



CHAPTER 2
EXISTING CONDITIONS

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2.1 Project Area

The wetland restoration project area involves a total of approximately 80 acres, which comprises about 10 percent of the entire Kawainui Marsh. Figure 2.1 shows the project boundary in relation to the entire marsh. Notable land uses surrounding the restoration area include Le Jardin Academy to the west (*mauka*) and the Castle Medical Center and Pohakupu residential subdivision to the east (*makai*) as shown on the figure.

The project area is bounded on the west (*mauka* side) by Kapa‘a Quarry Road which runs in a north-south direction from its intersection with Kalaniana‘ole Highway. The highway forms the project’s southern boundary generally running in an east-west direction. Remaining areas of the project area are bordered by the marsh. An area known as Mokulana peninsula is situated across the highway’s intersection with Auloa Road. A portion of the marsh planned for the creation of ponds by the Department of Army, Corps of Engineers (COE) is located below (east) the restoration project area.

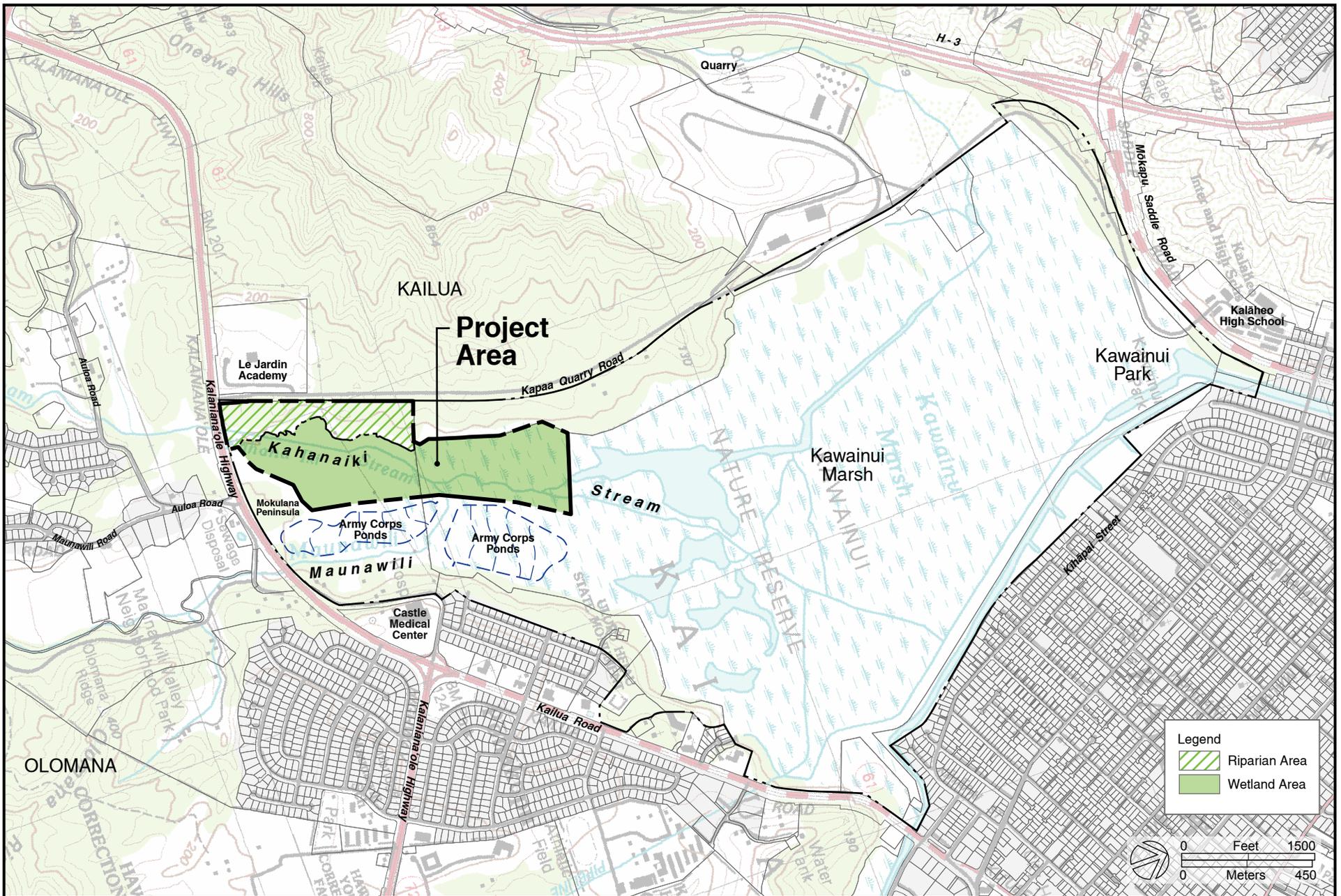
The 80-acre project area can be characterized as consisting of approximately 60 acres of wetland with Kahanaiki Stream extending through the site in a north-south orientation. The remaining 20 acres consists of adjacent upland riparian and

forested slopes situated above the wetland area and *makai* of Kapa‘a Quarry Road.

2.2 Property Information and Land Use Designations

The project area is identified as Tax Map Key (TMK) No. (1) 4-02-013: portions of 005 and 022. These parcels are larger properties owned by the State of Hawai‘i and under the jurisdiction of the DOFAW. Figure 2.2 shows the project area in relation to the parcel boundaries based upon the Tax Map. It should be noted that parcel 43 shown on the TMK map was previously created for the intended issuance of a revocable permit, but has not been officially subdivided as a parcel. That revocable permit is no longer applicable and subdivision not required. Therefore, the correct boundary for parcel 5 follows the project boundary up to Kapa‘a Quarry Road based upon a State survey map dated July 2, 2007 prepared for Governor’s Executive Order 4102.

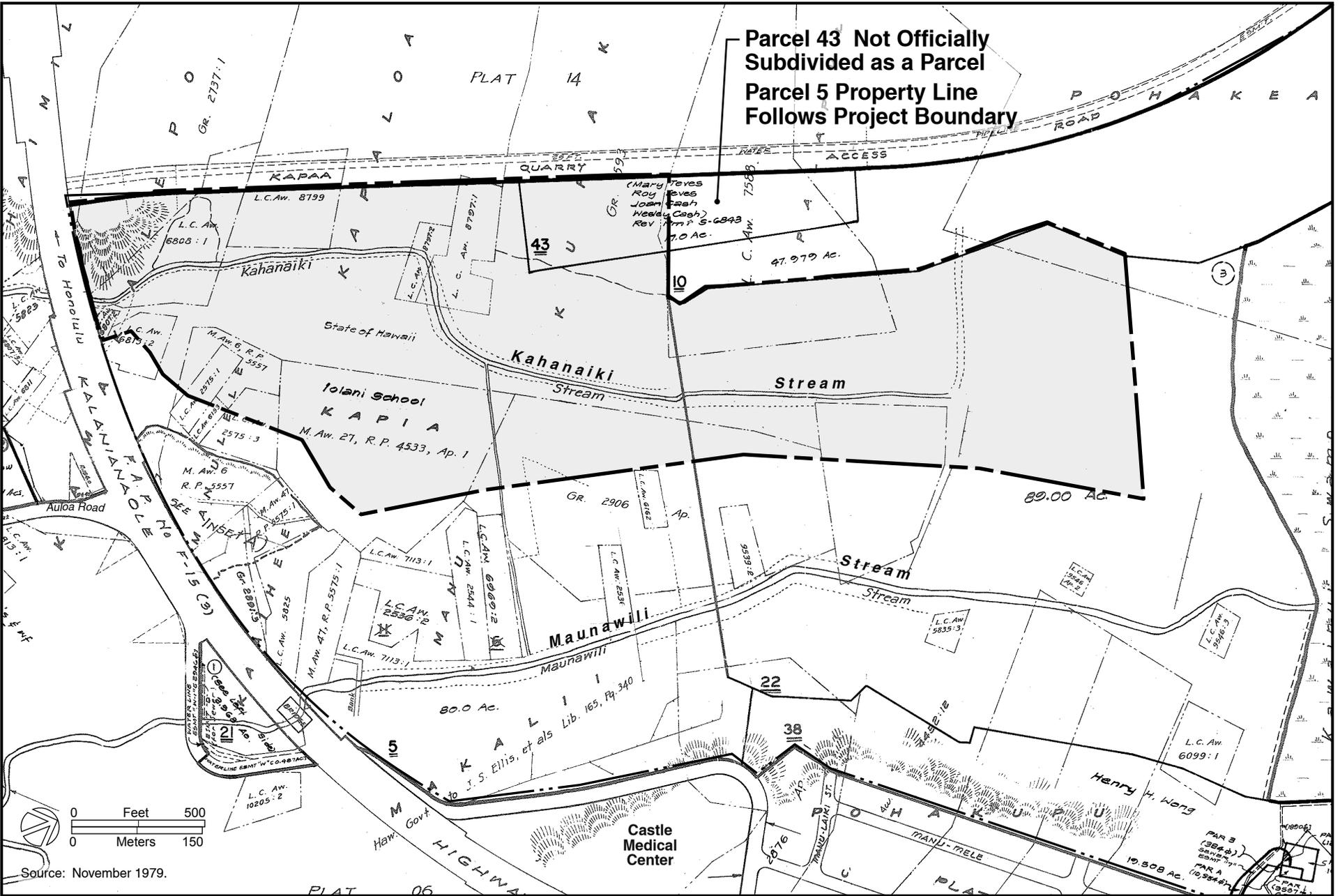
Parcel 5 consists of 97.224 acres based upon the State’s survey map. The Tax Map incorrectly identifies this parcel as being 80.0 acres. The Tax Map identifies parcel 22 as consisting of 89.0 acres. It was estimated that about 50 acres of the project area is situated within parcel 5 and 30 acres situated within parcel 22. A summary of this parcel information along with applicable land use designations for the project area is summarized below.



Project Vicinity Map
KAWAINUI MARSH WETLAND RESTORATION
AND HABITAT ENHANCEMENT PLAN
 KAILUA, O'AHU

Figure 2.1





Tax Map Key 4-02-013

KAWAINUI MARSH WETLAND RESTORATION
AND HABITAT ENHANCEMENT PLAN
KAILUA, O'AHU

Figure 2.2

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State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife



Table 1 TMK Parcel Summary and Land Use Designations		
Tax Map Key Parcels: (1) 4-02-013:	Parcel 005 Parcel 022	97.22 acres 89.00 acres (Project Area: 50 acres) (Project Area: 30 acres)
State Land Use District:	Urban District: Conservation District:	Primarily associated with upland area Primarily associated with wetland area
Ko’olau Poko Sustainable Communities Plan Designation:	Open Space / Preservation Areas (entire project area)	
Special Management Area:	Entire project area is within the SMA boundary.	
City and County of Honolulu Zoning District:	P-1, Restricted Preservation District: P-2, General Preservation District:	Follows Conservation District Follows Urban District

Parcel 5 was purchased by the State of Hawaii using federal assistance from the Land and Water Conservation Fund (LWCF). As a result, the parcel is subject to Section 6(f) of the LWCF Act that requires a public outdoor recreational use component that might include elements such as pathways, viewing areas, boardwalks, etc.

2.3 General Site Conditions

Kawainui Marsh serves as an important flood control basin protecting the low-lying urbanized areas of Kailua Town and Coconut Grove subdivision that experienced flooding in 1988 when floodwaters breached the levee. The levee was constructed in 1966 along the northernmost edge of the marsh to enhance its

flood storage capacity. It was later modified by the COE and City and County of Honolulu (City) in 1997 raising its height and constructing a concrete floodwall to address the 100-year flood level estimated for Kawainui.

The marsh generally drains in a south to north direction from Kapa‘a Quarry Road and Kalaniana‘ole Highway toward the shoreline. In the project area, Maunawili Stream is the main source of surface water flowing into the marsh with Kahanaiki Stream providing most of the remaining flows. Other inflow to the marsh comes from peripheral drainages and smaller, non-perennial streams. Water from the marsh is discharged into the Kawainui Channel (also referred to as Oneawa Channel) which drains into Kailua Bay.

Figure 2.3 provides an aerial photo of the project area and shows the general location of relevant streams. Additional photo documentation of existing conditions in the project area is provided in Appendix A.

Previous studies have estimated inflow from all sources in the marsh ranging from a low of 6.8 million gallons per day (mgd) to as much as 13.1 mgd. A 1994 assessment of the Maunawili Stream and Kawainui Marsh system used stream flow data to estimate flow from Maunawili and Kahanaiki Streams into the marsh at 12.3 mgd and estimated 0.3 mgd from other sources. Outflow from the marsh was estimated at approximately 4.6 mgd by evapotranspiration and 8 mgd through surface outlets and groundwater seepage (U.S. Army Corps of Engineers, December 2008).

Kahanaiki Stream is a perennial stream running through the project's 60-acre wetland restoration area characterized as generally consisting of a shallow (less than 1-foot deep) flow of water about four to seven feet wide. Exhibit 2 provides photos of the stream. Existing invasive vegetation has been encroaching the stream bank and the reducing open-water flows and shallow-water habitat. An abundant growth of this invasive vegetation has formed a very thick layer of peat (partially decomposed plant matter that is saturated with anoxic water) along the stream. The vegetation mat has also filled most of wetland area associated with Kawainui Marsh in this project area.

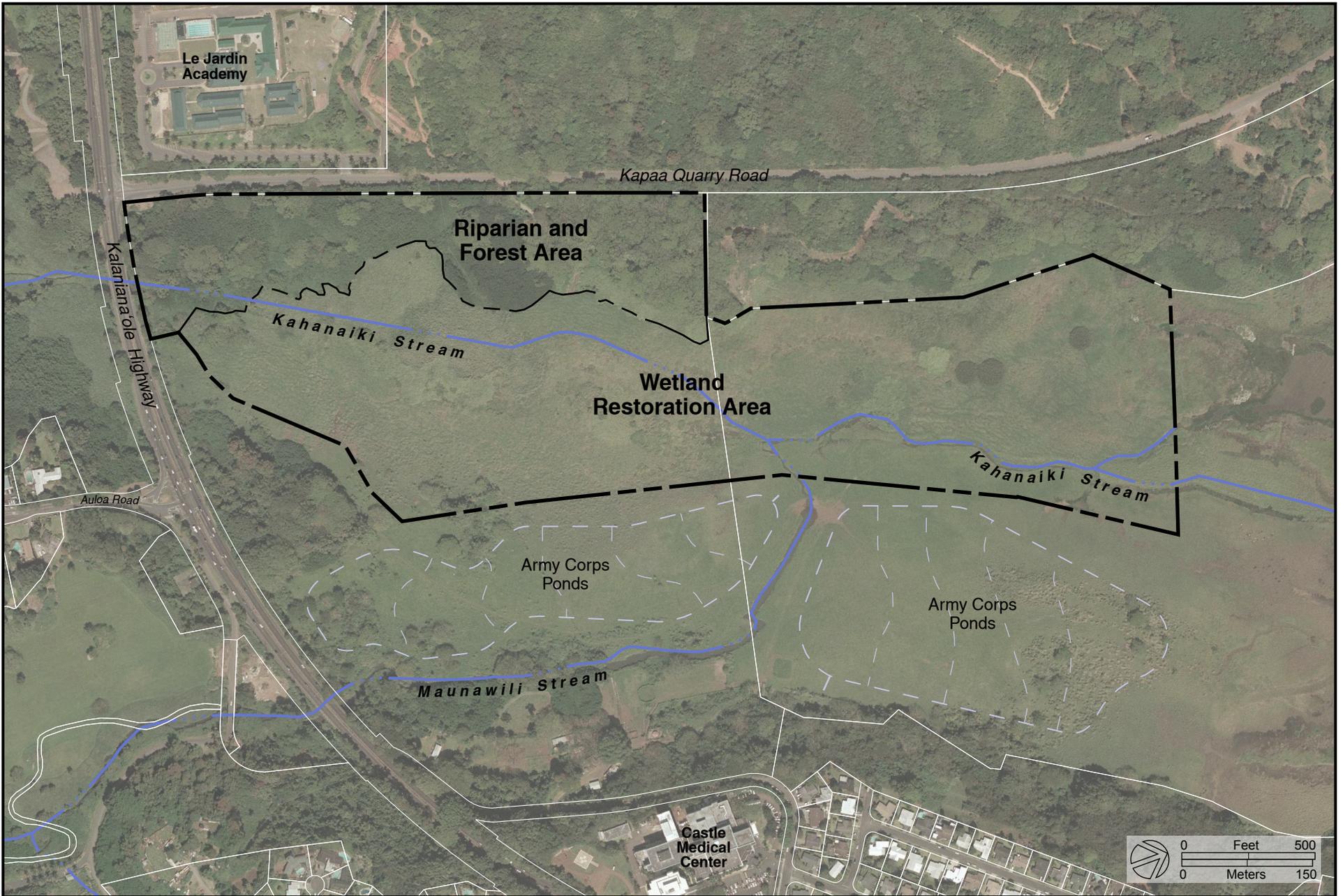


Northbound Photo of Stream



Southbound Photo of Stream

**Exhibit 2 – Photos of Kahanaiki Stream
within Restoration Project Area**



Existing Conditions Aerial Map
KAWAINUI MARSH WETLAND RESTORATION
AND HABITAT ENHANCEMENT PLAN
 KAILUA, O'AHU

Figure 2.3

Vegetation in the wetland area can be characterized as consisting of a California grass (*Urochloa mutica*) community, Elephant grass (*Pennisetum purpureuma*) stands, and some pasture lands typically dominated by California grass. The California grass community is dominant, along with patches of cattail (*Typha latifolia*) and bulrush occur and terrestrial vines (ex. *Canavalia cathartica* and *Paederia scandens*) in some places. Figure 2.4 includes a map showing a summary of general vegetation assemblages (Oceanit Laboratories, Inc., June 2006).

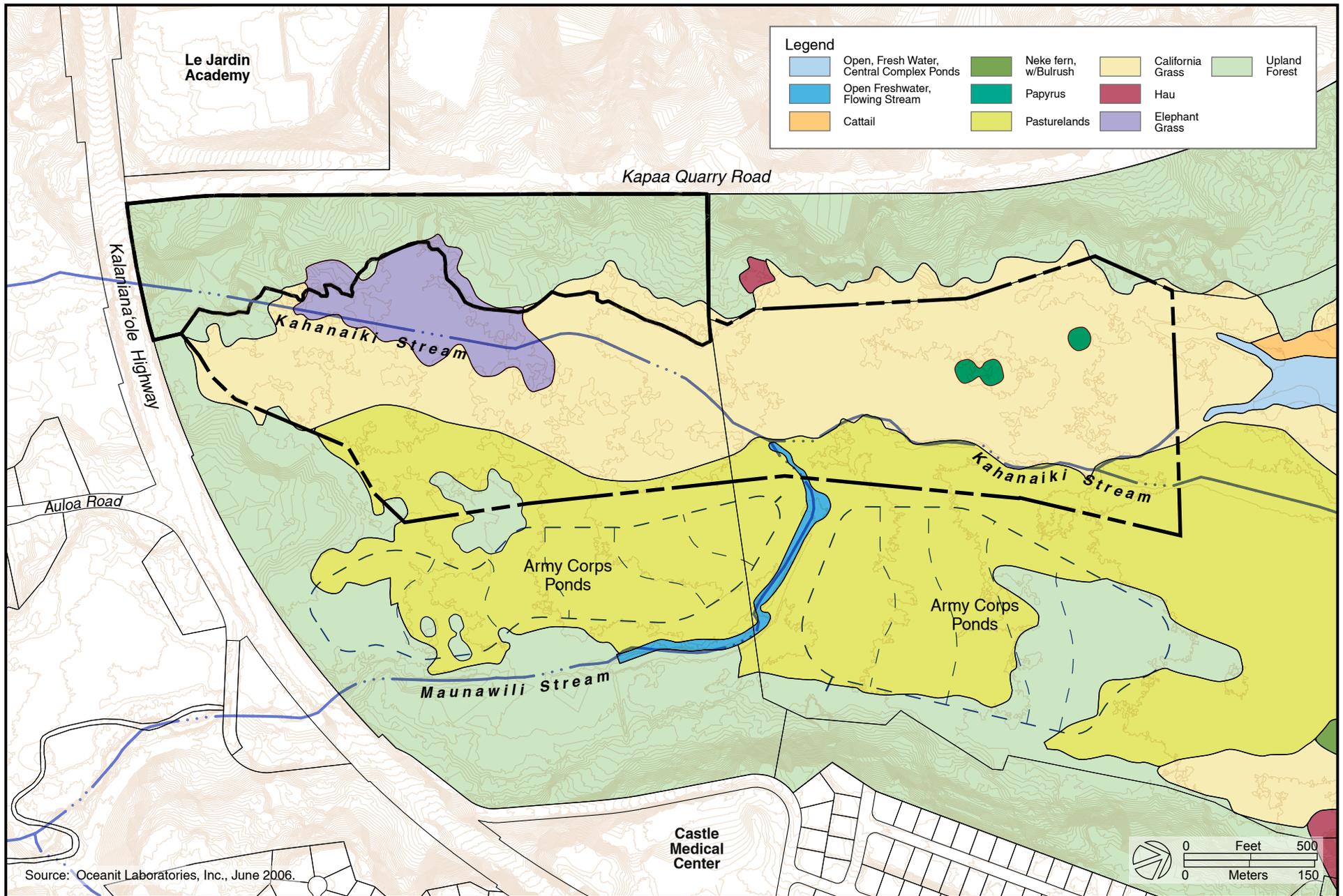
The 20-acre upland riparian project area hosts a variety of plants and several large trees (monkeypods and java plum) associated with an upland forest as shown in Figure 2.4. The southern end near Kalaniana'ole Highway is overgrown with trees and other invasive vegetation. The northern section has been cleared by DOFAW to provide an open grassed area, and a row of hau trees is located along a portion of Kapa'a Quarry Road. The northern most portion of the area has a canopy of various trees. Exhibits 3, 4, and 5 illustrate existing conditions in the project area. Additional images are provided in Appendix A.



Exhibit 3 – Northbound Photo of Open Grass
and Trees Along Kapa'a Quarry Road



Exhibit 4 –Photo of Overgrown Southern Portion of Project Area



Vegetation Assemblages for Project Area
 KAWAINUI MARSH WETLAND RESTORATION
 AND HABITAT ENHANCEMENT PLAN
 KAILUA, O'AHU

Figure 2.4

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 Division on Forestry and Wildlife





Photo of Trail and Vegetation in Northern Portion



Photo of Canopy Forest in Northern Portion

Exhibit 5 –Photos of Northern Upland
Forest Project Area

Avifauna and Aquatic Resources

Kawainui Marsh provides important habitat for four endangered species of native Hawaiian water birds and for migratory bird species. It was identified by the U.S. Fish and Wildlife Service as a “primary habitat” for the recovery of these water bird species. Its waters also support a variety of introduced and indigenous aquatic wildlife.

The project area provides habitat for various migratory waterfowl, wintering shorebirds and a variety of resident and introduced bird species. Standing ponds, wet pastures, and open water areas are attractive habitat for migratory waterfowl during the rainy season. Several migratory shorebirds identified in Kawainui Marsh include Pacific golden plovers (*Pluvialis dominica*), ruddy turnstones (*Arenaria interpres*), sanderlings (*Calidris alba*), and wandering tattlers (*Heteroscelus incanus*). Four species of endangered Hawaiian waterbirds found in Kawainui Marsh include the Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinule chloropus sandvicensis*), and Hawaiian duck (*Anas wyvilliana*).

In the upper reaches of the marsh, Kahana‘iki and Maunawili Streams are dominated by introduced species such as tilapia (*Oreochromis mossabmica* and *Sarothorodon melanotheron*), mosquito fish (*Gambusia affinis*), guppy (*Poecilia spp.*), carp (*Cyprinus carpio*), Chinese catfish (*Clarias fuscus*), swordtail

(*Xiphophorus heller*), bronze catfish (*Corydoras aeneus*) and smallmouth bass (*Microphterus dolomieu*). Native fish have been found in the marsh in low densities. These include the endemic goby (*Awaous guamensis*), an indigenous goby (*Stenobobius genivittatus*) and an endemic eleotrid (*Eleotris sandwicensis*).

There are several invertebrates within the marsh. Some of the introduced species include the Tahitian prawn (*Macrobrachium lar*), crayfish (*Procambarus clarkia*), damselfly (*Ischnura ranburii*), apple snail (*Pomacea sp.*), and pond snails (*Melanoides sp.*). Native invertebrates include the native shrimp (*Atyoida bisculata* and *Macrobrachium grandimanus*) (U.S. Army COE, December 2008).

Kawainui Marsh Predators

A wide variety of waterbird predators, mammalian, avian and amphibian, live within Kawainui Marsh or access the marsh from the surrounding areas. The small Indian mongoose (*Herpestes auropunctatus* or *javanicus*) is the most pernicious of the predators in the marsh and a key predator to waterbirds. The roof rat (*Rattus rattus*) inhabits a wide range of environmental conditions, and has been identified as a predator of native birds. Feral dogs (*Canis familiaris*) may constitute a threat to ground-nesting birds to a limited degree although they seem to confine their foraging to rats, sheep, goats and pigs. Because of the proximity of urban communities, domesticated dogs may also pose a threat to the Kawainui Marsh waterbirds, particularly

when dogs are walked through the marsh. Feral cats (*Felis catus*) pose a threat to both ground nesting and arboreal nesting birds.

Other species have been observed consuming or endangering native waterbirds and therefore constitute a threat to their recovery at the marsh. The cattle egret (*Bubulcus ibis*), introduced in Hawai'i in 1959 to control flies on cattle, is a predator on Hawaii's endangered waterbirds. Predation of waterbird chicks by the cattle egret and Black-Crowned Night Heron (*Nycticorax nycticorax*) has been documented at the Oahu National Wildlife Refuge (NWR). Predation of Hawaiian stilt chicks by the American bullfrog (*Rana catesbeiana*) also accounted for 45 percent of chick losses during the 2003-2004 season at the James Campbell NWR, and can be a threat at Kawainui Marsh.

Historic and Cultural Resources

The project area lies within the Kawainui Marsh archaeological cultural-historical complex that was deemed eligible for listing on the National Register of Historic Places in 1979 (SIHP 50-80-11-2029). The historic and cultural significance associated with Kawainui Marsh as a whole has been well documented. There are three identified heiau distributed around the marsh including Pahukini Heiau (Site 359), Holomakani Heiau (Site 360) and Ulupō Heiau (Site 371).

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 *Māhele* of 1848. Within the project restoration area, there were over two dozen *lo'i* patches fed by *'auwai* and possibly Maunawili Stream. The *lo'i* patches were converted to rice cultivation within the marsh in the late 1800s and early 1900s. Modern sediment deposits from floods and cattle grazing have both impacted the integrity of what may have been left in the way of archeology within the lowland areas of Kawainui Marsh.

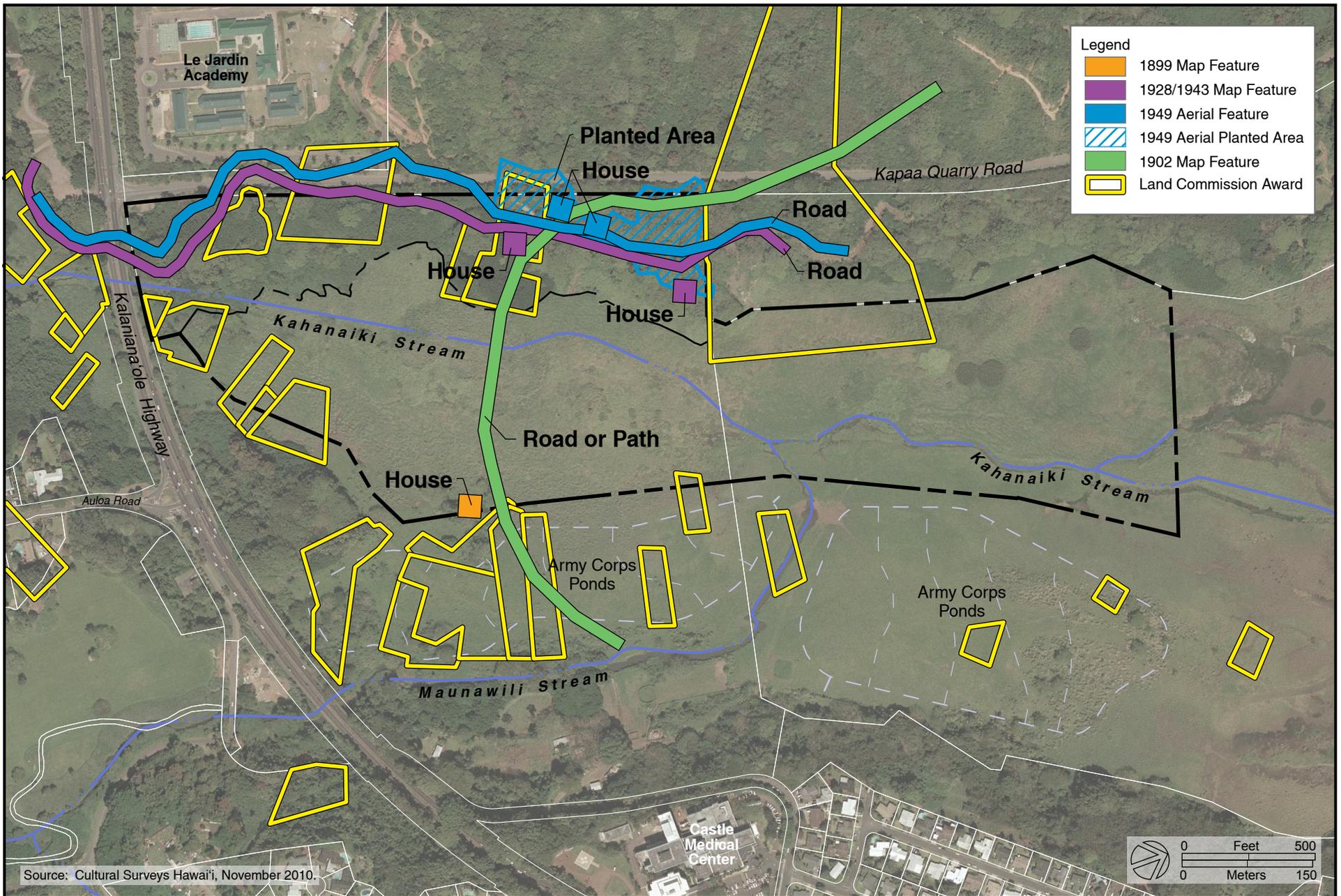
A pedestrian survey conducted by Cultural Surveys Hawai'i, Inc. (CSH) indicated no observable surface archeology within the project area. A long linear northeast/southwest trending break in slope ascending from the west (*mauka*) side of the marsh near a grindstone was identified. This probable terrace remnant is suggested to relate to two terraces previously identified by others (Ewart & Tuggle's 1977 "Site 7", Clark's 1980 "Cluster 12", and B. P. Bishop Museum Site # 50-Oa-G6-36). It appears these two sites may be the same but were shown as being 1,720 feet (550 meters) apart. However, it is probable that these two terrace sites both relate to road and house construction in the immediate area in the early twentieth century. This terrace is also believed to relate to extensive early twentieth century activity including grading for a road, agricultural field preparation, and possibly four houses. Figure 2.5 shows the locations of these post-contact features.

Access and Drainage Conditions

Currently, access to the project area is restricted to DOFAW employees for management and maintenance operations along with contractors hired by DOFAW for support activities. Kawainui Marsh is a State regulated wildlife sanctuary under Title 13, Chapter 126, HAR. As a result, it is prohibited for any person to enter the sanctuary unless authorized by permit by the Board of Land and Natural Resources or DOFAW. Additional access could be permitted by perimeter marked trails or roads. However, no such access trails have been established.

DOFAW has six (6) vehicular access locations to the project area which are shown on Figure 2.6. One access is from the DOFAW Kawainui Marsh Headquarters located behind Castle Medical Center along Ulakahiki Street. This location allows DOFAW to enter the lower (*makai*) portion of the project area between the two ponds being developed by the COE.

There are three access driveway locations along the State Department of Transportation's (DOT) Kalaniana'ole Highway. One location is referred to as the "Mokulana" access across from Auloa Road, which used to serve a former residence on the site. The second access along the highway is situated slightly east of the Mokulana access as shown on the figure. A third access is located further east near the highway's bridge serving Maunawili Stream. All these access points are gated.



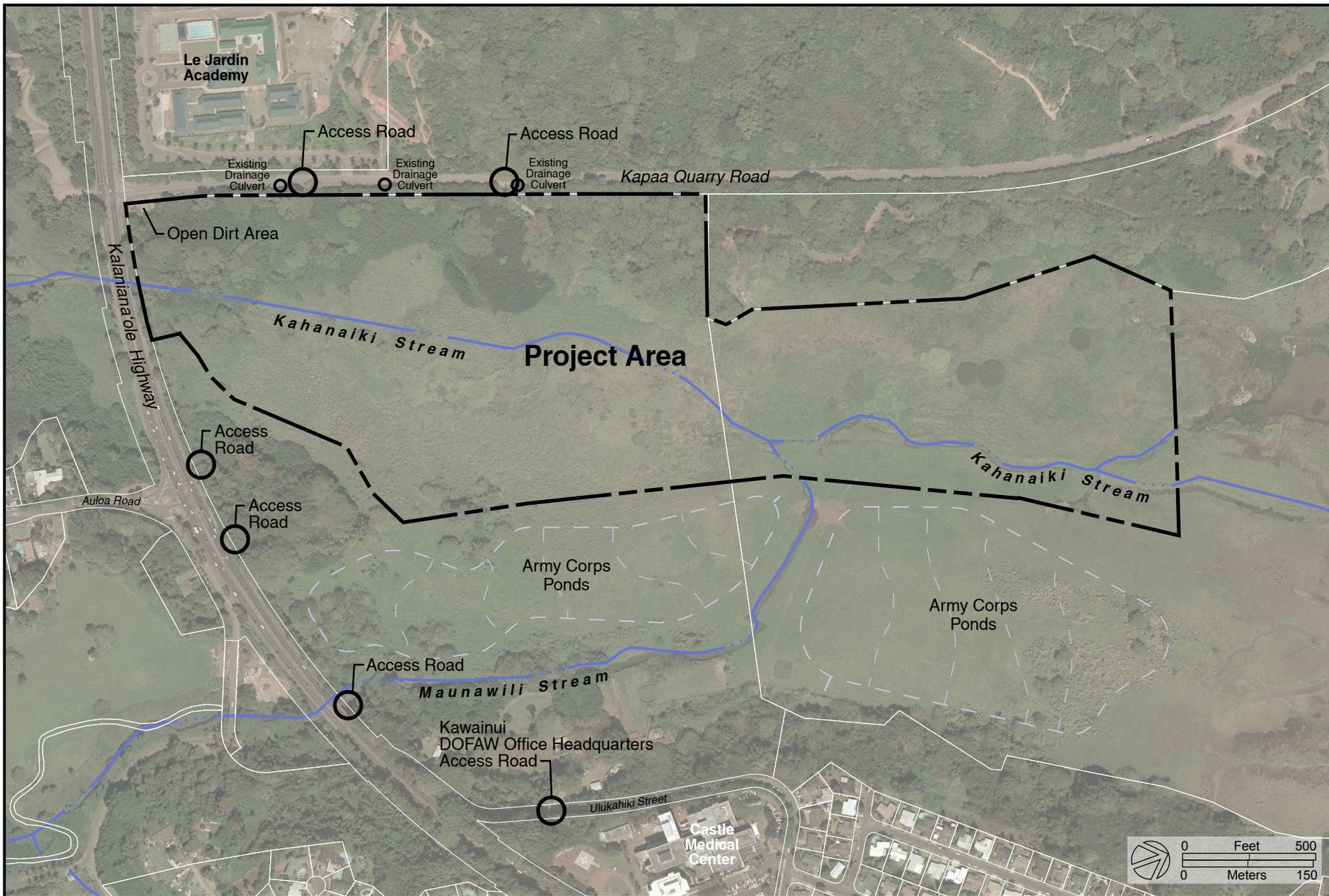
Post-Contact Features

KAWAINUI MARSH WETLAND RESTORATION
AND HABITAT ENHANCEMENT PLAN
KAILUA, O'AHU

Figure 2.5

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DOFAW Access Locations and Drainage Culverts
 KAWAINUI MARSH WETLAND RESTORATION
 AND HABITAT ENHANCEMENT PLAN
 KAILUA, O'AHU

Figure 2.6

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The fifth access is from Kapa‘a Quarry Road about 620 feet north from the intersection with the highway. This access has been closed and is blocked off from use at this time. The sixth access is about 350 feet north of the entrance to Le Jardin Academy. This gated location provides access to a dirt road that runs through the northern upland area of the project.

Kapa‘a Quarry Road is a privately owned road in the vicinity of this project area (part of TMK 4-02-014: 002). There are no established parking areas along Kapa‘a Quarry Road for vehicles within this area. The posted speed limit along this road is 25 mph, however, vehicles frequently travel at higher speeds. An open dirt area along Kapa‘a Quarry Road near the intersection with Kalaniana‘ole Highway is frequently used for parking (photo of area included in Appendix A).

The portion of Kapa‘a Quarry Road along the project area has a history of individuals dumping rubbish or bulky items along the roadside. This problem is periodically addressed through community clean-up events. There is no fencing or barriers around the perimeter of the marsh separating it from the highway and roadway, but vegetative buffers do form a visual barrier as indicated in photos in Appendix A.

Surface water runoff in the project area enters the marsh primarily from Kahanaiki and Maunawili Streams. Runoff from the highway also sheet flows into drainage culverts eventually discharging into these streams. A State DOT drainage ditch runs

along the northern side of the highway from the intersection of Kapa‘a Quarry Road discharging into Kahanaiki Stream at the bridge crossing. The drainage ditch is within the State DOT’s highway right-of-way and outside of the project area.

There are three drainage culverts along Kapa‘a Quarry Road collecting runoff from Le Jardin Academy and *mauka* areas before discharging into Kawainui Marsh. There is also one drainage location collecting overland sheet flow from Le Jardin Academy’s access road and discharging runoff across Kapa‘a Quarry Road and into the marsh. These culverts are in poor condition, filled with sediment, or in complete disrepair (see Exhibit 6).



Exhibit 6 –Photo of Existing Drainage Culvert

As a result, runoff discharging into the marsh from these general areas have contributed to erosion of the marsh's upland areas and may have begun to undermine the structural stability of some portions of Kapa'a Quarry Road. Runoff from Le Jardin Academy's access driveway also concentrates some flows from the campus across the road and into the marsh.

DOFAW Maintenance Operations

DOFAW maintenance operations at Kawainui Marsh are limited due to a shortage of available assigned staff. Three full-time positions were initially established for maintenance of the area. However, three existing positions were subsequently cut due to the State's fiscal circumstances. This forced DOFAW to increase the responsibilities of existing personnel making it more difficult to achieve maintenance objectives for the marsh. Recent maintenance operations have focused on reducing the amount of invasive vegetation in the wetland and upland areas. Vegetation is mowed or cut, and herbicide is applied periodically to control weeds as necessary.

DOFAW maintenance operations in the project area average approximately 12 man-days per month depending on weather conditions. Consequently, most work takes place during dry summer months. Some staff utilizes excavators or other mechanical equipment for larger maintenance activities, while others, including prisoners from the State's work furlough program, use weed whackers.

Equipment maintenance is also a factor that affects the availability of staff and their ability to maintain the environment at Kawainui Marsh. Machinery needs to be serviced, oiled, and frequently parts are ordered for replacement. These activities reduce the amount of time actually spent clearing and removing invasive vegetation by DOFAW staff.

DOFAW implements a predator control program as part of their maintenance operations since 2008. DOFAW currently has a contract with the U.S. Department of Agriculture to implement a trapping program. Cage traps are placed around the perimeter of the upper reaches of the project area, as well as in other areas of the marsh. Cage traps are the primary tool for controlling mongoose and feral cats.

