY CONTROL

Dear Mr. Hooser:

Subject: Draft Environmental Assessment: Repair/Reconstruction of Moanakai Seawall, Kapa'a, Kaua'i, Hawai'i

The County of Kaua'i, Department of Public Works, requests publication of the subject document in the next issue of The Environmental Notice. Enclosed are the following items:

- One (1) copy in pdf format and a completed OEQC publication form on CD
- One (1) hard copy of the Draft Environmental Assessment (DEA)
- DEA Distribution List

If you have any questions, please call the undersigned at (808) 241-4849.

Sincerely,

Larry Dill, P.E.

cc: Brian Takeda
R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai'i 96819

Tuiolosega, Herman

From: Doug Haigh <dhaigh@kauai.gov>
Sent: Wednesday, September 07, 2011 11:33 AM
To: Tuiolosega, Herman
Cc: Michael Okamoto; Brian Takeda
Subject: Moanakai Seawall DEA
Attachments: DEA Submittal Letter to OEQC.docx

I apologize that our submittal letter did not include our initial determination. As discussed in Chapter 10 of the DEA we expect a Finding of No Significant Impact.

Douglas Haigh, PE, CFM
Chief, Building Division
Department of Public Works
County of Kauai

Phone: 808-241-4849
Fax: 808-241-6806
E-mail: dhaigh@kauai.gov

OEQC Publication Form
The Environmental Notice

Instructions to Applicant or Agency:

1. Fill out this Publication Form and email to: oeqc@doh.hawaii.gov
2. Send one (1) pdf and one (1) hardcopy of the EA / EIS to OEQC

Name of Project: Repair/Reconstruction of Moanakai Seawall
Applicable Law: Ch. 343 HRS
Type of Document: Draft Environmental Assessment
Island: Kaua'i
District: Kapa'a
TMK: (4) 4-5-002: 023
Permits Required:

- Conservation District Use Permit
- Special Management Area Permit
- Shoreline Setback Variance
- Department of the Army Permit
- Section 401 Water Quality Certification Permit
- Coastal Zone Management Federal Consistency Determination Permit
- NPDES Permit for Discharges Associated with Construction Stormwater
- NPDES Permit for Construction Activity Dewatering Effluent

Name of Applicant or Proposing Agency: County of Kaua'i, Department of Public Works
Address: 4444 Rice Street, Suite 275
City, State, Zip: Līhu'e, HI 96766
Contact and Phone: Larry Dill, P.E., County Engineer, (808) 241-4996

Approving Agency: County of Kaua'i
Address: Department of Public Works
City, State, Zip: 4444 Rice Street, Suite 175
Contact and Phone: Līhu'e, HI 96766
Larry Dill, P.E., County Engineer, (808) 241-4996

Consultant: R. M. Towill Corporation
Address: 2024 N. King Street, Suite 200
City, State, Zip: Honolulu, Hawai'i 96819-3494
Contact and Phone: Brian Takeda, Project Coordinator, (808) 842-1133

Project Summary: Summary of the direct, indirect, secondary, and cumulative impacts of the proposed action (less than 200 words).

The proposed project involves the repair and reconstruction of the Moanakai Seawall to maintain the protection of the shoreline from further wave and stormwater related erosion. An Erosion Control Plan (ECP) will provide measures to control storm-water runoff from the project site. An NPDES permit for the discharge of construction related stormwater will be filed. A Best Management Practices (BMPs) Plan will be submitted to control and treat the discharge of pollutants into receiving waters. The direct impacts related to construction activities will be contained within the property and should not create any indirect, secondary or cumulative impacts within the property or to adjacent properties.
The proposed repair and reconstruction is not expected to result in significant adverse impacts to geology, soils, hydrology, stream flow, biological resources, air quality, natural hazards, cultural resources, socio-economics, or land uses. Minimal impacts may consist of minor traffic, noise and air quality disturbances to residents in the surrounding area of the site, however impacts will be temporary, and conditions will return to their previous state once construction is complete.

Hawai‘i Revised Statutes, Chapter 343, Draft Environmental Assessment

Repair/Reconstruction of Moanakai Seawall

Kapa‘a, Kaua‘i, Hawai‘i

July 2011

County of Kaua‘i
Department of Public Works
4444 Rice Street, Suite 175
Lihue, Hawai‘i 96766

R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawai‘i 96819

HRS, Chapter 343, Draft Environmental Assessment

Repair/Reconstruction of Moanakai Seawall

Kapaʻa, Kauaʻi, Hawaiʻi

July 2011

Prepared for:

County of Kauaʻi
Department of Public Works
4444 Rice Street, Suite 175
Lihue, Hawaiʻi 96766

Prepared by:

R. M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, Hawaiʻi 96819

Table of Contents

List of Photographs

List of Figures

Appendices

Section 1
Project Summary

Project	Moanakai Seawall Restoration Kapa'a, Island of Kaua'i, Hawai'i
Applicant	County of Kaua'i Department of Public Works
Accepting Agency	County of Kaua'i Department of Public Works
Agent	R. M. Towill Corporation
Location	Coastal Kapa'a, Island of Kaua'i, Hawai'i
Proposed Action	Repair and restoration to existing seawall
Site Determined	Yes
Present Use	Seawall
Tax Map Key (TMK)	(4) 4-5-002: 023
Total Project Area	Approximately 1 Acre
Flood Insurance Rate Map (FIRM)	#1500020204E, Zone VE
State Land Use District	Urban
Special Management Area	Yes
County of Kaua'i Zoning	Urban Center
Land Owner	State of Hawai'i
Permits That May be Required	Conservation District Use Permit; Special Management Area Permit; Shoreline Setback Variance; Department of the Army Permit; Section 401 Water Quality Certification Permit; Coastal Zone Management Federal Consistency Determination Permit; NPDES Permit for Discharges Associated with Construction Stormwater; NPDES Permit for Construction Activity Dewatering Effluent
Anticipated Determination	Finding of No Significant Impact (FONSI)

Section 2
Project Purpose and Location

2.1 Purpose of Project

The proposed project involves the repair and restoration of the existing Moanakai seawall located along the eastern shoreline of the town of Kapaʻa, island of Kauaʻi, Hawaiʻi. The coastline in this area is characterized by a combination of river and stream mouths, sandy beaches, fringing coral reef, and shore protection structures that include the seawall (**see Photo 1**). The Department of Public Works (DPW), County of Kauaʻi, proposes to restore and repair the existing seawall to maintain the protection of the shoreline from further wave and stormwater related erosion.

The Moanakai seawall was constructed in late 1992 in response to accelerated coastal erosion that was occurring as a result of the direct passing of Hurricane Iniki over the island of Kauaʻi on September 11, 1992. Kauaʻi was declared a federal disaster area by President Bush the day after on September 12, 1992 (FEMA, 2004). The seawall was declared an emergency project and work to restore protection to the shoreline was completed immediately thereafter.

Nearly twenty years since its construction, the seawall is presently in poor condition with erosion occurring between the road and seawall in the form of sinkholes and undermining of the shoulder of the road (**see Photos 2 and 3**). This condition poses a risk of shoreline erosion, damage to property, and the safety of vehicles, passengers, and users that traverse along Moanakai Road (i.e., pedestrians, joggers, bicyclists, fishermen, and sight-seers).

The DPW proposes to repair and restore the condition and function of the seawall with the following objectives:

- Provide improved shoreline protection to address the immediate need for vehicular and pedestrian safety for users of the Moanakai Road;
- Maintain safe public access to the shoreline;
- Minimize the possibility of adverse future effects to the surrounding shoreline from dilapidation of the Moanakai seawall; and
- Preserve the existing property along both *makai* and *mauka* ends of the project site.

The project will benefit both the residences and visitors who use the area for transit along the Moanakai Road. Recreational users will benefit from improvements to the seawall that will address further erosion and dilapidation of the structure.

Photo 1: View of coral rubble beach and protected swimming area
(Source: Sea Engineering, Inc., 2011)

Photo 2: Tree stump and hole at station 3+85
(Source: Sea Engineering, Inc., 2011)

Photo 3: Erosion formed hole at station 1+05
(Source: Sea Engineering, Inc., 2011)

2.2 Purpose of Environmental Assessment

The purpose of this Environmental Assessment (EA) is to address the requirements of Hawaiʻi Revised Statutes (HRS), Chapter 343, and Hawaiʻi Administrative Rules (HAR), Chapter 11-200. The specific action that requires the preparation of this EA includes the use of county or state lands and/or funds for development.

This EA provides information and evaluation of the potential for adverse environmental impacts on the natural and built environment associated with the proposed project. This EA will also inform interested parties of the proposed project and seek public comment on relevant environmental issues that should be addressed during preparation of the Final EA.

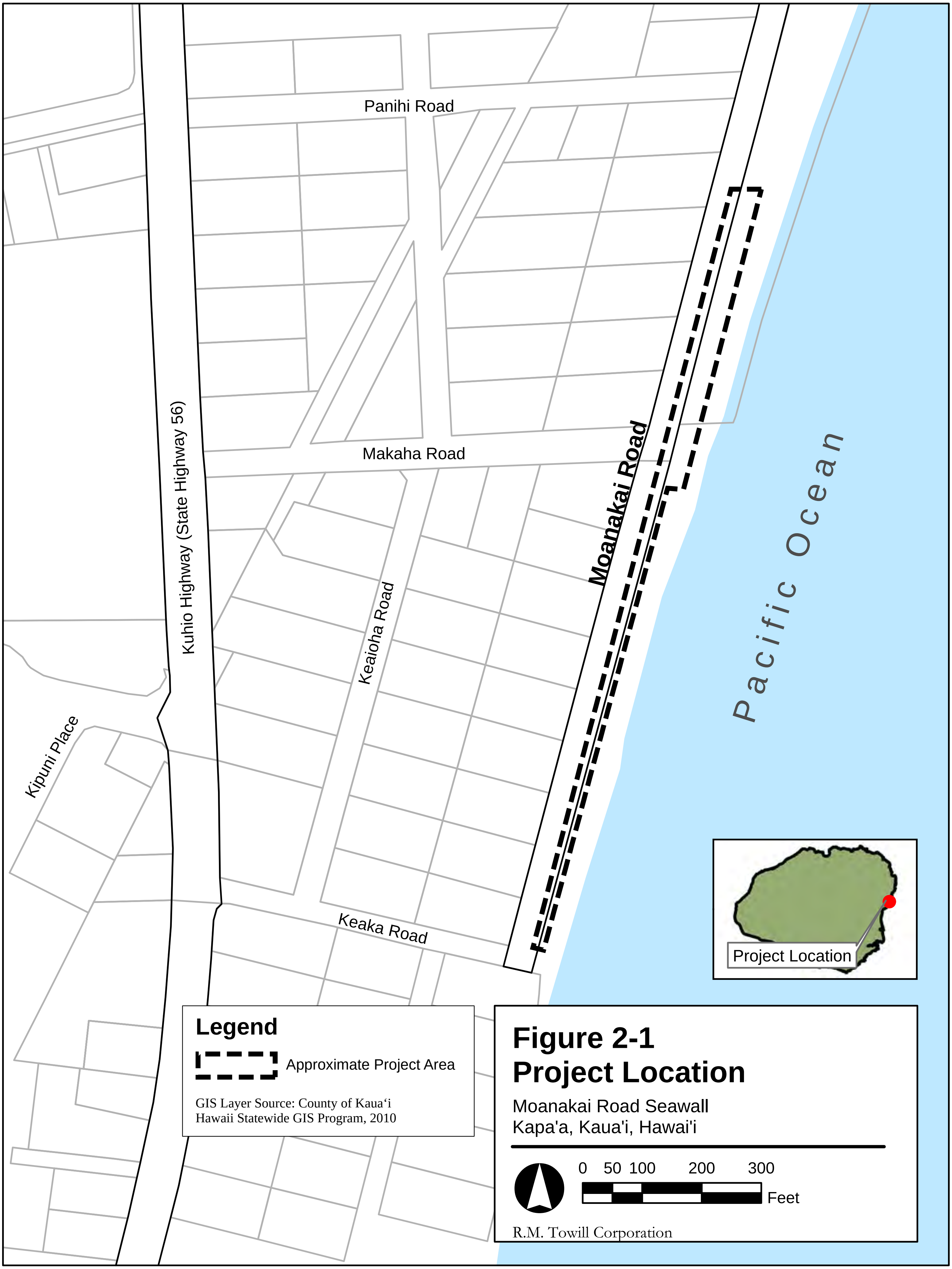
2.3 Project Location

East of the Moanakai Road is the Pacific Ocean, and to the west are single family residences. The Moanakai seawall is approximately 1,080 feet long and runs parallel to the Moanakai Road and coastline. The south end of the seawall begins near the intersection of Moanakai Road and Keaka Road, extending for approximately 1,080 feet northward along the eastern side of Moanakai Road. Moanakai Road ends approximately 400 feet south of the Waikaʻea Canal (**see Figure 2-1, Project Location**).

The project site is located within an approximately 1,080 foot corridor, between Moanakai Road and Tax Map Key (4) 4-5-002: 023, Kapaʻa Ahupuaʻa, Kawaihau District (Puna Moku), Kauaʻi Island (**see Figure 2-2, Tax Map Key**). This site is owned by the State of Hawaiʻi.

Section 2 – Figures

Repair/Reconstruction of Moanakai Seawall


Panihi Road
Makaha Road
Moanakai Road
Kuhio Highway (State Highway 56)
Keaioha Road
Kipuni Place
Keaka Road
Pacific Ocean
Project Location
Legend
Approximate Project Area
GIS Layer Source: County of Kaua'i
Hawaii Statewide GIS Program, 2010
Figure 2-1
Project Location
Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i
0 50 100 200 300
Feet
R.M. Towill Corporation

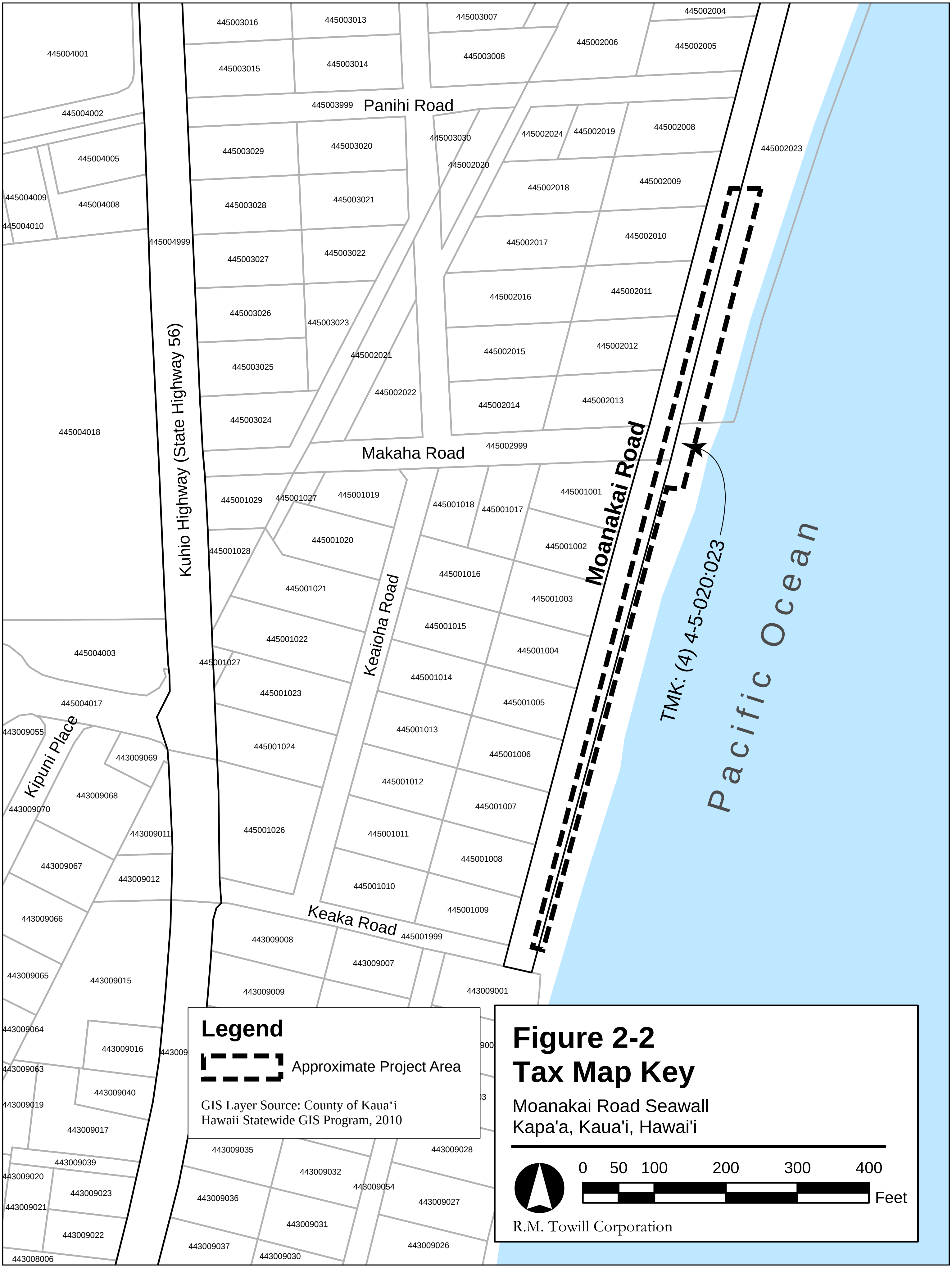


Figure 2-2
Tax Map Key
Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

Section 3
Project Description, Estimated Construction Cost and Schedule

3.1 Primary Issues and Recommendations

A Coastal Assessment report was prepared in 2011, by Sea Engineering Inc., (see **Appendix A**, Repair/Reconstruction of Moanakai Seawall: Moana Kai Road Coastal Assessment). The purpose of the assessment was to provide an evaluation and conceptual design for the repaired seawall structure and surrounding area. The objectives of the Coastal Assessment included:

- Evaluate coastal processes and oceanographic parameters at the project site;
- Identify areas of damage or erosion along the structure;
- Evaluate effectiveness of the existing structures; and
- Produce conceptual solutions and designs to replace the existing structure, if necessary.

The results of the report are summarized below in three sections as: (1) existing structure; (2) primary issues; and (3) recommendations.

3.1.1 Existing Structure

South Reach (Stations 0+00 to 5+70, See Photo 4 for general area)

The neighboring property to the south of the project site contains a steep-faced CRM (cement rubble masonry) seawall. The toe of the seawall has been undermined by erosion and has collapsed, leaving the base of the seawall exposed to further erosion and undermining. The project structure begins at station 0+00 and is offset inshore from the neighboring seawall by 15 to 20 feet; the southern 25 feet of the structure is obscured by a thick naupaka hedge. Overall, the structure is essentially straight, bowing only slightly in a few places. The southern reach of the revetment transitions into the northern reach at station 5+70.

The as-built cross section for the south reach is shown in **Figure 3-1, As-Built Cross Section of Southern Reach of Revetment**. The existing revetment is constructed primarily of armor stone with no underlayer or geotextile filter fabric that would reduce the possibility of soil or fill material from the backshore side being siphoned through the armor stone by water motion and wave action.

During the site visit, the dimensions of 15 representative armor stones were measured in three locations along the southern reach, showing the nominal stone diameter to range from 1.8 to 6.0 feet, with an average of 3.2 feet, which would weigh approximately 2.6 tons. The field investigation also showed the slope of the face of the revetment to be 15V (vertical):9H (horizontal) (even though the as-built slope is labeled 12V:6H), which is consistent with the 1.5V:1H slope interpreted from a March 2010 topographic survey. This side slope is steeper than is typically recommended for rock rubblemound revetments, for which a standard design practice would be a flatter 1V:1.5H or 1V:2H slope. The revetment has a 2.5 to 3-foot wide grouted CRM cap that acts as a walkway. The as-built drawing indicates that a solid basalt layer at elevation -4 feet provides the foundation for the revetment. Crest elevations along the southern reach of revetment were measured to range from about +9.5 feet to +11.0 feet mllw (mean lower low water).

Photo 4: Typical view of beach and revetment in southern reach (Source: Sea Engineering, Inc., 2011)

Northern Reach (Stations 5+70 to 10+50, See Photo 5 for general area)

This section of revetment is shown in **Figure 3-2, As-Built Cross Section of Northern Reach of Revetment**, and has a flatter slope than the southern section consistent with standard design practice. This section of revetment is to be constructed of a single layer of armor stone with a slope of 1V:2H; however, the topographic survey shows the revetment to have a slightly steeper 1V:1.5H face slope. While there is no indication on the drawings that an underlayer or geotextile filter fabric was used, smaller stones were observed in the armor stone voids. The drawing shows the crest to be two stones wide.

Stone size is not discernable from the as-built drawings; however, ten stones were measured from two locations during the site visit. The nominal diameter of those stones ranged in size from 1.9 to 6.0 feet with an average of 3.9 feet. Crest elevation along this reach of revetment ranged from about +8.5 to +9.5 feet mllw (mean lower low water).

The north section of revetment extends from station 5+70 to station 10+50. The crest of the northern section of revetment is generally obscured by fill material or vegetation, typically naupaka, along the roadway. Portions of the crest show some evidence of fill with smaller stones. North of the end of the revetment, the beach widens to about 40 feet north of the end of the revetment and extends more than 900 feet from the end of the revetment past Waipoli Park to Waikaea Canal.

Photo 5: View of beach, revetment and protected swimming area in northern reach
(Source: Sea Engineering, Inc., 2011)

Structure Condition

Locations of erosion or damage were noted during the site visit. Construction of the revetment appears to have been performed with the goal of preserving existing trees along the revetment alignment. Thus, in several locations, trees or tree stumps were found to be projecting from the top of the revetment. Tree mortality and the subsequent root decay have produced gaps in the revetment that leave the backshore unprotected against wave action and the effects of erosion (see **Appendix A** for further detail).

3.1.2 Primary Issues

The existing rock revetment shore protection was not constructed in accordance with standard design practice for this type of structure, the primary issues being the following:

- The southern half of the revetment has a side slope much steeper than is recommended for a rock rubblemound structure. Despite this, it does appear to be stable, with little or no evidence of stone movement. This may be partly attributable to the very large stones used to construct the revetment, which generally greatly exceed the stone size required for the wave heights at the shore.
- No filter (e.g., geotextile filter fabric) or underlayer of smaller stone was placed behind the large armor stone; thus, water motion and wave action, as well as ground water flow during heavy rains, can remove fine grained material from behind the armor through the voids between stones. This will cause the stones to shift and settle, and result in

sinkholes forming behind the revetment. Unfortunately, this problem is difficult to correct without removing and rebuilding the entire revetment.

- The revetment was constructed around trees, which can eventually affect the stability of the revetment stone, either by continued growth of the tree and its roots which can dislodge and move the stone, or by the tree dying and its decay resulting in a void between stones.

3.1.3 Recommendations

The emergent rock bench seaward of the shoreline acts as natural shore protection by significantly limiting the wave heights and energy at the shoreline, and this contributes to the effectiveness of the revetment. Recommendations for shore protection maintenance and repair are as follows:

Southern Reach (Stations 0+00 to 5+70)

According to Sea Engineering, Inc., while some damage is evident, the damage does not appear to be sufficient to significantly de-stabilize the revetment. Ongoing maintenance of this reach is considered a viable alternative, e.g., filling the sink holes, removing dead trees and replacing them with armor stone. It appears that repairs and maintenance can generally be done above the mhhw (mean higher high water) line and behind the existing revetment, and thus out of federal (Department of the Army) permit jurisdiction and the State Conservation District.

Northern Reach (Stations 5+70 to 10+50)

The existing revetment in this reach is badly damaged and has failed completely, or is likely to fail in the future. Sea Engineering Inc., recommends that this portion of the revetment be rebuilt in accordance with generally accepted design practice. The various design options considered for the northern reach of the project included:

- Two alternative seawall designs were evaluated: Alternative 1 – Rock Rubblemound Revetment, and Alternative 2 – Hybrid Seawall/Revetment. While both designs address the requirement for a properly engineered and designed seawall, the principal difference is that Alternative 2 further reduces the footprint of the structure within the surrounding area, thereby allowing for the installation of less mass within the shoreline environment;
- An alternative design to anchor the toe of the seawall is provided to address different substrate conditions and to maintain sufficient stability of the revetment structure; and
- Appropriate methods to stabilize the respective ends of the revetment are recommended to maintain protection against erosion.

3.2 Description of Proposed Plan

The following plan prepared by Sea Engineering, Inc., will be utilized by the County of Kaua'i, as described below.

Southern Reach (Stations 0+00 to 5+70)

1. All trees, stumps and vegetation that interfere with the stability of the structure will be removed.
2. Base course and cement cap will be saw cut and sinkholes will be lined with geotextile filter fabric prior to filling.
3. Fill will be replaced in sinkholes, as needed. Removed trees will be replaced with armor stone and also filled as needed with appropriate material, e.g., gravel, base course, or crusher run.
4. All debris will be hauled off-site and disposed at a county-approved landfill site in conformance with County regulations.

Northern Reach (Stations 5+70 to 10+50)

This portion of the revetment will be rebuilt based on a hybrid seawall containing elements of both a revetment and a seawall which are proposed to reduce the overall revetment footprint. The seawall would be constructed as a CRM or similar material wall prior to construction of the revetment. The top of the CRM wall is designed to have a typical elevation +9.5 feet mllw. While the elevation of the road varies along the project reach, the crest elevation should remain constant, and if variability in the structure elevation is required to meet road requirements, then the variability should be made to the CRM wall, rather than the rocks. The base of the wall should extend to below the armor layer.

The steps involved will include:

1. Existing revetment will be removed, working inward from shore to the road. As required the contractor will maintain the existing revetment.
2. Loose sand and gravel will be excavated to place the revetment stone on hard, non-erodible, rock substrate.
3. Smaller two to four hundred pound underlayer stones will be placed on geotextile fabric.
4. A single armor stone layer will be placed over the underlayer stone and geotextile fabric. Existing armor stone will be reused as available to create the revetment[1]. The stones will be carefully chosen and placed in a keyed and fitted manner to minimize gaps between stones and ensure maximum contact between adjacent stones.
5. A reinforced concrete header will be constructed at the top of the revetment against the crest stones. Imported granular fill will be used to fill in areas mauka of the concrete header before replacing the road shoulder.
6. Base course will be used to reconstruct the road shoulder against the concrete header.

[1] "Standard rock revetment design practice is for armor stones to be within the allowable size range to maximize interlocking and stability, as well as to insure that layer thicknesses and "neat line" slope tolerances are maintained. Of the 10 armor stones measured, only one is considered to be of proper size to be reused.. Based solely on this, it can be tentatively concluded that about 10% of the rocks on site may be reused." (Section 5.5, Additional Design Considerations, Moana Kai Road Coastal Assessment, Sea Engineering, 2011).

The area of disturbance on the Northern Reach will extend about 20 feet outward from the end of the existing seawall (see **Figure 3-2** and **Figure 3-4**).

Toe Design (see Figure 3-5)

The cross sections shown for the alternatives are predicated on the assumption that there is a hard substrate layer at approximate elevation -4 ft, based on this feature being shown in as-built drawings of the project site (see **Figures 3-1** and **3-2**). There have thus far been no investigations to confirm this assumption. If hard substrate is found to differ slightly from the as-built drawings, the revetment could be extended or shortened as needed to fit.

In the event hard substrate is not encountered during construction, an alternative toe configuration designed for soft substrate should be used. **Figure 3-5** shows Alternative 1 with a toe scour apron specifically designed for use in soft substrate, such as sand. The scour apron for Alternative 2 would be similar.

The scour apron design has additional armor stones and underlayer placed at the toe of the revetment in order to reduce the potential for scour, which would destabilize the revetment. The scour apron adds approximately 3.3 feet to the cross section width. The toe stones shown in the alternative designs would be placed at the same elevation to facilitate transition of the revetment between regions of hard substrate and soft substrate.

Revetment Termination (see Figure 3-6)

Construction of the revetment against non-erodible material is recommended practice to reduce the potential of undermining and flanking. The revetment foundation is the existing hard substrate that was identified in the as-built drawings. Founding the revetment on hard substrate prevents the toe stone from being undermined and the revetment from being destabilized. An alternative toe design was presented in the event that hard substrate is not encountered. The threat of flank erosion near Station 5+70 can be reduced by wrapping the proposed revetment in a radial manner, maintaining the 1V:1.5H slope, until it intersects the existing revetment on the south. Terminating the new revetment this way reduces the discontinuity in the two revetments and reduces the potential for flanking of either portion of revetment. A plan view of this intersection is shown in **Figure 3-6**.

At the northern end of the proposed revetment (Sta. 10+70), there is no non-erodible material against which to terminate, which presents a risk of structure failure should flank erosion occur. The existing revetment, however, does not appear to terminate against non-erodible material, and there is no indication that there has been any erosion as a result. The best option in this case is to excavate the sand from this area and wrap the revetment 90 degrees to the shoulder of the road, where it would terminate against the existing substrate along and below the shoulder of the road. To reduce the exposure of the revetment termination and the road shoulder from erosion, the end of the revetment should be buried using native material to existing lines and grades, compacting if necessary.

This termination should be visually inspected regularly for erosion and maintained as needed. A typical inspection schedule might be as follows: every month for three months, then every three months for 9 months. Should there be no apparent flanking or other threat to the revetment or road, inspections annually and following large wave events thereafter would be sufficient. In the event of erosion, proper steps should be taken based on the specific nature of the erosion.

3.3 Estimated Construction Cost and Schedule

The estimated construction cost for this project is $1.6 million to be funded by the County of Kauaʻi. The anticipated project duration is 6 to 12 months with construction to be scheduled starting in 2011.

Section 3 – Figures

Repair/Reconstruction of Moanakai Seawall

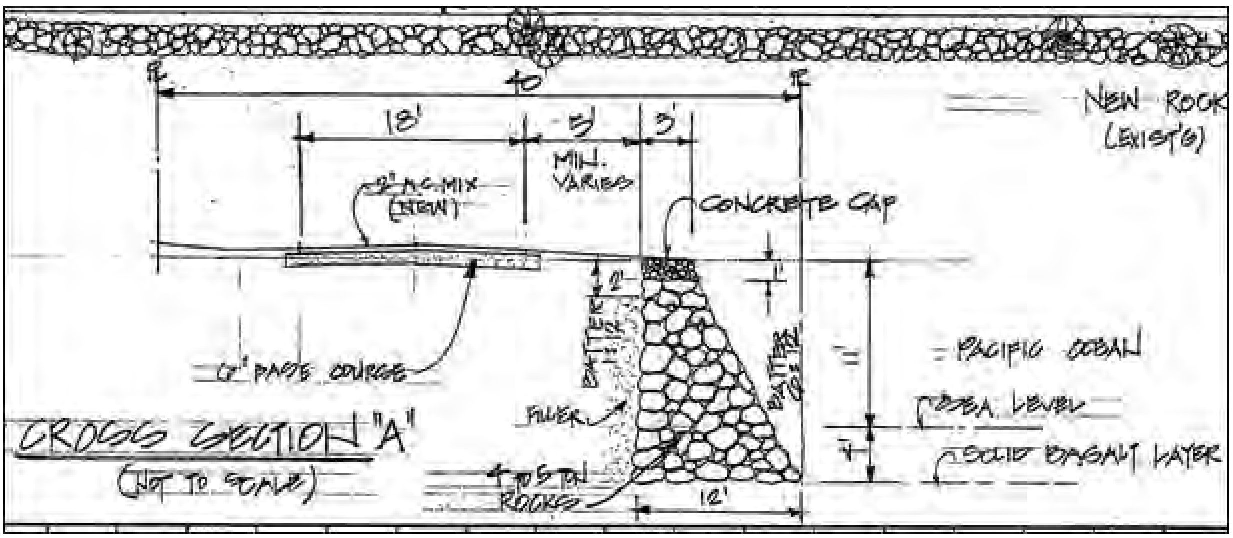


Figure 3-1: As-built Cross Section of Southern Reach of Revetment
(Sea Engineering, Inc., 2011)

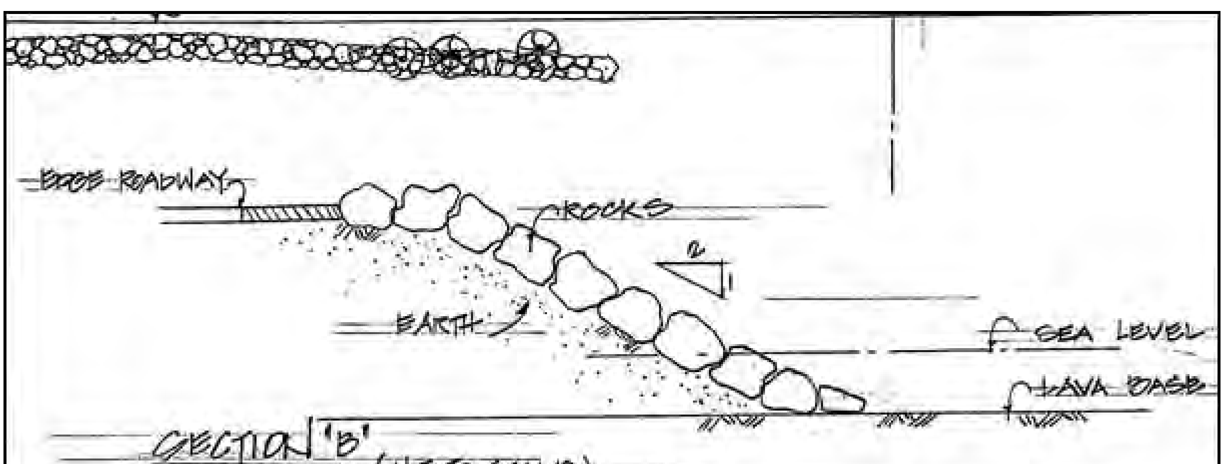


Figure 3-2: As-built Cross Section of Northern Reach of Revetment
(Sea Engineering, Inc., 2011)

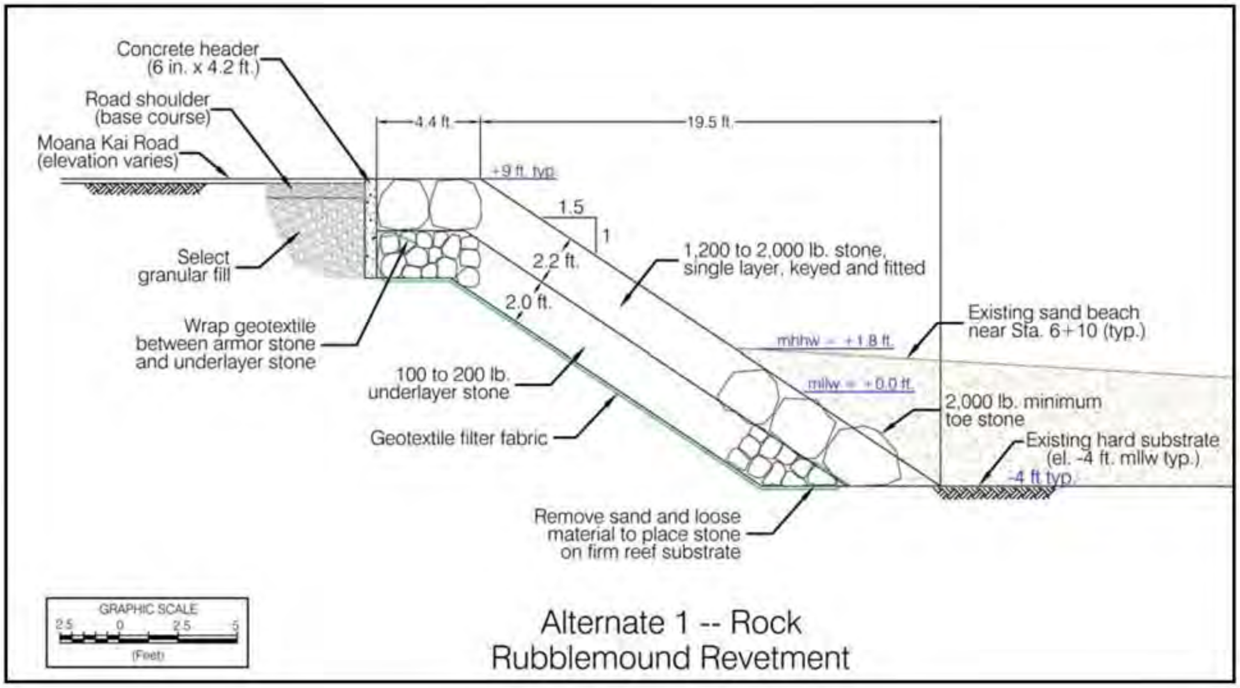


Figure 3-3, Alternative 1 – Rock Rubblemound Revetment

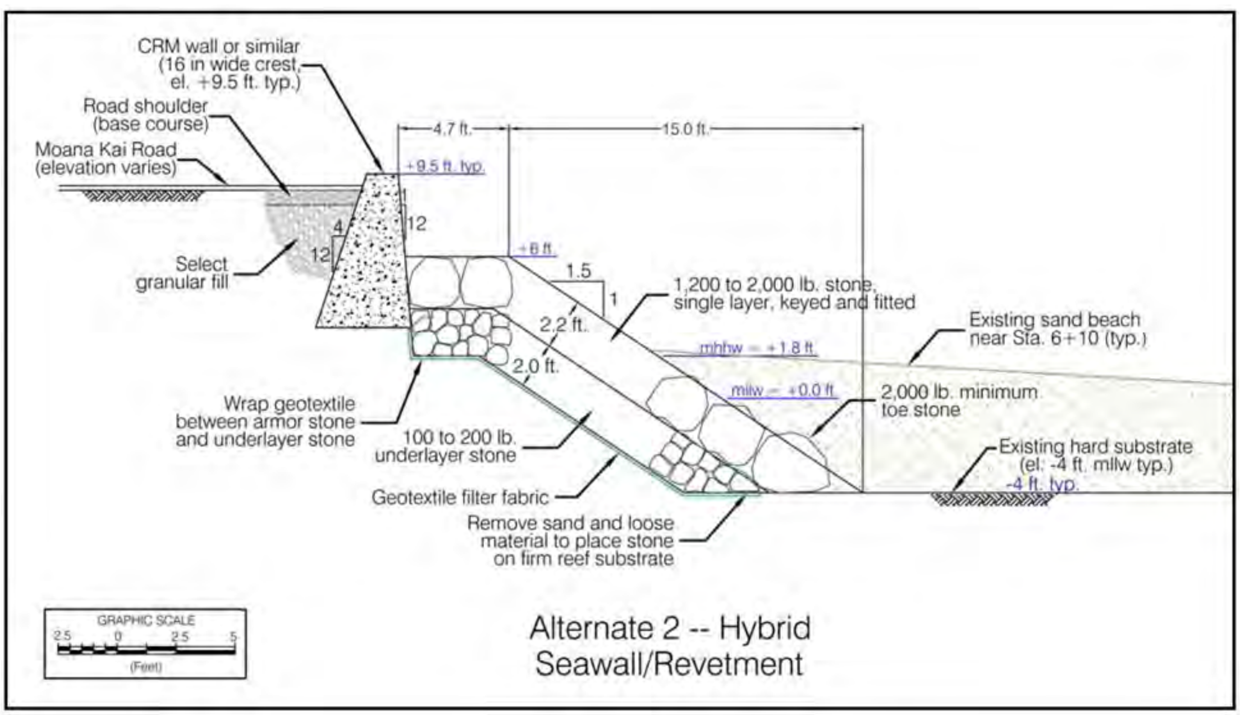


Figure 3-4, Alternative 2 – Hybrid Seawall/Revetment
(Sea Engineering, Inc., 2011)

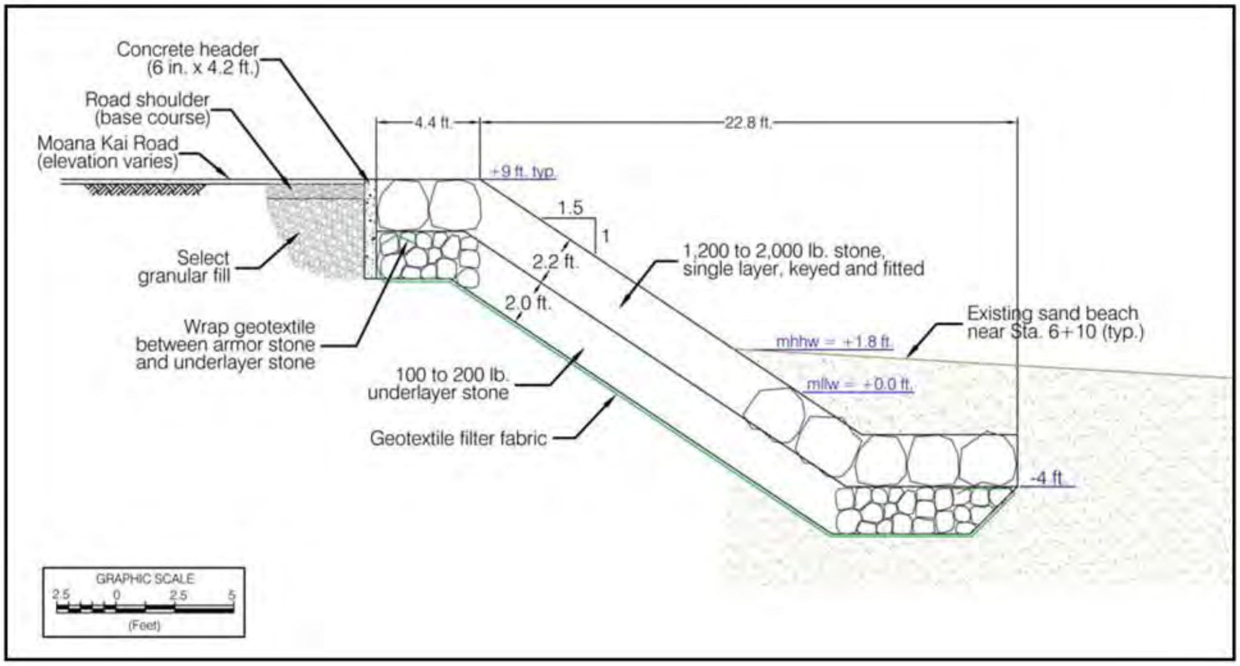


Figure 3-5, Alternative 1 Showing Toe Scour Apron
(Sea Engineering, Inc., 2011)

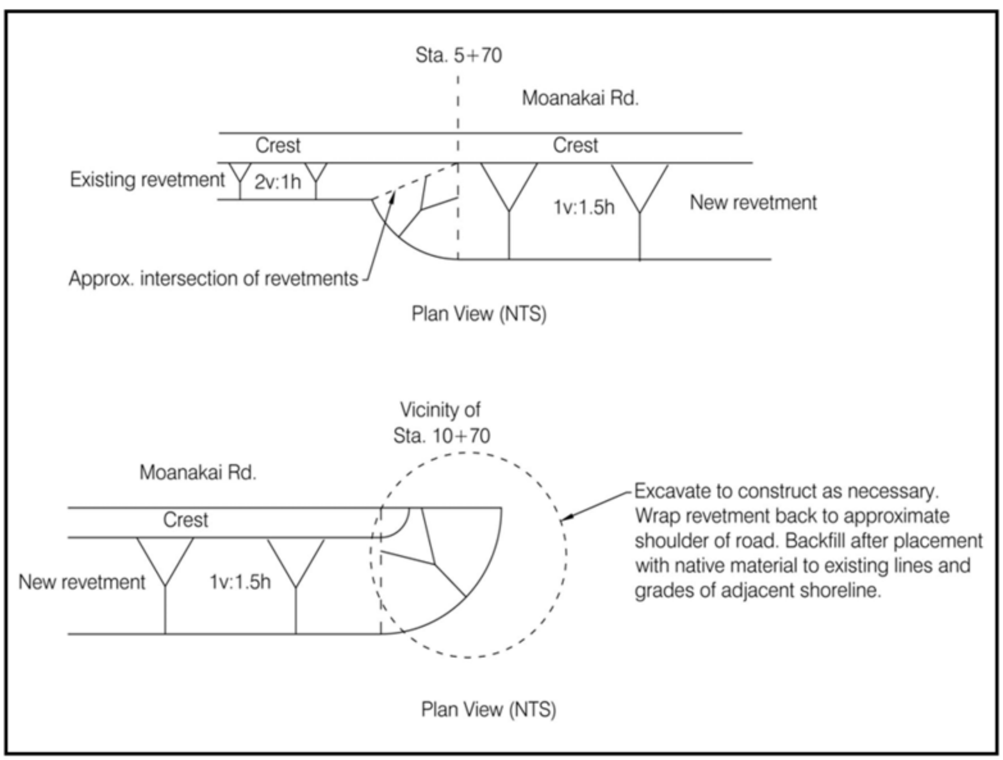


Figure 3-6
Concept Revetment Terminations
(Sea Engineering, Inc., 2011)

Section 4
Project Alternatives and Preferred Alternative

4.1 Alternatives to the Proposed Action

Alternatives to the proposed project that were considered include: (1) the No Action Alternative; (2) the Delayed Action Alternative; (3) Alternative Design 1; and (4) Alternative Design 2/Preferred Alternative. A description of each of these alternatives is provided below.

4.1.1 No Action

The No Action alternative involves taking no further action to repair or restore the Moanakai seawall. Taking no action would avert the potential for negative adverse environmental impacts associated with construction activities and would eliminate the expenditure of public funds for design, engineering, and construction. However, taking no further action would maintain the existing substandard structural condition of the Moanakai seawall which is of a structure in dilapidated condition susceptible to further shoreline erosion and wave processes that could eventually lead to the failure of the structure.

Taking no further action would also fail to accomplish the objectives for this project which are to provide: improved shoreline protection to address the immediate need for vehicular and pedestrian safety for users of the Moanakai Road; the maintenance of safe public access to the shoreline (e.g., recreational users could be at increased risk of injury from loose rocks and cobbles along the shoreline); minimizing the possibility of adverse future effects to the surrounding shoreline from further dilapidation of the Moanakai seawall; and, preserving the existing property along both makai and mauka ends of the project site.

Because the No Action alternative would fail to address the objectives for this project and fail to maintain an existing public facility for the safety and benefit of the community, it was rejected from further consideration.

4.1.2 Delayed Action

The Delayed Action alternative involves the construction of the project, but at a later date. Delaying the proposed project would temporarily avoid the potential for adverse environmental effects and the need for the expenditure of funds for planning, design, development, and construction activities. However, because the potential for environmental impacts and project costs would only be delayed, impacts and costs associated with the project would eventually be borne when the project is implemented:

- Construction costs would be averted in the short-term, but could ultimately prove to be higher due to inflation and other factors while generating environmental outcomes similar to the preferred alternative of proceeding with the project.
- Delayed action would forestall the project's implementation schedule with the possible result of further deterioration to the seawall requiring repair and restoration. The potential environmental impacts and mitigation measures required for the project is expected to either remain unchanged or require additional mitigation due to the possibility of further deterioration of the seawall over time.

Delaying the project to a later time is expected to have many of the same effects as the No Action alternative, with the additional prospect of potentially higher costs associated with further deterioration of the seawall from ongoing natural coastal shoreline processes.

Because the Delayed Action alternative would also fail to accomplish the objective of the project, it was also rejected from further consideration.

4.1.3 Alternative Design 1

Alternative Design 1 (**Figure 3-3, Alternative 1 – Rock Rubblemound Revetment**) was developed by Sea Engineering, Inc., and is based in part on the relatively low design wave heights at the shore. The design incorporates a single armor stone layer placed over underlayer stone and geotextile filter fabric. The design section has a two-stone crest and a face slope of 1v:1.5h, based on the assumption of intersecting hard substrate at elevation -4 feet mllw (mean lower low water). A larger toe stone is specified to increase stability. An underlayer of smaller stone, as well as a geotextile layer is included in the design to reduce the potential for fine material to escape through voids in the stone.

Although Alternative Design 1 addresses the requirement for the design of a shoreline protection structure consistent with generally accepted design and engineering practice, the County of Kaua‘i requested that the structure also possess a minimal footprint while meeting design requirements. The purpose for seeking to minimize the footprint of the structure is to increase or improve upon the area of shoreline available for public recreational use. Because Alternative Design 2 (see below) achieves this objective, the Alternative Design 1 was removed from further consideration.

(see **Appendix A**, Section 5.2, for further detail).

4.1.4 Alternative Design 2/Preferred Alternative

This revetment alternative was developed to reduce the overall footprint of the structure and is designed containing elements of both a seawall and a revetment. This design features a revetment with a lower crest elevation that reduces the seaward extent of the structure, and the potential for increased overtopping at higher wave conditions is limited with the use of a seawall.

Because the hybrid design addresses the requirements of the project to improve safety while reducing the potential for adverse visual and aesthetic impacts associated with the repair of the revetment, it is selected as the preferred alternative.

As required, the revetment toe design will be subject to adjustment in order to address the presence of either hard or soft substrate. In the event that hard substrate is encountered at the approximate -4 feet elevation the toe design as shown in **Figure 3-4** will be utilized. However, in the event that soft substrate is found, a toe scour apron as indicated in **Figure 3-5**, would be added to the Hybrid Seawall/Revetment design.

(see **Appendix A**, Section 5.2, for further detail).

Section 5
Description of Existing Site Conditions, Potential Impacts, and Proposed Mitigation

5.1 Existing Site Conditions

The Moanakai seawall is fronted by a sand and coral gravel beach, and bounded by the ocean to the east and Moanakai Road to the west. The coastline in this area is characterized by a combination of river and stream mouths, sandy beaches, fringing coral reef, and shore protection structures that includes the Moanakai seawall. Further to the west or mauka of the Moanakai Road are single family residences that are part of the town of Kapaʻa. Kapaʻa is mostly rural with residential development and a small concentration of buildings for commercial and industrial uses around the center of Kapaʻa Town. (Sea Engineering, Inc., 2011).

The Moanakai seawall is a rock rubblemound revetment constructed with two profiles. The southern 570 feet of the structure has a steep seaward face, and a 2.5 to 3-foot wide concrete cap provides a walkway. The northern 480 feet of the structure has a gentler slope and no cap (**see Photo 6**). (Sea Engineering, Inc., 2011).

Photo 6: Transition between revetment profiles (Source: Sea Engineering, Inc.)

Between station 0+00 and station 3+00 (measured from south to north), the beach is 20 to 25 feet wide and is composed primarily of sand. For approximately 75 feet north of station 3+00, the beach is about 15 to 20 feet wide and contains a higher percentage of coral gravel. Beyond this area, the beach is predominately sand; in some locations through here, there was no dry sand beach at the time of a site visit in August 2010. The beach widens gradually to the north, to a width of about 40 feet (Sea Engineering, Inc., 2011).

A fossil rock bench that extends the full length of the project site is shown in Photos 1, 4 and 5. The rock bench is 60 to 75 feet wide with elevations of up to +3 feet relative to mean lower low water (mllw). At the north end of the project area, the rock bench is further offshore and provides a shallow, protected swimming area in its lee. The rock bench diminishes and then disappears 350 feet past the north end of the revetment. Offshore of the rock bench, a reef flat with typical depths of 3 to 5 feet extends approximately 1,500 feet from shore (Sea Engineering, Inc., 2011).

5.2 Climate

5.2.1 Description

Kapaʻa Ahupuaʻa is located on the windward side of Kauaʻi and is exposed to the prevailing tradewinds and their associated weather patterns. Līhuʻe, which is approximately 6 miles away from Kapaʻa, has an average rainfall of 41.06 inches. Rainfall occurs sporadically throughout the year, with most precipitation occurring during the months of March and April. Monthly temperatures in the area of Līhuʻe are in the range of 69.8 degrees Fahrenheit (F) mean temperature in February and 81.1 degrees F in August. The annual mean temperature is 75.7 degrees F (The State of Hawaiʻi Data Book, 2009).

5.2.2 Potential Impacts and Proposed Mitigation

Improvements to the seawall will not affect the climate; however, the proposed project will be affected by climatic conditions such as rainfall. Impacts and mitigation measures for these climatic factors are discussed in Section 5.8, Natural Hazards.

5.3 Geology and Topography

5.3.1 Description

The topography of Kapaʻa is characterized as fairly flat, with irregularly-shaped gulches and small valleys in the uplands, through which small tributary streams including Kapahi, Makaleha and Moalepe run. While some of these streams combine with other tributaries in neighboring Keālia to form Kapaʻa Stream (often referred to as Keālia River), which empties into the ocean at the northern border of the *ahupuaʻa*, others flow directly into the lowlands of Kapaʻa, creating a large (approximately 170-acre) swamp area that has been mostly filled in modern times (Handy and Handy 1972:394, 423). Elevation within Kapaʻa town ranges from about 5-7 feet mean sea level (msl) along the shoreline up to 10-15 feet msl along mauka properties. Towards the northern end of Kapaʻa, elevations increase to about 15-20 feet msl.

5.3.2 Potential Impacts and Proposed Mitigation

The potential for significant adverse effects to topography and geology are not anticipated based on the limited scope and scale of the proposed project. The project site will be cleared of excess material and graded. The extent of grading will cause no major changes in topography, as the foundation for the seawall already exists; because of this, adverse impacts are not expected.

Protection from construction storm water runoff will be addressed through the use of a Best Management Practices (BMPs) plan to govern all work to ensure proper treatment of storm water runoff to waters of the State. This will include the use of vegetative, structural and management practices, as required, to prevent untreated construction storm water runoff from entering state water and reduce the effects of erosion and weathering. See Section 5.5, Soils, for further discussion.

5.4 Erosion and Wave Patterns

5.4.1 Description

Coastal erosion along this section of shoreline was evaluated by the University of Hawai'i's Coastal Geology Group (CGG). The CGG used historical aerial photographs dating from 1927 to 2008 to compare changes along the shoreline. The aerial photographs were ortho-rectified[2] and geo-referenced[3], and the low water marks on the photographs were digitized to provide a record of the long-term changes to that representative coastal feature. The erosion map shows annual erosion rates in the project area (transects 159-177) of up to about one foot per year. (**see Figure 5-1, Historical Shoreline Map**). (Sea Engineering, Inc. 2011).

The wave climate in Hawai'i is typically characterized by four general wave types. These include northeast tradewind waves, southern swells, North Pacific swells, and Kona wind waves. Tropical storms and hurricanes also generate waves that can approach the islands from virtually any direction. Unlike winds, any and all of these wave conditions may occur at the same time. (Sea Engineering, Inc. 2011).

Tradewind waves occur throughout the year and are most persistent April through September when they usually dominate the local wave climate. They result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Tradewind deepwater waves are typically between 3 to 8 feet high with periods of 5 to 10 seconds, depending upon the strength of the tradewinds and how far the fetch extends east of the Hawaiian Islands. The direction of approach, like the tradewinds themselves, varies between north-northeast and east-southeast and is centered on the east-northeast direction. The project site is directly exposed to tradewind wave energy. (Sea Engineering, Inc. 2011).

Southern swells are generated by storms in the southern hemisphere and are most prevalent during the summer months of April through September. Traveling distances of up to 5,000 miles, these waves arrive with relatively low deepwater wave heights of 1 to 4 feet and periods of 14 to 20 seconds. Depending on the positions and tracks of the southern hemisphere storms, southern swells approach between the southeasterly and southwesterly directions. The project site is somewhat sheltered from southern swells by the island of Kaua'i itself; however, some wave energy does refract and diffract around the island and impact the site. (Sea Engineering, Inc. 2011).

During the winter months in the northern hemisphere, strong storms are frequent in the North Pacific in the mid latitudes and near the Aleutian Islands. These storms generate large North Pacific swells that range in direction from west-northwest to northeast and arrive at the northern Hawaiian shores with little attenuation of wave energy. These are the waves that have made surfing beaches on the north shore of O'ahu famous. Deepwater wave heights often reach 15 feet

[2] A geometrically corrected image or photograph so that the distances shown are uniform and can be measured as with a map. en.wiktionary.org/wiki/orthorectified.

[3] The process of associating map information held in an image file with its location on the earth so that, for example, each pixel becomes associated with a latitude and longitude allowing routes and tracks to be correctly plotted and displayed. www.maps-gps-info.com/maps-gps-glossary-g.html.

and in extreme cases can reach 30 feet. Periods vary between 12 and 20 seconds, depending on the location of the storm. The project site is not directly exposed to north swells; however, this wave energy does refract and diffract around the island and impact the site. (Sea Engineering, Inc. 2011).

Waves that approach from the southeasterly to southwesterly direction associated with Kona winds and Kona lows are known as Kona storm waves. Kona storms occur when the winter low pressure systems that travel across the North Pacific Ocean dip south and approach the islands. Strong southerly and southwesterly winds generated by these storms result in large waves on exposed shorelines and often heavy rains. These events are infrequent; however, they can result in very large waves with deepwater heights up to 15 feet (Noda, 1991). Periods typically range from 6 to 10 seconds. The project site is not directly exposed to Kona storm waves. (Sea Engineering, Inc. 2011).

Severe tropical storms and hurricanes have the potential to generate extremely large waves, which in turn could potentially result in large waves at the project site. Recent hurricanes impacting the Hawaiian Islands include Hurricane Iwa in 1982 and Hurricane Iniki in 1992. Iniki directly hit the island of Kaua'i and resulted in large waves along the southern shores of all the Hawaiian Islands. Damage from these hurricanes was extensive. Although not frequent or even likely events, they should be considered in the project design, particularly with regard to coastal structure stability. (Sea Engineering, Inc. 2011).

5.4.2 Potential Impacts and Proposed Mitigation

The potential impacts associated with wave energy involve the exposure of the Moanakai Seawall to wave energy that can erode the materials comprising and supporting the seawall. These impacts would involve a loss of the structural material used to anchor the revetment stones or rocks, with the resultant movement and/or collapse of the seawall itself. Mitigation against wave energy forces will involve factoring into the design of the seawall appropriate parameters that include the structural composition of the repaired and restored seawall to withstand the design wave, and wave crest elevation and wave runup values.

Further detail on these factors is provided in **Appendix A**, Repair/Reconstruction of Moanakai Seawall: Moana Kai Road Coastal Assessment (Sea Engineering, Inc., 2011).

5.5 Soils

5.5.1 Description

The soil types in the surrounding area of the proposed project include beaches (BS) and Mokūle'ia fine sandy loam (Mr) (**see Figure 5-2, Soils**). According to Soil Survey of Islands of Kaua'i, O'ahu, Maui, Moloka'i, and Lāna'i, State of Hawai'i, as prepared by the U.S. Department of Agriculture, 1972:

> *"Kapa'a soils have a subsurface layer of dark-brown to yellowish-brown, friable silty clay. The subsoil is yellowish-red to reddish-brown friable silty clay and clay loam. The substratum is soft, weathered basic igneous rock (Soil Survey, 4)."*

> *"Mokūle'ia fine sandy loam (Mr).—This soil occurs on the eastern and northern coastal plains of Kaua'i. It is nearly level. This soil has a profile like that of Mokūle'ia clay loam,*

except for the texture of the surface layer. Permeability is moderately rapid on the surface layer and rapid in the subsoil. Runoff is very slow and the erosion hazard is slight. The available water capacity is about 1 inch per foot in the surface layer and 0.7 inch per foot in the subsoil. Included in mapping were small areas where the slope is as much as 8 percent. This soil is used for pasture (Soil Survey, 95)."

5.5.2 Potential Impacts and Proposed Mitigation

No long term adverse impacts are anticipated to the area soils. Work at the site will principally involve the repair and reconstruction of the existing seawall. Ground disturbance will only be undertaken during construction, and any waste material that cannot be reused will be removed from the project site. Potential impacts involving soil stability or erosion will be addressed by the design of the project in accordance with industry practices for the construction of structures such as seawalls, by a professional engineer licensed in the State of Hawai'i.

Adherence to Federal, State, and County of Kaua'i regulations and guidelines governing construction of the project shall also be employed including the review and approval of the construction plans and related environmental entitlements that will be filed with the appropriate governmental agencies for this project. This will include the preparation of an Erosion Control Plan (ECP) and the implementation of erosion controls in accordance with the State and County of Kaua'i requirements. A list of environmental entitlements is provided in Section 7 of this document.

Mitigation against the loss of soils and construction materials in storm water runoff will be addressed through adherence to the requirements of Hawai'i Administrative Rules (HAR), Chapter 11-55, Water Pollution Control (National Pollutant Discharge Elimination System [NPDES] Permit Program), and Section 209, Water Pollution and Erosion Control.

Vegetation and/or structural controls will be used to stabilize surfaces that are exposed or susceptible to runoff and/or wave action. Use of native vegetation will be considered. Structural controls will include use of surfacing that is consistent with the area surroundings while meeting runoff and wave design requirements.

The following are typical BMP measures that would be applied to the subject project to address NPDES construction stormwater requirements:

Before Construction

- Existing ground cover will not be destroyed, removed or disturbed more than 20 calendar days prior to start of construction.
- Erosion and sediment control measures will be in place and functional before earthwork may begin, and will be maintained throughout the construction period. Temporary measures may be removed at the beginning of the work day, but shall be replaced at the end of the work day.

During construction:

- Clearing shall be held to the minimum necessary for grading, equipment operation, and site work.

- Construction shall be sequenced to minimize the exposure of cleared surface areas. Areas of one phase shall be stabilized before another phase can be initiated. Stabilization shall be accomplished by protecting areas of disturbed soils from rainfall and runoff by use of structural controls such as berms or vegetative controls such as grass seedling or hydromulching.
- Temporary soil stabilization with appropriate vegetation shall be applied on areas that remain unfinished. Permanent soil stabilization using vegetative controls shall be applied as soon as practicable after final construction.
- All control measures will be checked as necessary.
- Maintenance and fueling of construction equipment and vehicles shall be preformed only in designated areas. Clean up materials shall be placed in a conspicuous location to facilitate cleanup in the event of inadvertent leaks or spills. Refueling and maintenance of vehicles and equipment shall not be permitted outside of designated refueling areas.
- All liquid materials including petroleum, oils, and lubricants (POLs), solvents and cleaners shall be stored in sealable containers. No open containers for the storage of such materials will be permitted.

After construction:

- All equipment no longer necessary to the site will be removed. Construction debris (that cannot be recycled in accordance with Section 1805 of Public Law 109-59) and refuse will be disposed of at an approved facility that accepts construction and demolition debris waste by the contractor.

5.6 Water Resources and Hydrology

5.6.1 Surface Water

There are no standing bodies of water on the subject property and no channels to carry flowing surface waters. Storm waters that fall on the subject property drain toward the ocean, either over land or through existing storm sewer systems.

The only major surface water feature of the site includes the ocean, directly to the west of the project site. Other surface water features including perennial or intermittent streams are not present in close vicinity of the proposed site, although three wetland features are located in proximity to the site (see Section 5.7, Wetlands).

Waiākea Canal is a straightened and hardened canal that flows through Kapa'a town and discharges into the ocean between boulder jetties. This canal has boulder riprap banks and a sand bottom. There is a boat launching ramp and dock located nearby the existing cane haul road bridge used by pedestrians and bicyclists. Lihi Park is an undeveloped park area located along the southern side of this canal.

5.6.2 Surface Water, Potential Impacts and Proposed Mitigation

Potential impacts to water quality include the potential for the generation of silt and sediments in storm water runoff from the project site discharging into the ocean. In order to address this potential, mitigative measures that include the use of a County approved ECP and construction storm water BMPs plan will be employed to control against soil, sediment and construction related erosion.

Construction activities will temporarily disturb soils on the property, however, silt fences, berms and other applicable erosion control measures will be implemented to prevent soil, sediment, and construction related debris from discharging into the nearby marine waters. As required, exposed soils will be covered with PVC sheet plastic and/or berms shall be used to prevent inadvertent contact and mixing with storm water. During construction, silt curtains will be employed around the work area to limit the migration of silt and sediments into the coastal water column ().

5.6.3 Nearshore Water Quality

A nearshore water quality survey was conducted by AECOS, Inc., on September 24, 2010 and is discussed in the report Repair/Reconstruction of Moanakai Seawall: Water quality survey for Moanakai Road seawall improvements, Kapa'a Kaua'i, Hawai'i (**see Appendix B**). The methods and findings of the investigation are summarized below.

Methods

AECOS biologists measured certain parameters in the field and collected water samples for analyses in the laboratory at three stations ("North", "Mid", and "South") in the Project area. The stations were located in the water shoreward of the beach rock formation. An additional sample was collected at station (Sta.) Mid to serve as baseline data for the NPDES application. Field measurements were made and samples collected around 3:30 pm during the high tide.

Findings

Water quality at the project site is good. All three stations had similar water quality, indicating the water is well-mixed. The temperature was quite high, although not unusual for measurements taken in shallow water during the late afternoon towards the end of summer. The salinity measured is indicative of seawater with little freshwater input. The water was supersaturated (saturation greater than 100%) with oxygen and the pH was slightly elevated—indicating photosynthesizing algae. Chlorophyll α, a direct indicator of phytoplankton biomass, was also slightly elevated, as were turbidity and total suspended solids (TSS). Ammonia (a dissolved form of inorganic nitrogen) was elevated at Sta. Mid, although nitrate nitrite (another dissolved inorganic nitrogen species) was low at all stations. Total nitrogen (TN), which includes inorganic, organic, and particulate nitrogen moieties, was low, as was total phosphorus (TP).

Table 1. Water quality characteristics of nearshore waters off Moanakai seawall, Kaua'i, as determined at LHW on September 24, 2010.

	Time Sampled	Temp. (°C)	DO (Mg/l)	DO sat. (%)	Salinity (psu)	pH	Chl α (μg/l)
North	1538	29.5	7.19	114	35	8.19	0.31
Mid	1549	29.3	7.41	118	35	8.25	0.44
South	1515	28.9	7.05	110	34	8.13	0.42
		Turbidity (ntu)	**TSS (mg/l)**	**Ammonia (μgN/l)**	**Nitrate + nitrite (μgN/l)**	**Total N (μgN/l)**	**Total P (μgP/l)**
North		1.16	8.8	18	<1	132	5

Mid	1.04	8.3	38	<1	121	5
South	1.06	8.7	6	<1	116	4

The detection limits of the methods required to be used for nutrient analysis of water quality samples for NPDES permit applications (HDOH, 2007a, 2007b) are higher than that used to characterize the water quality of the project area. No nutrients (ammonia, nitrate nitrite, TN, or TP) were detected in levels above the reporting limits for these analyses (Table 2). Oil and grease was not detected in the sample.

Table 2. Baseline water quality data from nearshore waters at Moanakai seawall, Kaua'i at Sta. "Mid" to be used for NPDES application

	Time Sampled	**Temp. (ºC)**	**DO (Mg/l)**	**DO sat. (%)**	**Salinity (psu)**	**pH**	**Oil & Grease (mg/l)**
Mid	1549	29.3	7.41	118	35	8.25	<1.0
		Turbidity (ntu)	**TSS (mg/l)**	**Ammonia (µgN/l)**	**Nitrate + nitrite (µgN/l)**	**Total N (µgN/l)**	**Total P (µgP/l)**
Mid		1.04	6.9	<100	<100	<500	<100

Waters off the east coast of Kaua'i are designated as Class A with state water quality criteria pertaining to either "wet" and "dry" conditions. The coastal waters within the lagoon off the Moanakai seawall fall into the "wet" set of criteria due to the freshwater input along the coastline from Waikaea Canal to the north and Waipouli Canal to the south. As stated in the water quality regulations, it is the objective of Class A waters that their use for recreation and aesthetic enjoyment be protected.

5.6.4 Nearshore Water Quality, Potential Impacts and Proposed Mitigation

Since the water quality at the project site is good. Project specific best management practices (BMPs), including silt curtains, will need to be developed to ensure that water quality of the lagoon and adjacent reef flat are protected from sedimentation and project related runoff. Any brief periods of impaired water quality associated with construction should have minimal impacts inside the lagoon or on the nearby reef flat as daily water exchange is high in these areas. Much of the construction should occur on land, which will reduce the risk of concrete and construction related material spills into marine waters.

Potential exists for short term impacts from construction activities on the water quality of the nearshore environment. Activities involving mechanical equipment in the vicinity of the shoreline can lead to increased turbidity during construction, but adverse effects can be mitigated through the use of silt curtains and the curtailment of certain activities during high tide, adverse seas, or high rainfall conditions. Temporary increases in suspended sediments as a result of construction activities will cease once the project is completed.

Care must be taken to avoid depositing construction materials, oil, grease, hydraulic fluid, fuel and/or any other noxious chemicals fluids directly or indirectly into the marine environment. Discharges can be mitigated by employing best management practices (BMPs) including, but not necessarily limited to:

1. Proper storage, handling, and disposal of construction and waste materials away from the shore;
2. Construction equipment washing and other similar activities done in a manner that allows for the proper disposal of the resultant wastewater;
3. Maintenance of heavy machinery to ensure fluids of any kind is not leaked;
4. Proper use of silt curtains during construction activities; and
5. Water quality monitoring to ensure compliance with permit requirements.

Further discussion on BMPs for storm water and dewatering can be found in Section 5.5.2.

The employment of BMPs during construction of the proposed project will involve the preparation of BMPs associated with the types of discharges that are anticipated. The types of discharges that will be addressed by the NPDES permit program include: discharges of construction storm water and construction dewatering. All NPDES permit applications prepared for this project will be in accordance with HAR, Chapter 11-55, Water Pollution Control.

The mitigations described above, as well as the measures that will be provided in the project environmental permit applications including the Section 404/10 Department of the Army and Section 401 Water Quality Certification permit applications are anticipated to be sufficient to ensure against construction, operations related, and inadvertent or accidental spills of pollutants in state waters. No adverse impacts to nearshore waters are therefore anticipated. As required, the applicant intends to further consult with the State DOH-CWB during construction and operation of facility to maintain all regulatory requirements.

5.6.5 Groundwater

Ground water in Kapa'a comes from diked basal ground water derived from rainfall. The rainfall is absorbed into the ground and is impeded by a series of volcanic dikes. These dikes supply the basal lens of fresh water that sits under the island. The quality of groundwater in the area is very good and requires no treatment except disinfection (http://www.kauaiwater.org/ce_ws_lihue.asp).

5.6.6 Groundwater, Potential Impacts and Proposed Mitigation

The proposed project is not anticipated to itself constitute an adverse potential impact on the groundwater resources of the area. The potential for construction related impacts to groundwater are principally anticipated to involve discharges percolating into the ground from stormwater commingling with demolition debris, sediments, and stored construction materials. Mitigation measures include the preparation of a NPDES Construction Stormwater Permit to ensure against mixing and discharges of storm water runoff with construction associated materials and debris. A BMPs Plan will address the potential for mixing of stormwater with construction materials and debris by describing management, structural, and vegetative controls that may be applied at the project site (refer to Section 5.5.2 for discussion of further mitigation measures).

5.7 Wetlands

5.7.1 Description

Wetlands play an integral role in the environment. They prevent erosion in the surrounding area through the presence of wetland associated plants with root systems that hold soil in place. The plants also serve as a physical barrier and absorb energy from waves. Wetlands also provide a natural filtration system for runoff. Nutrients swept into the wetland from runoff are absorbed by plant roots and microorganisms that live in the soil, or stick to the soil particles themselves. Through this process, most of the nutrients and pollution in the water are absorbed and retained and are prevented from entering the ocean (Environmental Protection Agency, 2010).

There are four U. S. Fish and Wildlife (USFWS) National Wetlands Inventory coded wetlands in the vicinity of the project site (**see Figure 5-3, Wetlands**). These wetlands are designated M2USP, M2USN, M1UBL and R2UBHx. The following describes each code based on the USFWS description:

M2USP and M2USN:

> M – System MARINE: The Marine System describes open ocean and high energy coast lines with salinities exceeding 30 parts per thousand (ppt) and little or no dilution except outside the mouths of estuaries.
>
> 2 – Subsystem INTERTIDAL: This is defined as the area from extreme low water to extreme high water and associated splash zone.
>
> US – Class UNCONSOLIDATED SHORE: Includes all wetland habitats having two characteristics: (1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders or bedrock and; (2) less than 30 percent areal cover of vegetation. Landforms such as beaches, bars, and flats are included in the Unconsolidated Shore class.
>
> P – WATER REGIME Irregularly Flooded: Tidal water floods the land surface less often than daily.
>
> Or,
>
> N – WATER REGIME Regularly Flooded: Tidal water alternately floods and exposes land surface at least once daily.

M1UBL:

> M – System MARINE: The Marine System describes open ocean and high energy coast lines with salinities exceeding 30 parts per thousand (ppt) and little or no dilution except outside the mouths of estuaries.
>
> 1 – Subsystem SUBTIDAL: These habitats are continuously submerged substrate, (i.e. below extreme low water).
>
> UB – Class UNCONSOLIDATED BOTTOM: Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%.
>
> L – WATER REGIME Subtidal: The substrate is permanently flooded with tidal water.

R2UBHx:

R – System RIVERINE: The Riverine System includes all wetlands and deepwater habitats contained in natural or artificial channels periodically or continuously containing flowing water or which forms a connecting link between the two bodies of standing water. Upland islands or Palustrine wetlands may occur in the channel, but they are not part of the Riverine System.

2 – Subsystem LOWER PERENNIAL: This Subsystem is characterized by a low gradient and slow water velocity. There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. The floodplain is well developed. Oxygen deficits may sometimes occur.

UB – Class UNCONSOLIDATED BOTTOM: Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%.

H – WATER REGIME Permanently Flooded: Water covers the land surface throughout the year in all years.

x – SPECIAL MODIFIER Excavated: Lies within a basin or channel that have been dug, gouged, blasted or suctioned through artificial means by man.

5.7.2 Potential Impacts and Proposed Mitigation

The potential for construction related impacts to the nearby salt marsh wetlands and coastal waters can result from a release of materials or debris directly falling into the water, and by stormwater runoff that could mix with sediments and construction materials. These discharges would most likely occur during construction with the excavation of soil and the use of materials such as concrete.

Mitigation measures to ensure protection against construction associated discharges will be employed at the site and will include the following:

- ECP - Discharges of construction associated stormwater runoff will be subject to preparation and filing of an ECP as required by the County of Kaua'i Department of Public Works. Erosion control measures will be as prescribed in the County's Erosion and Sedimentation Standards. These measures include limiting the areas subject to excavation before allowing work in new areas; planting grass or applying hydromulch to stabilize bare surfaces; and use of a stabilized construction entry to inhibit the spreading of sediments unto adjoining roads from construction vehicles leaving the job site.
- To prevent negative impacts to the salt-marsh wetland, the work area may be sectioned off using silt curtains or other appropriate measures to isolate the work area and prevent earth-moving activities from directly impacting the *muliwai*. All land disturbances will be stabilized prior to removal of silt curtains (or similar) erosion control measures.
- A NPDES NOI Form C, Construction Stormwater permit application will be prepared to ensure against mixing and discharge of storm water runoff with construction associated materials and debris. A BMPs Plan will address the potential for mixing of stormwater with construction materials by describing management, structural, and vegetative controls that may be applied at the project site.

The use of the mitigation measures prescribed above is expected to ensure against the potential for adverse effects to wetlands.

5.8 Natural Hazards

5.8.1 Description

The Hawaiian Islands are susceptible to five main types of natural hazards: earthquakes and volcanic activity; hurricanes; tsunamis; and flooding. Natural hazards including hurricanes, flooding, and tsunamis are unavoidable for coastal areas.

Earthquakes and Volcanic Activity

Natural hazards in the Hawai'i region are infrequent and rarely destructive. The most frequent are small earthquakes that usually go unnoticed. Earthquakes occurring in Hawai'i are closely linked to volcanic activity. Numerous earthquakes take place every year, with the majority beneath the Island of Hawai'i. The largest earthquake in the recent past occurred in 2006 approximately 6 miles southwest of the Island of Hawai'i measuring 6.7 on the Richter scale. Volcanic activity will not affect the proposed project directly through volcanic eruption, as there are no active volcanoes on the island of Kaua'i.

Kaua'i is located in the Zone 1 category for seismic activity as established by the Uniform Building Code (UBC). The UBC provides minimum design criteria to address the potential for damage due to seismic disturbances. The range of seismic risk varies from Zone 0, indicating no damage, to Zone 4, indicating major damage.

Although the possibility of earthquakes on Kaua'i is lower than on other islands, the potential for damage to the proposed project site may occur from an earthquake of sufficient magnitude. The potential for damages to the proposed seawall will be minimized by complying with appropriate Federal, State, and County design standards.

Hurricanes

Heavy rains and strong winds associated with tropical storms occasionally impact the Hawaiian Islands and can cause flooding and major erosion. Hurricanes occasionally approach the Hawaiian Islands, but rarely reach the islands with hurricane force wind speeds.

Hawaii's annual "hurricane season" is from June through November. Hawai'i has experienced the full effects of five hurricanes since 1949. The first Hiki (1950) moved from east to west, north of the islands. The other four, Nina, (1957), Dot (1959), Iwa (1982) and Iniki (1992), all traveled on more-or-less northerly headings. Except for Hiki, the storms moved across, or very close to, Kaua'i. Hurricane Iwa passed within 30 miles of Kaua'i and Iniki passed directly over Kaua'i. Nina remained southwest and west of the islands (U.S. Navy, 2002).

Tsunami

Tsunamis are a series of enormous waves created by an underwater disturbance such as an earthquake, landslide, volcanic eruption, or meteorite. A tsunami can move hundreds of miles per hour in the open ocean and smash into land with waves as high as 100 feet or more. From the area where the tsunami originates, waves travel outward in all directions. Once the wave approaches the shore, it builds in height. The topography of the coastline and the ocean floor will influence the size of the wave. There may be more than one wave and the succeeding one may be larger than the one before. That is why a small tsunami at one beach can be a giant wave a few miles away. (http://www.fema.gov/hazard/tsunami/index.shtm)

All tsunamis are potentially dangerous, even though they may not damage every coastline they strike. A tsunami can strike anywhere along most of the U.S. coastline. The most destructive tsunamis have occurred along the coasts of California, Oregon, Washington, Alaska, and Hawai‘i (http://www.fema.gov/hazard/tsunami/index.shtm). Most tsunami affecting the Hawaiian Islands come from sources in the zone of mountain building that borders the Pacific Ocean. Hawai‘i has experienced nine damaging tsunami since 1820 (University of Hawai‘i at Hilo, 1983).

A tsunami can occur at any time with limited or no warning. Persons in low lying shoreline or beach areas are advised to immediately go to higher ground.

According to the Kaua‘i Civil Defense Agency, the tsunami evacuation boundary includes the entire project site to just below Kealoha Road (**see Figure 5-4, Tsunami Hazard Map**).

Flooding

Sudden high waves and the strong currents they generate are perhaps the most consistent and predictable coastal hazards in Hawai‘i (University of Hawai‘i at Hilo, 1998). According to the Flood Insurance Rate Map (FIRM) #1500020204E, the project area is located Zone VE, an area inundated by 100-year flooding with velocity hazard (wave action); Base Flood Elevations (BFEs) have been determined. (**see Figure 5-5, Flood Zones**).

5.8.2 Potential Impacts and Proposed Mitigation

Earthquake and Volcanic Activity Hazard

Although the proposed project is not required to be designed in accordance with State or County building codes, the design will be in accordance with the regulatory requirements and design guidelines[4] of the U. S. Army Corps of Engineers. Mitigation measures to address the potential for earthquake hazards will be addressed by requiring that structures proposed for this project be built, at a minimum according to the relative low Kaua‘i values for seismic activity in accordance with the 2003 International Building Code (IBC).

Hurricane and Tsunami Hazards

To mitigate against potential impacts from hurricanes, the proposed project will ensure that improvements are designed to present building codes which offer some protection from damage.

To mitigate against tsunami and storm surge impacts, engineering analyses will be preformed to determine proper design criteria to be applied to structures associated with this project. The State and County of Kaua‘i Civil Defense will implement established procedures in the event of a flood or tsunami.

Flood Hazard

The proposed project involving seawall improvements is located within the Federal Emergency Management Agency (FEMA) Flood Zone VE. The proposed project intends to protect the

[4] U. S. Army Corps of Engineers, Shore Protection Manual (1984); and, Coastal Engineering Manual (2006)

shoreline from storm surges, and will be constructed for this purpose; thus significant impacts to the seawall are not expected.

No habitable structures are proposed that would constitute an unreasonable risk to life or property. Given the requirement for the proposed project to be located within proximity of the shoreline, the proposed use is considered reasonable and is not anticipated to have a significant impact on flood conditions. No further mitigation measures related to flooding are planned or proposed.

5.9 Flora and Fauna

5.9.1 Flora

The existing Moanakai seawall project area consists of mostly hard surfaces that include paved areas comprising the road travelway and shoulders, and rocky ground with loosely scattered pockets of soil. Vegetation found in this area is sparse with the exception of introduced and exotic species used for landscaping and ground cover along the roadway and within adjoining and nearby residential lots.

Terrestrial flora found at the project site include native species such as naupaka (*Scaevola taccada*) and introduced species, such as coconut (*Cocos nucifera*) and Ironwood trees (*Casuarina equisetifolia*), with mostly herbaceous plants including grasses and weedy species typical of disturbed areas. No plant species within the project are considered threatened or endangered, or which otherwise are considered to be rare or of special significance by the State of Hawai‘i or federal government.

The natural vegetation in the surrounding area of the project site consists of *kiawe* (*Prosopis pallida*) *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena leucocephala*), and bermudagrass (*Cynodon dactylon*) in the drier areas and Napier grass (*Pennisetum purpureum*), guava (*Psidium guajava*), and joee (*Verbena litoralis*) in the wetter areas (Foote et al. 1972:95; visual confirmation by CSH, 2010).

Existing homes, landscaped lawns and plantings also cover surrounding areas of the site. These may contain commonly grown ornamental species such as areca palm (*Chrysalidocarpus lutescens*), avocado (*Persea americana*), various croton (*Codiaeum variegatum*) hibiscus (*Hibiscus rosa-sinensis*), plumeria (*Plumeria rubra*), papaya (*Carica papaya*), and Alexandra palm (*Archontophoenix alexandrae*).

No threatened or endangered plant species were observed within the project limits.

5.9.2 Flora, Potential Impacts and Proposed Mitigation

No adverse effects to rare, threatened or endangered flora are anticipated as all work will remain within an already disturbed area. Upon the completion of work, all areas of exposed soils will be replanted to maintain erosion and sediment control.

5.9.3 Fauna

Terrestrial fauna found at the project site principally consists of small mammals and birds. These species include mice, cats (*Felix domesticus*), dogs (*Canis familiaris*), barred doves (*Feopelia* *striata*), rats (*Rattus ssp*.), Pacific Golden Plovers (*Pluvialis fulva*), feral chickens (*Gallus gallus*) and finches (*Cardopacus mexicanus frontalis*). None of these terrestrial species are listed as candidate threatened or endangered species by the State or Federal government.

The potential for marine fauna and flora that may be present at the site was assessed by AECOS Consultants, Inc., in the report Repair/Reconstruction of Moanakai Seawall: Marine biological survey for Moanakai Road seawall improvements, Kapaʻa, Kauaʻi, Hawaiʻi, in 2010 (see **Appendix C**). Biologists recorded environmental characteristics and species of marine fauna and flora observed in all these areas. Biologists walked along the revetment boulders and the limestone bench, and snorkeled the waters in the lagoon and over the reef flat. Marine algae, fishes, and macroinvertebrates were identified in the field and verified with various texts (Hoover, 1999; Huisman, et al. 2007). A listing, including relative species abundance for *limu* and marine animals observed is found in **Appendix C**. The following is a summary of the findings of the AECOS Consultants, Inc., report, organized by the location inspected.

Revetment

The basalt boulders of the seawall and revetment are sparsely inhabited. Small numbers of barnacle (*Chthamalus proteus*), nerite snail (*Nerita picea*), periwinkle (*Littoraria intermedia*), mussel (*Brachiodontes crebristriatus*), and aʻama crab (*Grapsus tenuicrustatus*) occur in the intertidal zone. No algae were observed on the basalt boulders.

Lagoon

Schools of varying size classes of āholehole (*Kuhlia xenura*) and mullet (*Mugil cephalus* or ʻamaʻama) use these protected lagoon waters. Juvenile manini (*Acanthurus triostegus*) and adult tilapia (*Sarotherodon melanotheron*) also school in the lagoon. The north end of the lagoon hosts slightly larger fishes and reef fishes, including small schools of weke ula (*Mulloidichthys vanicolensis*), saddle wrasse (*Thalassoma duperrey*), and belted wrasse (*Stethojulis balteata*). Noticeably absent on the lagoon side are sea urchins. Many juvenile fishes, including butterflyfishes, wrasses, manini, flagtails, and mullet inhabit these calmer waters.

Bench

The limestone bench has many cracks, holes, and depressions in which gobies and blennies reside. The south end of the bench is submerged less frequently than the north end and therefore hosts organisms adapted to conditions of the upper interidal. Most notable, at the south end, are the many false ʻopihi (*Siphonaria normalis* or ʻopihi ʻawa) and thousands of tiny snails (keeled periwinkle, *Paesiella tantilla*). In addition, small brown egg masses were observed in this area nearby false ʻopihi scars devoid of algae. The water-filled depressions of the bench host goby (Bathygobius sp.), marbled blenny (*Entomacrodus marmoratus*), snakehead cowry (*Cypraea caputserpentis*), and coralline algae nodules. Yellow-foot and black-foot ʻopihi (*Cellana sandwicensis* and *C. exarata*) also occur, but in small numbers towards the north end. Biota at the north end of the bench are more subtidal marine in nature. Teated sea cucumbers (*Holothuria whitmaei* or loli), zebra blenny (*Istiblennius zebra*), and xanthid crabs are common here. Live, unattached coral fragments (*Porites spp., Pocillopora meandrina, Psammocora stellata*, and *Poc. damicornis*) are present in water-filled depressions; these likely cast up during high sea conditions from parent colonies on the adjacent reef flat. Algae here include green bubble algae

(*Dichtyosphaeria versluysii*), *Sargassum echinocarpum*, and *Padina japonica*, with *Padina* being most common.

Reef Flat

Corals are represented by at least 9 species. The most common coral genus is *Pocillopora* with three species represented: *Poc. damicornis* (lace coral), *Poc. meandrina* (cauliflower coral), and *Poc. eydouxi* (antler coral). Next most common is *Porites*, also with three species: *P. lobata* (lobe coral), *P. lutea* (mound coral), and *P. compressa* (finger coral). Also present are *Psammocora stellata* (stellar coral), *Montipora patula* (sandpaper rice coral), and *Cyphastrea ocellina* (ocellated coral), all in low numbers and with low cover. A visual estimate of coral cover over the reef area surveyed is less than 5%. The most well-represented fishes on the reef flat are wrasses (Family *Labridae*) with numerous juvenile saddle wrasse (*Thalassoma duperrey*) and belted wrasse (Stethojoulis balteata) present. Various damselfish, including the brighteye damsel (*Plectroglyphidodon imparipennis*), Hawaiian sergeant (*Abudefduf abdominalis*), and Hawaiian Gregory (*Stegastes marginatus*) are also present. Convict tang and brown surgeonfish feed on the sparse algae present. Conspicuously absent are parrotfish and jacks.

5.9.4 Fauna, Potential Impacts and Proposed Mitigation

Some terrestrial wildlife species may be displaced into surrounding areas during construction as a result of increased activity and noise at the project site. Existing conditions however are expected to return to the area upon the completion of construction. Thus, the project is not expected to have a long-term adverse effect to the area's terrestrial fauna.

The AECOS Consultants, Inc., assessment determined that direct impacts to the marine environment from the proposed project will be minimal. The seawall and revetment basalt boulders host very little life and no sensitive biological resources occur in the immediate project area; any loss of biota will be small with recovery occurring rapidly.

Sea turtles, spinner dolphins, and humpback whales were not observed during the survey; however, they may occur in the project vicinity (although well offshore). The project area is not within the Hawaiian Islands Humpback Whale National Marine Sanctuary, but Humpback whales may occur in offshore waters. The generation of adverse sound levels should not be a problem to protected species, as no blasting or pile driving is anticipated. Monk seals are known to frequent the project area; however, if BMPs are followed, the project will not adversely affect the monk seal or other protected resources.

BMPs will be used to ensure that marine biota of the lagoon and adjacent reef flat are protected from sedimentation and project-related runoff. Construction may cause a temporary increase in turbidity, but this will be minimized with the use of silt curtains. Any brief periods of impaired water quality associated with construction should have minimal long term impacts inside the lagoon or on the nearby reef flat as daily water exchange is high in these areas. Construction will occur on land, which will reduce the risk of cement and construction-related material spills directly into the marine waters (AECOS Consultants, Inc., 2010).

The following BMPs to minimize the potential for adverse effects to threatened and endangered species will be implemented as recommended in the following guidelines provided by the National Marine Fisheries Services (NMFS/PIRO, 2008). As appropriate, adjustments to specific provisions involving the length of time for monitoring may be adjusted to a shorter period (i.e., 10 – 15 minutes) if it is clearly observed by on-site personnel that no marine protected species are present in the work area and safety zone:

- For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. The National Marine Fisheries Service (NMFS) may be contacted for scheduling educational briefings to convey information on marine mammal behavior, and explain why and when to call NMFS and other resource agencies.
- Establish a safety zone around the project area whereby observers will visually monitor this zone for marine protected species 30 minutes prior to, during, and for 30 minutes as a post project activity.
- Upon sighting of a monk seal or turtle within the safety zone during the monitoring time period or during project activity, immediately postpone or halt the activity until the animal has left the zone. Conduct activities only if the safety zone is clear of monk seals and/or turtles.
- If a marine protected species is in the area, either hauled out onshore or in the nearshore waters, a 150 foot buffer must be observed with no humans approaching them. If a monk seal/pup pair is present, a minimum 300 foot buffer must be observed. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).
- In the event that a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, David Schofield at (808) 944-2269, as well as the monk seal hotline at (888) 256-9840. For turtles, contact the turtle hotline at (808) 983-5730.

The requirement for further mitigative measures will be based on regulatory review of the project as required from the respective Federal, State and County governmental agencies. Regulatory review of the project from these agencies may involve the addition of mitigative measures or other controls to reduce impacts to flora and fauna. The applicant shall review the project with the appropriate governmental agencies, thereby reducing the potential for adverse impacts to the environment.

5.10 Archaeological Resources

5.10.1 Description

Cultural Surveys Hawai‘i, Inc. (CSH) conducted an archaeological literature review and study for the proposed project in the report, Repair/Reconstruction of Moanakai Seawall: Archaeological Monitoring Plan for the Moanakai Sea Wall Repair Project, July 2010 (**Appendix D**). The CSH study included historical research on archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near the property. The study also included preparation of a report including the results of the historical research and recommendations for further archaeological work, as appropriate.

The results of the investigation are summarized below in: (1) background research; and (2) recommendations.

5.10.2 Background Research

Historical Uses of the Area

The association of the *ahupua'a* of Kapa'a with legendary historical figures such as Mō'īkeha implies that the area was settled prior to Mō'īkeha's time (early fourteenth century), although the extent of this settlement is not known. Handy (1940) counts Kapa'a as one of the major settlement areas of Kaua'i in pre-contact times, and both Vancouver (1798) and Wilkes (1840) were impressed with this "most fertile and pleasant district" with its fields of "sugarcane, taro" and other crops. Through archaeology and other sources, it is known that at one time agricultural and domestic activities extended into the far *mauka* areas of Kapa'a, but were abandoned by the mid-nineteenth century.

During the Māhele, Kapa'a was retained as Crown Lands. The *'ili* of Paikahawai and Ulukiu in Kapa'a Ahupua'a were retained as Government Lands. Land Commission Awards show that six *maka'āinana* were awarded land parcels in Kapa'a. During the late 19th and early 20th century, Kapa'a experienced the plantation era with the commercial cultivation of sugarcane, rice, and pineapple. Freight shipping and a railroad system also developed to cater to commercial activities of the plantations.

In the 1920s, land immediately *mauka* of the project area was first developed for residential homes. Floods in 1940 led to the dredging and construction of the Waika'ea and Mō'īkeha Canals. Subsequent dredging of the reefs and shoreline north of the project area may be responsible for accelerated erosion along the coast in the area.

The Land Commission Awards (LCAs) pattern in Kapa'a shows *lo'i* and *kula* on the rim of the swamplands and extending into the watered valleys. Marshlands without known LCAs may have had *lo'i* along the edges. However, in the early twentieth century, the entire area behind Kapa'a Town consisted of rice and *kula* lots. Flood control measures were instituted in the 1960s and marshlands, used previously for taro and then taken over by the rice farmers, were drained and became cane and pasture.

Traditional and Legendary Accounts of Kapa'a

Ka Lulu o Mō'īkeha
Kapa'a was the home of the legendary *ali'i*, Mō'īkeha. Akina (1913) tells the story of how Mō'īkeha's son, Kila, stocked the islands with the fish *akule*, *kawakawa*, and *'ōpelu*.

Pāka'a and the wind gourd of La'amaomao (Keahiahi)
Kapa'a also figures prominently in the famous story of Pāka'a, and the wind gourd of La'amaomao. Pāka'a was the son of Kūanu'uanu, a high-ranking retainer of the Big Island ruling chief Keawenuia'umi, and La'amaomao, the most beautiful girl of Kapa'a and member of a family of high status *kahuna*. Kūanu'uanu left the island of Hawai'i, traveled throughout the other islands, and finally settled on Kaua'i, at Kapa'a.

Kaweloleimākua
Kapa'a is also mentioned in traditions concerning Kawelo (Kaweloleimākua), Ka'ililauokekoa (Mo'ikeha's daughter, or granddaughter, dependent on differing versions of the tale), the *mo'o* Kalamainu'u and the origins of the *hīna'i hīnālea* or the fish trap used to catch the *hīnālea* fish, and the story of Lonoikamakahiki.

Kalukalu grass of Kapa'a
Kalukalu is a sedge grass used for weaving mats and is associated with lovers. Kaua'i was famous for this peculiar grass, and it probably grew around the marshlands of Kapa'a.

Previous Findings

The pattern of archaeological studies in Kapa'a Ahupua'a is somewhat skewed, with a dozen projects in urban Kapa'a Town and very little work along the coast. Major archaeological sites have been found in the Kapa'a Town area, including extensive cultural layers with burials and other cultural features underlying Kūhiō Highway near All Saints Gym and near the older part of Kapa'a Town between Waika'ea Canal and Kapa'a Beach Park, *makai* of Kūhiō Highway (Hammatt 1991; Kawachi 1994; Creed et al. 1995; Jourdane 1995; Calis 2000). The *maukamakai* extent of these cultural layers has not been clearly defined. These extensive cultural deposits associated with pre-contact and early historic habitation are known to exist in a relatively narrow sand berm that makes up the physiogeography of Kapa'a.

Marshy areas are *mauka* of Kapa'a Town, although most of the marshlands have been filled in within recent decades. Five *kuleana* awarded during the Māhele are located adjacent to the present highway. The more *mauka* studies (Spear 1992; Chaffee et al. 1994a, 1994b; Hammatt, Ida and Chiogioji 1994; McMahon 1996) are thought to be located towards the *mauka* fringe of the sand berm, approaching more marshy conditions and have generally reported no significant or minimal findings. Less than 1.5 km to the south of Waika'ea Canal is another extensive subsurface cultural deposit that is associated with a pre-contact fishing encampment located at the southern boundary of Waipouli adjacent to Uhalekawa'a Stream (Waipouli Stream) and the ocean (Hammatt et al. 2000). (**see Figure 5-6, U.S. Geological Survey Map**).

No historic properties have been previously identified within the immediate vicinity of the project area, however, due to presence of Mokūle'ia Fine Sandy Loam sediments, human burials or intact cultural materials may be encountered during project activities.

5.10.3 Recommendations

On-site archaeological monitoring is recommended for all ground disturbance conducted below the existing ground surface to facilitate the identification and treatment of any burials that might be discovered during project construction, and to alleviate the project's effect on nonburial archaeological deposits.

Under Hawai'i State historic preservation legislation, "Archaeological monitoring may be an identification, mitigation, or post-mitigation contingency measure. Monitoring shall entail the archaeological observation of, and possible intervention with, on-going activities which may adversely affect historic properties" (HAR, Chapter 13-279-3). For this project, the proposed monitoring program will serve as a mitigation measure that insures proper documentation should historic properties be encountered during development work.

Hawai'i State historic preservation legislation governing archeological monitoring programs requires that each monitoring plan discuss eight specific items (HAR, Chapter 13-279-4). The monitoring provisions below address the eight requirements in terms of the archaeological monitoring for the construction within the project area.

1. *Anticipated Historic Properties:*
   The project area has a potential for pre-contact and post-contact cultural deposits as well as human burials.
2. *Locations of Historic Properties:*
   Historic properties may be encountered anywhere within the project area.
3. *Fieldwork:*
   - *On-site archaeological monitoring is recommended for all ground disturbance activities below the existing ground surface. On-call monitoring consisting of weekly inspections is recommended for all additional ground disturbances. Any departure from this will only follow consultation with and written concurrence from the State Historic Preservation Division (SHPD)/Department of Land and Natural Resources (DLNR).*
   - *The monitoring fieldwork may encompass the documentation of subsurface archaeological deposits (e.g., trash pits and structural remnants) and will employ current standard archaeological recording techniques. This will include drawing and recording the stratigraphy of excavation profiles where cultural features or artifacts are exposed as well as representative profiles. These exposures will be photographed, located on project area maps, and sampled. Photographs and representative profiles of excavations will be taken even if no historically-significant sites are documented. As appropriate, sampling will include the collection of representative artifacts, bulk sediment samples, and/or the on-site screening of measured volumes of feature fill to determine feature contents.*
   - *If human remains are identified, no further work will take place, including no screening of back dirt, no cleaning and/or excavation of the burial area, and no exploratory work of any kind unless specifically requested by the SHPD. All human skeletal remains that are encountered during construction will be handled in compliance with HRS, Chapter 6E-7 and 6E-8 and HAR, Chapter 13-300 and in consultation with SHPD/DLNR.*
4. *Archaeologist's Role:*
   The on-site archaeologist will have the authority to stop work immediately in the area of any findings so that documentation can proceed and appropriate treatment can be determined. In addition, the archaeologist will have the authority to slow and/or suspend construction activities in order to insure that the necessary archaeological sampling and recording can take place.
5. *Coordination Meeting:*
   Before work commences on the project, the on-site archaeologist shall hold a coordination meeting to orient the construction crew to the requirements of the archaeological monitoring program. At this meeting the monitor will emphasize his or her authority to temporarily halt construction and that all historic finds, including objects such as bottles, are the property of the landowner and may not be removed from

the construction site. At this time it will be made clear that the archaeologist must be on site during subsurface excavations, if warranted.

6. *Laboratory work:*
   Laboratory analysis of non-burial related finds will include standard artifact and midden recording, as follows: Artifacts will be documented as to provenience, weight, length, width, type of material, and presumed function. Bone and shell midden materials will be sorted down to species, when possible, then tabulated by provenience, and presented in table form.

7. *Report Preparation:*
   One of the primary objectives of the report will be to present a stratigraphic overview of the project area which will allow for predictive assessments of adjacent properties, which may be the subject of future development. The report will contain a section on stratigraphy, description of archaeological findings, monitoring methods, and results of laboratory analyses. The report will address the requirements of a monitoring report (HAR, Section 13-279-5). Photographs of excavations will be included in the monitoring report even if no historically-significant sites are documented. Should burial treatment be completed as part of the monitoring effort, a summary of this treatment will be included in the monitoring report. Should burials and/or human remains be identified, then other letters, memos, and/or reports may be requested by the Burial Sites Program.

8. *Archiving Materials:*
   All burial materials will be addressed as directed by the SHPD/DLNR. Materials not associated with burials will be temporarily stored at the contracted archaeologist's facilities until an appropriate curation facility is selected, in consultation with the landowner and SHPD.

5.10.4 Potential Impacts and Proposed Mitigation

According to CSH, there are no known archeological sites in the immediate construction area. However, due to the presence of Mokūle'ia Fine Sandy Loam sediments, human burials or intact cultural materials may be encountered during project activities.

On-site monitoring is highly recommended for all ground disturbances. This will include disturbance below the existing ground surface to facilitate the identification and treatment of any burials that might be discovered during project construction, and to alleviate the project's effect on non-burial archaeological deposits. For this project, the recommended on-site monitoring will serve as a mitigation measure to insure proper documentation should historic properties be encountered during construction.

The aforementioned archaeological monitoring plan referenced in Section 5.10.3, Recommendations, fulfills the requirements of HAR, Chapter 13-279-4 and supports the proposed project's historic preservation review under HRS, Chapter 6E-8 and HAR, Chapter 13-284. The plan is intended for review and approval by the SHPD/DLNR.

5.11 Cultural Resources

5.11.1 Description

A review of the proposed project site in accordance with the requirements of Session Laws of Hawai'i (SLH), Act 50, was undertaken by CSH in the report, Repair/Reconstruction of Moanakai Seawall: Cultural Impact Assessment for the Moanakai Seawall Repair Project in July 2010, to identify a correlation between the law and the proposed project (**see Appendix E**).

The use of the project site for traditional or cultural practices is not anticipated to be adversely affected as the project site consists of a previously disturbed area that is adjacent to the shoreline and therefore allows for public shoreline access. The modified condition of the site also includes the presence of introduced plant species (**see Section 5.8, Flora and Fauna**) not normally associated with cultural gathering or use activities.

The following is a summary of the principal findings of the Cultural Impact Assessment (CIA).

The CIA included effort to contact and consult with Hawaiian cultural organizations, government agencies, and individuals with knowledge of and/or concerns about traditional cultural practices, resources, and beliefs related to the project area. In interviews done by CSH with long-time local residents, it was noted that the two main sources of cultural practice in the project area consist of fishing and *limu* gathering; however, the abundance of native species of fish and *limu* have greatly declined over the years. According to CSH all of the participants to the CIA attributed the depletion of ocean resources near the project area to the following factors: predation by the Hawaiian monk seal, sharks, and turtles, among others; windsurfing activities; and the introduction of invasive species such as *ta'ape* (Bluestripe snapper, an introduced species) and *roi* (Striped or Blue spotted grouper, also an introduced species). No impacts directed from the seawall or proposed improvements were implied.

Participants in the interviews also claimed that native plants for *lā'au lapa'au* (traditional plant medicine) are more difficult to find in Kapa'a today. Plants used for *lā'au lapa'au* included *pōpolo* (glossy nightshade), '*uhaloa* (American weed), *kukui* (candlenut), *'ōlena* (tumeric), and plantain. These plants are used for ailments such as colds, congestion, cold sores, sore throat, ear aches, and ulcers. Participants believe that invasive plants like guinea grass, as well as the use of pesticides during the plantation era, have killed many of the useful plants.

The natural vegetation in the surrounding area consists of *kiawe* (*Prosopis pallida*) *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena leucocephala*), and bermudagrass (*Cynodon dactylon*) in the drier areas and Napier grass (*Pennisetum purpureum*), guava (*Psidium guajava*), and joee (*Verbena litoralis*) in the wetter areas (Foote et al. 1972:95; visual confirmation by CSH, 2010). None of these plants were mentioned for use in traditional or cultural practices.

5.11.2 Potential Impacts and Proposed Mitigation

According to CSH the maintenance of access to the ocean for gathering, ceremonial and recreational uses is crucial because the ocean is an extension of the Hawaiian people. Concern regarding project-related contamination of the nearby marine resource system should also be considered since these resources are culturally valuable to Native Hawaiians. Mitigation measures including the use of silt fencing/curtains, berms, and other applicable erosion controls are planned to be in place prior to and during the construction phase to ensure that contaminants do not discharge into the ocean. During construction, BMPs will be employed to prevent potential pollutant (sediment) discharges into storm water runoff. The BMPs will also be maintained for the duration of the construction period (see Section 5.5.2, Potential Impacts and Mitigation Measures, relating to Soils) for further information).

Construction of the proposed project is not expected to adversely impact long term access to the area for fishing or gathering activities. Temporary impacts however, may occur along segments of the approximately 1,050 foot construction area when heavy equipment is in use. During this period as each phase of construction progresses it will be necessary to cordon or restrict access to the immediate area of the seawall undergoing work to maintain public safety and ensure security of the site. The areas of temporary closure however, will not limit access to the shoreline since access will remain open along either side of the work area. This temporary period of closure will also be mitigated through the provision of an alternative access path in the area along Panihi Street. Unrestricted access will return to the site following the completion of construction.

5.12 Noise Conditions

5.12.1 Description

Regulation of noise is governed by the State Department of Health (DOH) through HAR, Title 11, Chapter 46, "Community Noise Control." Allowable day and nighttime noise standards for sensitive receptors have been established for residential, preservation, hotel, apartment, and business districts. Existing noise levels at the site are relatively low due to the existing residential zoning of the site. The maximum allowable day and night noise levels at the project site are as follows:

Time	*Allowable Levels*
7:00 am to 10:00 pm	*55 dBA*
10:00 pm to 7:00 am	*45 dBA*

Construction associated noise is anticipated to result from clearing and grading activities involving the use of a crane, bulldozer, excavator, grader, paver, dump trucks, concrete delivery trucks, jackhammers and other powered hand tools. Construction vehicles and workers will also occasionally have to pass through residential areas as they traverse along Moanakai Road from and to the job site.

5.12.2 Potential Impacts and Proposed Mitigation

The potential noise receptors that may be adversely affected by construction associated noise will primarily include nearby residences and recreational users of the nearby beach and shoreline. However, noise generated from construction activities will for the most part not radiate or extend beyond the immediate surrounding project site. The construction related noise is expected to be temporary, of limited duration, and restricted to daytime hours.

Mitigation measures to address the generation of temporary construction related noise includes:

- All equipment will be properly muffled in accordance with noise and air emissions regulations of the DOH.
- All combustion and air-powered equipment will be maintained in proper working order. Any equipment that is in disrepair shall be replaced or repaired prior to use.
- Work will be limited to weekdays during daylight hours between 8:30 am and 3:30 pm. No work will be scheduled on federal or state holidays.
- The contractor will secure a noise permit from the DOH prior to the initiation of the seawall improvements.

Although the generation of some noise will be unavoidable to accomplish the required repair and restoration of the seawall, the mitigation measures as proposed will help to minimize and reduce construction related noise associated impacts. Upon the completion of work no further construction noise will be generated and pre-existing background noise levels will return to the area.

No further measures are anticipated to be required.

5.13 Air Quality

5.13.1 Description

No sampling data was collected on air quality. Air quality at the project site is generally good due to the regular presence of tradewinds and the location of the site along the eastern coastline of the island. Existing major sources of air pollution are not present with the exception of vehicular exhausts from use of the Moanakai Road.

5.13.2 Potential Impacts and Proposed Mitigation

Construction activities are expected to have little to no impact since the project will be of limited duration, and where engine exhausts may be a source of potential air pollution, all internal combustion equipment will be governed in accordance with applicable state regulations in HAR, Chapters 11-59 and 11-60, relating to Air Pollution Control.

During construction, fugitive dust is expected to be generated. Fugitive dust will be controlled with the regular wetting of the soil by the contractor and/or by the use of dust screens, as required. The use of water for dust control will only be in amounts sufficient to dampen the soils to inhibit the generation of dust without causing sediments to runoff to state waters. There will be no long-term effects to air quality once construction is completed.

5.14 Visual Resources

5.14.1 Description

The Kauaʻi General Plan identifies important scenic resources such as major land forms, open spaces, viewing points, scenic drives, etc. Consequently, the Kawaihau Planning District Heritage Resources map was reviewed to identify such resources that may be affected by the project.

According to the map, the project site lies within the "Residential, Urban Center, Resort, Transportation, Military" resource area and does not provide any natural, historic, cultural, or scenic features directly within the corridor that would be affected by the project (**see Figure 5-7, Scenic Resources**).

5.14.2 Potential Impacts and Proposed Mitigation

The proposed project is expected to have no long-term, indirect or cumulative effects on visual resources. Construction activities will temporarily alter the visual resources of the area, due to the presence of equipment and personnel in the vicinity of the project site, but should not be considered a negative effect, as repairs at the site will advance the aesthetic value of the area once completed. Upon the completion of construction all equipment and personnel will be removed and the site will be permitted to return to existing conditions with no permanent visual intrusion to the site. No mitigation measures are anticipated to be required.

5.15 Socio-Economic Environment and Demographics

5.15.1 Description

The town of Kapaʻa offers an array of hotels, shopping centers, and tourist-oriented shops and restaurants.

In 2000, the Kapaʻa Census Designated Place (CDP) had a total population of 9,472, 3,129 households, and 2,281 families, with the median age of residents at 35.2. The population density was 971.2 people per square mile (375.1/km²). There were 3,632 housing units at an average density of 372.4/sq mi. The racial demographics of the Kapaʻa area included 27.81% White, 0.34% African American, 0.52% Native American, 31.67% Asian, 9.95% Pacific Islander, 1.00% from other races, and 28.72% from two or more races. Hispanic or Latino of any race accounted for 9.46% of the population.

The median income for a household in the 2000 census was $39,448, and the median income for a family was $45,878. Males had a median income of $30,129 versus $25,680 for females. The per capita income for Kapaʻa was $16,878. About 14.1% of families and 15.7% of the population were below the poverty line, including 18.6% of those under age 18 and 12.6% of those aged 65 or over (Hawaiʻi Census, 2000).

5.15.2 Potential Impacts and Proposed Mitigation

In the short term, construction expenditures associated with the proposed project will have a beneficial impact on the local construction industry, and construction activities will benefit the community indirectly through the creation of jobs. Construction crew members will most likely come from all areas of Kaua'i, including some workers from the Kapa'a area. However, the crew size will have no significant effect relative to the local or regional population.

No long-term adverse impacts are expected. The proposed project will not, by itself, stimulate unexpected changes in population. It will, however, accommodate current and future economic and social activities in the area by improving shoreline protection, improving the aesthetics of the shorefront, maintaining access to the shoreline, minimizing adverse effects on neighboring shorelines, preserving existing property, and preventing erosion and sinkholes from reoccurring.

5.16 Public Facilities and Services

5.16.1 Roads and Transportation

Kūhiō Highway is a State Department of Transportation (DOT) operated highway that generally runs along the coastline. Within the project corridor, the highway is the primary thoroughfare providing vehicular access through Kapa'a Town. Kūhiō Highway is a three-lane State arterial highway from its junction with Kapule Highway and Kamoa Road in Waipouli. From Waika'ea Canal, this highway becomes a two-lane road with on-street parking provided through Kapa'a Town. From the northern end of Kapa'a Town up through Anahola, Kūhiō Highway is a two-lane arterial highway. Within Kapa'a Town, the posted speed limit is 25 mph which increases to 50 mph north of the town to Anahola.

Moanakai Road is a narrow two-lane AC road which starts at Keaka Street and runs parallel to the coastline for approximately 1,600 feet. The speed limit on this road is 20 mph.

5.16.2 Roads and Transportation, Potential Impacts and Proposed Mitigation

Short-term construction activities associated with the project will involve the use of a crane and/or bulldozer/backhoe to move heavy boulders and form the appropriate slope for the seawall revetment. This use of equipment may require temporary lane closures along segments of the Moanakai Road to maintain public safety. Portions of the Kūhiō Highway could also be disrupted by the movement of construction vehicles and equipment that are in transit to the site.

As required, a traffic control plan will be prepared and coordinated with the Department of Public Works and required County and State agencies for review and approval. The traffic control plan will identify the use of specific vehicular controls and safety equipment to maintain the flow of traffic around active areas of work. This would include the use of signage, and flagmen or police officers to direct the flow of traffic during construction activities.

5.16.3 Utilities

There are no utilities present that would be affected by the proposed project.

5.16.4 Utilities, Potential Impacts and Proposed Mitigation

No utilities to the surrounding area are expected to be impacted during the proposed improvements. No mitigation measures are anticipated and none are proposed.

5.17 Solid Waste

5.17.1 Description

The County of Kaua'i operates an island-wide system of municipal solid waste collection and disposal. The Kekaha Landfill is a County owned facility serving as the primary disposal site for solid waste. Refuse transfer stations that serve as collection points for solid waste requiring disposal are located throughout the island. The Kapa'a Transfer Station is the closest station serving the project site.

The proposed project is expected to generate construction related waste typical of similar projects involving earthwork and construction of a seawall. The waste generated is expected to consist of vegetation, rocks and sediments, and construction related waste and expended materials. Whenever possible excavated materials will be reused either on-site or for other County related projects.

5.17.2 Potential Impacts and Proposed Mitigation

The construction of the proposed project is not expected to result in long term impacts to solid waste facilities based on the limited scope and scale of work. Short-term impacts are anticipated in the form of construction debris that will be generated requiring disposal. The construction contractor shall be responsible for the disposal of construction debris at a county-approved landfill or disposal site in conformance with County regulations.

Materials excavated from the site that are intended to be reused will either be stockpiled on-site at a designated location or hauled off-site for reuse by the County.

5.18 Recreational Resources

5.18.1 Description

The project area is located within coastal Kapa'a and is used by residents and visitors for recreation and fishing. Baby Beach, as shown in **Photo 7,** abuts the north end of the Moanakai Seawall. It is a safe place for children to swim due to protection from the reef. The beach is used daily, particularly by families with children. The area is also a popular kite surfing site due to the prevailing trade winds. In addition, ironwood trees along the seawall provide shade and a scenic location for people to drive through and park on the *makai* side of Moanakai Road.

Various segments along the Moanakai Road are also widely used by fishermen to access the ocean. Consultations by CSH with community members indicated that all participants were long-time fishermen in the ocean area fronting Baby Beach. Participants spoke particularly of skin diving for fish in the area. However, all participants agreed that the reef adjacent to the project area has changed with less fish and seaweed over time. All participants attributed the depletion of ocean resources near the project area to a number of factors that include predators such as the Hawaiian monk seal, sharks, and turtles; windsurfing activities; and the introduction of invasive species such as *ta'ape* and *roi* (CSH, 2010).

Photo 7: Baby Beach (Source: Cultural Surveys Hawai‘i, Inc.)

5.18.2 Potential Impacts and Proposed Mitigation

As described above, Moanakai Road is used as a beach access road for shoreline recreation, as well as for fishing. However, should construction for the proposed project commence, work should not significantly affect beach access because both Baby Beach and the ocean can be accessed from Panihi Street, north of the project area.

The period of time involving closure of Moanakai Road is expected to be temporary and will last only for the duration that mobilization, construction activities, and use of the detour beach access is required. Upon completion of all work the area will be reopened to the public as prior to construction.

Section 5 – Figures

Repair/Reconstruction of Moanakai Seawall

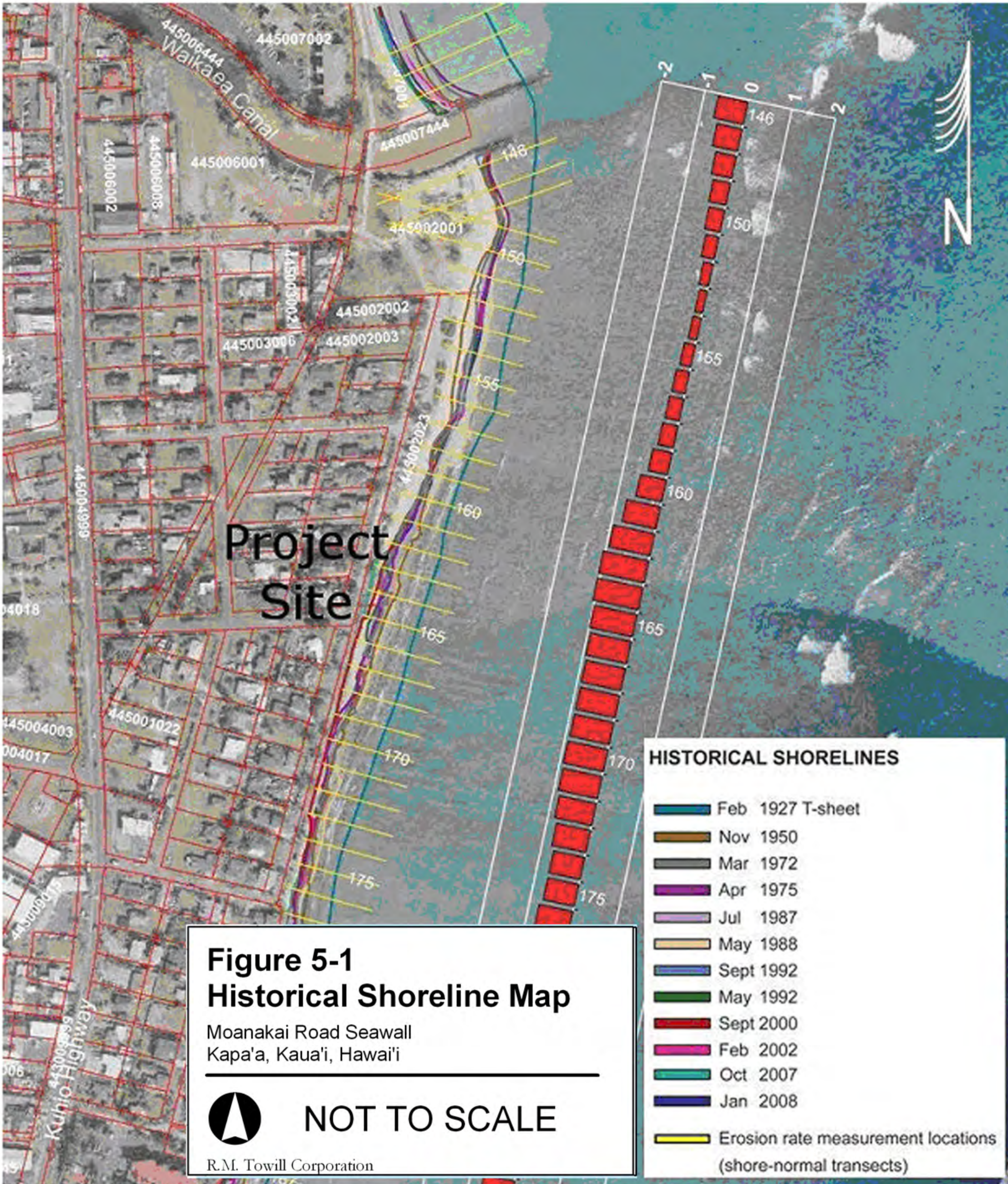


Figure 5-1
Historical Shoreline Map

Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

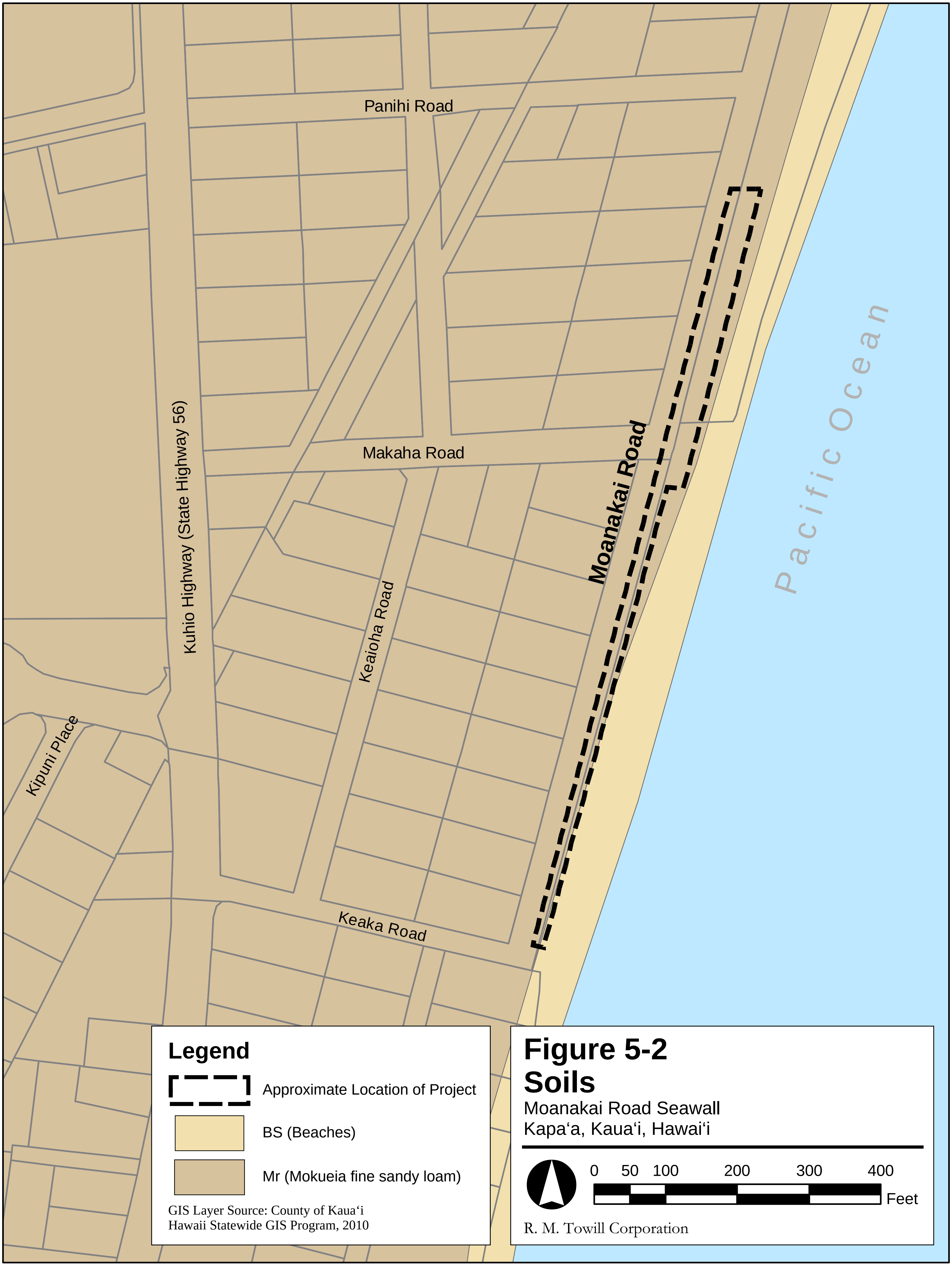


Figure 5-2
Soils
Moanakai Road Seawall
Kapaʻa, Kauaʻi, Hawaiʻi

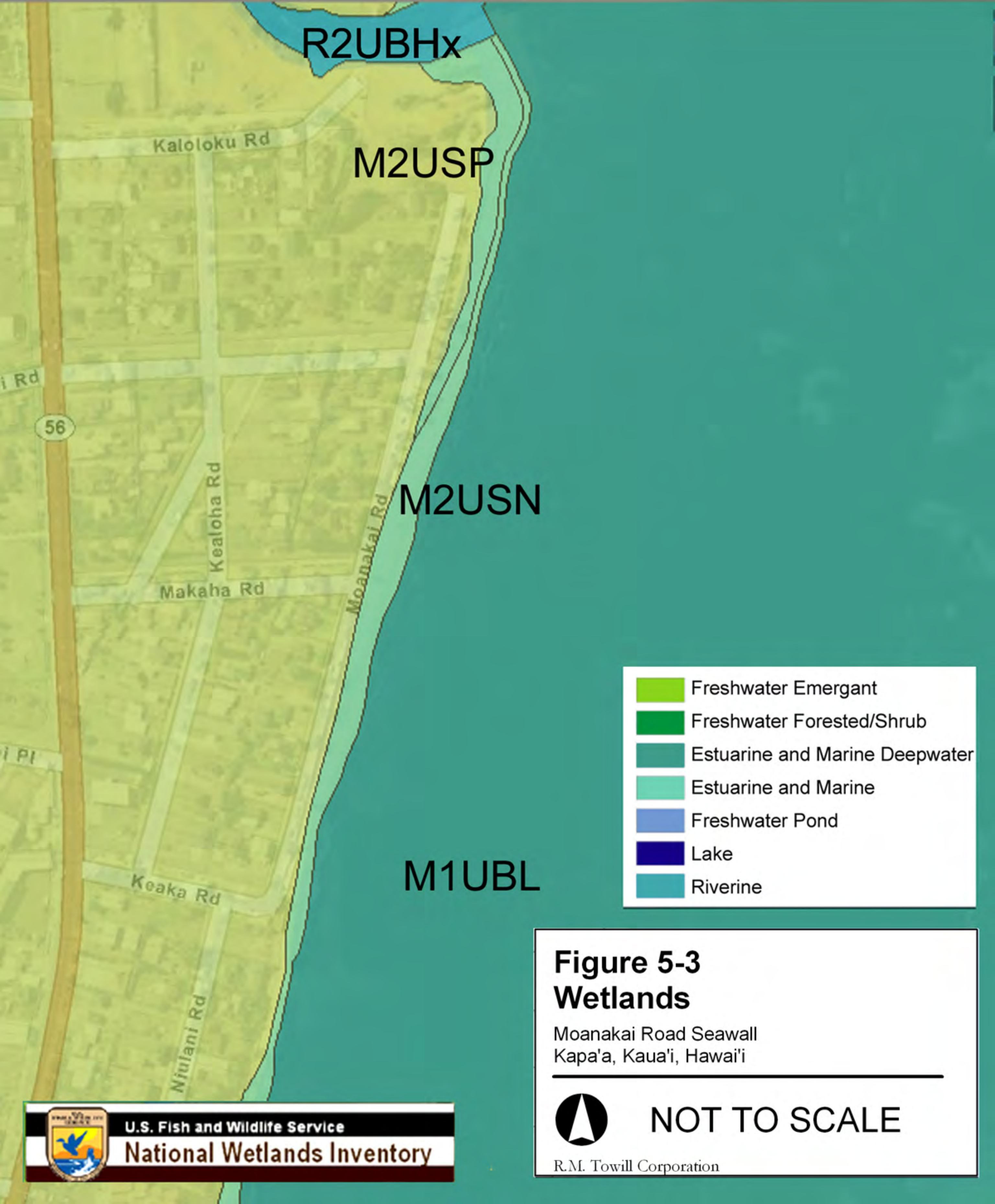


Figure 5-3
Wetlands

Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

Figure 5-4
Tsunami Hazard Map
Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

Legend

Zone X An area that is determined to be outside the 100- and 500-year floodplains.

Zone AE An area inundated by 100-year flooding, for which BFEs have been determined.

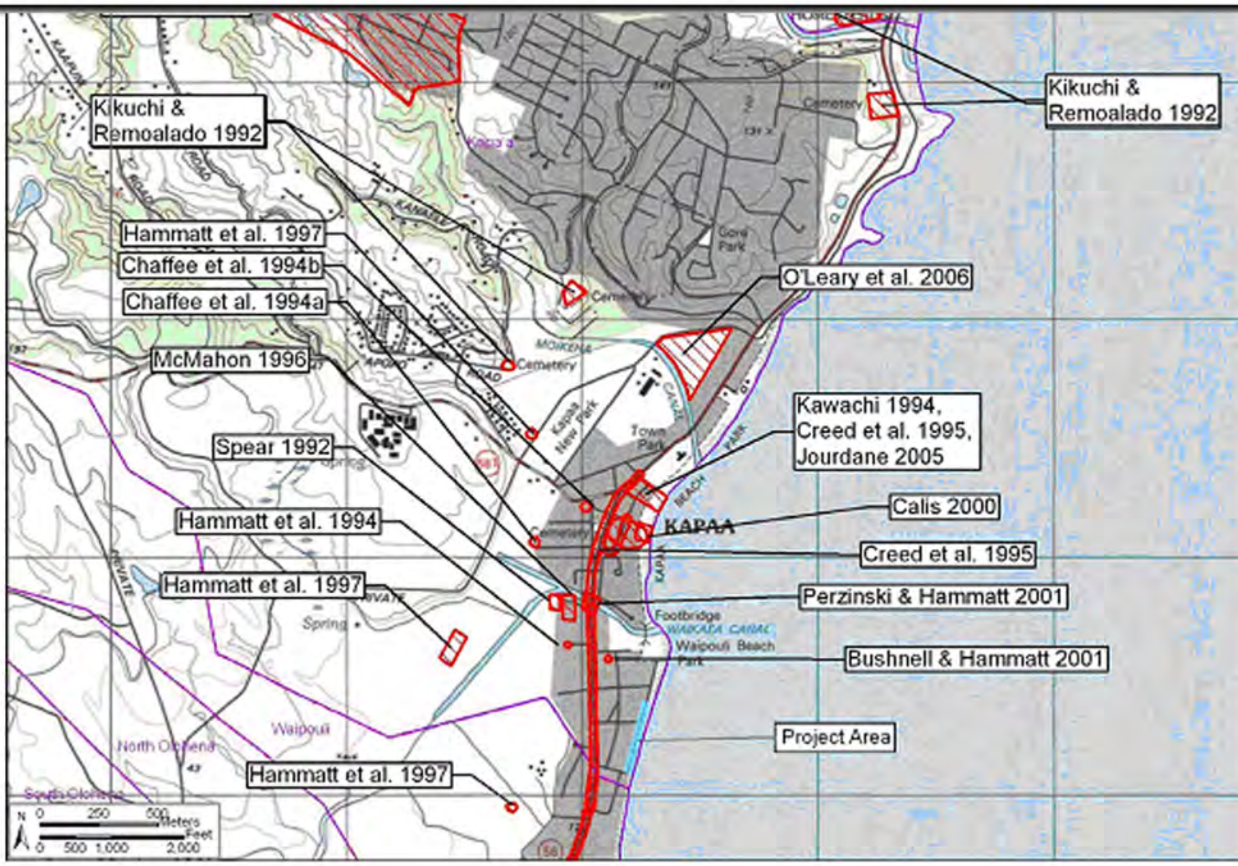
Zone VE An area inundated by 100-year flooding with velocity hazard (wave action); BFEs have been determined.

Figure 5-5
Flood Zones

Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

NOT TO SCALE

R.M. Towill Corporation



U.S. Geological Survey Map, showing location of previous archaeological studies in Kapa'a

(Source Cultural Surveys Hawai'i, Inc.)

Figure 5-6
U.S. Geological Survey Map

Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

NOT TO SCALE

R.M. Towill Corporation

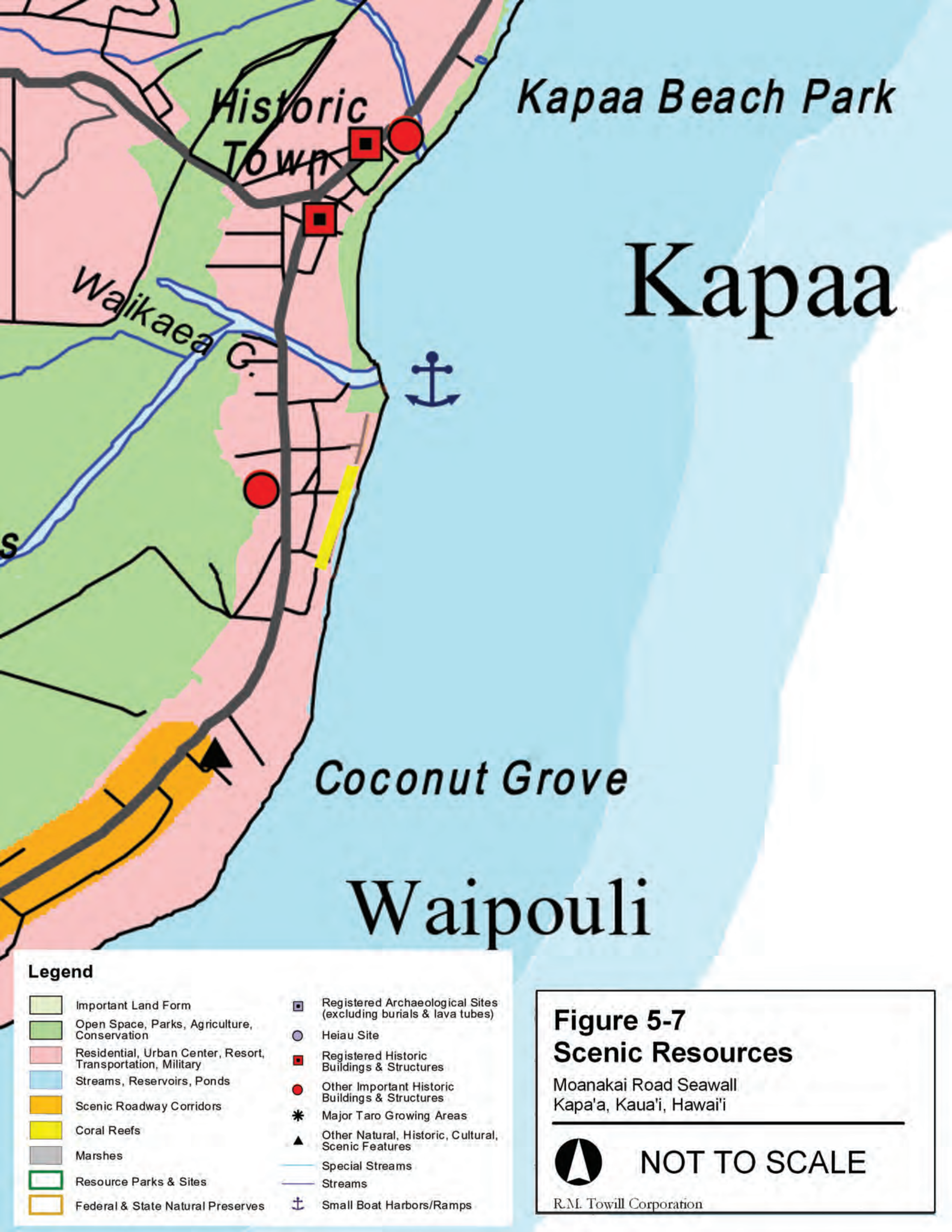


Figure 5-7
Scenic Resources
Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

Section 6
Relationship to Land Use Policies, Plans, and Controls

6.1 Overview

Federal, State and County of Hawai'i policies, plans, and land use controls are established to guide development in a manner that enhances the environment and quality of life. The establishment of policies, plans, and land use controls at all levels of government are further promulgated to help ensure that the long-term social, economic, environmental, and land use needs of the community and region can be met. The proposed project's relationship to land use policies, plans, and controls for the region and proposed activity are as follows.

6.2 Federal

Various activities required to construct the project will trigger permitting requirements under the Clean Water Act (CWA). These include the following:

1. Section 404 of the CWA will require a permit before dredge or fill activities may be discharged into waters of the United States. The U. S. Army Corps of Engineers (USACE), Regulatory Branch, and the Department of Health (DOH), Clean Water Branch, will be consulted for the proposed project to identify permitting requirements pertinent to their respective areas of jurisdiction under to the Clean Water Act. A jurisdictional determination from the USACE will be sought. The determination will identify the requirements for a Section 404 Permit from the Department of the Army (DA).

2. Section 401 of the CWA requires a Water Quality Certification (WQC) for actions that require certain Federal permits (such as the Section 404 Permit to conduct an activity, construction or operation that may result in discharge to waters of the United States. The DOH, Clean Water Branch issues the WQC for Hawai'i waters.

3. Section 402 of the CWA requires NPDES permits for point source discharges including storm water discharges associated with construction activities that disturb a land area of 1 acre or more and discharge storm water from construction sites to waters of the U. S. The DOH-CWB issues the NPDES for Hawai'i waters.

   Two NPDES permits will be required based on discharges of construction stormwater[4] and the need for construction dewatering during construction activities to restore the revetment[5].

   In order to maintain compliance with NPDES permitting requirements, methods, measures, and practices that will be included for the NPDES NOI Forms C and G permit applications will involve the provision of BMP Plans to treat effluent and dewatering discharges from the area of work. The BMPs will provide, but not be limited to the following:

[4] NPDES Notice of Intent (NOI) Form C, Construction Stormwater Permit Application.
[5] NPDES Notice of Intent (NOI) Form G, Construction Activity Dewatering Effluent

- A Site-Specific BMPs plan will be prepared to minimize and prevent runoff and discharges of pollutants into State waters. The BMP Plans will be prepared by the construction contractor as part of the project construction plan and will be submitted to the DOH-CWB for review and approval.
- Discharge pollution prevention measures will be employed in all phases of the project.
- Control measures to prevent discharges of untreated effluent will be in place and functional before construction activities begin, and will be maintained throughout the construction period.
- The BMPs will include guidelines and mitigation measures to minimize and prevent runoff, discharge pollution, and other detrimental effects related to construction activities. In addition, contingency plans will be included as part of the BMPs to address the potential for heavy rain conditions.

The NPDES NOI Form G and C permit applications will be prepared in compliance with HAR, Chapter 11-54, Water Quality Standards, and Chapter 55, Water Pollution Control.

6.3 State of Hawai‘i

6.3.1 Hawai‘i State Plan

The Hawai‘i State Plan, adopted in 1978, and promulgated in HRS, Chapter 226, consists of three major parts:

Part I, describes the overall theme including Hawaii’s desired future and quality of life as expressed in goals, objectives, and policies.

Part II, Planning Coordination and Implementation, describing a statewide planning system designed to coordinate and guide all major state and county activities and to implement the goals, objectives, policies, and priority guidelines of the Hawai‘i State Plan.

Part III, Priority Guidelines, which express the pursuit of desirable courses of action in major areas of statewide concern.

The proposed project is consistent with the objectives and policies of the Hawai‘i State Plan. Specifically, the proposed action will reduce impacts associated with the potential threat of hazards and disasters. Described below are sections of the Hawai‘i State Plan’s goals, objectives, and policies that are relevant to the proposed action.

§226-13 Objectives and policies for the physical environment--land, air, and water quality. (a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:

(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.

(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

(6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.

(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors. [L 1978, c 100, pt of §2; am L 1986, c 276, §12]

The proposed project will reduce the threat to life and property from erosion, flooding, tsunamis and hurricanes. The design and development of this project will address the needs of the community and region through the improvement of an existing facility for shoreline protection, to maintain access to the shoreline, to minimize adverse effects on neighboring shorelines, and to preserve existing property. The project will be developed in accordance with all laws and regulations necessary to ensure against the potential for adverse environmental effects.

6.3.2 State Land Use Law

The State Land Use Commission classifies all lands in the State of Hawai'i into one of four land use designations: Urban, Rural, Agricultural and Conservation. According to HRS, Chapter 205, an explanation of land use districts is provided:

> *"Chapter 205, HRS, Districting and classification of lands:"*
>
> *"(a) There shall be four major land use districts in which all lands in the State shall be placed: urban, rural, agricultural and conservation. The land use commission shall group contiguous land areas suitable for inclusion in one of these four major districts. The commission shall set standards for determining the boundaries of each district provided that:"*
>
> *"(1) In the establishment of boundaries of urban districts those lands that are now in urban use and a sufficient reserve area for foreseeable urban growth shall be included;"*
>
> *"In establishing the boundaries of the districts in each count, the commission shall give consideration to the master plan or general plan of the county."*
>
> *(b) Urban districts shall include activities or uses as provided by ordinances or regulations of the county within which the urban district is situated.*

The proposed action would involve activity on land classified as Urban. The proposed project does not require changing the existing State Land Use designation as the current designation is compatible with the proposed seawall improvements. County of Kaua'i land uses within the Urban District are regulated through the Zoning Ordinance, Chapter 8. No action from the State Land Use Commission is required to implement the proposed seawall repairs (**see Figure 6-1, State Land Use District**).

6.3.3 Coastal Zone Management Act (CZMA)

All land and water use activities in the state are required to comply with Hawaii's Coastal Zone Law in HRS, Chapter 205A. The State designates the Coastal Zone Management Program (CZMP) to manage the intent, purpose and provisions of HRS, Chapter 205(A)-2, as amended, for all areas from the shoreline to the seaward limit of the State's jurisdiction, and any other area which a lead agency may designate for the purpose of administering the CZMP.

The following is an assessment of the project with respect to the CZMP objectives and policies set forth in Section 205(A)-2.

1. Recreational resources

   Objective: Provide coastal recreational opportunities accessible to the public.

   Policies:

   A) Improve coordination and funding of coastal recreational planning and management; and

   B) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

(i) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

(ii) Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(iv) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

(v) Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;

(vii) Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

Recreational and shoreline facilities, and public access to the shoreline will not be permanently affected by the project; area activities can commence as soon as construction is completed and the site demobilized by the contractor. Residents will not be adversely affected but may be temporarily limited by equipment noise, dust, and construction related traffic that will be minimized and mitigated to the extent practicable. Moanakai Road is also widely used by fishermen to access the ocean. Consultation by CSH, Inc., with community members indicated that all participants were long-time fishermen in the ocean area fronting Baby Beach. Construction should not significantly affect beach access because both Baby Beach and the ocean will remain accessible from Panihi Street, north of the project area.

2. Historic resources

Objective: Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in (C) and American history and culture.

Policies:

(A) Identify and analyze significant archaeological resources;

(B) Maximize information retention through preservation of remains and artifacts or salvage operations; and

(C) Support state goals for protection, restoration, interpretation, and display of historic resources.

There are no archaeological or cultural resources that are known to be present within the immediate area of the seawall, as much of the project vicinity had been previously disturbed during the construction of the preexisting seawall and roadway. However, in accordance with HRS, Chapter 6E and the requirements of the DLNR, SHPD, should any historic resources, including human skeletal and significant cultural remains, be identified during the construction of the proposed project: (1) work will cease in the immediate vicinity of the find; (2) the find will be protected from any additional disturbance by the contractor; and (3) the SHPD, will be contacted immediately at (808)

692-8015 (Kauaʻi) or (808) 692-8015 (Main Office, Oʻahu) for further instructions including the conditions under which work activities may resume.

3. Scenic and open space resources

Objective: Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

(A) Identify valued scenic resources in the coastal zone management area;

(B) Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural land forms and existing public views to and along the shoreline;

(C) Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and

(D) Encourage those developments that are not coastal dependent to locate in inland areas.

The potential for adverse visual impacts is anticipated to be minimal. The improvements are on the existing seawall; so there will be no drastic changes to visual resources in the area. The proposed project is expected to be consistent with the surrounding use of land to meet the growing need of repair to the structure. Public access to the area will be maintained during the construction period; however, residents may be affected by equipment noise, dust, and construction related traffic. These activities will be limited to the Moanakai Road seawall for a temporary period of time and will not cause any permanent changes to any scenic or open space resources.

4. Coastal ecosystems

Objective: Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(B) Improve the technical basis for natural resource management;

(C) Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;

(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Coastal ecosystems will not be affected by the project. No use of the coastal ecosystem will be required. During construction, BMPs will be employed to prevent potential pollutant (sediment) discharges in storm water runoff and will be in place and functional before project activities begin. All designated BMPs will be maintained throughout the construction period.

5. Economic uses

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

(A) Concentrate coastal dependent development in appropriate areas;

(B) Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

(i) Use of presently designated locations is not feasible;

(ii) Adverse environmental effects are minimized; and

(iii) The development is important to the State's economy.

The proposed project has been assessed for potential social, visual, and environmental impacts in accordance with County of Kaua'i regulations. With implementation of the mitigation measures as identified in this document, no adverse impacts are expected to result. In the short term, construction expenditures will have an overall beneficial impact on the local construction industry, and construction activities will benefit the community indirectly through the limited creation of jobs.

6. Coastal hazards

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.

Policies:

(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

(D) Prevent coastal flooding from inland projects.

The proposed project has been evaluated for potential impacts associated with natural hazards including flooding, erosion, and pollution. Natural hazards such as hurricanes, flooding, and tsunami are unavoidable for coastal areas. To mitigate from hurricanes, the proposed project will ensure that improvements are designed to present building and construction codes which offers some protection from damage. To mitigate tsunami and storm surge impacts, engineering analyses will be preformed that will determine proper design criteria. Given the requirement for the proposed project to be located within proximity of the shoreline, the proposed use is considered reasonable and is not anticipated to have a significant impact on flood conditions.

7. Managing development

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;

(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and

(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

The proposed project conforms to all State and County of Kauaʻi land use regulations. A comprehensive list of permits that may be required can be found in Section 7, <u>Permits and Approvals That May Be Required</u>. While the proposed project site is under jurisdiction of the CZMA, no coastal resources will be adversely affected.

8. Public participation;

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

(A) Promote public involvement in coastal zone management processes;

(B) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

(C) Organize workshops, policy dialogues, and site-specific mitigation to respond to coastal issues and conflicts.

The provision for public participation will be provided through the environmental review process promulgated in HRS, Chapter 343. Public comments will be received during the public comment period associated with the filing of the Draft Environmental Assessment for this project. In addition, environmental permit applications filed for the subject project will be subject to governmental agency and public review as required under law.

9. Beach protection;

Objective: Protect beaches for public use and recreation.

Policies:

(A) Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;

(B) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

(C) Minimize the construction of public erosion-protection structures seaward of the shoreline.

The proposed project is designed to repair and restore the seawall not only to improve shoreline protection, but to improve the aesthetics of the shorefront, maintain access to the shoreline, minimize adverse effects on neighboring shorelines, preserve existing property, and prevent erosion and sinkholes from reoccurring.

10. Marine resources

Objective: Promote the protection, use, and development of marine and coastal resources to assure their sustainability.

Policies:

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

> *(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*
>
> *(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*
>
> *(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*
>
> *(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

Marine biological, water quality, and coastal engineering assessments were conducted to determine the effect of the proposed project on marine resources. These studies are included in this document (**see Appendices**). All necessary permit applications and environmental and building approvals will be secured prior to the initiation of construction activities. See Section 7, <u>Permits and Approvals That May Be Required</u>, for further detail.

6.4 County of Kauaʻi

6.4.1 General Plan

The County of Kauaʻi's General Plan (GP) is a policy document for the long range comprehensive development of the Island of Kauaʻi. According to the County of Kauaʻi, the GP provides the legal basis for all subdivision, zoning and related ordinances. It also provides the legal basis for the initiation and authorization for all public improvements and projects.

> *1.2 Purpose*
>
> *Pursuant to the provisions of the Charter for the County of Kaua'i, the General Plan sets forth in graphics and text, policies to govern the future physical development of the county. The General Plan is intended to improve the physical environment of the County and the health, safety and general welfare of Kaua'i's people.*
>
> *The General Plan states the County's vision for Kaua'i and establishes strategies for achieving that vision. The strategies are expressed in terms of policies and implementing actions. They may be augmented and changed as new strategies are developed.*
>
> *The General Plan is a direction-setting, policy document. It is not intended to be regulatory. It is intended to be a guide for future amendments to land regulations and to be considered in reviewing specific zoning amendment and development applications.*
>
> *The vision, the maps and text policies, and the implementing actions are intended to guide county actions and decisions. In addition, the maps and text policies are intended to guide the County in specific types of actions: making revisions to land use and land development regulations; deciding on zoning changes; preparing and adopting Development Plans and Public Facility Plans; and preparing and adopting capital improvement plans.*

Chapter 3, Caring for Land, Water and Culture, identifies the specific relationship of the project to the GP:

> *"Kaua'i's coastal areas are safeguarded to preserve beaches, natural landmarks, Hawaiian fishponds and other Native Hawaiian sites. Coral reefs, surfing sites and fishing grounds are also protected. The beaches and shoreline area belong to the public trust, and the County assures that access from public roads to the shoreline is maintained and improved."*

The proposed project will repair and restore the seawall not only to improve shoreline protection, but also to improve the aesthetics of the shorefront, maintain access to the shoreline, minimize adverse effects on neighboring shorelines, preserve existing property, and prevent erosion and sinkholes from reoccurring.

6.4.2 Special Management Area

The County of Kaua'i has designated the shoreline and certain inland areas of Kaua'i as being within the Special Management Area (SMA). SMA areas are designated sensitive environments that should be protected in accordance with the State's Coastal Zone Management policies, as set forth in HRS, Section 205A, Coastal Zone Management.

The entirety of the proposed project is located within the SMA (**see Figure 6-2, Special Management Area**). Based on the location of the proposed project within the SMA, a SMA permit application will be prepared and filed with the County of Kaua'i Planning Department.

6.4.3 Zoning

According to the County of Kaua'i Zoning Map, the project site is zoned as within the Urban Center zoning district (**see Figure 6-3, Zoning**). No change to the zoning of the project site will be necessary as work will be to restore an existing public facility. According to County Ordinance, Chapter 8, Comprehensive Zoning Ordinance, a Shoreline Setback Variance permit will be required for this project:

> *Sec. 8-13.4 Permits Required.*
>
> *(a) A Class IV Zoning Permit is required for any construction, development, use or activity proposed to be carried out within forty (40) feet of the upper reaches of the wash of waves other than storm or tidal waves, or within the shoreline setback area as established by the State Land Use Commission pursuant to Chapter 205, HRS, whichever is the lesser. The Planning Commission shall issue a permit only if the requirements of both Chapter 205, HRS and this Chapter have been met.*

Section 6 – Figures

Repair/Reconstruction of Moanakai Seawall

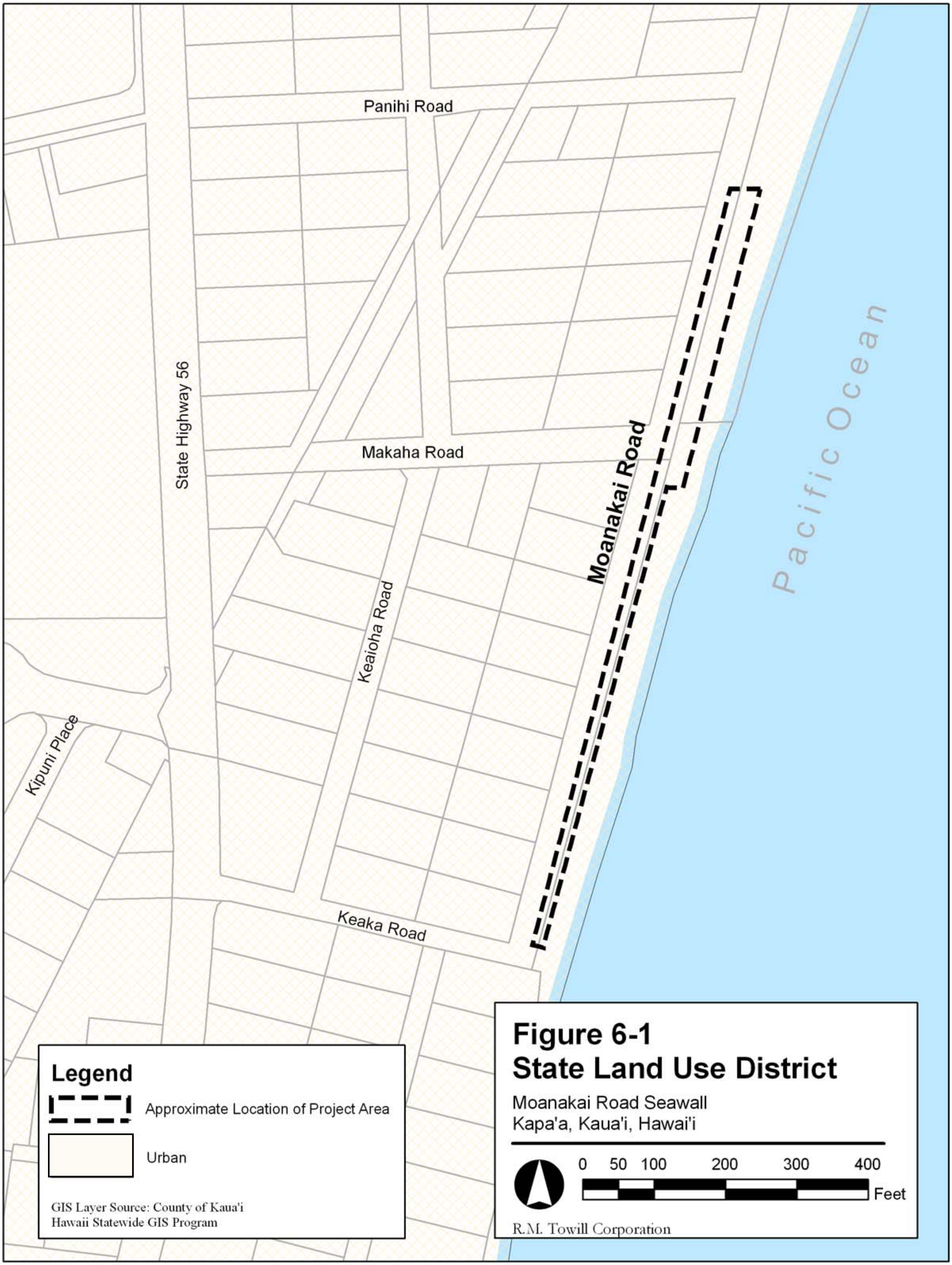


Figure 6-1
State Land Use District
Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

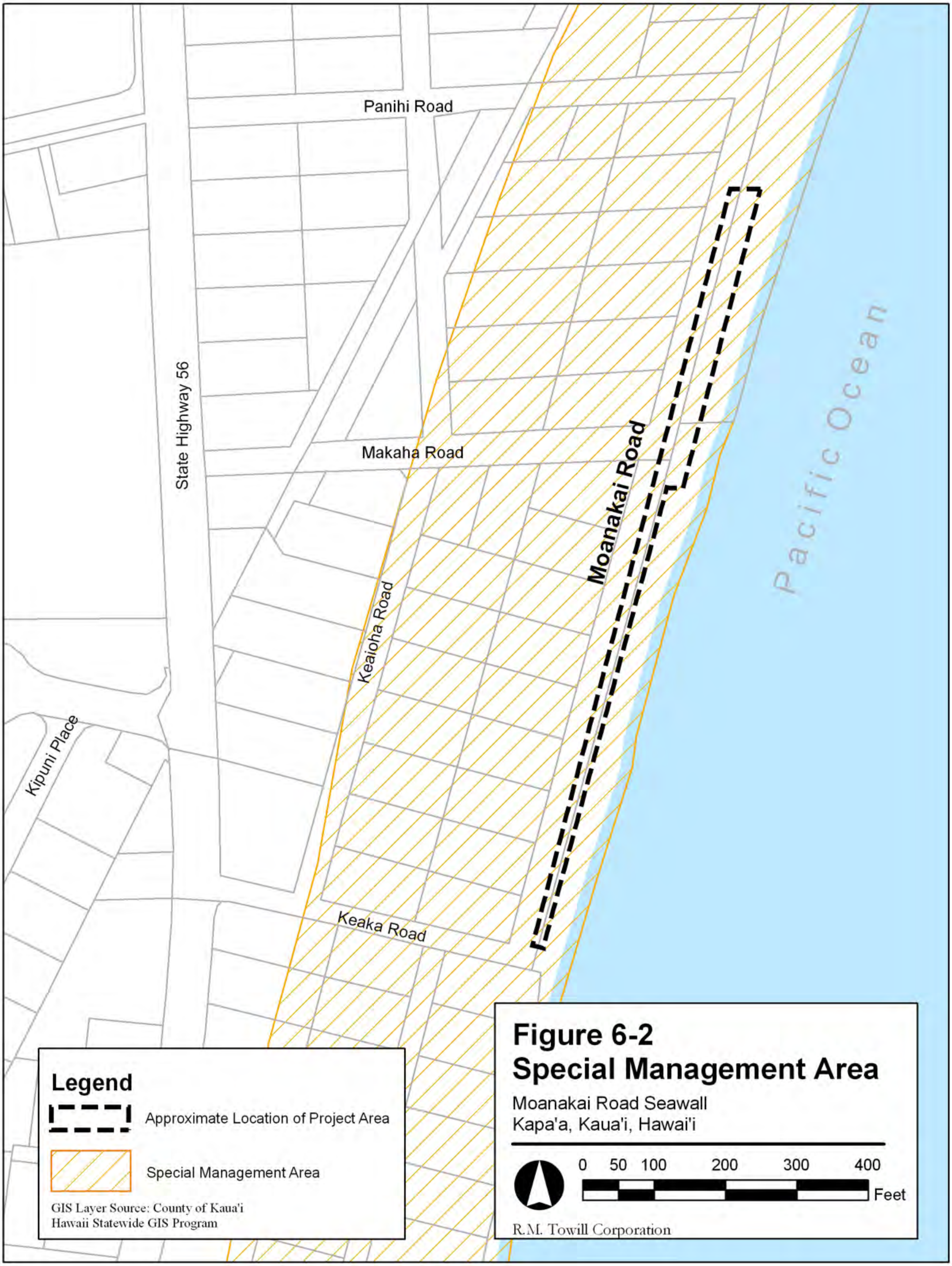


Figure 6-2
Special Management Area
Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

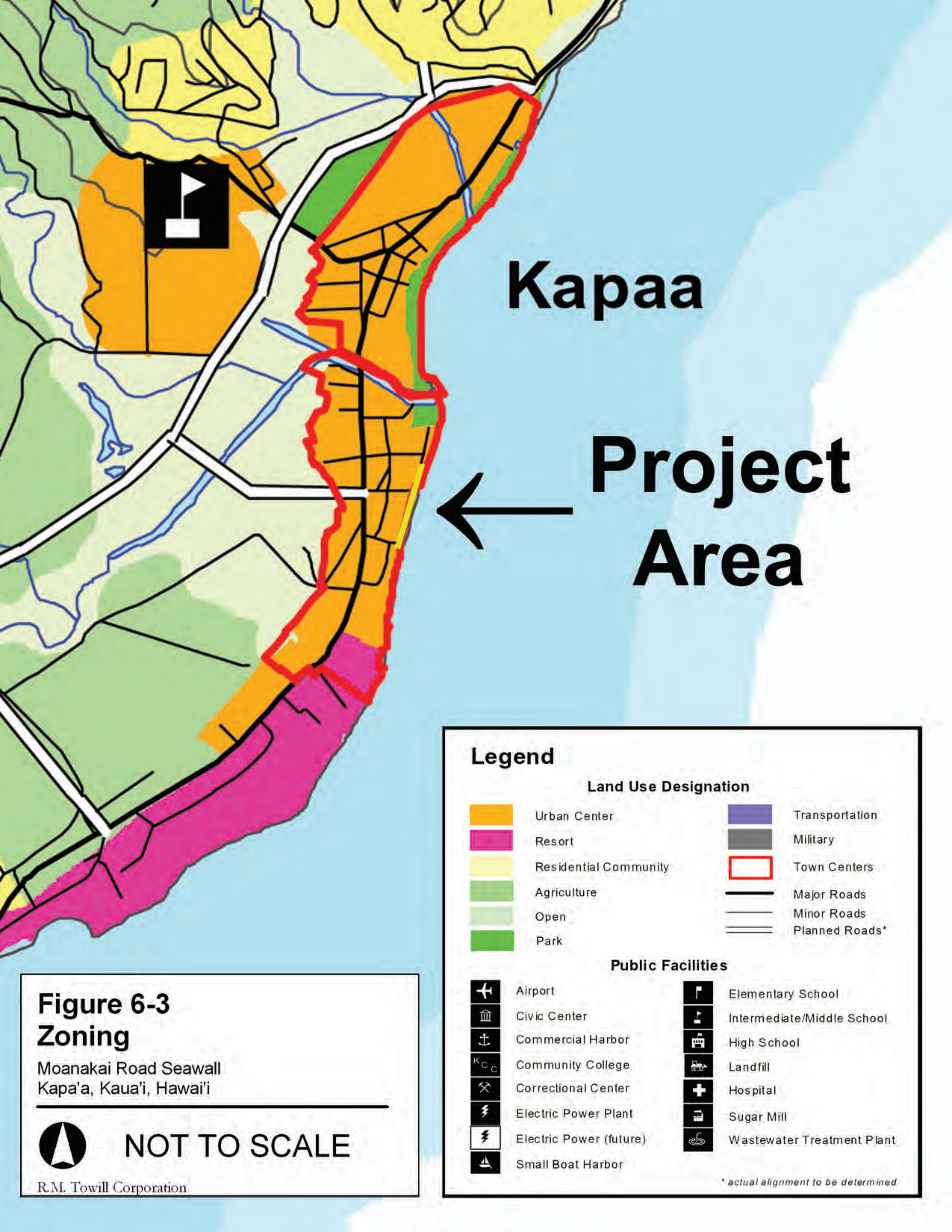


Figure 6-3
Zoning

Moanakai Road Seawall
Kapa'a, Kaua'i, Hawai'i

Section 7
Permits and Approvals That May Be Required

7.1 Federal

Department of the Army Permit Application (Section 404, CWA/
Section 10 Rivers and Harbors Act of 1899)
U. S. Army Corp of Engineers

7.2 State of Hawai'i

Section 401, Water Quality Certification Permit Application
Department Health (DOH), Clean Water Branch

Coastal Zone Management Federal Consistency Determination Permit Application
Department of Business, Economic Development, & Tourism
State Office of Planning

Conservation District Use Permit
Office of Conservation and Coastal Lands,
Department of Land and Natural Resources (DLNR)

State Certified Shoreline Determination
State Survey Office, Department of Accounting and General Services (DAGS), and
Office of Conservation and Coastal Lands, DLNR

NPDES General Permit Applications:
Notice of Intent (NOI) Form C: Storm Water Associated with Construction Activities
and NOI Form G: Construction Activity Dewatering
DOH, Clean Water Branch

7.3 County of Kaua'i

Shoreline Setback Variance Permit Application
County of Kaua'i, Planning Department

Special Management Area Permit Application
Kaua'i Planning Department

Construction Plan Approvals and Road Permit
Kaua'i, Department of Public Works

Section 8
Agencies and Organizations Consulted for the Environmental Assessment

The following agencies, organizations, and individuals will be contacted during the Chapter 343, HRS, environmental review process to disclose the environmental conditions of the site, the proposed undertaking, and the potential impacts and mitigation measures that will be applied to ensure against adverse impacts.

8.1 Federal

U. S. Army Corps of Engineers

U. S. Fish and Wildlife Service (as applicable)

8.2 State of Hawai'i

Department of Land and Natural Resources

State Historic Preservation Division

Department of Transportation – Highways Division

Department of Civil Defense

8.3 County of Kaua'i

Department of Public Works

Planning Department

Department of Water Supply

Department of Civil Defense

Fire Department

Police Department

8.4 Elected Officials, Organizations and Individuals

State Senator Ronald D. Kouchi, 7th Senatorial District

State Representative Derek S.K. Kawakami, 14th Representative District

Kaua'i County Council Chair Jay Furfaro

Section 9
Summary of Effects

9.1 Short Term Effects

Short term effects associated with the proposed project will be principally during the construction phase. The County of Kaua‘i and its designated contractor will require access to the project site via Moanakai Road. Noise will be temporarily generated from construction and related mobilization of equipment for the temporary duration of work. Construction equipment is expected to include, but not be limited to, a crane, backhoe(s), front-end loader(s), or excavator(s), dump trucks and powered hand tools. All equipment will be muffled in accordance with standard engine operating practices to minimize noise. Upon construction completion, noise levels will return to ambient levels.

Fugitive dust may be generated during construction. The contractor will be required to control fugitive dust through the regular wetting of soils and ground areas susceptible to the generation of dust during work activities. Only enough water will be used to wet the surface of ground areas and prevent the generation of runoff.

Protection of water quality will be through the use of mitigative measures including silt fencing/curtains, berms, and other applicable erosion controls to prevent construction stormwater related soils and silt from leaving active areas of work. Specifications for the use of these measures will be through the construction plan approval process and the required NPDES permit applications that will be filed prior to the start of work.

Upon completion of work all construction equipment, machinery, and personnel will be demobilized from the job site with no further disturbance to the area. As required, all debris and waste materials will be disposed of at an approved refuse facility, and active areas of work will be replanted as required with vegetation similar to that found at the existing site.

9.2 Long Term Effects

Long term benefits derived from this project include improved shoreline protection, improved aesthetics of the shorefront, provision to maintain access to the shoreline, and the minimization of adverse effects on neighboring shorelines through proper engineering and design of the proposed seawall repairs. The project will benefit residents and visitors who use the area for habitation and recreational activities as it will prevent future erosion from dilapidation of the existing seawall.

No long term adverse effects are anticipated. Upon the completion of work, all equipment used on-site will be demobilized and all debris and waste materials disposed of at an approved County refuse facility.

9.3 Significance Criteria

In accordance with the provisions set forth in HRS, Chapter 343, and the significance criteria in HAR, Chapter 11-200-12, this Environmental Assessment has preliminarily determined that the project will have no significant adverse impact to air and water quality, existing utilities, noise, archaeological or cultural sites, or wildlife habitat. All anticipated impacts will be temporary and will not adversely impact the environmental quality of the area.

According to the Significance Criteria:

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;*

The proposed project is not anticipated to adversely impact any natural or cultural resources. The existing project site was previously disturbed by clearing and grading to accommodate paving and construction of the existing Moanakai Road and seawall. If any potential remains (natural or cultural) exist at the site, such remains are expected to have been recovered or destroyed during prior development activities.

However, in the event that any remains or artifacts are encountered, practices as identified in <u>Section 5.10 Archaeological Resources</u>, will be applied. In accordance with HRS, Chapter 6E and the requirements of the DLNR, SHPD, should any historic resources, including human skeletal and significant cultural remains, be identified during the construction of the proposed project: (1) work will cease in the immediate vicinity of the find; (2) the find will be protected from any additional disturbance by the contractor; and (3) the SHPD, will be contacted immediately at (808) 692-8015 (Kauaʻi) or (808) 692-8015 (Main Office, Oʻahu) for further instructions including the conditions under which work activities may resume.

2. *Curtails the range of beneficial uses of the environment;*

The proposed project site is located on land owned by the State of Hawaiʻi and is used as a seawall protecting the shoreline fronting the area of the Moanakai Road from further coastal erosion following Hurricane Iniki in September 1992. The proposed project will seek to maintain this use and will not curtail the range of other beneficial uses of the environment. In order to reduce the potential for adverse environmental impacts the planned seawall repairs will be based on a hybrid seawall and revetment design to minimize the footprint needed for the structure.

3. *Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in chapter 343, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;*

The proposed project is consistent with the environmental polices, goals and guidelines as delineated in HRS, Chapter 343, and as documented in this Environmental Assessment.

4. *Substantially affects the economic welfare, social welfare, and cultural practices of the community or State;*

The proposed project has been assessed for potential social, visual, and environmental impacts in accordance with the requirements of HRS, Chapter 343, and HAR, Chapter 11-200. With implementation of the mitigation measures as identified in this document, no substantial impacts are expected to result. In the short term construction activities will benefit the construction industry and the community indirectly through the creation of jobs.

5. *Substantially affects public health;*

The proposed project will be developed in accordance with Federal, State, and County of Kaua'i, rules and regulations governing public safety and health. Potential sources of adverse impacts have been identified and appropriate mitigative measures developed. The primary public health concerns are anticipated to involve air, water, noise, and traffic impacts associated with construction activities. However, it is expected that these impacts will be either minimized or brought to negligible levels by the appropriate use of the mitigation measures described in this document.

6. *Involves substantial secondary impacts, such as population changes or effects on public facilities;*

The proposed project will not, by itself, stimulate unexpected changes in population. It will, however, accommodate current and future economic and social activities in the area by improving shoreline protection, improving the aesthetics of the shorefront, maintaining access to the shoreline, and minimizing adverse effects on neighboring shorelines.

7. *Involves a substantial degradation of environmental quality;*

The proposed project will be developed in accordance with the environmental policies of HRS, Chapter 343. The analysis provided in this Environmental Assessment indicates that no adverse environmental degradation is anticipated or expected.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;*

The proposed project is designed to specifically address the need for repairs to an existing seawall and does not involve a commitment for other, larger actions. The potential for cumulative impacts associate with the proposed project are not anticipated or expected.

9. *Substantially affects a rare, threatened, or endangered species, or its habitat;*

Sea turtles, spinner dolphins, and humpback whales were not observed during the marine survey, although they may occur well offshore of the project site. Monk seals are known to visit the project area; however, if BMPs are followed, the project will not adversely affect the monk seal or other protected resources. BMPs will be used to ensure that marine biota of the lagoon area and adjacent reef flat are protected from sedimentation and project-related runoff (see Section 5.9.4, Fauna, Potential Impacts and Proposed Mitigation, for further detail).

10. *Detrimentally affects air or water quality or ambient noise levels;*

Any potential for adverse impacts to air, water quality, or noise levels will be addressed by use of appropriate mitigative measures as described in this Environmental Assessment.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;*

The proposed project is located in an erosion prone area due to the dilapidated condition of an existing seawall. The proposed project is intended to repair and restore the condition and function of the seawall to reduce erosion and provide some protection from strong waves and storm surge impacts. The design of the proposed hybrid seawall/revetment will be in accordance with accepted engineering design standards to ensure that a reasonably safe and secure facility will be constructed. The proposed action is not expected to have a significant impact on flood conditions.

12. *Substantially affects scenic vistas and view planes identified in county or state plans or studies;*

The proposed site is not anticipated to adversely affect scenic vistas or view planes along the shoreline. The project area is already in use as a seawall and does not itself possess any sensitive characteristics that would detract from or adversely impact the surrounding visual environment. Visual impacts associated with construction activities will be temporary and will cease with the removal of construction equipment and personnel.

13. *Requires substantial energy consumption.*

The proposed project will require use of energy primarily in the form of petroleum-based fuels for construction vehicles and equipment. Electricity will also be required and may be provided by a generator or by direct connection to outlets provided on-site. Other uses of energy will be in the form of labor to complete the project. Upon completion of the project, there will be no further requirement for the use of construction related energy. Operation of the structure is not expected to result in any further use of energy resources.

Based on the review and analysis of the above factors, it has been preliminarily determined that a HRS, Chapter 343, Environmental Impact Statement (EIS) will not be required, and that an anticipated Finding of No Significant Impact (FONSI) should be issued for this project.

Section 10
Summary of Findings and Significance Determination

In accordance with the provisions set forth in HRS, Chapter 343, and the significance criteria in HAR, Chapter 11-200-12, this Environmental Assessment has evaluated and assessed the potential for environmental impacts associated with the proposed project and it is preliminarily determined that a HRS, Chapter 343, EIS will not be required.

The proposed project is not expected to result in significant adverse impacts to geology, soils, hydrology, stream flow, biological resources, air quality, natural hazards, cultural resources, socioeconomics, or land uses. Minimal impacts may consist of minor traffic, noise and air quality disturbances to residents in the immediate surrounding location of the site, but will completely cease once construction is complete.

Section 11
Draft Environmental Comments and Responses

This section is reserved for comments and responses for the Draft Environmental Assessment.

References

Akina, Joseph 1913 "I Ke hou i Ka Lulu-o-Mōʻīkeha i ka laula o kapaa", Kuʻokoʻa May 2-9, 1913. Bishop Museum Archives, Hawaiian Ethnological Notes (HEN) Place Names, Kauaʻi.

Chafee, David B., Berdena Burgett, and Robert L. Spear 1994a An Inventory Survey of a Māmane Street Houselot, Kapaʻa Ahupuaʻa, Kawaihau District, Puna, Island of Kauaʻi (TMK: 4-5-09:51). Scientific Consultant Services, Kāneʻohe, Hawaiʻi.

1994b An Inventory Survey of a Kukui Street Houselot, Kapaʻa Ahupuaʻa, Kawaihau District, Puna, Island of Kauaʻi (TMK: 4-5-09:10). Scientific Consultant Services, Inc., Kāneʻohe, Hawaiʻi.

County of Kauaʻi Department of Civil Defense. 2010. http://www.kauai.gov/Government/Departments/CivilDefenseAgency/tabid/90/Default.aspx

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson, and John Winieski 1995 A Summary of the Archaeological Monitoring for the Kapaʻa Sewerline Project, Waipouli and Kapaʻa Ahupuaʻa, Puna District, Kauaʻi (TMK: 4-3-09 and 4-5-03 to 11). Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Department of Business, Economic Development, and Tourism, State of Hawaiʻi. 2009. The State of Hawaiʻi Data Book. http://Hawaiʻi.gov/dbedt/info/economic/databook/db2009/

Department of Business, Economic Development, and Tourism, State of Hawaiʻi. 2000. Hawaiʻi Census 2000. http://Hawaiʻi.gov/dbedt/info/census/Hawaiʻi_Census_2000/

Federal Emergency Management Agency. Hawaiʻi Hurricane Iniki. 2004. http://www.fema.gov/news/event.fema?id=2162

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens 1972 Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lānaʻi. State of Hawaii. Soil Conservation Service, U.S. Department of Agriculture.

__ ,1997. Guidelines Assessing Cultural Impacts.

Hammatt, Hallett H., David W. Shideler, John Winieski, and David Perzinski 2000 Archaeological Data Recovery for a 12-Acre Parcel (The Golding Property) at Waipouli, Puna, Kauaʻi (TMK 4-3-08:1) Volume I. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Handy, E. S. Craighill 1940 The Hawaiian Planter, Volume 1. Bishop Museum, Bulletin No. 161.Bernice P. Bishop Museum, Honolulu.

Huisman, J. M., I. A. Abbott, C. M. Smith. 2007. Hawaiian Reef Plants. Hawaiʻi Sea Grant College Program, Honolulu, Hawaiʻi. 264 pp.

Hoover, J. P. 1999. Hawaii's Sea Creatures: A Guide to Hawaii's Marine Invertebrates. Mutual Publishing, Honolulu, Hawai'i. 366 pp.

National Oceanic and Atmospheric Administration. 2010. http://www.prh.noaa.gov/hnl/climate/phli_clim.php

National Oceanic and Atmospheric Administration - National Marine Fisheries

Service (NMFS). 2007. Recovery Plan for the Hawaiian Monk Seal (*Monachus schauinslandi*). Second Revision. National Marine Fisheries Service, Silver Spring, MD. 165 pp. http://www.nmfs.noaa.gov/pr/pdfs/recovery/hawaiianmonk seal.pdf

Spear, Robert L. 1992 Letter Report Concerning Monitoring for the Cost-U-Less Project Kapa'a, Kaua'i, Hawai'i (TMK: 4-5-5:4 and 9). Scientific Consultant Services, Inc., Kāne'ohe, Hawai'i.

State of Hawaii, Department of Health, Office of Environmental Quality Control, 1997. A Guidebook for the Hawaii State Environmental Review Process.

State of Hawaii. Title 11, Hawaii Administrative Rules, Chapter 59, "Ambient Air Quality Standards", Hawaii State Department of Health; November, 1993.

State of Hawaii. Title 11, Hawaii Administrative Rules, Chapter 60, "Air Pollution Control" Hawaii State Department of Health; November, 1993.

University of Hawai'i, Department of Geography. 1983. Atlas of Hawai'i. Honolulu: University of Hawai'i Press.

U.S. Soil Conservation Service, December 1973. Soil Survey of Islands of Kaua'i, O'ahu, Maui, Moloka'i, and Lāna'i. State of Hawaii.

Vancouver, George l798 A Voyage of Discovery to the North Pacific Ocean...performed in the years 1790, 1791, 1792, 1793, 1794, and 1795, in the Discovery ... and ... Chatham ... Amsterdam, N. Israel. Vols. 1-3. London.

Wilkes, Charles 1844 Narrative of the U.S. Exploring Expedition During the Years 1838, 1839, 1840, 1841, 1842.... C. Sherman, Philadelphia.

Appendix A

Repair/Reconstruction of Moanakai Seawall: Moana Kai Road Coastal Assessment

Sea Engineering, Inc., July 2011

Repair/Reconstruction of Moanakai Seawall
Moana Kai Road Coastal Assessment and Basis of Design
Kapaa, Kauai

July 2011

Prepared for:
R.M. Towill Corporation
2024 North King Street, Suite 200
Honolulu, HI 96819

Prepared by:
Sea Engineering, Inc.
Makai Research Pier
Waimanalo, HI 96795

Job No. 25208

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ACES	Automated Coastal Engineering System
CEDAS	Coastal Engineering Design and Analysis System
CGG	Coastal Geology Group
cot	Cotangent
CRM	Concrete Rubble Masonry
Dir	Direction
ft	Feet
H	Horizontal
H	Wave Height
K_D	Armor Stone Stability Coefficient
lb, lbs	Pounds
LiDAR	Light Detecting and Ranging
m	Meters
mhhw	Mean Higher High Water
mhw	Mean High Water
mllw	Mean Lower Low Water
mlw	Mean Low Water
msl	Mean Sea Level
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
sec	Seconds
SHOALS	Scanning Hydrographic Operational Airborne LiDAR Survey
S_r	Specific gravity
SWL	Still Water Level
T	Wave Period
V	Vertical
W	Weight
WIS	Wave Information Studies
w_r	Unit Weight of Stone

1. INTRODUCTION

The County of Kauai is investigating potential repairs to the 1,050-foot long shore protection structure along Moana Kai Road in Kapaa, located on the windward side of Kauai (Figure 1-1), approximately six miles north of the Lihue airport. The site is presently experiencing erosion between the road and the structure in the form of sinkholes and undermining of the shoulder of the road. The properties across the road from the project site are residential, and the road is used by walkers, joggers, bicyclists, fishermen, and sight-seers. The uninterrupted viewscape draws motorists who park on the roadside while enjoying the view.

Sea Engineering, Inc., as a subcontractor to R.M. Towill Corp., has completed a coastal engineering assessment of the Moana Kai project site. The objectives of the evaluation and conceptual design are:

- Evaluate coastal processes and oceanographic parameters at the project site
- Identify areas of damage or erosion along the structure
- Evaluate effectiveness of the existing structures
- Produce conceptual solutions and designs to replace the existing structure, if necessary.

In addition to repairing/improving the shore protection, goals of the design will be to improve or maintain aesthetics of the shorefront, improve or maintain lateral access along the shoreline, minimize effect on neighboring shoreline, and preserve existing property to the extent possible.

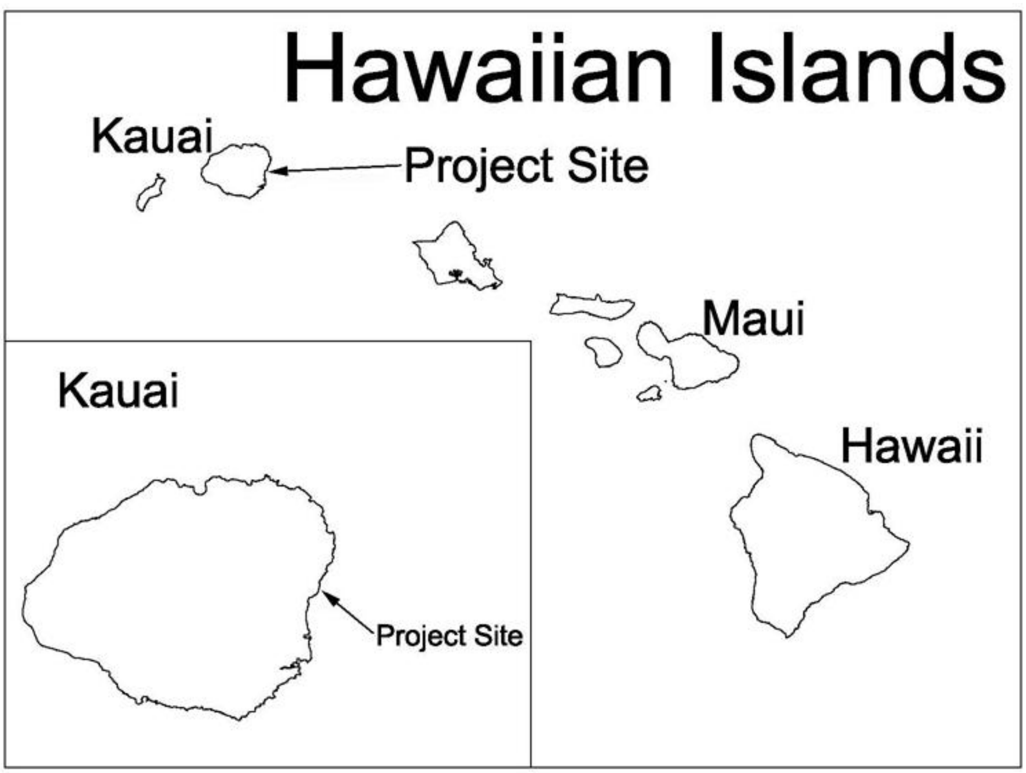


Figure 1-1 Project location map

2. SITE CONDITIONS

2.1 Regional Setting/Site Survey

Moana Kai Road runs along a section of coastline in Kapaa, a town located on the eastern shore of Kauai (Figure 1-1). The coastline through Kapaa is characterized by a combination of river and stream mouths, sandy beaches, fringing coral reef, and shore protection structures. A two-part seawall/revetment was constructed along Moana Kai Road following Hurricane Iniki to protect against further erosion. The south end of the structure begins near the intersection of Moana Kai Road and Keaka Road, extending for approximately 1,050 feet northward along the eastern side of Moana Kai Road (Figure 2-1). Moana Kai Road has two-way traffic and parallel parking occurs in select locations along the makai side of the road. Moana Kai Road ends approximately 400 feet south of Waikaea Canal.

The structure is fronted by a sand and coral gravel beach. Between Station 0+00 and Station 3+00 (measured from south to north), the beach is 20 to 25 feet wide and is composed primarily of sand (Figure 2-2); beach elevations at the toe of the structure are typically +1 to +4 feet mllw (all elevations referenced in this report are relative to mllw). For approximately 75 feet north of Station 3+00, the beach is about 15 to 20 feet wide and contains a higher percentage of coral gravel (Figure 2-3). Beyond that area, the beach is predominately sand (Figure 2-4); however, in some locations there was no dry sand beach at the time of the site visit. The beach widens gradually to the north, to a width of about 40 feet.

A fossil rock bench that extends the full length of the project site can also be seen in Figure 2-2 through Figure 2-4. The rock bench is 60 to 75 feet wide with elevations of up to +3 feet mllw. At the north end of the project area, the rock bench is further offshore and provides a shallow, protected swimming area in its lee, as seen in (Figure 2-4). The rock bench diminishes and then disappears 350 feet past the north end of the revetment. Offshore of the rock bench, a reef flat with typical depths of 3 to 5 feet extends approximately 1,500 feet from shore.

Figure 2-1 Moana Kai project location

Figure 2-2 Typical view of beach and revetment in southern reach

Figure 2-3 View of coral rubble beach and protected swimming area

Figure 2-4 View of beach, revetment and protected swimming area in northern reach

2.2 Existing Structure

The project structure, termed the "Moana Kai Seawall," is actually a rock rubblemound revetment constructed with two profiles. The southern 570 feet of the structure has a steep seaward face, and a 2.5 to 3-foot wide concrete cap provides a walkway (Figure 2-2 and Figure 2-3). The northern 480 feet of the structure has a gentler slope and no cap (Figure 2-4 and Figure 2-5). The structure was built in response to an accelerated erosion threat to Moana Kai Road as a result of Hurricane Iniki in 1992. The structure was given emergency status and was thus constructed without obtaining the permits that would otherwise have been required.

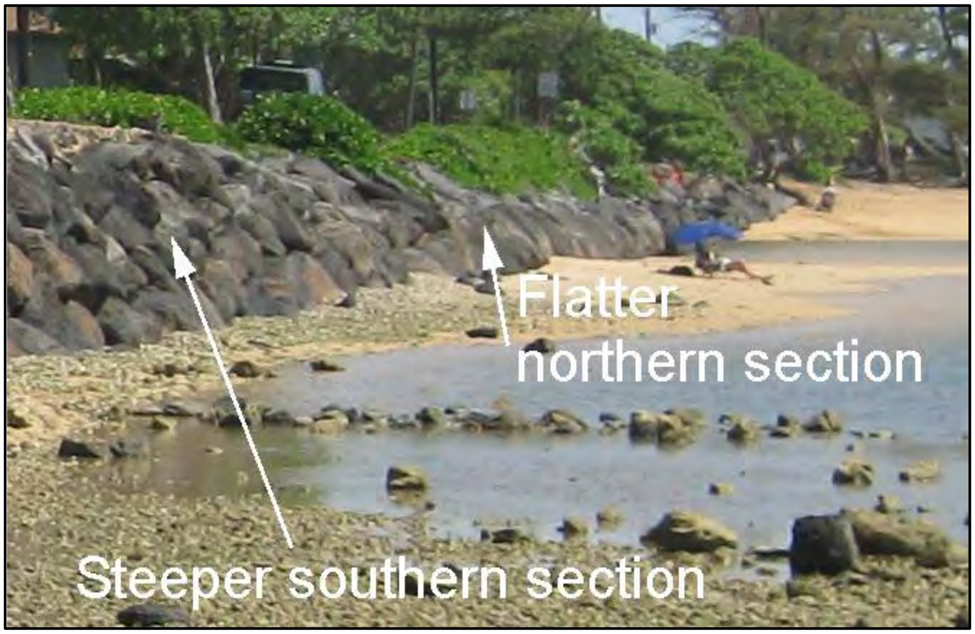


Figure 2-5 Transition between revetment profiles

2.2.1 South Reach (Stations 0+00 to 5+70)

The neighboring property to the south of the project site contains a steep-faced CRM seawall. The toe of the seawall has been undermined by erosion and has collapsed, leaving the base of the seawall exposed to further erosion and undermining (Figure 2-6). The project structure begins at Station 0+00 and is offset inshore from the neighboring seawall by 15 to 20 feet; the southern 25 feet of the structure is obscured by a thick naupaka hedge. Overall, the structure is essentially straight, bowing only slightly in a few places. The southern reach of revetment transitions into the northern reach at Station 5+70.

Figure 2-6 Collapsed toe and undermined seawall on neighboring property to the south

The as-built cross section for the southern reach is shown in Figure 2-7. The figure shows the revetment to be constructed primarily of armor stone with no underlayer or geotextile filter fabric that would reduce the possibility of soil or fill material from the backshore side being siphoned through the armor stone by water motion and wave action.

During our site visit, the dimensions of 15 representative armor stones were measured in three locations along the southern reach, showing the nominal stone diameter to range from 1.8 to 6.0 feet, with an average of 3.2 feet, which would weigh approximately 2.6 tons. The field investigation also showed the slope of the face of the revetment to be 15v:9h (even though the as-built slope is labeled 12v:6h), which is consistent with the 1.5v:1h slope interpreted from the March 2010 topographic survey. This side slope is steeper than is typically recommended for rock rubblemound revetments, for which a standard design practice would be a flatter 1v:1.5h or 1v:2h slope. The revetment has a 2.5 to 3-foot wide grouted CRM cap that acts as a walkway. The as-built drawing indicates that a solid basalt layer at elevation -4 feet provides the foundation for the revetment. Crest elevations along the southern reach of revetment were measured to range from about +9.5 feet to +11.0 feet mllw.

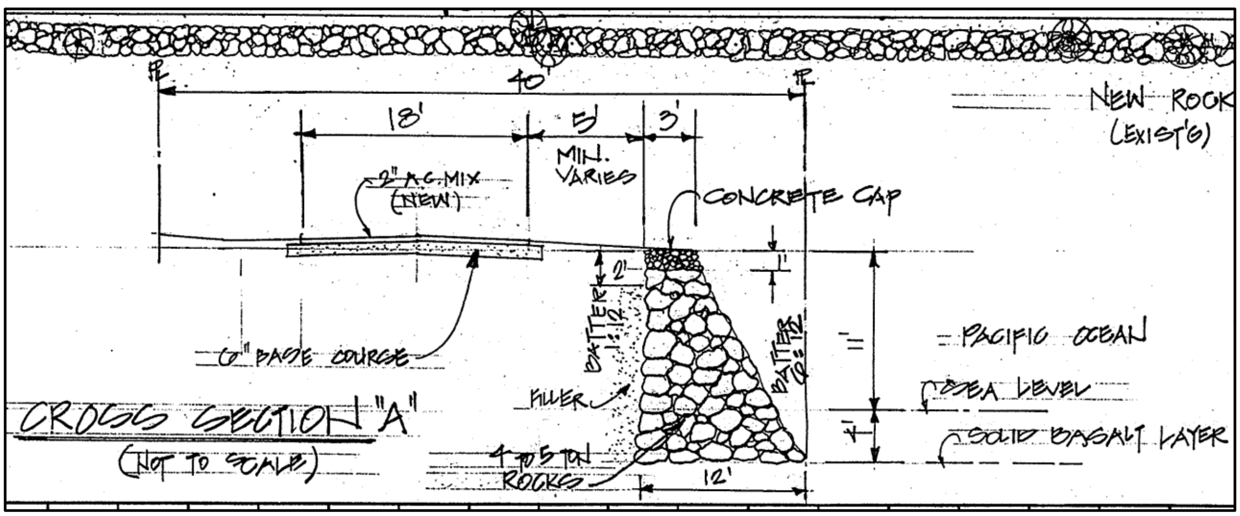


Figure 2-7 As-built cross section of southern reach of revetment

2.2.2 Northern Reach (Stations 5+70 to 10+50)

The as-built cross section for the northern reach is shown in Figure 2-8. The figure shows this section of revetment to have a flatter slope than the southern section, consistent with standard design practice. The figure shows this section of revetment to be constructed of a single layer of armor stone with a slope of 1v:2h; however, the topographic survey shows the revetment to have a slightly steeper 1v:1.5h face slope. While there is no indication on the drawings that an underlayer or geotextile filter fabric was used, smaller stones were observed in the armor stone voids. The drawing shows the crest to be two stones wide.

Stone size is not discernable from the as-built drawings; however, ten stones were measured from two locations during the site visit. The nominal diameter of those stones ranged in size from 1.9 to 6.0 feet with an average of 3.9 feet, which would weigh approximately 4.7 tons. Crest elevation along this reach of revetment ranged from about +8.5 to +9.5 feet mllw.

The north section of revetment extends from Station 5+70 to Station 10+50. The crest of the northern section of revetment is generally obscured by fill material or vegetation, typically naupaka, along the roadway. Portions of the crest show some evidence of fill with smaller stones. The beach widens to about 40 feet north of the end of the revetment and extends more than 900 feet from the end of the revetment past Waipoli Park to Waikaea Canal.

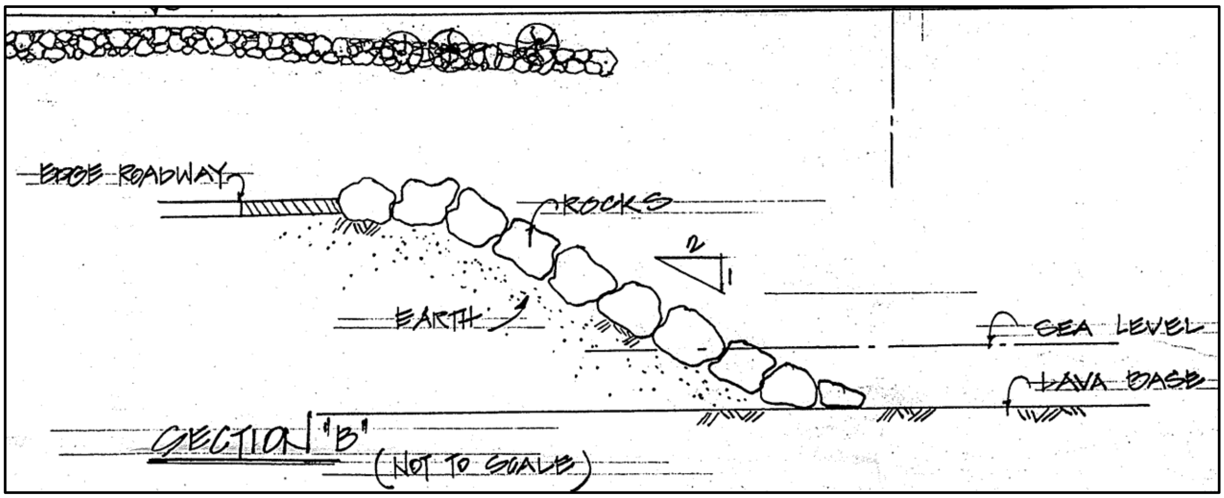


Figure 2-8 As-built cross section of northern reach of revetment

2.2.3 Structure Condition

Locations of erosion or damage were noted during the site visit. Construction of the revetment appears to have been performed with the goal of preserving existing trees along the revetment alignment. Thus, in several locations, trees or tree stumps were found to be projecting from the top of the revetment. Tree mortality and the subsequent root decay have produced gaps in the revetment that leave the backshore unprotected against wave action and the effects of erosion. Locations of damage or erosion are described below.

Station 1+05

Damage to the cap was found. The damaged section is about 6 to 8 feet long and shows a history of past repairs. The grout repair shows signs of crumbling and the soil beneath it has eroded, extending laterally under the original cap (Figure 2-9).

Figure 2-9 Hole in revetment cap at Station 1+05

Station 1+70

At this location, a six to eight foot long gap in the concrete cap is occupied by a naupaka hedge and a tree stump. There is no obvious damage at this time; however, root decay could cause a void in the revetment.

Figure 2-10 Stump in revetment at Station 1+70

Station 2+10

Two trees were found growing out of the top of the revetment in this location. Sediment loss was observed around the trees and the adjacent cap was being undermined.

Figure 2-11 Trees and hole in revetment at Station 2+10

Station 3+85

Extensive erosion was found to have occurred around a stump at Station 3+85. Root decay has produced a void in the revetment and a cavern produced by the subsequent erosion extends approximately five feet inshore of the seaward edge of the concrete cap.

Figure 2-12 Stump and hole in revetment at Station 3+85

Station 4+50

At Station 4+50, a hole extends five feet inshore below the concrete cap (Figure 2-13). While tree root decay was the cause of holes seen in other locations, there was no obvious cause for this hole.

Figure 2-13 Hole at Station 4+50

Station 4+75

Extensive erosion has occurred around three tree stumps and one live tree at Station 4+75 (Figure 2-14). The hole that has formed extends 6 to 8 feet in the alongshore direction and 6 to 8 feet inshore from the concrete cap.

Figure 2-14 Erosion around stumps at Station 4+75

Station 5+70

The concrete cap ends at Station 5+70 (Figure 2-15) and the revetment slope flattens, as previously discussed in Section 2.2.2. Erosion is evident around the end of the concrete cap.

Figure 2-15 End of concrete cap, start of revetment, Station 5+70

Stations 6+40 to 7+10

Base fill between the shoulder of the road and the revetment was seen to be eroding and was being interspersed within the revetment (Figure 2-16). Ground vegetation such as grass was sparse through this area and was ineffective at controlling the erosion.

Figure 2-16 Roadway and eroding bank at Station 6+80

Station 8+20 to 8+40

Tree mortality and root decay, along with the existence of a thick naupaka hedge has left a portion of the backshore exposed through this area (Figure 2-17 and Figure 2-18). The erosion has extended to the shoulder of the road (Figure 2-19) and temporary orange fencing has been installed along this area. This is an area where the revetment appears to have been constructed around existing vegetation, which has since died, leaving the area without full armor stone coverage. The shoulder of the road is narrow from Station 8+40 to Station 8+80 (Figure 2-20). Base fill is exposed along the shoulder of the road and appears to be slowly moving into the voids in the armor stone.

Figure 2-17 Naupaka hedge and tree stumps at Stations 8+20 to 8+40

Figure 2-18 Erosion around northern stump at Station 8+40

Figure 2-19 View looking east at erosion along roadway at Station 8+20

Figure 2-20 Narrow road shoulder between Stations 8+40 and 8+80

Station 8+80 to Station 10+00

Erosion up to the edge of the road occurs starting at Station 8+80 and continues to Station 10+00. Temporary orange fencing lines this section of the roadway (Figure 2-21 and Figure 2-22). Erosion from Station 9+70 to Station 10+00 is aggravated by the lack of armor stones along the roadway (Figure 2-23). The cause for the lack of stones was not immediately apparent, and was initially believed to be due to construction around vegetation, followed by loss of vegetation leaving a void. This, however, no longer appears to be the case. Figure 2-24, a photo taken by Sea Engineering in 2004, shows the existence of a continuous revetment through this area and the as-built cross section, shown previously in Figure 2-8, indicates that the armor stone was placed on "earth" for all but the toe. The most plausible explanation for the change from 2004 to present is that the revetment has been undermined and has settled. This is further evidenced by the small dead tree within the revetment at the right edge of Figure 2-22, which is seen to be alive and closer to the road in Figure 2-24.

Figure 2-21 View of erosion and fencing looking north from Station 9+10

Figure 2-22 Erosion along roadway looking north from Station 9+90

Figure 2-23 View looking west at erosion between Stations 9+70 and 10+00

Figure 2-24 A 2004 photo showing the intact revetment between Stations 9+70 to 10+30

Station 10+50 and beyond

The view looking north at the end of the revetment (Figure 2-25) reveals several more ironwoods with exposed root structure that would indicate erosion.

Figure 2-25 Ironwood trees with exposed roots north of the end of the revetment

2.3 Historical shorelines and sediment transport

Coastal erosion along this shoreline has been evaluated by the University of Hawaii's Coastal Geology Group (CGG). The CGG used historical surveys and aerial photographs dating from 1927 to 2008 to compare the shoreline change. The photographs have been ortho-rectified and geo-referenced, and the low water marks on the photographs were digitized to provide a record of the long-term changes to that representative coastal feature. The section of the erosion map pertaining to the project site is shown in Figure 2-26. The erosion map shows annual erosion rates in the project area (transects 159-177) of up to about one foot per year.

A closer look at the shoreline positions shows that, with the exception of the 1928 T-sheet, which was produced using less sophisticated technology than today, the shoreline positions were typically found along the inshore edge of the rock bench, and since 2000, the shoreline position alternates between the toe of the revetment and the inshore side of the rock bench. These differences in the more recent shoreline positions are likely the result of analysis of photographs taken at different tide levels, where the beach at high tide is submerged, and at low tide, much of the beach is exposed. The revetment and the rock bench thus act as cross-shore bounds for the beach.

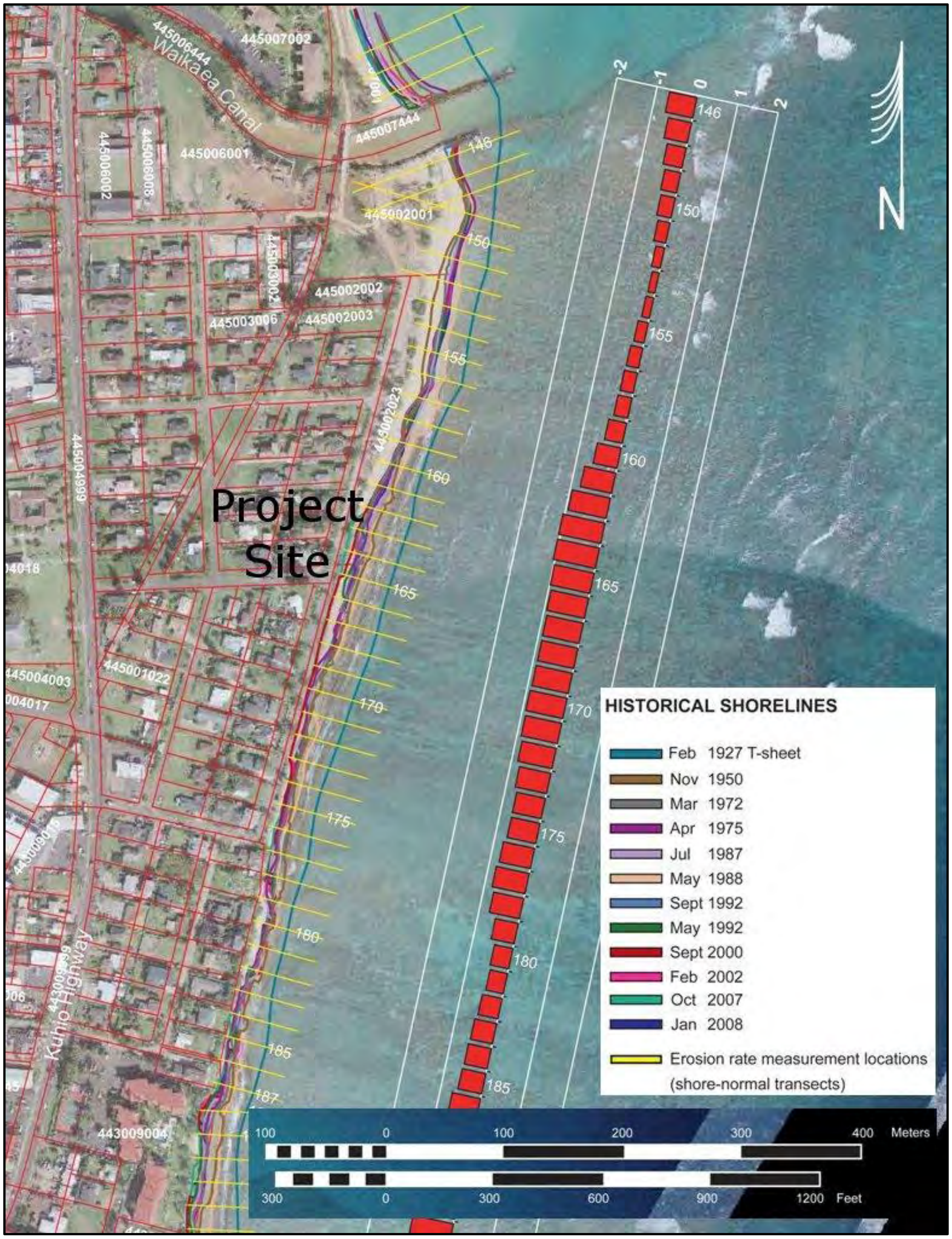


Figure 2-26 Historical shoreline map of the project vicinity (after UH Coastal Geology Group)

The project site is exposed to north swell, tradewind waves, and south swell. The circulation pattern over the offshore reef tends to be toward the north, where the Waikaea Stream outlet provides a pathway for the return flow of water seaward (Inman, et al., 1963). Sediment transport along the beach, however, depends significantly on water level. At low tide, the rock bench blocks a significant portion of the incident wave energy; the only wave energy reaching the beach at low tide is found in the northern portion of the project site, where the rock bench has lower elevations and is submerged at all tide levels. In this location, waves can pass over the rock bench as well as refract and diffract past the end of the rock bench, with the potential of transporting sand in the southerly direction.

At higher water levels, when waves overtop the rock bench, a wave-induced water level setup is created along the shore. This in turn creates a current that flows to the north inside of the rock bench, and which then exits at the Waikaea Stream outlet. This wave-induced current may be sufficient to transport sand with it. As the tide falls, the water trapped between the rock bench and shore exits northward past the end of the rock bench toward the Waikaea Stream outlet.

3. OCEANOGRAPHIC DESIGN PARAMETERS

3.1 Winds

The prevailing wind throughout the year in the Hawaiian Islands is the northeasterly trade wind. Its average frequency varies from more than 90% during the summer season to only 50% in January, with an overall annual frequency of about 70%. Westerly, or Kona, winds occur primarily during the winter months, generated by low pressure or cold fronts that typically move from west to east past the islands.

Tradewinds are produced by the outflow of air from the Pacific Anticyclone high pressure system, also known as the Pacific High. The center of this system is located well north and east of the Hawaiian island chain and moves to the north and south seasonally. In the summer months, the center moves to the north, causing the tradewinds to be at their strongest from May through September. In the winter, the center moves to the south, resulting in decreasing tradewind frequency from October through April. During these months, the tradewinds continue to blow; however, their average monthly frequency decreases to 50%.

During the winter months, wind patterns of a more transient nature increase in prevalence. Winds from extratropical storms can be very strong from almost any direction, depending on the strength and position of the storm. The low pressure systems associated with these storms typically track west to east across the North Pacific north of the Hawaiian Islands. At Honolulu Airport, wind speeds resulting from these storms have on several occasions exceeded 60 mph. Kona winds are generally from a southerly to southwesterly direction and occur when low pressure systems have a close approach to the islands. These storms are often accompanied by heavy rains.

Figure 3-1 shows a wind rose diagram applicable to the site based on wind data recorded at Lihue Airport between 1950 and 1995. The wind rose shows that the winds there come from the east through northeast more than 65% of the time.

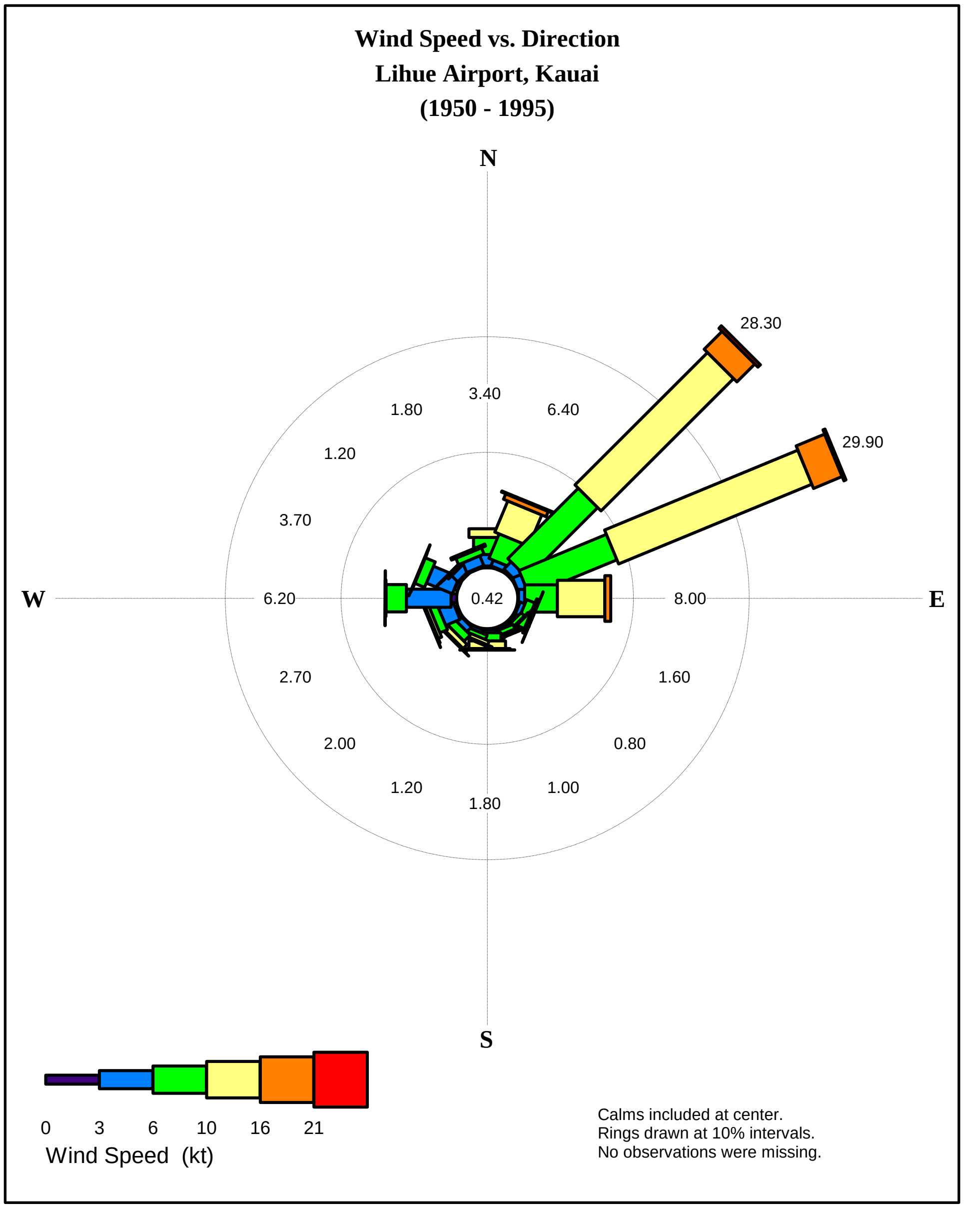


Figure 3-1 Wind rose for Lihue Airport (1950 - 1995)

3.2 Waves

3.2.1 Prevailing Waves

The wave climate in Hawaii is typically characterized by four general wave types. These include northeast tradewind waves, southern swell, North Pacific swell, and Kona wind waves. Tropical storms and hurricanes also generate waves that can approach the islands from virtually any direction. Unlike winds, any and all of these wave conditions may occur at the same time.

Tradewind waves occur throughout the year and are most persistent April through September when they usually dominate the local wave climate. They result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Tradewind deepwater waves are typically between 3 to 8 feet high with periods of 5 to 10 seconds, depending upon the strength of the tradewinds and how far the fetch extends east of the Hawaiian Islands. The direction of approach, like the tradewinds themselves, varies between north-northeast and east-southeast and is centered on the east-northeast direction. The project site is directly exposed to tradewind wave energy.

Southern swell is generated by storms in the southern hemisphere and is most prevalent during the summer months of April through September. Traveling distances of up to 5,000 miles, these waves arrive with relatively low deepwater wave heights of 1 to 4 feet and periods of 14 to 20 seconds. Depending on the positions and tracks of the southern hemisphere storms, southern swells approach between the southeasterly and southwesterly directions. The project site is somewhat sheltered from southern swell by the island of Kauai itself; however, some wave energy does refract and diffract around the island and impact the site.

During the winter months in the northern hemisphere, strong storms are frequent in the North Pacific in the mid latitudes and near the Aleutian Islands. These storms generate large North Pacific swells that range in direction from west-northwest to northeast and arrive at the northern Hawaiian shores with little attenuation of wave energy. These are the waves that have made surfing beaches on the north shore of Oahu famous. Deepwater wave heights often reach 15 feet and in extreme cases can reach 30 feet. Periods vary between 12 and 20 seconds, depending on the location of the storm. The project site is not directly exposed to north swell; however, this wave energy does refract and diffract around the island and impact the site.

Waves that approach from the southeasterly to southwesterly direction associated with Kona winds and Kona lows are known as Kona storm waves. Kona storms occur when the winter low pressure systems that travel across the North Pacific Ocean dip south and approach the islands. Strong southerly and southwesterly winds generated by these storms result in large waves on exposed shorelines and often heavy rains. These events are infrequent; however, they can result in very large waves with deepwater heights up to 15 feet (Noda, 1991). Periods typically range from 6 to 10 seconds. The project site is not directly exposed to Kona storm waves.

Severe tropical storms and hurricanes obviously have the potential to generate extremely large waves, which in turn could potentially result in large waves at the project site. Recent hurricanes impacting the Hawaiian Islands include Hurricane Iwa in 1982 and Hurricane Iniki in 1992. Iniki directly hit the island of Kauai and resulted in large waves along the southern shores of all the Hawaiian islands. Damage from these hurricanes was extensive. Although not frequent or even likely events, they should be considered in the project design, particularly with regard to coastal structure stability.

3.2.2 Prevailing Deepwater Wave Climate

The Kapaa seashore faces east and is primarily affected by tradewind waves; however, during the winter, north Pacific swell can refract and also affect the site. Wave information is available in the form of hindcast data sets provided by the U.S. Army Corps of Engineers' Wave Information Studies (WIS). WIS results are generated by numerical simulation of past wind and wave conditions. WIS information produces records of wave conditions based on historical wind and wave conditions at numerous stations around the Hawaiian Islands. These hourly records of wave conditions are available for the years 1981 through 2004.

The Kapaa project site is directly exposed to waves approaching from the north clockwise through south. WIS Station 099, located 120 miles east of Kauai, was chosen as having similar wave exposure to the project site. The data set, however, contains a significant amount of energy from the northwest direction that does not impact the project site. Table 3-1 shows the frequency of occurrence of wave height and period for the full WIS 099 data. Additionally, the wave height and wave period distributions for the full WIS 099 data set are presented as roses in Figure 3-2 and Figure 3-3. Since the WIS station is located far from shore, the wave roses show the north swell, south swell, and tradewind waves; however, the waves likely to have the most impact on the project site will approach from directions northeast to southeast.

Table 3-1 WIS Station 099, hindcast deepwater waves, 1981-2004. Percent frequency of occurrence: significant wave height H_s (feet) vs. peak period T_p (seconds)

WIS 099

		Period (s)												
Dir (°TN)	**Hs\Ts**	**<4**	**4-6**	**6-8**	**8-10**	**10-12**	**12-14**	**14-16**	**16-18**	**18-20**	**20-22**	**22-24**	**>24**	**Total%**
NNW	<4	-	-	-	0.0	0.0	0.0	-	0.0	0.0	-	-	-	**0.1**
326.25 -	4-6	-	-	-	0.9	0.6	0.1	0.0	0.0	0.0	-	-	-	**1.7**
348.75	6-8	-	-	-	0.5	2.5	0.8	0.2	0.1	0.0	0.0	-	-	**4.1**
	8-10	-	-	-	0.1	1.6	1.4	0.3	0.1	0.0	0.0	-	0.0	**3.6**
Hs (ft)	10-12	-	-	0.0	0.0	0.6	1.1	0.4	0.1	0.0	0.0	0.0	0.0	**2.2**
	12-14	-	-	-	0.0	0.2	0.6	0.3	0.1	0.0	0.0	0.0	0.0	**1.3**
	14-16	-	-	-	-	0.0	0.3	0.3	0.1	0.0	0.0	0.0	0.0	**0.7**
	16-18	-	-	-	-	0.0	0.1	0.2	0.1	0.0	-	-	-	**0.3**
	>18	-	-	-	-	0.0	0.0	0.0	0.1	0.0	-	-	-	**0.2**
	Total%	**0.0**	**0.0**	**0.0**	**1.5**	**5.5**	**4.5**	**1.8**	**0.7**	**0.2**	**0.0**	**0.0**	**0.0**	**14.1**
N	<4	-	-	0.0	0.1	0.0	0.0	-	-	-	-	-	-	**0.1**
-11.25 -	4-6	-	-	0.1	1.0	0.4	0.1	0.0	-	-	-	-	-	**1.5**
+11.25	6-8	-	-	0.0	0.6	1.0	0.2	0.0	0.0	-	-	-	-	**1.9**
	8-10	-	0.0	0.0	0.2	0.8	0.3	0.1	0.0	-	-	-	-	**1.4**
Hs (ft)	10-12	-	-	0.0	0.1	0.5	0.3	0.1	0.0	-	-	-	-	**1.0**
	12-14	-	-	0.0	0.0	0.2	0.3	0.1	0.0	-	-	-	-	**0.6**
	14-16	-	-	-	0.0	0.1	0.1	0.1	0.0	-	-	-	-	**0.3**
	>16	-	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	**0.1**
	Total%	**0.0**	**0.0**	**0.1**	**2.0**	**3.0**	**1.3**	**0.4**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**7.0**
NNE	<4	-	-	0.1	0.1	0.0	-	-	-	-	-	-	-	**0.1**
11.25 -	4-6	-	-	0.2	0.9	0.2	0.0	0.0	0.0	-	-	-	-	**1.2**
33.75	6-8	-	-	0.1	0.8	0.4	0.1	0.0	0.0	-	-	-	-	**1.5**
	8-10	-	-	0.0	0.3	0.4	0.1	0.0	0.0	-	-	-	-	**0.9**
Hs (ft)	10-12	-	-	0.0	0.1	0.3	0.1	0.0	-	-	-	-	-	**0.5**
	12-14	-	-	0.0	0.1	0.2	0.1	0.0	-	-	-	-	-	**0.3**
	>14	-	-	0.0	0.0	0.1	0.0	0.0	-	-	-	-	-	**0.1**
	Total%	**0.0**	**0.0**	**0.4**	**2.3**	**1.5**	**0.4**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.7**
NE	<4	0.0	0.0	0.1	0.1	0.0	-	-	-	-	-	-	-	**0.2**
33.75 -	4-6	-	0.0	0.9	1.1	0.1	0.0	0.0	-	-	-	-	-	**2.2**
56.25	6-8	-	0.0	1.1	1.5	0.3	0.0	0.0	-	-	-	-	-	**2.9**
	8-10	-	-	0.3	0.7	0.3	0.0	0.0	-	-	-	-	-	**1.3**
Hs (ft)	10-12	-	-	0.1	0.3	0.2	0.0	0.0	-	-	-	-	-	**0.6**
	12-14	-	-	0.0	0.1	0.1	0.0	0.0	-	-	-	-	-	**0.3**
	14-16	-	-	0.0	0.1	0.1	0.0	0.0	-	-	-	-	-	**0.2**
	>16	-	-	-	0.0	0.1	-	-	-	-	-	-	-	**0.1**
	Total%	**0.0**	**0.0**	**2.5**	**3.9**	**1.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**7.7**
ENE	<4	0.0	0.0	0.2	0.1	0.0	0.0	-	-	-	-	-	-	**0.3**
56.25	4-6	-	0.2	2.9	1.2	0.1	0.0	0.0	-	-	-	-	-	**4.5**
78.75	6-8	-	0.1	5.0	2.8	0.2	0.0	0.0	-	-	-	-	-	**8.1**
	8-10	-	-	1.3	2.3	0.2	0.0	-	-	-	-	-	-	**3.8**
Hs (ft)	10-12	-	-	0.2	0.9	0.2	0.0	-	-	-	-	-	-	**1.2**
	12-14	-	-	0.0	0.4	0.2	0.0	-	-	-	-	-	-	**0.6**
	14-16	-	-	0.0	0.1	0.2	0.0	0.0	-	-	-	-	-	**0.4**
	>16	-	-	-	0.0	0.1	0.0	-	-	-	-	-	-	**0.2**
	Total%	**0.0**	**0.3**	**9.7**	**7.8**	**1.3**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**19.1**
E	<4	-	-	0.1	0.1	0.0	0.0	0.0	-	-	-	-	-	**0.3**
78.75 -	4-6	-	0.0	1.1	1.3	0.3	0.2	0.0	0.0	-	-	-	-	**2.9**
101.25	6-8	-	0.0	1.4	2.0	0.3	0.3	0.1	0.0	-	-	-	-	**4.0**
	8-10	-	-	0.2	1.0	0.3	0.0	0.0	-	-	-	-	-	**1.5**
Hs (ft)	10-12	-	-	0.0	0.4	0.2	0.0	-	-	-	-	-	-	**0.7**
	12-14	-	-	-	0.1	0.2	0.0	-	-	-	-	-	-	**0.2**
	>14	-	-	-	0.0	0.1	0.0	0.0	-	-	-	-	-	**0.1**
	Total%	**0.0**	**0.0**	**2.8**	**4.9**	**1.3**	**0.6**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**9.8**

Table 3-2 (continued)

ESE	<4	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	**0.0**
101.25 -	4-6	-	-	0.0	0.2	0.1	0.1	0.0	0.0	-	-	-	-	**0.3**
123.75	6-8	-	-	-	0.0	0.1	0.1	0.1	0.0	-	-	-	-	**0.3**
	8-10	-	-	-	0.0	0.0	0.1	0.0	-	-	-	-	-	**0.1**
Hs (ft)	>10	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	**0.0**
	Total%	**0.0**	**0.0**	**0.0**	**0.2**	**0.2**	**0.3**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.8**
SE	0-2	-	-	-	-	-	-	-	-	-	-	-	-	**0.0**
123.75 -	2-4	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	**0.0**
146.25	4-6	-	-	0.0	0.0	0.0	0.1	0.0	-	-	-	-	-	**0.1**
Hs (ft)	>6	-	-	-	-	0.0	0.0	0.0	-	-	-	-	-	**0.1**
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**
SSE	0-2	-	-	-	-	-	-	-	-	-	-	-	-	**0.0**
146.25 -	2-4	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	**0.0**
168.75	4-6	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	**0.1**
Hs (ft)	>6	-	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	**0.1**
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.2**
S	0-2	-	-	-	-	-	-	-	-	-	-	-	-	0.0
168.75 -	2-4	-	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	0.1
191.25	4-6	-	-	-	0.0	0.1	0.3	0.2	0.1	0.0	0.0	-	-	0.7
Hs (ft)	>6	-	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	-	-	0.3
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.4**	**0.3**	**0.2**	**0.0**	**0.0**	**0.0**	**0.0**	**1.1**
SSW	0-2	-	-	-	-	-	-	-	-	-	-	-	-	0.0
191.25 -	2-4	-	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-	0.1
213.75	4-6	-	-	-	0.0	0.0	0.3	0.2	0.1	0.0	-	-	-	0.7
Hs (ft)	>6	-	0.0	-	-	0.0	0.0	0.1	0.1	0.0	0.0	-	-	0.3
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.4**	**0.4**	**0.3**	**0.0**	**0.0**	**0.0**	**0.0**	**1.1**
SW	<4	-	-	-	-	-	0.0	0.0	-	-	-	-	-	0.0
213.75 -	4-6	-	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	0.1
236.75	6-8	-	-	0.0	-	0.0	0.0	0.0	0.0	-	-	-	-	0.0
Hs (ft)	>8	-	-	0.0	-	-	-	0.0	0.0	-	-	-	-	0.0
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**
WSW	<4	-	-	-	-	0.0	-	-	-	-	-	-	-	0.0
236.75 -	4-6	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-	-	0.1
258.75	6-8	-	-	-	-	0.0	0.0	0.0	0.0	-	-	-	-	0.0
Hs (ft)	>8	-	-	0.0	0.0	0.0	-	0.0	0.0	-	-	-	-	0.0
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**
W	<4	-	-	-	-	0.0	0.0	0.0	-	-	-	-	-	0.0
258.75 -	4-6	-	-	-	-	0.0	0.1	0.0	0.0	-	-	-	-	0.2
281.25	6-8	-	0.0	-	-	0.0	0.1	0.0	0.0	-	-	-	-	0.1
Hs (ft)	>8	-	-	0.0	0.0	-	0.0	0.0	0.0	-	-	-	-	0.0
	Total%	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**
WNW	<4	-	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	0.1
281.25 -	4-6	-	-	-	0.0	0.2	0.2	0.1	0.0	0.0	-	-	-	0.5
303.75	6-8	-	0.0	0.0	0.0	0.2	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.7
	8-10	-	-	0.0	0.0	0.0	0.6	0.2	0.0	0.0	0.0	-	-	0.8
Hs (ft)	10-12	-	-	-	0.0	0.0	0.2	0.3	0.1	0.0	0.0	-	-	0.6
	12-14	-	-	-	-	0.0	0.1	0.2	0.1	0.0	0.0	-	-	0.4
	14-16	-	-	-	-	0.0	0.0	0.1	0.1	0.0	-	-	-	0.2
	>16	-	-	-	-	-	0.0	0.0	0.0	0.0	-	-	-	0.1
	Total%	**0.0**	**0.0**	**0.0**	**0.1**	**0.5**	**1.6**	**0.9**	**0.3**	**0.1**	**0.0**	**0.0**	**0.0**	**3.4**
NW	<4	-	-	-	0.0	0.0	0.0	0.0	0.0	-	-	-	-	0.1
303.75 -	4-6	-	-	-	0.4	1.3	0.4	0.1	0.0	0.0	0.0	-	-	2.3
326.25	6-8	-	-	-	0.2	2.7	2.2	0.5	0.2	0.0	0.0	0.0	0.0	5.8
	8-10	-	-	0.0	0.0	1.6	4.4	1.1	0.4	0.1	0.0	0.0	0.0	7.7
Hs (ft)	10-12	-	-	-	0.0	0.4	3.4	1.6	0.5	0.2	0.0	0.0	0.0	6.2
	12-14	-	-	-	-	0.1	1.6	1.5	0.4	0.1	0.0	0.0	0.0	3.8
	14-16	-	-	-	0.0	0.0	0.5	1.0	0.4	0.1	0.0	0.0	-	2.1
	16-18	-	-	-	-	0.0	0.2	0.5	0.4	0.1	0.0	0.0	-	1.1
	18-20	-	-	-	-	0.0	0.1	0.2	0.2	0.1	0.0	-	0.0	0.5
	>20	-	-	-	-	-	0.0	0.1	0.1	0.0	0.0	0.0	-	0.3
	Total%	**0.0**	**0.0**	**0.0**	**0.6**	**6.2**	**12.7**	**6.7**	**2.7**	**0.7**	**0.1**	**0.0**	**0.0**	**29.9**
													Total	**100.0%**

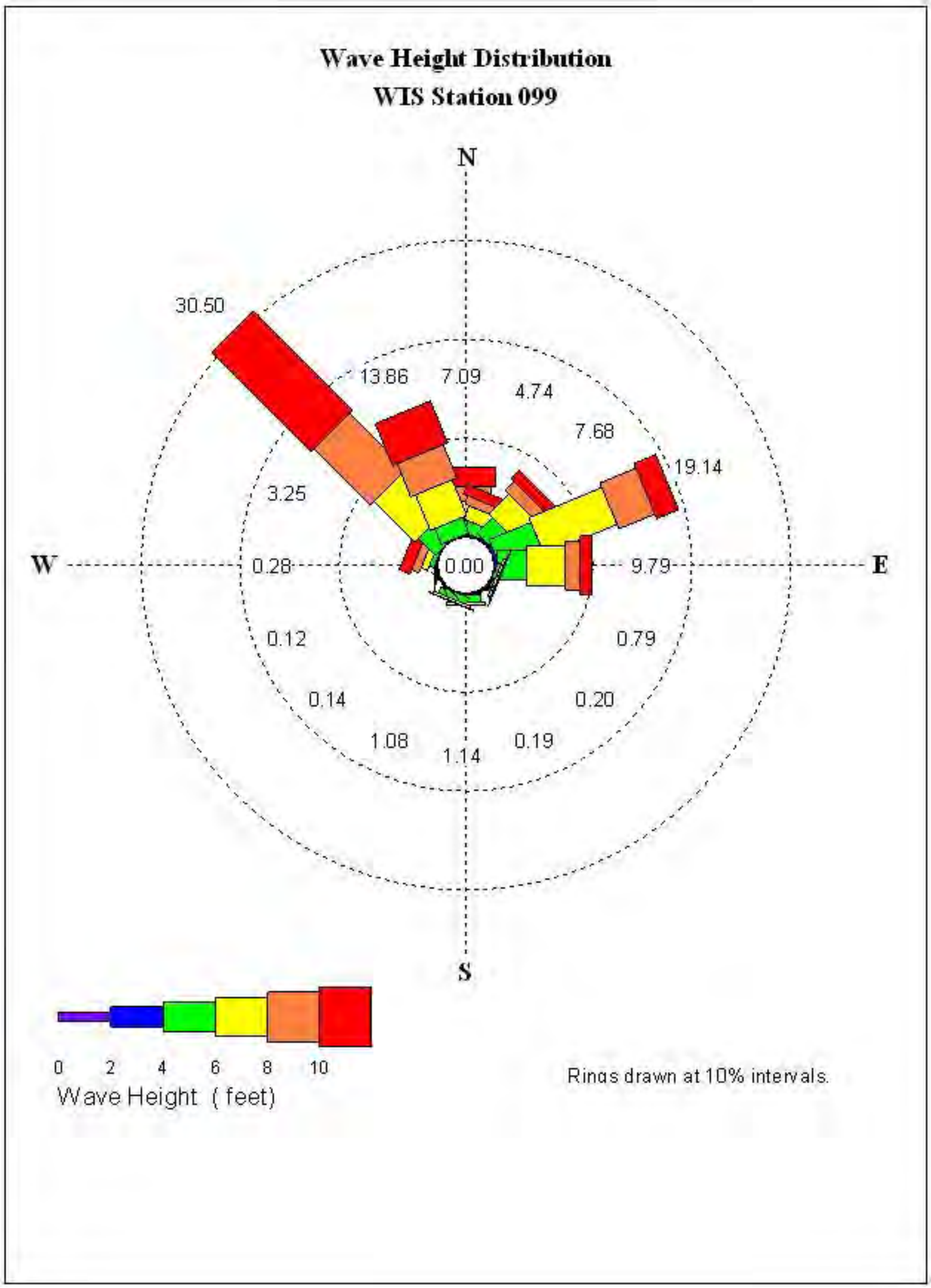


Figure 3-2 Wave height rose for WIS Station 099

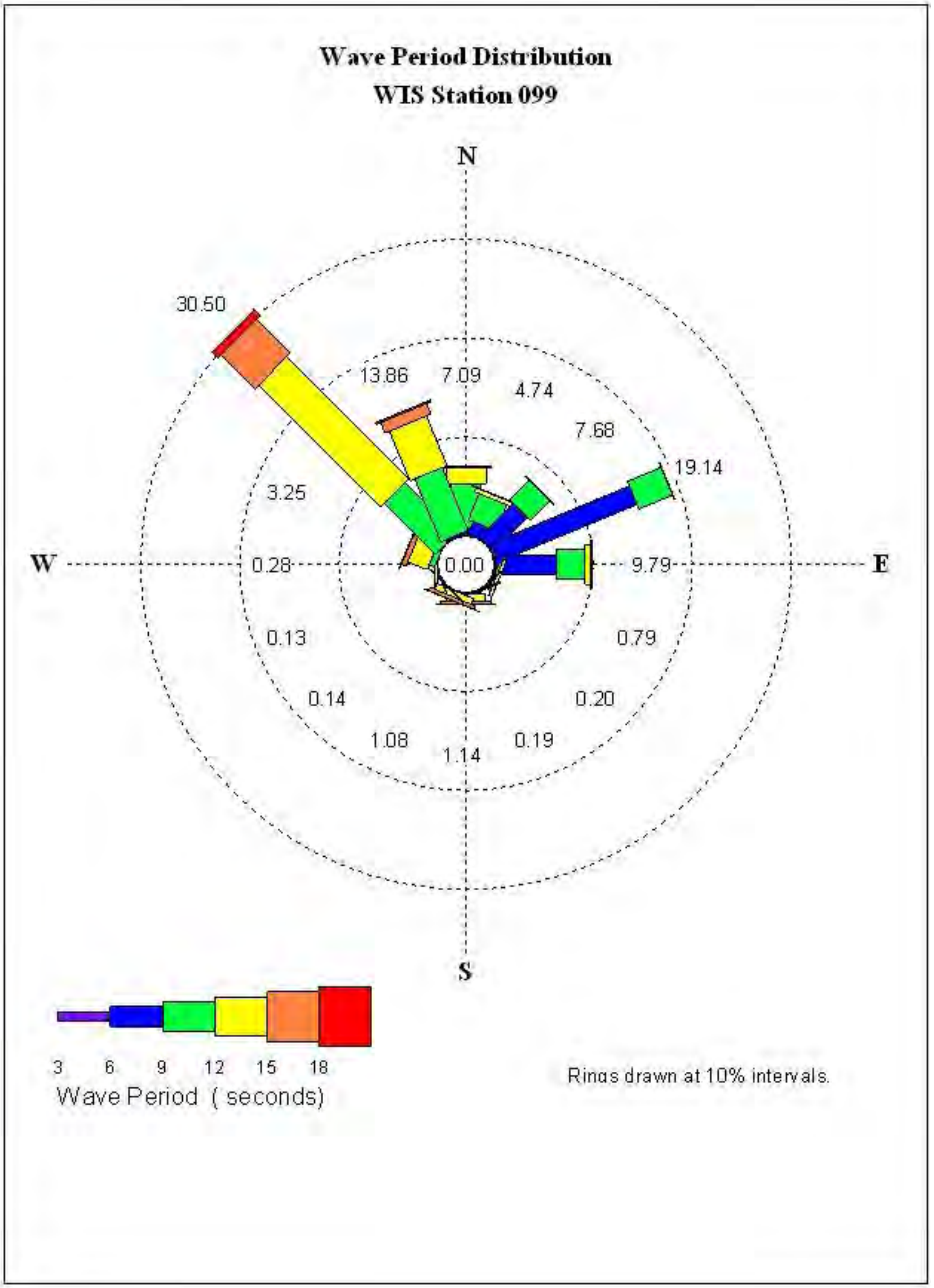


Figure 3-3 Wave period rose for WIS Station 099

3.2.3 Extreme Deepwater Wave Height

The Hawaiian Islands are annually exposed to severe storms and storm waves generated by passing low pressure systems, tropical storms including hurricanes, and large swell waves generated by distant north or south Pacific storms. Storms and high wave events considered here include:

- One-year return period wave
- Fifty-year return period wave
- Close approach hurricane generated waves

The WIS hindcast wave data set presented previously can be further analyzed using a Gumbel distribution of extreme events to obtain design wave heights and return periods. While north swell energy refracts and impacts the project site, a significant portion of this energy is lost during wave transformation, resulting in lower energy waves at the project site versus the offshore WIS station. The data set was therefore filtered for waves whose approach direction was between northeast and southeast; these are the wave directions considered to have the most effect on the project site. The highest annual waves from the filtered data were obtained and these 24 waves ranged in height from 13.5 feet to 23.5 feet, while the wave periods corresponding to these waves ranged from 8.6 seconds to 12.8 seconds. The design wave heights and return periods based on the Gumbel analysis using these 24 waves are shown in Table 3-2. As a comparison, Vitousek and Fletcher (2008) determined the maximum annually recurring wave height in the direction range of 60° to 90° TN to be 17.6 feet, which is consistent with the annual wave presented in Table 3-2.

Table 3-2 Wave heights vs. return periods

Return Period (years)	Wave Height (feet)
1	17.8
5	21.0
10	22.4
25	24.2
50	25.5
75	26.3
100	26.9

Within the 24 years of data, the five largest annual waves have periods of 10.9 to 12.3 seconds; thus, the wave period of the 50-year wave is taken to be the average of these five wave periods, or 11.8 seconds. The average direction of these waves is approximately east-northeast, which is also the prevailing wave direction for the complete data set.

The report *Hurricanes in Hawaii* (Haraguchi, 1984), prepared for the U.S. Army Corps of Engineers, Honolulu Engineer District (HED), presents hypothetical model and worst-case hurricane scenarios for the Hawaiian Islands. These scenario hurricanes have been used for detailed studies of hurricane storm wave inundation limits for the islands of Oahu and Kauai, prepared by Bretschneider and Noda (1985) and Sea Engineering (1986, 1993, and 2000) for the

USACE-HED. The model hurricane is defined as the probable hurricane that will strike Hawaii in the future, based on the characteristics of storms previously approaching or striking the islands. The worst-case hurricane characteristics are based on subjective analysis of the data from 20 critical hurricanes in the Central Pacific and understanding of the basic atmospheric and oceanic conditions surrounding the Hawaiian Islands. For this study, deepwater model hurricane wave parameters off the east shore of Kauai as reported by Sea Engineering, Inc. (2000) are selected as hurricane waves. Wave heights, periods, and approach directions resulting from the model hurricanes are:

Model 4A: H_o = 30.5 feet, T = 12.2 seconds, Dir = 110 degrees
Model 5A: H_o = 22.3 feet, T = 10.4 seconds, Dir = 120 degrees

The design wave conditions selected for further analysis are summarized in Table 3-3.

Table 3-3 Selected design wave conditions

Type of Wave	Deepwater Wave Height (feet)	Breaking Wave Height (feet)	Wave Period (sec.)
Prevailing Wave	6.0	8.5	8.0
1-Year Wave	17.8	23.3	11.8
50-Year Wave	25.5	30.5	11.8
Model Hurricane (4A)	30.6	32.0	12.2

3.3 Nearshore Water Levels

3.3.1 Wave Transformation in Shallow Water

As deepwater waves approach the shoreline, they begin to transform due to the effects of shoaling, bottom friction, refraction, and diffraction. As waves shoal, heights increase and the wave crests steepen, to the point that the waves become unstable, leading to breaking and dissipation of wave energy. Wave energy can also be attenuated due to bottom friction. The approach direction can change as the wave front refracts, or becomes oriented parallel to the existing bathymetric contours. Lateral spreading of energy, known as diffraction, can occur behind a natural or man-made barrier.

The breaking wave values given in Table 3-3 for the selected design wave conditions reflect the shoaling and refraction characteristics of these waves at the project site as determined using site bathymetry though the Automated Coastal Engineering System (ACES) module in the Coastal Engineering Design and Analysis System (CEDAS) package, which were developed by the U.S. Army Corps of Engineers' Coastal & Hydraulic Laboratory (CHL).

3.3.2 Tsunamis

Loomis (1976) presented runup elevations for tsunamis that have affected the Hawaiian Islands. Table 3-4 shows the tsunami runup elevations that were measured near the project site. Runup elevations are relative to mean lower low water. The 1957 tsunami was generated near Alaska, while the 1960 tsunami was generated near Chile. Based on these historical tsunamis, a tsunami of similar size may cause minor overtopping and inundation.

Table 3-4 Tsunami Runup Elevations, Kapaa

Tsunami	Runup elevation (feet)
1957	11
1960	8

3.3.3 Tide

Hawaii tides are semi-diurnal with pronounced diurnal inequalities (i.e., two high and low tides each 24-hour period with different elevations). Tidal predictions and historical extreme water levels are given by the Center for Operational Oceanographic Products and Services, NOS, NOAA, website. The nearest tide station to the project site is at Nawiliwili near the Lihue Airport. The water level data for Nawiliwili, based on the 1983-2001 tidal epoch, is shown in Table 3-5.

Table 3-5 Water level data for Nawiliwili

Mean Higher High Water	1.8 feet
Mean High Water	1.4 feet
Mean Tide Level	0.8 feet
Mean Low Water	0.2 feet
Mean Lower Low Water	0.0 feet

Hawaii is also subject to periodic extreme tide levels due to large-scale oceanic eddies that propagate through the islands. These eddies produce tide levels up to 0.5 to 1 foot higher than normal for periods of up to several weeks.

3.3.4 Still Water Levels and Nearshore Wave Heights

During high wave conditions, the nearshore water level may be elevated above the tide level by the action of breaking waves. This water level rise, termed wave setup, could be as much as 1 to 2 feet during severe storm wave conditions. During hurricane conditions, an additional water level rise due to wind stress and reduced atmospheric pressure can occur. Collectively termed "storm surge," this can potentially add another 1 to 2 feet to the stillwater level. For example, during the 1992 passage of Hurricane Iniki over Port Allen Harbor on the island of Kauai, a National Weather Service tide gauge recorded a water level rise of 4.9 feet above the predicted tide elevation.

During storm or large wave conditions, there may be multiple zones of wave breaking. Wave heights are said to be *depth-limited* because once the water depth becomes shallow enough the wave breaks, losing size and energy. The wave, however, may reform before it reaches the shoreline and break again when the depth-limited ratio is again attained. The still water level rise during storm events is an important design consideration because it allows larger wave heights to reach the shoreline than during lower water levels.

Estimation of still water level rise may be accomplished by traditional methodology which uses bathymetry and wave heights as inputs. Still water level rise at the shoreline is a combination of astronomical tide, storm surge, and wave setup. The astronomical tide level chosen for design conditions is mhhw due to its frequency of occurrence, which was presented earlier as 1.8 feet at nearby Nawiliwili (Table 3-5).

Wave setup is a function of the breaking wave height, period, and bottom topography. The mass transport of water due to breaking waves produces wave setup—the increase in water depth shoreward of the breaker zone. The available analytical methods for calculating wave setup have been simplified and assume long, straight, parallel bathymetric contours, continuous breaking waves, and breaker zones relatively near shore; these methods are presented in the Shore Protection Manual (1984) and Coastal Engineering Manual (2006). Experience has shown that these methods tend to over-predict wave setup, because the natural environment has discontinuous breaking zones, irregular bathymetry, channels, and gaps in the reef that allow for a relief of wave setup. Site-specific wave setup was calculated during the Kauai Island Hurricane Vulnerability Study (Sea Engineering, Inc., 2000) and can be used to calibrate the analytical methods for the project site. The model results indicate that traditional methods may overestimate wave setup in this area by about 20%. A correction factor of 0.8 is therefore applied to calculated wave setup for the prevailing, 1-year, and 50-year waves presented previously.

3.3.5 Design Still Water Level

The project site is exposed to waves from north clockwise through south as presented in Section 3.2.2. While all of these waves would lose some energy through refraction, a wave approaching with a deepwater direction from the east-northeast would experience the least refraction. For design purposes, the design waves are considered to approach from the east-northeast, which was found in Section 3.2.3 to be the average direction of the five largest annual waves from the WIS 099 data set.

The limiting-water depth is found over the sandstone bench described in Section 2.1. Forty-two transects were measured across the bench, and the maximum crest elevation at each of these transects was determined. Those crest elevations ranged from +1.7 feet to +2.9 feet mllw, and the elevation of +1.7 feet mllw is selected as the limiting water depth to produce the most conservative estimate. A summary of design parameters for the four wave conditions discussed in Section 3.2 is presented in Table 3-6.

Table 3-6 Design wave conditions

	Prevailing wave	1-year wave	50-year wave	Hurricane
Deepwater Wave Height H_o (ft)	6	17.8	25.5	30.6
Breaking Wave Height H_b (ft)	8.5	23.3	30.5	32.0
Still Water Level Rise				
Astronomical tide (ft)	1.8	1.8	1.8	1.8
Large-scale eddy (ft)	0.5	0.5	0.5	0.5
Storm Surge	0.0	0.0	0.0	0.7
Wave setup (ft)	0.8	2.4	3.3	3.5
Total SWL rise (ft)	3.1	4.7	5.6	6.5
Rock bench elevation (ft)	1.7	1.7	1.7	1.7
Design Water Depth (ft)	1.4	3.0	3.9	4.8
Design Wave Height H (design, ft)	1.0	2.1	2.7	3.4

4. SHORE PROTECTION DESIGN PARAMETERS

This section produces a concept revetment profile using accepted coastal engineering design guidelines based on the wave conditions discussed in Section 3.3.5 . The concept structure is designed as a rock rubblemound revetment with a face slope of 1v:1.5h, which is the steepest slope recommended by the Coastal Engineering Manual (2006) for rock rubblemound structures. Crest width is taken to be two stones. The structure is designed with a single layer of armor stone with an underlayer of smaller stone, and the armor stones should be carefully placed in a keyed-and-fitted manner. While two layers of armor stone are generally recommended for rock rubblemound revetments, a single keyed-and-fitted armor stone layer has been found to be appropriate along shorelines that have shallow nearshore bathymetry that limits the wave energy reaching the structure.

4.1 Stone Size

Armor stone size calculations were performed for the four design wave conditions presented in Table 3-6. The required revetment armor stone weight for stability under the design wave height is given by the Hudson Formula (Coastal Engineering Manual, 2006):

$$W = \frac{w_r H^3}{K_D (S_r - 1)^3 \cot\theta}$$

where,

W = weight in pounds of an individual armor stone
w_r = unit weight of the stone
H = wave height
K_D = armor stone stability coefficient
S_r = specific gravity of the stone relative to seawater
$\cot\theta$ = cotangent of the groin face slope

The resultant armor stone weights and diameters are presented in Table 4-1, where nominal diameter is calculated as

$$D_{nom} = \left(\frac{W}{w_r}\right)^{1/3}$$

4.2 Crest elevation and wave runup

Wave runup is the vertical excursion of a wave breaking at the shoreline or on a structure. Runup elevation was calculated using the computer program ACES, which was referenced in Section 3.3.1. Runup is a function of the wave height at the project site at the design water level, and in the project area, the shallow nearshore bathymetry limits the wave height that can impact the structures. The sand beach fronting the revetment also serves to dissipate wave energy, limiting wave effects on the revetment. As a worst-case scenario, the sand beach is assumed to be completely eroded, leaving the revetment foundation exposed at -4 feet mllw.

Calculated runup values are presented in Table 4-1 for the design cross section. The topographic survey showed the revetment crest elevation to be typically +9.5 feet to +11 feet mllw in the southern reach, decreasing to about +8 feet mllw for the northern end of the revetment (neglecting the damaged portion between Stations 8+80 and 10+00). If the structure crest is lower than the runup height, the structure would be considered overtopped.

Table 4-1 Design wave conditions and armor stone size

	Prevailing wave	1-year wave	50-year wave	Hurricane wave
Deepwater wave height H_o (ft)	6	17.8	25.5	30.6
Breaking wave height H_b (ft)	8.5	23.3	30.5	32.0
Design water depth (ft)	1.4	3.0	3.9	4.8
Design wave height (ft)	1.0	2.1	2.7	3.4
Armor stone size				
W_{50} (lbs)	41	380	810	1,610
D_{nom} (ft)	0.6	1.2	1.6	2.2
Runup elevation (ft mllw)	3.1	6.7	8.5	10.5

As mentioned previously, armor stone nominal diameters measured along the southern revetment reach ranged from 1.8 to 6.0 feet, with an average of 3.2 feet, while in the northern reach, the measured armor stones ranged from 1.9 to 6.0 feet, with an average of 3.9 feet. The present analyses have found the existing average armor stone along the northern reach to greatly exceed the size necessary to remain stable under model hurricane wave conditions if properly designed and constructed. Additionally, existing revetment crest elevations would be expected to allow little wave overtopping for up to a 50-year wave event. While the southern reach of revetment appears to be stable, the stability cannot be quantified, as that section does not meet coastal engineering design standards, and use of the Hudson Formula is inappropriate for revetment face slopes steeper than 1v:1.5h.

5. SUMMARY AND RECOMMENDATIONS

The existing rock revetment shore protection was not constructed in accordance with standard design practice for this type of structure, with the primary issues being the following.

- The southern half of the revetment has a side slope much steeper than is recommended for a rock rubblemound structure. Despite this, it does appear to be stable, with little or no evidence of stone movement. This may be partly attributable to the very large stones used to construct the revetment, which generally greatly exceed the stone size required for the wave heights at the shore.
- No filter (e.g., geotextile filter fabric) or underlayer of smaller stone was placed behind the large armor stone; thus, water motion and wave action, as well as ground water flow during heavy rains, can remove fine material from behind the armor through the voids between stones. This will cause the stones to shift and settle, and result in sinkholes forming behind the revetment. Unfortunately, this problem is difficult to correct without removing and rebuilding the entire revetment.
- The revetment was constructed around trees, which can eventually affect stability of the revetment stone, either by continued growth of the tree and its roots which can dislodge and move the stone, or by the tree dying and its decay resulting in a void between stones.

The emergent rock bench seaward of the shoreline acts as natural shore protection by significantly limiting the wave heights and energy at the shoreline, and this contributes to the effectiveness of the revetment. Recommendations for shore protection maintenance and repair are as follows.

5.1 Stations 0+00 to 5+70 (southern reach)

While some damage is evident, the damage does not appear to be sufficient to significantly de-stabilize the revetment. Ongoing maintenance of this reach is considered a viable alternative (e.g., filling the sinkholes, removing dead trees and replacing them with armor stone). When filling sinkholes behind the revetment, the ocean side and bottom of the hole should be lined with geotextile filter fabric prior to filling, and the fill material should be rock (e.g., gravel, base course, crusher run). When adding or replacing armor stone, the surrounding stone should be removed and reset as necessary to key and fit the new stone into the revetment. It appears that repairs and maintenance can generally be done above the mhhw line and behind the existing revetment, and thus out of federal (Department of the Army) permit jurisdiction and the state conservation district.

5.2 Stations 5+70 to 10+50 (northern reach)

5.2.1 Alternate Design 1

The existing revetment in this reach is badly damaged and has failed completely, or is likely to fail in the future. It is recommended that this portion of the revetment be rebuilt in accordance with generally accepted design practice. Given the relatively low design wave heights at the shore, a single armor stone layer placed over underlayer stone and geotextile filter fabric is recommended, as shown on Figure 5-1. The design section has a two-stone crest and a face slope of 1v:1.5h, intersecting hard substrate at -4 feet mllw. A larger toe stone is specified to increase stability. An underlayer of smaller stone, as well as a geotextile layer are included in the design to reduce the potential for fine material to escape through voids in the stone.

The crest elevation is designed to be +9 feet mllw, which is consistent with the typical design elevation of the shoulder of the road. Although the elevation of Moana Kai Road decreases slightly toward the north along the project site, the crest elevation of the revetment should remain at +9 feet mllw, and any variability in the design elevations should be accounted for in the shoulder of the road and/or the concrete header.

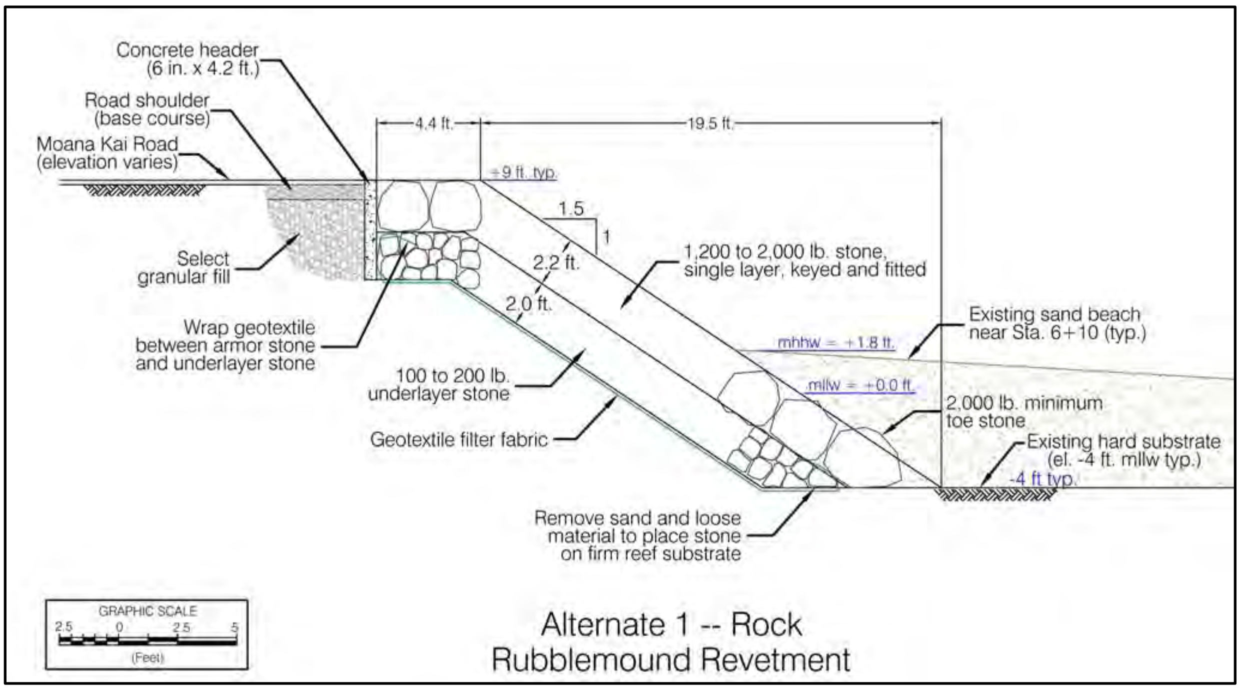


Figure 5-1 Alternate 1 revetment cross section

When constructing a single layer of armor stone, the stone should be carefully chosen and placed in a keyed-and-fitted manner to minimize gaps between stones and ensure maximum contact between adjacent stones. The loose sand and gravel should be excavated to place the revetment stone on hard, non-erodible, rock substrate where possible. The sand excavated from the beach during construction should be replaced as close to existing lines and grades as possible.

Following placement of the revetment stone, a concrete header can be cast in-place between the shoulder of the road and the first crest stone, and the road should be paved to the header. The header will help prevent scour behind the crest by overtopping storm waves, and thus will buttress both the revetment crest stone and the road shoulder.

5.2.2 Alternate Design 2

A second section was developed to reduce the overall footprint of the structure. This section is shown in Figure 5-2 and is referred to as a hybrid structure, containing components of both a seawall and a revetment. The rubblemound portion of the design has the same general characteristics as Alternate Design 1 (e.g., stone size, face slope), with the exception of the revetment crest elevation being lower (+6 feet mllw), thereby reducing the seaward extent of the structure. The increased overtopping at higher wave conditions that would occur with this design would be limited by the seawall.

The seawall would be constructed as a CRM wall or similar prior to constructing the revetment. The top of the CRM wall is designed to have a typical elevation +9.5 feet mllw. While the elevation of the road varies along the project reach, the crest elevation should remain constant, and if variability in the structure elevation is required to meet road requirements, then the variability should be made to the CRM wall, rather than the rocks. The base of the wall should extend to below the armor layer.

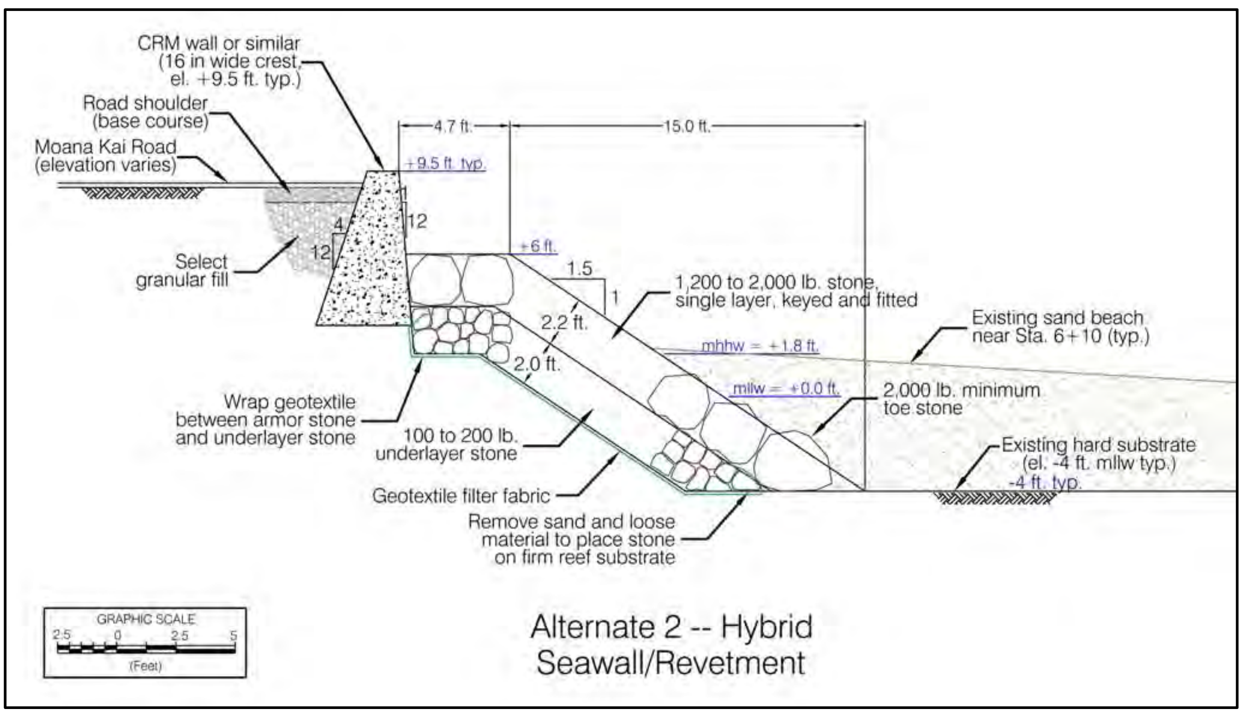


Figure 5-2 Alternate 2 hybrid seawall/revetment cross section

5.2.3 Alternative Toe Design

The cross sections shown on Figure 5-1 and Figure 5-2 are predicated on the assumption that there is a hard substrate layer at approximate elevation -4 feet, based on this feature being shown in the as-built drawings (Figure 2-7 and Figure 2-8). There have thus far been no investigations to confirm this assumption. If hard substrate is found to differ slightly from the as-built drawings, the revetment could be extended or shortened as needed to fit.

In the event hard substrate is not encountered during construction, an alternative toe configuration designed for soft substrate should be used. Figure 5-3 shows Alternate 1 with a toe scour apron specifically designed for use in soft substrate, such as sand. The scour apron for Alternate 2 would be similar.

The scour apron design has additional armor stones and underlayer placed at the toe of the revetment in order to reduce the potential for scour, which would destabilize the revetment. The scour apron would add approximately 3.3 feet to the cross section width. The toe stones in Figure 5-1 and Figure 5-3 would be placed at the same elevation to facilitate transition of the revetment between regions of hard substrate and soft substrate.

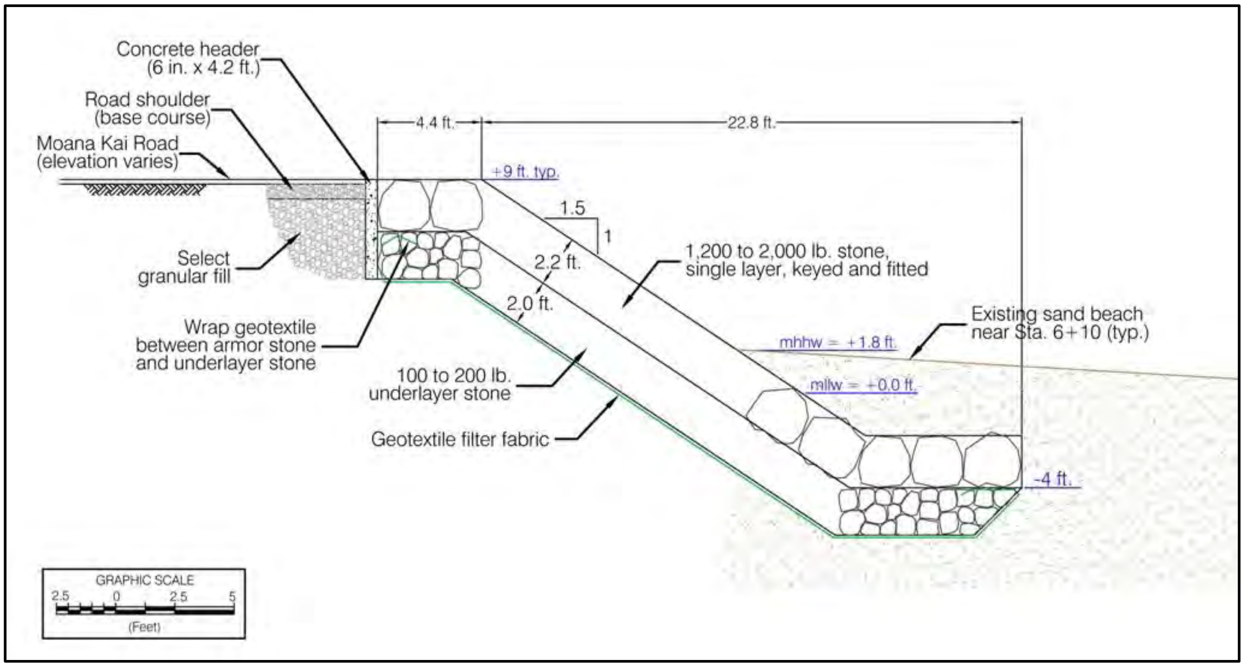


Figure 5-3 Alternate 1 showing toe scour apron

5.3 Revetment Termination

Construction of the revetment against non-erodible material is recommended practice to reduce the potential of undermining and flanking. As shown in Figure 5-1 and Figure 5-2, the revetment foundation is the existing hard substrate that was identified in the as-built drawing shown as Figure 2-8. Founding the revetment on hard substrate prevents the toe stone from being undermined and the revetment from being destabilized. An alternative toe design was presented in the event that hard substrate is not encountered. The threat of flank erosion near Station 5+70 can be reduced by wrapping the proposed revetment in a radial manner, maintaining the 1v:1.5h slope, until it intersects the existing revetment on the south. Terminating the new revetment this way reduces the discontinuity in the two revetments and reduces the potential for flanking of either portion of revetment. A plan view of this intersection is shown in Figure 5-4.

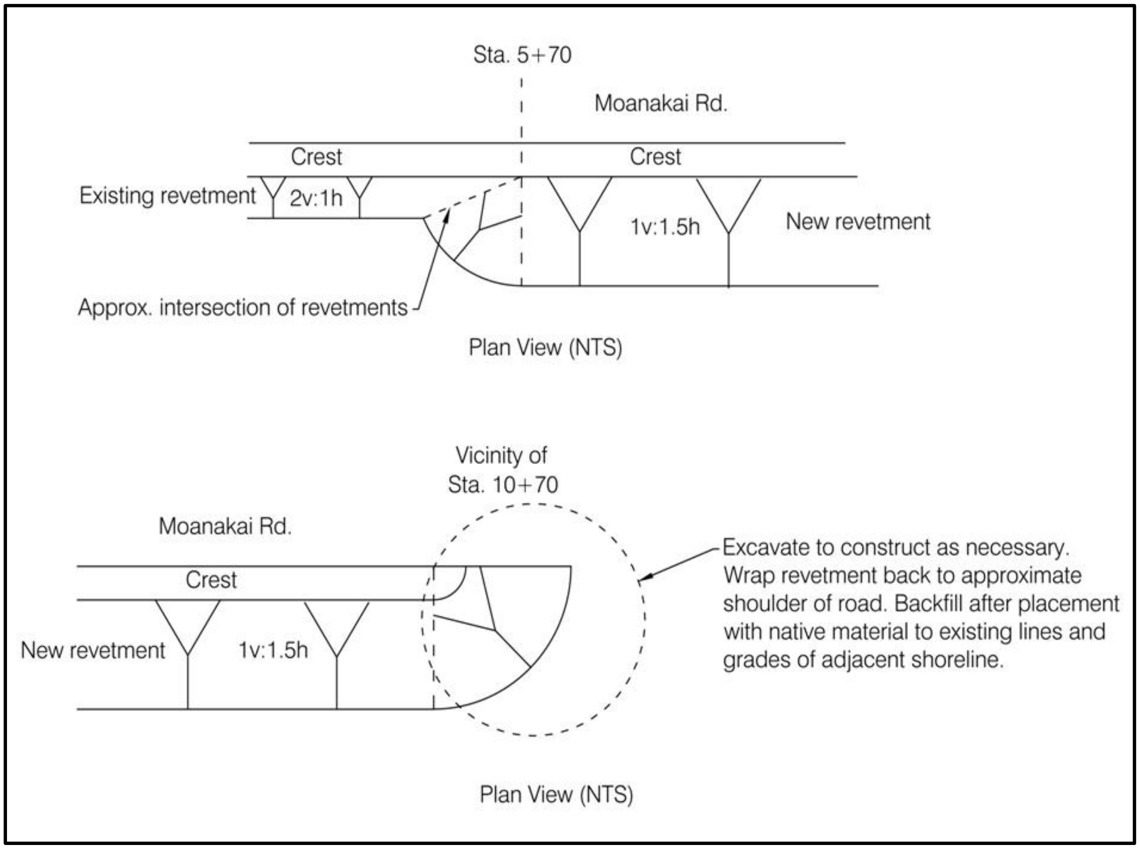


Figure 5-4 Concept revetment terminations

At the northern end of the proposed revetment (Station 10+70), there is no non-erodible material against which to terminate, which presents a risk of structure failure should flank erosion occur. The existing revetment, however, does not appear to terminate against non-erodible material, and there is no indication that there has been any erosion as a result. The best option in this case is to excavate the sand from this area and wrap the revetment 90 degrees to the shoulder of the road, where it would terminate against the existing substrate along and below the shoulder of the road

(Figure 5-4). To reduce the exposure of the revetment termination and the road shoulder from erosion, the end of the revetment should be buried using native material to existing lines and grades, compacting if necessary.

This termination should be visually inspected regularly for erosion and maintained as needed. A typical inspection schedule might be as follows: every month for three months, then every three months for nine months. Should there be no apparent flanking or other threat to the revetment or road, inspections annually and following large wave events thereafter would be sufficient. In the event of erosion, proper steps should be taken based on the specific nature of the erosion.

5.4 Potential Impacts

The proposed construction activity would occur from Station 5+70 to Station 10+70. While there is sandy beach the full length of the existing revetment, the section of beach fronting the proposed construction is the most dynamic, as discussed in Section 2. Design of shore protection along sandy shorelines requires careful attention to assure that sedimentation patterns and beach stability will not be impacted.

The Alternate 1 cross section shown in Figure 5-1 is consistent in crest elevation and face slope with the existing portion of revetment that it will replace. The main differences between the existing revetment and the proposed design are the use of smaller armor stone and the addition of an underlayer and a geotextile filter fabric to prevent the loss of fine material from behind the revetment. Alternate 2, shown in Figure 5-2, has a slightly smaller footprint than the existing revetment. The seawall component is included to protect the backshore against overtopping, which is expected to occur only for higher wave conditions. Wave reflection, which could be detrimental to beach stability, is not expected to be significant.

Reconstruction of Moana Kai Road is a major aspect of the overall project. The shoulder of the road along the southern portion of revetment is 7 to 9 feet wide, while there is no effective shoulder along much of the northern portion. To accommodate the road modifications and the inclusion of a nominal road shoulder along this reach, the proposed revetment will need to be shifted seaward slightly and the footprint will extend beyond the footprint of the existing revetment.

The existing beach though this area is 50 to 85 feet wide, as measured from the revetment to the rock bench. Each of the alternates will have a straight alignment parallel to the road and will have similar energy dissipation characteristics as the existing revetment. Neither alternate contains features that would impact sediment transport. Replacement of the existing revetment with either of the alternate is therefore not expected to affect sedimentation patterns and beach stability.

5.5 Additional Design Considerations

As mentioned previously, the existing 1,000-foot long revetment does not meet standard design practice, and there is no basis of design report available. There is no explanation why the revetment was constructed using two cross sections. The present design has been performed for the north reach of the revetment, which is shown in the as-built drawing as having a 1v:2h face slope. By contrast, the south portion of the revetment is shown to have been built with a much steeper 2v:1h face.

Only the northern reach of revetment is proposed to be rebuilt, as the damage to the southern reach can be addressed via maintenance. The designs presented above are based on design guidance for rock rubblemound revetments as published by the U.S. Army Corps of Engineers. While the steeper existing reach of revetment in the south appears to be stable, published design guidance is not available for rock rubblemound revetments with faces steeper than 1v:1.5h; thus, this report does not recommend as an option that the northern portion of revetment be replaced with a cross section that matches the southern reach of revetment.

Additionally, a steep-faced structure such as a seawall is not recommended. Seawalls are a common shore protection structure recommended when the landward property/infrastructure needs to be protected at the expense of the shoreline. Seawalls and other steep structures are highly reflective, causing an offshore transport of sediment, increased longshore currents, and a flattening of the beach profile, none of which are conducive to beach stability. While sediment dynamics are very site specific, and the beach in front of the southern portion of revetment appears stable, proposing a steep and potentially reflective structure that could destabilize a popular sandy shoreline is not in the public's best interest, nor is it likely to be permitted.

The first iteration of design considered utilizing as much of the existing stone as possible. Armor stone sizes at the face of the revetment were measured during the site visit (see Section 2.2.2). The nominal diameters of the 10 stones along the northern reach ranged from 1.8 feet to 6.0 feet, with an average of 3.9 feet, or 4.7 tons, which is considerably larger than this report has found necessary based on wave conditions at the shoreline. Attempts to design the revetment using this larger stone resulted in the structure extending seaward beyond the existing structure's footprint. In order to remain within the footprint of the existing revetment, the design section was produced with the stone size calculated in Section 4.1, without consideration of the stone on site.

Standard rock revetment design practice is for armor stones to be within the allowable size range to maximize interlocking and stability, as well as to insure that layer thicknesses and "neat line" slope tolerances are maintained. Of the 10 armor stones measured, only one is considered to be of proper size to be reused. Based solely on this, it can be tentatively concluded that about 10% of the rocks on site may be reused. However, any stone that meets the size range and required physical characteristics (e.g., specific gravity) may be used. The attempts made here to quantify the amount of stone that can be reused are merely to provide an initial level of guidance.

6. PERMIT CONSIDERATIONS

The existing shore protection structure along Moana Kai Road was constructed following Hurricane Iniki to protect the road against further erosion. The construction was considered to be an emergency, thus the typical permit process was not required. In order to repair the structure, it is expected that the County of Kauai would have to participate in the full permitting process, which could have the following components:

State

- A project that proposes to use state or county lands or funds, or land in the conservation district or shoreline setback area, requires an Environmental Assessment (EA) (or possible EIS if significant impacts are expected) prepared in accordance with HRS Chapter 343. Exemptions can be made by the state or county agency that has oversight for the proposed activity for repair and maintenance of existing structures, or replacement or reconstruction of existing structures. Repair or replacement of the existing revetment may thus be exempt from the requirements of Chapter 343.
- A Certified Shoreline determination by the State Department of Accounting and General Services, State Survey Office, and Department of Land and Natural Resources Office of Conservation and Coastal Lands may be required to determine the boundary between state and county permitting jurisdiction.
- Work seaward of the certified shoreline and in nearshore coastal waters would require a Conservation District Use Permit from the Board of Land and Natural Resources.
- Any fill in coastal waters, such as revetment stone, would require a Clean Water Act Section 401 Water Quality Certification from the Department of Health.
- A construction work area greater than one acre would require a Clean Water Act NPDES permit from the State Department of Health.

County

- Work landward of the certified shoreline would require a Special Management Area (SMA) permit and a Shoreline Setback Variance (SSV).

Federal

- Work in waters of the U.S., typically defined as work in coastal water below the intersection of mean higher high water (mhhw) and the shoreline, would require a Rivers and Harbors Act Section 10 permit from the Department of the Army (administered by the Army Corps of Engineers).
- If the work involves placing fill in waters of the U.S., for example revetment stone, a Clean Water Act Section 404 permit would also be required from the Department of the Army.
- Work requiring a federal Section 10 and/or 404 also require a Hawaii Coastal Zone Management Act consistency determination by the Department of Business Economic Development & Tourism, Office of Planning, CZM Program.

REFERENCES

Bretchneider, C.L. and Edward K. Noda and Associates. 1985. *Hurricane Vulnerability Study for Honolulu, Hawaii, and Vicinity: Volume 2, Determination of Coastal Inundation Limits for South Oahu from Barbers Point to Koko Head*, Prepared for US Army Engineer Division, Pacific Ocean Planning Branch, Flood Plains Management Section.

Haraguchi, P., 1984, *Hurricanes in Hawaii*, Prepared for USACOE, Pacific Ocean Division.

Inman, D.L., W.R. Gayman, and D.C. Cox. 1963. "Littoral Sedimentary Processes on Kauai, A Subtropical High Island." *Pacific Science*, vol. 17(1).

Loomis, H. G. 1976. *Tsumani Wave Runup Heights in Hawaii*. Hawaii Institute of Geophysics report no. HIG-76-5.

Noda, E.K., 1991; *Coastal Processes and Conceptual Design Considerations for Waikiki Beach Improvements*; 56 pp.

Sea Engineering, Inc. 1986. *Hurricane Vulnerability Study for Kauai, Vicinity of Waimea and Kekaha, Storm Wave Runup and Inundation.* Prepared for the U.S. Army Corps of Engineers, Pacific Division.

Sea Engineering, Inc. 1993a. *Hurricane Iniki Coastal Inundation Modeling.* Prepared for the U.S. Army Corps of Engineers, Pacific Division.

Sea Engineering, Inc. 1993b. *Leeward Oahu Hurricane Vulnerability Study, Determination of Coastal Inundation Limits.* Prepared for the State of Hawaii Department of Defense, the U.S. Army Corps of Engineers, Pacific Division, and Federal Emergency Management Agency, Region IX.

Sea Engineering, Inc. 2000. *Kauai Island Hurricane Vulnerability Study, Determination of Coastal Inundation Limits.* Prepared for the State of Hawaii Department of Defense, the U.S. Army Corps of Engineers, Pacific Division, and Federal Emergency Management Agency, Region IX.

U.S. Army Corps of Engineers. 1984. *Shore Protection Manual*.

U.S. Army Corps of Engineers. 2006. *Coastal Engineering Manual*.

Vituosek, S., and C.H. Fletcher. 2008. "Maximum Annually Recurring Wave Heights in Hawaii." *Pacific Science*, vol. 62(4:541-553).

Appendix B

Repair/Reconstruction of Moanakai Seawall:
Water quality survey for Moanakai Road seawall improvements

AECOS, Inc., December 2010

AECOS No. 1238B

Repair/Reconstruction of Moanakai Seawall

Water quality survey for Moanakai Road seawall improvements, Kapaʻa Kauaʻi, Hawaiʻi

---

Prepared by:

AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744-3221

December 14, 2010

Water quality survey for Moanakai Road seawall improvements, Kapaʻa, Kauaʻi, Hawaiʻi[1]

December 14, 2010 | ***DRAFT*** | *AECOS* No. 1238B

Susan Burr
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: aecos@aecos.com

Introduction

The project site along Moanakai Road is located on the eastern coast of Kauaʻi, in Kapaʻa (Fig. 1). Moanakai Road is a narrow, two lane street that gives access to home sites and to Waipouli Beach Park (locally referred to as "Baby Beach"). A seawall and boulder rock revetment hold back the earthen fill on which the road is built. The protective revetment is eroding in some areas. The Repair/Reconstruction of Moanakai Road Seawall (Project) proposed by the County of Kauaʻi Public Works includes improvements to the existing protective structure with an additional 1.5 to 1.8 m (5 to 6 ft) of boulder revetment. Design alternatives are being studied to find a solution to protect Moanakai Road from erosion damage (SEI, 2010).

In September 2010, *AECOS,* Inc. biologists conducted a survey to assess the marine resources and measure water quality adjacent to the roughly 330-m (1,080-ft) long revetment fronting Moanakai Road (Fig. 2). The results of the marine biological survey are presented in a separate report (*AECOS*, 2010). The purpose of the present report is to describe the results of water quality sampling intended to characterize existing or baseline water quality in the Project area and provide data required for a National Pollutant Discharge Elimination System (NPDES) permit.

[1] Report prepared for R. M. Towill, for use in project permitting. This document will become part of the public record for the project.

Site Description

The shoreline in the project area faces nearly due east and experiences the regular Northeast Tradewinds. To the north is Waipouli Beach Park and Waikaea Canal. Fronting the Project at Moanakai Road is a narrow swath of sand and rubble, separated from the fringing reef flat beyond by a narrow limestone beachrock formation that exposes at low tide. The beachrock creates a small, semi-enclosed body of water or "lagoon," which is narrowest at the south end and widest at the north end where the lagoon opens to the ocean. Portions of the sand and beachrock stay wet throughout the tidal cycle, a result of a gentle downward slope from south to north. A fringing reef extends some 400 m (1,300 ft) seaward from the shoreline. Prevailing currents offshore from the Project are from south to north and converge with north to south currents between Moikeha and Waiakea (drainage) canals (Inman et al., 1963).

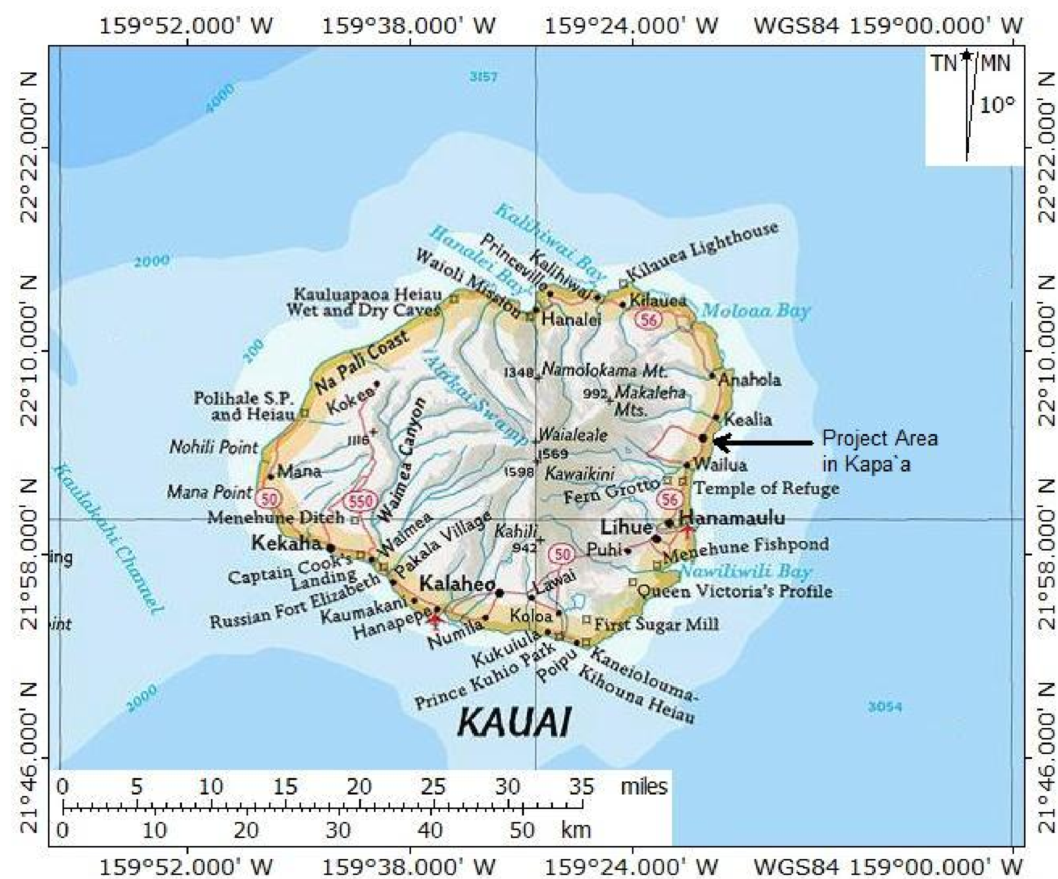


Figure 1. Project location at Kapaʻa on the Island of Kauaʻi.

Methods

On September 24, 2010, *AECOS* biologists measured certain parameters in the field and collected water samples for analyses in the laboratory (*AECOS* Laboratory Log No. 26670) at three stations ("North", "Mid", and "South") in the Project area (Fig. 2). The stations were located in the water shoreward of the beachrock formation. An additional sample was collected at Sta. Mid to serve as baseline data for the NPDES application. Field measurements were made and samples collected around 3:30 pm during the high tide. On that date, the 1.3-ft high tide (lower high water or LHW) was predicted (at nearby Nawiliwili Harbor) to occur at 3:47 pm (NOAA/NOS, 2010).

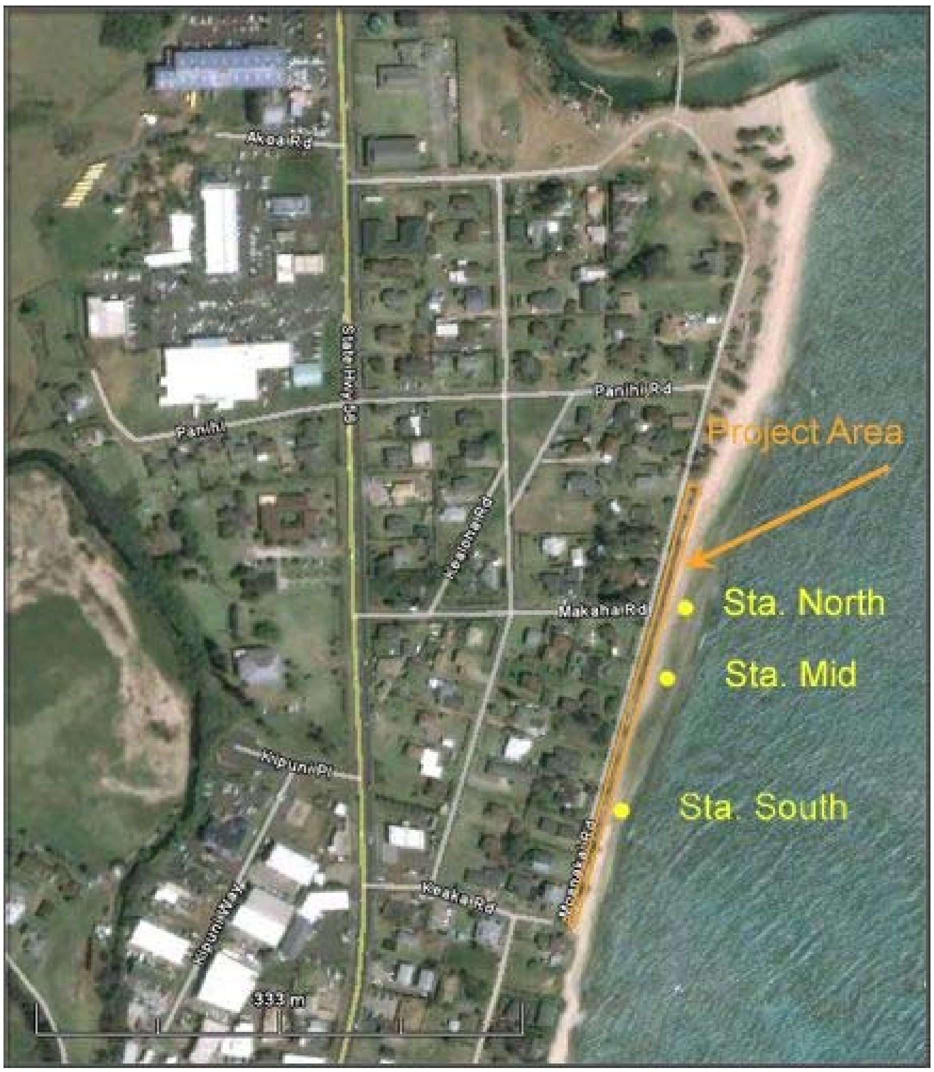


Figure 2. Satellite image of Project area showing water quality station locations.

Table 1 lists the instruments and analytical methods used in the field and to analyze the collected samples. Table 2 lists the instruments and analytical methods used to evaluate the sample collected to serve as baseline data collected at Sta. “Mid” for the NPDES application.

Table 1. Analytical methods and instruments used for September 24, 2010 water quality analyses to characterize nearshore waters off Moanakai seawall, Kaua'i.

Analysis	Method	Reference	Instrument
Temperature	thermister calibrated to NBS. Cert. thermometer SM 2550 B	Standard Methods (1998)	YSI Model 550A Dissolved Oxygen Meter
Dissolved Oxygen	SM 4500-O G	Standard Methods (1998)	YSI Model 550A Dissolved Oxygen Meter
Salinity	SM 2520 B	Standard Methods (1998)	Refractometer
pH	SM 4500 H+	Standard Methods (1998)	Hannah pocket pH meter
Turbidity	EPA 180.1 Rev 2.0	USEPA (1993)	Hach 2100N Turbidimeter
Total Suspended Solids	Method 2540 D	Standard Methods (1998)	Mettler H31 balance
Ammonia	EPA 350.1	USEPA (1993)	Lachat Flow Injection Analysis
Nitrate + Nitrite	EPA 353.2 Rev 2.0	USEPA (1993)	Technicon AutoAnalyzer II
Total Nitrogen	persulfate digestion/EPA 353.2	Grasshoff et al. (1986)/ USEPA (1993)	Technicon AutoAnalyzer II
Total Phosphorus	EPA 365.3	USEPA (1993)	Beckman UV/VIS

Table 2. Analytical methods, instruments, and detection limits used for September 24, 2010 water quality analyses at Moanakai seawall, Kauaʻi at Sta. "Mid" for NPDES application.

Analysis	Method	Detection Limit	Reference
Temperature	EPA 170.1	0.1 C°	Standard Methods (1998)
Dissolved Oxygen	EPA 360.1	0.1 mg/L	Standard Methods (1998)
Salinity	SM 2520 B	1 psu	Standard Methods (1998)
pH	SM 4500 H+	0.1 SU	Standard Methods (1998)
Turbidity	EPA 180.1 Rev 2.0	0.01 NTU	USEPA (1993)
Total Suspended Solids	EPA 160.2	0.1 mg/L	Standard Methods (1998)
Ammonia	SM 4500 NH_3 B/C	100 µg N/L	Standard Methods (1998)
Nitrate + Nitrite	SM 4500 NO_3 E	100 µg N/L	Standard Methods (1998)
Total Nitrogen	SM 4500 NO_3 E + N ORG B	500 µg N/L	Standard Methods (1998)
Total Phosphorus	SM 4500 P B/E	100 µg P/L	Standard Methods (1998)
Oil & Grease	EPA 1664A	1 mg/L	USEPA (1996)

Results

Results are summarized in Table 3 and Table 4 (NPDES). All three stations have similar water quality, indicating the water is well-mixed. The temperature was quite high, although not unusual for measurements taken in shallow water during the late afternoon towards the end of summer. The salinity measured is indicative of seawater with little freshwater input. The water was supersaturated (saturation greater than 100%) with oxygen and the pH was slightly elevated—indicating photosynthesizing algae. Chlorophyll α, a direct indicator of phytoplankton biomass, was also slightly elevated, as were turbidity and total suspended solids (TSS). Ammonia (a dissolved form of inorganic nitrogen) was elevated at Sta. Mid, although nitrate-nitrite (another dissolved inorganic nitrogen species) was low at all stations. Total nitrogen

(TN), which includes inorganic, organic, and particulate nitrogen moieties, was low, as was total phosphorus (TP).

Table 3. Water quality characteristics of nearshore waters off Moanakai seawall, Kauaʻi, as determined at LHW on September 24, 2010.

	Time sampled	Temp. (°C)	DO (mg/l)	DO sat. (%)	Salinity (psu)	pH	chl α (μg/l)
North	1538	29.5	7.19	114	35	8.19	0.31
Mid	1549	29.3	7.41	118	35	8.25	0.44
South	1515	28.9	7.05	110	34	8.13	0.42

	Turbidity (ntu)	TSS (mg/l)	Ammonia (μg N/l)	Nitrate + nitrite (μg N/l)	Total N (μg N/l)	Total P (μg P/l)
North	1.16	8.8	18	<1	132	5
Mid	1.04	8.3	38	<1	121	5
South	1.06	8.7	6	<1	116	4

The detection limits of the methods required to be used for nutrient analysis of water quality samples for NPDES permit applications (HDOH, 2007a, 2007b) are higher than that used to characterize the water quality of the Project area. No nutrients (ammonia, nitrate-nitrite, TN, or TP) were detected in levels above the reporting limits for these analyses (Table 4). Oil and grease was not detected in the sample.

Table 4. Baseline water quality data from nearshore waters at Moanakai seawall, Kauaʻi at Sta. "Mid" to be used for NPDES application

	Time sampled	Temp. (°C)	DO (mg/l)	DO sat. (%)	Salinity (psu)	pH	Oil & Grease (mg/l)
Mid	1549	29.3	7.41	118	35	8.25	<1.0

	Turbidity (ntu)	TSS (mg/l)	Ammonia (μgN/l)	Nitrate + nitrite (μgN/l)	Total N (μgN/l)	Total P (μgP/l)
Mid	1.04	6.9	<100	<100	<500	<100

Discussion

Water quality samples collected on September 24, 2010 represent high tide conditions on that date and results could vary depending upon tidal stage. Much of the environment immediately seaward of the Project site is intertidal. The sand beach at the south end of the Project area is dry at low tide and nearly completely inundated at high tide. A deep area of the lagoon (roughly 1 m or 3 ft deep) located along the north quarter of the project area remains flooded throughout the tidal cycle. Small waves crest over the beachrock with the rising tide allowing seawater to flood the narrow lagoon. As water flows over the beachrock, a current results with the water escaping towards the north end of the lagoon. The current over the reef flat offshore of the beachrock formation flows in the opposite direction, from north to south on a rising tide.

Waters off the east coast of Kauaʻi are designated as Class A with state water quality criteria pertaining to either "wet" and "dry" conditions (Table 5; HDOH, 2009). The coastal waters within the lagoon off the Moanakai seawall likely fall into the "wet" set of criteria due to the freshwater input along the coastline from Waikaea Canal to the north and Waipouli Canal to the south. As stated in the water quality regulations, it is the objective of Class A waters that their use for recreation and aesthetic enjoyment be protected (HDOH, 2009).

The primary purpose of the water quality measurements presented in this report was to characterize the existing aquatic environment, not to determine compliance with Hawaiʻi's water quality criteria. In fact, the state criteria for all nutrient measurements, chlorophyll α, and turbidity are based upon making comparisons to geometric mean values, so a minimum of three separate samples per sampling location would be required to generate the proper statistic. Ideally, multiple samplings would encompass a "typical" range of conditions for the location, including but not limited to such events as rising, versus ebbing tide, wet versus dry weather periods, and even storm events. The criteria presented in Table 5 may be used, together with a data collected from a series of preconstruction sampling events, to develop decision rules as part of the data quality objectives (DQO) process in an applicable monitoring and assessment program (AMAP) developed in accordance with the required Clean Water Act Section 401 Water Quality Certification.

Water quality at the Project site is good. Project-specific best management practices (BMPs), including silt curtains, will need to be developed to ensure that water quality of the lagoon and adjacent reef flat are protected from sedimentation and project-related runoff. Any brief periods of impaired water quality associated with construction should have minimal impacts inside the lagoon or on the nearby reef flat as daily water exchange is high in these areas.

Much of the construction should occur on land, which will reduce the risk of concrete and construction-related material spills into marine waters.

Table 5. Selected state of Hawaiʻi water quality criteria for open coastal waters for both wet (upper value) and dry (*lower value*) coastal areas (HAR §11-54-05.2; HDOH, 2009).

Parameter	Geometric Mean value not to exceed this value	Value not to be exceeded more than 10% of the time	Value not to be exceeded more than 2% of the time
Total Nitrogen	150.00	250.00	350.00
(µg N/l)	*110.00*	*180.00*	*250.00*
Ammonia Nitrogen	3.50	6.50	15.00
(µg N/l)	*2.00*	*5.00*	*9.00*
Nitrate+Nitrite	5.00	14.00	25.00
(µg N/l)	*3.50*	*10.00*	*20.00*
Total Phosphorus	20.00	40.00	60.00
(µg P/l)	*16.00*	*30.00*	*45.00*
Chlorophyll α,	0.30	0.90	1.75
(µg/l)	*0.15*	*0.50*	*1.00*
Turbidity	0.50	1.25	2.00
(NTU)	*0.20*	*0.50*	*1.00*

Two values: upper, "wet" criteria apply when the open coastal waters receive more than three million gallons per day of freshwater discharge per shoreline mile; lower "dry" (italicized) criteria apply when the open coastal waters receive less than three million gallons per day of freshwater discharge per shoreline mile.

Other "standards":

- pH units shall not deviate more than 0.5 units from a value of 8.1.
- Dissolved oxygen shall not decrease below 75% of saturation.
- Temperature shall not vary more than 1C^{o} from ambient conditions.
- Salinity shall not vary more than 10% from natural or seasonal changes.

Conclusions

Potential exists for short term impacts from construction activities on the water quality of the nearshore environment. Activities involving mechanical equipment in the vicinity of the shoreline can lead to increased turbidity during construction, but adverse effects can be mitigated through the use of silt curtains and the curtailment of certain activities during high tide, adverse seas, or high rainfall conditions. Temporary increases in suspended sediments as a result of construction activities will cease once the project is completed. More significantly, stabilizing the backshore will reduce terrigenous inputs to the marine environment, a management priority identified and pursued in West Maui (SEI, 2002).

Care must be taken to avoid depositing construction materials, oil, grease, hydraulic fluid, fuel and/or any other noxious chemicals fluids directly or indirectly into the marine environment. Discharges can be mitigated by employing best management practices (BMPs) including, but not necessarily limited to:

1) proper storage, handling, and disposal of construction and waste materials away from the shore;
2) construction equipment washing and other similar activities done in a manner that allows for the proper disposal of the resultant wastewater;
3) maintenance of heavy machinery to ensure fluids of any kind are not leaked;
4) proper use of silt curtains during construction activities; and
5) water quality monitoring to ensure compliance with permit requirements.

References

AECOS, Inc (*AECOS*). 2010. Marine biological survey for Moanakai Road seawall improvements, Kapaʻa, Kauaʻi, Hawaiʻi. Prep. for: R.M. Towill. AECOS Report No. 1238A: 16 pp.

Grasshoff, K., M. Ehrhardt, & K. Kremling (eds). 1986. Methods of Seawater Analysis (2nd ed). Verlag Chemie, GmbH, Weinheim. 600 pp.

Hawaiʻi Department of Health (HDOH). 2007a. Hawaii Administrative Rules, Title 11, Department of Health, Chapter 55, Appendix A. Department of Health Standard General Permit Conditions. State of Hawaiʻi, Department of Health. 28 pp.

_______. 2007b. Hawaii Administrative Rules, Title 11, Department of Health, Chapter 55, Appendix G. NPDES General Permit Authorizing Discharges Associated with Construction Activity Dewatering. State of Hawaiʻi, Department of Health. 19 pp.

Hawaiʻi Department of Health (HDOH). 2009. Hawaiʻi Administrative Rules, Title 11, Department of Health, Chapter 54, Water Quality Standards. State of Hawaiʻi, Department of Health. 90 pp.

Inman, D. L., W. R. Grayman, and D. C. Cox. 1963. Littoral sedimentary processes on Kauai, a subtropical high island. *Pac. Sci.,* 17: 106-130.

National Oceanic and Atmospheric Administration and National Ocean Service (NOAA/NOS). 2020. Water level tidal predictions for Hawaiian Islands in 2010. Available online at URL: http://www.co-ops.nos.noaa.gov/get_predictions.shtml?year=2010&stn=1400+Nawiliwili; last accessed November 2, 2010.

Sea Engineering, Inc. (SEI). 2010. Moana Kai Road coastal assessment, Kapaa, Kauai. Prep. for R. M. Towill Corp. 44 pp.

Standard Methods (SM). 1998. Standard Methods for the Examination of Water and Wastewater. 20th Edition. (Greenberg, Clesceri, and Eaton, eds.). APHA, AWWA, & WEF. 1100 pp.

U.S. Environmental Protection Agency (USEPA). 1993. Methods for the Determination of Inorganic Substances in Environmental Samples. EPA 600/R-93/100.

______. 1999. Method 1664 Revision A, N-Hexane Extractable material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry. EPA 821-R-98-002. February 1999. 28 pp.

Appendix C

Repair/Reconstruction of Moanakai Seawall:
Marine biological survey for Moanakai Road seawall improvements

AECOS, Inc., November 2010

AECOS No. 1238A

Repair/Reconstruction of Moanakai Seawall

Marine biological survey for Moanakai Road seawall improvements, Kapaʻa Kauaʻi, Hawaiʻi

---

Prepared by:

AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744-3221

November 24, 2010

Marine biological survey for Moanakai Road seawall improvements, Kapaʻa, Kauaʻi, Hawaiʻi[1]

November 24, 2010 *AECOS* No. 1238A

Katie Laing
AECOS, Inc.
45-939 Kamehameha Hwy, Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: aecos@aecos.com

Introduction

The project site along Moanakai Road is located on the eastern shore of Kauaʻi, Hawaiʻi at Kapaʻa town (Fig. 1). Moanakai Road is a narrow, two lane road that gives access to beach home sites and to Waipouli Beach Park (locally referred to as "Baby Beach"). A seawall and boulder rock revetment hold back the earthen fill on which the road is built. The protective revetment is eroding in some areas. The Repair/Reconstruction of Moanakai Road Seawall (Project) proposed by the County of Kauaʻi Public Works includes improvements to the existing protective structure with an additional 1.5 to 1.8 m (5 to 6 ft) of boulder revetment. Design alternatives are being studied to find a solution to protect Moanakai Road from erosion damage (SEI, 2010).

In September 2010, *AECOS,* Inc. biologists conducted a survey to assess the marine resources adjacent to the roughly 330-m (1,080-ft) long revetment fronting Moanakai Road (Fig. 2). The purpose of this survey and report is to identify sensitive biological resources that may be impacted by the Project.

Site Description

The shoreline in the project area faces nearly due east and experiences the regular Northeast Tradewinds. To the north is Waipouli Beach Park and Waikaea Canal. Fronting the Project at Moanakai Road is a narrow swath of

[1] Report prepared for R. M. Towill, for use in project permitting. This document will become part of the public record for the project.

sand and rubble, separated from the fringing reef flat beyond by a narrow beachrock formation that exposes with the tide. The beachrock creates a small. semi-enclosed body of water or "lagoon," which is narrowest at the south end and widest at the north end where the lagoon opens to the ocean. Portions of the sand and beachrock stay wet throughout the tidal cycle, a result of a gentle downward slope from south to north. A fringing reef extends some 400 m (1,300 ft) seaward from the shoreline. Prevailing currents offshore from the Project are from south to north and converge with north to south currents between Moikeha and Waiakea (drainage) canals (Inman et al., 1963).

Figure 1. Project location at Kapa'a on the Island of Kaua'i.

Methods

On September 24, 2010, *AECOS* biologists conducted a biological reconnaissance survey of marine resources at the Project area (Fig. 2). Direct impacts from the Project can be anticipated for the existing revetment and intertidal sand beach. The narrow intertidal lagoon and beachrock formation, and the adjacent reef flat are expected to be only indirectly impacted by the Project. Biologists recorded environment characteristics and species of marine flora and fauna observed in all these areas. Biologists walked along the revetment boulders and the beachrock formation, and snorkeled the waters of the lagoon and over the reef flat. Marine algae, fishes, and macroinvertebrates were identified in the field and verified with various texts (Hoover, 1999; Huisman, et al. 2007). A listing, including relative abundances, of species of macroalgae (*limu*) and marine animals observed is presented as Appendix A.

Figure 2. Satellite image of Project area located in Kapaʻa on the east coast of Kauaʻi, Hawaiʻi.

The survey began at 10:00 am, 10 minutes before the 0.5-ft low tide (higher low water or HLW) and was completed at 2:40 pm, 1 hour and 7 minutes before the 1.3-ft high tide (lower high water or LHW). Water visibility during the survey was about 2 m (6 ft) in the lagoon and about 5 m (15 ft) on the reef flat. Around 3:30 pm during the LHW tide, water quality measurements were made and samples collected for analysis in the laboratory. Water quality results will be presented in a separate report.

Results

Much of the environment seaward of the Project site is intertidal and provides habitats for intertidal species, as well as subtidal species at higher tides. The intertidal sand beach at the south end of the project area is dry at low tide and nearly completely inundated at high tide. A deep area of the lagoon (roughly 1 m or 3 ft deep), located along the north quarter of the project area remains flooded throughout the tidal cycle. Small waves crest over the beachrock with the rising tide allowing seawater to flood the lagoon. Whenever waves result in water flowing over the beachrock, a northerly current is produced as the water escapes towards the north end of the lagoon. The current over the reef flat adjacent to the beachrock flows in the opposite direction, from north to south.

A juvenile Hawaiian monk seal (*Monachus schauinslandi*) was observed hauled out on a narrow beach south of the Project area. Prior to the biologists' arrival at the site, the monk seal ("Kaikoa"; tag number "RAOO", an approximately 1.5 year old female) was observed on the fringing reef adjacent to the project area at 9:00 the same morning (pers. comm., NOAA Monk Seal Response volunteer). The monk seal was no longer on the beach at 2:40 pm, when the rising tide had encroached over the narrow sand strip. The beach fronting Waipouli Beach Resort is an important haul out beach and is frequently used by a variety of monk seal individuals of varying age classes (pers. comm., Mimi Olwry, DLNR-DAR).

A fisherman was fishing with small hook and line for juvenile *kupipi* (*Abudefduf sordidus*) to use as bait. He related that *oama* (juvenile goatfish, family Mullidae) come into the project area during season.

Revetment - The basalt boulders of the seawall (Fig. 3) and revetment are sparsely inhabited. Small numbers of barnacle (*Chthamalus proteus*), nerite snail (*Nerita picea*), periwinkle (*Littoraria intermedia*), mussel (*Brachiodontes crebristriatus*), and *aʻama* crab (*Grapsus tenuicrustatus*) occur in the intertidal zone. No algae were observed on the basalt boulders.

Figure 3. View of south extent of revetment with limestone and narrow beach in foreground.

Lagoon - The limestone beachrock nearly parallels the seawall, but angles slightly seaward creating a narrow (9-m or 30-ft wide) sand and rubble beach at the south end and a wide (26-m or 85-ft wide) sand and rubble beach and lagoon at the north end (Fig. 4). During low tide, the base of the beach is an exposed sand and rubble bottom with a small lagoon which opens to the ocean at its north end. During higher stands of the tide cycle the entire lagoon area is inundated and provides suitable environment for reef fishes. Schools of varying size classes of *āholehole* (*Kuhlia xenura*) and mullet (*Mugil cephalus* or ʻ*amaʻama*) use these protected waters. Juvenile *manini* (*Acanthurus triostegus*) and adult tilapia (*Sarotherodon melanotheron*) also school in the lagoon. The north end of the lagoon with greater ocean influence hosts slightly larger fishes and reef fishes, including small schools of *weke ula* (*Mulloidichthys vanicolensis*), saddle wrasse (*Thalassoma duperrey*), and belted wrasse (*Stethojulis balteata*).

Figure 4. Sand and rubble beach of lagoon area during low tide.

The biological assemblage on the lagoon side of the beachrock resembles the community present on the outside of the reef flat, with the addition of several species and higher densities of other animals adapted to live in the more extreme conditions of temperature and salinity, while taking advantage of a measure of protection from waves and predators. Examples include blennies and gobies, schools of *āholehole* or Hawaiian flagtail (*Kuhlia xenura*), mullet (*Mugil cephalus*), and young *manini*. Noticeably absent on the lagoon side are sea urchins. Many juvenile fishes, including butterflyfishes, wrasses, *manini*, flagtails, and mullet inhabit these calmer waters.

Beachrock - The limestone beachrock has many cracks, holes, and depressions in which gobies and blennies reside (Fig. 5). The south end of the beachrock is submerged less frequently than the north end and therefore hosts organisms adapted to conditions of the upper interidal. Most notable, at the south end, are the many false *ʻopihi* (*Siphonaria normalis* or *ʻopihi ʻawa*) and thousands of tiny snails (keeled periwinkle, *Paesiella tantilla*). In addition, small brown egg masses were observed in this area nearby false ʻ*opihi* scars devoid of algae. The water-filled depressions of the beachrock formation host goby (*Bathygobius* sp.), marbled blenny (*Entomacrodus marmoratus*), snakehead cowry (*Cypraea caputserpentis*), and coralline algae nodules. Yellow-foot and black-foot *ʻopihi* (*Cellana sandwicensis* and *C. exarata*) also occur, but in small numbers towards the north end.

Figure 5. View north with limestone beachrock in foreground.

The environment at the north end of the beachrock is subtidal, marine in nature and this is reflected in the biota. Teated sea cucumbers (*Holothuria whitmaei* or *loli*), zebra blenny (*Istiblennius zebra*), and xanthid crabs are common here. Live, unattached coral fragments (*Porites* spp., *Pocillopora meandrina*, *Psammocora stellata*, and *Poc. damicornis*) are present in water-filled depressions; these likely cast up during high sea conditions from parent colonies on the adjacent reef flat. Algae here include green bubble algae

(*Dichtyosphaeria versluysii*), *Sargassum echinocarpum*, and *Padina japonica*, with *Padina* being most common.

Reef Flat - The reef flat offshore of the beach and beachrock has roughly 1.5 to 2.5 m (5 to 7 ft) of water depth with a slightly undulating limestone bottom with widely scattered outcrops and fields of rubble. Corals are represented by at least 9 species. The most common coral genus is *Pocillopora* with three species represented: *Poc. damicornis* (lace coral), *Poc. meandrina* (cauliflower coral), and *Poc. eydouxi* (antler coral). Next most common is *Porites*, also with three species: *P. lobata* (lobe coral), *P. lutea* (mound coral), and *P. compressa* (finger coral). Also present are *Psammocora stellata* (stellar coral), *Montipora patula* (sandpaper rice coral), and *Cyphastrea ocellina* (ocellated coral), all in low numbers and with low cover.

Pocilloporids exhibit a great deal of plasticity in their growth forms with delicately branching and stout robust forms of *P. damicornis* observed in the same general area. Many *P. meandrina* colonies show signs of mechanical damage with fragments lying about, likely damage caused by waves. Corals are generally small, ranging in size between 5 to 25 cm (2 to 10 in) in diameter, although the diameter of one *Pocillopora eydouxi* colony was measured at 75 cm (30 in). Remnant coral growth was evident by several large, dead, mound-forming *Porites lutea* colonies. A visual estimate of coral cover over the reef area surveyed is less than 5%.

The most well-represented fishes on the reef flat are wrasses (Family Labridae) with numerous juvenile saddle wrasse (*Thalassoma duperrey*) and belted wrasse (*Stethojoulis balteata*) present. Various damselfish, including the brighteye damsel (*Plectroglyphidodon imparipennis*), Hawaiian sergeant (*Abudefduf abdominalis*), and Hawaiian Gregory (*Stegastes marginatus*) are also present. Convict tang and brown surgeonfish feed on the sparse algae present. Conspicuously absent are parrotfish and jacks.

Discussion

Very little direct impacts are anticipated with this Project as the seawall and revetment basalt boulders host very little life and no sensitive biological resources occur in the immediate Project area. Project-specific best management practices (BMPs), including silt curtains, will need to be developed to ensure that marine biota of the lagoon and adjacent reef flat are protected from sedimentation and project-related runoff. Any brief periods of impaired water quality associated with construction should have minimal long term impacts inside the lagoon or on the nearby reef flat as daily water exchange is high in these areas. Much of the construction should occur on land, which will reduce the risk of concrete and construction-related material spills into marine waters.

ʻOpihi (*Cellana* spp.) were observed on the limestone adjacent to the Moanakai Road seawall. *ʻOpihi* are protected throughout the State of Hawaiʻi (HAR 13-92-1) and "it is unlawful to take, possess, sell, or offer for sale any *ʻopihi*" that does not meet State size requirements (DLNR, 1978). ʻ*Opihi* in the project vicinity should not be directly impacted by Project activities.

No species listed under the Endangered Species Act (USFWS, 2010) were encountered at the Project site during the marine survey, although a Hawaiian monk seal (*Monachus schauinslandi*) was reported to be swimming offshore the project site immediately prior to the survey and was observed hauled out on the sand beach south of the Project site. Sea turtles, spinner dolphins, and humpback whales were not observed during the survey; however, they may occur in the Project vicinity (although well off the shore). The Project area is not within the Hawaiian Islands Humpback Whale National Marine Sanctuary, but Humpback whale may occur in offshore waters. Sound emanation should not be a problem to protected species, as no blasting or pile driving is anticipated.

The ʻ*ilio holo i ka uaua* or Hawaiian monk seal was listed as endangered in 1976 (USFWS, 2005, 2010), is endemic to the Hawaiian Islands, and is the only pinniped found in Hawaiian waters (USFWS, 2005). The Hawaiian monk seal has experienced a steady population decline from a population estimate of around 1,400 in the late 1990s to a population of approximately 1,000 individuals in 2006 (NMFS, 2007). Although most monk seal are found in the Northwestern Hawaiian Islands, lower numbers occur throughout the Main Hawaiian Islands where documented births and sightings suggest that numbers are increasing around the main islands (Baker and Johanos, 2004). Monk seal feed on fish, crustaceans, and octopus, and haul out on beaches to rest, digest, and escape predators.

Monk seal pup (give birth) primarily in the remote Northwestern Hawaiian Islands, but also pup in the main Hawaiian Islands, including the islands of Maui, Kauaʻi, and Oʻahu. Monk seal births have been documented in all months of the year, but are most common between February and August, peaking in March and April. Crucial threats to the remaining population are food limitation, marine debris entanglement, and shark predation. Other threats include: infectious disease, fisheries interactions, male aggression, habitat loss, and human interaction. With appropriate BMPs in place, the Project will not adversely affect protected species. A list of protected species BMPs is provided for guidance in Appendix B.

Conclusions

Direct impacts on the marine environment from the proposed Project will be minor. Construction may cause a temporary increase in turbidity, but this may be minimized by the use of silt curtains. Very little marine epibenthic flora and fauna exist on the seawall and revetment boulders and any loss will be small with recovery occurring rapidly. Monk seal are known to frequent the project area; if BMPs are followed, the project will not adversely affect the monk seal or other protected resources.

Bibliography

Baker, J. D., and T. C. Johanos. 2004. Abundance of the Hawaiian monk seal in the main Hawaiian Islands. *Biol. Conserv.*, 116: 103-110.

Hawaiʻi Department of Land and Natural Resources (DLNR). 1978. Hawaii Administrative Rules, Title 13, Chapter 92. 2 pp. Available online at URL: http://hawaii.gov/dlnr/dar/rules/ch92.pdf; last accessed October 3, 2010.

Hoover, J. P. 1999. *Hawaiʻi's Sea Creatures: A Guide to Hawaiʻi's Marine Invertebrates*. Mutual Publishing, Honolulu, Hawaiʻi. 366 pp.

Huisman, J. M., I. A. Abbott, C. M. Smith. 2007. *Hawaiian Reef Plants.* Hawaiʻi Sea Grant College Program, Honolulu, Hawaiʻi. 264 pp.

National Oceanic and Atmospheric Administration - National Marine Fisheries Service, Pacific Islands Regional Office (NMFS/PIRO). 2008. Letter dated May 21, 2008 regarding Endangered Species Act Section 7 consultation for the Iroquois Point Beach Restoration and Stabilization project. 7 pp.

National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NMFS). 2007. Recovery Plan for the Hawaiian Monk Seal (*Monachus schauinslandi*). Second Revision. National Marine Fisheries Service, Silver Spring, MD. 165 pp. Available online at URL: http://www.nmfs.noaa.gov/pr/pdfs/recovery/hawaiianmonk seal.pdf; last accessed April 15, 2010.

Sea Engineering, Inc. (SEI). 2010. Moana Kai Road coastal assessment, Kapaa, Kauai. Prep. for R. M. Towill Corp. SEI Job No. 25208. 44 pp.

U.S. Fish & Wildlife Service (USFWS). 2005. Part II. Department of the Interior, Fish and Wildlife Service. 50 CFR 17. Endangered and Threatened Wildlife and Plants; Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened: Annual Notice of Findings on Resubmitted Petition: Annual Description of Progress on Listing Actions. *Federal Register*, 70 (90; Wednesday, May 11, 2005): 24870-24934.

______. 2010. Endangered and Threatened Wildlife and Plants. 50 CFR 17:11 and 17:12. Available online at URL: http://ecos.fws.gov/tess_public/pub/stateListingIndividual.jsp?state=HI&status=listed; last accessed on September 30, 2010.

Appendix A. Inventory of aquatic biota observed in the Moanakai Road seawall Project area, Kapaʻa, Kauaʻi on September 24, 2010.

PHYLUM, CLASS, ORDER FAMILY *Genus species*	Common name	Revetment	Limestone Beachrock	Lagoon	Reef Flat
CYANOPHYTA	CYANOBACTERIA				
Undetermined spp.			O	O	
CHLOROPHYTA	GREEN ALGAE				
Cladophora catenata			O		
Dictyosphaeria versluysii			O		O
Halimeda discoidea					O
Microdictyon sp.				R**	
HETEROKONTOPHYTA	BROWN ALGAE				
Dictyota sp.			O	O	C
Dictyota ceylanica			R	O	C
Dictyota friabilis			R		
Padina japonica			C	C	C
Ralfsia pangoensis			C		
Sargassum echinocarpum			R		
Turbinaria ornata			R		O
RHODOPHYTA	RED ALGAE				
Acanthophora spicifera	spiny seaweed		O	O	
Ahnfeltiopsis flabelliformis			C		
Amansia glomerata				R**	
Galaxaura rugosa			O	R	C
Hydrolithon spp.			O	C	C
Laurencia sp.			O		C
Lithophyllum spp.			R	C	C
Martensia fragilis				R	
CNIDARIA, ANTHOZOA, ZOANTHIDEA					
ZOANTHIDAE					
Palythoa caesia	blue-gray zoanthid				R
CNIDARIA, ANTHOZOA, SCLERACTINIA					
POCILLOPORIDAE					
Pocillopora damicornis	lace coral		R**	R**	C
Pocillopora meandrina	cauliflower coral		R**	R**	C
Pocillopora eydouxi	antler coral				R
ACROPORIDAE					
Montipora patula	sandpaper rice coral				R
PORITIDAE					
Porites compressa	finger coral		R**	R**	C
Porites lutea	mound coral		R**	R**	O
Porites lobata	lobe coral		R**	R**	C
SIDERASTREADAE					
Psammocora stellata	stellar coral		R**	R**	R
FAVIIDAE					
Cyphastrea ocellina	ocellated coral				R
ANELLIDA, POLYCHAETA	WORMS				
AMPHINOMIDAE					
Eurythoe complanata	orange fireworm			O	
MOLLUSCA, BIVALVIA	BIVALVES				

PHYLUM, CLASS, ORDER FAMILY *Genus species*	Common name	Revetment	Limestone Beachrock	Lagoon	Reef Flat
MYTILIDAE					
Brachidontes crebristriatus	Hawaiian mussel	O			
MOLLUSCA, GASTROPODA	SNAILS				
PATELLIDAE					
Cellana exarata	black-foot *ʻopihi*		C		
Cellana sandwicensis	yellow-foot *ʻopihi*		R	R	
SIPHONARIIDAE					
Siphonaria normalis	false *ʻopihi*, *ʻopihi ʻawa*		C		
NERITIDAE					
Nerita picea	black nerite, *pipipi*	A	O		
LITTORINIDAE					
Nodilittorina hawaiiensis	Hawaiian periwinkle	O	C		
Paesiella tantilla	keeled periwinkle		A***		
Littoraria intermedia	dotted periwinkle	O	C		
CYPRAEIDAE					
Cypraea caputserpentis	Snakehead cowry, *leho kupa*		C		
Cypraea mauritiana	humpback cowry, *leho ahi* or *leho paʻa*		R		
MURICIDAE					
Drupa ricina	spotted drupe		O		
Morula granulata	granular drupe, *makaʻawa*		C		
Drupa (drupa) ricinus albolabris	white-lipped drupe		O		
APLYSIIDAE					
Dolabella auricularia	eared sea hare, *kualakai*				R
ARTHROPODA, MAXILLOPODA, THORACICA					
CHTHAMALIDAE					
Chthamalus proteus	Caribbean barnacle	O			
ARTHOPODA, CRUSTACEA, DECAPODA					
ALPHEIDAE					
Alpheus sp.	snapping shrimp			R	
CALLIANASSIDAE					
Corallianassa borradailei	Borradaile's ghost shrimp			R	
PALINULARIDAE					
Panularis penicillatus	tufted spiny lobster †		R	R	
CALAPPIDAE					
Calappa hepatica	common box crab			R	
GRAPSIDAE					
Grapsus tenuicrustatus	*ʻaʻama*	R			
Pachygrapsus plicatus	pleated rock crab		R		
XANTHIDAE					
Liomera sp.	liomera			R	
indet.	xanthid crab		R		

PHYLUM, CLASS, ORDER FAMILY *Genus species*	Common name	Revetment	Limestone Beachrock	Lagoon	Reef Flat
ECHINODERMATA, ECHINOIDAE					
DIADEMATIDAE					
Echinothrix calamaris	banded urchin †	R			
ECHINOMETRIDAE					
Echinometra mathaei	rock-boring urchin			O*	C
Echinometra oblonga	oblong urchin	U			
ECHINODERMATA, HOLOTHUROIDAE					
HOLOTHURIIDAE					
Actinopyga mauritiana	white-spotted sea cucumber, *loli*		O	O	O
Holothuria atra	black sea cucumber		R	O	O
Holothuria arenicola	sand sea cucumber, *kohe lelewa*			O‡	
Holothuria whitmaei	teated sea cucumber, *loli*		O		O
VERTEBRATA, PICES	FISHES				
MURAENIDAE					
Echidna nebulosa	snowflake moray, *puhi kappa*			R	
SYNODONTIDAE					
Synodus variegatus	reef lizardfish			R	R
FISTULARIIDAE					
Fistularia commersonii	cornetfish			R	
SERRANIDAE					
Cephalopholis argus	peacock grouper, *roi*				R
KUHLIIDAE					
Kuhlia xenura (E)	Hawaiian flagtail, *āholehole*		R	D	
LUTJANIDAE					
Lutjanus fulvus	blacktail snapper, *toʻau*			R	
MUGILIDAE					
Mugil cephalus	striped mullet, *ʻamaʻama*			A	
MULLIDAE					
Mulloidichthys vanicolensis	yellowfin goatfish, *weke ula*			O	
Mulloidichthys flavolineatus	yellowstripe goatfish			R	
Parupeneus multifasciatus	manybar goatfish, *moano*				R
KYPHOSIDAE					
Kyphosus sandvicensis	gray chub, *nenue*			R	R
CHAETODONTIDAE					
Chaetodon lunula	raccoon butterflyfish, *kikakapu*			R	
Chaetodon auriga	chevron butterflyfish			R	
CICHLIDAE					
Sarotherodon melanotheron	blackchin tilapia			R	
POMOCENTRIDAE					
Abudefduf abdominalis (E)	Hawaiian sergeant, *mamo*			O (juv) R (adult)	O
Abudefduf sordidus	blackspot sergeant, *kupipi*		R	O	

PHYLUM, CLASS, ORDER FAMILY *Genus species*	Common name	Revetment	Limestone Beachrock	Lagoon	Reef Flat
Plectroglyphidodon imparipennis	bright-eye damsel				O
Stegastes marginatus	Hawaiian Gregory				R
LABRIDAE					
Gomphosus varius	bird wrasse, *hinālea ʻiʻiwi*				O
Stethojulis balteata (E)	belted wrasse, *ʻōmaka*			O	C
Thalassoma duperrey (E)	saddle wrasse, *hinālea lauwili*			O	C
Thalassoma trilobatum	Christmas wrasse, *ʻāwela*			R	O
BLENNIDAE					
Cirripectes vanderbilti	scarface blenny, *paoʻo*		R		R
Entomacrodus marmoratus	marbled blenny, *paoʻo*		C		
Istiblennius zebra (E)	Hawaiian zebra blenny, *paoʻo*		C		
GOBIIDAE					
Bathygobius sp.	goby		O		
ZANCLIDAE					
Zanclus cornutus	Moorish idol, *kihikihi*				R
ACANTHURIDAE					
Acanthurus triostegus	convict tang, *manini*		R	C	O
Acanthurus nigrofuscus	lavender tang				R
Naso unicornis	bluespine unicornfish, *kala*			R	R
Zebrasoma flavescens	yellow tang, *lauʻipala*				R
TETRAODONTIDAE					
Arothron hispidus	stripebelly puffer			R	
Canthigaster amboensis	ambon toby				R
Canthigaster jactator (E)	Hawaiian whitespotted toby	R			R

KEY TO SYMBOLS USED:

Abundance categories:

R – Rare – only one or two individuals observed.
O – Occasional – seen irregularly in small numbers.
C – Common -observed everywhere, although generally not in large numbers.
A – Abundant – observed in large numbers and widely distributed.

Other symbols and categories:

† - Shell, carapace, or test only (not seen alive).
E – Endemic – Found in Hawaii and nowhere else.
‡Occasionally found under boulders in lagoon.
* Only present towards north end of lagoon.
** Unattached fragments. Most 5 cm or less.
*** Abundant only at south end of limestone beachrock.

Appendix B. Endangered species best management practices (BMPs) for use during construction are provided for guidance (NMFS/PIRO, 2008).

A. For on-site project personnel that may interact with a listed species potentially present in the action area, provide education on the status of any listed species and the protections afforded to those species under Federal laws. NMFS may be contacted for scheduling educational briefings to convey information on marine mammal behavior, and explain why and when to call NMFS and other resource agencies.

B. Establish a safety zone around the project area whereby observers will visually monitor this zone for marine protected species 30 minutes prior to, during, and 30 minutes post project activity.

C. Upon sighting of a monk seal or turtle within the safety zone during the monitoring time period or during project activity, immediately postpone or halt the activity until the animal has left the zone. Conduct activities only if the safety zone is clear of monk seals and turtles.

D. If a marine protected species is in the area, either hauled out onshore or in the nearshore waters, a 150-ft buffer must be observed with no humans approaching them. If a monk seal/pup pair is present, a minimum 300-ft buffer must be observed. Record information on the species, numbers, behavior, time of observation, location, start and end times of project activity, sex or age class (when possible), and any other disturbances (visual or acoustic).

E. In the event a marine protected species enters the safety zone and the project activity cannot be halted, conduct observations and immediately contact NMFS staff in Honolulu to facilitate agency assessment of collected data. For monk seals contact the Marine Mammal Response Coordinator, David Schofield at (808) 944-2269, as well as the monk seal hotline at (888) 256-9840. For turtles, contact the turtle hotline at 983-5730.

Appendix D

Repair/Reconstruction of Moanakai Seawall:
Archaeological Monitoring Plan for the Moanakai Sea Wall Repair Project
Cultural Surveys of Hawai‘i, July 2010

Final
Archaeological Monitoring Plan for the Moanakai Sea Wall Repair Project
Kapa‘a Ahupua‘a, Kawaihau District (Puna Moku), Island of Kaua‘i
TMK: (4)-4-5-001 and 4-5-002:023 por.

Prepared for

R.M. Towill Corporation

Prepared by

Randy Groza, M.A.

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.

Kailua, Hawai‘i

(Job Code: KAPAA 7)

July 2010

O‘ahu Office
P.O. Box 1114
Kailua, Hawai‘i 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

Maui Office
16 S. Market Street, Suite 2N
Wailuku, Hawai‘i 96793
Ph: (808) 242-9882
Fax: (808) 244-1994

Management Summary

Reference	Archaeological Monitoring Plan for the Moanakai Sea Wall Repair Project Kapa‘a Ahupua‘a, Kawaihau District (Puna Moku), Island of Kaua‘i TMK: [4]-4-5-001 and 4-5-002:023
Date	July 2010
Project Number (s)	Cultural Surveys Hawai‘i (CSH) Job Code: KAPAA 7
Investigation Permit Number	The planned archaeological monitoring fieldwork will be carried out under state archaeological permit No. 10-10 issued to Cultural Surveys Hawai‘i, Inc. (CSH) by the Hawai‘i State Historic Preservation Division/ Department of Land and Natural Resources (SHPD/DLNR), per Hawai‘i Administrative Rules (HAR) Chapter 13-13-282.
Project Location	The project corridor is within TMK [4]-4-5-001 and 4-5-002:023, Kapa‘a Ahupua‘a, Kawaihau District (Puna Moku), Kaua‘i Island. The project corridor extends from approximately 75 m north of Makaha Road, south to Keaka Road along Moanakai Road. The ocean is to the east, and residential buildings are to the west. The project area is south of Waipoli Park and Waika‘ea Canal as shown on the 1996 Kapa‘a USGS 7.5-minute topographic quadrangle (Figure 1)
Land Jurisdiction	County of Kaua‘i
Agencies	State Historic Preservation Division / Department of Land and Natural Resources (SHPD / DLNR)
Project Description	The project proposes the restoration and repair of the Moanakai Sea Wall and a 1,080-foot (329.2 m) portion of Moanakai Road.
Project Area Length	1,080 feet (329.2 m)
Project Related Ground Disturbance	The height of the new Moanakai Sea Wall is estimated as 11 feet (3.35 m) above sea level and 4 feet (1.22 m) below sea level. Ground disturbance associated with Moanakai Road repairs will likely affect less than two (2) feet (0.61 m) below surface.
Historic Preservation Regulatory Context	In consultation with SHPD (email, May 5, 2010 from Nancy McMahon, Deputy State Historic Preservation Officer to CSH archaeologist Randy Groza), this archaeological monitoring plan was written to fulfill the requirements of Hawai‘i Administrative Rules Chapter 13-279-4 and to support the proposed project’s historic preservation review under Hawai‘i Revised Statutes (HRS) Chapter 6E-8 and HAR Chapter 13-284. The plan is intended for review and approval by the State Historic Preservation Division/Department of Land and Natural Resources.
Historic Properties Potentially Affected	No historic properties have been previously identified within the immediate vicinity of the project area, however, due to presence of Mokuleia Fine Sandy Loam sediments, human burials or intact cultural materials may be encountered during project activities

Recommended Project-Related Monitoring	On-site monitoring is recommended for all ground disturbance below the existing ground surface to facilitate the identification and treatment of any burials that might be discovered during project construction, and to alleviate the project's effect on non-burial archaeological deposits

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

At the request of R.M. Towill Corporation, Cultural Surveys Hawaiʻi (CSH) has prepared this archaeological monitoring plan for the Moanakai Sea Wall Repair Project in Kapaʻa Ahupuaʻa, Kawaihau District (Puna Moku), Island of Kauaʻi (TMK [4]-4-5-001 and 4-5-002:023) (Figure 1 through Figure 3). The project area consists of Moanakai Sea Wall and a 1,080-foot (329.2 m [meters]) portion of Moanakai Road. The project corridor extends from approximately 75 m north of Makaha Road, south to Keaka Road. The ocean is to the east, and residential buildings are to the west.

The project proposes the restoration and repair of Moanakai Sea Wall and a portion of Moanakai Road as shown on Figure 4. The height of the new Moanakai Sea Wall is estimated as 11 feet (3.35 m) above sea level and 4 feet (1.22 m) below sea level. Ground disturbance associated with Moanakai Road repairs will likely affect less than two (2) feet (0.61 m) below surface.

This archaeological monitoring program is to be implemented to facilitate the identification and treatment of any burials that might be discovered during subsurface disturbance and to alleviate the project's effect on any non-burial archaeological deposits that might be uncovered during project construction. In consultation with SHPD (email, May 5, 2010 from Nancy McMahon, Deputy State Historic Preservation Officer to CSH archaeologist Randy Groza), this monitoring plan is designed to fulfill the state requirements for monitoring plans [HAR Chapter 13-279-4]. This document was prepared to support the proposed project's historic preservation review under Hawaiʻi Revised Statutes (HRS) Chapter 6E-8 and HAR Chapter 13-284.

1.2 Environmental Setting

1.2.1 Natural Environment

Kapaʻa Ahupuaʻa is on the windward side of Kauaʻi and is exposed to the prevailing tradewinds and their associated weather patterns. Rainfall on the coastal plains and plateaus of Kapaʻa average approximately 40 inches per year (Juvik and Juvik 1998:56). Historically, this *ahupuaʻa* contained two prominent landscape features: a coastal plain with sand dunes and a large marsh. Kapaʻa can be characterized as fairly flat, with irregularly-shaped gulches and small valleys in the uplands, through which small tributary streams run, including Kapahi, Makaleha and Moalepe. While some of these streams combine with other tributaries in neighboring Keālia to form Kapaʻa Stream (often referred to as Keālia River), which empties into the ocean at the northern border of the *ahupuaʻa*, others flow directly into the lowlands of Kapaʻa, creating a large (approximately 170-acre) swamp area that has been mostly filled in modern times (Handy and Handy 1972:394, 423). Kapaʻa Town area is built on a sand berm with the ocean on the *makai* (seaward) side and the marsh on the *mauka* (inland) side. The sand berm was probably slightly wider here than in other localities, but dry land was probably always at a premium.

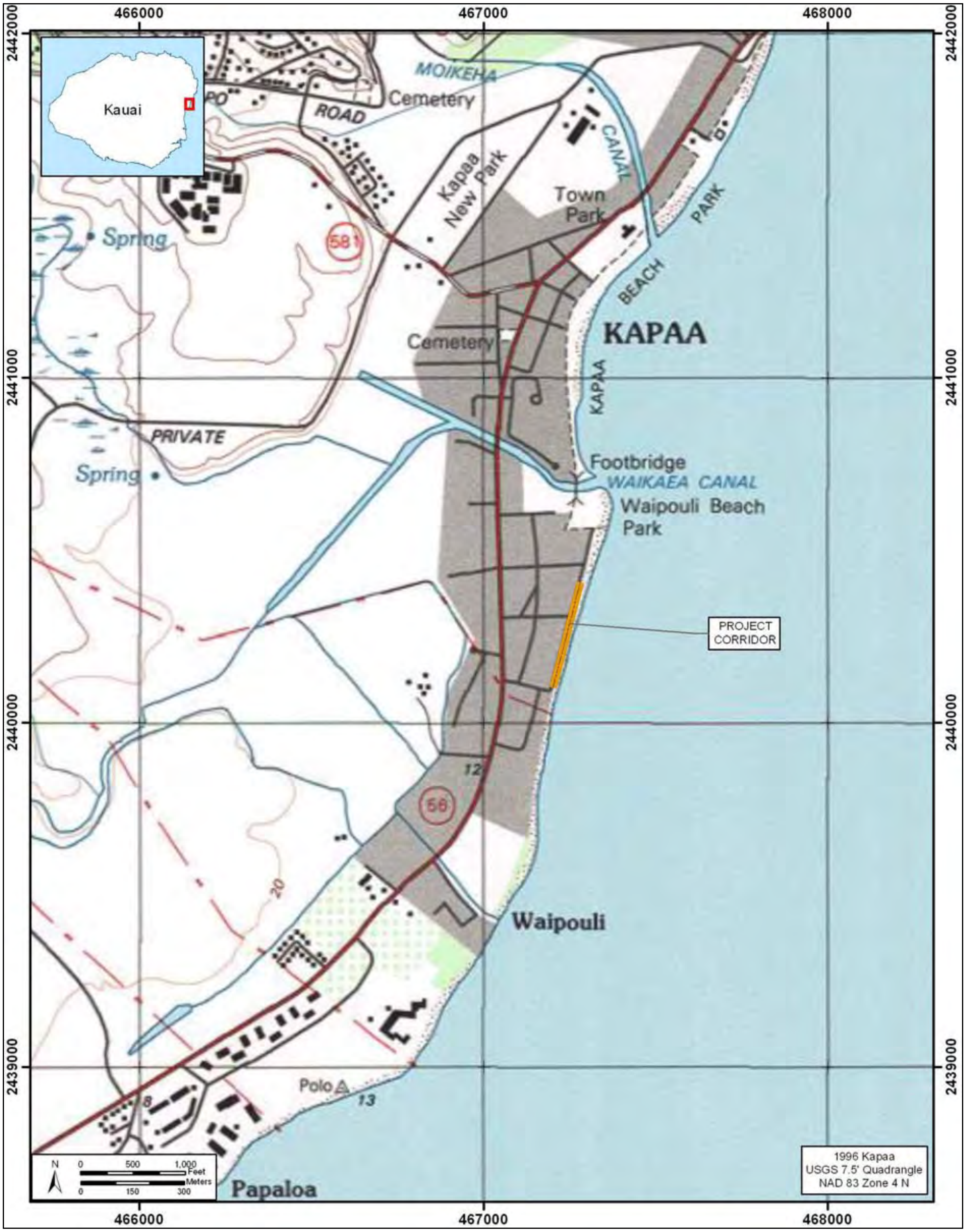


Figure 1. A portion of the 1996 Kapa‘a U.S. Geological Survey 7.5-minute topographic quadrangle showing the project corridor location

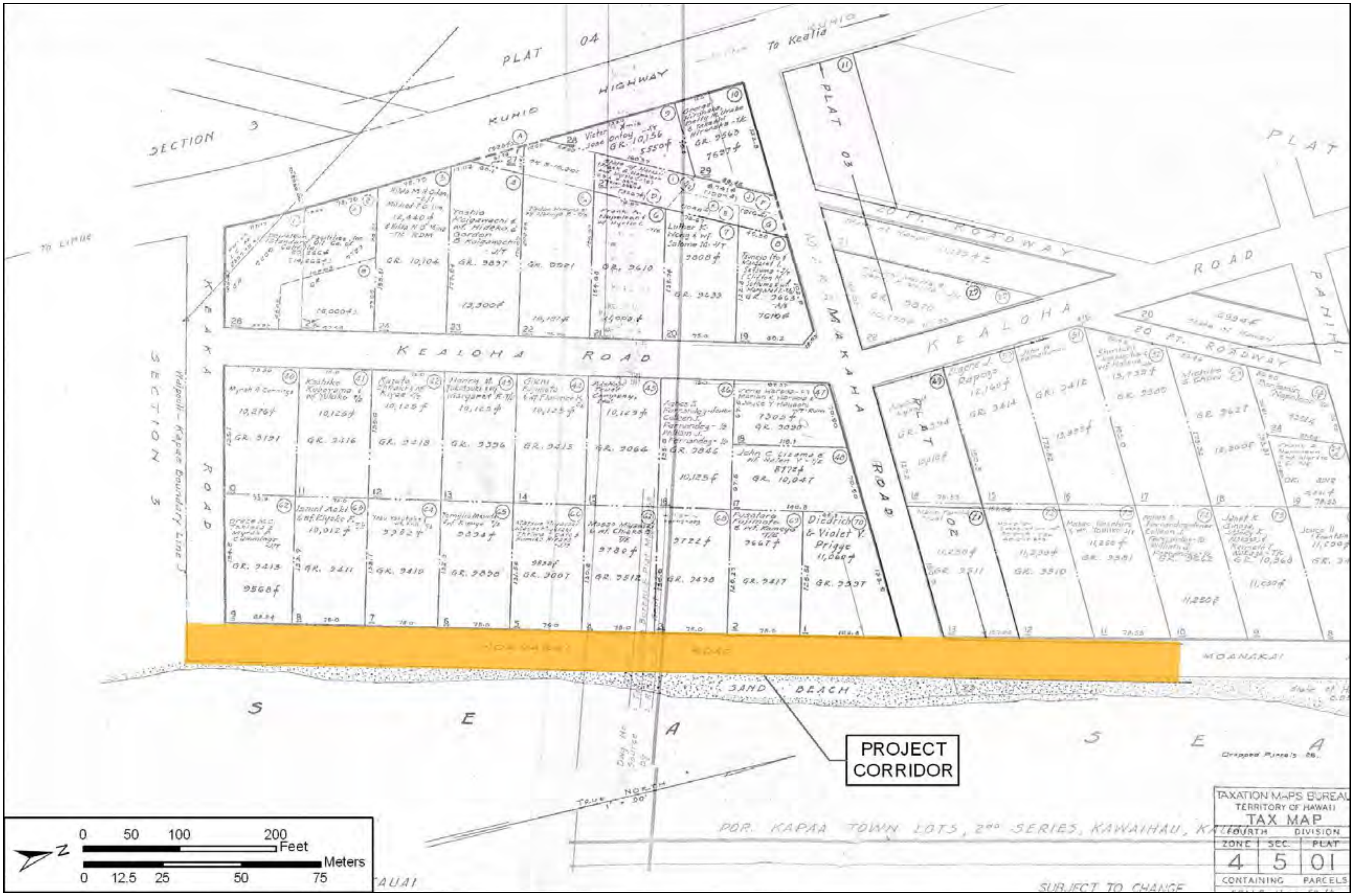


Figure 2. Composite of TMK plats 4-5-01 and 4-5-02, showing project corridor

Figure 3. Aerial photograph showing the project corridor (Source: U.S. Geological Survey Orthoimagery 2005)

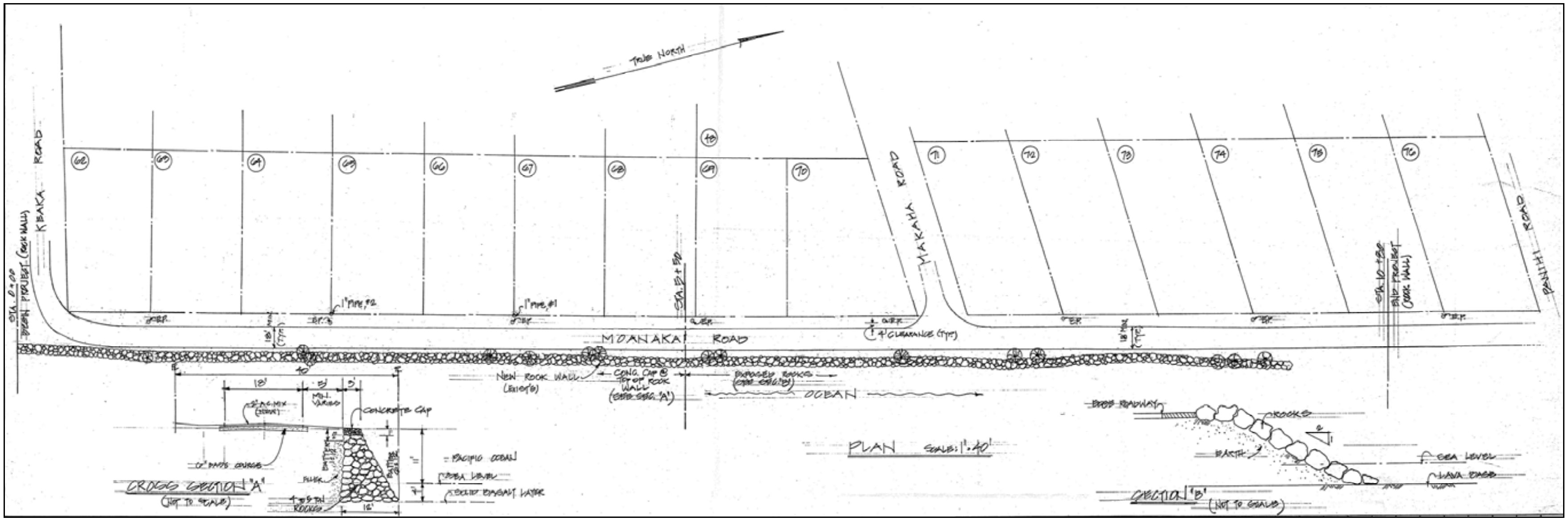


Figure 4. Proposed project plans (source: County of Kauai, Department of Public Works)

The natural sediment of the project area is described by Foote et al. (1972) as Mokuleia Fine Sandy Loam (Mr), a well-drained soil typically found along the coastal plains of eastern and northern Kauaʻi (Figure 5). This sediment is used for pasture (Foote et al. 1972:96).

The natural vegetation consists of *kiawe* (*Prosopis pallida*) *klu* (*Acacia farnesiana*), *koa haole* (*Leucaena leucocephala*), and bermudagrass (*Cynodon dactylon*) in the drier areas and napiergrass (*Pennisetum purpureum*), guava (*Psidium guajava*), and joee (*Verbena litoralis*) in the wetter areas (Foote et al. 1972:95).

1.2.2 Built Environment

The project area is on the coast, generally south of Waikaʻea Canal and the Boat Ramp or "Lihi" Park as Waipoli Park is locally referred to. The project area consists of a roadway and seawall bounded by the ocean to the east and residential housing to the west.

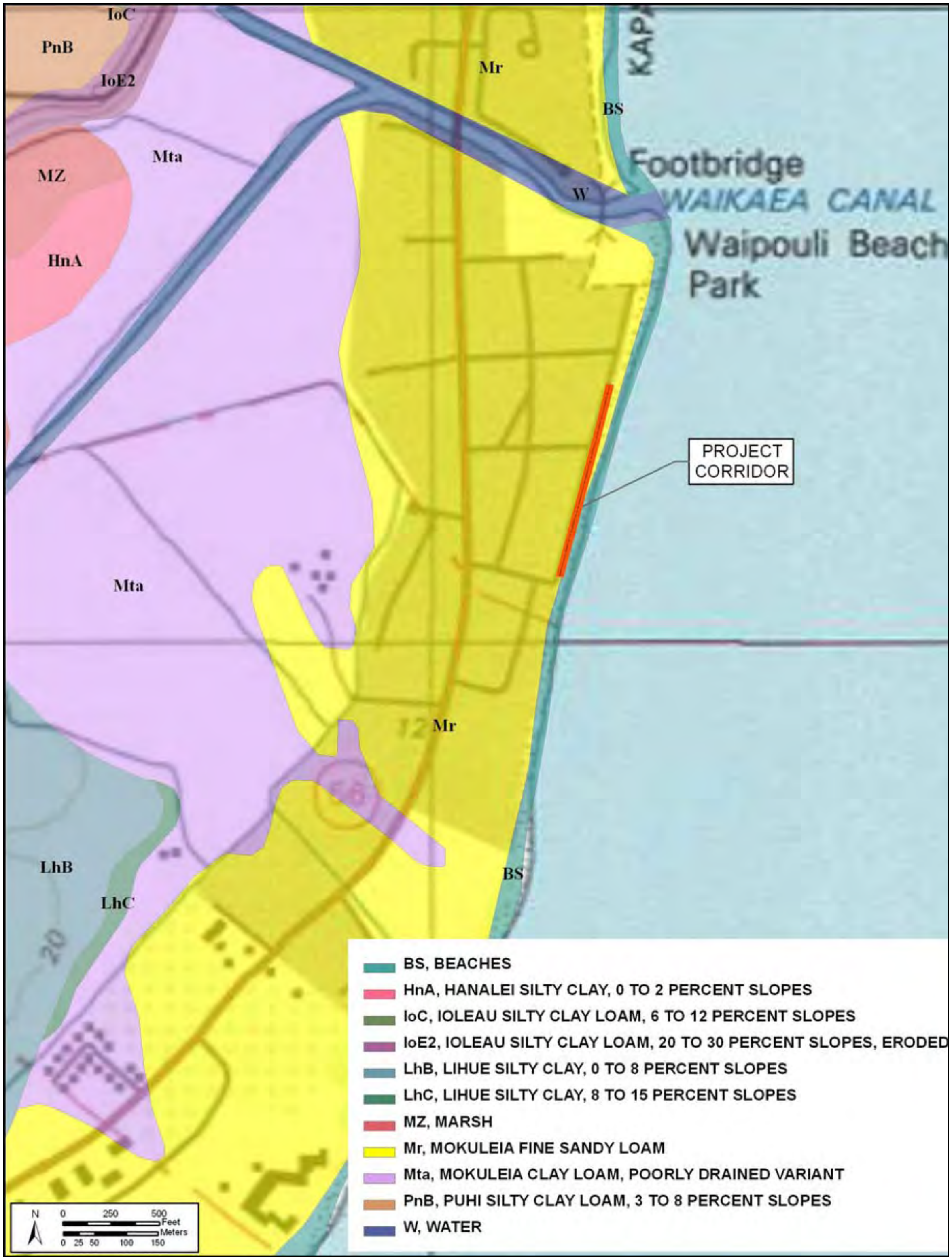


Figure 5. Overlay of Soil Survey of the State of Hawai'i (Foote et al. 1972), showing sediment types within the project corridor (indicated in red)

Section 2 Background Research

The *ahupuaʻa* of Kapaʻa is situated in the ancient district of Puna, one of five ancient *moku*, or districts, on Kauaʻi (King 1935:228). Puna was the second largest district on Kauaʻi, after Kona, and extended from Kīpū, south of Līhuʻe to Kamalomaloʻo, just north of Keālia. In the 1840s new districts were created for taxation, educational and judicial reasons. The Puna District became the Līhuʻe District, which retained the same boundaries. This "new" district was named Līhuʻe after the largest town in the district. In 1878, King Kalākaua proposed a special mandate, renaming the new district Kawaihau after Hui Kawaihau (see Section 3.5 below). This new district encompassed the *ahupuaʻa* ranging from Olohena on the south to Kīlauea on the north. Subsequent alterations to district boundaries in the 1920s left Kawaihau with Olohena as its southernmost boundary and Moloaʻa as its northernmost boundary (King 1935:222).

2.1 Traditional and Legendary Accounts of Kapaʻa

2.1.1 Ka Lulu o Mōʻīkeha

Kapaʻa was the home of the legendary *aliʻi* (chief), Mōʻīkeha. Born at Waipiʻo on the island of Hawaiʻi, Mōʻīkeha sailed to Kahiki (Tahiti), the home of his grandfather Maweke, after a disastrous flood. On his return to Hawaiʻi, he settled at Kapaʻa. Kila, Mōʻīkeha's favorite of his three sons by the Kauaʻi chiefess Hoʻoipoikamalani, was born at Kapaʻa and was said to be the most handsome man on the island. It was Kila who was sent by his father back to Kahiki to slay his old enemies and retrieve a foster son, the high chief Laʻamaikahiki (Handy and Handy 1972:424; Beckwith 1970:352-358; Kalākaua 1888:130-135; Fornander 1917, vol. 4 pt.1:160). Mōʻīkeha's love for Kapaʻa is recalled in the *ʻōlelo noʻeau:*

Ka lulu o Mōʻīkeha i ka laulā o Kapaʻa. "The calm of Mōʻīkeha in the breadth of Kapaʻa" (Pukui 1983:157).

"*Lulu-o-Mōʻīkeha*" is described as being situated "near the landing and the school of Waimahanalua" (Akina 1913:5). The landing in Kapaʻa was known as Makee Landing and was likely constructed in the late 1870s, the same time period as the Makee Sugar Mill originated. Today, the old Makee Landing has been replaced with a portion of a breakwater located on the north side of Mōʻīkeha Canal near the present day Coral Reef Hotel on the *makai* side of Kūhiō Highway.

Akina (1913) tells the story of how Mōʻīkeha's son, Kila, stocked the islands with the fish *akule*, *kawakawa*, and *ʻōpelu*. When Kila traveled to Kahiki, he sought out his grandfather Maweke and explained that he was the child of Mōʻīkeha. When Maweke asked Kila if Mōʻīkeha was enjoying himself, Kila answered with the following chant:

My father enjoys the billowing clouds	*I walea no kuʻu makuakāne i ke ao*
over Pōhaku-pili,	*hoʻokanunu, iluna o Pōhakupili*
The sticky and delicious poi,	*I ka poi uouo ono ae no a,*
With the fish brought from Puna,	*Me ka Iʻa i na mai o ka Puna,*
The broad-backed shrimp of Kapalua,	*Ka opae hoainahanaha o Kapalua*;
The dark-backed shrimp of Pōhakuhapai,	*Na opae kua hauli o Pohakuhapai,*

The potent awa root of Maiakiʻi,	*Na puawa ona mai no o Maiakii,*
The breadfruit laid in the embers at Makialo	*Me ka ulu moelehu mai no o Makialo,*
The large heavy taros of Keahʼāpana	*Me na kalo pehi hua o Keahapana,*
The crooked surf of Makāiwa too	*A i kekee nalu ae no hoi o Makaiwa,*
The bending hither and thither of the reed and rush blossoms,	*A i ke kahuli aku kahuli mai o ka pua uku me ka pua neki,*
The swaying of the *kalukalu* grasses of Puna	*A i ka nuʻa ae no o ke kalukalu o Puna,*
The large, plump, private parts of my mothers,	*A i na mea nui nepunepu no a kuʻu mau makuahine.*
Of Hoʻoipoikamalanai and Hinau-u,	*O Hoioipo ikamalanai me Hinau-u,*
The sun that rises and sets,	*A i ka la hiki ae no a napoo aku,*
He enjoys himself on Kauaʻi,	*Walea ai no ka nohona ia Kauaʻi*
All of Kauaʻi is Mōʻīkeha's [Akina 1913:6].	*Ua puna a puni Kauaʻi ia Mōʻīkeha*

Maweke was delighted with the news. Kila told his grandfather that the purpose of his journey to Kahiki was fish for his family. Maweke told Kila to lead the fish back to his homeland. This is how Kila led the *akule*, *kawakawa* and *ʻōpelu* to Hawaiʻi.

2.1.2 Pākaʻa and the wind gourd of Laʻamaomao (Keahiahi)

Kapaʻa also figures prominently in the famous story of Pākaʻa, and the wind gourd of Laʻamaomao. Pākaʻa was the son of Kūanuʻuanu, a high-ranking retainer of the Big Island ruling chief Keawenuiaʻumi (the son and heir to the legendary chief ʻUmi), and Laʻamaomao, the most beautiful girl of Kapaʻa and member of a family of high status *kahuna* (priestly or specialist class). Kūanuʻuanu left the island of Hawaiʻi, traveled throughout the other islands, and finally settled on Kauaʻi, at Kapaʻa. It was there that he met and married Laʻamaomao, although he never revealed his background or high rank to her until the day a messenger arrived, calling Kūanuʻuanu back to the court of Keawenuiaʻumi.

By that time, Laʻamaomao was with child, but Kūanuʻuanu could not take her with him. He instructed her to name the child, if it was a boy, Pākaʻa. Pākaʻa was raised on the beach at Kapaʻa by Laʻamaomao and her brother Maʻilou, a bird snarer. He grew to be an intelligent young man, and it is said he was the first to adapt the use of a sail to small fishing canoes. Although Pākaʻa was told by his mother from a very young age that his father was Maʻilou, he suspected otherwise and after constant questioning, Laʻamaomao told her son the truth about Kūanuʻuanu.

Intent on seeking out his real father and making himself known to him, Pākaʻa prepared for the journey to the Big Island. His mother presented him with a tightly covered gourd containing the bones of her grandmother, also named Laʻamaomao, the goddess of the winds. With the gourd and chants taught to him by his mother, Pākaʻa could command the forces of all the winds in Hawaiʻi. This story continues on at length about Pākaʻa and his exploits on the Big Island and later on Molokaʻi. It is important to note that several versions of this story include the chants that provide the traditional names of all of the winds of all the districts on all of the islands, preserving them for this and future generations (Nakuina 1990; Rice 1974:69-89; Beckwith

1970:86-87; Thrum 1923:53-67; Fornander 1918, Vol. 5, Pt.1:78-128). For Kauaʻi, Pākaʻa chants:

> There, see the wind,
> A wind, the wind gourd of Laʻamaomao,
> The Kiu, the Koʻoluwahine breeze, where I left it,
> Calling out to the multitudes, to the row of mountains,
> A cloud sign of the scattering wind,
> A cloud formed by winds gathering at Kapaʻa,
> There they are, the winds of Kauaʻi, . . .
> Inuwai is of Waipouli,
> Hoʻolua is the wind of Makaīwa,
> Kēhau is of Kapaʻa,
> Malamalamamaikai is of Keālia . . .
> [Nakuina 1990: 45-46].

Frederick Wichman (1998:84) writes that Pākaʻa grew up on a headland named Keahiahi. Here, Pākaʻa learned to catch *mālolo*, his favorite fish. After studying the ocean and devising his plan to fabricate a sail, Pākaʻa wove a sail in the shape of a crab claw and tried it out on his uncle's canoe. One day, after going out to catch *mālolo*, he challenged the other fishermen to race to shore. He convinced them to fill his canoe with fish suggesting it was the only way he could truly claim the prize if he won:

> The fishermen began paddling toward shore. They watched as Pākaʻa paddled farther out to sea and began to fumble with a pole that had a mat tied to it. It looked so funny that they began to laugh, and soon they lost the rhythm of their own paddling. Suddenly Pākaʻa's mast was up and the sail filled with wind. Pākaʻa turned toward shore and shot past the astonished fishermen, landing on the beach far ahead of them. That night, Pākaʻa, his mother, and his uncle had all the mālolo they could eat [Wichman 1998:85].

2.1.3 Kaweloleimākua

Kapaʻa is also mentioned in traditions concerning Kawelo (Kaweloleimākua), Ka'ililauokekoa (Moʻikeha's daughter, or granddaughter, dependent on differing versions of the tale), the *moʻo* Kalamainuʻu and the origins of the *hīnaʻi hīnālea* or the fish trap used to catch the *hīnālea* fish, and the story of Lonoikamakahiki (Fornander 1917, Vol.4, Pt.2:318, Vol.4, Pt.3:704-705; Rice 1974:106-108; Thrum 1923:123-135; Kamakau 1976:80).

2.1.4 *Kalukalu* grass of Kapaʻa

"*Kūmoena Kalukalu Kapaʻa*" or "Kapaʻa is like the *Kalukalu* mats" is a line from a chant recited by Lonoikamakahiki. *Kalukalu* is a sedge grass, apparently used for weaving mats (Fornander 1917, Vol. 4, Pt. 2: 318-19). Pukui (1983:187) associates the *Kalukalu* with lovers in "*ke Kalukalu moe ipo o Kapaʻa*; the *Kalukalu* of Kapaʻa that sleeps with the lover". According to Wichman (1998:84), "a *Kalukalu* mat was laid on the ground under a tree, covered with a thick pile of grass, and a second mat was thrown over that for a comfortable bed," thus the association with lovers. Kauaʻi was famous for this peculiar grass, and it probably grew around the marshlands of Kapaʻa. It is thought to be extinct now, but an old-time resident of the area recalled that it had edible roots, "somewhat like peanuts." Perhaps it was a famine food source (Kapaʻa Elementary School 1933:VI).

2.2 Heiau of Kapaʻa

During their expeditions around Hawaiʻi in the 1880s, collecting stories from *ka pōʻe kahiko* (the people of old*)*, Lahainaluna students stopped in Kapaʻa and Keālia and gathered information regarding *heiau* of the region. All together, fourteen *heiau* were named in Kapaʻa and Keālia, suggesting the two *ahupuaʻa* were probably more politically significant in ancient times. Table 1 lists the names of the *heiau* identified in the *ahupua'a* of Kapaʻa, their location if known, their type, associated chief and priest, and any comments and the reference.

Table 1. *Heiau* of Kapaʻa

Name	Location	Associated	Chief/Priest
Mailehuna	Kapaʻa (Mailehuna is the area of the present day Kapaʻa School)	Kiha, Kaumualiʻi/ Lukahakona	Ref: Bishop Museum Archives (HEN I: 214) Lahainaluna Student Compositions
Pueo	Kapaʻa	Kiha, Kaumualiʻi/ Lukahakona	Ref: Same as above
Pahua	Kapaʻa/Keālia	Kiha/ Lukahakona	Ref: Same as above
Kumalae	Kapaʻa/Keālia	Kiha/ Lukahakona	Ref: Same as above
Waiehumalama	Kapaʻa/Keālia	Kiha/ Lukahakona	Ref: Same as above
Napuupaakai	Kapaʻa/Keālia	Kiha/ Lukahakona	Ref: Same as above
Noeamakalii	Kapaʻa/Keālia	Unknown	"*heiau* for birth of Kauaʻi Chiefs, like Holoholokū"Ref: " "
Puukoa	Kapaʻa/Keālia	Unknown	"*unu* type *heiau*"Ref: " "
Piouka	Kapaʻa/Keālia	Unknown	"*unu* type *heiau; heiau* where standing chiefs quarreled over stream that flowed through them. When drought came, the water at Piouka dried up"/ Ref: " "
Una	Kapaʻa/Keālia	Kiha/ Lukahakona	Ref: Same as above
Mano	Kapaʻa/Keālia	Kiha/ Lukahakona	Ref: Same as above
Kuahiahi	Kapaʻa (govn't school stands on site now)	Kaumualiʻi/ Lukahakona	Bishop Museum Archives (HEN I:216)
Makanalimu	Upland of Kawaihau	Kaumualiʻi	Ref: Same as above
Kaluluo Mōʻīkeha	Kapaʻa	Mōʻīkeha	Ref: Same as above

The exact locations of these *heiau* are unknown. The locations of two of the *heiau* correlate with the locations of *wahi pana* that are known to be near the coast, Kuahiahi and Kaluluomōʻīkeha. Kuahiahi (also spelled Kaahiahi and Keahiahi) is the rocky headland at the north end of Kapaʻa where the first Kapaʻa School was once located. Kaluluo Mōʻīkeha is thought to be in the general area near the Mōʻīkeha Canal and the present day Coral Reef Hotel.

2.3 Pre-Contact and Early Post-Contact Land Use

E. Craighill Handy (1940) describes the remains of agricultural sites in Kapaʻa in the early part of the twentieth century:

> There are extensive terrace areas on the flatlands below the mountains, watered by Kapahi, Makaleha, and Moalepi Streams, where the upper Kapaa homesteads are located. Kapaa river is formed by the union of these three streams. For 4 miles or more along the course of this river the pockets of flatland along the river bottom were built into terraces. A little way up Kaehulua, there were small terrace areas which are now either in cane or under grass. The flatlands of Waianuenue and coastal Kapaa, which are now mostly planted in sugar cane, were presumably terrace anciently, except perhaps the marshy sections [Handy 1940:68].

These agricultural fields were used to grow irrigated taro; Kapaʻa once had a “highly developed irrigation system,” and thus was one of the pre-contact centers of population (Handy and Handy 1972:269). Handy also mentions that Kapaʻa is a district with a broad coastal plain bordering the sea “which would be suitable for sweet potato plantings; presumably a great many used to be grown in this section” (Handy 1940:153). Yams were grown inland in all sections of Puna (Handy 1940:171). The farmers in the valleys of Puna practiced “diversified farming: Taro, sweet potatoes, breadfruit, coconuts” (Handy and Handy 1972:423).

George Vancouver (1798:221-223) examined the east coast of the island from his ship in 1793 and stated that it was the “most fertile and pleasant district of the island . . .” However, he did not anchor nor go ashore due to inhospitable ocean conditions.

In 1840, Peale and Rich, with Charles Wilkes’ United States Exploring Expedition (1844), traversed the coastline there on horseback heading north from Wailua:

> The country on the way is of the same character as that already seen. They passed the small villages of Kuapau [Kapaʻa], Keālia, Anehola, Mowaa, and Kauharaki, situated at the mouths of the mountain streams, which were closed with similar sand-bars to those already described. These bars afforded places to cross at, though requiring great precaution when on horseback. The streams above the bars were in most cases, deep, wide, and navigable a few miles for canoes. Besides the sugarcane, taro, etc., some good fields of rice were seen. The country may be called open; it is covered with grass forming excellent pasture-grounds, and abounds in plover and turnstones, scattered in small flocks [Wilkes 1844:69].

2.4 The Māhele: Kapaʻa Land Commission Awards

In the mid-1800s, Kamehameha III decreed a division of lands called the Māhele. Lands were divided into three portions: crown lands, government lands, and lands set aside for the chiefs.

Individual plots, called *kuleana* awards, were granted within these divided lands to native inhabitants who lived on and farmed these plots and came forward to claim them. Researching the claims and testimonies that were given in the mid-1800s can sometimes assist in forming a settlement pattern for the region at that time and possibly earlier.

During the Māhele, Kapaʻa was retained as Crown Lands (Office of the Commissioner of Public Lands of the Territory of Hawaii 1929). The *ʻili* of Paikahawai and Ulakiu in Kapaʻa Ahupuaʻa were retained as Government Lands. The Land Commission Awards (LCAs) during this period show that six individuals, other than *aliʻi* or chiefs were awarded land parcels in the relatively large *ahupua'a* of Kapaʻa (Table 2; Figure 6).

Table 2. Māhele Land Claims in Kapaʻa Ahupuaʻa

LCA	Claimant	Land se And Location	Award
3554 and 3599	Keo	(1) 15 *loʻi* in the entire *ʻili* of Kahanui (2) House lot in Puhi Village LCA 3599 was not awarded	2 *ʻāpana*, 1 acre
3638	Huluili, Kahoiu (Kadaio)	(1)15 *loʻi* and *kula* in Maeleʻele ʻIli (2) House lot in Kaloko (Kalolo) Village	2 *ʻāpana*, 5 acres, 1 rood, 19 rods
3243 and 3971	Honolii, Ioane	(1) 6 uncultivated *loʻi in* Kahana ʻIli (2) House lot in Kupanihi Village	2 *ʻāpana*, 2 acres, 1 rood, 1 rod
8247	Ehu	Approx. 20 *loʻi* lying waste, some orange trees at Moalepe ʻIli	1 *ʻāpana*, 3 roods
8559B	W.C. Lunalilo	No information	790 acres
8837	Kamapaʻa	(1) 3 *loʻi* in Ulukiu ʻIli (2) 2 *loʻi* in Awawaloa ʻIli (2) House lot in Ulukiu Village	3 *ʻāpana*, 2 roods, 33 rods
8843	Kiau and son, Apahu	(1) 6 *loʻi* ʻin Apopo ʻIli (2) House lot in Kalolo Village	2 *ʻāpana*, 2.75 acres, 3 rods
10564	Daniela Oleloa	Hikinui, (or Hahanui) a farm plot (10 *loʻi*) with fishpond	1 *ʻāpana*, 1 acre

Daniela Oleloa is likely an *aliʻi* based on testimony provided by an informant to substantiate Oleloa's claim, "Kanama, sworn, says I am Konohiki of Waiakalua & have been since 1844, when I was placed there by D. Oleloa" (Ulukau 2005). Oleloa also claimed other parcels within other Kauaʻi *ahupuaʻa*, which is unusual unless the individual is an *aliʻi*.

The other six awardees are Keo (LCA 3554/3599), Huluili (LCA 3638), Ioane Honolii (LCA 3971/3243), Ehu (LCA 8247), Kamapaa (LCA 8837), and Kiau (LCA 8843). Five of the six awardees received multiple parcels that have similarities. All five had *loʻi*, or irrigated *kalo* (taro) fields on the *mauka* side of the lowland swampy area, sometimes extending a short distance up into small, shallow gulches and valleys. Many of these *loʻi* parcels name *pali*, or hills/cliffs, as boundaries. Each LCA also had a separate house lot located on the *makai* side of the swamp, near the beach. Two of the land claims name ponds on their lands: Puhi Pond (LCA 3554) and

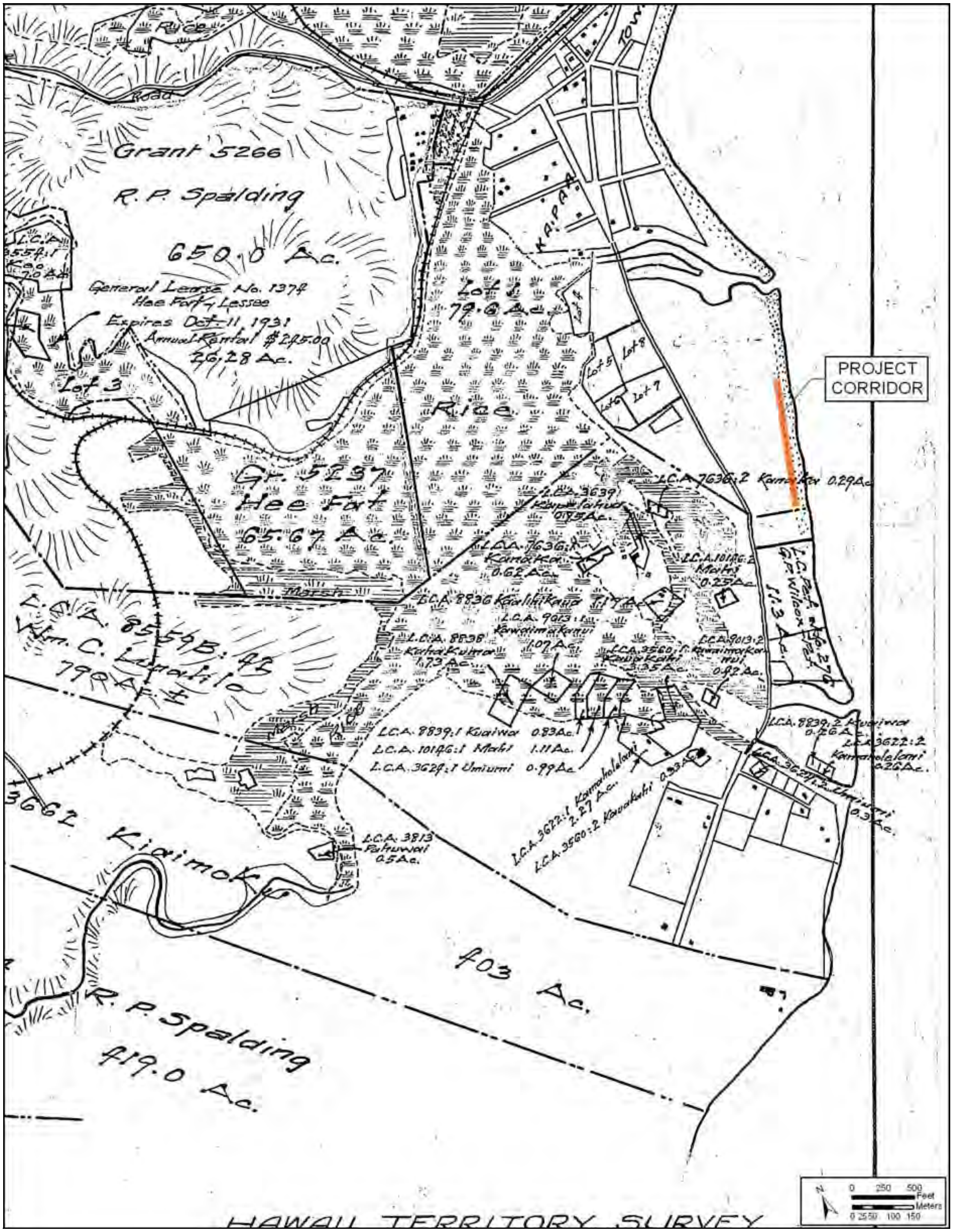


Figure 6. Portion of 1914 Hawaii Territory Survey map by Walter E. Wall, showing coastal and inland LCAs, and the project corridor (Plat 3014)

fishponds in Kupanihi ʻIli (LCA 3971). The two *loko* are associated with house lots, situated on the *makai* edge of the Kapaʻa swamps, suggesting modification of the natural swamplands.

Other natural and cultural resources mentioned in the LCAs include freshwater springs, pigpens, *hau* bushes, *hala* (pandanus) clumps, streams, *ʻauwai* (irrigation ditches), and *kula* (land used for pasture or dryland agriculture). Some of these natural features and the agricultural fields *mauka* of the coastal marsh lands can be seen on the 1914 Hawaii Territory Survey of Kapaʻa (see Figure 6).

Interestingly, the residential "village" of Kapaʻa did not exist as a single entity, but was a series of probably small settlements, or compounds, perhaps even individual house lots, which stretched along the shoreline of the *ahupuaʻa* and included (south to north) Kupanihi (Makahaikupanihi), Kalolo (Kaulolo), Puhi, and Ulukiu. The current project area is closer to a village in Waipouli *ahupuaʻa* (see Figure 6), as discussed in section 2.4.1.

The fifth individual, Ehu (LCA 8247), was the only person to be awarded a single parcel in the upland area of Kapaʻa, in Moalepe Valley, approximately five miles *mauka* of the coast. In 1848, when Ehu made his claim, he was the only resident. A few years later, according to Honolii's testimony to support Ehu's claim, "There are no houses and no people now living on the land. Ehu found himself lonely there, all his neighbors having either died or left the land. Ehu now lives in Wailua." Evidently, Ehu may have been the last person to live at and cultivate, in the traditional way, the far *mauka* region of Kapaʻa.

The project area is within one of the few areas shown on Figure 6 that is not designated as an LCA, or under cultivation, or designated as within the "Kapaa Town Lots."

2.4.1 Waipouli *ahupuaʻa* LCAs within Close Proximity

The northern-most boundary of Waipouli *ahupuaʻa* is just south of the project corridor. William C. Lunalilo, the awardee of LCA 8559B and the entire *ahupuaʻa* of Waipouli as well as a portion of Kapaʻa *ahupuaʻa* was the son of Charles Kanaʻina, and the grandson of Kalaimamahu, who was Kamehameha I's half-brother. Lunalilo was known as the "People's King"; he was democratically elected in 1873 defeating Kalākaua. Lunalilo enjoyed "the quiet life of Waikīkī", and living "on fish and poi with his native friends." Queen Emma, the widow of King Kamehameha IV, Alexander Liholiho, inherited the property following Lunalilo's death in 1874 (Kanahele 1995:115, 133, 148-149). No information related to the land usage for Lunalilo's claims were found.

LCA 7636.2 is the closest LCA to the project corridor, approximately 300 m southwest (see Figure 6). Granted to Kaanaka, Apana 2 of LCA 7636 is a house lot within Makahokoloko Village, thus Makahokoloko Village is the closest village to the project corridor.

In 1913 Gaylord .P. Wilcox, the manger of Grove Farm Plantation, petitioned for a portion of the *ahupuaʻa* of Waipuli, approximately 150 m south of the project corridor. Research does not indicate land usage of LC petition 276.

2.4.2 Place Names in Land Commission Records and Other Sources

Place names and *wahi pana* (legendary place [Pukui and Elbert 1986:376]) are an integral part of Hawaiian culture. "In Hawaiian culture, if a particular spot is given a name, it is because an event occurred there which has meaning for the people of that time" (McGuire and Hammatt 2000:17). The *wahi pana* were then passed on through language and oral tradition, thus preserving the unique significance of the place. Hawaiians named all sorts of objects places, and points of interest that may have gone unnoticed by persons of other cultural backgrounds.

Table 3 lists place names of Kapaʻa, compiled from traditional literature (*moʻolelo*, chants), historical sources, maps and Māhele records. Most of the *ʻili* names are from the Māhele Land Commission Awards. Another resource is the list of all place names mentioned in LCA documents of Kauaʻi compiled by Lloyd Soehren (2002). The list includes, among others, names of: *ahupuaʻa*; *ʻili* (smaller land divisions within an *ahupuaʻa*); *ʻili kū* (*ʻili kūpuna*; land unit that pays tribute to the chief of the district); *ʻauwai* (irrigation ditches); *kula* (land used for pasture or dryland agriculture); *loʻi*; *kauhale* (group of houses belonging to one family); *heiau*; *puʻu* (hills or mountains); and *pali*. Soehren primarily used *Place Names of Hawaiʻi* (Pukui et al. 1974) for all place name translations. When translations were unavailable, a literal translation of the place name was sometimes made, using the *Hawaiian Dictionary* (Pukui and Elbert 1986).

"Kaluakalepo" is the name of the marker at the boundary between Kapaʻa and Waipouli, just south of the project corridor. The marker is "a galvanized iron pipe and a long large flat rock set on edge to the West of it. On beach… (Hawaii Dept. of Survey 1909:13). No meaning was found for the place name.

Table 3. Place Names of Kapaʻa

Name	Meaning	Type	Location
ʻApōpō	tomorrow	*ʻili*, *pali*	LCA 8343
Awāwaloa	long valley, gulch, ravine	*ʻili*, *pali*	LCA 8837
Hāhānui/ Kahanui		*ʻili*, *pali*, stream	LCAs 3599 and 3554
Hoʻopiʻi		falls	
Hoa		*pali*	LCA 3638:1
Humuulu		*puʻu*, *puʻu*	
Kahana	Lit. cutting	*ʻili*	LCAs 3971, 3243
Kalolo/ Kaloko		*kauhale*, *kula*	LCAs 3638:2, 8843:2
Kaloloku		swamp	Coastal swamp of Kapaʻa and Waipouli
Kamahuna		*puʻu*	
Kamakīiwa	the mother-of-pearl eyes	surf	
Kamaliʻi	children	ridge	
Kapaʻa	the solid, or the closing	*ʻahupuaʻa*, town, stream	
Kapahi	the knife	village, stream	
Kapeku	the kick	*lo*ʻi	LCA 8837:1
Kaulolo		*kauhale*, *kula*	LCAs 3638:2, 8843:2

Name	Meaning	Type	Location
Keiwa	the ninth	ridge, boundary point	
Koʻalua	prob. two coral heads	surf	
Kolehaka		*pali*	3971, 3243
Kolouna		*pali*	8247
Kuahiahi/ Kaahiahi/ Keahiahi		rocky headland;	location of first Kapaʻa School (1883-1908); location of Kuahiahi Heiau (HEN I:216), place where the legendary figure Pakaʻa, keeper of the wind gourd of Laʻamaomoa, grew up and fished (Wichman 1998:85).
Kupanihi		*ʻili*, *kauhale*, fishpond	
Lauii		*puʻu*	
Māʻeleele	numb	*ʻili*	
Mailehuna		*puʻu*, *heiau*;	Hill where Kapaa School is now located; name of a former *heiau* on this location (HEN:214)
Makaleha	eyes looking about as in wonder and admiration	stream, boundary point	corner of Kapaa, Kealia, and Kalihiwai; stream
Makanalimu	gift of seaweed	place (district or village?), *heiau*	old name for Kawaihau
Mākea	fallow land; a variety of kalo, a variety of kava	*ʻauwai*	LCAs 3599, 3554
Moalepe/ Maolepi	chicken with comb	*ʻili*, stream	LCA 8247
Mōʻīkeha		canal	Named after the chief Mōʻīkeha
Naele	swamp bog	*pali*	LCA 8837:2
Paikahawai		*ʻili ku*	An *ʻili* awarded and then returned by Ioane ʻĪʻī and retained by the *aupuni* (government) at the Māhele
Poʻo	head	surf	
Pōhākiʻikiʻi	tilted stone	*puʻu*	

Name	Meaning	Type	Location
Pāhakupili	joined stone	*pu‘u*, boundary point	
Pu‘u ‘Eke‘eke		*pali*	LCA 8837:1
Pu‘u Lau‘i‘i	native fern (Doodia spp)		LCA 8837:1
Pueo	owl	*pali*	LCA 8843:1
Puhi	blow, or eel, etc.	*kauhale*, pond	LCA 3599, 3554
Puohomaka		*pali*	LCA 8837:2
Pupukai		*pali*	LCA 3638:1
Ulakiu		*‘ili ku*	LCA 8837:1, 2, 4
Waikaea		ditch	
Wailē‘ia	abundant water	rock, boundary point	
Waimahanalua		stream	Located near the old Makee Landing near the Mō‘īkea Canal

2.5 Mid-1800 to 1900

Most of the historic record documents for Kaua‘i during this period revolve around missionary activities and the missions themselves. There were, however, indications that the Kapa‘a area was being considered for new sugar cane experiments, similar to those occurring in Kōloa. In a historic move, Ladd & Company received a 50-year lease on land in Kōloa from Kamehameha III and Kaua‘i Governor Kaikio‘ewa. The terms of the lease allowed the new sugar company “the right of someone other than a chief to control land” and had profound effects on “traditional notions of land tenure dominated by the chiefly hierarchy” (Donohugh 2001:88). In 1837, a very similar lease with similar terms was granted to Wilama Ferani, a merchant and U.S. citizen based in Honolulu (Hawai‘i State Archives, Interior Dept., Letters, Aug. 1837). The lease was granted by Kauikeaouli for the lands of Kapa‘a, Keālia, and Waipouli for twenty years for the following purpose:

> . . . for the cultivation of sugar cane and anything else that may grow on said land, with all of the right for some place to graze animals, and the forest land above to the top of the mountains and the people who are living on said lands, it is to them whether they stay or not, and if they stay, it shall be as follows: They may cultivate the land according to the instructions of Wilama Ferani and his heirs and those he may designate under him . . . [Hawai‘i State Archives, Interior Dept., Letters, Aug. 1837].

Unlike Ladd & Company, which eventually became the Kōloa Sugar Company, there is no further reference to Wilama Ferani and his lease for lands in Kapa‘a, Keālia, and Waipouli. In a brief search for information on the Honolulu merchant, Wilama Ferani, nothing was found. It is thought that perhaps Wilama Ferani may be another name for William French, a well known Honolulu merchant who is documented as having experimented with grinding sugar cane in

Waimea, Kauaʻi at about the same time the 1837 lease for lands in Kapaʻa, Keālia, and Waipouli was signed (Joesting 1984:152).

In 1849, a son of a Waiʻoli missionary, William P. Alexander, recorded his trip around Kauaʻi. Although, he focuses on the larger mission settlements like Kōloa and Hanalei, he does mention Kapaʻa.

> A few miles from Wailua, near Kapaʻa we passed the wreck of a schooner on the beach, which once belonged to Capt. Bernard. It was driven in a gale over the reef, and up on the beach, where it now lies. A few miles further we arrived at Keālia. We had some difficulty crossing the river at this place, owing to the restiveness of our horses. The country here near the shore was rather uninviting, except the valley which always contained streams of water [Alexander 1991:123].

In later years, the notorious Kapaʻa reef was to become the location of many shipwrecks, particularly after the construction of a landing in the 1880s.

In 1876, Captain James McKee and his son-in-law, Col. Z.S. Spaulding, bought the Ernest Krull cattle ranch for the sum of $30,000.00. The first large scale agricultural enterprise in Kapaʻa began on this property in 1877 by the two men and by the society, the Hui Kawaihau (Dole 1916:8). The Hui Kawaihau was originally a choral society begun in Honolulu whose membership consisted of many prominent people, both Hawaiian and non-Hawaiian. It was Kalākaua's thought that the Hui members could join forces with Makee, who had previous sugar plantation experience on Maui, to establish a successful sugar corporation on the east side of Kauaʻi. Captain Makee built a mill in Kapaʻa and agreed to grind cane grown by Hui members. Kalākaua declared the land between Wailua and Moloaʻa, the Kawaihau District, a fifth district and for four years the Hui attempted to grow sugar cane at Kapahi, on the plateau lands above Kapaʻa. After a fire destroyed almost one half of the Hui's second crop of cane and the untimely death of one of their principal advocates, Captain James Makee, the Hui began to disperse; property and leasehold rights passed on to Makee's son-in-law and the new Makee Plantation owner, Colonel Z.S. Spalding (Dole 1916:14).

As part of the infrastructure of the new plantation, a sugar mill was erected, and Makee Landing was built in Kapaʻa during the early years of the Makee Sugar Plantation. Following Captain Makee's death, Colonel Spalding took control of the Plantation, and in 1885, he moved the mill to Keālia (Cook 1999:51). The deteriorating stone smokestack and landing were still there well into the 1900s (Damon 1931). Condè and Best (1973:180) suggest that railroad construction for the Makee Plantation started just prior to the mid 1890s. There is one reference to a railroad line leading from the Kapaʻa landing to Keālia in 1891. During Queen Liliuokalani's visit to Kauaʻi in the summer of 1891, the royal party was treated to music by a band, probably shipped in from Oʻahu. "The band came by ship to Kapaʻa and then by train to Keālia" (Joesting 1984:252).

By the late 1800s, Makee Plantation was a thriving business, with more than one thousand workers employed (Cook 1999:51). Hundreds of Portuguese and Japanese immigrants found work on Makee Plantation, and the new influx of immigrants required more infrastructure. In 1883, a lease for a school lot was signed between Makee Sugar Company and the Board of Education (Kapaʻa School 1982:9). Stipulations found in the Portuguese immigrant contracts with Makee Sugar Company stated that "children shall be properly instructed in the public schools" (*Garden Island*, April 1, 1983). The original Kapaʻa School was constructed in 1883 on a rocky point adjacent to the Makee Sugar Company railroad. Traditionally, this point was known as Kaahiahi (Kapaʻa School 1982:10). In 1908, Kapaʻa School was moved to its present site directly *mauka* and up the hill at Mailehune.

As on most of the Hawaiian Islands, Chinese rice farmers began cultivating the lowlands of Kapaʻa with increasing success in the latter half of the 1800s. Several Hawaiian *kuleana* owners leased or sold their parcels *mauka* of the swamp land to Chinese rice cultivators. Chinese rice cultivators appealed to the government for swamplands, first leasing and later buying them. As a result of the developing rice and sugar industries, the economic activity displaced the houselot *kuleana* on the *makai* side of the marsh for increasing commercial and residential development (Lai 1985:148-161).

Narrow wagon roads gave way to macadamized roads in the early part of the twentieth century. This new road was called the Kauaʻi Belt Road, and parts of it are believed to have followed the "Old Government Road" (Cook 1999). In Kapaʻa, the present day Kūhiō Highway probably follows the same route as the original Government Road and subsequent Kauaʻi Belt Road. The locations of the *kuleana* awards in Kapaʻa indicate that the majority of the houselots were situated along the Government Road. LCA 3243 names a "road" as one of its boundaries.

2.6 1900 to 1940

In the early 1900s, government lands were auctioned off as town lots in Kapaʻa to help with the burgeoning plantation population. As shown in Figure 6, the project area is south of the Kapaʻa town lots.

The Hawaiʻi Dept. of Survey (1909:13) completed Kapaʻa surveys by 1908. Their report relates that "4 lots of from 64 to 60 acres near the Waipouli boundary were completed." However, the surveyor (Wall) reports that although Kapaʻa lots were established with

> …an average of 35 acres of good agricultural land, the balance being either waste or pasture, but in the case of the 4 lots [presumably in the vicinity of the project corridor] … it was not possible to get even that average on account of the numerous gulches in the tract [Hawaii Dept. of Survey 1909:14].

The 1910 U.S. Geological Survey map (Figure 7) shows a road in place at the project corridor although no buildings are shown adjacent to the project area.

In 1923 a fire destroyed most of Kapaʻa however residents worked together to rebuild the town (Fernandez 2009:51). Development within the project corridor vicinity appears to have also begun during the reconstruction of Kapaʻa. A 1924 photograph (Figure 8) contains a description of the project area as having been cleared "for future development" (Fernandez 2009:113).

A 1929 Sanborn Map (Figure 9) shows single family dwellings ("D"), most of which have garages ("A"), along "Beach Road", the current Moanakai Road. It is uncertain when the street name was changed. The literal translation of Moanakai is salt sea or salt ocean according to Andrews (1865:393).

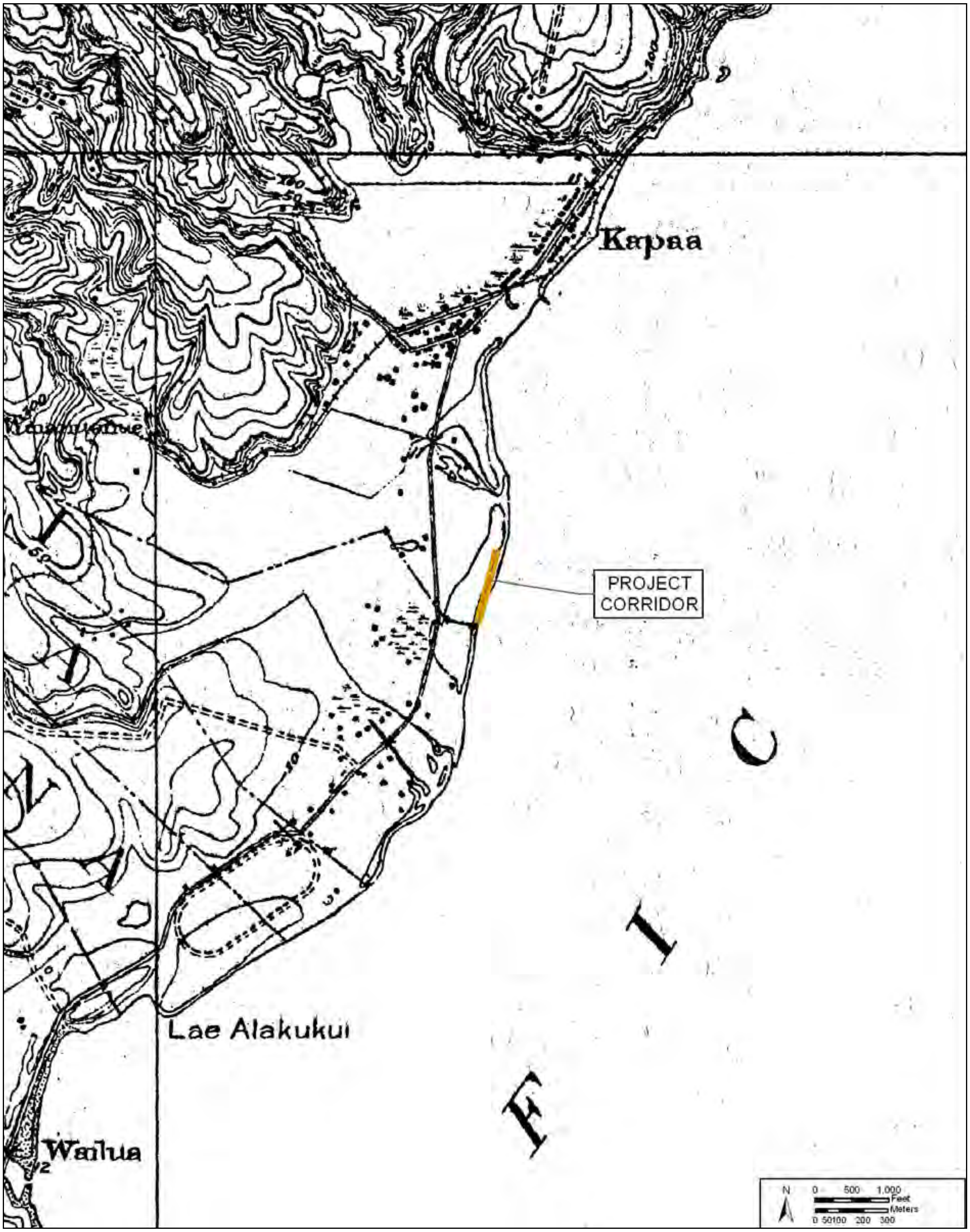


Figure 7. 1910 U.S. Geological Survey Kapa‘a quad map showing project corridor

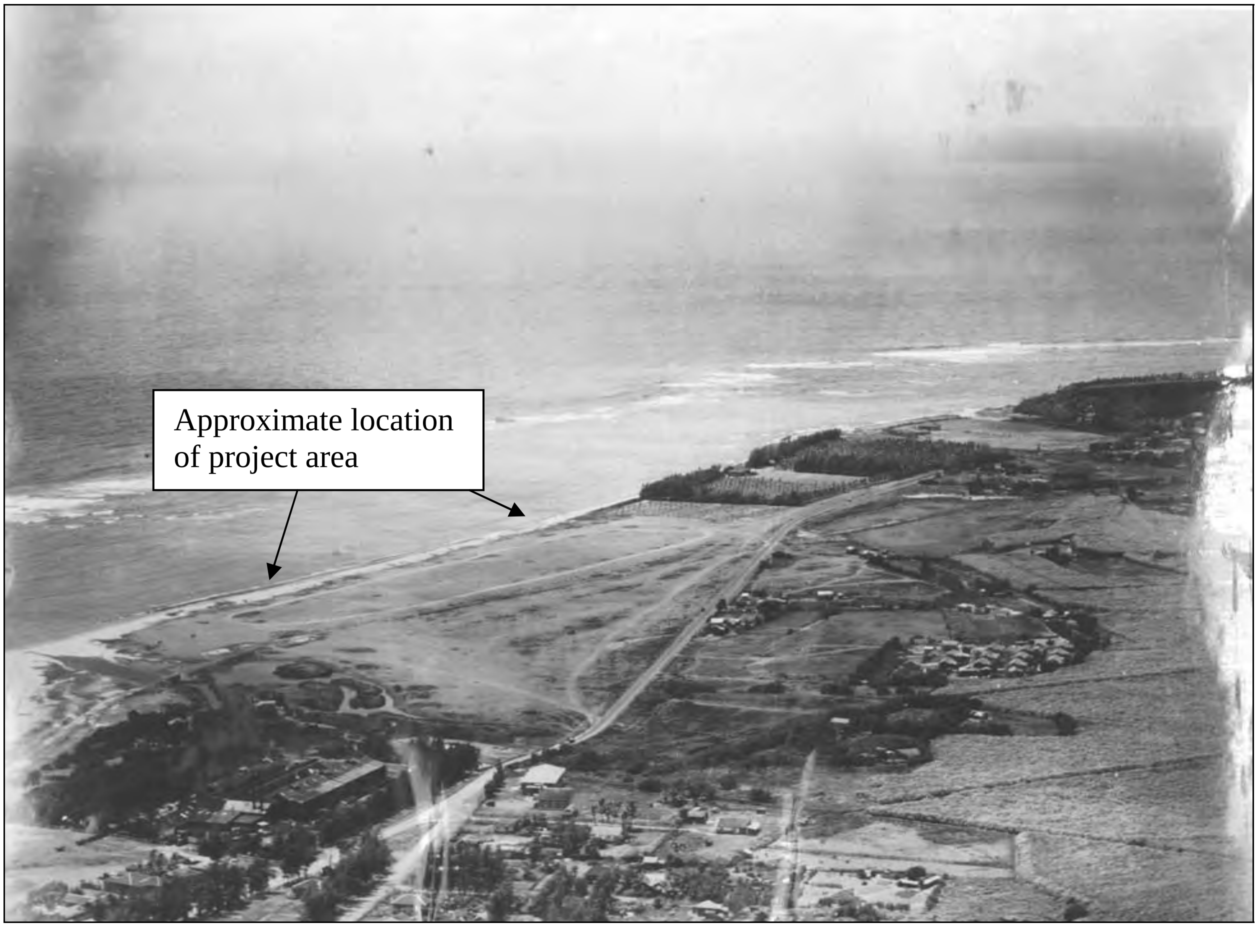


Figure 8. 1924 aerial photograph of Kapa‘a showing the project area vicinity. The area is described as cleared “for future subdivision” (Fernandez 2009:113). Hawaiian Canneries Co. is in foreground, *makai* of highway

A former resident of the project area (Fernandez 2009:60) described Waikaʻea Canal, north of the project corridor, prior to its channelization as a "pestilent swamp" that "was not a running stream" and was "bottled up by sand dunes and dead coral flung ashore by ocean waves." South of "this bog", in the location of the project area,

> ….stretched sand dunes that continued until one came to the suburb of Waipouli. Sometime in the early part of the twentieth century, a developer replaced sand with bungalows. He planted rows of ironwood trees along the shore and exotic plants and flowers…it became home for the middle class families of Kapaʻa, including [the writer's] parents [Fernandez 2009:61].

Based on this description, in addition to the maps and photograph of the area, the project corridor and its vicinity were apparently not developed until the early 1900s.

2.6.1 Hawaiian Canneries Company, Limited

In 1913, Hawaiian Canneries opened in Kapaʻa at the site now occupied by Pono Kai Resort (Cook 1999:56), just north of Waikaʻea Canal and the project area. A resident of Kapaʻa described how the town "came alive" after the cannery opened (Fernandez 2009:48). Japanese moved into town after they completed their plantation contracts and

> …opened mom and pop grocery stores. Portuguese opened dairy farms in the hinterland or repair shops in Kapaʻa. Former plantation laborers became farmers, raising pineapple and other crops for sale. Service businesses started: the slop-gatherer who came to homes to take the garbage as feed for his pigs, the fish monger selling fish on their street, the cattle rancher who slaughtered cows and provided fresh meat to the market, the traveling wagon man hawking fresh fruits and vegetables [Fernandez 2009:48].

Kapaʻa became "an integrated multi-racial town, containing an extraordinary mix of people living and working together in harmony" all due to the new cannery (Fernandez 2009:48).

In 1923 Hawaiian Canneries Company, Limited purchased the approximately 8.75 acres of land they were leasing through the Hawaiian Organic Act (Bureau of Land Conveyances, Grant 8248). At that time the cannery only contained four structures but by 1956, 1.5 million cases of pineapple were being packed. By 1960, 3,400 acres were in pineapple and the cannery employed 250 full time and 1000 seasonal workers (*Honolulu Advertiser,* March 20, 1960). In 1962, Hawaiian Canneries went out of business due to competition from canneries in other countries.

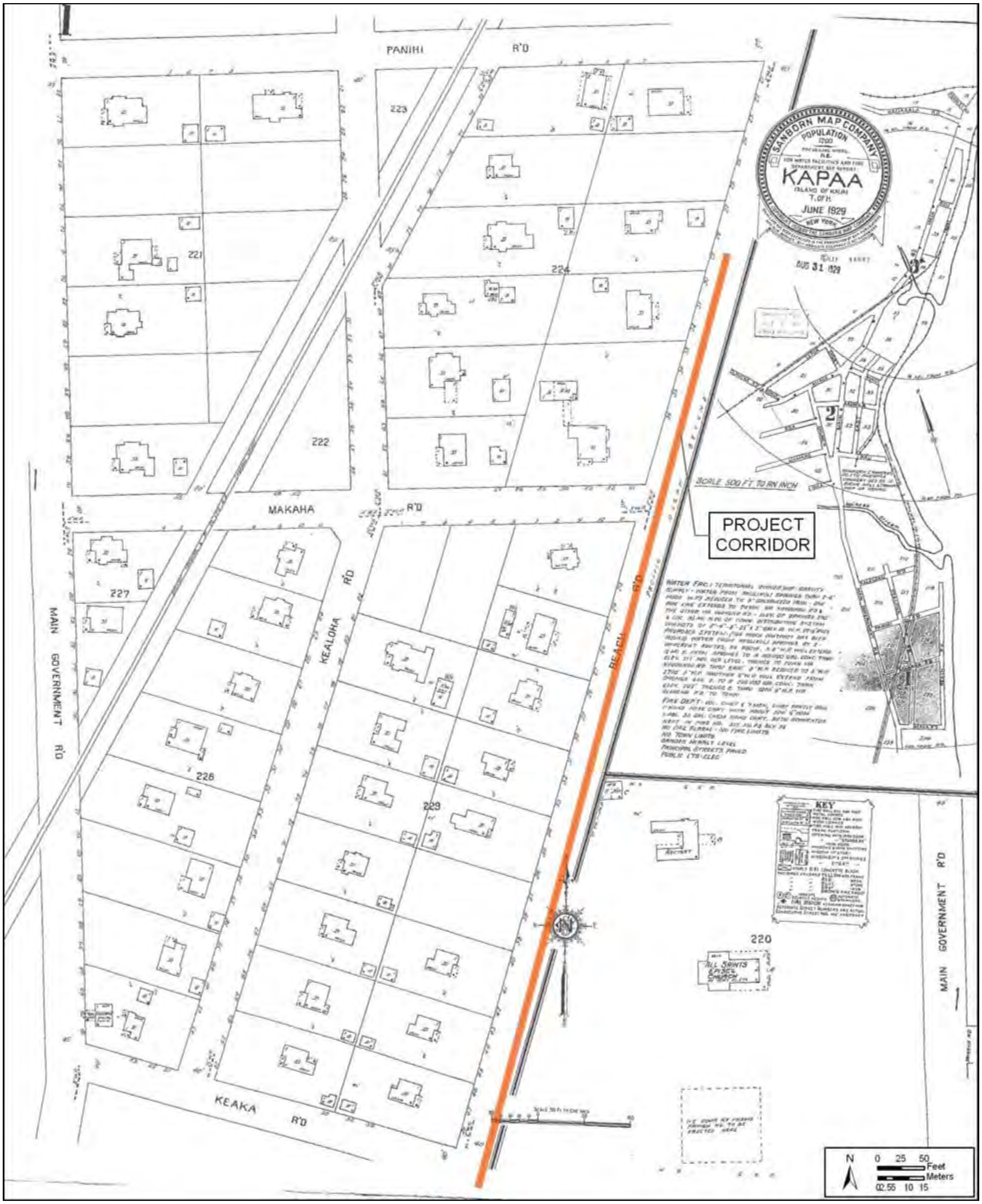


Figure 9. 1929 Sanborn Map showing the approximate location of the project corridor and its vicinity

2.6.2 Ahukini Terminal & Railway Company

The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Keālia, and Kapa‘a to Ahukini Landing and “provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet” (Condé and Best 1973:185). The company was responsible for extending the railroad line from Makee Landing, which was no longer in use, to Ahukini Landing, and for constructing the original Waika‘ea Railroad Bridge and the Mō‘īkeha Makai Railroad Bridge.

In 1934, the Lihue Plantation Company absorbed the Ahukini Terminal & Railway Company and Makee Sugar Company (Condé and Best 1973:167). The railway and rolling stock formerly owned by Makee Sugar Company became the Makee Division of the Lihue Plantation. At this time, in addition to hauling sugar cane, the railroad was also used to haul plantation freight, including “fertilizer, etc . . . canned pineapple from Hawaiian Canneries to Ahukini and Nawiliwili, pineapple refuse from Hawaiian Canneries to a dump near Anahola and fuel oil from Ahukini to Hawaiian Canneries Co., Ltd.” (Hawaiian Territorial Planning Board 1940:11). Former plantation workers and *kama‘āina* (old-time resident) growing up in Kapa‘a remember when the cannery sent their waste to the pineapple dump, a concrete pier just north of Kumukumu Stream by railroad. The structure is built over the water where the rail cars would dump the pineapple waste. The current carried the waste to Kapa‘a, where the waste attracted fish and sharks (Bushnell et al. 2002).

Lihue Plantation was the last plantation in Hawai‘i to convert from railroad transport to trucking. “By 1957 the company was salvaging a part of their plantation railroad, which was being supplanted by roads laid out for the most part on or close to the old rail bed” (Condé and Best 1973:167). By 1959, the plantation had completely converted to trucking.

2.7 1940 to Present

Severe floods in Kapa‘a in 1940 led to the dredging and construction of the Waika‘ea and Mō‘īkeha Canals sometime in the 1940s (Hawaiian Territorial Planning Board 1940:7). The construction of Waika‘ea Canal, approximately 275 m north of the project area, had been proposed as early as 1923 (Bureau of Land Conveyances, Grant 8248). A 1940 Master Plan for Kapa‘a requested that the Territorial Legislature set aside funds for the completion of a drainage canal and for filling *makai* and *mauka* of the canal (Hawaiian Territorial Planning Board 1940:7). In 1955, a report was published on proposed coral dredging for the reef fronting Kapa‘a Beach Park (*Garden Island Newspaper*, September 21, 1955). The coral was to be used for building plantation roads. This dredging was later blamed for accelerated erosion along Kapa‘a Beach (*Garden Island Newspaper*, October 30, 1963). Today, there are several sea walls along the Kapa‘a Beach Park to check erosion. Old time residents claim the sandy beach in Kapa‘a was once much more extensive than it is now (Bushnell et al. 2002).

Residents of Keālia Town slowly dispersed after the incorporation of Makee Sugar Company into Lihue Plantation in the 1930s. Many of the plantation workers bought property of their own and moved out of plantation camps. The plantation camps that bordered Kūhiō Highway were finally disbanded in the 1980s. The Lihue Plantation began to phase out in the last part of the twentieth century. Kapaʻa Town suffered after the closing of the Kapaʻa Cannery, however, the growing tourist industry helped to ease the economic effects of the cannery's closing.

The 1945 Sanborn Map (Figure 10) shows the two previously vacant lots on "Beach Road" adjacent to the project corridor now contain single residence dwellings as compared to the 1929 Sanborn Map (see Figure 9). The majority of dwellings shown on the 1945 Sanborn Map (Figure 10) appear to be the same dwellings as those shown in 1929 (see Figure 9). The 1963 USGS map (Figure 11) does not contain the level of detail as provided by the Sanborn Maps, however, buildings that are likely residences, are still shown adjacent to the Moanakai Road project corridor.

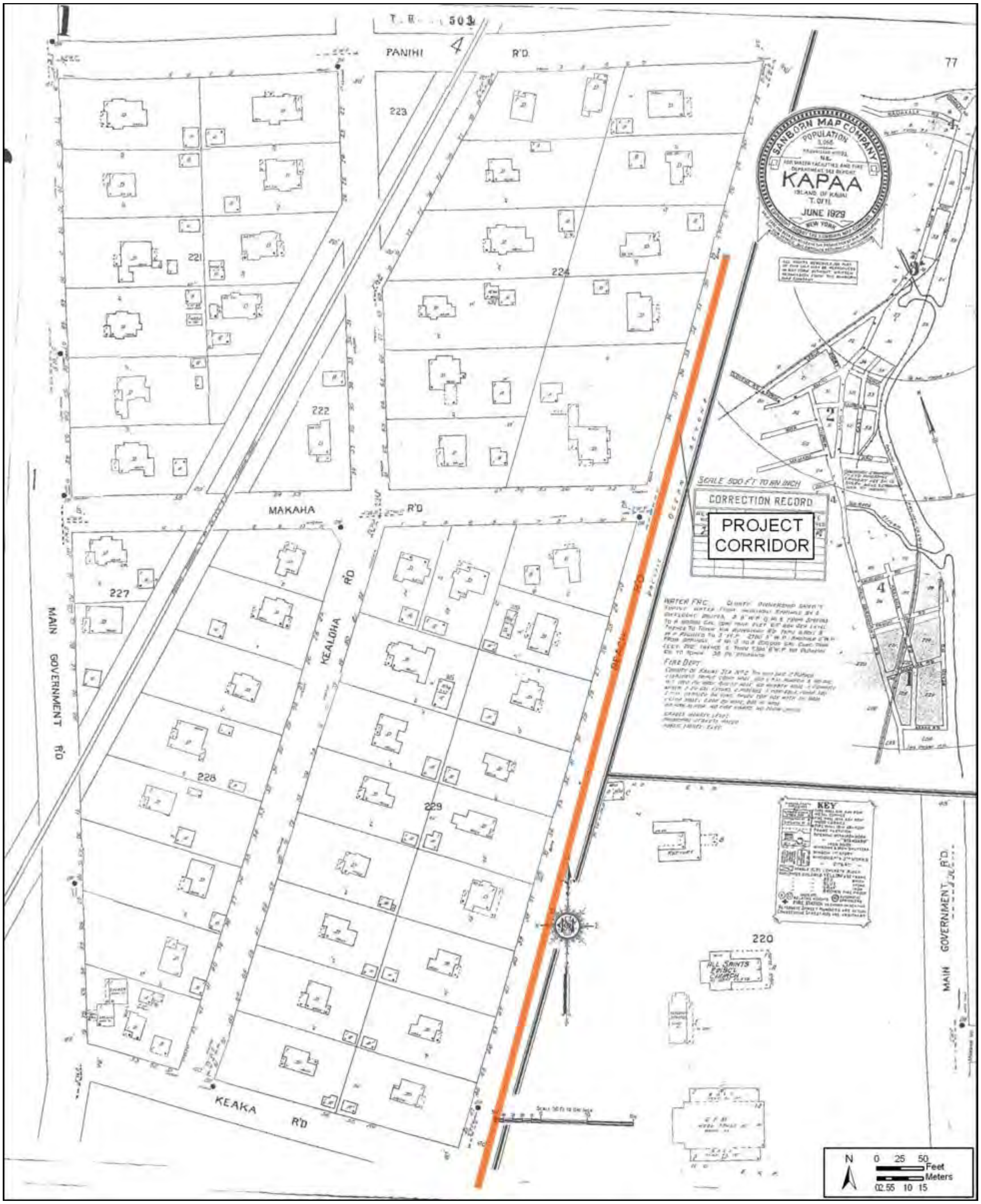


Figure 10. 1945 Sanborn Map showing approximate location of project corridor and its vicinity

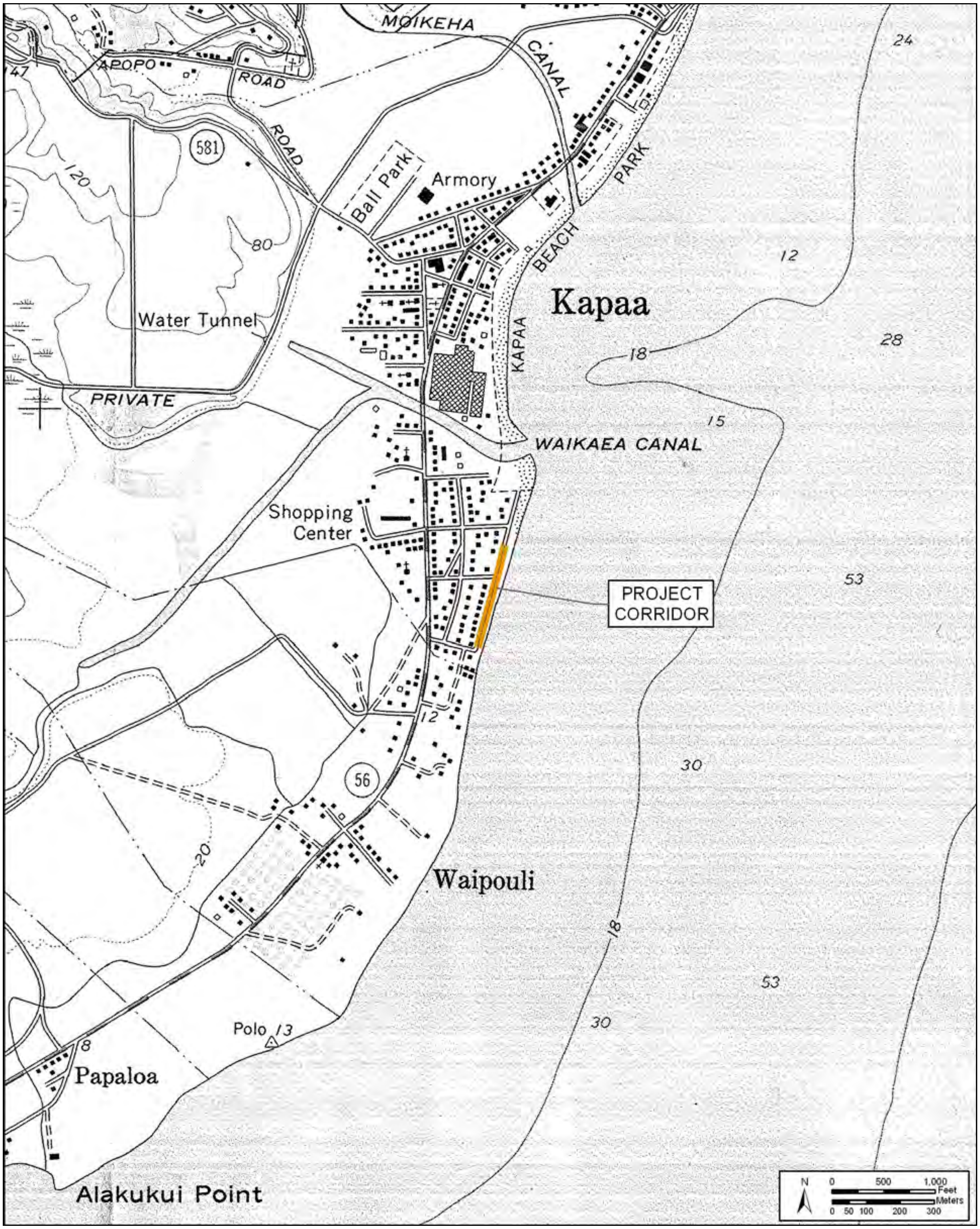


Figure 11. Portion of 1963 U.S. Geological Survey map, Kapaa Quadrangle, showing project corridor and vicinity

Section 3 Previous Archaeological Research

The following maps and tables present the archaeological research and historic properties identified in Kapaʻa Ahupuaʻa. Table 4 provides a list of archaeological research conducted within Kapaʻa Ahupuaʻa, including columns for source, location, nature of study, and findings; Figure 12 shows the location of these projects. Table 5, a list of known historic properties within the *ahupuaʻa*, is comprised of columns for state site numbers, site type, location, and reference.

3.1 Pattern of Archaeological Sites in Kapaʻa

The pattern of archaeological studies in Kapaʻa Ahupuaʻa is somewhat skewed, with a dozen projects in urban Kapaʻa Town and very little work along the coast. Major archaeological sites have been found in the Kapaʻa Town area, including extensive cultural layers with burials and other cultural features underlying Kūhiō Highway near All Saints Gym and near the older part of Kapaʻa Town between Waikaʻea Canal and Kapaʻa Beach Park, *makai* of Kūhiō Highway (Hammatt 1991; Kawachi 1994; Creed et al. 1995; Jourdane 1995; Calis 2000). The *mauka-makai* extent of these cultural layers has not been clearly defined. These extensive cultural deposits associated with pre-contact and early historic habitation are known to exist in a relatively narrow sand berm that makes up the physiogeography of Kapaʻa.

Marshy areas are *mauka* of Kapaʻa Town, although most of the marshlands have been filled-in within recent decades. Five *kuleana* awarded during the Māhele are located adjacent to the present highway. The more *mauka* studies (Spear 1992; Chaffee et al. 1994a, 1994b; Hammatt, Ida and Chiogioji 1994; McMahon 1996) are thought to be located towards the *mauka* fringe of the sand berm, approaching more marshy conditions and have generally reported no significant or minimal findings. Less than 1.5 km to the south of Waikaʻea Canal is another extensive subsurface cultural deposit that is associated with a pre-contact fishing encampment located at the southern boundary of Waipouli adjacent to Uhalekawaʻa Stream (Waipouli Stream) and the ocean (Hammatt et al. 2000).

3.2 Archaeological Studies on Kapaʻa Settlement Pattern

The first archaeologist to survey Kauaʻi, William Bennett in 1928-1929, listed only one site for the entire *ahupuaʻa*:

> Site 110. Taro terraces and bowl. Back of Kapa homesteads.
>
> In the foothills of the mountains are many little valleys which contain taro terraces. Single rows of stone mark the divisions with some 2-foot terraces. Under a large mango trees was found a bowl [Bennett 1931:72].

Bennett (1931:73) also refers to “taro terraces and house sites” at Kapahi, approximately 5 miles from the shoreline.

Table 4. Previous Archaeological Studies in Kapaʻa

Source	Location	Nature of Study	Findings
Bennett 1931	Island wide	Archaeological Reconnaissance	Identifies two sites: Site 110, taro terraces and bowl; and, Site 111, a large simple dirt Hawaiian ditch
Handy and Handy 1972	Archipelago-wide	Native Planter study	Discusses “highly developed irrigation system”
Ching 1976	Just south of the Waikaʻea Drainage Canal	Archaeological Reconnaissance	No significant findings
Hammatt 1981	Upland Kapaʻa (TMK 4-4-6-013:001)	Archaeological Reconnaissance	No significant findings
Tomonari-Tuggle 1984	Mt. Wekiu - upland Kapaʻa (TMK 4-4-6-001:001)	Archaeological Reconnaissance	
Hammatt 1986	Upper reaches of the Makaleha Stream valley (4-4-6-001:001)	Archaeological Reconnaissance	No significant findings
Kam 1987	Makaleha Stream (4-4-6-001:001)	Field Inspection	
Hammatt 1991	Along Kūhiō Highway	Subsurface Testing	Identifies two sub-surface cultural layer sites
Kikuchi and Remoaldo 1992	Around Kapaʻa Town	Cemeteries of Kauaʻi	Identifies six cemeteries
Spear 1992	South side Waikaʻea Canal, *mauka* of Kūhiō Highway. (TMK: 4-4-5-005, -004, -009)	Monitoring Report	Designated subsurface site 50-30-08-547
Chaffee et al. 1994a	A houselot near the corner of Kukui and Ulu Streets in *mauka* Kapaʻa Town. (TMK:4-4-5-009:010)	Archaeological Inventory Survey	No significant findings
Chaffee et al. 1994b	Māmane Street Kapaʻa Town (TMK:4-4-5-009:051)	Archaeological Inventory Survey	No significant findings
Hammatt, Ida and Chiogioji 1994	Proposed bypass routes *mauka* of Kapaʻa Town	Archaeological Assessment	No new field work, reviews literature
Hammatt, Ida and Folk 1994	South side Waikaʻea Canal, *mauka* of Kūhiō Highway (TMK:4-4-5-005:006)	Archaeological Inventory Survey	Weak cultural layer designated site 50-30-08-748

Source	Location	Nature of Study	Findings
Kawachi 1994	Inia (Jasper)Street (TMK:4-4-5-008:033)	Burial Report	Designates Site 50-30-08-871
McMahon 1994	"behind the armory in Kapaʻa near the godstones." The location is uncertain and "Buzz's near the Coconut Marketplace"	Documents second hand report of burials in two locations	Bones in three areas reported from behind the armory, 16 sets of remains reported from Buzz's restaurant. No site numbers assigned
Pietrusewsky et al. 1994	Kapaʻa Sewer Line	Osteological Study	
Creed et al. 1995	Kapaʻa Sewerline project, Kūhiō Highway, south and central Kapaʻa Town	Archaeological Monitoring Report	Documents cultural layer of site -1848 and (an enlarged) site -1849 and recovery of thirty burials at sites –867, -868, -871, and -1894
Jourdane 1995	1382-A Inia Street, *makai* of Kūhiō Highway, central Kapaʻa Town (TMK:4-5-0-110:008)	Burial Report	Site 626
Hammatt et al. 1997	Kūhiō Highway Bypass, Wailua, Olohena, Waipouli, and Kapaʻa	Archaeological Inventory Survey	Four test trenches were excavated inland of Kapaʻa Town
McMahon 1996	South side Waikaʻea Canal, *mauka* of Kūhiō Highway (TMK:4-4-5-005:008)	Archaeological Inventory Survey	No significant cultural material
Borthwick and Hammatt 1999	Kapaʻa Seventh-Day Adventist Church at 1132 Kūhiō Highway (TMK:4-4-5-003:019)	Archaeological Monitoring and Burial Treatment Plan	Monitoring was indicated as this parcel lay within the designated Site 50-30-08-1848.
Bushnell and Hammatt 2000	Seventh-Day Adventist Church, *makai* of Kūhiō Highway, south of the Waikaʻea Canal (TMK:4-4-5-003:019)	Archaeological Monitoring Report	Minimal findings (one piece of worked bone)
Calis 2000	Kapaʻa Beach Park	Human Burial Removal and Archaeological Monitoring Report	Human Remains
McIntosh and Cleghorn 2000	398-acre parcel in Kapaʻa (TMK:4-4-3-003:005)	Inventory Survey	

Source	Location	Nature of Study	Findings
Perzinski and Hammatt 2001	Kūhiō Highway on the margins of the Waikaʻea Canal	Archaeological Monitoring Report	No significant cultural material
Bushnell et al. 2002	Proposed Kapaʻa-Keālia Bike Path, Kapaʻa and Keālia	Archaeological Inventory Survey	No findings within the vicinity of the current project area
Dega and Powell 2003	Kūhiō Highway from Moloaʻa through Hanamāʻulu	Archaeological Monitoring Report	Four postholes and one hearth were considered part of previously identified site –1848; one cultural layer with one burial was considered part of previously identified site 1849. Six burials were recorded under site # –868, 871, and 872
Elmore and Kennedy 2003	Kūhiō Highway	Archaeological Monitoring Report	No significant cultural material
Hammatt and Shideler 2003	Kūhiō Hwy. from Hanamāʻulu to Kapaʻa	Archaeological Assessment	No historic properties recorded in Kapaʻa Ahupuaʻa
Terry et al. 2004	Waikaʻea Bridge (TMK 4-4-5-005, -006, -007, -009)	Monitoring Report	Five burials within four sites (-672, -673, -674, & -3894)
Van Ryzin and Hammatt 2004	Proposed sites (3) for new water reservoir (TMK 4-4-6-003:010)	Archaeological Assessment	No findings
Mitchell et al. 2005	3.1 acre parcel (TMK 4-4-6-014:026)	Field Inspection and Literature Review	No findings
O'Leary et al. 2006	Proposed soccer park in 11.5 acre parcel (TMK: 4-4-5-015:036)	Archaeological Inventory Survey	No findings

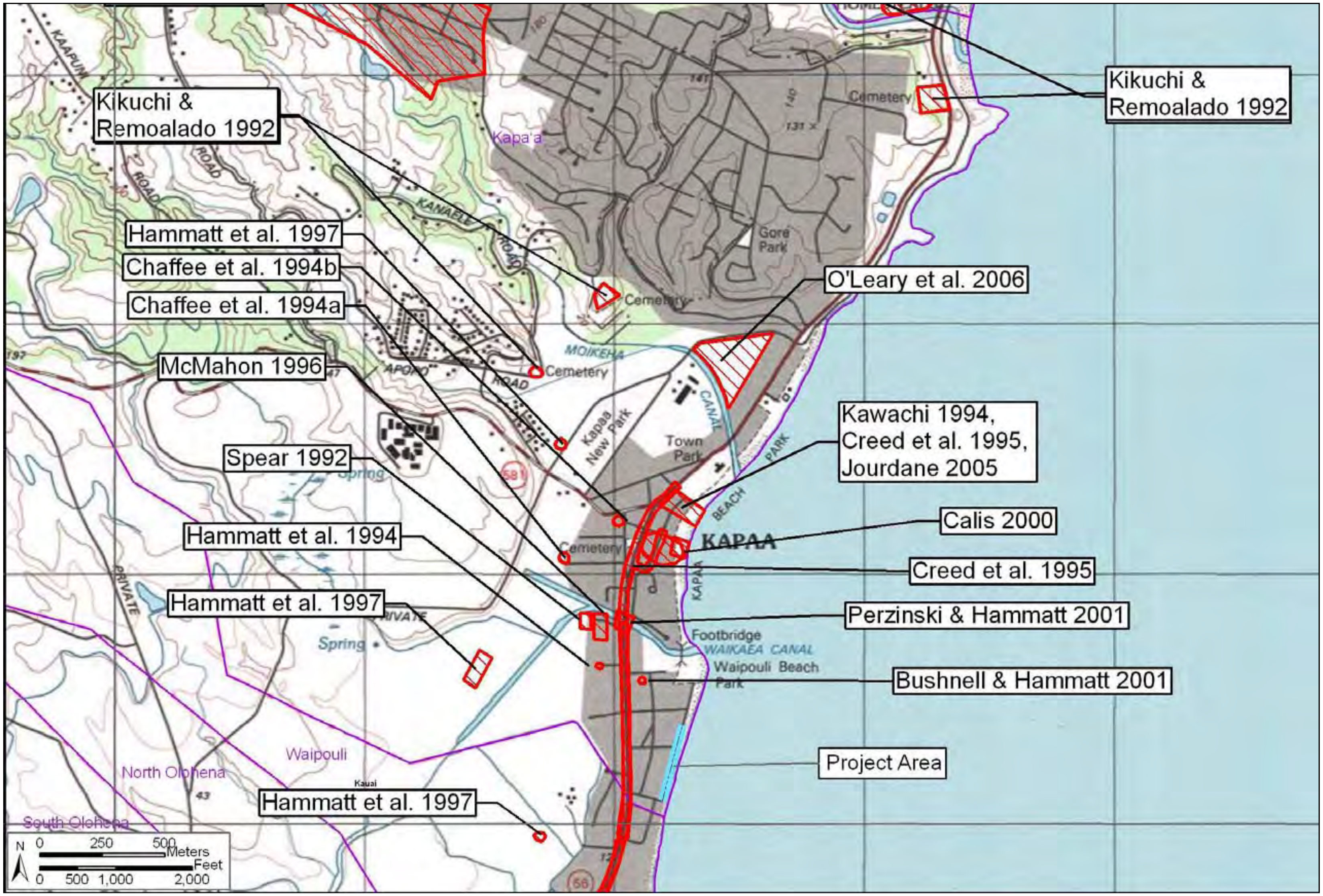


Figure 12. U.S. Geological Survey map, showing location of previous archaeological studies in Kapa‘a

Table 5. Kapa‘a Ahupua‘a Historic Properties that contain burials

Site # 50-30-08-	Site Type/ Name (if any)	Location	Comments	Reference
B001	Historic Cemetery	South of bend of Kapa‘a Stream, a kilometer *mauka* from Kūhiō Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B002	Historic Cemetery	Just *mauka* from Kūhiō Highway, south of Kapa‘a Stream	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B003	Kapa‘a Public Cemetery	South of Kanaele Road, approximately one kilometer inland of Kūhiō Highway	Appears to be a discrete historic cemetery	Kanaele Road; Kikuchi and Remoaldo 1992
B004	Historic Cemetery	North of Apopo Road, approximately one kilometer inland of Kūhiō Highway	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B013	Historic Cemetery	Just *mauka* from Kūhiō Highway, north of the Waika‘ea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992
B014	All Saints Episcopal Church Cemetery	Just *mauka* from Kūhiō Highway, south of the Waika‘ea Canal	Appears to be a discrete historic cemetery	Kikuchi and Remoaldo 1992:62-65
-547	Sub-surface features, including a firepit and a possible house foundation	South of bend of Waika‘ea Canal, *mauka* of Kūhiō Highway	Archaeological monitoring in the vicinity is recommended	Spear 1992:3
-626	Burial	Inia Street, *makai* of Kūhiō Highway, central Kapa‘a	Consultation and monitoring in vicinity indicated	Jourdane 1995
-748	Minimal findings, a weak cultural layer (buried A-horizon)	South of the bend of the Waika‘ea Canal, *mauka* of Kūhiō Highway	Considered no longer significant within project area	Hammatt, Ida and Folk 1994
-867	1 set of human remains	Kukui Street, just *mauka* of Kūhiō Highway, Kapa‘a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50

Site # 50-30-08-	Site Type/ Name (if any)	Location	Comments	Reference
-868	1 set of human remains	Lehua Street *mauka* of Kūhiō Highway, Kapaʻa Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50
-871	13 sets of human remains (Creed et al. 1995:50)	Inia Street, *makai* of Kūhiō Highway	Consultation and monitoring in vicinity indicated	Kawachi 1994, Creed et al. 1995:50
-1848	Cultural layer and sub-surface features;	Along Kūhiō Highway between Wana Road and the Waikaʻea Drainage Canal	Archaeological monitoring in the vicinity is recommended	Hammatt 1991; Creed et al. 1995; Dega and Powell 2003
-1849	Cultural layer and sub-surface features; Creed et al. 1995:53 expands boundaries to incl. burial sites, -626, -867, -868 -871, and -1894	Along Kūhiō Highway between Inia Street and Kauwila Street extending to the coast	Consultation and monitoring in vicinity indicated	Hammatt 1991; Creed et al. 1995; Dega and Powell 2003
-1894	11 sets of human remains	Ulu Street, just N of Kūhiō Highway, Kapaʻa Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50

More recent studies have been conducted in the inland sections of Kapaʻa. Hammatt (1981) did not observe any archaeological sites during his reconnaissance of 52.56 acres of primarily *kula* land in upland Kapaʻa, nor were there any terraces or other sites apparent during a 1986 reconnaissance of the upper reaches of the Makaleha stream valley (Hammatt 1986).

Cultural Surveys Hawaiʻi excavated test trenches and sediment cores for the Kūhiō Highway Bypass project (Hammatt et al. 1997). Three trenches were excavated in the Kapaʻa Marsh area near Waiaʻkea Canal and one was excavated in Kapaʻa just south of the Mōʻīkeha Canal. In the Mōʻīkeha trench, the marsh soil was represented by Stratum II, a highly organic very dark gray clay loam. One soil sample yielded a radiocarbon date of A.D. 1660 to 1950. No burials or artifacts were found associated with this stratum.

Surveys of coastal areas have been more productive. In 1991 during subsurface testing for the proposed Kapaʻa sewer line, Hammatt (1991) obtained radiocarbon dates from a buried habitation deposit along Inia Street, which parallels the beach *makai* of Kūhiō Highway. This cultural deposit was radiocarbon dated to A.D. 1435 to 1665. Archaeological work on the Kapaʻa Sewer line (Creed et al. 1995) encountered 26 burials associated with habitation locations, which ultimately totaled 30 individuals in the sewer line corridor, within the sand deposits underlying Kapaʻa Town and Kūhiō Highway to the south.

Despite urban development, large areas of undisturbed subsurface sediments have been found to be present, presumably within areas adjacent to Kūhiō Highway and are associated with habitation areas (SIHP # 50-30-08-1848, -1849). The *mauka* east and west boundaries of the latter site can now be extended in Kapaʻa Town to include a continuous stretch from ʻŌhia Street eastward to Lehua Street. These sites are expressed as preserved pre-contact A-horizon/cultural layers with artifactual and midden material, charcoal, and soil pits. On ʻInia Street, small deep pits probably represent postholes of pole and thatch dwellings. Five radiocarbon dates ranging from A.D. 1165 to 1950 were recovered. Three dates were from the cultural layer of SIHP –1849, one from a burial pit on Ulu street, and one from a pit feature on the corner of Lehua and Niu Streets. Two of these dates are well within the pre-contact period: one from A.D. 1435 to 1665 and the other A.D. 1165 to 1400. Dega and Powell (2003:56) found additional features associated with previously identified SIHP –1848 and –1849, one was a firepit dated to A.D. 1650-1810. All of these features were found in a segment that extended from Waipouli north to Olohena Street in Kapaʻa, along Kūhiō Highway west or well northwest of the current project area.

The cultural layer, usually identified as Stratum II, was observed intact through long extensions of excavations. Stratum II survives as a buried A-horizon/cultural layer with variable amounts of midden, charcoal, and artifactual material. The lower portion of this stratum generally dates the pre-contact period with mixing of historic materials in the upper portions of the stratum. It represents continuous occupation on a stable beach sand surface from as early as A.D. 1165. Major erosional or depositional events to interrupt this stability were not apparent in the stratigraphic profiles, such as storm surf, tsunami, flood events, etc. In almost all cases, burial pits could be traced to an origin somewhere in the Stratum II cultural layers. However, on ʻInia Street three burials occurred in pits that were sealed by sterile sand underling Stratum II and were probably slightly older. The five LCAs within Kapaʻa Town are all adjacent to the present highway. Perhaps, because of the narrowness of this sandy strip and limited land available for habitation, the human burials and habitation areas (cultural layers) are not separate entities.

Materials from the historic development of Kapaʻa town were observed in the trash pits from various localities in the present commercial district. Bottles and other historic materials were recovered associated with the clearing of debris after the December 22, 1923 Kapaʻa town fire, which affected more than 25 buildings along Kukui, Lehua, Huluili and Niu Streets.

3.3 Previous Archaeological Studies within the Vicinity of the Project Corridor

3.3.1 Bushnell et al. 2002

During the archaeological inventory survey for the Kapaʻa/Keālia Bike and Pedestrian Path, CSH (Bushnell et al. 2002) conducted subsurface testing at the south end of Waikaʻea Canal, approximately 150 m north of the current project area. The area tested is known as the Boat Ramp or "Lihi" Park, although it is identified as "Waipouli Beach Park" on the Kapaa Quadrangle (see Figure 1). The need for testing was based on the previously identified buried cultural layers and associated burials found on either side of Waikaʻea Canal (50-30-08-1848 and -1849) in the vicinity of Kūhiō Highway.

Five trenches (Trenches 9 – 13) were excavated, and the stratigraphic soil sequence was primarily sand. Stratum I in all five trenches was sand or loamy sand and ranged in colors, depending on content, from browns to dark grays. Trenches 10 and 12 contained charcoal, modern trash, and some marine shell midden in Trench 10. The layer did not appear to be an intact pre-contact (or early historic) cultural layer. Modern materials were mixed within these deposits and the charcoal and midden may be related to recent beach use (Bushnell et al. 2002:75).

Stratum II in Trenches 9, 10, 12, and 13 consisted of a sterile beach sand layer. There were intrusive pit features in Trenches 9, 12, and 13 that were a mixture of Stratum I and II and lacked cultural material. Mixed pit features in actively utilized beach sand areas are common and occur with typical beach activities.

Stratum II of Trench 11, the trench closest to Waikaʻea Canal, consisted of dark bluish gray clay that extended below the present water table level. This clay is likely from terrestrial soils deposited in a low energy environment. Waikaʻea Canal is a modern channelized drainage feature. However, Stratum II in Trench 11 indicates a broader estuary, or *muliwai*, for the Waikaʻea drainage prior to channelization (Bushnell et al. 2002:75).

3.3.2 Terry et al. 2004

CSH conducted archaeological monitoring after human remains were encountered during construction activities related to the installation of water main transmission lines adjacent to the Waikaʻea Bridge at Kūhio Highway (Terry et al. 2004). Five partial human burials (SIHP # 50-30-08-672 [single adult], -673 [two juvenile burials, including a cultural layer containing small, yellow beads], -674 [single incomplete adolescent], and -3894 [single adult]) with associated cultural layers were documented. Waikaʻea Bridge is approximately 400 m northwest of the current project area.

3.4 Background Summary and Predictive Model

The association of the *ahupuaʻa* of Kapaʻa with legendary historical figures such as Mōʻīkeha implies that the area was settled prior to Mōʻīkeha's time (early fourteenth century), although the extent of this settlement is not known. Handy (1940) counts Kapaʻa as one of the major settlement areas of Kauaʻi in pre-contact times, and both Vancouver (1798) and Wilkes (1840) were impressed with this "most fertile and pleasant district" with its fields of "sugarcane, taro" and other crops. Through archaeology and other sources, it is known that at one time agricultural and domestic activities extended into the far *mauka* areas of Kapaʻa, but were abandoned by the mid-nineteenth century.

The LCA pattern in Kapaʻa shows taro *loʻi* and *kula* on the rim of the swamplands and extending somewhat into watered valleys. Marshlands without known LCAs may have had *loʻi* along the edges. The six claimants had shoreline house lots *makai* of the swamp. We assume that permanent settlement existed in association with *mauka* agricultural lands in the pre-contact period, but this is not reflected in the LCA testimonies. The *mauka* settlements were probably abandoned before the nineteenth century. Permanent settlement occurred along the coast throughout late pre-contact, as indicated by the presence of extensive and thick habitation deposits in the shore and backshore areas of Kapaʻa, especially along Inia Street and Kūhiō Highway (Hammatt 1991). However, in the early twentieth century, the entire area behind Kapaʻa Town was rice and *kula* lots. When flood control measures were instituted in the 1960s, these marsh lands, used previously for taro and then taken over by the rice farmers, were drained and became cane and pasture.

The current project is situated adjacent to the ocean. Coastal areas were generally used for pre-contact habitation, agriculture and/or for burials. Handy (1940:153) related that the Kapaʻa coastal plain "would be suitable for sweet potato plantings; presumably a great many used to be grown in this section." Additionally, the project corridor is within an area labeled as Mokuleia Fine Sandy Loam (Mr) on soil maps (see Figure 5) in which cultural strata and burials have been previously found in the vicinity of Kūhiō Highway, 120 to 180 m inland from the project corridor.

Background research indicates that in the early 1900s the project corridor and vicinity contained "numerous gulches" (Hawaii Dept. of Survey 1909:14) and/or sand dunes (Fernandez 2009:16). Therefore, the project corridor and vicinity would have been leveled prior to development in the early twentieth century (see Figure 6 through Figure 8).

During the Kapaʻa/Keālia Bike and Pedestrian Path study (Bushnell et al. 2002), subsurface testing was undertaken within Waipouli Beach Park (or Boat Ramp or Lihi Park, as it is locally known), 150 m north of the project corridor. Although there were no findings during the subsurface testing, there is a potential for cultural strata and burials within the project corridor, based on its proximity to the ocean and previous findings in sandy soils.

Section 4 Archaeological Monitoring Provisions

On-site archaeological monitoring is recommended for all ground disturbance conducted below the existing ground surface to facilitate the identification and treatment of any burials that might be discovered during project construction, and to alleviate the project's effect on non-burial archaeological deposits.

Under Hawaiʻi State historic preservation legislation, "Archaeological monitoring may be an identification, mitigation, or post-mitigation contingency measure. Monitoring shall entail the archaeological observation of, and possible intervention with, on-going activities which may adversely affect historic properties" (HAR Chapter 13-279-3). For this project, the proposed monitoring program will serve as a mitigation measure that insures proper documentation should historic properties be encountered during development work.

Hawaiʻi State historic preservation legislation governing archeological monitoring programs requires that each monitoring plan discuss eight specific items (HAR Chapter 13-279-4). The monitoring provisions below address those eight requirements in terms of the archaeological monitoring for the construction within the project area. The ninth requirement provides a research focus to better define the chronological sequence of the area and to provide insight into past lifeways.

1. <u>Anticipated Historic Properties</u>:

   The project area has a potential for pre-contact and post-contact cultural deposits as well as human burials.

2. <u>Locations of Historic Properties</u>:

   Historic properties may be encountered anywhere within the project area.

3. <u>Fieldwork</u>:

   On-site archaeological monitoring is recommended for all ground disturbance activities below the existing ground surface. On-call monitoring consisting of weekly inspections is recommended for all additional ground disturbances. Any departure from this will only follow consultation with, and written concurrence from, SHPD/DLNR.

   The monitoring fieldwork may encompass the documentation of subsurface archaeological deposits (e.g, trash pits and structural remnants) and will employ current standard archaeological recording techniques. This will include drawing and recording the stratigraphy of excavation profiles where cultural features or artifacts are exposed as well as representative profiles. These exposures will be photographed, located on project area maps, and sampled. Photographs and representative profiles of excavations will be taken even if no historically-significant sites are documented. As appropriate, sampling will include the collection of representative artifacts, bulk sediment samples, and/or the on-site screening of measured volumes of feature fill to determine feature contents.

   If human remains are identified, no further work will take place, including no screening of back dirt, no cleaning and/or excavation of the burial area, and no exploratory work of any kind unless specifically requested by the SHPD. All human skeletal remains that are encountered during construction will be handled in compliance with HRS Chapter 6E-7 and 6E-8 and HAR Chapter 13-300 and in consultation with SHPD/DLNR.

4. Archaeologist's Role:

   The on-site archaeologist will have the authority to stop work immediately in the area of any findings so that documentation can proceed and appropriate treatment can be determined. In addition, the archaeologist will have the authority to slow and/or suspend construction activities in order to insure that the necessary archaeological sampling and recording can take place.

5. Coordination Meeting:

   Before work commences on the project, the on-site archaeologist shall hold a coordination meeting to orient the construction crew to the requirements of the archaeological monitoring program. At this meeting the monitor will emphasize his or her authority to temporarily halt construction and that all historic finds, including objects such as bottles, are the property of the landowner and may not be removed from the construction site. At this time it will be made clear that the archaeologist must be on site during subsurface excavations, if warranted.

6. Laboratory work:

   Laboratory analysis of non-burial related finds will include standard artifact and midden recording, as follows: Artifacts will be documented as to provenience, weight, length, width, type of material, and presumed function. Bone and shell midden materials will be sorted down to species, when possible, then tabulated by provenience, and presented in table form.

7. Report Preparation:

   One of the primary objectives of the report will be to present a stratigraphic overview of the project area which will allow for predictive assessments of adjacent properties, which may be the subject of future development. The report will contain a section on stratigraphy, description of archaeological findings, monitoring methods, and results of laboratory analyses. The report will address the requirements of a monitoring report (HAR section 13-279-5). Photographs of excavations will be included in the monitoring report even if no historically-significant sites are documented. Should burial treatment be completed as part of the monitoring effort, a summary of this treatment will be included in the monitoring report. Should burials and/or human remains be identified, then other letters, memos, and/or reports may be requested by the Burial Sites Program.

8. Archiving Materials:

   All burial materials will be addressed as directed by the SHPD/DLNR. Materials not associated with burials will be temporarily stored at the contracted archaeologist's facilities until an appropriate curation facility is selected, in consultation with the landowner and SHPD.

9. Research Questions:

The current project may provide the opportunity to gather settlement information for southeastern Kapaʻa Ahupuaʻa. Research questions that may be answered as a result of monitoring activities related to the sea wall and road repair project include:

a. Is any evidence of the early 1900 clearing of "numerous gulches" (Hawaii Dept. of Survey 1909:14) and/or sand dunes (Fernandez 2009:16) present within the project corridor and vicinity?

b. Has any evidence of the permanent settlement that occurred along the coast throughout late pre-contact, as indicated by the presence of extensive and thick habitation deposits in the shore and backshore areas of Kapaʻa, especially along Inia Street and Kūhiō Highway (Hammatt 1991), been preserved within the project area?

c. What types of activities and land use are reflected in the archaeological record?

Section 5 References Cited

Akina, Joseph

1913 "I Ke hou i Ka Lulu-o-Mōʻīkeha i ka laula o kapaa", *Kuʻokoʻa* May 2-9, 1913. Bishop Museum Archives HEN Place Names, Kauaʻi.

Alexander, William Patterson

1991 "A Tour of Kauaʻi in 1849: Private Journal of William DeWitt Alexander." In *The Kauaʻi Papers*. Kauaʻi Historical Society, A Kauaʻi Historical Society Publication, Līhuʻe, Kauaʻi, Hawaiʻi.

Andrews, Lorrin

1865 *A Dictionary of the Hawaiian Language, to which is Appended an English-Hawaiian Vocabulary and a Chronological Table of Remarkable Events*. Henry M. Whitney, Honolulu.

Beckwith, Martha

1970 *Hawaiian Mythology*. The University Press of Hawaiʻi, Honolulu.

Bennett, Wendell C.

1931 *The Archaeology of Kauaʻi*. Bishop Museum Bulletin 80, Bernice P. Bishop Museum, Honolulu.

Bishop Museum Archives

HEN I: 214 "*Heiau*s of Kealia and Kapaa" and "Well Known Things [or Places]". Bernice P. Bishop Museum, Honolulu.

HEN I: 216 "*Heiau*s from Kapaa to Kealia" and "Things for which Kapaa was Known". Bernice P. Bishop Museum, Honolulu.

Borthwick, Douglas F., and Hallett H. Hammatt

1999 *Archaeological Monitoring and Burial Treatment Plans for the Proposed Improvements to the Kapaʻa Seventh-day Adventist Church, Kapaʻa Ahupuaʻa, Puna District, Kauaʻi Island (TMK 4-5-03: 19)*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Bureau of Land Conveyances

Grant 8248

Bushnell, Kristina, and Hallett H. Hammatt

2000 *An Archaeological Monitoring Report for Improvements to the Kapaʻa Seventh-Day Adventist Church, 1132 Kūhiō Highway, Kapaʻa Ahupuaʻa, District of Puna, Island of Kauaʻi (TMK 4-5-03:19).* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Bushnell, K.W., Melanie Mann, Douglas Borthwick, Tony Bush, Todd Tulchin, David Shideler and Hallett H. Hammatt

2002 *Archaeological Inventory Survey for the Proposed Kapaʻa/Keālia Bike and Pedestrian Path, Kapaʻa and Keālia, Kawaihau District, Kauaʻi Island, Hawaii (TMK 4-5, 4-6-14, 4-7-03 & 04).* Cultural Surveys Hawaiʻi, Inc. Kailua, Hawaiʻi.

Calis, Irene

2000 *End of Field Work Report: Human Burial Removal and Archaeological Monitoring, Kapaʻa Beach Park Public Bathroom Installation, Kapaʻa, Kauaʻi* Scientific Consultant Services, Kāneʻohe, Hawaiʻi.

Chafee, David B., Berdena Burgett, and Robert L. Spear

1994a *An Inventory Survey of a Māmane Street Houselot, Kapaʻa Ahupuaʻa, Kawaihau District, Puna, Island of Kauaʻi (TMK: 4-5-09:51).* Scientific Consultant Services, Kāneʻohe, Hawaiʻi.

1994b *An Inventory Survey of a Kukui Street Houselot, Kapaʻa Ahupuaʻa, Kawaihau District, Puna, Island of Kauaʻi (TMK: 4-5-09:10).* Scientific Consultant Services, Inc., Kāneʻohe, Hawaiʻi.

Ching, Francis K. W.

1976 *Letter Report: Archaeological Reconnaissance - Report, Kapaa "Wastewater Treatment and Disposal System.* Archaeological Research Center Hawaiʻi, Lāwaʻi, Kauaʻi, Hawaiʻi.

Condé, Jesse C. and Gerald M. Best

1973 *Sugar Trains, Narrow Gauge Rails of Hawaii*. Glenwood Publishers, Felton, CA.

Cook, Chris

1999 *Kauaʻi, the Garden Island: A Pictorial History of the Commerce and Work of the People.* Donning Co., Virginia Beach, Virginia.

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson, and John Winieski

1995 A Summary of the Archaeological Monitoring for the Kapaʻa Sewerline Project, Waipouli and Kapaʻa Ahupuaʻa, Puna District, Kauaʻi (TMK: 4-3-09 and 4-5-03 to 11). Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Damon, Ethel M.

1931 *Koamalu.* Privately printed at the Honolulu Star-Bulletin Press, Honolulu, (2 Volumes).

Dega, Michael F., and James Powell

2003 *Archaeological Monitoring During Phase I of the Kauaʻi Rural Fiber Optic Duct Lines Project, Kauaʻi Island, Hawaiʻi.* Scientific Consultant Services, Inc., Kāneʻohe, Hawaiʻi.

Dole, Charles S.

1916 "The Hui Kawaihau" pp.8-15. A Paper read at the November meeting of the Kauaʻi Historical Society on November 16, 1916 in Līhuʻe, Kauaʻi.

Donohugh, Donald

2001 *The Story of Kōloa, A Kauaʻi Plantation Town.* Mutual Publishing, Honolulu.

Elmore, Michelle, and Joseph Kennedy

2003 *An Archaeological Monitoring Report for the Proposed Kūhiō Drainage Improvements Kapaʻa and Anahola (Project # 56AC-01-01) Located in Kawaihau District, Island of Kauaʻi.* Archaeological Consultants Pacific, Inc.

Fernandez, Bill

2009 *Rainbow Over Kapaʻa*. Central Pacific Media Corporation, Honolulu.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lānaʻi.* State of Hawaii. Soil Conservation Service, U.S. Department of Agriculture.

Fornander, Abraham

1917 *Collection of Hawaiian Antiquities and Folklore*, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. IV), Bishop Museum Press, Honolulu.

1918 *Collection of Hawaiian Antiquities and Folklore*, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. V), Bishop Museum Press, Honolulu.

The Garden Island

1955 "Geologists Says Kapaa Coral Removal No Threat to Town." *The Garden Island*, September 21, 1955.

1963 "Kapaa Blames Federal Role As Erosion Continues. Says Barrier on Reef is Required." *The Garden Island*, October 30, 1963.

1983 "Centennial Year, Kapaʻa School Wants Pix of its 100 Years." *The Garden Island*, April 1, 1983.

Hammatt, Hallett H.

1981 *Archaeological Reconnaissance of 52.56 Acres for a Proposed Subdivision, TMK: 4-8(?)-13-1, Kapaʻa, Puna, Kauaʻi Island.* Archaeological Research Consultants of Hawaiʻi, Honolulu.

1986 *Archaeological Reconnaissance of the Makaleha Springs Water Source Development, Kapaʻa, Kauaʻi TMK: 4-6-01:1.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

1991 *Archaeological Subsurface Testing for the Proposed Kapa'a Sewerline, Wailua, Olohena, Waipouli and Kapaʻa, Kauaʻi.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., and David W. Shideler

2003 *Archaeological Assessment for the Kūhiō Highway Improvements, Kapaʻa to Hanamaʻulu (Kapaʻa Relief Route) Project within the Ahupuaʻa of Kapaʻa, Waipouli, North Olohena, South Olohena, Wailua, and Hanamaʻulu, Island of Kauaʻi.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., Rodney Chiogioji, Gerald K. Ida, and Victoria S. Creed

1997 *An Archaeological Inventory Survey for the Kūhiō Highway Widening and Bypass Options within the Ahupuaʻa of Wailua, South Olohena, North Olohena, Waipouli and Kapaʻa, Island of Kauaʻi*, with Appendix on Palynology by Jerome Ward, Ph.D. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., Gerald K. Ida and William H. Folk

1994 *Archaeological Inventory of a 1.87-Acre Parcel, Kapaʻa, Kauaʻi (TMK 4-5-05:6). Rev. August 1994.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., Gerald K. Ida, and Rodney Chiogioji

1994 *Archaeological Document Review and Assessment of Three Alternative Widening and Bypass Options for the Kūhiō Highway Within the Ahupuaʻa of Hanamāʻulu, Wailua, South Olohena, North Olohena, Waipouli & Kapaʻa, Līhuʻe and Kawaihau Districts, Island of Kauaʻi,* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., David W. Shideler, John Winieski, and David Perzinski

2000 *Archaeological Data Recovery for a 12-Acre Parcel (The Golding Property) at Waipouli, Puna, Kauaʻi (TMK 4-3-08:1) Volume I.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Handy, E. S. Craighill

1940 *The Hawaiian Planter*, Volume 1. Bishop Museum, Bulletin No. 161.Bernice P. Bishop Museum, Honolulu.

Handy, E.S. Craighill and Elizabeth G. Handy

1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment.* Bishop Museum Bulletin 233, Bernice P. Bishop Museum, Honolulu.

Hawaii Dept. of Survey

1909 *Report of the Surveyor to the Governor of the Territory of Hawaii for the Two Years Ending December 31, 1908*. Hawaiian Gazette Co., Honolulu.

Hawaii State Archives

1837 Interior Department, Land, Incoming Letter. August 1837.

Hawaiian Territorial Planning Board

1940 *Master Plan of the Town of Kapaa.* In collaboration with the Kauaʻi County Board of Supervisors, Publication No. 8. Advertiser Publishing Co., Honolulu.

Honolulu Advertiser

1960 "Kauaʻi Tries to See into Future." *Honolulu Advertiser*, March 20, 1960.

Joesting, Edward

1984 *Kauaʻi, The Separate Kingdom.* University of Hawaiʻi Press and Kauaʻi Museum Association, Ltd., Honolulu.

Jourdane, Elaine

1995 *Inadvertent Discovery of Human Remains at 1382-A Inia Street, Kapaʻa, Kauaʻi (Kapaʻa Sewerline Project Laterals) Site 626.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Juvik, Sonia P., and James O. Juvik

1998 *Rainfall Atlas of Hawaiʻi, Third Edition*. Sonia P. Juvik and James O. Juvik, Editors, Chief Cartographer, Thomas R. Paradise University of Hawaii Press, Honolulu.

Kalākaua, David

1888 *The Legends and Myths of Hawaii*. Charles L. Webster (Reprint of three volumes published in 1877-85), New York.

Kam, Wendell

1987 *Field Inspection Report: Makaleha Stream Well Project, DLNR, Division of Water and Land Development (DOWALD), Kealia Forest Reserve, Kawaihau, Kauaʻi, TMK:4-4-6-001:001*. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Kamakau, Samuel Manaiakalani

1976 *The Works of the People of Old, Na Hana a ka Po'e Kahiko*. Bishop Museum Special Publication, No. 61, Bernice P. Bishop Museum, Honolulu.

Kanahele, George S.

1995 *Waikiki 100 B.C. to 1900 A.D. An Untold Story*. The Queen Emma Foundation, Honolulu.

Kapaʻa Elementary School

1933 *Kapaa Elementary School, Kula O Kapaʻa, 1883-1933*. Published by the school on its fiftieth anniversary, Kapaʻa, Kauaʻi.

1982 *Kapaʻa School 1883-1983: A "Century of Knowledge."* Kapaʻa Elementary, Kapaʻa, Kauaʻi.

Kawachi, Carol T.

1994 *Inadvertent Burial at 1316 Inia Street (Jasper) TMK 4-5-08:33, Kapaʻa, Kawaihau, Kauaʻi 50-30-08-871*. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Kikuchi, William K. and Susan Remoaldo

1992 *Cemeteries of Kauaʻi*, Vol. 1. Kauaʻi Community College and University of Hawaiʻi, Puhi, Kauaʻi.

King, Robert D.

1935 "Districts in the Hawaiian Islands." In Coulter, John Wesley (compiler) *A Gazetteer of the Territory of Hawaii*. University of Hawaii Research Publications, No. 11, University of Hawaiʻi, Honolulu.

Lai, Violet L. assisted by Kum Pui Lai

1985 *He Was a Ram, Wong Aloiau of Hawaii*. Published for the Hawaii Chinese History Center and the Wong Aloiau Association by University Press of Hawaiʻi, Honolulu.

McGuire, Kaʻohulani and Hallett H. Hammatt

2000 *A Traditional Practices Assessment for the Proposed Nānākuli IV Elementary School Site, Nānākuli, Waiʻanae District, Island of Oʻahu (TMK: 8-9-02: 65,23, por 1*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

McIntosh, James, and Cleghorn, Paul L.

2000 *Archaeological Inventory Survey at a 398 Acre Parcel in Kapaʻa, Kawaihau District, Island of Kauaʻi.* Pacific Legacy, Inc., Kailua, Hawaiʻi.

McMahon, Nancy A.

1994 *Inadvertent Burial Find, Kapaʻa, Kawaihau, Kauaʻi.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

McMahon, Nancy A.

1996 *Archaeological Inventory Survey for 5 Unit Apartment, TMK: 4-5-05:8, Kapaʻa, Kawaihau, Kauaʻi.* Exploration Associates, Ltd., Koloa, Kauaʻi, Hawaiʻi.

Mitchell, Auliʻi, Todd Tulchin, and Hallett H. Hammatt

2005 *Archaeological Literature Review, Field Inspection, and Cultural Impact Evaluation of a 3.1 acre area, Kapaʻa Ahupuaʻa, Kawaihau District, Kauaʻi Island, TMK 4-4-6-014:026.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Nakuina, Moses K.

1990 *The Wind Gourd of Laʻamaomao.* Translated by Esther T. Mookini, and Sarah Nakoa. Kalamaku Press, Honolulu.

Office of the Commissioner of Public Lands

1929 Indices of Awards, Made by the Board of Commissioners to Quiet Land Title in the Hawaiian Islands.

O'Leary, Owen L, Constance R. O'Hare, and Hallett H. Hammatt

2006 *Archaeological Inventory Survey for an Approximately 11.5 Acre Parcel Proposed as a Soccer Park at Kapaʻa Ahupuaʻa, Kawaihau District (Puna Moku), Island of Kauaʻi, TMK: 4-4-5-015:036*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Perzinski, Mary and Hallett H. Hammatt

2001 *A Summary of Archaeological Monitoring for the Kūhiō Highway, Waikaea Bridge Widening Project Kapaʻa Ahupuaʻa, Kawaihau District, Kauaʻi Island (TMK: 4-3-06 to 4-3-08).* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Pietrusewsky, Michael, Rona Ikehara-Quebral, Michele T. Douglas

1994 *Human Skeletal Remains from the Kapaʻa Sewer Line Project, Wailua, Olohena, Waipouli and Kapaʻa, Kauai*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Pukui, Mary Kawena

1983 ʻ*Ōlelo No'eau: Hawaiian Proverbs and Poetical Sayings*. Bishop Museum Special Publication No. 71, Bernice P. Bishop Museum Press, Honolulu.

Pukui, Mary Kawena, and Samuel H. Elbert

1986 *Hawaiian Dictionary*. 2nd Edition, University of Hawaii Press, Honolulu.

Pukui, Mary K., Samuel H. Elbert, and Esther Mookini

1974 *Place Names of Hawaiʻi.* University of Hawaiʻi Press, Honolulu.

Rice, William Hyde

1974 *Hawaiian Legends.* Bernice P. Bishop Museum Bulletin 3, Honolulu. Originally published 1923, Kraus Reprint, Millwood, New York.

Sanborn Map Company

1929 Kapaa, Sheet 1. Sanborn Map Company, Pelham, New York.

1945 Kapaa, Sheet 1. Sanborn Map Company, Pelham, New York.

Soehren, Lloyd J.

2002 *A Catalog of Kaua‘i Place Names, Including Ni‘ihau, Lehua and Ka‘ula, Compiled from the Records of the Boundary Commission and The Board of Commissioners to Quiet Land Titles of the Kingdom of Hawaii.* Collected and Annotated by Lloyd J. Soehren, Honoka‘a, Kaua‘i, Hawai‘i.

Spear, Robert L.

1992 *Letter Report Concerning Monitoring for the Cost-U-Less Project Kapa‘a, Kaua‘i, Hawai‘i (TMK: 4-5-5:4 and 9).* Scientific Consultant Services, Inc., Kāne‘ohe, Hawai‘i.

Terry, Daniel, Melanie Mann, and Hallett H. Hammatt

2004 *Archaeological Monitoring Report for the Installation of 16-inch Waters, Waika‘ea Bridge, Kūhiō Highway, Kapa‘a Ahupua‘a, Kawaihau District, Kaua‘i Island, 4-4-5-005, -006, -007, -009.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Thrum, Thomas G. (compiler)

1923 *More Hawaiian Folk Tales.* A.C. McClurg and Co., Chicago.

Tomonari-Tuggle, Myra J.

1984 *An Archaeological Reconnaissance Survey: Mt. Wekiu, Kaua‘i, TMK 4-2-01:2.* Ms of file at Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai‘i.

Ulukau

2005 Māhele Database. Ulukau, The Hawaiian Electronic Library, http://ulukau.org/cgi-bin/vicki?l=en.

U.S. Geological Survey Maps/ U.S. Department of War Maps. Available at USGS Information Services, Box 25286, Denver, Colorado

1910 U.S. Geological Survey, 7.5 minute topographic map, Kapa‘a Quadrangle.

1963 U.S. Geological Survey, 7.5 minute topographic map, Kapa‘a Quadrangle.

1996 U.S. Geological Survey, 7.5 minute topographic map, Kapa‘a Quadrangle.

2005 U.S. Geological Service, Orthoimagery, Kapa‘a Quad (Aerial photograph)

Van Ryzin, Karl, and Hallett H. Hammatt

2004 *An Archaeological Assessment for the Proposed Water Reservoir, Kapa‘a Ahupua‘a, Kaua‘i, 4-4-6-003:010.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Vancouver, George

l798 *A Voyage of Discovery to the North Pacific Ocean...performed in the years 1790, 1791, 1792, 1793, 1794, and 1795, in the Discovery ... and ... Chatham ...* Amsterdam, N. Israel. Vols. 1-3. London.

Wall, Walter E.

1914 Kapaa Section, Hawaii Territory Survey. Traced from Govt. Survey Map by Jos. Iao, Nov. 1914. Plat 3014, available online at the State of Hawai‘i Department of Accounting and General Services, http://dags.hawaii.gov/survey/search.php.

Wichman, Frederick B.

1998 *Kauaʻi Ancient Place Names and Their Stories.* University of Hawaiʻi Press, Honolulu.

Wilkes, Charles

1844 *Narrative of the U.S. Exploring Expedition During the Years 1838, 1839, 1840, 1841, 1842*.... C. Sherman, Philadelphia.

Appendix E

Repair/Reconstruction of Moanakai Seawall:
Cultural Impact Assessment for the Moanakai Seawall Repair Project

Cultural Surveys of Hawai‘i, July 2010

Cultural Impact Assessment for the Moanakai Seawall Repair Project, Kapa‘a Ahupua‘a, Kawaihau District, Kaua‘i Island TMK: [4] 4-5-002:023 (por.)

Prepared for

R M. Towill Corporation

Prepared by

Angela Fa‘anunu, M.S.P.H.

and

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.

Kailua, Hawai‘i

(Job Code: KAPAA 8)

July 2010

O‘ahu Office
P.O. Box 1114
Kailua, Hawai‘i 96734
Ph.: (808) 262-9972
Fax: (808) 262-4950

www.culturalsurveys.com

Maui Office
1993 Main St.
Wailuku, Hawai‘i 96793
Ph: (808) 242-9882
Fax: (808) 244-1994

Prefatory Remarks on Language and Style

A Note about Hawaiian and other non-English Words:

Cultural Surveys Hawaiʻi (CSH) recognizes that the Hawaiian language is an official language of the State of Hawaiʻi, it is important to daily life, and using it is essential to conveying a sense of place and identity. In consideration of a broad range of readers, CSH follows the conventional use of italics to identify and highlight all non-English (i.e., Hawaiian and foreign language) words in this report unless citing from a previous document that does not italicize them. CSH parenthetically translates or defines in the text the non-English words at first mention, and the commonly-used non-English words and their translations are also listed in the *Glossary* (Appendix A) for reference. However, translations of Hawaiian and other non-English words for plants and animals mentioned by community participants are referenced separately (see explanation below).

A Note about Plant and Animal Names:

When community participants mention specific plants and animals by Hawaiian, other non-English, or common names, CSH provides their possible scientific names (Genus and species) in the *Common and Scientific Names of Plants and Animals Mentioned by Community Participants* (Appendix B). CSH derives these possible names from authoritative sources, but since the community participants only name the organisms and do not taxonomically identify them, CSH cannot positively ascertain their scientific identifications. CSH does not attempt in this report to verify the possible scientific names of plants and animals in previously published documents; however, citations of previously published works that include both common and scientific names of plants and animals appear as in the original texts

Abbreviations

APE	Area of Potential Effect
CIA	Cultural Impact Assessment
CSH	Cultural Surveys Hawaiʻi
DOH/OEQC	Department of Health/Office of Environmental Quality Control
HAR	Hawaiʻi Administrative Rules
HRS	Hawaiʻi Revised Statutes
KNIBC	Kauaʻi/Niʻihau Burial Council
LCA	Land Commission Award
Mr	Mokuleia Fine Sandy Loam
OHA	Office of Hawaiian Affairs
SIHP	State Inventory of Historic Properties
SHPD	State Historic Preservation Division
TCP	Traditional Cultural Property
TMK	Tax Map Key
UH	University of Hawaiʻi
USGS	United States Geological Survey

Management Summary

Reference	Cultural Impact Assessment for the Moanakai Seawall Repair Project, Kawaihau District, Kapaʻa Ahupuaʻa, Kauaʻi Island, TMK: [4] 4-5-002:023 (Faʻanunu and Hammatt 2010).
Date	July 2010
Project Number	Cultural Surveys Hawaiʻi (CSH) Job Code: KAPAA 8
Project Location	The proposed Project area encompasses portions of TMK: [4] 4-5-002:023 and portions of an adjacent parcel immediately south with an undefined parcel number. The Project area is located *makai* (inland) of Moanakai Road between Panihi Street and Keaka Street in the Kapaʻa Ahupuaʻa. The Project area is depicted in Figure 1 to 3.
Land Jurisdiction	County of Kauaʻi
Agencies	State of Hawaiʻi Department of Health/Office of Environmental Quality Control (DOH/OEQC)
Project Description	The proposed Project involves the repair and/or reconstruction of the existing Moanakai Road Seawall which runs parallel to Moanakai Road between Panihi Street and Keaka Street. The seawall is approximately 1080 feet long which abuts sand and ocean immediately to the east, and the shoulder of Moanakai Road to the west. Portions of the seawall have been damaged over time, therefore, construction activities for the proposed Project will involve the excavation of soil and sand in order to place and secure the seawall and footings. If required, it is possible that the entire seawall may need to be replaced based on the completion of a coastal engineering study. Construction activities associated with the seawall may also affect Moanakai Road and its infrastructure as the road shoulder is located immediately adjacent to the seawall in certain areas. The proposed Project may also involve the repair of sink holes along Moanakai Road that have resulted from heavy rains and high surf incidents. The proposed Project is intended to secure the seawall, and improve Moanakai Road to protect public health and ensure safety of the area from an otherwise faulty seawall.
Project Acreage	1,080 feet (329.2 meters)
Area of Potential Effect (APE)	According to the County of Kauaʻi, Department of Public Works, the height of the new Moanakai Sea Wall is estimated as 11 feet (3.35 meters) above sea level and four feet (1.22 meters) below sea level. Ground disturbance associated with Moanakai Road repairs will likely affect less than two feet (0.61 meters) below surface. The Project's APE is defined as the entire Project area within the larger context of Kapaʻa Ahupuaʻa. The APE also includes the Project area's relationship with the rest of the *moku* (district, island, islet, section) of Kawaihau, the island of Kauaʻi, and other islands, as these relate to

	Hawaiian beliefs, resources, and practices.
Document Purpose	This CIA was prepared to comply with the State of Hawaiʻi's environmental review process under Hawaiʻi Revised Statutes (HRS) Chapter 343, which requires consideration of the proposed Project's potential effect on cultural beliefs, practices, and resources. Through document research and cultural consultation efforts, this report provides information, compiled to date, pertinent to the assessment of the proposed Project's potential impacts to cultural beliefs, practices, and resources (per the *Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCPs) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places. The document is intended to support the Project's environmental review and may also serve to support the Project's historic preservation review under HRS Chapter 6E-8 and Hawaiʻi Administrative Rules Chapter 13-275.
Community Consultation	Hawaiian organizations, agencies, and community members were contacted in order to identify individuals with cultural expertise and/or knowledge of the Project area and its vicinity. The organizations consulted included the State Historic Preservation Division (SHPD), the Office of Hawaiian Affairs (OHA), and the Kauaʻi-Niʻihau Island Burial Council (KNIBC). Kauaʻi community and cultural organizations consulted included the Queen Deborah Kapule Hawaiian Civic Club, Hui Hoʻokipa o Kauaʻi, Kauaʻi Health Heritage Coastal Corridor, and Mālama Kauaʻi. This effort was made by letter, e-mail, telephone, and in person contact. Initial contact letters with maps of the Project area were mailed to most informants.
Results of Background Research	Background research conducted for this Project yielded the following results: 1. The *ahupuaʻa* (land division) of Kapaʻa is situated in the ancient *moku* (district) of Puna, the second largest district on Kauaʻi, extending from Kīpū, south of Līhuʻe, to Kamalomaloʻo, just north of Keālia. Puna Moku is now considered to be part of Kawaihau District. 2. Kapaʻa, literally "the solid" or the "closing," is associated with *moʻolelo* (stories, oral histories) about Kawelo, Pākaʻa, and the legendary *aliʻi* (chief), Mōʻīkeha. 3. In the 1880s, 14 *heiau* (traditional places of worship, shrines) were named by Lahainaluna students in Kapaʻa and Keālia Ahupuaʻa. Numerous lines of historical and archaeological evidence suggests Kapaʻa has been an important *ahupuaʻa* and area of settlement for many centuries.

	4. During the Māhele, Kapaʻa was retained as Crown Lands. The *ʻili* (land section, usually a subdivision of an *ahupuaʻa*) of Paikahawai and Ulukiu in Kapaʻa Ahupuaʻa were retained as Government Lands. Land Commission Awards show that six *makaʻāinana* were awarded land parcels in Kapaʻa. 5. During the late 19th and early 20th century, Kapaʻa experienced the plantation era with the commercial cultivation of sugarcane, rice, and pineapple. Freight shipping and a railroad system also developed to cater to commercial activities of the plantations. 6. In the 1920s, land immediately *mauka* (inland) of the Project area was first developed for residential homes. Floods in 1940 led to the dredging and construction of the Waikaʻea and Mōʻīkeha Canals. Subsequent dredging of the reefs and shoreline north of the Project area may be responsible for accelerated erosion along the coast in the area. 7. Many archeological sites, including burials, have been identified near Waikaʻea Canal and within Kapaʻa Town in previous archaeology studies; it is therefore possible that the Project area may have an impact on burials and cultural practices associated with caring for burials.
Results of Community Consultation	CSH attempted to contact 19 community members (government agency or community organization representatives, or individuals such as residents, cultural and lineal descendants, and cultural practitioners) for the purposes of this CIA. Nine people responded of which four *kūpuna* (elders) and/or *kamaʻāina* (Native-born) were interviewed for more in-depth contributions to the CIA and one person commented on the Project. Community consultation research conducted yielded the following results: 1. According to Mr. Kaneakua, the general area of the Project area is called Waipouli or "dark water" which was a swampy area prior to recent development. Homes adjacent to and *mauka* of the Project area are now occupied mostly by non-Hawaiian immigrants. 2. The ocean area immediately adjacent to the northern end of the Project area is known as Baby Beach or Fuji Beach which Mr. Nunes fears might be contaminated by underwater cesspools from residential homes near the Project area. 3. All participants agreed that the reef adjacent to the Project area has changed with less fish and seaweed over time. Fish like *kūmū* (white saddle goatfish), *ʻāweoweo* (bigeye), *kala* (unicorn fish), *manini* (convict tang), *uhu* (parrotfish), *weke ula* (red

goatfish), *menpachi*, and *tako* (squid or octopus) were reported by all participants to have been once abundant. *Limu kohu* (seaweed) and *limu kala* (seaweed that *kala* fish feed on) were also reported by Mr. Kaneakua and Mr. Nunes to have been abundant. (see Appendix B for common and scientific plant and animal names).

4. All participants attributed the depletion of ocean resources near the Project area to the following factors: predators like the Hawaiian monk seal, sharks, and turtles; windsurfing activities; and the introduction of invasive species like *taʻape* (bluestripe snapper) and *roi* (peacock grouper) (Appendix B). Participants expressed the following opinions:
   - i. Mr. Kaneakua claimed that the fish and seaweed have become less abundant because of the Hawaiian monk seal, sharks, and turtles.
   - ii. Mr. Nunes believed that windsurfing, a sport that has become a predominant activity near the Project area, negatively impacts the feeding cycle of fish and that the shadow of the windsurfing kites scare the fish and prevent them from their normal feeding habits.
   - iii. Mr. Ako attributed resource depletion to the Hawaiian monk seal, as well as the introduction of invasive species like the *taʻape* and *roi*.
5. Mr. Ako reported that *akule* (big-eyed scad) once frequented the Wailua River, south of the Project area, but the schools are not as common today. He explained that the ways of fishing have also changed and that people today are more selfish because of the value of money placed on fish. He also explained that people nowadays are lazy—that they would rather buy *kūhonu* (an edible spotted-back crab) from the supermarket than fish for the crab themselves (see Appendix B).
6. Mr. Kaneakua claimed that native plants for *lāʻau lapaʻau* (traditional plant medicine) are more difficult to find in Kapaʻa today. Plants used for *lāʻau lapaʻau* included *pōpolo* (glossy nightshade), *ʻuhaloa* (American weed), *kukui* (candlenut), *ʻōlena* (tumeric), and plantain (see Appendix B for common and scientific plant and animal names mentioned by community participants). The plants are used for ailments like colds, congestion, cold sores, sore throat, ear aches, and ulcers. He believes invasive plants like guinea grass, as well as the use of pesticides during plantation times, have killed many of the

	useful plants. 7. According to Mr. Kaneakua, Kapaʻa was known mostly for sugarcane and pineapple and these crops were cultivated throughout the *ahupuaʻa*. Rice was also cultivated by the Chinese but in the lowlands towards Wailua, to a lesser extent. The plantations brought many cultures to Kapaʻa such as Chinese, Filipino, Portuguese, and Native Hawaiian. 8. Mr. Ako explained that taro in Kapaʻa is planted in the *kuahiwi* or the top land section at higher elevations with more water while potatoes and other vegetables are planted in the drier *kula* (pasture, plain, field) areas, half-way between the ocean and the top of the mountain. The Project area would be within the *kahakai* (beach or seashore) near the ocean. Taro was grown at a smaller scale due to water limitations. Though Kapaʻa was swampy, Mr. Kaneakua stated that the its stagnant waters were not favorable for *loʻi* (irrigated terrace especially of taro) which needs running water. Taro is currently predominantly grown in the northern part of the island where the climate is wetter, such as Hanalei (see Appendix B for common and scientific plant and animal names mentioned by community participants). 9. The varieties of taro planted in Kapaʻa include the following: *moi*, *ʻowāhi o pele*, *maui lehua*, *ulukanu*, *aiʻehē*, and *kāī*. Mr. Ako reported that *maui lehua* is the most common because it matures faster than the other varieties. Today, Native Hawaiians like Mr. Ako still practice the traditional art of making *poi* (pounded cooked taro thinned with water) and *kūlolo* (pudding made of grated taro and coconut cream). He also recalled his mother's sweet potato *poi*, also known as *koʻele palau* which she made on special occasions. The *koʻele palau* was made from the *huamoa* (a variety of sweet potato), or orange sweet potato (see Appendix B for common and scientific plant and animal names mentioned by community participants). 10. A pineapple cannery was located in the Kapaʻa in the location of the present Pono Kai Hotel. The cannery provided livelihood and jobs for many Kapaʻa residents and school children. 11. Mr. Nunes and Mr. Kaneakua both claimed that a railroad track, built to cater to the sugarcane plantations, ran behind the Project area. 12. Mr. Nunes reported that the reef north of the Project area was dredged during plantation times to provide the plantations with

	aggregate for building roads. He believes that the erosion experienced in the area is a by-product of that activity. 13. The area in the immediate vicinity of the Project area, including Safeway all the way to Wailua, is known as the battleground. Residents associated the battleground with King Kamehameha I during his plight to conquer Kauaʻi. 14. One participant made reference to the presence of a *heiau* in Kapaʻa. Mr. Nunes believed that there was a *heiau* at Poliahu. 15. All interviewees discovered *iwi* (bones) within or near the Project area, thus indicated that there is a likelihood of finding *iwi* in the sand of the Project area. Regarding burials, each participant expressed the following: i. Mr. Kaneakua remembered as a child seeing bones sticking out of the sand at the location of the Project area. ii. Mr. Nunes expressed that Kapaʻa has many burials and personally discovered human remains in the area. He stated that burials may be found at the Project area as burials have been found in the surrounding vicinity. iii. Mr. Ako indicated that he would not be surprised if bones are found within the Project area and emphasized that Hawaiian burials were carried out in sand because Hawaiians used *ʻōʻō* (digging stick or implement) for digging graves, thus preferred sand because it was easier. 18. Mr. Ako found 87 bodies on the Coco Palms Resort property in Wailua, located directly south of the Project area. To identify these graves, three or four *ʻōhiʻa* (tree) logs were placed on the top of the skull. He described the bones as belonging to a people who were not ordinary Hawaiians—big people with large skulls and bones. Mr. Ako also stated that the bones have settled to the water level, thus, archaeologists may not find anything if excavating only a few feet from the surface. 19. Mr. Ako also found a conch shell on the Coco Palms Resort property which he believed to have been used as a signal—alerting fishermen and women of the arrival of the *akule* in Wailua.
Impacts and Recommendations	The following cultural impacts and recommendations are based on a synthesis of all information gathered during preparation of the CIA. The most significant cultural impact is the possibility of encountering *iwi kūpuna* (human skeletal remains) during subsurface ground disturbance. To help mitigate the potential adverse impacts of the

	proposed Project on Hawaiian cultural beliefs, practices, and resources, CSH recommendations the following measures. 1. In light of the sandy soil composition of the Project area, the discovery of burials near Waika‘ea Canal in previous archaeology studies, and the discovery of *iwi* by interview participants within and near the Project area, it is possible that the Project may have an impact on burials and cultural practices associated with caring for burials. CSH recommends archaeological monitoring, as well as cultural monitoring, during all phases of development. i. Personnel involved in development activities in the Project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law. 2. CSH recommends that alternatives to the proposed Project should be considered if significant cultural resources, including human skeletal remains and/or burial sites, are encountered. 3. CSH recommends consultation with community participants in this CIA; consultation should continue throughout all phases of the proposed Project. 4. CSH recommends that OHA’s concern regarding project-related contamination of the nearby marine resource system should be considered since these resources are considered culturally valuable to Native Hawaiians. CSH recommends mitigation measures should be in place prior to and during the construction phase to ensure that contaminates do not filter into the ocean.

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

Cultural Surveys Hawaiʻi, Inc. (CSH) conducted this Cultural Impact Assessment (CIA) at the request of R. M. Towill Corporation, for the repair and/or replacement of the Moanakai Seawall on portions of TMK [4] 4-5-002:023 and of an adjacent undefined TMK parcel immediately south. Portions of the seawall have been damaged over time, therefore, construction activities for the proposed Project will involve the excavation of soil and sand in order to place and secure the seawall and footings. A coastal engineering study is currently being conducted to assess whether the entire seawall must be replaced. Construction activities associated with the seawall may affect Moanakai Road and its infrastructure as the Moanakai Road shoulder is located immediately adjacent to the seawall in certain areas. The proposed Project may also include the repair of sink holes along Moanakai Road that have resulted from heavy rains and high surf incidents. The proposed Project is intended to secure the seawall, and improve Moanakai Road to protect public health and ensure safety of the area from an otherwise faulty seawall.

The proposed Project area extends approximately 1080 feet along the *makai* side of Moanakai Road from Keaka Street in the south towards Panihi Street in the north. The Project area is located within the Kapaʻa Ahupuaʻa in the Kawaihau District, on the island of Kauaʻi. The general location of the Project area is depicted in Figure 1, Figure 2 and Figure 3.

The extent of sub-surface construction is dependent on the extent of repair work required for the seawall. Complete replacement of the seawall would call for sub-surface construction for the entirety of the approximately 1080-foot corridor while work to repair only damaged portions of the seawall would be less. Ground disturbance may also be expected along Moanakai Road during repairs of existing sink holes.

The Project's area of potential effects (APE) is defined as the entire Project area within the larger context of Kapaʻa Ahupuaʻa. The APE also includes the Project area's relationship with the rest of the *moku* of Kawaihau, the island of Kauaʻi, and other islands, as these relate to Hawaiian beliefs (e.g., *moʻolelo*, or oral-historical accounts, and *wahi pana*, or storied places), resources and practices.

1.2 Document Purpose

This CIA was prepared to comply with the State of Hawaiʻi's environmental review process under Hawaiʻi Revised Statutes (HRS) Chapter 343, which requires consideration of the proposed Project's potential effect on cultural beliefs, practices, and resources. Through document research and cultural consultation efforts, this report provides information, compiled to date, pertinent to the assessment of the proposed Project's potential impacts to cultural beliefs, practices, and resources (per the *Office of Environmental Quality Control's Guidelines for Assessing Cultural Impacts*) which may include Traditional Cultural Properties (TCPs) of ongoing cultural significance that may be eligible for inclusion on the State Register of Historic Places. The Hawaiʻi State Historic Preservation Statute (Chapter 6E) guidelines for significance criteria (HAR §13-275-6) under Criterion E defines a significant historic property as one that has:

> 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.

The document is intended to support the Project's environmental review and may also serve to support the Project's historic preservation review under HRS Chapter 6E-8 and Hawaiʻi Administrative Rules Chapter 13-275.

1.3 Scope of Work

The scope of work for this CIA includes:

1. Examination of cultural and historical resources, including Land Commission documents, historic maps, and previous research reports, with the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources as may be indicated in the historic record.
2. A review of previous archaeological work at and near the subject parcel that may be relevant to reconstructions of traditional land use activities; and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Consultation and interviews with knowledgeable parties regarding traditional cultural practices at or near the parcel; present uses of the parcel; and/or other (non-Hawaiian) practices, uses, or traditions associated with the parcel.
4. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

1.4.1 Natural Environment

Kapaʻa Ahupuaʻa is located on the eastern side of Kauaʻi between Keālia Ahupuaʻa in the north and Waipouli Ahupuaʻa in the south. Its location on the windward side exposes the area to the prevailing trade winds and their associated weather patterns. Rainfall on the coastal plains and plateaus of Kapaʻa average approximately 40 inches per year (Juvik and Juvik 1998:56). Historically, this *ahupuaʻa* contained two prominent landscape features: a coastal plain with sand dunes and a large marsh. Kapaʻa can be characterized as fairly flat, with irregularly-shaped gulches and small valleys in the uplands, through which small tributary streams run, including Kapahi, Makaleha and Moalepe. Some of these streams combine with other tributaries in neighboring Keālia to form Kapaʻa Stream (often referred to as Keālia River) which empties into the ocean at the northern border of the *ahupuaʻa*. Others flow directly into the lowlands of Kapaʻa, creating a large (approximately 170-acre) swamp area that has been mostly filled in modern times (Handy and Handy 1972:394, 423).

Kapaʻa Town, immediately northwest of the Project area is built on a sand berm with the ocean on the *makai* side and the marsh on the *mauka* side. The sand berm was probably slightly wider here than in other localities, but dry land was probably always at a premium. The natural sediment of the Project area is described by Foote et al. (1972) as Mokuleia Fine Sandy Loam (Mr), a well-drained soil typically found along the coastal plains of eastern and northern Kaua‘i (Figure 4). This sediment is used for pasture (Foote et al. 1972:96).

1.4.2 Built Environment

The landscape of Kapa‘a is rural and the built environment is characterized by residential development with a small concentration of buildings for commercial and industrial use around the center of Kapa‘a Town (Figure 5 and Figure 6). The Project area is situated southeast of Kapa‘a Town along the coast, generally south of Waika‘ea Canal (Figure 7) and the Boat Ramp or “Lihi” Park as Waipoli Park is locally known. The Project area consists of a seawall that is bounded by the ocean to the east and Moanakai Road to the west. The built environment in the immediate vicinity of the Project area is residential housing west of Moanakai Road (Figure 8).

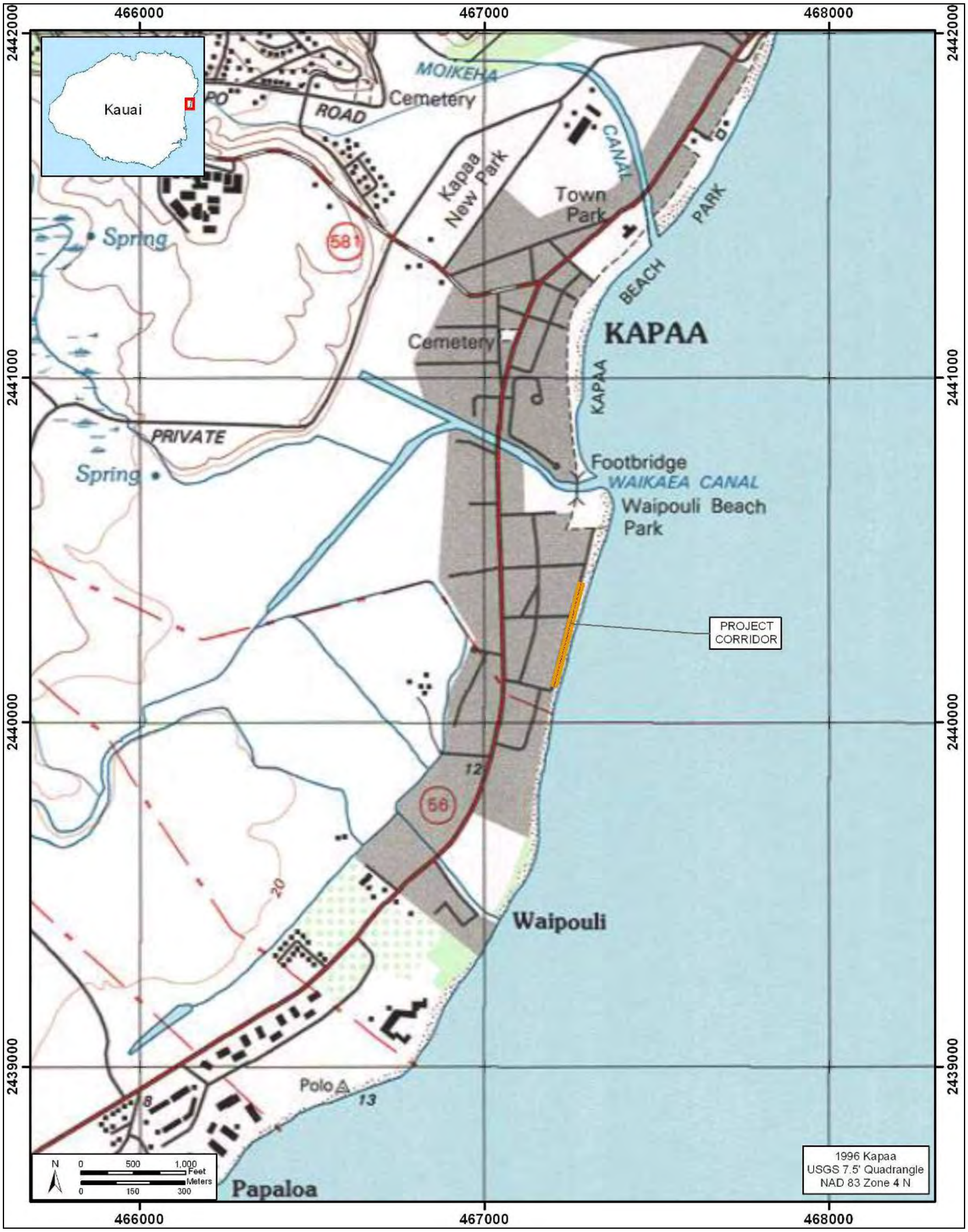


Figure 1. 1996 USGS Map showing the Project area

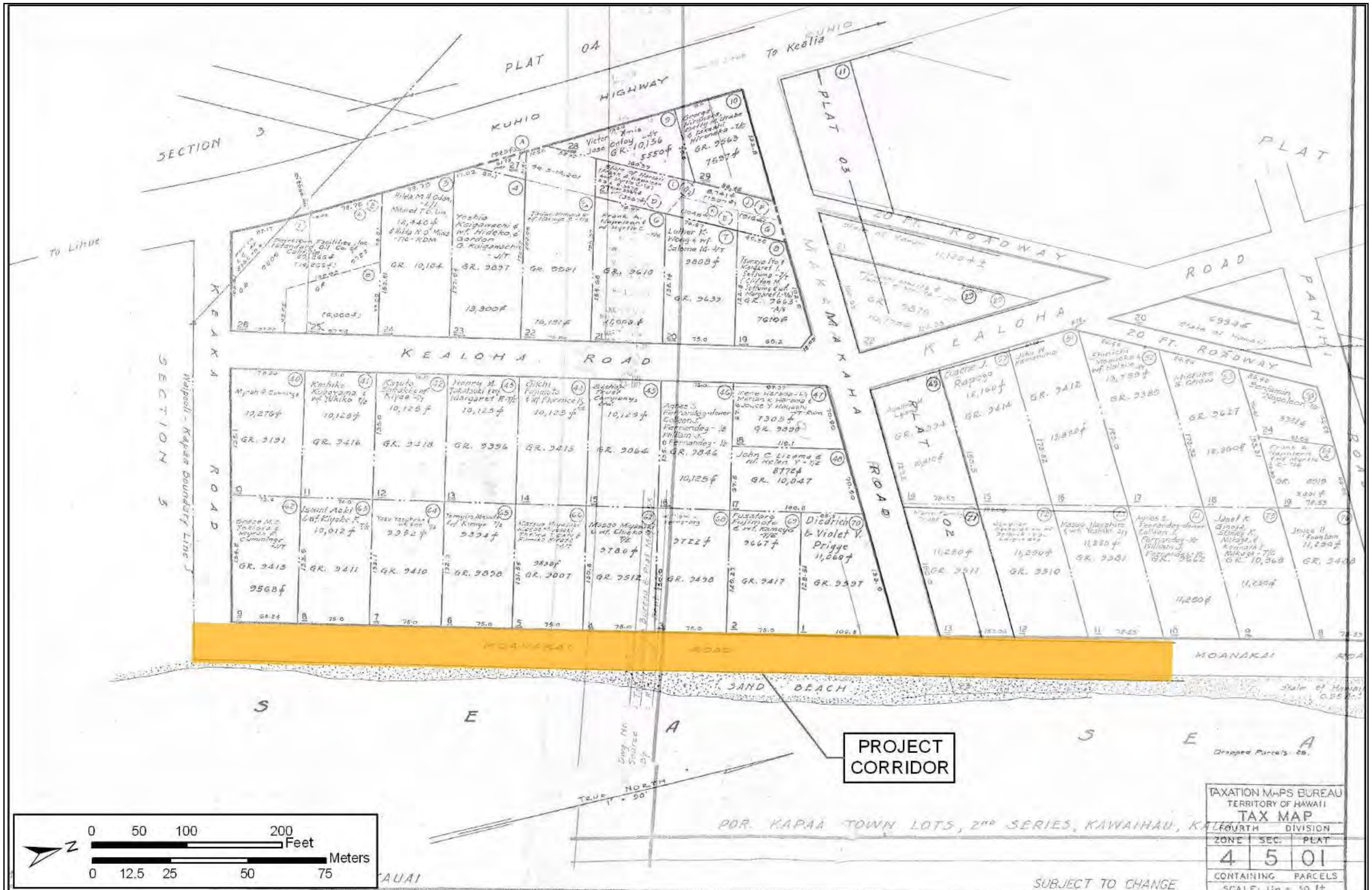


Figure 2. TMK map depicting the location of the Project area

Figure 3. Aerial photograph showing the location of the Project area

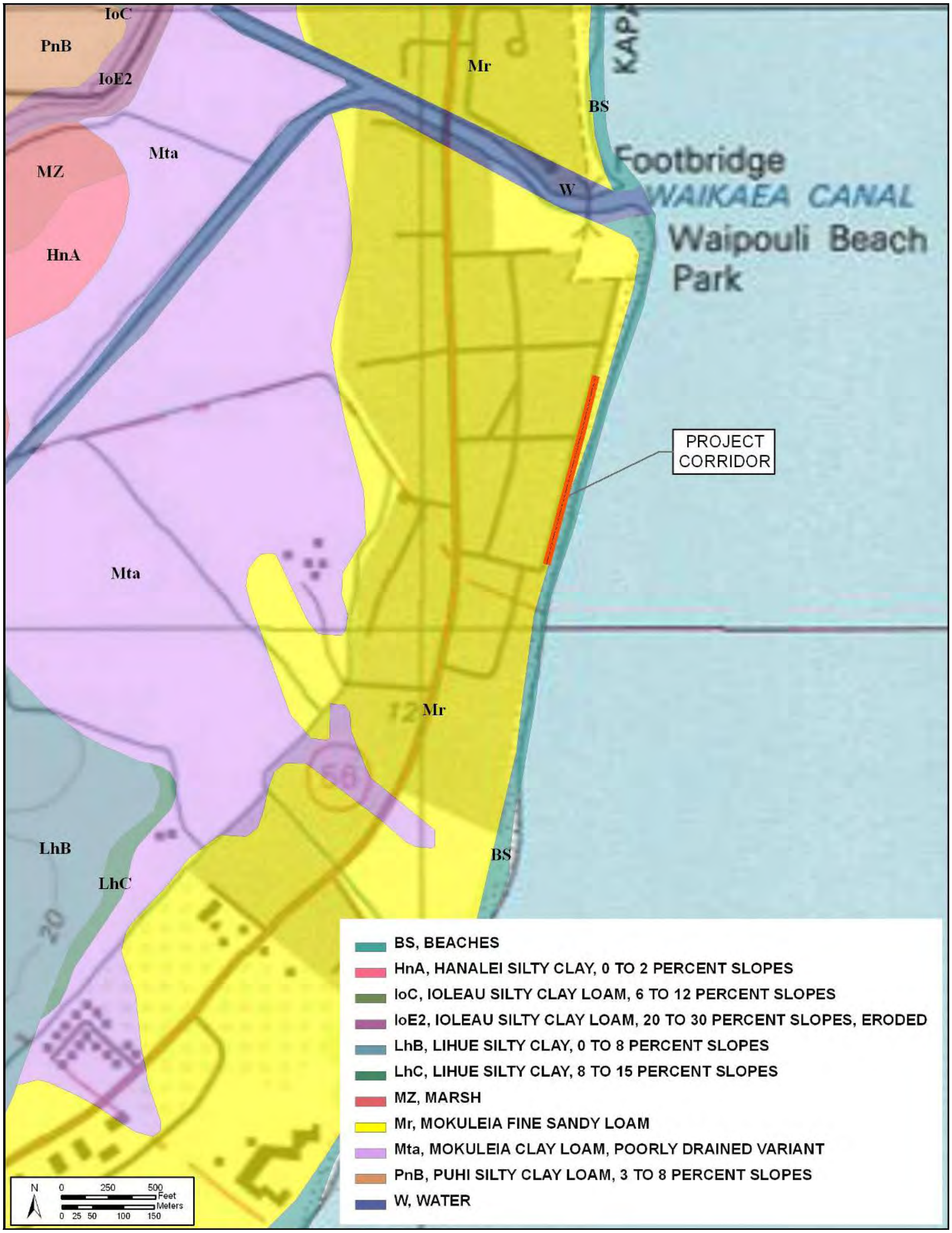


Figure 4. Soil Map of the Project area (Foote et al. 1972)

Figure 5. Kapaʻa Town (Source: Angela Faʻanunu)

Figure 6. Residential development characterizing Kapaʻa landscape (Source: Angela Faʻanunu)

Figure 7. Waikaʻea Canal, about 400 meters northwest of the Project area (Source: Angela Faʻanunu)

Figure 8. Built environment near Project area (Source: Angela Faʻanunu)

Section 2 Methods

2.1 Archival Research

Historical documents, maps and existing archaeological information pertaining to Kapaʻa Ahupuaʻa and the Project area were researched at the CSH library and other archives including the University of Hawaiʻi at Mānoa's Hamilton Library, the State Historic Preservation Division library, the Hawaiʻi State Archives, the State Land Survey Division, the Kapaʻa Public Library, and the archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and photographs and primary and secondary historical sources. Information on Land Commission Awards was accessed through Waihona ʻAina Corporation's Māhele Data Base (www.waihona.com) as well as a selection of CSH library references.

For cultural studies, research for the Traditional Background section centered on Hawaiian activities including: religious and ceremonial knowledge and practices; traditional subsistence land use and settlement patterns; gathering practices and agricultural pursuits; as well as Hawaiian place names and *moʻolelo, mele* (songs), *oli* (chants), *ʻōlelo noʻeau* (proverbs) and more. For the Historic Background section, research focuses on land transformation, development and population changes beginning in the early post–European Contact era to the present day (see Scope of Work above).

2.2 Community Consultation

2.2.1 Sampling and Recruitment

A combination of qualitative methods, including purposive, snowball, and expert (or judgment) sampling, were used to identify and invite potential participants to the study. These methods are used for intensive case studies, such as CIAs, to recruit people that are hard to identify, or are members of elite groups (Bernard 2006:190). Our purpose is not to establish a representative or random sample. It is to "identify specific groups of people who either possess characteristics or live in circumstances relevant to the social phenomenon being studied….This approach to sampling allows the researcher deliberately to include a wide range of types of informants and also to select key informants with access to important sources of knowledge" (Mays and Pope 1995:110).

We began with purposive sampling informed by referrals from known specialists and relevant agencies. For example, we contacted the State Historic Preservation Division (SHPD), Office of Hawaiian Affairs (OHA), Kauaʻi/Niʻihau Island Burial Council (KIBC), and community and cultural organizations in the Kawaihau District for their brief response/review of the project and to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the Project area and vicinity, cultural and lineal descendants of Kapaʻa Ahupuaʻa, and other appropriate community representatives and members. Based on their in–depth knowledge and experiences, these key respondents then referred CSH to additional potential participants who were added to the pool of invited participants. This is snowball sampling, a chain referral method that entails asking a few key individuals (including agency and organization representatives) to provide their comments and referrals to other locally recognized experts or stakeholders who would be likely candidates for the study (Bernard 2006:192). CSH also employs expert or judgment sampling which involves assembling a group of people with recognized experience and expertise in a specific area (Bernard 2006:189–191). CSH maintains a database that draws on over two decades of established relationships with community consultants: cultural practitioners and specialists, community representatives and cultural and lineal descendants. The names of new potential contacts were also provided by colleagues at CSH and from the researchers' familiarity with people who live in or around the study area. Researchers often attend public forums (e.g., Neighborhood Board, Burial Council and Civic Club meetings) in (or near) the study area to scope for participants. Please refer to Table 5, Section 6, for a complete list of individuals and organizations contacted for this CIA.

CSH focuses on obtaining in–depth information with a high level of validity from a targeted group of relevant stakeholders and local experts. Our qualitative methods do not aim to survey an entire population or subgroup. A depth of understanding about complex issues cannot be gained through comprehensive surveying. Our qualitative methodologies do not include quantitative (statistical) analyses, yet they are recognized as rigorous and thorough. Bernard (2006:25) describes the qualitative methods as "a kind of measurement, an integral part of the complex whole that comprises scientific research." Depending on the size and complexity of the project, CSH reports include in–depth contributions from about one–third of all participating respondents. Typically this means three to twelve interviews.

2.2.2 Informed Consent Protocol

An informed consent process was conducted as follows: (1) before beginning the interview the CSH researcher explained to the participant how the consent process works, the project purpose, the intent of the study and how his/her information will be used; (2) the researcher gave him/her a copy of the Authorization and Release Form to read and sign (Appendix A); (3) if the person agreed to participate by way of signing the consent form *or* providing oral consent, the researcher started the interview; (4) the interviewee received a copy of the Authorization and Release Form for his/her records, while the original is stored at CSH; (5) after the interview was summarized at CSH (and possibly transcribed in full), the study participant was afforded an opportunity to review the interview notes (or transcription) and summary and to make any corrections, deletions or additions to the substance of their testimony/oral history interview; this was accomplished either via phone, post or email or through a follow–up visit with the participant; (6) the participant received the final approved interview and any photographs taken for the study for record. If the participant was interested in receiving a copy of the full transcript of the interview (if there is one as not all interviews are audio-recorded and transcribed), a copy was provided. Participants were also given information on how to view the report on the OEQC website and offered a hardcopy of the report once the report is a public document. If an interviewee agreed to participate on the condition that his/her name be withheld, procedures are taken to maintain his/her confidentiality.

2.2.3 Interview Techniques

To assist in discussion of natural and cultural resources and cultural practices specific to the study area, CSH initiated semi–structured interviews (as described by Bernard 2006) asking questions from the following broad categories: gathering practices and *mauka* and *makai* resources, burials, historic properties and *wahi pana.* The interview protocol is tailored to the specific natural and cultural features of the landscape in the study area identified through archival research and community consultation. For example, for this study "gathering practices," "historic properties" and "*wahi pana*" were emphasized over other categories less salient to project participants. These interviews and oral histories supplement and provide depth to consultations from government agencies and community organizations that may provide brief responses, reviews and/or referrals gathered via phone, email and occasionally face–to–face commentary.

2.2.3.1 In–depth Interviews and Oral Histories

Interviews were conducted initially at a place of the study participant's choosing (usually at the participant's home or at a public meeting place) and/or—whenever feasible—during site visits to the Project area. Generally, CSH's preference is to interview a participant individually or in small groups (two–four); occasionally participants are interviewed in focus groups (six–eight). Following the consent protocol outlined above, interviews may be recorded on tape and in handwritten notes, and the participant photographed. The interview typically lasts one to four hours, and records the—who, what, when and where of the interview. In addition to questions outlined above, the interviewee is asked to provide biographical information (e.g., connection to the study area, genealogy, professional and volunteer affiliations, etc.).

2.2.3.2 Field Interviews

Field interviews are conducted with individuals or in focus groups comprised of *kūpuna* and *kamaʻāina* who have a similar experience or background (e.g., the members of an area club, elders, fishermen, *hula* dancers) who are physically able and interested in visiting the Project area. In some cases, field visits are preceded with an off–site interview to gather basic biographical, affiliation and other information about the participant. Initially, CSH researchers usually visit the Project area to become familiar with the land and recognized (or potential) cultural places and historic properties in preparation for field interviews. All field activities are performed in a manner so as to minimize impact to the natural and cultural environment in the Project area. Where appropriate, Hawaiian protocol may be used before going on to the study area and may include the offering of *hoʻokupu* (offering, gift), *pule* (prayer) and *oli*. All participants on field visits are asked to respect the integrity of natural and cultural features of the landscape and not remove any cultural artifacts or other resources from the area.

2.3 Compensation and Contributions to Community

Many individuals and communities have generously worked with CSH over the years to identify and document the rich natural and cultural resources of these islands for cultural impact, ethno–historical and, more recently, Traditional Cultural Properties (TCP) studies. CSH makes every effort to provide some form of compensation to individuals and communities who contribute to cultural studies. This is done in a variety of ways: individual interview participants are compensated for their time in the form of a small honorarium and/or other *makana* (gift); community organization representatives (who may not be allowed to receive a gift) are asked if they would like a donation to a Hawaiian charter school or nonprofit of their choice to be made anonymously or in the name of the individual or organization participating in the study; contributors are provided their transcripts, interview summaries, photographs and—when possible—a copy of the CIA report; CSH is working to identify a public repository for all cultural studies that will allow easy access to current and past reports; CSH staff do volunteer work for community initiatives that serve to preserve and protect historic and cultural resources (for example in, Lānaʻi and Kahoʻolawe). Generally our goal is to provide educational opportunities to students through internships, share our knowledge of historic preservation and cultural resources and the State and Federal laws that guide the historic preservation process, and through involvement in an ongoing working group of public and private stakeholders collaborating to improve and strengthen the Chapter 343 environmental review process.

Section 3 Traditional Background

3.1 Overview

The *ahupuaʻa* of Kapaʻa belongs in the ancient district of Puna, one of five ancient *moku*, or districts, on Kauaʻi (King 1935:228). Puna was the second largest district on Kauaʻi, behind Kona, and extended from Kīpū, south of Līhuʻe to Kamalomaloʻo, just north of Keālia. For taxation, educational and judicial reasons, new districts were created in the 1840s. The Puna District, with the same boundaries, became the Līhuʻe District, named for an important town in that district. In 1878, an act of King Kalākaua in securing a future and name for the new Hui Kawaihau, created the new district of Kawaihau (see Section 4). This new district encompassed the *ahupuaʻa* ranging from Olohena on the south to Kīlauea on the north. Subsequent alterations to district boundaries in the 1920s left Kawaihau with Olohena as its southernmost boundary and Moloaʻa as its northernmost boundary (King 1935:222).

3.2 Place Names

Place names and *wahi pana* are an integral part of Hawaiian culture. "In Hawaiian culture, if a particular spot is given a name, it is because an event occurred there which has meaning for the people of that time (McGuire 2000:17)." The *wahi pana* were then passed on through language and the oral tradition, thus preserving the unique significance of that place. Hawaiians named objects and points of interest, thus place names encompasses names of important places within or near Kapaʻa, such as valleys, streams, mountains, land sections, surfing areas, towns, villages, streets, and buildings (Pukui et al. 1974). In this section, place names are in bold for clarity. Translations presented without attribution in this subsection are from Pukui et al. (1974). Spelling and diacriticals also follow Pukui et al.'s (1974) usage.

Kapaʻa is the name of a land section, town, ditch, elementary school, weir, and beach park in the Kawaihau District in Kauaʻi. Kapaʻa literally translates as "the solid or the closing." The name Kapaʻa is also a place in Kailua, Oʻahu where a rock quarry has been located since the 1950s. While Pukui et al. believe that the name Kapaʻa may have been derived from the solid rock of the place, no explanations are offered for how the Kapaʻa in Kauaʻi was thus named.

Kahana is the name of a land, possibly and *ʻili* in Kapaʻa where uncultivated *loʻi* were claimed (LCA 03971). Kahana literally translates as, "cutting."

Kalolo/Kaloko is the name of a village or house lot in the Kapaʻa Ahupuaʻa (LCA 3638, 8843).

Kaloloku is the name of a swamp in the back of Kapaʻa and Waipouli.

Kehau is the name of a wind of Kapaʻa (Fornander 1916-1919: vol. V: 96-97).

Kuahiahi/Kaahiahi/Keahiahi are the possible names of a rocky headland at the north end of Kapaʻa Ahupuaʻa; it is also the location of the first Kapaʻa School from 1883 to 1908; also the location of a former *heiau* called Kuahiahi (Lahainaluna Students 1885: 216); as well as the place where the legendary figure and keeper of the wind guard of La‘amaomao, Pāka‘a (sometimes spelled Paka‘a, e.g., in Pukui 1983), grew up and fished (Wichman 1998:85).

Kupanihi is the name of a pond in the Puna district associated with Kaeo, Kaumuali‘i’s older brother (Lahainaluna Students 1885: 216). It is also the name of a fishpond and land in Kapa‘a claimed in LCA 3971, 3243).

Maele‘ele is the name of a land division, possibly and *‘ili* in Kapa‘a in which *lo‘i* were cultivated (LCA 3638).

Mailehuna is the name of a hill where the present day Kapa‘a School is located. It is also the name of a former heiau at this location (Lahainaluna Students 1885).

Moikeha Canal is the canal which is traversed by two plantation era railroads near the present day Kapa‘a Public Library and the Coral Reef Hotel.

Puhi is the name of a village or house lot in the Kapa‘a Ahupua‘a claimed in LCAs 3554, 3599.

Waika‘ea/Waikaeee is a canal and boat ramp in Kapa‘a which is described as being located in the uplands near Nonou (Akina,1913).

Waimahanalua is the name of a stream and school located near the old Makee Landing near the present day Moikeha Canal (Akina, 1913). The name mahanalua suggests the stream was forked and fed by multiple streams which could well be the case since the backlands of Kapa‘a were swamp lands fed by many streams.

Ulukiu is the name of a village or house lot in the Kapa‘a Ahupua‘a claimed in LCA 08837.

3.3 Mo‘olelo Associated with Specific Place Names

3.3.1 Palila and Ka‘ea

High in the *mauka* region of Kapa‘a in the Makaleha mountains at a place called Ka‘ea, is reported to be the supernatural banana grove of the Kaua‘i *kupua* or demigod Palila, grandson of Hina (Handy and Handy 1972:424). Joseph Akina writing for Kuokoa Newspaper in 1913 describes Palila’s banana grove:

> The stalk could hardly be surrounded by two men, and was about 35 feet high from the soil to the lowest petiole. The length of the cluster from stem to lowest end of the bunch of bananas was about 1 ¾ fathoms long (one anana and one muku). There were only two bananas on each about 4 ½ inches around the middle. There were just two bananas, one on the east side and one on the west, each about a foot or more in length. The one on the east side was tartish, like a waiawi (Spanish guava) in taste and the one on the west was practically tasteless. The diameter of the end of the fruit stem of this banana seemed to be about 1 ½ feet. This kind of banana plant and its fruit seemed almost supernatural…(Akina 1913:5).

3.3.2 Ka Lulu o Mōʻīkeha

Kapaʻa was the home of the legendary *aliʻi*, Mōʻīkeha. Born at Waipiʻo on the island of Hawaiʻi, Mōʻīkeha sailed to Kahiki (Tahiti), the home of his grandfather Maweke, after a disastrous flood. On his return to Hawaiʻi, he settled at Kapaʻa, Kauaʻi. Kila, Mōʻīkeha's favorite of three sons by the Kauaʻi chiefess Hoʻoipoikamalani, was born at Kapaʻa and was said to be the most handsome man on the island. It was Kila who was sent by his father back to Kahiki to slay his old enemies and retrieve a foster son, the high chief Laʻamaikahiki (Beckwith 1970:352-358; Fornander 1916:160; Handy and Handy 1972:424; Kalākaua 1888:130-135). Mōʻīkeha's love for Kapaʻa is recalled in the *ʻōlelo noʻeau*: "Ka lulu o Moikeha i ka laulā o Kapaʻa. *The calm of Moikeha in the breadth of Kapaʻa*" (Pukui 1983:157).

"Lulu-o-Moikeha" is described as being situated "near the landing and the school of Waimahanalua" (Akina 1913:5). The landing in Kapaʻa was known as the Makee Landing and was probably constructed in the late 1870s, along with the Makee sugar mill. Today, in place of the old Makee Landing is part of a breakwater located on the north side of Moikeha Canal near the present day Coral Reef Hotel.

Akina (1913) tells the story of how Mōʻīkeha's son, Kila stocks the islands with the *akule*, *kawakawa* (mackerel tuna), and *ʻōpelu* (mackerel scad) fish (Appendix B). When Kila travels to Kahiki, he seeks out his grandfather Maweke and explains that he is the child of Mōʻīkeha. When Maweke asks Kila if Mōʻīkeha is enjoying himself, Kila answers with the following chant of Puna:

My father enjoys the billowing clouds	I walea no kuʻu makuakāne i ke ao
over Pōhaku-pili,	hoʻokanunu, iluna o Pōhakupili
The sticky and delicious poi,	I ka poi uouo ono ae no a,
With the fish brought from Puna,	Me ka Iʻa i na mai o ka Puna,
The broad-backed shrimp of Kapalua,	Ka opae hoainahanaha o Kapalua;
The dark-backed shrimp of Pōhakuhapai,	Na opae kua hauli o Pohakuhapai,
The potent awa root of Maiakiʻi,	Na puawa ona mai no o Maiakii,
The breadfruit laid in the embers at Makialo	Me ka ulu moelehu mai no o Makialo,
The large heavy taros of Keah'āpana	Me na kalo pehi hua o Keahapana,
The crooked surf of Makāiwa too	A i kekee nalu ae no hoi o Makaiwa,
The bending hither and thither of the reed	A i ke kahuli aku kahuli mai o ka pua
and rush blossoms,	uku me ka pua neki,
The swaying of the kalukalu grasses	A i ka nuʻa ae no o ke kalukalu
of Puna	o Puna,
The large, plump, private parts of	A i na mea nui nepunepu no a kuʻu
my mothers,	mau makuahine.
Of Hoʻoipoikamalanai and Hinau-u,	O Hoioipo ikamalanai me Hinau-u,
The sun that rises and sets,	A i ka la hiki ae no a napoo aku,
He enjoys himself on Kauaʻi,	Walea ai no ka nohona ia Kauaʻi
All of Kauaʻi is Mōʻīkeha's	Ua puna a puni Kauaʻi ia Mōʻīkeha

(Akina 1913:6)

Maweke was delighted and when the boy is questioned as to his purpose, Kila tells his grandfather he is seeking fish for his family. Maweke tells Kiwa to lead the fish back to his homeland. This is how Kila led the *akule*, *kawakawa*, and *ʻōpelu* to Hawaiʻi.

3.3.3 Pākaʻa and the wind gourd of Laʻamaomao (Keahiahi)

Kapaʻa also figures prominently in the famous story of Pākaʻa and the wind gourd of Laʻamaomao. Pākaʻa was the son of Kūanuʻuanu, a high-ranking retainer of the Big Island ruling chief Keawenuiʻumi (the son and heir to the legendary chief ʻUmi), and Laʻamaomao, the most beautiful girl of Kapaʻa and member of a family of high status *kahuna*. Kūanuʻuanu left the island of Hawaiʻi, traveled throughout the other islands and finally settled on Kauaʻi, at Kapaʻa. It was there that he met and married Laʻamaomao, although he never revealed his background or high rank to her until the day a messenger arrived, calling Kūanuʻuanu back to the court of Keawenuiʻumi. By that time, Laʻamaomao was with child but Kūanuʻuanu could not take her with him. He instructed her to name the child, if it turned out to be a boy, Pākaʻa. Pākaʻa was raised on the beach at Kapaʻa by Laʻamaomao and her brother Maʻilou, a bird snarer. He grew to be an intelligent young man and it is said he was the first to adapt the use of a sail to small fishing canoes. Although Pākaʻa was told by his mother from a very young age that his father was Maʻilou, he suspected otherwise and after constant questioning Laʻamaomao told her son the truth about Kūanuʻuanu.

Intent on seeking out his real father and making himself known to him, Pākaʻa prepared for the journey to the Big Island. His mother presented to him a tightly covered gourd containing the bones of her grandmother, also named Laʻamaomao, the goddess of the winds. With the gourd and chants taught to him by his mother, Pākaʻa could command the forces of all the winds in Hawaiʻi. While this story continues on at length about Pākaʻa and his exploits on the Big Island and later on Molokaʻi, it will be dwelt upon further here. It is important to note that several versions of this story do include the chants which give the traditional names of all the winds in all the districts of all the islands, preserving them for successive generations (Beckwith 1970:86-87; Fornander 1918 vol.V pt.I:78-128; Nakuina 1990; Rice 1923:69-89; Thrum 1923:67).

Fredrick Wichman (1998:84) writes that Pākaʻa grew up on a headland named Keahiahi, north of the Project area. Here, Pākaʻa learned to catch *mālolo* (general term for Hawaiian flying fishes), his favorite fish. After studying the ocean and devising his plan to fabricate a sail, Pākaʻa wove a sail in the shape of a crab claw and tried it out on his uncles canoe. One day, after going out to catch *mālolo*, he challenged the other fishermen to race to shore. He convinced them to fill his canoe with fish suggesting it was the only way he could truly claim the prize if he won:

> The fishermen began paddling toward shore. They watched as Pākaʻa paddled farther out to sea and began to fumble with a pole that had a mat tied to it. It looked so funny that they began to laugh, and soon they lost the rhythm of their own paddling. Suddenly Pākaʻa's mast was up and the sail filled with wind. Pākaʻa turned toward shore and shot past the astonished fishermen, landing on the beach far ahead of them. That night, Pākaʻa, his mother, and his uncle had all the *mālolo* they could eat. (Wichman 1998:85)

3.3.4 Kaweloleimākua

Kapaʻa is also mentioned in traditions concerning Kawelo (Kaweloleimākua), Kaʻililauokekoa (Mōʻīkeha's daughter, or granddaughter, depending on differing versions of the *moʻolelo*), the *moʻo* (supernatural water spirit) Kalamainuʻu and the origins of the fish trap used to catch the *hīnālea* (psychedelic wrasse) fish, and the story of Lonoikamakahiki (Fornander 1917, vol. IV, pt.II:318, vol. IV, pt. III:704-705; Kamakau 1976:80; Rice 1923:106-108; Thrum 1923:123-135).

3.3.5 *Kalukalu* grass of Kapaʻa

"*Kūmoena kalukalu Kapaʻa*," or "Kapaʻa is like the *kalukalu* mats," is a line from a chant recited by Lonoikamakahiki. *Kalukalu* is a sedge grass, apparently used for weaving mats (Fornander 1917, vol. IV, pt. II, pp. 318-19). Pukui (1983:187) associates the *kalukalu* with lovers in "Ke kalukalu moe ipo o Kapaʻa: *The* kalukalu *of Kapaʻa that sleeps with the lover*." According to Wichman (1998:84), "a *kalukalu* mat was laid on the ground under a tree, covered with a thick pile of grass, and a second mat was thrown over that for a comfortable bed", thus the association with the lovers. Kauaʻi was famous for this peculiar grass, and it probably grew around the marshlands of Kapaʻa. It is thought to be extinct now, but an old-time resident of the area recalled that it had edible roots, "somewhat like peanuts." Perhaps it was a famine food source (Kapaʻa Elementary School 1933:vi).

3.4 Heiau

In the 1880s, a group of Lahainaluna students traveled throughout Hawaiʻi collecting stories. During their expedition, they stopped in Kapaʻa and Keālia and gathered information regarding *heiau* of the region. More than a dozen *heiau* were named in Kapaʻa and Keālia, which reinforces the traditional significance of these *ahupuaʻa* to Native Hawaiians (Lahainaluna Students 1885). Table 1 lists the location, type, associated chief or priest, and other relevant comments or references for each *heiau*.

Table 1. List of Heiau in Kapaʻa (source: Bushnell et al. 2002)

Name	Location	Type	Associated Chief/Priest
Mailehuna	Kapaʻa (Mailehuna is the area of the present day Kapaʻa School)	Unknown	Kiha, Kaumualiʻi/ Lukahakona
Pueo	Kapaʻa	Unknown	Kiha, Kaumualiʻi/ Lukahakona
Pahua	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Kumalae	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Waiehumalama	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Napuupaakai	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona

Noemakalii	Kapaʻa/Keālia	"*Heiau* for birth of Kauai Chiefs, like Holoholokū"	Unknown
Puukoa	Kapaʻa/Keālia	"*Unu*" (*heiau* for fishermen or an agricultural *heiau*)	Unknown
Piouka	Kapaʻa/Keālia	"*Unu*-type *heiau*"	Unknown
Una	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Mano	Kapaʻa/Keālia	Unknown	Kiha/ Lukahakona
Kuahiahi	Kapaʻa (Where government school stands now)	Unknown	Kiha/ Lukahakona
Makanalimu	Upland of Kawaihau	Unknown	Kaumualiʻi
Kaluluomoikeha	Kapaʻa	Unknown	Mōʻīkeha

The exact locations of these *heiau* are unknown. The general locations of two of the *heiau* correlate with *wahi pana* of Kuahiahi and Kaluluomoikeha. Kuahiahi (also spelled Kaahiahi and Keahiahi) is the rocky headland at the north end of Kapaʻa where the first Kapaʻa School was once located. Kaluluomoikeha is thought to be the general area near the Moikeha Canal and the present day Coral Reef Hotel, north of the Project area.

3.5 Settlement and Subsistence

The association of the *ahupuaʻa* of Kapaʻa with legendary historical figures such as Mōʻīkeha implies that the area was settled prior to Mōʻīkeha's time (early fourteenth century), although the extent of this settlement is not known. Handy (1940) counts Kapaʻa as one of the major settlement areas of Kauaʻi in pre-Contact times, and both Vancouver (1798) and Wilkes (1844) were impressed with this "most fertile and pleasant district" with its fields of "sugarcane, taro" and other crops. Through archaeology and other sources, it is known that at one time agricultural and domestic activities extended into the far *mauka* areas of Kapaʻa, but were abandoned by the mid-nineteenth century.

The LCA pattern (see Section 4.3) in Kapaʻa shows taro *loʻi* and *kula* on the rim of the swamplands and extending somewhat into watered valleys. Marshlands without known LCAs may have had *loʻi* along the edges. All six LCA claimants had shoreline house lots *makai* of the swamp. Permanent settlement is assumed to have existed in association with *mauka* agricultural lands in the pre-Contact period, but this is not reflected in the LCA testimonies. The *mauka* settlements were probably abandoned before the nineteenth century. Permanent settlement occurred along the coast throughout late pre-Contact, as indicated by the presence of extensive and thick habitation deposits in the shore and backshore areas of Kapaʻa, especially along Inia Street and Kūhiō Highway (Hammatt 1991). However, in the early twentieth century, the entire area behind Kapaʻa Town was rice and *kula* lots. Flood control measures were instituted in the 1960s and marshlands, used previously for taro and then taken over by the rice farmers, were drained and became cane and pasture.

The current Project is situated adjacent to the ocean. Coastal areas were generally used for pre-Contact habitation, agriculture and/or for burials. Handy (1940:153) related that the Kapaʻa coastal plain "would be suitable for sweet potato plantings; presumably a great many used to be grown in this section." Additionally, the Project area is within an area labeled as Mokuleia Fine Sandy Loam, as depicted in Figure 4, in which cultural strata and burials have been previously found in the vicinity of Kūhiō Highway, 120 to 180 meters inland from the Project area.

Section 4 Historical Background

4.1 Overview

The following section briefly summarizes the historical background of Kapaʻa from the time of Captain Cook or the early post-Contact period, to modern times.

4.2 Early Post-Contact Period

E. Craighill Handy (1940) describes the remains of agricultural sites in Kapaʻa in the early part of the twentieth century:

> There are extensive terrace areas on the flatlands below the mountains, watered by Kapahi, Makaleha, and Moalepi Streams, where the upper Kapaa homesteads are located. Kapaa river is formed by the union of these three streams. For 4 miles or more along the course of this river the pockets of flatland along the river bottom were built into terraces. A little way up Kaehulua, there were small terrace areas which are now either in cane or under grass. The flatlands of Waianuenue and coastal Kapaa, which are now mostly planted in sugar cane, were presumably terrace anciently, except perhaps the marshy sections. (Handy 1940:68)

These agricultural fields were used to grow irrigated taro; Kapaʻa once had a "highly developed irrigation system," and thus was one of the pre-Contact centers of population (Handy and Handy 1972:269). Handy also mentions that Kapaʻa is a district with a broad coastal plain bordering the sea "which would be suitable for sweet potato plantings; presumably a great many used to be grown in this section" (Handy 1940:153). Yams were grown inland in all sections of Puna (Handy 1940:171). The farmers in the valleys of Puna practiced ". . . diversified farming: taro, sweet potatoes, breadfruit, coconuts" (Handy and Handy 1972:423).

In 1793, George Vancouver (1798:221-223) examined the east coast of the island from his ship and stated that it was the "most fertile and pleasant district of the island . . ." However, he did not anchor nor go ashore due to inhospitable ocean conditions.

In 1840, Peale and Rich, with Charles Wilkes' United States Exploring Expedition (1844), traversed the coastline there on horseback heading north from Wailua:

> The country on the way is of the same character as that already seen. They passed the small villages of Kuapau [Kapaʻa], Keālia, Anehola, Mowaa, and Kauharaki, situated at the mouths of the mountain streams, which were closed with similar sand-bars to those already described. These bars afforded places to cross at, though requiring great precaution when on horseback. The streams above the bars were in most cases, deep, wide, and navigable a few miles for canoes. Besides the sugarcane, taro, etc., some good fields of rice were seen. The country may be called open; it is covered with grass forming excellent pasture-grounds, and abounds in plover and turnstones, scattered in small flocks. (Wilkes 1844:69)

4.3 The Māhele

In the mid-1800s, Kamehameha III decreed a division of lands called the Māhele which introduced private property into Hawaiian society (Chinen 1958). In 1848, lands were divided into three portions: crown lands, government lands, and lands set aside for the chiefs. Individual plots, called *kuleana* (Native Hawaiian land rights) awards, were granted within these divided lands to native inhabitants who lived on and farmed these plots and came forward to claim them. Researching the claims and testimonies that were given in the mid-1800s can sometimes assist in forming a settlement pattern for the region at that time and possibly earlier. Thus, it is through records for Land Commission Awards (LCAs) generated during the Māhele that specific documentation of traditional life in Kapaʻa Ahupuaʻa comes to light.

4.3.1 Land Commission Awards

During the Māhele, Kapaʻa was retained as Crown Lands (Office of the Commissioner of Public Lands of the Territory of Hawaii 1929). The *ʻili* of Paikahawai and Ulukiu in Kapaʻa Ahupuaʻa were retained as Government Lands. The LCAss during this period show that six individuals, other than *aliʻi* or chiefs were awarded land parcels in the relatively large *ahupuaʻa* of Kapaʻa, outside of the Project area (Table 2).

Table 2. Māhele Land Claims in Kapaʻa Ahupuaʻa

LCA	CLAIMANT	LAND USE AND LOCATION	COMMENTS
3554 and 3599	Keo	(1) 15 *loʻi* in the entire *ʻili* of Kahanui (2) House lot in Puhi Village	Two *ʻāpana*, one acre
3638	Huluili, Kahoiu (Kadaio)	(1)15 *loʻi* and *kula* in Maeleʻele ʻIli (2) House lot in Kaloko (Kalolo) Village	Two *ʻāpana*, five acres
3971 and 3243	Honolii, Ioane	(1) Six uncultivated *loʻi in* Kahana ʻIli (2) House lot in Kupanihi Village	Two *ʻāpana*, two acres
8247	Ehu	Approximately 20 *loʻi* lying waste, some orange trees at Moalepe ʻIli	One *ʻāpana*
8837	Kamapaa	(1) Three *loʻi* in Ulukiu ʻIli (2) Two *loʻi* in Awawaloa ʻIli (2) House lot in Ulukiu Village	Three *ʻāpana*
8843	Kiau and son, Apahu	(1) Six *loʻi* ʻin Apopo ʻIli (2) House lot in Kalolo Village	Two *ʻāpana*, two and three-quarter acres

The six awardees are Keo (LCA 3554/3599), Huluili (LCA 3638), Ioane Honolii (LCA 3971/3243), Ehu (LCA 8247), Kamapaa (LCA 8837), and Kiau (LCA 8843). Five of the six awardees received multiple parcels, which show similarities. All five had *loʻi* on the *mauka* side of the lowland swampy area, sometimes extending a short distance up into small, shallow gulches and valleys. Many of these *loʻi* parcels name *pali* (cliff or steep hill) as boundaries. Each LCA also had a separate house lot located on the *makai* side of the swamp, near the beach. Two of the land claims name ponds on their lands: Puhi Pond (LCA 3554) and fishponds in Kupanihi

‘Ili (LCA 3971). The two *loko* are associated with house lots, situated on the *makai* edge of the Kapa‘a swamps, suggesting modification of the natural swamplands.

Other natural and cultural resources mentioned in the LCAs include freshwater springs, pigpens, *hau* (*Hibiscus tiliaceus*) bushes, *hala* (pandanus) clumps, streams, *‘auwai* (ditch, canal), and *kula*. Some of these natural features and cultivated fields are adjacent to one of these large swamps.

Interestingly, the residential “village” of Kapa‘a did not exist as a single entity, but was a series of probably small settlements, or compounds, perhaps even individual house lots, which stretched along the shoreline of the *ahupua‘a* and included (south to north) Kupanihi (Makahaikupanihi), Kalolo (Kaulolo), Puhi, and Ulukiu. The current Project area was probably in the *‘ili* of Ulukiu adjacent to Ulukiu Village.

The fifth individual, Ehu (LCA 8247), was the only person to be awarded a single parcel in the upland area of Kapa‘a, in Moalepe Valley, approximately five miles *mauka*. In 1848, when Ehu made his claim, he was the only person living there. A few years later, according to Honolii’s testimony to support Ehu’s claim, “There are no houses and no people now living on the land. Ehu found himself lonely there, all his neighbors having either died or left the land. Ehu now lives in Wailua.” Evidently, Ehu may have been the last person to live at and cultivate, in the traditional way, the far *mauka* region of Kapa‘a.

4.3.2 Waipouli Ahupua‘a LCAs within Close Proximity

The northern-most boundary of Waipouli *ahupua‘a* is just south of the project area. William C. Lunalilo, the awardee of LCA 8559B and the entire *ahupua‘a* of Waipouli as well as a portion of Kapa‘a Ahupua‘a, was the son of Charles Kana‘ina, and the grandson of Kalaimamahu, who was Kamehameha I’s half-brother. Lunalilo was known as the “People’s King”; he was democratically elected in 1873 defeating Kalākaua. Lunalilo enjoyed “the quiet life of Waikīkī,” and living “on fish and poi with his native friends.” Queen Emma, the widow of King Kamehameha IV, Alexander Liholiho, inherited the property following Lunalilo’s death in 1874 (Kanahele 1995:115, 133, 148-149). No information related to the land usage for Lunalilo’s claims were found.

LCA 7636-2 is the closest LCA to the Project corridor. Granted to Kaanaka, Apana 2 of LCA 7636, is a house lot within Makahokoloko Village, which may have been the closest village to the project area.

In 1913, Gaylord .P. Wilcox, the manger of Grove Farm Plantation, petitioned for a portion of the *ahupua‘a* of Waipouli, approximately 150 meters south of the Project area. Research does not indicate land usage of LCA petition 276.

4.4 Mid-1800 to 1900

Most of the historic record documents for Kauaʻi in this period revolve around missionary activities and the missions themselves. There were, however, indication that the Kapaʻa area was being considered for new sugar cane experiments, similar to those occurring in Kōloa. In a historic move, Ladd & Company received a 50-year lease on land in Kōloa from Kamehameha III and Kauaʻi Governor, Kaikioʻewa. The terms of the lease allowed the new sugar company "the right of someone other than a chief to control land" and had profound effects on "traditional notions of land tenure dominated by the chiefly hierarchy" (Donohugh 2001:88). In 1837, a very similar lease with similar terms was granted to Wilama Ferani, a merchant and U.S. citizen based in Honolulu (Hawaiʻi State Archives, Interior Dept., Letters, Aug. 1837). The lease was granted by Kauikeaouli (Kamehameha III) for the lands of Kapaʻa, Keālia, and Waipouli for twenty years for the following purpose:

> . . . for the cultivation of sugar cane and anything else that may grow on said land, with all of the right for some place to graze animals, and the forest land above to the top of the mountains and the people who are living on said lands, it is to them whether they stay or not, and if they stay, it shall be as follows: They may cultivate the land according to the instructions of Wilama Ferani and his heirs and those he may designate under him . . . (Hawaiʻi State Archives, Interior Dept., Letters, Aug. 1837)

Unlike Ladd & Company, which eventually became the Kōloa Sugar Company, there is no further reference to Wilama Ferani and his lease for lands in Kapaʻa, Keālia and Waipouli. In a brief search for information on the Honolulu merchant, Wilama Ferani, nothing was found. It is thought that perhaps Wilama Ferani may be another name for William French, a well known Honolulu merchant who is documented as having experimented with grinding sugar cane in Waimea, Kauaʻi at about the same time the 1837 lease for lands in Kapaʻa, Keālia and Waipouli was signed (Joesting 1984:152).

In 1849, a son of a Waiʻoli missionary, William P. Alexander, recorded a trip he took around Kauaʻi. Although, he focuses on the larger mission settlements like Kōloa and Hanalei, he does mention Kapaʻa.

> A few miles from Wailua, near Kapaʻa we passed the wreck of a schooner on the beach, which once belonged to Capt. Bernard. It was driven in a gale over the reef, and up on the beach, where it now lies. A few miles further we arrived at Keālia. We had some difficulty crossing the river at this place, owing to the restiveness of our horses. The country here near the shore was rather uninviting, except the valley which always contained streams of water. (Alexander 1991:123)

In later years, the notorious Kapaʻa reef was to become the location of many shipwrecks, particularly once a landing was built there in the 1880s.

In 1876, Captain James McKee and his son-in-law, Col. Z.S. Spaulding, bought the Ernest Krull cattle ranch for the sum of $30,000.00. The first large scale agricultural enterprise in Kapaʻa began on this property in 1877 by the two men and by the society, the Hui Kawaihau

(Dole 1916: 8). The Hui Kawaihau was originally a choral society begun in Honolulu whose membership consisted of many prominent people, both Hawaiian and *haole*. It was Kalākaua’s thought that the Hui members could join forces with Makee, who had previous sugar plantation experience on Maui, to establish a successful sugar corporation on the east side of Kaua‘i. Captain Makee built a mill in Kapa‘a and agreed to grind cane grown by Hui members. Kalākaua declared the land between Wailua and Moloa‘a, the Kawaihau District, a fifth district and for four years the Hui attempted to grow sugar cane at Kapahi, on the plateau lands above Kapa‘a. After a fire destroyed almost one half of the Hui’s second crop of cane and the untimely death of one of their principal advocates, Captain James Makee, the Hui began to disperse; property and leasehold rights passed on to Makee’s son-in-law and the new Makee Plantation owner, Colonel Z.S. Spalding (Dole 1916:14).

As part of the infrastructure of the new plantation, a sugar mill was erected, and Makee Landing was built in Kapa‘a during the early years of the Makee Sugar Plantation. Following Captain Makee’s death, Colonel Spalding took control of the Plantation, and in 1885, he moved the mill to Keālia (Cook 1999:51). The deteriorating stone smokestack and landing were still there well into the 1900s (Damon 1931). Condè and Best (1973:180) suggest that railroad construction for the Makee Plantation started just prior to the mid 1890s. There is one reference to a railroad line leading from the Kapa‘a landing to Keālia in 1891. During Queen Liliuokalani’s visit to Kaua‘i in the summer of 1891, the royal party was treated to music by a band, probably shipped in from O‘ahu. “The band came by ship to Kapa‘a and then by train to Keālia” (Joesting 1984:252). This railroad line is depicted on a 1914 map (Figure 9), which shows the line heading south from Keālia Mill and splitting near the present Coral Reef Hotel, one finger going to the old Kapa‘a Landing (Makee Landing). The other line headed *mauka*, crossing the present Mō‘īkeha Canal, traveling southwest up Lehua Street and through what is now goat pasture, along a plateau and into the *mauka* area behind Kapa‘a swamplands. This railroad line was part of a twenty-mile network of plantation railroad with some portable track; it ran through a portion of Keālia Valley and into the *mauka* regions of the plateau lands north of Keālia (Condé and Best 1973:180).

By the late 1800s, Makee Plantation was a thriving business, with more than one thousand workers employed (Cook 1999:51). Hundreds of Portuguese and Japanese immigrants found work on Makee Plantation, and the new influx of immigrants required more infrastructure. In 1883, a lease for a school lot was signed between Makee Sugar Company and the Board of Education (Kapa‘a School 1982:9). Stipulations found in the Portuguese immigrant contracts with Makee Sugar Company stated that “children shall be properly instructed in the public schools” (*Garden Island*, April 1, 1983). The original Kapa‘a School was constructed in 1883 on a rocky point adjacent to the Makee Sugar Company railroad. Traditionally, this point was known as Kaahiahi (Kapa‘a Elementary School 1982:10). In 1908, Kapa‘a School was moved to its present site directly *mauka* and up the hill at Mailehune.

As in much of the rest of Hawai‘i, the Chinese rice farmers began cultivating the lowlands of Kapa‘a with increasing success in the latter half of the 1800s. Several Hawaiian *kuleana* owners leased or sold their parcels *mauka* of the swamp land to Chinese rice cultivators. One 1914 map (see Figure 9) indicates that while the current Project area was still within or adjacent to marshland, the areas just inland of this marsh were used to grow rice. Other Chinese rice

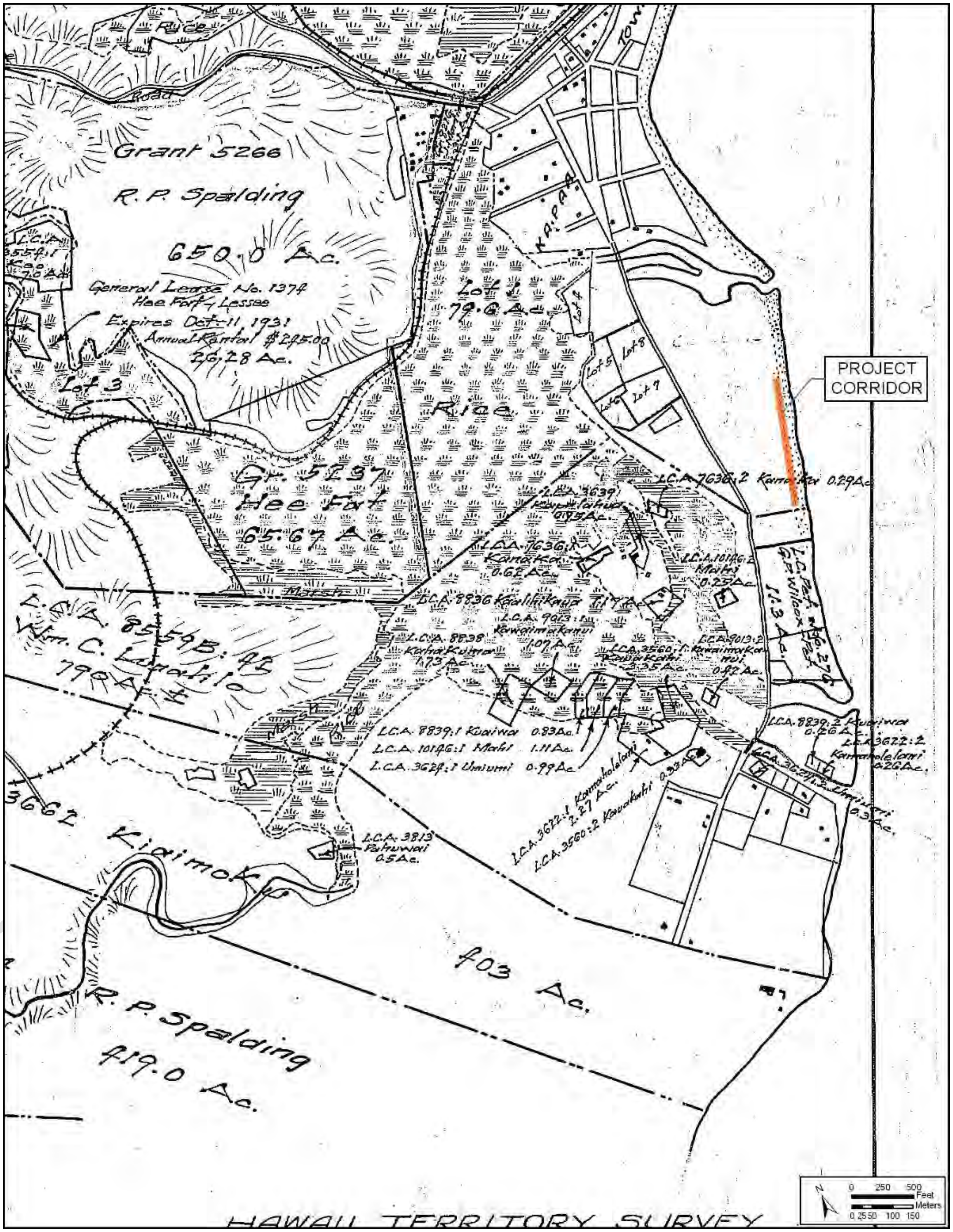


Figure 9. Portion of 1914 Hawaii Territory Survey map by Walter E. Wall, showing coastal and inland LCAs, and the Project area (Plat 3014)

cultivators appealed to the government for swamplands, first leasing and later buying. As a result of the growing rice and sugar industries, the economic activity displaced the house lot *kuleana* on the *makai* side of the marsh for increasing commercial and residential development (Lai 1985:148-161).

Narrow wagon roads gave way to macadamized roads in the early part of the twentieth century. This new road was called the Kauaʻi Belt Road, and parts of it are thought to have followed the "Old Government Road" (Cook 1999). In Kapaʻa, the present day Kūhiō Highway probably follows the same route as the original Government Road and subsequent Kauaʻi Belt Road. The location of the *kuleana* awards in Kapaʻa indicates that the majority of the house lots were situated along the Government Road. LCA 3243 names a "road" as one of its boundaries.

4.5 1900 to 1940

In the early 1900s, government lands were auctioned off as town lots in Kapaʻa to help with the burgeoning plantation population. As shown in Figure 9, the Project area is south of the Kapaʻa Town lots.

The Hawaiʻi Dept. of Survey (1909:13) completed Kapaʻa surveys by 1908. Their report relates that "4 lots of from 64 to 60 acres near the Waipouli boundary were completed." However, the surveyor (Wall) reports that although Kapaʻa lots were established with

> …an average of 35 acres of good agricultural land, the balance being either waste or pasture, but in the case of the 4 lots [presumably in the vicinity of the project area] … it was not possible to get even that average on account of the numerous gulches in the tract. (Hawaii Dept. of Survey 1909:14)

The 1910 U.S. Geological Survey map (Figure 10) shows a road in place at the Project area although no buildings are shown adjacent to the Project area.

In 1923, a fire destroyed most of Kapaʻa, however, residents worked together to rebuild the town (Fernandez 2009:51). Development within the Project area vicinity appears to have also begun during the reconstruction of Kapaʻa. A 1924 photograph (Figure 11) contains a description of the Project area as having been cleared "for future development" (Fernandez 2009:113).

A 1929 Sanborn Map (Figure 12) shows single family dwellings ("D"), most of which have garages ("A"), along "Beach Road," the current Moanakai Road. A 1945 Sanborn Map (Figure 13) still shows it as Beach Road, and CSH has not determined when the street name was changed. The literal translation of Moanakai is salt sea or salt ocean according to Andrews (1865:393).

A former resident of the Project area (Fernandez 2009:60) described Waikaʻea Canal, north of the Project area, prior to its channelization as a "pestilent swamp" that "was not a running stream" and was "bottled up by sand dunes and dead coral flung ashore by ocean waves." South of "this bog", in the location of the Project area,

> ….stretched sand dunes that continued until one came to the suburb of Waipouli. Sometime in the early part of the twentieth century, a developer replaced sand with bungalows. He planted rows of ironwood trees along the shore and exotic

> plants and flowers…it became home for the middle class families of Kapaʻa, including [the writer's] parents. (Fernandez 2009:61).

Based on this description, in addition to the maps and photograph of the area, the Project area and its vicinity were apparently not developed until the early 1900s.

4.5.1 Hawaiian Canneries Company, Limited

In 1913, Hawaiian Canneries Company, Limited opened in Kapaʻa at the site now occupied by Pono Kai Resort (Cook 1999:56), just north of Waikaʻea Canal and the Project area. A resident of Kapaʻa described how the town "came alive" after the cannery opened (Fernandez 2009:48). Japanese moved into town after they completed their plantation contracts and

> …opened mom and pop grocery stores. Portuguese opened dairy farms in the hinterland or repair shops in Kapaʻa. Former plantation laborers became farmers, raising pineapple and other crops for sale. Service businesses started: the slop-gatherer who came to homes to take the garbage as feed for his pigs, the fish monger selling fish on their street, the cattle rancher who slaughtered cows and provided fresh meat to the market, the traveling wagon man hawking fresh fruits and vegetables. (Fernandez 2009:48)

Kapaʻa became "an integrated multi-racial town, containing an extraordinary mix of people living and working together in harmony" all due to the new cannery (Fernandez 2009:48).

In 1923 Hawaiian Canneries Company, Limited purchased the approximately 8.75 acres of land they were leasing through the Hawaiian Organic Act (Hawaiʻi Bureau of Conveyances, Grant 8248). At that time the cannery only contained four structures but by 1956, 1.5 million cases of pineapple were being packed. By 1960, 3,400 acres were in pineapple and the cannery employed 250 full time and 1000 seasonal workers (*Honolulu Advertiser*, March 20, 1960). In 1962, Hawaiian Canneries went out of business due to competition from canneries in other countries.

4.5.2 Ahukini Terminal & Railway Company

The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Keālia, and Kapaʻa to Ahukini Landing and "provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet" (Condé and Best 1973:185). The company was responsible for extending the railroad line from Makee Landing, which was no longer in use, to Ahukini Landing, and for constructing the original Waikaʻea Railroad Bridge and the Mōʻīkeha Makai Railroad Bridge.

In 1934, the Lihue Plantation Company absorbed the Ahukini Terminal & Railway Company and Makee Sugar Company (Condé and Best 1973:167). The railway and rolling stock formerly owned by Makee Sugar Company became the Makee Division of the Lihue Plantation. At this time, in addition to hauling sugar cane, the railroad was also used to haul plantation freight, including "fertilizer, etc . . . canned pineapple from Hawaiian Canneries to Ahukini and Nawiliwili, pineapple refuse from Hawaiian Canneries to a dump near Anahola and fuel oil from Ahukini to Hawaiian Canneries Co., Ltd." (Hawaiian Territorial Planning Board 1940:11).

Former plantation workers and *kamaʻāina* growing up in Kapaʻa remember when the cannery sent their waste to the pineapple dump, a concrete pier just north of Kumukumu Stream by railroad. The structure is built over the water where the rail cars would dump the pineapple waste. The current carried the waste to Kapaʻa, where the waste attracted fish and sharks (Bushnell et al. 2002).

Lihue Plantation was the last plantation in Hawaiʻi to convert from railroad transport to trucking. "By 1957 the company was salvaging a part of their plantation railroad, which was being supplanted by roads laid out for the most part on or close to the old rail bed" (Condé and Best 1973:167). By 1959, the plantation had completely converted to trucking.

4.6 1940 to Present

Severe floods in Kapaʻa in 1940 led to the dredging and construction of the Waikaʻea and Mōʻīkeha Canals sometime in the 1940s (Hawaiian Territorial Planning Board 1940:7). The construction of Waikaʻea Canal, approximately 275 meters north of the project area, had been proposed as early as 1923 (Bureau of Land Conveyances, Grant 8248). A 1940 Master Plan for Kapaʻa requested that the Territorial Legislature set aside funds for the completion of a drainage canal and for filling *makai* and *mauka* of the canal (Hawaiian Territorial Planning Board 1940:7). In 1955, a report was published on proposed coral dredging for the reef fronting Kapaʻa Beach Park (*Garden Island Newspaper*, September 21, 1955). The coral was to be used for building plantation roads. This dredging was later blamed for accelerated erosion along Kapaʻa Beach (*Garden Island Newspaper*, October 30, 1963). Today, there are several sea walls along the Kapaʻa Beach Park to check erosion. Old time residents claim the sandy beach in Kapaʻa was once much more extensive than it is now (Bushnell et al. 2002).

Residents of Keālia Town slowly dispersed after the incorporation of Makee Sugar Company into Lihue Plantation in the 1930s. Many of the plantation workers bought property of their own and moved out of plantation camps. The plantation camps that bordered Kūhiō Highway were finally disbanded in the 1980s. The Lihue Plantation began to phase out in the last part of the twentieth century. Kapaʻa Town suffered after the closing of the Kapaʻa Cannery, however, the growing tourist industry helped to ease the economic effects of the cannery's closing.

Comparison of the 1929 and 1945 Sanborn Maps (see Figure 12 and Figure 13) shows the residential subdivision adjacent to the Project area was fully built out by the end of World War II. The 1963 USGS map (Figure 14) does not contain the level of detail as provided by the Sanborn Maps, however, buildings that are likely residences, are still shown adjacent to the Moanakai Road Project area.

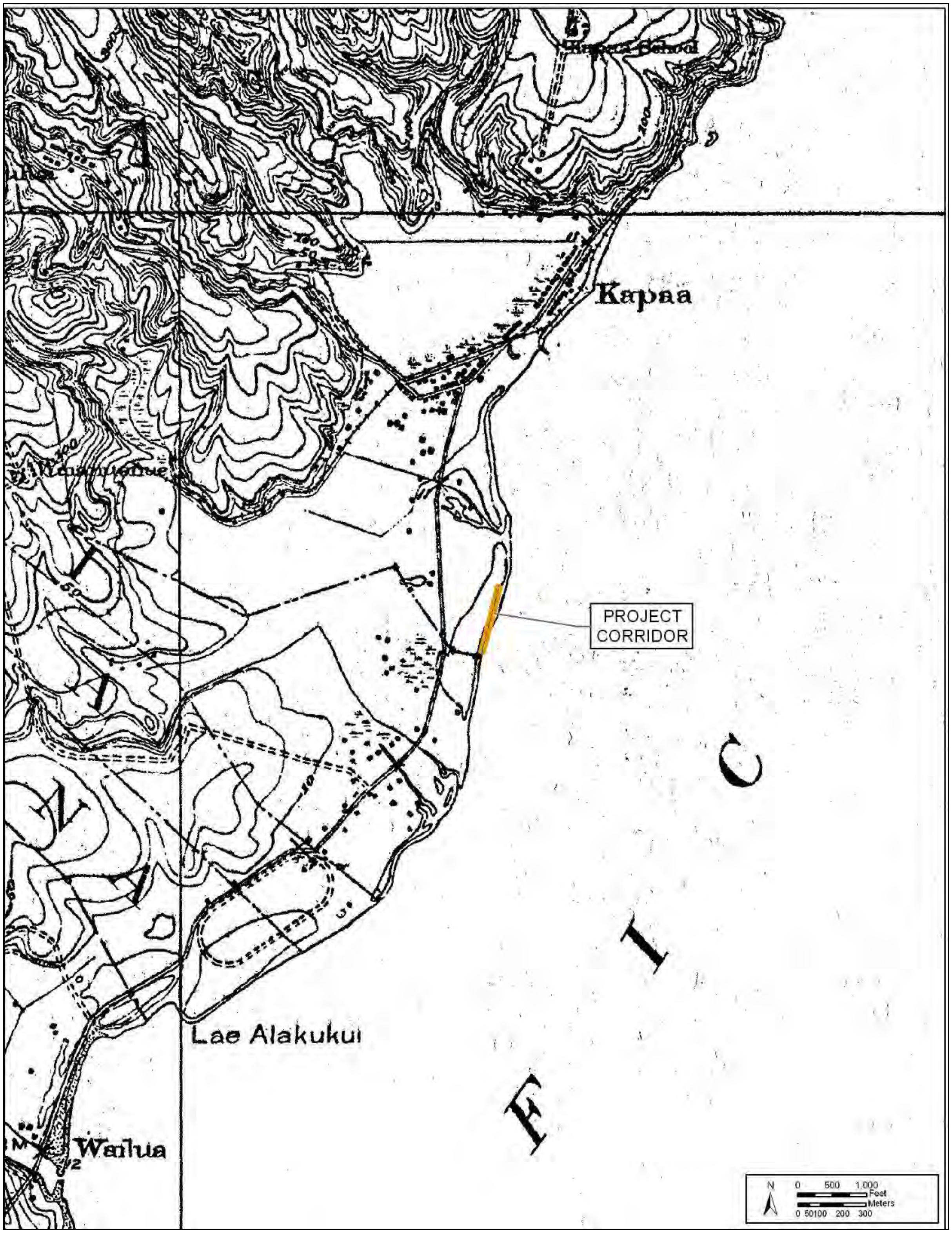


Figure 10. 1910 U.S. Geological Survey Kapaʻa quad map showing Project area

Figure 11. 1924 aerial photograph of Kapaʻa showing the Project area vicinity. The area is described as cleared "for future subdivision" (Fernandez 2009:113). Hawaiian Canneries Company Limited. is in foreground, *makai* of highway

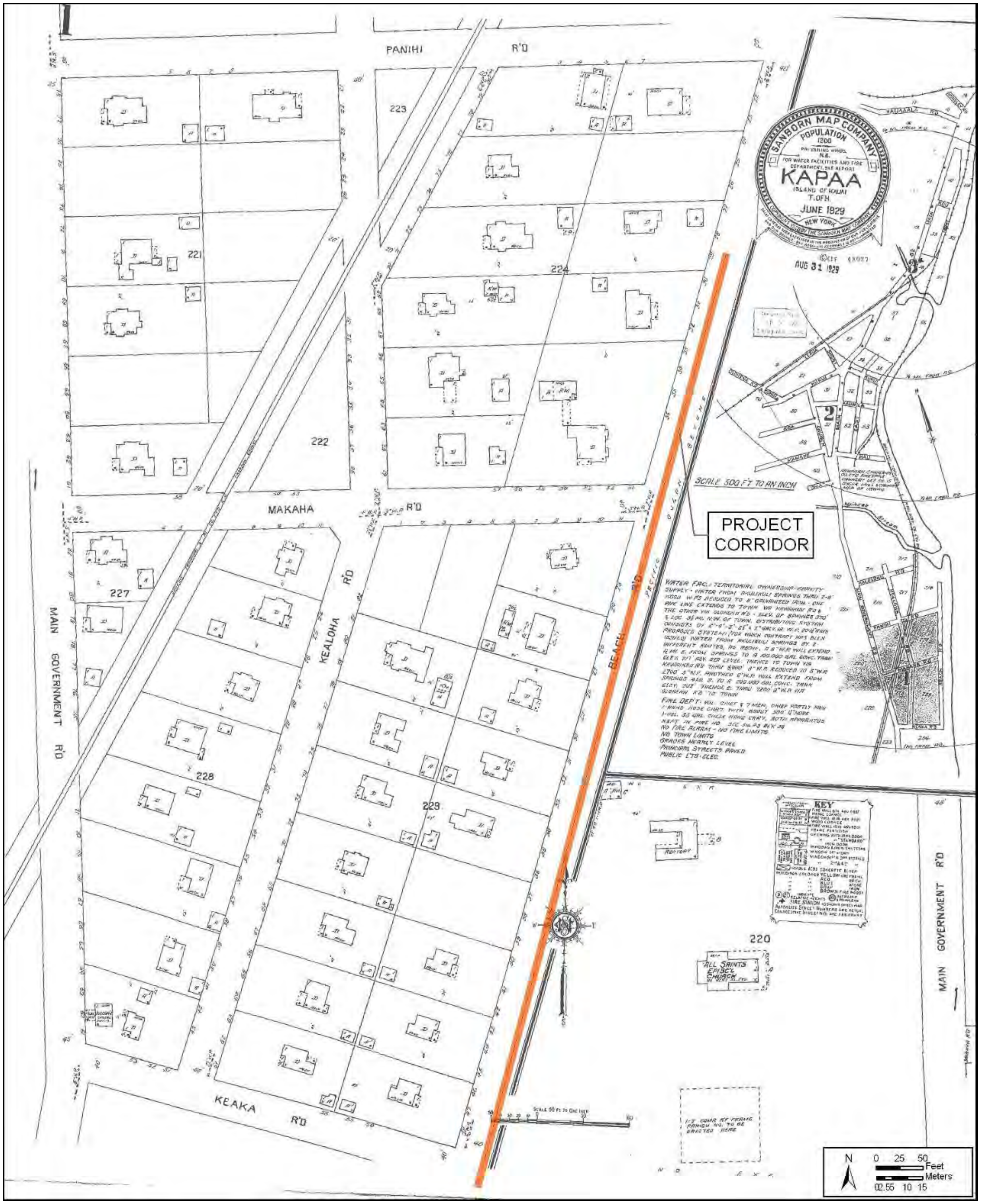


Figure 12. 1929 Sanborn Map showing the approximate location of the Project area and its vicinity

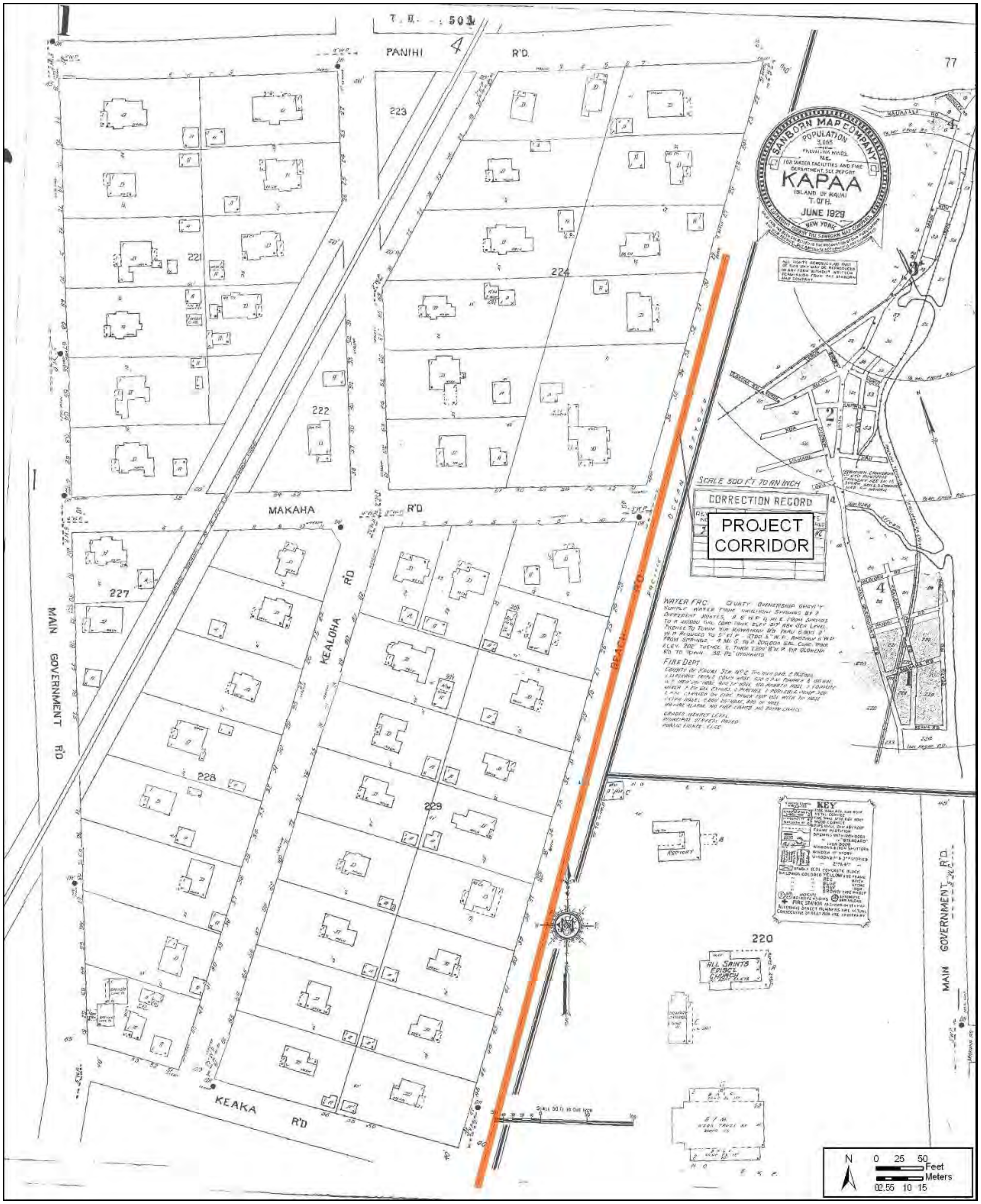


Figure 13. 1945 Sanborn Map showing approximate location of Project area and its vicinity

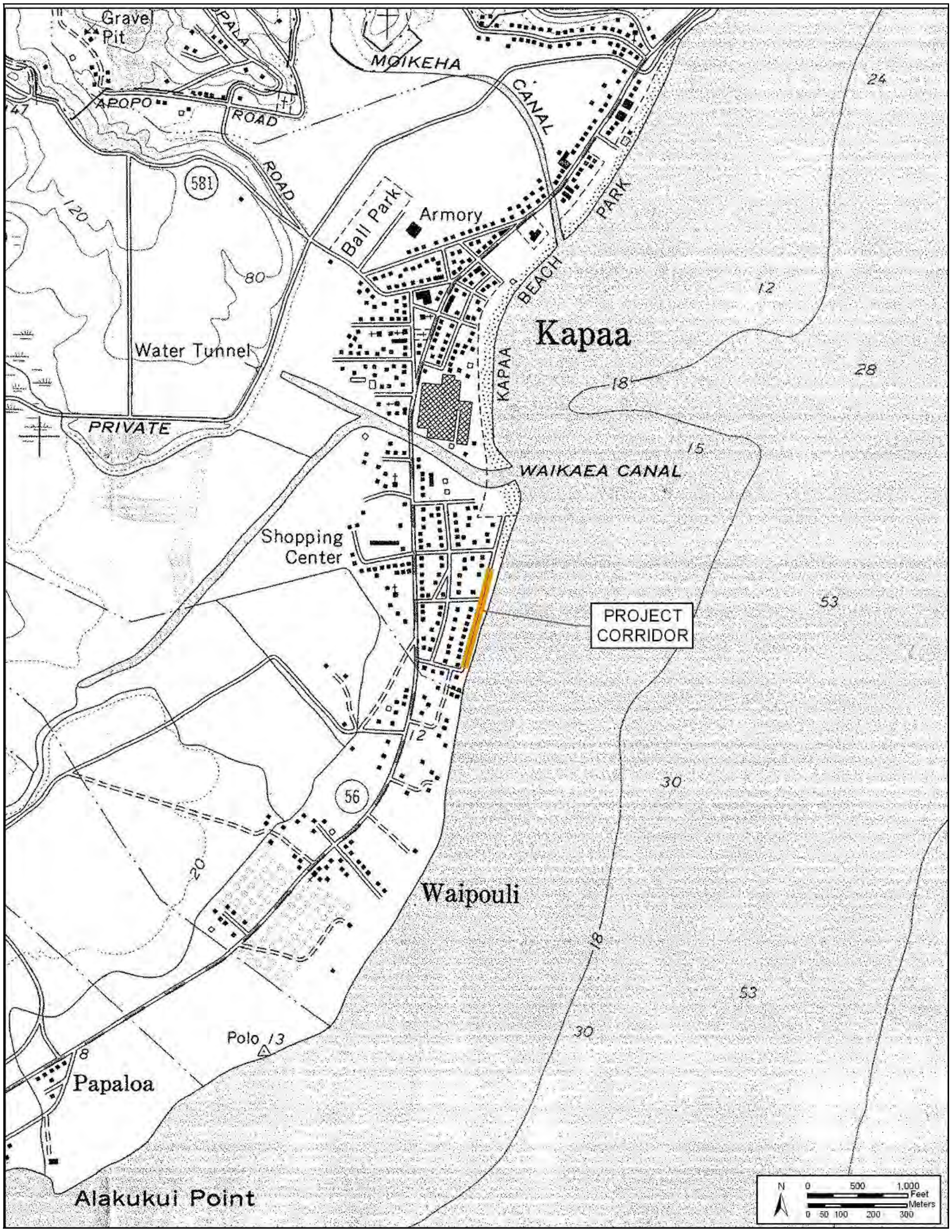


Figure 14. Portion of 1963 U.S. Geological Survey map, Kapaa Quadrangle, showing Project area and vicinity

Section 5 Archaeological Research

This section provides a summary of archaeological research conducted in and near the Project area. Archaeological research is intended to identify culturally important sites within or near the Project area that could potentially be impacted by the proposed Project.

5.1 Pattern of Archaeological Sites in Kapaʻa

The pattern of archaeological studies in Kapaʻa Ahupuaʻa is somewhat skewed, with a dozen projects in urban Kapaʻa Town and very little work along the coast (Table 3; Figure 15). Major archaeological sites have been found in the Kapaʻa Town area, including extensive cultural layers with burials and other cultural features underlying Kūhiō Highway near All Saints Gym and near the older part of Kapaʻa Town between Waikaʻea Canal and Kapaʻa Beach Park, *makai* of Kūhiō Highway (Hammatt 1991; Kawachi 1994; Creed et al. 1995; Jourdane 1995; Calis 2000). The *mauka* to *makai* extent of these cultural layers has not been clearly defined. These extensive cultural deposits associated with pre-Contact and early historic habitation are known to exist in a relatively narrow sand berm that makes up the physical geography of Kapaʻa.

Marshy areas are *mauka* of Kapaʻa Town, although most of the marshlands have been filled-in within recent decades. Five *kuleana* warded during the Māhele are located adjacent to the present highway. The more *mauka* studies (Spear 1992; Chaffee et al. 1994a, 1994b; Hammatt et al. 1994; McMahon 1996) are thought to be located towards the *mauka* fringe of the sand berm, approaching more marshy conditions and have generally reported no significant or minimal findings. Less than 1.5 kilometers to the south of Waikaʻea Canal is another extensive subsurface cultural deposit that is associated with a pre-Contact fishing encampment located at the southern boundary of Waipouli adjacent to Uhalekawaʻa Stream (Waipouli Stream) and the ocean (Hammatt et al. 2000). Many burials have been documented in Kapaʻa Ahupuaʻa (Table 4).

5.2 Previous Archaeological studies in Kapaʻa Ahupuaʻa

Working in the late 1920s, William Bennett, the first professional archaeologist to systematically survey Kauaʻi, listed only one site for the entire *ahupuaʻa* of Kapaʻa. The following is his description of the site:

> Site 110. Taro terraces and bowl. Back of Kapahi homesteads.
>
> In the foothills of the mountains are many little valleys which contain taro terraces. Single rows of stone mark the divisions with some 2-foot terraces. Under a large mango trees was found a bowl. (Bennett 1931:72)

Bennett (1931:73) also refers to "taro terraces and house sites" at Kapahi, approximately five miles *mauka* of the shoreline.

Table 3. Previous Archaeological Studies in Kapaʻa

Source	Location	Nature of Study	Findings
Bennett 1931	Island wide	Archaeological Reconnaissance	Identifies two sites: Site 110, taro terraces and bowl; and, Site 111, a large simple dirt Hawaiian ditch.
Handy and Handy 1972	Archipelago-wide	Native Planter study	Discusses a “highly developed irrigation system.”
Ching 1976	Just south of the Waikaʻea Drainage Canal	Archaeological Reconnaissance	No significant findings.
Hammatt 1981	Upland Kapaʻa (TMK 4-4-6-013:001)	Archaeological Reconnaissance	No significant findings.
Tomonari-Tuggle 1984	Mt. Wekiu - upland Kapaʻa (TMK 4-4-6-001:001)	Archaeological Reconnaissance	
Hammatt 1986	Upper reaches of the Makaleha Stream valley (4-4-6-001:001)	Archaeological Reconnaissance	No significant findings.
Kam 1987	Makaleha Stream (4-4-6-001:001)	Field Inspection	
Hammatt 1991	Along Kūhiō Highway	Subsurface Testing	Identifies two sub-surface cultural layer sites.
Kikuchi and Remoaldo 1992	Around Kapaʻa Town	Cemeteries of Kauaʻi	Identifies six cemeteries.
Spear 1992	South side Waikaʻea Canal, *mauka* of Kūhiō Highway. (TMK: 4-4-5-005, -004, -009)	Monitoring Report	Designated subsurface site 50-30-08-547.
Chaffee et al. 1994a	A house lot near the corner of Kukui and Ulu Streets in *mauka* Kapaʻa Town. (TMK:4-4-5-009:010)	Archaeological Inventory Survey	No significant findings.
Chaffee et al. 1994b	Māmane Street Kapaʻa Town (TMK:4-4-5-009:051)	Archaeological Inventory Survey	No significant findings.
Hammatt, Ida and Chiogioji 1994	Proposed bypass routes *mauka* of Kapaʻa Town	Archaeological Assessment	No new fieldwork, reviews literature.

Source	Location	Nature of Study	Findings
Hammatt, Ida and Folk 1994	South side Waika‘ea Canal, *mauka* of Kūhiō Highway (TMK:4-4-5-005:006)	Archaeological Inventory Survey	Weak cultural layer, designates site 50-30-08-748.
Kawachi 1994	Inia (Jasper)Street (TMK:4-4-5-008:033)	Burial Report	Designates site 50-30-08-871.
McMahon 1994	“Behind the armory in Kapa‘a near the godstones” and Buzz’s restaurant.	Documents second hand report of burials in two locations	Bones in three areas reported from behind the armory, 16 sets of remains reported from Buzz’s restaurant. No site numbers assigned.
Pietrusewsky et al. 1994	Kapa‘a Sewer Line	Osteological Study	
Creed et al. 1995	Kapa‘a Sewerline project, Kūhiō Highway, south and central Kapa‘a Town	Archaeological Monitoring Report	Documents cultural layer of site -1848 and (an enlarged) site -1849 and recovery of thirty burials at sites -867, -868, -871, and -1894.
Jourdane 1995	1382-A Inia Street, *makai* of Kūhiō Highway, central Kapa‘a Town (TMK:4-5-0-110:008)	Burial Report	Site 626
Hammatt et al. 1997	Kūhiō Highway Bypass, Wailua, Olohena, Waipouli, and Kapa‘a	Archaeological Inventory Survey	Four test trenches were excavated inland of Kapa‘a Town
McMahon 1996	South side Waika‘ea Canal, *mauka* of Kūhiō Highway (TMK:4-4-5-005:008)	Archaeological Inventory Survey	No significant cultural material.
Borthwick and Hammatt 1999	Kapa‘a Seventh-Day Adventist Church at 1132 Kūhiō Highway (TMK:4-4-5-003:019)	Archaeological Monitoring and Burial Treatment Plan	Monitoring was indicated as a parcel within the designated site 50-30-08-1848.
Bushnell and Hammatt 2000	Seventh-Day Adventist Church, *makai* of Kūhiō Highway, south of the Waika‘ea Canal (TMK:4-4-5-003:019)	Archaeological Monitoring Report	Minimal findings (one piece of worked bone).
Calis 2000	Kapa‘a Beach Park	Human Burial Removal and Archaeological Monitoring Report	Human Remains.

Source	Location	Nature of Study	Findings
McIntosh and Cleghorn 2000	398-acre parcel in Kapaʻa (TMK:4-4-3-003:005)	Inventory Survey	
Perzinski and Hammatt 2001	Kūhiō Highway on the margins of the Waikaʻea Canal	Archaeological Monitoring Report	No significant cultural material.
Bushnell et al. 2002	Proposed Kapaʻa-Keālia Bike Path, Kapaʻa and Keālia	Archaeological Inventory Survey	No findings within the vicinity of the current Project area.
Dega and Powell 2003	Kūhiō Highway from Moloaʻa through Hanamāʻulu	Archaeological Monitoring Report	Four postholes and one hearth were considered part of previously identified site –1848; one cultural layer with one burial was considered part of previously identified site 1849. Six burials were recorded under site number –868, 871, and 872.
Elmore and Kennedy 2003	Kūhiō Highway	Archaeological Monitoring Report	No significant cultural material.
Hammatt and Shideler 2003	Kūhiō Hwy. from Hanamāʻulu to Kapaʻa	Archaeological Assessment	No historic properties recorded in Kapaʻa Ahupuaʻa.
Terry et al. 2004	Waikaʻea Bridge (TMK 4-4-5-005, -006, -007, -009)	Monitoring Report	Five burials within four sites (-672, -673, -674, and -3894).
Van Ryzin and Hammatt 2004	Proposed sites (3) for new water reservoir (TMK 4-4-6-003:010)	Archaeological Assessment	No findings.
Mitchell et al. 2005	3.1 acre parcel (TMK 4-4-6-014:026)	Field Inspection and Literature Review	No findings.
O'Leary et al. 2006	Proposed soccer park in 11.5 acre parcel (TMK: 4-4-5-015:036)	Archaeological Inventory Survey	No findings.

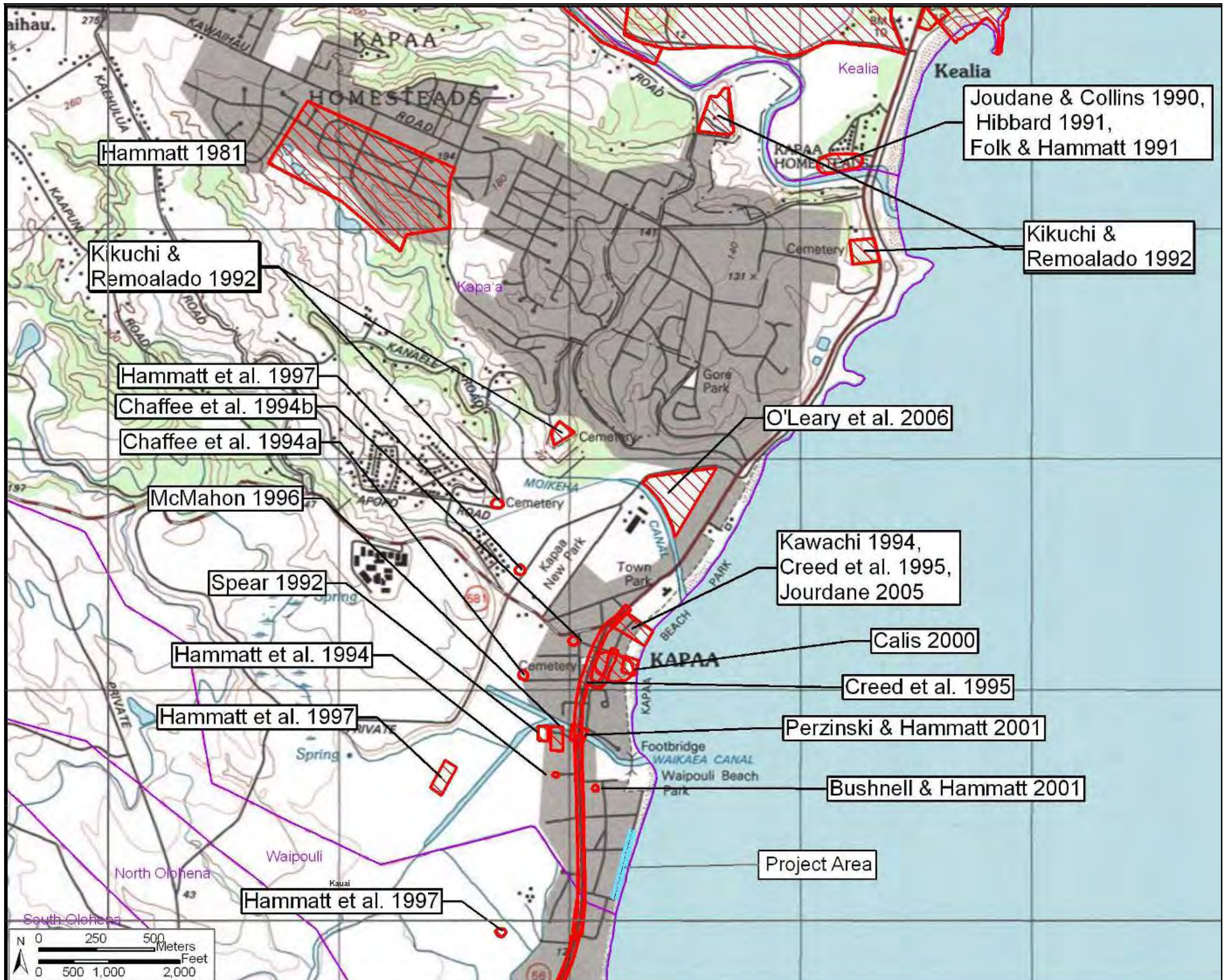


Figure 15. Previous archaeology studies near the Project area

Table 4. Burials Documented in Kapa‘a Ahupua‘a

Site Number 50-30-08-	Site Type/ Name (if any)	Location	Comments	Reference
B001	Historic Cemetery	South of bend of Kapa‘a Stream, a kilometer *mauka* from Kūhiō Highway.	Appears to be a discrete historic cemetery.	Kikuchi and Remoaldo 1992
B002	Historic Cemetery	Just *mauka* from Kūhiō Highway, south of Kapa‘a Stream.	Appears to be a discrete historic cemetery.	Kikuchi and Remoaldo 1992
B003	Kapa‘a Public Cemetery	South of Kanaele Road, approximately one kilometer inland of Kūhiō Highway.	Appears to be a discrete historic cemetery.	Kikuchi and Remoaldo 1992
B004	Historic Cemetery	North of Apopo Road, approximately one kilometer inland of Kūhiō Highway.	Appears to be a discrete historic cemetery.	Kikuchi and Remoaldo 1992
B013	Historic Cemetery	*Mauka* from Kūhiō Highway, north of the Waika‘ea Canal.	Appears to be a discrete historic cemetery.	Kikuchi and Remoaldo 1992
B014	All Saints Episcopal Church Cemetery	*Mauka* from Kūhiō Highway, south of the Waika‘ea Canal.	Appears to be a discrete historic cemetery.	Kikuchi and Remoaldo 1992:62-65
-547	Sub-surface features, including a fire pit and a possible house foundation	South of bend of Waika‘ea Canal, *mauka* of Kūhiō Highway.	Archaeological monitoring in the vicinity is recommended.	Spear 1992:3
-626	Burial	Inia Street, *makai* of Kūhiō Highway, central Kapa‘a.	Consultation and monitoring in vicinity indicated.	Jourdane 1995
-748	Minimal findings, a weak cultural layer	South of the bend of the Waika‘ea Canal, *mauka* of Kūhiō Highway.	Considered no longer significant within Project area.	Hammatt, Ida and Folk 1994

Site Number 50-30-08-	Site Type/ Name (if any)	Location	Comments	Reference
-867	One set of human remains	Kukui Street, just *mauka* of Kūhiō Highway, Kapa‘a Town.	Consultation and monitoring in vicinity indicated.	Creed et al. 1995:50
-868	One set of human remains	Lehua Street *mauka* of Kūhiō Highway, Kapa‘a Town.	Consultation and monitoring in vicinity indicated.	Creed et al. 1995:50
-871	Thirteen sets of human remains (Creed et al. 1995:50)	Inia Street, *makai* of Kūhiō Highway.	Consultation and monitoring in vicinity indicated.	Kawachi 1994, Creed et al. 1995:50
-1848	Cultural layer and sub-surface features	Along Kūhiō Highway between Wana Road and the Waika‘ea Drainage Canal	Archaeological monitoring in the vicinity is recommended.	Hammatt 1991; Creed et al. 1995; Dega and Powell 2003
-1849	Cultural layer and sub-surface features; Creed et al. 1995:53 expands boundaries to include burial sites: -626, -867, -868 -871, and -1894	Along Kūhiō Highway between Inia Street and Kauwila Street extending to the coast.	Consultation and monitoring in vicinity indicated.	Hammatt 1991; Creed et al. 1995; Dega and Powell 2003
-1894	Eleven sets of human remains	Ulu Street, just N of Kūhiō Highway, Kapa‘a Town	Consultation and monitoring in vicinity indicated	Creed et al. 1995:50

More recent studies have been conducted in the inland sections of Kapa‘a. Hammatt (1981) did not observe any archaeological sites during his reconnaissance of 52.56 acres of primarily *kula* land in upland Kapa‘a, nor were there any terraces or other sites apparent during a 1986 reconnaissance of the upper reaches of the Makaleha stream valley (Hammatt 1986).

CSH excavated test trenches and sediment cores for the Kūhiō Highway Bypass project (Hammatt et al. 1997). Three trenches were excavated in the Kapa‘a Marsh area near Waika‘ea Canal and one was excavated in Kapa‘a just south of the Mō‘īkeha Canal. In the Mō‘īkeha trench, the marsh soil was represented by Stratum II, a highly organic very dark gray clay loam. One soil sample yielded a radiocarbon date of A.D. 1660 to 1950. No burials or artifacts were found associated with this stratum.

Surveys of coastal areas have been more productive. In 1991 during subsurface testing for the proposed Kapa‘a sewer line, Hammatt (1991) obtained radiocarbon dates from a buried habitation deposit along ‘Inia Street, which parallels the beach *makai* of Kūhiō Highway. This cultural deposit was radiocarbon dated to A.D. 1435 to 1665. Archaeological work on the Kapa‘a sewer line (Creed et al. 1995) encountered 26 burials associated with habitation locations, which ultimately totaled 30 individuals in the sewer line corridor, within the sand deposits underlying Kapa‘a Town and Kūhiō Highway to the south.

Despite urban development, large areas of undisturbed subsurface sediments have been found to be present, presumably within areas adjacent to Kūhiō Highway and are associated with habitation areas (SIHP number 50-30-08-1848 and -1849). The *mauka* east and west boundaries of the latter site can now be extended in Kapa‘a Town to include a continuous stretch from ‘Ōhia Street eastward to Lehua Street. These sites are expressed as preserved pre-Contact A-horizon/cultural layers with artifactual and midden material, charcoal, and soil pits. On ‘Inia Street, small deep pits probably represent postholes of pole and thatch dwellings. Five radiocarbon dates ranging from A.D. 1165 to 1950 were recovered. Three dates were from the cultural layer of SIHP –1849, one from a burial pit on Ulu Street, and one from a pit feature on the corner of Lehua and Niu Streets. Two of these dates are well within the pre-Contact period: one from A.D. 1435 to 1665 and the other A.D. 1165 to 1400. Dega and Powell (2003:56) found additional features associated with previously identified SIHP –1848 and –1849, one was a fire pit dated to A.D. 1650-1810. All of these features were found in a segment that extended from Waipouli north to Olohena Street in Kapa‘a, along Kūhiō Highway west or well northwest of the current Project area.

The cultural layer, usually identified as Stratum II, was observed intact through long extensions of excavations. Stratum II survives as a buried A-horizon/cultural layer with variable amounts of midden, charcoal, and artifactual material. The lower portion of this stratum generally dates the pre-Contact period with mixing of historic materials in the upper portions of the stratum. It represents continuous occupation on a stable beach sand surface from as early as A.D. 1165. Major erosion or depositional events to interrupt this stability were not apparent in the stratigraphic profiles, such as storm surf, tsunami, and flood events. In almost all cases, burial pits could be traced to an origin somewhere in the Stratum II cultural layers. However, on ‘Inia Street, three burials occurred in pits that were sealed by sterile sand underling Stratum II and were probably slightly older. The five LCAs within Kapa‘a Town are all adjacent to the present highway. Perhaps, because of the narrowness of this sandy strip and limited land available for habitation, the human burials and habitation areas (cultural layers) are not separate entities.

Materials from the historic development of Kapaʻa town were observed in the trash pits from various localities in the present commercial district. Bottles and other historic materials were recovered associated with the clearing of debris after the December 22, 1923 Kapaʻa town fire, which affected more than 25 buildings along Kukui, Lehua, Huluili and Niu Streets.

5.3 Previous Archaeological Studies near the Project area

During the archaeological inventory survey for the Kapaʻa/Keālia Bike and Pedestrian Path project, CSH (Bushnell et al. 2002) conducted subsurface testing at the south end of Waikaʻea Canal, approximately 150 meters north of the current Project area. The area tested is known as the Boat Ramp or “Lihi” Park, although it is identified as “Waipouli Beach Park” on the Kapaa Quadrangle (see Figure 15). The need for testing was based on the previously identified buried cultural layers and associated burials found on either side of Waikaʻea Canal (50-30-08-1848 and -1849) in the vicinity of Kūhiō Highway.

Five trenches (Trenches 9 – 13) were excavated, and the stratigraphic soil sequence was primarily sand. Stratum I in all five trenches was sand or loamy sand and ranged in colors, depending on content, from browns to dark grays. Trenches 10 and 12 contained charcoal, modern trash, and some marine shell midden in Trench 10. The layer did not appear to be an intact pre-Contact (or early historic) cultural layer. Modern materials were mixed within these deposits and the charcoal and midden may be related to recent beach use (Bushnell et al. 2002:75).

Stratum II in Trenches 9, 10, 12, and 13 consisted of a sterile beach sand layer. There were intrusive pit features in Trenches 9, 12, and 13 that were a mixture of Stratum I and II and lacked cultural material. Mixed pit features in actively utilized beach sand areas are common and occur with typical beach activities.

Stratum II of Trench 11, the trench closest to Waikaʻea Canal, consisted of dark bluish gray clay that extended below the present water table level. This clay is likely from terrestrial soils deposited in a low energy environment. Waikaʻea Canal is a modern channelized drainage feature. However, Stratum II in Trench 11 indicates a broader estuary, or *muliwai*, for the Waikaʻea drainage prior to channelization (Bushnell et al. 2002:75).

CSH conducted archaeological monitoring after human remains were encountered during construction activities related to the installation of water main transmission lines adjacent to the Waikaʻea Bridge at Kūhiō Highway (Terry et al. 2004). Five partial human burials (SIHP # 50-30-08-672 [single adult], -673 [two juvenile burials, including a cultural layer containing small, yellow beads], -674 [single incomplete adolescent], and -3894 [single adult]) with associated cultural layers were documented. Waikaʻea Bridge is approximately 400 meters northwest of the current Project area.

Section 6 Community Consultation

6.1 Community Consultation Effort

An effort was made to contact and consult with Hawaiian cultural organizations, government agencies, and individuals with knowledge of and/or concerns about traditional cultural practices, resources, and beliefs related to the Project area. This effort was made by letter, e-mail, telephone, and in person. Initial community outreach letters, including a map and an aerial photograph of the Project area, were sent to community contacts. Letters provided detailed information on the purpose of the proposed Project, as well as the specific purposes of the cultural study. The following is a sample outreach letter:

> At the request of R. M. Towill Corporation, Cultural Surveys Hawai‘i, Inc. (CSH) is conducting a Cultural Impact Assessment for the Moanakai Road Seawall Repair Project, located in the Kapa‘a Ahupua‘a in the Kawaihau District, on the Island of Kaua‘i, on portions of tax map key (TMK) [4] 4-5-002:023 and an adjacent TMK with an undefined parcel number. The attached aerial photograph and U.S. Geological Survey map show the corridor of the Project area.
>
> The proposed Project involves the repair and/or reconstruction of the existing Moanakai Road Seawall which runs parallel to Moanakai Road between Panihi Street and Keaka Street. The seawall is approximately 1080 feet long; it abuts sand and ocean immediately to the east, and the shoulder of Moanakai Road to the west. Portions of the seawall have been damaged over time; therefore, construction activities for the proposed Project will involve the excavation of soil and sand in order to place and secure the seawall and footings. If required, it is possible that the entire seawall may need to be replaced based on the completion of a coastal engineering study. Construction activities associated with the seawall may also affect Moanakai Road and its infrastructure as the road shoulder is located immediately adjacent to the seawall in certain areas. The proposed Project may also involve the repair of sink holes along Moanakai Road that have resulted from heavy rains and high surf incidents.
>
> The proposed Project is intended to secure the seawall, and improve Moanakai Road to protect public health and ensure safety of the area from an otherwise faulty seawall.
>
> The purpose of this cultural study is to assess potential impacts to cultural practices, as a result of the proposed Project, in the Kapa‘a Ahupua‘a. We are seeking your *kōkua* and guidance regarding the following aspects of our study:
>
> - General history and present and past land use of the Project area.
> - Knowledge of cultural sites which may be impacted by future development of the Project area, for example, historic, archaeological, and burial sites.

- Knowledge of traditional gathering practices in the Project area, both past and ongoing.
- Cultural associations of the Project area, such as legends and traditional uses.
- Referrals of *kūpuna* or elders and *kama‘āina* who might be willing to share their cultural knowledge of the Project area and the surrounding *ahupua‘a* lands.
- Any other cultural concerns the community might have related to Hawaiian cultural practices within or in the vicinity of the Project area.

In most cases, individuals, organizations, and agencies apposite to the CIA were contacted following the mailing of initial contact letters via follow-up e-mails or phone calls to encourage participation. Due to time and budgeting constraints, attempts to contact non-responsive community members were abandoned. All community consultation efforts and results are presented in Table 5. Consultation responses and review letters from government agencies, such as DLNR/SHPD and OHA, are included in Figure 16 and Figure 17, respectively. Results of talk-story interviews, specifically relating to Kapa‘a Ahupua‘a and its vicinity, are presented in Section 7.

Table 5. Community Contacts and Consultation Effort

Name	Affiliation, Background	
Aipoalani, Clisson (Kunane)	Kauaʻi-Niʻihau Island Burial Council, Chairman	CSH mailed the initial contact letter on 04/09/2010. CSH did not receive a response.
Ako, Valentine	Fisherman and farmer	CSH staff, Margaret Magat, recommended Mr. Ako. Mr. CSH contacted Mr. Ako via telephone on 04/15/2010 after which he was interviewed on 04/20/2010. Refer to Section 7 for the complete interview.
Apana-Muraoka, Beverly	*Kumu hula*	CSH mailed the initial contact letter on 05/21/2010. Mrs. Apana-Muraoka contacted CSH by telephone on 06/22/2010 to comment on the Project.
Ayau, Halealoha	Hui Mālama I Nā Kupuna O Hawaiʻi Nei	CSH mailed the initial contact letter on 04/09/2010. CSH did not receive a response.
Bushnell, Andrew	Kauaʻi Health Heritage Coastal Corridor Committee	CSH mailed the initial contact letter on 05/21/2010. CSH did not receive a response.
Cataluna, Don	OHA Kauaʻi/Niʻihau, Trustee	CSH mailed the initial contact letter on 04/09/2010. CSH did not receive a response.
Cayan, Phyllis "Coochie"	State Historic Preservation Division (Oʻahu office) History and Culture Branch Chief	CSH mailed the initial contact letter on 04/09/2010. No answer was received so a follow-up letter was e-mailed on 07/01/2010. SHPD re-sent a response letter dated 04/19/2010. SHPD expressed concern about the probability of as-yet undiscovered cultural resources in the Project area despite previous development of the existing seawall. SHPD was also concerned about maintaining access to the ocean for cultural practices such as gathering, ceremonial and recreational uses. Finally SHPD expressed concernwith ground disturbance work that may uncover burials or burial sites particularly in the sandy areas of the Project area. SHPD made the following referrals: Barbara Say, John Cruse, Keith Yap, Kumu Hula Kehau Kekua, Kumu Hula Nathan

Name	Affiliation, Background	
		Kalama, Valentine Ako, and Sharon Pomroy. Though two referrals, Kumu Hula Nathan Kalama and Valentine Ako were contacted for this Project, the remaining referrals were not consulted due to receipt of this letter after the community consultation process was completed. Refer to Figure 16 for the letter from SHPD.
Hussey-Albao, Liberta	Queen Deborah Kapule Hawaiian Civic Club, President	CSH contacted Mrs. Hussey-Albao via telephone on 04/09/10 but she was off-island. CSH mailed the initial contact letter on 04/09/2010 but no response was received.
Kai, Keala	Kapaʻa resident	CSH contacted Mr. Kai via telephone on 04/05/2010. He recommended his uncle, Mr. Leslie Nunes, for the Project. Mr. Nunes was interviewed on 04/23/2010 at Mr. Kai's home residence in Kapaʻa. Refer to Section 7 for Mr. Nunes' complete interview.
Kalama, Nathan	*Kumu hula* (Hawaiian dance teacher)	CSH mailed the initial contact letter on 04/25/2010. CSH did not receive a response.
Kamae, Missy	Cultural Surveys Hawaii, Kauaʻi Office	CSH contacted Missy Kamae via telephone for referrals to *kūpuna* and *kamaʻāina* in Kapaʻa. She recommended Mr. Ako (who was interviewed by CSH, refer to Section 7 for the complete interview).
Kaneakua, James	Kapaʻa resident	Mr. Kaneakua was referred by Mr. Kaipo Akana. CSH contacted Mr. Kaneakua via telephone on 04/15/2010 and left a message with his wife. Mr. Kaneakua did not return the call so CSH made no further attempts to contact him.
Kaneakua, William, and Kaneakua, Anita B.	Fisherman and residents of Kapaʻa	CSH contacted Mr. Kaneakua via telephone on 04/16/2010 to set up an interview. CSH interviewed Mr. Kaneakua and his wife in Līhuʻe on 04/21/2010. Refer to Section 7 for the complete interview.
Kealoha, Keone	Mālama Kauaʻi, Executive Director	CSH mailed the initial contact letter on 04/09/2010. Mr. Kealoha did not respond.

Name	Affiliation, Background	
McMahon, Nancy	SHPD, Deputy State Historic Preservation Officer	CSH mailed the initial contact letter on 04/09/2010. CSH did not receive a response.
Nāmuʻo, Clyde	OHA, Administrator	CSH mailed the initial contact letter on 04/09/2010. OHA responded indicating concern with maintaining and controlling marine debris, pollutants, and any foreign matter that may be harmful to marine resources, water quality, and Hawaiian reef ecosystems, resulting from the proposed Project. OHA emphasized that the ocean is an extension of the Hawaiian people, therefore, taking care of Hawaiʻi marine resources is crucial. Finally, OHA recommended consultation with SHPD and with the Waipouli Neighborhood and Community Association. Refer to Figure 17 for the letter from OHA.
Nunes, Leslie	Fisherman and resident of Kapaʻa	Mr. Kai recommended his uncle Mr. Nunes after which he was interviewed at Mr. Kai's home residence in Kapaʻa. Refer to Section 7 for the complete interview.
Rogers, Puanani	Hui Hoʻokipa o Kauaʻi	CSH mailed the initial contact letter on 05/21/2010. CSH did not receive a response.

LINDA LINGLE
GOVERNOR OF HAWAII

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

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

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

April 19, 2010

LOG NO: 2010.1767
DOC. NO: 1002PC01007

MEMORANDUM

TO: Angela Fa'anunu, M.S.P.H.
Cultural Surveys Hawai'i-Hawai'i Office, P.O. Box 1114, ~~Kailua~~, Hawaii 96734

FROM: Phyllis Coochie Cayan, History and Culture Branch Chief *P. Coochie Cayan*

Subject: KAPA'A 8: A Cultural Impact Assessment for the Moanakai Road Seawall Repair Project, Kapa'a Ahupua'a, Kawaihau District, Island of Kaua'i.
TMK: [4] 4-5-002:023 and adjacent TMK with an undefined parcel number.

Mahalo for the opportunity to comment on a CIA for the Moanakai Road Seawall Repair Project in the Kapa'a Ahupua'a located in the Kawaihau District on the island of Kaua'i at TMK: [4] 4-5-002:023 and an adjacent TMK with an undefined parcel number.

While the project area has been previously developed there is always a general probability that some cultural resources remain unknown or unseen. There are cultural practices **in the general area** which include but are not limited to access to the ocean for gathering, for ceremonial and for recreational uses.

SHPD is also concerned with any ground disturbance work which may uncover burials or burial sites in sandy areas such as this project area (see separate comments from N. McMahon, Archaeologist). The department is mindful that traditional cultural access in the project area to cultural places and/or resources in the general ahupua'a and/or the ocean should also be considered in your study that may impact community as well as cultural practitioners.

The folks listed may have mana'o to share or refer you to others about the project area:

- Aunty Barbara Say, KNIBC — 296 Makani Rd. Kapaa 96746 — Phone: 808-821-0430
- John Kruse — P.O. Box 628, Koloa, HI 96756 — Phone: 808-241-6222
- Keith Yap, KNIBC — P.O. Box 1571, Kapaa, HI 96746 — Phone: 808-632-2543
- Kumu Hula Kehau Kekua — please ask Aunty Barbara Say
- Kumu Hula Nathan Kalama — please ask Aunty Barbara Say
- Mr. Val Ako, fisherman/kupuna — please ask Aunty Barbara Say
- Sharon Pomroy, farmer/fisher folk — Phone: 808-822-3231

Please do talk story with these folks and get information or referrals of any traditional or cultural practices in the project area. Any questions, please call me at 808-692-8015 or via email at Phyllis.L.Cayan@hawaii.gov

C: Nancy McMahon, State Archaeologist
All KNIBC members above

Figure 16. DLNR/SHPD response letter

PHONE (808) 594-1888 FAX (808) 594-1865

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

HRD10/4933

April 19, 2010

Angela Fa'anunu, M.S.P.H.
Cultural Research Specialist
Cultural Surveys Hawai'i, Inc.
P.O. Box 1114
Kailua, Hawai'i 96734

RE: Cultural Impact Assessment consultation
Moanakai Road Seawall Repairs Project
Kapa'a Ahupua'a, Kawaihau District
Tax Map Key: (4) 4-5-002:023

Aloha e Ms. Fa'anunu:

The Office of Hawaiian Affairs (OHA) is in receipt of your April 9, 2010 letter initiating consultation and seeking comments ahead of a cultural impact assessment (assessment) for the Moanakai Road Seawall Repairs Project. According to the information in your letter, the area of interest is about a 1080 feet long which abuts sand and ocean immediately to the east, and the shoulder of Moanakai Road to the west.

Your letter details that this project proposes the repair and/or replacement of the existing Moanakai Road Seawall between Panihi Street and Keaka Street. Based on the information within your letter, portions of the seawall have been damaged overtime; therefore project construction activities for the proposed project will include the excavation of soil and sand in order to place and secure the seawall and footings. OHA is concerned with maintaining and controlling the marine debris, pollutants and any foreign matter that may endanger or cause harm to marine resources, water quality and our fragile Hawaiian reef ecosystems. While OHA recognizes the need for upgrades and improvements to the Moanakai Road Seawall we strongly advocate for the protection of our ocean environment.

We seek assurances that best management practices will be implemented and employed during the proposed repair and/or replacement of the existing Moanakai Road Seawall Project to ensure the protection of marine resources and water quality.

Figure 17. OHA response letter

Angela Fa‘anunu
Cultural Surveys Hawai`i
April 19, 2010
Page 2 of 2

In traditional Hawaiian thinking, natural and cultural resources are one and the same. There is interconnectivity between all resources from the skies and highest mountain peaks, through the valleys and lava plains, to the shoreline and into the depths of the ocean. Hawaiian genealogical chants link man not only to primary gods and the deified chiefs born into the living world, but also to the stars in the heavens and the plants and animals on earth. The first and seconds chants of the sacred Kumulipo detail that in the darkness at the beginning of time were born the coral polyp, sea cucumbers, shellfish, and seaweeds, which were then followed by larger marine life.

With this in mind, it is important to acknowledge that the reefs and marine life found within the near and off shore waters of Hawai'i are not merely resources for man, but are the building blocks of life in the physical Hawaiian world. OHA continues to advocate for the preservation and protection of our cultural and natural resources. We respect the ocean as an extension of our Hawaiian people.

OHA recommends consultation be initiated with the community and neighborhood who may be willing to share their mana‘o regarding this assessment: the State Historic Preservation and the Waipouli Neighborhood and Community Association. We are also aware of the many ocean activities that occur in the Waipouli Beach area on a daily basis. These include many local recreational fishing boats that use the Waikaea Canal, Lihi Harbor, and individuals who access this area for subsistence fishing, swimming, and family recreation. Please know that this list is not all encompassing and we are sure additional individuals will be identified as you move forward with your consultation process.

Thank you for initiating consultation at this early stage and we look forward to the opportunity to review the completed assessment. Should you have any questions, please contact Kathy Keala at 594-0272 or kathyk@oha.org.

‘O wau iho nō me ka ‘oia‘i‘o,

Clyde W. Nāmu‘o
Chief Executive Officer

C: OHA-Kaua‘i Community Resource Coordinator

Section 7 Summaries of Kamaʻāina "Talk Story" Interviews

7.1 Overview

Kamaʻāina and *kūpuna* with knowledge of the Kapaʻa Ahupuaʻa and the area within the vicinity of the proposed Moanakai Seawall Repair Project participated in "talk-story" sessions for this CIA. The CSH approach to cultural impact studies affords community contacts an opportunity to review transcriptions and/or interview notes and to make any corrections, deletions, or additions to the substance of their testimony.

CSH employs snowball sampling, an informed consent process, and semi-structured interviews (Bernard 2006). CSH contacted nineteen individuals for this draft CIA (see Table 5 above); seven individuals responded of which four participated in formal interviews; one participant provided brief comments. At the present time, this individual has not yet provided permission to CSH to use the information; however, efforts to include it are ongoing, and the information will be included in the final version of this CIA, if available. CSH initiated the "talk-story" sessions with questions from the following five broad categories: Traditional and Customary Resources and Practices, Religious and Spiritual Resources and Practices, Freshwater and Marine Resources and Practices, Burials, Trails and Cultural and Historic Properties. Brief backgrounds of participants' "talk-story" sessions and their comments and concerns about the proposed Project area are presented below.

7.2 Acknowledgements

The authors and researchers of this CIA extend our deep appreciation to everyone who took time to speak and share their *manaʻo* (thought, belief, opinion) with CSH in talk story interviews and in brief phone, post, or email consultations noted in Table 5; including contacts who opted not to contribute to the current CIA, but nevertheless spent time explaining their position on the proposed Projects. We request that if these interviews are used in future documents, the words of contributors are reproduced accurately and not in any way altered, and that report preparers obtain the express written consent of the interviewees.

7.3 William Kaneakua

CSH interviewed William Kaneakua, hereafter referred to as Mr. Kaneakua, in Līhuʻe, Kauaʻi, on 04/21/2010. His wife, Anita B. Kaneakua, was also present and contributed to the discussion. Mr. Kaneakua was born in 1935 and grew up in Kapaʻa. His parents are James N. P. Kaneakua and Louise Kamanuwai. Mr. Kaneakua, along with his five siblings, grew up on Mamane Street on a Hawaiian Homelands lot granted to their grandfather, John ʻUmuʻiwi. He is of Hawaiian ancestry though did not grow up speaking Hawaiian. When he was a child, his family owned a lot opposite the Project area and he grew up fishing all along the coastal waters adjacent to the Moanakai Seawall. According to Mr. Kaneakua:

> This lot [at the corner of Moanakai and Panihi], this big square lot, we used to own this lot and it had a big yard. I was a small boy then and we had to go clean

> the yard. That was our lot. We had to sell it to help my brother…. That place was my fishing grounds…. That was our fishing grounds all the way up to Keālia.

Therefore, Mr. Kaneakua is intimately familiar with the Project area and its immediate vicinity and is knowledgeable of changes that have occurred at the Project area over time. Mr. Kaneakua shared his *mana‘o* with CSH staff.

Regarding place names and *mo‘olelo* associated with the Project area. Mr. Kaneakua explained that the ocean area directly adjacent to the northern end of the Project area is known as Baby Beach and also as Fuji *Beach*. He stated:

> This place here is Baby Beach [Figure 18]. It’s good for small kids because they’re protected from the reef. It’s also called Fuji Beach because Dr. Fuji’s office used to be across there in one of the side roads.

Figure 18. Baby Beach (Source: Angela Fa‘anunu)

Mr. Kaneakua also referred to the general area of the Project area as Waipouli. He translated the name to mean *wai* for “water” and *pouli* for “dark.” He described the vicinity of the Project area as a swampy place prior to recent developments, as reflected in the following excerpt:

> The general name of this place is Waipouli. *Wai* means water and *pouli* is dark. Actually, this is a swampy area you know. Even up to the shopping center was all swamp. Big Save was a swampy area. That’s why this canal is here. This contractor came down, dredged, and made this canal to draw all the water. The main road [that runs through Kapa‘a] was always there but all these lowlands over here was swamp lands.

> The Waipouli area used to be all Hawaiians. This lot used to belong to our family [on the waterfront over-looking the ocean]. Across from Baby Beach, you hardly have any of the original families. It's all *haole*s there now.

Mr. Kaneakua recalled frequenting the Project area as a fisherman since childhood. He attested to the abundance of fish, particularly of *kūmū*, *ʻāweoweo*, *uhu, kala*, *menpachi*, and *tako* in the ocean area adjacent to the Project area. He stated:

> That place was my fishing grounds. I used to go skin diving there. We'd fish for *kūmū*, *ʻāweoweo*, *kala*, and it was so plentiful, me and my friends would do color days. Today, we'd only catch red fish like *menpachi*. If it was *uhu*, we'd get red *uhu*. If it was *kūmū*, we'd get *kūmū*. Inside of the reef, we'd catch *tako* but we'd go skin diving in the outside. We'd skin dive most of the time. No lung, just natural diving. That was our fishing grounds all the way up to Keālia.

Mr. Kaneakua explained that the abundance of fish has decreased during his lifetime and attributed the change to the Hawaiian monk seal, an animal, he reports, that was not as common during his childhood times. He believes that the monk seal, sharks, and the shadow of kite surfers, scare the fish away, making it more difficult to fish, particularly, using throw-net:

> Nowadays, we don't have as much fish. I hate to say this and my *tūtū* [grandmother] told this to us too. I don't know what the big deal is about this Hawaiian monk seal. The Hawaiians never used to like the monk seal because they'd compete with them for the fish. They're fast. When I was growing up, there never were too many monk seals and when we'd see them, we'd chase them away. When you look at Hawaiian history, there were no *ʻaumakua* [family or personal gods] that were seals. Now they make up all these laws against netting and how we can't do this or that but this is our livelihood. They say, "Well, this is the Hawaiian Monk seal." But I was born and raised here and we always fished. Now the fish are all scared. Nowadays, you might as well just pack up your stuff and go home because the fish are scared especially when they see the shape of the kite surfers above them. It makes it harder to fish especially for throw net. The area also has plenty of sharks. Every once in awhile, you'll see a great white come into this area.

Mr. Kaneakua also reported that the seaweed, *limu kohu*, for making *poke* (raw fish dish), was abundant but has decreased due to larger populations of turtles. He stated that:

> Now, the seals eat all the fish. Now we also have plenty of turtles that eat all the *limu—Limu kohu*. The kind that you use to make the *poke*. The *ʻono* [delicious] one. It used to be plentiful but not so much now.

Regarding his knowledge of the history of Kapaʻa Ahupuaʻa and the areas surrounding the Project area, Mr. Kaneakua explained that Kapaʻa was known mostly for sugarcane and pineapple. A sugar mill was in Keālia, the next town north of Kapaʻa while the pineapple cannery was located in Kapaʻa, where the current Pono Kai Hotel is located in Kapaʻa town. Thus, sugarcane and pineapple were cultivated throughout Kapaʻa. Mr. Kaneakua explained:

> Kapaʻa was known mostly for sugarcane and pineapple. The mill was in Keālia, the next town over. They’d grind the sugarcane over in that mill. From Keālia side, that used to be all sugarcane and all the way up there. The sugarcane was all up. You know Wailua? You know the sleeping giant? That lower parcel from Wailua was all sugarcane. Where the Kapaʻa Bypass Road is now, that was all sugarcane. You go all the way up to Keālia, part of the lower land and high lands was all pineapple.
>
> They had a pineapple cannery right in the heart of Kapaʻa where the Pono Kai is right now. That was the cannery until 1979. When it came down, Pono Kai went up. People used to use the cannery warehouse for parties. I have a picture of the last party they had in the cannery. It was for mama guy’s fiftieth anniversary. That was the last party in that place. My first son had his birthday party in there. The cannery shut down because it couldn’t make any money.

The mill and cannery provided jobs for Kapaʻa residents and for children during the summer time. Mrs. Kaneakua worked for the cannery trimming the prickles off the pineapples while Mr. Kaneakua picked pineapples in the field, and worked in the cannery checking all the cans. Both Mr. and Mrs. Kaneakua spoke fondly of their experiences with the cannery:

> In 1966/67, it was a dollar and a quarter an hour working in the cannery. But you know, we were happy because that was a good job. In the summer, we’d work to pay for books and all that kind of stuff for school so working at the plantation helped…. It was honest work. Everybody looked forward to the summer. I don’t think the kids deserve that seven dollars something an hour they make now. The pineapple fields— that was blood money. That’s what we called it because you know how the pineapples have thorns and all. We’d go harvest pineapples and the boom would come out and we’d throw them [the pineapples] into the truck. We’d have to go fast. It was hot. It was fun. It was good working there. A lot of locals worked there. When the kids came home from school, they’d have a job in the cannery and in the plantations. They would weed the sugarcane with *sabidong*—a big can of poison that they’d carry on their backs and spray the weeds. It killed the weeds in the cane fields not knowing that all that would be going on our land. It killed a lot of herbs that we used for medicine.

Mr. Kaneakua also explained that railroad tracks were built in Kapaʻa for the sugar industry and described how the tracks were built throughout Kapaʻa. The tracks are still evident today as shown by remnants of a railroad track in Figure 19, located near the public library in Kapaʻa. According to Mr. Kaneakua, the railroad track ran behind the lot that his family used to own near the Project area. He stated:

> The railroad went over that canal [by the public library]. We used to go catch *ʻoama* [young *weke* or goatfish] there in the summer time. There were tracks that went all the way to the mill in Keālia. It was for sugar. One track went up to the back and the mountains to the fields. There were several tracks over here. They’d bring the sugarcane down here, store it over here, then they’d empty the cars and pull them back up. The tracks came all along the shoreline. The tracks came down

> from town along the shore towards Waipouli. It came right behind our lot by the ocean [approximately a block away from the Project area]. Before, the trains needed water for steam yeah? They’d stop for water.

Figure 19. Railroad tracks near the public library in Kapa‘a (Source: Angela Fa‘anunu)

The plantations also brought many cultures to Kapa‘a. According to Mr. Kaneakua, the workers at the cannery, sugar mill, and plantations were of many cultures. He marveled at the manner in which workers of different cultures were able to get along but stated that it was different with the *haole* (white person, Caucasian). He believed that it was difficult with the haole because they (*haole*) wanted to change the other cultures. Mr. Kaneakua seemed worried that the younger generations have accepted the *haole* ways. Mr. Kaneakua shared his sentiments:

> Across from Keālia Beach was all plantation houses. That’s where the workers used to stay. They were Filipino, Chinese, Portuguese, Hawaiians. Funny how we got all these nationalities and we’re able to live together next to each other. You know the only one that we can’t live together with? *Haole*. Why? Because everybody has a culture except the *haole*. Hawaiians have a culture, Filipinos have a culture. Everybody respect each other’s culture but they [*haole*] don’t. They come here and they want to change everything. Our young generation. They like what’s going on. Our own grandchildren have accepted all that. I talk to my children and my grandchildren but I can talk all I like but it’s up to them.

Rice was also cultivated by the Chinese in the lowlands near Wailua. Though Kapa‘a area was swampy, Mr. Kaneakua claimed that *lo‘i* were not prevalent because *lo‘i* need running water whereas the swamps of Kapa‘a were stagnant. Mr. Kaneakua explained:

> The rice was more Wailua side. You know where Coco Palms is? The flat area was all rice patties. The Chinese worked the patties. They used to have a stand in

> the middle of the field and from the stand, they’d be connected to other stands. When they’d see the birds come eat the rice, they’d pull the string connected to the stand to scare the birds away. Waipouli used to be all swampy. When they drained the swamp through the canal, then they started developing that area. They never planted *lo‘i* over there. Even though it was swampy, the water was stagnant and you need running water for *lo‘i*. Hanalei and Hanapepe were where the *lo‘i* were.

With regards to Native Hawaiian cultural practices, Mr. Kaneakua stated that he continues to practice *lā‘au lapa‘au* (traditional plant medicine) using leaves from the *ahupua‘a* of Kapa‘a. However, he claimed that the native plants, used in *lā‘au lapa‘au* such as *pōpolo* and *‘uhaloa*, once abundant in the area, are difficult to find in Kapa‘a today. He believes invasive plants as well as the use of pesticides during plantation times have killed many of the useful plants. According to Mr. Kaneakua:

> A lot of plants that we used to use, we don’t see any more. They sprayed a lot of pesticide so it killed plenty of the good herbs. Like *pōpolo*. It’s hard to find *pōpolo* nowadays. You see this grass over here? Guinea grass. It never used to be like that. It came in and choked out all the plants.

Mr. Kaneakua shared common traditional Hawaiian remedies that he practices on his children and grandchildren. He explained the use of specific plants, the ailments they cured, and how they were prepared. The plants included *pōpolo, ‘uhaloa*, *kukui*, *‘ōlena*, and plantain. He shared the following:

> We use *pōpolo* for the kids when they have colds and get congested. It helps get out the mucus. You just get the younger leaves and pound them up then you squeeze out the juice. You can eat the berries. It’s not poisonous. There’s two kinds. There’s white and purple. These researchers came and told us that it’s poisonous and we’re like. “Eh, we’re still alive!” The research was not correct.
>
> *‘Uhaloa*—That plant used to grow. We use the root. We’d scrape the outside then pound it up and you could either make tea with it or chew it like chewing tobacco when you have a scratchy throat. It’s kind of bitter but it works. There used to be plenty all over here. Now, I go all over and can’t find it.
>
> *Kukui* nut—we’d use it for colds. We use the sap but we also use it for oil. When babies get cold sores in the mouth, Hawaiians call it *peha*. It’s like a cold sore or something in the mouth.
>
> *‘Ōlena*—we use it for ulcers and ear infection. I got a nephew and at one time he had an ear infection that smelled bad. He went to the doctor who gave him western medicine. It didn’t work. He was still suffering. His ear was always running. So then my nephew called me, “Uncle, oh man, I get one earache no can take. Night time, no can sleep. I went doctor but no work.” So, we got *‘ōlena*. You see, with *‘ōlena*, you have to grow it in a container otherwise they’ll run away. It’s like ginger. It travels. We always had *‘ōlena*. I pounded it up and took a couple more to give him and tell him to get a dropper and put five drops in the

> ear. It's supposed to relieve and clean the infection. I told him to go to the doctor and check it out [his ear]. It never bothered him after that.
>
> Plantain—used to be planted and when we'd need them, we'd use the leaves. We used it for boils. Sometimes when you open up boils they give you a scar, yeah? Boils start off from one boil and then the eye comes out. When the boil is kind of ripe you put on a bit of Hawaiian salt then wrap it up with the plantain leaves. The boil is not going to heal until you pull out the root and there's a big hole. But when you do it this way, there's no scar.
>
> We also used the heart of the banana for colds.

When asked about the presence of *heiau* within the Kapaʻa Ahupuaʻa, Mr. and Mrs. Kaneakua stated that none existed in Kapaʻa. However, they believed that the area including the Project area and towards Wailua, may consist of burials. When asked about the likely presence of burials in the immediate vicinity of the Project area, Mr. Kaneakua responded:

> You know what they're gonna come up with? Bones. Oh yeah, this area [Project area] may have burials. Up to where they made the new hotel, by Safeway and all the way up to Wailua. You go through here [area including Project area to Wailua] you're gonna find [bones]. Guarantee. The battleground is where the Safeway is, where the new hotel is now. You start from there all the way across to Wailua. I don't know what battle but it's known as the battleground. I was told that Kamehameha came over and the King of Kauaʻi at the time, King Kaumualiʻi, didn't want bloodshed so they didn't fight.
>
> When I was young and fishing over there, sometimes the sand would erode and you'd see bones. Summer storms carry the sand this way and come back this way. You know, the ocean takes back too. There's no Hawaiians living over there [along the shoreline]. There's a reason why. Hawaiians never used to live over there because when the big storms come, the front would get wiped out. It [the ocean] claims what belongs to it.
>
> Hurricane ʻIniki [in 1992] was the worst one. We had gas tanks so we could cook. When disasters strike, everybody comes together eh? We share. You pick up the pieces and start over again. For some reason, our telephone was working. So, we had our phone outside on the porch and anybody who wanted to call their family could use the phone. That's what we do. We never had traffic lights. The traffic was perfect. People communicated. Once they put in the traffic lights, people get aggressive. During ʻIniki, big waves came over on the south side. It was bad over there. A lot of houses there were wiped out.

Mr. Kaneakua also shared stories from his family associated with the Night Marchers. He explained that his mother and his grandmother used to see the ancestors marching. He described:

> *Po*—That's the darkest night and that's when the ancestors march. Always to the ocean. My mom used to tell us, she used to stay outside and she'd see our ancestors march yeah? Her *tūtū* would tell her to "go down." My mom said

> somehow she could see because my great grandma was psychic or something like that and that she was powerful but in a dark way. She heard that my mom had that foresight—that she could see.

Regarding the Menehune, Mr. Kaneakua stated that none were in Kapaʻa—that they were mostly in the Waimea area.

7.4 Leslie M. Nunes

Born in 1933, Mr. Leslie M. Nunes was born and raised in Kapaʻa. His father was originally from Portugal but lived in Kapaʻa while his mother's family was originally Chinese although she was born and raised in Hanalei. His grandfather came to Hanalei when it opened up for rice farming but his Chinese ancestors initially landed in Maui in the 1800s. Mr. Nunes grew up in Kapaʻa behind the Bank of Hawaiʻi building currently located in Kapaʻa town, not too far away from the Project area. He attended Kapaʻa Elementary and Kapaʻa High School. He joined the National Guard as a teenager then the Coast Guard and eventually became a Merchant Marine. Mr. Nunes is an experienced fisherman who frequently fished in the ocean areas adjacent to the Project area; thus, he is extremely familiar with the Project area. In addition, his lifetime experience of living in Kapaʻa and growing up as a child during World War II, provided him with a wealth of knowledge of the Project area and Kapaʻa Ahupuaʻa in general. The following section summaries the *manaʻo* that he shared with CSH staff.

Mr. Nunes spoke of the natural landscape of the area in the immediate vicinity of the Project area, particularly of the residential houses adjacent to Moanakai Road and Baby Beach. He pointed out that residential homes in this area still have underground cesspools for sewage disposal and voiced concern over the possibility of contamination, especially at Baby Beach. He stated:

> You know that portion of the highway [Moanakai], all the people who live there still have the same type of underground cesspools. I don't know how often they take out the waste from there and I don't know if there's bacteria or anything that gets into the ocean. You look at Baby Beach, the majority of babies go over there at low tide. All that waste goes out there. That's why the Hawaiians, the ones with plenty kids, they don't bring their kids there to swim because all those cesspools leak.

Mr. Nunes reminisced about fishing on the reef near the Project area since his childhood days. He recalled an abundance of reef fish including the unicorn fish, *manini*, *kūmū*, *ʻuhu*, and *tako*.

> I used to throw net as a small kid, dive, all that. I used to get all kind of fish. Unicorn, *manini*, *kūmū*, all the reef fish, *uhu*, *tako*. Plenty *tako*…. We still have fish but it's not like before.

He also remembered an abundance of the seaweed *limu kala* (seaweed that the unicorn fish would feed on) but reported that the reef has changed and is devoid of the seaweed now. He reminisced:

> I remember back in my young days, the reef over there had a lot of *limu kala*, you know, the unicorn fish. Now you walk on the reef, it's just like Clorox or something went on there. There's no more *limu kala*. That's the seaweed that the unicorn fish used to feed on.

Mr. Nunes believed that windsurfing, a sport that has recently become a predominant activity near the Project area, negatively impacts the feeding cycle of fish in the area. He believed that the shadow of the windsurfing kites scare the fish and prevent them from their normal feeding habits. He explained:

> In due time too, you know what's gonna jam up the reef too? The windsurfers. You know why? The fish now don't have the time while they're feeding. They see the shadow and they hide. They've stopped the cycle of feeding. One time I couldn't even bring in one *kala*. The thing is like a razorblade-so skinny. Baby Beach, all down over there, windsurfers. Sometimes they come up here, up north.

Mr. Nunes also spoke of other changes to the shoreline further north of the Project area, particularly with regards to erosion and the loss of sand. According to Mr. Nunes:

> The place that was really sad was where the old Hawaiian Cannery used to be. In the back there, there were rows of pinewood trees. Plenty. Now, that's where all the erosion is. When I was a young boy, I used to go diving over there. We had so much sand. The reef is not like now where you gotta swim way out to get out where the reef starts. In my time, it wasn't that far because there was a lot of sand and then you'd just walk out and then dive. There was all this sand in all of Kapaʻa. Never had any erosion. All the way back to the swimming pool [Kapaʻa community pool]. No erosion.

Mr. Nunes believed that the erosion started when the reef was dredged to provide the plantations with aggregate for building roads.

> [The reef was] dredged for the plantations. Aggregate. The plantations were using that for roads. For sugar. They were taking that to build. Yes, the Big Four, the Big Five. They were taking that…. When they had all the reef, when it wasn't dredged, they had a pumping station over there. I remember there was no erosion there. When it was high tide, all that water came down and went on the reef. Now, at the place that they dredged, the water comes down faster and that's how I think it erodes.

Mr. Nunes suggested installing a barrier to slow down the water pressure over the reef and slow down erosion. He stated:

> I was telling the guys, what they should do to slow down the erosion [is that] they should put out one rock [out there] to slow down the process of the water that's coming over the reef so that inside here, it'll be more quiet. Yeah, that's what I think. You try and go stand at high tide by the mouth of that dredge, especially when it's really rough, you can feel the push.

Regarding the era of plantations, Mr. Nunes explained that Kapaʻa was known for the pineapple cannery which provided jobs for many children during the summertime.

> Kapaʻa was known for the pineapple cannery, where they hired about a thousand kids during the summer, all in the back of Keālia. That was all pineapple too and sugarcane. Keālia Kai, all over there was all sugarcane. The only thing Kapaʻa had was a lot of sugarcane fields.

Rice was also reported to be grown in Kapaʻa towards Wailua. Though taro was grown, it was at a smaller scale due to water limitations. Taro is currently grown predominantly in the northern part of the island, such as Hanalei, where the climate is wetter. Mr. Nunes explained:

> In the back of Coco Palms, all over there on the right side, that was all rice. It was very wet. Then after that, there was taro but [it was] taro Hawaiians used to plant on their own…. They say that the law of the land is that the water is for everyone. But, all the *haole*s come, they buy all the land up there, and they control the water. What about the taro farmers? They have *loʻi* in Anahola and Koʻolau. All the way up there in the back, they had that too. The biggest one [*loʻi*] now is only Hanalei. That's the main thing, for taro, you gotta have a lot of water.

Mr. Nunes also described the orientation of the railroads throughout Kapaʻa and Keālia, the next town north of Kapaʻa, which were built to cater to the plantations. A railroad track used to run behind the Project area according to Mr. Nunes:

> There were railroads all in the back up here behind Kapaʻa Ball Park. The walking path, that's where the rails started from Keālia. The bike path. All in there, that used to be the railroad track. It came all the way down here to Waikaʻea Canal, to Waipouli, then it cut across the highway [right behind the Project area]. There were two or three different tracks. The crossing was right across at Waipouli, then it went down to Coco Palms where it cut across the bridge to the other side and went to Hanomalo. That was for sugarcane. After that, they changed over and bought trucks—big diesel trucks.

CSH staff asked Mr. Nunes about the presence of *heiau* and sites of cultural significance in Kapaʻa Ahupuaʻa. He responded that:

> The *heiau* is only at Poliahu [in Wailua river valley] but who knows. Like Hāʻena, that place is terrible. When I go by there, where Wai ka Pele is—the cave, I walk straight out there to get *limu* in the morning and I feel something. Early in the morning. All by myself. It feels like somebody is looking at me. You have a funny feeling. When I'm getting *limu*, out there, I don't feel anything but when I come through there again, I feel the same thing.

With regards to burials, Mr. Nunes expressed that Kapaʻa has many burials and spoke of his personal experience of discovering human remains in the area. He stated that burials may be found at the Project area as burials have been found in the surrounding vicinity. He stated:

> There's burials all as far as that Marine camp and even Waikea. I was telling him [Keala Kai], I was picking up skeleton remains when they were digging that

> canal. Yeah, the first one right by Kapaʻa Ball Park. There was one [human remains] right there so I went and saw the guy at the Hawaiian church and talked to the Hawaiian man. He said, "Pick up all the bones and put them in a box." Skull, beautiful teeth. No cavities. Man, I tell you. I held the head and everything but my friend played with the thing. He started pulling out the teeth and fooling around. They were digging over there, you know, and they were going to make that canal. They started digging and I saw it. So I took it to the Kapaʻa Pavilion over there and dug one hole and just said a little prayer. Nobody saw me. I prayed that, "I hope you don't bother me. I'm doing something good for you—putting you in a better place." It never bothered me.
>
> I would think even around over there [Project area] would have bones. The construction guys, they don't care. Not like now, people are more up to that. Right across where the hotel, they found all the *iwi* over there too eh? Across from Longs. All over there. So, it's very likely that there's burials. Every house that lives along the coast over there, they're gonna find bones.

7.5 Valentine Ako

Mr. Valentine Ako is an 84-year-old man of Native Hawaiian ancestry, born in 1926. Though he was born and raised on the Big Island, Mr. Ako has spent the majority of his life in Kapaʻa where he has lived for approximately 57 years. Mr. Ako moved to Kauaʻi after meeting his wife. They have three daughters and one son.

During his childhood, Mr. Ako attended elementary school in Kailua, Kona, then advanced to high school at Konawaena High School on the Big Island. He became a fisherman in order to support his brothers and sisters through school. He was drafted to the Merchant Marine in the Pacific at the age of twenty-four and spent many years working on ships. In Kauaʻi, Mr. Ako worked for several resorts such as Coco Palms and Waiohai. As a Native Hawaiian field staff, he was often responsible for taking care of the *iwi* and items of cultural importance found on the properties.

Mr. Ako is an experienced fisherman and taro farmer who makes his own *poi* and *kūlolo* (pudding made of grated taro and coconut cream). Combined with his life experience of living in the *ahupuaʻa* of Kapaʻa, Mr. Ako possessed a wealth of information and cultural knowledge pertaining to that area. He shared his *manaʻo* with CSH staff.

Mr. Ako shared his experience of fishing in Kapaʻa. He spoke of the abundance of *weke ula* and attributes the depletion of ocean resources to the Hawaiian monk seal, as well as the introduction of invasive species like the *taʻape* (*Lutjanus kasmiri*) and *roi* or peacock grouper. He stated:

> Over here we've got tons and tons of that red *weke*. They call it *weke ula*. Out here. I used to go catch them. We'd catch *weke* with deep-sea net. We fished all over here but what's really depleting our oceans are the seals. The *haole*s talk about them as endangered species but they're the ones eating all our fish. They're eating all the lobsters. Another thing that was brought in from Tahiti was the

> *ta‘ape*. We used to have plenty of *kona* crab. It’s the *ta‘ape* that’s eating all the baby crabs. When they first brought it, I was working for the [U.S.] Fish and Wildlife. Another fisherman and I opposed it. We said, “No, you’re gonna spoil our fishing grounds.” But we were not the majority so they brought them in anyway. I know who brought them in. They also brought in the *roi*. That *roi* gets all ciguatera. The *haole*s, they don’t eat the [reef] fish but that’s our livelihood. My [own] children are spoilt. They only like tuna and *mahimahi*. They don’t like the bones [of the reef fish].

Mr. Ako expressed that times have changed. He spoke of a time when the *akule* would frequent Wailua, south of the Project area. He explained that the ways of fishing have changed and that people today are more selfish because of the value of money placed on fish. He also explained that people nowadays are lazy—that they would rather buy *kūhonu* from the supermarket than fish for the crab themselves. The following excerpt tells his thoughts:

> It’s so different today. The *kūpuna* before, in the Wailua area where they’re building the big bridge, they used to have *akule* come inside. There’s an old saying that the *akule* have ears, have eyes, and they know when people are fighting. In the old days when they used to fight, they’d have *‘ohana* [to gather for family prayers] then the fish would come inside. But, as time went by, the fishing became selfish. Before, when you’d catch fish, the workman would get the fish first then the owners would sell the leftovers. These days it’s the opposite way where the owner, once he gets the fish, in his mind, it’s money. He’ll first sell all the fish, then the leftovers he’d give to the workers. It’s selfish. It’s not like the old days. Over there they’ve got plenty of the white crab. They sell them in the stores now from Japan. They call that *kūhonu*. People get lazy. Now they’d rather go to the supermarket and get one box for fourteen bucks rather than fish it from ocean. We catch *kūhonu* with a net.

Though he doesn’t fish anymore, Mr. Ako had some tricks to share of how to scale fish. He explained:

> Physically, I don’t go fish anymore so my friends fish for me. I have a trick for scaling fish if you’re going to fry the fish and not eat them raw. You soak the fish with the scales in the water, take it out, then you get hot hot water. As long as you’re going to fry them and not eat them raw, you pour the water on the fish then dunk it right away in cold water. Then you scale it and the scale comes out easily.

Mr. Ako expressed that he tries to share his knowledge of traditional fishing methods with the younger generation but relate that they are not very receptive to the old ways. He hinted at inter-generational differences that make it difficult to relate to one another. According to Mr. Ako:

> I’ve learnt the old methods of fishing but when I try to share this *mana‘o* with the younger *kūpuna*, my nephews say, “You know uncle, that was in your day. They are not gonna work.” These are methods that our *kūpuna* have used for centuries. It’s hard to relate to the younger *mākua* [any relative of parents’ generation]—

> younger people. They have different ideas…. We're willing to share our knowledge only when we're accepted.

Other traditional knowledge that Mr. Ako shared included his extensive knowledge of taro farming and of making *poi* and *kūlolo*. He explained that many varieties of taro are planted which include: *moi*, *ʻowāhi o pele*, *maui lehua*, *ulukanu*, *aiʻehē*, and *kāī*. He explained that the most common taro in Kauaʻi is *maui lehua* because it matures faster than most other types though he prefers the *kaʻī* for making *poi* and *kūlolo* because of its gummy texture. He explained:

> I plant dry land taro. We have a lot of different varieties. There's the *moi*, *ʻowāhi o pele*, *maui lehua*, the *ulukanu*— the yellow taro that looks like *ʻulu* [breadfruit] *poi* when you mix it. Then we have the *aiʻehē*. It's kind of starchy. They're real *ʻono*. It becomes the white *poi*. These are the varieties. We also have the *kāī*. The *kāī* taro is gummy. The *poi* factory doesn't like that because it breaks their machine. It's really gummy. In my case, I like *kāī* for *kūlolo* and for *poi*. A lot of people boil the taro. In the South Pacific, they *kālua* [to bake in the ground oven] the taro. When you *kālua* the taro, to make the *imu* [underground oven], it becomes steamed. Our *kūpuna* didn't have containers to boil taro so that's why they cooked everything underground.

> The type of taro we plant here in Kauaʻi, most of them is the *maui lehua*. The reason why we plant that is because it takes only nine months before it matures whereas the other varieties take about fourteen months. There's another variety called the *ʻaliʻi* taro that takes eighteen months. One of the corms, they call it *makua*, is about thirty pounds. That's why they always say that was special for the *ʻaliʻi*. You know the baby taro you get off the big taro, you get only three. So that's why many of the *kūpuna* would plant them. It was just for show. I just met a group of women at Costco today and they want to learn how to make *kūlolo*.

Mr. Ako described in detail the art of making *kūlolo*. According to Mr. Ako, traditionally, each village in Hawaiʻi had one *kūpuna* who was the chief of the *kūlolo*. He described the following:

> I make my own *poi*. I make *kūlolo*. I make *kūlolo* to teach the young *mākua*…. In the past, every village had one *kūpuna* who was the chief of the *kūlolo*. The reason why they didn't share the *kūlolo* recipe is because these *kūpuna* would mix all these ingredients and taste them raw. Taro is so itchy when it's raw. That's why in the village they didn't share their recipes with the younger *mākua*. When it came to my time, I used to work for a *poi* factory and they used to make the *kūlolo*. They were Chinese who came from Maui. Although I worked for him and helped make the *kūlolo* I never asked him for the recipe. I felt that it was his livelihood.

> When I stopped working over there, I worked overseas. When I came back, I was still *ʻono* [craving] for *kūlolo* so I thought to make my own recipe. So I made my own recipe. It took me four years to make my own recipe. My teachers were the *kūpuna*. I would make the *kūlolo* and share it with them. They would tell me, not

> enough sugar to make them a little bit more sweet. It took me four years until I made this recipe and the *kūpuna* said, “Eh, this is the recipe that our *kūpuna* used to have.” So I have it today. In preparing, I don’t taste it. I scale everything. I scale the taro. I scale the coconut milk. In those days we had to go grate the coconut to get the juice. Now you can buy it in a can from Thailand and Indonesia at Costco. I have the grater at home but the ones in the can have no sugar so it’s all bland. So that was so easy for me for making my *kūlolo*. When you weigh a bag of taro from the farmer, it’s eighty pounds for one bag. If the taro is good, whether you’re gonna make *poi* or *kūlolo*, you’re gonna get about sixty or seventy pounds of taro. That’s how I made my recipe. *Mākua* come to me and they say, “Hey uncle, how come my *kūlolo* is itchy?” So I tell them, “Eh, how long you cook it for? Oh, six hours? That’s the problem. You’re eating it half-cooked. Gotta be twelve hours.”
>
> When *kūlolo* is frozen, you take it home and you steam it in a steamer. You boil it in a hot steamer for ten to fifteen minutes. When you feel the thing is soft, you dunk it in cold water to cool it off then you cut the package. It’ll taste like the day I made it. Not everybody makes it over here. I teach only the *mākua*.

Mr. Ako also reminisced about his mother’s sweet potato *poi*, also known as *ko‘ele palau* which she made on special occasions. The *ko‘ele palau* was made from the *huamoa*, the orange sweet potato as described in the following excerpt:

> There’s one recipe that my mama made. The only time they made that sweet potato putting was when they had special occasions like Christmas. You steam the sweet potato and then you mash it like mashed potato and add coconut milk and sugar. The Hawaiian name for that is *ko‘ele palau*. Hardly anybody knows that recipe. It’s my mom’s recipe. This was only meant for special occasions because they were selective about the type of sweet potato. The sweet potato they used to use was orange which we call, *huamoa*—the chicken yolk. They were able to make *ko‘ele palau* from that because that sweet potato is solid and starchy. My mama was very selective in making that *ko‘ele palau*.

Mr. Ako also explained the different uses of the land sections of *kahakai*, *kula*, and *kuahiwi* for farming. He explained that in Kapa‘a, taro is planted in the *kuahiwi* or the top land section where water is plentiful. He explained:

> When you’re down on the beach, it’s called, *kahakai*. When they say *kula*, that’s where you plant all your vegetables because that’s half-way between the ocean and the top of the mountain. The elevation is high there and depends a lot on water. In the *kula* area, that’s where they used to plant potatoes and everything. The *kuahiwi* is the top land section and that’s where people planted taro in Kapa‘a. Most of the people are planting wet taro. Plenty water. Still now. In my case, I have a small property and I gotta eat *poi* because I cannot eat rice because of my health. So I decided to raise my own taro. In fact, wetland taro people come look at my taro because my one corm, which we call in Hawai‘i, *makua*, is about ten pounds. That’s the kind they grow in Tonga and the Marquesas.

Mr. Ako also spoke at length about his experience working at Coco Palms in Wailua where many *iwi* have been discovered. He found *iwi* on the property which he described as belonging to people who were not ordinary Hawaiians—big people with large skulls and bones. He believed that the area surrounding and including Coco Palms, which is near the Project area, has many burials. He also stated that the bones have settled to the water table, thus, archaeologists may not find anything if they dig only a few feet from the surface. He shared the following with CSH staff:

> At Coco Palms, I took care of all the *iwi* over there. These particular *kūpuna* were not ordinary Hawaiians. They were giants. This bone I saw went up to my hip. The skull was big. According to the archaeologist, the Hawaiian jaw, if you put it on the table, will rock. But these particular *kūpuna* I found, you put them on the table, the thing is flat. It doesn't rock. I was kind of wondering whether they were here before our Polynesians were here. They were all buried in the sand. Coco Palms was just loaded. Until today, it's still loaded with those *kūpuna*. You know, I went and testified against the bike path in this area. I testified against where they were going to put the bike path because over there, it's all graves. They wouldn't listen. You're not gonna find them on the surface. They had this archaeologist from the mainland who came down to dig. They called me and they told me that there's no graves there. I said, "Eh, where are you from?" He said, "I'm from the mainland. I had somebody come help me. We dug around here. No graves." I said, "Yeah, you cannot find those graves at four feet. You gotta go down to water level. Those graves settled over four hundred years so they've settled down." I said, "If you dig down, you're gonna find all those things." That's why they're having problems now.

Mr. Ako reported that he found 87 bodies on the Coco Palms property. He explained that the bodies were buried in a crouching position with their legs crossed and facing east. Mr. Ako was responsible for relocating the bodies. He described the following:

> At Coco Palms, where I found all those graves, they were all sitting down with their arms this way, and their legs crouched. They were all facing east. Everyone of them facing east. They weren't wrapped in *kapa* [tapa, as made from *wauke* or *māmaki* bark]. Was old. They were all in a sitting position. When I found the grave, I never used any wooden tools. I dug them by hand. To identify these particular graves, they'd have *ʻōhiʻa* logs— three or four on the top of the skull. I found eighty-seven bodies. The owner of the hotels gave me the authority to take care of all of those. That's why she never had any problems with the hotel because he respected the *kūpuna*. I dug them out and buried them. I had *ʻohana* before I buried them. I had a good feeling they were asking me, "Where you gonna put me?" I said, "I'll put you folks where nobody's gonna touch you" and I made it so that legally, by law, nobody is to touch that particular area where I buried them.

He also found a conch shell on the property which he believed to have been used as a signal—alerting fishermen and women of the arrival of the *akule* in Wailua. Mr. Ako stated:

> I also found one big conch shell. It's the biggest I've ever come across. That conch shell was supposed to be for the head fisherman in Wailua where they had a fishing tower across the bridge. When the *akule* came in, in those days, he'd blow that conch shell and people from behind Sleeping Giant, they call, Olohena, the sound would go all the way in the back and the natives would come down to fish. That's how much I know about that Olohena area. But I found that big conch shell. That day I found it, I cleaned it all up and put it in my field office. These *haole* kids from the mainland came and one boy took the conch shell and blew it. You ought to see Coco Palms shake up. He wasn't supposed to touch it. Oh, I got so angry. When I heard the sound, it was such a beautiful sound. I told the *haole* kid, "Eh, I'm going to kick you and I can fire you right now. Don't you ever touch that."…. I reburied the thing. I know where it is.
>
> We had a Hawaiian engineer when they were starting to develop Coco Palms. He came and told me, "Uncle, can we remove the graves and the conch shell?" I said, "You know something, you're Hawaiian, yeah? You ever touch that, you're gonna *make* [to die]." I said, "How can you do that? All for money? Don't you ever touch that. You tell those developers that if you guys touch those graves, whoever's going to own that hotel is not going to succeed."

Mr. Ako also had similar experiences working at Waiohai Resort. Though Waiohai Resort is located on the west side of the island, the following story relayed by Mr. Ako reflects his traditional belief system. The story also reflects connections with the Wailua River which is directly south of the Project area.

> I worked at Waiohai. At Waiohai, the same thing. The original Waiohai was wooden buildings. They removed all the wooden buildings and built concrete buildings. The building was built like a W. You had the west wing, the center wing, the east wing, all facing the ocean. They had a *heiau* over there. So, the boss says to me, "Tell me Val, can you find one *kahuna* [priest, sorcerer] to go bless the place?" So I had a *kahuna* lady from the Hawaiian church. Her name was Elenor Wong—well known throughout the state. So I told her, "Auntie, you can go bless Waiohai?" She says, "Sure." So, we went over there and she blessed the place. She told me, " You know Val, you tell the owners, no touch the *heiau*. Leave the *heiau* the way it is." When they finished the hotel, the developer, the owner said, "Eh, you know all the rocks that's all over, we're gonna rebuild the *heiau*." I told him, "Do not touch the *heiau*. If you're gonna touch it, Waiohai is not gonna last." They laughed at me. They said, "Oh, you belong to the old method." I said, "I was told to tell you guys not to touch the *heiau*. Mother Wong told me that that *heiau* is connected with Wailua River. You know what they call the *moʻo* yeah? There was a *moʻo*—fish. That one traveled from Wailua to Waiohai and is connected to Kaʻula. That *moʻo* travels to Waiohai first then heads straight to Kaʻula Island. Right after that, we had Hurricane ʻIwa and there was a big slab inside the *heiau*. The waves picked up the slab and threw it right inside the dining room. It destroyed everything. My big boss came to me and said he

> wanted me to come and work for him again to renovate the hotel. I said, “No. I told you guys, but you guys never listened, so that’s what happened.”

With regards to the Project area, Mr. Ako indicated that he would not be surprised if bones are found in the area. He emphasized that Hawaiian burials were carried out in sand because Hawaiians used *‘ō‘ō* or sticks for digging graves which explains why sand was preferred for burials. He stated:

> The Westerners don’t understand. Prior to Westerners coming to Hawaii, our *kūpuna* didn’t have metal implements to dig a grave. Every island has a different concept of burials…. Whatever beaches have sand, you’ll find graves there. The reason why is because the closest implement they had was an old stick, the *‘ō‘ō*. That’s the closest thing that they used to dig. Most of the graves that our *kūpuna* used to dig were all by hand.

Section 8 Cultural Landscape

8.1 Overview

Discussions of specific aspects of traditional Hawaiian culture as they relate to the Project area are presented below. This section examines cultural resources and practices identified within or in proximity to the subject Project area in the broader context of the encompassing Kapaʻa Ahupuaʻa landscape. Excerpts from interview sessions from past and the present cultural studies are incorporated throughout this section where applicable.

8.2 Hawaiian Habitation and Agriculture

Data on settlement patterns during pre-Contact are limited but the association of the *ahupuaʻa* of Kapaʻa with legendary historical figures such as Mōʻīkeha implies that the area was settled prior to Mōʻīkeha's time (early fourteenth century), although the extent of this settlement is not known. Handy (1940) counts Kapaʻa as one of the major settlement areas of Kauaʻi in pre-Contact times, and both Vancouver (1798) and Wilkes (1840) were impressed with the fertile lands of the district which had fields of sugarcane, taro, and other crops. Through archaeology and other sources, it is known that at one time agricultural and domestic activities extended into the far *mauka* areas of Kapaʻa, but were abandoned by the mid-nineteenth century.

As discussed in Section 4, LCA maps show that taro *loʻi* and *kula* existed on the rim of the swamplands and extending somewhat into watered valleys. Marshlands without known LCAs may have had *loʻi* along the edges. Permanent settlement is assumed to have existed in association with *mauka* agricultural lands in the pre-Contact period, but this is not reflected in the LCA testimonies. The *mauka* settlements were probably abandoned before the nineteenth century. Permanent settlement occurred along the coast throughout late pre-Contact, as indicated by the presence of extensive and thick habitation deposits in the shore and backshore areas of Kapaʻa, especially along Inia Street and Kūhiō Highway (Hammatt 1991). However, in the early twentieth century, the entire area behind Kapaʻa Town was rice and *kula* lots. Flood control measures were instituted in the 1960s and marsh lands, used previously for taro and then taken over by the rice farmers, were drained and became cane and pasture.

Consultations with community members from Kapaʻa indicate that commercial agriculture was prevalent in the *ahupuaʻa* through the latter half of the twentieth century. Participants described the distribution of sugarcane, pineapple, rice, and even taro throughout Kapaʻa:

> From Keālia side, that used to be all sugarcane and all the way up there. The sugarcane was all up. You know Wailua? You know the sleeping giant? That lower parcel from Wailua was all sugarcane. Where the Kapaʻa Bypass Road is now, that was all sugarcane. You go all the way up to Keālia, part of the lower land and high lands was all pineapple —Mr. Kaneakua

> The rice was more Wailua side. You know where Coco Palms is? The flat area was all rice patties. The Chinese worked the patties…. used to be all swampy. When they drained the swamp through the canal, then they started developing that

> area. That was all pineapple too and sugarcane. Keālia Kai, all over there was all sugarcane. The only thing Kapa‘a had was a lot of sugarcane fields…. In the back of Coco Palms, all over there on the right side, that was all rice. It was very wet. Then after that, there was taro but taro, Hawaiians used to plant on their own…. They say that the law of the land is that the water is for everyone. But, all the *haole*s come, they buy all the land up there, and they control the water. What about the taro farmers? They have *lo‘i* in Anahola and Ko‘olau. All the way up there in the back, they had that too. The biggest one [*lo‘i*] now is only Hanalei. That’s the main thing, for taro, you gotta have a lot of water. —Mr. Nunes

While early post-Contact Kapa‘a through most of the twentieth century boasted of much agricultural activity, Mr. Kaneakua explained that though Kapa‘a had a plethora of water in marshlands and swamp, the water was stagnant, and thus, not suitable for taro farming:

> They never planted *lo‘i* over there [in the Wailua-side, south of the Project area]. Even though it was swampy, the water was stagnant and you need running water for *lo‘i*. Hanalei and Hanapepe were where the *lo‘i* were.

Taro farming is a small-scale operation unlike the larger *lo‘i* of wetter regions of the island like Hanapepe and Hanalei. Though taro cultivation is not as prominent, farmers like Mr. Ako still practice the traditional art of making *poi* and *kūlolo* and may buy taro from the store or other farmers for their production.

Participants also remembered the cultivation of rice by the Chinese within their lifetime indicating that rice cultivation probably stopped with the draining and filling of the marshlands for development.

Today, Kapa‘a has transformed from being largely dependent on commercial agriculture to tourism. The transformation of the marshlands allowed for more development. Similarly, the sandy coastline of Kapa‘a is a favorable tourist locale that has attracted hotels and resorts like Pono Kai and Coco Palms, and Kapa‘a Town has developed to cater to the tourism industry. The immediate vicinity of the Project area itself has also changed according to Mr. Kaneakua who reported that the original Native Hawaiian families living adjacent to the Project area have been displaced by non-Hawaiian immigrants from the U.S. Mainland.

8.3 Gathering of Plant Resources

Consultations with community members of Kapa‘a revealed that plant resources utilized by Native Hawaiians for *lei* (necklace of flowers)-making and *lā‘au lapa‘au* have diminished significantly in the Kapa‘a Ahupua‘a. Mr. Kaneakua reminisced of a time when native plants were more plentiful throughout Kapa‘a and when it was easy for him to find plants for his practice of *lā‘au lapa‘au*. He attributes the change to the use of pesticides during the plantation era which killed plants indiscriminately. The following statement reflects his sentiments:

> A lot of plants that we used to use, we don’t see anymore. They sprayed a lot of pesticide so it killed plenty of the good herbs. Like *pōpolo*. It’s hard to find *pōpolo* nowadays. You see this grass over here? Guinea grass. It never used to be like that. It came in and choked out all the plants.

Nevertheless, Mr. Kaneakua still widely practices *lāʻau lapaʻau* to treat the ailments of his children and grandchildren.

It is interesting to note that *kalukalu* grass, a native sedge grass used for weaving mats, was once abundant in Kapaʻa but now thought to be extinct. As discussed in Section 3.3.5, the *moʻolelo* associated with *kalukalu* grass suggest that Kauaʻi was once famous for the grass and most likely was prevalent in Kapaʻa. *Kalukalu* grew around the marshlands so dredging of these areas to allow for development may have attributed to its loss.

Located near the ocean, the Project area is relatively isolated from significant vegetation except for the rows of ironwood trees along Moanakai Road and *naupaka kahakai* bushes interspersed throughout the Project area (Refer to Appendix B for scientific names of plants). *Naupaka kahakai* is a native shrub to Hawaiʻi.

8.4 Marine Resources

8.4.1 Recreation

The Project area is located within a marine resource system utilized by the people of Kapaʻa for recreation, as well as for the traditional practice of fishing. Baby Beach, as shown in Figure 20, abuts the north end of the Moanakai Seawall. It is a safe place for children to swim because the reef protects the inside, thus is calm and shallow. The beach is used daily, particularly by families with children, for recreation. The area is also a popular kite surfing site due to the prevailing trade winds. In addition, ironwood trees along the seawall provide shade and a scenic location for people to drive through and park on the *makai* side of Moanakai Road. As such, Moanakai Road is used as a beach access road.

Figure 20. Toddlers played at Baby Beach which abuts the north end of the Project area (Source: Angela Faʻanunu)

8.4.2 Fishing

Moanakai Road is also widely used by fishermen to access the ocean. Consultations with community members indicated that all participants were long-time fishermen in the ocean area fronting Baby Beach. Participants spoke particularly of skin diving for fish in the area. However, all participants agreed that the reef adjacent to the Project area has changed with less fish and seaweed over time. Section 7 discusses in detail the species of fish that were once abundant. All participants attributed the depletion of ocean resources near the Project area to the following factors: predators like the Hawaiian monk seal, sharks, and turtles; windsurfing activities; and the introduction of invasive species like *taʻape* and *roi*.

Mr. Nunes brought up the issue of sand erosion along the Kapaʻa coastline and recalled that a reef, north of the Project area, was dredged during the plantation era to provide aggregate for building the roads for the plantations. Mr. Nunes recalled that the beaches of Kapaʻa had significantly more sand when he was a child and believed that much of the sand erosion experienced in Kapaʻa is attributed to the dredging of the reef. Similarly, background research for this Project in Section 4 showed that in 1955, the Garden Island Newspaper published the proposed coral dredging for the reef which was later blamed for the loss of sand in Kapaʻa and the need for seawalls.

8.4.3 Beach Access

As described above, Moanakai road is used as a beach access road for recreation, as well as for fishing. However, should construction for the proposed Project commence, work should not significantly affect beach access because Baby Beach and the ocean can also be accessed from Panihi Street, north of the Project area.

8.5 Historic and Cultural Properties

The presence of 14 documented *heiau* within Kapaʻa, as well as *moʻolelo* associated with prominent chiefs like Mōʻīkeha, suggests Kapaʻa has traditionally been an important *ahupuaʻa* and area of settlement (Bushnell et al. 2002). However, community members Mr. and Mrs. Kaneakua, as well as Mr. Ako, reported no recollection of any *heiau* in Kapaʻa, although Mr. Nunes mentioned one *heiau*. Therefore, it is possible that the physical structures of the *heiau* reported in Section 4 are no longer present.

However, with regards to burials, all community members reported discovering *iwi* along the coastline of Kapaʻa (See Section 7). Mr. Kaneakua remembered seeing bones in the sand near the Project area, as a child. He stated, "When I was young and fishing over there [near the Project area], sometimes the sand would erode and you'd see bones." Thus, due to personal experience, as well as local knowledge of burials in the vicinity of the Project area, particularly of burials associated with Wailua, south of the Project area, all participants believed that the likelihood of encountering burials at the Project site was highly plausible. Mr. Kaneakua stated:

> You know what they're gonna come up with? Bones. Oh yeah, this area [Project area] may have burials. Up to where they made the new hotel, by Safeway and all the way up to Wailua. You go through here [area including Project area to

> Wailua] you're gonna find [bones]. Guarantee. The battleground is where the Safeway is, where the new hotel is now. You start from there all the way across to Wailua. I don't know what battle but it's known as the battleground. I was told that Kamehameha came over and the King of Kauaʻi at the time, King Kaumualiʻi, didn't want bloodshed so they didn't fight.

Though no historic properties have been previously identified within the Project area, the natural sediment of the Project area is described by Foote et al. (1972) as Mokuleia Fine Sandy Loam, a well-drained soil typically found along the coastal plains of eastern and northern Kauaʻi. The presence of this sandy sediment, the proximity to the ocean, and the presence of human burials along the coast of Kapaʻa, suggests that human burials or intact cultural materials may be encountered during Project activities.

Section 9 Summary and Recommendations

Cultural Surveys Hawaiʻi (CSH) conducted this Cultural Impact Assessment (CIA) at the request of R. M. Towill Corporation. The CIA includes, broadly, the *ahupuaʻa* of Kapaʻa, Kawaihau District, on the island of Kauaʻi; and, more specifically, portions of TMK: [4] 4-5-002:023. The proposed Project includes the repair and/or replacement of the existing Moanakai Seawall. Portions of the seawall have been damaged over time; therefore, construction activities for the proposed Project will involve the excavation of soil and sand in order to place and secure the seawall and footings. Construction activities associated with the seawall may affect Moanakai Road and its infrastructure as the Moanakai Road shoulder is located immediately adjacent to the seawall in certain areas. The proposed Project may also include the repair of sink holes along Moanakai Road that have resulted from heavy rains and high surf incidents. The proposed Project is intended to secure the seawall, and improve Moanakai Road to protect public health and ensure safety of the area from an otherwise faulty seawall.

The results of document research and community consultations conducted to assess the potential impact of the proposed Project on cultural beliefs, practices, and resources in the Kapaʻa Ahupuaʻa, are presented in this section. Based on these findings, cultural impacts are identified and recommendations are offered to help mitigate potential adverse impacts. A good faith effort to address these issues may improve the Project and its acceptance by the community.

9.1 Results of Background Research

Background research conducted for this Project yielded the following results:

1. The *ahupuaʻa* of Kapaʻa is situated in the ancient district of Puna, one of five ancient *moku* on Kauaʻi (King 1935:228). Puna was the second largest district on Kauaʻi, after Kona, and extended from Kīpū, south of Līhuʻe, to Kamalomaloʻo, just north of Keālia. In 1878, King Kalākaua proposed a special mandate, renaming a new district Kawaihau after Hui Kawaihau which ranged from Olohena in the south to Kīlauea in the north. Subsequent alterations to district boundaries in the 1920s left Kawaihau with Olohena as its southernmost boundary and Moloaʻa as its northernmost boundary (King 1935:222).
2. Kapaʻa literally translates as "the solid or the closing." The name Kapaʻa is also a place in Kailua, Oʻahu, where a rock quarry has been located since the 1950s. While Pukui et al. believe that the name Kapaʻa may have been derived from the solid rock of the place, no explanations are offered for how the Kapaʻa in Kauaʻi was thus named (Pukui 1974).
3. *Moʻolelo* associated with Kapaʻa Ahupuaʻa concern Kawelo, Pākaʻa, and the legendary *aliʻi*, Mōʻīkeha.
4. At least 14 *heiau* were named in Kapaʻa and Keālia by Lahainaluna students, which reinforces the traditional significance of these *ahupuaʻa* to Native Hawaiians.

5. According to Handy and Handy (1972: 269), Kapaʻa once had a "highly developed irrigation system," and thus, was one of the pre-Contact centers of population. Kapaʻa also has a broad coastal plain bordering the sea suitable for cultivation; sweet potato and yams were grown inland in all sections of Puna Moku (Handy 1940:171). Farmers in the valleys of Puna practiced "diversified farming: taro, sweet potatoes, breadfruit, coconuts" (Handy and Handy 1972:423).
6. During the Māhele, Kapaʻa was retained as Crown Lands (Office of the Commissioner of Public Lands of the Territory of Hawaii 1929). The *ʻili* of Paikahawai and Ulukiu in Kapaʻa Ahupuaʻa were retained as Government Lands. The LCAs during this period show that six individuals, other than *aliʻi* or chiefs were awarded land parcels in the relatively large *ahupuaʻa* of Kapaʻa. None of these LCAs are located within the project area.
7. Sugarcane and rice were predominant crops in Kapaʻa particularly in the latter half of the 1800s. The sugar mill, known as the Makee Landing, was initially established in Kapaʻa, but was later moved to Keālia in 1885. Chinese rice farmers cultivated the lowlands and marshes of Kapaʻa.
8. In 1913, Hawaiian Canneries Company Limited opened in Kapaʻa at the site now occupied by Pono Kai Resort (Cook 1999:56), just north of Waikaʻea Canal and the Project area. By 1960, 3,400 acres were in pineapple and the cannery employed 250 full time and 1000 seasonal workers (*Honolulu Advertiser*, March 20, 1960). The cannery attracted many immigrant workers, thus, Kapaʻa became a multi-ethnic town. In 1962, the cannery went out of business due to competition from canneries in other countries.
9. The Ahukini Terminal & Railway Company was formed in 1920 to establish a railroad to connect Anahola, Keālia, and Kapaʻa to Ahukini Landing and "provide relatively cheap freight rates for the carriage of plantation sugar to a terminal outlet" (Condé and Best 1973:185). Remnants of the tracks are still evident in Kapaʻa today.
10. The area south of Waikaʻea Canal, including the Project area, was once an extensive landscape of sand dunes. In the early twentieth century, a developer replaced the sand with bungalows, planted exotic plants and flowers, and turned the area into a home for the middle class families of Kapaʻa (Fernandez 2009:61).
11. Severe floods in Kapaʻa in 1940 led to the dredging and construction of the Waikaʻea and Mōʻīkeha Canals sometime in the 1940s (Hawaiian Territorial Planning Board 1940:7). In 1955, a report was published on proposed coral dredging of the reef fronting Kapaʻa Beach Park to use the coral for building plantation roads (*Garden Island Newspaper*, September 21, 1955). The dredging was later blamed for accelerated erosion along Kapaʻa Beach (*Garden Island Newspaper*, October 30, 1963). Today, several sea walls are along the Kapaʻa Beach Park to check erosion.
12. The natural sediment of the Project area is described by Foote et al. (1972) as Mokuleia Fine Sandy Loam, a well-drained soil typically found along the coastal plains of eastern and northern Kauaʻi.

13. Many archaeological studies have been conducted within the Kapaʻa Ahupuaʻa though the majority have concentrated around Kapaʻa Town, located *mauka* of the Project area, with few studies along the coast. Major archaeological sites have been found in the Kapaʻa Town area, including extensive cultural layers with burials and other cultural features underlying Kūhiō Highway near All Saints Gym and near the older part of Kapaʻa Town between Waikaʻea Canal and Kapaʻa Beach Park, *makai* of Kūhiō Highway (Hammatt 1991; Kawachi 1994; Creed et al. 1995; Jourdane 1995; Calis 2000).
14. Of note are the studies by Bushnell et al. (2002) and Terry et al. (2004), which document sand or loamy sand ranging in colors, as well as five partial human burials (SIHP # 50-30-08-672 [single adult], -673 [two juvenile burials, including a cultural layer containing small, yellow beads], -674 [single incomplete adolescent], and -3894 [single adult]) with associated cultural layers near Waikaʻea Canal, approximately 400 meters northwest of the Project area.

9.2 Results of Community Consultation

Community consultations yielded the following results:

1. The general area of the Project area is called Waipouli. Mr. Kaneakua described "*wai*" as referring to "water" while "*pouli*" meant "dark" or "dark water." He described the Waipouli and lowlands near the coast as having been a swampy area prior to recent development.
2. The ocean area immediately adjacent to the northern end of the Project area is known as Baby Beach because the place is safe for toddlers and young children to swim. It is also known as Fuji Beach because Dr. Fuji's office was located across from the beach, *mauka* of Moanakai Road.
3. According to Mr. Kaneakua, Native Hawaiian families used to live in the residential areas adjacent to and *mauka* of the Project area but nowadays the original families have been displaced by non-Hawaiian immigrants.
4. Mr. Nunes pointed out that residential homes near the Project area still have underground cesspools for sewage disposal and voiced concern over the possibility of contamination, especially at Baby Beach.
5. All participants agreed that the reef adjacent to the Project area has changed with less fish and seaweed over time. Fish like *kūmū* (whitesaddle goatfish), *ʻāweoweo* (bigeye), *kala* (unicorn fish), *manini* (convict tang), *uhu* (parrotfish), *weke ula* (red goatfish), *menpachi*, and *tako* (squid or octopus) were reported by all participants to have been once abundant. *Limu kohu* (seaweed) and *limu kala* (seaweed that *kala* fish feed on) were also reported by Mr. Kaneakua and Mr. Nunes to have been abundant.
6. All participants attributed the depletion of ocean resources near the Project area to the following factors: predators like the Hawaiian monk seal, sharks, and turtles;

windsurfing activities; and the introduction of invasive species like *taʻape* (bluestripe snapper) and *roi* (peacock grouper). Participants expressed the following opinions:

i. Mr. Kaneakua claimed that the fish and seaweed have become less abundant because of the Hawaiian monk seal, sharks, and turtles.

ii. Mr. Nunes believed that windsurfing, a sport that has become a predominant activity near the Project area, negatively impacts the feeding cycle of fish in the area. He believed that the shadow of the windsurfing kites scare the fish and prevent them from their normal feeding habits.

iii. Mr. Ako attributed resource depletion to the Hawaiian monk seal, as well as the introduction of invasive species like the *taʻape* and *roi* or peacock grouper.

7. Mr. Ako reported that *akule* once frequented the Wailua River, south of the Project area, but the schools are not as common today. He explained that the ways of fishing have also changed and that people today are more selfish because of the value of money placed on fish. He also explained that people nowadays are lazy—that they would rather buy *kūhonu* from the supermarket than fish for the crab themselves.
8. Mr. Kaneakua claimed that native plants for *lāʻau lapaʻau* are more difficult to find in Kapaʻa today. Plants used for *lāʻau lapaʻau* included *pōpolo*, *ʻuhaloa*, *kukui*, *ʻōlena*, and plantain. The plants are used for ailments like colds, congestion, cold sores, sore throat, ear aches, and ulcers. He believes invasive plants like guinea grass, as well as the use of pesticides during plantation times, have killed many of the useful plants.
9. According to Mr. Kaneakua, Kapaʻa was known mostly for sugarcane and pineapple and these crops were cultivated throughout the *ahupuaʻa*. Rice was also cultivated by the Chinese but in the lowlands towards Wailua, to a lesser extent. The plantations brought many cultures to Kapaʻa such as Chinese, Filipino, Portuguese, and Native Hawaiian.
10. According to Mr. Ako, taro in Kapaʻa is planted in the *kuahiwi* or the top land section at higher elevations with more water while potatoes and other vegetables are planted in the drier *kula* areas, half-way between the ocean and the top of the mountain. The Project area would be within the *kahakai* near the ocean. Taro was grown at a smaller scale due to water limitations. Though Kapaʻa was swampy, Mr. Kaneakua stated that its stagnant waters were not favorable for *loʻi* which needs running water. Taro is currently predominantly grown in the northern part of the island where the climate is wetter, such as Hanalei.
11. The varieties of taro planted in Kapaʻa include the following: *moi*, *ʻowāhi o pele*, *maui lehua*, *ulukanu*, *aiʻehē*, and *kāī*. Mr. Ako reported that *maui lehua* is the most common because it matures faster than the other varieties. Today, Native Hawaiians like Mr. Ako still practice the traditional art of making *poi* and *kūlolo*. He also recalled his mother's sweet potato *poi*, also known as *koʻele palau* which she made

on special occasions. The *koʻele palau* was made from the *huamoa*, or orange sweet potato.

12. A pineapple cannery was located in the Kapaʻa in the location of the present Pono Kai Hotel. The cannery provided livelihood and jobs for many Kapaʻa residents and school children.
13. Mr. Nunes and Mr. Kaneakua both claimed that a railroad track, built to cater to the sugarcane plantations, ran behind the Project area.
14. Mr. Nunes reported that the reef north of the Project area was dredged during plantation times to provide the plantations with aggregate for building roads. He believes that the erosion experienced in the area is a by-product of that activity.
15. The area in the immediate vicinity of the Project area, including Safeway all the way to Wailua, is known as the battleground. Residents associated the battleground with King Kamehameha I during his plight to conquer Kauaʻi.
16. One participant made reference to the presence of a *heiau* in Kapaʻa. Mr. Nunes believed that there was a *heiau* at Poliahu.
17. All participants discovered *iwi* within or near the Project area, thus indicated that there is a likelihood of finding *iwi* in the sand of the Project area. Regarding burials, each participant expressed the following:
    i. Mr. Kaneakua remembered as a child seeing bones sticking out of the sand at the location of the Project area.
    ii. Mr. Nunes expressed that Kapaʻa has many burials and personally discovered human remains in the area. He stated that burials may be found at the Project area as burials have been found in the surrounding vicinity.
    iii. Mr. Ako indicated that he would not be surprised if bones are found within the Project area and emphasized that Hawaiian burials were carried out in sand because Hawaiians used *ʻōʻō* for digging graves, thus preferred sand because it was easier.
18. Mr. Ako also found 87 bodies on the Coco Palms Resort property in Wailua, located directly south of the Project area. To identify these graves, three or four *ʻōhiʻa* logs were placed on the top of the skull. He described the bones as belonging to a people who were not ordinary Hawaiians—big people with large skulls and bones. Mr. Ako also stated that the bones have settled to the water level, thus, archaeologists may not find anything if excavating only a few feet from the surface.
19. Mr. Ako also found a conch shell on the Coco Palms Resort property which he believed to have been used as a signal— alerting fishermen and women of the arrival of the *akule* in Wailua.

9.3 Impacts and Recommendations

The following cultural impacts and recommendations are based on a synthesis of all information gathered during preparation of the CIA. The most significant cultural impact is the possibility of encountering *iwi kūpuna* (human skeletal remains) during subsurface ground disturbance. To help mitigate the potential adverse impacts of the proposed Project on Hawaiian cultural beliefs, practices, and resources, CSH recommendations the following measures.

1. In light of the sandy soil composition of the Project area, the discovery of burials near Waikaʻea Canal in previous archaeology studies, and the discovery of *iwi* by interview participants within and near the Project area, it is possible that the Project may have an impact on burials and cultural practices associated with caring for burials. CSH recommends archaeological monitoring, as well as cultural monitoring, during all phases of development.

    ii. Personnel involved in development activities in the Project area should be informed of the possibility of inadvertent cultural finds, including human remains. Should cultural or burial sites be identified during ground disturbance, all work should immediately cease, and the appropriate agencies notified pursuant to applicable law.

2. CSH recommends that alternatives to the proposed Project should be considered if significant cultural resources, including human skeletal remains and/or burial sites, are encountered.
3. CSH recommends consultation with community participants in this CIA; consultation should continue throughout all phases of the proposed Project.
4. CSH recommends that OHA’s concern regarding project-related contamination of the nearby marine resource system should be considered since these resources are considered culturally valuable to Native Hawaiians. CSH recommends mitigation measures should be in place prior to and during the construction phase to ensure that contaminates do not filter into the ocean.

Section 10 References Cited

Akina, Joseph
1913 "I Ke hou i Ka Lulu-o-Mōʻīkeha i ka laula o kapaa", *Kuʻokoʻa* May 2-9, 1913. Bishop Museum Archives, Hawaiian Ethnological Notes (HEN) Place Names, Kauaʻi.

Alexander, William Patterson
1991 "A Tour of Kauaʻi in 1849: Private Journal of William DeWitt Alexander." In *The Kauaʻi Papers*. Kauaʻi Historical Society, A Kauaʻi Historical Society Publication, Līhuʻe, Kauaʻi, Hawaiʻi.

Andrews, Lorrin
1865 *A Dictionary of the Hawaiian Language*, to which is Appended an English-Hawaiian Vocabulary and a Chronological Table of Remarkable Events. Henry M. Whitney, Honolulu.

Beckwith, Martha
1970 *Hawaiian Mythology*. University of Hawaiʻi Press, Honolulu.

Bennett, Wendell C.
1931 *The Archaeology of Kauaʻi*. Bishop Museum Bulletin 80, Bernice P. Bishop Museum, Honolulu.

Bernard, H. Russell
2006 *Research Methods in Anthropology: Qualitative and Quantitative Approaches, Fourth Edition*. Rowman Altamira, Lanham, Maryland.

Borthwick, Douglas F., and Hallett H. Hammatt
1999 *Archaeological Monitoring and Burial Treatment Plans for the Proposed Improvements to the Kapaʻa Seventh-day Adventist Church, Kapaʻa Ahupuaʻa, Puna District, Kauaʻi Island (TMK 4-5-03: 19)*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Bushnell, Kristina, and Hallett H. Hammatt
2000 *An Archaeological Monitoring Report for Improvements to the Kapaʻa Seventh-Day Adventist Church, 1132 Kūhiō Highway, Kapaʻa Ahupuaʻa, District of Puna, Island of Kauaʻi (TMK 4-5-03:19)*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Bushnell, K.W., Melanie Mann, Douglas Borthwick, Tony Bush, Todd Tulchin, David Shideler and Hallett H. Hammatt
2002 *Archaeological Inventory Survey for the Proposed Kapaʻa/Keālia Bike and Pedestrian Path, Kapaʻa and Keālia, Kawaihau District, Kauaʻi Island, Hawaii (TMK 4-5, 4-6-14, 4-7-03 & 04)*. Cultural Surveys Hawaiʻi, Inc. Kailua, Hawaiʻi.

Calis, Irene
2000 *End of Field Work Report: Human Burial Removal and Archaeological Monitoring, Kapaʻa Beach Park Public Bathroom Installation, Kapaʻa, Kauaʻi*. Scientific Consultant Services, Kāneʻohe, Hawaiʻi.

Chafee, David B., Berdena Burgett, and Robert L. Spear
1994a An Inventory Survey of a Māmane Street Houselot, Kapaʻa Ahupuaʻa, Kawaihau District, Puna, Island of Kauaʻi (TMK: 4-5-09:51). Scientific Consultant Services, Kāneʻohe, Hawaiʻi.

1994b An Inventory Survey of a Kukui Street Houselot, Kapaʻa Ahupuaʻa, Kawaihau District, Puna, Island of Kauaʻi (TMK: 4-5-09:10). Scientific Consultant Services, Inc., Kāneʻohe, Hawaiʻi.

Ching, Francis K. W.
1976 Letter Report: Archaeological Reconnaissance - Report, Kapaa "Wastewater Treatment and Disposal System." Archaeological Research Center Hawaiʻi, Lāwaʻi, Kauaʻi, Hawaiʻi.

Chinen, Jon H.
1958 *The Great Mahele*. University of Hawaii Press, Honolulu.

Condé, Jesse C. and Gerald M. Best
1973 *Sugar Trains, Narrow Gauge Rails of Hawaii*. Glenwood Publishers, Felton, CA.

Cook, Chris
1999 *Kauaʻi, the Garden Island: A Pictorial History of the Commerce and Work of the People*. Donning Co., Virginia Beach, Virginia.

Creed, Victoria, Hallett H. Hammatt, Gerald K. Ida, Ian Masterson, and John Winieski
1995 *A Summary of the Archaeological Monitoring for the Kapaʻa Sewerline Project, Waipouli and Kapaʻa Ahupuaʻa, Puna District, Kauaʻi (TMK: 4-3-09 and 4-5-03 to 11)*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Damon, Ethel M.
1931 *Koamalu*. Privately printed at the Honolulu Star-Bulletin Press, Honolulu, (2 Volumes).

Dega, Michael F., and James Powell
2003 *Archaeological Monitoring During Phase I of the Kauaʻi Rural Fiber Optic Duct Lines Project, Kauaʻi Island, Hawaiʻi*. Scientific Consultant Services, Inc., Kāneʻohe, Hawaiʻi.

Dole, Charles S.
1916 "The Hui Kawaihau" pp.8-15. A Paper read at the November meeting of the Kauaʻi Historical Society on November 16, 1916 in Līhuʻe, Kauaʻi.

Donohugh, Donald
2001 *The Story of Kōloa, A Kauaʻi Plantation Town*. Mutual Publishing, Honolulu.

Elmore, Michelle, and Joseph Kennedy
2003 *An Archaeological Monitoring Report for the Proposed Kūhiō Drainage Improvements Kapaʻa and Anahola (Project # 56AC-01-01) located in Kawaihau District, Island of Kauaʻi*. Archaeological Consultants Pacific, Inc.

Fernandez, Bill
2009 *Rainbow Over Kapaʻa*. Central Pacific Media Corporation, Honolulu.

Foote, Donald E., Elmer L. Hill, Sakuichi Nakamura, and Floyd Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lānaʻi.* State of Hawaii. Soil Conservation Service, U.S. Department of Agriculture.

Fornander, Abraham

1916- 1919 *Fornander Collection of Hawaiian Antiquities and Folk-Lore, with translations*, edited and illustrated with notes by Thomas G. Thrum, Volume 4, First series, 1916-1917 notes by Thomas G. Thrum, Memoirs of the Bernice P. Bishop Museum, Vols. 4, 5, 6, Honolulu.

1917 *Collection of Hawaiian Antiquities and Folklore,* T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. IV), Bishop Museum Press, Honolulu.

1918 *Collection of Hawaiian Antiquities and Folklore*, T.G. Thrum edit., Memoirs of the Bernice Pauahi Bishop Museum (Vol. V), Bishop Museum Press, Honolulu.

The Garden Island

1955 "Geologists Says Kapaa Coral Removal No Threat to Town." *The Garden Island*, September 21, 1955.

1963 "Kapaa Blames Federal Role As Erosion Continues. Says Barrier on Reef is Required." *The Garden Island*, October 30, 1963.

1983 "Centennial Year, Kapaʻa School Wants Pix of its 100 Years." *The Garden Island*, April 1, 1983.

Hammatt, Hallett H.

1981 *Archaeological Reconnaissance of 52.56 Acres for a Proposed Subdivision, TMK: 4-8(?)-13-1, Kapaʻa, Puna, Kauaʻi Island*. Archaeological Research Consultants of Hawaiʻi, Honolulu.

1986 *Archaeological Reconnaissance of the Makaleha Springs Water Source Development, Kapaʻa, Kauaʻi TMK: 4-6-01:1*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

1991 *Archaeological Subsurface Testing for the Proposed Kapa'a Sewerline, Wailua, Olohena, Waipouli and Kapaʻa, Kauaʻi.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., and David W. Shideler

2003 *Archaeological Assessment for the Kūhiō Highway Improvements, Kapaʻa to Hanamaʻulu (Kapaʻa Relief Route) Project within the Ahupuaʻa of Kapaʻa, Waipouli, North Olohena, South Olohena, Wailua, and Hanamaʻulu, Island of Kauaʻi*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., Gerald K. Ida, and Rodney Chiogioji

1994 *Archaeological Document Review and Assessment of Three Alternative Widening and Bypass Options for the Kūhiō Highway Within the Ahupuaʻa of Hanamāʻulu, Wailua, South Olohena, North Olohena, Waipouli & Kapaʻa, Līhuʻe and Kawaihau Districts, Island of Kauaʻi,* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., Rodney Chiogioji, Gerald K. Ida, and Victoria S. Creed
1997 *An Archaeological Inventory Survey for the Kūhiō Highway Widening and Bypass Options within the Ahupuaʻa of Wailua, South Olohena, North Olohena, Waipouli and Kapaʻa, Island of Kauaʻi, with Appendix on Palynology by Jerome Ward, Ph.D.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Hammatt, Hallett H., Gerald K. Ida and William H. Folk
1994 *Archaeological Inventory of a 1.87-Acre Parcel, Kapaʻa, Kauaʻi (TMK 4-5-05:6). Rev. August 1994. Cultural Surveys Hawaiʻi, Inc.*, Kailua, Hawaiʻi.

Hammatt, Hallett H., David W. Shideler, John Winieski, and David Perzinski
2000 *Archaeological Data Recovery for a 12-Acre Parcel (The Golding Property) at Waipouli, Puna, Kauaʻi (TMK 4-3-08:1) Volume I*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Handy, E. S. Craighill
1940 *The Hawaiian Planter*, Volume 1. Bishop Museum, Bulletin No. 161.Bernice P. Bishop Museum, Honolulu.

Handy, E.S. Craighill and Elizabeth G. Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment.* Bishop Museum Bulletin 233, Bernice P. Bishop Museum, Honolulu.

Hawaiʻi Bureau of Converyances
1825-1883 Land Record Booklet (Grant 8248). Copy of file at the Department of Land and Natural Resources, Hawaiʻi Bureau of Conveyances, 1151 Punchbowl Steet, Honolulu.

Hawaii Dept. of Survey
1909 *Report of the Surveyor to the Governor of the Territory of Hawaii for the Two Years Ending December 31, 1908*. Hawaiian Gazette Co., Honolulu.

Hawaii State Archives
1837 Interior Department, Land, Incoming Letter. August 1837.

Hawaiian Territorial Planning Board
1940 *Master Plan of the Town of Kapaa.* In collaboration with the Kauaʻi County Board of Supervisors, Publication No. 8. Advertiser Publishing Co., Honolulu.

Honolulu Advertiser
1960 "Kauaʻi Tries to See into Future." *Honolulu Advertiser*, March 20, 1960.

Joesting, Edward
1984 *Kauaʻi, The Separate Kingdom.* University of Hawaiʻi Press and Kauaʻi Museum Association, Ltd., Honolulu.

Jourdane, Elaine
1995 *Inadvertent Discovery of Human Remains at 1382-A Inia Street, Kapaʻa, Kauaʻi (Kapaʻa Sewerline Project Laterals) Site 626*. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Juvik, Sonia P., and James O. Juvik
1998 *Rainfall Atlas of Hawaiʻi, Third Edition*. Sonia P. Juvik and James O. Juvik, Editors, Chief Cartographer, Thomas R. Paradise University of Hawaii Press, Honolulu.

Kalākaua, David
1888 *The Legends and Myths of Hawaii*. Charles L. Webster (Reprint of three volumes published in 1877-85), New York.

Kam, Wendell
1987 Field Inspection Report: Makaleha Stream Well Project, DLNR, Division of Water and Land Development (DOWALD), Kealia Forest Reserve, Kawaihau, Kauaʻi, TMK:4-4-6-001:001. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Kanahele, George S.
1995 *Waikiki 100 B.C. to 1900 A.D. An Untold Story*. The Queen Emma Foundation, Honolulu.

Kapaʻa Elementary School
1933 *Kapaa Elementary School, Kula O Kapaʻa, 1883-1933*. Published by the school on its fiftieth anniversary, Kapaʻa, Kauaʻi.

1982 Kapaʻa School 1883-1983: "A Century of Knowledge." Kapaʻa Elementary, Kapaʻa, Kauaʻi.

Kawachi, Carol T.
1994 *Inadvertent Burial at 1316 Inia Street (Jasper) TMK 4-5-08:33, Kapaʻa, Kawaihau, Kauaʻi 50-30-08-871*. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Kikuchi, William K. and Susan Remoaldo
1992 *Cemeteries of Kauaʻi*, Vol. 1. Kauaʻi Community College and University of Hawaiʻi, Puhi, Kauaʻi.

King, Robert D.
1935 "Districts in the Hawaiian Islands." In Coulter, John Wesley (compiler) *A Gazetteer of the Territory of Hawaii*. University of Hawaii Research Publications, No. 11, University of Hawaiʻi, Honolulu.

Lahainaluna Students
1885 Kauaʻi; Outside the surf of Makaʻiwa, as far as Wailua. Lahainaluna Student Compositions No. 18. HMS Misc. 43. [Translation in] Bishop Museum Archives HEN I: 216 [translated by Mary Pukui]

Lai, Violet L. assisted by Kum Pui Lai
1985 *He Was a Ram, Wong Aloiau of Hawaii*. Published for the Hawaii Chinese History Center and the Wong Aloiau Association by University Press of Hawaiʻi, Honolulu.

Mays, Nicholas and Catherine Pope
1995 "Rigour and qualitative research." *British Medical Journal* 311:109-112.

McGuire, Kaʻohulani and Hallett H. Hammatt

2000 *A Traditional Practices Assessment for the Proposed Nānākuli IV Elementary School Site, Nānākuli, Waiʻanae District, Island of Oʻahu (TMK: 8-9-02: 65,23, por 1*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

McIntosh, James, and Cleghorn, Paul L.

2000 *Archaeological Inventory Survey at a 398 Acre Parcel in Kapaʻa, Kawaihau District, Island of Kauaʻi*. Pacific Legacy, Inc., Kailua, Hawaiʻi.

McMahon, Nancy A.

1994 *Inadvertent Burial Find, Kapaʻa, Kawaihau, Kauaʻi.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

McMahon, Nancy A.

1996 *Archaeological Inventory Survey for 5 Unit Apartment, TMK: 4-5-05:8, Kapaʻa, Kawaihau, Kauaʻi*. Exploration Associates, Ltd., Koloa, Kauaʻi, Hawaiʻi.

Mitchell, Auliʻi, Todd Tulchin, and Hallett H. Hammatt

2005 *Archaeological Literature Review, Field Inspection, and Cultural Impact Evaluation of a 3.1 acre area, Kapaʻa Ahupuaʻa, Kawaihau District, Kauaʻi Island, TMK 4-4-6-014:026*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Nakuina, Moses K.

1990 *The Wind Gourd of Laʻamaomao.* Translated by Esther T. Mookini, and Sarah Nakoa. Kalamaku Press, Honolulu.

Office of the Commissioner of Public Lands

1929 Indices of Awards, Made by the Board of Commissioners to Quiet Land Title in the Hawaiian Islands.

O'Leary, Owen L, Constance R. O'Hare, and Hallett H. Hammatt

2006 *Archaeological Inventory Survey for an Approximately 11.5 Acre Parcel Proposed as a Soccer Park at Kapaʻa Ahupuaʻa, Kawaihau District (Puna Moku), Island of Kauaʻi, TMK: 4-4-5-015:036*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Perzinski, Mary and Hallett H. Hammatt

2001 *A Summary of Archaeological Monitoring for the Kūhiō Highway, Waikaea Bridge Widening Project Kapaʻa Ahupuaʻa, Kawaihau District, Kauaʻi Island (TMK: 4-3-06 to 4-3-08)*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Pukui, Mary K., Samuel H. Elbert, and Esther Mookini

1974 *Place Names of Hawaiʻi.* University of Hawaiʻi Press, Honolulu.

Pukui, Mary Kawena

1983 *ʻŌlelo No'eau: Hawaiian Proverbs and Poetical Sayings*. Bishop Museum Special Publication No. 71, Bernice P. Bishop Museum Press, Honolulu.

Pietrusewsky, Michael, Rona Ikehara-Quebral, Michele T. Douglas

1994 *Human Skeletal Remains from the Kapaʻa Sewer Line Project, Wailua, Olohena, Waipouli and Kapaʻa, Kauaʻi*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Rice, William Hyde

1923 *Hawaiian Legends*. Bernice P. Bishop Museum Bulletin 3, Honolulu.

1974 *Hawaiian Legends.* Bernice P. Bishop Museum Bulletin 3, Honolulu. Originally published 1923, Kraus Reprint, Millwood, New York.

Spear, Robert L.

1992 *Letter Report Concerning Monitoring for the Cost-U-Less Project Kapaʻa, Kauaʻi, Hawaiʻi (TMK: 4-5-5:4 and 9)*. Scientific Consultant Services, Inc., Kāneʻohe, Hawaiʻi.

Terry, Daniel, Melanie Mann, and Hallett H. Hammatt

2004 *Archaeological Monitoring Report for the Installation of 16-inch Waters, Waikaʻea Bridge, Kūhiō Highway, Kapaʻa Ahupuaʻa, Kawaihau District, Kauaʻi Island, 4-4-5-005, -006, -007, -009*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Thrum, Thomas G. (compiler)

1923 *More Hawaiian Folk Tales.* A.C. McClurg and Co., Chicago.

Tomonari-Tuggle, Myra J.

1984 *An Archaeological Reconnaissance Survey: Mt. Wekiu, Kauaʻi, TMK 4-2-01:2.* Ms of file at Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Vancouver, George

l798 A Voyage of Discovery to the North Pacific Ocean...performed in the years 1790, 1791, 1792, 1793, 1794, and 1795, in the Discovery ... and ... Chatham ... Amsterdam, N. Israel. Vols. 1-3. London.

Van Ryzin, Karl, and Hallett H. Hammatt

2004 *An Archaeological Assessment for the Proposed Water Reservoir, Kapaʻa Ahupuaʻa, Kauaʻi, 4-4-6-003:010*. Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Wall, Walter E.

1914 Kapaa Section, Hawaii Territory Survey. Traced from Govt. Survey Map by Jos. Iao, Nov. 1914. Plat 3014, available online at the State of Hawaiʻi Department of Accounting and General Services, http://dags.hawaii.gov/survey/search.php.

Wichman, Frederick B.

1998 *Kauaʻi Ancient Place Names and Their Stories*. University of Hawaiʻi Press, Honolulu.

Wilkes, Charles

1844 *Narrative of the U.S. Exploring Expedition During the Years 1838, 1839, 1840, 1841, 1842....* C. Sherman, Philadelphia.

Appendix A Glossary

To highlight the various and complex meanings of Hawaiian words, translations from Pukui and Elbert (1986) are used unless otherwise noted. In some cases, alternate translations may resonate stronger with Hawaiians today; these are placed prior to the Pukui and Elbert (1986) translations and marked with “(common).”

Diacritical markings used in the Hawaiian words are the *ʻokina* and the *kahakō*. The *ʻokina*, or glottal stop, is only found between two vowels or at the beginning of a word that starts with a vowel. A break in speech is created between the sounds of the two vowels. The pronunciation of the *ʻokina* is similar to saying “oh-oh.” The *ʻokina* is written as a backwards apostrophe. The *kahakō* is only found above a vowel. It stresses or elongates a vowel sound from one beat to two beats. The *kahakō* is written as a line above a vowel.

Hawaiian Word	English Translation
ahupuaʻa	Land division usually extending from the uplands to the sea, so called because the boundary was marked by a heap (*ahu*) of stones surmounted by an image of a pig (*puaʻa*), or because a pig or other tribute was laid on the altar as tax to the chief.
aliʻi	Chief, chiefess, officer, ruler, monarch, peer, headman, noble, aristocrat, king, queen, commander.
ʻāpana	Piece, slice, portion, fragment, section, land parcel.
ʻaumakua	Family of personal gods, deified ancestors who might assume the shape of sharks, owls, hawks (etc…). A symbiotic relationship existed; mortals did not harm or eat *ʻaumakua*, and *ʻaumakua* warned and reprimanded mortals in dreams, visions, and calls. *ʻAumākua*—plural of *ʻaumakua*.
ʻauwai	Ditch, canal.
haole	White person, American, Englishman, Caucasian; American, English; formerly, any foreigner; foreign, introduced, of foreign origin, as plants, pigs, chickens
heiau	Pre-Christian place of worship, shrine; some *heiau* were elaborately constructed stone platforms, others simple earth terraces. Many are preserved today.
huamoa	A variety of sweet potato
hoʻokupu	Offering, gift
ʻili	Land section, next in importance to an *ahupuaʻa* and usually a subdivision of an *ahupuaʻa*.

imu	Underground oven
iwi	Bone; carcass (as of a chicken); core (as of a speech). The bones of the dead, considered the most cherished possession, were hidden, hence there are many figurative expressions meaning life, old age.
kahuna	Priest, sorcerer, magician, wizard, minister, expert in any profession. *Kāhuna*—plural of *kahuna*.
kāī	A variety of taro, the corms of which are fragrant when cooked and, though tough, yield excellent poi.
kālua	To bake in the ground oven, to burn brick or lime
kamaʻāina	Native-born, one born in a place, host; native plant; acquainted, familiar, Lit., land child.
kapa	Tapa, as made from *wauke* (paper mulberry) or *māmaki* bark.
kula	Plain, field, open country, pasture. An act of 1884 distinguished dry or *kula* land from wet or taro land.
kumu	Teacher, tutor. *Kumu hula*, *hula* teacher.
kuleana	Native Hawaiian land rights (common). Right, privilege, concern, responsibility, title, business, property, estate, portion, jurisdiction, authority, liability, interest, claim, ownership, tenure, affair, province.
kupua	Demigod or culture hero, especially a supernatural being possessing several forms; one possessing *mana*; to possess *kupua* (magic) powers.
kupuna	Elders (common). Grandparent, ancestor, relative or close friend of the grandparent's generation, grandaunt, granduncle. *Kūpuna*—plural of *kupuna*.
kūlolo	Pudding made of baked or steamed grated taro or coconut cream.
limu	A general name for all kinds of plants living under water, both fresh and salt.
lāʻau lapaʻau	Traditional plant medicine (common). Medicine. Lit. Curing medicine.
lei	Garland, wreath, necklace of flowers, shells, ivory, feathers, or paper, given as a symbol of affection; any ornament worn around the head or about the neck.
loʻi	Irrigated terrace, especially for taro, but also for rice; paddy.
makai	Seaward

makana	Gift
make	To die, perish, defeated
makua	Parent, any relatives of the parents’ generation, as uncle, aunt, cousin.
mana‘o	Thought, idea, belief, opinion, theory
mauka	Inland.
mele	Song, anthem or chant of any kind; poem, poetry; to sing, chant
moku	District, island, islet, section.
mo‘o	Lizard, reptile of any kind, dragon, serpent; water spirit
mo‘olelo	Story, tale, myth, history, tradition, literature, legend, journal, log, yarn, fable, essay, chronicle, record, article; minutes, as of a meeting. (From *mo‘o ‘ōlelo*, succession of talk; all stories were oral, not written).
‘ohana	Family, to gather for family prayers
‘ōhi‘a	Two kinds of trees: see *‘ōhi‘a ai* and *‘ōhi‘a lehua*
‘ōlelo no‘eau	Proverb, wise saying, traditional saying.
oli	Chant that was not danced to, especially with prolonged phrases chanted in one breath, often with a trill at the end of each phrase; to chant thus.
‘ono	Delicious, tasty, savory
‘ō‘ō	Digging stick, digging implement, spade
pali	Cliff, precipice, or steep slope
poke	To slice, cut crosswise into pieces, as fish or wood; to press out, as the core of a boil or the meat of an *‘opihi* shell; section, slice, piece. *Poke he‘e*, a severed portion of octopus.
pouli	Dark, darkness, dark night
poi	*Poi*, the Hawaiian staff of life, made from cooked taro corms, or rarely breadfruit, pounded and thinned with water.
pule	Prayer
tūtū	Grandparent
‘ulu	Breadfruit, a tree perhaps originating in Malaysia and distributed through tropical Asia and Polynesia
unu	Alter, heiau, especially a crude one for fishermen or for the god

	Lono, an agricultural heiau.
wahi pana	Storied place (common). Legendary place.
wai	Water, liquid or liquor of any kind other than sea water.

Appendix B Common and Scientific Names for Plants and Animals Mentioned by Community Participants

Common Names		Possible Scientific Names		Source
Hawaiian	**Other**	**Genus**	**Species**	
āholehole	juvenile *āhole* (Hawaiian flagtail)	*Kuhlia*	*xenura*	Hoover 2003
akule	big-eyed scad	*Selar*	*crumenophthalmus*	Hoover 2003
ʻamaʻama	striped mullet	*Mugil*	*cephalus*	Hoover 2003
ʻāweoweo	bigeye	*Heteropriacanthus*	*cruentatus*	Hoover 2003
ʻāweoweo	bigeye	*Priacanthus*	*meeki*	Hoover 2003
hala	pandanus	*Pandanus*	spp.	Wagner et al. 1999
hau	beach hibiscus	*Hibiscus*	*tiliaceus*	Wagner et al. 1999
hīnālea	psychedelic wrasse	*Anampses*	*chrysocephalus*	Randall 1996
kala	unicorn fish	*Naso*	spp.	Randall 1996
kalo	taro	*Colocasia*	*esculenta*	Wagner et al. 1999
kawakawa	makerel tuna	*Euthynnus*	*affinis*	Hoover 2003
kūhonu	Spotted-back crab	*Portunus*	*sanguinolentus*	Hoover 1993
kukui	candlenut	*Aleurites*	*moluccana*	Wagner et al. 1999
kūmū	White saddle goatfish	*Parupenus*	*porphyreus*	Hoover 1993
heʻe	octopus, squid, *tako*	Multiple families and species	--	Hoover 1993

Common Names		Possible Scientific Names		Source
Hawaiian	**Other**	**Genus**	**Species**	
limu kohu	seaweed, algae	*Asparagopsis*	*taxiformis*	Abbott and Williamson 1974
manini	convict tang	*Acanthurus*	*triostegus*	Hoover 2003
naupaka kahakai		*Scaevola*	*Sericea*	Wagner et al. 1999
ʻoama	goatfish	*Mulloidicthys*	spp.	Randall 1996
ʻōlena	tumeric	*Curcuma*	*longa*	Wagner et al. 1999
ʻōpelu	mackerel scad	*Decapterus*	*macarellus*	Hoover 2003
Paina	ironwood	*Casuarina*	sp.	Wagner et al. 1999
pōpolo	glossy nightshade	*Solanum*	*americanum*	Wagner et al. 1999
roi	peacock grouper	*Cephalopholis*	*argus*	Randall 1996
taʻape	bluestripe snapper	*Lutjanus*	*kasmira*	Randall 1996
ʻuala	sweet potato	*Ipomoea*	*batatas*	Wagner et al. 1999
uhu	parrotfish	Multiple genera and species in the family Scaridae	--	Hoover 1993
ʻūʻū	*menpachi* , soldierfish	*Myripristis*	spp.*	Randall 1996
ʻuhaloa	American weed	*Waltheria*	*indica*	Wagner et al. 1999
weke ula	goatfish (red)	*Mulloidichthys*	spp.	Hoover 1993

Appendix C Authorization and Release Form

Cultural Surveys Hawaiʻi, Inc.
Archaeological and Cultural Impact Studies
Hallett H. Hammatt, Ph.D., President

P.O. Box 1114 Kailua, Hawaiʻi 96734 Ph: (808) 262-9972 Fax: (808) 262-4950
Job code: KAPAA 8 afaanunu@culturalsurveys.com www.culturalsurveys.com

AUTHORIZATION AND RELEASE FORM

Cultural Surveys Hawaiʻi (CSH) appreciates the generosity of the *kūpuna* and *kamaʻāina* who are sharing their knowledge of cultural and historic properties, and experiences of past and present cultural practices in the Kapaʻa Ahupuaʻa for the Cultural Impact Assessment CSH is preparing for the proposed Moanakai Seawall Repair Project.
We understand our responsibility in respecting the wishes and concerns of the interviewees participating in our study. Here are the procedures we promise to follow:

1. The interview will not be tape-recorded without your knowledge and explicit permission.
2. You will have the opportunity to review the written transcript or notes of our interview with you. At that time you may make any additions, deletions or corrections you wish.
3. You will be given a copy of the interview transcript or notes for your records.
4. You will be given a copy of this release form for your records.

For your protection, we need your written confirmation that:

1. You consent to the use of the complete transcript and/or interview quotes for reports on cultural sites and practices, historic documentation, and/or academic purposes.
2. You agree that the interview shall be made available to the public.

Out of courtesy we would like to reconfirm that:

1. If you provided an interview to CSH in the past (for Molokaʻi Island), we may include all or parts of the prior interview/s published in past reports in the current report.

I, ________________________________, agree to the procedures outlined above and, by my signature, give my consent and release for this interview and/or photograph to be used as specified.

____
(Signature)

____
(Date)