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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
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JAN 23 2009

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January 7, 2009

Ms. Katherine Puana Kealoha, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Kealoha:

Subject: Final Supplemental Environmental Assessment (SEA) and Draft Finding of No Significant Impact (FONSI) for Kawai Nui Marsh Environmental Restoration Project, TMK 1-4-2-13:5 and 1-4-2-13:22, Kailua, Oahu

The U.S. Army Corps of Engineers and the State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife reviewed the comments received for the Draft SEA during the 30-day public comment period that began on February 8, 2008. The agency has determined that this project will not have significant environmental effects and has issued a Draft FONSI. Please publish this notice in the next Environmental Notice.

We are enclosing a completed OEQC Publication Form, two hard copies of subject report and one electronic (*.pdf) copy and project summary on disk. Please contact David G. Smith at 973-9787 if you have any questions.

Sincerely,

Paul J. Conry
Administrator
Division of Forestry and Wildlife

Kawai Nui Marsh Environmental Restoration Project, Kailua, Island of O‘ahu, Hawai‘i

Final Supplemental Environmental Assessment

Prepared by:
US Army Corps of Engineers,
Honolulu District
CEPOH-PP-E
Building 252, Fort Shafter, HI 96858-5440

December 2008

SUMMARY

Under authority of Section 1135 of the Water Resources Development Act of 1986, as amended, the U.S. Army Corps of Engineers, Honolulu District and the State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife, propose to restore habitat at the Kawai Nui Marsh Flood Control Project, Kailua, Island of O'ahu, Hawai'i, for four endemic endangered Hawaiian waterbirds: the Hawaiian Coot, Hawaiian Duck, Hawaiian Moorhen and the Hawaiian Stilt.[1]

The *Kawai Nui Marsh Master Plan*, dated July 1994, provided recommendations for enhancement and management of the marsh. The following excerpts are taken from the master plan:

> *Kawai Nui Marsh is the largest remaining wetland in Hawai'i, encompassing approximately 830 acres of land in Kailua, Oahu. The marsh provides important habitat for four endangered species of native Hawaiian waterbirds and for migratory bird species, and is identified by the U.S. Fish and Wildlife Service as a waterbird recovery area. Its waters also support a variety of introduced and indigenous aquatic wildlife. In addition, the marsh serves as a critical flood control basin to protect the developed lower-lying areas of urban Kailua, and to protect the water quality of Kailua Bay. With two prominent heiau overlooking the marsh and numerous and significant archaeological sites below, the entire marsh has been determined to be eligible for listing in the National Register of Historic Places. The marsh is also an aesthetic open space resource for the Windward community, and provides a variety of recreational and educational opportunities.*
>
> *Although the marsh has these significant values, a variety of resource management concerns hinder the potential of the marsh as a wildlife habitat, flood storage basin, cultural and education asset, and recreational area. As a waterbird habitat, open water areas are continually choked with vegetation and there is no control of predation. In terms of flood storage capacity, increased urbanization around the edge of the marsh and natural infilling of sediment have reduced the marsh's containment capacity. Culturally, the value of the marsh is diminished by poor access to cultural sites and lack of interpretive and educational programs. As a recreational and aesthetic resource, limited access is available to spots where the ecological and open space values of the marsh can be appreciated.*

The proposed project features include creation of 24 acres of mudflats and shallow ponds, installation of 8,040 linear feet of predator control fencing, implementation of a trapping program, and construction of two access roads to construct, operate and maintain the ~~two~~ pond systems that will be bisected by Maunawili Stream. The total project area will

[1] Vertical lines at left margin indicates change between Draft SEA, Jan 2008 and Final SEA, Dec 2008

encompass 37.8 acres.

This Supplemental Environmental Assessment is written strictly for actions covered under this Section 1135 project and does not address all of the actions in the *Kawai Nui Marsh Master Plan*. It updates and amends the Final Environmental Assessment portion in the *Kawainui Marsh Environmental Restoration Project, Final Ecosystem Restoration Report and Environmental Assessment*, as revised March 2000.

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LIST OF ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulation
cfs	cubic feet per second
DOFAW	Division Of Forestry and Wildlife
DOH	Hawaii State Department of Health
EA	Environmental Assessment
ERR	Ecosystem Restoration Report
FEA	Final Environmental Assessment
FEMA	Federal Emergency Management Agency
FCP	Flood Control Project
FIRM	Flood Insurance Rate Map
FWCA	Fish and Wildlife Coordination Act
gpd	gallons per day
gpm/acre	gallons per minute per acre
HTRW	Hazardous, Toxic and Radioactive Wastes
mgd	million gallons per day
mg/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
NTU	Nephelometric Turbidity Units
OMRR&R	Operations, Maintenance, Repair, Rehabilitation and Replacement
ppb	parts per billion
ppm	parts per million
SLH	State Law Hawaii
SHPD	Hawaii State Historic Preservation Division
SQG	Small Quantity Generator
TMK	Tax Map Key
ug N/L	micrograms Nitrogen per liter
ug P/L	micrograms Phosphorus per liter
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
w	watts

SECTION 1.0 – INTRODUCTION

1.1 General.

The U.S. Army Corps of Engineers, Honolulu District (hereafter referred to as the "Corps") and the State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife (hereafter referred to as "DOFAW"), propose to restore habitat within the Kawai Nui Marsh Flood Control Project (FCP), Kailua, Island of O'ahu, Hawai'i, for four endemic endangered Hawaiian waterbirds: the Hawaiian Coot, Hawaiian Duck, Hawaiian Moorhen, and ~~the~~ Hawaiian Stilt.[2]

This Supplemental Environmental Assessment (EA) discusses alternatives for the proposed action, including the No-Action Alternative. Two of the alternatives were previously described and evaluated in earlier reports, the *Kawainui Marsh Final Environmental Assessment and Finding of No Significant Impact*, dated July 1998 (hereafter referred to as the "*Kawai Nui FEA*") and the *Kawainui Marsh Ecosystem Restoration Report*, as revised in March 2000 (hereafter referred to as the "*Revised Kawai Nui ERR*"). The Supplemental EA will update and amend information and discussion on these two alternatives, as applicable. A new alternative is also presented and discussed in this Supplemental EA for consideration with the other alternatives to determine which is most responsive to the proposed project's purpose and need. Discussion will evaluate the environmental effects and consequences of implementing these alternatives.

1.2 Project Authorization.

The proposed Kawai Nui Marsh Ecosystem Restoration Project is authorized under Section 1135 of the Water Resources Development Act of 1986, as amended. Under this Act, the Secretary of the Army is authorized to review the operations of authorized water resource projects to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest. Modifications must be both feasible and consistent with the authorized project's original purpose. The proposed project would restore habitat for four endangered Hawaiian waterbirds and ~~not interfere with~~ support the Kawai Nui Marsh FCP's purpose to protect the Coconut Grove subdivision and the town of Kailua from flooding by serving as a flood storage basin.

1.3 Project Location and General Site Description.

The proposed project location is within Kawai Nui Marsh on the northeast, windward coast of the Island of O'ahu, in the State of Hawai'i, nestled between the base of the Ko'olau mountain range to the west and the town of Kailua to the east (Figure 1-1). The proposed site is in the southern, upper reaches of the marsh and is bounded by Kalaniana'ole Highway to the south, Kapa'a Quarry Road and a portion of the Kawai Nui Marsh wetland

[2] Vertical lines at left margin indicates change between Draft SEA, Jan 2008 and Final SEA, Dec 2008

to the west, the greater Kawai Nui Marsh wetland to the north and Ulukahiki Road, Castle Medical Center and the Kūkanono subdivision to the east (Figure 1-2).

The project will be sited on gently sloping, vegetated land currently used as a cattle grazing area for a small ranching operation that is bisected by Maunawili Stream.

1.4 Project Purpose.

The Corps and DOFAW propose to construct an ecosystem restoration project for the purpose of restoring habitat within the existing Kawai Nui FCP suitable for four endemic endangered Hawaiian waterbirds; the Hawaiian Coot (Hawaiian name: *`alae ke`oke`o*, Scientific name: *Fulica alai*), Hawaiian Duck (Hawaiian Name: *koloa maoli*, Scientific name: *Anas wyvilliana*), Hawaiian Moorhen (Hawaiian name: *`alae `ula*, Scientific name: *Gallinula chloropus sandivicenis*), and the Hawaiian Stilt (Hawaiian name: *ae`o*, Scientific name: *Himantopus mexicanus knudseni*).

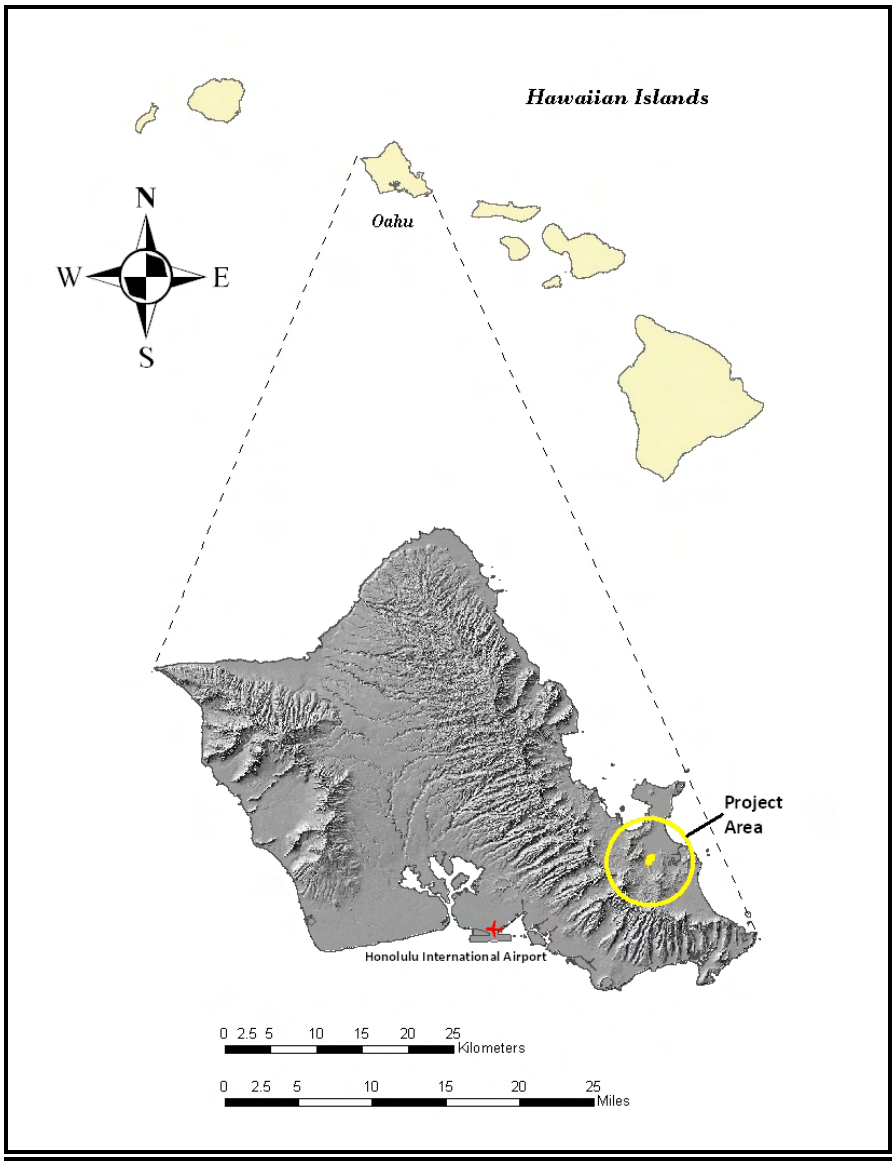


Figure 1-1 Island Location

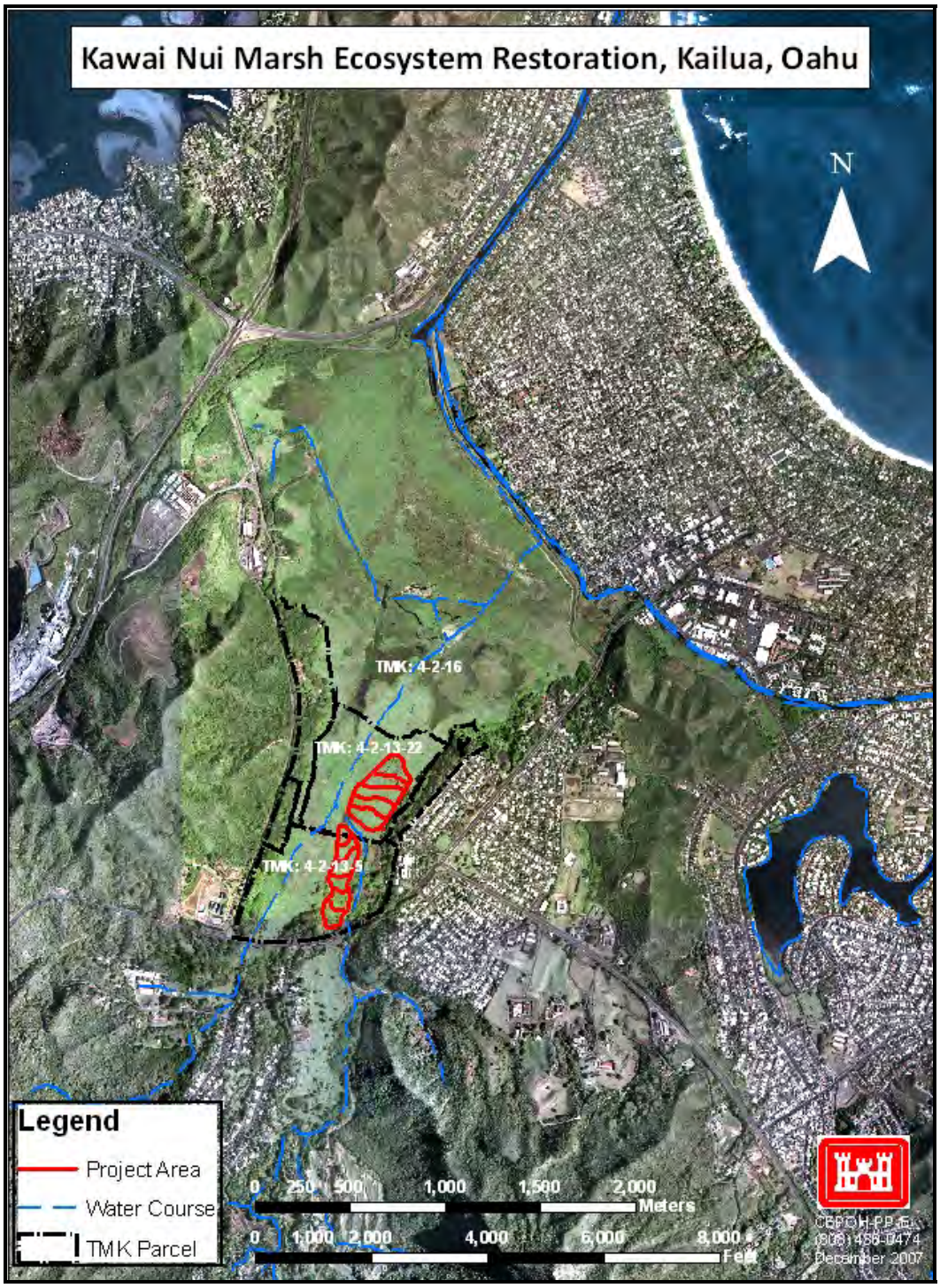


Figure 1-2 Project Location

1.5 Project Need.

As in other parts of the United States, Hawai'i's wetlands are under constant pressure from development. Declines in waterbird species which depend on wetlands have accompanied the destruction of these wetlands.

As the largest remaining wetland in the State of Hawai'i, Kawai Nui Marsh is an integral part of the U.S. Fish and Wildlife Service's (USFWS) *Draft Revised Recovery Plan for Hawaiian Waterbirds*, dated May 2005, as a protected core wetland for the conservation and recovery of the Hawaiian Coot, Hawaiian Duck, Hawaiian Moorhen and Hawaiian Stilt. The proposed project will restore diverse habitats in the marsh for these waterbirds with the potential of supporting the USFWS's ultimate recovery goal to restore and maintain self-sustaining populations of these Hawaiian waterbirds within their historical ranges., ~~which~~ This level of recovery will allow them to be reclassified to threatened status and eventually removed from the Federal List of Endangered and Threatened Wildlife and Plants.

The proposed project will also support DOFAW in fulfilling itsthe~~ir~~ long-term vision for the use and management of Kawai Nui Marsh as described in the *Kawai Nui Marsh Master Plan*, dated July 1994, and the *Management Plan for Kawai Nui Marsh*, dated March 2000, to protect the Coconut Grove subdivision and the town of Kailua from flooding and enhance the natural and cultural resources of the marsh. The proposed action will provide additional habitat to enhance DOFAW's conservation and recovery efforts for the four endangered Hawaiian waterbirds and support the primary purpose of the Kawai Nui FCP to serve as a flood storage basin. It also has the potential to serve as an integral component in ongoing governmental and community public education and interactive efforts by drawing public attention and providing opportunities to display and discover the marsh's natural resource significance and past historical and cultural practices.

1.6 Project History.

Construction of the original Kawai Nui Marsh FCP was authorized by the Flood Control Act of 1950 and was completed in August 1966 by the Corps. Project features included a 9,470-foot-long trapezoidal channel (Oneawa Channel); a 6,850-foot-long earthen levee with a maximum crest elevation of 9.5 feet; a 50-foot-long stub groin and 50-foot-long revetment at the outlet of Oneawa Channel; a 370-foot-long and 10-foot-deep silt basin; and drainage outlets (Figure 1-3).

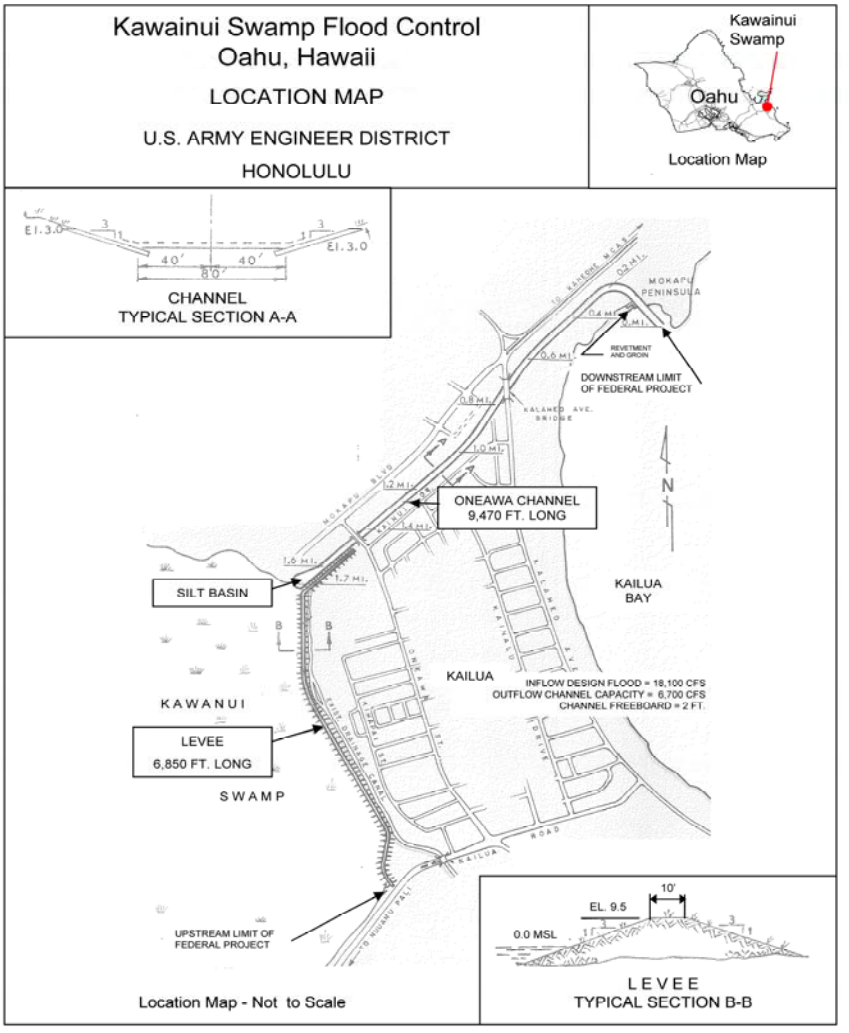


Figure 1-3 Kawai Nui Marsh Flood Control Project

The Kawai Nui Marsh FCP functions as a flood storage basin to protect the town of Kailua from flooding. Over the years, vegetation within the marsh has created a dense mat which has affected the hydraulics of the marsh. From December 31, 1987 through January 1, 1988, severe flooding of the Coconut Grove community occurred when the water level in the marsh exceeded the crest of the existing levee. Following this storm event, an emergency ditch was excavated alongside the levee to increase outflow from the marsh. However, the hydraulic capacity of the ditch (1,700 cfs) and Oneawa Channel (6,750 cfs) was much smaller than the 100-year flow (21,300 cfs) into the marsh.

As a long-term solution to the impacts experienced from the 1988 flood event, the Corps and the City and County of Honolulu modified the project under authority of Section 205 of the Flood Control Act of 1948, as amended. The modifications were completed in 1997 and included a concrete floodwall on the raised levee. The levee was raised up to 4-1/2 feet and the floodwall averages 4 feet in height. The total structure raise is about 6,300 feet long and varies from 8-1/2 feet at Kailua Road on the south to a gradual tapering into the existing levee at the Oneawa Channel outlet to the north. The City and County of Honolulu added a flood warning system to the project ~~and~~ that consists of two real time reporting stations. One station monitors rainfall and stream levels in the Makawao Stream area of Maunawili Valley and the other station monitors marsh water elevations and rainfall near the levee.

In 1994, the Corps received funding to prepare a Project Modification Report to investigate the feasibility and potential for modifying the existing Kawai Nui FCP to restore habitat for endemic, endangered Hawaiian waterbirds in accordance with Section 1135 of the Water Resources Development Act of 1986, as amended. The results of this planning effort were described in the *Kawainui Marsh Environmental Restoration Project, Final Ecosystem Restoration Report and Environmental Assessment*, dated July 1998, hereafter referred to as the "*Kawai Nui ERR/FEA*". The Federally Recommended Plan project features included: the creation of four main pond systems of mudflats and shallow ponds encompassing 70.7 acres, the removal of trees and other vegetation and the flattening of banks along 2,100 lineal feet of Maunawili Stream and 700 lineal feet of Kahanaiki Stream to restore riparian habitat, the installation of 16,200 lineal feet of fencing for predator control, implementation of a trapping program, the purchase of a flail mower and the mowing of 17 acres. Subsequent refinement of the pond area measurements increased the area from 70.7 acres to 71.7 acres.

The Ecosystem Restoration Report portion of the *Kawai Nui ERR/FEA* was subsequently revised in March 2000 based on project cost adjustments and amended results of the complimentary cost effectiveness/incremental analysis. The project features in the *Revised Kawai Nui ERR*, remained essentially the same except that the ponds were downsized from four main pond systems to three encompassing a decreased area of 60.9 acres. These features were deemed to be the most cost effective plan and found to be most responsive to the problems and needs of the marsh. This became the new Federally Recommended Plan, however the *Kawai Nui FEA* portion of the *Kawai Nui ERR/FEA* was not amended to reflect this change. Subsequent refinement of the pond area measurements increased the

area from 60.9 acres to 61.5 acres.

Further progress on the proposed project was suspended until a land ownership issue affecting the project was resolved. The proposed project was situated on two parcels, one owned by the State of Hawai'i, identified under the Tax Map Key (TMK) designation, TMK 1-4-2-13-5, and the other by the City and County of Honolulu, TMK 1-4-2-13-22. In order for the proposed project to proceed, the project sponsor was required to obtain either a perpetual easement or fee title to the entire proposed project area in order to maintain unrestricted access for construction, operation and maintenance activities. Disagreements between the two parties on the terms to resolve this requirement delayed execution of the project.

This ~~delay~~ impasse formally ended on June 30, 2007 when Governor Linda Lingle of the State of Hawai'i, signed into law Act 235, *"A Bill for an Act Relating to Kawai Nui Marsh"* (SLH 2007), that transferred the fee simple interest in the City and County of Honolulu's parcel to the State of Hawai'i. Passage and enactment of this law was based upon contingency terms specified in the *Subagreement and Acknowledgment of Local Cooperating Agreement* between the two parties signed on April 5, 2007. ~~Actual transfer of the fee interest awaits determination that these terms have been met.~~

In anticipation of this land transfer, the Corps reanalyzed the project scope and revised the project features based on the following factors: inflation in construction costs since the time the project scope was last revised in March 2000; discovery of site conditions that made a portion of the lower pond system unsuitable for construction due to persistent water inundation; Federal and State funding constraints; and the elimination of anticipated land credits to the sponsor because they were deemed ineligible. This reevaluation resulted in the development of the following project features: construction of two main pond systems with 24 acres of open pond area comprised of eleven terraced ponds with source water to each pond supplied through individual shallow groundwater wells equipped with solar powered pumps, installation of 8,040 linear feet of predator control fencing, implementation
of a year round trapping program, and construction of two access roads to construct, operate and maintain the ~~two~~ pond systems that will be bisected by Maunawili Stream. The total project area will encompass 37.8 acres within the boundaries defined in the *Revised Kawai Nui ERR*.

SECTION 2.0 – DESCRIPTION OF PROPOSED ACTION

2.1 General.

The proposed action is to restore habitat for four endemic endangered Hawaiian waterbirds within the Kawai Nui FCP by constructing two main pond systems encompassing a total of 24 acres of open pond area comprised of eleven terraced ponds, with source water to each pond supplied through individual shallow groundwater wells equipped with solar powered pumps, installation of 8,040 linear feet of predator control fencing around the perimeter of these ponds, implementation of a year round trapping program, and construction of two access roads to construct, operate and maintain the two pond systems that will be bisected by Maunawili Stream. The total project area will encompass 37.8 acres (Figure 2-1).

Oceanit Laboratories, Inc. (Oceanit) was contracted by the Corps to evaluate and design a wetland habitat based upon the earlier work contained in the *Revised Kawai Nui ERR* and *Kawai Nui FEA*. A full description of the various design considerations, options explored, and recommendations are written in their report entitled, *Kawainui Marsh Restoration Project, Source Water Engineering Report*, dated October 2006. The contents of the report are summarized in this chapter to describe the design concepts and selection rationale.

2.2 Project Hydrology.

2.2.1 Hydrologic Setting.

The proposed action is~~n~~ located entirely within the Kawai Nui Marsh FCP, ~~whose~~ the primary purpose of which is to serve as a flood storage basin to protect the Coconut Grove subdivision and town of Kailua from flooding. ~~This~~ The proposed project cannot interfere with this purpose in its effort to restore habitat.

The pond system is designed to not impede flood flow and will allow for surface flow during wet periods. The constructed ponds will act as grassed retention basins and may augment flood storage capabilities during small to moderate storms with outflow controlled by a system of adjustable weirs. Once the ponds have reached their operating capacity, as defined by the height of their weir boards, the excess flow will pass through the supply/drainage channel to the greater marsh system.

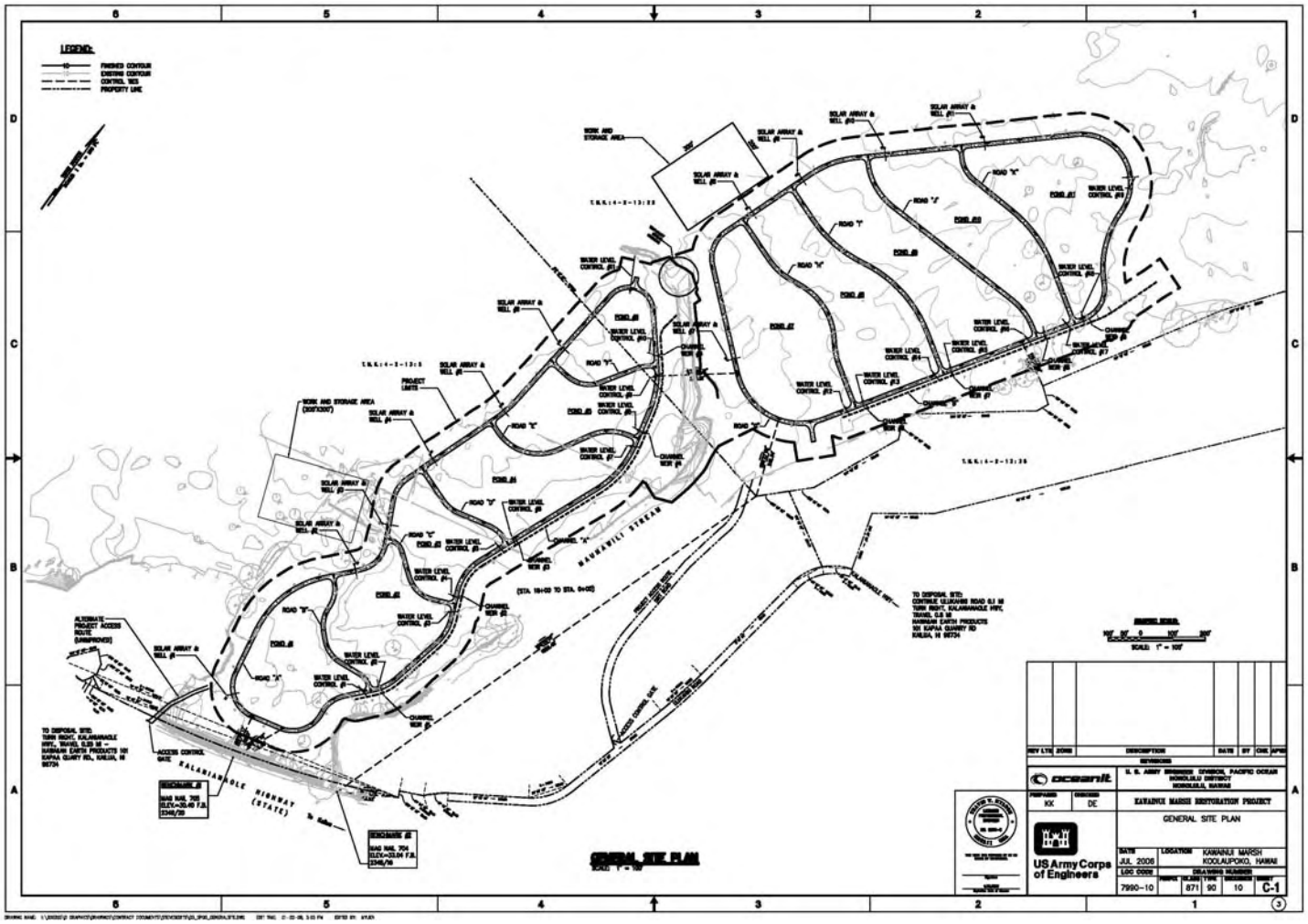


Figure 2-1 General Site Plan

2.2.2 Pond System Water Balance.

In order to create ideal habitat for the four endemic endangered Hawaiian waterbirds, water levels in the pond cells should remain at a constant level with minor fluctuations. The equation that governs the volume of water in a pond cell with no outflow is as follows:

Pond Water Volume = Applied Water + Rainfall – Evaporation – Infiltration

Rainfall and evaporation rates are known for the Kawai Nui Marsh area. In order to determine the infiltration rate, Oceanit constructed a small test pond which they monitored over a three month period. They determined experimentally that the rate was 6 gallons per minute per acre (gpm/acre) and was conservatively estimated to be 5 gpm/acre once the ground below the pond reached saturation.

The ponds vary in size from 1.0 to 2.2 acres in the upper pond set to 2.5 to 3.1 acres in the lower set. Water demand for a given pond will ~~be~~ dependent upon the size of the pond cell and the amount of rainfall received and must be sufficient to counteract infiltration and evaporation rates to maintain the desired level.

2.3 Source Water Alternatives.

To the greatest extent possible, DOFAW intends to utilize natural rain events to fill and maintain water levels within the ponds. Surface water, groundwater, and combinations of these source water alternatives were considered to meet water demands that could not be met through rainfall events alone.

2.3.1 Surface Water.

Two sources of surface water are available as potential source waters for the constructed wetland system: ~~;~~ water from Maunawili Stream and water from Kawai Nui Marsh.

- **2.3.1.1 Stream Supply.**

Maunawili Stream runs adjacent to the upper pond set and bisects the project area. The stream's flow averages ~~less than~~ just under 10 million gallons per day (mgd) and could easily meet the constructed wetlands estimated demand of 200,000 gallons per day (gpd). The quality of the water would be acceptable for use in this habitat though it would be subject to residential runoff.

Three techniques to transport this water to the project site were examined. One technique would be to pump the water from its normal flow profile over land to the site. This would not pose an economic or technical challenge, but it could be considered a stream diversion requiring an extensive permitting approval process. It would also require a large pump and

the routing of electrical power to the site. A second technique that was looked at involved utilizing the force of gravity to channel the stream water through an ʻ*auwai* water diversion system~~.~~, ~~h~~However, this too would be considered a stream diversion and would be too costly to construct. The third and probably most effective means of routing this water supply to the site would be through the temporary use of portable flood control ~~"~~"trash" pumps on an as needed basis.

- **2.3.1.2 Marsh Supply.**

Open water in the marsh downslope from the project site could also be used as a supply source. The water would have to be lifted by mechanical means and piped to the project site. Using a pumping system would be less than ideal due to the head losses that would be encountered. These losses may be avoided through the use of a siphon but it would be prohibitively expensive to construct and maintain.

2.3.2 Groundwater.

Groundwater is an attractive alternative as a water source because it is stored on-site, is of relatively consistent quality, and can be applied in a controlled manner. The drawback is that energy must be applied to lift the water out of the ground and into the pond system.

- **2.3.2.1 Availability.**

A site-specific hydrological investigation was conducted to determine the viability of using groundwater as source water for the project. The investigation revealed that a 60-foot well with a 6-inch diameter was capable of yielding 15-20 gallons per minute (gpm) of water on a sustainable basis. Constructing a dedicated well and pump to service each pond would provide the greatest flexibility. With an infiltration rate conservatively estimated at 5 gpm /acre and a typical pond sized less than 3 acres, the yield of such a shallow well would be at the lower range of its sustainable yield. The wells would be spaced hundreds of feet apart so there would be no drawdown interaction among wells.

- **2.3.2.2 Pumping Systems.**

If a groundwater supply option was selected, a suitable pumping system would have to be employed to provide the required yield. Based on the results of the hydrological investigation, it was calculated that approximately 70 watts (w), or less than 1/10 horsepower, would be needed to lift 20 gpm to a height of 12 feet in a typical shallow well configuration. This would equate to 770 w or about one horsepower to meet the water demand for all 11 ponds simultaneously. Since a typical groundwater pump, sized to meet the flow and lift requirements begin at a ½ horsepower size, a total of 5.5 horsepower or a little over 4,000 w would be necessary to power 11 of these pumps.

Four power supply alternatives were considered and evaluated against the following

factors~~;~~ cost, power conveyance, operation and maintenance complexity, performance, and environmental stewardship. The identified alternatives were~~;~~ inline power, independent solar, hybrid solar (inline and solar), and solar and battery. Inline power would provide an uninterrupted source of electrical power~~;~~ however, negative aspects ~~involving~~ include installation costs to route power lines to and within the project site, the potential to damage possible subsurface archaeological artifacts if these lines are buried, the high water table, the risk of accidentally unearthing buried power lines during maintenance plowing and tilling activities, and energy costs. Independent solar is a viable alternative as solar energy levels are adequate within the marsh, photovoltaic arrays are available to provide the required electrical energy to meet the pump's power demands, trenching of power lines would not be necessary as each pump would be fitted with ~~their~~ its own array, no additional fuel will be required for batteries or generators, and there would be no recurring energy costs. The negative aspects of this alternative are the higher maintenance cost that would be incurred to maintain and replace the arrays once they~~'~~ have surpassed their useable life and the operational limitation to periods when adequate solar light intensities are available. The third alternative ~~was~~ is the hybrid solar option that would employ a combination of inline power and solar arrays. All the negative aspects of the strictly inline alternative would still apply. The benefits that could be realized would be that the pumps could still operate when limited solar energy is available and perhaps any excess energy generated from the array may be credited back to the user to help defray installation and operating costs. The fourth alternative is to utilize solar power with a battery backup using rechargeable batteries that would be utilized to provide power to the pumps in low light conditions: The drawbacks of this system would be storage of the batteries, replacement and disposal costs, and questionable reliability.

Based upon an evaluation of the alternatives presented in this section, an independent, solar-powered, groundwater pumping system was recommended as the most effective and efficient means to augment source water requirements (Figure 2-2).

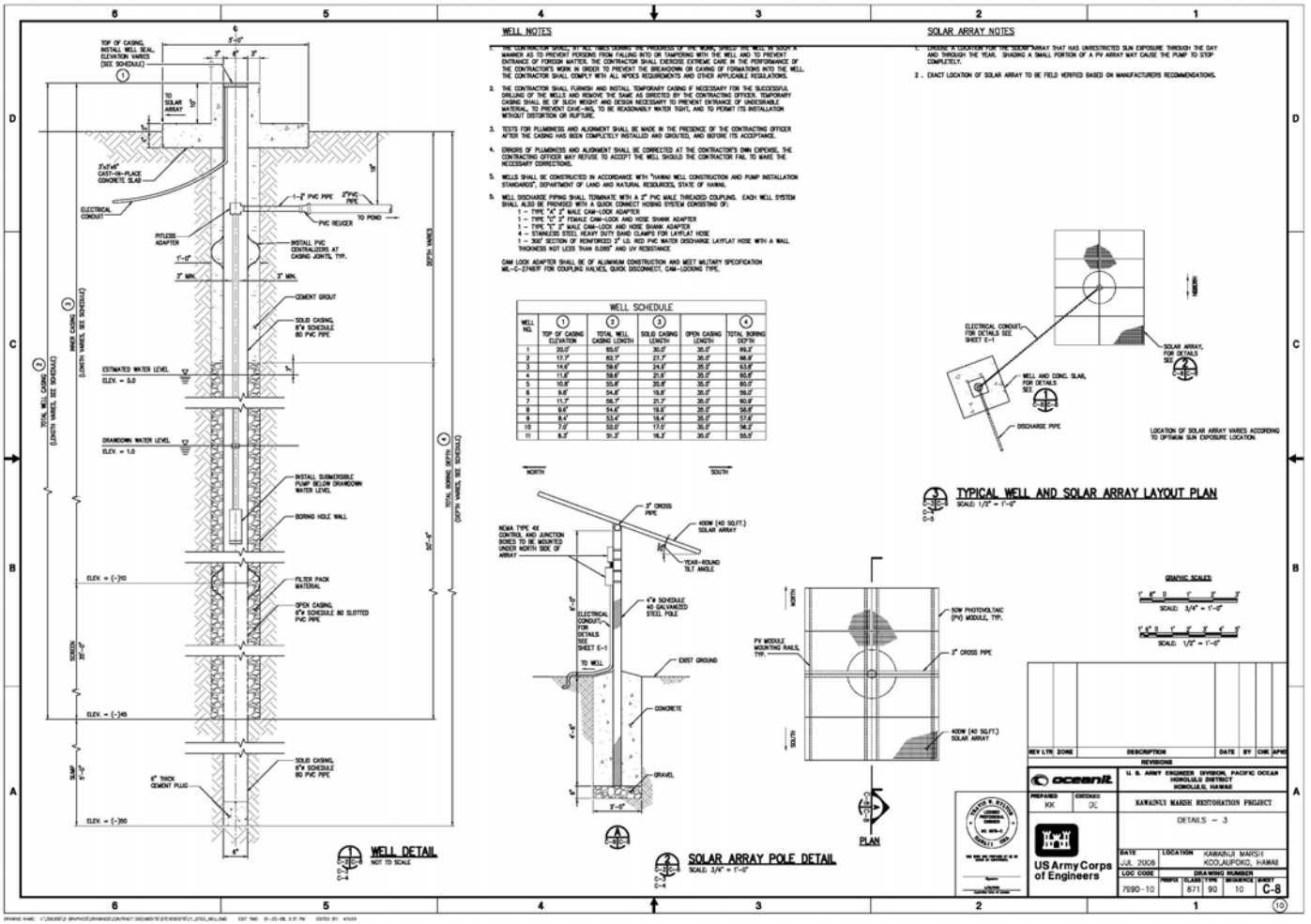


Figure 2-2 Well and Solar Array Layout

2.4 Pond System Design.

Considerations that went into developing the design of the ponds that would make up the constructed wetland included:; waterbird habitat preferences, predator control techniques, pond feed water configurations, pond-cell grading options and water level controls.

2.4.1 Waterbird Habitat Design Considerations.

Each of the four endangered Hawaiian waterbirds has its own preferences for habitat, nesting, and foraging areas. The Hawaiian Stilt prefers mudflat habitat and adjacent vegetated areas for nesting and feeding. They feed on a wide variety of aquatic organisms in mudflat and shallow water habitats. The Hawaiian Coot uses open water for feeding and adjacent vegetated areas for nesting habitat. They seek areas with vegetation and stable water levels. They feed near the surface of the water and are known to dive in their efforts. They also forage in sand and mud for snails, crustaceans, aquatic and terrestrial insects, and seeds and leaves of aquatic plants. The Hawaiian Moorhen prefers open waterways, channels, and densely vegetated areas. Areas with open water mixed with marsh vegetation are preferred for nesting. Areas with vegetative cover are used as feeding and nesting sites. This species is relatively secretive in nature and is rarely sited even though it is a permanent resident of Kawai Nui Marsh. The Hawaiian Duck is also a permanent resident of Kawai Nui Marsh. It can be found around open waterways and channels and tends to nest on the ground near water. They feed on snails, earthworms, rice, algae, and seeds and leaves of aquatic plants.

The primary design criteria will be to provide enough water depth (about 3 inches) and shoreline to create a diverse habitat to support much of the waterbirds' habitat preferences. The water in the pond does not have to circulate continuously but since the natural topography is bumpy, the site will have to be graded to insure levelness of the ponds and ensure positive drainage. Water retention time in the ponds may be from weeks to months. It is the intent of DOFAW to utilize rainfall events as much as possible to fill and maintain water levels at the desired levels and to augment the water demand with groundwater as necessary. During the summer, there number of ponds in operation will be scaled back due to water availability and to coincide with the annual pond maintenance schedule. Maintenance will involve drying out of the ponds and then tilling the soil with farm-type tractors to encourage the development of a hard pan that will aid in water retention. The contours of the ponds will take on a meandering profile in order to mimic natural water bodies and to follow existing topographic profiles to reduce the extent of excavation.

2.4.2 Predator Control Techniques.

The primary predator control technique to be employed under the construction Contractor's scope of work will be the installation of predator control fencing around the perimeter of the ponds (Figure 2-3). This will prevent predator access within the project site, which is

critical in providing a safe environment ~~from predators~~ for the waterbirds. DOFAW will establish a year-round trapping program that will call for the placement of predator traps spaced 100 feet apart within the fence line. These traps will be equipped with a water source and a roofing tile overhead to provide shelter for the captured animal. These traps will be checked every 48 hours to ensure that any waterbirds mistakenly captured are released.

These first two photographs show typical traps used at wildlife refuges on Oahu. Animals entering the trap will trigger the spring-loaded door. Bright colored flagging attached to a tall stake makes it easy to locate the trap even in brushy areas. Food, water and shade are provided to sustain trapped animals.

Perimeter predator fencing such as typical dog (left) and mongoose (right) fencing should be used around the facility.

Figure 2-3 Predator Control

2.4.3 Pond Feed Water Configurations.

The pond feed water ~~feed~~ configuration must be selected to deliver and distribute the source water among the ponds. The selected configuration will also have a bearing upon the layout of the ponds. In general, the ponds will be arranged in a mosaic pattern following the contours of the project site. This arrangement minimizes earthwork and ~~their~~ its associated costs and mimics natural pond contours that are more attractive to the waterbirds. In addition, this work will be confined to the top 18-inches of soil to minimize any adverse affect that this activity may have on archaeological artifacts that may be buried below this level. The ponds will be terraced so that gravity flow can be used for water distribution among the ponds. The layout calls for two sets of connected ponds, separated by a section of Maunawili Stream that traverses the project site. The upper set is comprised of six ponds with areas between 1.5 and 2.0 acres. The lower set of ponds is wider and consists of five ponds with areas in the 2.0 to 2.7 acre range.

The pond feed water configuration would be tied to the pond arrangement so that water can be moved and circulated throughout the pond system by gravity with simple flow control structures and equipment. Four options were considered and evaluated on the basis of: flexibility and simplicity in operation and maintenance; costs associated with construction, operation and maintenance; and hydraulics involved with circulation, distribution and flow control. The first option was a top feed configuration where the uppermost pond would serve as a reservoir that would feed water to the paired ponds below and adjacent to it (Figure 2-4). This flow would then cascade to the lower ponds in succession. Though simple to construct and operate, it would not allow operational flexibility and control to drain and fill ponds independently. The second option, center feed, would position the channel down the center of the pond system (Figure 2-5). Though this configuration provides operational flexibility it may be complicated to construct and require greater operator oversight to operate. The third option is the single side channel side feed in which the feeder channel is constructed on one side of the pond system (Figure 2-6). This option provides operational flexibility and would be easier to construct and operate. And the last option is the dual channel side feed in which two channels are constructed on either side of the pond system (Figure 2-7). One channel would serve as the inflow channel and the other as the outflow. This option would entail additional construction cost and cannot easily reuse outflow from one pond to fill a lower pond.

Based upon an evaluation of the various options, the single side channel configuration (Figure 2-6) was selected as the recommended configuration.

2.4.4 Pond Cell Grading Options.

The pond cell grading options refer to how the internal area of the ponds would be graded to achieve some level of circulation within the pond from the passive inflow/outflow of water and to ensure that the ponds can be completely drained. Seven options were

considered and evaluated on the basis of flexibility and simplicity in operation and maintenance; costs associated with construction, operation and maintenance; and hydraulics involved with circulation, ease of draining and filling; ability to reuse water for downstream ponds; and the ability to provide shoreline and standing water habitat through level control. These options are linked to the feed water configuration selected and are grouped accordingly.

For the top feed configuration, the top feed flow grading option is applicable (See Figure 2-8). This simple grading scheme moves water from top to bottom of each pond cell or laterally between adjacent cells. The ponds would be graded such that low point would be at the exit gate. This may channelize flows across the pond creating a constant current and no areas of still water.

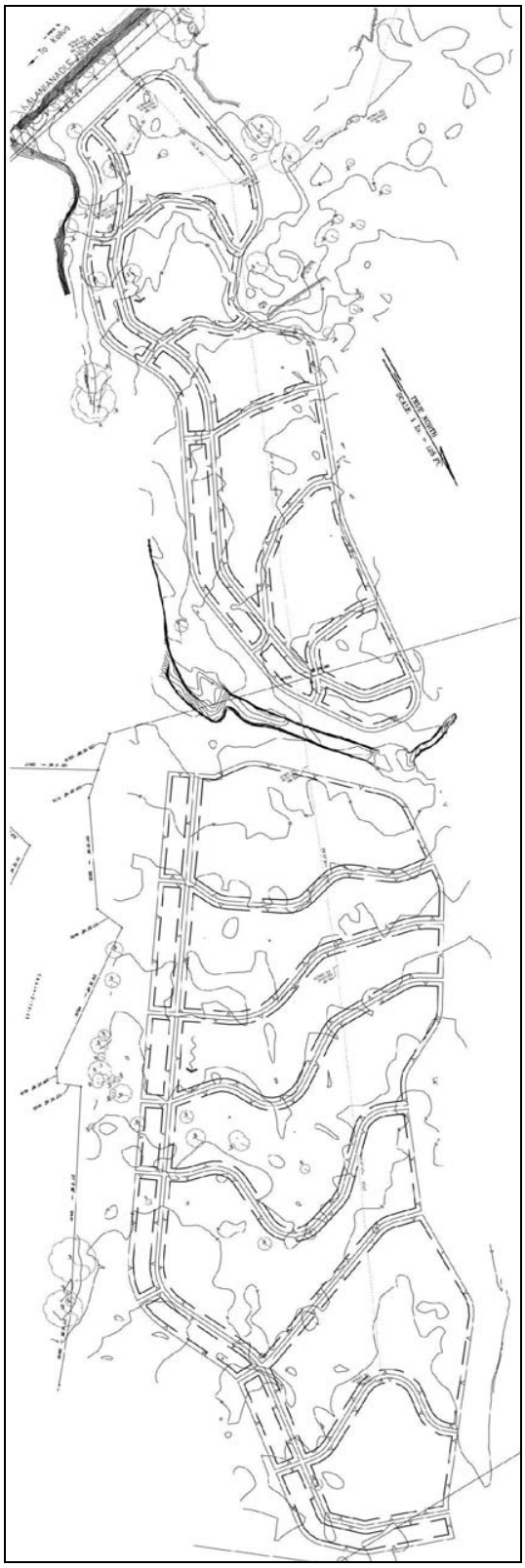


Figure 2-4 Top Feed

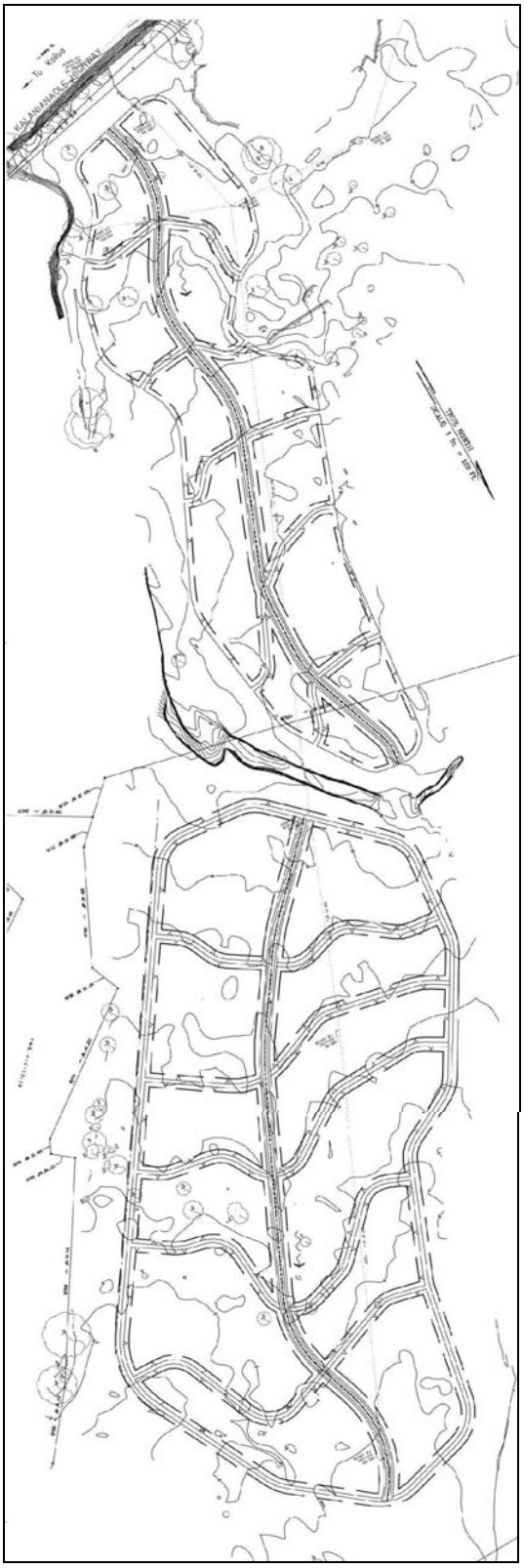


Figure 2-5 Center Channel

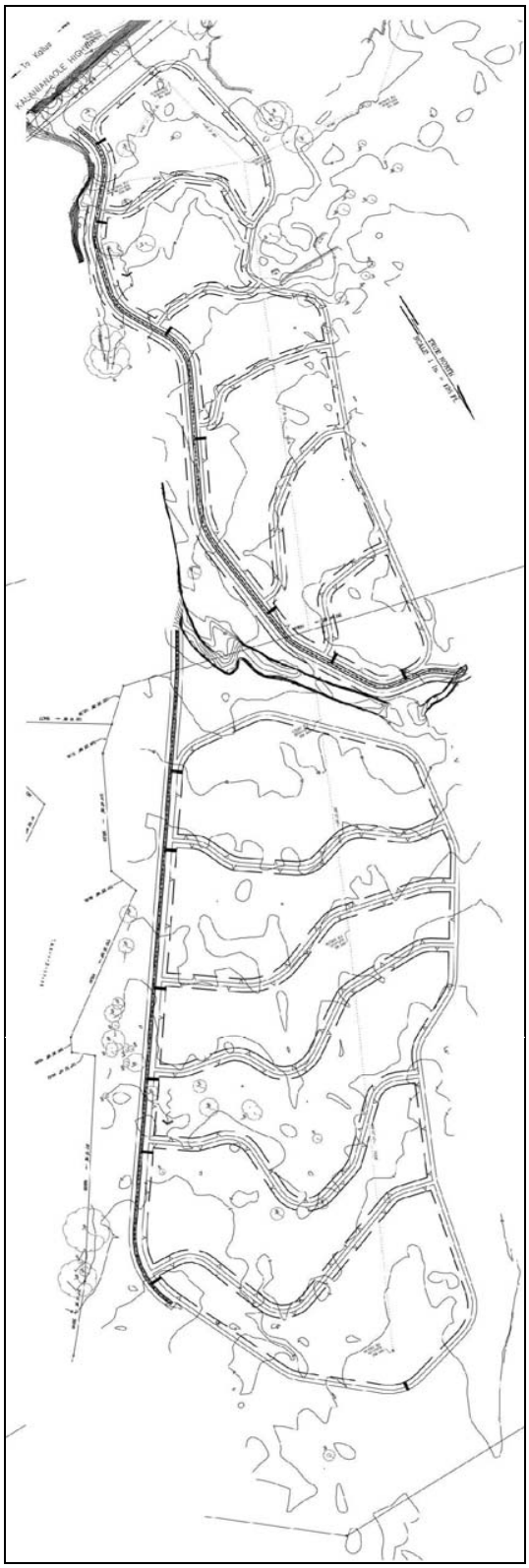


Figure 2-6 Single Side Channel Feed

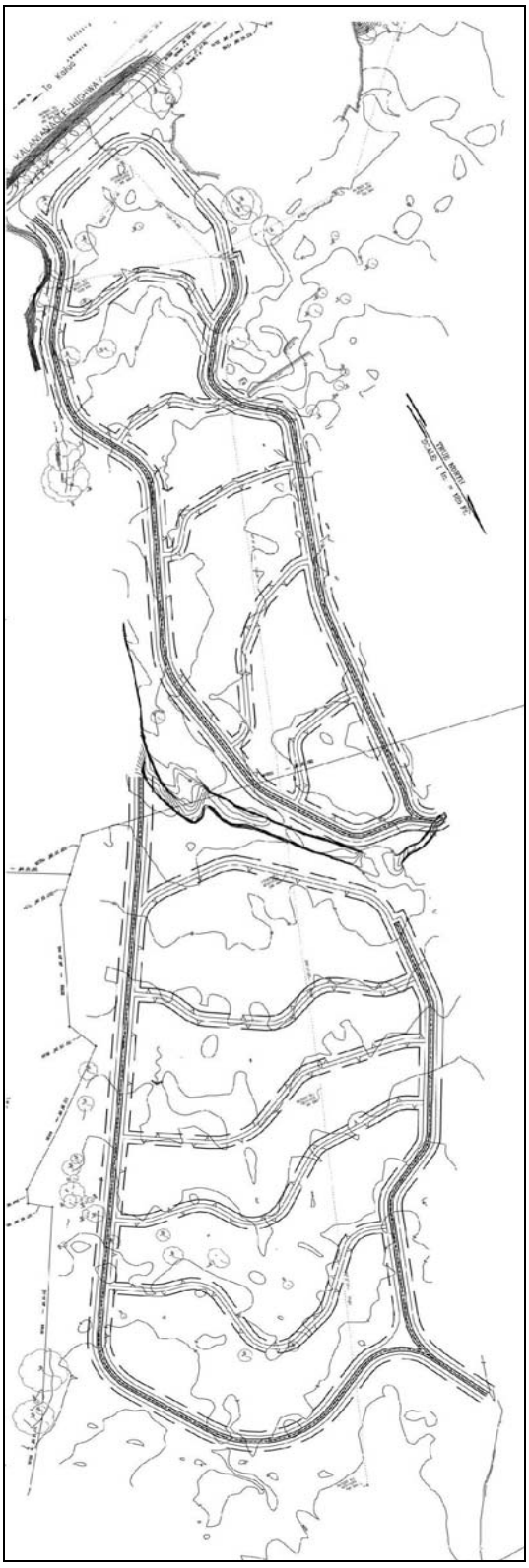


Figure 2-7 Dual Side Channel Feed

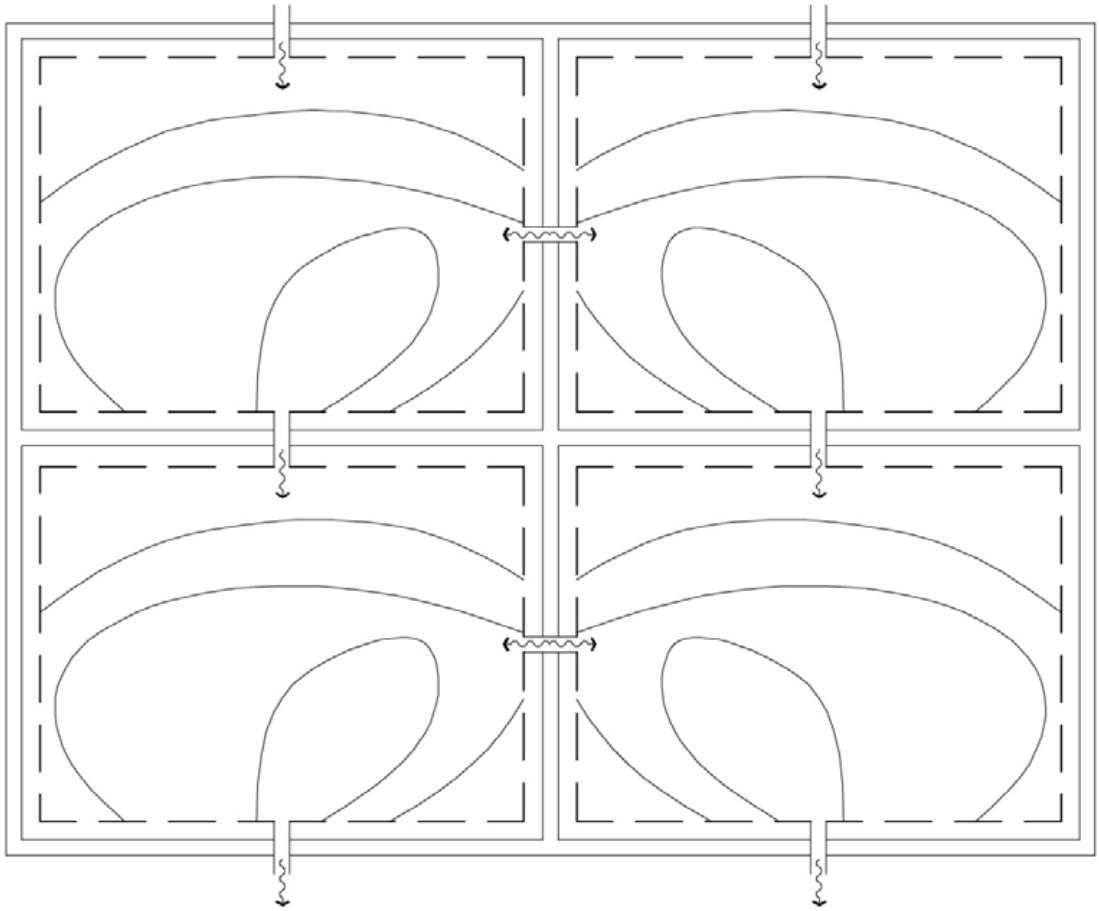


Figure 2-8 Top Feed Flow

Filling and draining of individual ponds cannot be accomplished independently;, drainage must be routed sequentially through the lower ponds which could be problematic should one of the ponds become contaminated.

Four options were provided for the single side channel configuration;, the gate meandering flow, gate flow, gate series flow, and single gate flow. For the gate meandering flow option (Figure 2-9), water would enter the top of the pond cell and be directed in a meandering fashion by the grading contours to the exit gate at the lower portion of the pond. The grading contour would circulate the water with speed directly related to the rate of flow. The main disadvantage would be the expense to construct and maintain this grading contour. The gate flow option (Figure 2-10) would grade the bottom contour to funnel the water towards the exit gate at the lower portion of the pond. The water would enter the top of the pond and the low point would have to be located near the channel for effective drainage. Ease of construction and maintenance are advantages. The gate series flow grading configuration would have a single entry from the channel to each pond and the bottom would be graded to direct the flow to the far end where the outlet would be into the adjacent downstream pond cell, thus filling the ponds in series (Figure 2-11). There would be a benefit in channelizing the flow and it would be relatively easy to construct and maintain., hHowever, it could be problematic if contamination were to occur in an upstream cell that empties into a downstream one. The last option is the single gate flow, where there would be a single gate to fill and drain the pond cell (Figure 2-12). Circulation would be limited to times when water is flowing into or out of the cell. Water cannot be circulated back into the system while simultaneously filling the pond.

Though no grading options were specifically linked to the center feed configuration within the report, it can be assumed that the options presented for the single side channel would be most applicable.

A single option was provided for the dual side channel feed configuration called the gate dual channel flow (Figure 2-13). In this grading scheme, the water would enter the top of the cell and the pond bottom would be graded to direct the flow towards the outlet into the side channel on the other side of the pond. This allows draining and filling from two separate channels but does not allow the water exiting the pond to be available as feed water to lower pond cells. It may channelize flows across the pond creating a constant current and no areas of still water.

The last option is called the grading to create berms only option. Ponds would be created through the construction of divider berms alone, without a system of gates and designed pond drainage. Installation of flow control devices could be accomplished at a later date. This is the least desirable option as it wouldn't positively address all the evaluation criteria.

As the single side channel feed water configuration was the recommended option, the gate flow grading option (Figure 2-10) presented above provides the most desirable outcomes in comparison to the other options and is the recommended grading option.

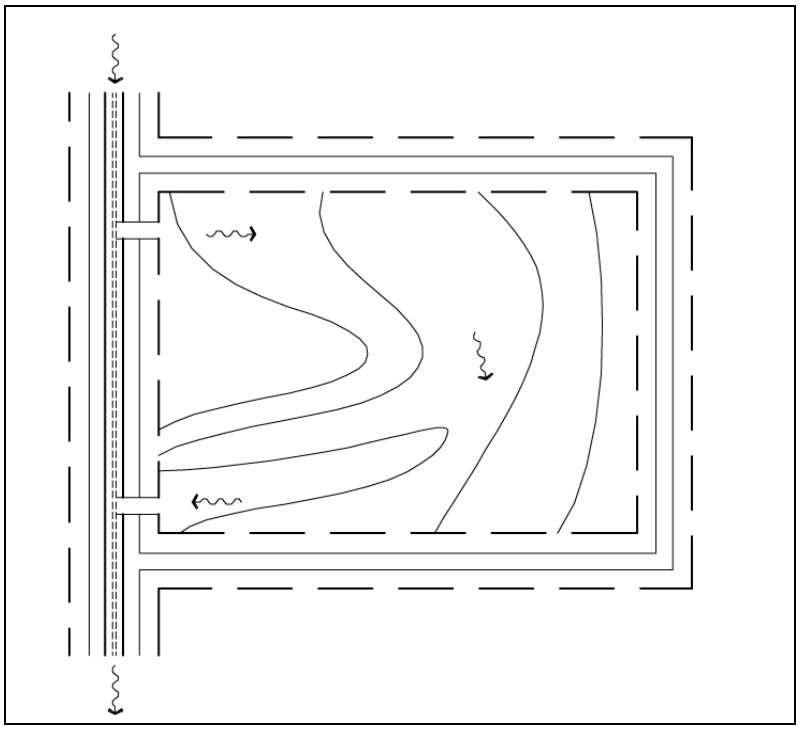


Figure 2-9 Gate Meandering Flow

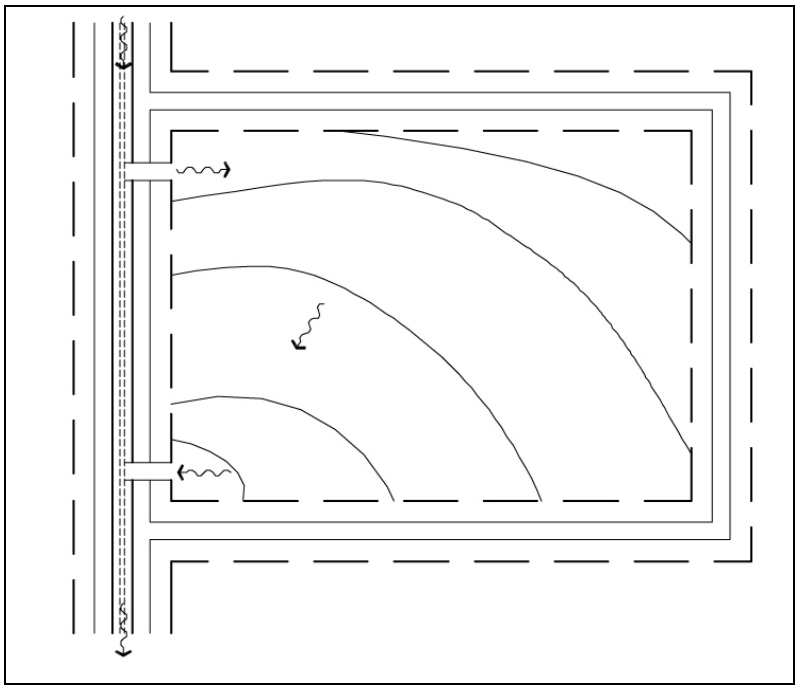


Figure 2-10 Gate Flow

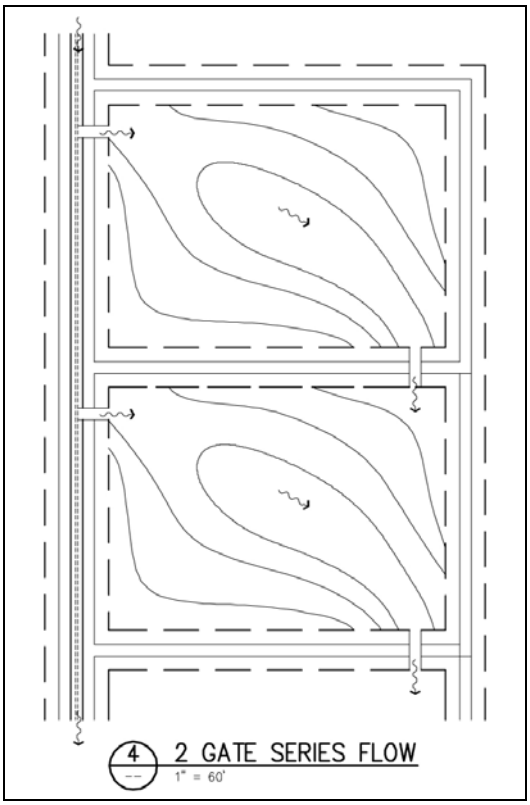


Figure 2-11 Gate Series Flow

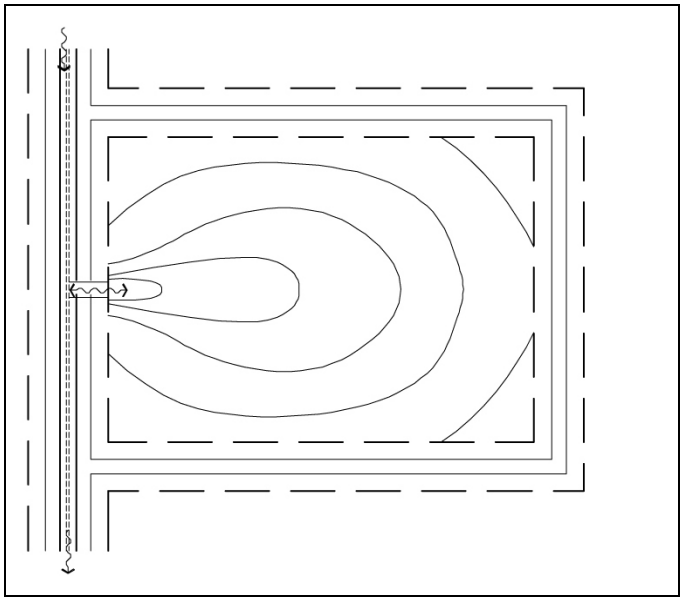


Figure 2-12 Single Gate Flow

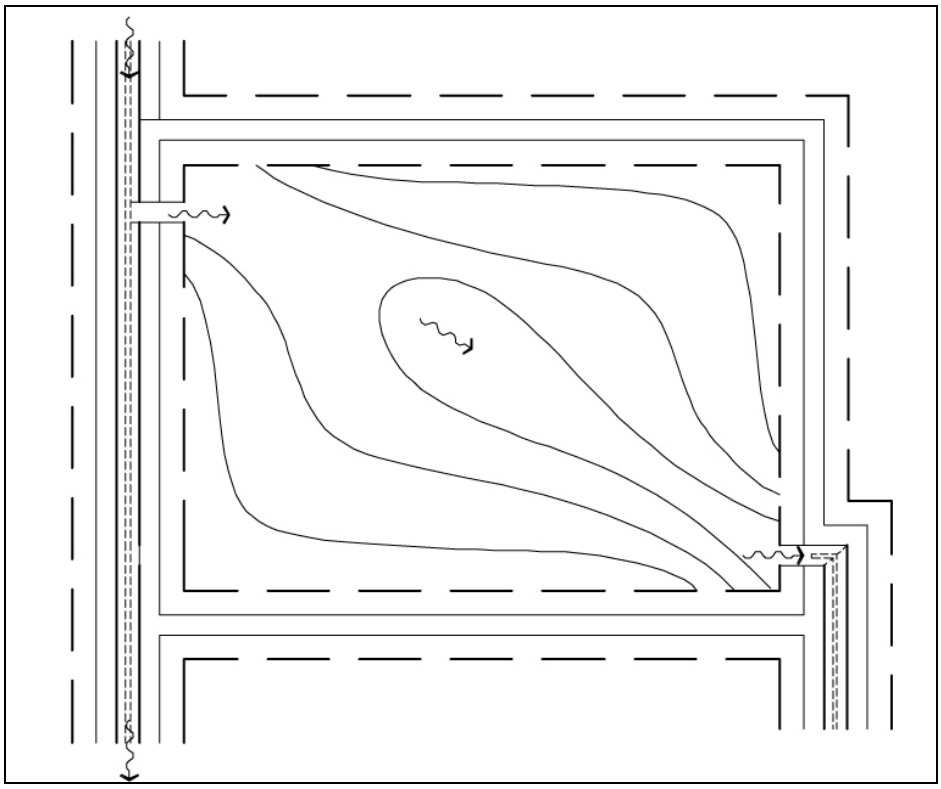


Figure 2-13 Gate Dual Channel Flow

2.4.5 Water Level Controls.

The gates described in the grading discussion will not be physical breaks in divider berms, but rather manufactured flow control structures. These structures are designed so that water levels can be controlled by the addition or removal of weir planks. Each pond cell will have two devices installed within the pond cell, each with a pipe connecting a weir structure to the single side feed channel. One will be positioned in the uppermost corner of the pond cell as the inflow gate and at the lowest corner as the exit gate (Figure 2-14).

Water levels within the single side feed channel will be controlled by weir structures. These structures may also be used to control water level within the ponds through their design (Figure 2-15).

2.5 Cost Estimates.

The Federal statutory limit for Section 1135 projects is $5,000,000. There is a cost sharing requirement wherein the Federal government will fund 75% of the total project costs with the local sponsor contributing 25% of the costs. The State of Hawai'i's cost share for the proposed project would be $1,667,000 for a total overall project budget of $6,667,000. Any costs exceeding this total will be the responsibility of the local sponsor. The total project costs, which include feasibility, design and construction phase cost~~s~~, are currently estimated at $5,912,000.

2.6 Access Roads.

The original project design called for the development of a single gravel access road with gated access leading from Ulukahiki Road to the project site. ~~that~~ The access road would be built for construction activities and remain in place to maintain access for subsequent operations and maintenance of the project.

A value engineering study was conducted in 2007 on the project design elements to examine how the design met the project's functions and to identify alternative ways to achieve the equivalent function while increasing the overall value of the project. During the deliberative process, the need to incorporate a second access route to the upper pond set or a bridge structure over Maunawili Stream was deemed necessary to provide access to the upper pond set. The single access road as designed provided access to only the lower pond set. Maunawili Stream would bisect the project site effectively hindering access to the area where the upper ponds would be located. To overcome this obstacle a second access road leading directly to the upper pond set area from Kalanianaole Highway was determined to be more cost effective in meeting this functional requirement than a bridge structure and it was included as a project feature.

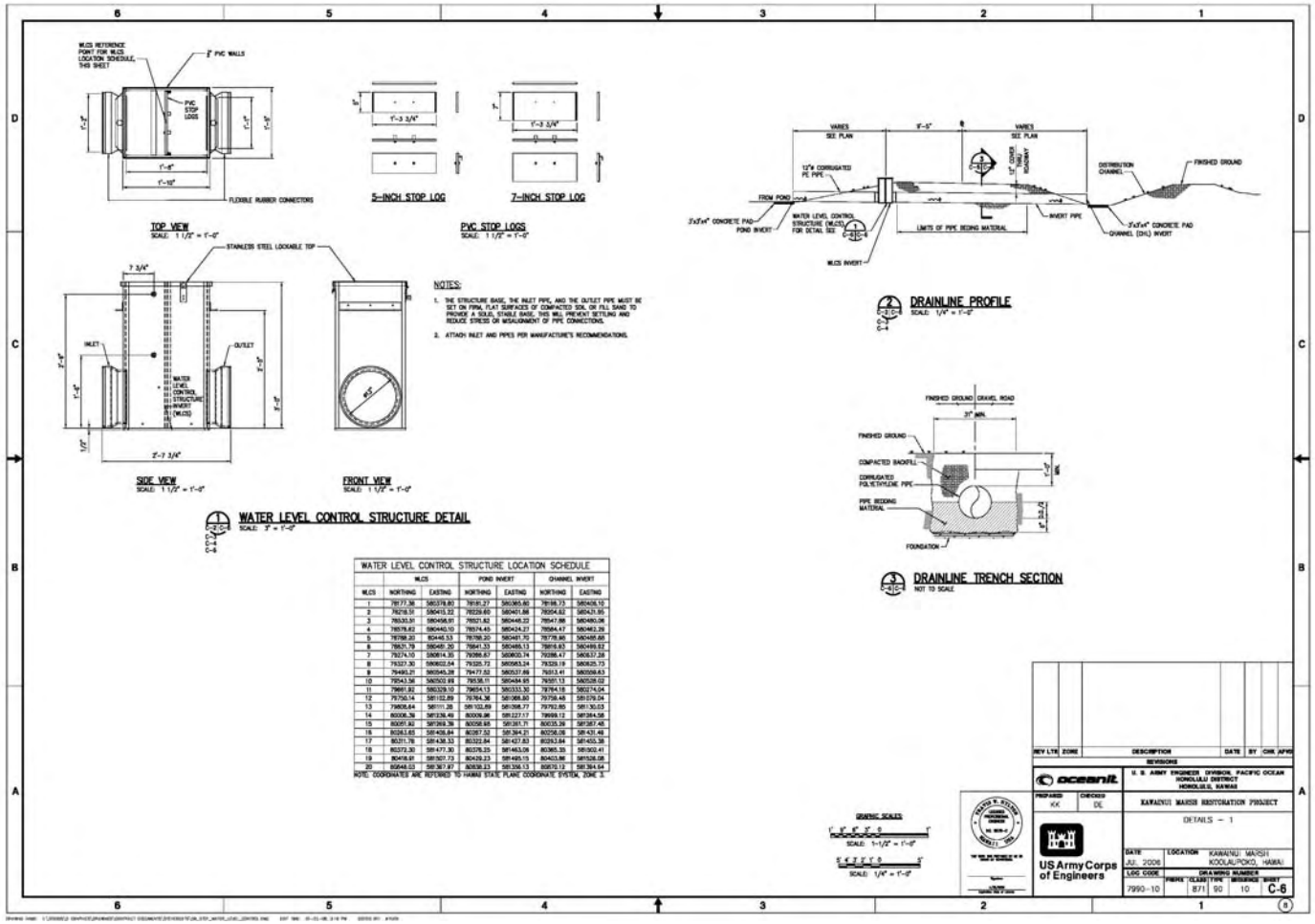


Figure 2-14 Water Level Control Structure

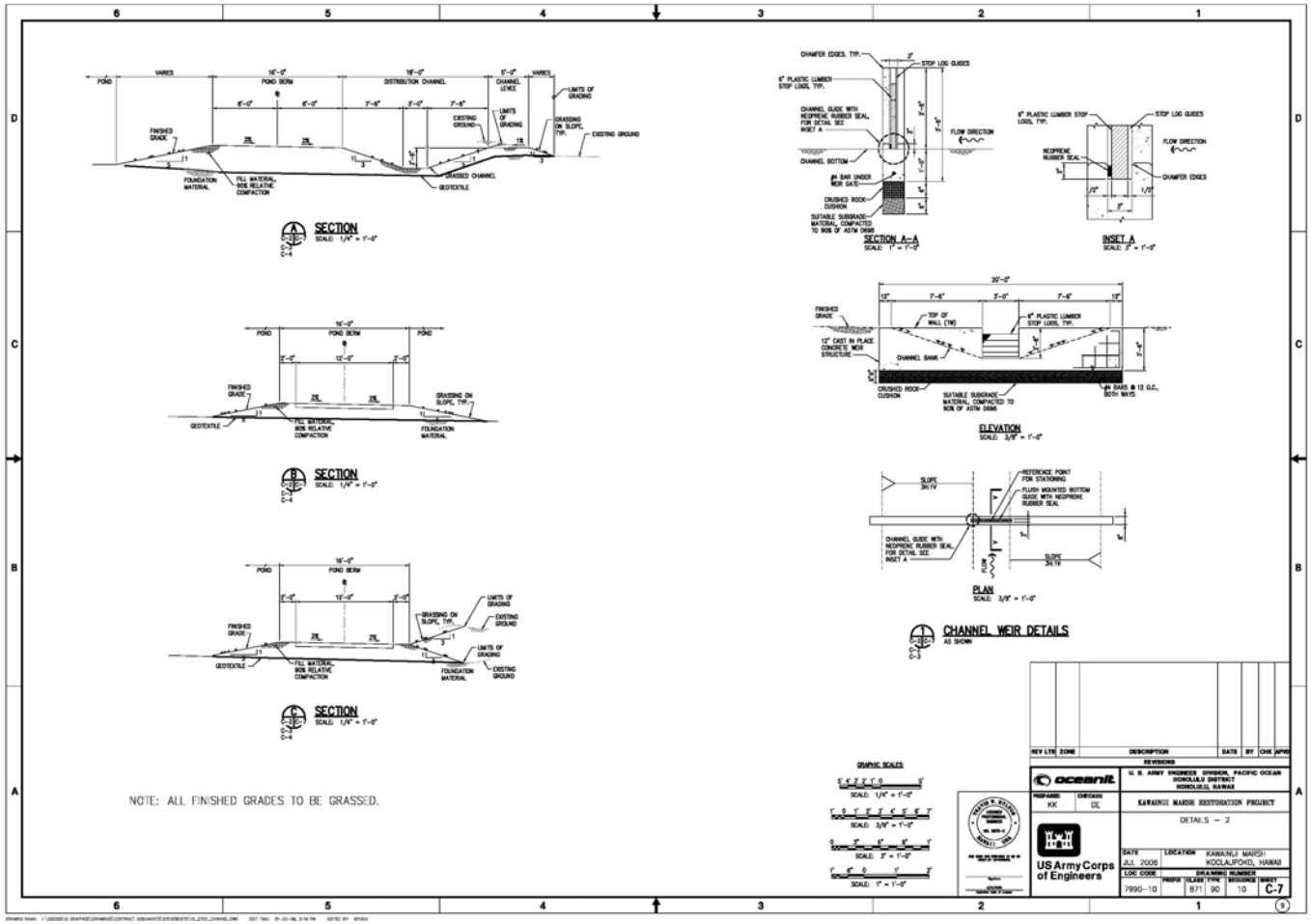


Figure 2-15 Weir Details

SECTION 3.0 – ALTERNATIVES

3.1 General.

~~F~~The four alternatives for the proposed action are ~~presented that include; :~~ Alternative 1 (No-Action Alternative), Alternative 2 (71.7-Acre Alternative), Alternative 3 (61.5-Acre Alternative), and Alternative 4 (37.8-Acre Alternative). Alternatives 2 and 3 were the recommended alternatives documented in the *Kawai Nui FEA* and *Revised Kawai Nui ERR*, respectively. Alternative 4 is the proposed action described in Section 2.0 of this Supplemental EA.

Alternative siting locations for the proposed action within the Marsh were explored, and subsequently ruled out on the basis of hydrologic control. Hydrologic control, for control of flooding and drying out individual ponds, is greatest at this area of highest elevation within the marsh. The benefits of hydrologic control could not be achieved elsewhere in the marsh where water levels are affected by tidal influence. Wetlands (as exist in the northwest corner of the marsh) would not elicit the same benefits as the desired plan because water levels can be too deep, and it would be difficult to establish a shoreline habitat. The current location was selected after extensive field reconnaissance and in coordination with multiple community groups and state agencies since the mid 1990s.

3.2 Alternative 1 (No-Action Alternative).

Under Alternative 1 (No-Action Alternative), construction of the proposed pond system to restore habitat for four endemic endangered Hawaiian waterbirds would not take place and the project area would remain in its present state as an open area within the Kawai Nui FCP. Kawai Nui FCP's purpose as a flood storage basin would remain unchanged. The subject area would continue to be leased on a month-to-month basis to Knott Ranch as a cattle grazing area to control vegetative overgrowth until such time as DOFAW decides that this activity is not compatible with their efforts to restore the marsh's habitat value. There would be no increase in waterbird habitat value and DOFAW's and USFWS's goals for the conservation and recovery of the Hawaiian waterbirds would not be supported.

3.3 Alternative 2 (71.7-Acre Alternative).

Alternative 2 has been thoroughly examined in previous studies and the results are documented in the *Kawai Nui FEA*. It was the recommended alternative out of those examined at the time. Although 9-10 years has elapsed since the *Kawai Nui FEA* was released, environmental conditions within the project's region of influence have remained relatively unchanged with regard to the project area. For this reason, an extensive re-

examination of this alternative will not be presented in this Supplemental EA. The project features for this alternative are summarized below and the *Kawai Nui FEA* should be consulted for a more detailed evaluation of this alternative (See also Figure 3-1).

- Construct four ponds A, B, C and D that would encompass a total area of 71.7 acres.
- Install 16,200 linear feet of predator fencing in order to reduce access to the marsh by predators that would begin at the levee to Kailua Road, continue along Kapaʻa Quarry Road and terminate at the vegetative processing area. Floating mat and open water within the greater marsh area would provide a natural barrier for predators from the northern approaches of the marsh.
- Implement trapping program to remove and control feral animals, mongoose, and other species which prey on waterbirds and their eggs. One hundred traps would be placed within the marsh and checked four times a week until there was a total reduction in captures.

- Purchase flail mower, mow and clear vegetation from 17 acres to control vegetative growth in the grassy upland and transitional areas to reduce cover for mongoose. Reduction in this predator's habitat needs will enable the ponds to achieve their potential waterbird productivity while exposure of seasonally wet areas will provide loafing and foraging opportunities for waterbirds.
- Remove trees and flatten banks along 2,100 lineal feet of Maunawili Stream to provide additional transitional habitat for waterbirds.
- Remove trees and flatten banks along 700 lineal feet of Kahanaiki Stream to provide additional transitional habitat for waterbirds.

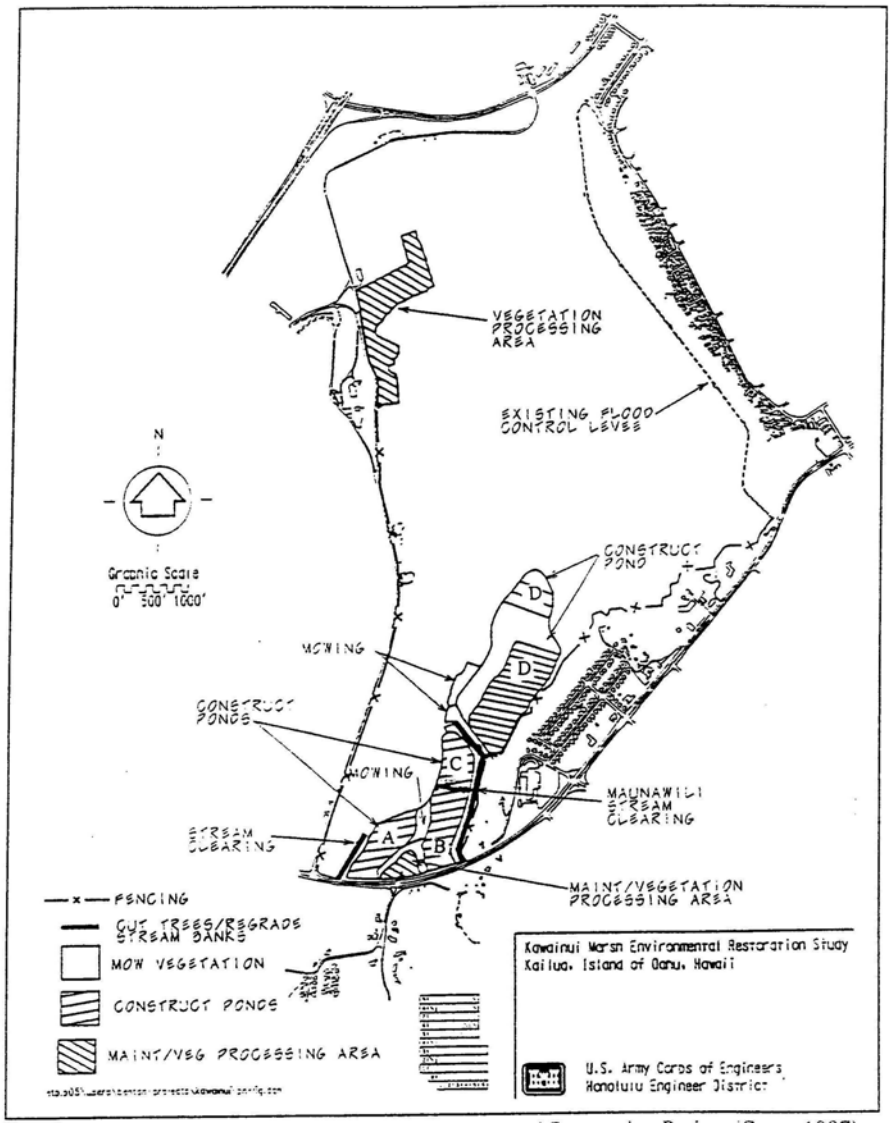


Figure 3-1 Alternative 2 (71.7 Acre Alternative)

3.4 Alternative 3 (61.5-Acre Alternative).

Alternatives 3 has been thoroughly examined in previous studies, the results of which have been documented in the *Revised Kawai Nui ERR* and the *Kawai Nui FEA*. This alternative is basically a downsized version of Alternative 2. The change in project size was based upon the discovery that one of the ponds would be difficult to construct and maintain because of the wet conditions of the area. This pond was eliminated from the design. Re-evaluation of the cost/benefits of the altered design was deemed the most cost effective plan and became the Federally Recommended Plan.

Although 7-10 years has elapsed since the *Revised Kawai Nui ERR* and *Kawai Nui FEA* were released, environmental conditions within the project's region of influence have remained relatively unchanged with regard to the project area. For this reason, an extensive re-examination of this alternative will not be presented in this Supplemental EA. The project features are summarized below and the *Revised Kawai Nui ERR* and *Kawai Nui FEA* should be consulted for a more detailed evaluation of this alternative (See also Figure 3-2).

- Construct three ponds B, C and D that would encompass a total area of 61.5 acres.
- Install 16,200 linear feet of predator fencing in order to reduce access to the marsh by predators that would begin at the levee to Kailua Road, continue along Kapaʻa Quarry Road and terminate at the vegetative processing area. Floating mat and open water within the greater marsh area would provide a natural barrier for predators from the northern approaches of the marsh.
- Implement trapping program to remove and control feral animals, mongoose, and other species which prey on waterbirds and their eggs. One hundred traps would be placed within the marsh and checked four times a week until there was a total reduction in captures.
- Purchase flail mower, mow and clear vegetation from 17 acres to control vegetative growth in the grassy upland and transitional areas to reduce cover for mongoose. Reduction in this predator's habitat needs will enable the ponds to achieve their potential waterbird productivity while exposure of seasonally wet areas will provide loafing and foraging opportunities for waterbirds.
- Remove trees and flatten banks along 2,100 lineal feet of Maunawili Stream to provide additional transitional habitat for waterbirds.
- Remove trees and flatten banks along 700 lineal feet of Kahanaiki Stream to provide additional transitional habitat for waterbirds.

Figure 3-2 Alternative 3 (61.5 Acre Alternative)

3.5 Alternative 4 (37.8-Acre Alternative).

As discussed in ~~the~~ Section 1.6, the scope of the Federally Recommended plan presented in the *Revised Kawai Nui ERR* was reevaluated when it became apparent that the land ownership issue that had suspended activity towards project execution would be resolved. This was done to determine if the then Federally Recommended plan could still meet the project's purpose and need given the rise in construction costs in the intervening period, the Federal and State funding constraints, emergent information regarding the suitability of part of the project area for pond construction, and the ineligibility of land credits to the sponsor. Oceanit was contracted by the Corps to evaluate and design a wetland habitat based upon the earlier work and recommendations contained in the *Revised Kawai Nui ERR* and *Kawai Nui FEA* that would be responsive to the project's purpose and need in light of these new issues. This re-evaluation resulted in the development of the proposed action described in Section 2.0. The project features are summarized below (See also Figure 3-3).

- Total project area of 37.8 acres.
- Construction of two main pond systems separated by low, earthen berms arranged in an irregular mosaic pattern with six cells above the area where Maunawili Stream bisects the project site and five cells below encompassing a total of 24 acres. The arrangement of the pond cells will roughly follow site topography in order to minimize earthwork. This is especially important as earthwork must be confined to the upper 18 inches of soil due to the possible presence of objects of archaeological importance below this depth. Water will be routed among pond cells through a single side channel that will be used to drain the ponds. Flow control structures with adjustable weirs will be utilized within the ponds and the feedwater/drainage channel to control water levels within the pond cells. This arrangement is relatively easy to construct and maintain, allows for maximum flexibility in water distribution and circulation, and provides the best opportunities for maximizing waterfowl habitat area and variation.
- Source water to each pond would be supplied through individual shallow groundwater wells equipped with solar powered pumps.
- Installation of 8,040 linear feet of predator control fencing around the perimeter of the ponds.
- Implementation of a trapping program.
- Construction of two access roads to provide site access to construct, operate and maintain the two pond systems that would be bisected by Maunawili Stream.

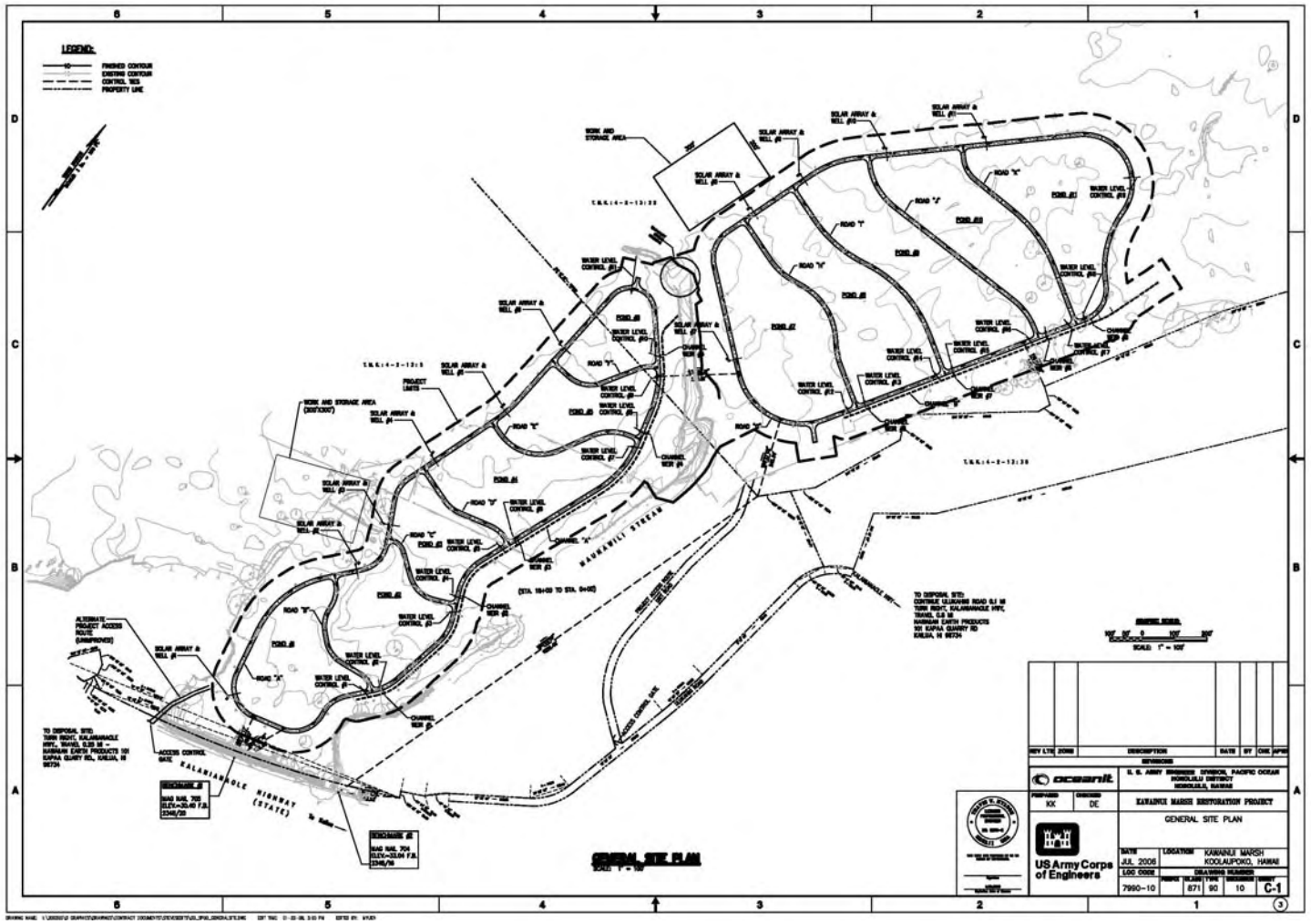


Figure 3-3 Alternative 4 (37.8 Acre Alternative)

3.6 Recommended Alternative.

Alternative 1 (No-Action Alternative) is considered non-responsive to the project's purpose and need and was not considered for further evaluation and recommendation.

A cost effectiveness evaluation was performed on the remaining alternatives to determine the most cost effective plan. Cost effectiveness reveals information about good financial investments given the dollar costs and non-dollar outputs ("benefits") among the alternatives. Cost effectiveness analysis begins with a comparison of the costs and outputs of the alternatives to identify the least cost plan for every possible level of output considered. The resulting least cost alternative plans are then compared to identify those that would produce greater levels of output at the same cost, or at a lesser cost, as other alternative plans. Alternative plans identified through this comparison are the cost effective alternative plans. The cost effective alternative plans are compared to identify the most economically efficient plans, that is, the "Best Buy" alternatives that would provide the greatest benefit for the cost.

Based on studies at the Hamakua Marsh Wetland, DOFAW biologists estimate that the Kawai Nui Marsh Ecosystem Restoration Project will yield the following beneficial impacts for endangered Hawaiian waterbirds:

- **Hawaiian Coots:** 0.2 nesting pairs per acre per year;
- **Hawaiian Moorhens:** 0.75 nesting pairs per acre per year;
- **Hawaiian Stilts:** 0.65 nesting pairs per acre per year;
- **Hawaiian Ducks:** no significant change in nesting pairs per acre per year.

The economic analysis assumed that these average annual nesting rates remain constant for each acre of restored habitat. Further, it assumed that the habitat is combinable; that is, all the species can prosper living in the new habitat together. Table 3-1 shows the derivation of the habitat units for each of the three alternatives. The Hawaiian Duck is not listed on Table 3-1 because there would be no significant change in nesting pairs; however, Kawai Nui Marsh offers foraging opportunities for the ducks.

TABLE 3-1
ESTIMATE OF HABITAT UNITS

		Alternative 2	Alternative 3	Alternative 4
	Nesting Pairs/Acre	**71.7 Acres**	**61.5 Acres**	**37.8 Acres**
Coots	0.2	14.34	12.3	7.56
Moorhens~~Gallinule~~	0.75	53.775	46.125	28.35
Stilts	0.65	46.605	39.975	24.57
	Total Habitat Units	114.72	98.4	60.48

Table 3-2 shows the costs of the three alternatives evaluated in this Section. The Annual Equivalent Cost is calculated based upon the total project construction cost times the interest and amortization factor for the current interest rate. The State of Hawai`i~~non-Federal sponsor~~ will be responsible for operation and maintenance costs (OMRR&R), which are assumed to be 10 percent (10%) of the construction cost annually. The Total Annual Cost is the sum of the Annual Equivalent Cost and the Annual OMRR&R Cost.

TABLE 3-2
SUMMARY OF THE COST EFFECTIVENESS EVALUATION
FOR THE KAWAI NUI MARSH ECOSYSTEM RESTORATION PROJECT

KAWAI NUI MARSH COST MATRIX	Alternative 2 71.7-Acres	Alternative 3 61.5-Acres	Alternative 4 37.8-Acres
Total Project Construction Cost	$8,533,000	$7,190,000	$5,912,000
Annual Equivalent Cost	$441,400	$368,400	$318,900
Annual OMRR&R Cost	$643,600	$515,200	$426,200
Total Annual Cost	$1,085,000	$883,600	$745,100

Table 3-3 presents the cost effectiveness analysis results for the three alternatives under consideration. All three alternatives are cost effective; however, the best buy plans are Alternatives 2 and 3~~, not Alternative 4~~.

TABLE 3-3
RESULTS OF THE COST EFFECTIVENESS ANALYSIS
FOR THE KAWAI NUI MARSH ECOSYSTEM RESTORATION PROJECT

Alternatives	Average Annual Habitat Units	Average Annual Cost	Cost per Habitat Unit	Cost Effective?	Best Buy?
Alternative 2 71.7-Acres	115	$1,085,000	$9,434	Yes	Yes
Alternative 3 61.5-Acres	98	$883,600	$9,017	Yes	Yes
Alternative 4 37.8-Acres	61	$745,100	$12,215	Yes	No

Based upon the analysis, Alternative 4 is cost effective but not a "Best Buy" alternative costing $12,215 per unit (according to Cost per Habitat Unit in Table 3-3). Although Alternatives 2 and 3 are cost effective and "Best Buys", they exceed the project's overall budget. ~~there simply is not enough money available to purchase them. It is analogous to a volume discount when shopping for certain commodities; one might be able to lower the unit price for a good by purchasing more of it, but at some point, you are likely to reach a cost that you cannot afford to exceed.~~

As discussed in Section 2.5 of this Supplemental EA, the project's total overall budget ~~ceiling~~ is $6,667,000, based upon the Federal funding 75% cost share limit of $5,000,000 and the sponsor's 25% matching cost share of $1,667,000. All three alternatives are cost effective but only Alternative 4 falls within the funding limitation. ~~Therefore,~~ Alternative 4 achieves the purpose and need for this project and at 37.8 acres, is the least environmentally damaging practicable alternative to the project site. Therefore, it is the Federally Recommended and Locally Preferred Plan.

SECTION 4.0 - AFFECTED ENVIRONMENT

4.1 General.

This section describes the affected environment in and around the vicinity of the proposed action and amends the description presented in the *Kawai Nui FEA.*

4.2 Physical Setting

4.2.1 Location and General Description.

Kawai Nui Marsh is located on the northeast, windward coast of the island of Oʻahu, in the state of Hawaiʻi nestled between the base of the Koʻolau mountain range and the town of Kailua. Boundaries of the marsh include Kapaʻa Quarry Road to the west, Mōkapu Boulevard on the north, the Coconut Grove subdivision on the east, and Kailua Road, the subdivisions of Kawai Nui Vista, Pōohāakapu and Kūkanono, and Kalanianaʻole Highway on the south. Oneawa Channel connects the marsh to Kailua Bay. Kahanaiki and Maunawili Streams drain into the marsh.

The proposed site is in the southern, upper reaches of the marsh and is bounded by Kalanianaʻole Highway to the south, Kapaʻa Quarry Road and a portion of the Kawai Nui Marsh wetland to the west, the greater Kawai Nui Marsh wetland to the north and Ulukahiki Road, Castle Medical Center and the Kūkanono subdivision to the east.

4.2.2 Geology.

The island of Oʻahu is the product of two ancient volcanoes. The first volcano created the Waianae mountain range and the second formed the Koʻolau mountains. Kawai Nui was once located at the center of the volcanic caldera which formed the Koʻolau mountains. Over time, erosion has shaped the mountain range into a series of valleys and embayments. Studies indicate that Kawai Nui and Kaʻelepulu were embayments approximately 4,000 to 6,000 years ago. Accretion across the mouth of the two embayments created the land forming much of the Kailua area. (For a more detailed and complete description of the geology and geomorphology of the area, refer to *"Archaeological Excavation in Kawainui Marsh, Island of Oʻahu,"* by J. Allen Wheeler 1981, and/or *"Hoʻona'auao No Kawai Nui, a Multi-Media Educational Guide,"* by D. Drigot and M. Seto, 1982.)

Due to years of vegetation growth, a layer of organic matter and peat can be found in the central portions of the marsh. A layer of organic silt underlays the peat to a maximum

depth of 30 feet. Below the silt layer are coral sands and marine deposits. The Natural Resources Conservation Service maps most of the soils in the project area as Marsh (MZ), Pearl Harbor Silty Clay (Ph) and Hanalei Silty Clay (HnA). Erosion of areas above and upstream of the Kawai Nui Marsh ~~have~~has contributed a variety of other soils.

4.3 Hydraulic and Hydrologic Conditions.

The water budget or water balance for Kawai Nui Marsh in simplest terms is made up of inflow minus outflow, and because the water level of the marsh is relatively stable over long periods of time, the water balance is zero. Maunawili Stream is the chief source of inflow with Kahanaiki Stream providing most of the remaining inflow. The rest of the inflow to the marsh is from peripheral drainages and smaller, non-perennial streams. Outflow or the discharge of water from the marsh is through outlets like Oneawa Channel, evapotranspiration, and groundwater seepage. To sustain Kawai Nui Marsh as a wetland in its present condition, there should be no decrease in the inflow and no increase in the outflow.

Previous studies have estimated inflow from all sources from a low of 6.8 mgd to as much as 13.1 mgd. John Mink and George Yuen and Associates in their 1994 assessment of the Maunawili Stream-Kawai Nui Marsh system used stream flow data to estimate flow from Maunawili and Kahanaiki Streams into the marsh at 12.3 mgd and estimate 0.3 mgd from other sources. Outflow is approximately 4.6 mgd by evapotranspiration and 8 mgd through surface outlets and groundwater seepage.

4.4 Drainage and Flooding.

Most of the project area where the lower pond set will be located is in the base flood plain, Zone A of the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Map (FIRM), as depicted o~~i~~n Map Number: 15003C0290 E, Panel 290 of 395, Effective Date: November 20, 2000. Zone A is within the 100-year flood plain where no base flood elevations or depths have been determined.

The rest of the project area is delineated as Zone D o~~i~~n this same map. The Zone D designation is used for areas where there are possible but undetermined flood hazards. No analysis of flood hazards has been conducted (See Figure 4-1). The marsh is protected from development as a result of its use as a flood storage basin. There is no regulatory floodway designated within the project area.

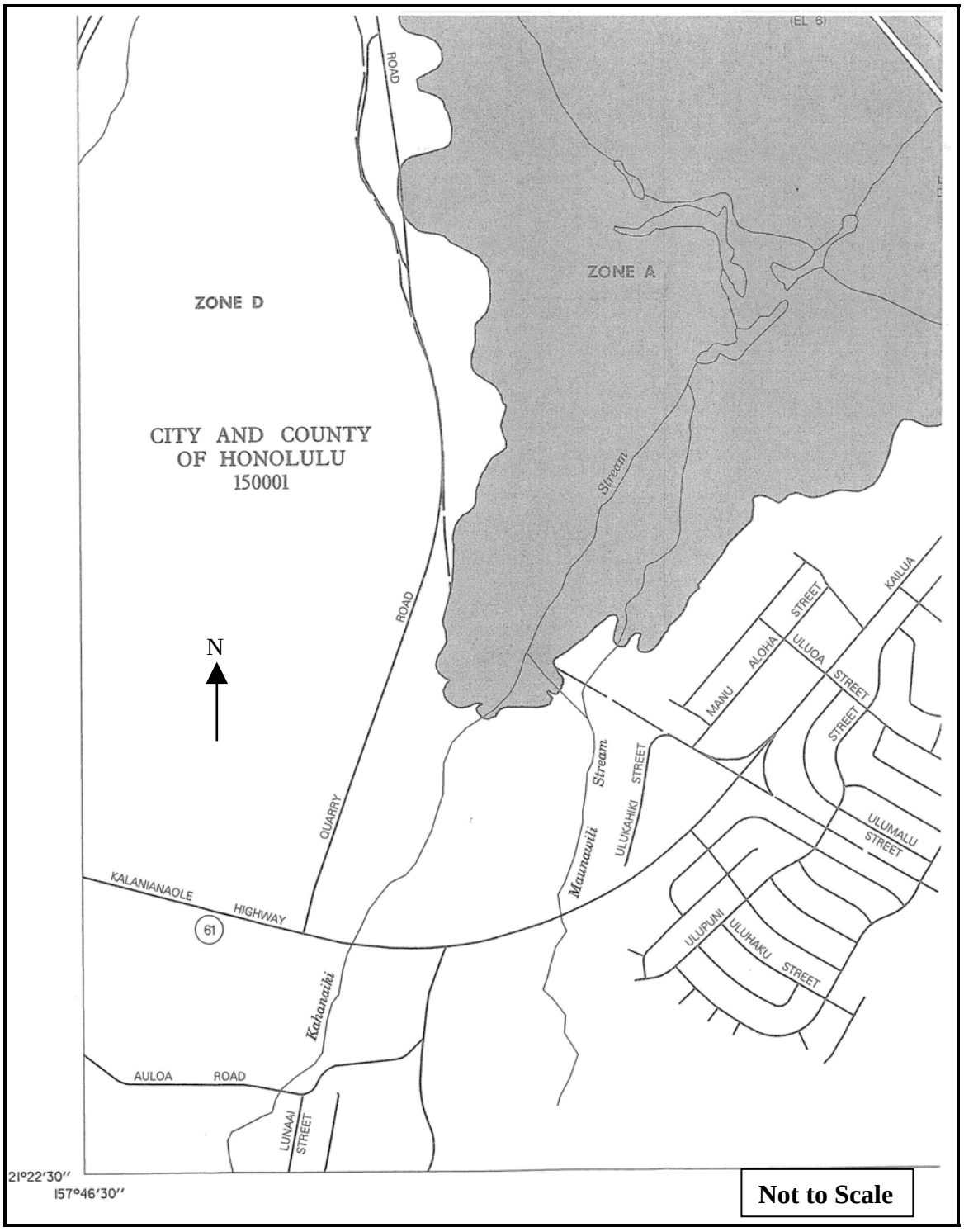


Figure 4-1 Flood Zone Designations

4.5 Wetlands.

In 2005, the United States designated Kawai Nui Marsh a Wetland of International Importance under the Ramsar Convention, adding to the level of protection warranted this valuable wetland resource. A wetland delineation study of the project area was conducted jointly by the National Resources Conservation Service (NRCS) and the Corps in June 2008. Figure 4-2 shows the results of the study with small portions of areas designated as wetland falling within the project area. The area proposed for pond construction have been gradually filled and altered by a succession of land uses over the years from fishpond to taro and rice production, and finally cattle grazing. Natural erosion within the watershed and the influx of nutrients and floccular material from past sewage discharges has also contributed to the degradation of former and present wetland areas. ~~Figure 4-2 shows a generalized wetland map which was developed based on field surveys in 1996 and 1997.~~

4.6 Water Quality.

Kahanaiki and Maunawili Streams are the primary sources of water for Kawai Nui Marsh. Springs and runoff carried by intermittent streams around the perimeter of the marsh also contribute to the water budget. Water exits through Oneawa Channel which discharges into Kailua Bay.

Past and present land use affects the water quality in Kawai Nui Marsh. Early Hawaiians used Kawai Nui Marsh as a fishpond and to grow taro. Rice was planted in the latter half of the nineteenth century until cultivation stopped in the 1920's. At that time ranching and pasture became more predominant uses of Kawai Nui Marsh. Grazing cattle and the model airplane field are among the only few active uses within the marsh. There are no permanent industrial uses within the marsh.

Water was diverted from the upper portions of the Maunawili watershed since the late 1870's to provide irrigation water for sugar operations in Waimanalo. Although sugar is no longer grown in Waimanalo, the water is used for other agricultural crops. Urbanization has led to increased runoff from areas surrounding the marsh. Adjacent to the marsh are the abandoned Pōohāakupu and Kūkanono Wastewater Treatment Plants which formerly discharged treated sewage directly into Kawai Nui Marsh. They were considered temporary and discharges were terminated in 1988 after completion of the Olomana-Maunawili sewer system improvements.

A City and County of Honolulu sanitary land fill was located at an old quarry area west of Kapaʻa Quarry Road. A large man-made mountain has been created which extends into the valley. The landfill was closed on January 20, 1997. In addition to the landfill, an auto wrecking business was located at the northern edge of the marsh along Mōkapu Saddle Road. Up to 15,000 cars were stored in this area until they were finally removed in 1986.

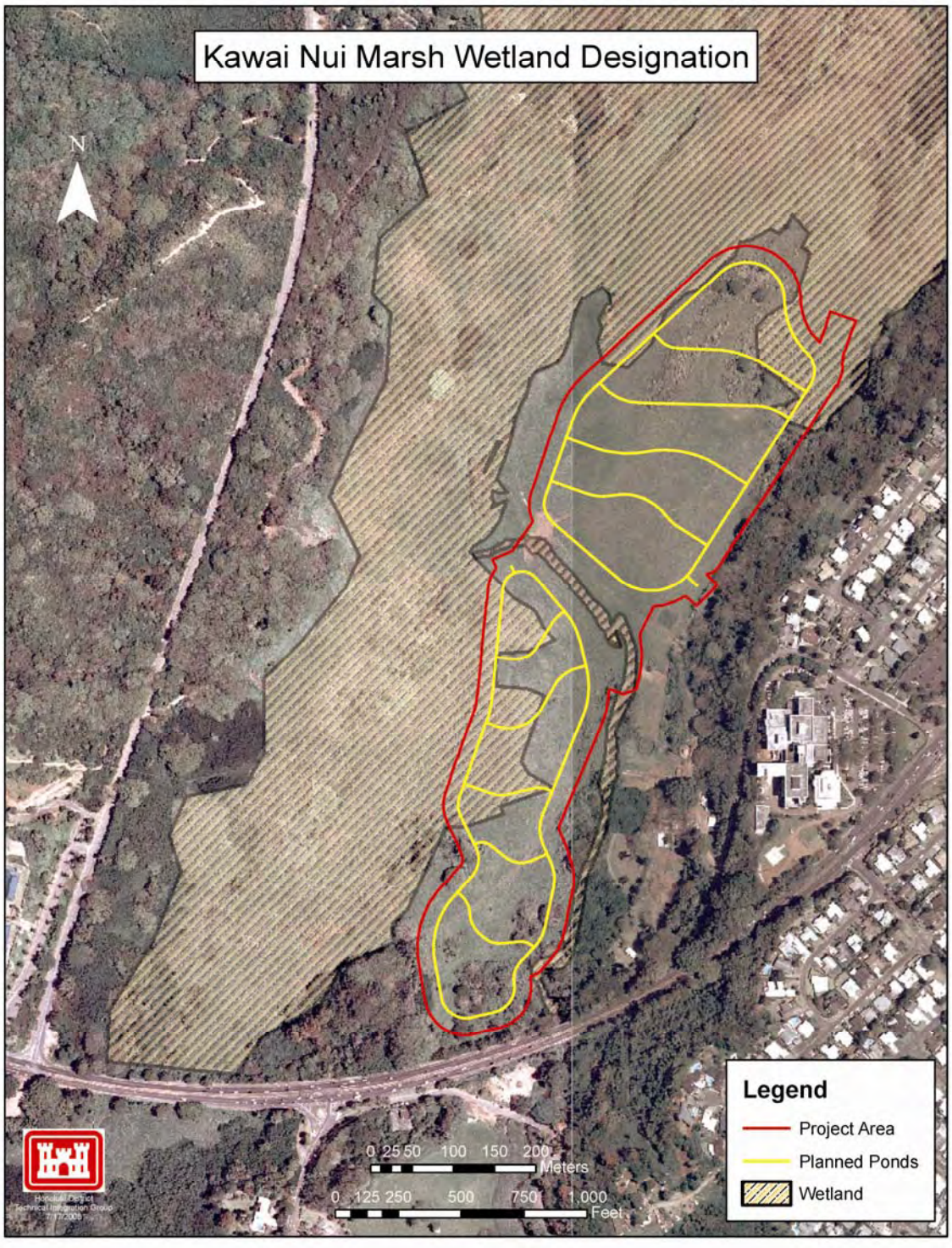


Figure 4-2 ~~Generalized~~ Wetlands Designation Map

In 1981, AECOS, Inc. collected samples at the head of Oneawa Canal to estimate nutrients and sediments at Kawai Nui Marsh. To determine if changes had occurred, AECOS, Inc. conducted another water quality study in 1989 at eight sampling stations measured on two occasions. In 1992 AECOS, Inc. conducted two separate water quality baseline studies for a housing project and the proposed dredging of Kawai Nui and Kaʻelepulu Streams. The 1989 data confirmed trends reported in the 1981 study regarding nutrient and suspended solids removal by the marsh and a reduction in nutrient mass loading due to the cessation of sewage discharges. Sediment samples from the 1989 study also indicate that the marsh contains heavy metals including chromium, lead, and mercury. In comparison with other Oʻahu watersheds, this is not considered unusual due to heavy metals being naturally present in weathered basalt. The upstream end of the marsh appeared to have higher levels of heavy metals (City and County of Honolulu, 1990). In their 1990 EIS, the City and County of Honolulu compared the sediment sample data and found that the levels of heavy metals were lower than the maximum concentration of contaminants for characteristics of EP Toxicity, CFR 40-261.

Acting like giant sponges, wetlands control floods by slowing down and absorbing storm runoff, then releasing the stored water at a slower rate to reduce peak flows downstream. By slowing the water, suspended solids carried by floodwaters are allowed to settle, decompose, oxidize or be made available for uptake by plant roots. Recognizing these qualities, there has been an increase in the use of natural and constructed wetlands for water treatment. Due to characteristics such as decomposing vegetation, low flow rates, and removal of sediments and pollutants, water quality parameters in wetlands cannot be compared with streams or ocean conditions. Under the State Department of Health's Title 11, Chapter 54 Water Quality Standards, the waters of Kawai Nui Marsh are classified as inland low wetlands, Class 1.a. For this classification only there are no specific water quality criteria that must be met, just the basic water quality criteria for all waters found in 11-54-4. Specific criteria have been established for freshwater streams above the proposed project and estuaries which are applicable below the project.

As part of the ongoing flood control improvement project, the Corps and the City and County of Honolulu are establishing two water level monitoring gauges at Kawai Nui Marsh. The downstream gage was formerly installed at the levee but was removed to allow modification of the levee. This gauge will be relocated to the Oneawa Canal near the Oneawa Street overpass. A second gauge is to be installed at the model airplane field. In cooperation with the U.S. Geological Survey and the City and County of Honolulu, both gauges will be augmented with instrumentation to monitor water temperature, pH, and dissolved oxygen. The downstream gauge would also be able to monitor salinity.

Oceanit conducted analyses on groundwater samples from their test well during their hydrological investigation and stream water samples from Maunawili Stream upstream and downstream from the test well site. The results are summarized in Table 4-1, below.

Table 4-1
Hydrologic Investigation Water Quality Results

Analyte	Upstream Sample	Test Well	Downstream Sample
Total Suspended Solids, mg/L	3.9, 12.9	38.8	24.5, 42.9
Total Dissolved Solids, mg/L	147, 163	344	15,800, 258
Total Nitrogen, ug N/L	227, 341	324	3260, 1350
Total Phosphorus, ug P/L	42, 71	238	245, 289
Ortho Phosphate, ug P/L	19, 18	45	110, 46
Nitrate+Nitrite, ug N/L	60, 50	1	10, 5
Chloride, mg/L	20, 20	38	8200, 48
pH	7.41, 7.14	7.02	8.03, 6.82
Turbidity, NTU	5.67, 10.4	12.5	12.4, 112

Table 4-2 is a compilation of State Water Quality Standards for comparative purposes.

Table 4-2
Comparative State Water Quality Standards

Parameter		Geometric mean not to exceed		Not to exceed more than 10%		Not to exceed more than 2%	
	Season	Wet	Dry	Wet	Dry	Wet	Dry
Total Nitrogen, ug N/L	Streams	250	180	520	380	800	600
	Estuaries	200	200	350	350	500	500
Nitrate+Nitrite, ug N/L	Streams	70	30	180	90	300	170
	Estuaries	8	8	25	25	35	30
Total Phosphorus, ug P/L	Streams	50	30	100	60	150	80
	Estuaries	25	25	50	50	75	75
Total Suspended Solids, mg/L	Streams	20	10	50	30	80	55
	Estuaries	NA	NA	NA	NA	NA	NA
Turbidity, NTU	Streams	5	2	15	5.5	25	10
	Estuaries	1.5	1.5	3	3	5	5
pH	Streams	5.5-8.0					
	Estuaries	7.0-8.6					
Oxygen, % saturation	Streams	80					
	Estuarie	75					

	S	

In general, the results indicated that both the upstream Maunawili Stream sample and the local area groundwater water quality measurements were comparable to State Water Quality standards. The test well generally contained higher nutrient concentrations than the stream water but this could be attributed to the fact that its depth precludes nutrient uptake. Wetland application of this water should provide the nutrients for plant uptake, thereby removing it from the water stream.

4.7 Biological Resources.

The description of biological resources within the project area are derived from the initial USFWS's *Biological Opinion*, dated August 15, 1997, and the *Fish and Wildlife Coordination Act Report*, dated July 1997, for this project in support of the *Kawai Nui FEA*. USFWS will be amending their reports based on changed project features, which resulted in the new Federally Recommended and Locally Preferred Plan. Any new or additional information in these amended reports will be incorporated into the final version of this Supplemental Environmental Assessment as necessary.

4.7.1 Flora.

As described in Section 4.2.2, Geology, Kawai Nui Marsh was once an embayment open to the ocean. Early Hawaiians used a portion of the marsh as a fishpond and to raise taro. Deposition of material eroded from upstream areas, lush vegetation growth, and human influence has changed the area to wetlands, transitional areas, and uplands. Human activities including diversion of water, grazing, taro farming, rice farming and filling have also changed the composition of vegetation presently found within the marsh.

In the initial Fish and Wildlife Coordination Act Report for this project, the USFWS characterized the vegetation within the project site into plant communities as shown in Figure 4-3. The following are descriptions of the dominant plant species within each community.

A. Due to heavy grazing, the majority of plants in this area reach no more than 2 to 3 feet high. The area is interspersed with hummocks formed by the trampling of cows and horses. The most abundant species are California grass (*Brachiaria mutica*), Hilo grass (*Paspalum conjugatum*), honohono (*Commelina diffusa*), and Indian pluchea (*Pluchea indica*). As the area shifts to slightly higher elevation, other species, such as the sensitive plant *(Mimosa pudica* var. *unijuga*), wedelia (*Wedelia trilobata*), and kamole (*Ludwigia octovalvis),* increase in frequency, especially in the middle of drier hummocks. A large stand of bamboo (*Phyllostachys nigra*) also occurs in this area.

B. This area encompasses Maunawili Stream and adjacent banks that cut through the

center of the pasture. At the time of the site visit, the stream was approximately one foot deep. The bank shows signs of undercutting, and bare ground due to heavy cattle disturbance is common. The most abundant plant species along the bank are California grass, arrowhead (*Sagittaria latifolia*), taro (*Colocasia esculenta*) and honohono. Just beyond the boundary of area A on the west end of the stream are several dense stands of Egyptian papyrus (*Cyperus papyrus*) and elephant grass (*Pennisetum purpureum*).

C. This area includes the uplands and steep banks of Maunawili Stream. The stream is approximately 5 to 6 feet below the bank. This area contains landscaping species such as banyan (*Ficus sp.*), monkey pod (*Samanea saman*), and castor bean *(Ricinus communis*) with an understory of Hilo grass, honohono, Indian pluchea, the sensitive plant, sour grass (*Digitaria insularis),* and wedelia.

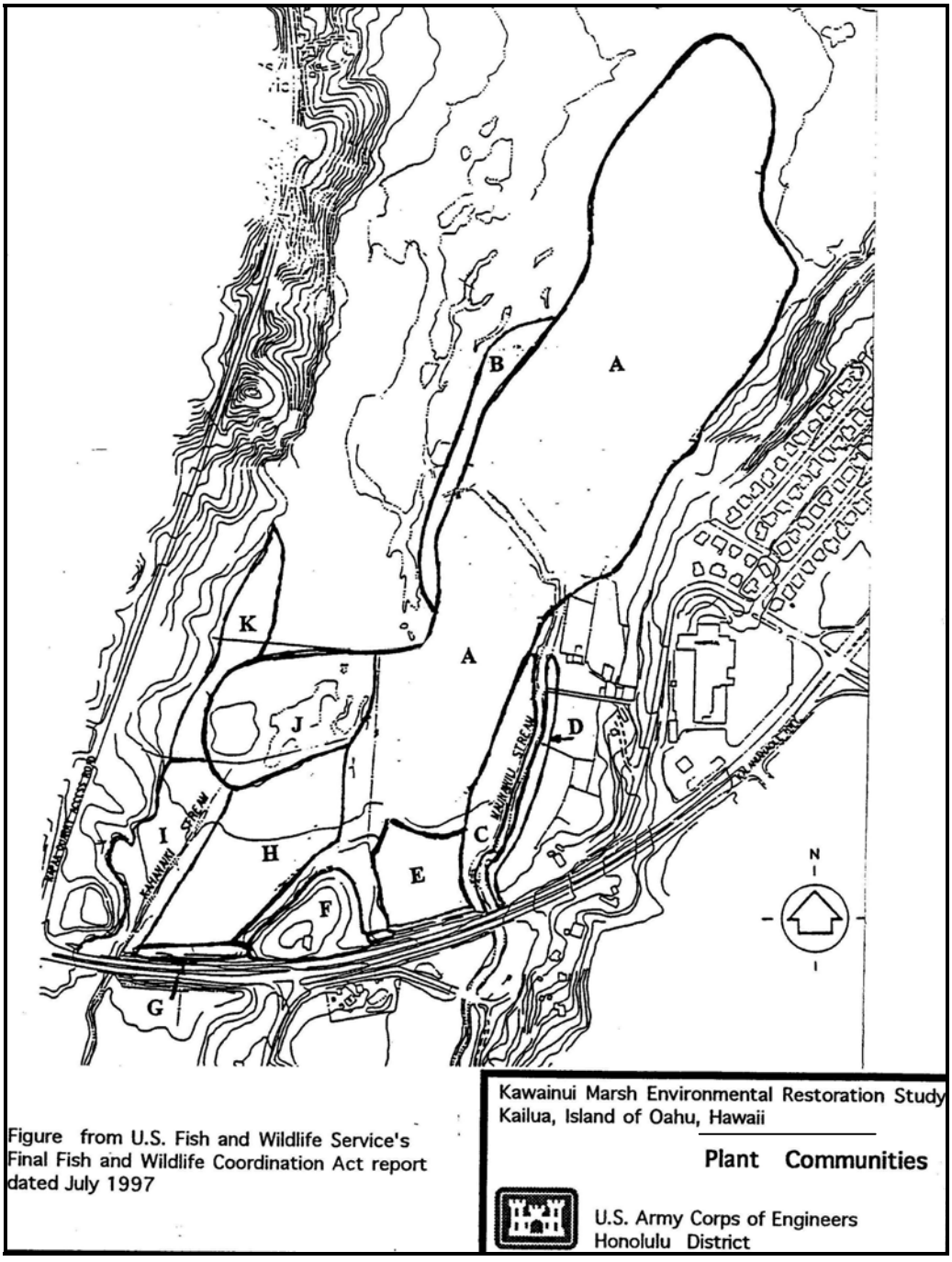


Figure 4-3 Plant Communities

D. The east bank of Maunawili Stream is densely covered with hau (*Hibiscus tiliaceus*). Hau becomes the dominant species on both banks closer to the southern border.

E. This area is characterized by a castor bean canopy and a wedelia and Hilo grass understory.

F. This area was once a plant nursery and consists of many species commonly used in landscaping such as banyan, monkey pod, African tulip (*Spathodea campanulata*), Java plum (*Syzgium cumini*), and octopus tree (*Schefflera actinophylla*). The understory and climbing vegetation are dominated by golden pothos (*Epepremnum pinnatum)* and *Syngonium auritum.* The edges of area F are dominated by thick stands of hau.

G. This area has been built up for the road. It is characterized by rip rap and a variety of common wayside plants. At the base of the rip rap the hydrology changes and plants fairing well in wetlands, such as California grass and Job's tears (*Coix lachryma jobi*) dominate.

H. This has not been filled or grazed and the vegetation is approximately 6-8 feet high. It is dominated by California grass. Where the water appears to be deeper, there are a few areas of Job's tears.

I. This area includes both banks along Kahanaiki Stream. Thick stands of hau have encroached upon the stream making the water appear stagnant.

J. This area is composed of California grass with interspersed stands of elephant grass and Job's tears. The grasses here grow to between 6 and 12 feet tall and are extremely thick.

K. This area is predominantly California grass and Job's tears. The area is bordered to the west with hau.

4.7.2 Fauna - Aquatic Resources.

Kahanaiki and Maunawili Streams in the upper reaches of the marsh are inhabited by introduced species including Chinese catfish (*Clarias fuscus*), carp (*Cyprinus carpio*), smallmouth bass *(Micorpterus dolomieui*), guppies (*Poecilia sp*.), *Tilapia mosambica*, swordtail (*Xiphophorus helleri*), crayfish (*Procambarus clarkii*), and Tahitian prawn (*Machrobrachium lar*). Native species including shrimp (*Atyoida bisculata*) and pond snail (*Melanoides spp*.) are also present in small numbers.

Oneawa Channel is tidally influenced and inhabited by native species including ʻoʻopu nakea (*Awaous stamineus* an endemic goby), ʻoʻopu naniha (*Stenogobius genivittatus* - an indigenous goby), an endemic eleotrid (*Eleotris sandwicensis*), āholehole (*Kuhlia sandvicensis* - an endemic flagtail), mullet (*Mugil cephalus*), and barracuda (*Sphyraena barracuda*). Exotic species include milkfish (*Chanos chanos*), tilapia, and Samoan crab (*Scylla serrata*).

Tilapia, mosquito fish, crayfish, and apple and pond snails are common in the marsh. The oriental rice eel (*Monopterus albus*), smallmouth bass, and the bullfrog, also inhabit the marsh.

Amphidromous species are animals which live their adult life in freshwater environments but spend their larval period as marine zooplankton (Kinzie 1990). The shrimp, prawns, and gobies are examples of amphidromous species which traverse the marsh during their life cycle.

4.7.3 Fauna - Terrestrial Resources.

- #### 4.7.3.1 Birds.

Kawai Nui Marsh provides habitat for avian species including migratory waterfowl, wintering shorebirds, and resident species of wading birds. The U.S. Fish and Wildlife Service's initial Fish and Wildlife Coordination Act Report, provided a listing and description of species. The *Kawai Nui Marsh Master Plan* (1994) contains a table listing the birds recorded at Kawai Nui Marsh as adapted from surveys by Conant (1981), and descriptions from the levee raise EIS by the Corps (1992) and by Drigot and Seto (1982). The list includes endemic species, indigenous species, migratory birds, and introduced species. Interested readers are referenced to the master plan.

Four of the six federally listed endangered waterbird species found in Hawaiʻi can be found in Kawai Nui Marsh (Figures 4-4 and 4-5): The Hawaiian Stilt or Aeʻo (*Himantopus mexicanus knudsenii*), the Hawaiian Coot or ʻAlae keʻokeʻo (*Fulica alai*), Hawaiian Moorhen or ʻAlae ʻula *(Gallinula chloropus sandvicensis*), and the Hawaiian Duck or Koloa maoli (*Anas wyvilliana*). All four species are endemic to the Hawaiian Islands. According to the initial USFWS Planning Aid letter, dated May 15, 1996, birds nest in the marsh throughout the year with peak nesting for the moorhen, coot and stilt during March through September. Peak nesting for Koloa maoli is December through May.

The Hawaiian Stilt is a subspecies of the black-necked stilt found in the continental U.S. Ducks Unlimited Inc.'s Hawaiian Islands Wetlands Conservation Plan (HIWCP) estimated that there are approximately 1,500 Hawaiian Stilts throughout the state. The Hawaiian Stilt is a wading bird which frequents mudflats and shallow open water. Unchecked vegetation

is a primary cause for degradation of this type of habitat at Kawai Nui Marsh. Stilts may nest and forage in different wetland sites, and the birds will move between these areas daily. Diet of the Hawaiian Stilt includes polychaete worms, crustaceans, aquatic insects and small fish.

Biannual waterbird counts in Kawai Nui Marsh indicate an extremely low population compared to the size of the marsh. Table 4-3 compares waterbird counts at Kawai Nui and the Kiʻi unit of the James Campbell National Wildlife Refuge in Kahuku. The Kiʻi unit represents a variety of habitat types which is the goal for Kawai Nui Marsh.

Table 4-3
Waterbird Population Comparison Between Kawai Nui Marsh and Ki'i Unit Wetlands
(Data provided by DOFAW and USFWS, January 2008)

	Kawai Nui Marsh		Ki'i Unit	
	Population	**Density (birds/acre)**	**Population**	**Density (birds/acre)**
Stilt	0	0.00	245	3.32
Coot	9	0.04	358	4.85
Moorhen	3	0.01	98	1.33
Koloa	0	0.00	91	1.23
Waterfowl	83	0.33	348	4.72
Shorebirds	18	0.07	388	5.62
Acreage	250		73.8	

Hawaiian Moorhen or 'Alae 'ula
Gallinula chloropus sandvicensis

Description: 13 inches long; sexes similar; bluish-black with white feathers under tail and on flanks. Bill and frontal shield are red, except for yellow tip. Feet and legs are yellowish-green with reddish patches near body. Downy young are black with pale yellow or brown bill.*

Hawaiian common moorhen.
Photo by Eric VanderWerf.

Hawaiian duck female (front) and male. USFWS file photo.

Hawaiian Duck or Koloa maoli
Anas wyvilliana

Description: Similar to mallard. 19-20 inches, males darker brown than females; most similar to mallard drake in first nuptial plumage. Hens are streaked brown and smaller than males. Both sexes have blue wing speculum. Downy young are brownish-yellow. *

* Descriptions from Shallenberger (1977)

Figure 4-4 Endangered Hawaiian Waterbirds

Hawaiian Stilt or Ae'o
Himantopus mexicanus knudseni

Description: 16 inches long; sexes similar; black above and white below with white forehead. Straight, black bill and long, pink legs. Downy chicks are tan, blotched with black, later turning gray. Older juveniles resemble parents, although back feathers are browner, legs are paler in color and tarsometarsus is thicker at proximal end.*

Adult male Hawaiian stilt.
Photo by Eric VanderWerf.

Hawaiian coot. Photo by Eric VanderWerf.

Hawaiian Coot or 'Alae ke'o ke'o
Fulica alai

Description: 14 inches long; sexes similar; solid grayish-black except for white patches under tail; white bill and frontal shield. Small percentage of Hawaiian birds have deep red lobe at top of frontal shield and black marking on tip of bill, similar to mainland race. Feet are lobed. Downy young are black with reddish color on head, with red bill and frontal shield. Juvenile birds are brownish gray; frontal shield yellowish-brown turning to white.*

* Descriptions from Shallenberger (1977)

Figure 4-5 Endangered Hawaiian Waterbirds

Formerly a subspecies of the American Coot, the Hawaiian Coot was recently elevated to species status. Engilis and Pratt (1993) estimated the coot population at 2,000 to 4,000 birds. Engilis and Pratt also indicated that the population could be increased if properly managed wetlands were available and mammalian predators could be controlled. Coots prefer open water areas of the marsh where nesting has been observed (Corps of Engineers, 1992). However, coots are also seen in shallow water areas and mudflats. Coots will nest in fresh and brackish ponds, and construct floating nests of aquatic vegetation in open water or semi-floating nests anchored to emergent vegetation. The Hawaiian Coots typically feed close to their nesting area but will travel long distances when food is not available.

Although Hawaiian Moorhens were once present on 5 of the main Hawaiian Islands, they are now found only on Kauaʻi and Oʻahu. Six moorhen were released at Kakahaiʻa National Wildlife Refuge on Molokaʻi but the lack of appropriate habitat on that island restricts development of a significant population. Hawaiian Moorhens prefer freshwater marshes and inhabit open water areas that are bordered by dense stands of robust emergent vegetation. The initial USFWS Biological Opinion also indicates the moorhen also prefers water depths less than 3.3 feet. Agricultural areas appeal to this species as high moorhen concentrations can be found in lotus farms on Oʻahu (Engilis and Pratt 1993). Waterbird counts at Kawai Nui Marsh have tallied no more than 7 birds at a time. However, the counts may not accurately reflect the number of moorhen due to their secretive nature.

Koloa maoli was at one time found on all of the main Hawaiian Islands except Lānaʻi and Kahoʻolawe. Hunting pressure and loss of habitat has adversely affected the Koloa population. The Oʻahu population was thought to have been wiped out by the early 1960s. From 1968 to 1982, the State conducted a captive breeding program and released 350 Koloa on the island of Oʻahu. Hybridization with feral mallards has been a major concern for these species.

Like the Hawaiian Coot, the Koloa favor open water areas of the marsh. Koloa nest on the ground, near water. The diet of the Koloa includes snails, dragonfly larvae, earthworms, grass seeds, rice, green algae, seed, and leaves. Feeding in streams and wetlands typically occurs in depths of one to five inches.

Although no wetland habitat has yet been designated as critical habitat for these species, the USFWS's *Draft Revised Recovery Plan for Hawaiian Waterbird* designated Kawai Nui Marsh as protected core habitat, important to the recovery efforts of endangered waterbirds.

In addition to the endangered waterbirds, two species indigenous to the Pacific are frequently seen in the marsh: the aukuʻu or black-crowned night heron (*Nycticorax nycticorax hoactli*) and the ʻiwa or great frigate bird (*Fregata minor palmerstoni*). Resident and migratory waterbirds and shorebirds also visit the marsh including golden

plovers (*Pluvialis dominica*), ruddy turnstones (*Arenaria interpres*), sanderlings (*Calidris alba*) and cattle egrets (*Bubulcus ibis*). Other avian species in the area include doves (*Geopilia striata*), finches (*Carpodacux mexicanux*), bulbuls (*Pycnonotus cater*), and mynas (*Acridotheres tristis*)

- **4.7.3.2 Feral and Domestic Animals.**

Since Captain Cook discovered the Hawaiian Islands, more bird life has been lost in Hawai'i than any other part of the United States. Of the remaining 40 species endemic to Hawai'i, 70% are currently endangered (Engilis and Pratt, 1993). A major reason for the decline is the introduction of animals that prey upon birds. These include the mongoose (*Herpestes auropunctatus*), and feral cats and dogs. The mongoose was brought in to control the rat population in sugar cane fields in the 1880s and quickly adapted to the local environment. The mongoose preys on birds and their eggs. Cats (*Felis catus*), dogs (*Canis familiaris*) and rats *(Rattus rattus*) also reside in and around the marsh and all three species are known to take eggs, young birds and nesting waterbirds. The southern portions of the marsh are used for grazing cattle.

4.8 Archaeological and Cultural Resources.

The archaeology and history of Kawai Nui Marsh have been well documented in previous studies. The proposed project area lies within State Site #50-80-11-2029, the Kawai Nui Marsh archaeological cultural-historical complex, deemed eligible for listing on the National Register of Historic Places in 1979. Historic maps, aerial photographs and Land Commission Award records all demonstrate the vitality and abundance of the marsh during the time of the *Māhele* (land division of 1848). Records indicate that within the Kawai Nui Marsh Environmental Restoration project area alone, there were over two dozen irrigated pondfields (*loʻi*) fed by ditches (*ʻauwai*), and possibly Maunawili Stream. Rice cultivation overtook taro *loʻi* patches within the marsh by the late 1800s and early 1900s. More recently, sediment deposits from floods and cattle crazing have likely impacted the integrity of archaeology within many parts of Kawai Nui Marsh (Mann and Hammatt, 2003: 49).

Research of historic properties within Kawai Nui Marsh has identified eleven (11) cultural sites within the Tax Map Key (TMK) of the project area (TMK 04-02-0013). These properties are listed in Table 4-3, and their general locations are shown in Figure 4-6.

Formal consultation under Section 106 of the National Historic Preservation Act was initiated with the Hawai'i State Historic Preservation Division (SHPD), and other consulting parties, in 1996. Through formal correspondence, the SHPD expressed concern over suspected buried *loʻi* walls associated with State Site 50-80-11-2029.

An early design layout explored creating shallow ponds by following existing contours in

an effort to maximize the pond area. After consultation with SHPD, it was determined that the design could have an adverse effect on buried historic taro *loʻi* walls. Since this *loʻi* system has been deemed eligible for listing on the National Register of Historic Places, this design would have difficulty complying with Section 106 of the National Historic Preservation Act, and this alternative was dismissed. Using historical aerial photographs, SHPD drew the suspected locations of the *loʻi* walls in their last known configuration in the 1920s (Figure 4-7). The walls are thought to be approximately 50 cm beneath existing ground elevations. Based on this information, interior and exterior pond walls were redesigned to follow the projected footprint of the buried *loʻi* walls. The mitigation measures that resulted from consultation were developed to ensure that there will be no adverse effect on historic properties during wetland restoration.

Archaeological investigations were conducted within the project area by Cultural Surveys Hawaiʻi, Inc. (Mann and Hammatt, 2003). Their work was performed to confirm the presence or absence of *loʻi* walls within the project area and to provide appropriate mitigation measures to ensure the integrity of cultural deposits. Mann and Hammatt concluded that "pedestrian survey of the Kawai Nui Marsh Environmental Restoration project area indicated no observable surface archeological deposits. Two test trenches located in the central region of the project area indicated that a buried cultural layer is present approximately 50 cm below the current ground surface. However, no walls or berms corresponding to Land Commission Awards were documented. The current data collected from the archaeological investigation indicates no archaeological reality of ponds that need to correspond to any Land Commission Awards in the construction of the native bird habitat area." (Mann and Hammatt, 2003: 49). The archaeological investigation is attached herein as Appendix B.

Table 4-4 is modified from 1994 Kawai Nui Marsh Master Plan, Table 2-8

Table 4-4
Historic Properties Within TMK 04-02-0013

State Site #	Source	Description
50-80-11-2023	Clark (1980)	Kawai Nui Cluster 2023: extremely rocky area; retaining walls, L-shaped rock alignment, terraces, a level terrace or platform, an old road bed; excavation yielded carbon date of 8th Century
50-80-11-2024	Clark (1980) Ewart & Tuggle (1977)	Makaliʻi Slope Cluster 2024: a terrace, small stone mounds, an old road bed runs above the site: wall (Ewart & Tuggle, 1977) may be related to this
50-80-11-2026	Clark (1980) Ewart & Tuggle (1977)	Kapaloa Agricultural Terrace 2026: a large agricultural terrace, walls single-course high, rusting crane north of site
50-80-11-2029	Clark (1980) Cordy (1977)	Kawai Nui Marsh Site 7: large agricultural complex of rectangular walled fields, probable water channel; excavation yielded basaltic glass A.D. 1738 ±34 years, also large taro root stains and pollen
50-80-11-2031	Athens (1983)	Kawai Nui Slope Site 2031: surface artifacts showing evidence of prehistoric occupation, corrected carbon dates range A.D. 1240-1385
50-80-11-3957	Clark (1980) Cordy (77-78) Ewart & Tuggle (1977)	Kawai Nui Agricultural Complex 3957: dryland agricultural terraces, mounds, small c-shaped structures, walls, a walled depression, historic structure remains, small adze found on surface
50-80-11-3959	Clark (1980) Cordy (77-78) Ewart & Tuggle (1977)	Miomio Agricultural & Habitation Complex: mounds dryland agricultural terraces, linear walls, historic house foundation, prehistoric basalt mirrors and other basalt artifacts, large boulder grindstone, historic artifacts
50-80-11-3961	Clark (1980) Cordy (1977)	Kūkanono Cluster 3961: historic terraces and retaining wall, stone mounds and a stone-lined canal along marsh edge
50-80-11-3962	Clark (1980) Ewart & Tuggle (1977)	Makalii Historic 3962: remains of 3 historic buildings
50-80-11-3963	Clark (1980) Ewart & Tuggle (1977)	Makalii Mounds 3963: unusual earthen mounds, may be natural

Table 4-4
Historic Properties Within TMK 04-02-0013

State Site #	Source	Description
50-80-11-3965	Ewart & Tuggle (1977)	Pohakea Terrace 3965: low stone terrace perpendicular to stone wall

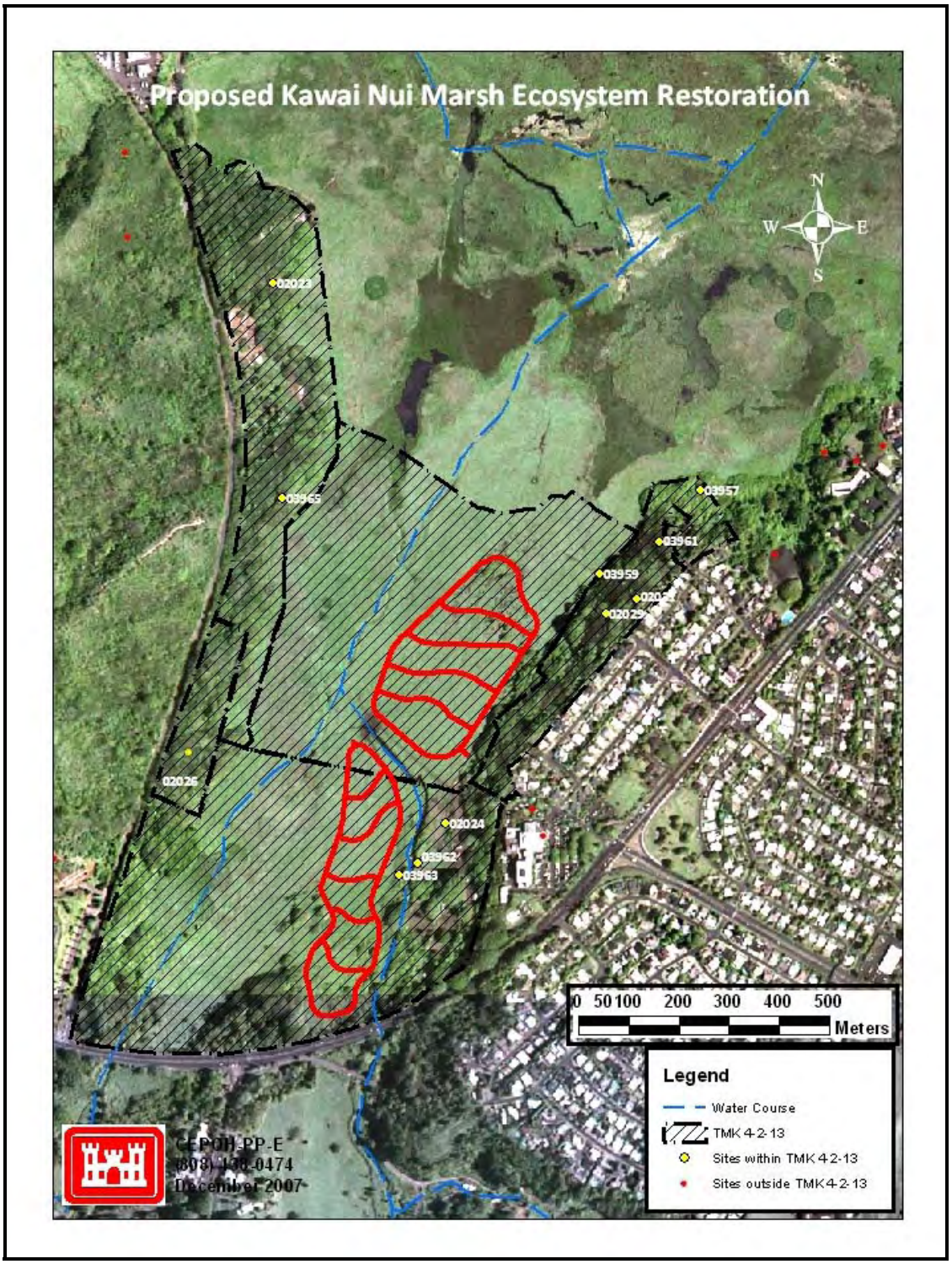


Figure 4-6 Cultural Resources in Vicinity of Project Area

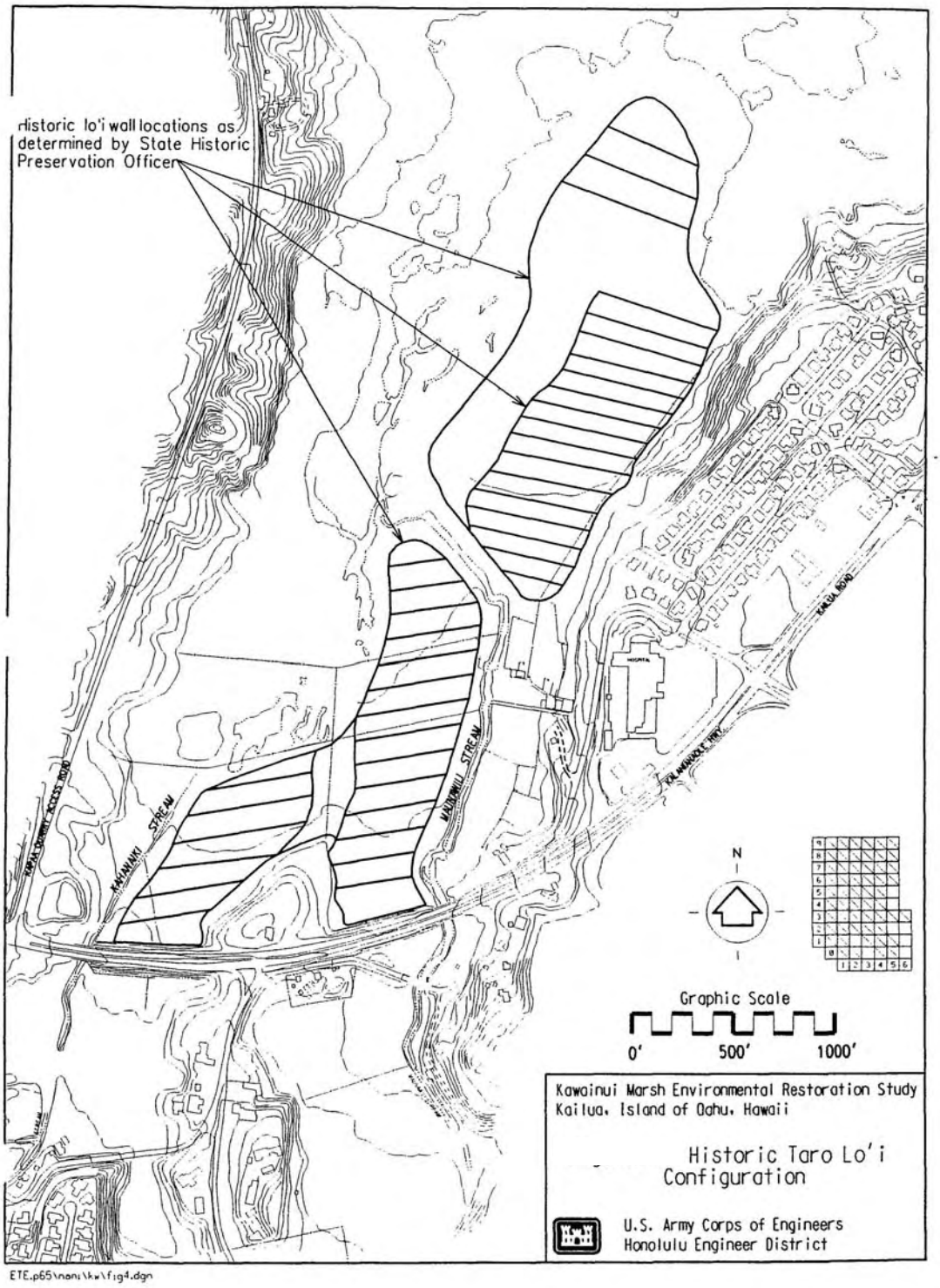


Figure 4-7 SHPO Rendering of Historic Taro Loʻi Configuration

4.9 Aesthetics.

The entire project area is undeveloped with the exception of fencing and power lines. Mount Olomana and the Koʻolau Mountains provide a scenic backdrop for the marsh. The central portions of the marsh are relatively flat while the edges of the marsh are sloped. Much of the accessible areas are presently covered with vegetation. Open water is visible from higher elevations. The natural setting of Kawai Nui Marsh presents an aesthetic resource to residents and visitors of windward Oʻahu.

4.10 Land Use.

The proposed project is situated within two State-owned parcels identified by their tax map key identifiers as TMK: 4-2-13:005 ~~which is owned by the State of Hawai'i,~~ and TMK: 4-2-13:022~~, which is owned by the City and County of Honolulu (See Figure 1-2). The fee simple interest in the City's parcel will be transferred to the State of Hawai'i under Act 235, *A Bill for an Act Relating to Kawai Nui Marsh*, SLH 2007, that was signed into law by the Governor of the State of Hawai'i, Linda Lingle, on June 30, 2007. Passage and enactment of this law was based upon contingency terms specified in the *Subagreement and Acknowledgment of Local Cooperating Agreement* between the two parties that was signed on April 5, 2007. Actual transfer of the property awaits resolution of the contingency terms~~.

Most of Kawai Nui Marsh is in the P-1 protective subzone of the State's Land Use Conservation District. Adjacent areas including the slopes above the marsh and the nearby Mokulana area are designated as Urban.

The City and County of Honolulu's land use map designates the bulk of Kawai Nui Marsh as preservation. Kawai Nui Marsh is entirely located within the City and County's Special Management Area boundaries.

The project area is currently leased to Knott Ranch on a month-to-month basis to provide vegetation for a small cattle grazing operation. DOFAW leases this area and permits this activity to help control vegetative overgrowth of the area. Kūkanono Subdivision and Castle Medical Center are to the east of the site. A filled and former junkyard area of the marsh in the northwestern corner of the marsh is used by model airplane enthusiasts for recreational purposes. The Kapaʻa Industrial Park and the Kapaʻa Refuse Transfer Station are to the west of the park. A small ranching operation, VO Ranch, and Le Jardin School lie to the west of the site (Figure 4-8). Flood storage and other natural wetland functions continue to be the primary function for Kawai Nui Marsh.

4.11 Hazardous, Toxic and Radioactive Wastes (HTRW).

The Hawaiʻi State Department of Health (DOH) and U.S. Environmental Protection

Agency (USEPA) were requested to provide information on any known incidents of HTRW releases in the study area. By letter dated May 9, 1996, USEPA indicated that there were no hazardous waste licenses/permit actions, compliance actions or discoveries of illegal dumping or contamination in the project area. The ~~Hawai'i State Department of Health~~ DOH provided files on past actions which are summarized below.

The former City and County of Honolulu, Kapaʻa Landfill is located at an old quarry area west of Kapaʻa Quarry Road. A large man-made mountain had been created which extends into the valley. The landfill is downstream of the proposed improvements and was closed on January 20, 1997.

In addition to the landfill, an auto wrecking business was located at the northern edge of the marsh along Mōkapu Saddle Road. Up to 15,000 cars were stored in this area until they were removed in 1986. This area is downstream of the proposed improvements.

In 1994, the Kawai Nui Heritage Foundation reported the discovery of approximately 325 barrels located on a slope at Kapaʻa Quarry Access Road near the fork leading to the Kapaʻa Landfill. The assessment by the DOH indicated that the corroded drums had been abandoned for more than a decade, and were either empty or contained soils. Soil samples were taken and analyzed for polychlorinated biphenyls, chlorinated pesticides, semivolatile organics, polycyclic aromatic hydrocarbons, and heavy metals. Results of the analysis indicated low levels of barium (423 ppm), cadmium (0.24 ppm), lead (32 ppm), nickel (190 ppm) and a diethylphthalate (630 ppb), a semivolatile organic (4). In a December 29, 1994 letter to the USEPA, the DOH concluded that levels of hazardous substances were below reference dose levels and did not pose a threat to the environment. The barrels were classified as solid waste, not hazardous waste, and had been removed.

In order to update information on HTRW releases in the vicinity of the project area, the DOH and USEPA were requested to provide information on any known incidents of HTRW in the study area since their last response. This section will be amended in the final version of this Supplemental EA based upon their responses.

The Corp and the City and County of Honolulu conducted a Phase I Environmental Site Assessment to identify recognized environmental conditions in and around Kawai Nui Marsh to meet one of the contingency terms for the land transfer of the marsh to the State of Hawai'i. The *Phase 1 Environmental Site Assessment, Kawai Nui Marsh*, updated ~~January~~ October 2008, reported the presence or likely presence of any hazardous substances or petroleum products through a records review of documented sources and reported releases, site reconnaissance of the property and interviews with owners and occupants knowledgeable about the property. The following summarizes new findings from this report pertinent to the proposed project area:

- The Resource Conservation and Recovery Act defined a Small Quantity Generator (SQG) as a facility that generates less than 1,000 kilograms per month (kg/mo) of

non-acutely non-hazardous waste or 1 kg/mo of hazardous waste. There are two SQGs in the vicinity of the proposed project area; Castle Medical Center (451 Ulukahiki Street) and Kailua High School (451 Ulumanu Drive). One violation was recorded for the Castle Medical Center that was determined to pose no realistic threat to the property based upon the nature of the violation and the operations and waste generated at this facility.

- The Women's Community Correctional Facility (42-477 Kalanianaole Highway) was identified as a State Hazardous Waste Site with a status of No Further Action with DOH and is not suspected to pose an adverse environmental impact to the property.

- Leaking Underground Storage Tank sites were identified at Castle Medical Center and the Women's Community Correctional Facility with a DOH status of "Site Cleanup Completed" and are therefore not suspected to have an adverse environmental impact on the property.

- Underground Storage Tank (UST) sites were identified at the Kūkanono Wastewater Pump Station (705 Manu O'o Street), Castle Medical Center, and the Maunawili Park Wastewater Pump Station (830 Auloa Road). The Kūkanono Wastewater Pump Station has a single, 1,000-gallon diesel UST. Castle Medical Center lists 5 USTs of which only one 6,000-gallon diesel UST is still in use. The Maunawili Park Wastewater Pump Station has a single, 1,000-gallon diesel UST.

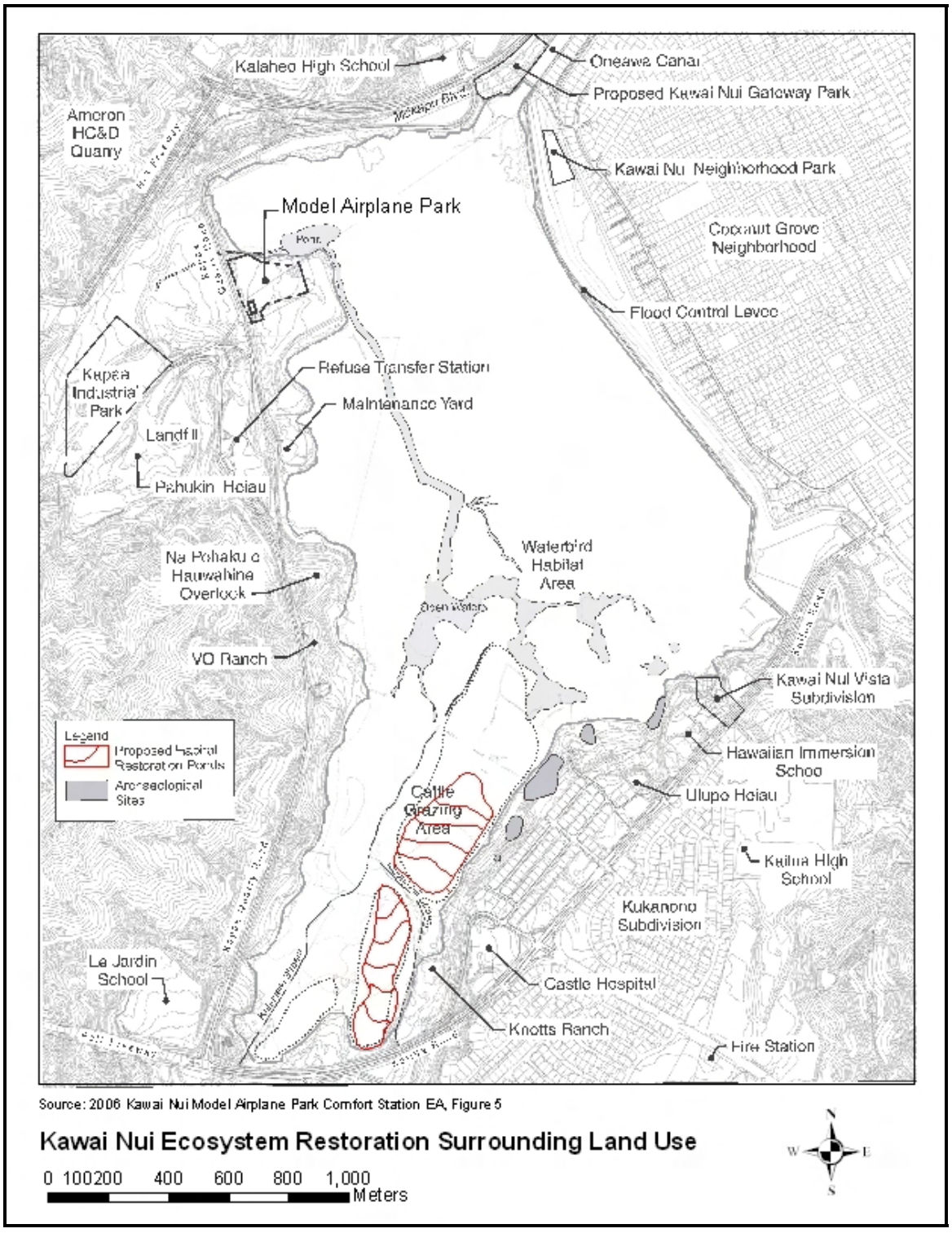


Figure 4-8 Existing Land Use

4.12 Solid Waste.

Solid waste at Kawai Nui Marsh consists mostly of soil, vegetation, and other organic matter. As described in Section 4.7.1, Flora, a variety of trees, shrubs, and grasses are found in and around the marsh.

4.13 Public Infrastructure.

4.13.1 Water System.

There are no potable water sources at or downstream of the project site. The City and County of Honolulu, Board of Water Supply provides service to areas surrounding the site. Existing lines include a 12-inch line along Kailua Road, a 12-inch line along Auloa Road, an 8-inch line along Mōkapu Boulevard, a 12-inch line along Ulukahiki Street, an 8-inch water line within Manu O'o Street, and a 36-inch transmission main along Kapaʻa Quarry Road and Kailua Road, transitioning to a 24-inch main east of Uluoa Street. There is no water service at the project site.

4.13.2 Sewage System.

Sewage in the vicinity of the project is treated at the City and County of Honolulu, Department of Environmental Services' Kailua Regional Wastewater Treatment Plant. Design capacity of the plant is 13.27 million gallons per day. There is no sewage service at the project site.

4.13.3 Electrical System.

Hawaiian Electric Company services the area with 12-kV overhead electrical lines at Kailua Road and Ulukahiki Street and a 4-kV overhead line along Mōkapu Boulevard. A 46-kV overhead transmission lines crosses through the southwestern portion of the marsh. There is no electrical service at the project site.

4.14 Air Quality.

Air quality monitoring data is not collected in the vicinity of the project area. The nearest State air monitoring station is located in Waimanalo and measures particulate matter less than 10 microns in size. Because of the distance from the proposed project site, the data collected from this monitoring station would not have any bearing in describing air quality at Kawai Nui Marsh.

No business or industrial sources of air pollutants exist in the vicinity of the proposed project site. The only true source of air pollutants would be from vehicular traffic from nearby Kalanianaʻole Highway, Kapaʻa Quarry Road, and neighboring side streets. The levels of pollutants would be expected to rise and fall in direct correlation to traffic flow on these streets but it is unknown if the levels would be of any significance.

4.15 Noise.

There are no businesses or industrial operations in the vicinity of the project site that could be identified as a noise generating point source. Vehicular traffic from Kalanianaʻole Highway and Kapaʻa Quarry Road would be transient sources of noise that peak and ebb in direct relation to traffic flow.

4.16 Socioeconomic.

To preserve its function as a flood storage basin, no development is allowed within Kawai Nui Marsh. The communities in the vicinity of the project area are primarily residential with a stable population in the medium to high median income level. The socioeconomic make up of the neighboring communities of Kailua and Maunawili is based on 2000 U.S. Census Bureau data, and are summarized in Table 4-5. Businesses in the area are primarily service oriented with trades and light industrial business composing a small percentage.

Table 4-5
Socioeconomic Data on Communities Adjacent to Kawai Nui Marsh
(Data from 2000 U.S Census)

	Kailua	Maunawili
Total Population	36,513	4,869
Median Age	-	40.6 yrs
Population Percentages:		
White	43.8%	35%
Black	0.8%	-
American Indian/Native Alaskan	0.3%	0.1%
Asian	21.1%	28.5%
Native Hawaiian/Pacific Islander	8.1%	8.8%

Table 4-5 Socioeconomic Data on Communities Adjacent to Kawai Nui Marsh (Data from 2000 U.S Census)		
Hispanic	6.1%	5.8%
Two or more races	25%	25%
Other	0.9%	0.6%
Housing Units	12,780	1491
Homeownership Rate	69.7%	89%
Median Income	$72,784	$100,731

4.17 Recreation.

Formal recreational activities in Kawai Nui Marsh are limited. The Kawai Nui Model Airplane Park, in the western corner of the marsh, is an area where enthusiasts can gather and fly their model aircraft. The levee has become a pathway that people within the surrounding community use for walking, running and biking.

SECTION 5.0 - ENVIRONMENTAL CONSEQUENCES

5.1 General.

The environmental consequences of implementing the Federally Recommended and Locally Preferred Plan are evaluated and discussed with relation to the No-Action Alternative in which the current conditions and operations at the proposed project site will remain unchanged. The recommended plan would create 37.8 acres of mudflats and shallow ponds, install 8,040 lineal feet of predator control fencing around the perimeter of these ponds, implement a trapping program and construct two access roads to the project site.

The environmental consequences for all alternatives evaluated would be the same even though the acreage for the alternatives differ. Therefore, in this section, only the No-Action Alternative and the Preferred Alternative are mentioned for comparison purposes.

5.2 Physical Setting.

Alternative 1, No-Action Alternative, would result in continued deposition of sedimentation and vegetative growth turning the current marginal wetlands into an upland community. This would decrease the flood water storage capacity of the Kawai Nui FCP over time.

The proposed project would replace upland and marginal wetland areas with shallow ponds and mudflats. Pond excavation depths ~~will~~ would be restricted to prevent unearthing archaeological artifacts and structures in the project area. These ponds would act as grassy retention basins to store and slow rain water runoff that would otherwise carry sediments into the marsh, thus delaying the potential of the marsh's succession into an upland community.

In ~~their~~ its Draft Revised FWCA 2(b) report dated August 2008, the USFWS recommends a trained biologist be present on site during the mobilization and clearing of vegetation to prevent disturbance of~~ing~~ nesting waterbirds that may be present. Prior to start of work, a search for nests where waterbirds have been observed is recommended. Also, after a 3-day delay, a search for nests should be conducted in case the birds attempted to nest during that time. If a nest is discovered, work in the vicinity will cease for a minimum of 60 days. If a nest with chicks is discovered, work in the vicinity will cease for 30 days. If a previously undiscovered nest is found after work begins, all work within a minimum radius of 100 feet of the nest shall cease and the USFWS contacted within 24 hours.

Pond construction shall be scheduled during the driest time of the year. However, if there is a rainfall sufficient to create ponded water and waterbirds are present, the contractor will avoid these ponded areas until the areas have dried and the birds have moved out of the area.

5.3 Hydrologic and Hydraulic Conditions

The initial goals in developing a project design were to provide water through a series of ponds managed at variable water depths, to create mudflats, and to allow for maintenance. The ponds or mudflats were designed so as not to impede flood flow, to allow for surface flow during wet periods, and to allow complete drawdown for vegetation manipulation. Other considerations included avoiding hardened structures, using "low tech" or low cost structures, and following the general layout of historical *loʻi* walls believed to exist within in the marsh.

A limited hydrologic analysis was performed. Results indicated that the very limited size of the project area to be affected, as compared to the watershed as a whole, would have a negligible effect on the purpose of the flood control project.

The low elevation of diversion structures and berms to retain water in the mud flats would not increase the flood stage level and would not have an impact on the flood control structure during large storm events. A positive hydraulic impact during small storm events would be a small increase in floodwater storage in the ponds.

Considerable attention and effort have been put into determining the water budget for the marsh in previous studies. The numbers vary for inflow, transpiration, and discharge. For this project, it is not necessary to identify the quantities, only to identify the impacts of the project on the water budget.

It is important to note John Mink and George Yuen and Associates in their 1994 assessment of the Maunawili Stream-Kawai Nui Marsh system noted no additional diversions should be allowed unless the same volume of water was returned to the marsh. Any diversions of Maunawili Stream inflow away from the marsh would diminish its ecological utility. The recommended plan would not call for any stream diversions. Rainfall will be the primary source water to fill and maintain water levels within the ponds. Groundwater pumped from shallow wells will augment this supply source as needed. Therefore, it is anticipated the project will have no impact on the inflows to the marsh. Water captured in the ponds would percolate into the underlying soil and recharge the groundwater below. The construction contractor will have to apply for, and receive, a Well Construction and Pump Installation Permit through the State of Hawaiʻi, Commission on Water Resource Management, prior to commencing construction activities.

5.4 Drainage and Flooding.

The No-Action Alternative would not change existing conditions and would have no short-term impact on drainage and flooding. However, continued sedimentation, if left

unmonitored, may have long-term negative impacts by decreasing the flood storage capacity of the Kawai Nui FCP.

Construction of the ponds under the recommended plan would serve to slow the flow of water into the marsh, decreasing the sedimentation potential. This would have a long-term benefit of maintaining the flood storage capacity of the marsh and would delay or eliminate the need to engineer a solution to recoup this lost capacity. The project improvements are consistent with the flood control project's purpose.

5.5 Wetlands.

The No-Action Alternative would not assist in preventing the succession of the wetland to an upland environment.

The recommended plan would call for the construction of several ponds that will help retain and slow overland water flow, decreasing the sedimentation load on the marsh. This would have a long-term positive impact in preserving the wetland for a longer period of time. Although this alternative would not restore Kawai Nui Marsh, it would add managed pond habitat for the waterbirds.

As seen in Figure 4-2, the Kawai Nui Marsh Restoration project will overlap onto existing wetland areas in both the upper and lower pond sets. However, as explained by project designers at Oceanit, it is important to note that the purpose of the project is effectively to create and enhance wetland habitat. The project will augment the existing wetland areas. The upper pond set will be partially located on existing wetland areas in the four lowest of six pond cells, while the lower pond set will be partially located on existing wetland areas in the two lowest of five pond cells. The design of the pond system has undergone a value engineering study, and none of the value engineering analyses conducted resulted in a positive cost-benefit ratio where redesign or realignment of the pond system earthworks were considered. There is no way to avoid impacting the existing wetland areas and maintain the hydraulic continuity of the project's terraced pond cell configuration.

Fortunately, most of the impacts to the existing wetland will be positive. The existing wetland areas that overlap the project layout will remain wetland areas and will be expanded and enhanced. Some relatively small areas of the project are slated to become pond cell divider berms or vehicle access pathways, but this should be mitigated by bringing the vast majority of the project site into a functional constructed wetland state.

Impacts to the wetland will also be minimized by the operation of the constructed wetland system. Regular operation of the pond system will avoid discharge of pond cell water to the greater wetland area. Normal operations will be conducted to maintain constant water levels within the constructed pond systems, with water added only to offset losses due to infiltration and evapotranspiration. The ponds will also have enough

freeboard capacity to capture large rainfall events without discharge into the greater Kawai Nui Marsh system.

5.6 Water Quality.

As indicated in the *Kawai Nui Marsh Master Plan*, Maunawili Stream drains a 5.58 square mile watershed while the Kahanaiki Stream watershed is approximately 1.92 square miles. The streams travel beneath Pali Highway at Maunawili with a confluence approximately 2,800 feet downstream of the highway. Historical photographs show that downstream of Pali Highway, Maunawili Stream has been straightened and altered. Kahanaiki Stream becomes a meandering waterway shortly past the highway.

Downstream of the confluence, the stream becomes undefined as it sheet flows into the marsh. During storm runoff conditions, the levee creates a backwater effect due to the restriction of flow towards Oneawa Channel. Hydraulic modeling for the levee raise project showed that during the 100-year storm, the entire marsh would become flooded between the levee and a short distance upstream of Pali Highway.

During construction, grading activities may generate the release of particulate matter into the air that may find their way to the nearby waterbodies. Best Management Practices to be proposed by the construction contractor, and approved by the Corps, will be employed to reduce the impact of these particulates and contain runoff from exposed graded areas (includes the use of silt containment devices and curtailment of work during adverse weather conditions). All project-related materials and equipment (backhoes, excavators, etc.) to be placed in the water shall be cleaned and free from pollutants or invasive species propagules prior to entry into the site. No project-related materials (fill, revetment, rock, pipe, etc.) shall be stockpiled in the water or in wetland areas. All debris removed from the aquatic environment shall be disposed of at an approved upland or ocean dumping site. No contamination (trash or debris disposal, alien species introductions, etc.) of adjacent aquatic environments (stream channels, wetlands, etc.) shall result from project related activities. Fueling of project-related vehicles and equipment shall~~ould~~ take place away from the water, and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site to facilitate the clean up of the project area. Any under-layer fills used in the project shall be protected from erosion. Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric, etc.) after exposure and stabilized as soon as practicable (with vegetation matting, hydroseeding, etc.). Upon completion of the proposed modifications, the ponds will increase the sediment holding capacity of the marsh and reduce the sediment load on downstream areas.

The plans and specifications for the project will include a requirement that a traffic control plan be prepared for the job site. The plan will focus on reducing erosion of temporary roadbeds by construction traffic, especially during wet weather, and reducing the amount of mud transported onto paved public roads by motor vehicles or runoff.

Both a State Water Quality Certification and NPDES permit will be applied for. In conjunction with these permits, water quality monitoring will be conducted prior to, during, and after construction to ensure compliance with State water quality standards.

Although they will not be used during construction, an herbicide may be used to control vegetation during routine maintenance and operation. Application of herbicides such as Rodeo® are not anticipated to have any long term effect on water quality as it is absorbed onto soil particles in the water or sediment where it is degraded by microorganisms into its natural components. Glyphosate, the active ingredient in Rodeo®, is non-volatile and does not bioaccumulate. Rodeo® was applied to nearly 90 acres at Kawai Nui in 1988. On the day of the spraying and at four day intervals thereafter (for twenty days), all water samples in Oneawa Canal were found to contain less than the laboratory detection limit of 0.01 ppm. Widely accepted, Rodeo® is used in wildlife refuges in Hawai'i, and across the nation.

5.7 Biological Resources.

Under the No-Action Alternative, waterbird habitat would continue to decline due to lack of suitable habitat and predator control. Vegetation growth and sedimentation will continue the trend of vegetative communities changing from wetland to upland. Species which rely on wetland habitat would be consolidated into a shrinking wetland until they are forced to find other suitable habitat.

The recommended plan will restore biodiversity to the marsh by restoring wetland and waterbird habitat. Creating the shallow mudflats/ponds will provide habitat that will attract the four endangered waterbirds to the marsh. Similar improvements at nearby areas such as the Hamakua Marsh Wetland and the Kaʻelepulu Wetland in Enchanted Lakes have increased waterbird populations as soon as they were completed. Part of the population was recruited from other areas, which allows more habitats to be available at other locations. Kawai Nui Marsh is much larger than the other two sites and enjoys a much larger buffer from urbanization. The anticipated increase in food supply and habitat should bring a dramatic increase in waterbird population. Waterbird census information provided by DOFAW at Kawai Nui Marsh was compared with similar information from the Kiʻi unit of the James Campbell National Wildlife Refuge. The waterbird densities of the managed wetlands are significantly larger than Kawai Nui Marsh. When the sizes of the wetland are taken into consideration, Kawai Nui Marsh can be seen to hold enormous potential towards the recovery of the endangered waterbirds.

Avian botulism is a disease observed in waterbirds or shorebirds caused by ingestion of foods containing a toxin produced by the bacterium *Clostridum botulinum*. This bacterium occurs naturally in Hawaiian wetlands and throughout the world. Initial symptoms of avian botulism include drooping wings or necks and the inability to fly (USFWS and DOFAW letters dated June 23 and June 27, 1997 respectively). Approximately 14 ducks were found dead at the head of Oneawa Channel in August 1988, with signs pointing to botulism. The outbreak was believed to be related to warm water conditions and lowered water levels in

the marsh.

With the No-Action Alternative, the potential for avian botulism is not affected. The recommended plan will enable management of any outbreaks of avian botulism and the ability to modify conditions to eliminate or reduce the risk of avian botulism. In their letter dated June 27, 1997, the USFWS recommended three measures to prevent outbreaks of avian botulism as recommended by the USFWS: (1) a water management plan will be implemented to prevent high water temperatures, anaerobic conditions, and excessive decaying of protein and vegetable matter; (2) immediate collection of dead birds; and (3) immediate notification to the Biological Services Division of the U.S. Geological Service whenever dead birds are found. Also recommended by the USFWS in their Draft Revised FWCA 2(b) report dated August 2008 is maintaining sufficient flows to provide ample water circulation. A botulism outbreak control plan shall be developed in coordination with the USFWS prior to project implementation (to include procedures for immediate draining of ponds in which an outbreak occurs, immediate removal of all bird carcasses, and monitoring of bird populations in the area to prevent the further spread of the outbreak). All three measures will be incorporated into the project as well as any additional measures that may arise when ~~they~~ USFWS issues ~~their~~ its amended Coordination Act Report.

The adverse impacts from the project are primarily associated with construction activities. Noise levels, emissions, and turbidity may temporarily disturb or displace wildlife, including endangered species. Construction equipment will be required to meet federal and state emission control standards. Construction impacts are not all bad, as birds are known to follow construction equipment, waiting to gobble up the worms, insects, and other organisms exposed by clearing and grading. While providing temporary food sources, this has the effect of drawing birds into hazardous areas during construction.

The USFWS's *Draft Revised Recovery Plan for Hawaiian Waterbirds* identifies predation (along with disturbance and unstable habitat conditions) as a primary factor limiting waterbird production and recommends predator control for breeding areas. Fencing and removal of predators (cats, dogs, and cattle egrets) will have positive impacts on the waterbird population. The traps themselves could cause unintentional capture and death of avian species or pets. The traps will be checked at least every 48 hours~~regularly~~ to reduce the potential for harm to accidentally trapped fauna. Rodenticides may also be used to control rodents.

After wetland creation, the ponds shall be surveyed on a regular basis for early detection of American bullfrogs (*Rana catesbeiana*). If American bullfrogs are discovered, appropriate methods will be employed for immediate eradication. Appropriate measures will be implemented to control cattle egrets.

The USFWS cited seven recommendations in their initial Biological Opinion and sixteen recommendations in their Fish and Wildlife Coordination Act Report to minimize indirect adverse impacts to fish and wildlife resources. The Corps believes that these

recommendations are reasonable and have incorporated or will incorporate them into the plans, specifications and construction of the project. Any additional recommendations expressed in their amended Biological Opinion and Fish and Wildlife Coordination Act Report, awaiting issue, will be reviewed and, if reasonable and acceptable, will be incorporated into the plans, specifications and construction of the project to the maximum extent possible.

5.8 Archaeological and Cultural Resources.

The proposed undertaking may have two primary potential effects on State Site 50-80-11-2029: buried agricultural features may be impacted by excavations for the waterbird habitat and the restoration of waterbird habitat may alter the character of the agricultural system's original setting by introducing large open-water areas that differ from the system's design, which incorporated terraces approximately an acre and a half in size. Beginning in 1996, consultation with SHPD and other consulting parties has identified several procedures to be followed to avoid impacting subsurface archaeological deposits comprising the Kawai Nui Marsh archaeological cultural-historical complex (Site 50-80-11-2029). These mitigations include the following:

1. Archaeologists from the Corps (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *loʻi* walls. If *loʻi* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible.
2. Ground disturbance for pond construction will generally be to depths between 1 and 2 feet to avoid possible impacts to archaeological resources believed to exist below this depth. Ground disturbance for wells and fencing will likely be deeper, but disturbances will be in relatively small areas and strategically placed.
3. The Corps (or their contractor) will provide for archaeological monitoring of ground disturbing activities. Archaeological monitoring will be in accordance with an Archaeological Monitoring Plan (AMP) approved by SHPD prior to construction.
4. Maintenance procedures to be established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment on maintenance procedures will be elicited from public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, and the Office of Hawaiian Affairs, among others.

5.9 Aesthetics.

Visual aesthetics would remain unchanged without the project. The view plane would remain an open grassy area.

Excavating ponds will bring the area closer to the estuarine condition that Kawai Nui Marsh enjoyed in the past. The creation of additional open water should improve the aesthetics of the marsh. Since no large structures will be constructed, the natural setting of the marsh will be retained.

5.10 Land Use.

There would be no changes in land use designations with or without the project. The proposed project site will still remain within the Kawai Nui FCP footprint, preventing development within the site that would interfere with the FCP's primary function to serve as a flood storage basin.

The project site is located within a conservation district and special management area. The construction contractor will be responsible for ensuring that a Special Management Use Permit issued through the City and County of Honolulu, Department of Planning and Permitting is obtained for this project, and that a Federal Consistency Determination from the State of Hawaiʻi, Coastal Zone Management Program is obtained before construction begins.

Under the No-Action Alternative, ranching operations would continue with vegetative control until such time that DOFAW ceases the leasing arrangement with Knott Ranch.

Execution of the project will convert the project site from a grazing area to an engineered waterbird habitat. This would increase the site's value in promoting conservation and recovery for the four endangered waterbirds and for recreation by providing bird and wildlife watching as well as educational and interpretive tour opportunities.

5.11 Hazardous, Toxic, and Radioactive Wastes (HTRW).

Formal responses from DOH and USEPA regarding reported releases of HTRW in the project area since their last responses received in 1996 are pending. Their initial responses in 1996 did not reveal any significant releases that would impact the immediate project area. A search of available State and USEPA databases did not uncover any reportable releases in the project area of significance since 1996. The Phase I Environmental Site Assessment for Kawai Nui Marsh reported in ~~January~~ October 2008 did not reveal any environmental conditions in the project area that would have an adverse impact on the property. Site conditions and uses should remain unchanged under the No-Action Alternative so no potential for HTRW releases are anticipated.

During a recent site visit, several old telephone poles were observed in the project area being used as fence posts. These telephone poles are expected to be removed as part of the pond creation. In the past, these telephone poles were treated with creosote (an oily,

petroleum smelling, tar-like substance)~~,~~ in order to control termites, other insects, rot, and fire. Creosote is a carcinogen which can cause various ailments and even death. Prior to removal of these old telephone poles, testing for the presence of creosote and leaching should be conducted. If creosote contamination is present, proper disposal of the poles and soil shall be done in accordance with applicable federal and state regulations.

There will be no anticipated HTRW impacts resulting from the project. As part of the Environmental Protection Plan that the contractor will have to submit for review and approval by the Corps before construction activities begin, they will have to delineate what Best Management Practices they will implement to prevent the release of any HTRW materials in the project areas and what steps will be taken should a release occur.

5.12 Solid Wastes.

There would be no change in the amount of solid waste currently generated at the project site under the No-Action Alternative.

The solid wastes generated if this project is executed will consist almost entirely of soil and vegetation. The project will reuse much of the excavated soil on-site to build the earthen berms that will form the ponds. Excess soil and vegetative wastes will be removed from the site and transported to a green waste recycling facility, Hawaiian Earth Products, at Kapaʻa Industrial Park, for disposal and conversion into compost material. Vegetative growth, once the ponds are in place, will be controlled with herbicides approved for use in wetlands or tilled under when the ponds are drained for annual maintenance. The contractor for this project will be required to prepare a plan on handling and disposal of solid wastes as part of the Environmental Protection Plan that must be reviewed and approved by the Corps before construction can begin.

5.13 Public Infrastructure.

5.13.1 Water System.

There would be no change in the amount of solid waste currently generated at the project site under the No-Action Alternative.

The solid wastes generated if this project is executed will consist almost entirely of soil and vegetation. The project will reuse much of the excavated soil on-site to build the earthen berms that will form the ponds. Excess soil and vegetative wastes will be removed from the site and transported to a green waste recycling facility, Hawaiian Earth Products, at Kapaʻa Industrial Park, for disposal and conversion into compost material. Vegetative growth, once the ponds are in place, will be controlled with herbicides approved for use in

wetlands or tilled under when the ponds are drained for annual maintenance. The contractor for this project will be required to prepare a plan on handling and disposal of solid wastes as part of the Environmental Protection Plan that must be reviewed and approved by the Corps before construction can begin.
~~No water service is currently provided to the project area and no service requirement will be necessary if the project is executed so there would be no positive or negative impact on the potable water supply system with or without the project.~~

5.13.2 Sewage System.

There are currently no sewage connections to the project site and none will be required to support this project.~~,~~ ~~t~~Therefore, there will be no impact ~~one way or the other~~ to the sewage system with or without the project.

5.13.3 Electrical System.

There is currently no electrical service to the project site and none will be required if the project should go forward as designed. Water pumps that will draw groundwater to the surface to aid in filling and maintaining water levels in the ponds will be solar powered. There would be no impact on the electrical system and there may be a long-term positive impact. By not powering these pumps through the electrical grid, there would not be an added demand on the power generating system. This project would not contribute to the need for fossil fuels and the generation of green house gases.

5.14 Air Quality.

The major source of air pollutants in the vicinity of the project site would be from vehicular traffic. Levels of potential pollutants would rise and fall with the level of traffic activity with or without the project.

There would be a potential increase in the level of air pollutants from the use of heavy equipment during construction of the ponds but this impact would only persist for the duration of construction activity. These operations would take place outdoors so any pollutants generated would not be concentrated. Pond maintenance work will also involve use of mechanized equipment but this will be short in duration and recur a few times each year. The water pumps will be solar powered so no emissions will be generated during their operation. Their operation will not place a demand on the power grid so this may have a long-term positive impact in not contributing to the demand for fossil fuels and the generation of green house gases.

According to CFR Title 40, Protection of Environment, Part 52, Approval and

Promulgation of Implementation Plans, Subpart M – Hawaii, Hawai'i is classified as an attainment area, under the clean air act. The State of Hawai'i has also established ambient air quality standards under the Hawai'i Administrative Rules, Title 11, Chapters 59 and 60.

5.15 Noise.

The No-Action Alternative would not affect present ambient noise levels in the project area since the types and levels of current activities would not change.

Earth moving equipment would raise the ambient noise levels during pond construction. These impacts would be short-term in duration and would occur during daylight within established hours. There would be no long-term impacts as the project area would remain an unpopulated open area. Water pumps would be solar powered so they would only operate during daylight hours when there is sufficient light intensity. Pond maintenance using farm machinery is anticipated to occur during the summer months and would be short-term in duration. Any increase in noise levels due to these activities would be minimal and of short duration. Due to the distance from the project area to the nearest residential community, noise impacts due to construction, operation, and maintenance of the ponds are anticipated to be insignificant

5.16 Socioeconomic.

The No-Action Alternative would not provide opportunities for growth within the project area above its existing state. Knott Ranch is a small family-owned ranching operation with little commercial output. Expansion of its operation is limited to the available land offered in short-term lease by DOFAW. This operation is not conducive to establishing a wetland habitat for waterbirds so continued use of the area for cattle grazing would not add to conservation and recovery efforts. Public education opportunities to foster interest and present the marsh's significance as a natural and cultural resource would not be realized to the fullest extent possible.

The project will create short-term socioeconomic benefits by creating jobs during its construction. It will also provide limited long-term employment opportunities to operate and maintain the ponds. The expected increase in habitat and wildlife has the potential to generate community interest and awareness of the natural values of the wetlands. Execution of this project would help spur execution of other projects around the marsh described in the *Kawai Nui Marsh Master Plan* such as the Kawai Nui Pathway and the Kawai Nui Gateway Park ~~that would support these opportunities~~. In executing this project, the ranching operation must be displaced. DOFAW has already informed the operator that their lease may not be renewed in the near future. The loss of this operation will not pose a significant commercial loss but would be a personal loss to the operator's lifestyle.

5.17 Recreation.

Under the No-Action Alternative, this area would continue to serve as a grazing area for Knott Ranch and would not be accessible to the general public, negating any recreational opportunity. Ranching operations ~~would~~ are not ~~be~~ compatible with the development of waterbird habitat, so ~~there would be~~ no potential for recreational opportunities ~~that~~ could be realized.

Recreational opportunities in the project area would be in the form of bird and wildlife watching, which would be improved with the proposed project. Similar projects conducted on a smaller scale, such as the Hamakua Marsh Wetland, have attracted waterbirds to the ponds affording the public an opportunity to view these creatures and learn more about them. Viewing would be at a distance to prevent disturbances so that the waterbirds would return to the area. Educational tours of the habitat area would provide organized opportunities for the general public to interact and learn more about the marsh and its critical role in providing habitat for waterbird conservation and recovery.

5.18 Traffic.

There should be no traffic impacts under the No-Action Alternative as there would be no change in the type and level of activity currently experienced in the project area. There are no public access points in or out of the proposed project area and none ~~would be~~ are foreseen to be built as long as the leasing agreement between DOFAW and Knott Ranch continues. Traffic in and out of the area would be confined to existing cattle operations support.

There would be an increase in traffic under the Federally Recommended and Locally Preferred Plan but is not anticipated to be significant. Construction activities would entail a short-term increase in traffic flow in the area as trucks and heavy equipment will be using portions of Ulukahiki Street, Pali Highway, and Kapaʻa Quarry Access Roads to move in and out of the area. The contractor will prepare a traffic control plan prior to commencement of construction. Because of the relatively small size and simplicity of the project construction elements, a large work force is not anticipated. Also, since most of the excavated soil will be utilized on-site to construct the earthen berms of the ponds, truck hauling traffic would be minimized. It's estimated that 200 truckloads of material will taken off the site. Once the ponds are constructed, DOFAW personnel will access the site periodically to tend the ponds and perform other maintenance functions. Periodic organized educational tours may be scheduled in the future that would increase the number of vehicles in the area. These tours could be scheduled at off peak hours, or the number of participants limited if this should become problematic. DOFAW has begun clearing vegetation from the Mokulana area off of Kalanianaole Highway to create a park-like area envisioned in the *Kawai Nui Master Plan* that could provide parking opportunities and spread the vehicular load around the perimeter of the marsh.

SECTION 6.0 – CUMULATIVE IMPACTS

6.1 General.

There are two projects that DOFAW will be undertaking in an area immediately adjacent to the proposed action that will integrate with the project's purpose and need (See Figure 6-1). One project lies adjacent to the western boundary of the proposed project and is funded by the National Resources Conservation Service (NRCS). The other project is positioned between the NRCS funded project and Kapaʻa Quarry Road and is funded by the USFWS. Each is briefly described below.

6.2 NRCS Funded Project.

DOFAW applied for and received a grant through the NRCS's Wildlife Habitat Incentives Program (WHIP) to enhance approximately 20 acres of wetland habitat in the vicinity of Kahanaiki Stream. WHIP is a voluntary program that encourages creation of high quality wildlife habitats that support wildlife populations of National, State, Tribal, and local significance.

Through NRCS's funding and technical experience, DOFAW seeks to enhance the wetland in the vicinity of Kahanaiki Stream by clearing the overgrowth in the area and gradinge its embankments to provide habitat suitable for the endangered waterbirds. Native flora species will be replanted in the area to aid in soil stabilization. In addition to providing additional habitat value to the marsh, it is hoped that the work will allow Kahanaiki Stream to re-establish its prior watercourse. The project also will establish a predator control program to protect waterbirds and their nests. NRCS completed the Conservation Plan required for continued execution.

6.3 USFWS Funded Project.

DOFAW applied for and received a grant through the USFWS Pacific Islands Coastal Program to create 60 acres of wetland and stream bank habitat for the four endangered Hawaiian waterbirds. The work will take place on land between the NRCS Project and Kappa Quarry Road. The project's boundary limit will be distinct and not overlap the NRCS Project but will be complementary to the goals of the proposed action and the NCRS Project.

The project will involve clearing and grading slopes in the area and providing erosion control measures to decrease runoff velocity, minimize contamination from the roadway and redirect the runoff in a way that will enhance wildlife habitat performance.

Vegetation will be cleared and replanted with native flora to provide additional wetland habitat for the waterbirds to increase their foraging opportunities and nesting potential. A predator control program will be implemented to control and exclude predators from the area. Planning work has already begun on the design of this project.

6.4 Cumulative Impacts.

The proposed action will have a direct cumulative impact on and in association with the NRCS and USFWS projects. All three projects seek to restore or enhance habitat that will be suitable for the same targeted species, the four endangered Hawaiian waterbirds. The approach in achieving this objective varies between the projects but they compliment each other by creating a diverse habitat that will attract and provide foraging, loafing and nesting opportunities for these waterbirds. This project will add an additional 37.8 acres of habitat to the 80 combined acres being created under the other two projects, significantly adding to the waterbirds conservation and recovery potential.

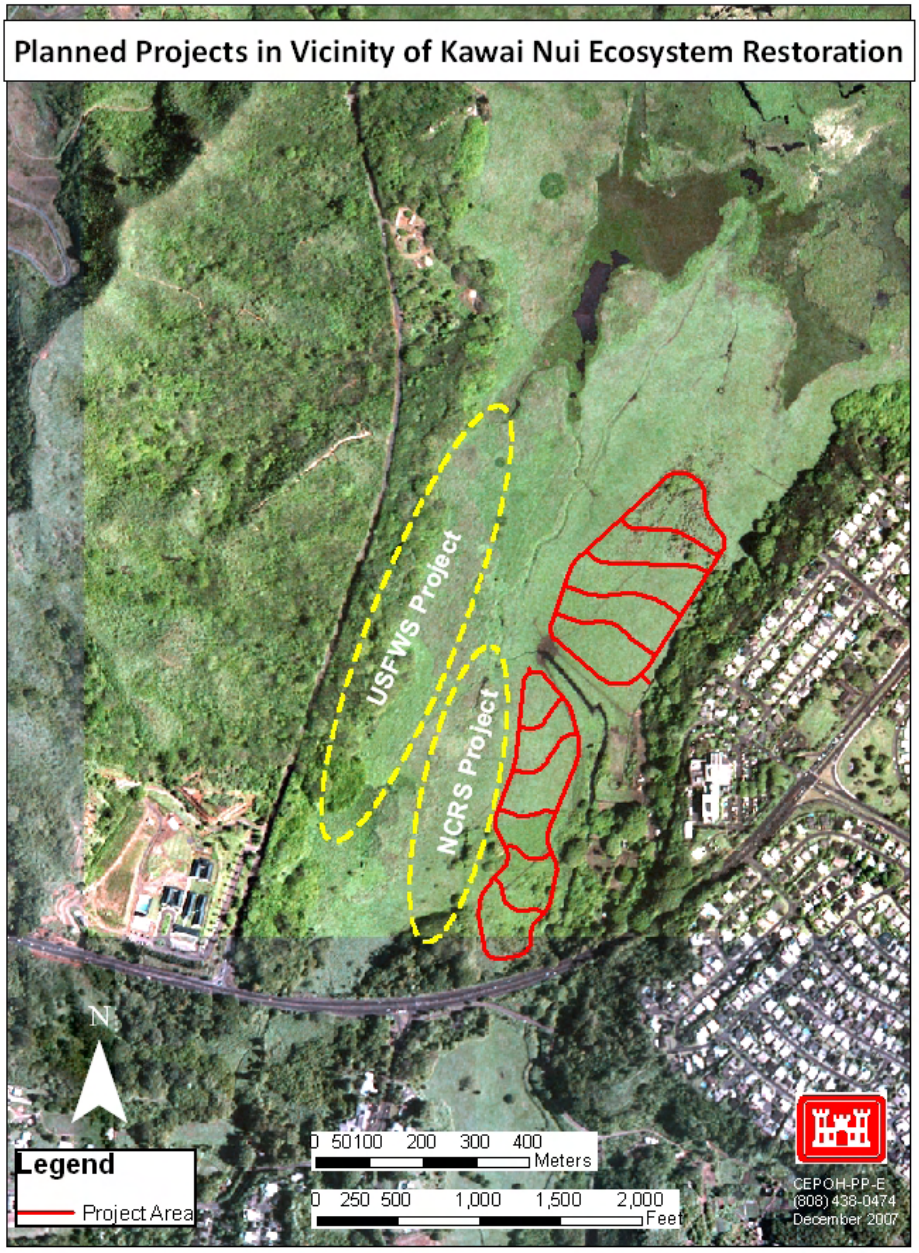


Figure 6-1 Planned Projects in Vicinity to Ecosystem Restoration

SECTION 7.0 – PUBLIC INVOLVEMENT

Discussions were held with several state, local, federal, and private consultants on the design of the project. A list of organizations and agencies consulted can be found in Section 9.0 of this report. Correspondences with these organizations are located in Appendix A.

SECTION 8.0 – CLEAN WATER ACT (CWA) SECTION 404(b)(1) ANALYSIS

8.0 Clean Water Act (CWA) Section 404(b)(1) Analysis.

In accordance with Section 404(b)(1) of the Clean Water Act, the Corps must evaluate the effects of any discharge of dredged or fill materials into waters of the U.S.

Section 404 (b) (1) states that " no discharge of dredged or fill material shall be permitted if there is a ***practicable alternative*** to the proposed discharge which would have ***less adverse impact on the aquatic ecosystem,*** so long as the alternative does not have other significant adverse environmental consequences." (40 CFR Part 230.10(a) (emphasis added).) Section 404(b)(1) additionally stipulates that "where the activity associated with a discharge which is proposed for a special aquatic site does not require access or proximity to or siting within the special aquatic site in question to fulfill its basic purpose (i.e., is not "water dependent"), practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise. In addition, ***where a discharge is proposed for a special aquatic site, all practicable alternatives to the proposed discharge which do not involve a discharge into a special aquatic site are presumed to have less adverse impact on the aquatic ecosystem***, unless clearly demonstrated otherwise." (40 CFR Part 230.10(a)(3) (emphasis added)

8.1 Project Description.

The project is located on the Island of Oahu on the north eastern side of the island just southwest of the town of Kailua. The Kawainui Marsh Restoration Project (KMRP) will create a series of 11 terraced shallow ponds within the upper portion of the Kawainui Marsh that encompasses 24 acres. The total project area, which includes a berm around the ponds, totals 37.8 acres. The project purpose is to restore this area to habitat suitable for endangered Hawaiian waterbird; namely the Hawaiian Duck (Hawaiian name: Koloa maoli, Scientific name: *Anas wyvilliana*), Hawaiian Stilt (Hawaiian name: Aʻeo, Scientific name: *Himantopus mexicanus knudseni*), Hawaiian Moorhen (Hawaiian name: ʻAlae ʻula, Scientific name: *Gallinula chloropus sandviceensis*), and Hawaiian Coot (Hawaiian name: ʻAlae keʻo keʻo, Scientific name: *Fulica Americana alai*).

The project is being developed jointly by the U.S. Army Corps of Engineers and the State Department of Land and Natural Resources. This project is authorized under Section 1135 of the Water Resources Development Act of 1986, as amended. Under this Act, the Secretary of the Army is authorized to review the operations of authorized water resource projects for the purpose of improving the quality of the environment in the public interest.

8.2 Waters of the U.S.

Kawainui Marsh and Maunawili Stream are navigable waterways, considered waters of the U.S. and regulated under the Clean Water Act. Portions of the ponds on the western and northern sides are within areas designated as wetlands. This project will increase the wetlands area by creating a series of ponds that can be utilized by plant and animal wetland species.

8.3 Description of Dredged or Fill Material.

Excavation of the ponds will begin at the northern or lower elevation side of the ponds. The excavated material will be stored off site near a DLNR field office located adjacent to the marsh. The excavated material will be dewatered and reused, as needed, to construct the berm around the ponds. These berms will service as access for maintenance of the ponds.

8.4 Description of Disposal Methods

Water used in the ponds will not be discharged into waters of the State. All water will be confined within the boundaries of the ponds. The water levels within the ponds will be regulated by on-site wells. Weirs between each pond will also pass water from one pond to the other. If any of the ponds need to be drained for maintenance reasons, they will drain into the adjacent pond at a lower elevation. A drainage swale adjacent to all of the ponds will also serve to drain the ponds, and the water will evaporate or percolate into the ground. A test pond was developed and the percolation rate of the water was estimated at 5 gallons per minute (gpm) per acre.

8.5 Factual Determinations (Section 230.11)

The elevation of the site at the uppermost pond is 19 feet mean sea level (msl) and slopes northeast to the lowest pond at approximately elevation 5 feet msl. The distance from the uppermost pond to the lowest pond is approximately 3,500 feet. Therefore the slope is approximately 0.4 percent.

The soils in the area consist of “fill land, mixed” (FL), possibly due to the past agricultural uses of the area (SCS 1972). On the southwestern side of the site, soils consist of the Papaa series (PYE and PYD), which are well-drained soils derived from basalt. Borings taken at the site show that the surface layer of terrigenous soils are several feel thick overlay marsh sediments and peat to a depth of about 10 feet. Beneath this, to about 30 feet depth, are organic silts that overlay marine deposits with calcareous silt and shells. Basalt rock beneath the marine deposits is unknown, but due to the proximity of the adjacent uplifted hills, it is assumed to be shallower than the 60-foot

depth reported from borings in the central areas of the marsh.

The project area currently does not contain any water, with the exception of Maunawili Stream, which traverses between the upper and lower ponds. Water will be pumped into the ponds via 60-foot deep wells. Within Maunawili Stream, AECOS, Inc. conducted monthly water quality samples in 2003 for the Kailua Bay Advisory Committee. The results of the data are shown in Table 8-1. Since there will be no discharge of water into the stream, the water quality should remain the same as existing conditions during the wet and dry seasons. In the vicinity of the project area, the existing use of pasture lands for cattle and horses will be discontinued, so the water quality in the vicinity of the proposed ponds may improve.

Table 8-1. Summary of Existing Water Quality Data

	Dry Season			Wet Season		
	Number of samples	Geometric Mean	Standard Deviation	Number of Samples	Geometric Mean	Standard Deviation
Temperature ^{o}C	11	23.5	0.7	20	22.2	1.6
pH	7	7.39	0.51	11	7.32	0.35
Turbidity	14	8.61	4.3 – 17.2	20	4.68	2.5 – 8.5
TSS mg/l	14	5.7	2.7 – 12.0	20	3.9	1.6 – 176
NO_3+NO_2 ug/l	7	35	11 - 107	11	108	67 - 176
Total N ug/l	7	153	108 – 215	11	199	150 -263
Total P ug/l	7	38	24 - 63	11	30	19 – 45
Source: AECOS						

The main purpose of this project is to create wetland habitat for endangered water birds and to encourage aquatic species habitat typical of a wetland environment. Under existing conditions, the area where the ponds will be constructed do not have any aquatic species. However, once the ponds have been developed, aquatic species that thrive in wetlands will begin to populate the ponds and create foraging and nesting habitat for water birds and other wetland species.

8.6 Findings of Compliance

– During the Alternatives Analysis stage of the project, it was determined that this alternative was the least environmentally damaging alternative. Excavated materials will be used to create a berm around the ponds and contain all water on-site. There will be no discharge into the waters of the State. Water will flow via gravity from pond to pond. If the pond needs to be drained, it will drain to the adjacent pond at a lower elevation or to the single side channel of the ponds where the water will percolate and evaporate. Draining of the ponds will only be needed for maintenance purposes. The creation of these ponds will enhance the aquatic ecosystem and have no adverse impacts.

SECTION 9.0 – PREPARERS OF THE SUPPLEMENTAL EA

Kevin Nishimura
Environmental Protection Specialist
U.S. Army Corps of Engineers, Honolulu District

Karen Tomoyasu
Environmental Protection Specialist
U.S. Army Corps of Engineers, Honolulu District

Loren Zulick
Archaeologist
U.S. Army Corps of Engineers, Honolulu District

SECTION 10.0 - LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS CONTACTED

National Marine Fisheries Service, Pacific Area Office
U.S. Fish and Wildlife Service, Pacific Islands Office
United States Environmental Protection Agency, Region IX
The Advisory Council on Historic Preservation

State Department of Health, Clean Water Branch
State Department of Health, Clean Air Branch
State Department of Health, Office of Hazard Evaluation & Emergency Response
State Department of Health, Environmental Planning Office
State Department of Land and Natural Resources, Division of State Parks
State Department of Land and Natural Resources, Historic Preservation Division
State Department of Land and Natural Resources, Division of Aquatic Resources
State Department of Land and Natural Resources, Commission on Water Resource Development
State Department of Land and Natural Resources, Office of Conservation and Environmental Affairs

City and County of Honolulu, Department of Land Utilization
City and County of Honolulu, Department of Public Works

Ducks Unlimited, Inc.

Ahahui Malama I Ka Lokahi
Kawai Nui Heritage Foundation
Office of Hawaiian Affairs
Hui Malama I Na Kupuna 0 Hawaii Nei
Hawaii's Thousand Friends
Oahu Council of Hawaiian Civic Clubs
Kailua Hawaiian Civic Club
Kailua Historical Society

SECTION 11.0 - REFERENCES

Final Environmental Assessment, Management Plan for Kawai Nui Marsh, Department of Land and Natural Resources, Land Division, March 2000.

Kawai Nui Marsh Master Plan, Oahu, Hawaii, Report R-100, State of Hawaii, DLNR, DOFAW, Wilson Okamoto & Associates, July 1994.

Kawainui Marsh Environmental Restoration Project, Final Ecosystem Restoration Report and Environmental Assessment, State of Hawaii, DLNR, DOFAW, U.S. Army Corps of Engineers, Honolulu Engineer District, Revised March 2000.

Kawainui Marsh Restoration Project, Island of Oahu, Hawaii, Source Water Engineering Report, Oceanit, October 2005.

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project, State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife, June 2005, Grant proposal.

Phase I Environmental Site Assessment, Kawai Nui Marsh, Kailua, Oahu, Hawaii, U.S. Army Engineer District, Honolulu, January 2008.

U.S. Fish and Wildlife Service. 2005. Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision, U. S. Fish and Wildlife Service.

Appendix A

Environmental Coordination

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

November 27, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Patrick Leonard
Field Supervisor
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard
Room 3-122, Box 50088
Honolulu, Hawaii 96850

Dear Mr. Leonard:

The U.S. Army Engineer District, Honolulu (POH) is writing to inquire if formal consultations under Section 7 of the Endangered Species Act of 1973, as amended, would have to be reinitiated, and, if a revised Fish and Wildlife Coordination Act Report under Section 2(b) of the Fish and Wildlife Coordination Act of 1934, as amended, is required for a proposed ecosystem restoration project at Kawainui Marsh, Oahu, Hawaii.

The Kawainui Marsh Ecosystem Restoration Project was authorized under Section 1135 of the Water Resources Development Act of 1986, as amended, in order to create mudflat, shallow pond habitat for endemic endangered waterbirds. Informal consultations to discuss the project with your agency began in October 1994. On April 9, 1997, POH submitted a copy of the revised *Kawainui Marsh Environmental Restoration Project, Draft Project Modification Report and Environmental Assessment* to your agency and requested initiation of formal consultation for the project. A Final Fish and Wildlife Coordination Act Report dated July 1997 and the Biological Opinion for the project dated August 15, 1997 was subsequently issued by your agency based upon the project parameters in existence at that time. A compact disc containing the *Kawainui Marsh Environmental Restoration Project, Final Ecosystem Restoration Report and Environmental Assessment* is enclosed for your reference that contains copies of the initial correspondence between us and the reports generated as appendices to the Environmental Assessment.

In the interim between our consultations and the present, execution of the proposed project had been delayed primarily due to land ownership issues at the project site. The footprint of the entire site fell on parcels owned separately by the State of Hawaii and the City and County of Honolulu. The issues revolving around this split ownership has since been resolved with the recent agreement between the two parties to transfer ownership to the State of Hawaii.

Reevaluation of the original project has necessitated a decrease in the project scope to effectively meet the original purpose within present funding constraints. The major differences between the original project features and the current 95% design features are summarized in the table below. Accompanying figures are included in this letter to provide a representation of the project's location and pond configurations (Figure 1 and 2, respectively). In addition, the *Source Water Engineering Report* that describes the rationale that went into designing the ponds has also been included on the enclosed compact disc to aide your review in determining the level of effort that would be necessary to update the original Coordination Report and/or Biological Opinion to reflect these changes.

Summary of Changes to the Kawainui Marsh Ecosystem Restoration Project Scope		
Project Features	Original Project Scope	Revised Project Scope
Site Location	Kawainui Marsh	Unchanged except footprint smaller (Fig. 1)
Acreage Involved	70.7 acres	40 acres
Number of ponds	4 major ponds subdivided into as many as 40 smaller ponds.	2 major ponds subdivided into 11 smaller ponds
Pond Source Water	Primarily rainfall with supplemental water from nearby streams.	Primarily rainfall with supplemental water from underground wells for each pond using solar powered pumps.
Predator Control Fencing	16,200 linear feet	4,600 linear feet
Predator Trapping	Included as part of predator control measures.	Unchanged
Project Maintenance and Operations	Utilize Hawaii State Division of Fish and Wildlife (DOFAW) personnel to carry out duties.	The State has internally approved the hiring of a biologist and two technicians to augment present DOFAW staff.
Stream Bank Clearing Leveling	Remove trees and flatten banks along 2,100 lineal feet of Maunawili Stream and 700 lineal feet along Kahanaiki Stream.	Not included in scope.
Flail Mower	Assist w/maintenance	Not included in scope

If you have any questions about this project please contact Mr. Kevin Nishimura at the address above, or via e-mail at kevin.h.nishimura@usace.army.mil or by telephone at (808) 438-3832. Thank you for your assistance in this matter.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

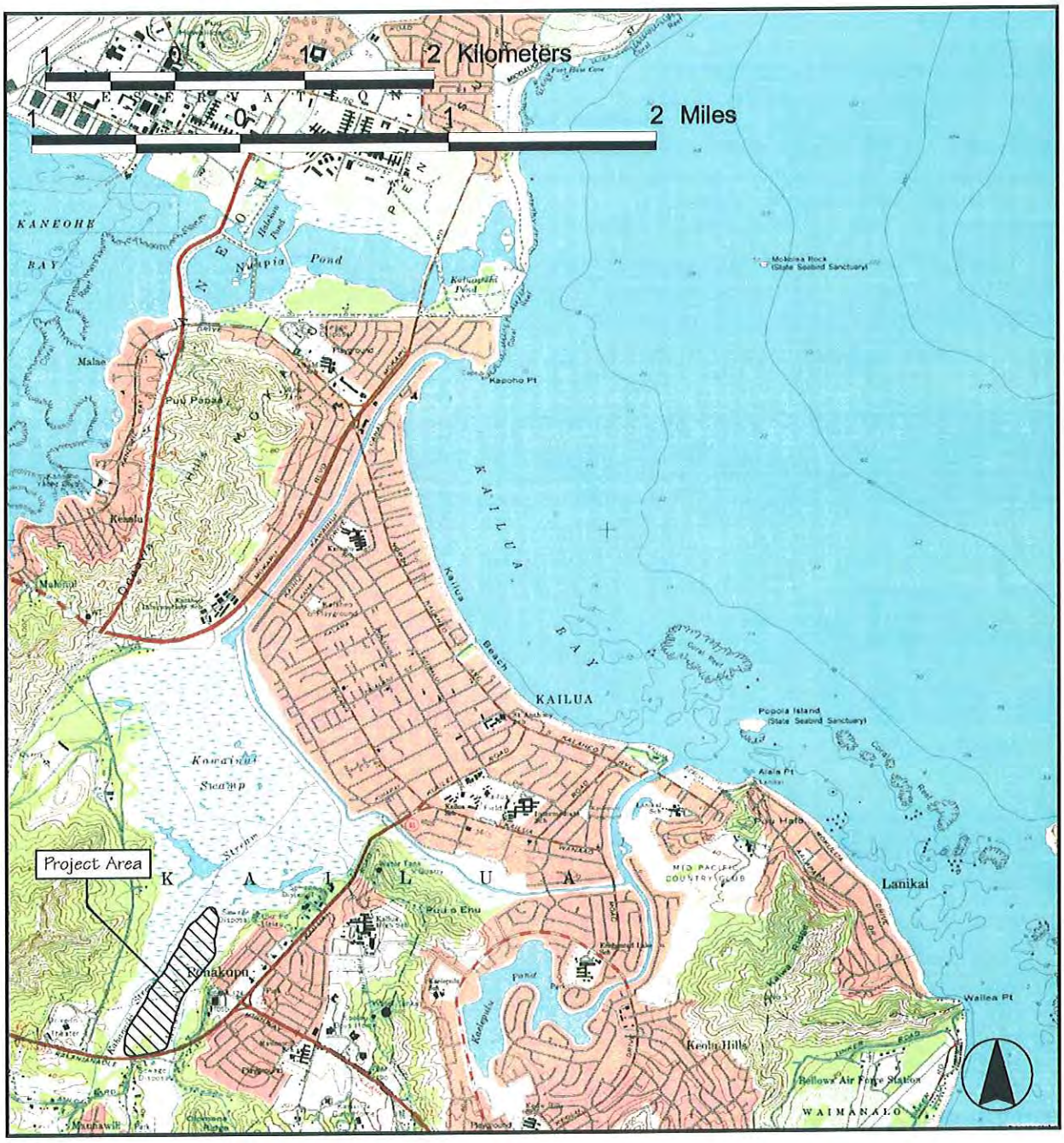


Figure 1. USGS 7.5 Minute Topographic Map Showing Area of Potential Effect for the Kawai Nui Marsh Wetlands Restoration Project (Source: Mann and Hammatt, 2003).

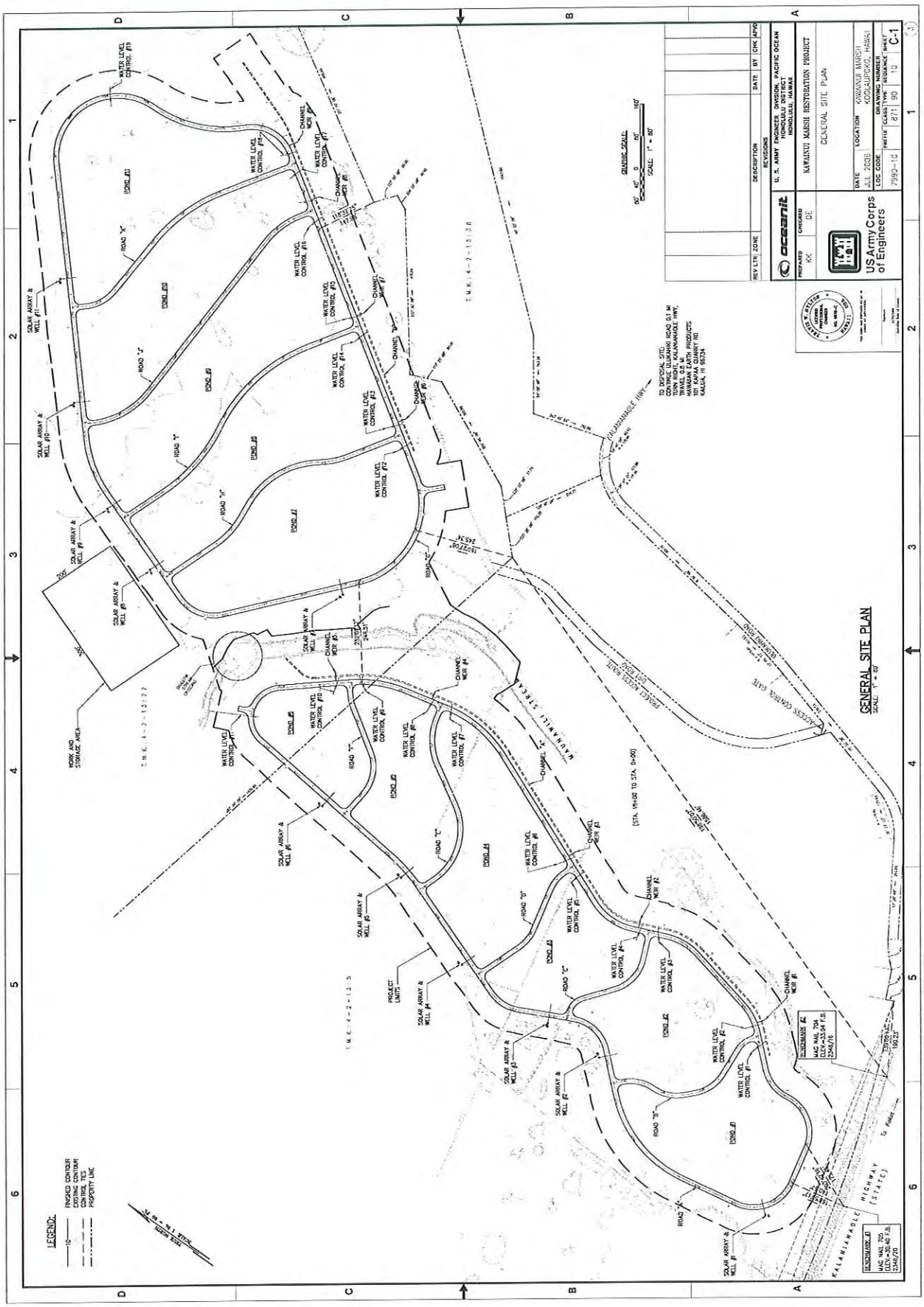


Figure 2. 95% Design Site Plan for Kawai Nui Marsh Restoration Project

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
12200-2008-FA-0140

DEC 1 8 2008

Anthony J. Paresa, P.E.
Deputy District Engineer
Programs and Project Management Division
U.S. Army Corps of Engineers, Honolulu District
Fort Shafter, Hawaii 96858-5440

Subject: Final Revised Fish and Wildlife Coordination Act 2(b) Report for the Kawainui Ecosystem Restoration Project, Kailua, Oahu, Hawaii

Dear Mr. Paresa:

The Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended (FWCA), was established to provide a framework for the consideration of fish and wildlife conservation measures to be incorporated into Federal and federally permitted or licensed water resources development projects. In coordination with U.S. Army Corps of Engineers (Corps) Honolulu District Civil Works program staff, we are providing the enclosed Final Revised FWCA section 2(b) investigation report for the proposed Kawainui Marsh Environmental Restoration Project. This report was prepared under the authority of and in accordance with provisions of the FWCA and the Federal Clean Water Act of 1977 [33 U.S.C. 1251 *et seq.*; 62 stat. 1155], as amended (CWA). These comments are also consistent with the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq.*; 83 Stat. 852], as amended (NEPA), and other authorities mandating concern for environmental values.

The proposed Kawainui Marsh Environmental Restoration Project (Project) was authorized under section 1135 of the Water Resources Development Act of 1986 (WRDA). In the WRDA, the Corps is authorized to review the operations of water resources projects to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest. Implementation of the Project was delayed due to a protracted land transfer process between the City and County of Honolulu and the State of Hawaii Department of Land and Natural Resources. Recently, the Project was re-evaluated and its scope was reduced due to increased construction costs. Despite these changes to the project, we acknowledge that Kawainui Marsh is widely-recognized to be an important natural resource and we support the Corps efforts to restore and maintain the environmental integrity of the marsh.

Mr. Anthony J. Paresa 2

Throughout our review process we have recommended that the Corps work closely with the local sponsor (State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife) to implement effective wildlife management and endangered species recovery actions at the Project site. Thank you for the opportunity to participate in the planning process for the Kawainui Ecosystem Restoration Project. If you have questions regarding our report, please contact Fish and Wildlife Biologist Aaron Nadig at 808/792-9400.

Sincerely,

for Patrick Leonard
Field Supervisor

cc: Wendy Wiltse, USEPA–PICO
Paul Conry, DLNR–DOFAW
Alec Wong, DOH–CWB

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

November 27, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Ms. Marilyn Luipold
NEPA Coordinator
Pacific Islands Regional Office
NOAA Fisheries Service
1601 Kapiolani Boulevard, Suite 1110
Honolulu, Hawaii 96814

Dear Ms. Luipold:

The U.S. Army Engineer District, Honolulu (POH) is writing to request reconfirmation on the listed, proposed, or candidate threatened or endangered species identified in the vicinity of a proposed ecosystem restoration project in Kawainui Marsh, Oahu, Hawaii previously identified by your agency, and, if your opinion still holds true that the project is not likely to affect them.

The Kawainui Marsh Ecosystem Restoration Project was authorized under Section 1135 of the Water Resources Development Act of 1986, as amended, in order to create mudflat, shallow pond habitat for endemic endangered waterbirds. A letter was sent to your agency dated March 26, 1996 with an accompanying Initial Appraisal Report describing the project and requested a listing of threatened and endangered species that may be affected by the project. Your agency's reply letter dated April 11, 1996 identified the threatened green turtle, *Chelonia mydas*, as the only species of concern under your jurisdiction near the project site. It also stated that the project would not likely have any adverse affect on them. Copies of the correspondence are provided as an enclosure for your reference.

During the time period between our first correspondence and the present, execution of the proposed project had been delayed primarily due to land ownership issues at the project site. The footprint of the entire site fell on parcels owned separately by the State of Hawaii and the City and County of Honolulu. The issues revolving around this split ownership has since been resolved with the recent agreement between the two parties to transfer ownership to the State of Hawaii.

Reevaluation of the original project has necessitated a decrease in the project scope to effectively meet the original purpose within present funding constraints. The major differences between the original project features and the current 95% design features are summarized in the table below. Accompanying figures are included in this letter to provide a representation of the project's location and pond configurations (Figures 1 and 2, respectively). In addition, a compact disc is provided as an enclosure that contains

copies of the *Kawainui Marsh Environmental Restoration Project, Final Ecosystem and Restoration Report and Environmental Assessment* that describes the proposed project before the reevaluation and the *Source Water Engineering Report* that describes the rationale that went into the design of the current pond configuration for your comparative review.

Summary of Changes to Kawainui Marsh Ecosystem Restoration Project Scope		
Project Features	Original Project Scope	Revised Project Scope
Site Location	Kawainui Marsh	Unchanged except footprint smaller (Fig. 1)
Acreage Involved	70.7 acres	40 acres
Number of ponds	4 major ponds subdivided into as many as 40 smaller ponds.	2 major ponds subdivided into 11 smaller ponds
Pond Source Water	Primarily rainfall with supplemental water from nearby streams.	Primarily rainfall with supplemental water from underground wells for each pond using solar powered pumps.
Predator Control Fencing	16,200 linear feet	4,600 linear feet
Predator Trapping	Included as part of predator control measures.	Unchanged
Project Maintenance and Operations	Utilize Hawaii State Division of Fish and Wildlife (DOFAW) personnel to carry out duties.	The State has internally approved the hiring of a biologist and two technicians to augment present DOFAW staff.
Stream Bank Clearing Leveling	Remove trees and flatten banks along 2,100 lineal feet of Maunawili Stream and 700 lineal feet along Kahanaiki Stream.	Not included in scope.
Flail Mower	Assist w/maintenance	Not included in scope

If you have any questions about this project please contact Mr. Kevin Nishimura at the address above, or via e-mail at kevin.h.nishimura@usace.army.mil or by telephone at (808) 438-3832. Thank you for your assistance in this matter.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

March 26, 1996

Planning and Operations Division

Mr. Eugene Nitta
Protected Species Coordinator
Pacific Area Office
National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii 96822-2396

Dear Mr. Nitta:

We are presently undertaking the environmental documentation and coordination for the Kawainui Marsh Environmental Restoration Project. Enclosed for your use is an Initial Appraisal Report (IAR) which was completed in 1994 and is the basis for the current study. The IAR recommended modifications to the marsh which will restore habitat for four species of endangered Hawaiian waterbirds.

We are requesting any information you may have on any listed, proposed, or candidate threatened or endangered species that may be affected by the project. We would appreciate your comments within 30 days of the date of this letter.

Thank you for your cooperation in this matter. If you have any questions regarding the project, please contact Mr. Benton Ching of my planning staff at 438-1157.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering
and Technical Services

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

April 11, 1996 F/SWO33:ETN

Mr. Ray H. Jyo, P.E.
Director of Engineering
and Technical Services
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Jyo:

Thank you for your letter requesting information on any listed, proposed or candidate species that may be present in the proposed Kawainui Marsh Environmental Restoration Project area. Only the threatened green turtle (Chelonia mydas) is likely to be found near the project site, in the nearshore waters of Kailua Bay. It is unlikely that green turtles will be affected by the proposed modifications to the flood control structures and enhancement of waterbird habitat.

Based on the available information, the proposed shore protection structure will not likely adversely affect listed species or their habitats.

I may be reached at 808/973-2987 if you have any questions concerning these comments.

Sincerely,

Eugene T. Nitta
Protected Species Program
Coordinator

cc: F/SW03 - Lecky

Enclosure (1)

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 10, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Wayne Nastri
Regional Administrator
Region 9
United States Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

Dear Mr. Nastri:

The U.S. Army Engineer District, Honolulu is renewing its efforts to proceed with the Kawainui Marsh Ecosystem Restoration Project that was authorized under Section 1135 of the Water Resources Development Act of 1986, as amended, in order to create mudflat, shallow pond habitat for endemic endangered waterbirds at Kawainui Marsh, Oahu, Hawaii and is seeking updated information that your office may have regarding hazardous, toxic and radioactive wastes (HTRW) in the project area and in the general vicinity that may affect or be affected by this project. Specifically, we are interested in any license/permit actions, compliance actions (violation, enforcement and/or litigation against property owners), and for general information about HTRW problems such as illegal dumping and past contamination.

An initial solicitation for this information was sent to your office dated March 26, 1996 when the project was still under study and we received a response dated May 6, 1996 that stated that your database did not delineate information of probable environmental interest in the project area on record at the time. Copies of this correspondence are provided as an enclosure for your review and information.

In the interim between our initial request and the present, execution of the proposed project had been delayed primarily due to land ownership issues at the project site. The footprint of the entire site fell on parcels owned separately by the State of Hawaii and the City and County of Honolulu. The issues revolving around this split ownership has since been resolved with the recent agreement between the two parties to transfer ownership to the State of Hawaii. This agreement has spurred our efforts to move the project forward once again.

Reevaluation of the original project has necessitated a decrease in the project scope to effectively meet the project's original purpose within present funding constraints. The major differences between the original project features and the current 95% design features are summarized in the table below. Accompanying figures are included in this

letter to provide a representation of the project's location and pond configurations (Figure 1 and 2, respectively).

Summary of Changes to the Kawainui Marsh Ecosystem Restoration Project Scope		
Project Features	Original Project Scope	Revised Project Scope
Site Location	Kawainui Marsh	Unchanged except footprint smaller (Figure 1)
Acreage Involved	70.7 acres	40 acres
Number of ponds	4 major ponds subdivided into as many as 40 smaller ponds.	2 major ponds subdivided into 11 smaller ponds
Pond Source Water	Primarily rainfall with supplemental water from nearby streams.	Primarily rainfall with supplemental water from underground wells for each pond using solar powered pumps.
Predator Control Fencing	16,200 linear feet	4,600 linear feet
Predator Trapping	Included as part of predator control measures.	Unchanged
Project Maintenance and Operations	Utilize Hawaii State Division of Fish and Wildlife (DOFAW) personnel to carry out duties.	The State has internally approved the hiring of a biologist and two technicians to augment present DOFAW staff.
Stream Bank Clearing Leveling	Remove trees and flatten banks along 2,100 lineal feet of Maunawili Stream and 700 lineal feet along Kahanaiki Stream.	Not included in scope.
Flail Mower	Assist w/maintenance	Not included in scope

Thank you in advance for your assistance in this matter. If you have any questions about this project, please contact Mr. Kevin Nishimura at the address above, or via e-mail at kevin.h.nishimura@usace.army.mil or by telephone at (808) 438-3832.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

March 26, 1996

Planning and Operations Division

Ms. Felicia Marcus
Administrator
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105-3901

Dear Ms. Marcus:

We are presently undertaking the environmental documentation and coordination for the Kawainui Marsh Environmental Restoration Project. Enclosed for your use is an Initial Appraisal Report (IAR) which was completed in 1994 and is the basis for the current study. The IAR recommended modifications to the marsh which will restore habitat for four species of endangered Hawaiian waterbirds.

As part of the study, we are interested in obtaining any information that your office may have regarding hazardous, toxic, and radioactive wastes (HTRW) which may be located within the study boundary or may affect or be affected by a Corps Civil Works project in the area. Specifically, we are interested in any license/permit actions, compliance actions (violation, enforcement and/or litigation against property owners), and for general information about local HTRW problems such as illegal dumping and past contamination. Hard copies of any pertinent information would be appreciated.

Thank you for your cooperation in this matter. If you have any questions regarding the project, please do not hesitate to contact Mr. Benton Ching of my planning staff at (808) 438-1157.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering and
Technical Services

Enclosures

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

May 9, 1996

Mr. Benton Ching
Planning and Operations Division
Department of the Army
Pacific Ocean Division
Corps of Engineers
Fort Shafter, HI 96858-5440

SUBJECT: Kawainui Marsh Environmental Restoration Project

Dear Mr. Ching:

I am writing in follow-up to our recent telephone conversation regarding your request for information on hazardous, toxic, and radioactive wastes (HTRW) which may be located within the study boundary or may affect or be affected by the Kawainui Marsh Environmental Restoration Project. The database which is used to track hazardous waste facilities regulated under the Resource Conservation and Recovery Act (RCRA) does not indicate any permitted treatment, storage, or disposal facilities in the project area.

I also checked with Mr. Eric Sadoyama, Hawaii Department of Health, regarding the status of any underground storage tanks (USTs) in the project area. Enclosed please find copies of UST information Mr. Sadoyama sent in reply. Mr. Sadoyama may be reached directly at (808) 586-4231.

Should you have any questions, or if you need further assistance, please do not hesitate to call me at (415) 744-2069.

Sincerely,

Mary Blevins
Environmental Scientist

cnc

Enclosure (1)

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 10, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Laurence K. Lau
Deputy Director
Environmental Health Administration
Hawaii State Department of Health
1250 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Lau:

The U.S. Army Engineer District, Honolulu is renewing its efforts to proceed with the Kawainui Marsh Ecosystem Restoration Project that was authorized under Section 1135 of the Water Resources Development Act of 1986, as amended, in order to create mudflat, shallow pond habitat for endemic endangered waterbirds at Kawainui Marsh, Oahu, Hawaii and is seeking updated information that your office may have regarding hazardous, toxic and radioactive wastes (HTRW) in the project area and in the general vicinity that may affect or be affected by this project. Specifically, we are interested in any license/permit actions, compliance actions (violation, enforcement and/or litigation against property owners), and for general information about HTRW problems such as illegal dumping and past contamination.

An initial solicitation for this information was sent to your office dated March 26, 1996 when the project was still under study and we received a response dated July 10, 1996 that delineated information of probable environmental interest in the project area on record with your office at the time. Copies of this correspondence are provided as enclosures for your review and information.

In the interim between our initial request and the present, execution of the proposed project had been delayed primarily due to land ownership issues at the project site. The footprint of the entire site fell on parcels owned separately by the State of Hawaii and the City and County of Honolulu. The issues revolving around this split ownership has since been resolved with the recent agreement between the two parties to transfer ownership to the State of Hawaii. This agreement has spurred our efforts to move the project forward once again.

Reevaluation of the original project has necessitated a decrease in the project scope to effectively meet the project's original purpose within present funding constraints. The major differences between the original project features and the current 95% design features are summarized in the table below. Accompanying figures are included in this

letter to provide a representation of the project's location and pond configurations (Figure 1 and 2, respectively).

Summary of Changes to the Kawainui Marsh Ecosystem Restoration Project Scope		
Project Features	Original Project Scope	Revised Project Scope
Site Location	Kawainui Marsh	Unchanged except footprint smaller (Figure 1)
Acreage Involved	70.7 acres	40 acres
Number of ponds	4 major ponds subdivided into as many as 40 smaller ponds.	2 major ponds subdivided into 11 smaller ponds
Pond Source Water	Primarily rainfall with supplemental water from nearby streams.	Primarily rainfall with supplemental water from underground wells for each pond using solar powered pumps.
Predator Control Fencing	16,200 linear feet	4,600 linear feet
Predator Trapping	Included as part of predator control measures.	Unchanged
Project Maintenance and Operations	Utilize Hawaii State Division of Fish and Wildlife (DOFAW) personnel to carry out duties.	The State has internally approved the hiring of a biologist and two technicians to augment present DOFAW staff.
Stream Bank Clearing Leveling	Remove trees and flatten banks along 2,100 lineal feet of Maunawili Stream and 700 lineal feet along Kahanaiki Stream.	Not included in scope.
Flail Mower	Assist w/maintenance	Not included in scope

Thank you in advance for your assistance in this matter. If you have any questions about this project, please contact Mr. Kevin Nishimura at the address above, or via e-mail at kevin.h.nishimura@usace.army.mil or by telephone at (808) 438-3832.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT SHAFTER, HAWAII 96858-5440

March 26, 1996

Planning and Operations Division

Bruce Anderson, Ph.D.
Deputy Director for Environmental Health
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Anderson:

We are presently undertaking the environmental documentation and coordination for the Kawainui Marsh Environmental Restoration Project. Enclosed for your use is an Initial Appraisal Report (IAR) which was completed in 1994 and is the basis for the current study. The IAR recommended modifications to the marsh which will restore habitat for four species of endangered Hawaiian waterbirds.

As part of the study, we are interested in obtaining any information that your office may have regarding hazardous, toxic, and radioactive wastes (HTRW) which may be located within the study boundary or may affect or be affected by a Corps Civil Works project in the area. Specifically, we are interested in any license/permit actions, compliance actions (violation, enforcement and/or litigation against property owners), and for general information about local HTRW problems such as illegal dumping and past contamination. Hard copies of any pertinent information would be appreciated.

Thank you for your cooperation in this matter. Should you have any questions regarding the project,

please feel free to contact Mr. Benton Ching of my planning staff at (808) 438-1157.

Sincerely,

Ray H. Jyo, P.E.
Director of Engineering
and Technical Services

Enclosure

Copy Furnished (without enclosure):

Ms. Felicia Marcus
Administrator
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105-3901

Enclosure (1)

BENJAMIN J. CAYETANO
... GOVERNOR OF HAWAII

LAWRENCE MIKE
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P O BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to

July 10, 1996

Mr. Ray H. Jyo, P.E.
Director of Engineering
and Technical Services
Department of the Army
Pacific Ocean Division,
Corps of Engineers
Ft. Shafter, Hawaii 96858-5440

Dear Mr. Jyo:

Subject: Request for Public Records
Kawainui Marsh Restoration Project

This correspondence is in response to your letter requesting information regarding the subject site from the Environmental Management Division, Department of Health.

We have reviewed our files in the Clean Air, Clean Water, Safe Drinking Water, Hazardous Waste and Wastewater Branches, the Office of Hazard Evaluation and Emergency Response (HEER) and the Office of Solid Waste Management. We have the following comments to offer:

Hazard Evaluation and Emergency Response (HEER) Office

This office has files in both the Release (spills) Report and the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database. For information on these files, please call Mr. Bill Perry at 586-4249.

Underground Storage Tanks (Hazardous Waste Branch)

This office has two (2) files in this area.

1. #9-200243 - Kapaa Quarry Maintenance Yard

2. #9-201165 - Ameron HC&D, Kapaa Quarry

For more information on these files, please contact Mr. Jack Richardson of the UST Section at 586-4226.

Office of Solid Waste Management (OSWM)

This office has files on Kapaa Landfill, Ameron and All Pool and Spa. For more information on these files, please call Ms. Ronda Randolph at 586-4240.

Please be advised that the absence of information on reports of spills, releases, or the existence of underground storage tanks does not absolve the owner from future clean up liabilities under the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, or the Hawaii Environmental Response Law, as amended, or any other applicable state or federal regulation.

A copy of the most recent CERCLIS List, which lists potential hazardous waste sites which are undergoing evaluation or have been evaluated by the U. S. Environmental Protection Agency and the site-specific files on the CERCLIS List may be obtained by contacting the HEER Office at 586-4249. The latest copies of the Underground Storage Tank List, the Leaking Underground Storage Tank List, and the RCRA List may be obtained by contacting the Underground Storage Tank (UST) Section for the UST List and the LUST List and/or the Hazardous Waste Section for the RCRA List at 586-4226.

If you would like to see or purchase a copy of the Spills Report or Log, which is a compilation of all hazardous substance/material spills reported to the HEER Office since 1988, please contact the HEER Office at 586-4249.

Very truly yours,

THOMAS E. ARIZUMI, P.E., Chief
Environmental Management Division

c: OSWM
SHWB
HEER

Enclosure (2)

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Don Klima
Director, Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 803
Washington, DC 20004

Dear Mr. Klima:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. Hawaii SHPO Log No: 17178, Doc No: 9602TD02, and Log

No: 19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
3. All excavations will be monitored by an archaeologist from the Corps or DLNR or by DOFAW personnel;
4. Maintenance procedures established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment of these procedures will be elicited from interested public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, who are curators of Ulu Po Heiau, and the Office of Hawaiian Affairs.

To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

1. Archaeologists from POH (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *lo`i* walls. If *lo`i* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible per item #1 above.
2. Ground disturbance for pond construction will generally be to depths between 1 and 2 feet to avoid possible impacts to archaeological resources believed to exist below this depth. Ground disturbance for wells and fencing will likely be deeper, but disturbances will be in relatively small areas and strategically placed. Contrary to #2 above, archaeologists will not establish depths of excavation prior to construction, as this will be indicated in the design plans and specifications.
3. POH will provide for archaeological monitoring of ground disturbing activities. Archaeological monitoring will be in accordance with an Archaeological Monitoring Plan (AMP) to be submitted separately, prior to construction. Among other things, the AMP will include proposed treatment of inadvertent discoveries and define reporting requirements.

Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. If you choose to participate in the 106 process, we ask for your review and comment on the proposed revised implementing actions, and concurrence with our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

References:

Mann, Melanie M., and Hallett H. Hammatt
2003 *Kawai Nui Marsh Environmental Restoration Project Mitigation Plan & Field Verification & Flagging, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, TMK 4-2-13*, Cultural Surveys Hawai`i, Inc., Kailua, HI.

U.S. Army Corps of Engineers Honolulu District, and State of Hawaii Department of Land & Natural Resources, Division of Forestry & Wildlife
1998 *Final Ecosystem Restoration Report and Environmental Assessment/Findings of No Significant Impact for Kawai Nui Marsh Environmental Restoration Project, Kailua, Island of Oahu, Hawaii.* Revised March 2000

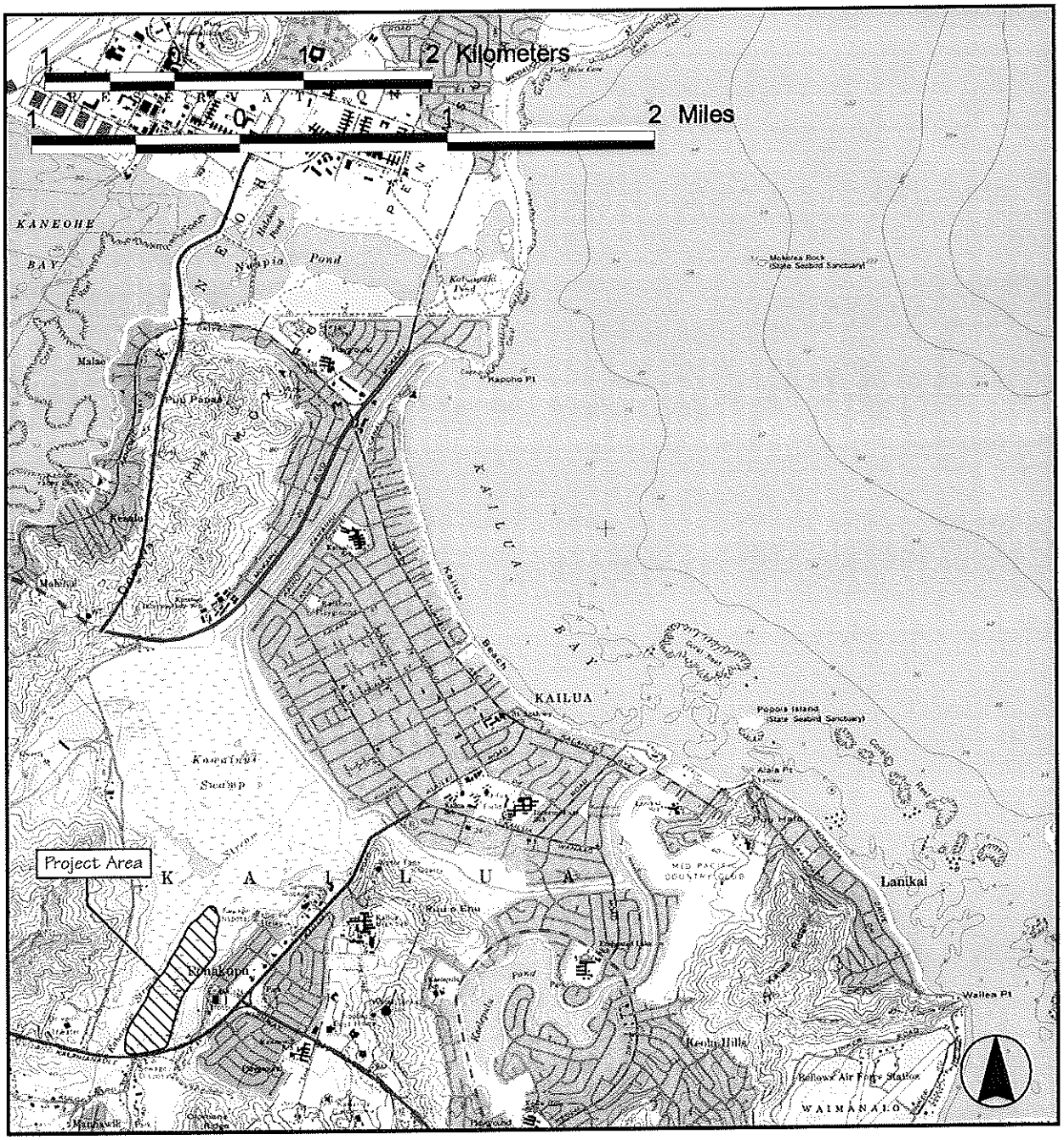


Figure 1 USGS 7.5 Minute Topographic Map Showing Area of Potential Effect for the Kawai Nui Marsh Wetlands Restoration Project (Source: Mann and Hammatt, 2003).

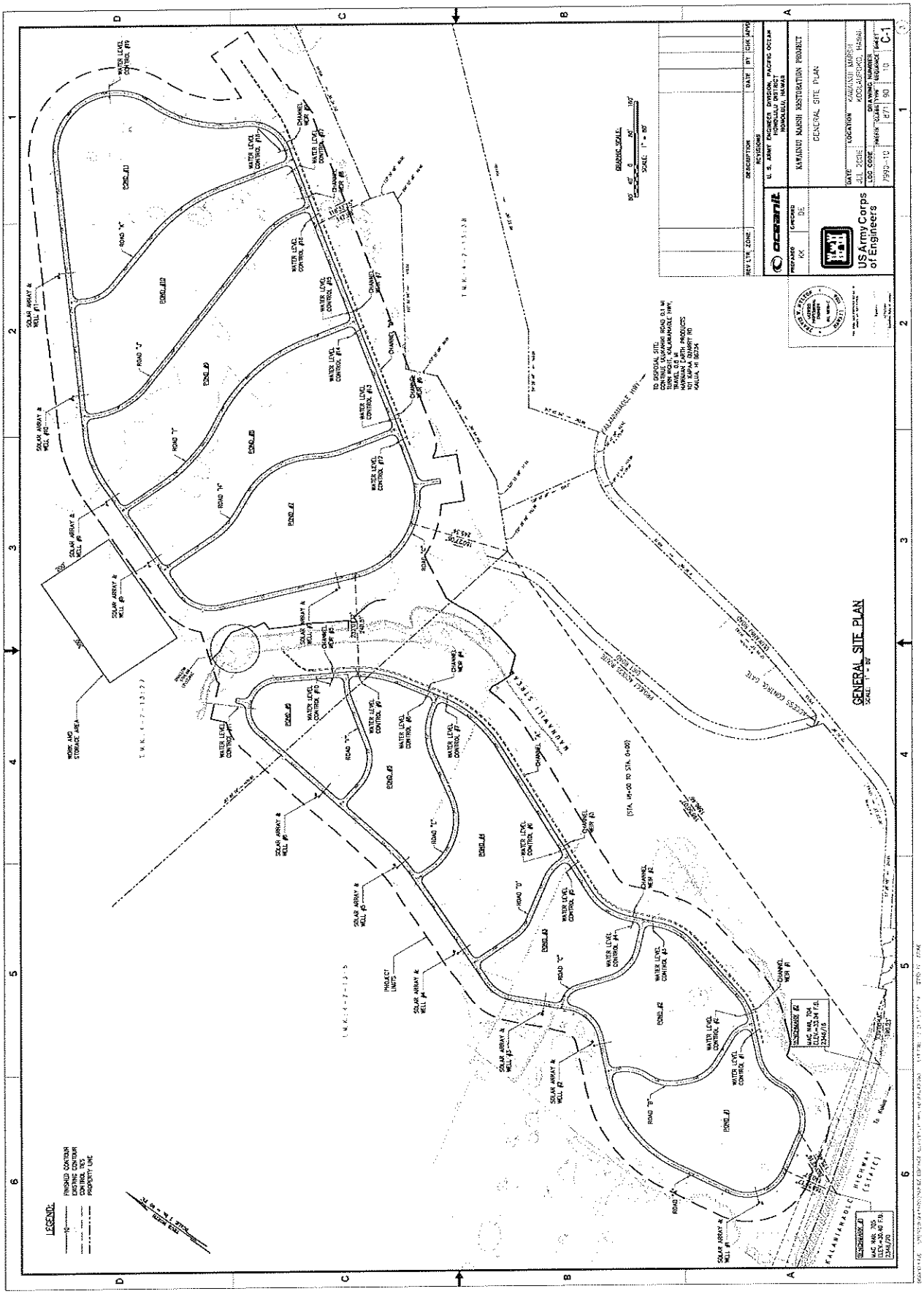
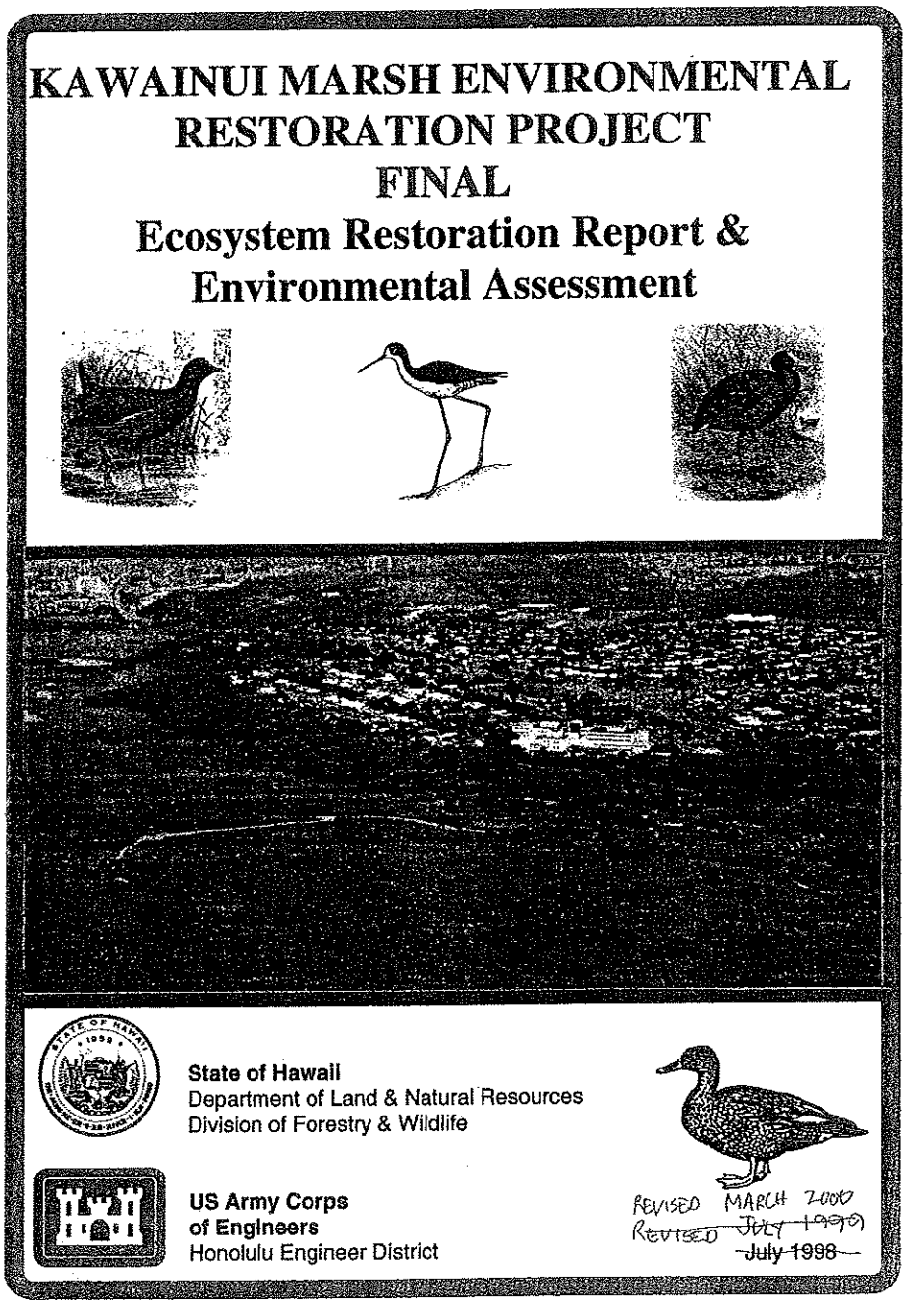


Figure 2 95% Design Site Plan for Kawai Nui Marsh Restoration Project.

Cover of Kawai Nui Marsh Restoration Project ERR & EA Revised March 2000



Enclosure 1

Cover of CSH, Inc. Archaeological Investigations Report Dated June 2003

KAWAI NUI MARSH ENVIRONMENTAL RESTORATION PROJECT

MITIGATION PLAN & FIELD VERIFICATION & FLAGGING

KAILUA *AHUPUA`A*, KO`OLAUPOKO DISTRICT, ISLAND OF O`AHU

TMK 4-2-13

by

Melanie M. Mann, B.A.
and
Hallett H. Hammatt, PhD

Prepared for
Oceanit
1001 Bishop Street #2970
Honolulu, Hawai`i 96813

by
Cultural Surveys Hawai'i, Inc.
June 2003

Enclosure 2

Section 106 Consulting Parties for Proposed Kawai Nui Marsh Restoration Project

Mr. Don Klima
Director, Federal Agency Programs
Advisory Council on Historic Preservation
Old Post Office Building
1100 Pennsylvania Avenue, NW, Suite 803
Washington, DC 20004

Ms. Laura H. Thielen
State Historic Preservation Officer
Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Mr. Dan Quinn
Administrator
Department of Land and Natural Resources
Division of State Parks
1151 Punchbowl Street, Room 310
Honolulu, HI 96809

Mr. Clyde Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Mr. Edward Halealoha Ayau, Po`o
Hui Malama I Na Kupuna O Hawai`i Nei
P.O. Box 365
Ho'olehua, HI 96729

Mr. Charles K. Maxwell
President, Board of Directors
Hui Malama I Na Kupuna O Hawai`i Nei
157 'Ale'a Place
Pukalani, HI 96768

Ms. Dana Kokubun
President
Kawai Nui Heritage Foundation
P.O. Box 1101
Kailua, HI 96734

Mr. Benton Kealii Pang
President
`Ahahui Malama I Ka Lokahi
P.O. Box 61578
Honolulu, HI 96839-1578

Ms. Donna Wong
Executive Director
Hawaii's Thousand Friends
25 Maluniu Avenue, Suite 102, #282
Kailua, HI 96734

Ms. Jalna Keala
C/O Mr. Shad Kane
President
Oahu Council of Hawaiian Civic Clubs
92-1309 Uahanai Street
Kapolei, HI 96707

Enclosure 3

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Ms. Laura H. Thielen
State Historic Preservation Officer
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Ms. Thielen:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. LOG NO: 17178, DOC NO: 9602TD02, and LOG NO: 19306, DOC NO: 9705EJ07). The following mitigations were agreed to in 1998, through

consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
3. All excavations will be monitored by an archaeologist from the Corps or DLNR or by DOFAW personnel;
4. Maintenance procedures established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment of these procedures will be elicited from interested public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, who are curators of Ulu Po Heiau, and the Office of Hawaiian Affairs.

To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

1. Archaeologists from POH (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *lo`i* walls. If *lo`i* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible per item #1 above.
2. Ground disturbance for pond construction will generally be to depths between 1 and 2 feet to avoid possible impacts to archaeological resources believed to exist below this depth. Ground disturbance for wells and fencing will likely be deeper, but disturbances will be in relatively small areas and strategically placed. Contrary to #2 above, archaeologists will not establish depths of excavation prior to construction, as this will be indicated in the design plans and specifications.
3. POH will provide for archaeological monitoring of ground disturbing activities. Archaeological monitoring will be in accordance with an Archaeological Monitoring Plan (AMP) to be submitted separately, prior to construction. Among other things, the AMP will include proposed treatment of inadvertent discoveries and define reporting requirements.

Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and concurrence, once again, with our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 31, 2008

LOG NO: 2007.4277
DOC NO: 0801ED24
Archaeology

James Bersson, PE
Deputy District Engineer for Programs and Project Management
Department of the Army
U.S. Army Engineering District, Honolulu
Fort Shafter, Hawai'i 96858-5440

Dear Mr. Bersson:

SUBJECT: National Historic Preservation Review (NHPA) Section 106 Review – Wetlands Restoration Project at Kawainui Marsh Kailua Ahupua'a, Ko'olaupoko District, Island of O'ahu TMK: (1) 4-2-013

Thank you for the opportunity to comment on the aforementioned project, which we received on December 11, 2007. The proposed undertaking involves constructing and operating a designed wetland habitat for endangered Hawaiian waterfowl in the area of Kawainui Marsh known as Site -7. According to the submitted documents, a total of 11 terraced ponds separated by low earthen berms are proposed. Each pond will be supplied by a well fitted with solar pumps. The undertaking also involves installing 4,600 linear feet of predator fencing. Kawainui Marsh, including the area known as Site -7, was determined eligible for the national Register of Historic Places in 1979 (50-80-11-12029).

Proposed mitigation for the undertaking involves: (1) Archaeologists from the U.S. Army Engineering District (POH) will be present during clearing activities to examine the cleared ground for lo'i walls and/or cultural resources, (2) Ground disturbance will range approximately 2 feet in depth to avoid possible impacts to archaeological resources believed to exist below this depth, and (3) a POH archaeologist will monitor all ground disturbing activities and an archaeological monitoring plan will be submitted to SHPD for review and comment.

We concur with the proposed mitigation and we look forward to receiving the archaeological monitoring plan. We strongly suggest that all measures be taken to avoid the cultural resources that may exist within the project area. As a suggestion, this may include preparing alternative construction plans in the event that archaeological resources are encountered. Additionally, we request that should heavy machinery be used to excavate, controlled excavations of 10 centimeter increments be implemented to avoid inadvertent damage to archaeological features that may be located subsurface within the project area.

In the event that historic resources, including human skeletal remains, are identified during the construction activities, all work needs to cease in the immediate vicinity of the find and the appropriate laws need to be followed.

Please contact Teresa Davan at (808) 692-8015 if you have any questions or concerns regarding this letter.

Aloha,

Laura H. Thielen, Chairperson
State Historic Preservation Officer

ED

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Charles K. Maxwell
President, Board of Directors
Hui Malama I Na Kupuna O Hawai`i Nei
157 'Ale'a Place
Pukalani, HI 96768

Dear Mr. Maxwell:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. SHPO Log No: 17178, Doc No: 9602TD02, and Log No: 19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through

consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
3. All excavations will be monitored by an archaeologist from the Corps or DLNR or by DOFAW personnel;
4. Maintenance procedures established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment of these procedures will be elicited from interested public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, who are curators of Ulu Po Heiau, and the Office of Hawaiian Affairs.

To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

1. Archaeologists from POH (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *lo`i* walls. If *lo`i* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible per item #1 above.
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3. POH will provide for archaeological monitoring of ground disturbing activities. Archaeological monitoring will be in accordance with an Archaeological Monitoring Plan (AMP) to be submitted separately, prior to construction. Among other things, the AMP will include proposed treatment of inadvertent discoveries and define reporting requirements.

Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic

properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Edward Halealoha Ayau, Po`o
Hui Malama I Na Kupuna O Hawai`i Nei
P.O. Box 365
Ho'olehua, HI 96729

Dear Mr. Ayau:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. SHPO Log No: 17178, Doc No: 9602TD02, and Log No: 19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through consultation, to avoid impacting subsurface archaeological deposits containing

agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
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To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

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Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic properties occur. We believe that the revised actions listed above along with

implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Ms. Dana Kokubun
President
Kawai Nui Heritage Foundation
P.O. Box 1101
Kailua, HI 96734

Dear Ms. Kokubun:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

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Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. SHPO Log No: 17178, Doc No: 9602TD02, and Log No: 19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through

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Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Ms. Donna Wong
Executive Director
Hawaii's Thousand Friends
25 Maluniu Avenue, Suite 102, #282
Kailua, HI 96734

Dear Ms. Wong:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

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Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic

properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Ms. Jalna Keala
C/O Mr. Shad Kane
President
Oahu Council of Hawaiian Civic Clubs
92-1309 Uahanai Street
Kapolei, HI 96707

Dear Ms. Keala:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. SHPO Log No: 17178, Doc No: 9602TD02, and Log No:

19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
3. All excavations will be monitored by an archaeologist from the Corps or DLNR or by DOFAW personnel;
4. Maintenance procedures established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment of these procedures will be elicited from interested public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, who are curators of Ulu Po Heiau, and the Office of Hawaiian Affairs.

To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

1. Archaeologists from POH (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *lo`i* walls. If *lo`i* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible per item #1 above.
2. Ground disturbance for pond construction will generally be to depths between 1 and 2 feet to avoid possible impacts to archaeological resources believed to exist below this depth. Ground disturbance for wells and fencing will likely be deeper, but disturbances will be in relatively small areas and strategically placed. Contrary to #2 above, archaeologists will not establish depths of excavation prior to construction, as this will be indicated in the design plans and specifications.
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Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO ATTENTION OF:

Programs and Project Management Division

Dr. Charles Burrows
President
`Ahahui Malama I Ka Lokahi
P.O. Box 751
Honolulu, HI 96808

Dear Dr. Burrows:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. SHPO Log No: 17178, Doc No: 9602TD02, and Log No: 19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through

consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
3. All excavations will be monitored by an archaeologist from the Corps or DLNR or by DOFAW personnel;
4. Maintenance procedures established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment of these procedures will be elicited from interested public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, who are curators of Ulu Po Heiau, and the Office of Hawaiian Affairs.

To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

1. Archaeologists from POH (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *lo`i* walls. If *lo`i* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible per item #1 above.
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properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Clyde Namu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Dear Mr. Namu'o:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

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consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

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properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

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

HRD07/ 21E

December 21, 2007

Loren Zulick
Department of the Army
U.S. Army Engineer District
Ft. Shafter, Hawai'i 96858-5440

RE: Reopen National Historic Preservation Act (NHPA) Section 106 Consultations, Kawai Nui Marsh Wetlands Restoration, Kailua, O'ahu, TMK: 4-02:13.

Dear Mr. Zulick,

The Office of Hawaiian Affairs (OHA) is in receipt of your request for written comments regarding the reopening of the NHPA Section 106 consultations concerning the Kawai Nui Marsh wetlands restoration in Kailua on O'ahu. We have the following comments:

As you know, the lands that this project potentially impacts are ceded lands. As such, we require that they be treated with the respect due to them, as they are part of the 1.8 million acres of land that belong to the Hawaiian monarchy. Further, because these lands became a part of the public land trust under section 5(b) of the Admissions Act, OHA is entitled to 20% of all revenue generated on this land.

Of additional concern to OHA are all the numerous archaeological sites present on the listed TMK for this proposed project. The Kawai Nui Marsh Master Plan in Table 2-8 lists 16 sites on this TMK, while this project only lists two. While OHA appreciates that the Area of Potential Effect (APE) has been downsized, we are still concerned that the construction of a series of 11 terraced ponds with earthen berms separating them and each with its own

well will still alter the characteristics of the historic properties on this site. OHA, therefore, requests that the Department of the Army share the steps they have taken to determine the basis for their findings of historic properties that this project may affect.

OHA wishes to remind the Department of the Army that under Section 106 consultations, the definition of 'effect' does not have to be a certainty, direct or physical, and that reasonably foreseeable effects must be considered. As such, this is the type of analysis and consultation that we would look for.

In the State of OHA and the Native Hawaiian Community
Remarks made by Trustee Haunani Apoliona on Monday, December 17, 2007 she said

> Our island lifestyle and respect for limited natural resources has been the legacy of our ancestors, generation to generation. We are experts in caring for the environment. Mālama 'āina goes to the core of who we are as a people. Our cultural practices and our values are all about caring for the 'āina, loving our motherland, not just to use, but to conserve and replenish. These traditions and values coincide with the global desire to protect the environment to secure and sustain a certain quality of life for future generations.

As such, OHA stands in support of wetland preservation and habitat conservation for Kawai Nui Marsh. We look forward to working with the Department of the Army during this consultation process to make this project the best that it can be.

If you have any further questions or concerns please contact Grant Arnold at (808) 594-0263 or granta@oha.org.

Sincerely,

Clyde W. Nāmu'o
Administrator

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

January 10, 2008

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Clyde Nāmu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Dear Mr. Nāmu'o:

The U.S. Army Corps of Engineers, Honolulu Engineering District (POH) is writing in response to your National Historic Preservation Act (NHPA) Section 106 consultation letter dated December 21, 2007 (HRD07/21E), regarding a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

Your letter presented a concern for the numerous archaeological sites identified within the TMK for this proposed project, and that the proposed project will alter the characteristics of historic properties that may be present within the project area. Your office has requested that POH share the steps that have been taken to determine the basis for our findings of historic properties that this project may affect.

To date, the steps taken to identify historic properties that may be affected by this project include planning meetings with the Hawaii State Historic Preservation Division (SHPD) and community groups, formal Section 106 consultation with the SHPD and other interested parties, including the Office of Hawaiian Affairs, and archaeological survey.

Since 1996, POH has held meetings and requested input from SHPD, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. Formal Section 106 consultation with the SHPD and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration. During consultation, the SHPD identified *lo`i* walls associated with State Site #50-80-11-2029 as being of greatest concern for historic properties possibly impacted by the restoration project. The following quote from the Ecosystem Restoration Report revised 22 March 2000, demonstrates some of the efforts made to identify and avoid historic properties; "Using Historical aerial photographs, the SHPO drew the approximate locations of the *lo`i* walls in their last known configuration in the 1920's (see Figure 4 as Enclosure 1). The walls are thought to be approximately 50 cm beneath existing ground elevations. Based on this

information, interior and exterior pond walls were designed to follow the footprint of the *lo`i* walls." (ERR/EA, 1998: 9). SHPD's rendering of *lo`i* wall locations, referenced as Figure 4 above, is attached as Enclosure 1. A digital copy of the complete Ecosystem Restoration Report/Environmental Assessment was enclosed with our letter reopening consultation dated December 3, 2007.

Additionally, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003), to assist with the identification and evaluation of alternatives for the construction of the planned wetland. Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology (Mann and Hammatt, 2003: 40). Their efforts also included subsurface investigations directed by SHPD. A digital copy of the complete archaeological investigation report was enclosed with our last letter.

Although there are multiple records of historic properties within Zone 04, Section 02, Plat 0013 (TMK 4-2-13), consultation thus far has helped us determine that most historic properties identified within the TMK are not within the project area, and therefore are not likely to be impacted by the proposed project. Attempts to identify (and avoid) historic properties within the project area have been undertaken through archaeological survey and through mitigations such as archaeological monitoring and shallow excavations. These steps taken, and the resulting mitigations, will be implemented to avoid, as much as possible, altering the characteristics of historic properties that may be present within the project area.

POH has taken many steps towards the identification and protection of cultural resources within the project area through the Section 106 process, and invite you to our office to review and comment on this history, and to provide any information you may have that is not contained in the record thus far. If you have any other concerns, additional knowledge of the area, or insight that you'd like to present, please contact Mr. Loren Zulick at the address above, via e-mail at loren.a.zulick@usace.army.mil, or by telephone at (808) 438-0474. We thank you for your comments and interest in the preservation of historic properties, and look forward to your valued input as we continue to consult on this project.

Sincerely,

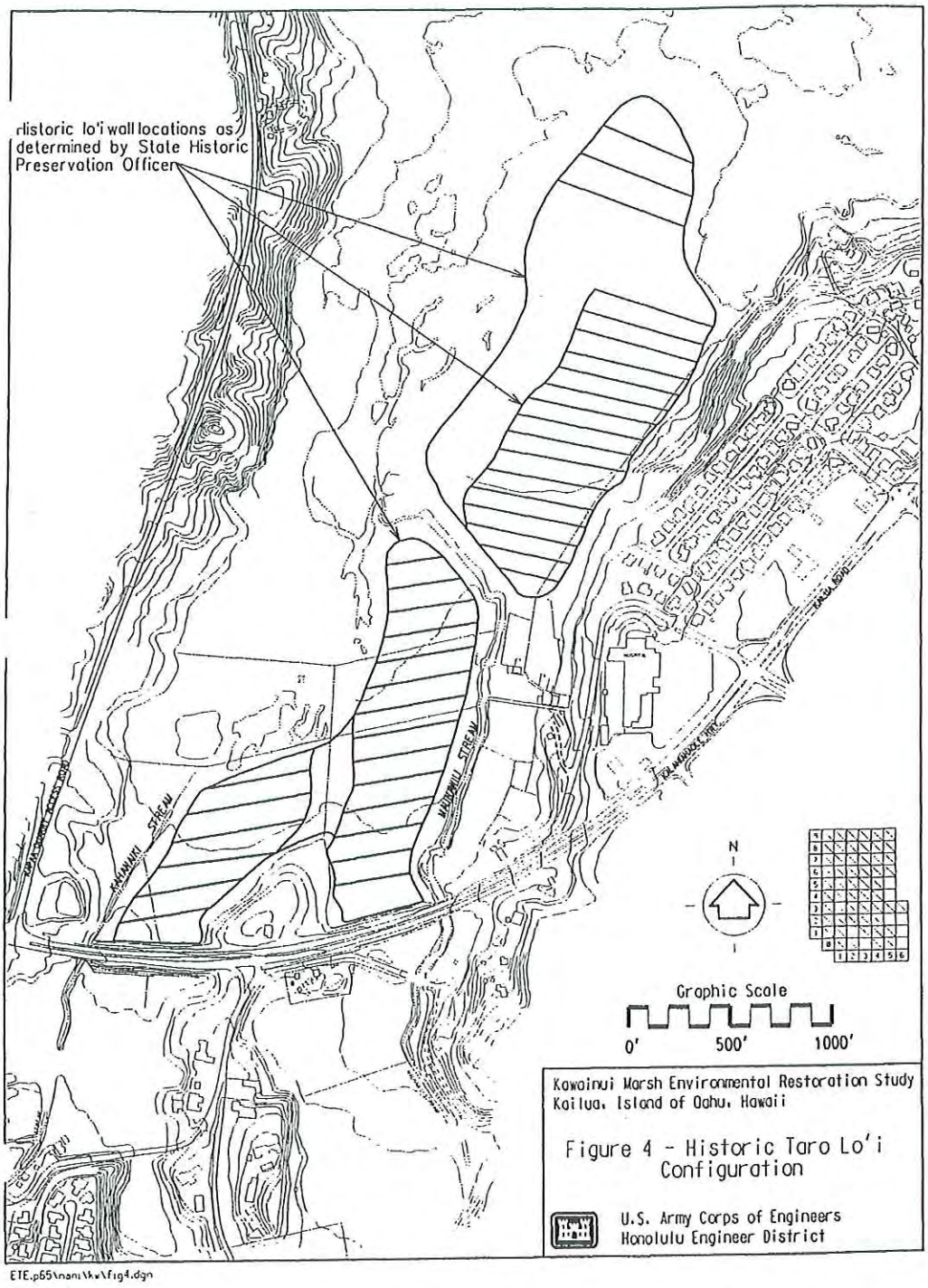
James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosure

References:

Mann, Melanie M., and Hallett H. Hammatt
2003 *Kawai Nui Marsh Environmental Restoration Project Mitigation Plan & Field Verification & Flagging, Kailua Ahupua`a, Ko`olaupoko District, Island of O`ahu, TMK 4-2-13*, Cultural Surveys Hawai`i, Inc., Kailua, HI.

U.S. Army Corps of Engineers Honolulu District, and State of Hawaii Department of Land & Natural Resources, Division of Forestry & Wildlife
1998 ERR/EA (*Final Ecosystem Restoration Report and Environmental Assessment/Findings of No Significant Impact for Kawai Nui Marsh Environmental Restoration Project, Kailua, Island of Oahu, Hawaii).* Revised March 2000



State Historic Preservation Division's rendering of *lo`i* wall locations within the Project Area (from 1998 Environmental Restoration Report).

Enclosure 1

PHONE (808) 594-1888 FAX (808) 594-1865

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

HRD08/0021F

February 20, 2008

James L. Bersson, P.E.
Deputy District Engineer
Programs and Project Management Division
Department of the Army
Fort Shafter, Hawaii 96858-5440

RE: Section 106 Consultation regarding proposed wetlands restoration project at Kawai Nui Marsh, O'ahu Island, Hawai'i, TMK (1) 4-2-013

Dear Mr. James L. Bersson,

The Office of Hawaiian Affairs (OHA) is in receipt of your January 10, 2008 submission regarding a proposed wetlands restoration project at Kawai Nui Marsh and offers the following comments:

Under the requirements of 36 CFR Part 800.4 (b)(1) which states, *"The agency official shall make a reasonable and good faith effort to carry out appropriate identification efforts"*, OHA requests additional surface and sub-surface archaeological efforts to adequately identify historic properties within the subject Area of Potential Effect (APE).

The level of identification that was conducted by Cultural Surveys Hawai'i, Inc. does not satisfy recommendations made by the State of Hawaii Historic Preservation Officer (SHPO) and is not consistent with the type of study needed considering the cultural and archeological significance of the archeological district State Inventory of Historic Places (SIHP) 50-80-11-2029, the Kawai Nui Marsh archeological cultural-historical complex. The marsh was deemed eligible for listing on the National Register of Historic Places in 1979 and merits an elevated inventory survey effort.

It is our opinion that the excavation of two trenches within the 60 acres of the project area, previously identified as a historic property, does not constitute an adequate subsurface testing effort. We also believe that the artifacts salvaged from these excavations, dug perpendicular to the linear boundary markers of LCA 2544:1 and LCA 6969:2, confirm the existence of significant historic properties and clearly warrant further study.

The subject excavations identified a *"distinct mass of water worn cobbles, pushed into a mound like feature"*. A cultural layer was also identified in both trenches which yielded significant artifacts and evidence of past agricultural practices. These findings are consistent with subsequent archeological reports (Cordy, 1978 and Wheeler, 1981). Based upon these and the subject inventory, Hammatt (Mann and Hammatt, 2003) clearly states that *"cultural deposits are still present and intact below the existing ground surface"*.

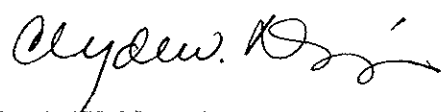
Dr. Ross Cordy elaborated on the significance of Kawai Nui in his 1978 report: *"The Kawainui Marsh taro field appears to be one of few if not the only lowland taro field on Oahu that may have used a drainage technology in contrast to an irrigation technology. The fields appear to be well-preserved. The location of the field, the construction of the walls, and the possible drainage system are considered a distinctive ancient Hawaiian agricultural system of which there remain few examples apparently so well preserved as this site (Cordy 1978)."*

According to historic aerial imagery, photographs, and oblique photos, lo'i walls were present in Kawai Nui during the early 1900s. This is in concurrence with the determination that the SHPO rendered to the U.S. Army Corps of Engineers, Honolulu Engineering District. Over the years, sediment has likely covered historic lo'i walls, thus obscuring them from view. OHA request that more work be done in order to clearly identify historic properties within the APE.

As an aside, our staff would like to point out that although the time stamp provided on this letter by the Army was January 10, 2008, OHA did not receive it until letter on January 22, 2008. We began our 30-day consultation period twelve days after the time stamped date and are therefore still within our compulsory 30 day comment period.

Thank you for the opportunity to comment. If you have further questions or concerns, please contact Jason Jeremiah, Policy Advocate-Preservation, Native Rights, Land and Culture, at (808) 594-1816 or jasonj@oha.org.

Aloha,



Clyde W. Nāmu'o
Administrator

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

October 15, 2008

REPLY TO
ATTENTION OF:

Programs and Project Management Division
Environmental Programs Branch

Mr. Clyde Nāmu'o
Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Dear Mr. Nāmu'o:

The U.S. Army Corps of Engineers, Honolulu District (POH) is writing in response to your second letter dated February 20, 2008 (HRD08/0021F) as part of the ongoing National Historic Preservation Act (NHPA) Section 106 consultation for the proposed wetlands restoration project at Kawai Nui Marsh, Island of O'ahu, Hawai'i (TMK 4-2-13).

Your letter requested additional surface and sub-surface archaeological efforts to adequately identify historic properties within the Area of Potential Effect (APE). The letter indicated that the Office of Hawaiian Affairs (OHA) does not believe that the archaeological investigations done to date for this project satisfy recommendations made by the Hawai'i State Historic Preservation Officer (SHPO), and that archaeological investigations performed are not consistent with the type of study needed for a site that is eligible for listing on the National Register of Historic Places (NRHP).

After receipt of your letter, OHA, POH, and the U.S. Fish and Wildlife Service (USFWS) staffs conducted a site visit on April 9, 2008. The purpose of this site visit was to discuss archaeological issues and environmental resource benefits of the Kawai Nui Marsh Environmental Restoration Project. Attending were Messrs. Jesse Yorck and Jason Jeremiah of OHA, Messrs. Gordon Smith and Aaron Nadig of the USFWS, and Mr. Loren Zulick of POH.

On June 4, 2008, OHA and POH staffs met to discuss observations made in the field and steps necessary to come to an agreement on proceeding with the restoration project. Attending were Messrs. Jason Jeremiah and Keola Lindsey of OHA, and Messrs. Loren Zulick and Kanalei Shun of POH.

Most recently, on October 2, 2008, OHA and POH staffs met to discuss options in coming to an agreement that would be beneficial to both proceeding forward with the Kawai Nui Marsh Restoration Project construction and OHA's desire to protect and restore ancient taro lo'i.

Attending were Ms. Heidi Guth and Messrs. Jason Jeremiah and Keola Lindsey of OHA, and Mr. Derek Chow of POH. It was noted in this meeting that the construction of the restoration project is an important action to further protect and restore endangered indigenous waterbirds and their habitat. Furthermore, it was noted that Kawai Nui Marsh contains unique ancient taro lo'i complexes.

In this meeting it was agreed that OHA would support the Kawai Nui Marsh Environmental Restoration Project without requiring further subsurface investigations in the design phase and that POH would have an archaeological monitor present at all times during ground disturbing activities of the construction phase. The details of archaeological monitoring will be described in the Archaeological Monitoring Plan (AMP) that will be developed for and followed during all construction activities.

POH also understands that OHA is interested in pursuing taro lo'i rediscovery and restoration in Kawai Nui Marsh outside the restoration project limits. Upon a formal request for assistance from OHA, POH will request Federal funds to initiate a new project study to restore Kawai Nui Marsh taro lo'i complexes under its Continuing Authorities Program (CAP). Several of these statutory authorities allow us to restore ecosystems. The design of the project would rely on reconstruction of the taro lo'i system to achieve ecosystem restoration. Funding for the study must be authorized and appropriated by Congress, with the first $100,000 of the study funded by the Federal Government. Feasibility study costs greater than $100,000 are cost shared equally by the Corps and the project sponsor, in this case presumably OHA.

The Honolulu District looks forward to participating in a future partnership with OHA to restore taro lo'i in Kawai Nui Marsh. If you have any questions, please do not hesitate to call me at (808) 438-1634, Mr. Derek Chow, Chief of the Civil & Public Works Branch at (808) 438-7009, or Mr. Loren Zulick, project archaeologist, at (808) 438-0474. We thank you for your commitment to the preservation of historic properties in Hawai'i, and genuinely hope that you recognize our efforts to do the same.

Sincerely,

for Anthony J. Paresa, P.E.
Deputy District Engineer for
Programs and Project Management

Zulick, Loren A POH

From: Shimabuku, Lorayne P POH
Sent: Wednesday, November 12, 2008 8:18 AM
To: Zulick, Loren A POH
Subject: FW: Mahalo

From: Heidi Guth
To: Chow, Derek J POH
Sent: Mon Nov 10 19:42:37 2008
Subject: Mahalo

Mahalo for your kind letter, Derek. We received it on October 20, and Keola, Jason and I all concur with what you wrote. Your letter has been added to our files, and we will be in touch about future collaboration. You have been a pleasure to work with, and we wish you much good fortune with your project.

Aloha,
Heidi

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
FORT SHAFTER, HAWAII 96858-5440

December 3, 2007

REPLY TO
ATTENTION OF:

Programs and Project Management Division

Mr. Dan Quinn
Administrator
Department of Land and Natural Resources
Division of State Parks
1151 Punchbowl Street, Room 310
Honolulu, HI 96809

Dear Mr. Quinn:

The U.S. Army Engineer District, Honolulu (POH) is writing to reopen National Historic Preservation Act (NHPA) Section 106 consultation with your office concerning a proposed wetlands restoration project at Kawai Nui Marsh, Oahu Island, Hawaii (TMK 4-2-13).

As a reminder, POH, in partnership with the Hawaii State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to construct and operate a designed wetland to provide habitat for endangered Hawaiian waterfowl in the upper reaches of Kawai Nui Marsh located adjacent to the town of Kailua in the Ko`olaupoko District on the windward side of Oahu. The project site is bisected by Maunawili Stream, which meanders northward into the waters of Kawai Nui Marsh, and is bounded by Kapaa Quarry Road to the west, open Kawai Nui Marsh wetland to the north, and Kailua Road and Kalanianaole Highway on the south and east respectively (Figure 1).

The wetlands restoration project is moving forward with a scope of work that has been reduced from the 1998 plan (Enclosure 1 on CD). The Area of Potential Effect has been downsized to 40 acres with 24 acres dedicated to open pond area. As indicated in the attached 95% design plan (Figure 2), a series of 11 terraced shallow ponds are planned with six ponds above (south of) the area where Maunawili Stream crosses the project site, and five ponds below Maunawili Stream. The ponds will be separated by low earthen berms, and supplied by a well that's fitted with a solar pump, one well for each pond (total 11 wells). In addition, approximately 4,600 linear feet of predator control fencing will surround the environmental restoration project area.

Formal Section 106 consultation with the Hawaii State Historic Preservation Office (SHPO) and other consulting parties began in 1996, and resulted in mitigation measures designed to ensure that there will be no adverse effect on historic properties during wetlands restoration (ref. SHPO Log No: 17178, Doc No: 9602TD02, and Log No:

19306, Doc No: 9705EJ07). The following mitigations were agreed to in 1998, through consultation, to avoid impacting subsurface archaeological deposits containing agricultural pondfields (taro *lo`i*) and terraces comprising the Kawai Nui Marsh Archaeological District (State Site #50-80-11-2029) and "Site 7":

1. Prior to excavation, individual plot boundaries will be established and clearly marked by archaeologists from the Corps and DLNR working in conjunction with staff from DLNR's Division of Forestry and Wildlife (DOFAW) and with representatives of Kawainui Heritage Foundation;
2. Excavation will generally be to depths between 1 and 2 feet, with excavation depths for individual plots to be established prior to excavation by archaeologists;
3. All excavations will be monitored by an archaeologist from the Corps or DLNR or by DOFAW personnel;
4. Maintenance procedures established by DOFAW will be provided to SHPD and Kawai Nui Heritage Foundation for review and comment. Additional review and comment of these procedures will be elicited from interested public interest groups and native Hawaiian organizations such as the Kailua Hawaiian Civic Club, who are curators of Ulu Po Heiau, and the Office of Hawaiian Affairs.

To assist with the identification and evaluation of alternatives for the construction of the planned wetland, archaeological investigations were conducted within the project area by Cultural Surveys Hawai`i, Inc. (Mann and Hammatt, 2003). Mann and Hammatt attempted to identify *lo`i* walls or buried cultural deposits that may be impacted by this project, and concluded that there were no boulder alignments consistent with *lo`i* walls or rice paddies on the surface, nor any surface indication of remaining archaeology. A copy of this report is enclosed for your reference (Enclosure 2 on CD). Following the results of archaeological investigations, and for clarification of the mitigations, POH proposes:

1. Archaeologists from POH (or their contractor) will be present during clearing activities to examine the cleared ground for indications of *lo`i* walls. If *lo`i* walls, or any cultural resources are identified, then features will be buffered and avoided wherever possible per item #1 above.
2. Ground disturbance for pond construction will generally be to depths between 1 and 2 feet to avoid possible impacts to archaeological resources believed to exist below this depth. Ground disturbance for wells and fencing will likely be deeper, but disturbances will be in relatively small areas and strategically placed. Contrary to #2 above, archaeologists will not establish depths of excavation prior to construction, as this will be indicated in the design plans and specifications.
3. POH will provide for archaeological monitoring of ground disturbing activities. Archaeological monitoring will be in accordance with an Archaeological Monitoring Plan (AMP) to be submitted separately, prior to construction. Among other things, the AMP will include proposed treatment of inadvertent discoveries and define reporting requirements.

Although historic properties exist within the project area, identification and avoidance procedures have, and will be taken to ensure that no adverse effects to historic properties occur. We believe that the revised actions listed above along with implementation of the forthcoming Archaeological Monitoring Plan, satisfactorily identify and define the responsibilities and obligations of POH and participating parties to ensure that potential adverse effects to identified and unidentified cultural resources will not occur from the restoration activities. Based on implementation of the proposed measures, POH has determined there will be no adverse effect on historic properties for the reduced scope of the Kawai Nui Marsh restoration project. We ask for your review and comment on the proposed revised implementing actions, and our no adverse effect determination for the downsized project.

Since 1996, POH has held meetings and requested input from the SHPO, the Office of Hawaiian Affairs, Hui Malama I Na Kupuna O Hawaii Nei, Ahahui Malama I Ka Lokahi, Kawai Nui Heritage Foundation, Kailua Hawaiian Civic Club, and Hawaii's Thousand Friends. We will continue to consult with these parties and any additional parties identified during the consultation process on this matter. A complete list of consulting parties is included as Enclosure 3.

If you have any questions about this project please contact Mr. Loren Zulick at the address above, or via e-mail at loren.a.zulick@usace.army.mil or by telephone at (808) 438-0474. As always, we look forward to further discussion and consultation on this and future actions, and we thank you for your timely response.

Sincerely,

James L. Bersson, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

PP-C

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF STATE PARKS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
1-10-08

January 3, 2008

Mr. James L. Bersson, Deputy District Engineer
Programs and Project Management Division
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawai'i 96858-5440

Dear Mr. Bersson:

SUBJECT: Section 106 Consultation: Kawainui Marsh Wetlands Restoration Project, Kailua, O'ahu

Thank you for your letter of December 3, 2007 informing us of your agency's plans to move forward with the Kawainui Marsh Wetlands Restoration Project in partnership with the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW). A major portion of the project area (TMK: 4-2-13: 5) was recently transferred from the Division of State Parks to DOFAW. Therefore, the project will not affect any historic properties located within Ulupō Heiau State Historical Park (SHP) or the Kawainui State Park Reserve, which have been retained under the jurisdiction of State Parks (refer to attached map). In regards to the historic properties in the project area, we defer to the State Historic Preservation Division.

Since your initial consultation in 1996, several community groups have become active with State Parks in projects at Kawainui Marsh. In 2005, 'Ahahui Mālama I Ka Lōkahi became co-curators of Ulupō Heiau SHP along with the Kailua Hawaiian Civic Club (HCC). In addition, 'Ahahui is recognized by State Parks as the curator of Nā Pōhaku O Hauwahine within the Kawainui State Park Reserve. As curators, these organizations assist State Parks with the management, interpretation, and care of the cultural and natural sites in the parks. 'Ahahui has been restoring a dryland forest environment at Nā Pōhaku and while clearing alien vegetation, they have been uncovering archaeological sites that have not been previously recorded. It appears that both 'Ahahui and the Kailua HCC have already been identified by your agency as parties for consultation.

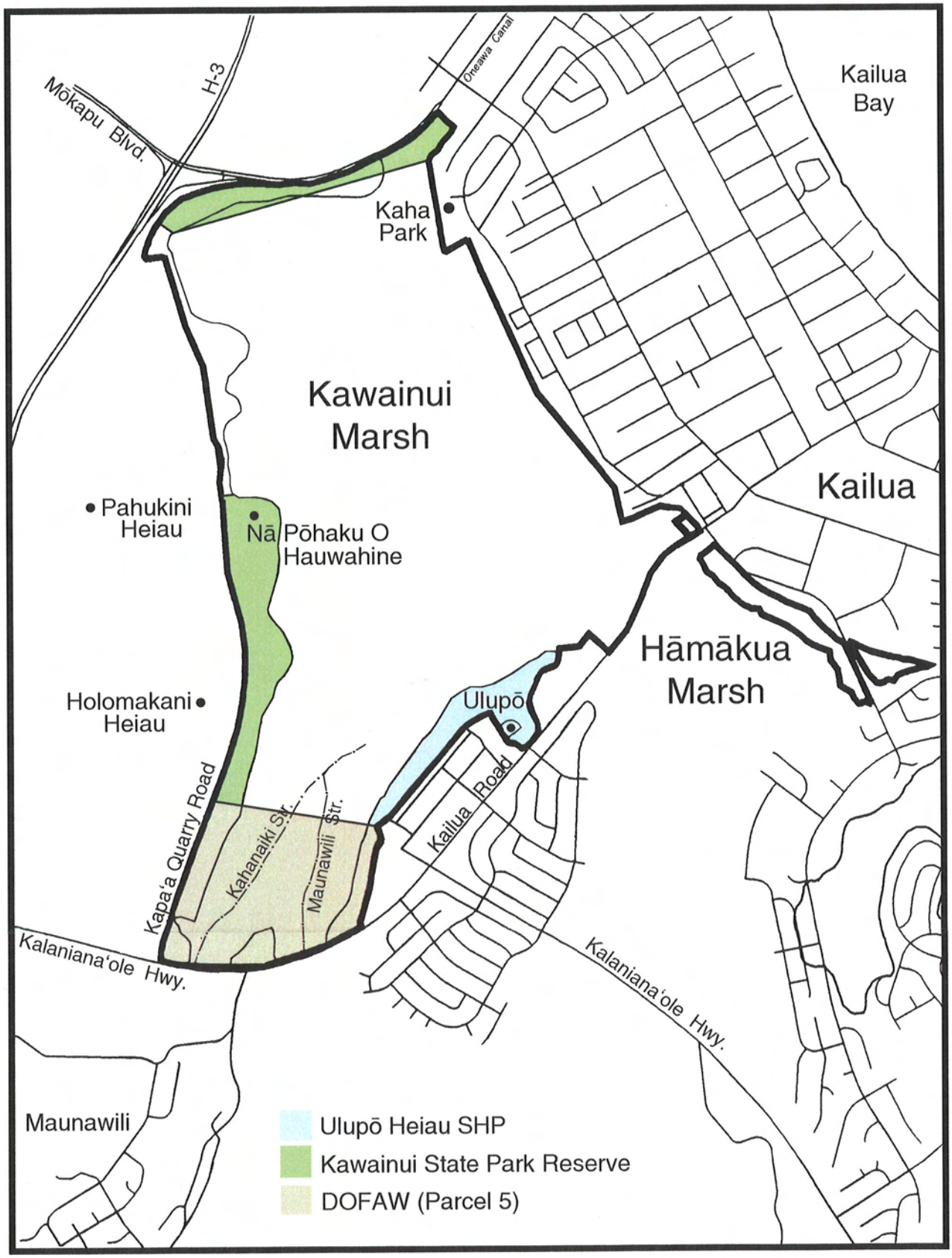
We would also like to inform you of another organization, Ho'olaulima Ia Kawainui, that was formed several years ago. It consists of representatives from the various community groups and government agencies with an interest in Kawainui Marsh. The current project is to develop an interpretive plan for Kawainui Marsh. The contact for this group is Mr. Ray Sweeney, 533-0033.

If we can be of further assistance, please feel free to contact us again.

Very truly yours,

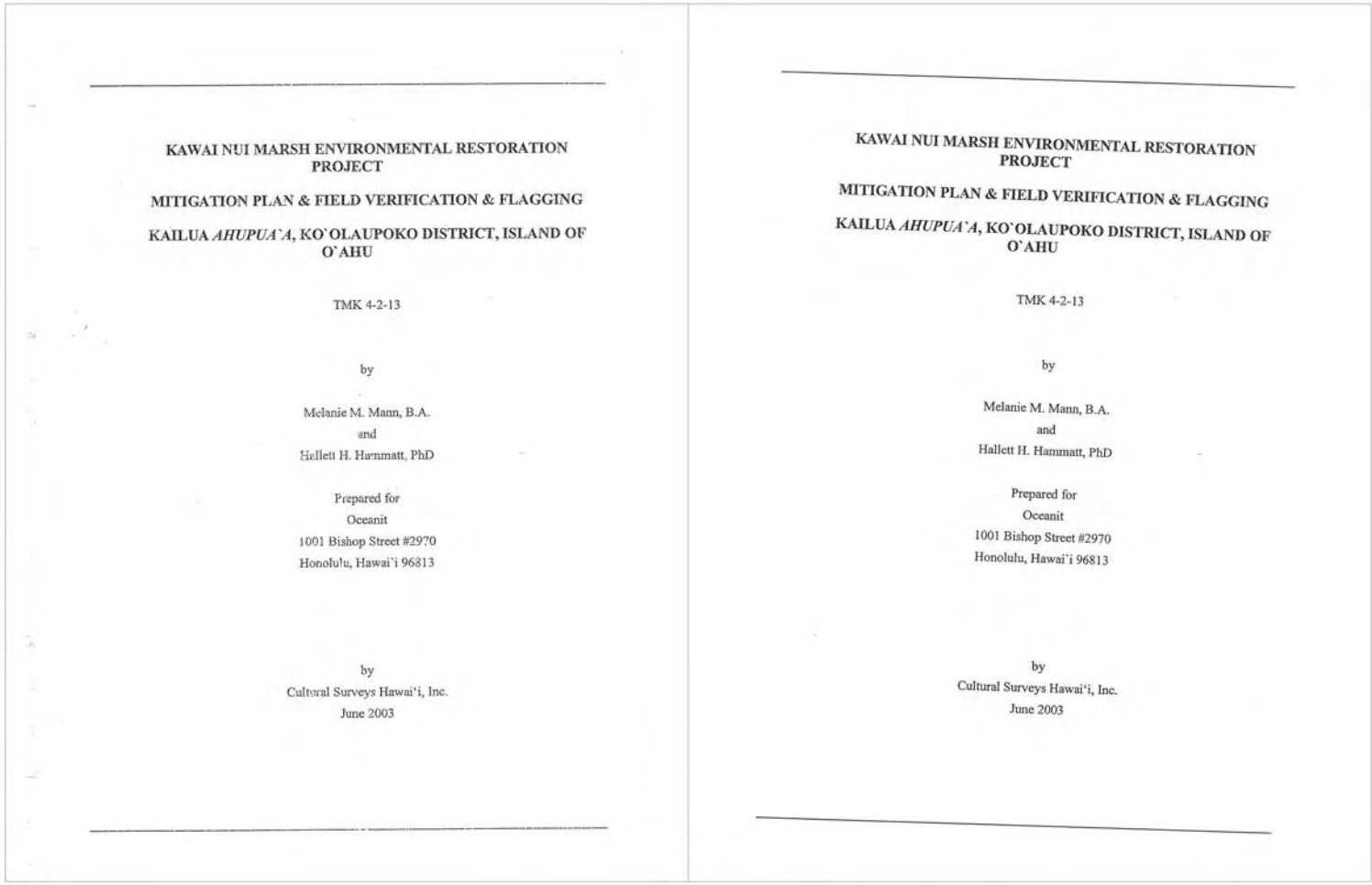
DANIEL S. QUINN
State Parks Administrator

cc: 'Ahahui Mālama I Ka Lōkahi
Kailua Hawaiian Civic Club
Ray Sweeney, Ho'olaulima Ia Kawainui


Mōkapu Blvd.
H-3
Oneawa Canal
Kailua Bay
Kaha Park
Kawainui Marsh
Kailua
Pahukini Heiau
Nā Pōhaku O Hauwahine
Hāmākua Marsh
Holomakani Heiau
Ulupō
Kailua Road
Kapa'a Quarry Road
Kahanaiki St.
Maunawili St.
Kalaniana'ole Hwy.
Kalaniana'ole Hwy.
Maunawili
Ulupō Heiau SHP
Kawainui State Park Reserve
DOFAW (Parcel 5)

Appendix B

Archaeological Investigations



KAWAI NUI MARSH ENVIRONMENTAL RESTORATION PROJECT

MITIGATION PLAN & FIELD VERIFICATION & FLAGGING

KAILUA *AHUPUA`A*, KO`OLAUPOKO DISTRICT, ISLAND OF O`AHU

TMK 4-2-13

by

Melanie M. Mann, B.A.
and
Hallett H. Hammatt, PhD

Prepared for
Oceanit
1001 Bishop Street #2970
Honolulu, Hawai`i 96813

by
Cultural Surveys Hawai'i, Inc.
June 2003

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June 2003

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I. INTRODUCTION

A. Project Background

Cultural Surveys Hawai'i, Inc. was contracted by Oceanit to provide a mitigation plan and field verification and flagging for an approximately 60-acre portion of Kawai Nui Marsh, Kailua *Ahupua'a*, Ko'olaupoko District, Island of O'ahu (Figures 1 through 3). The Kawai Nui Environmental Restoration project area encompasses the southern one-fourth of Kawai Nui Marsh. The project area is located north of Kalaniana'ole Highway and ends just northwest of Pōhākupu.

A series of pond systems to encourage the habitat of endangered bird species is proposed for the Kawai Nui Marsh Environmental Restoration project area. Preliminary plans indicate subsurface excavations between 1 and 2 feet below surface.

A 1977 archaeological reconnaissance study of Kawai Nui Marsh conducted by the Army Corps of Engineers' archaeologist, Dr. Ross Cordy, had indicated a conceptual layout of *lo'i* walls observed on a series of historic aerial photographs within Site 7, and in the immediate vicinity of the Kawai Nui Marsh Environmental Restoration project area. The primary goal of the current archaeological investigation is to confirm the presence or absence of *lo'i* walls within the 60-acre Kawai Nui Marsh Environmental Restoration project area and twofold, to provide appropriate mitigation measures to insure the integrity of any surface or subsurface cultural deposits.

B. Scope of Work

To facilitate the location of *lo'i* walls and to insure the integrity of any buried cultural deposits, the following Scope of Work was established:

1) Utilize the best available maps and photographs in the field to locate *lo'i* berms.
2) Utilize Global Positioning System, (GPS), tape and compass, and direct observations to trace out individual berm orientation and length.
3) Stake out two to four locations of individual berms with highly visible flagging on stakes and in between stakes as necessary.
4) Complete an in-field verification of berm locations with restoration construction crew; and
5) Provide a map of all located berms.

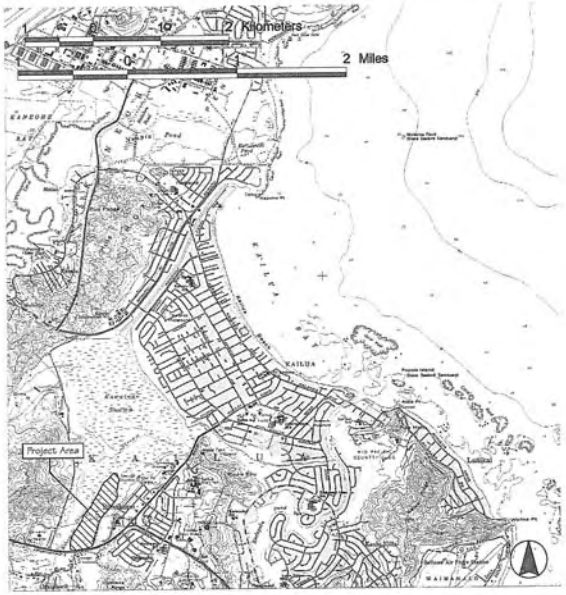


Figure 1 USGS 7.5 Minute Topographic Map Showing Approximate Location of Kawai Nui Environmental Restoration Project Area.

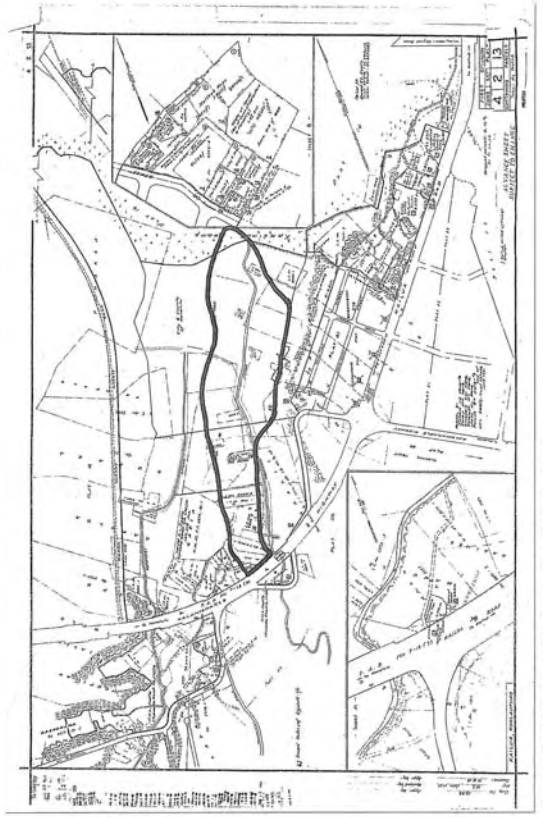


Figure 2 Tax Map Key 4-2-13, Showing Kawai Nui Project Area

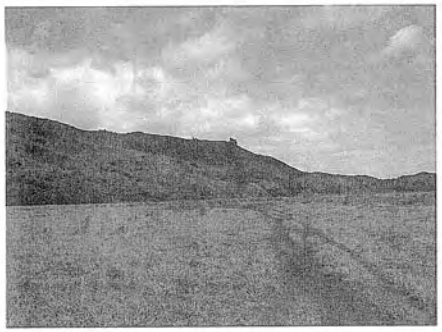


Figure 3 General Photo of Kawai Nui Marsh Environmental Restoration Project Area. Photo Taken to Southeast.

Figure 4 General Photo of Kawai Nui Marsh Environmental Restoration Project Area. Photo Taken to West.

C. Methods

Background Research

Preliminary background research carried out in advance of the fieldwork involved gathering and reviewing historic and contemporary aerial photographs and historic maps, as well as analyzing and interpreting Land Commission Awards and Royal Patents from the *Māhele*. Previous archaeological reports of Kawainui Marsh were also consulted and closely reviewed. Research was conducted at the State Historic Preservation Division of the Department of Land and Natural Resources, the Army Corps of Engineers, the Photogrammetry department of R.M. Towill, the Hawai'i State Archives; and the Survey Office of the Department of Accounting and General Services. Land conveyance research relating to the *Māhele* was done through *Waihona-ʻʻĀina.com*, the Internet search company. O'ahu island archaeologists, Dr. Sara Collins and Ms. Elaine Jourdane, of the State Historic Preservation Division were further consulted regarding field verification methods.

Field Inspection

Once the historic records were consulted, a pedestrian survey of the 60-acre project area was conducted. Field work was completed by two Cultural Surveys Hawai'i, Inc. archaeologist, Melanie Mann, B.A. and Constance Ohare, B.A. During the course of the in-field survey, two linear vegetation alignments were observed and documented. Based on the current TMK, the linear vegetation alignments may have corresponded to two *kūleana* land commission award boundaries (LCA 2544:1 and 6969:2). Based on the meets and bounds on the current TMK, as well as the meets and bounds descriptions provided on the Royal Patents, calculations were utilized to approximate the location of the two LCA boundaries. Utilizing the additional meets and bounds information, a second field inspection was undertaken to verify if the linear vegetation alignments indeed corresponded to the two LCA boundaries. The two linear vegetation alignments were then flagged with flagging tape and galvanized steel piping.

In order to ground-truth the linear vegetation alignments observed on the surface, two test units were then excavated with the aid of a backhoe machine. Backhoe services were provided by Mike Matustani of Mike's Backhoe Service. The stratigraphy of each test unit was documented and a single charcoal sample was extracted. Artifacts collected from the test units were analyzed at the Cultural Survey's Hawai'i, Inc. laboratory.

D. Natural Setting

Kawainui Marsh is the largest remaining fresh water marsh in the Hawaiian Islands (Elliott and Hall 1977: 101) and is approximately 1.5 m above sea level. According to Foote *et al.* (1972), the Kawainui Marsh Environmental Restoration project area consists of Marsh (MZ) sediment described as wet, periodically flooded areas covered dominantly with grass and bulrushes or other herbaceous plants (Foote 1972: 95). Marsh vegetation within the project area is dominated by California grass (*Brachiaria mutica*), which occurs on alluvial clays that are continuously damp and flooded periodically.

II. CULTURAL AND HISTORICAL SETTING OF KAWAI NUI WITHIN THE *AHUPUA'A* OF KAILUA

The history of Kailua region of O`ahu has been documented in a number of studies including, but not limited to, Hall's (1997) "The History of Kailua", Creed and Chiogioji's (1991) "Facets of Maunawili Valley and Kailua *Ahupua'a* History", and Kelly and Nakamura's (1981) "Historical Study of Kawai Nui Marsh Area, Island of O`ahu". All of these studies detail the legendary history and oral traditions, the legendary rulers and personalities, the early historic accounts, land ownership and utilization changes during and following the *Māhele*, and the changes in land use from traditional to modern times. Included in this section, under the discussion of the *Māhele* land divisions of the mid 19th century, is a detailed discussion of the Land Commission Awards claimed and awarded within the current Kawai Nui Marsh Environmental Restoration project area.

A. Setting

Kailua *Ahupua'a* is the largest valley on the windward side of O`ahu, and the largest *Ahupua'a* of the Ko`olaupoko District (approximately 15 km by 11 km). Flanked by the *Ahupua'a* of Waimānalo on the southeast, Kāne`ohe on the northwest and Honolulu to the south, the *Ahupua'a* of Kailua is shaped like a rectangle. From the Ko`olau ridge line it extends down two descending ridge lines which provide the natural boundaries for the sides of the *Ahupua'a*. The fourth side of the rectangle is the reef line of Kailua Bay.

The natural environment includes the sand accretion barrier upon which Kailua Town stands, the mountainous upland terrain and alluvial valley of Maunawili, the largest fresh water marsh in Hawai`i (Kawai Nui Marsh), another inland pond (Ka`elepulu), approximately 18 permanent and intermittent streams, a freestanding mountain halfway between the shore and the Ko`olau (Olomana–1,643 ft.), several low ridge lines, and off-shore the Mokulua Islands, Mokole`a Rock, and Popoia Island. It comprises 11,885 acres of land according to the Boundary Commission Review of the mid-19th century, but in fact extends beyond the shore approximately a mile out to sea, to the reef.

During the estimated 1000 to 1500 years since initial Polynesian settlement, the sand barrier that forms the shore at Kailua Bay has provided a desirable location for residences with a sunny, dry beach area. The well-watered interior lands, including the two marsh/pond areas of Ka`elepulu and Kawai Nui and the many springs and streams of Maunawili, provided bountiful agricultural and resource gathering areas. During the 15th and 16th centuries, Kailua, O`ahu was the center of a large royal complex with sample playgrounds for sports and physical training, and recreation (Sterling and Summers 1978:231-232). Supporting this large complex was a most bountiful garden hinterland where fish, fowl, and vegetables were plentiful (Sterling and Summers:227-228).

Mele or chants about Kailua frequently mention the two fishponds famous for their mullet or *awa*. They also tout the taro gardens of the area (see Beckwith 1970 and Drigot 1982), in the legendary *mo`olelo*, or epics (e.g. Hi`iakaikapoliopele, Kahinahinanui, Makalei Tree and Ka`ulu are a few of the stories). Early visitors (Bowser 1880, in particular) also mention a wealth of birds in the area.

Besides a sunny beach area and uplands watered by frequent showers, other resources were easily available in Kailua. As the center of the caldera of the ancient Ko`olau Volcano (MacDonald and Abbott 1974:363) a basalt quarry (the present Ameron Quarry is built upon the site of the pre-contact quarry) for material for lithic tools was near at hand. Kailua was a residential district surrounded by *Ahupua'a* that were also highly cultivated and capable of providing ample resources for a large resident and visiting population. Kailua apparently also was a *pu`uhonua* (place of refuge) before Kamehameha I conquered the island of O`ahu. After this time the ancient *pu`uhonua* were abolished.

B. Oral Traditions and Legends

Legends and oral history provide stories for many of the place names and also give specific beliefs Hawaiians held and hold about the land. The name Kailua, meaning "two seas", apparently refers to the two large inland waters, Ka`elepulu Pond and Kawai Nui Pond (Pukui *et al.* 1974:69; Quebral 1991:14). That Kailua was a "fat" land, a land of plentiful food in all times, is suggested by several legends. The *Makalei*, or Fish-Attracting Tree was a mythological tree or stick which could summon fish from Kawai Nui. Reportedly located near the present day Hāmākua Street Bridge, it was described as a never failing source of a plentiful supply of food (Beckwith 1970:279-280 and Pukui and Elbert 1981:382, cited in Kelly and Nakamura 1981:5). Another tradition of the ample productivity of the Kailua region involves the edible, *haupia*-like mud, called *lepo`ai`ai*, which was available from Kawai Nui Marsh (Kelly and Nakamura 1981:5). This legend implies a bountiful Kailua where even the mud is edible.

Kailua is one of the places where, following their arrival on O`ahu from Kahiki, the *menehune* were assigned to live. These legendary workers are credited with the construction of numerous fish ponds and religious structures. Fornander points out that the term menehune in Tahitian had become the name for the lowest laboring class of people–suggesting a Tahitian origin for the term for the legendary workers (Fornander 1969:23).

There are legendary accounts of the prominent Mount Olomana, which is named after a great mythological giant and/or chief (Kelly and Nakamura 1981:1). Tradition also says Kawai Nui was inhabited by a *mo`o* (large dragon-like mythical creature) called Hauwahine, whose name literally means "female ruler". Her residency at Kawai Nui follows Haumea's, the earth-mother goddess whose name literally means "red ruler". She made sure all the people of the *Ahupua'a* shared in the pond's wealth and punished those who were greedy (Beckwith 1970: 126).

Oral history notes that the stones overlooking Kawai Nui on Pu`u o `Ehu are sacred to Hauwahine and her companion (Paki 1976). The reason for this is connected to the ancient Hawaiian notion that the channel/canal beneath Pu`u o `Ehu connects Kawai Nui and Ka`elepulu and was considered to be the coital connection between the two fishponds, giving the area great *mana*. Kawai Nui Marsh was considered male and Ka`elepulu Pond, female. They mated at Kawailoa according to a Hawaiian tradition (Paki 1976).

Traditional history credits Kailua as the residence of many prominent O`ahu ruling chiefs. There is `Olopana "who with his brother Kahikiula came to O`ahu from Kahiki...He is said to have established several *heiau* in Kāne`ohe and Kailua, including Pahukini and Holomakani in the Kawai Nui area" (Kelly and Nakamura 1981:3). One of the earliest great chiefs to reside in Kailua was Kakuhihewa, who built himself a great house at `Alele in Kailua

(Kelly and Nakamura 1981:5). At approximately the same time (the 16th century) another prominent chief, Kūali`i, born at Kalapawai, Kailua, and raised in Kualoa and Kailua, had his navel cutting ceremony at the *heiau* of Alala (present day Lanikai point), and, after being the hero of many battles, became the high chief of all O`ahu (Kelly and Nakamura 1981:6). In early historic times the conquering chief Kahekili followed by Kamehameha I resided in Kailua for a time (Kelley and Nakamura 1981.:6-7).

C. Early Population Estimates

The drastic depopulation of the Hawaiian Islands following the introduction of Western disease has been documented in a number of sources (Bingham 1847; Stannard 1989; and Bushnell 1993). According to one estimate the population of Hawaiians and part-Hawaiians fell from approximately 300,000 in 1778 to 82,593 by 1850 (Schmitt 1968:43; 74 cited in Kelly and Nakamura 1981:10). Population counts from the 1830s place the population of Kailua at approximately 760 individuals (Schmitt 1973:19 cited in Kelly and Nakamura 1981:10). This low population figure is incongruous with the productivity of the region, but well in keeping with population decline estimates due to western disease. Westerners passing through Ko`olaupoko in the mid 1840s made note of the cold and flu symptoms among the native Hawaiians and that much formerly productive land appeared abandoned (Wyllie 1848:20 cited in Kelly and Nakamura 1981:10).

D. Early Historic Accounts

Historic accounts of Kailua before 1850s are rare. One of the only accounts that could be located is that of Levi Chamberlain, a missionary who made a circuit around O`ahu to inspect the mission schools in 1828. This account is particularly important because Chamberlain travels through and describes the landscape in the immediate vicinity of the current Kawai Nui Environmental Restoration project area. Chamberlain describes his progress from the settlement at Kailua through the low hills, today called the Kalaheo hills and the location of Kalaheo High School, that separate Kailua from Kāne`ohe.

> Directing our course towards Kāne`ohe, the next district, we were obliged to pass over a tract of low land mostly overflowed with water by the late rains. Here I was obliged to wade, as the distance was too great to admit of my being carried on the shoulders of my attendants, as was generally the case in passing a small stream of water. After emerging from the flat, our path was not improved, for we had now to walk through mud instead of water–we walked some distance along the steep hill, and at length by a winding path ascended to the top of it. We sat down to rest for a few minutes, and I found myself upon the summit of a ridge extending from the mountains in a right line to the sea and dividing the low lands of Kailua from those of Kaneohe (Chamberlain Ms.:664 in Kelly and Nakamura 1981:7).

It is clear from this account that this west-northwest portion of Kailua, in the vicinity of the project area, was low lying and prone to flooding. As we shall see in later discussions, this does not appear to change with the passage of time.

E. *Māhele* Records

Māhele records are an important resource for determining land-use during the first half of the 19th century. In the great division of lands among Kamehameha III and his people between 1848 and 1853, approximately 250 Land Commission Awards (LCAs) were claimed before the Board of Commissioners to Quiet Land Titles (Land Commission) in Kailua. Many persons claimed their land from the time of their *makuakane* (ancestors) but no one indicates any time farther back than the time of Kaloli (contemporaneous with Kamehameha I). The most recent claims are probably those granted by Governor Kekūʻanaoʻa. Not all claimants told how long they had occupied the land but of those who do they refer primarily to the ruling chiefs and then some refer to the local *konohiki*.

Many Kailua claimants list kings, queens, *kuhina nui* or governors to provide a time frame for when they received their land. The earliest such reference appears to be Kaloli, the wife of Kalaniopuʻu who lived from 1752 to 1782 (Kuykendall 1980, vol I:30-32), followed by Kamehameha I, *Moʻi* or king and conqueror of O`ahu in 1795 (p.87), Liholiho, King Kamehameha II in the 1820s, Kaomi, the Tahitian companion of Kamehameha III who died in 1833 (p. 135), Boki, governor in the 1820s and his wife Liliha, *kuhina nui* - after 1829 and during the 1830s, Kīnaʻu, Queen from 1832-1839, Kaʻahumanu, Queen and *kuhina nui* in the 1820s and Kekūʻanaoʻa, the governor of O`ahu in the 1830s and 40s (p. 286), Paki, a high chief during the same period (p. 285), and Kamehameha III during the early 1840s. Some claimants give specific dates and these range from 1828-1848. Thus, the people established in Kailua by 1848-1853 only ascribe their roots to the land from the period of the 60-70 years before the Land Commission Awards. While some claimant's lands may have been in their family for longer periods, it would not have been political in the land commission claims for land offered to them by Kamehameha III to refer to rulers prior to the Kamehameha dynasty.

At the time of the *Māhele*, it would appear that Kailua, Kāneʻohe and Waimānalo were considered choice locations, for these *Ahupuaʻa* were awarded to the Crown, the royal family, and then to important *aliʻi*, particularly warrior chiefs for Kamehameha I. The entire *Ahupuaʻa* of Kailua was awarded to Queen Kalama. Within the *Ahupuaʻa* the Crown took for itself the *ʻili* of Kawailoa which surrounds the Olomana peaks, with a portion in Maunawili Valley and the major portion descending to the sand barrier and yet another detached portion of this *ʻili* is found along the shoreline. Princess Victoria Kamāmalu was awarded the *ʻili* of Kaʻelepulu, which has both a down land and upland portion.

At the time of the *Māhele* land claimants testified before the Land Commission. This testimony provides valuable information in terms of land use circa 1850 and before. The LCAs records for Kailua document a thriving area of garden areas clustered along its 18± permanent and intermittent streams. The Maunawili/Kahanaʻiki Stream delta is a large, marshy low-lying area with no more than a 6% slope, with fertile soils along stream beds with many taro *loʻi*. Kapaʻa Valley is narrow but also had many gardens along its stream. Other fertile areas are on the *mauka* side of Kaʻelepulu Pond (modern fill now surrounds most of the former pond) going toward Waimānalo; and several very fertile areas are found within the present-day MidPac Country Club. The two great lagoonal fish ponds joined underneath the lookout point of Puʻu o ʻEhu and a few LCAs are found nearby. Another area between Keolu Hills, just to the southeast of the Pond/Lake, which shows fertile soils but does not have recorded Hawaiian farming there. This is not to say that farming was not taking place there, merely that we have no records of it. A very narrow fertile area sits on the Pōhākupu upland about the location of Kailua High School.

These fertile soil areas are the location of most of the awards in the LCAs Native Register, Foreign Testimony and Native Testimony.

`Ili* are the land divisions within the *Ahupua`a, and these were governed by the lesser chiefs and *konohiki*. Land divisions came about supposedly under the reign of Maʻilikūkahi (born about 1360 A.D.), one of the chiefs who spent time in Kailua. There were approximately 70-80 *`ili* exploited in Kailua at the time of the *Māhele.*

A majority of the *`ili* in Kailua, O`ahu were divided up among 41of Kamehameha III's high chiefs. Others (39 *konohiki* awards) received *`ili* or partial *`ili* from Kamehameha III (13 or 20% of the 60 *ali`i* granted land in Kailua). These 39 are given 38 *`ili* (two each get a half of P). Thirteen of the 60 high chiefs and *ali`i* retained the majority of the 70-80 *`ili*. At least two of the descendants of these chiefs still live on their land in Kailua; the descendants of Kuke (Tute) and the descendants of Peleleu. In addition to the names of those persons applying for a claim, we have witnesses' names and names of neighbors. Field boundaries are described by naming the neighboring cultivators, and many of these names did not appear on the LCAS list. Some claimants mention where they are cultivating under the aegis of another. In all, there are about 251 names given in the Native Register, Foreign and Native Testimony in the claims dealing with the Kailua, O`ahu area. Of these 251,200 persons are mentioned tilling the land in Kailua Ko'olaupoko in some way. About 65% of those working the land actually applied for an award.

In the *Māhele* records, 123 house lots are mentioned in the awards. This probably does not offer a true reflection of habitations, as the majority of 171 claimants probably lived within the *Ahupua`a.* Where "*kauhale*" or homes are mentioned the location of these house lots is typically bounded "on all sides by upland." However, although they were close to the field, they had to be out of the wetlands.

Ali`i* in Kailua don't specify what use they are making of their land in the LCAs. Most land use information comes from the LCAs (*kuleana*) belonging to commoners. In Kailua most claims include taro patches. All the many upper and lower valley streams are lined with taro *lo`i. Upper valley springs also have their taro patches. Some 1255± taro *lo`i* are listed in the LCAs. (Where Native Register and Foreign Testimony differ, the smaller number was used for conservative estimation, (cf Kelly 1981:27). Kelly researched both the *`ili* of Olohana and Kumu and found no boundaries ever defined, the LCAs listed there all claimed taro *lo`i.* Although we don't have information on the size of the taro patches, we know that there were 1,255 taro *lo`i* being tilled by some 200 claimants at the time of the *Māhele* in Kailua, O`ahu.

Kailua LCAs list other crops: *malas* of *wauke* or tapa fields, bananas, sugarcane, *`awa,* sweet potatoes and gourd fields; coconut, *hala*, *kukui, koa*, and fruit trees and one in Kukanono mentions cotton growing. An upland *`ili* is named for a *koa* pit, which would indicate that at some time in the past, *koa* existed in the area. Other woods mentioned in the *`ili* names are *noni* (*`Ainoni*-"to eat noni"), *koa* (*Kālaikoa*-"to hew koa"), *`ohia* (*Ka`ohia*), *kukui* (*Kukuimoemoe*-kukui and sleep or ambush), and *kamani* (*Kalelekamani*-"where the *kamani* trees sway"). *Wauke* (paper mulberry), melons and potatoes, potatoes or sweet potatoes and *`awa* are some crops mentioned in the LCAs. Four *`ili* in Kailua have names associated with *tapa/kapa*. Kapaloa (long *kapa*), (LCAs 2464, 8799 mention a *mo`o* or *kula* without specifying what kind of cultivation), *Kapa`ele* (dark *kapa*), *Kapalai* (silent *kapa*), and *Kapalepo* (dirty *kapa*). There are many *mo`o* (garden plots) mentioned in the LCAS testimonies with no crop designated. According to local farmers (Rocky Mikami, pers. comm.), the small piles of rocks in rows that

one encounters on hillsides in Kailua are a sign of sweet potato patches and because sweet potatoes were a staple of the Hawaiian diet, it would make sense that these *mo`o* where crops are unspecified were mostly being used to grow sweet potatoes.

No mention of livestock shows up in the claims, but presumably there was some. Mention is made of numerous fisheries and pools where fish would have been raised. Early 20th century testimony (S. Mahoe) indicates that the fishermen at the shore traded ocean fish for taro with the upland farmers and this is probably a long-established pattern.

F. Land Commission Award Information within the Kawai Nui Marsh Environmental Restoration Project Area

Queen Hakaleleponi Kapakuhaili Kalama (ca 1820-1870), wife of Kamehameha III received the entire *ahupua`a* of Kailua of 11,885 acres as Land Commission Award 4452: portion 12 at the time of the *Māhele* (1848-1853). There are over 250 claims for the entire *ahupua`a*, of which 12 Land Commission Awards were awarded within the Kawai Nui Marsh Environmental Restoration project area (See Table 1 following this section and Appendix A for complete LCAs and Royal Patent descriptions). Majority of the LCAs are concentrated in the southern one-third of the project area, with a few isolated LCAs to the north.

***Māhele* Award 6** - Honaunau, an *ali`i* (M.Aw 6), is awarded ½ *`ili* of Manulele in Kailua in *Māhele* Award 6 (12.88 Acs in 2 *apana*). Honaunau also claimed and received lands in Lāhaina, Maui and 'Ewa, O`ahu. Honaunau died in 1854 and since his wife Julia Kekoa died before him, he left his property to an adopted son, Beritani [Pelekane] and an adopted daughter, Halakaipo. A. Paki was to be administrator. Honaunau claims his right from the King, but does not mention which king (Barrère 1994:56). No land use is given, but because this is in the marsh, it is likely *lo`i* land with perhaps some other *kula* type plantings.

Māhele Award 27 - Kalawaiaku, an *ali`i* is awarded a *Māhele* Award (M.Aw 27). The claim for the *`ili* of Kapia is listed under land claim 7146 which was not awarded. Also under another claim, 5668, Kalawaiaku claims several *po`alima* (land that is worked by others for him) and the *`ili* of Manu in Kailua and other pieces in Nu`uanu. He received the *`ili* of Kapia, supposedly in 2 *apana*, which amounted to 14.12 Acs. He does not receive the other claims. No land use is given, but its location would indicate *lo`i* land, with perhaps some *kula.*

***Māhele* Award 47**- Kaeliwai, an *ali`i*, is awarded a *Māhele* Award (M.Aw 47). The claim for this award is described in land claim 6237 which is not awarded. Kaeliwai claims ½ of Kaaihee *`ili* in Kailua) which is 2 *apana* amounting to 9.12 Acs, as well as land in Wai`anae and land on Moloka'i.

LCA 2536:1&2 - Ukikolo, whose house lot is in Kūkanono, also claims 2 patches in "Olohana", an *`ili* bounded on the Waimānalo side by the stream and 4 patches in "Manu," an *`ili* which is also bounded on the Waimānalo side by the stream. Section 1 he received from Hekona in 1845 or 1856 and Section 2 he received some time before Poki (or Boki) went to Kahiki in 1828.

LCA 2544:1 - Lapalapa claims a *mo`o* at Manu from the time of Kaiola. And he has some orange and lemon trees at Hoaauloa. He is awarded 4 *lo`i* and a house lot; 1 *apana* in *`ili* of Manu for 1.38 Acs and another *`ili*, Kalaiopu'u, for 6.46 Acs. The section 1 description describes

the land as bounded by Ukikolo *makai* and the stream on the Waimānalo side. Section 2 is described as being in the upland.

LCA 2575:1&3 (2?) - Hekona claims an *ʻili*, Manulele, and a *kula* from the time of Kaleohano. He had one *mala ipu* [gourd garden] in the *kula* of Pōhākupu. The second claim is for *ʻili* of Olohana. He is awarded 10 *loʻi* and a house lot in the *ʻili* of Olohana (2.29 Acs). His *loʻi* land is bounded by the stream on the Koolauloa side. His house lot is bounded on all sides by upland. He received his land from Honaunau in the time of Liliha. He died in 1849 and his widow, Kamakakau is his heir.

LCA 5825 - Kaanaana claims 4 *apana* which contain a *moʻo*, 4 *loʻi*, and a *kula* house lot. He receives only 1 *apana* in Kaaihee of 2.297 Acs. His section 1 is bounded by an *ʻauwai mauka* and the river on the Waimānalo side. It is likely that he received a consolidated parcel of land to make up for the 4 parcels claimed, since he only received 1 of them. He received his land in 1840 or thereabouts and appears to be a resident of Kailua. It is likely that this is *loʻi* land and his house may have been higher up on the same piece of land.

LCA 6153 - Nanawahine claims 2 *loʻi* and a *kapa* field at Manulele and a *mala* of *wauke* at Kawailoa from the time of Kalola (a wife of Kamehameha ca. 1795). He received 1 *apana* of .22 Ac. He does not receive his nearby *wauke* land.

LCA 6162 - Punipeki (LCA 6162) claims 12 loʻi at Olohana, and a small *kula* in P. He receives 1 *apana* in Olohana of 2 *loʻi* totaling .47 Ac.

LCA 6969:2 - Kuwahine (Kuahine) claims 30 *loʻi*, a *kula* and a house. Five of his patches are in the *ʻili* of Manu, the others in Kawailoa. Section 2 is bounded by the creek on the Waimānalo side. He receives a 1.3 Ac.-parcel in the *ʻili* of Manu and 1.52 Acs in Kawailoa.

LCA 7113:1&2 - Keaka claims ½ Manu *ʻili*. He claims it is his one-half right from the King. He resides at Kapamoo, not in Kailua. Keaka receives 1.52 Acs in Manu and 1.52 Acs in Kawailoa, both are for taro lands. The Royal Patent further notes an *ʻainawai* or wetland for *āpana* one.

LCA 9539:2 - Kaikihoio claims a *moʻo ʻāina* at Palawai which is bounded by the creek on Koolauloa side and a hill called Auelepu *mauka*. He is awarded 2 pieces of land totaling 4.36 Acs. The parcel in the marsh is section 2 for which there is no separate description. Kaikihoio received his land in 1842. He died in 1848 and Ohole, his wife is heir. This claim is contested by C. Kanaina who claims Kaikihoio has all the patches and he has none, but the award is upheld. Being on the Maunawili Stream, it is likely these were taro patches.

Settlement Patterns within the Project Area and Surrounding Marsh Vicinity

As reflected by Land Commission documentation, the settlement pattern within the Kawai Nui Marsh Environmental Restoration project area during the mid 1800s was dominated by both dry-land and irrigated agriculture. Agricultural lands included numerous spring and stream watered pond fields (*loʻi*) with their associated irrigation and drainage ditches (*ʻauwai*). Dryland agriculture would have dotted the hill slopes above the marsh. Crops included traditional Hawaiian economic plants as well as Western introduced economic plants, such as fruit trees. House lots would have been dispersed on the higher grounds surrounding the marsh. *Māhele* records indicate differing periods of occupation of the land claimants. Some appear to be

long time local residents. Others evidently received their land from the Kamehameha dynasty relatively recently.

Table 1 lists the LCAs for the Kawai Nui Marsh Environmental Restoration project area. The table was compiled using LCA information available through Waihona-ʻAina.com and from the Hawai'i State Archives. For complete LCA and Royal Patent information, see Appendix A. These data provide insight into the specific land-use that was under way within the Kawai Nui Environmental Restoration project area during the mid-19th century.

Table 1 Land Claim Awards within the Kawai Nui Environmental Restoration Project Area

Land Claim #	Claimant	ʻIli (Land Division)	Land Use	Acreage Awarded	Royal Patent
Māhele Award 6	Honaunau		No land use given.		5557
Māhele Award 27	Kalawaiaku	*ʻili* of Kapia	no land use given; likely *loʻi* land with some *kula*?	2 *ap.*; 14.12 Acs	4533
Māhele Award 47	Kaeliwai	½ of Kaaihee	*Kalo* and *kula makai*; *awai* west corner	2 *ap.*; 9.12 Acs	5575
2536:1	Ukikolo	Olohana	2 *loʻi*	3 *ap.*; 4.19 Acs	2136
2536:2		Manu	4 *loʻi*		2136
2544:1	Lalapa	Manu	*moʻo*	1 *ap.* 1.38 Acs	2291
2575	Hekona	Manulele	10 *loʻi* and a house	2 *ap.*; 2.29 Acs	2318
5825	Kaanaana	Kaaihee	*loʻi* and house lot?	1 *ap.* 2.297 Acs	2032
6153	Nanawahine	Manulele	2 *loʻi* and a *kappa* field	1 *ap.*; 0.22 Ac.	
6162	Punipeki	Olomana	12 *loʻi*	1 *ap.*; .47 Ac.	2135
		P	*kula*	Not awarded	
6969:2	Kuwahine	Manu	5 *loʻi*	1 *ap.*; 1.3 Ac.	3063
	(Kuahine)	Kawailoa	30 *loʻi*, a *kula* and a house	1 *ap.*; 1.52 Acs	
7113:1 & 2	Keaka	½ Manu *ʻili*	taro lands	1 *ap.*; 1.52 Acs	1652
				1 *ap.*; 1.52 Acs	
9539:2	Kaikihoio	Palawai	*moʻo* (*loʻi*)	2 *ap.*; 4.36 Acs	1371

G. Ranching

In the early 1900s Kāne`ohe Ranch came to dominate land holdings in the Kailua and Kane`ohe area. Included within this acreage is much ranch land which has been bought, sold, let and used as ranch land by numerous parties since the mid-1850s. Kelly and Nakamura's history (1981:34-35) mentions that Government land sales amounting to 3,000 acres were sold to 21 buyers in Kailua between the years 1849 and 1863. The largest parcel went to William Jarrett of the *`ili* of Maunawili in 1849. The second largest was 399.5 acres to T. Cummins in Mokulua. Both parcels were used for ranching. Other land holdings which were turned into ranch land in the mid-1850s included the *`ili* of Puanea and `Ohua`uli (by the son of Paula Marin, Paul F. Manini). These large land holdings were used for years as ranch lands before becoming part of the Castle's Kāne`ohe Ranch. Cattle, sheep, and horses, were thus allowed to roam at will through many parts of Kailua, and would have destroyed many gardens and abandoned habitation areas. Kelly and Nakamura point out that although specific records are not available, based on tax information, it is not unreasonable to estimate that several thousand head of cattle were grazing in Kailua by 1975 (Kelly and Nakamura 1981:69).

Kāne`ohe Ranch (Castle Trust) eventually acquired much of the land in Kailua (Hall 1997:84). Kāne`ohe Ranch, in addition to ranching, grew pineapple and sugarcane. With the decline of rice farming around the margins of Kawai Nui, cattle stock move onto the abandoned agricultural lands. Ranching in Kailua continues to this day, albeit on a drastically reduced scale.

H. Growth of Cash Crops in Kailua

For the nearly 100 years following the *Māhele*, Kailua grew into an important area of commercial agriculture. Until the early 1900s, rice was the major crop. Rice was followed by truck farming of taro and Western crops. The truck farming gave way to suburbanization, as Kailua became the premier bedroom community for growing Honolulu.

The Reciprocity Treaty between the United States and the Kingdom of Hawaii allowed for the duty free exportation of Hawaiian sugar to the U.S. This 1876 treaty greatly fanned the flame of the already smoldering Hawaiian export sugar industry. The duty free export of rice was also covered under the treaty, however, it was the growing Asian population, first Chinese and later Japanese, brought to Hawai`i to supply labor to the escalating export sugar industry, that provided the main impetus for the expansion of rice growing. With local consumption steadily growing, and duty-free export, rice growing in Hawaii had a boom period of its own.

Unlike the adjacent *Ahupua`a* of Ko`olaupoko, Kailua's main cash crop became rice rather than sugar. Kailua's numerous abandoned taro *lo`i* in the former taro lands of Maunawili and Kawai Nui provided perfect areas for the expansion of rice. By the early 1900s, majority of the taro *lo`i* in Kawai Nui marsh were converted to rice paddies, leaving little to no physical evidence of previous *lo`i* cultivation. At one time, there were multiple rice mills functioning in Kailua *Ahupua`a*, one of which was located in the vicinity of the present day Castle Medical Center. "The principle landowners at this time were N.R. Rice, Wong Leong, W.G. Irwin, the Crown and heirs of J.S. Ellis" (Ewart and Tuggle 1977: 8). By 1913, Wong Leong had sold his various parcels, land, leaseholds and rice mill to N.R. Rice and by this time, only five LCAs remained with their original claimant or heirs (Ewart and Tuggle 1977: 9). By the first part of the 20th century, rice growing in California was using more modern production methods to reduce their costs. This lead to the rapid decline in rice farming in Hawai`i (Kelly and Nakamura

1981: 51-63). Coulter (1937: 53) also mentions the prohibition of Chinese immigrants to Hawai`i beginning in 1876 as another reason for the decline in rice cultivation.

Sugar never became an important crop in Kailua itself, but the need for water for the adjacent sugar lands of Waimānalo was an important factor in the transformation of the Kailua water shed. Following the 1876 Reciprocity Treaty the adjacent *Ahupua`a* of Waimānalo became the site of rapid sugar development, what became the extensive Waimānalo Sugar Company's fields. The development of these fields relied upon water from Kailua. As early as the late 1870s a system of flumes, ditches, and tunnels were built in the *mauka* portion of adjacent Maunawili to collect water from the abundant springs and streams. By 1881 close to 1,000 acres of sugar had been planted, and milling operations were underway in Waimānalo (Kelly and Nakamura 1981:76). Expansion in acreage continued, increasing the need for water. By the 1920s, improvements to the Waimānalo Irrigation System included catchment tunnels that were excavated into the base of the Ko`olau in Maunawili to increase flow.

Also, completed in 1923, was a system of pumps, pipelines, tunnels, and ditches, which conducted water from Kawai Nui Marsh into the Kailua ditch, a portion of the Waimānalo Irrigation System. This system continued to supply Kawai Nui water to Waimānalo until the early 1950s (Harland, Bartholomew, and Associates 1959:53-54; Hall 1997:94; Kelly and Nakamura 1981:778-79). According to Wilcox (1996:111) two pumps lifted water from Kawai Nui and took it to the head of a 10,000-foot system of small tunnels, most through stone or hard earth, into a reservoir in Waimānalo.

In 1909, the Hawaiian Copra Company was established on the sandy area that is today bounded by Kalaheo and `Oneawa Streets. Over 130 thousand trees were planted in an operation that involved leveling "the sand dunes and smooth[ing] out the sand hillocks" (Honolulu Star Bulletin, Sept. 12, 1931 cited in Kelly and Nakamura 1981:100; Hall 1997:77-78). The name Coconut Grove stuck, referring to most of the sand barrier area of Kailua. Clearly this leveling and smoothing of former dune areas had a great impact on the archaeological record of this area in Kailua.

The most prominent inroad made by sugar agriculture in Kailua was the establishment of the Hawaiian Sugar Planter's Association's field laboratory in 1926. It was established in former rice fields in stream bottoms, near present day Kailua Town. By 1946 the laboratory was in the process of moving further *mauka* into Maunawili (Kelly and Nakamura 1981:100).

By the 1950s, the truck farms that had flourished since the turn of the century within the bounds of present day Kailua Town, are slowly replaced by housing, municipal and retail developments. Kailua is promoted as the bedroom community for Honolulu businessmen, only "8 miles and 20 minutes" from Downtown. Residential developments are planned for more outlying areas of Kailua Town, such as Olomana, Pōhākupu, and Oneawa Hills (Hall 1997:141).

III. PREVIOUS ARCHAEOLOGICAL RESEARCH

A. Summary of Previous Archaeological Research in Kailua *Ahupua`a*

This previous archaeology section is intended to compliment the cultural and historical background section. It discusses the archaeology of Kailua *Ahupua`a* in general, with many specific references to Kawai Nui, to provide an archaeological context for the Kawai Nui Marsh Environmental Restoration project area.

Twentieth century archaeological findings from inventory surveys, data recovery projects, and inadvertent finds during development are the main source of our knowledge about the archeological record in Kailua. Archaeological work in the last 25 years in Kailua has been fairly extensive. This work has been concentrated along the margins of Kawai Nui Marsh and within Maunawili Valley for the most part. This is largely due to the fact that most of the *makai* portions of the Ahupua`a had been developed prior to the implementation of State and Federal Historic Preservation Rules (Dye 1992). The many archaeological reports dealing with Kailua are listed and briefly summarized in Table 2.

The earliest habitation of the Kailua area is still under debate. A radiocarbon date obtained from a charcoal enriched soil layer has been interpreted as evidence that human habitation of Kailua began somewhere in the neighborhood of 350-650 A. D (Clarke 1980: 32-33, 77-78). This date is not universally accepted, however, it is fairly well agreed among the archaeological community that by approximately 1200-1300 A. D. dramatic changes in the pollen record are indicative of the expansion of agriculture in the Kailua area, most likely in the well-watered margins of Kawai Nui Marsh (Hammatt et al. 1990; Athens and Ward 1991). Human colonization of the region would clearly have had to precede this agricultural expansion, perhaps by many centuries. Erkelens (1993:51) reports three early dates, A.D. 1024-1296, A.D. 779-1256, and A.D. 770-1270, from his excavations along the Kukanono slopes within the current project area. It is logical that Kailua, and other regions of Koʻolaupoko, with their abundant marine and terrestrial resources, would have been attractive to the initial Polynesian colonizers.

The work of Hammatt (et al. 1990) and Athens and Ward (1991), has largely discredited Kraft's (1980) earlier assertions that Kawai Nui Marsh was an open water embayment at the time of initial Polynesian colonization. Athens and Ward (1991) suggest the Kawai Nui Embayment was sealed off during the first millennium B. C. as the result of a drop in sea-level. They correlate the Kawai Nui event with similar events at the same time in Kahana Valley and Ft. Shafter Flats, Oʻahu.

Remains of upland terraces show that taro has been grown extensively and intensively in Kailua since the 13th or 14th century, and possibly earlier (Allen 1981, Williams, Mills and Allen 1995). The work of Cordy (1977, 1978), Allen (1981, 1986-87), and Athens (1983a) all document the mix of irrigated and dryland agriculture that was carried out in Kailua during prehistory and continuing into the historic period. Dryland agriculture, including yams, gourds, and sweet potato, would have been carried out on slopes and on drier flat-lands. Modification to the landscape would have been variable, ranging from none at all to the construction of terraces and mounds for planting. According to Handy (1940:155) the beach barrier at Kailua (current day Coconut Grove) was famous for its production of sweet potatoes, grown in small mounds. Irrigated agriculture would have been carried out along streams and below springs. Associated

landscape modifications would have included construction of terraces and/or pondfields, *`auwai*, and earthen and stacked-stone berms. These types of dryland and irrigated agricultural features have been found in Maunawili and along the margins of Kawai Nui Marsh.

Previous archaeological investigations in Kailua have located dispersed prehistoric habitation remnants. This is in keeping with the observations of early Westerners in Hawaii that the settlement pattern for the most part was dispersed habitations scattered across the landscape amid agricultural fields. It should be remembered that settlement data is conspicuously absent from the lowland, beach berm areas of Kailua, due to early development of these areas.

McAllister (1933) reported eight *heiau* within the *Ahupua`a* of Kailua, and it is not unreasonable to conclude there were several more of which McAllister's informants had no knowledge. This is well in keeping with Kailua's status as a productive *Ahupua`a*, the residence of *Ali`i*. The three known *heiau* closest to the current project area are McAllister's sites 359 Pahukini *Heiau*, 360 Holomakani *Heiau*, and 371 Ulupo *Heiau*.

In the last eleven years over 15 reports of inadvertent finds of human skeletal remains have been made in Kailua, on the sandy beach berm of Coconut Grove and Lanikai. As with other near shore sandy areas in Hawai'i, clearly Kailua was used for burial of the dead. These burial remains are not nearly as extensive, however, as the hundreds of human burials discovered from nearby Mōkapu peninsula (Snow 1974).

Table 2 Previous Archaeological Reports, *Ahupua`a* of Kailua, Koʻolaupoko, Oʻahu

Reference	Location	Description and Results
Thrum, various 1907-1918.	Kailua *Ahupua`a*	In his articles for the *Hawaiian Almanac and Annual* (1907-1918) Thrum is the first to document many of the *heiau* in the *Ahupua`a* of Kailua.
McAllister 1933	Kailua *Ahupua`a*	McAllister's island-wide survey of the major archaeological sites of Oʻahu supplies some of the first detailed descriptions, maps, and photographs of Kailua's archaeological remains. He describes 16 sites within Kailua *Ahupua`a*, including Kawai Nui pond (#370), Kaʻelepulu fishpond (#377), Ulupo *heiau* (#371),Holomakani *heiau*, and Pahukini *heiau* (#359). In all eight *heiau* are reported for Kailua.
Handy 1940	Kailua *Ahupua`a*	Handy's discussion of traditional Hawaiian agriculture gives regional descriptions of what crops were planted where within the Hawaiian chain. Kailua *Ahupua`a* is described as a rich, productive, well terraced taro growing area (p. 99). The "sandy plains" of Kailua were planted in sweet potato, using a planting system of small soil mounds (p. 155, plate 8)
Clark and Connolly 1977	Hāmākua Drive along Kaelepulu Stream.	This survey identified five stacked-stone alignments, a possible wall alignment, a potential habitation site, two agricultural sites, the remains of an irrigation ditch, and surface midden. A possible *heiau* was also recorded, however, when Hommon (1982) and Morgenstein (1982) revisited this project area, they found no remains of the possible *heiau* structure reported by Clark and Connolly.
Cordy 1977	Kawai Nui Marsh	Cordy, working for the U. S. Army Corps of Engineers, performed archaeological survey, historic document research, and aerial photograph analysis, for the alignment of a proposed City and County sewer-line along the south and southeastern margin of Kawai Nui Marsh. He documented historic house sites and both dryland and wetland agricultural features, including terraces.

Ewart & Tuggle 1977	Kawai Nui Marsh	This archaeological investigation involved a reconnaissance survey of two parcels within Kawai Nui Marsh. Nine archaeological features or complexes of feature were located. Archeological monitoring was recommended for areas between Maunawili and Kahana Iki Streams.
Cordy & Morgenstein 1978	Kawai Nui Marsh	Agricultural features from Cordy's earlier identified "Site 7" (from Cordy 1977) were subjected to excavation to determine the chronology of land use. Previous examination of aerial photographs revealed extensive agricultural fields in this southern extension of Kawai Nui Marsh. Excavations revealed sequential land use of the area, from prehistoric irrigated taro agriculture, into historic irrigated taro agriculture, into later historic rice agriculture. Prehistoric agricultural features, such as terrace walls, were found buried below sediments, suggesting that they had not been substantially disturbed by later historic rice and livestock grazing activities in the area.
Dye 1979b	Kapa`a Ridge	Reports the discovery, mapping and excavation of Bishop Museum site # 50-Oa-G6-31, a combination of terrace remnants and cobble paving, thought to be prehistoric agricultural remnants. The site is located just below the summit of Ulumawao Ridge, in a hanging valley of an intermittent stream. After the work was completed these features were destroyed by the expansion of the Ameron Quarry facility
Kraft 1980a,b	Kawai Nui Marsh	John C. Kraft is a specialist in prehistoric and historic coastal land form changes. Based on his research, which included coring various spots around the marsh, Kawai Nui Marsh was a shallow marine embayment of the coastal reef tract, very similar to present day Kāne'ohe Bay. Between 6000 and 2800 years B. P., before the Kailua sand berm had formed, corals grew and marine foraminiferal sands and carbonate muds were deposited around the margins of the embayment. Only after 2800 B.P. did the sand berm begin to form, slowly closing off the embayment. Until 400 or 500 years B. P. both the north and south outlets of the embayment (`Oneawa and Ka`elepulu) remained open. Kraft suggested the possibility that formation of the sand berm could be related to human factors, such as the construction of stacked stone fish ponds within the embayment. According to Kraft's recreation, the terrigenous in filling of the margins of the embayment was a relatively recent development, in the last 400-500 years B. P., with most taking place in the last 200 years.
Allen-Wheeler 1981	Kawai Nui Marsh	Allen-Wheeler conducted excavations in the Marsh with results that confirmed and refined Krafts' (1980) sequence of Kawai Nui development from embayment to marsh. Terrestrial in-filling of the marsh began about 650 A.D. with the formation of a peat layer. By 1300 A. D. a layer of alluvial soil had been deposited--possibly the result of human agricultural activity within Maunawili. Rapid alluvial in-filling continued at a rapid rate until the present. Taro cultivation within the marsh could not have taken place until approximately 1200 A.D.
Morgenstein 1982; Hommon 1982	Hāmākua Drive adjacent to Ka`elepulu Stream	Morgenstein and Hommon report surface survey and subsurface testing conducted to assess the potential of archaeological features along the Ka`elepulu truck sewer line. The investigation documented layers of historic fill in the upper layers and the presence of one potential agricultural bund, thought to be associated with rice farming, below.
Neller 1982a	Kawai Nui, Kukanono area TMK 4-2-13:38	Neller reports the work he undertook in Kukanono as part of a field school on behave of the Sierra Club School Hikers Program and Hawaii Science Teachers Association. These limited subsurface investigations were carried out in the same area reported by Clark (1980) and Athens (1983a). Neller dismisses the early date reported by Clark (1980).
Neller 1982b-	Maunawili Valley TMK 4-2-09:1	This short letter report documents a field trip to investigate archaeological sites in the back of Maunawili Valley. The reported locations of McAllister's sites 373 (Halaulolo *Heiau*), 374 (Kukapoki *Heiau*), and 375 (house sites, were visited. The extensive agricultural terraces, abandoned *lo`i*, were noted along large portions of both Omao and Maunawili Streams.

Athens 1983a	P Kukanono slope S.S. #50-80-11-2022	Working in much the same area documented by Clark (1980), these investigations consisted predominantly of surface collections and subsurface testing. Excavation revealed that the abundant surface features (primarily agricultural mounds and terraces) were built in the most recent soil layers after 1900 A. D. Only one small area of the project area contained undisturbed prehistoric deposits. An earth oven in this prehistoric deposit was dated to the 13th to 15th centuries A. D., calling into question the early dates (4th to 7th century A. D.) obtained by Clark on the same slope of Kawai Nui. Soil erosion on the P-Kukanono slope was apparently intense during the prehistoric period and soil deposition and development was infrequent prior to construction of the historic terraces.
Athens 1983b	83 Kihipai Street, Kailua TMK 4-3-57:65	This report documents the 11 grid units excavated in site 50-Oa-G6-40, the H.A.R.C. site. The site consists of marine midden, and subsurface features including hearths and pits. Radiocurbon dates indicate occupation of the site sometime in the mid- 13th to early 15th century. Midden remains were analyzed and conclusions suggest a change through time in the exploitation pattern. Athens suggests the use of the Kailua accretion barrier for habitation may have started about the same time as the occupation of the site. This site was originally located and excavated by Wheeler (1981).
Toenjes and Donham 1986	Maunawili Valley	This reconnaissance for the City and County's Maunawili District Trunk Sewer was located along Maunawili Stream north (*mauka*) of Maunawili Road to the southern extent of Kawai Nui Marsh and Kalaniana`ole Highway. One historic site, a ditch which once carried water from Maunawili Stream to a rice mill, and several potentially prehistoric terrace remnants were discovered within the project area. The authors report previously unreported archaeological features within the vicinity of the project area, associated with Maunawili Stream.
Brennan 1986	Maunawili Valley	This reconnaissance survey was done for Royal Hawaiian Country Club, Inc., for a parcel proposed for a golf course in Maunawali. Brennan located and described 42 sites, some of which had been previously identified. Sites include historic features (a bath site), a *heiau* (which appears to match McAllister's site 374, "*Heiau* on the land of Kukapoki") prehistoric irrigated taro fields, habitations, walls, burials and stream embankments.
Allen 1986, 1987	Maunawili Valley	These mitigation and data recovery plans and preliminary reports detail the results of archaeological investigations at the site of the Royal Hawaiian Country Club, Inc. golf course. Sites investigated included historic habitations, charcoal kilns, roads and trails, and agricultural sites. The final report for these investigations is forthcoming
Shun, Price-Beggerly, and Athens 1987	Kailua *mauka*, west of the Pali Golf Course	This inventory survey of approximately 200 acres, the site of a proposed golf course, revealed that the area was not used extensively by traditional Hawaiians for habitation, agriculture, or other activities. Historic document research revealed that Pineapple agriculture (c. 1912) and truck farming, in the 1920s, were some of the greatest land uses of the parcels. Sites found included a small terrace complex, two charcoal kilns or seepage wells, a habitation complex, and a rock wall.
Williams 1988	Maunawili	This reconnaissance survey took place to investigate the proposed new location for the displaced Luluku farmers (by H-3 development). 13 sites were recorded in this *mauka* portion of Maunawili (540'-920' elevation), including probable historic charcoal kilns and agricultural complexes.
Szabian 1989	Foot of Mount Olomana	During this archaeological reconnaissance survey of the proposed site of the Women's Community Correctional Complex (adjacent to Maunawili Elem. School) no new surface or subsurface archaeological sites of deposits were discovered. The authors did reap the remains of Kukuipilau *Heiau* (State Site # 50-80-11-372), which was first reported by Thrum and McAllister (site # 372), and re-discovered by Neller. They also note the freshwater spring "Kawailoa freshwater spring" adjacent to the *heiau*.

Hammatt, *et al.* 1990	Kawai Nui Marsh	The sediments from sediment cores from 10 locations in the Marsh were analyzed to characterize their "depth, age, and nature". Conclusions: Kawai Nui was marine bay with open circulation and tidal activity for most of the Holocene. Around the end of the first millennium B. C., in a relatively sudden geological event, the bay was partially blocked by a sand barrier, becoming a lagoon of mixed fresh and saline waters. This change is marked by a 600% increase in sedimentation rates on within the Kawai Nui basin. The lagoon persisted until as late as 570 A. D. By 1400 A. D. the lagoons outlet to the sea was closed and the Kawai Nui basin, already largely filled with terrestrial silty clays developed its wetland appears of today. Pollen samples which bracket the periods from bay to marsh show no apparent changes resulting from early Polynesian settlement. At approximately 1400 A. D. there are dramatic changes showing voluminous drops in mixed mesic forest species and an increase in grasses and sedge. These changes may well be the result of increases in Hawaiian subsistence activities.
Quebral, Orndoff, and Athens 1991	Hāmākua Drive and Puʻu o Ehu Ridge	Four most likely historic sites were located during this inventory survey along the margins of Kaʻelepulu Stream, in an area that has seen modern in filling. Although background research indicated the importance of the project area for traditional agriculture, no specific indication of traditional Hawaiian land use was found. The project area was used for historic rice cultivation and livestock grazing.
Athens and Ward 1991	Kawai Nui Marsh	Thirty-seven core/auger units were dug along the eastern margin of Kawai Nui Marsh, in the vicinity of the drainage control levee, three small test excavations were undertaken, and two cores were extracted from the central portion of the marsh. Conclusions: The marsh basin was transformed into a relatively closed, freshwater system at about 200 B. C. Data from other locations on Oʻahu (Ft. Shafter Flats and Kahana Valley) support the conclusion that the transformation was due to regional causes, namely a fall in mean sea-level, rather than local forces, as had previously been proposed. The Kailua sand berm begins to form between 600 and 1000 B. C. Until approximately 1000 A. D., the Kailua lowlands were dominated by *Pritchardia*-palm forest. After 1000 A. D. these forests decline rapidly. The vegetation transformation is attributed to rising human population levels and the expansion of agriculture. Counts for cheno-am type and grass pollen rise dramatically after approximately 1200 A. D. These pollen types are indicators of disturbed environments and are thought to be indicators of the expansion of agriculture. Based on increases in sedge pollen after about 1000 A. D., it appears that Kawai Nui basin was too deep to support a marsh community, except along its margins, until this time.
Hammatt and Shideler 1991	Maunawili	This inventory survey for the Na Ala Hele Trail Corridor through the *mauka* portion of Maunawili Valley found seven sites. Sites included the Old Pali Road, two probable historic charcoal kilns, and a large agricultural complex. It was unclear if any of the sites were prehistoric.
Hammatt, Pfeffer and Creed 1992	Puʻu o Ehu Ridge TMK 4-2-03:46	This inventory survey for the proposed location of the Kailua 272 Reservoir found no historic properties. Oral history research did reveal the traditional Hawaiian significance of Puʻu o Ehu peak as a spot overlooking the waterway that joined Kaʻelepulu and Kawai Nui ponds.
Brennan 1993	Maunawili Valley	This short letter report, address to Dr. Tom Dye, SHPD, documents and explains significance evaluations for 8 newly recorded sites in Maunawili. These sites were found during monitoring for the Royal Hawaii Country Club Golf Course. Features include pondfields, firepits, trash dumps, a cemetery documented from oral history, habitations, slope retainers, terraces, and a possible military training bunker.
Hammatt, Creed and Masterson 1994	Maunawili Estates (TMK 4-2-63:31,38)	This reconnaissance survey of a 10 acre parcel revealed no historic properties.

Williams, Mills, and Allen 1995	Upper Maunawili Valley	Excavations at six sites within upper Maunawili Valley (the location of the Luluku Banana Farmers Relocation) are reported. These six predominantly prehistoric agricultural sites, based on radiocarbon dating results, were constructed between 1260 and 1650 A. D. These radiocarbon dates suggest that extensive agricultural and other cultural activities began in the valley by the 14th century, and possibly a few centuries earlier. No human burials or definite habitation areas were discovered in the six sites, but evidence for pre-Contact habitation was found at a previously unidentified site.
Hammatt and Chiogioji 1997	ʻAuloa Road	This reconnaissance assessment of a 0.8 mile section of ʻAuloa Road, immediately *makai* of Castle Junction, found no historic or archaeological sites, other than the previously recorded Kāneʻohe Ranch office building and the adjacent war memorial monument (State site 50-80-10-1360).
Hammatt and Medeiros 1999	Kailua Ahupuaʻa TMK 4-3-28:73	Inadvertent burial find of a single individual, represented by the remains of one bone fragment (radius or ulna) in situ. The lower skeletal remains were recovered by SHPD/DLNR staff, while the contents of the excavated sand was intensively screened and fragmented remains were recovered. The remains collected by the Burial Program staff included both femora, both fibulae, one tibia, both innominates, both humeri, proximal fragments of right ulna and radius, distal fragment of left ulna, mandible, sacrum, and a frontal fragments of the cranium.
Medeiros, Bush, and Hammatt 2000	Kailua Ahupuaʻa TMK 4-3-53:29	Inadvertently discovered burial of a single individual was partially recovered because of previous disturbance of this Kailua project area. A total of 5 human bones were recovered during the length of this project, including 1 adult skull (minus the mandible), 1 rib fragment, 1 carpal fragment, and two unidentified fragments. This represents less than 5% of the total remains. The remains collected appear to represent one individual. The ethnicity of the remains is not apparent, especially with the low percentage of the entire burial recovered. There was no evidence near the remains, or anywhere within the stratum containing the burial, to suggest ethnicity.
Kikiloi, McDermott, and Hammatt 2000	Kailua Ahupuaʻa TMK 4-2-17:por 4	Archaeological inventory survey with a focus on the evaluation of subsurface deposits of a small lot on the north-northwest margin of Kawai Nui Marsh. Backhoe testing revealed modern fill sediments overlying sandy marsh type sediments at a depth of 1.25-1.5 m below the current land surface. No historic properties documented. This margin of the marsh was heavily modified by the dredging of the adjacent Oneawa and "Inner" canals that control Kawai Nui drainage.
McDermott *et al.* 2000	Kawai Nui Marsh Periphery	This archaeological assessment and background literature search explores the cultural context of the marsh periphery, discusses the impact of the proposed Circle-Kawai Nui Trail on archaeological sites, and makes recommendations for public interpretive signage along the proposed trail.
Mann *et al.*, 2001	Kawai Nui Marsh and Periphery	This historic background study archaeological assessment was completed for the proposed Kawai Nui Gateway Park. The archaeological assessment discuss the presence of sand deposits within the Coconut Grove portion of the project area, and recommends a full archaeological inventory survey prior to development.

B. Most Relevant Archaeological Reports Conducted in Kawai Nui Marsh

Most relevant to the current project area are seven archaeological investigations by Ewart and Tuggle (1977), Cordy (1977), Cordy (1978), Allen-Wheeler (1981), Athens (1983b), Hammatt *et al.* (1990) and Athens and Ward (1991).

An archaeological reconnaissance survey and historic literature review of Kawai Nui Marsh was undertaken in 1977 by Ewart and Tuggle (1977). The project area consisted of two parcels: one area of higher ground between Maunawili and Kahana Iki Stream to the south of the marsh, and the slopes immediately adjacent to the marsh as far north as Kapaʻa Quarry on the west and St. Johns Lutheran Church on the east. As a result of the reconnaissance survey, nine archaeological features were identified on the Kūkanono-Pōhakupu slope. With the exception of a single terrace and two abandoned modern house sites, no cultural remains were noted in the

remainder of the project area. The authors note however, that cultural deposits may exist in the area between Maunawili and Kahana Iki Sream and along the marsh periphery, but due to historic surface alterations and vegetation coverings, these areas were not visible to ground surveyors. Subsequently, the authors recommended archaeological monitoring in the area between Maunawili and Kahana Iki Stream.

Cordy (1977) completed a cultural resource study involving historic background research and a reconnaissance survey for the proposed City and County sewerline in Kawai Nui Marsh. Study results indicated that the only archaeological remains found during the reconnaissance survey existed on the Kūkanono-Pōhākupu slope. Seven archeological sites were identified in the project area, consisting of clusters of terraces, walls, mounds, and historic houses. Site 7 encompasses a large area east of Maunawili Stream along the slopes of Pōhākupu from Kalaniana'ole Highway to the southern most extreme of Kūkanono slope. Site 7 is the area of concern for the current Kawai Nui Environmental Restoration project area. The author concluded that the sewerline alignment would not affect most of the sites identified, and recommended no further archaeological work. However, the author did indicate that the Kūkanono and Pōhākupu sites remains to be of significant value and further recommended that any future work in the vicinity should be preceded by additional archaeological work.

A second phase of archaeological investigation in relation to the proposed City and County sewerline was undertaken less then a year later by Cordy (1978). The second phase was initiated after the first study concluded that an intensive cultural survey be conducted to characterize and describe the sites, and to make an accurate determination of probable significance. In the initial 1977 study, several aerial photographs constituting Site 7 were reviewed. Several of the aerial photographs showed a few faint parallel lines extending into the marsh (Cordy 1977: 1; Figure 2). An earlier series of aerial photographs (circa 1940) suggested that Kawai Nui marsh from the mouth of Maunawili Valley to Kūkanono consisted of abandoned agricultural fields (Cordy 1977: 1; Figure 3). As a result of the preliminary aerial photograph review, Cordy excavated three test units within Site 7 and one test unit within Site 5. All four test trenches were located east of Maunawili Stream and in the immediate vicinity of Pōhākupu slope. Test trench 1 and 2 were excavated across two stone walls that were 45 and 25 cm below surface. The authors concluded that the stones walls were associated with taro cultivation. A basaltic glass fragment was also recovered in-situ and radiocarbon dated. Test Trench 4, was excavated across a surface visible stone wall. The authors indicate that associated stratigraphic layers suggest that the stone wall may have been used for crops other than taro. Test trench 3 was located upon Pōhākupu slope. No stone walls were identified, although the presence of charcoal suggested agricultural use. This study was significant in demonstrating that buried cultural deposits are still present and intact below the existing ground surface.

Allen-Wheeler (1981) examined four test trenches in the central portion of Kawai Nui Marsh, in areas where both taro and rice were believed to have grown. The most significant finding was a boulder alignment buried 60 cm below soil, which appeared to correspond to one of the linear alignments observed on an aerial photograph. The alignment was constructed of small to medium basalt angular to sub-angular basalt boulders and large basalt cobbles. Also recovered in the same trench were seven indigenous basalt flakes 55-126 cm below surface. The other three test trenches revealed no additional boulder alignments consistent with taro or rice cultivation; however several *kukui* nuts and indigenous basalt flakes were recovered. This study

is critical in demonstrates that buried cultural deposits and remnants of cultivation exist below the current ground surface.

Athens (1983b) documented the 11 excavation units in site 50-Oa-G6-40, the H.A.R.C. site, in 1983. The site consisted of marine midden, artifacts, and subsurface features including hearths and pits. Radiocarbon dates indicated occupation of the site sometime in the mid- 13th to early 15th century. Midden remains were analyzed and conclusions suggest a change through time in the exploitation pattern. Athens suggested the use of the Kailua accretion barrier for habitation may have started about the same time as the occupation of the site. This site was originally located and excavated by Wheeler (1981). This study demonstrated the potential for significant archaeological deposits within the sandy deposits of the previously disturbed residential neighborhoods along the inland margin of Kawai Nui Marsh.

Hammatt et al. (1990), like Athens and Ward (1991), conducted sediment coring in Kawai Nui Marsh with the goal of palaeoenvironmental reconstruction. The U.S. Army Corps of Engineers proposed construction of open water channels in the marsh for flood control. There was concern for impacts to archaeological resources within/surrounding the marsh. The objective of the study was to (1) characterize depth, age and nature of sediments to be impacted in relation to present marsh sediments and (2) reconstruct environmental history of marsh to determine nature and location of native Hawaiian use including shoreline habitation, fishponds, and agricultural sites. Ten sediment cores were taken from Kawai Nui Marsh and analyzed for pollen, organic clay mineralogy, stratigraphy and heavy metals.

In 1991, Athens and Ward (1991) carried out an archaeological investigation for a flood control project at Kawai Nui Marsh. Thirty-seven core/auger units were dug along the eastern margin of marsh, in the vicinity of the drainage control levee. The purpose of the investigation was to evaluate the presence or absence of significant archaeological remains in the vicinity. The investigation revealed no archaeological deposits or architectural features. Some possible archaeological sites proved to consist only of levee fill and previously dredged sediment. The palaeoenvironmental investigations of Athens and Ward (1991) were highly successful. These results, coupled with those of Hammatt et al. (1990), did much to broaden our understanding of prehistoric human induced environmental change in the Hawaiian lowlands.

C. Summary of Significant Archaeological Findings

Based on previous archeological investigations, it appears that majority of the remaining archeological sites are concentrated upon the slopes of Kūkanono and Pōhākupu (Ewart and Tuggle, 1977 and Cordy 1977. Two archeological studies conducted by Cordy (1978) and Allen-Wheeler (1981), consisted of subsurface test excavations. In both archaeological investigations, basalt-boulder alignments were documented. The alignments ranged in depth from visible on the ground surface to 60 cm below ground surface. Cultural deposits consisting of basalt and volcanic glass flakes were also recovered at a depth of 55-126 cm below surface. Based on the information gathered from the two subsurface studies suggest that intact cultural deposits consistent with taro cultivation still remain both on the surface, as well as buried beneath sediment deposits. Neither one of the subsurface archaeological studies were undertaken within the immediate corridor of the Kawai Nui Marsh Environmental Restoration project area.

Also pertinent to the current project are the aerial photograph overviews conducted by Cordy (1977 & 1978) during his archaeological reconnaissance for the City and County sewerline. Several historic aerial photographs taken from the early 1940s through the 1960s showed faint parallel lines extending into the marsh. His analysis suggested that the entire marsh from the mouth of Maunawili Valley to Kūkanono consisted of an elaborate network of abandoned agricultural fields consistent with rice and taro cultivation as indicated by the historic literature review.

The current archaeological investigation for the Kawai Nui Marsh Environmental Restoration project is a complementary component to these previous archaeological studies. The current project extends between Maunawili and Kahana Iki stream, an area which in previous archaeological investigations has been uncertain. As suggested by Ewart and Tuggle (1977), modern historic modifications of Kawai Nui marsh within the current project area have been significant and vegetation growth has compromised visibility.

IV. HISTORIC MAP AND AERIAL PHOTOGRAPH OVERVIEW

In addition to historic background research of land use and ownership during the time of the *Māhele*, a second component of the historic investigation involved reviewing and analyzing historic maps and aerial photographs. In Cordy's 1977 archaeological reconnaissance survey and historic overview of Kawai Nui Marsh for the proposed City and County sewerline, he indicated that oblique parallel lines were visible on several 1940 and 1960 aerial photographs that were consulted. Cordy also mentioned that these aerial photographs suggested that the entire marsh from the mouth of Maunawili Valley to Kūkanono consisted of an elaborate network of abandoned agricultural fields (Cordy 1978: 1). The primary objective of the "historic map and aerial photograph overview" section of this report was to consult additional map and aerial photograph resources that may contribute to the location of any existing *loʻi* walls or rice paddies within the limits of the current project area. Table 3 below list those maps and aerial photographs consulted during the course of the study with a brief description of observable changes that were occurring from previous years.

Table 3 Historic Map and Aerial Photograph Overview

Date	Name of Map	Scale	Description
1908-1913 (Figure 5)	Hawaii Territorial Survey Map, Sheet #10 (Waimanalo)	1:20,000	Four structures are depicted within the project area. Three structures are located southwest and one is located west. All four structures are located west of Maunawili Stream. The four structures may correspond to LCAs 3825, 6162 and *Māhele* Award 47. A Rice Mill is also indicated east of the project area in the approximate location of the present Castle Medical Center. A mosaic of oblique lines, possibly associated with rice fields, is also visible. The old Pali Road is indicated outside the project area to the east and south.
1919 (Figure 6)	Iao, Jos, Map of Kailua, Koolaupoko, Oahu, Traced from W.A. Wall Map. Archaeological and Anthropological Sources Annotated by Vicky Creed 1992.	1:500	*ʻIli* and Land Commission Awards are indicated.
1927-1930 (Figure 7)	USGS Map	1:20,000	Maunawili Stream and Kahana Iki Stream are running parallel to each other. The old Pali Road and the new Kalanianaole Highway are indicated. An unidentified road located in the southwest extreme of the project area, directed north for approximately 10,000 feet and terminating at a north structure is further indicated. The northern half of the project area is indicated in the swamp, while the southern half is indicated in a relatively dry area.

Date	Name of Map	Scale	Description
1943 (Figure 8)	USGS Map	1:20,000	Maunawili Stream and Kahanaiki Stream are running parallel to each other. The old Pali road and Kalanianaole Highway are indicated. A cattle trail is indicated parallel to the east-central boarder of the project area (for approximately 7, 000 ft) and cutting west across the project area into Kahana Iki Stream for approximately 10,000 ft. An unidentified road located on the southwest extreme of the project area running north for approximately 10,000 feet and terminating at a structure located in the center of the project area is also depicted. The northern half of the project area is indicate in the swamp, while the southern half is indicated in a relatively dry area.
1949 (Figures 9 and 10)	R.M. Towill Aerial Photo of Kawainui Marsh Ref: Photo No. 154-14 Date: 9/3/49	No Scale	Maunawili Stream and Kahana Iki Stream are running parallel to each other. The old Pali Road is depicted south of the marsh. An old road (in the approximate location of the current Kapa'a Quarry Road) is further indicated west of the marsh. Several east-west linear disturbances are further noted in the approximate locations of LCA 2544: 1, 25361:1, 6162 and 9539:2. Overall, there are no housing developments and agricultural activities are still noted southwest of the project area in the approximate location of the old Kailua Drive In.
1961 (Figure 11)	Oblique Aerial, Kukanono-P	No Scale	Photo captures the central and northern aspects of the project area. Faint, small, rectangular areas in the right foreground and to the left of Maunawili Stream are indicated and may be former rice fields (Cordy 1977: 33).
1968 (Figure 12)	USGS Map	1:20,000	Maunawili Stream meanders to the west at the center of the project area, to converge with Kahana Iki Stream located outside of the project area. A cattle trail is also depicted positioned west to east at the southern extreme of the project area, and runs approximately 1200 feet within the project area. A Gaging Station is also indicated at the southeastern corner of the project area. The northern half of the project area is indicated in the swamp, while the southern half is indicated in a relatively dry area. Kalanianaole Highway is indicated, as well as Kailua Road.

Date	Name of Map	Scale	Description
1969 (Figure 13 and 14)	R.M. Towill Aerial Photograph of Kawainui Marsh Ref: Photo No. 5232-6 Date: 12/22/69	No Scale	Maunawili Stream is noted meandering to the west at the center of the project area, to converge with Kahana Iki Stream located outside of the project area. Several linear disturbances are noted, although none of the lines appear to correspond to any LCAs. A cloud of white disturbance is noted in the center of the project area, which may relate to construction activities in adjacent areas. Kūkanono subdivision and Castle Medical Center, located to the east and southeast of the project area are fully developed.
1983 (Figure 15)	USGS Map	1:20,000	Maunawili Stream meanders to the west at the center of the project area, to converge with Kahana Iki Stream located outside of the project area. A cattle trail is also depicted positioned west to east at the southern end of the project area, and runs approximately 1200 feet within the project area. The Gaging Station is no longer indicated.
1988 (Figure16)	R.M. Towill Aerial Photograph	1:300	Maunawili Stream is clearly depicted, meandering west at the center of the project area, and converging with Kahana Iki Stream outside of the project area. A very distinct fence line is shown running east to west within the southern aspect of the project area for approximately 720 feet and curves around southbound for 1000 feet, ending near Kalanianaole Highway. An unidentifiable line (possibly a power line) is also indicated in the southern regions of the project area, positioned southwest to northeast.

Summary Historic Maps and Aerial Photograph Overview

Several of the aerial photographs consulted, including the 1949 and 1969 R.M. Towill aerial photographs, provided some information regarding possible linear disturbances within the project area. However, the density of the vegetation restricted any such field-verifications of the linear disturbances observable on either of the 1949 or 1969 aerial photographs. The project area and relevant LCA boundaries were superimposed on both aerial photographs and subsequently used in the field during the walk through survey. The 1961 aerial photograph provided by Dr. Ross Cordy had a few very faint linear disturbances observed, but the aerial photograph only encompasses a very small portion of the northern extreme of the project area. Additionally the 1988 R.M. Towill aerial photograph provided a more recent photograph of the marsh; however, it too provided little information for field verification.

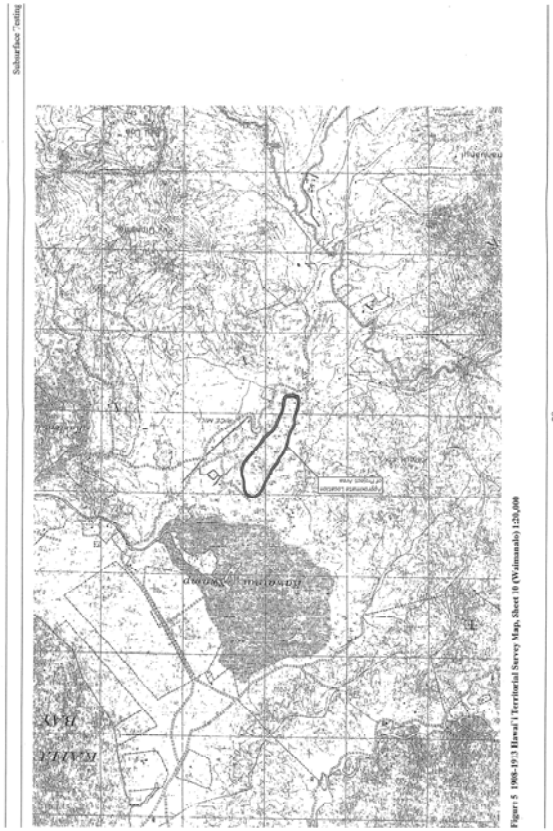


Figure 5 1908-19/3 Hawai'i Territorial Survey Map, Sheet 10 (Waimanalo) 1:20,000

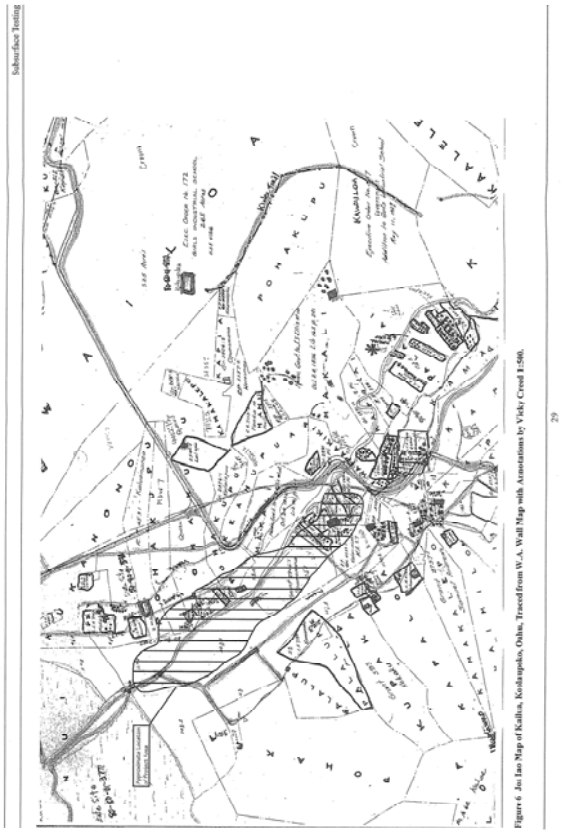
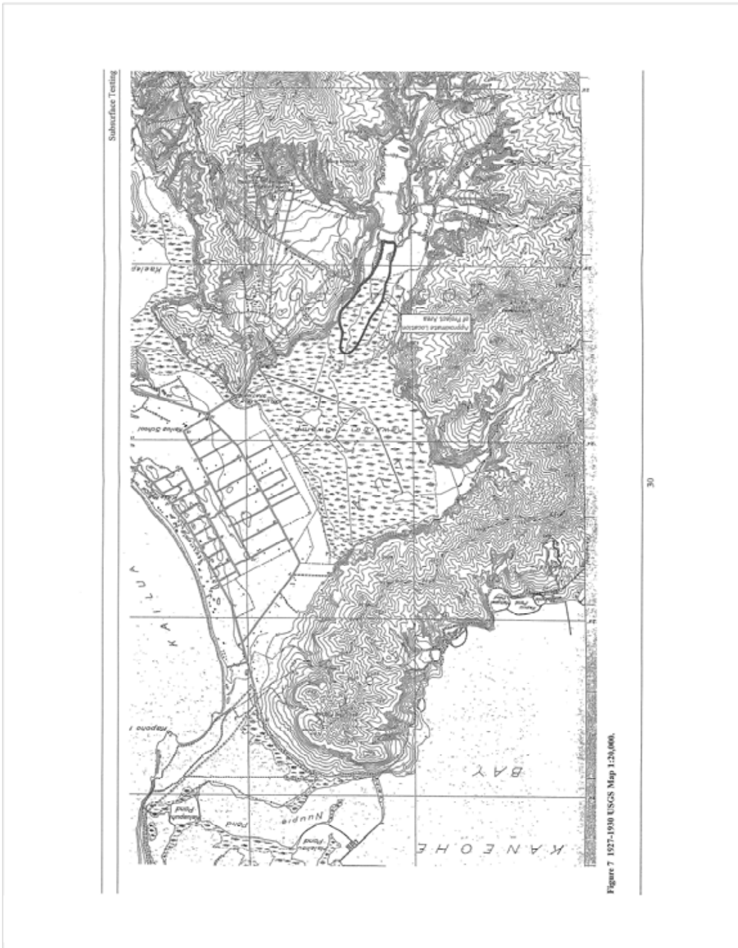


Figure 6 Jas Isao Map of Kailua, Koolaupoko, Oahu, Traced from W.A. Wall Map with Annotations by Vicky Creed 1:500.


Subsurface Testing
KANEOHE
BAY
Figure 7 1927-1930 USGS Map 1:20,000.
30

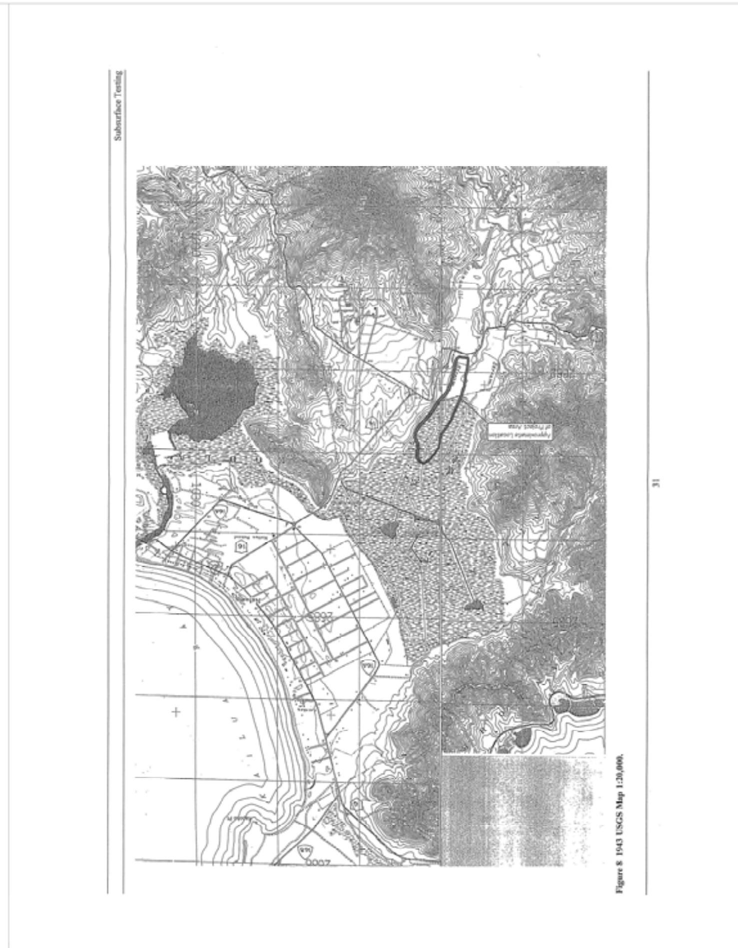

Subsurface Testing
Figure 8 1943 USGS Map 1:20,000.
31

Figure 9 R.M. Towill 1949 Aerial Photograph.

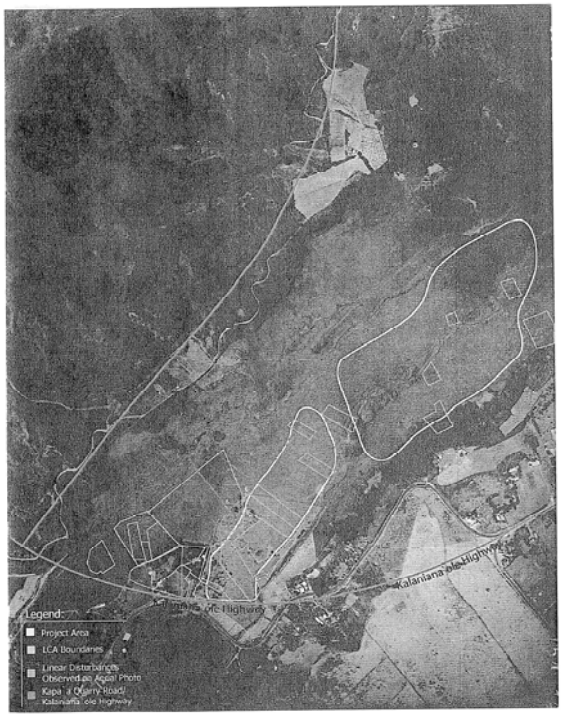


Figure 10 R.M. Towill 1949 Aerial Photograph with Project Area, LCA Boundaries, Roads and Linear Disturbances.

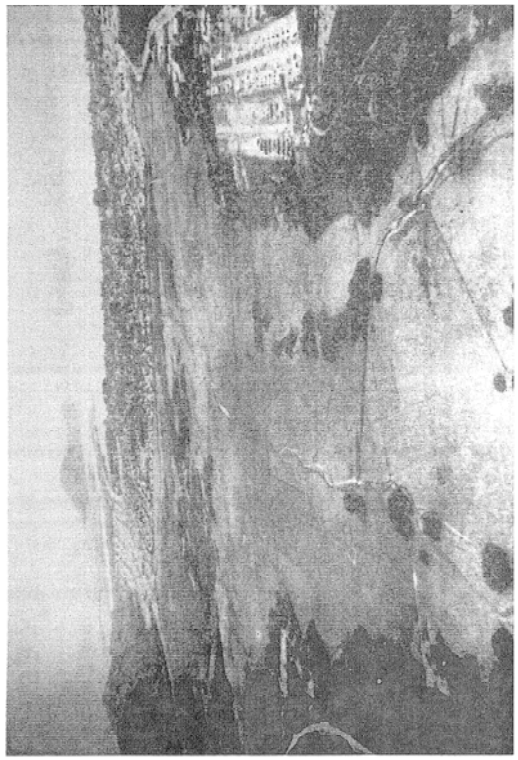


Figure 11 1961 Oblique Aerial Photograph, Provided by Dr. Ross Cordy.

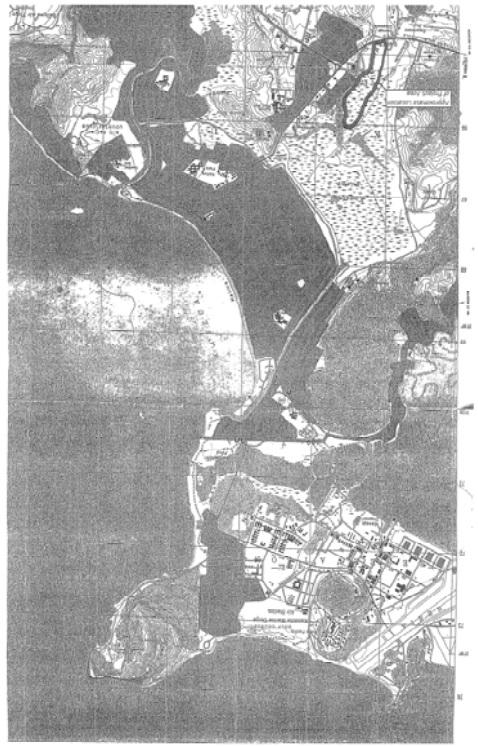


Figure 12 1968 USGS Map 1:25,000.

Figure 13 R.M. Towill 1969 Aerial Photograph.

Figure 14 R.M. Towill 1969 Aerial Photograph Showing Project Area, LCA Boundaries and Linear Disturbances.

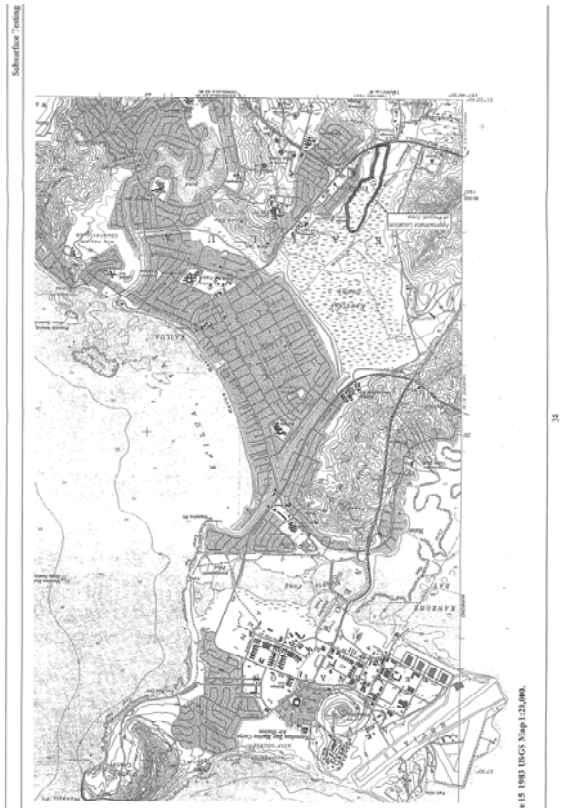


Figure 15 1983 USGS Map 1:25,000.

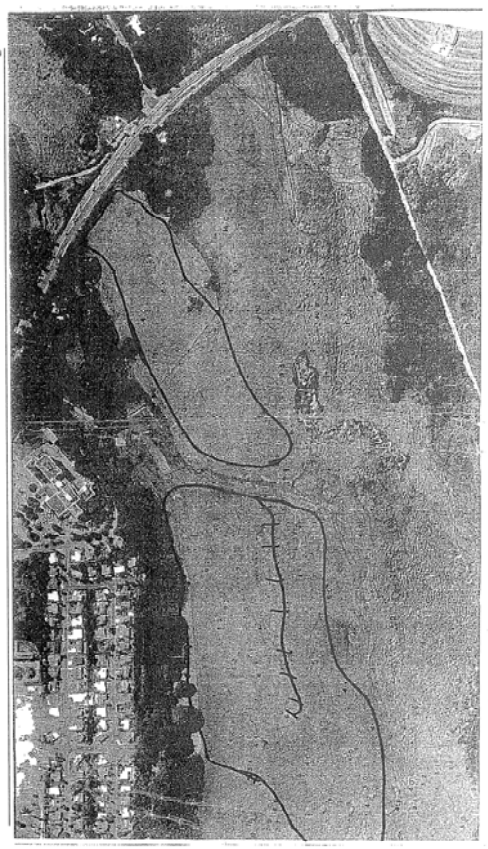


Figure 16 1988 R.M. Towill Aerial Photograph.

V. FIELD VERIFICATION AND FLAGGING

The project area consists of approximately 60-acres on a relatively leveled surface. Ground visibility varied from relatively excellent in the northern regions of the project area to severe in the southern extremes. One third of the project area was covered in waist high California grass (*Brachiaria mutica*), various shrubs, two extra large bamboo clusters and several Monkey Pod trees. Visibility in these areas was moderate to severe. The only swampy area was located on the west-central side of the project area. The water was stagnant and approximately knee to waist high. Visibility in the swampy areas was minimal. The remaining two-thirds of the project area were very dry with low-grade California grass. Visibility in these areas was excellent.

A walk-through survey was completed by two Cultural Surveys Hawai'i, Inc. archaeologists, Melanie M. Mann, B.A. and Constance Ohare, B.A. Historic maps and aerial photographs compiled during the historic overview were consulted throughout the walk-through survey. No boulder-alignments consistent with *lo'i* walls or rice paddies were observed on the surface and there was no surface indication of any remaining archaeology. However, two linear vegetation alignments running east to west in the central aspect of the project area were observed. These linear vegetation alignments appeared, at the time, to correspond to two LCA boundaries (LCA 2544:1 and 6969:2).

To better support this theory, additional research on the meets and bounds of the two LCAs were carried out. The *Māhele* award descriptions and Royal Patents provided the necessary information to locate the two LCAs. Using the descriptions derived from the *Māhele* award descriptions and the Royal Patents, calculations were made, and finally compared to LCA boundaries depicted on a current Tax Map Key. The information provided on the *Māhele* descriptions and Royal Patents were very consistent with the lengths and angles calculated on the current Tax Map Keys.

With the lengths and angles calculated, a second field inspection was undertaken. Using tape and compass, two Cultural Survey's Hawai'i, Inc. archeologists attempted to confirm if the two linear vegetation alignments observed during the initial walk-through was consistent with the lengths and angles depicted in the *Māhele* award descriptions and Royal Patents for LCAs 2544:1 and 6969:2. At the end of the second walk-through it was concluded that based on the information provided through the *Māhele* descriptions and the Royal Patents, that indeed the linear vegetation alignments are consistent with the boundaries for LCA 2544:1 and 6969:2. However, it should be noted that there was no indication of any surface archeological findings other than the alignment of vegetation at this stage of the investigation.

After the first project area walk-through, Dr. Sara Collins and Ms. Elaine Jourdane of the State Historic Preservation Division, were consulted. Dr. Collins and Ms. Jourdane recommended subsurface testing perpendicular to the two linear vegetation alignments. Although subsurface testing was not initially a part of the Scope of Work outlined for the Kawai Nui Marsh Environmental Restoration project, Cultural Survey's Hawai'i, Inc. felt that ground truthing was necessary as a means of verifying what was found during the initial project area walk through. Descriptions and results of the subsurface testing are discussed in the following section.

VI. SUBSURFACE TESTING

Backhoe test excavations were carried out to investigate subsurface deposits in the vicinity of the two linear vegetation alignments. Two units were selected for backhoe testing: one unit in the vicinity of LCA 2544:1 and a second unit in the vicinity of LCA 6969:2. Both test units were positioned perpendicular to the two linear vegetation alignments in anticipation of transecting a segment of a *lo'i* wall associated with LCA 2544:1 and 6969:2. The locations of trenches 1 and 2 are shown on Figure 17.

The stratigraphy was consistent in both test units. Stratum I and II were associated with the present grass mat and consisted of a dark grayish brown to dark brown sandy loam to loam. Stratum III consisted of a very dark brown clay loam, oxidized with a reddish brown staining observed throughout the stratum. This staining is consistent with cultivation and may correspond to the Old A-Horizon. Cultural deposits collected *in situ* included a basalt adz recovered 97 cm below surface in trench 1 and two volcanic glass flakes recovered 70 cm below surface in trench 2. Abundant basalt water-worn river cobbles was observed throughout the trenches. In both trench 1 and trench 2, a mound of river cobbles was observed in an isolated area of the trench profile. It is not clear what purpose or function this may have played in either *lo'i* or rice cultivation. Charcoal flecking was diffused throughout Stratum III. Stratum III is considered the cultural layer. Stratum IV consists of a very dark gray water logged sticky clay. This stratum may correspond to the natural river bed. The water table was observed approximately 115 cm below surface. Stratum V consists of a dark gray sandy clay loam with a layer of basalt river cobbles aligned 2 meters below surface.

One basalt adz was recovered *in situ* 97 cm below ground surface within Trench 1. Additionally several basalt flakes were collected from the dirt pile during excavations; their *in situ* origins are unknown. Within Trench 2, two volcanic glass flakes were recovered *in situ* 70 cm below ground surface. See Table 4 for Artifact Analysis.

Unfortunately, no basalt boulder alignments were observed within the test units. In both trenches, however, a distinct mass of basalt water worn cobbles was observed. Its function in correlation to *lo'i* or rice cultivation is unknown, although it appeared to have been pushed up into a mound-like feature.

The test units yielded no archaeological reality in terms of discrete *lo'i* walls or berms. It is evident however, that there is a buried cultural layer 50 cm below ground surface that contains buried cultural material and charcoal. This cultural layer is approximately 50 cm thick and is composed of organic material and oxidized sediments.

Table 4 Artifact Analysis

#	Test Unit	Stratum	Depth	# of pieces	Length (cm)	Width (cm)	Thickness (cm)	Weight (gms)	Material/ Type
1	T-1	III	97 cm	1	11.5	4.2	3.1	314.5	basalt adz
2	T-1	---	dirt pile	1	4.9	2.8	0.7	13.5	basalt flake
3	T-1	---	dirt pile	1	4.5	2.8	1	18.8	basalt flake
4	T-1	---	dirt pile	1	5.3	2.1	0.7	17.6	basalt flake
5	T-1	---	dirt pile	1	6.5	4.2	4.2	370	basalt flake
6	T-2	III	70 cm	1	0.08	0.05	0.02	0.1	volcanic glass
7	T-2	III	70 cm	1	2.2	1.7	0.07	2.0	volcanic glass

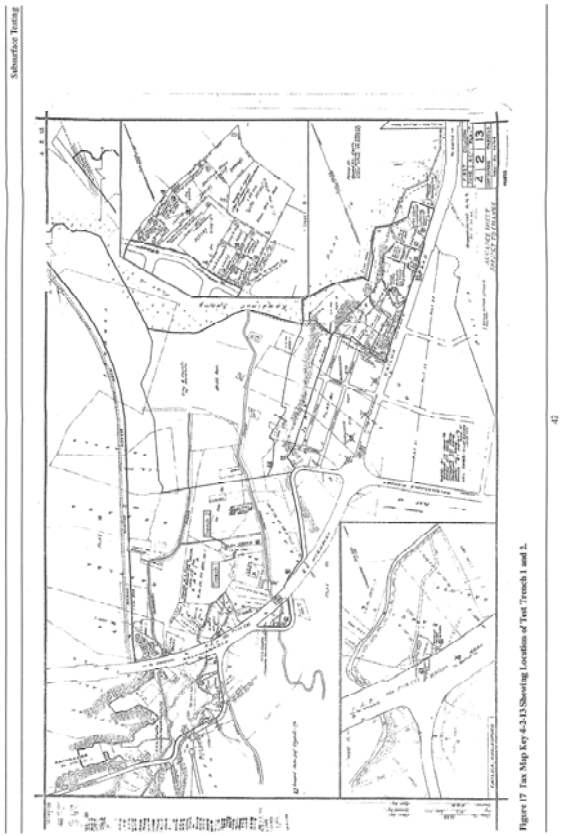


Figure 17 Tax Map Key 4-3-13 Showing Location of Test Trench 1 and 2.

Trench #1 (Figures 18 through 20)
Orientation: 344˚ Magnetic North
Maximum Length: 8.80 meters
Maximum Width: 80 cm
Maximum Depth: 2.10 meters

Strata	Depth	Description
Stratum I	0-20 cmbs	(Dry) 10YR 3/2, very dark grayish brown, very compact, sandy loam; structures are weak, blocky peds; contains abundant roots and rootlets: no apparent cultural material; modern A-Horizon; grass mat; Lower Boundary (LB) not very clear.
Stratum II	20-50 cmbs	(Dry) 10YR 3/3, dark brown loam, compact, fine angular blocky peds; thin rootlets; no apparent cultural material; associated with Stratum I, LB clear, smooth.
Stratum III	50-100 cmbs	(Moist) 10 YR 2/2 very dark brown mottled with oxidized 5 YR 4/3 to 4/4 reddish brown clay loam; semi-compact; very weak structures and block peds; abundant water-worn basalt cobbles at the lower boundary of stratum; distinct mound of river cobbles observed; iron staining is consistent throughout; charcoal flecking and lithic material encountered; Old A-Horizon associated with agriculture; LB clear, smooth. Charcoal sample collected
Stratum IV	100-150 cmbs	(Wet) 10YR 3/1 very dark gray water logged clay; loose; fine grained; sticky; water level at 115 cmbs; no apparent cultural deposits encountered; possibly associated with natural river bed; LB clear, smooth.
Stratum V	150-200 cmbs	(Wet) 5 YR 4/1 dark gray sandy clay loam; compact medium grained; abundant river cobbles at 2 meters below surface; no apparent cultural deposits encountered.

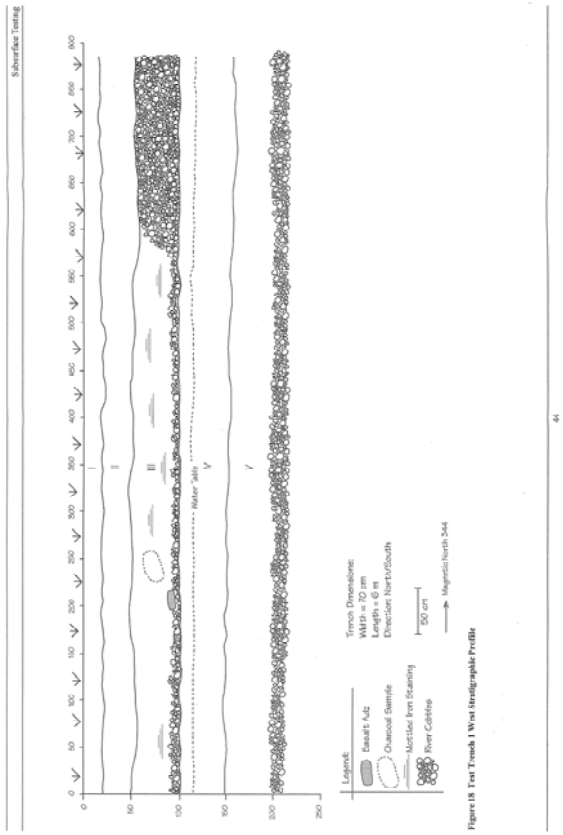


Figure 18 Test Trench 1 West Stratigraphic Profile

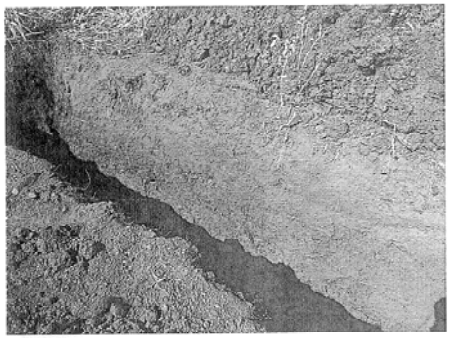


Figure 19 Test Trench 1, West Stratigraphic Profile. Stratum III is Indicated Above Shadow, Visible as an Orange Oxidation Stain.

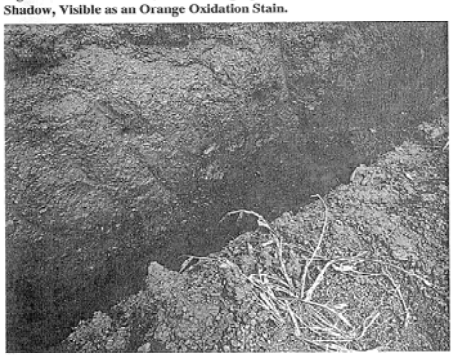


Figure 20 Test Trench 1, West Stratigraphic Profile Showing River Cobbles within Strata III.

Trench #2 (Figures 21 through 23)
Orientation: 342˚ Magnetic North
Maximum Length: 6.0 meters
Maximum Width: 80 cm
Maximum Depth: 2.40 meters

Strata	Depth	Description
Stratum I	0-20 cmbs	(Dry) 10YR 3/2, very dark grayish brown, very compact, sandy loam; structures are weak, blocky peds; contains abundant roots and rootlets; no apparent cultural material; modern A-Horizon; grass mat; Lower Boundary (LB) not very clear.
Stratum II	20-50 cmbs	(Dry) 10YR 3/3, dark brown loam, compact, fine angular blocky peds; thin rootlets; no apparent cultural material; associated with Stratum I; LB clear, smooth.
Stratum III	50-100 cmbs	(Moist) 10 YR 2/2 very dark brown mottled with oxidized 5 YR 4/3 to 4/4 reddish brown clay loam; semi-compact; very weak structures and block peds; abundant water-worn basalt cobbles at the lower boundary of stratum; a distinct mound of water-worn cobbles present; iron staining is consistent throughout; charcoal flecking and lithic material encountered; Old A-Horizon associated with agriculture; LB clear, smooth.
Stratum IV	100-150 cmbs	(Wet) 10YR 3/1 very dark gray water logged clay; loose; fine grained; sticky; water level at 115 cmbs; no apparent cultural deposits encountered; possibly associated with natural river bed; LB clear, smooth.
Stratum V	150-200 cmbs	(Wet) 5 YR 4/1 dark gray sandy clay loam; compact medium grained; abundant river cobbles at 2 meters below surface; no apparent cultural deposits encountered.

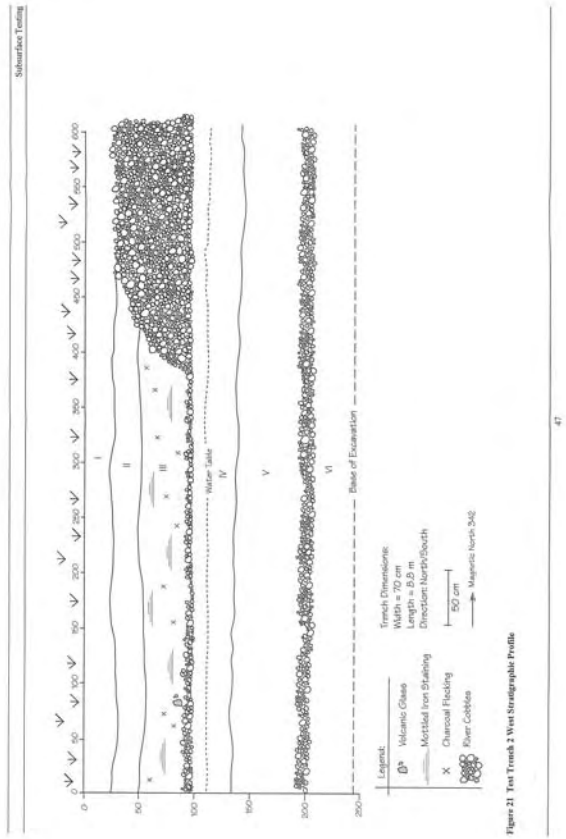


Figure 21 Test Trench 2 West Stratigraphic Profile

Figure 22 Test Trench 2, West Stratigraphic Profile Showing Strata I, II and III. Note River Cobbles above Water Table.

Figure 23 Test Trench 2, West Stratigraphic Profile Showing Strata I, II and III. Note River Cobbles in Far Right.

VII. RECOMMENDATIONS

The archaeology and history of Kawai Nui Marsh have been well documented in numerous previous studies. Historic maps, aerial photographs and Land Commission Award records all demonstrate the vitality of the marsh and describe the abundant *lo'i* cultivation during the time of the *Māhele*. Within the Kawai Nui Marsh Enviornmental Restoration project area alone, there were over two dozen *lo'i* patches fed by *'awai* and possibly Maunawili Stream. The fate of *lo'i* patches were soon overcome by rice cultivation within the marsh in the late 1800s and early 1900s. Modern sediment deposits from floods and cattle crazing have both impacted the integrity of what may have been left in the way of archeology within the lowland areas of Kawai Nui Marsh.

The pedestrian survey of the Kawai Nui Marsh Environmental Restoration project area indicated no observable surface archeological deposits. Two test trenches located in the central region of the project area indicated that a buried cultural layer is present approximately 50 cm below the current ground surface. However, no walls or berms corresponding to Land Commission Awards were documented. The current data collected from the archaeological investigation indicates no archaeological reality of ponds that need to correspond to any Land Commission Awards in the construction of the native bird habitat area.

It is therefore recommended that construction of the pond system be designed and developed according to what will optimize the environment for the endangered species. It is advised, however, that all subsurface work below 50 cm or 20-inches of the current ground surface be monitored by a qualified archeologist. This will ensure that in the event that buried cultural deposits are encountered, relevant archaeological data and documentation may be recorded.

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APPENDIX A: LAND COMMISSION AWARDS AND ROYAL PATENT

<B>No. 6 M.A., Honaunau</B>

<B>No. 8140, Honaunau Honolulu, Oahu, February 10, 1848
N.R. 490v5</B>

To the Land Commissioners, Greetings: I, Honaunau, hereby give you my claim for land from the Mo`i. It is one half of Manulele, an `Ili of Kailua, Koolaupoko, Oahu, which is to be for me and my heirs forever, from the `Ii`i. I have been directed to have title quieted.
I am, respectfully,
HONAUNAU

[Award 6 M.A.; R.P. 5557; Manulele Kailua Koolaupoko; 2 ap.; 12.88 Acs; No. 8140 not awarded]

<B>Helu 5557, Honaunau, Manulele Ili, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, Volume 22, pps 15-16</B> [kumupono Reel 11 1416-1417.tif]

Palapala Sila Nui
<strike>A Ke Alii, Mamuli o Ka Olelo a Ka Poe Hoona Kuleana</strike>
I haawi ia e ka Moi ke Alii mamuli o Ke Kanawai i Aponoia i ka la 24 Augate 1860

No ka mea ua hooholo ia e ke Kuhina Kalaiaina le Kuleana oiaio ko <strike>No ka mea, ua hooholo na Luna Hoona i ua kumu kuleana aina i ka olelo, he kuleana oiaio ko</strike> Honaunau, Kuleana Helu 6 [6 MA] ma ke Ano Kuleana Nui malalo.o ke Ano Alodio iloko o kahi o oleloia malalo, a no ka mea ua haawi mai ua Honaunau i na dala he $11.50. No ko Ke Aupuni Kuleana iloko o keia aina, he hapalua ili aina. A me $30.50 no ka hapalua o keia aina no ke Aupuni huina $42.00.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kamaka a pau, i keia la, nono iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Honaunau, i kela wahi a pau loa ma Kailua Koolaupoko ma ka mokupuni o Oahu, penei na mokuna.

Ili Aina Manulele. Apana 1
E hoomaka ma ke kihi Komohana, e holo
Hema 62° Hikina 8 kaulahao ma Kamakalepo
Hema 85° Hikina 5.82 kaulahao ma Kamakalepo
Akau 26° Komohana 7.90 kaulahao ma Kaalhee
Hema 60° Komohana 50 [.50?] kaulahao ma Kapia
Akau 76° Komohana 6 kaulahao ma Kapia
Hema 37 1/2° Komohana 4.30 kaulahao ma Kahawai
Hema 15° Komohana 1.20 kaulahao ma Kamakalepo
He 7.45 Eka

Apana 2. He Kula no Manulele
E hoomaka ma ke kihi Akau, e holo
Hema 56 1/2° Komohana 7 kaulahao ma ka palena o Ahupuaa
Hema 14° Hikina 1.55 kaulahao ma ko Manu
Hema 62 1/2° Komohana 2 kaulahao ma ko Manu
Hema 53° Hikina 6 kaulahao ma Makalii
Akau 16 1/2° Hikina 2.13 kaulahao ma Pohakupu o Kaluainanea
Hema 55° Hikina 7 kaulahao ma Pohakupu o Kauainanea
Akau 20 1/2° Komohana 5.90 kaulahao ma Kapia
Akau 36° Komohana 3.65 kaulahao ma Kapia
Akau 9° Hikina 2.80 kaulahao ma Kamakalepo
Akau 58° Hikina 40 kaulahao ma Kamakalepo
Akau 31° Komohana 40 kaulahao ma Kamakalepo
He 5.43 Eka

Koe nae ke kuleana o na Kanaka

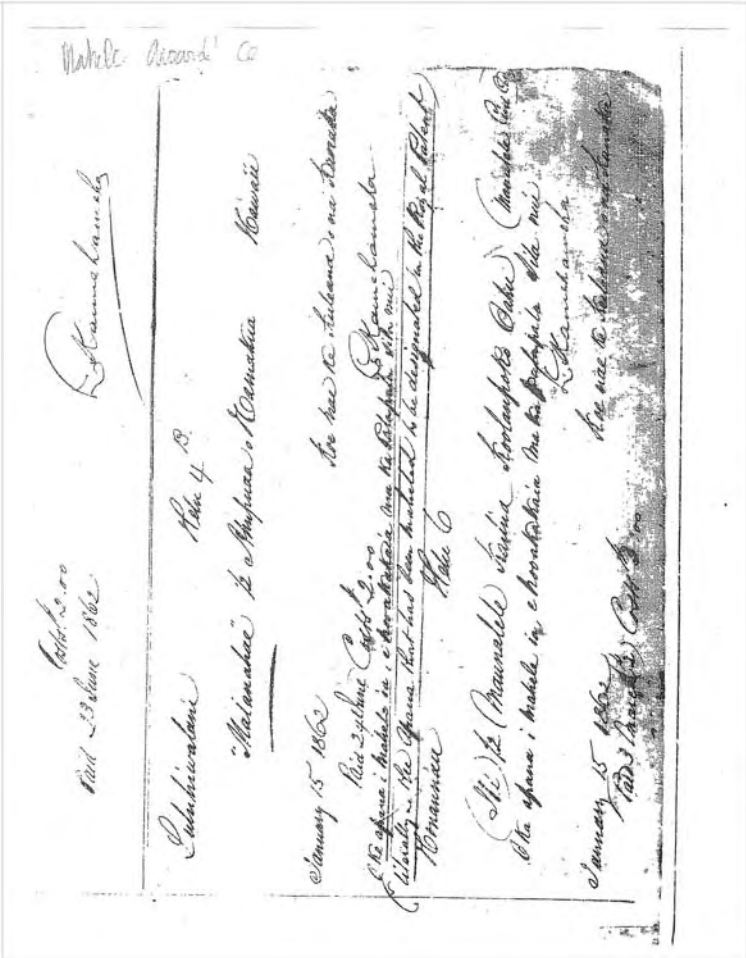
[Page 16]

Maloko o keia mau Apana 12.88 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke aupuni na mine minerela a me na metela a pau.
No Honaunau ua aina la i haawiia ma ke Ano Alodio a no kona mau hoolina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i Mea o ikea'i ua kau wau i ko'u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 27 o Augate 1863

[Inoa] Kamehameha
Kaahumanu
L. Kamehameha

[Royal Patent 5557, Honaunau, Manulele III, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, 2 apana, 12.88 Acres, 1863]



<B>No. 27 M.A., Kalawaiaku</B>

<B>N.R. 110v5</B>
No. 5668, Kalawaiaaku

To the Land Commissioners: Claim for land, 'Ili of Luakaha, Nuuanu. I, the one whose name is below, hereby state my claim for three lo`i with water; two lo`i are on the east, adjoining Hilia's lo`i. Five lo`i are in the land of Holoaa. On the south are two kula which are planted. There are also some houses standing there. My claim at Luakaha is ended.
KALAWAIAAKU

2. Kailua at Koolau. Another land claim. One Po`alima, awi i ke kala wai aku /obscure/. Manu is another claim for land. 5 Po`alima. This is an inherited right.
KALAWAIAKU X

[Award 27 M.A.; R.P. 4533; Kapia Kailua Koolaupoko; 2 ap.; 14.12 Acs; No. 5668 not awarded]

Helu 4533, Kalawaiaku, Manulele Iii, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, Volume 18, pps 641-642 [kumupono Reel 10 835-836.tif]

Palapala Sila Nui
A Ke Alii, Mamuli o Ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoona i ua kumu kuleana aina i ka olelo, he kuleana oiaio ko Kalawaiaku, Kuleana Hooko Mahele Helu 27 ma ke Ano Kuleana Nui malalo.o ke Ano Alodio iloko o kahi o oleloia malalo, a no ka mea ua haawi mai ola Kekahi wahi he hapaha o kona hapalua aina no ko ke Aupuni Kuleana iloko o kona hapalua iii aina.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kamaka a pau, i keia la, nono iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Kalawaiaku, i kela wahi a pau loa ma Kailua Koolaupoko ma ka mokupuni o Oahu, penei na mokuna.

3/8 o Kapia
Apana 1. Aina kalo.
E hoomaka ke ana ma ke kihi Komohana, e pili ana ma Manulele a me ke Ahupuaaa holo
Hema 76° Hikina 6 kaulahao ma Manulele
Akau 65° Hikina 4.13 kaulahao pauku
Akau 13° Komohana 50 pauku
Akau 56° Hikina 2 kaulahao ma Kaaihee
Akau 28° Komohana 120 pauku
Akau 39° [illegible Hikina?] 1.80 pauku ma Manu
Akau 30° Komohana 4 kaulahao ma Manu no, alaila
Akau 51° Komohana 680 pauku ma ka Kapa o ke Aupuni
Hema 21° Komohana 12 1/2 kaulahao ma ka Ahupuaa a hiki i ke kahi i hoomaka'i
He 10.62 Eka

Apana 2. He Kula
E hoomaka ma ke kihi Hema mauka e pili ana ma Kawailoa no ke Aupuni & Pohakupu, holo
Akau 2° 30' Hikina 6.30 pauku
Akau 35° Komohana 6 kaulahao ma ke Aupuni
Hema 62° Komohana 420 pauku ma ka kapa o Aupuni
Hema 45° Hikina 580 pauku
Hema 30° Hikina 567 pauku ma Pohakupu – kihi mua
He 3.50 Eka

Koe nae ke kuleana o na Kanaka

Olelo hoakaka – Ua lawa ke Aupuni i kona hapaha ma ka aina iloko o ka 1/2 o Kalawaiaku me Kapia Koe i a ia e 3/8 a oia. Keia ana maluna e like me ka mea i ae like ia.

[Page 642]

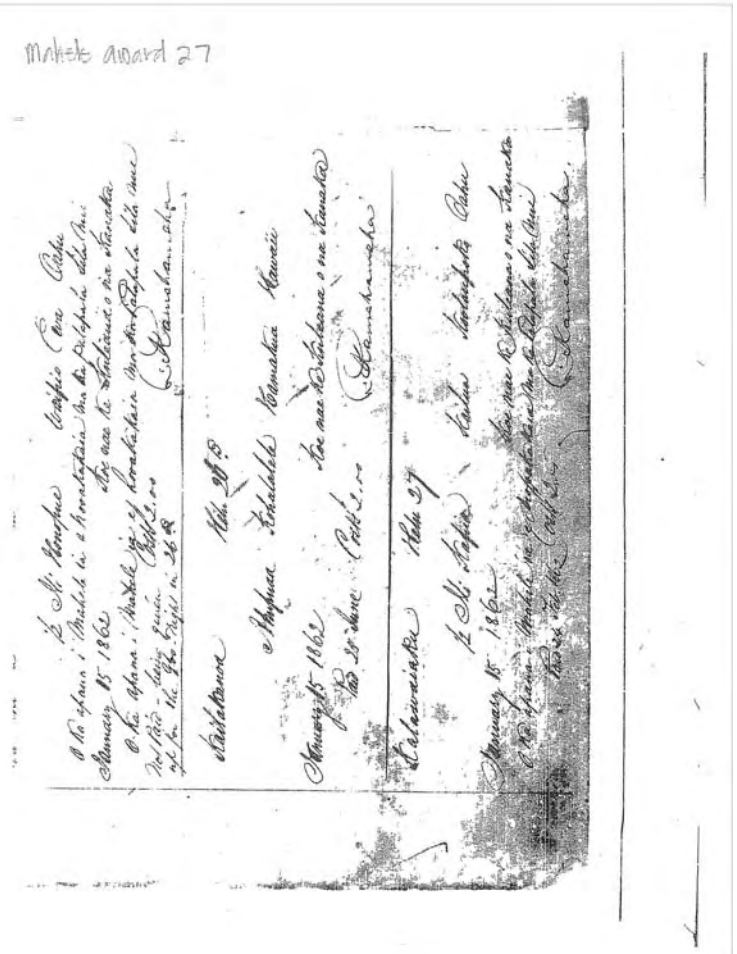
Maloko o keia mau Apana 14.12 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke aupuni na mine minerela a me na metela a pau.

No Kalawaiaku ua aina la i haawiia ma ke Ano Alodio a no kona mau hoolina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i kela manawa.

A i Mea o ikea'i ua kau wau i ko'u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 18 o Sepetemaba 1862

Kamehameha
Kaahumanu
L. Kamehameha

[Royal Patent 4533, Kalawaiaku, Manulele Iii, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, 2 apana, 14.12 Acres, 1862]



<B>No. 47 M.A. Kaeliwai</B>

<B>No. 6237*H, Kaeliwai, February 4, 1848
N.R. 265v5</B>

Greetings to the Land Commissioners: I hereby state my claim for land: one half of Kahananui Ahupua'a on Molokai, and one half of Kaaihee ´Ili in Kailua, Koolaupoko, Oahu.
KAELIWAI

Paalua
Here also is a claim of my wahine: One half of Waimea, Koolauloa, Oahu. A house lot and a planting of sweet potato are also at Waimea. /Also/ Kau Ahupua'a in Kona, Hawaii.
PAALUA

<B>N.T. 337v10</B>
No. 6237, Kaeliwai, 30 January 1854

Kaeliwai's land distribution.
½ Kaaihee ili for Kailua, Koolaupoko, Oahu
½ Kahananui ahupuaa, Molokai.
True Copy,
A.G. Thruston, Clerk
Interior Department, 30 January 1854

[Award 47 M.A.; R.P. 5575; Kaaihee Kailua Koolaupoko; 2 ap.; 9.12 Acs; No. 6237 not awarded]

Helu 5575, Kaeliwai, Manulele Ili, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, Volume 22, pps 51-52 [kumupono Reel 11 1457-1458.tif]

Palapala Sila Nui
<strike>A Ke Alii, Mamuli o Ka Olelo a Ka Poe Hoona Kuleana</strike>
I haawi ia e ka Moi ke Alii mamuli o Ke Kanawai i Aponoia i ka la 24 Augate 1860

ia e ke Kuhina Kalalaina le Kuleana oiaio ko
No ka mea, ua hooholo ia e ke Kuhina Kalaiaina ~~na Luna Hoona i ua kumu kuleana aina i ka olelo~~, he kuleana oiaio ko Kaeliwai, Kuleana Helu 47 Mahele ma ke Ano Kuleana Nui malalo.o ke Ano Alodio iloko o kahi o olelola malalo, a no ka mea ua haawi mai ua Kaeliwai i na dala he Ehiku 25/100 no ko Ke Aupuni Kuleana iloko o keia aina, he hapalua ili aina.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha V, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kamaka a pau, i keia la, nono iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Kaeliwai, i kela wahi a pau loa ma Kaaihee, Ili ma Kailua Koolaupoko ma ka mokupuni o Oahu, penei na mokuna.

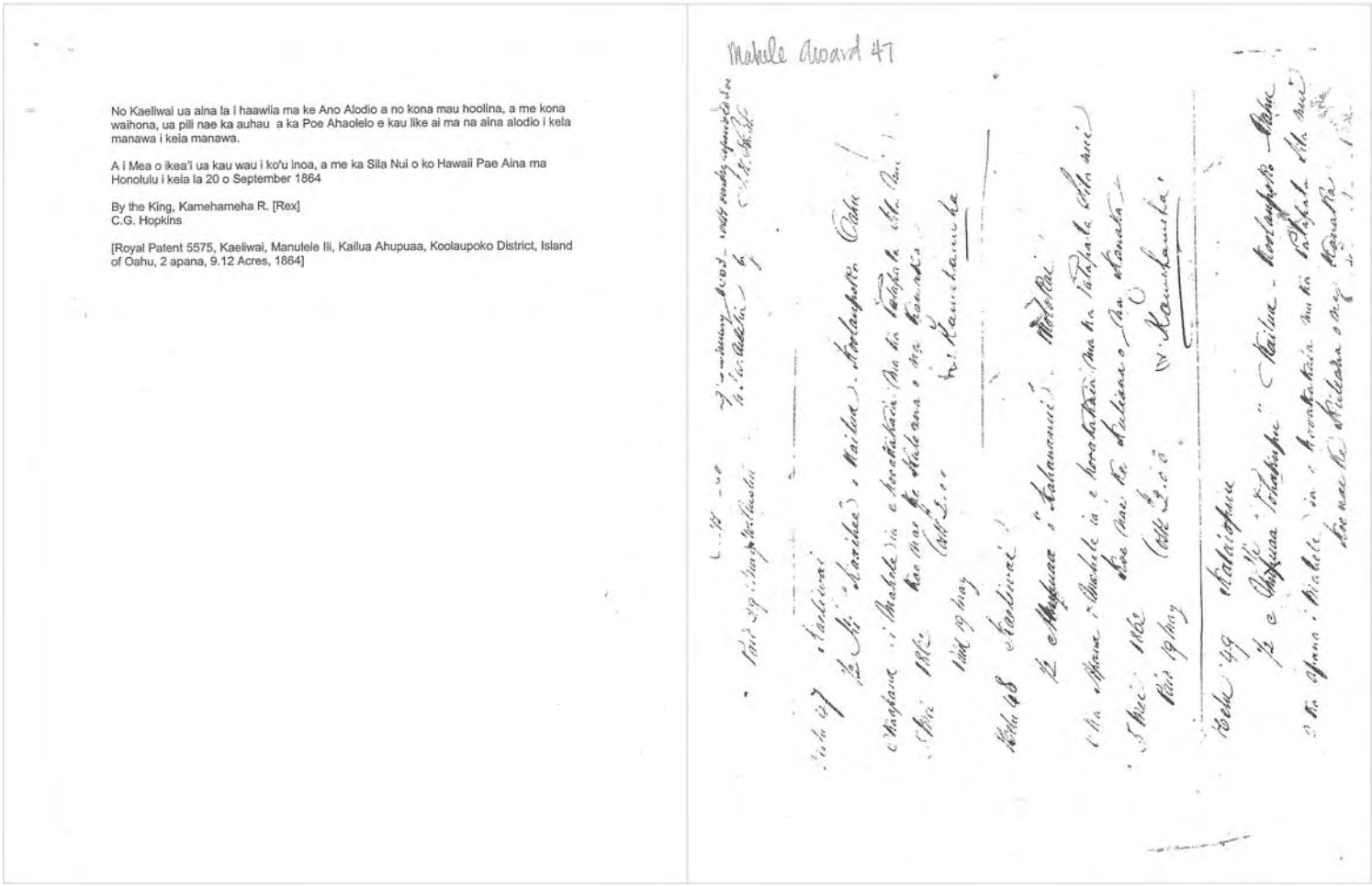
1/2 Kaaihee – Apana 1 Aina kalo & Kula aoao makai
E hoomaka i ke ana ma ke kihi Komohana, e pili ana i ke kula a me ke Auwai a holo
Akau 65° Hikina 413 pauku ma Kapia
Akau 13° Komohana 50 pauku
Akau 56° Hikina 2 kaulahao
Hema 63° Komohana 7 kaulahao ma Manu
Hema 20° Hikina 343 pauku ma ka lihi Kahawai, alaila
Akau 89° Komohana 8 1/2 kaulahao
Akau 81° Komohana 3 kaulahao ma ka Kapalua o ke Aupuni alaila
Akau 26° Komohana 270 pauku ma ke Kula o Kamakalepo i ke kihi mua
5 Eka Kalo
1.40 Kula
6.40 Eka

Apana 2. He Kula
E hoomaka ma ke kihi Akau, e pili ana me Manu & Ahupuaa a holo
Hema 62° 30' Hikina 666 pauku
Hema 35° 30' Hikina 267 pauku ma Manu
Hema 38° Hikina 154 pauku ma Manulele
Akau 76° Komohana 10.23 Pauku ma Makalii
Akau 18° Hikina 431 Pauku ma ke Ahupuaa i ke kihi mua.
2.72 Eka

Koe nae ke kuleana o na Kanaka

[Page 52]

Maloko o keia mau Apana 9.12 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke aupuni na mine minerela a me na metela a pau.



No Kaeliwai ua aina la i haawiia ma ke Ano Alodio a no kona mau hoolina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i Mea o ikea'i ua kau wau i ko'u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 20 o September 1864

By the King, Kamehameha R. [Rex]
C.G. Hopkins

[Royal Patent 5575, Kaeliwai, Manulele Iii, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, 2 apana, 9.12 Acres, 1864]

Mahele Award 47

LCA

<B>No. 2536, Ukikolo
N.R. 542v3</B>

To the Land Commissioners, Greetings: I hereby state my claim for an `ili, Manu, and the kula. The second of my `ilis is Malamalama. I have 3 lo`i at Olohana in the `ili of Hekona, Kailua, Koolau, whose konohiki is Mahina, These were gotten by my makuas in the time of Kamehameha I, till myself at the present. The konohiki is Hoonaulu.
UKIKOLO

<B>N.T. 421v10</B>
No.2536, Ukikolo, Kailua, 19 October, 1854

Makakau, sworn, I have seen his land claims in Kailua, Koolaupoko, Oahu.

Section 1 - 2 patches in "Olohana", an ili.
Mauka by Konohiki's land
Kaneohe by Kinipeki's land
Makai by Konohiki's land
Waimanalo by stream.

Section 2 - 4 patches in "Manu," and ili.
Mauka by Konohiki land
Kaneohe by "Kapaia" a land
Makai by Lalapa's land
Waimanalo by a stream.

Section 3 - enclosed at Kukanono, a house lot.
Surrounded by a stone wall.

Section 1 from Hekona in 1845 or 1856. Section 2 received before Poki went to Kahiki in 1828. Section 3 from Keaweamahi before the death of Kinau. Ukikolo lived peacefully and died in 1853, from small pox, the bequest was to his daughter, Kaiwikuilani, no objections.

Kaulaila (wahine), sworn every word above is true, no one has objected.

SEE page 423

<B>N.T. 423v10</B>
No. 2536, Ukikolo, Protest, (from page 421), No. 7147, Kahele

Kalaniwahine, sworn, I have seen that place over which there is a dispute in the ili of Kukanono in Kailua, Koolaupoko, Oahu.

Mauka and all round is Kahele's land.

This had been a heiau long ago and when we arrived in 1841, I saw Ukikolo's house there and it is still standing today. The konohiki has disputed because the land was closely associated with Kahele. I believe this place is probably truly associated with the konohiki.

[Award 2536; R.P. 2136; Olohana Kailua Koolaupoko; 3 ap.; 4.19 Acs]

KO

No. 2136, Ukikolo, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 9, pps. 205-206 [kumupono Reel 5, 733-734.tif]

[Great Seal]

Helu 2136

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko Ukikolo, Kuleana Helu 2536, ma ke ano Kuleana Nui malalo o ke ano Alodio iloko o kahi i oleloia malalo a no ka mea,

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Ukikolo

i kela wahi a pau loa ma Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

Apana 1.
E hoomaka ana ma ke kihi Komohana Akau a e holo
Hema 84 Hikina 446[?] pauku ia Konohiki
Hema 14 1/2 Komohana 135 pauku ia Konohiki
Akau 83 1/2 Komohana 445[?] pauku Konohiki
Akau 16 1/2 Hikina 135 pauku ia Konohiki i ke kihi mua.
He 59/100 Eka

Apana 2
E hoomaka ana ma ke kihi Hikina a e holo ana
Hema 15 3/4 Komohana 288 pauku ia Konohiki
Akau 69 3/4 Komohana 181 pauku ia Konohiki
Akau 15 3/4 Hikina 149 pauku ia Konohiki
Hema 30 1/2 Komohana 138 pauku ia Konohiki
Akau 60 Komohana 143 pauku ia Konohiki
Akau 25 3/4 Hikina 495 pauku ia Konohiki
Hema 83 1/2 Hikina 379[?] pauku ia Lalapa i ke kihi mua
He 2 30//100 Eka

[page 206]
Apana 3.
E hoomaka ana ma ke kihi Hema, a e holo
Akau 47 1/2 Hikina 339 pauku pili ia Konohiki
Akau 28 Komohana 336 pauku pili ia Konohiki
Hema 63 1/2 Komohana 264 pauku pili ia Konohiki
Hema 13 1/2 Komohana 170 pauku pili ia Konohiki
Hema 35 1/2 Hikina 297 pauku pili ia Konohiki i ke kihi mua.
He 1 30/100 Eka.

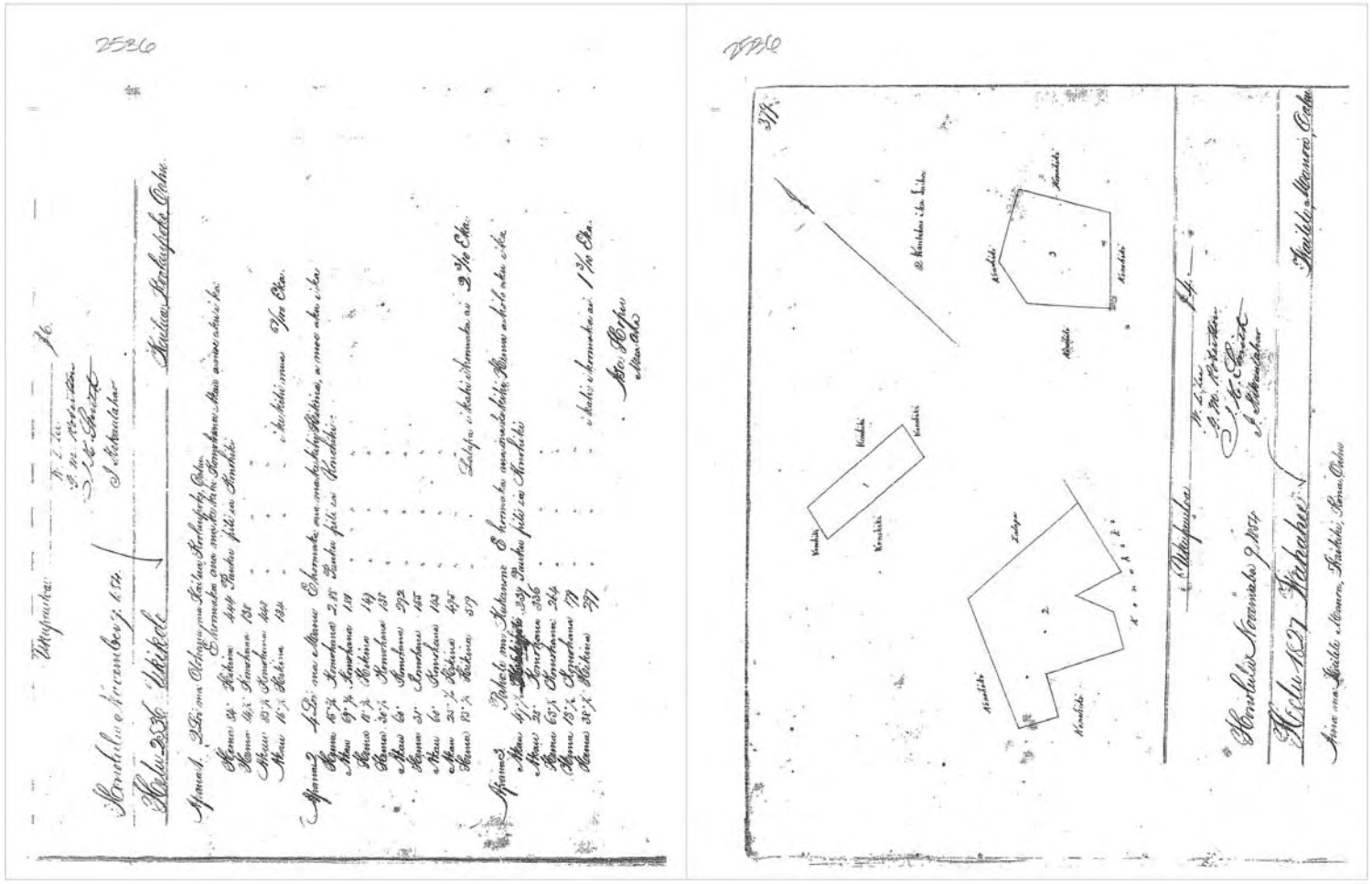
Maloko o keia mau Apana 4 19//100 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

No Ukikolo ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona wailhona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like al ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea`i, ua kau wau i ko`u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 17 o Sepatemaba 1855.

Na ka Moi [Signed] Kamehameha
V.K. Kaahumanu, pp Lot Kamehameha

[Royal Patent 2136, Ukikolo, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, 4.19 Eka, 1855]



<B>No. 2544, Lalapa, December 30, 1847
N.R. 548v3</B>

To the Land Commissioners, Greetings: I hereby state my claim for my mo`o at Mana in the `ili of Ukikolo in Kailua, and my house. I got it in the time of Kaiola. Some orange and lemon trees are at Hoauloa
LALAPA
Kailua, Koolau, Oahu.

<B>F.T. 203v14</B>
No. 2544, Lalapa, Claimant

Kekalei, sworn, say I know the land of Claimant in Kailua in the ili of Manu, and consists of 4 taro patches and a house lot.

No. 1 is bounded:
Mauka by the taro of Noulu
Kaneohe by waste land
Makai by land of Ukikolo
K. [Waimanalo] by a Creek.

No. 2 is bounded:
Mauka by Upland
Kaneohe by stone fence
Makai by a grove of hao trees
K. [Waimanalo] by Upland.

Claimant had his land from Makai in the time of Kaahumanu and had it in peace to the year 1848, when it was taken from them by the Konohiki, but without any good reason. It should be given to claimant.

Holo, sworn, says the above is true. Claimant has a small Orange & Lime grove in the ili of Hoaoloa, which was planted by himself.

[Award 2544; R.P. 2291; Kalaiopuu Kailua Koolaupoko; 1 ap.; 6.46 Acs; Manu Kailua Koolaupoko; 1 ap. 1.38 Acs]

<B>No. 2291, Lalapa, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 10 pps. 145-146</B> [kumupono Reel 5, 1370-1371.tif]

[Great Seal]

Helu 2291

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana olaio ko Lalapa, Kuleana Helu 2544, ma ke ano Kuleana Nui malalo o ke ano Alodio iloko o kahi i oleloia malalo a no ka mea,

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Lalapa

i kela wahi a pau loa ma Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

Apana 1. He moo kalo Kamahuo[?] Ili Manu
E hoomaka ma ke kihi Komohana Hema, a hele ana
Akau 38° Komohana 171 kaulahao ma Kapia
Akau 35° Hikina 663 kaulahao ma Kapia
Hema 85° Hikina 850 kaulahao ma Kapia Konohiki
Hema 8° Komohana 150 kaulahao ma ka Auwai
Akau 88° Komohana 750 kaulahao ma ko Konohiki
A hiki i ka hoomaka ana. He 1 38/100 Eka

Apana 2. He Kahua Hale me he kula ma[?] Hoaoloa [?] Ili o Olohana?, Pohakupu o Kaluaopuu.
E hoomaka ana Akau, e hele ana
Hema 52° Komohana 660 kaulahao ma ka pa o Kamehameha
Hema 50° Hikina 780 kaulahao ma kula o Olohana
Akau 59° Hikina 660 kaulahao ma ko Konohiki
Akau 56° Komohana 780 kaulahao ma kula o Pohakupu a hiki i ka hoomaka ana.
He 6 46/100 Eka

[Page 146]

[Note: 7.84 Acres]

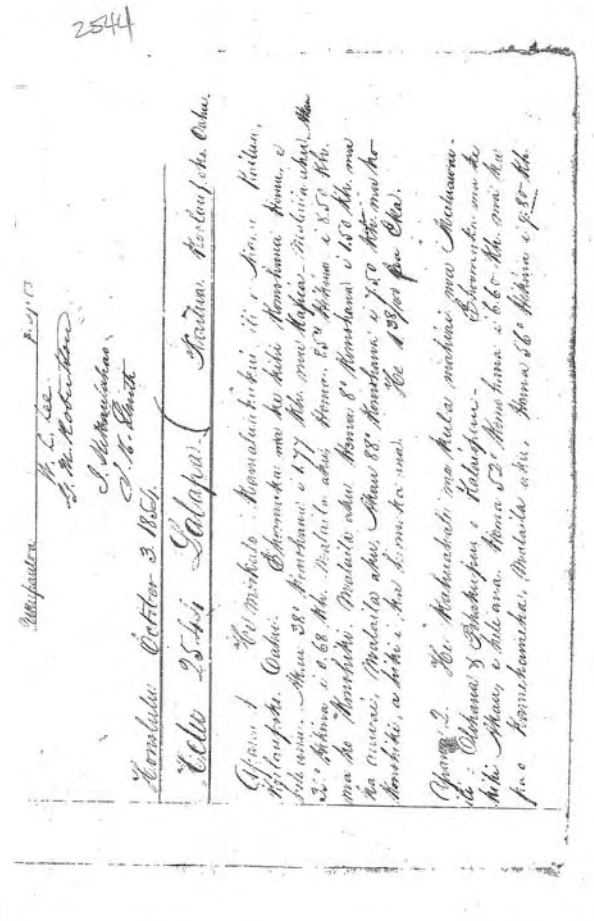
Maloko o keia mau Apana Ehiku 84/100 kaulahao huinaha Eka 2 kaulahao huinana 6 14/100 Eka a oi iki aku, a emi iki mai paha. Ua koe i ke aupuni na mine minerala a me na metela a pau.

No Lalapa ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea`i, ua kau wau i ko`u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 26th o Dekemaba 1855.

Kamehameha

[Royal Patent 2291, Lalapa, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, 2 apana, 2.61 Acres, 1855]



<B>No. 2575, Hekona, December 31, 1847
N.R.562v3</B>

To the Land Commissioners, Greetings: I hereby state my claim for an `ili, Manulele, and a kula which I got in the time of Kaleohano. I have one mala ipu [gourd garden] in the kula of Pohakupu. In the kula of Koahaleole I have 1 lo`i, in the `ili of Makaloa. The second of my `ili is Olohana, Kailua, Koolau, Oahu. The Konohiki is Kalama.
HEKONA

<B>F.T. 288v14</B>
Helu 2575, Hekona (Make), See 338 P

Kuna, Hoohikiia, Ua ike au i kona aina ma Kailua Ili o Manulele.

Apana 1. 10 Loi.
Apana 2. Kahuahale.

Apana 1 na palena:
Mauka, aina o ke Aupuni
Kaneohe, Kahawai
Makai, Ili o Kapia
K.[Waimanalo], kula.

Apana 2: Ua puni i ke Kula na aoao a pau.

Na Honaunau mai loaa ia`u i ka wa ia Liliha, aole keakeala. Ua make ka mea nona keia Kuleana i ka M. H. 1849 a oia hooili i kana Wahine ia Makakau.

Maile, Hoohikiia, Ua like no ko`u me Kuna i hai ae nei.

<B>F.T. 328v14</B>
No. 2575, Kekona, Claimant

Kuna, sworn, says I know the land of claimant. It is in the Ili of Manulele in Kailua as follows

No. 1. 10 taro patches.
No. 2. House Lot.

No. 1 is bounded:
Mauka by government land
Kaneohe by a Creek
Makai by the Ili of Kapia
K. [Waimanalo] by upland

No. 2 is bounded: On all sides by upland

Claimant had his land from Honaunau in the time of Liliha and held it in peace to the time of his death in the year 1849. His widow Kamakakau is his heir.

Maile, sworn, says the above is all true.

[Award 2575; R.P. 2318; Olohana Kailua Koolaupoko; 2 ap. ; 2.29 Acs]

No. 2318, Hekona, Manulele & Olohana Ili, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 10, pps. 253-254</B>

Helu 2318

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko <strike>Kahekona</strike> Hekona, Kuleana Helu 2575, ma ke ano Kuleana Nui malalo o ke ano Alodio iloko o kahi i oleloia malalo a no ka mea,

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Hekona

i kela wahi a pau loa ma Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

Apana 1. Aina Loi ma Manulele
E hoomaka ana ma ke kihi Akau e holo ana
Hema 42 3/4° Hikina 527 papuku ma ko Kanahino[?]
Hema 58 1/2°[?] Komohana 138 pauku ma ko Konohiki
Akau 41 3/4° Komohana 486 pauku ma ko Konohiki
Akau 45 1/2°[?] Hikina 139 pauku ma ko Konohiki
I ke kihi mua He 74/100 Eka

Apana 2. Pahale ma Olohana
E hoomaka ma ke kihi Hema e holo ana
Akau 26° Hikina 257 pauku ma ko Konohiki
Akau 64° Komohana 100 pauku ma ko Konohiki
Hema 26° Komohana 250 pauku ma ko Konohiki
Hema 64° Hikina 100 pauku ma ko Konohiki i ke kihi mua
He 25/100 Eka

<strike>Apana 3. Aina Loi ma Manulele
E hoomaka ma ke kihi Komohana, e holo ana
Hema 39 1/2° Hikina</strike>

[Page 254]

Apana 3. Aina Loi ma Manulele
E hoomaka ma ke kihi Komohana, e holo ana
Hema 39 1/2° Hikina 413 pauku ma ko Nanahine[?]
Akau 30 1/2° Hikina 473 pauku ma ko Konohiki
Akau 771/2° Komohana ma ko Konohiki
Hema 23 1/2° Komohana ma ko Konohiki
I ke kihi mua.
He 1 30/100 Eka

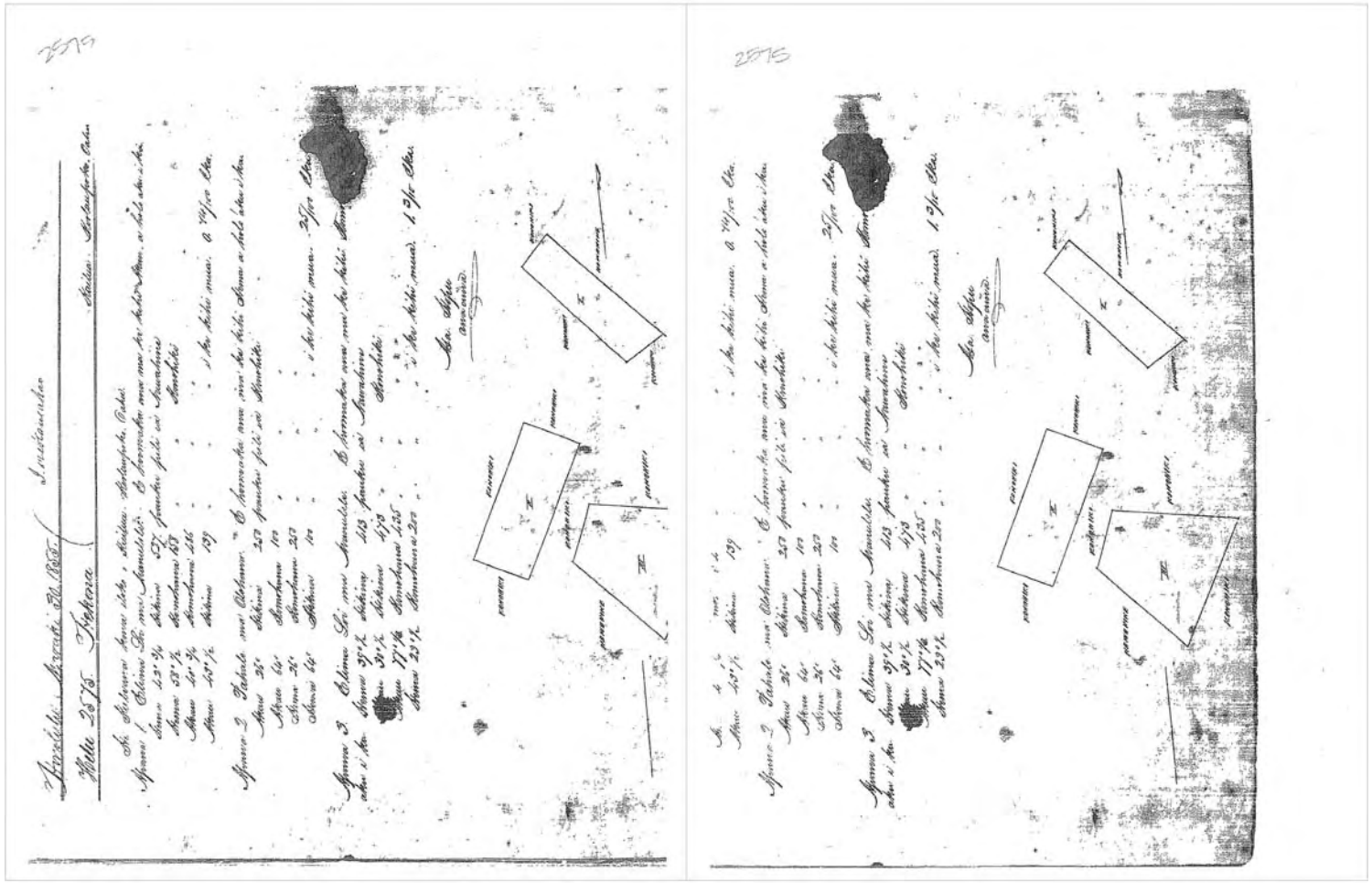
Maloko o keia mau Apana Elua 29/ /100 Eka a oi iki aku, a emi iki mai paha. Ua koe i ke aupuni na mine minerala a me na metela a pau.

No Hekona ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea`i, ua kau wau i ko`u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 28th o Decemaba 1855.

Kamehameha
Kaahumanu

[Royal Patent 2318, Hekona, Manulele & Olohana Ili, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, 3 apana, 2.29 Acres, 1855]



<B>No. 5825, Kaanaana
N.R. 150-151v5</B>

The Land Commissioners, Greetings: I hereby state my claim for land. I have one mo`o, some lo`i, four of them, and a kula. In the land of Nakolina is one lo`i. In the land of Kaiekea is a kula, a house lot. In the land of Kekuku is a house lot, in Kailua, Island of Oahu; I got them in the time of Kinau.
KAANAANA

<B>F.T. 283-284v14</B>
Helu 5825, Kaanaana, See 333 Page

Maile, hoohikiia: Ua ike au i kona Aina ma Kailua. Ili o Kaaihee.

Apana 1 - 4 Loi.
Apana 2 - 8 Loi.
Apana 3 - 1 Loi ma ka Ili o Pohakupu.
Apana 4 - Kahuahale.

Apana 1:
Mauka, Auwai
Koolauloa, Kahawai
Makai, Nahelehele
K.[Waimanalo], Kahawai.

Apana 2:
Mauka, Nahelehele
Koolauloa, Kula
Makai, na loi Eha
K. [Waimanalo], Kahawai.

Apana 3:
Mauka, loi o Koahaleole
Koolauloa loi o Kualua
Makai loi o Keulu
K. [Waimanalo], Pali.

Apana 4: Ua puni ke Kula na aoao a pau.

No Nakalina mai loaa ia`u i ka M. K. 1840. Ua lawe ia e 2 loi e Aimiki [Aimoku] Konohiki hou.

Kahiliopua, hoohikiia, Ua like no kou ike me Maile i hai ae nei.

<B>F.T. 333v14</B>
No. 5825, Kaanaana, Claimant, From Page 283

Maile, sworn says, I know this land in Kailua in the ili of Aihee, and is as follows

No. 1 - 4 Lois.
No. 2 - 8 Lois.
No. 3 - 1 Loi in Pohakupu.
No. 4 - House Lot.

No. 1 is bounded:
Mauka by a creek
Koolauloa by a creek
Makai by waste land
K. [Waimanalo] by a Creek.

No. 2 is bounded:
Mauka by waste land
Koolauloa by upland
Makai by Claimant's four taro patches
K. [Waimanalo] by creek.]

No. 3 is bounded:
Mauka by lois of Koahaleole
Koolauloa by lois of Kualua
Makai by lois of Keulu
K. [Waimanalo] by a Pali.

No. 4 is bounded: On all sides by Upland.

Claimant had his land from Nakalina in the year 1840 or about that time & has had it in peace to this time. A new Konohiki has taken to lois but without any good reason.

Kahiliopua, sworn says, the above is true.

[Award 5825; R.P. 2032; Kaaihee Kailua Koolaupoko; 1 ap.; 2.297 Acs]

No. 2032, Kaanaana, Kaaihee Iii, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 8, pps. 413-414 [kumupono Reel 5, 308-309.tif]

Helu 2032

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana olaio ko Kaanaana, Kuleana Helu 5895 [insert: 5825], ma ke ano Kuleana Nui malalo o ke ano Alodio iloko o kahi i oleloia malalo a no ka mea,

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha III, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Kaanaana

i kela wahi a pau loa ma Kaaihee, Kailua, Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

E hoomaka ma ke kihi Hema, e holo ana
Akau 74° Komohana 4.55 kualahao ma ka palena no Konohiki Malaila aku
Akau 28° Komohana 0.40 kaulahao
Hema 88° Komohana 3.30 kaulahao ma ka palena koele
Akau 10° Komohana 4.00 kaulahao ma kula o Konohiki
Akau 62° Hikina 0.60 kaulahao ma ko Kalawaiaku
Akau 14° Komohana 0.40 kaulahao
Akau 58° Hikina 0.80 kaulahao
Hema 36° Hikina 1.00 kaulahao ma ko Kalawaiaku
Hema 23° Hikina 1.70 kaulahao ma ko Konohiki
Hema 67° Hikina 7.30 kaulahao ma ko Konohiki
Hema 19° Komohana 1.50 kaulahao ma Kahawai
He 2 Eka 2 97/100 kaulahao

[Page 414]

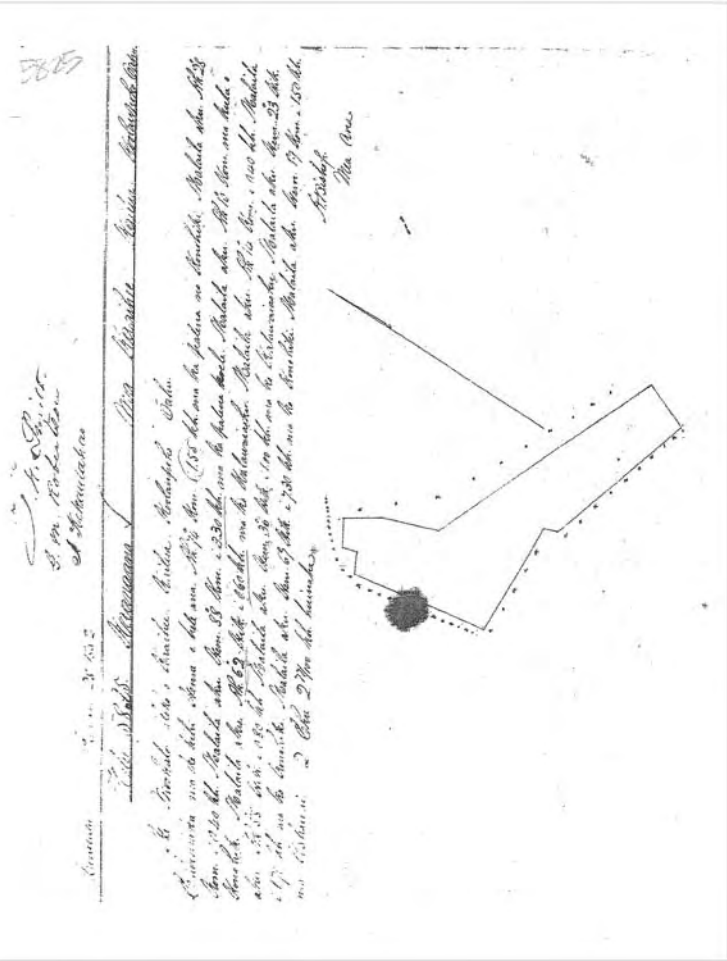
Maloko o keia mau [sic?] Apana 2 Eka 2 97/100 kaulahao huinaha a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

No Kaanaana ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea`i, ua kau wau i ko`u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 7 o Augate 1855.

Kamehameha
Victoria K. Kaahumanu

[Royal Patent 2032, Kaanaana, Kaaihee Iii, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, 2 Eka 2.97 kaulahao huinaha (2.297 Acs), 1855]



<B>No. 6153, Nanawahine
N.R. 248v5</B>

The Land Commissioners, Greetings: I hereby state my claim for land. I have two loʻi at Manulele in the land of Kekona. In the upland of Hekala is a mala of bananas in the land of Aahoaka. At Kawailoa is a mala of wauke, Kikoi is the Konohiki. At Kailua, Island of Oahu. I got these in the time of Kalola.
NANAWAHINE

<B>F.T. 296v14</B>
Helu 6153, Nawahine See 348 Page

Kuna, Hoohikila, Ua ike au i kona aina ona Kailua Ili o Manulele.

Apana 1 - 2 loi.
Apana 2 - 1 mala wauke i ke ili o Kawailoa.

Apana 1 na palena:
Mauka, Aina o Makakau
Koolauloa, Nahelehele
Makai, aina o Makakau
K.[Waimanalo], Kula.

Apana 2: Puni i ke Kula o Kawailoa na aoao a pau.

Na Kekona mai i ka wa ia Liliha aole Keakeaia.

<B>F.T. 348v14</B>
No. 6153, Nanawahine, Claimant, From page 295

Kuna, sworn says, I know the land of claimant in Kailua in Manulele as follows:

No. 1 - 2 lois.
No. 2 - a kapa field.

No. 1 is bounded:
Mauka by the land of Makakau
Koolauloa by Waste land
Makai by Land of Makakau
K.[Waimanalo] by Upland.

No. 2 is bounded: On all sides by the Upland of Kawaaloa.

Claimant had his land from Kekona in the time Liliha and has had it in peace to this time.

[Award 6153; no R.P. Manulele Kailua Kooluapoko; 1 ap.; .22 Ac.]

<B>No. 6162, Punipeli, [Punipeki]
N.R. 251v5</B>

The Land Commissioners, Respectful Greetings: I hereby state my claim for my twelve loʻi at Olohana; the Konohiki is Kumaikona. A small kula is at Pohakupu; the Konohiki is Kaluainanea. Kailua, Island of Oahu. I got these in the year 1846.
PUNIPELI

<B>N.T. 210v14</B>
No. 6162, Punipeki, Claimant

Miomioi, sworn, I know this land, It is in Kailua in the ili of Olohana and consists of 2 taro patches.

No. 1 is bounded:
Mauka by the land of Kinikahiko
Koolauloa by taro patch of Konohiki
Makai by Waste land
K.[Waimanalo] by the taro land of Ukikolo.

Claimant had his land from the Konohiki Kekona about the year 1846 and has had it in peace to this time.

[Award 6162; R.P. 2135; Olohana Kailua Koolaupoko; 1 ap.; .47 Ac.]

<B>No. 2135, Punipeki, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 9, pps. 201-202</B> [kumupono Reel 5, 729-730.tif]

[Great Seal]

Helu 2135

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko Punipeki, Kuleana Helu 6162, ma ke ano Kuleana Nui malalo o ke ano Alodio iloko o kahi i oleloia malalo a no ka mea,

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio la Punipeki

i kela wahi a pau loa ma Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

E hoomaka ana ma ke kihi Komohana Hema a mai aku
Hema 83 1/2 Hikina 330 pauku Konohiki
Akau 15 Hikina 142 [?] pauku Konohiki
Akau 84 Komohana 331 pauku Konohiki
Hema 15 Komohana 141 pauku Konohiki
I ke kihi mua.
47/100 Eka

[page 202]

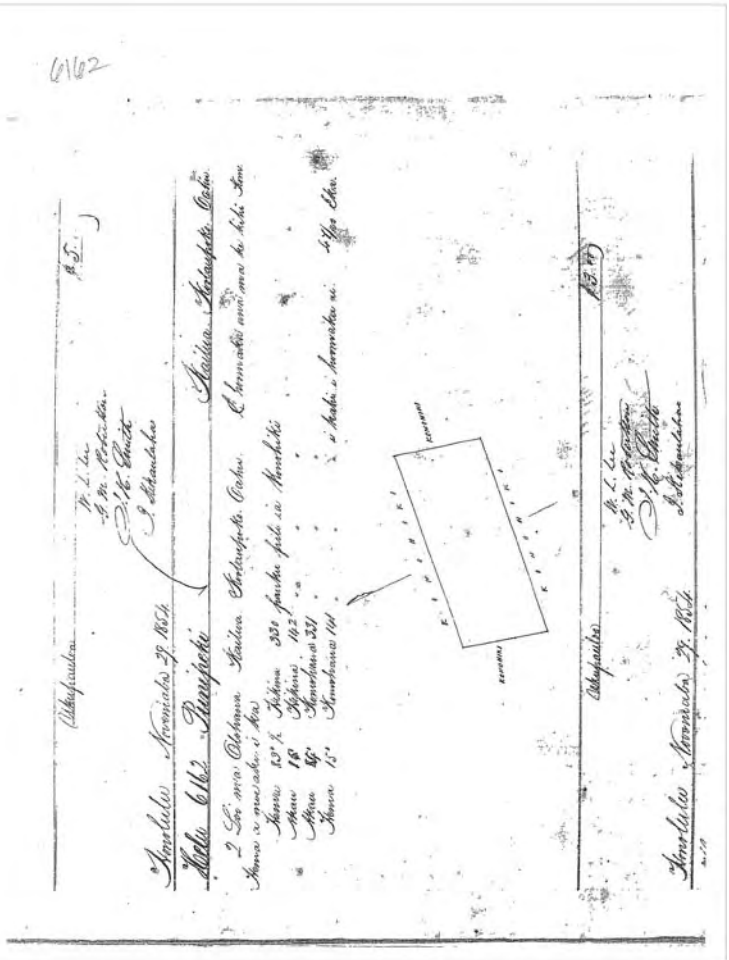
Maloko o keia Apana 47/100 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

No Punipeki ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea`i, ua kau wau i ko`u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 17 o Sepatemaba 1855.

Na ka Moi [Signed] Kamehameha
V.K. Kaahumanu, pp Lot Kamehameha

[Royal Patent 2135, Punipeki, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, .47 Ac., 1855]



<B>No. 6969, Kuahine, Kailua, Island of Oahu, December 30, 1847
N.R. 408v5</B>

To the Land Commissioners, Greetings: Here is my claim for land in the ʻIlí of Kawailoa, consisting of twenty three loʻi, a kula and a house. It got it from Kikoi. Four loʻi were from Ukikolo. I got them in 1846.
KUWAHINE X, his mark

<B>F.T. 241v14</B>
No. 6969, Kuwahine, Claimant

Kailihao, sworn says, I know the land of Claimant. It is in the Ahupuaa of Kailua in the ili of Kawailoa, and consists of 30 taro patches and house lot. Claimant has 5 taro patches in the ili of Manu.

No. 1 is bounded:
Mauka by the taro land of Peni
Koolauloa by Upland
Makai by Upland.
K.[Waimanalo] by Upland.

No. 2 is bounded:
Mauka by the taro land of Lalapa
Koolauloa by ili Kapia
Makai by Olohana
K.[Waimaanlo] by Creek.

Claimant had his land in Kawailoa from Kikoi, the Konohiki and that in the ili of Manu from Ukikolo the Konohiki about the year 1845 or 1845 and has had the land in Kawailoa undisturbed to this time.

[Award 6969; R.P. 3063; Kawailoa Kailua Koolaupoko; 1 ap.; 1.52 Acs; Manu Kailua Koolaupoko; 1 ap.; 1.3 Acs]

No. 3063, Kuahine, Kawailoa & Manu Ili, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 13, pps. 609-610

Helu 3063

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko Kuahine, Kuleana Helu 6969, ma ke ano Alodio iloko o kahi i oleloia malalo.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Kuahine

i kela wahi a pau loa ma Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

Apana 1. Loi & Kahua Hale ma Kawailoa
E hoomaka ma ke kihi Komohana Hema, e holo ana
Hema 16° Hikina 100 pauku pili ia Konohiki
Hema 74° Hikina 250 pauku pili ia Konohiki
Akau 16° Hikina 196 pauku pili ia Konohiki
Akau 81 1/4° Hikina 299 pauku pili ia Konohiki
Hema 1 1/4° Hikina 104 pauku pili ia Konohiki
Hema 84° Hikina 059 [659?] pauku pili ia Konohiki
Hema 14° Komohana 322 pauku pili ia Konohiki
Akau 76° Komohana 373 pauku pili ia Konohiki
Akau 74° Komohana 250 pauku pili ia Konohiki
I ke kihi i hoomakai. 1 52/100 Eka huinaha.

Apana 2. 5 Loi ma Manu
E hoomaka ana ma ke kihi Komohana Hema a moe aku i ka
Hema 81° Hikina 8.07 pauku pili me Lalapa
Akau 10 1/2° Hikina 1.86 pauku pili me Konohiki
Akau 84° Komohana 8.24 pauku pili me Konohiki
Hema 71 1/2° Komohana 1.42 pauku pili me Konohiki
i ke kihi mua.
1 3/10 Eka huinaha

[Page 610]

Maloko o keia mau Apana 2.82 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

No Kuahine ua aina la i haawiia ma ke Ano Alodio a no kona mau hoolilna, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea ai, ua kau wau i koʻu inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 4th o Augate 1856.

Kamehameha
[V.K.] Kaahumanu

[Royal Patent 3063, Kuahine, Kawailoa & Manu Ili, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, 2 apana, 2.82 Acres, 1856]

<B>No. 3063, Kuahine, Kawailoa & Manu Ili, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, Volume 13, pps. 609-610</B> [kumupono Reel 7, 759-760.tif]

Helu 3063

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko Kuahine, Kuleana Helu 6969, ma ke ano Alodio iloko o kahi i oleloia malalo.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii Nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la, nona iho a no kona mau hope Alii ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Kuahine

i kela wahi a pau loa ma Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

Apana 1. Loi & Kahua Hale ma Kawailoa
E hoomaka ma ke kihi Komohana Hema, e holo ana
Hema 16° Hikina 100 pauku pili ia Konohiki
Hema 74° Hikina 250 pauku pili ia Konohiki
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Akau 81 1/4° Hikina 299 pauku pili ia Konohiki
Hema 1 1/4° Hikina 104 pauku pili ia Konohiki
Hema 84° Hikina 059 [659?] pauku pili ia Konohiki
Hema 14° Komohana 322 pauku pili ia Konohiki
Akau 76° Komohana 373 pauku pili ia Konohiki
Akau 74° Komohana 250 pauku pili ia Konohiki
I ke kihi i hoomakai. 1 52/100 Eka huinaha.

Apana 2. 5 Loi ma Manu
E hoomaka ana ma ke kihi Komohana Hema a moe aku i ka
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Akau 84° Komohana 8.24 pauku pili me Konohiki
Hema 71 1/2° Komohana 1.42 pauku pili me Konohiki
i ke kihi mua.
1 3/10 Eka huinaha

[Page 610]

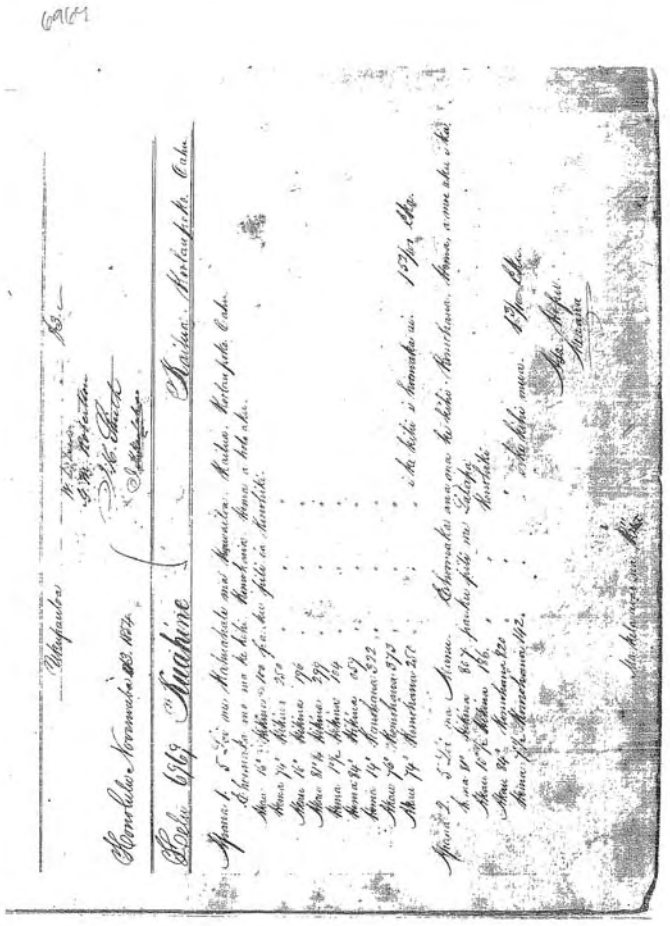
Maloko o keia mau Apana 2.82 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

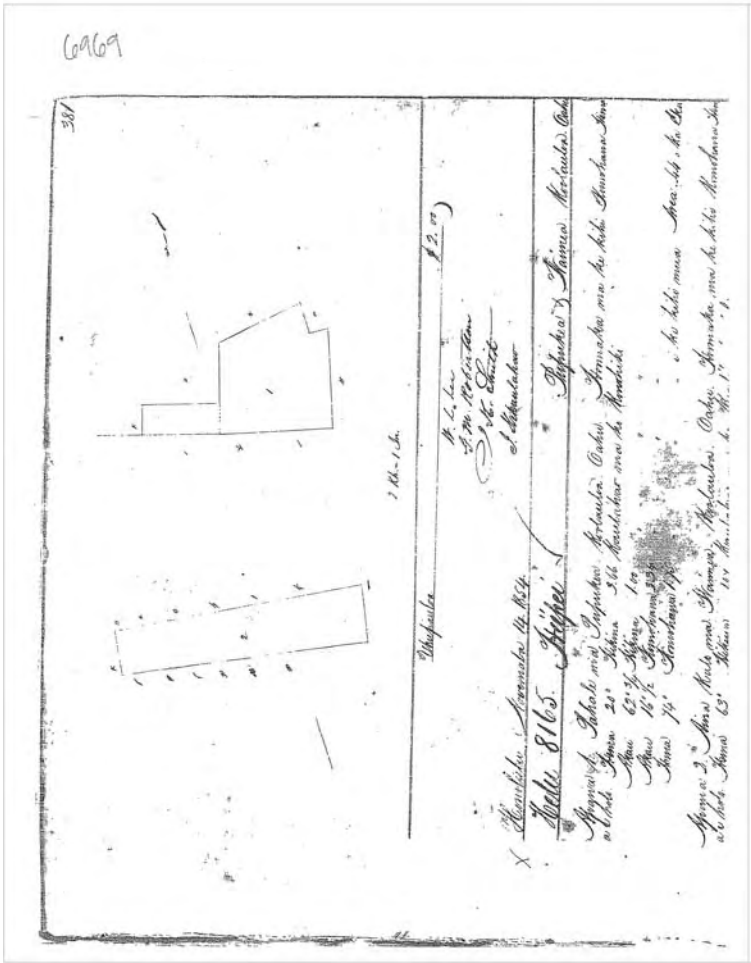
No Kuahine ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona waihona, ua pili nae ka auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A i mea e ikea ai, ua kau wau i koʻu inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 4th o Augate 1856.

Kamehameha
[V.K.] Kaahumanu

[Royal Patent 3063, Kuahine, Kawailoa & Manu Ili, Kailua Ahupuaa, District of Koolaupoko, Island of Oahu, 2 apana, 2.82 Acres, 1856]





<B>No. 7113, Keaka
N.R. 279v5</B>

Keaka's share. One half Manu `ili in kailua, Koolaupoko, Oahu. That is my one-half right from the Mo`i. That is my statement to you, the Land Commissioners. My residence is at Kapamoo.
KEAKA X, his mark
Honolulu, 10 February 1848

<B>N.T. 235v10</B>
No. 7113, Keaka

Keaka's one half property in the Mahele Registry.
1/2 Manu ili for Kailua, Koolaupoko, Oahu.
TRUE COPY
Interior Department, 11 June 1853
A.G. Thruston, Clerk

[Award 7113; R.P. 1652; Manu Kailua Koolaupoko; 2 ap.; 13.54 Acs]

No. 1652, Keaka, Heirs of, Manu Ili, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, Volume 5, pps. 215-216 [kumupono Reel 4, 221-222.tif]

Helu 1652

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko Keaka no na Hooilina, Kuleana Helu 7113 ma ke ano Kuleana Nui o ke ano Alodio. iloko o kahi i oleloia malalo a no ka mea ua hookaa main a hooilina iloko o ka Waihona Dala Aupuni i kanaholuhumamahiki dala no ko ke Aupuni la kana iloko o ia aina.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha IV, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la nona iho, a no kona mau hope alii, ua hoolilo, a na haawi aku oia ma ke ano Alodio ia na Hooilina o Keaka

i kela wahi a pau loa ma Manu Kailua Koolaupoko, ma ka mokupuni o Oahu, penei na mokuna.

Apana 1. Aina Wai.
E hoomaka ma ke kihi Hema, a e holo
Akau 63° Komohana 7.00 kaulahao ma Kaaihee, alaila
Akau 28° Komohana 1.20 kaulahao
Akau 39° Hikina 1.80 kaulahao
Akau 31° Komohana 4.00 kaulahao ma Kapia,
Akau 52° Hikina 0.80 kaulahao
Akau 6 1/2° Hikina 1.50 kaulahao, alaila
Hema 37 1/2° Hikina 8.20 kaulahao ma Olohana
Hema 6° Komohana 11.60 kaulahao ma kahawai i ke kihi mua.
8.25 Eka

Apana 2. Aina Kula
E hoomaka ma ke kihi Akau a e hele
Hema 21 1/2° Komohana 9.00 kaulahao ma ke Ahupuaa
Hema 62 1/2° Hikina 6.66 kaulahao a
Hema 35 1/2° Hikina 2.67 kaulahao ma Kaaihee
Akau 62 1/2° Hikina 2.00 kaulahao ma Manulele
Akau 14° Komohana 1.55 kaulahao;
Akau 14 1/2° Komohana 10.00 kaulahao ma ke Ahupuaa
Akau 23 1/2° Komohana 4.36 kaulahao a hiki i ke kihi mua.
5.29 Eka

Koe ke Kuleana o na Kanaka

[Page 416]

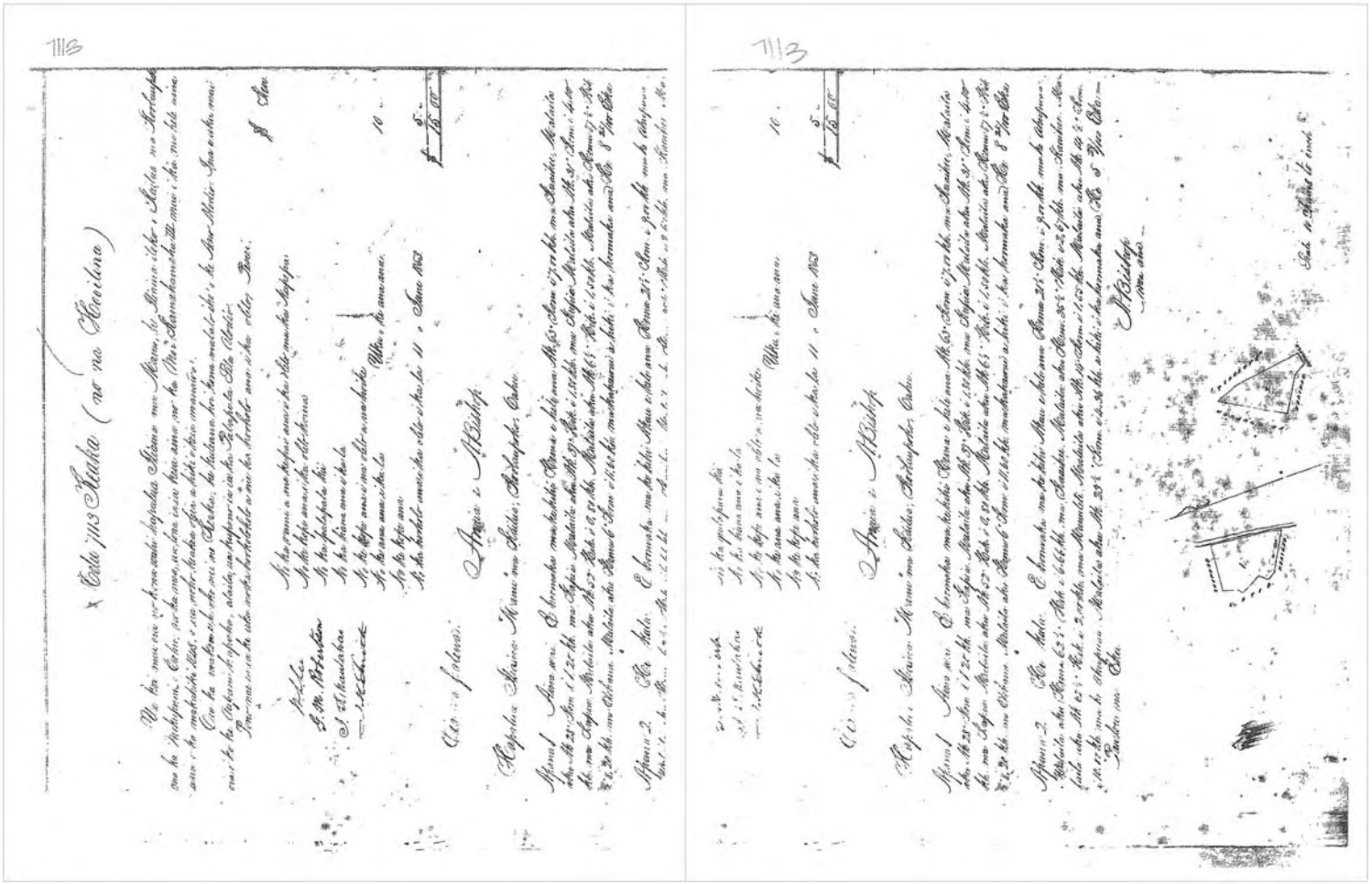
Maloko o ia mau Apana 13.54 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

Na Hooilina o Keaka ua aina la i haawiia ma ke Ano Alodio nona iho, a no kona poe hooilina, a me kona waihona he poe kanaka Hawaii lakou, mau loa aku, ua pili nae ka auhau a ka Poe ahuolelo e kau like ai ma na aina aiodio i kela manawa keia manawa.

A i mea e ikeaʻi, ua kau wau i koʻu inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 17 o Aperila, 1854

Inoa, Kamehameha
Inoa, Keoni Ana

[Royal Patent 1652, Keaka, Heirs of, Manu Ili, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, 2 apana, 13.54 Acres, 1854]



<B>No. 9539, Kaikihoio, February 11, 1848
N.R. 475v4</B>

I have a little claim, which was from the konohiki /at/ Palawai, Kailua, Koolaupoko, Island of Oahu.
KAIKIHOIO

<B>F.T. 203v14</B>
No. 9539, Kaikihoio, Claimant

Kekalei, sworn say, I know the land of Claimant in Kailua, in the ili of Palawai and consists of a Mooaina called Kaiilahiki.

Claimant land is bounded:
Mauka by a hill called Auelepu
K [Koolauloa] by Creek
Mauka by the land of Kohale
K.[Waimanalo] by Poalima taro patch.

Claimant had his land from Kahele the konohiki of Kailua about the year 1842 and has had it in peace to the time of his death in the year 1848. Ohole is his heir, his wife, who now comes for the claim of her deceased husband.

Kahuna swears to the truth of the above testimony.

<B>N.T. 159v10</B>
No. 9539, Kaikihoio, 23 April 1852, Vs. C. Kanaina

G.M. Robertson (land officer) to C. Kanaina - Why have you resisted Kaikihoio's claim?

C.Kanaina - The same reason as given for the others. Kaikihoio has all of the patches, 16 of them and I have none.

G.M.Robertson to Kaikihoio - How many patches have you?

Kaikihoio. - Sixteen, and all of them have been cultivated with the exception of one patch with weeds, which has been done partially. There is no Friday patch in all of these patches. Kealohanui, Napuawa and Kalakoa have all related in the same way, "there is Friday patch, they are only for the tenants."

Decision: Kaikiholo's claim is correct, the konohiki's objection is in error. C. Kanaina comments, I have not approved this claim, my denial shall be recorded (in the book).

[Award 9539; R.P. 1371; Palawai Kailua Koolaupoko; 2 ap.; 4.36 Acs]

<B>No. 1371, Kaikiholo Palawai Ili, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, Volume 5, pps. 313-314</B>

Helu 1371

Palapala Sila Nui, A Ke Alii, Mamuli o ka Olelo a Ka Poe Hoona Kuleana

No ka mea, ua hooholo na Luna Hoonai na kumu kuleana aina i ka olelo, he kuleana oiaio ko Kaikiholo, Kuleana Helu 9539 ma ke ano Kuleana Nui o ke ano Alodio. Iloko o kahi i olelola malalo.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha III, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la nona iho, a no kona mau hope alii, ua hoolilo, a na haawi aku oia ma ke Ano Alodio ia Kaikiholo,

i kela wahi a pau loa ma [Palawai Kailua? illegible], ma ka mokupuni o Oahu, penei na mokuna.

Apana 1. Mooaina [illegible]
2.65[?] Eka

Apana 2. Moo kalo***
E hoomaka make ke kihi Hikina[?]
[illegible]
1.71 Eka

Koe ke Kuleana o na Kanaka

[Page 416]

Maloko o ia mau Apana 4.36 Eka a oi iki aku, a emi iki mai paha. Ua koe nae i ke Aupuni na mine minerala a me na metala a pau.

Na Kaikiholo ua aina la i haawiia ma ke Ano Alodio nona iho, a no kona poe hooilina, a me kona waihona he poe kanaka Hawaii lakou, mau loa aku, ua pili nae ka auhau a ka Poe ahauolelo e kau like ai ma na aina alodio i kela manawa keia manawa.

A i mea e ikea'i, ua kau wau i koʻu inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 13 o Julai, 1852

Inoa, Kamehameha
Inoa, Keoni Ana

[Royal Patent Kaikiholo Palawai Ili, Kailua Ahupuaa, Koolaupoko District, Island of Oahu, 2 apana, 4.36 Acres, 1852]

Appendix C

Fish and Wildlife Coordination Act (FWCA) Section 2(b) Report

FINAL

REVISED FISH AND WILDLIFE COORDINATION ACT REPORT
for the
KAWAINUI MARSH ECOSYSTEM RESTORATION PROJECT

Prepared for
U.S. Army Corps of Engineers
Honolulu Engineer District
Fort Shafter, Hawaii

By the
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

December 2008

FINAL

REVISED FISH AND WILDLIFE COORDINATION ACT REPORT

for the

KAWAINUI MARSH ECOSYSTEM RESTORATION PROJECT

By
Gordon Smith
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Honolulu, Hawaii

Prepared for
U.S. Army Corps of Engineers
Honolulu Engineer District
Fort Shafter, Hawaii

December 2008

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INTRODUCTION

Authority, Purpose and Scope

This is the U.S. Fish and Wildlife Service's (Service) final revised report on the proposed Kawainui Marsh Environmental Restoration Project developed by the U.S. Army Corps of Engineers (Corps), in cooperation with the State of Hawaii, Department of Land and Natural Resources (DLNR) to create habitat for native endangered waterbirds, migratory waterfowl, and shorebirds at a site adjacent to Kawainui Marsh on the island of Oahu. This report has been prepared under the authority of section 2(b) of the Fish and Wildlife Coordination Act of 1934 [16 U.S.C. 661 *et seq.*; 48 Stat. 401], as amended (FWCA), and other authorities mandating U.S. Department of the Interior (DOI) concern for environmental values. This report is also consistent with the National Environmental Policy Act of 1969 [42 U.S.C 4321 *et seq.*; 83 Stat. 852], as amended (NEPA). The purpose of this report is to document the existing fish and wildlife resources at the proposed project site and to ensure that fish and wildlife conservation goals are adequately considered as required under the FWCA. This report includes an evaluation of potential impacts associated with the currently proposed project design alternatives and recommendations to achieve the fish and wildlife conservation goals targeted by the project.

The proposed Kawainui Marsh Environmental Restoration Project was authorized under section 1135 of the Water Resources Development Act of 1986, as amended (WRDA). In the WRDA, the Secretary of the Army is authorized to review the operations of water resources projects to determine the need for modifications in the structures and operations of such projects for the purpose of improving the quality of the environment in the public interest. Modifications of a Corps project under section 1135 must be both feasible and consistent with the originally authorized project purposes. For the modifications, the non-federal sponsor must provide all required lands, easements, rights-of-way, and borrow and excavated material disposal areas, which are not otherwise available due to construction of the original project. An initial appraisal report for Kawainui Marsh restoration was approved in October 1994. Funds in the amount of $270,000 were approved for preparation of a Project Modification Report on the feasibility and potential for modifications to the Federal Flood Control Project that was completed at Kawainui Marsh in August 1966.

Kawainui Marsh is the largest remaining lowland emergent wetland in the State of Hawaii, and has been identified as an integral part of the Service's *Hawaiian Waterbird Recovery Plan* (U.S. Fish and Wildlife Service 2005). The purpose of the proposed project is to construct artificial pond habitat that will be managed to benefit waterbirds, including Hawaii's four endangered waterbirds. Feasibility planning for this project identified several potential methods of habitat modification and pond construction in and around Kawainui Marsh to achieve the goal to improve or create habitat for waterbirds. Some of the methods that were examined include: construction of a water level control structure at the marsh outlet to the sea; mechanical control of vegetation to create open water areas; creation of managed waterbird habitat ponds in the marsh itself and in uplands adjacent to the marsh through excavation; predator control fencing trapping; and vegetation management.

Coordination with Federal and State Resource Agencies

Service biologists have discussed the proposed project with staff from the DLNR Division of Forestry and Wildlife (DOFAW) and the DLNR Division of Aquatic Resources (DAR). Concerns expressed by DLNR biologists relative to the protection, conservation, and opportunity for enhancement of fish and wildlife resources at Kawainui Marsh are incorporated into this FWCA report. Copies of this report are being provided to the U.S. Environmental Protection Agency (EPA), the National Marine Fisheries Service (NMFS), DAR, DOFAW, and the State of Hawaii Department of Health (DOH) and Coastal Zone Management (CZM) offices.

Prior Fish and Wildlife Service Correspondence, Site Visits, and Reports

May 15 1996 – Transmittal of a Planning Aid Letter to the Corps describing Service fish and wildlife resource concerns, restoration goals, and restoration opportunities for Kawainui Marsh.

July 1997 – Transmittal to the Corps of the *Final Kawainui Marsh Environmental Restoration Project FWCA 2(b) Report* describing anticipated project impacts to Kawainui Marsh stream and wetland water quality, and requesting written confirmation by DLNR of a State commitment and capacity to provide long-term maintenance of the project infrastructure, including pumps, and control of invasive vegetation and predators. The report included a summary of relevant Service correspondences, site visits, and reports, which occurred prior to July 1997.

April 8, 2008 – Site visit to the project area by Service biologists and Corps representatives to discuss a revised modification to project pond configuration.

August 11, 2008 – Transmittal to the Corps of the *Draft Revised Kawainui Marsh Environmental Restoration Project FWCA 2(b) Report* describing existing biological resources in the marsh and anticipated project-related impacts to Kawainui Marsh under revised project configurations.

DESCRIPTION OF THE PROJECT AREA

The proposed project area is on the island of Oahu in the State of Hawaii. Oahu is the third largest of the Hawaiian Islands, with a total area of 607.7 square miles. Kawainui Marsh encompasses 1,000 acres and is the largest remaining low-elevation wetland in the Hawaiian Islands (Service 2005). It is located on the windward side of Oahu between the Koolau Mountains and Kailua Bay. Kawainui Marsh was once a marine embayment open to the sea until about 2,800 years ago when the Kailua sand barrier first began to form. Geologically, Kawainui Marsh marks the approximate center of the caldera complex of the great Koolau shield volcano that formed east Oahu (University of Hawaii 1983).

Early records of Polynesian activity in and around Kawainui Marsh indicate that it was once a large inland fishpond joined by a stream to nearby Kaelepulu Pond. Oral histories describe the

ponds as being well-maintained and that numerous fish were raised for Hawaiian chiefs. Surrounding lands were used primarily for taro cultivation. By the mid-1860s, many of the Hawaiian taro *lo`i* (flooded fields) in Kailua were being used to grow rice. Rice production declined in the 1920s and the former rice fields were converted to pasture land for grazing cattle. A ditch and tunnel system constructed in 1878 and later expanded in the 1920s, transported water from the upper reaches of Maunawili Stream to sugarcane fields at the Waimanalo Sugar Plantation (Kelly and Nakamura 1981).

As the area around Kawainui Marsh was converted to residential and commercial use, residents around the marsh recognized the importance of the marsh in providing a natural storage area for flood waters. Severe floods occurred occasionally, and floodwater overflow from the marsh caused serious damage. In the 1940s, the Corps initiated plans to construct an alternative channel to provide an outlet for flood waters from the Kawainui area. Construction of the original Kawainui Marsh Flood Control Project was authorized by the Flood Control Act of 1950 and was completed in August 1966. Original project features included construction of Oneawa Canal, a channel (9,470 feet [ft] long) that traversed the sand and limestone berm where the residential community of Coconut Grove is located; an earthen levee (6,850 ft long) with a maximum crest elevation of 9.5 ft; a stub groin (50 ft long) and revetment (50 ft long) at the outlet of Oneawa Canal; and a silt retention basin (370 ft long and 10 ft deep) (Corps 1997).

In the years since completion of the Corps' original flood control project, abundant growth of invasive vegetation has formed a very thick layer of peat (partially decomposed plant matter that is saturated with anoxic water) within the central basin of the marsh. This vegetation mat has filled in all but a tiny fraction of the original Kawainui Marsh. The formation of this peat layer has reduced the marsh flood storage capacity and virtually eliminated open-water and shallow-water habitat favored by endangered Hawaiian waterbirds. On January 1, 1988, severe flooding of the Coconut Grove community occurred when the water level in the marsh exceeded the crest of the original levee.

As a result of the 1988 flood, the Corps and the City and County of Honolulu modified the Kawainui Flood Control Project to include a concrete flood wall that raised the average elevation of the original levee by 4.5 ft. The total structure is about 6,300 ft long, with the height of the flood wall varying from 8.5 ft at Kailua Road on the south to a gradual tapering into the existing levee at the Oneawa Canal outlet on the north end (Corps 1997).

A short distance upstream from the point where Oneawa Canal exits the marsh at the end of the flood-control levee, a series of small islets were constructed as mitigation for wetland fill when the levee structure was enlarged. These islets are made of material dredged from the channel (mostly coral rubble). Unfortunately, the design of the islets did not result in making them viable wetland habitat for waterbirds. Changes in water surface elevation due to tides, marsh water volume, and the soil characteristics of the islands themselves have combined to create nearly vertical islet shorelines, and the flat surface at an elevation above the reach of the tide simply promotes the islets being covered with non-aquatic vegetation. These features make the islets unattractive to wetland birds.

Most of the marsh is designated by the State Land Use Conservation District as P-l protective subzone and zoned by the City and County of Honolulu as Preservation. Today, the primary beneficial use associated with the marsh is flood storage. However, the DLNR published a report entitled *Kawai Nui Marsh Master Plan* that identified other potential benefits of the marsh (DLNR 1994). The master plan outlined the State's long-term plan to enhance not only the flood storage potential of the marsh but also recreation, aesthetics, historical features, natural wetland functions, and other benefits that could be derived from the marsh.

On February 2, 2005, the Hamakua and Kawainui Marsh complex was designated as a Ramsar Wetland of International Importance (Ramsar site number 1460). The Ramsar Convention of 1971 is an international treaty organization that supports conservation and sustainable use of wetlands. Designation of the Hamakua and Kawainui Marsh complex as a Ramsar site represents international recognition of the unique biological and cultural importance of the site. In the future, the Ramsar designation may lead to additional support for wetland restoration and management in the form of small grants and international technical assistance.

FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

The Service's primary concern with the proposed project is the potential for indirect adverse impacts to endangered and other significant fish and wildlife species and their habitats that may result from implementation of the project. Specific Service planning objectives are to enhance the existing significant habitat values at the proposed project site by (1) obtaining basic biological data for the site, (2) evaluating and analyzing the potential benefits to fish and wildlife resources of the proposed project alternatives under consideration, (3) identifying the proposed project alternative most beneficial to fish and wildlife resources, and (4) recommending conservation measures to avoid and minimize potential direct and indirect project-related impacts.

Under the authority of the Endangered Species Act (ESA), the U.S. Department of the Interior and the Department of Commerce share responsibility for the conservation, protection, and recovery of federally listed endangered and threatened species. Section 7(a)(2) of the ESA requires federal agencies, in consultation with and with the assistance of the Service or NMFS, to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of any designated critical habitat. If listed species may be affected, then a Biological Opinion is issued to state the position of the Service or NMFS as to whether the Federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat.

The Service's Mitigation Policy (Service 1981) outlines internal guidance for evaluating project impacts affecting fish and wildlife resources. The Mitigation Policy complements the Service's responsibilities under NEPA and FWCA. The Service's Mitigation Policy was formulated with the intent of protecting and conserving the most important fish and wildlife resources while facilitating balanced development of this nation's natural resources. The policy focuses primarily

on habitat values and identifies four resource categories and mitigation guidelines. The resource categories are:

a. Resource Category 1: Habitat to be impacted is of high value for the evaluation species and is unique and irreplaceable on a national or eco-regional basis;

b. Resource Category 2: Habitat to be impacted is of high value for the evaluation species and is relatively scarce or becoming scarce on a national or eco-regional basis;

c. Resource Category 3: Habitat to be impacted is of high to medium value for the evaluation species and is relatively abundant on a national basis; and

d. Resource Category 4: Habitat to be impacted is of medium to low value for the evaluation species.

Migratory waterfowl and shorebirds were selected as evaluation species for wetland habitats that may be affected by the proposed project. These species are also protected under the Migratory Bird Treaty Act and Executive Order 13186.

The emergent wetlands of Kawainui Marsh provide high-value habitat for the evaluation species. These habitats are relatively scarce in Hawaii. Because the goal of the proposed project is to create habitat adjacent to Kawainui Marsh, the Service does not anticipate any long-term loss of in-kind habitat values. However, there may be short-term indirect unavoidable impacts from the proposed project. The Service will provide comments on ways to avoid or minimize these impacts.

EVALUATION METHODOLOGY

Service biologists made numerous site visits to the marsh in years prior to 1996 with Corps and DLNR staff. Because the alternatives under consideration were revised in 2008, an additional site visit was completed in April 2008. Site visits were used to help evaluate the alternative project footprints and management requirements with respect to marsh topography and hydrology. As a result of early (pre-1996) site visits, a preliminary plan was developed to provide open water and mudflat areas intended to benefit endangered Hawaiian waterbirds as well as the migratory waterfowl and shorebirds that utilize open-water habitat (Figure 1). Based on these early planning efforts, the Service provided a FWCA Planning Aid Letter to the Corps, outlining information for consideration in the engineering and design of the proposed project. Once the preliminary plan was completed, the Corps began its cost and benefit evaluation and consultation with State Historical Preservation Office (SHPO). Based on the cost/benefit evaluation and recommendation from SHPO to avoid impacting the old taro lo`i walls, the proposed project footprint was significantly modified.

In April 1997, the Service received a draft copy of the *Kawainui Marsh Environmental Restoration Project Draft Project Modification Report & Environmental Assessment* (Kawainui ERR-DEA) for review and comment. After completing an initial review, Service biologists met

with the Corps in June 1997, to further review project design maps and related information, including aerial and infra-red photographs of the project area, and to set up site visits. Following these meetings, two days of site inspections were conducted by Service biologists in conjunction with staff from the Corps, the Kawainui Heritage Foundation, SHPO, and the University of Hawaii Windward Community College. The purpose of these site visits was to identify potential adverse impacts from the construction and implementation of the proposed restoration project. In addition, a public hearing on the Kawainui Restoration Project was convened by the Corps and attended by a representative from the Service. Other organizations represented at the public hearing were the Corps, DOFAW, the Kawainui Heritage Foundation, and members of the public. The Corps distributed the final *Kawainui Marsh Environmental Restoration Project Draft Project Modification Report & Environmental Assessment* (Kawainui ERR-FEA) in July 1998. Upon further review and reanalysis, the Corps finalized a revised report *Kawainui Marsh Environmental Restoration Project Draft Project Modification Report & Environmental Assessment* (Kawainui ERR-FEA 2000 Reissue) in March 2000.

In November 2007, the Corps transmitted a letter to the Service describing a delay in project implementation due to the protracted process of land ownership transfer from the City and County of Honolulu to the State, which is a pre-requisite for project implementation. The letter also described a reduction in the size and scope of the project as a result of funding and physical constraints (described below). In January 2008, the *Preliminary Draft Supplemental Environmental Assessment*, which describes the re-scoping of the project, and the *Source Water Engineering Report*, which provides the engineering rationale for the design of constructed ponds and water system management, were provided to the Service. The availability of the *Draft Supplemental Environmental Assessment* was announced in the February 8, 2008, Hawaii Office of Environmental Quality Control Bulletin.

DESCRIPTION OF FISH AND WILDLIFE RESOURCES

Existing Conditions

Flora:

The vegetative community of Kawainui Marsh has been significantly disturbed and is dominated by introduced species. Cattle grazing, agriculture, increased storm water runoff, and erosion from the surrounding urban development have accelerated sediment loading in the marsh. Higher ground elevations resulting from decades of unchecked growth of invasive vegetation and associated accumulation of peat, increased sediment loading, and withdrawal of water from the Maunawili Stream system have resulted in severely limiting open-water habitat. Based on field observations, plant communities associated with specific areas in and adjacent to the proposed project site were identified (Figure 3). The following narrative is a brief description of the dominant species comprising the plant community within each area. The field effort to develop the following description was completed in 1997. Since that time, grazing intensity has been reduced and grazing pressure has changed from mostly cattle to a mix of horses and cattle at reduced numbers. A complete list of plant species observed during the 1997 vegetation surveys is in Table 1 of Appendix A.

Area A. Primarily upland pasture, although the northern extent of this vegetation zone is wetland. The area is interspersed with hummocks formed by the browsing and trampling actions of cows and horses. The most abundant species are California grass *(Brachiaria mutica),* Hilo grass *(Paspalum conjugatum),* honohono *(Commelina diffusa),* and Indian pluchea *(Pluchea indica).* As the area shifts to slightly higher elevation, other species, such as the sensitive plant *(Mimosa pudica* var. *unijuga),* wedelia *(Wedelia trilobata),* and kamole *(Ludwigia octovalvis),* increase in frequency, especially in the middle of drier hummocks. One large stand of bamboo *(Phyllostachys nigra)* also occurs in this area.

Area B. This area encompasses Maunawili Stream and adjacent banks that meander through the center of the pasture area described above. At the time of the site surveys, the stream was approximately one foot deep. The bank shows signs of undercutting, and bare ground due to cattle disturbance is widespread. The most abundant plant species along the bank are California grass, arrowhead *(Sagittaria latifolia),* taro *(Cocasia esculenta)* and honohono. Just beyond the boundary of area A on the west end of the stream are several dense stands of Egyptian papyrus *(Cyperus papyrus)* and elephant grass *(Pennisetum purpureum).*

Area C. This area includes the uplands and steep banks of Maunawili Stream. The stream is approximately 5 to 6 ft below the bank. This area contains landscaping species such as banyan *(Ficus sp.),* monkey pod *(Samanea saman),* and castor bean *(Ricinus communis)* with an understory of Hilo grass, *Solanum torvum,* honohono, Indian pluchea, the sensitive plant, sour grass *(Digitaria insularis)* and wedelia.

Area D. The east bank of Maunawili Stream is densely covered with hau *(Hibiscus tiliaceus).* Hau becomes the dominant species on both banks closer to the southern border near Kalanianaole Highway.

Area E. This area is characterized by a castor bean canopy and a wedelia and Hilo grass understory.

Area F. This area was once a plant nursery and consists of many species commonly used in landscaping such as banyan, monkey pod, African tulip *(Spathodea campanulata),* Java plum *(Syzgium cumini),* and octopus tree *(Scheflera actinophyla).* The understory and climbing vegetation are dominated by golden pothos *(Epepremnum pinnatum)* and *Syngonium auritum.* The edges of Area F are dominated by thick stands of hau.

Area G. This area has been built up to provide vehicle access. It is characterized by rip-rap and a variety of common introduced upland plants. At the base of the rip rap the hydrology changes and plants that grow well in wetland soils, such as California grass and Job's tears *(Coix lachrymajobi),* are dominant.

Area H. This area has not been filled or grazed, and the vegetation is approximately 6-8 ft high. It is dominated by California grass. Where the water appears to be deeper, there are a few patches of Job's tears.

Area I. This area includes both banks along Kahanaiki Stream. Thick stands of hau have encroached upon the stream making the water appear stagnant.

Area J. This area is composed of California grass with interspersed stands of elephant grass and Job's tears. The grasses here grow to between 6 and 12 ft tall and are extremely thick.

Area K. This area is predominantly California grass and Job's tears. The area is bordered to the west with hau.

The remaining area within the project site is located in the northwest portion of Kawainui Marsh. This upland section was identified as a potential site for a future green waste recycling center. The vegetation consists mostly of koa haole *(Leucaena leucocephala)* and primrose willow *(Ludwigia octovalvis).* Surrounding the area is an open-water channel with abundant water hyacinth *(Eichhornia crassipes),* water lettuce *(Pisna stranotes)* and emergent vegetation such as great bulrush *(Schoenoplectus californicus),* arrowhead, taro, and cattail *(Typha angustata).*

Fauna:

Kawainui Marsh provides essential nesting, breeding, feeding, and resting habitat for four federally listed endangered waterbirds. These species, which are all resident and non-migratory species endemic to the Hawaiian Islands, include the Hawaiian coot *(Fulica alai),* Hawaiian stilt *(Himantopus mexicanus knudseni),* Hawaiian common moorhen *(Gallinula chloropus sandvicensis),* and Hawaiian duck *(Anas wyvilliana).* Nesting by all of these species has been documented at Kawainui Marsh.

Hawaiian ducks nest on the ground near water and are opportunistic feeders. Food consumed by Hawaiian ducks include snails, dragonfly larvae, earthworms, grass seeds, rice, green algae, and seeds and leaf parts of wetland plants. Feeding in wetlands and streams typically occurs in water 1 to 5 inches deep (Service 2005). In the late 1950s or early 1960s the Hawaiian duck was apparently extirpated on Oahu. Subsequent State-led recovery efforts led to the release of 177 captive-bred or translocated Hawaiian ducks on Oahu, mostly in and around Kawainui Marsh. Hybridization of Hawaiian ducks with feral domesticated ducks is documented to be very high (Engilis and Pratt 1993) and the majority of observations are presumably Hawaiian duck X domestic/feral duck hybrids. As a result, the genetic integrity of the Hawaiian duck is in question on Oahu and across the State, and genetically pure individuals may be rapidly becoming extinct in the wild.

Hawaiian ducks (primarily hybrids) are now most commonly observed around open waterways and channels (Service 2005). In recent years, state-led biannual waterbird counts in Kawainui Marsh have indicated a very low population with only a few observations recorded during each count (Table 1).

Moorhen are the most secretive of the native Hawaiian waterbirds, preferring to forage, nest and rest in dense emergent vegetation. Most birds encountered in open or exposed areas will quickly seek cover when disturbed (Service 2005). Because of their secretive nature, observing them in the wild is often difficult. An average of 6.4 moorhen have been observed during state-

coordinated waterbird counts in Kawainui Marsh (Table 1). These observations have ranged from 0 to 23 individuals recorded during counts conducted within the last 10 years. (Note that the State waterbird counts are not population estimates. State waterbird count data represent simple counts of birds observed at repeated observation points that are visited twice per year. These repetitive observations provide an index of waterbird density and distribution on a statewide scale.)

Hawaiian coots prefer habitat similar to the Hawaiian Moorhen, however, coots prefer more open water. The Hawaiian coot will nest in fresh and brackish ponds, and construct floating nests of aquatic vegetation in open water or semi-floating nests anchored to emergent vegetation. Coots typically feed close to their nesting area but will travel long distances when food is not available (Service 2005). During State waterbird counts at Kawainui Marsh, an average of 8 coots have been observed in winter months and 9 individuals have been observed during the summer (Table 1). These observations have ranged from 0 to 60 individuals recorded on counts conducted within the last ten years.

Hawaiian silts use a variety of aquatic habitats but are limited by water depth and vegetation cover. Stilts require wadable mudflats or early successional marshlands with a water depth less than 6 inches and perennial vegetation that is limited and low-growing, or exposed tidal flats (Service 2005). Because suitable shallow habitat is limited in and around Kawainui Marsh, State waterbird counts have resulted in few stilt observations (Table 1). These observations have ranged from 0 to 10 individuals recorded on counts conducted within the last 10 years.

Kawainui Marsh provides habitat for migratory waterfowl, wintering shorebirds, and resident species of wading birds (Appendix A, Table 2). Migratory waterfowl are found within the small ponds in the wet pasture and the larger open-water areas during winter months (Shallenberger 1977). Migratory geese and ducks observed at Kawainui Marsh include northern pintails *(Anas acuta),* northern shovelers *(Anas clypeata),* mallards *(Anas platyrhynchos),* Canada geese *(Branta collaris),* lesser scaup *(Aythya affinis),* green-winged teal *(Anas crecca),* American wigeon *(Anas americana),* and redheads *(Aythya americana)* (Shallenberger 1977, Conant 1981, and Engilis 1988). Feral mallards are abundant throughout the marsh, particularly near residential areas along the banks of Kaelepulu Canal and Oneawa Channel. Migratory shorebirds reported from Kawainui Marsh include Pacific golden plovers *(Pluvialis dominica),* ruddy turnstones *(Arenaria interpres),* sanderlings *(Calidris alba),* and wandering tattlers *(Heteroscelus incanus)* (Shallenberger 1997, Conant 1981, and Engilis 1988). The black-crowned night heron *(Nycticorax nycticorax)* is commonly seen within the open water and potholes of the wet pasture. In addition, there are a number of introduced bird species found in and adjacent to the marsh. Among them, the following species are commonly observed: spotted doves *(Streptopelia chinensis),* red-vented bulbuls *(Pycnonotus cater),* house sparrows *(Passer domesticus),* cattle egrets *(Bubulcus ibis),* and common mynas *(Acridotheres tristis).*

Other wildlife species that use wetland habitats within Kawainui Marsh include non-native species such as mongoose (*Herpestes auropunctatus*), domestic and feral cats (*Felis cattus*) and dogs (*Canus familiarus*), mice (*Mus* sp.) and rats (*Rattus* sp.). Feral pigs (*Sus scrofa*) were observed in the pasture adjacent to the marsh during the April 2008 site visit. As described above, cattle and horses are grazed on leased lands on drier, perimeter portions of the marsh.

The aquatic community within the marsh is generally dominated by introduced species. A list of these introduced species is provided in Appendix A (pers. comm., Mike Yamamoto, DAR 1997). Some of the most abundant fish species found in the marsh include the introduced tilapia *(Oreochromis mossambica* and *Sarothorodon melanotheron),* mosquito fish *(Gambusia affinis),* guppy *(Poecilia spp.),* carp *(Cyprinus carpio),* Chinese catfish *(Clariasfuscus),* swordtail *(Xiphophorus heller),* bronze catfish *(Corydoras aeneus)* and smallmouth bass *(Micorpterus dolomieui).* Some native fish that may exist in low densities include an endemic goby (*Awaous guamensis*); indigenous goby (*Stenogobius genivittatus*); and endemic eleotrid (*Eleotris sandwicensis*). Native invertebrates that may exist in the marsh are the native shrimp *(Atyoida bisculata* and *Macrobrachium grandimanus).* Introduced invertebrates include the Tahitian prawn *(Macrobrachium lar),* crayfish *(Procambarus clarkii),* damselfly *(Ischnura ramburii),* apple snail *(Pomacea sp.),* and pond snails *(Melanoides sp.).*

Kahanaiki and Maunawili Streams in the upper reaches of the marsh have similar introduced species. Oneawa Canal is tidally influenced and inhabited by both introduced species and native estuarine species. The canal may have a higher number of the following native species: *A. guamensis*, *S. genivittatus,* and *E. sandwicensis),* and an endemic flagtail *(Kuhlia sandvicensis),* indigenous mullet *(Mugil cephalus)* and milkfish *(Chanos chanos).*

Future Without the Project

Kawainui Marsh is gradually undergoing a conversion to an upland ecosystem. The processes that are leading to this slow conversion of wetland to upland conditions are primarily related to invasive alien plant growth and watershed-scale soil erosion and deposition. These processes are either entirely due to, or greatly accelerated by, human land use and species introductions in the surrounding watersheds. Because lowland wetlands have been lost on an enormous scale from the landscapes of the main Hawaiian Islands, the existing conditions and ongoing changes in Kawainui Marsh have the potential to adversely impact wetland-dependent fish and wildlife resources.

Without the project, the loss of waterbird habitat due to uncontrolled invasion of alien plants in and around Kawainui Marsh will continue. Accumulation and deposition of peat and sediment within the marsh will continue to limit suitable wetland habitat by slowly converting wet areas to drier upland conditions. Elevated nutrient loads carried by urban run-off will continue to support uncontrolled growth of invasive alien plant species, which overgrow the remaining open-water habitat left for waterbirds. Despite the use of best management practices and land treatment measures to control erosion and run off from the nearby urban development, the long-term viability of this wetland and its habitat for the four endangered waterbirds, migratory waterfowl, wintering shorebirds, and resident species of wading birds cannot be guaranteed. The degradation of this wetland is apparent in the low densities of endangered waterbirds in Kawainui Marsh as compared to other wetlands found on Oahu.

In December 1991, the City and County of Honolulu completed initial clearing of approximately 20 acres of open-water channels and removal of water hyacinth within Kawainui Marsh as part of the Kawainui Marsh Flood Damage Mitigation Project. These channels provide increased

edge and open-water habitats within areas that were previously overgrown with emergent vegetation. The areas of newly created open water benefited migratory waterfowl and three species of endangered waterbirds, the Hawaiian coot, Hawaiian duck, and Hawaiian moorhen. Unfortunately, the invasive water hyacinth expanded into much of the open-water habitat created by the Flood Damage Mitigation Project. The rapid encroachment into open-water areas by invasive aquatic plant species demonstrates that open-water and bare-ground habitat created either by clearing within the marsh or excavating ponds adjacent to the marsh will be viable only for a temporary amount of time in the absence of a long-term commitment to maintain and control the re-growth of invasive plants. Open-water ponds and stream banks must be maintained routinely to keep aquatic and emergent plant densities from overtaking banks or occluding ponds. Without ongoing aggressive maintenance, the long-term benefit to waterbirds from the creation of open-water and edge habitat will be rapidly lost.

DESCRIPTION OF ALTERNATIVES EVALUATED

Four alternative actions are identified by the Corps in the *Preliminary Supplemental Draft Environmental Assessment for the Kawai Nui Environmental Restoration Project (January 2008).* Details of these alternative actions are summarized below.

Alternative 1: No Action. This alternative would leave the existing project site as is and would not result in the federally planned measures to expand native endangered waterbird, migratory waterfowl and shorebird habitat in Kawainui Marsh.

Alternative 2: This alternative was the recommended action under consideration leading up to the July, 1997 *Kawainui ERR-FEA* (Figure 3). Project components include:

- Excavation of four ponds from existing wetland and upland pasture adjacent to wetland to create a total area of 70.7 acres of pond habitat managed for waterbird use.

- Installation of 16,200 ft of predator fencing, which would begin at the levee to Kailua Road, continue along Kapaa Quarry Road and terminate at the proposed green waste processing area, to reduce access into the marsh by predators. The floating vegetation mat and open water of the lower marsh area would provide a natural barrier for predators along the northern perimeter of the project.

- Implementation of a trapping program to control predators that prey on waterbirds and their eggs. One hundred traps would be placed within the marsh and checked four times a week year round.

- Purchase of a flail mower, and mowing and clearing of vegetation from 17 acres to control vegetative growth in the grassy upland and transitional areas to reduce potential cover for predatory mongoose. Reduction in mongoose cover and increased sightlines for waterbirds would enable the ponds to achieve their potential waterbird productivity while exposure of mowed, seasonally wet areas would also provide loafing and foraging opportunities for waterbirds.

• Removal of trees and flattening of banks along 2,100 ft of Maunawili Stream to provide additional transitional habitat for waterbirds.

• Removal of trees and flattening of banks along 700 ft of Kahanaiki Stream to provide additional transitional habitat for waterbirds.

Alternative 3: This alternative was the federally recommended plan put forth in the year 2000 reissue of the *Kawainui ERR-FEA.* This alternative included a change in overall project acreage based upon the discovery that one of the previously proposed ponds would be difficult to construct and maintain because of the wet conditions of the area. This pond was, therefore, eliminated from the proposed design. Reevaluation of the cost/benefit of the altered design was deemed the most cost effective among all alternatives being considered and this alternative became the federally recommended plan at that time (Figure 4). Project components include:

• Excavation of four ponds from existing wetland and upland pasture adjacent to wetland to create a total area of 60.9 acres of pond habitat managed for waterbird use.

• Installation of 16,200 ft of predator fencing, which would begin at the levee to Kailua Road, continue along Kapaa Quarry Road and terminate at the proposed green waste processing area, in order to reduce access to the marsh by predators. The floating vegetation mat and open water within the greater marsh area would provide a natural barrier to predators approaching from the northern perimeter of the marsh.

• Implementation of a trapping program to remove and control feral animals, mongoose, and other species that prey on waterbirds and their eggs. One hundred traps would be placed within the marsh and checked four times a week year round.

• Purchase of a flail mower, and mowing and clearing of vegetation from 17 acres to control vegetative growth in the grassy upland and transitional areas to reduce cover for predatory mongoose. Reduction in mongoose cover and increased sightlines for waterbirds would enable the ponds to achieve their potential waterbird productivity while exposure of mowed, seasonally wet areas would also provide loafing and foraging opportunities for waterbirds.

• Removal of trees and flattening of banks along 2,100 ft of Maunawili Stream to provide additional transitional habitat for waterbirds.

• Removal of trees and flattening of banks along 700 ft of Kahanaiki Stream to provide additional transitional habitat for waterbirds.

Alternative 4 (Current Preferred Alternative): The scope of the final federally recommended plan presented in the March 2000 *Kawai Nui ERR-FEA* was again revisited when it became apparent that the land ownership issue that had suspended activity towards project execution would be resolved. A review of the project was undertaken by the Corps to determine if the previous federally recommended plan could still meet the project's purpose and need in consideration of the following: (1) increase in construction costs and effects of inflation during

the intervening 10-year period, (2) availability of Federal and State funding, and (3) new information regarding the suitability of part of the proposed project area for pond construction. An environmental and engineering consultant was contracted by the Corps to evaluate and design constructed pond habitat based upon the earlier work and recommendations contained in the *Kawai Nui ERR-FEA* that would achieve the project's purpose and need under current site-specific and fiscal constraints. This reevaluation resulted in the development of the Current Preferred Alternative (Figure 5). The revised project features include:

• Excavation of two ponds on a 42-acre site. These ponds would be excavated primarily from upland pasture adjacent to Kawainui Marsh and result in 24 acres of pond habitat managed for waterbird use.

• Enclosure of ponds within low earthen berms arranged in an irregular mosaic pattern and subdivision of each pond into cells. Each cell is designed for independent water level control. A pond with six interior cells would be constructed along the upstream northerly bank of Maunawili Stream, and a pond with five interior cells would be excavated within the lower pasture and would extend west toward the central marsh. The arrangement of the pond cells would roughly follow site topography in order to minimize earthwork.

• It is anticipated that pond water would be supported primarily by rainfall. Source water will be augmented to each pond through individual shallow groundwater wells equipped with 14 individual solar powered pumps. Water will be routed among pond cells through a single side channel that can also be used to drain the ponds. Flow control structures with adjustable weirs will be utilized within the ponds and the feed-water/drainage channel to control water levels within the pond cells. This arrangement is relatively easy to construct and maintain, allows for maximum flexibility in water distribution and circulation, and provides the best opportunities for maximizing a range of waterfowl habitat types.

• Installation of 4,600 ft of predator control fencing around the immediate perimeter of the ponds.

• Construction of two management access ways to provide entry onto the site to construct, operate and maintain the two pond systems that will be bisected by Maunawili Stream.

• Implementation of a predator trapping program with traps placed every 100 ft along the perimeter of the fence line (46 traps).

PROJECT IMPACTS

Terrestrial Resources

The focus of the Service's review of the proposed project is to determine potential benefits and to identify and recommend avoidance measures for any potential direct and indirect adverse effects that the various project alternatives may have on migratory waterfowl and shorebirds, resident species of wading birds, and the four federally listed endangered Hawaiian waterbirds. Based on

this review, the No Action alternative would lead to no modification of the Corps' flood control project in and adjacent to Kawainui Marsh and would not change the physical landform and hydrology associated with the project to provide benefits to the evaluation species identified above. Moreover, the No Action alternative would not alleviate the gradual ongoing loss of habitat described earlier in the "Future Without the Project" section of this report.

Construction and management of the proposed ponds will benefit wildlife species within Kawainui Marsh provided that: (l) the construction methods employed to implement the project are not detrimental to wildlife, (2) water quality within the excavated ponds and down-gradient of the ponds is maintained or improved, (3) the project does not lead to an increase in sedimentation in the existing open-water habitats within the marsh, and (4) the project does not decrease water levels within the marsh to the extent that the ongoing conversion of the wetland to upland is accelerated.

If created, the proposed additional open-water and edge habitats will act as physical barriers between predators, such as rats, cats, dogs and mongooses, and the waterbirds that are attracted to the area, including vulnerable nesting birds with their young. Nevertheless, a predator control program that includes predator assessment and implementation of measures to address rodents, feral animals etc. will likely be needed to ensure that the newly created habitat will be relatively free of predators and generally safe for waterbird use.

Open-water and edge habitats also support the growth of the plant, invertebrate and vertebrate food items used by waterbirds. Ponds that can be managed as intermittent, shallow mudflats provide important feeding and loafing areas for migratory waterfowl, wintering shorebirds, and resident species of wading birds. The majority of open-water and mudflat habitat areas in Kawainui Marsh have diminished over the years due to encroaching vegetation and sedimentation. Currently, the only open-water habitats that exist within the project area are Maunawili and Kahanaiki streams, which traverse the project area, and the occasional shallow ponds that form in the pasture areas during large rain events. It is generally accepted that the loss of open water has lowered the value of Kawainui Marsh habitat for waterbird feeding, breeding, nesting, and loafing. Creation of additional open-water and mudflat habitat in and adjacent to Kawainui Marsh should increase the amount of usable habitat available for migratory waterbirds, shorebirds, and endangered Hawaiian waterbirds.

Despite the overall long-term benefits associated with the proposed project, there is a potential for temporary, adverse construction-related impacts to occur. These potential impacts include: (1) temporary displacement of wildlife species during construction; (2) attraction of birds into hazardous areas during construction; (3) increases in the presence of avian predators, such as cattle egrets, black-crowned night herons, barn owls, and bull frogs, which may be attracted to mowed and cleared areas and may prey on endangered waterbird chicks; (4) increased risk of avian botulism; and (5) the unintentional capture of native avian fauna in predator traps, when predator trapping is initiated.

<u>Aquatic Resources</u>

Larger native aquatic species that inhabit inland waters such as gobies, shrimp and prawns are not likely to benefit from the proposed project. The predominant aquatic invertebrate community that would develop in the ponds is likely to be comprised primarily of introduced species. In fact, the pond management scheme will likely be set to maximize the standing crop of non-native invertebrates in order to provide maximum feeding opportunities for birds.

Construction and clearing activities associated with the proposed project may temporarily increase turbidity and siltation, which will adversely impact water quality within the marsh. To minimize sediment release during construction, we suggest construction of the outer perimeter berm of each pond prior to disturbing soils to create cells within the interior of the ponds.

SERVICE RECOMMENDATIONS

The original scoping for this project was undertaken in the years prior to 1997 and included significant Service input. The Service was an active participant in planning efforts for long-term management of Kawainui Marsh, such as the Kawainui Marsh Advisory Committee and development of the DLNR *Kawainui Master Plan*. In addition to input from the Service, these planning efforts included considerable agency coordination, technical analysis, and community input.

During the identification of management challenges at Kawainui Marsh at that time, a high priority was placed on control of invasive vegetation within the marsh. This was to accomplish multiple objectives, including improved water quality and increased waterbird habitat by expanding the extent of open water. An additional restoration suggestion was management of water levels within the entire marsh through construction and operation of a water control structure at Oneawa Canal to allow hydrologic manipulation of wetland habitat. Various early proposals suggested restoration of over 100 acres within the central marsh by removal and on-going control of invasive vegetation. In these proposals, only a relatively small amount of excavated/constructed habitat adjacent to the southern end of the marsh near Maunawili and Kahanaiki streams was proposed (Figure 1).

The scope of the project was re-evaluated several times, and with each reiteration, the extent of the project was reduced due to cost increases and technical feasibility issues. As a result, the basic premise of the project has changed. The proposed actions within the central wetland portion of Kawainui Marsh have been eliminated from consideration. The Current Preferred Alternative now consists of an engineered solution designed to create permanently flooded wetland habitat out of a mix of upland and wetland pasture adjacent to the marsh by excavating and constructing ponds and using a system of solar pumps for augmenting pond hydrology. A fine-scale wetland delineation has not yet been performed for the project site, however, National Wetland Inventory maps, which illustrate wetland habitats based on air photo interpretation, indicate that at least the upper pond will be excavated mostly out of upland pasture. An on-the-ground wetland delineation that adheres to the U.S. Army Corps of Engineers Regulatory Branch delineation manual will show the extent of the restoration project that is planned for upland vs. wetland areas.

The outcome of this gradual reduction of planned restoration for the central portion of the wetland is that the issue of actually addressing the most important management challenges of Kawainui Marsh proper is side-stepped. If "restoration" is defined as improving existing but degraded wetlands to a condition usable by birds, only a partial component of the original restoration goal remains in the project, as it is currently conceived. The central Kawainui basin will essentially be abandoned in place and left in an unmanaged state. As described above, the marsh is undergoing a human-caused (or human-accelerated) conversion to upland conditions because of siltation and invasive vegetation. Because of this, the marsh is becoming increasingly degraded with respect to its habitat function for waterfowl. Under the revised project plan, this process is largely left to proceed unchecked.

Waterbirds were selected as the evaluation species for planning the project and determining its potential benefits. Because of this, the Current Preferred Alternative is a reasonable project that maximizes benefits to the evaluation species. The enormous financial cost of on-going intensive vegetation management over the entire area of Kawainui Marsh may be prohibitive, and creating a manageable system of smaller ponds appears to be cost-effective. Furthermore, this approach is consistent with a nationwide trend in conservation management of waterbirds toward developing intensively managed habitat units where hydrology and invasive vegetation are highly controlled to maximize target waterbird densities. These techniques are generally referred to as *Moist Soil Management* (Fredrickson and Taylor 1982). In order to increase the likelihood of project success, and in light of the reality of limited funding resources, an early decision was made to avoid spreading small efforts of habitat improvement across a broad area, but rather to focus efforts on a smaller project at a single location.

We recommend that the planning documentation for the proposed project be clear about the landscape-scale implications of the project and that the cost effectiveness of the Current Preferred Alternative be clearly shown in the *Final Supplemental Environmental Assessment for the Kawainui Marsh Environmental Restoration Project* (FSEA). The actual extent of jurisdictional wetlands should be mapped and the document should disclose the extent of wetland restoration verses upland excavation for pond creation proposed by the project. Future outreach and information materials developed by cooperating resource agencies should similarly disclose the evolutionary process that led to development of the current scope of the project. The relative costs of long-term vegetation management *vs.* pond construction and operation should be described in the FSEA.

The Service believes that the Draft SEA provides sufficient information upon which to base an assessment of potential impacts from the proposed project. Because the Corps is turning over the entire project to the local sponsor (DOFAW) to maintain after construction, we recommend that the State continue to coordinate with us for continued technical advice and support, especially with regard to long-term maintenance and predator control at the site. The Service may be able to provide substantial technical assistance for such efforts. The ultimate success or failure of this project will depend on a long-term commitment by DOFAW of adequate funds and trained personnel dedicated to management of the ponds. Without long-term maintenance of water level control devices (pumps and head gates), control of invasive plants, and control of avian predators, the value of this project may never be fully realized. Once established, the habitat benefits of the project could be lost because ongoing maintenance needs of the site will be high

throughout the life of the project. A poorly managed project that becomes an “attractive nuisance" by attracting endangered and migratory birds to the site only to be killed by disease or predators would be detrimental to those resources and run counter to Service and State recovery goals for endangered waterbirds.

Although the Corps’ Civil Works Branch will not have to obtain a Clean Water Act (CWA) section 404 permit from the Corps Regulatory Branch for wetland work related to the project, the environmental protection requirements of section 404 still apply. The Kawainui Marsh Restoration Project may largely conform to *Nationwide Permit 30 - Moist Soil Management*. We recommend that the Corps address these environmental requirements and describe efforts to meet CWA goals in the FSEA for this project. A related requirement is the need for a CWA section 401(c) Water Quality Certification issued by the State water quality agency to assure that the project will not violate State-administered water quality standards. Because issuance of this certification usually takes well over a year, we further recommend that the Corps begin coordination with the State of Hawaii Department of Health-Clean Water Branch early in future project planning efforts.

To minimize the indirect adverse impacts to fish and wildlife resources in Kawainui Marsh and the surrounding area, we recommend the following measures be incorporated in the design and construction of the selected alternative:

1) A trained biologist will be present on site during the mobilization and clearing of vegetation to provide assistance to the contractor in preventing any disturbances to nesting waterbirds that may be present. In areas where endangered waterbirds have been observed, nest searches by a biologist(s) familiar with nesting behavior of Hawaiian waterbirds will be performed prior to any work being conducted and after any subsequent delay in work of three or more days (during which birds may attempt nesting). If a nest is discovered, work will cease in the vicinity for a minimum of 60 days; if a nest with chicks is discovered, work will cease for 30 days. These guidelines are intended to protect chicks, and may be shortened if monitoring is conducted often enough to note when chicks have fledged (usually five to six weeks after hatching). If a previously undiscovered nest is found after work begins, all work should cease within a minimum radius of 100 feet of the nest and the Service will be contacted within 24 hours.

2) Pond construction will be scheduled during the driest time of the year. However, if there is rainfall sufficient to create ponded water and waterbirds are present, the contractor will avoid these ponded areas until the area has dried and the birds have moved out of the area.

3) Project design features must include capacity to control water levels throughout the wildlife management ponds. Ample water circulation can prevent conditions that lead to the outbreak of botulism. Therefore, sufficient flows to provide water circulation should be incorporated into project design. The *Management Plan for the Control of Avian Botulism at Kawainui Marsh, Oahu* (August 1997) will be amended in coordination with the Service prior to project implementation. The amended plan will include procedures for taking immediate action to control outbreaks, including immediate removal of all bird carcasses to

prevent the spread of botulism and monitoring of bird populations in the area to prevent the further spread of the outbreak.

4) After wetland creation, ponds will be surveyed on a regular basis for early detection of American bullfrogs (*Rana catesbeiana*). If American bullfrogs are discovered, appropriate methods will be employed for immediate eradication.

5) Predation by cattle egrets, small mammals (mongooses, feral cats, and rats) and American bullfrogs has been identified as one of the major factors inhibiting the recovery of listed waterbirds in the *Draft Revised Recovery Plan for Hawaiian Waterbirds, Second Draft of Second Revision* (August 2005). Live trapping for mongooses and feral cats will be conducted year round, for the protection of listed waterbirds attracted to the enhanced wetland. Traps for small mammals and frogs will be checked at least every 48 hours when trapping activity occurs. Bait stations (utilizing a rodenticide approved by the U.S. Environmental Protection Agency) will be utilized year round to control rat predation on listed species. Appropriate measures to control cattle egrets will also be implemented.

6) Hawaiian ducks are declining primarily due to hybridization with feral domesticated mallard ducks (Engilis and Pratt 1993). Mallard X Hawaiian duck hybrid populations on Oahu are increasing based on State bi-annual waterbird survey data. Because Kawainui Marsh is adjacent to an urban area where feral ducks are encouraged (fed) on a regular basis, we recommend that feeding feral ducks be discouraged in newly created wetlands. The proposed pond complex will have limited available habitat and feral ducks could displace listed species at the site if they are encouraged to perpetuate. Because of this potential to increase hybridization, a program of survey and eradication should be in place to address incursions by feral ducks.

7) If migratory shorebirds, waterbirds or resident native birds are captured and found uninjured in a trap, they are to be released immediately. Appropriate Service personnel will be notified of the incident within 24 hours (808-792-9400 or 808-861-8525). A written report describing the incident must be provided to the Service's Division of Law Enforcement, 3375 Koapka St., Honolulu, Hawaii 96819, and Pacific Islands Fish and Wildlife Office, P.O. Box 50088, Honolulu, Hawaii 96850 within 48 hours of the incident.

8) If any migratory shorebird, waterbird or resident native bird is injured or appears harmed within the project area during project construction, appropriate Service personnel will be contacted as identified above.

9) In the event migratory or endangered birds are killed due to predator control activities, all predator control activities will be reviewed and addressed by DOFAW and the Service within 24 hours pursuant to requirements of the associated ESA Biological Opinion of the Service.

10) Turbidity and siltation from project-related work will be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse weather conditions.

11) All project-related materials and equipment (backhoes, excavators, etc) to be placed in the water will be cleaned of pollutants and invasive species propagules prior to entry into the site.

12) No project-related materials (fill, revetment rock, pipe etc.) will be stockpiled in the water or in wetland areas.

13) All debris removed from the aquatic environment will be disposed of at an approved upland or ocean dumping site.

14) No contamination (trash or debris disposal, alien species introductions etc.) of adjacent aquatic environments (stream channels, wetlands etc.) will result from project-related activities;

15) Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project will be developed. Absorbent pads and containment booms will be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases.

16) Any under-layer fills used in the project will be protected from erosion (with rock, core-loc units, etc) as soon after placement as practicable; and

17) Any soil exposed near water as part of the project will be protected from erosion (with plastic sheeting, filter fabric etc.) after exposure and stabilized as soon as practicable (with vegetation matting, hydroseeding, etc.).

18) Construction, operation, and maintenance of the project will not decrease water levels or water quality in the marsh below pre-project levels.

SUMMARY AND SERVICE POSITION

Substantial acreage of wetland habitat has been lost throughout the Hawaiian Islands in the last 150 years. Much of this loss has been due to filling and draining wetland areas to convert these lands to an upland condition more suitable for human uses such as agriculture. In the remaining wetland environments, the encroachment of invasive plants is largely uncontrolled, and this has resulted in the further loss of usable wetland habitat for birds to this day.

In light of the need to increase usable wetland habitat for waterbirds, the available financial resources from Federal and State sources, and the likely future of Kawainui Marsh without the project, the Service concludes that the proposed project to construct and maintain man-made ponds dedicated to support waterbird populations is reasonable. However, while the proposed project will add managed pond habitat acreage, it will not actually restore existing wetlands within Kawainui Marsh. In the interest of public disclosure, we recommend that this fine point be made clear in the project's Supplemental Final Environmental Assessment and other planning documents.

If appropriately managed, the wetlands created by the project should result in long-term benefits to fish and wildlife resources in the area. Our primary concerns with the proposed project are the temporary construction-related impacts to water quality, endangered species and other significant fish and wildlife species and their habitats, and the need for a firm commitment by the State DLNR to provide for the long-term maintenance of the newly created wetland habitats.

The Service considers wetland habitat in Kawainui Marsh to be Resource Category 2 habitat. Our goal for Category 2 habitat is no net loss of in-kind habitat values. The proposed project will result in an overall increase in amount of habitat through creation of shallow ponds and mudflats. There will be an increase in the value of wetland habitat throughout the site and adjacent areas through a reduction in the numbers of predators due to fencing and trapping. Therefore, the project should meet the requirements of no net loss of in-kind habitat values, have an overall benefit to fish and wildlife, and increase viable habitat acreage for wildlife found within the marsh.

In consideration of the potential benefits anticipated to result from this waterbird habitat creation project, and in compliance with the FWCA, we support the construction of the project provided that the Service's recommendations to minimize impacts to fish and wildlife resources are included in the final project design and maintenance plan. If the alternative selected for implementation is changed from the Current Preferred Alternative, the Corps must coordinate with the Service under the FWCA.

The Service recommends development and implementation of a long-term management program to adequately maintain the newly created wetland habitat. Without a viable habitat maintenance strategy, we are concerned that the benefits from the project will diminish over time. We recommend that this strategy include a commitment from the State for long-term management and maintenance of this habitat, and that this commitment be formalized prior to project implementation. The State should develop a management plan for the project site that specifies the level of funding and effort required to effectively manage the site and incorporates adaptive management principles that allows for modification of effort in response to environmental variables (e.g., drought, floods, disease) as well as unanticipated challenges including fence maintenance, pump replacement, water system maintenance, siltation, and maintenance of berm and bank stability. We recommend that the management plan document be included as an Appendix in the FSEA for the project.

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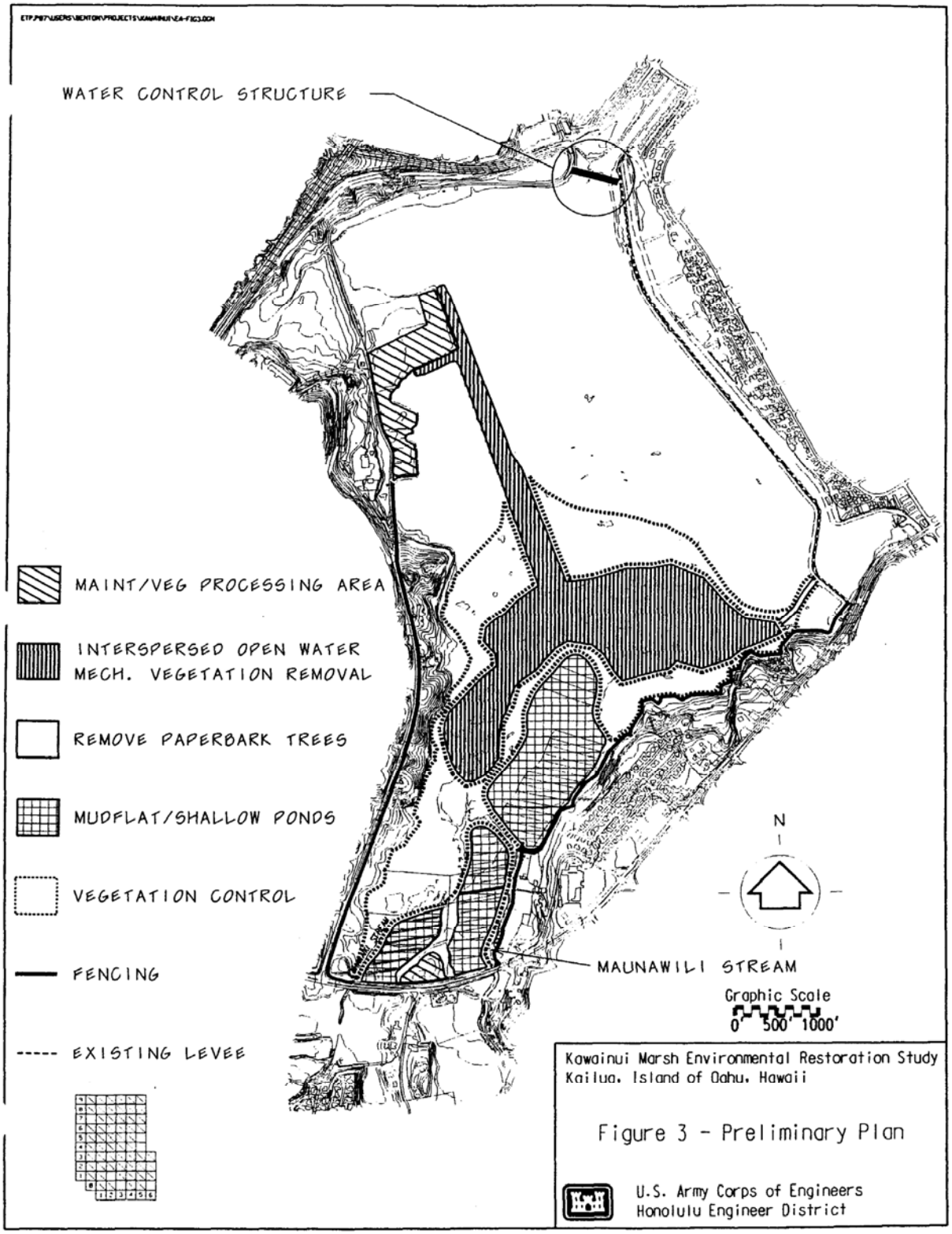

Figure 1. Preliminary project elements considered for restoration of Kawainui Marsh.

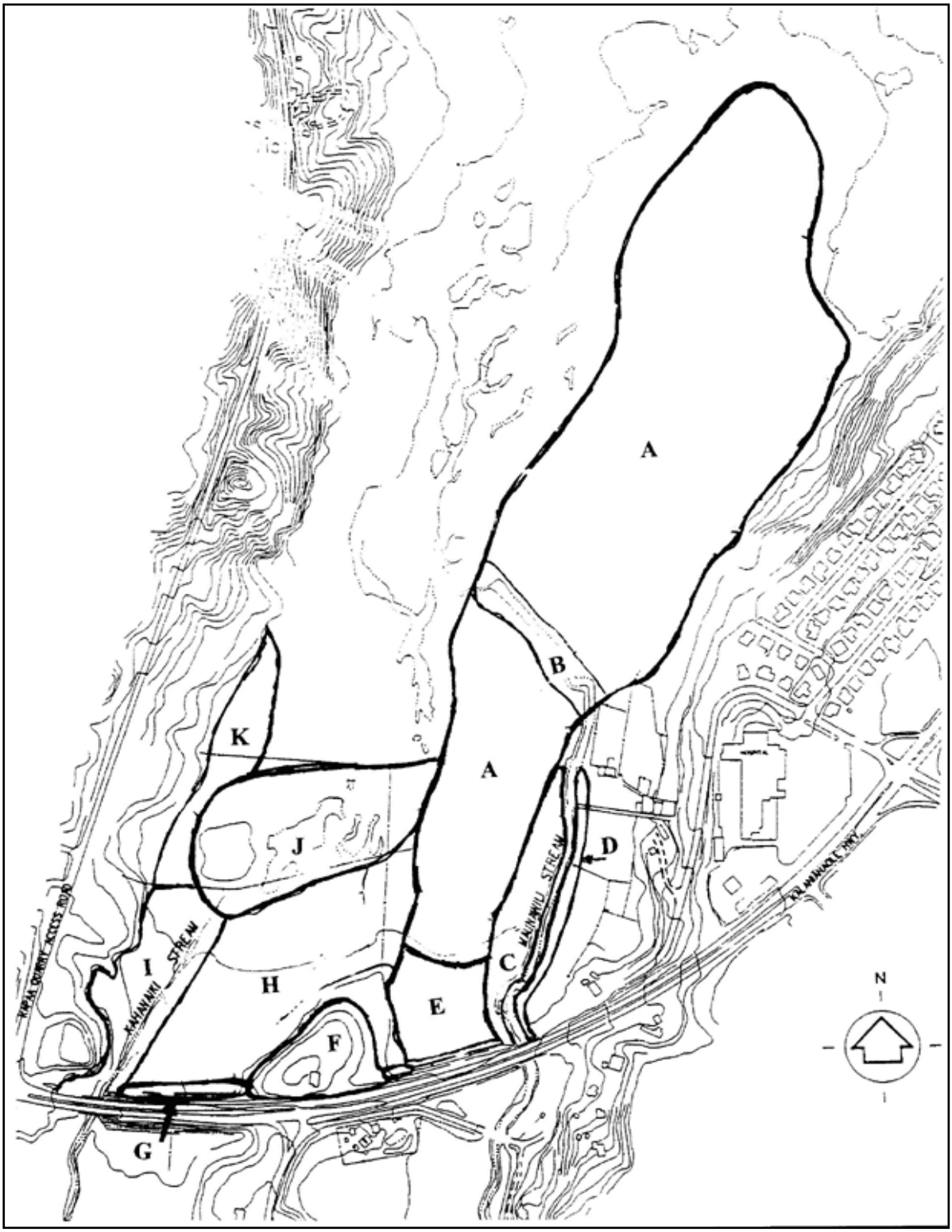

Figure 2. Vegetation communities identified in the Kawainui Ecosystem Restoration Project area.

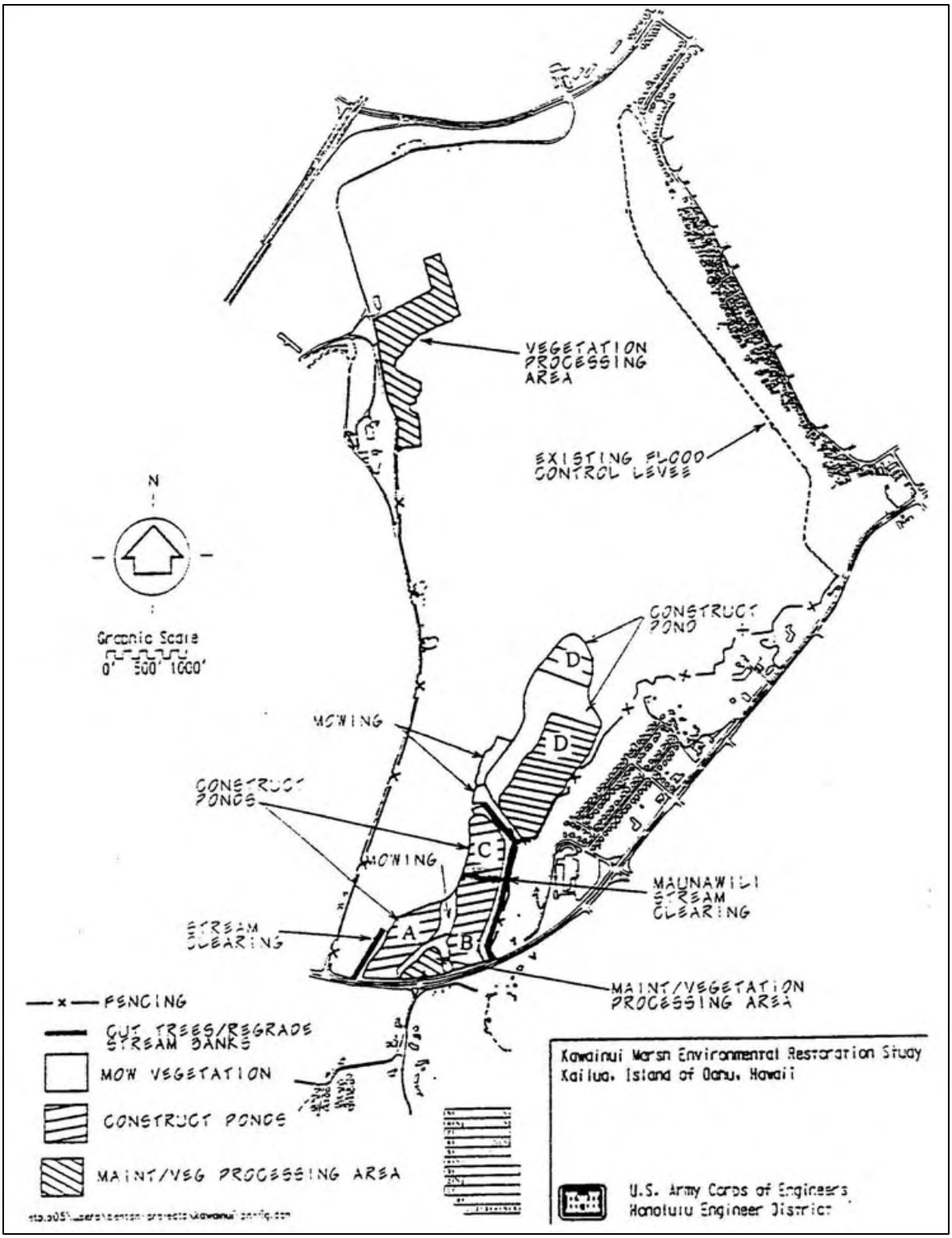

Figure 3. Alternative 2 site plan (four ponds, 70.7 acres).

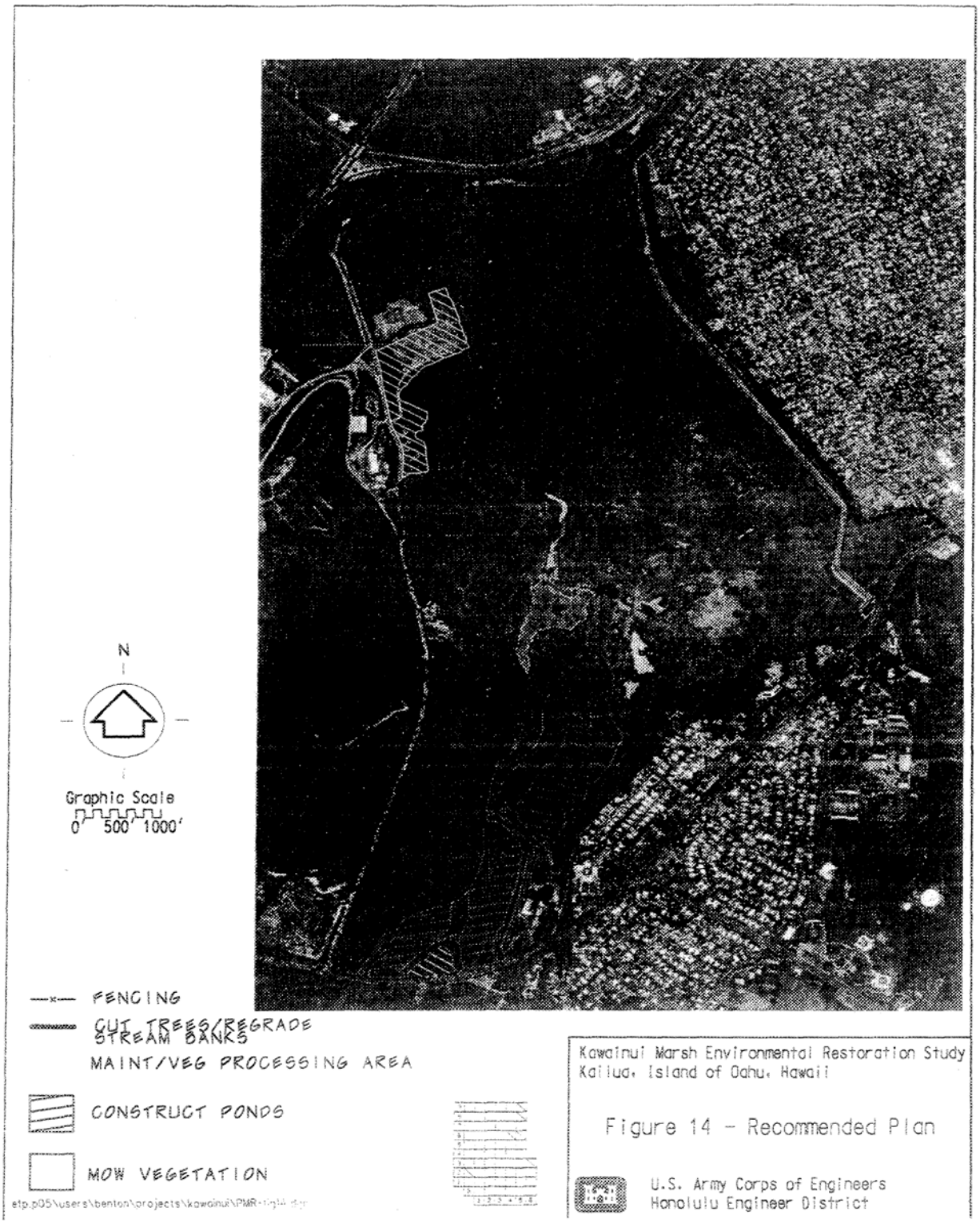

Figure 4. Alternative 3 site plan (three ponds, 60.9 acres).

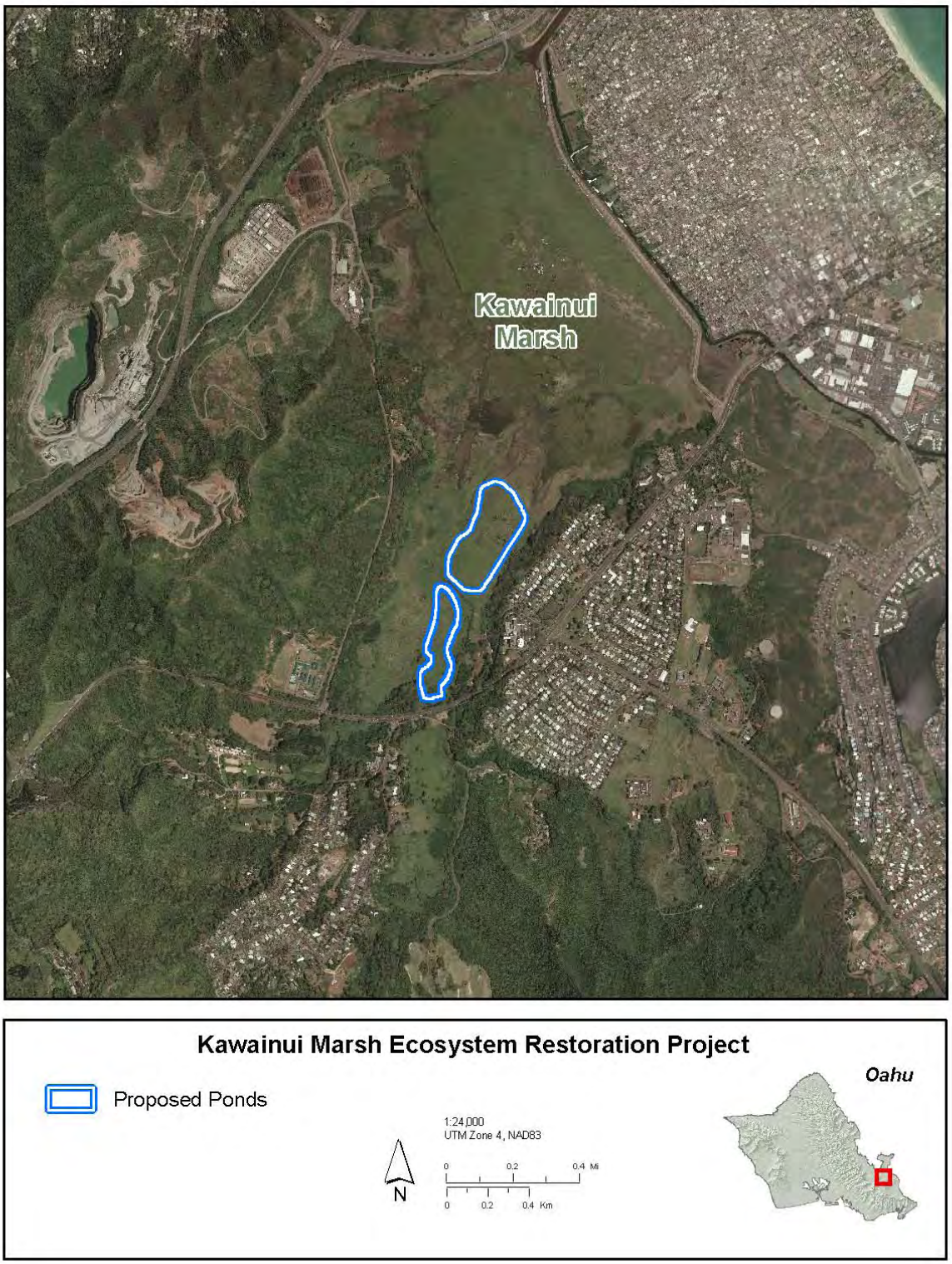

Figure 5. Alternative 4 site plan (two ponds, 24 acres on 40 acre site).

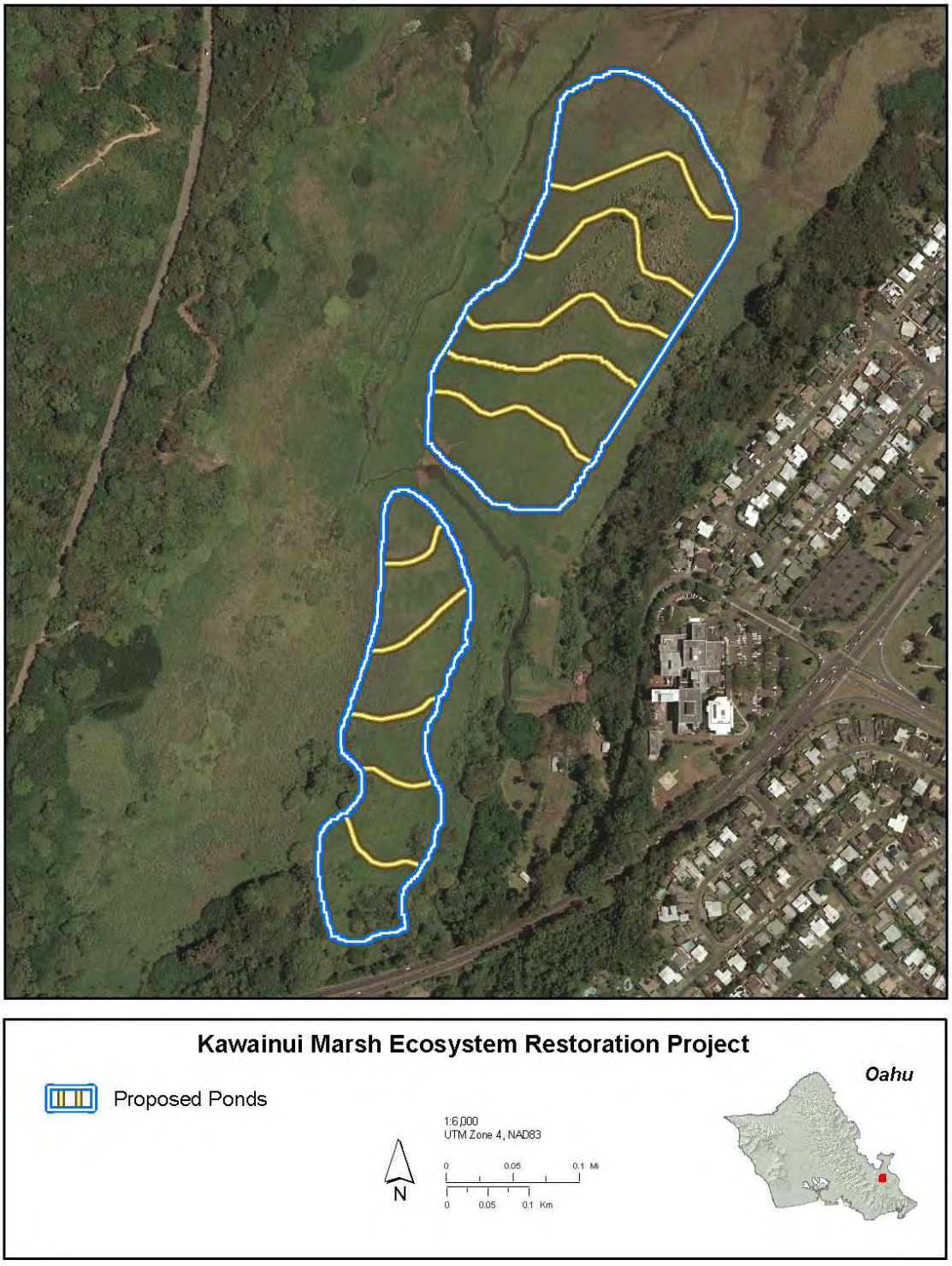

Figure 6. Alternative 4 pond and cell configuration.

Table 1. Waterbird observations recorded at the Kawainui Marsh complex during biennial State of Hawaii waterbird counts 1991-2007.

Year	Season	Hawaiian Duck (Hybrid?)	Hawaiian Coot	Hawaiian Gallinule	Hawaiian Stilt
2007	Winter	0	12	6	2
2006	Winter	2	0	15	3
2006	Summer	0	6	7	0
2005	Winter	0	3	10	4
2005	Summer	0	0	8	10
2004	Winter	0	7	9	0
2004	Summer	0	1	3	0
2003	Winter	0	2	5	0
2003	Summer	0	2	13	0
2002	Winter	0	4	8	0
2002	Summer	0	0	9	0
2001	Winter	0	7	19	3
2001	Summer	0	5	23	0
2000	Winter	0	8	13	5
2000	Summer	5	0	18	0
1999	Winter	8	14	6	0
1999	Summer	0	6	0	0
1998	Winter	2	18	3	0
1998	Summer	0	60	4	0
1997	Winter	0	0	2	0
1996	Winter	0	15	1	0
1995	Summer	0	7	0	0
1995	Winter	0	12	3	0
1994	Summer	1	15	4	0
1993	Summer	7	18	0	2
1993	Winter	3	14	1	2
1992	Summer	2	10	1	3
1992	Winter	7	11	1	1
1991	Summer	0	6	0	0
1991	Winter	0	3	2	2
Summer Mean Observed (n=14)		1.1	9.7	6.4	1.1
Winter Mean Observed (n=16)		1.4	8.1	6.5	1.4

APPENDIX A

Table A-1. Vegetation recorded in the Kawainui Marsh restoration project study area during June 1997 site visits. Abbreviations: I = Infrequent; 0 = Occasional; A = Abundant; nat = naturalized; ind = indigenous; end = endemic; pol = Polynesian introduction; esc = escaped from cultivation.

CLASS FAMILY *Species*	Common Name	Abundance	Status
MONOCOTYLEDONAE			
ALISMATACEAE			
Sagittaria latifolia	Arrowhead	A	nat
ARACACEAE			
Cocos nucifera	Coconut tree, niu	I	pol
ARACEAE			
Alocasia macrorrhiza	'Ape	I	pol
Epipremnum pinnatum	Golden pothos	A	nat
Colocasia esculenta	Taro		pol
Pistia stratiotes	Water lettuce		nat
Syngonium auritum		A	esc
ARALIACEAE			
Scheflera sp.		A	esc
COMMELINACEAE			
Commelina diffusa	Honohono	A	nat
CYPERACEAE			
Cladium jamaicense	Sawgrass, 'Uki	A	ind
Cyperus alternifolius	Umbrella sedge	A	nat
Cyperus papyrus	Egyptian papyrus	A	nat
Kyllinga brevifolia	Kili'o'opu	I	nat
Pycreus polystachyos		0	ind
Schoenoplectus californicus	Great bulrush	A	nat?
Schoenoplectus lacustris	Neki		ind
HELICONIACEAE			
Heliconia sp.	Heliconia	I	esc

Table A-1. (Continued)

POACEAE				
Brachiaria mutica	California grass	A		nat
Cenchrus echinatus	Common sandbur	I		nat
Coix lachryma jobi	Job's tears	A		nat
Echinochloa colona	Jungle rice	I		nat
Echinochloa crus-galli	Barnyard grass	I		nat
Eleusine indica	Wiregrass	I		nat
Digitaria insularis	Sourgrass	0		nat
Pennisetum purpureum	Elephant grass	A		nat
Paspalum conjugatum	Hilo grass	A		nat
Phyllostachys nigra	Bamboo	I		nat
Saccharum officinarum	Sugar cane	0		nat
Setaria verticillata	Bristly foxtail	I		nat
Sorghum halpense	Johnson grass	I		nat
PONTEDERIACEAE				
Eichhornia crassipes	Water hyacinth	A		nat
TYPHACEAE				
Typha angustata	Cattail	0		nat
DICOTYLENDONAE				
ACANTHACEAE				
Dicliptera chinensis		0		nat
AMARANTHACEAE				
Achyranthes aspera		I		nat
Amaranthus spinosus	Spiny amaranth	I		nat
ANACARDIACEAE				
Mangifera indica	Mango	I		nat
Schinus terebinthefolius	Christmas berry	I		nat
ASTERACEAE				
Ageratum conyzoides	Maile honohono	I		nat
Bidens pilosa	Nehe	0		nat
Crassosephalum crepidioides		I		nat
Emelia fosbergii		I		nat
Latuca serriola	Prickly lettuce	I		nat
Pluchea indica	Indian pluchea		I	nat
Pluchea symphytifolia	Sourbush	0		nat
Wedelia trilobata	Wedelia	A		nat

Table A-1. (Continued)

BIGNONIACEAE			
Spathodea campanulata	African tulip tree	I	nat
CONVOLVULACEAE			
Ipomoea triloba	Little bell	0	nat
Ipomoea alba	Moon flower	0	nat
CUCURBITACEAE			
Coccinia grandis	Ivy gourd	0	nat
EUPHORBIACEAE			
Chamaesyce hirta	Garden spurge	I	nat
Ricinus communis	Castor bean	I	nat
Phyllanthus deblis	Niruri	I	nat
FABACEAE			
Canavalia cathartica	Mounaloa	0	nat
Caesalpinia decapetala		I	nat
Desmodium incanum	Spanish clover	0	nat
Erythrina sp.	Coral tree	I	esc
Mimosa pudica var. unijuga	Sensitive plant	0	nat
Macroptilium lathyroides		I	nat
Samanea saman	Monkeypod	I	esc
LAMIACEAE			
Hyptis pectinata	Comb hyptis	0	nat
Leonotis nepetifolia	Lion's ear	I	nat
LYTHRACEAE			
Lythrum maritimum	Pukamole	0	ind?
MALVACEAE			
Hibiscus sp.	Hibiscus	I	esc
Hibiscus tiliaceus	Hau	0	ind?
Sida rhombifolia		0	nat?
Sida acuta		I	nat
MELASTOMATACEAE			
Arthrostema ciliatum		0	nat
MORACEAE			
Ficus sp.		I	esc
Ficus carica	Common ficus	I	esc
Ficus elastica	India rubber tree	I	esc
Ficus microcarpa	Chinese banyan	I	nat

Table A-1. (Continued)

MYRTACEAE			
Syzigium cumini	Java plum	I	nat
ONAGRACEAE			
Ludwigia octovalvis	Kamole	0	pol?
Ludwigia palustris	Water purslane	I	nat
RUTACEAE			
Murraya paniculata	Mock orange	I	esc
SOLANACEAE			
Solanum torvum		0	nat
TILIACEAE			
Triumfetta semitriloba	Sacramento bur	I	nat
VERBENACEAE			
Citharexylum caudatum	Fiddlewood	I	nat
Verbena lilttoralis	Vervain	I	nat
Stachytarpheta jamaicensis	Jamaican vervain	I	nat
Stachytarpheta urticifolia		I	nat

Table A-2. Aquatic species recorded in the Kawainui Marsh restoration project study area. Abbreviations: I = introduced; e = endemic; ind = indigenous; *From Draft EA and phone conversations with State Biologist; ** Observed during June 1997 and April 2008 site visits.

PHYLUM FAMILY *Species*	Common name	Status
MOLLUSCA		
AMPULLARIIDAE		
***Pomacea ssp.*	Apple snail	I
THIARIDAE (pond Snails)		
Melanoides ssp.	Pond snail	I
ARTHROPODA		
CONENAGRIONIDAE (Damselflies)		
***Ischnura ramburii*	Ramburs's forktail damselfly	I
LIBELLULIDAE (Dragonflies)		e
CRUSTACEA		
ATYOIDAE		
Atyoida bisculata	'Opae kala'ole	e
PALAEMONIDAE (prawns)		
Machrobrachium grandimanus	'Opae 'oeha'a	ind
Machrobrachium lar	Tahitian prawn	I
Procambarus clarkii	Crayfish	I
CHORDATA		
BUFONIDAE (NeotropicaI Toads)		
Bufo marinus	Marine toad	I
OSTEICHTHYES		
ELEOTRIDAE		
Eleotris sandwicensis	O'opu akupa	
GOBIIDAE (Gobies)		
Awaous guamensis	O'opu nakea	ind
Stenogobius genivittatus	O'opu naniha	ind

Table A-2. (Continued.)

KUHLIIDAE		
Kuhlia sandvicensis	Aholehole	ind
POECILIIDAE (Guppies, Swordtails)		
***Poecilia sp.*	Guppy	I
***Xiphophorus sp.*	Swordtail	I
CICHLIDAE		
Tilapia mossambica	Tilapia	I
CYPRINIDAE		
Cyprinus carpio	Carp	I
CENTRACHIDAE		
Micropterus dolomieui	Small mouth bass	I
MUGILIDAE		
Mugil cephalus	`Ama `ama	e
SPHYRAENIDAE		
Shyraena barracuda	Kaku	e
CALLICHTHYIDAE		
***Corydoras aeneus*	Bronze coryadoras	I
CHANIDAE		
Chanos chanos	Awa	e
SYNBRANCHIDAE		
Monopteros albus	Oriental rice eel	I
CLARIIDAE		
Clarias fuscus	Chinese catfish	I

Appendix D

U.S. Fish and Wildlife Service Biological Opinion Project Description

Description of the Proposed Action

Kawainui Marsh is the largest remaining lowland emergent wetland in the State of Hawaii, and has been identified as an integral part of the Service's *Hawaiian Waterbird Recovery Plan* (Service 2005). The project site is located in the southern portion of Kawainui Marsh, adjacent to Kailua town on the windward side of Oahu (Figure 1).

Figure 1. USGS 7.5 Minute Topographic Map Depicting the Kawainui Marsh Project Area.

Site History

Oahu is the third largest of the Hawaiian Islands, with a total area of 607.7 square miles. Kawainui Marsh encompasses 1,000 acres and is the largest remaining low-elevation wetland in the Hawaiian Islands (Service 2005). It is located on the windward side of Oahu between the Koolau Mountains and Kailua Bay. Kawainui Marsh was once a marine embayment open to the sea until about 2,800 years ago when the Kailua sand barrier first began to form. Geologically, it marks the approximate center of the caldera complex of the great Koolau shield volcano that formed east Oahu (University of Hawaii 1983).

Early records of Polynesian activity in and around Kawainui Marsh indicate that it was once a large inland fishpond joined by a stream to nearby Kaelepulu Pond. Oral histories describe the ponds as being well-maintained and that numerous fish were raised for Hawaiian chiefs. Surrounding lands were used primarily for taro cultivation. By the mid-1860s, many of the Hawaiian taro loi (flooded fields) in Kailua were being used to grow rice. Rice production declined in the 1920s and the former rice fields were converted to pasture land for grazing cattle. A ditch and tunnel system constructed in 1878 and later expanded in the 1920s, transported water from the upper reaches of Maunawili Stream to sugarcane fields at the Waimanalo Sugar Plantation (Kelly and Nakamura 1981).

As the area around Kawainui Marsh was converted to residential and commercial use, residents around the marsh recognized the importance of the marsh in providing a natural storage area for floodwaters. Severe floods occurred occasionally, and floodwater overflow from the marsh caused serious damage. In the 1940s, the Corps initiated plans to construct an alternative channel to provide an outlet for floodwaters from the Kawainui area. Construction of the original Kawainui Marsh Flood Control Project was authorized by the Flood Control Act of 1950 and was completed in August 1966. Original project features included construction of Oneawa Canal, a channel (9,470 feet [ft] long) that traversed the sand and limestone berm where the residential community of Coconut Grove is located; an earthen levee (6,850 ft long) with a maximum crest elevation of 9.5 ft; a stub groin (50 ft long) and revetment (50 ft long) at the outlet of Oneawa Canal; and a silt retention basin (370 ft long and 10 ft deep) (Corps 1997).

In the years since completion of the Corps' original flood control project, abundant growth of invasive vegetation has formed a very thick layer of peat (partially decomposed plant matter that is saturated with anoxic water) within the central basin of the marsh. This vegetation mat has filled in all but a tiny fraction of the original Kawainui Marsh. The formation of this peat layer has reduced the marsh flood storage capacity and virtually eliminated open-water and shallow-water habitat favored by endangered Hawaiian waterbirds. On January 1, 1988, severe flooding of the Coconut Grove community occurred when the water level in the marsh exceeded the crest of the original levee.

As a result of the 1988 flood, the Corps and the City and County of Honolulu modified the Kawainui Flood Control Project to include a concrete flood wall that raised the average elevation of the original levee by 4.5 ft. The total structure is about 6,300 ft long, with the height of the flood wall varying from 8.5 ft at Kailua Road on the south to a gradual tapering into the existing levee at the Oneawa Canal outlet on the north end (Corps 1997).

A short distance upstream from the point where Oneawa Canal exits the marsh at the end of the flood-control levee, a series of small islets were constructed as mitigation for wetland fill when the levee structure was enlarged. These islands are made of material dredged from the channel (mostly coral rubble). Unfortunately, the design of the islets did not result in making them viable wetland habitat for waterbirds. Changes in water

surface elevation due to tides, marsh water surface elevation, and the soil characteristics of the islands themselves have combined to create nearly vertical islet shorelines, and the flat surface at an elevation above the reach of the tide simply promotes the islets being covered with non-aquatic vegetation. These features make the islets unattractive to waterbirds.

Most of the marsh has been designated by the State Land Use Conservation District as P-l protective subzone and is zoned by the City and County of Honolulu as Preservation. Today, the primary beneficial use associated with the marsh is flood storage. However, the DLNR published a report entitled *Kawainui Marsh Master Plan* that identified other potential benefits of the marsh (DLNR 1994). The master plan outlined a the State's long-term plan to enhance not only the flood storage potential of the marsh, but also recreation, aesthetics, historical features, natural wetland functions, and other benefits that could be derived from the marsh.

The purpose of the proposed project is to construct artificial pond habitat that will be managed to benefit four of Hawaii's endangered waterbirds. Feasibility planning for this project identified several potential methods of habitat modification and pond construction in and around Kawainui Marsh to achieve the goal of enhancing or creating habitat for waterbirds. Some of the methods that were examined include: construction of a water level control structure at the marsh outlet to the sea; mechanical vegetation control to create open water areas; excavation of managed waterbird habitat ponds in the marsh itself and in uplands adjacent to the marsh; and fencing, and predator/vegetation control.

The Hamakua and Kawainui Marsh complex was designated as a Ramsar Wetland of International Importance (Ramsar site number 1460) on February 2, 2005. The Ramsar Convention of 1971 is an international treaty organization that supports conservation and sustainable use of wetlands. Designation of the Hamakua and Kawainui Marsh complex as a Ramsar site represents international recognition of the unique biological and cultural importance of the site. In the future, the Ramsar designation may lead to additional support for wetland restoration and management in the form of small grants and international technical assistance.

Through funding from the Corps, and the State of Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Oahu Branch (DOFAW) proposes to restore wetland habitat within the southern portion of Kawainui Marsh and to manage this habitat for four of Hawaii's endangered waterbirds. The restoration site is approximately 42 acres of pasture land of which approximately 24 acres will be converted to open ponds. The ponds will be enclosed by earthen berms, with rainfall as the primary source for water, supplemented by pumped groundwater to meet waterbird management objectives. Waterbird management will be guided by the Kawainui Marsh Restoration Area Management Plan that will be developed by DOFAW, the Corps, and the Service. The plan will include guidelines for waterbird management and monitoring, predator control, and a revised Management Plan for the Control of Avian Botulism at Kawainui Marsh, Oahu, Hawaii 1997.

Construction - Wetland Creation

Two ponds will be excavated from upland pasture adjacent to Kawainui Marsh. Excavation is expected to begin in 2009 through 2010 and will be started during the driest time of year, generally July through October. Heavy equipment will be used to remove vegetation and for pond construction. Because the preferred habitat requirements (water depth, vegetation cover, etc.) vary for each of the listed waterbirds, the depth of the ponds will have a maximum range from 18 inches to 24 inches. Water levels will be monitored to optimize suitability for each of the species, and a series of 14 solar-powered pumps will augment the ponds with water from groundwater wells. Ample water circulation can prevent conditions that lead to the outbreak of botulism. The pumps will ensure sufficient water circulation to minimize the potential for an outbreak.

Each of the ponds will be subdivided into five or six interior cells. The arrangement of the cells will follow site topography in an effort to minimize the extent of the earthwork. A single side channel will route water through the pond cells, and will be situated so that it can also be used to drain the ponds. Flow control structures with adjustable weirs will be utilized within the ponds and the feedwater/drainage channel will control water levels within pond cells. The perimeter of the two main ponds will be enclosed by a predator control fence. Management access will be maintained along berms of ponds for maintenance equipment and State service vehicles.

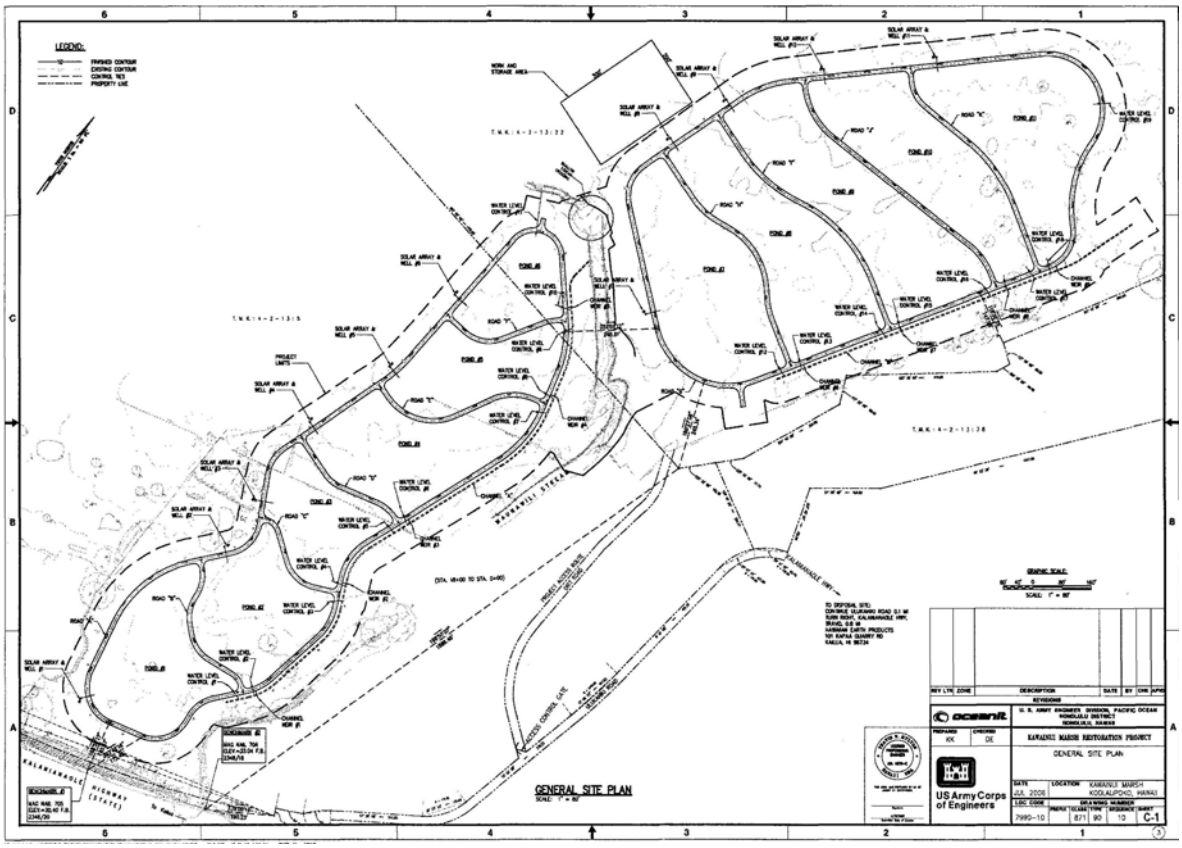

Figure 2. Army Corps of Engineers 95% Design Site Plan for Kawainui Marsh Restoration Project.

Post Construction Endangered Waterbird Management
The purpose of the project is to create habitat for four endangered Hawaiian waterbirds, and thereby increase the populations of these species. To ensure these goals are met, a Kawainui Marsh Restoration Area Management Plan (Management Plan) will be developed by DOFAW, in conjunction with the Service and the Corps. The plan will include:

- A predator control program with Best Management Practices (BMPs) to minimize interactions with listed waterbirds and other environmental impacts.

- A program of survey and eradication to address incursions by feral mallard and hybrid ducks.

- A revision to the *Management Plan for the Control of Avian Botulism at Kawainui Marsh, Oahu, Hawaii August 1997* to include recommendations from the Service including, but not limited to surveillance for outbreaks, response measures such as draining of ponds and removal of carcasses, and post-outbreak population monitoring.

- Population monitoring and breeding productivity monitoring to document project success.

- Adaptive management recommendations to address habitat requirements for Hawaiian waterbirds.

- Commitment of dedicated State biologists to manage, monitor and implement the Kawainui Marsh Restoration Area Management Plan.

Conservation Measures
The following conservation measures were developed to avoid or minimize effects to listed species reviewed in this consultation and are considered part of the project description. Any changes to, modifications of, or failure to implement these conservation measures may result in a need to reinitiate this consultation.

Construction - Wetland Creation
During vegetation removal, pond excavation, and wetland construction, listed waterbirds might be impacted either through disturbance of foraging or nesting or through increased attraction to the site as the habitat becomes improved, resulting in interactions with machinery and humans. To minimize the likelihood that waterbirds will be present during construction, it will begin during the driest time of year, July thru October. However, if there is sufficient rainfall during the construction period to create ponded water and waterbirds are present, the contractor will avoid these areas until it has dried and the birds have left the area. To minimize the likelihood that construction activities may impact listed waterbirds, a biologist familiar with Hawaiian waterbirds and their nesting behavior will be on site during the mobilization and clearing of vegetation to provide assistance to the contractor in preventing

disturbance to waterbirds that may be present. Nest searches by the biologist will be conducted prior to any work being conducted and after any subsequent delay in work of three or more days (during which birds may attempt nesting). If a nest is discovered, work will cease in the vicinity for a minimum of 60 days; if a nest with chicks is discovered, work will cease for 30 days. These standard guidelines are intended to protect chicks, and may be shortened if monitoring is conducted often enough to note when chicks have fledged (usually five to six weeks after hatching). If a previously undiscovered nest is found after work begins, all work should cease within a minimum radius of 100 feet of the nest and the Service shall be contacted within 24 hours.

Post Construction - Endangered Waterbird Management

The purpose of the project is to create or restore habitat for four endangered Hawaiian waterbirds, and thereby increase the populations of these species. To ensure these goals are met, the Kawainui Marsh Restoration Area Management Plan will be developed. The plan will include a predator control program, a revised avian botulism plan, recommendations for vegetation management, feral mallard and hybrid duck control, and recommendations for waterbird monitoring.

The predator control program will address the full suite of known waterbird predators; mammalian, avian, and amphibian. Live trapping for mongooses and feral cats will be conducted year round, for the protection of listed waterbirds attracted to the restored wetland. Bait stations (utilizing approved rodenticide) will be utilized year round to control rat predation on listed species. Avian predators such as non-native introduced cattle egret should be discouraged from using newly created wetlands. Management activities with equipment should be limited adjacent to nesting sites during Hawaiian stilt breeding season to minimize egret-waterbird interactions. Removal methods shall be utilized to discourage avian predation of Hawaiian waterbirds. Amphibian surveys will be conducted to detect bullfrogs as they attempt to colonize newly created wetlands. If bullfrogs are detected methods of removal shall be implemented to eradicate populations.

The revised Management Plan for the Control of Avian Botulism at Kawainui Marsh will include procedures for immediate action if an outbreak occurs, including pond water level manipulation, removal of all bird carcasses to prevent the spread of botulism, and monitoring of bird populations in the area to prevent the further spread of the outbreak.

Feeding feral ducks shall be discouraged in newly created wetlands. A program of survey and eradication should be in place to address incursions by feral and hybrid ducks. Guidance for ducks that will be removed will be done by DOFAW Oahu Wildlife Biologist coordinated with Pacific Islands Fish and Wildlife Office based on criteria outlined in Hawaiian duck - hybrid identification key. Specimens of hybrid duck shall be retained and disposition of carcasses shall be coordinated with Pacific Islands Fish and Wildlife Office.

The following activities will include the following BMPs:

Predator Control Procedures:

- Live traps for the control of predators will be strategically placed along fence lines, dikes, and marsh edges as outlined in the Management Plan or directed by the DOFAW biologist.

- Traps will be maintained in good working order; trip pans clear and moving parts free of debris.

- If traps catch Hawaiian moorhen, traps will be relocated with coordination from the Oahu DOFAW biologist.

    - ♦ Live traps for small mammals will be checked every 48 hours while trapping activities occur. Live traps will have filled water bottles replaced as needed, and traps will be shaded.

    - ♦ If a Hawaiian moorhen is incidentally captured during live trapping activities the bird will be examined and released immediately, if unharmed. If banded: location, band numbers, colors, and band orientation will be recorded and reported to DOFAW Oahu Wildlife Biologist. Pacific Islands Fish and Wildlife Office will be notified within 24 hours if a moorhen is captured.

    - ♦ If a Hawaiian moorhen is injured, an appropriate wildlife veterinarian will be contacted and the bird will be transported for care. The DOFAW Oahu Wildlife biologist and the Service will be notified immediately of this activity. Capture incidents will be evaluated within 24 hours and trapping efforts will be modified to assist in minimizing any future captures coordinated with Pacific Islands Fish and Wildlife Office.

- Bait Stations utilizing approved rodenticide will be strategically placed along fence lines and interior of fenced area coordinating with Oahu DOFAW biologist and in accordance to the label.

- Notification signs will be posted and maintained at all project areas.

- Bait Stations will be visited and cleaned on seven to ten day intervals based on consumption rates. Moldy or degraded baits will be removed and disposed of according to label restrictions. Fresh baits will be placed in each station as needed during visits.

- Rodenticide usage will be submitted annually to Pacific Islands Fish and Wildlife Office.

Vegetation Management:

- Invasive plant species will be removed pursuant to the guidelines defined in the Kawainui Marsh Restoration Area Management Plan. In addition, the Plan will address the proposed plant species palette and percentage of species coverage to open water depending upon the area and the target species of waterbird.

- Management of vegetation and removal of invasive plant species will be detailed in the Kawainui Marsh Restoration Area Management Plan. Issues to be addressed include timing of vegetation removal, process for removal (e.g., herbicide, mechanical, hand-weeding).

- The Kawainui Marsh Restoration Area Management Plan will address avoidance and minimization measures for vegetation management and potential effects to listed waterbirds.

Monitoring Waterbird Populations:

- Monitoring is a critical component of any management plan since it is important to know if actions are indeed beneficial for the target species. The Kawainui Marsh Restoration Area Management Plan will outline monitoring recommendations for waterbirds. The surveys will be designed to avoid any impact to nesting waterbirds.

Appendix E

Environmental Operating Principles

MEMORANDUM FOR THE RECORD
APPLICATION OF U.S. ARMY CORPS OF ENGINEERS
ENVIRONMENTAL OPERATING PRINCIPLES

1. Background.[3]

On 26 March 2002, the U.S. Army Corps of Engineers reaffirmed its commitment to the environment by formalizing a set of "Environmental Operating Principles" applicable to all its decision-making and programs. In the June 16, 2005 U.S. Army Corps of Engineers Campaign Plan issued by LTG Carl Strock, Chief of Engineers, the Corps' commitment to the environment and the Environmental Operating Principles is listed as one of the five campaign visions and goals for the Corps.

These principles foster unity of purpose on environmental issues, reflect a new tone and direction for dialogue on environmental matters, and ensure that employees consider conservation, environmental preservation and restoration in all Corps activities. The principles provide the Corps direction on how to better achieve its stewardship of air, water, and land resources, while demonstrating the connection between water resources, protection of environmental health, and the nation's security.

Environmental sustainability can only be achieved by the combined efforts of federal agencies, tribal, state and local governments, and the private sector, each doing their part, backed by the citizens of the world. These principles help the Corps define its role in that endeavor.

By implementing these principles, the Corps will continue its efforts to develop the scientific, economic, and sociological measures to judge the effects of its projects on the environment and to seek better ways of achieving environmentally sustainable solutions.

The principles are consistent with the National Environmental Policy Act, the Army's Environmental Strategy with its four pillars of prevention, compliance, restoration, and conservation, and other environmental statutes and Water Resources Development Acts that govern Corps activities. They will be integrated into all project management processes.

2. Environmental Operating Principles Checklist.

In order to ensure that all projects are consistent with the environmental operating principles to the extent practicable, following is a checklist of the environmental operating principles and how the

[3] Background information was obtained from "The USACE Campaign Plan", 16 June 2005 and the USACE website, http://www.hq.usace.army.mil/cepa/envprinciples.htm as accessed on 23 February 2006.

Kawai Nui Marsh Environmental Restoration Project, Kailua, Island of Oʻahu, Hawaiʻi meets these principles.

(a) Strive to achieve environmental sustainability. An environment maintained in a healthy, diverse, and sustainable condition is necessary to support life.

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: The Kawai Nui Marsh Environmental Restoration Project is a joint State of Hawaiʻi Department of Forestry and Wildlife and U.S. Army Corps of Engineers project to restore and enhance portions of the marsh as suitable habitat for four endangered Hawaiian waterbird species. Environmental considerations were therefore central in the planning process, and sustainable features and methods were utilized wherever possible. For example, source water to each pond will be supplied through individual shallow groundwater wells equipped with solar-powered pumps.

(b) Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: This project seeks to enhance the physical environment for the benefit of endangered waterbirds that utilize the marsh. The purpose of the project is to enhance the environment, and the Environmental Assessment (EA) and Supplemental EA prepared by the Corps did not reveal any potential negative environmental impacts.

(c) Seek balance and synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: The original flood control project protects life and property from flooding. This project adds to the effectiveness of the project to slow runoff and at the same time, create habitat for endangered Hawaiian waterbirds. The project benefits both humans and endangered species.

(d) Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: The Corps will participate in the development of long-term management principles for the ecosystem restoration project that will ensure accountability and success of the project.

(e) Seeks ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: This project will impact wetlands but will have positive cumulative impacts to the marsh by creating shallow open ponds of two to six inches that are attractive to the waterbirds. It also includes predator control and vegetation control to maintain the ponds.

(f) Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: By enticing the endangered Hawaiian waterbirds to the marsh, the birds may nest and forage there. Also, bird watching and observation may help the recovery of the species by learning more about them and their habits. It also has possibilities to educate the public on these endangered species.

(g) Respect the views of individuals and groups interested in Corps activities, listen to them actively, and learn from their perspective in the search to find innovative win-win

_X Project meets Principle
__ Principle is not met due to project constraints.
__ Principle is not applicable to this project.

Explanation: The current project was coordinated with the State Historic Preservation Office and several native Hawaiian groups. The project features took into consideration the concerns of the groups. Modifications to the project and its implementation were made in response to their concerns, including, but not limited to, having an archaeological monitor on site. The Office of Hawaiian Affairs (OHA) expressed its desire to include a taro loʻi as part of this project. Although this is not a viable option at this time, the Corps and OHA are hoping to partner in the future on a project to restore the loʻi in the vicinity of this project.