



Kanaio Forestry and Wildlife Area Project, Draft Environmental Assessment Maui Island, Hawai'i

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PREPARED FOR

**State of Hawaii, Department of Land and Natural Resources,
Division of Forestry and Wildlife**

PREPARED BY

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**KANAIO FORESTRY AND WILDLIFE AREA PROJECT,
DRAFT ENVIRONMENTAL ASSESSMENT
MAUI ISLAND, HAWAI'I**

Prepared for

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SUMMARY

TO BE AUTHORED FOLLOWING AGENCY REVIEW AND SWCA RESPONSE TO COMMENTS
ON THAT REVIEW

DRAFT

ACRONYMS AND ABBREVIATIONS

ANG	Army National Guard
APE	Area of Potential Effects
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWRM	Commission on Water Resource Management
DLNR	Department of Land and Natural Resources
DOCARE	Department of Conservation and Resources Enforcement
DOFAW	Division of Forestry and Wildlife
DOH	Department of Health
DOT	Department of Transportation
EA	Environmental Assessment
EHSD	Environmental Health Service Division
ESA	Endangered Species Act of 1973 [16 U.S.C. 1531-1544 et seq.]
FONSI	Finding of No Significant Impact
GMA	Game Management Area
GMAC	Game Management Advisory Commission
HIGAP	Hawaii GAP Analysis Project
HRS	Hawaii Revised Statutes
KFWA	Kanaio Forestry and Wildlife Area
KTA	Kanaio Training Area
MBTA	Migratory Bird Treaty Act
MHI	Main Hawaiian Islands
NAAQS	National Ambient Air Quality Standards
NAR	Natural Area Reserve
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
PHA	Public Hunting Area
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance

1 INTRODUCTION

In compliance with the National Environmental Policy Act of 1969 (NEPA) and Hawai'i Revised Statutes (HRS) 343, SWCA has prepared this environmental assessment (EA) to analyze potential effects of implementation of the Kanaio Forestry and Wildlife Management Plan. This EA examines the potential environmental effects of the proposed Kanaio Forestry and Wildlife Area (KFWA). The Division of Forestry and Wildlife (DOFAW) plans to establish the KFWA as a mixed-use public hunting area. The area will provide quality hunting opportunities and recreational use for the growing population on the island of Maui.

1.1 Proposed Action and Project Description

The Proposed Action consists of creating a Forest Reserve which will be called the Kanaio Forestry and Wildlife Area on the State-owned parcel and the potential cooperator parcel will be managed with emphasis on game management and fencing the border of the lower makai coastal area in the KFWA. The approximately 5,522-acre mauka (inland) portion of the KFWA extends from roughly 200 feet in elevation up to the Pi'ilani Highway (approximately 1,800 feet in elevation) and is to be considered a Forest Reserve. The approximately 1,939-acre makai (seaward) section of the KFWA, which extends from roughly 200 feet in elevation down to the coast, is designated as a separate makai coastal area. The coastal area includes the Hoapili Trail (also known as the King's Trail), which forms a portion of the traditional long trail (Ke Alaloha O Maui) that encircles the island of Maui (Figure 1).

The KFWA may consist of both public and private lands with the private lands being designated as a Game Management Area (GMA) and the state-owned lands designated as a Forest Reserve (through due process as per Hawaii Revised Statutes Chapter 183, Forest Reserves, Water Development, Zoning). DOFAW is proposing compatible uses for the proposed Forest Reserve area. These will include hunting, threatened and endangered species management, and cultural site and native ecosystem protection.

The goals of the KFWA project are to:

1. Protect the natural and cultural resources
2. Provide opportunities for public hunting
3. Maintain public access

1.2 Purpose and Need

The purpose of the Proposed Action is to increase public hunting opportunities and enhance protection of natural and cultural resources. The Department of Land and Natural Resources (DLNR), DOFAW has identified the following five factors that necessitate the designation of the land as a Forestry and Wildlife Area and that form the overall need of the Proposed Action.

- Reduce negative impacts to sensitive biological and cultural resources associated with ungulate trampling and grazing.
- Reduce negative impacts to sensitive biological and cultural resources from illegal off-road vehicle traffic and human disturbance.
- Reduce the impacts of wildfires.
- Provide a means to manage an overpopulation of game animals.
- Provide a means to provide the public with hunting opportunities.

- Ensure access to public lands and coastline

The 1,938.53-acre makai (seaward) section of the KFWA, which extends from roughly 200 feet down to the coast, will be fenced off from the remainder of the KFWA for ungulate control and protection of native ecosystems and cultural sites. This coastal area includes a section of the historic Hoapili Trail (also known as the King's Trail), which forms a portion of the traditional ala loa (long trail) that encircles the island of Maui, as well as numerous traditional shoreline settlement areas. The primary stewardship strategy for this coastal area will be to ensure the protection and preservation of these rich cultural resources.

The 5,522 acre mauka (inland) portion of the KFWA extends from roughly 200 feet (12 m) in elevation up to the Pi'ilani Highway (approximately 1,800 feet in elevation). These lands will be designated as a Public Hunting Area (PHA). Additional measures will be in place within the PHA for the protection of native species and cultural sites.

1.3 Legal Policy and Guidance

1.3.1 Endangered Species Act

The federal Endangered Species Act (ESA) of 1973, as amended, protects wildlife and plant species that have been listed as threatened or endangered. It is designed to conserve the ecosystem on which species depend. Candidate species, which may be listed in the near future, are not afforded protection under the ESA until they are formally listed as endangered or threatened. Section 9 of the ESA and rules promulgated under Section 4(d) of the ESA prohibit the unauthorized take of any endangered or threatened species of wildlife listed under the ESA. Under the ESA, the term *take* means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect species listed as endangered or threatened, or to attempt to engage in any such conduct." As defined in regulations, the term *harm* means "an act that actually kills or injures wildlife; it may include significant habitat modification or degradation, which actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (50 Code of Federal Regulations [CFR] 17.3). The rules define *harass* to mean "an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent, as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).

The ESA affords maximum legal protections to species listed as threatened or endangered under the law and also provides authorization for incidental take permits for take that occurs incidental to otherwise legal operations. To comply with federal laws, additional measures must be taken to ensure that take of ESA-listed species does not occur. Any fatality of a listed species should be reported to the U.S. Fish and Wildlife Service (USFWS) and DOFAW as soon as possible, and an incident report should be filed within 24 hours of detection

1.3.2 National Environmental Policy Act

NEPA provides a mandate and a framework for federal agencies to consider all reasonably foreseeable environmental effects of their proposed actions and to involve and inform the public in the decision-making process. The Council on Environmental Quality (CEQ) sets forth regulations (40 CFR 1500–1508) to assist federal agencies in implementing NEPA during the planning phases of any federal action. These regulations, together with specific federal agency NEPA implementation procedures, help ensure

that the environmental impacts of any proposed decisions are fully considered and that appropriate steps are taken to mitigate potential environmental impacts.

1.3.3 *Migratory Bird Treaty Act*

The Migratory Bird Treaty Act (MBTA) of 1918, as amended, prohibits the take of migratory birds. A list of birds protected under MBTA-implementing regulations is published under 50 CFR 10.13. Unless permitted by regulations, under the MBTA, “it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture or kill; possess, offer to sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product” (16 United States Code 703–712). The MBTA provides no process for authorizing incidental take of MBTA-protected birds. As a result, birds that are not covered under the ESA that may be adversely affected by the proposed action cannot be covered by take authorizations. Any take of MBTA-protected species should be documented and reported in a similar manner to any endangered or threatened species of wildlife listed under the ESA.

1.3.4 *National Historic Preservation Act*

Support for the creation of the KFWA is being provided by the United States Department of the Interior, Fish and Wildlife Service through their Pittman and Robertson Game Grant. The proposed establishment of the KFWA is therefore considered a federal undertaking under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. 40 et seq.) and subject to the requirements of 36 Code of Federal Regulations (CFR) 800.

Section 106 of the NHPA requires Federal agencies to take into account the effects of their proposed actions on historic properties, which are considered to be any prehistoric or historic district, site, building structure, or object included in or eligible for inclusion in the National Register of Historic Places. The Section 106 process seeks to incorporate historic preservation principles into project planning through consultation between a Federal agency and other parties with an interest in the effects of the Federal agency’s action upon historic properties.

1.3.5 *Executive Order 12898 – Environmental Justice.*

Executive Order 12898 requires federal agencies to take appropriate steps to identify and avoid disproportionately high and adverse effects of federal actions on the health and surrounding environment of minority and low-income persons and populations. All federal programs, policies, and activities that substantially affect human health or the environment shall be conducted to ensure that the action does not exclude persons or populations from participation in, deny persons or populations the benefits of, or subject persons or populations to discrimination under such actions because of their race, color, income level, or national origin. The Executive Order was also intended to provide minority and low-income communities with access to public information and public participation in matters relating to human health and the environment.

1.3.6 *Hawaii Revised Statutes, Chapter 343*

Hawai'i Revised Statutes (HRS) 343 was developed “to establish a system of environmental review which will ensure that environmental concerns are given appropriate consideration in decision making.” The project is located on State of Hawai'i land and is partially funded by the USFWS Pittman-Robertson Wildlife Restoration Grant. The federal funding triggers NEPA. The federal funding requires an EA to determine the impacts of the Proposed Action. The EA findings will undergo agency reviews to determine

if the potential impacts significantly impact the proposed action area. If the agency issues a Finding of No Significant Impact (FONSI) then the actions will be permitted.

1.3.7 Hawaii Revised Statutes Chapter 195D

The purpose of HRS Chapter 195D is “to insure the continued perpetuation of indigenous aquatic life, wildlife, and land plants, and their habitats for human enjoyment, for scientific purposes, and as members of ecosystems.” Section 195D-4 states that any endangered or threatened species of fish or wildlife recognized by the ESA shall be so deemed by the state statute. Like the ESA, the unauthorized take of such endangered or threatened species is prohibited (HRS 195-D-4[e]), but incidental take licenses can be obtained (HRS Section 195D-21). In addition to species protected under the ESA, rules adopted under HRS Section 195D-4 allow for the listing of indigenous species as threatened or endangered due to the following reasons:

- Habitat destruction or alteration (current or predicted)
- Overexploitation
- Disease or predation
- Lack of regulatory mechanisms
- Other factors threatening the species’ continued existence

Determinations are made based on any and all available sources of data (scientific, commercial, and other) and on consultation with appropriate agencies (federal, state, and county) and interested organizations and parties.

1.4 Public Involvement and Agency Coordination

The proposed management actions were developed by DOFAW and reviewed and supported by the Hawai'i Game Management Advisory Commission (GMAC) and members of the Maui hunting community (Meeting on November 4, 2019).

2 ALTERNATIVES, INCLUDING THE PROPOSED ACTION

2.1 Alternative 1: No Action Alternative

Under the No Action Alternative, DOFAW would not implement any of the proposed Kanaio Forestry and Wildlife Area Management Plan actions in the proposed area. Currently, no management designations or practices and activities are in place to protect public access, and natural and cultural resources in the area.

2.2 Alternative 2: Implement Kanaio Forestry and Wildlife Area Draft Management Plan

The proposed Kanaio Forestry and Wildlife Management Plan (Appendix B) will protect natural and cultural resources from further damage by humans and ungulates. The KFWA will provide and expand opportunities for public hunting, which has not been allowed to this date; aid in directing human traffic in the area; and curtail damage from activities such as illegal off-road vehicles, unauthorized cattle grazing,

and other human-caused disturbances, degradation, and destruction (including a legacy of impacts as a result of military training activities). The management plan actions for the establishment of the KFWA include constructing firebreaks, roads, signage, fencing, and other infrastructure.

This alternative ensures the protection of biological and cultural resources from further damage by humans and ungulates (including feral ungulates, primarily goats). DOFAW proposes an integrated approach to resource management. This approach will include curtailing of damaging activities such as illegal off-road driving, elimination of unauthorized cattle grazing, and provide and expand opportunities for public hunting to reduce ungulate herds to levels that are acceptable recreationally, socially and environmentally.

To facilitate this approach, DOFAW intends to undertake infrastructure improvements within the KFWA. These improvements include the maintenance of existing access roads, the construction of one additional internal road, the establishment of six water stations for game bird management, and the installation of an exclosure fence on Pu'u Pimoe and a makai boundary fence to protect biological and cultural resources along the coastline (Figure 1).

The proposed KFWA encompasses one of the last remaining stretches of lowland dry forest left in the state of Hawai'i and contains several threatened and endangered species. Studies have shown that approximately 10 percent of the original tropical dry forests remain in Hawai'i (Bruegmann 1996).

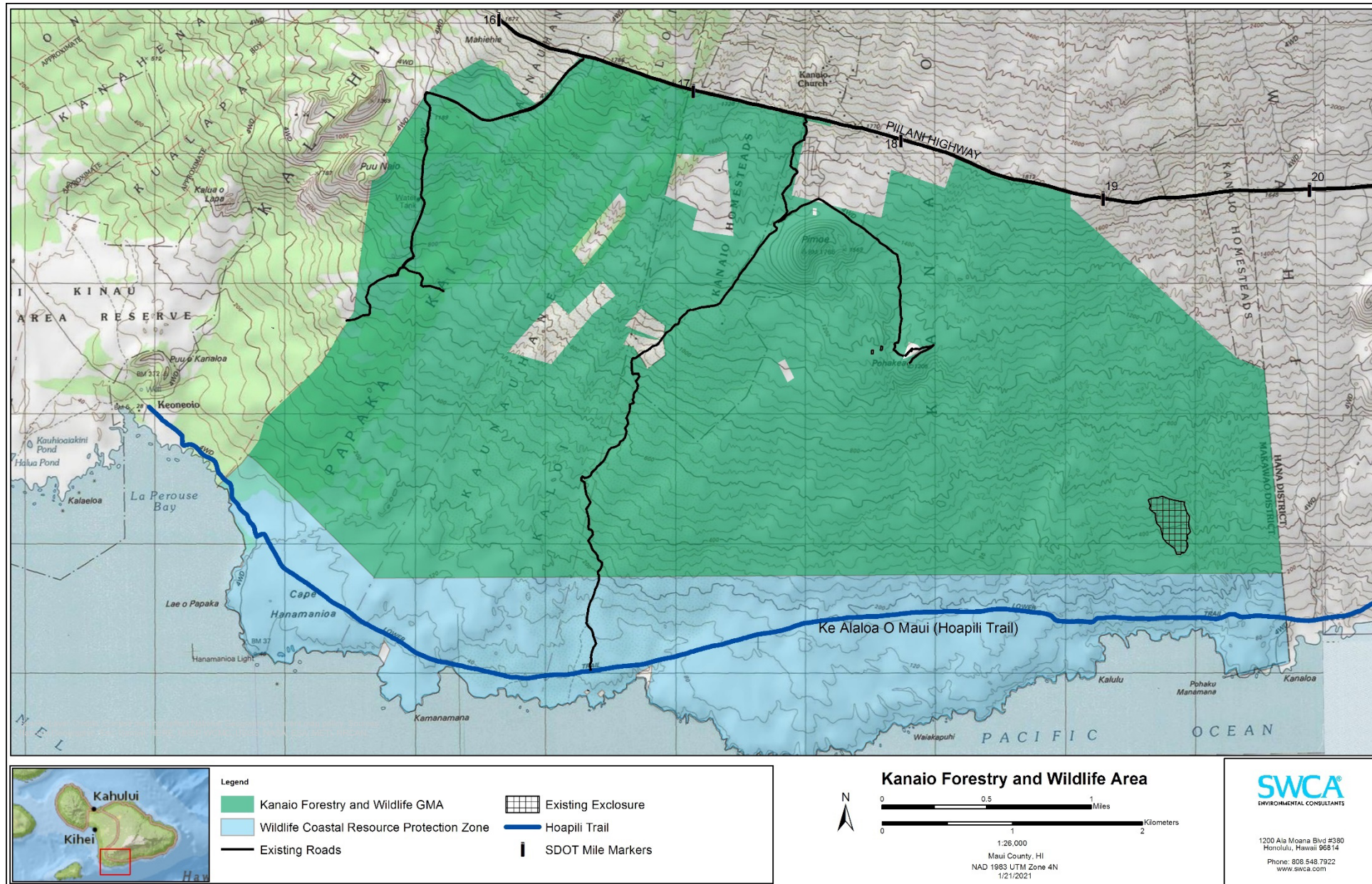


Figure 1. Location of the proposed Kanaio Forestry and Wildlife Area.

Public hunting in the KFWA will be limited to areas north of the proposed fence that separates the KFWA from the coastal area. Methods of hunting in the KFWA will include archery, and for a limited time shotguns for hunting goats, for game mammals (axis deer [*Axis axis*], feral pig [*Sus scrofa*], and feral goat [*Capra hircus*]) and use of shotgun for game birds (black francolin [*Francolinus francolinus*], gray francolin [*Francolinus pondicerianus*], and ring-necked pheasant [*Phasianus colchicus*]). The public hunting area will include firebreaks; safety zones; interior roads and turnouts; game bird watering stations; hunter check-in stations and related signage; and protective fencing for sensitive biological resources. A fence will be installed to separate the public hunting and non-hunting areas along the southern boundary. The Proposed Action will consist of the following major project components.

- Establish a 5,522-acre KFWA.
- Enclose the 1,939-acre coastal area.
- Construct one new road, 1.87 miles long and 12 feet wide, totaling 5.03 acres in the KFWA. Roads will allow hunters access to more area within the KFWA and create firebreaks.
- Install one new fence enclosure, 1.1 miles long and 1.6 feet wide, encompassing 56.5 acres (23 ha), located at the Pu'u Pimoe within the KFWA.
- Install one fence, approximately 5.8 miles long and 1.6 feet wide, totaling 1.1 acres, along the border between the KFWA and coastal area. To enclose the coastal area, the fence will connect with an existing fence at the western border; along the eastern border, the fence will terminate at the ocean shoreline.
- Remove ungulates from the coastal area.
- Construct six game bird watering stations, totaling 0.006 acre, in the KFWA.
- Establish seven non-hunting safety buffer areas around private land and around houses in the KFWA.
- Install one hunter check-in station and related signage in the KFWA.

To ensure the protection and viability of these resources, three distinct management goals and their related actions have been defined, as shown in Table 1.

Table 1. Management Goals and Actions

Goals	Actions
Goal 1 Ensure the protection of important, threatened, or endangered species and cultural resources	<ul style="list-style-type: none"> • Install Pu'u Pimoe fence • Install Makai lower boundary fence • Monitor public access • Conduct annual vegetation monitoring • Conduct fire management • Monitor condition of cultural resources • Maintain scenic wilderness character and uses by avoiding and minimizing improvements and developments
Goal 2 Provide consistent processes for actions within the Game Management Area	<ul style="list-style-type: none"> • Implement 5-Year Game Management Plan • Ensure quality hunting opportunities and game species viability • Conduct ungulate population surveys and management program • After implementation and achievement of 5-year plan, maintain ungulate populations at those agreed-to numbers.

Goals	Actions
Goal 3 Guide public use of the area, including hunting	<ul style="list-style-type: none">• Conduct DOCARE (Department of Conservation and Resources Enforcement) enforcement to reduce human impacts on cultural and natural resources• Establish coastal area public use• Post signs and information about the area's sensitive resources to guide recreational use• Educate hunters regarding sensitivity of cultural sites

3 PROPOSED INFRASTRUCTURE IMPROVEMENTS

To assist in the protection and long-term management of biological and cultural resources located within the KFWA, DOFAW is proposing to implement minimal infrastructure improvements. These improvements will all be located within the mauka KFWA, although they will help to protect both the KFWA and the Wildlife Coastal Resource Protection Zone.

4 EXISTING ACCESS ROADS

At present, there are two existing access roads leading from the Pi'ilani Highway down into the KFWA. The first of these roads is the main Kanaio Beach Road, whose entry off of Pi'ilani Highway is located near the center of the KFWA. The Kanaio Beach Road extends down to the coast. A shorter branch road leads past Pu'u Pimoe almost to Pu'u Pohakea (the Pohakea Road).

The entire Kanaio Beach Road, the Pohakea Road, and the lower section of the 'Ulupalakua Ranch Road are unpaved and require a four-wheel drive vehicle to access them. DOFAW does not intend to improve these existing roads to any major degree and does not intend to modify the nature or frequency of their use by the public to access KFWA. Instead, it will perform minor maintenance and install occasional pull-offs/turn-arounds on stretches of road located within the area. These roads will allow DOFAW crews to access and monitor the KFWA. Under DOFAW management, Department of Conservation and Resources Enforcement (DOCARE) officers will increase presence and issue citations for off-road driving and other activities detrimental to the natural and cultural resources of the KFWA.

The second access road is the 'Ulupalakua Ranch Road, which enters from Pi'ilani Highway at the northwestern corner of the KFWA. This road extends down to approximately 520 feet in elevation before bending west and continuing outside the boundary of the KFWA (Figure 2). The upper third of this road is already paved and therefore will not be affected by management actions and road maintenance activities. The road is currently private and closed. Currently there is an existing ranch gate at the top of the 'Ulupalakua access road, and DOFAW intends to keep this gate installed to help control access into the KFWA. DOFAW intends to install a hunter check-in station at the entrance to the 'Ulupalakua Ranch. The hunter check-in station will monitor traffic into the KFWA and provide hunters with educational materials informing them about the fragile natural and cultural resources within the area.

A proposed contour road would stretch from the existing 'Ulupalakua Ranch Road to the existing Kanaio Beach Road (Figure 1). The road will improve hunter access to the area and provide a fire break to support wildfire suppression efforts. The road is intended to be accessed by four-wheel drive vehicles only and is not intended for other recreational use.

5 WATER STATIONS

A total of six water tanks are proposed to be constructed within the KFWA. The tanks will serve as water stations to support game bird species such as Gray Francolin (*Francolinus pondicerianus*), Black Francolin (*Francolinus*), and Ring-necked Pheasant (*Phasianus colchicus*).

The footprint of these tanks will be no more than 10 feet (3 m) in radius (20 feet in diameter). Each tank will have a perimeter fence to prevent ungulate access to the water. All of these tanks will be located immediately adjacent to either existing or planned access roads: one along the Pohakea Road just north of Pu'u Pohakea (Water Tank 1), one along the Kanaio Beach Road (Water Tank 2), one along the Papaka Kai-Kaloi Road near its junction with the Kanaio Beach Road (Water Tank 3), one along the 'Ulupalakua Ranch Road (Water Tank 4), one at the junction of the 'Ulupalakua Ranch Road and the Papaka Kai-Kaloi Road (Water Tank 5), and one at the point where the 'Ulupalakua Ranch Road crosses the western boundary of the KFWA (Water Tank 6).

6 FENCES

The Army National Guard built a 20-acre enclosure in the southeast corner of the area. The fence was built in an effort to establish a viable population of 'ohai (*Sesbania tomentosa*). Currently the enclosure is maintained by DOFAW personnel and is an effective ungulate barrier.

DOFAW proposes to erect two ungulate exclusion fences. The first and longest of these fence lines will extend along the boundary separating the KFWA from the KFWA Wildlife Coastal Resource Protection Zone. This fence line is intended to restrict ungulate access to the coast and therefore protect the numerous biological resources and cultural sites located in the Wildlife Coastal Resource Protection Zone. Gates on the fence line will enable public access to the coast. A second ungulate exclusion fence is planned to encircle Pu'u Pimoe. This fence line will serve to protect listed native plant species and cultural resources on the pu'u (cinder cone). All of the materials used in fence construction will be flown in and dropped at designated staging areas.

7 PUBLIC HUNTING

Currently unlawful hunting of ungulates occurs in the KFWA, which poses potential impacts to the resources and also compromises public safety. The implementation of a regulated hunting program that ensures public safety and optimal hunting opportunities is one of the main objectives for the area. The KFWA will provide quality hunting opportunities for licensed hunters to pursue both game birds and game mammals. A hunter check-in stations will be installed at the private access road just off of Piilani Highway. The west access point will be regulated by a gate and access will be regulated by DOFAW. Hunters who are granted access on private lands by DOFAW and have the necessary documentation must check in after entering the gate. The east access point will not have a gate, but hunters will need to check in before accessing the area. Hunting methods for the area will include shotgun for game bird species and archery for game mammals. Signage at the entrance points off of Piilani Highway will provide information on designated hunting areas and natural and cultural resources in the area. Additional information will be available in the check-in station with the hunter sign-in sheet.

7.1 Game Bird Management

Game birds such as ring neck pheasant and gray francolin, as well as other game bird species, are common in the area. In order to enhance and maintain these existing populations of game birds, six bird water stations will be installed throughout the KFWA (Figure 2). The water stations will hold up to 400 gallons of water to feed the wildlife guzzlers. The water stations and supplemental feeding will help to sustain the game bird populations through the dry season. To ensure the stations support only game birds, the stations will be enclosed within an ungulate-proof fence (Figure 3). Game bird hunting seasons and regulations will follow existing game bird guidelines in Title 13, Chapter 122 Rules Regulating Game Bird Hunting, Field Trials and Commercial Shooting Preserves. All rules and regulations will be enforced by DOCARE.

In addition to enhancing game bird populations, these water stations will attract predator species such as mongoose, rats, and feral cats. These stations will provide an easy opportunity for predator species to prey on game birds as they visit the stations for the available food and water. These non-native species have caused considerable negative impact to Hawai'i's native ecosystems. Therefore, DOFAW will implement agency-approved humane predator control methods to prevent inadvertent support for predator species and reduce their negative impacts to both game and non-game native species.

In State of Hawai'i game management areas, the viability of game bird populations is assessed based on annual harvest data. DOFAW will also implement a standardized survey method to determine game bird population levels and nesting and brooding success. These surveys will be conducted prior to the start of the fall game bird season and potentially after the main brooding season.

7.2 5-Year Game Management Plan

A 5-year big game management plan will be implemented to establish a desired population level for game mammals and to reduce the population to that level primarily through public hunting in order to control their potential impacts to natural and cultural resources. The plan will provide public hunters with the opportunity to reduce the feral goat population under a managed system that requires animal harvesting benchmarks. If hunters are not successful at meeting the annual benchmarks established within this of the plan, DOFAW will implement staff-controlled removal efforts to cull the population to the acceptable levels. Maintaining agreed-to population levels of feral goats and axis deer will be one of the primary management objectives upon completion of the initial 5-year management plan.

8 NATURAL RESOURCE MANAGEMENT

Since the early 1990s there have been several biological surveys conducted in the KFWA. The surveys found isolated pockets of endangered species in a predominantly altered landscape. Each survey noted that the impacts to the natural resources are caused by illegal cattle and horse grazing, feral ungulates, and illegal dirt bike and off-road vehicle activity. These threats to the natural resources significantly damage vegetation, resulting in erosion and the introduction and establishment of invasive species. In order to mitigate these threats to the natural resources in the area, the management plan includes the following:

- Installation of the Pu'u Pimnoe fence to protect 'ohai (*Sesbania tomentosa*), critical habitat, and cultural features on the pu'u: The 1993 Kanaio Natural Area Reserve Biological Inventory and Management Recommendations suggests small fenced enclosures as a necessary first step to effectively preserve native vegetation.

- Removal of illegal cattle and horse grazing operations: Current grazing operations are illegal and DOFAW will coordinate with DOCARE to develop a plan to provide notice to the individuals to initiate the removal of their cattle, per HRS 183-19. Sufficient time will be allowed for individuals to remove their animals. All cattle remaining after the designated deadline will be removed by DOFAW.
- Enforcement to address illegal dirt bike and off-road activity: Signs will be posted at access points and near Pu'u Pimoe. DOCARE presence in the area will be increased to enforce violations and deter illegal activities, such as poaching, dirt bike riding, and off-road vehicles, that impact natural and cultural resources.
- Installation of fencing critical habitat on Pu'u Pimoe and the lower Makai boundary: A contour fence line will be installed to protect the significant number of cultural sites near the Hoapili Trail.

The management actions listed in Table 2 are expected to enhance the status of the natural resources and prevent further damage to cultural resources in the KFWA. These actions also ensure compatibility with public hunting opportunities and other recreational uses of the area.

Table 2. Threats and Management Actions to Protect Natural Resources within the KFWA

Threat	Threat Level	Preventative Measures
<i>Ungulate Impacts</i>		
Trampling and erosion caused by ungulates	High	Removal of illegal cattle grazing.
		Reduction of feral ungulates through increased hunting. 5-Year Game Management Plan
		Fencing to restrict ungulate access to sensitive areas around Pu'u Pimoe. Management of invasive species in enclosure fences.
<i>Human Impacts</i>		
Dirt bike and off-road driving	High	Control of access to the KFWA. DOCARE enforcement.
		Monitoring of human activities within the Wildlife Area.
Pedestrian traffic	Medium	Hunter and recreation outreach information about the natural resources in the area. Increase awareness of invasive species.
<i>Wildfires</i>		
	High	Maintenance of existing roads and installation of proposed contour road.
		Fuels reduction buffer along roads.

9 FIRE MANAGEMENT

As noted in the 1993 biological survey and following surveys, the area is significantly altered by decades of cattle grazing, unmanaged feral ungulate populations, and damaging human activities. These negative environmental impacts have displaced the native vegetation and introduced invasive non-native species to the area. These species flourish in the dry Kanaio climate and are evolved to thrive in a system with ungulate presence. The altered vegetation in the area and the global climb in annual temperatures has increased the fire potential of the area in the last decade.

9.1 Fire Management Actions

1. Install proposed road: Connect the lower section of the ranch road to the existing beach access road. The new road will serve as a fuel break and provide access for fire fighters and machinery.
2. Make existing road improvements: Make minimal improvements in areas of severe erosion as these eroded sections could prevent access by fire personnel.
3. Conduct fuels reduction and monitoring: Conduct annual brushing and herbicide treatment of the existing roads to buffer the roads and mitigate fire hazard. Well-buffered roads can serve as effective fire breaks and reduce impacts to natural and cultural resources.
4. Develop Wildfire Response Plan: DLNR fire team will develop a strategic response and suppression plan in coordination with agencies and private landowners.
5. Implement community outreach: Coordinate with 'Ulupalakua Ranch and other interested parties to inform the community about the best practices to prevent wildfires in KFWA.
6. Identify water sources: The area does not hold surface water and water would have to be hauled in for fire suppression by ground crews. DOFAW will with interested parties to obtain water support for fire suppression efforts in the KFWA.
7. Allow, limited to the cooperating landowner, within a limited time frame and limited areas, cattle grazing to reduce fuel loads in the area.

10 ACCESS ROADS

The two existing access roads, Kanaio Beach Road and the 'Ulupalakua Ranch Road, run along the northern boundary off of Pi'ilani Highway (Figure 1). Kanaio Beach is currently open and allows unrestricted access from the highway down to the coast. The 'Ulupalakua Ranch Road is gated and public access is strictly regulated by the ranch. Should the ranch parcel be included into the KFWA, the gate would remain and access would be regulated by DOFAW; access would only be granted to a small number of hunters on weekends (Friday through Monday). The existing roads will not be improved by widening or grading. However, on steep sections where heavy erosion occurs, DOFAW will install turn-out berms to divert water off the road. These sections will be determined during the wet season and the berms will be installed during the dry season. In areas heavily impacted by illegal off-roading and other activities, DOFAW plans to block those paths. Pu'u Pimoe is heavily impacted by illegal off-roading and the proposed fence will exclude both ungulates and illegal off-road activities. When the KFWA is established, DOCARE presence will increase to enforce management rules and further deter illegal off-road driving and other activities detrimental to the natural and cultural resources of the KFWA.

One additional road is proposed for the KFWA. The Papa Kai Kaloi Road will extend from the 'Ulupalakua Ranch Road to the Kanaio Beach Road. The proposed road route has been surveyed to ensure no impacts to biological and cultural resources would occur during road construction. Construction will be limited to one dozer and the road footprint will not exceed 12 feet (3.5 m). To minimize surface impacts, the road depth will not exceed 1 foot and DOFAW machine operators will be informed of biological and cultural resources in the area.

The Hoapili trail currently provides public access and scenic coastal hiking. Public access to the trail will continue under the proposed management actions for the area.

11 MAKAI COASTAL AREA

The coastal area ensures the conservation of cultural and natural resources in the area. In 2003, the National Park Service conducted a reconnaissance survey from La Perouse Bay to Kanaloa Point. The intent of the survey was to determine the feasibility of adding the coastal zone to the national park system. The survey noted the area is the greatest concentration of known archeological sites in the coastal area. The study also noted significant impacts to coastal vegetation from off-road vehicles and campsites, as well as feral ungulates. Although the coastal zone was determined to have limited feasibility to be a national park, the National Park Service recommended management of the area to protect the cultural and natural resources in the coastal zone.

The historic Hoapili Trail runs the length of the protection zone, and the trail is a favorite among tourists. A 2005 study of the impacts of human use at the Hoapili Trail head parking area estimated over 200,000 people visit the area annually.

A small anchialine pool community is located on the furthest southwest point of the coastal area. Anchialine pools are land-locked bodies of water that are adjacent to the ocean. These pools are fed indirectly through underground connections to the ocean. These pools support unique ecosystem and species specially adapted to the varying salinity (Hawai'i Heritage 1989).

The construction of a lower boundary makai fence line will be the first and most important step in the resource management actions for this section of the KFWA. The fence will enable DOFAW staff to remove all ungulates in the coastal zone.

12 CULTURAL RESOURCES MANAGEMENT

As evidence of its rich history, the KFWA contains a substantial number and variety of traditional Hawaiian and post-contact cultural resources. Many of these cultural sites have been damaged by trampling and erosion caused by the passage of cattle, goats, and other ungulates. Human activities, such as the mechanized clearing of vegetation undertaken during the ranching period to increase available pasturage and more recent illegal dirt bike and off-road driving, have also directly impacted archaeological sites.

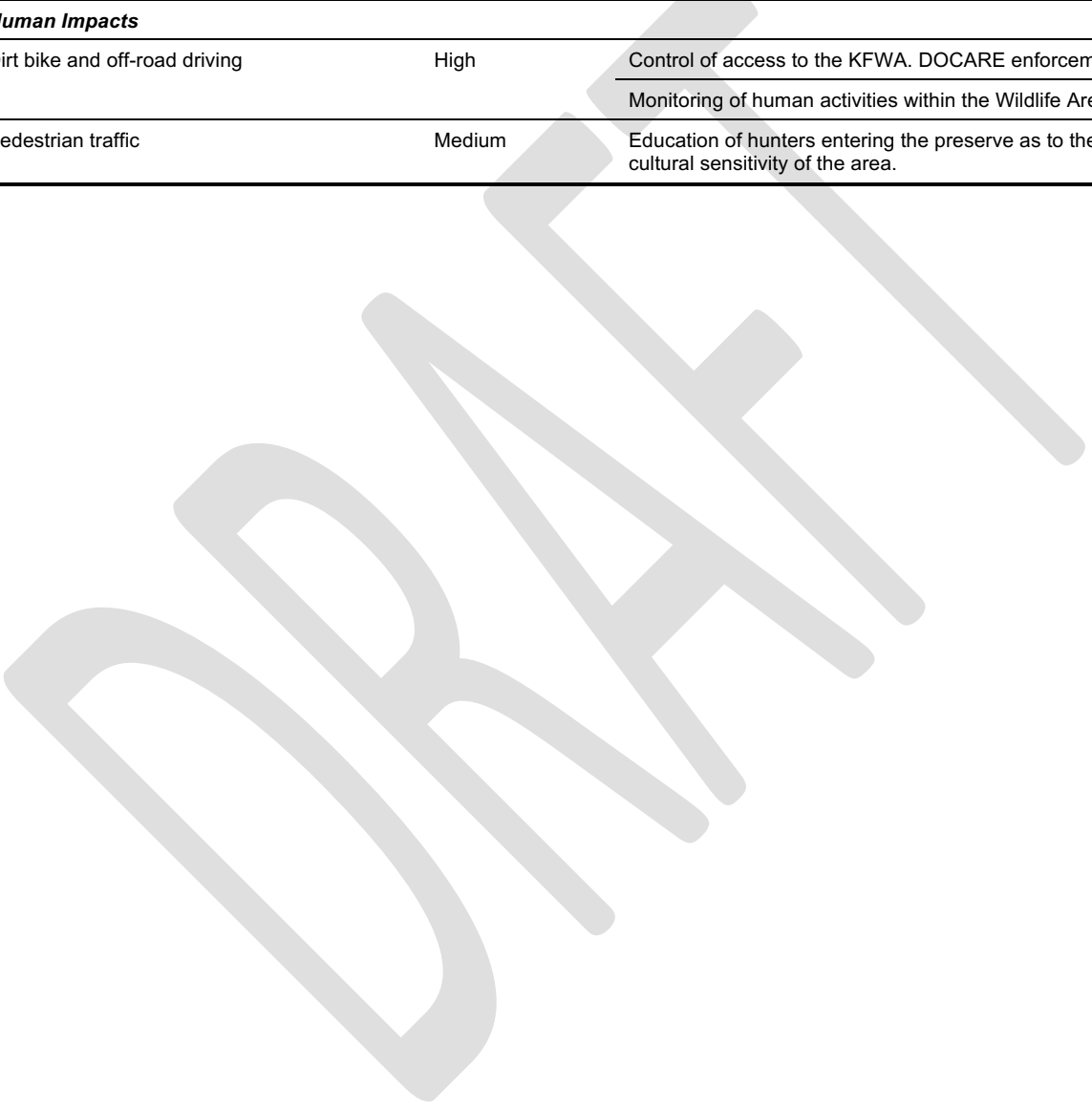
Guided by this management plan, DOFAW's stewardship of the KFWA is intended to reduce the active threats to these cultural resources. This program of protection and long-term management involves reducing damage from feral ungulates, removing illegal cattle grazing, preventing off-road driving, controlling public access, and educating those individuals who enter the preserve as to the significance and fragility of the area's cultural sites. The establishment of the KFWA will help to preserve and protect the physical remains of the area's rich cultural history.

12.1 Cultural Resources Management Actions

The actions to mitigate the identified threats to cultural resources in the area (Table 3) align with the measures to protect the natural resources. The highest density of cultural sites in the area is located near the Hoapili Trail and the fence line will ensure protection of cultural resources. For cultural sites above the fence, the immediate management of the ungulate population and elimination of illegal off-road activities will prevent further impacts to those cultural sites. In addition, hunter education and community outreach would inform the public about the rich cultural history of an area like the KFWA and how to avoid disturbance to these culturally significant sites.

Table 3. Threats and Management Actions to Protect Cultural Resources.

Threat	Threat Level	Management Actions
<i>Ungulate Impacts</i>		
Trampling and erosion caused by ungulates	High	Removal of illegal cattle grazing. Reduction of feral ungulates through increased hunting. Installation of fencing to restrict ungulate access to sensitive areas around Pu'u Pimoe and the coastal zone.
<i>Human Impacts</i>		
Dirt bike and off-road driving	High	Control of access to the KFWA. DOCARE enforcement. Monitoring of human activities within the Wildlife Area.
Pedestrian traffic	Medium	Education of hunters entering the preserve as to the cultural sensitivity of the area.



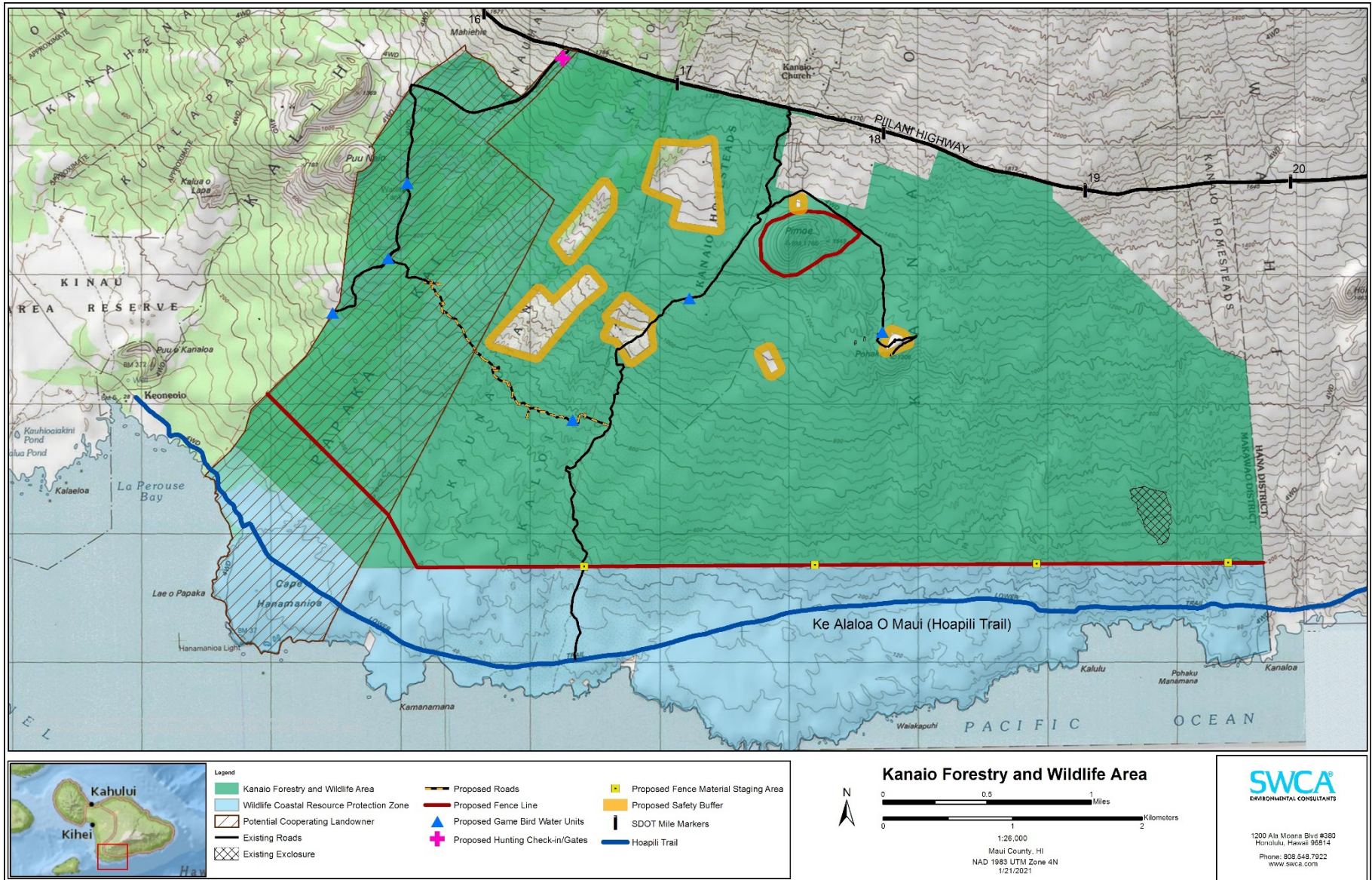


Figure 2. Location of proposed infrastructure improvements to the Kanaio Forestry and Wildlife Area

13 ENVIRONMENTAL SETTING

The KFWA is divided into two sections. The 5,522-acre mauka (inland) portion of the KFWA extends from roughly 200 feet (12 m) in elevation up to the Pi'ilani Highway (approximately 1,800 feet in elevation) and is considered a Game Management Area. The 1,938.53-acre makai (seaward) section of the KFWA, which extends from roughly 200 feet down to the coast. The coastal area includes the Hoapili Trail (also known as the King's Trail), a portion of the traditional ala loa (long trail) that encircles the island of Maui.

The mean annual rainfall for the survey area is approximately 25 inches (635 millimeters [mm]) on the leeward side of Haleakala and approximately 20 inches (508 mm) along the coastline (Giambelluca et al. 1986). The most current rainfall data, recorded at the Auwahi rain gauge located upslope and approximately 2.5 miles northeast of the action area, show an annual rainfall of 31 inches (788 mm). Rainfall is typically highest in January and lowest in July (Giambelluca et al. 2013).

13.1 Soils

The KFWA consists of a substrate categorized as rock land–rough mountainous land association, which is primarily a'a, stony land, or cinder land. The area below Pu'u Pimoe and Pu'u Pohakea is primarily covered by a'a which originated from Pu'u Pimoe and Pu'u Pohakea. The coastal area which supports vegetation has areas of Pahoehoe lava (Figure 3). The Soil Conservation Service (now called the Resource Conservation Service) classifies some soils in the action area as the Oanapuka series, described as well-drained, very stony soils developed in volcanic ash and material derived from cinders. The rest of the action area (about 90 percent) is classified as Lava Flows of recent geologic origin, and was described by the Soil Conservation Service as "a mass of clinkery, hard, sharp pieces of lava on rough to undulating topography."

13.2 Water

The Soil Conservation Service determined that approximately 90 percent of the area can be classified as recent lava flows and the other 10 percent of the area is well-drained cinder and stones. The high permeability of the KFWA substrate and low annual rainfall (<30 inches) precipitation is likely to evaporate rather than infiltrate (U.S. Geological Survey [USGS] 2000). The 2003 Hawai'i Army National Guard Assessment study of the KFWA noted that the Kanaio Training Area has low precipitation rates, high evaporation rates, and highly fractured and permeable surface lava. For these reasons, no surface water drainage features exist in the area.

Due to the absence of water in the area, the potential effects of Alternatives 1 and 2 are not addressed in Section 11, Environmental Effects.

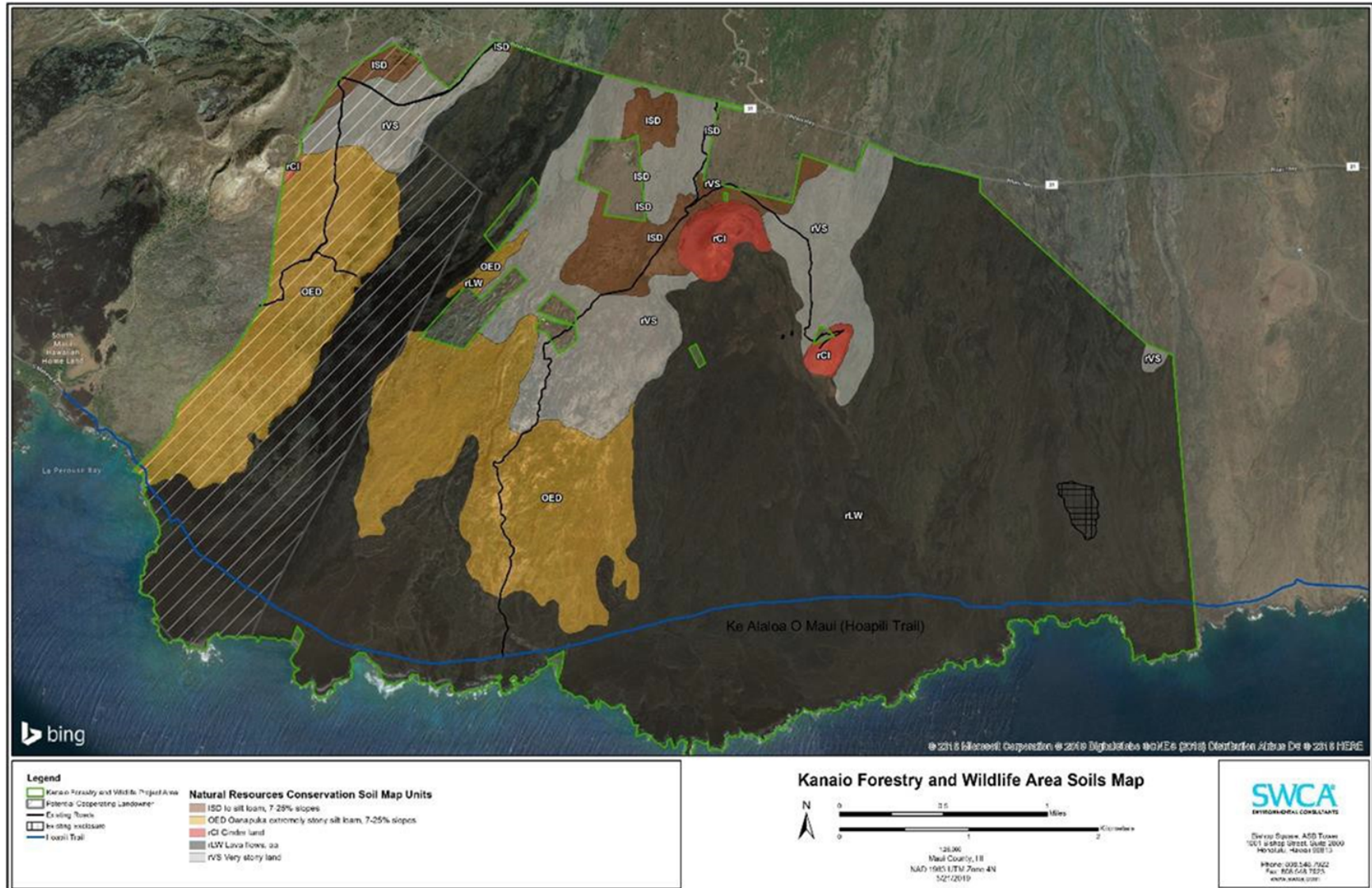


Figure 3. Soils of the Kanaio Forestry and Wildlife Area

13.3 Air Quality

The State of Hawai'i Department of Health's (DOH's) 2018 annual summary of statewide air quality noted that the State of Hawai'i was in attainment of all National Ambient Air Quality Standards (NAAQS), excluding any exceedances due to natural, volcanic eruption events. The report also found that pollutant levels have remained below state and federal standards at statewide monitoring stations over the past 5 years (DOH 2018). The DOH air quality monitoring stations are located in the urban populated areas that are likely to have detectable levels of pollution. The proposed Kanaio area is 30 miles away from the closest monitoring station in a remote rural area. Due to the remote location and natural setting, it is likely the air quality in the proposed management area is not a potential health risk and air pollutants are well below state and federal standards.

13.4 Flora

13.4.1 Flora Survey

SWCA Environmental Consultants (SWCA) conducted flora and fauna surveys on the proposed approximately 7,461-acre KFWA on the south side of the Island of Maui (Figure 1). The surveys involved an assessment of the area's terrestrial flora and fauna resources, including the potential for the presence of state- or federally listed threatened, endangered, proposed, or candidate species or rare species (hereafter referred to as special-status species). Surveys did not cover the entire area but focused on areas of known critical habitat within the action area, as well as areas with existing and proposed infrastructure that could affect special-status species.

One native special-status endangered plant species was observed in the action area during the surveys: 'aiea (*Nothocestrum latifolium*). An additional six special-status plant species have previously been recorded in the action area; however, they were not recorded during the surveys because they did not occur in areas of good habitat prioritized for survey by SWCA. The six species found during previous surveys are 'ohai (*Sesbania tomentosa*), *Vigna o-wahuensis*, *Melanthera kamolensis*, 'awikiwiki (*Canavalia pubescens*), *Bonamia menziesii*, and 'ihi (*Portulaca villosa*). In all, 26 native plant species were recorded during flora surveys. The vegetation in the action area consists of seven vegetation types: invaded pasturelands, pasturelands, koa haole forest, a'ali'i shrubland, dryland forest, native coastal strand, and non-native coastal. These vegetation types are described in Section 9.4.2, Vegetative Communities.

13.4.1.1 'AIEA

The federally endangered 'aiea is a small tree in the nightshade family (Solanaceae) that typically occurs in dry mesic forest habitat in dry cliff, lowland dry, and lowland mesic ecosystems (USFWS 2016c) at elevations ranging from 1,500 to 5,000 feet (University of Hawai'i 2001b). There are 18 known occurrences totaling approximately 1,600 individuals on east and west Maui (USFWS 2016c).

In summary, the species' range on each island has decreased dramatically since 2001 and there is an observed lack of regeneration in 'aiea in the wild (USFWS 2016c). Threats to 'aiea include modification and destruction of habitat and herbivory by non-native ungulates; modification and destruction of habitat by non-native plants; fire; and the black twig borer (*Xylosandrus compactus*). 'Aiea was found during SWCA's field surveys as scattered individuals occurring primarily in the northeast portion of the action area. Future management of these individuals should focus on protecting them from ungulates and fire, and promoting the establishment of a viable, reproducing population.

13.4.1.2 BONAMIA MENZIESII

The federally listed *Bonamia menziesii* is a perennial vine in the morning glory family (Convolvulaceae) found on steep slopes in dry to mesic forest and sometimes in wet forest between elevations of 492 to 2,051 feet (USFWS 1993). In 1993, the total population throughout the state was estimated at approximately 200 individuals (USFWS 1994). In 2012, *B. menziesii* was known from three occurrences on Lanai, nine occurrences on Kauai, six occurrences on Maui, two occurrences on Hawai'i Island, and 12 to 13 occurrences on Oahu. Currently, *B. menziesii* is known from four separate areas on Maui totaling approximately eight individuals, four of which are located in the Kanaio Natural Area Reserve (NAR) (USFWS 2016c). SWCA searched a location obtained from the USFWS in the in the action area. *B. menziesii* was not observed during the field surveys. This species was previously recorded in a single locality off of the main mauka-makai road in the action area.

13.4.1.3 KĀMONAMONA

Kāmonamona (*Cenchrus agrimonoides*) was listed as federally endangered under the ESA on October 10, 1996. It is a perennial in the grass family (Poaceae) that is known to occur in lowland dry forest habitat on dry, rocky outcroppings in mesic ohia-koa forest between 984 to 4,920 feet in elevation

(USFWS 1999). In 2014, 645 wild individual plants were known to exist in three separate populations on Maui, Oahu, and Kahoolawe. Threats to Kāmonamona include modification and destruction of habitat and herbivory by non-native ungulates; modification and destruction of habitat by non-native plants; fire; and human trampling. One patch of Kāmonamona, approximately 10 square feet, is known to occur within the Kanaio NAR (USFWS 1999) approximately 2 miles north of the Pi'ilani Highway and is not known to occur in the action area (DLNR 1993). SWCA did not observe Kāmonamona during the field surveys (SWCA 2019).

13.4.1.4 MĒHAMEHAME

Mēhamehame was listed as federally endangered under the ESA on October 10, 1996. It is a long-living dioecious perennial tree in the spurge family (Euphorbiaceae) that grows up to 100 feet tall (USFWS 2003a) at elevations between 820 to 3,280 feet in dry to mesic forest (USFWS 1994). This tree currently occurs on Kauai, Oahu, Maui, and Hawai'i Island (USFWS 2016a) and little is known about its life history (USFWS 2003a). At the time of critical habitat designation in 2004 there were four known occurrences on Maui. Currently, two individuals of mēhamehame are on east Maui's southern flank of Haleakala at Auwahi, in the lowland dry ecosystem (USFWS 2016a). SWCA did not observe mēhamehame during the field surveys (SWCA 2018). Threats include the black twig borer (*Xylosandrus compactus*), which has affected all known plants. Other major threats include habitat degradation by non-native ungulates, competition with alien plant species, and fire (USFWS 1994).

13.4.1.5 SPERMOLEPIS HAWAIIENSIS

S. hawaiiensis was listed as federally endangered under the ESA on November 10, 1994. It is a nonsucculent annual herb in the parsley family (Apiaceae) that grows 2 to 8 inches tall and the only member of the genus endemic to Hawai'i. Critical habitat was first designated in 2003. This herb is currently known to occur on Kauai, Oahu, Molokai, Lanai, and Hawai'i Island. An estimated

6,000 individuals are known to occur in the wild (USFWS 2016a) with approximately 2,000 on Maui. In the Kanaio region, there is one known population with potentially 1,000 individual plants in the lowland dry ecosystem (USFWS 2016a). SWCA did not observe *S. hawaiiensis* during the field surveys

(SWCA 2019). Threats include herbivory by non-native ungulates, competition with non-native plants, fire, erosion, landslides, rockslides, and drought (USFWS 2016c).

13.4.1.6 VIGNA O-WAHUENSIS

The federally endangered *V. o-wahuensis* is a twining, short-living perennial herb in the pea family (Fabaceae). When critical habitat was designated on Maui and Hawai'i in 2003 and Oahu in 2012, *V. o-wahuensis* was known from six occurrences totaling approximately 30 individuals on Lanai, Molokai, Maui, and Kahoolawe, and Hawai'i Island (USFWS 2016a).

This species has been recorded previously near the coastal Hoapili Trail, and critical habitat exists in that area for this species. This species has also been recorded in an Army National Guard (ANG) enclosure in the southeast portion of the action area. Future management of these individuals should focus on protecting them from ungulates and fire.

13.4.1.7 'OHAI

The federally endangered 'ohai is a short-living perennial shrub or small tree in the pea family (Fabaceae). When critical habitat was designated in 2003, 'ohai was known from one occurrence on Kauai, nine occurrences on Molokai, seven occurrences on Maui, several thousand individuals on Nihoa Island, "in great abundance" on Necker Island, 31 occurrences on Hawai'i Island, and, in 2012, from three occurrences on Oahu (USFWS 2016a). Historically widespread throughout the Hawaiian Islands and the northwestern Hawaiian Islands, this species now occurs in larger numbers (approximately 5,500 individuals) only on Nihoa and Necker of the northwestern Hawaiian Islands, with relatively few occurrences persisting on the main Hawaiian islands (MHI).

Currently, approximately 2,000 individuals of 'ohai occur on the islands of Kauai, Molokai, Maui, Kahoolawe, Oahu, and Hawai'i in the MHI. The population size at any one location is dependent on the amount of rainfall and therefore is variable. On west Maui, there are three occurrences totaling 80 individuals from Nakalele Point to Mokolea Point, in the coastal ecosystem. On east Maui, there is one occurrence of 10 individuals in the lowland dry ecosystem (USFWS 2016a). Current threats to this species are significant and include herbivory by non-native ungulates, non-native insects, and slugs; seed predation by rats; fire; drought; and low fruit production resulting from lack of pollinators or self-incompatibility, low seedling recruitment, and climate change (USFWS 2016a). Designation of critical habitat is essential to the conservation of 'ohai as it remains in danger of extinction throughout its range. This species has only been found previously in the Pu'u Pimoe crater. Individuals in this population have an arborescent habit, and it is possible that future taxonomic treatment may recognize these individuals as representing a rare subspecific taxon within an already endangered species.

13.4.1.8 MELANTHERA KAMOLENSIS

Melanthera kamolensis is a short-lived perennial herb in the sunflower family (Asteraceae). As of 2016, when critical habitat was last revised for this species, a single population of *M. kamolensis* was found in a lowland dry ecosystem in Kamole Gulch, totaling between 30 and 40 individuals. It is believed to be involved in a population of hybrid plants just west of Kamole, where hybrids between *M. kamolensis* and *Melanthera rockii*, and their resulting hybrid progeny, have formed a population (USFWS 2016a). This species was previously recorded in an ANG enclosure in the southeast portion of the action area.

13.4.1.9 'AWIKIWIKI

'Awikiwiki is a short-lived perennial vine in the pea family (Fabaceae). As of 2016, when critical habitat was last revised for this species, it was only known from the island of Maui, although it has historically occurred on Ni'ihau, Kaua'i, and Lāna'i. At that time, the only known locations for this species ranged from Pu'u o Kali south to Pohakea, occurring in a lowland dry ecosystem (USFWS 2016a). This species was previously recorded scattered widely throughout the action area, including in the ANG enclosure.

13.4.1.10 'IHI

'Ihi is a low-growing perennial herb in the purslane family (Portulacaceae). It occurs on dry, rocky, clay, lava, or coralline reef sites, from sea level to 1,600 feet, in both coastal and lowland dry ecosystems, although there has been one reported occurrence in the montane dry ecosystem from Hawai'i Island.

It has historically been documented from all the main Hawaiian islands except Niihau and Kaua'i, and has been observed on the small islets of Kaula and Lehua, and on Nihoa in the northwestern Hawaiian Islands. At the time it was listed as endangered in 2016, 'ihi was known from a few individuals on Molokai, two individuals in east Maui and 24 individuals in west Maui, fewer than 15 individuals on Kahoolawe, and five occurrences totaling 10 individuals on Hawai'i Island. This species was previously recorded in a single locality off of the Hoapili Trail in the southeastern corner of the action area.

13.4.2 Vegetative Communities

The vegetation types where native species can be found in the action area are represented by a map of HIGAP classifications (Figure 4). Each vegetation type is listed with the corresponding HIGAP classification(s) in Table 4, and the native species found in that vegetation type are listed in Table 4 below. Vegetation coverage was determined by equating HIGAP analysis with flora survey observations.

Table 4. Vegetation types and associated HIGAP classification

Vegetation Type	Represented by HIGAP Classification(s)
Invaded pastureland	Open Kiawe Forest and Shrubland; Alien Shrubland; Alien Grassland
Pasturelands	Kikuyu Grass Grassland/Pasture; Uncharacterized Open-Sparse Vegetation
koa haole forest	Closed Kiawe - Koa Haole Forest and Shrubland
aalii shrubland	Native Shrubland (alien grasses); Native Shrubland/Sparse Ohia (native shrubs)
Dryland forest	Very Sparse Vegetation to Unvegetated
Native coastal strand	Very Sparse Vegetation to Unvegetated (along coastline only)
Non-native coastal	Closed kiawe - Koa Haole Forest and Shrubland (along coastline only); Alien forest

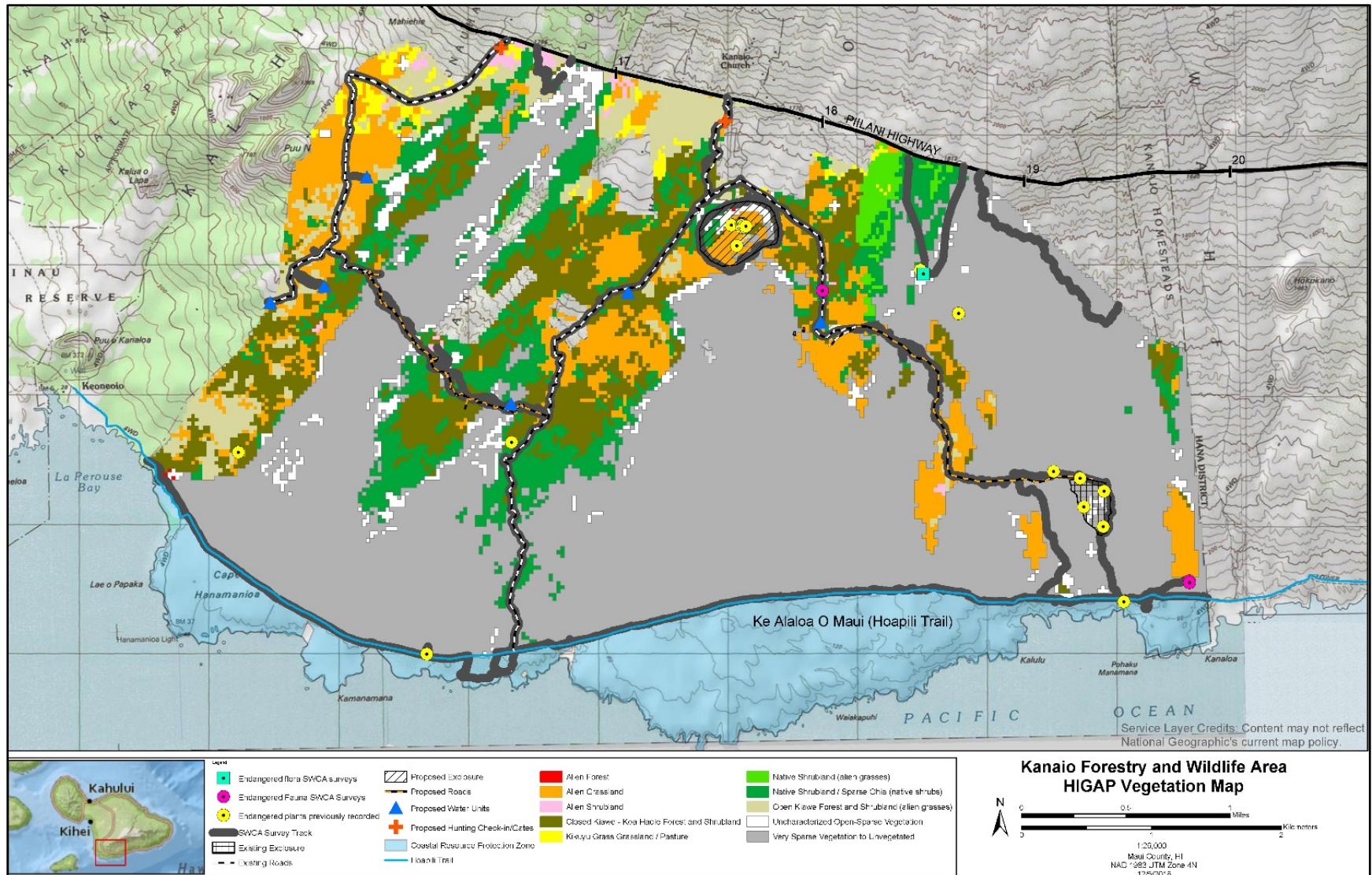


Figure 4. HIGAP Analysis Vegetation Communities

13.4.3 **Invaded Pasturelands**

This vegetation type comprises tracts of land occasionally (or formerly) grazed by domesticated livestock. These lands were once dominated by palatable grasses, but over time have become increasingly dominated by unpalatable herbaceous species, trees, and shrubs. Common woody canopy species in these areas include koa haole (*Leucaena leucocephala*) and kiawe (*Prosopis pallida*). These areas are dominated by a midcanopy of sourgrass (*Digitaria insularis*) covered by *Neonotonia wightii*. Scattered individuals of a native 'ākia (*Wikstroemia monticola*) occur in this vegetation type. Other, more invaded areas in this vegetation type are dominated by Jamaica vervain (*Stachytarpheta jamaicensis*), tree tobacco, and parthenium (*Parthenium hysterophorus*). Common herbaceous species include lantana (*Lantana camara*), *Kalanchoe x houghtonii*, spiny amaranth (*Amaranthus spinosus*), four-o'clock (*Mirabilis jalapa*), balloon plant (*Asclepias physocarpa*), and indigo (*Indigofera suffruticosa*).

13.4.4 **Pasturelands**

This vegetation type comprises areas grazed by domesticated livestock, and the vegetation consists mainly of palatable non-native grasses interspersed with other herbaceous plants. Woody species are generally uncommon to rare in these areas. Common species in this vegetation type include the non-native species Henry's crabgrass (*Digitaria ciliaris*), lantana, parthenium, tree tobacco, and kiawe. *Neonotonia wightii*, a perennial legume, is occasionally seen vining over other species in the area. The most common grass species in pasturelands is pitted beardgrass (*Bothriochloa pertusa*). One native species, 'uhaloa (*Waltheria indica*), is seen occasionally in the area.

13.4.5 **Koa Haole Forest**

This vegetation type is characterized by dense canopy cover of koa haole, with occasional cover of other non-native species such as Christmas berry (*Schinus terebinthifolius*). The understory is typified by a mix of non-native herbaceous species such as Guinea grass (*Urochloa maxima*), sourgrass, *Neonotonia wightii*, and four-o'clock. Other common species in this vegetation type include lantana, tree tobacco, and indigo. Rarely, the native species 'ānunu (*Sicyos pachycarpus*) can be seen in this type. In areas heavily populated by goats, this vegetation type consists of the same canopy species, with a minimal understory.

13.4.6 **A'ali'i Shrubland**

This vegetation type is typified by an open canopy, with the dominant species being 'a'ali'i (*Dodonaea viscosa*). In many areas, the 'a'ali'i is co-dominant with natal redtop (*Melinis repens*). The presence of many other scattered native species, both woody and herbaceous, makes this one of the most native species-rich of the vegetation types. Scattered woody native plants include 'ākia, lama (*Diospyros sandwicensis*), wiliwili (*Erythrina sandwicensis*), and hao (*Rauwolfia sandwicensis*). Herbaceous native species include 'ala'ala wai nui (*Plectranthus parviflorus*), kalamoho lau li'i (*Pellaea ternifolia*), and kumuniu (*Doryopteris decipiens*). Other species that may be present include tree tobacco.

13.4.7 **Dryland Forest**

Because of severe degradation, this vegetation type exists only as very small pockets of remnant native tree species, sometimes existing as scattered lone individuals. Typical species include lama, hao, wiliwili, and 'ohe makai (*Polyscias sandwicensis*). Other species that may be present include 'a'ali'i, 'aiea, maiapilo (*Capparis sandwichiana*), and nehe (*Melanthera lavarum*). These pockets are typically surrounded by expanses of bare a'a. Other species that may occur in these areas include tree tobacco and kiawe.

13.4.8 Native Coastal Strand

This vegetation type is typified by an open canopy, with the dominant species being naupaka kahakai (*Scaevola taccada*). Other woody species include 'a'ali'i, kiawe, tree tobacco, and pluchea (*Pluchea indica*). Individuals of other native species such as naio (*Myoporum sandwicensis*), hala (*Pandanus tectorius*), nohu (*Tribulus cistoides*), and maiapilo can be found in this vegetation type.

13.4.9 Non-native Coastal

This vegetation type is dominated by a canopy of kiawe. Bare ground makes up most of the understory, with occasional thickets of golden crown-beard (*Verbesina encelioides*), scarlet spiderling (*Boerhavia coccinea*), and khaki weed (*Alternanthera pungens*). Populations of tree tobacco exist in more open areas.

Table 5. Percent Coverage of Vegetation Types in the KFWA

Vegetation Type	Percent Coverage in the KFWA
Invaded pastureland	18% to 20%
Pasturelands	2% to 5%
koa haole forest	5%
aalii shrubland	5% to 8 %
Dryland forest	0.5% to 3%
Native coastal strand	0.5% to 3%
Non-native coastal	0.5% to 3%

13.5 Fauna

The fauna observed in the action area includes species that are endemic, indigenous, migratory, and non-native introductions. The endemic, indigenous, and migratory species often require specific niche habitats and are frequently locally abundant where they occur. The non-native introduced species tend to be more generalist and often occupy a range of habitats.

13.5.1 Avifauna

Bird species observed in the action area are species commonly found in low-elevation dry forest, shrubland, and lava fields in southeast Maui (Table 6).

Table 6. Birds Observed by SWCA in and near the Action Area

Common Name	Scientific Name	Status*	MBTA
African silverbill	<i>Euodice cantans</i>	NN	
Black francolin	<i>Francolinus</i>	NN	
Cattle egret	<i>Bubulcus ibis</i>	NN	X
Common myna	<i>Acridotheres tristis</i>	NN	
Eurasian skylark	<i>Alauda arvensis</i>	NN	X
Great frigatebird	<i>Fregata minor</i>	I	X

Common Name	Scientific Name	Status*	MBTA
Gray francolin	<i>Francolinus pondicerianus</i>	NN	
Hawaiian short-eared owl	<i>Asio flammeus sandwichensis</i>	I	X
House finch	<i>Haemorhous mexicanus</i>	NN	X
Japanese bush warbler	<i>Horornis diphone</i>	NN	
Japanese white-eye	<i>Zosterops japonicus</i>	NN	
Mourning dove	<i>Zenaida macroura</i>	NN	X
Northern cardinal	<i>Cardinalis</i>	NN	X
Northern mocking bird	<i>Mimus polyglottos</i>	NN	X
Nutmeg mannikin	<i>Lonchura punctulata</i>	NN	
Pacific golden-plover	<i>Pluvialis fulva</i>	M	X
Ring-neck pheasant	<i>Phasianus colchicus</i>	NN	
Zebra dove	<i>Geopelia striata</i>	NN	
Total		19	9

* Status: I = indigenous, NN = non-native permanent resident, M = migrant.

Three special-status seabirds could transit over the action area while traveling to and from their upland nesting sites: Hawaiian petrel (*Pterodroma sandwichensis*), Newell's shearwater (*Puffinus auricularis newelli*), and band-rumped storm-petrel (*Oceanodroma castro*). No suitable nesting sites for these species are present in the action area. These species nest inland in the mountainous interior of Maui (Mitchell et al. 2005). These species may fly over the action area at night while travelling to and from their upland nesting sites to the ocean. Special-status seabirds are discussed further in Section 14.5.6.

Suitable nest and forage habitat for the special-status Hawaiian goose (or nēnē [*Branta sandvicensis*]) occurs in the action area. The Hawaiian goose is discussed further in Section 14.5.7.1.

13.5.2 Mammals

Mammals detected during the field surveys include horse (*Equus ferus caballus*), cow (*Bos taurus*), feral goat (*Capra hircus*), and axis deer (*Axis axis*). No other mammals were observed during the surveys, although feral pig (*Sus scrofa*), feral cat (*Felis catus*), rat (*Rattus* spp.), mongoose (*Herpestes javanicus*), and mouse (*Mus musculus*) are expected to occur.

The potential for the presence of Hawaiian hoary bat was assessed based on the presence of suitable habitat and vegetation types; no acoustic survey was conducted. Suitable forage and roost habitat was documented during the biological surveys.

13.5.3 Ungulates

A 2017 aerial survey using Forward Looking InfraRed (FLIR) technology to assess the ungulate population found well-established populations of ungulates in the area. A total of 3,076 ungulates were observed in the area during two days of aerial surveys: 2,616 goats (*Capra hircus*), 318 axis deer (*Axis axis*), 117 cows (*Bos taurus*), and 25 pigs (*Sus scrofa*).

The survey results confirm the presence of a thriving game mammal population which can provide favorable hunting opportunities throughout the year. However, in order to reduce the impact to natural

and cultural resources in the area, initial management hunts to immediately reduce ungulate populations must be carried out.

13.5.4 Terrestrial Reptiles and Amphibians

No terrestrial reptiles or amphibians are native to Hawai'i. No terrestrial reptiles or amphibians were observed during the field surveys.

13.5.5 Insects and Other Invertebrates

Nine invertebrates were observed during the field surveys: Blackburn's sphinx moth larvae (*Manduca blackburni*; federally and state-listed), Monarch butterfly (*Danaus plexippus*), honey bee (*Apis* sp.), gulf fritillary butterfly (*Agraulis vanillae*), Sonoran carpenter bee (*Xylocopa sonorina*), praying mantis (*Tenodera* sp.), housefly (*Musca domestica*), seven-spotted lady beetle (*Coccinella septempunctata*), and green darner (*Anax junius*). Unknown species of paperwasp and various unknown species of ants were also observed. All these invertebrates are known to occur in the Kanaio area.

Three Blackburn's sphinx moth larvae were observed in the non-native tree tobacco in two separate areas. The Blackburn's sphinx moth is discussed further in Section 14.5.7.3.

Although not observed within the action area, suitable aquatic habitat for the federally and state endangered orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*) is adjacent to the action area in the anchialine pools near the Hanamania Point Lighthouse. The orangeblack damselfly is discussed further in Section 14.5.7.4.

Although the yellow-faced bee was not observed, habitat for yellow-faced bees does exist in the native vegetation in the action area. The yellow-faced bee is discussed further in Section 14.5.7.5.

13.5.6 Special-Status Species

One special-status species, the Blackburn's sphinx moth (*Manduca blackburni*), was observed during the field surveys. Based on current observations, distribution, and habitat requirements, the following additional species may occur in suitable habitat: Hawaiian goose, Hawaiian hoary bat (or 'ope'ape'a [*Lasiurus cinereus semotus*]), and yellow-faced bee (*Hylaeus anthracinus*). No suitable habitat was observed for the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*). Special-status species that are known to occur and may occur in the action area are discussed in the following section.

13.5.7 Fauna

13.5.7.1 HAWAIIAN GOOSE

The Hawaiian goose occupies various habitat types ranging from beach strand, shrubland, and grassland to lava rock at elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999).

The geese eat plant material, and the composition of their diet depends largely on the vegetative composition of their surrounding habitats. Most Hawaiian goose food items are leaves and seeds of grasses and sedges, leaves and flowers of various herbaceous composites, and various fruits of several species of shrub (Banko et al. 1999; Black et al. 1994). They appear to be opportunistic in their choice of food plants as long as the plants meet their nutritional demands (Banko et al. 1999; Woog and Black 2001). The Hawaiian goose has an extended breeding season, with eggs reported from all months except

May, June, and July, although most nest during the rainy (winter) season between October and March (Banko et al. 1999; Kear and Berger 1980).

The Hawaiian goose was not observed during the field surveys; however, suitable habitat for nesting and foraging was noted during the surveys. The invaded pasturelands, pasturelands, native coastal strand, non-native coastal, and 'a'ali'i shrubland vegetation types are suitable for Hawaiian goose foraging.

The Hawaiian goose has been observed nesting under lantana, 'a'ali'i, and Christmas berry and could nest in the koa haole forest, pasturelands, 'a'ali'i shrubland, dryland forest, native coastal strand, and invaded pasture vegetation types in the action area.

13.5.7.2 HAWAIIAN HOARY BAT

The Hawaiian hoary bat is known occur on all of the MHI and has been observed from sea level to an elevation of approximately 13,000 feet (DLNR 2015a, 2015b). Hawaiian hoary bats use both closed habitats near vegetation such as tunneled roadways, and open habitats adjacent to forests, above tree canopies, and over open oceans (Jacobs 1996). Hawaiian hoary bats are insectivores and are regularly observed foraging over streams, reservoirs, and wetlands up to 300 feet offshore (U.S. Department of Agriculture 2009). Hawaiian hoary bats forage in open, wooded, and linear habitats within a wide range of vegetation types (USFWS 1998). The bat typically roosts in dense canopy foliage or in the subcanopy when canopy is sparse, with open access for launching into flight (U.S. Department of Agriculture 2009). The Hawaiian hoary bat could forage over all vegetation types in the action area and could roost in trees 15 feet or taller in the strand vegetation and kiawe forest vegetation types. Hawaiian hoary bats have been documented roosting in kiawe and hala, and may roost in trees such as hao, wiliwili, lama, milo, alahe'e, keahi, 'aiea, and ohe makai in the pasturelands, invaded pasturelands, dryland forest, native coastal strand, non-native coastal, and 'a'ali'i shrubland vegetation types.

13.5.7.3 BLACKBURN'S SPHINX MOTH

Three Blackburn's sphinx moth larvae were observed on tree tobacco in two separate areas in the action area. One was observed on November 15, 2017, along the path of a proposed road, and two were observed on January 22, 2018, along the Hoapili Trail. Approximately 3,800 acres of designated Blackburn's sphinx moth critical habitat occurs in the action area.

The primary constituent elements required by Blackburn's sphinx moth larvae for foraging, sheltering, and maturation are the two documented native host plant species in the genus *Nothoestrum*, also known as 'aiea (*N. latifolium* and *N. breviflorum*) (USFWS 2005). Only *N. latifolium* was observed in the action area. At lower elevations, Blackburn's sphinx moth larvae are found most often on the non-native tree tobacco; they have also been found on tobacco (*Nicotiana tabacum*), eggplant (*Solanum melongena*), tomato (*S. lycopersicum* var. *cerasiforme*), and the indigenous pōpolo (*S. americanum*) (USFWS 2005). The larvae descend from their host plants and search for suitable soil before pupating. They are most likely to pupate within 33 feet (10 m) of the larval host plant, although they may transit farther over paved and hardened surfaces to find a suitable site to enter the ground. The pupal stage of moth has been suggested to last up to 1 year (Zimmerman 1958); however, no data exist to support this suggestion. Captive reared moths emerged within 6 weeks (Rubinoff and San Jose 2010). The Blackburn's sphinx moth larvae can be found in all the vegetation types within the action area.

13.5.7.4 ORANGEBLACK HAWAIIAN DAMSELFLY

The orangeblack Hawaiian damselfly was once Hawai'i's most abundant damselfly and is known to occur within the anchialine pool, coastal, lowland dry, and lowland mesic ecosystems (USFWS 2016c). This

species was common near standing or very slow-moving bodies of water, garden pools, large reservoirs, pools of an intermittent stream, fishponds, and freshwater marshes (USFWS 2018).

The orangeblack Hawaiian damselfly is known to breed in anchialine ponds near the La Perouse Lighthouse approximately 1,400 feet south of the action area (Polhemus et al. 1999). Because of the close proximity of the orangeblack Hawaiian damselfly to the action area, the damselfly may be attracted to pooled water within the action area during rain events.

13.5.7.5 YELLOW-FACED BEE

The yellow-faced bee is known to occur within coastal habitats that include rocky shoreline with naupaka and tree heliotrope (*Tournefortia argentea*) with either landscaped vegetation, kiawe, or bare rock (USFWS 2018). The bees are restricted to an extremely narrow corridor, typically 10 to 20 m wide, and do not occur on sandy beaches or inland, even on landscaped native plants on hotel grounds. The yellow-faced bee has been observed entering holes in coral rubble deposited on shore, and this may be their primary nesting site and a limiting factor on their distribution. The yellow crazy ant (*Anoplolepis gracilipes*) was often found in close proximity, but almost never on plants visited by the yellow-faced bee. Host plants for the yellow-faced bee recorded during the field surveys include naupaka, ilima, pua kala, and naio in the native coastal strand vegetation type. In addition, this species may also use 'akoko (*Chamaesyce* spp.) and tree heliotrope if found. Threats to the yellow-faced bee include habitat destruction and modification from non-native plants, ungulates, and fire, and predation by non-native ants and wasps.

13.5.7.6 HAWAIIAN MONK SEAL

Hawaiian monk seals spend most of their lives at sea, but also rely on land habitat for resting, molting, pupping, nursing, and avoiding marine predators. Monk seals can often be seen hauling-out on sand, corals, and volcanic rock to rest during the day and to give birth, preferring protected beaches surrounded by shallow waters when pupping (National Oceanic and Atmospheric Administration National Marine Fisheries Service [NOAA NMFS] 2015a). Pupping has been observed in a variety of terrestrial coastal habitats mostly consisting of sandy, protected beaches adjacent to shallow sheltered aquatic areas (NOAA 2015).

Hawaiian monk seals are considered foraging generalists, and the characteristics of their foraging habitat are variable. They generally hunt outside of the immediate shoreline in waters 60 to 300 feet deep but have been known to forage at depths of up to 1,000 feet (NOAA NMFS 2015a).

13.5.7.7 SEA TURTLES

The green and hawksbill sea turtles constitute the sea turtle group. Because these species share similar habitat requirements and biological characteristics, as well as potential project impacts and conservation measures, they can be discussed as a single group. No sea turtle critical habitat has been designated in the waters of Hawai'i.

The green sea turtle is widely distributed throughout the world and found primarily in tropical and subtropical waters. They are the most common sea turtle found in the Hawaiian archipelago. Green turtles in Hawai'i are genetically distinct from other green sea turtle populations (Bowen et al. 1992). Green sea turtles are generally common along all coastlines of the MHI from the shore out to at least the 100-foot bathymetry contour, and they are expected to use the coastal waters and shoreline within the action area and have been observed transiting Hawai'i rivers up to 2 miles inland (Clarke et al. 2012).

The hawksbill sea turtle is found circumtropically in waters of the Atlantic, Pacific, and Indian Oceans. Current global estimates are between 60,000 and 78,000 nesting adult female hawksbills. One hundred adult females were tagged on Hawai'i Island between 1991 and 2009 (Sietz et al. 2012). Hawksbill sea turtle hatchlings are believed to inhabit the pelagic environment, taking shelter in floating algal mats and drift lines of flotsam and jetsam. After a few years, small juveniles recruit to coastal foraging grounds (NOAA NMFS 2014). Coral reef ledges and caves provide shelter for resting hawksbill sea turtles both during the day and at night. Hawksbill sea turtles are known to exhibit high site fidelity, returning to the same resting spot night after night. They can also be found near rocky outcrops and high-energy shoals, which are optimum sites for sponge growth, a preferred species of forage (NOAA NMFS 2014).

13.6 Critical Habitat Considered

The project and action areas overlap with six critical habitat units: Blackburn's Sphinx Moth, Terrestrial Hawaiian Monk Seal, Marine Hawaiian Monk Seal, Maui Coastal Unit 06, Maui Lowland Dry Unit 01, and Maui Lowland Dry Unit 04 (Figure 5). This determination is based on information obtained from various *Federal Register* documents. The critical habitat units located in the action area are discussed below.

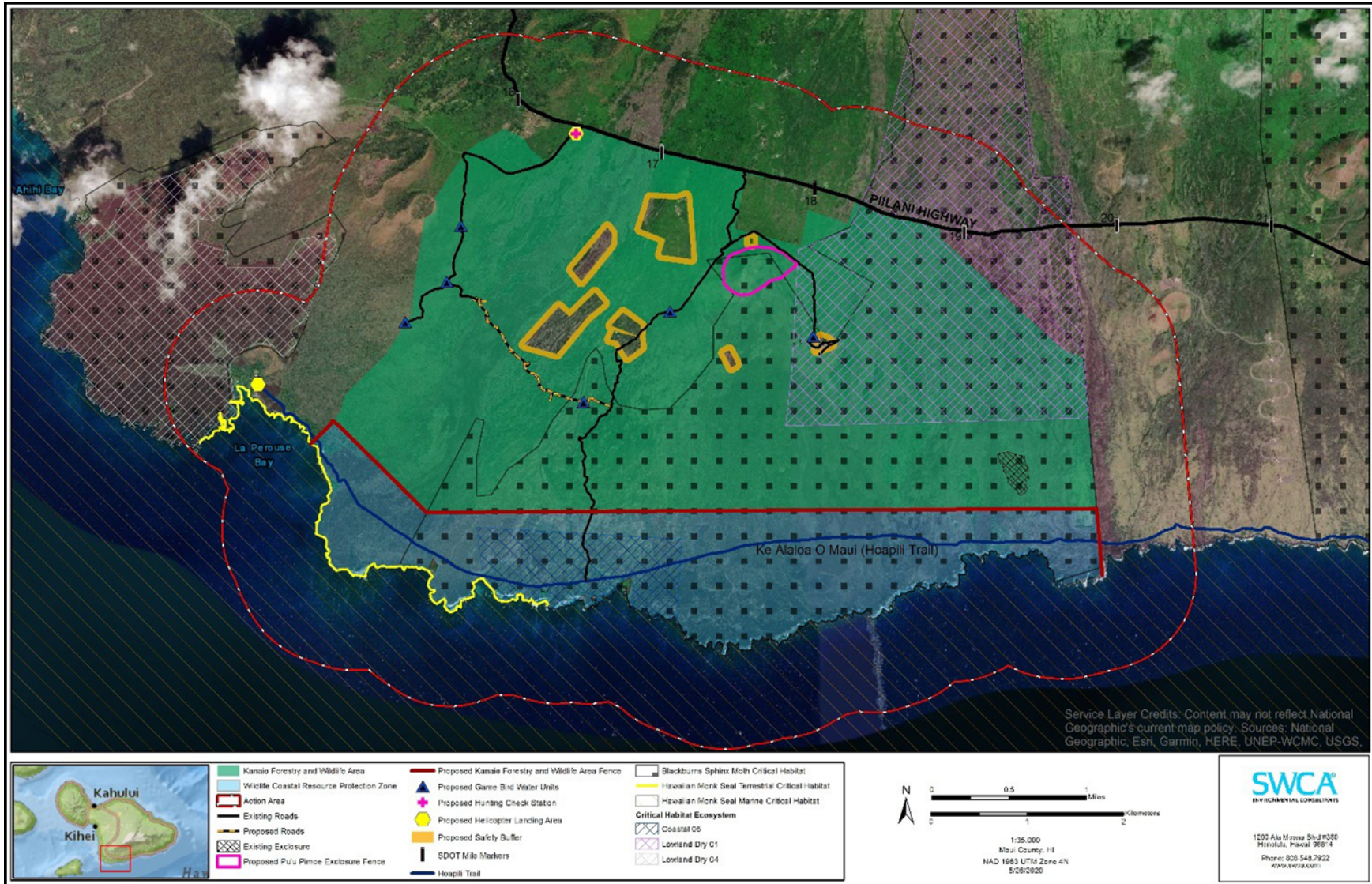


Figure 5. KFWA action area, survey area, and critical habitat

13.6.1 **Blackburn's Sphinx Moth**

On June 10, 2003, the USFWS designated approximately 23,496 acres on Maui as Blackburn's sphinx moth critical habitat (USFWS 2003b). The primary constituent elements required by the Blackburn's sphinx moth larvae for foraging, sheltering, maturation, and dispersal are the two documented host plant species within the endemic genus *Nothoecstrum* (*N. latifolium* and *N. breviflorum*), and the dry and mesic habitats between the elevations of sea level and 5,000 feet and receiving between 10 and 100 inches of annual precipitation. The primary constituent elements required by Blackburn's sphinx moth adults for foraging, sheltering, dispersal, breeding, and egg production are native, nectar-supplying plants including, but not limited to, *Ipomoea* spp., *Capparis sandwichiana*, and *Plumbago zeylanica*, and within the dry to mesic habitats between sea level and 5,000 feet above sea level and receiving between 10 and 100 inches of annual precipitation (USFWS 2003b). The designated Kanaio Blackburn's sphinx moth critical habitat consists of 5,981 acres. The action area contains approximately 5,620.14 acres of Blackburn's sphinx moth critical habitat; 2,998.09 acres occur in the KFWA and 1,654.16 acres occur in the coastal area.

13.6.2 **Hawaiian Monk Seal Terrestrial and Marine Critical Habitat**

On September 21, 2015, revised critical habitat for the Hawaiian monk seal became effective. The essential critical habitat features for this species are 1) terrestrial areas and adjacent shallow, sheltered aquatic areas with characteristics preferred for pupping and nursing; 2) marine areas from 0 to 656 feet deep that support adequate prey quality and quantity for juvenile and adult monk seal foraging; and 3) significant areas used by monk seals for hauling out, resting, or molting. The action area contains approximately 5.21 miles of terrestrial Hawaiian monk seal critical habitat and approximately 3,050.83 acres of marine Hawaiian monk seal critical habitat in the coastal area.

13.6.3 **Maui Coastal Unit 6**

On May 14, 2003, the USFWS designated 356 acres of critical habitat for *Vigna owahuensis* on Maui (USFWS 2016a). Maui Coastal Unit 6 critical habitat is occupied by the plant *Vigna o wahuensis* and contains unoccupied habitat for four additional federally listed plants (*Brighamia rockii*, *Cyperus pennatifolius*, *Ischaemum byrone*, and *Peucedanum sandwicense*). The primary constituent elements include the following physical and biological features: occurring less than 980 feet asl; less than 20 inches of precipitation per year; substrates that are well-drained, calcareous, with talus slopes; dunes; weathered clay soils; ephemeral pools; mudflats; a canopy containing at least one of the following: *Hibiscus* spp., *Myoporum* spp., *Santalum* spp., *Scaevola* spp.; a subcanopy containing at least one of the following: *Gossypium* spp., *Sida* spp., *Vitex* spp.; and an understory with at least one of the following: *Eragrostis* spp., *Jacquemontia* spp., *Lyceum* spp., *Nama* spp., *Sesuvium* spp., *Sporobolus* spp., *Vigna* spp. (USFWS 2016a). All of the Maui Coastal Unit 6 critical habitat on Maui occurs within the coastal area of the Proposed Action.

13.6.4 **Maui Lowland Dry Unit 01**

On March 30, 2016, the USFWS designated 13,537 acres of Lowland Dry Unit 01 critical habitat on Maui. Throughout Maui this critical habitat unit is known to be occupied by *Bonamia menziesii*, *Cenchrus agrimonioides*, *Flueggea neowawraea*, *Melicope adscendens*, *Santalum haleakalae* var. *lanaiense*, and *Spermolepsis hawaiiensis* and provides unoccupied habitat for 13 additional federally listed plants (*Alectryon macrococcus*, *Bidens micrantha kalealaha*, 'awikiwiki, *Colubrina oppositifolia*, *Ctenitis squamigera*, *Hibiscus brackenridgei*, *Melanthera kamolensis*, *Melicope mucronulata*, *Neraudia sericea*, *Nototrichium humile*, 'ohai, *Solanum incompletum*, and *Zanthoxylum hawaiiense*) (USFWS 2016a, 2018). The primary constituent elements include the following physical and biological features:

occurring less than 3,300 feet asl; less than 50 inches of precipitation per year; substrates that contain weathered silty loams to stony clay, rocky ledges, little weathered lava; a canopy containing at least one of the following: *Diospyros* spp., *Myoporum* spp., *Pleomele* spp., *Santalum* spp.; a subcanopy containing at least one of the following: 'akoko, *Dodonaea* spp., *Leptecophylla* spp., *Osteomeles* spp., *Psydrax* spp., *Scaevola* spp., and *Wikstroemia* spp.; and an understory containing at least one of the following: *Alyxia* spp., *Artemisia* spp., *Bidens* spp., *Chenopodium* spp., *Nephrolepis* spp., *Peperomia* spp., and *Sicyos* spp. (USFWS 2016a). In total, approximately 1,231 acres occur in the KFWA of the Proposed Action.

14 CULTURAL RESOURCES

The lands resting within the boundaries of the KFWA possess abundant evidence of human settlement and use stretching back to the period before Western contact. This rich cultural landscape contains both traditional Hawaiian archaeological features, including coastal villages, religious sites, trails, shelters, planting areas, and human burials, as well as later post-contact structures such as ranching era boundary walls and historic house sites. One of the primary purposes in creating the KFWA is to ensure the protection of these cultural resources from further damage by humans and ungulates.

14.1 Traditional Life

Situated within the rain shadow of the volcanic peak of Haleakalā and scarred by multiple lava flows, the ahupua'a of Kanaio, Kalo'i, Kaunuahane, and Papaka Kai may appear today to be barren and inhospitable. Archaeological evidence, however, suggests that during the pre-contact period these land divisions were home to a thriving Native Hawaiian population. Most traditional settlement appears to have been focused along the coastline where the nearshore waters offered an abundance of marine resources.

The remains of small fishing communities can be seen at the coves of Alaha-Wahene and Waiailio, while remnants of individual residences are scattered along the shore. When archaeologist Winslow Metcalf Walker visited the abandoned village of Waiailio in the 1920s he found 15 house foundations, one of which still had its grass roof in place, as well as animal pens, canoe sheds and other walled enclosures. The inhabitants of these oceanside settlements gathered shellfish along the rocky shoreline and fished the rich offshore waters. They obtained drinking water from brackish wells and submarine springs located offshore.

Coastal trails (ala kahakai) linked these shoreline settlements, while ala pi'i (ala meaning path or trail and pi'i meaning "to go inland") gave their residents access to the upper slopes where crops such as 'uala (sweet potato, *Ipomoea batatas*), uhi (yam, *Dioscorea* spp.), and dryland kalo (taro, *Colocasia esculenta*) were grown. These mauka (inland) to makai (seaward) trails also connected isolated kīpuka (pockets of older lava completely encircled by younger lava flows) that possessed well-developed soils and appear to also have been utilized as dryland planting areas. Two major trails that likely have origins in the traditional period are the Kanaio trails, which roughly follows the current Kanaio Beach Road and the Waia'ilio trail that runs from the Old Government Road (now the Pi'ilani Highway) to the east of Pu'u Pimoe and Pu'u Pohakea down to the shoreline near the eastern boundary of the KFWA.

Ala loa ("long trails"), trails of regional significance, served to cover extensive distances and connect major settlements. The post-contact Hoapili Trail (constructed in the 1840s by order of Governor Hoapili to link the shoreline settlements from Honua'ula to Kaupō), which passes through the makai portion of the KFWA, may roughly follow the original coastal ala loa built during the traditional period. A number of archaeological sites lie along the course of this well-defined trail. The mauka boundary of the KFWA is marked by the present Pi'ilani Highway, which likely corresponds to the traditional inland ala loa

connecting farming settlements. In this upland area rainfall was sufficient to support more extensive dryland fields as well as residence areas.

14.2 Post-Contact History

Traditional life in Kanaio and its neighboring ahupua'a remained relatively unchanged during the early years following Western contact. The settlements of rural south Maui were far removed from the centers of dramatic cultural change such as the growing whaling port of Lāhainā. With time, however, introduced disease began to affect the area, contributing to the decline of rural Native Hawaiian populations. This was exacerbated by economic migration as young people left their ancestral homes to look for work in the towns. Eventually, the coastal settlements within the KFWA were abandoned and some of the land given over to cattle grazing. Cattle ranching became the dominant economic activity in the region beginning in the 1840s. Several ranches, including the Kahikinui, 'Ulupalakua, Haleakala, and Kaupo Ranch, grazed cattle within the KFWA.

During the Second World War, the United States Army and Marine Corps utilized portions of the ahupua'a of Kanaio, including the area around Pu'u Pimoe, for live fire training, though the area was never bombarded by ship. In 1965, the Hawai'i ANG obtained a permit from 'Ulupalakua Ranch to use a portion of Kanaio ahupua'a as a live-fire and maneuver training ground. This became the Kanaio Training Area (KTA). The KTA measured approximately 4,707 acres in extent and covered most of the eastern half of the current KFWA. (Live) fire training within the KTA was primarily limited to a zone around the Pu'u Pimoe cinder cone and all live firing was done towards the sea into the Pu'u Pimoe flow zone inland of the Hoapili Trail. Exercises using high explosives were permanently suspended at KTA in 1981 and use of the area by the Hawai'i ANG was gradually phased out. From the 1980s to early 2000s, various unexploded ordnance (UXO) clearance operations were undertaken within the KFWA. The Hoapili Trail and adjacent areas were swept for ordnance. Several fenced enclosures were established as permanent off-limit areas that were judged as too unsafe to sweep for UXO.

14.3 Cultural Sites

Archaeological investigations conducted within the limits of the KFWA have identified an abundance of archaeological sites and features of various ages and functions. These studies provide a broad picture of the cultural landscape of this portion of the ahupua'a of Kanaio, Kalo'i, Kaunuaahane, and Papaka Kai.

The majority of archaeological studies undertaken have been concentrated within the boundaries of the former KTA or along and makai of the Hoapili Trail. The cultural resources identified date to both the pre- and post-contact periods. They include features related to habitation, agriculture, animal husbandry, and travel, as well as ceremonial and burial sites.

Archaeological sites located along the coast makai of the Hoapili Trail include the remains of fishing villages, isolated coastal residences, fishing shrines, wells, shelter caves, and trails, as well as the heiau of Keawanaku within the ahupua'a of Kaunuaahane and a cluster of burial sites at Ki'ipuna alongside the Hoapili Trail.

Within the upper portion of the KFWA, several subsurface lava tubes show evidence of both habitation and human burial. The twin cinder cones of Pu'u Pimoe and Pu'u Pohakea appear to have been favored burial areas. Other sites within the more mauka area appear related to dryland agriculture as well as inland settlement (both pre- and post-contact).

15 ENVIRONMENTAL EFFECTS

This section is an evaluation of the potential environmental effects of the Proposed Action and the No Action Alternative. The Proposed Action is inclusive of the actions of the Kanaio Forestry and Wildlife Area Draft Management Plan. The actions outlined in the Proposed Action are designed to achieve the following goals:

1. Protect the natural resources
2. Provide opportunities for public hunting
3. Maintain public access

The impacts are assessed on the basis that the actions would be implemented simultaneously so that the total impact on the environment can be evaluated. The impact analysis describes the intensity of effects. The following terms are adopted from the Biological Assessment for this area and used as needed to help provide context to the magnitude and timing of the impacts. Unless otherwise stated, the standard definitions for these terms are as follows:

- *No effect*: A determination of no effect means there are absolutely no effects to the species and its critical habitat, either positive or negative. It does not include small effects or effects that are unlikely to occur.
- *May affect, but is not likely to adversely affect*: Under this effect determination, all effects to the species and its critical habitat are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without adverse effects to the species (for example, there cannot be “balancing,” so that the benefits of the action will outweigh the adverse effects). Insignificant effects relate to the magnitude of the impact and should not reach the scale where take occurs. Discountable effects are considered extremely unlikely to occur. Based on best judgment, a person will not 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur. Determinations of “not likely to adversely affect, due to beneficial, insignificant, or discountable effects” require written concurrence from the USFWS.
- *May affect, and is likely to adversely affect*: This effect determination means that the Proposed Action will have an adverse effect on the species or its critical habitat. Any action that will result in “take” of an endangered or threatened species is considered an adverse effect. A combination of beneficial and adverse effects is still considered “likely to adversely affect,” even if the net effect is neutral or positive. The effect on the species and/or critical habitat must be extremely small to qualify as a discountable effect. Likewise, an effect that can be detected in any way or that can be meaningfully articulated in a discussion of the results of the analysis is not discountable; it is an adverse effect.

15.1 Soils

15.1.1 *Alternative 1 – No Action Alternative*

Under the No Action Alternative, unauthorized off-road vehicle activities in the area would be continue. Soils would be at a high risk for damage from illegal off-road activities, cattle, and ungulates. The long-term effects of no action are likely to adversely affect the soils by increasing erosion in the area.

15.1.2 Alternative 2 – Proposed Action

The actions of the proposed Kanaio Forestry and Wildlife Area Draft Management Plan focus on reducing damage from large numbers of feral ungulates, and activities such as illegal off-road vehicles, unauthorized cattle grazing, and degradation. Under the Kanaio Forestry and Wildlife Area Management Plan, law enforcement presence will reduce these damaging activities, which subsequently cause erosion and impact the soil quality in the area.

15.1.2.1 AIR QUALITY

15.1.3 Alternative 1 – No Action Alternative

The No Action Alternative is anticipated to have no effect on the existing air quality in the proposed KFWA.

15.1.4 Alternative 2 – Proposed Action

The proposed Kanaio Forestry and Wildlife Area Draft Management Plan is not expected to improve or result in deterioration of the air quality in the area. Although the physical conditions are anticipated to improve, it is likely there will be no measurable improvement in the air quality in the area. Therefore, the Proposed Action is expected to have no effect on air quality.

15.1.4.1 FLORA AND VEGETATIVE COMMUNITIES

15.1.5 Alternative 1 – No Action

The No Action Alternative is expected to degrade the conditions for flora species, especially native species that have been decimated by decades of unmanaged goat populations and cattle in the area.

15.1.6 Alternative 2 – Proposed Action

Under the actions of the Kanaio Forestry and Wildlife Area Draft Management Plan, the proposed Pu‘u Pimoe fence and the coastal area fence will reduce the impacts from unmanaged goat populations and cattle grazing. Flora and vegetation communities are expected to improve in the fenced areas. This is because grazing, browsing, and trampling of listed plants inside of these fenced areas would cease. By eliminating plant herbivory, the protected plants would be able to grow to maturity, which would increase survival and recruitment. Flora and the vegetation communities outside of the fenced areas may likely remain the same and stabilize as the ungulate population is managed at an acceptable level and cattle are completely removed from the area.

The Native Coastal Strand and Non-native Coastal Strand vegetation communities will be completely fenced. Both vegetation communities are likely to improve but the Non-native Coastal Community may increase in overall coverage once all the ungulates are removed from the coastal area.

Table 7 provides descriptions of the ESA-listed flora species evaluated and a rationale for expecting their presence or absence in the action area. The topography, vegetative communities, and habitat in the action area provide suitable conditions for 11 flora species: ‘aiea, *Bonamia menziesii*, *Cenchrus agrimonioides*, *Flueggea neowawraea*, *Melicope adscendens*, *Santalum haleakalae* var. *lanaiense*, *Spermolepsis hawaiiensis*, *Vigna o-wahuensis*, *Melanthera kamolensis*, ‘awikiwiki, and ‘ihi.

Table 7. Species Federally Listed as Endangered or Threatened with Potential to Occur In and Near the Proposed KFWA

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in KFWA	Determination of Effect
Plants				
'Aiea (<i>Nothocestrum latifolium</i>)	Endangered	Occurs in dry to mesic forest, between elevations of 1,509 to 5,020 feet. Has been documented on the islands of Kaua'i, O'ahu, Moloka'i, Lāna'i, and Maui.	Known to occur; multiple trees were observed during surveys, and species locations occur in gathered background data.	May affect, but is not likely to adversely affect
<i>Bonamia menziesii</i>	Endangered	Occurs in dry to mesic forest, very rarely in wet forest, between elevations of about 492 to 2,051 feet. Has been documented on the islands of Kaua'i, O'ahu, Moloka'i, Lāna'i, Maui, and Hawai'i.	May occur; the last confirmed sighting in the action area was in 2001. Suitable habitat exists in any vegetated portion of the action area. Four individuals are located in the nearby Kanaio Natural Area Reserve (NAR) (USFWS 2016).	May affect, but is not likely to adversely affect
Kāmonamona (<i>Cenchrus agrimonioides</i>)	Endangered	Occurs on sand and on dry, rocky slopes and ridges in partial shade, between elevations of 0 to about 2,493 feet.	May occur; one patch of Kāmonamona, approximately 10 square feet, is known to occur within the Kanaio NAR (USFWS 1999) approximately 2 miles north of the Pi'ilani Highway and is not known to occur in the action area.	May affect, but is not likely to adversely affect
Mēhamehame (<i>Flueggea neowawraea</i>)	Endangered	Occurs in dry to mesic forest, between elevations of about 820 to 3,280 feet. Has been documented on the islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i.	May occur; on East Maui, up to 6 individuals are known to occur at approximately 2,800 feet in elevation (USFWS 1994, 2009).	May affect, but is not likely to adversely affect
Alani (<i>Melicope adscendens</i>)	Endangered	Occurs in lowland dry and montane mesic ecosystems on the southwestern slope of Haleakala in east Maui at or above 3,200 feet in elevation (USFWS 2016a).	Unlikely to occur; the action area is below the species' elevational range.	No effect
'Iliahi (<i>Santalum haleakalae</i> var. <i>lanaiense</i>)	Endangered	Occurs in mesic to wet forest, from elevations of about 820 to 3,117 feet. Has been documented on the islands of Moloka'i, Lāna'i, and Maui.	Unlikely to occur; in east Maui there are fewer than 10 individuals at Ke'anae, south of Kahua, and in the upper Kepuni drainage (USFWS 2016b).	No effect
<i>Spermolepis hawaiiensis</i>	Endangered	Occurs in the lowland dry ecosystem, at elevations ranging from about 98 to 3,281 feet on Maui.	May occur; there is one population at Kanaio with approximately 1,000 individuals (USFWS 2016a).	May affect, but is not likely to adversely affect
'Ohai (<i>Sesbania tomentosa</i>)	Endangered	Occurs in dry areas at elevations below 2,500 feet on all of the main islands (University of Hawai'i 2001a).	Known to occur; one population of approximately 10 individuals in the action area.	May affect, but is not likely to adversely affect
<i>Vigna o-wahuensis</i>	Endangered	Occurs primarily in dry grassland and shrubland, at elevations ranging from about 3 to 3,281 feet. Has been documented on Ni'ihau, O'ahu, Moloka'i, Lāna'i, Maui, Kaho'olawe, and Hawai'i.	May occur; there are approximately 10 individuals at Kanaio Beach in the coastal ecosystem (USFWS 2016a).	May affect, but is not likely to adversely affect

* Federal (USFWS) status definitions:

Endangered: Any species considered by the USFWS as being in danger of extinction throughout all or a significant portion of its range. The ESA specifically prohibits the take of a species listed as endangered. *Take* is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

Threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA specifically prohibits the take (see definition above) of a species listed as threatened.

† Unless otherwise noted, data are from Wagner et al. 1990.

15.1.6.1 FAUNA

15.1.7 Alternative 1 – No Action

Under the No Action Alternative, avifauna species, which consist primarily of common non-native introduced species, are not likely to benefit or be negatively impacted. No impacts to non-listed fauna or Covered Species would be expected under this alternative. Under the No Action Alternative, feral ungulate populations and illegal cattle grazing would continue to degrade the natural resources in the area.

Small mammal predator species such as the feral cat (*Felis catus*), rat (*Rattus* spp.), mongoose (*Herpestes javanicus*), and mouse (*Mus musculus*) populations will continue at present status.

Special-status species that were recorded in the area will continue to decline in the area as non-native fauna will continue to displace native species.

15.1.8 Alternative 2 – Proposed Action

Under the proposed Kanaio Forestry and Wildlife Area Draft Management Plan, feral ungulate populations will be reduced to target levels, which would minimize impacts to natural resources in the proposed KFWA. DOFAW will enforce measures to stop all illegal cattle grazing in the proposed KFWA.

The potential effects to ESA-listed fauna species evaluated and a rationale for expecting their presence or absence in the action area. Identified are eight special status fauna species—Hawaiian hoary bat, Hawaiian goose or nēnē, Blackburn’s sphinx moth, yellow-faced bee (*Hylaeus anthracinus*), orangeblack Hawaiian damselfly, Hawaiian monk seal, green sea turtle (*Chelonia mydas*), and hawksbill sea turtle (*Eretmochelys imbricata*). The band-rumped storm-petrel, Hawaiian petrel, and Newell’s shearwater (collectively, Hawaiian seabirds) are unlikely to occur in the action area because suitable habitat does not exist there; the Proposed Action is not expected to attract Hawaiian sea birds. Species that may be affected by the Proposed Action and the potential effects are discussed in the table 8 below. Species that have a “no effect” determination are not discussed further.

Table 8. Species Federally Listed as Endangered or Threatened with Potential to Occur In and Near the Action Area

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in Action Area	Determination of Effect
Birds				

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in Action Area	Determination of Effect
Hawaiian goose or nēnē (<i>Branta sandvicensis</i>)	Threatened	Frequents scrubland, grassland, golf courses, sparsely vegetated slopes, and open lowland country. The species does not require standing or flowing water for successful breeding but will use it when available. Nest sites include various habitat types ranging from beach strand, shrubland, and grassland to lava rock, and elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999).	May occur; suitable foraging and nesting habitat occurs in the invaded pasturelands, pasturelands, koa haole forest, 'a'ali'i shrubland, dryland forest, native coastal strand, and non-native coastal vegetation types in the action area.	May affect, but is not likely to adversely affect
Band-rumped storm petrel (<i>Oceanodroma castro</i>)	Endangered	This species is found in several areas of the subtropical Pacific and Atlantic Oceans. In Hawai'i, this species is known to nest on Kaua'i, Lehua Islet, and the Island of Hawai'i. The species likely nests in remote cliff locations. Only three inactive nests have been found in the Hawaiian Islands; all were located in small caves or crevices. Adults of this species visit the nest site after dark. When not at nest locations, it forages on the open ocean.	Unlikely to occur in the action area. Band-rumped storm petrel may fly over the action area at night while transiting between nest sites and the ocean, but are not likely to land or use habitat because nesting habitat does not occur in the action area.	No effect
Hawaiian petrel (<i>Pterodroma sandwichensis</i>)	Endangered	Breeding season is from March to October, during which time this species nests in some of the main Hawaiian Islands, notably on Maui, Lāna'i, and Kaua'i. This species nests in burrows, primarily in remote montane locations, along large rock outcrops, under cinder cones, under old lichen-covered lava, or in soil beneath dense vegetation. This species was once abundant on all main Hawaiian islands except Ni'ihau. Today, the largest known breeding colonies are found at Haleakala Crater on Maui and on the summit of Lāna'i. Other colonies are on Kaua'i, the Island of Hawai'i, and possibly Moloka'i.	Unlikely to occur in the action area. Hawaiian petrels may fly over the action area at night while transiting between nest sites and the ocean, but they are not likely to land or use habitat because nesting habitat does not occur in the action area.	No effect
Newell's shearwater (<i>Puffinus auricularis newelli</i>)	Threatened	During their 9-month breeding season from April through November, this species nests in burrows under ferns on forested mountain slopes and needs an open downhill flight path through which it can become airborne. These burrows are used year after year and usually by the same pair of birds. This species was once abundant on all main Hawaiian islands. Today, Newell's shearwater breed on Kaua'i, the Island of Hawai'i, Moloka'i, and Lehua.	Unlikely to occur in the action area. Newell's shearwater may fly over the action area at night while transiting between nest sites and the ocean, but are not likely to land or use habitat because nesting habitat does not occur in the action area.	No effect
Mammals				

Common Name (Scientific Name)	Status*	Range or Habitat Requirements†	Potential for Occurrence in Action Area	Determination of Effect
Hawaiian monk seal (<i>Neomonachus schauinslandi</i>)	Endangered	Endemic to the Hawaiian archipelago and found mostly in the northwestern Hawaiian Islands. Increasing sightings reported from main Hawaiian Islands. Hawaiian monk seals spend most of their time in the ocean but rest on sandy beaches, and sometimes use beach vegetation as shelter from wind and rain. There are accounts of seals traveling up some rivers and streams.	Known to occur in the action area. The action area contains habitat that could support Hawaiian monk seal pupping, nursing, and hauling out.	May affect, but is not likely to adversely affect
Hawaiian hoary bat (<i>Lasiurus cinereus semotus</i>)	Endangered	This species is found primarily from sea level to 7,500 feet, although it has also been observed above 13,000 feet. Most of the available documentation suggests that this elusive bat roosts among trees in forested areas. It has been observed on the islands of Hawai'i, Maui, Moloka'i, O'ahu, and Kaua'i.	May occur in the action area. Bat foraging could occur over all the vegetation types in the action area. Bat roosting could occur in the invaded pasturelands, pasturelands, 'a'ali'i shrubland, dryland forest, and non-native coastal vegetation types of the action area.	May affect, but is not likely to adversely affect
Reptiles				
Green sea turtle (<i>Chelonia mydas</i>)	Threatened	The green sea turtle is found worldwide in warm seas. They occupy three habitat types: open beaches, open sea, and feeding grounds in shallow, protected waters. Nesting occurs throughout the Hawaiian archipelago.	May occur in the action area. The action area contains shallow waters and beaches that could support green sea turtle foraging and hauling out.	May affect, but is not likely to adversely affect
Hawksbill sea turtle (<i>Eretmochelys imbricata</i>)	Endangered	The hawksbill sea turtle is found in warm tropical waters worldwide. The hawksbill turtle is a shy tropical reef-dwelling species that feeds on jellyfish, sea urchins, and sea sponges. It may also eat algae that grows on the reef. In Hawai'i, nesting occurs on the islands of Hawai'i, Maui, Moloka'i, and O'ahu.	May occur in the action area. The action area contains rocky areas, coral reefs, shallow coastal areas, and beaches that could support hawksbill sea turtle foraging and nesting.	May affect, but is not likely to adversely affect
Invertebrates				
Blackburn's sphinx moth (<i>Manduca blackburni</i>)	Endangered	Occurs in topographically diverse landscapes from sea level to 5,000 feet that contain low to moderate levels of non-native vegetation. Most historical records were from coastal or lowland dry forest habitats in areas receiving less than 50 inches annual rainfall.	Known to occur in the action areas. Larvae were observed on tree tobacco during the field surveys.	May affect, but is not likely to adversely affect
Orangeblack Hawaiian damselfly (<i>Megalagrion xanthomelas</i>)	Endangered	Occurs within the anchialine pool, coastal, lowland dry, and lowland mesic ecosystems.	Known to occur in the action area in anchialine ponds near the La Perouse Lighthouse.	No effect
Yellow-Faced Bee (<i>Hylaeus anthracinus</i>)	Endangered	Occurs within coastal habitats that include rocky shoreline with naupaka and tree heliotrope with either landscaped vegetation, kiawe, or bare rock (USFWS 2018).	May occur in the action area.	May affect, but is not likely to adversely affect

* Federal (USFWS) status definitions:

Endangered: Any species considered by the USFWS as being in danger of extinction throughout all or a significant portion of its range. The ESA specifically prohibits the take of a species listed as endangered. *Take* is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

Threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA specifically prohibits the take (see definition above) of a species listed as threatened.

† Unless otherwise noted, data are from Wagner et al. 1990.

15.1.8.1 PROPOSED INFRASTRUCTURE

The initial phase of the proposed Kanaio Forestry and Wildlife Area Draft Management Plan will be to implement various infrastructure improvements. These improvements will all be located within the KFWA and will facilitate the protection of the coastal area. Infrastructure improvements include the Pu'u Pimoe fence, coastal area fence, one access road, one hunter check-in station, and six game bird water stations. These improvements are intended to promote quality hunting and benefit natural and cultural resources.

15.1.9 Alternative 1 – No Action

Under the No Action Alternative, the condition will remain the same in the short term. Ungulate populations will persist, and illegal cattle grazing will continue to impact the natural and cultural resources. In the long term, the system will further degrade, and ungulate populations will fluctuate with the wet and dry seasons to adjust to food availability.

Under the No Action Alternative, the existing roads will continue to deteriorate and erode to the point where vehicles could not safely access the area.

Under the No Action Alternative, hunting will not be permitted in the area.

15.1.10 Alternative 2 – Proposed Action

Under Alternative 2 - Proposed Action, DOFAW would implement the actions of the Kanaio Forestry and Wildlife Area Draft Management Plan. A 5,522-acre management unit would be created to manage mammalian ungulates and improve the game bird population. Game management would include public hunting on foot using a shotgun, bow, and/or crossbow. Further management would be conducted by DOFAW using a helicopter and firearms to reduce ungulate populations, if needed.

Impacts to the following listed species and critical habitats may occur from game management: listed plants, Hawaiian goose, Hawaiian hoary bat, Blackburn's sphinx moth, Hawaiian monk seal, green sea turtle, Hawaiian monk seal critical habitat, Coastal 06 critical habitat, Lowland Dry 01 critical habitat.

Public hunting in the KFWA would create a direct long-term low impact because hunters would not be confined to existing trails. Hunters could trample listed plants and disturb vegetation used by Hawaiian geese and by Blackburn's sphinx moth for reproduction. Hunters could disrupt nesting Hawaiian geese by damaging eggs and/or causing brood fragmentation. In addition, inexperienced hunters could accidentally shoot Hawaiian geese if they are mistaken for game birds. Furthermore, shotgun noise may flush Hawaiian geese, Hawaiian hoary bats, and Blackburn's sphinx moths from daytime roosting areas and increase their exposure to predation by predators.

Shotgun noise would have an identical effect to that described for helicopter noise for the Hawaiian goose, Hawaiian hoary bat, and Blackburn's sphinx moth. In addition, Hawaiian monk seals and green sea turtles could retreat from the shoreline into the water.

Permanent removal of bovids and equids and permanent reduction of ungulates would benefit natural and cultural resources.

15.1.10.1 ONE NEW ROAD

One new road would be constructed under the Proposed Action using heavy machinery (e.g., bulldozer). This new road would be located in the KFWA and connect the Kanaio Beach Road to the existing 'Ulupalakua Ranch Road, creating easier access to areas within the KFWA and serving as a fire break. In total, approximately 5.8 miles of 12-foot-wide road would be constructed. New road impacts to the KFWA are described below.

Impacts to the following listed species and critical habitat may occur due to new road construction: listed plants, Hawaiian goose, Hawaiian hoary bat, Blackburn's sphinx moth, and Blackburn's sphinx moth critical habitat.

Approximately 1.1 acres of ground would be removed for new road construction under the Proposed Action. Permanent removal of habitat that supports listed flora and fauna would constitute a long-term adverse impact on the plants and animals that occur within the 1.1 acres of road disturbance. Vegetation, including listed flora, would not be able to grow where fencing-related impacts occur, nesting and foraging habitat for the Hawaiian goose would be removed, roost trees for the Hawaiian hoary bat would be removed, and Blackburn's sphinx moth adult and larval food plants would be removed.

A new road would create a fire break and provide fire protection for individuals of listed plants, Hawaiian geese, Hawaiian hoary bats, and Blackburn's sphinx moths. In addition, a fire break would protect the habitats and resources that support these species including those that are within the Pu'u Pimoe enclosure.

In the short term, the human noise and disturbance associated with construction activities would be identical to that described for the KFWA fence construction.

15.1.10.2 GAME BIRD WATER STATIONS

Six game bird watering stations would be constructed under the Proposed Action. Game bird watering station materials would be brought to each site using the existing roads and minimal vegetation would be cleared for each location. Each game bird watering unit would be surrounded by a 8-foot-tall ungulate exclusion fence and encompass a total of 90 square feet.

Impacts to the following listed species and critical habitat may occur due to construction and presence of game bird watering units: listed plants, Hawaiian goose, Hawaiian hoary bat, Blackburn's sphinx moth, Blackburn's sphinx moth critical habitat, and Lowland Dry 01 critical habitat.

Approximately 0.006 acre of ground would be removed under the Proposed Action. The impacts caused by the permanent removal of habitat and the human noise and disturbance associated with construction activities would be identical to the impacts described by the construction of an ungulate exclusion fence for the coastal area, only at a much lesser magnitude because of the very small areas needed for the game bird watering units.

Access to available water would attract and increase the local presence of introduced predators such as mongoose, cat, rats, ants, and predatory wasps. This would cause increased risk of predation on listed plants, Hawaiian geese, Hawaiian hoary bats, and Blackburn's sphinx moths in and around the game bird watering units.

15.1.10.3 NEW FENCES

Fencing for the Proposed Action would take place in two areas. The KFWA fence would separate the coastal area and encompass the coastal area. The Pu'u Pimoe fence would encompass Pu'u Pimoe. In all, approximately 6.9 miles of fence 1.6 feet wide would be constructed, totaling 1.31 acres of habitat removal. In combination, the fences would enclose ungulates into approximately 1,995.5 acres, where the ungulates would then be removed by DOFAW. Ultimately, the fence would exclude ungulates from occurring in these areas, maintaining an ungulate-free zone.

Under the Proposed Action, the 1,939-acre coastal area would be fenced to separate the coastal area from the KFWA. Ungulates would be permanently removed from the coastal area by using a combination of methods including public hunting and a helicopter to shoot and/or herd the ungulates out of the area. Beneficial impacts of ungulate removal would be identical to that described for the coastal area ungulate exclusion fence.

The impacts caused by helicopter noise would be identical to impacts described in the section discussing game management in the KFWA.

The fence installation around Pu'u Pimoe would create an ungulate exclusion fence approximately 1.1 miles long and 1.6 feet wide encompassing 56.5 acres. A permanent fence would be constructed within the KFWA and located at the base of Pu'u Pimoe within the KFWA. Fencing materials would be flown in by a helicopter and existing roads and trails would be used to access the area on the ground.

Approximately 0.21 acre of ground would be removed under the Proposed Action. Permanent removal of habitat that supports listed flora and fauna would constitute a long-term adverse impact on the plants and animals that occur within the 0.21-acre fenced area. Vegetation, including listed plants, would not be able to grow where fencing-related impacts occur, once present nesting and foraging habitat for the Hawaiian goose would be removed, roost trees for the Hawaiian hoary bat would be removed, and Blackburn's sphinx moth adult and larval food plants would be removed.

15.1.10.4 HUNTER CHECK-IN STATION

One hunter check-in station located at the intersection of Pi'ilani Highway and the 'Ulupalakua Ranch Road would be constructed, providing a centralized location for data collection and would provide information on designated hunting areas and natural and cultural resources in the area. Data collected will be analyzed to determine management effectiveness, harvest success and be instrumental in determining future hunting opportunities and management decisions.

Impacts to the following listed species may occur due to the construction and presence of a hunter check station: Hawaiian goose, Hawaiian hoary bat, and Blackburn's sphinx moth.

Approximately 50 square feet of ground would be removed under the Proposed Action. The impacts cause by the permanent removal of habitat and the human noise and disturbance associated with construction activities would be identical to the impacts described for the construction of the ungulate exclusion fence for the coastal area, only at a much lesser magnitude because of the very small areas needed for the game bird watering units.

15.2 Archaeological, Historic, and Cultural Resources

15.2.1 *Alternative 1 – No Action Alternative*

In recent years, the lands that comprise the KFWA have suffered damaging impacts from illegal off-road driving and other human-caused disturbances, as well as unauthorized cattle grazing, and overgrazing by uncontrolled herds of feral goats, deer, and other ungulates. These combined impacts have resulted in increased soil erosion, reduction of native vegetation, and damage to cultural sites. Many of the KFWA's cultural sites have been harmed by trampling and erosion caused by the passage of cattle, goats, and other ungulates. Human activities, such as the mechanized clearing of vegetation undertaken during the ranching period to increase available pasturage and more recent illegal dirt bike and off-road driving, have also directly impacted archaeological sites. If no action is taken, these destructive activities will continue and the condition of the cultural sites within the KFWA will deteriorate further.

15.2.2 *Alternative 2 – Proposed Action*

DOFAW's stewardship of the KFWA is intended to reduce the active threats to cultural resources through a program of protection and long-term management. This program involves preventing unauthorized cattle grazing, and culling and managing ungulate herds through expanded opportunities for regulated public hunting. It will also involve enforcing regulations to prevent off-road driving and educating those individuals who enter the preserve as to the significance and fragility of the area's cultural sites. The establishment of the Kanaio Forestry and Wildlife Area will help to preserve and protect the physical remains of the area's rich cultural history.

With the establishment of the KFWA, DOCARE will have a greater presence in the area and will enforce management rules to deter illegal off-road driving and other activities detrimental to the natural and cultural resources of the KFWA.

DOFAW intends to undertake limited infrastructure improvements within the KFWA to assist in the protection of the area's biological and cultural resources. While all of the proposed infrastructure improvements will be located within the mauka portion of the KFWA, they will also serve to protect the makai portion of the KFWA. These infrastructure improvements include the maintenance of existing access roads, the construction of one additional internal road, the establishment of six water stations for game management, and the installation of two enclosure fences to protect biological and cultural resources.

15.2.2.1 **AREA OF POTENTIAL EFFECTS**

For federal undertakings subject to NHPA Section 106 historic preservation review, the area of potential effects (APE) represents the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The impacts of such alterations are considered in the context of the property's integrity, the primary question being, does the project have the potential to alter one of the seven aspects of integrity that make the historic property eligible for nomination to the National Register: its integrity of location, design, setting, materials, workmanship, feeling, or association (National Register of Historic Places 1991).

The Advisory Council on Historic Preservation, following a March 2019 District of Columbia circuit court opinion (USCA Case #18-5179, Document #1775491:24-25), has clarified that direct effects to historic properties are effects resulting from an undertaking that occur at the same time and place with no intervening cause, regardless of their specific type (e.g., whether the effect is visual, physical, auditory, etc.). Indirect effects to historic properties are those effects caused by an undertaking that occur later in

time or are farther removed in distance but are still reasonably foreseeable. Thus, direct effects to historic properties are considered to be the immediate impacts of a project in terms of time and space, whereas indirect effects are considered to be secondary, long term, or more distant impacts resulting from the undertaking.

For the establishment of the KFWA, the direct APE can be considered to be those areas where ground disturbance associated with infrastructure improvements are proposed. Such ground disturbance has the potential to have a direct impact on historic properties. The creation of the KFWA and the stewardship activities proposed by DOFAW, such as the regulated hunting of ungulates, have the potential to have later/long term effect upon historic properties. The indirect APE of the project can therefore be considered to be the entire KFWA (Figure 6).

15.2.2.2 DIRECT APE

The direct APE for this project encompasses existing stretches of the Kanaio Beach Road and the 'Ulupalakua Ranch Road, the new Papaka Kai to Kalo'i Road, six watering tank locations, and the two fence line corridors.

To assist DOFAW in fulfilling its obligations under NHPA Section 106 by identifying historic properties within the direct APE of the proposed infrastructure improvements associated with the establishment of the KFWA, an archaeological inventory survey was undertaken. The survey served to identify and document all historic properties located within the immediate vicinity of the infrastructure improvements so that they could be avoided during construction and maintenance activities.

The archaeological inventory survey (Reeve et al. 2021) identified a total of 26 archaeological sites located within the direct project APE. Nineteen of these historic resources were determined to be traditional in age, while 4 were established as likely dating from the post-Contact period. An additional 3 sites were of uncertain age.

Of the traditional sites, 7 appear to have been associated with agricultural activities within the upper slopes of the KFWA where soil and rainfall were suitable to support the cultivation of dryland crops such as 'uala and kalo. Five of the traditional resources appear to represent sites of temporary habitation, while one may represent the foundation of a longer term or seasonal residence. Five of the pre-Contact sites are trails or trail complexes. All of these trail segments were recognized on stretches of open 'a'ā lava where footpaths are more easily visible than in areas of soil and vegetation. The majority of trails are *ala pi'i*, mauka to makai paths that led from coastal settlements up into the inland agricultural zones. At least one trail appears to have continued in use into the early post-Contact period as evidenced by thrown horseshoes.

Of the post-Contact sites identified, 3 appear to be related to animal husbandry and to be associated with ranching activities in the area, while one is an ahupua'a boundary wall.

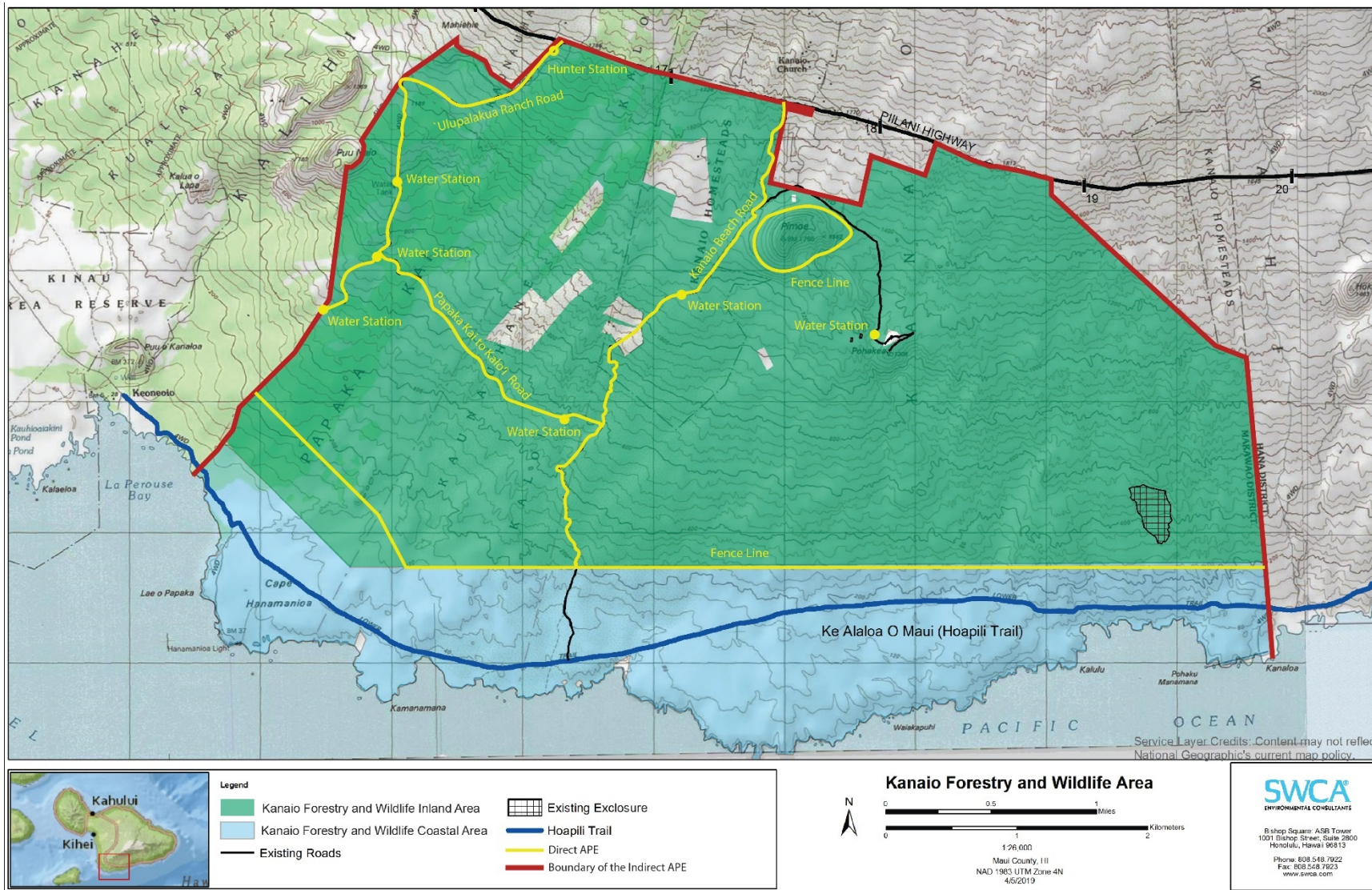


Figure 6. Relative locations of the components of the direct APE (infrastructure improvements) and the boundary of the indirect APE (the Kanaio Forestry and Wildlife Area).

15.2.2.2.1 Existing Roads

At present there are two existing access roads leading from the Pi'ilani Highway down into the KFWA. The first of these roads is the main Kanaio Beach Road whose entry off of Pi'ilani Highway is located near the center of the KFWA. The Kanaio Beach Road extends from Pi'ilani Highway down to the coast. A shorter branch road currently leads past Pu'u Pimoe almost to Pu'u Pohakea (the Pohakea Road). The entire Kanaio Beach Road and the Pohakea Road are unpaved and require a 4-wheel drive vehicle to access them. The Kanaio Beach Road is currently open, allowing unrestricted access from the highway down to the coast.

The second access road is the 'Ulupalakua Ranch Road that enters from Pi'ilani Highway at the northwestern corner of the KFWA. This road extends down to approximately 520 feet in elevation before bending west and continuing outside the boundary of the KFWA. The upper third of this road is already paved. The lower section of the 'Ulupalakua Ranch Road is unpaved and requires a 4-wheel drive vehicle to traverse it. The 'Ulupalakua road is gated and public access is strictly regulated by the ranch. Should the ranch parcel be included into the KFWA the gate would remain and access would be regulated by DOFAW and access would only be granted to a of hunters through a reservation system.

DOFAW does not intend to improve these existing roads to any major degree. Instead, it will perform minor maintenance and install occasional pull offs/turn arounds on stretches of road located within the Forestry and Wildlife Management Area. These roads will allow DOFAW crews to access and monitor the KFWA.

The existing roads will not be improved by widening or grading. However, on steep sections where heavy erosion occurs, DOFAW will install turnout berms to divert water off the road. These sections will be determined during the wet season and installed during the dry season. In areas heavily impacted by illegal off roading and other activities DOFAW plans to block offroad access. It also plans to block off the existing Pohakea Road so as to prevent further erosion around Pu'u Pimoe and the potential damage to known cultural sites located in this area, which include burials.

Kanaio Beach Road

As construction activities along the existing Kanaio Beach Road will be limited to the existing roadbed, with the exception of the installation of turnout berms for flood control and occasional pull offs/turn arounds, it is anticipated that the planned improvements to the road will have no impacts on identified historic properties. All of these archaeological sites are located some distance from the road, and in many cases are situated above the road or on the opposite side of a ridge from the road. Turnout berms and pull offs/turn arounds will be located in areas known to be free of historic properties.

'Ulupalakua Ranch Road

As with the Kanaio Beach Road, road improvement activities along the route of the existing 'Ulupalakua Ranch Road will be limited to the existing roadbed, with the exception of the installation of turnout berms for flood control and occasional pull offs/turn arounds. These road improvements will have no impacts on the identified historic properties. All of the archaeological sites recorded along the road are located some distance from it, and in many cases are situated above the road or on the opposite side of a ridge from the road. Turnout berms and pull offs/turn arounds will be located in areas known to be free of historic properties.

15.2.2.2.2 Proposed New Road

DOFAW proposes to construct one additional section of road within the KFWA Forestry and Wildlife Management Area. This new contour road will serve to connect the southern end of the 'Ulupalakua Ranch Road (within the KFWA) with the center of the Kanaio Beach Road. The road will improve hunter access to the area and provide a fire break to support wildfire suppression efforts. The road is intended to be accessed by four-wheel drive vehicles only and is not intended for use for other recreational use. It will be an unpaved road no more than 12 ft (3.5 m) in width and will be referred to as the Papa Kai-Kaloi Road.

To assist in this effort, a preliminary archaeological survey was undertaken along the route of the proposed road to identify and document any archaeological and cultural features situated within or near the proposed road corridor. With this information in hand, the road was realigned to avoid as much as possible impacting these identified features. Road construction will be limited to one dozer and the road footprint will not exceed 12ft (3.5m). To minimize surface impacts, the road depth will not exceed one foot and DOFAW machine operators will be informed of cultural resources in the area.

Papaka Kai to Kalo'i Road

At its western end, the proposed Papaka Kai to Kalo'i Road will follow the route of an existing jeep road so as to avoid impacts to the natural terrain. At the eastern end of this existing road, the route of the proposed road will be run through a gap in a ranch era wall. East of this point, the road has been routed so as to avoid impacting identified archaeological sites. The only potential impacts from the proposed road will be to a trail complex. As these trails run mauka to makai, there is no way to avoid crossing them. DOFAW intends to route the proposed road so as to have as little impact as possible on these trails. It also intends to have those trail segments that will be impacted by the road be documented in detail through photographs, plan view maps, and written descriptions.

To ensure that construction of the Papaka Kai to Kalo'i Road will minimize adverse impacts to identified historic properties, DOFAW will schedule a qualified archaeologist, if available to monitor ground disturbing activities along the full length of the road. The role of the archaeological monitor will be to point out to the construction crew the locations of known archaeological sites, visually inspect the road corridor for archaeological features that may have been missed during the AIS survey and route the road around these is needed, document the sections of the trail complex that will be crossed by the road, and observe all ground disturbing activities.

15.2.2.2.3 Water Stations

A total of six water tanks are proposed to be constructed within the KFWA Forestry and Wildlife Management Area. The tanks will serve as water stations to support game species such as Gray Francolin, Black Francolin, Ring-necked Pheasant. All tanks will be located immediately adjacent to either existing or planned access roads: one along the Pohakea Road just north of Pu'u Pohakea (Water Tank 1), one along the Kanaio Beach Road (Water Tank 2), one along the Papaka Kai-Kaloi Road near its junction with the Kanaio Beach Road (Water Tank 3), one along the 'Ulupalakua Ranch Road (Water Tank 4), one at the junction of the 'Ulupalakua Ranch Road and the Papaka Kai-Kaloi Road (Water Tank 5), and one at the point where the 'Ulupalakua Ranch Road crosses the western boundary of the KFWA (Water Tank 6).

The areas to be occupied by these water stations have been surveyed and found to be free of surface cultural features. As these structures will be set atop the ground surface, they will not adversely impact any potential buried cultural deposits.

15.2.2.2.4 Ungulate Exclosure Fences

DOFAW proposes to protect both native species and traditional cultural sites by erecting two ungulate exclusion fences. The first, and longest of these fence lines will extend along the boundary separating the KFWA Forestry and Wildlife Management Area from the KFWA Coastal Resources Protection Zone. This 6-foot high fence is intended to restrict ungulate access to the coast and therefore help protect the Hoapili Trail and the numerous shoreline cultural sites from continued degradation due to ungulate impacts.

A second ungulate exclusion fence is planned to encircle Pu'u Pimoe. This fence line will serve to protect critical native habitat, listed native plant species and cultural resources on the pu'u (cinder cone). At present, Puu Pimoe is heavily impacted by illegal off roading and the proposed fence will exclude both ungulates and illegal off-road activities.

All of the materials used in fence construction will be flown in and dropped at designated staging areas so as to minimize the potential impacts of fence construction. The alignment of both fences was altered when necessary to avoid impacting historic properties identified by the archaeological inventory survey.

Pu'u Pimoe Fence Line

Although no historic properties were identified within the corridor of the proposed Pu'u Pimoe Fence Line, DOFAW proposes to have a qualified archaeologist, if available, present on site during the erection of the fence. The role of the archaeological monitor will be to visually inspect the fence line corridor for archaeological features that may have been missed during the AIS survey and route the road around these is needed and observe all ground disturbing activities.

Makai Fence Line

In order to avoid impacting the small number of historic properties located along the Makai Fence Line corridor, DOFAW proposes the following measures.

- 1.) The ungulate fence be run up next to, but not impact, the post-Contact boundary wall located along the western edge of the KFWA.
- 2.) At those points where the fence line corridor crosses an identified structural site (a modified outcrop, modified overhang, or C-shaped wall) the alignment of the fence be adjusted slightly to pass around the archaeological feature. The current survey examined potential alternative routes to make certain that they are free of sites.
- 3.) Fence construction in the area where a trail crosses the fence line will be monitored and gates will be placed in the fence at each point where the fence line crosses a trail so as to allow continued access along the trail. This gate will span the trail so that the trail bed is not directly impacted by fence construction.

As with the Pu'u Pimoe Fence Line, DOFAW proposes to have a qualified archaeologist, if available, present on site during the erection of the Makai fence. The role of the archaeological monitor will be to visually inspect the fence line corridor for archaeological features that may have been missed during the AIS survey, indicate to the construction crew where detours around identified archaeological sites are needed, guide the placement of those detours, and observe all ground disturbing activities.

15.2.2.3 INDIRECT APE

The activities associated with the creation of the KFWA have the potential to indirectly affect all of the historic properties present within its boundaries. The indirect APE for this project can therefore be considered to be the entire KFWA. While the majority of these effects will be positive (the reduction of destructive ungulate populations, the restriction of illegal off-road vehicle traffic, etc.), the increased presence of hunters on the landscape raises the potential for inadvertent damage to historic properties (e.g. hunters climbing over and tumbling stacked stone walls). Mitigation measures to address these potential impacts include a DOFAW sponsored hunter education program informing hunters as to the presence and importance of cultural sites within the KFWA and instructing them on how to avoid disturbance to cultural sites. This will be combined with community outreach to inform the public about the rich cultural history of the KFWA.

Given the large number of historic properties present within the KFWA and the relatively intact nature of the area's archaeological landscape, the Hawai'i State Historic Preservation Division (SHPD) has recommended that the entire KFWA be designated as an archaeological district (as per National Register Bulletin 36, Guidelines for Evaluating and Registering Archaeological Properties).

The National Park Service National Register Bulletin 36 defines an archaeological district in the following way: "A district is a grouping of sites, buildings, structures, or objects that are linked historically by function, theme, or physical development or aesthetically by plan. The properties within a district are usually contiguous" (Little et al. 2000:43).

To support the SHPD's request, a descriptive list has been prepared of all known historic properties located within the boundaries of the KFWA and the locations of these historic properties have been plotted on a map of the KFWA. This information will assist DOFAW in its continuing stewardship effort to protect and preserve the cultural resources of the KFWA. An assessment has also been made as to the integrity and significance of the potential Kanaio Historic District, as well as its eligibility for nomination to the National Register of Historic Places.

15.3 Hunter Check in Station

Currently there is unmanaged and unregulated hunting of ungulates in the KFWA that poses potential impacts to the area's natural and cultural resources but also compromises public safety. The implementation of a regulated hunting program that ensures public safety and optimal hunting opportunities is one of the main objectives in the establishment of the KFWA. The KFWA will provide quality hunting opportunities for licensed hunters to pursue both game birds and game mammals.

A hunter check in station will be installed at the west access point regulated by a gate and access will be regulated by DOFAW. Hunters who are granted access by DOFAW must check in after entering the gate. The east access point will not have a check in. Hunting methods for the area will include shotgun for game bird species and archery for game mammals.

Signage at the west entrance point off of Piilani Highway will provide information on designated hunting areas and natural and cultural resources in the area. Additional information will be available in the check in station with the hunter sign in sheet.

Regulated hunting will provide an opportunity for DOFAW to educate individuals entering the KFWA concerning the rich natural and cultural resources present within the area. Information will be provided to hunters explaining how to recognize and avoid impacting cultural sites.

15.4 Cumulative Impacts

This section describes the analysis of potential cumulative impacts associated with implementation of the Kanaio Forestry and Wildlife Area Draft Management Plan.

15.4.1 *Projects or Activities Considered in the Cumulative Impacts Analysis*

Table 9 lists specific projects and activities considered in the cumulative impacts analysis and indicates for which resources impacts would overlap in space and time with impacts of the alternatives. The ongoing impacts of wildfires, feral ungulates, and invasive species, and climate change were also considered in the analysis.

This section considers ongoing and reasonably foreseeable future projects and activities, authorized or under review, that are considered to contribute to the cumulative impacts not only on endangered, threatened, and other rare species, but also on society and the human environment in the KFWA and the Island of Maui. This discussion is limited to those ongoing and reasonably foreseeable future actions that involve impacts on a resource that overlaps with the impacts from the alternatives on that same resource. The following cumulative impact analyses evaluate the potential for incremental impacts from the alternatives combined with only ongoing and reasonably foreseeable future projects and activities. A complete list of planned and proposed actions by name is detailed below in Table 9.

Table 9. Projects and Activities Considered for Cumulative Impacts

Location	Project Name/ Activity	Project Sponsor	Year Planned	Project Description	Ongoing or Reasonably Foreseeable	Resource CIAAs Overlapped ¹
Ulupalakua Ranch	Ranching operations	Ulupalakua Ranch	Ongoing	Road, fence, and waterline maintenance, cattle herding; approximately 72 water tanks are located throughout the ranch.	Ongoing	Flora and Fauna
Ulupalakua Ranch	Auwahi Forest Restoration Project	Art Medeiros (USGS), various federal, state and local agencies, and community groups	Ongoing	A 188-acre enclosure located at approximately 1,200 feet elevation in the Auwahi parcel. Within this enclosure, ungulates were eliminated, kikuyu grass mats were killed, and a program was initiated to augment numerous native plant species by broadcasting seeds and outplanting nursery-raised plants. Additional enclosures are planned for fencing and other restoration activities.	Ongoing	Flora and Fauna
Leeward Slope of Haleakala	Kahikinui Forest Project	DHHL, DOFAW, Ka Ohana o Kahikinui, and the Leeward Haleakala Watershed Restoration Partnership	TBD	Collaborative land management and forest restoration efforts including ungulate-proof fencing, ungulate/predator removal, and native plant restoration on up to 8,000 acres. Parcels are owned by DHHL and DOFAW and located along the southern border of Haleakala National Park.	Reasonably Foreseeable	Flora and Fauna

Location	Project Name/ Activity	Project Sponsor	Year Planned	Project Description	Ongoing or Reasonably Foreseeable	Resource CIAAs Overlapped ¹
Haleakala National Park	Feral Animal Management	National Park Service	Ongoing	The park is conducting ongoing feral animal removal efforts which include fencing, predator control, and monitoring.	Ongoing	Flora and Fauna
Haleakala Ranch	Ongoing ranching and resource management activities	DLNR and Haleakala Ranch	2011–2021	Koa planting projects and invasive species management of species that threaten the viability of the grazing operations.	Reasonably Foreseeable	Flora and Fauna
Ulupalakua Ranch	Existing roads	Numerous	Unknown	Ranch roads and gate access to the KFWA. Partnership with DOFAW to create the KFWA.	Past (but could have ongoing impacts)	Flora and Fauna
Ulupalakua Ranch	Hunting Game Birds, Axis deer and pigs.	Numerous	Ongoing	Ranch employees and stakeholders recreational hunting.	Ongoing.	Fauna

¹ Indicates that a past, present, or foreseeable project/activity impact overlaps in space and time with the same type of direct or indirect impact of the proposed actions of the KFWA.

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17 LIST OF AGENCIES AND ORGANIZATION CONTACTED

This list includes agencies and organizations contacted during preparation of the management plan, and EA, as well as agencies, organizations, and persons on the State EISPN distribution list.

17.1 Federal Agencies

- U.S. Fish and Wildlife Service (Service)

17.2 State Agencies

- Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW)

- Department of Land and Natural Resources (DLNR), Historic Preservation Division (SHPD)

DRAFT

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APPENDIX A

LIST OF PLANTS OBSERVED IN KFWA

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status
DICOTS			
Apocynaceae	<i>Rauvolfia sandwicensis</i> A.DC.	hao	E
Araliaceae	<i>Polyscias sandwicensis</i> (A.Gray) Lowry & G.M.Plunkett	'ohe, 'ohe kukulu'ae'o, 'ohe makai, 'ohe'ohe (Ni'ihau), 'oheokai	E
Asteraceae	<i>Melanthera lavarum</i> (Gaudich.) W.L.Wagner & H.Rob.	nehe	E
Capparaceae	<i>Capparis sandwichiana</i> DC.	maiapilo, pilo, pua pilo	E
Convolvulaceae	<i>Ipomoea indica</i> (Burm.) Merr.	koali 'awa, koali 'awahia, koali lā'au (Ni'ihau), koali pehu	I
Cucurbitaceae	<i>Sicyos pachycarpus</i> Hook. & Arn.	kūpala, 'ānunu	E
Ebenaceae	<i>Diospyros sandwicensis</i> (A.DC.) Fosberg	lama, ēlama	E
Fabaceae	<i>Erythrina sandwicensis</i> O.Deg.	wiliwili	E
Fabaceae	<i>Sophora chrysophylla</i> (Salisb.) Seem.	māmāne, mamani	E
Goodeniaceae	<i>Scaevola taccada</i> (Gaertn.) Roxb.	naupaka kahakai, huahekili, naupaka kai, auaka (Ni'ihau)	I
Lamiaceae	<i>Plectranthus parviflorus</i> Willd.	'ala'ala wai nui, 'ala'ala wai nui pua kī, 'ala'ala wai nui wahine, spurflower	I
Malvaceae	<i>Sida fallax</i> Walp.	'ilima	I
Malvaceae	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	milo, portia tree	I
Menispermaceae	<i>Cocculus orbiculatus</i> (L.) DC.	huehue, hue, hue'ie, 'inalua	I
Myoporaceae	<i>Myoporum sandwicense</i> A.Gray	naio, naeo, naieo, bastard sandalwood	I
Piperaceae	<i>Peperomia blanda</i> var. <i>floribunda</i> (Miq.) H.Huber	'ala'ala wai nui	I
Rubiaceae	<i>Psydrax odorata</i> (G.Forst.) A.C.Sm. & S.P.Darwin	alaha'e, 'ōhe'e, walahe'e	I
Sapindaceae	<i>Dodonaea viscosa</i> Jacq.	'a'ali'i, 'a'ali'i kū makani, 'a'ali'i kū ma kua, kūmakani	I
Sapotaceae	<i>Sideroxylon polynesianum</i> (Hillebr.) Smedmark & Anderb.	keahi	I
Solanaceae	<i>Nothocestrum latifolium</i> A.Gray	'aiea, hālena	E
Sterculiaceae	<i>Waltheria indica</i> L.	'uhaloa, 'ala'ala pū loa, hala 'uhaloa, hi'aloa, kanakaloa	I?
Thymelaeaceae	<i>Wikstroemia monticola</i> Skottsb.	'ākia, kauhi	E
Zygophyllaceae	<i>Tribulus cistoides</i> L.	nohu, nohunohu	I
MONOCOTS			
Pandanaceae	<i>Pandanus tectorius</i> Parkinson ex Z	hala, pū hala, screwpine	I?

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status
PTERIDOPHYTES			
Pteridaceae	<i>Doryopteris decipiens</i> (Hook.) J.Sm.	kumuniu, 'iwa'iwa, manawahua	E
Pteridaceae	<i>Pellaea ternifolia</i> (Cav.) Link	kalamoho lau li'i, laukahi, kalamoho	I

Note: P-Polynesian introduced, P?- probably Polynesian introduced but possibly introduced in historic times, I- indigenous, I?- probably indigenous but possibly naturalized, E- endemic, E?- probably endemic but possibly naturalized (see pg. 126-127 in Wagner et al. 1999), X- non-native, X*- non-native cultivated

DRAFT

APPENDIX B

KFWA DRAFT MANAGEMENT PLAN



Kanaio Forestry and Wildlife Area Management Plan

MAY 2020

PREPARED FOR

**State of Hawaii Department of Land
and Natural Resources – Division of
Forestry and Wildlife**

PREPARED BY

SWCA Environmental Consultants

KANAIO FORESTRY AND WILDLIFE AREA MANAGEMENT PLAN

Prepared for

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SWCA Project No. 033606.00

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EXECUTIVE SUMMARY

The Division of Forestry and Wildlife (DOFAW) plans to establish the Kanaio Forestry and Wildlife Area (KFWA) as a Forest Reserve and mixed-use public hunting area. The area will provide for protection of natural and cultural resources as well as public access and quality hunting opportunities and recreational use for the growing population on the island of Maui.

The Kanaio region is one of the last remaining stretches of lowland dry forest left in the State of Hawai'i. This area contains six known endangered species; several species of concern (rare, threatened, and endangered species, or in marked decline on Maui, such as taxa included in the Plant Extinction Prevention Program); and a multitude of culturally important resources, including burial grounds and cultural practice areas such as heiau and caves.

Since the 1800s, the natural and cultural resources in the area have been impacted by ranching (cattle, horses) and feral ungulates (primarily goats), which subsequently introduced invasive species. The area was also used by the Hawaii Army National Guard as a training area and small munitions range up to 2003. Today, illegal motorcycle and off-road activities are causing further damage to cultural sites and native vegetation. The off-road impacts are magnified when heavy storms pass through and wash away exposed topsoil, resulting in significant erosion on the existing roads.

The purpose of this plan is to protect these resources from further damage by humans and ungulates. The KFWA will expand opportunities for public hunting; aid in directing human traffic in the area; and curtail damage from activities such as illegal off-road vehicles, unauthorized cattle grazing, and other human-caused disturbances, degradation, and destruction (including a legacy of impacts as a result of military training). The management plan actions for the establishment of the KFWA include constructing firebreaks, roads, signage, fencing, and other infrastructure.

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1 INTRODUCTION

The project is located on unencumbered State of Hawai'i lands and is partially supported by federal funds, which require management actions to enhance and sustain the condition of natural resources. The Hawai'i Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), is proposing to establish a Forestry and Wildlife Area on State-owned lands in southwest Maui. The approximately 7460.66-acre Kanaio Forestry and Wildlife Area (KFWA) will be located within the ahupua'a (traditional land division) of Kanaio, Kalo'i, Kaunuahane, and Papaka Kai in the moku (district) of Honua'ula on the island of Maui [TMK: (2) 2-1-002:001 and 2-1-004:006] (Figure 1). The proposed KFWA encompasses one of the last remaining stretches of lowland dry forest left in the State of Hawai'i. Only ten percent of lowland dry forests remain in the state (Bruegmann 1996). This area contains several threatened and endangered species and a multitude of traditional Hawaiian cultural resources.

To ensure the protection of these biological and cultural resources from further damage by humans and ungulates (including feral ungulates, primarily goats), DOFAW proposes an integrated approach to resource management. This approach will include; curtailing of damaging activities such as illegal off-road driving, unauthorized cattle grazing, and other human-caused disturbances; and expanded opportunities for public hunting to reduce ungulate herds.

To facilitate this approach, DOFAW intends to undertake limited, minor improvements within the KFWA. These improvements include the maintenance of existing access roads, the construction of one additional internal road, the establishment of six water stations for game bird management, and the installation of an enclosure fence on Pu'u Pimoe and a makai boundary fence to protect biological and cultural resources along the coastline (Figure 1).

2 CURRENT CONDITION

The proposed KFWA is located on the southwestern flank of the shield dome volcano of Haleakalā. It is bordered to the north by the Pi'ilani Highway, to the west by 'Ulupalakua Ranch lands, to the east by the Auwahi wind farm, and extends to the south down to the shoreline. The KFWA ranges from sea level to approximately 1,600 feet (500 meters [m]) in elevation. The KFWA is located within the traditional moku of Honua'ula, and straddles the ahupua'a of Kanaio, Kalo'i, Kaunuahane, and Papaka Kai.

The KFWA is divided into two sections. The 5,522-acre mauka (inland) portion of the KFWA extends from roughly 200 feet (12 m) in elevation up to the Pi'ilani Highway (approximately 1,800 feet in elevation) and is unencumbered state land. The 1,938.53-acre makai (seaward) section of the KFWA, which extends from roughly 200 feet down to the coast, is designated as a separate Wildlife Coastal Resource Protection Zone. This Wildlife Coastal Resource Protection Zone includes the Hoapili Trail (also known as the King's Trail), a portion of the traditional ala loa (long trail) that encircles the island of Maui.

The mean annual rainfall for the survey area is approximately 25 inches (635 millimeters [mm]) on the leeward side of Haleakala and approximately 20 inches (508 mm) along the coastline (Giambeluca et al. 1986). The most current rainfall data, recorded at the Auwahi rain gauge located upslope and approximately 2.5 miles northeast of the project area, show an annual rainfall of 31 inches (788 mm).

Rainfall is typically highest in January and lowest in July (Giambelluca et al. 2013). The National Oceanic and Atmospheric Administration (NOAA) weather recording station at Kahului International Airport (OGG) recorded above-average rainfall for 2017 through the end of April (NOAA 2017).

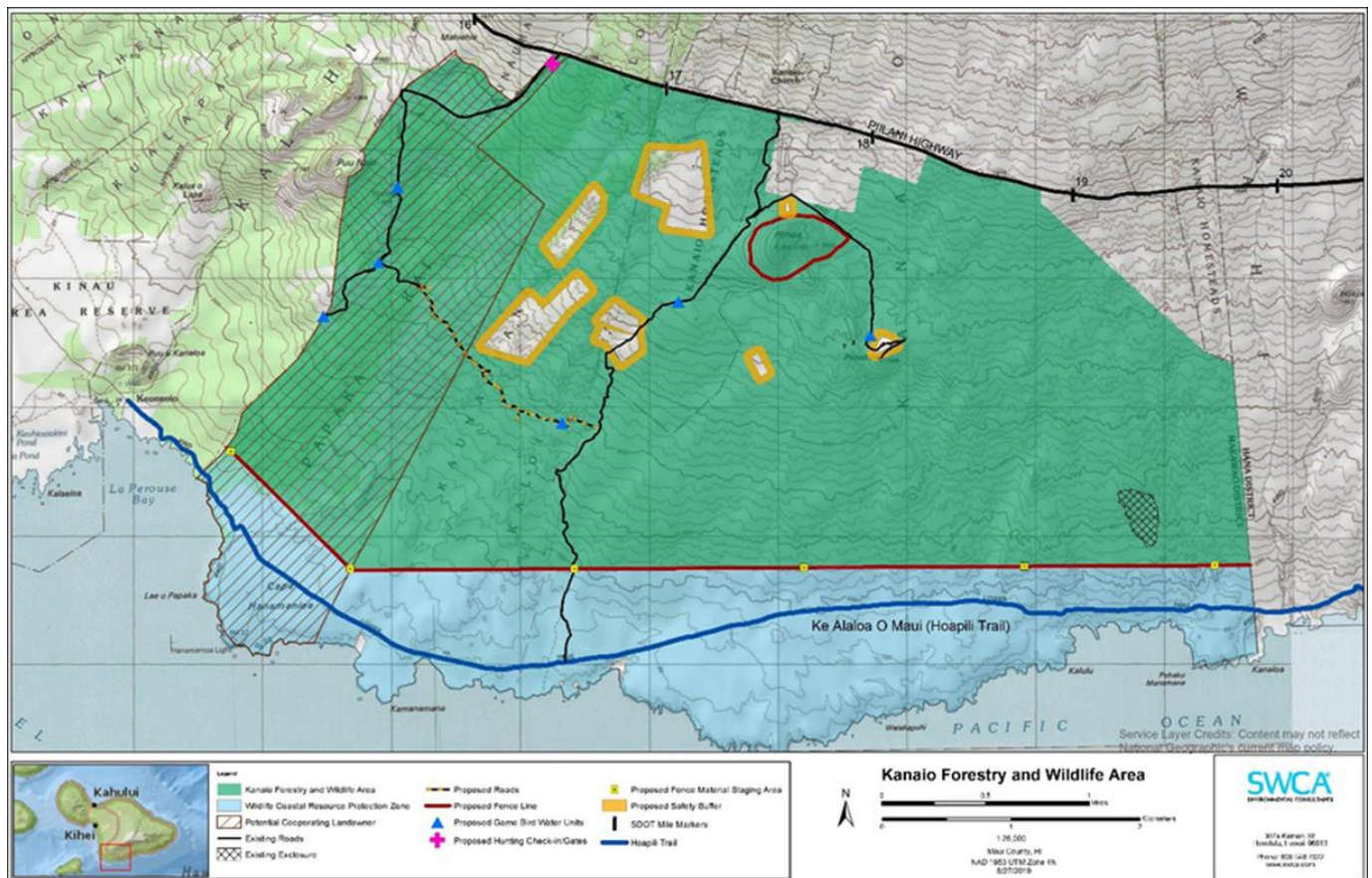


Figure 1. Location of proposed infrastructure improvements to the Kanaio Forestry and Wildlife Area

2.1 SOILS

The KFWA consists of a substrate categorized as rock land–rough mountainous land association, which is primarily a’a, stony land, or cinder land. The area below Pu’u Pimoe and Pu’u Pohakea is primarily covered by a’a which originated from Pu’u Pimoe and Pu’u Pohakea. The coastal area which supports vegetation has areas of Pahoehe lava (Figure 2). The Soil Conservation Service (now called the Resource Conservation Service) classifies some soils in the project area as the Oanapuka series, described as well-drained, very stony soils developed in volcanic ash and material derived from cinders. The rest of the project area (about 90 percent) is classified as Lava Flows of recent geologic origin, and was described by the Soil Conservation Service as “a mass of clinkery, hard, sharp pieces of lava on rough to undulating topography.”

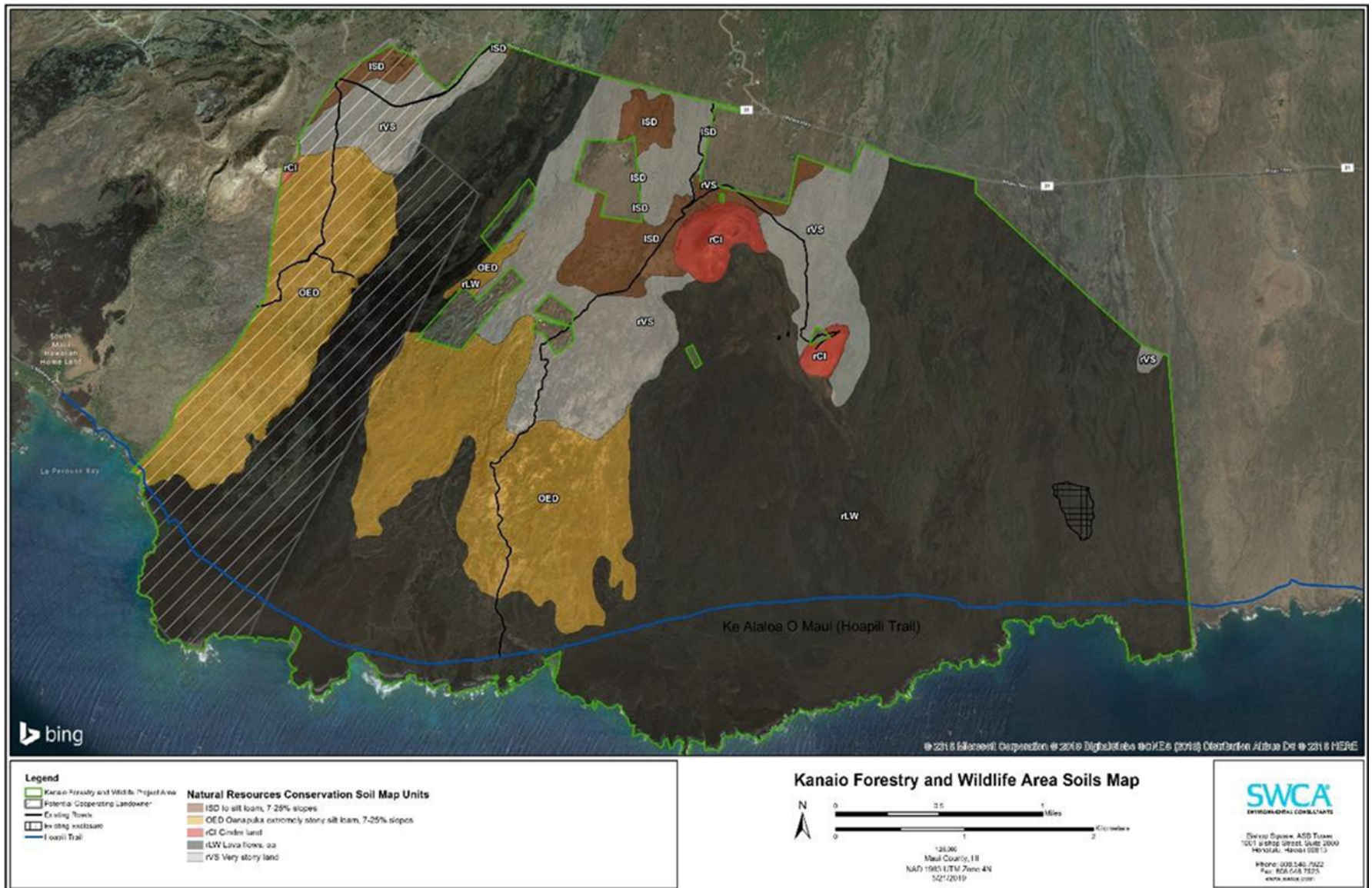


Figure 2. Soils of the Kanaio Forestry and Wildlife Area

2.2 FLORA

One native special-status plant species was observed in the project area during the field surveys: ‘aiea. An additional six threatened or endangered species have been recorded in the project area but were not seen during the field surveys: ‘ohai (*Sesbania tomentosa*), *Vigna o-wahuensis*, *Melanthera kamolensis*, ‘awikiwiki (*Canavalia pubescens*), *Bonamia menziesii*, and ‘ihi (*Portulaca villosa*). In all, 26 native plant species were recorded during the field surveys. Appendix A provides a list of all native plant species observed by SWCA biologists in the project area. The vegetation in the project area consists of seven vegetation types – Invaded Pasturelands, Pasturelands, Koa Haole Forest, ‘A‘ali‘i Shrubland, Dryland Forest, Native Coastal Strand, and Nonnative Coastal – and Special Status Flora.

2.2.1 Invaded Pasturelands 18-25%

This vegetation type comprises tracts of land occasionally (or formerly) grazed by domesticated livestock. These lands were once dominated by palatable grasses, but over time have become increasingly dominated by unpalatable herbaceous species, trees, and shrubs (Figure 3). Common woody canopy species in these areas include koa haole (*Leucaena leucocephala*) and kiawe (*Prosopis pallida*). These areas are dominated by a midcanopy of sourgrass (*Digitaria insularis*) covered by *Neonotonia wightii*. Scattered individuals of a native ‘ākia (*Wikstroemia monticola*) occur in this vegetation type. Other, more invaded areas in this vegetation type are dominated by Jamaica vervain (*Stachytarpheta jamaicensis*), tree tobacco, and parthenium (*Parthenium hysterophorus*). Common herbaceous species include lantana (*Lantana camara*), *Kalanchoe x houghtonii*, spiny amaranth (*Amaranthus spinosus*), four-o’clock (*Mirabilis jalapa*), balloon plant (*Asclepias physocarpa*), and indigo (*Indigofera suffruticosa*).



Figure 3. Invaded pasturelands in the project area.

2.2.2 Pasturelands 2-5%

This vegetation type comprises areas grazed by domesticated livestock, and the vegetation consists mainly of palatable nonnative grasses interspersed with other herbaceous plants. Woody species are generally uncommon to rare in these areas (Figure 4). Common species in this vegetation type include the nonnative species Henry's crabgrass (*Digitaria ciliaris*), lantana, parthenium, tree tobacco, and kiawe.

Neonotonia wightii, a perennial legume, is occasionally seen vining over other species in the area. The most common grass species in pasturelands is pitted beardgrass (*Bothriochloa pertusa*). One native species, 'uhaloa (*Waltheria indica*), is seen occasionally in the area.



Figure 4. Pasturelands in the project area.

2.2.3 Koa Haole Forest 5%

This vegetation type is characterized by dense canopy cover of koa haole (Figure 5), with occasional cover of other nonnative species such as Christmas berry (*Schinus terebinthifolius*). The understory is typified by a mix of nonnative herbaceous species such as Guinea grass (*Urochloa maxima*), sourgrass, *Neonotonia wightii*, and four-o'clock. Other common species in this vegetation type include lantana, tree tobacco, and indigo. Rarely, the native species 'ānunu (*Sicyos pachycarpus*) can be seen in this type. In areas heavily populated by goats, this vegetation type will consist of the same canopy species, with a minimal understory.



Figure 5. Koa haole forest in the project area.

2.2.4 ‘A‘ali‘i Shrubland 5-10%

This vegetation type is typified by an open canopy, with the dominant species being ‘a‘ali‘i (*Dodonaea viscosa*) (Figure 6). In many areas, the ‘a‘ali‘i is co-dominant with natal redbtop (*Melinis repens*). The presence of many other scattered native species, both woody and herbaceous, makes this one of the most native species-rich of the vegetation types. Scattered woody native plants include ‘ākia, lama (*Diospyros sandwicensis*), wiliwili (*Erythrina sandwicensis*), and hao (*Rauwolfia sandwicensis*). Herbaceous native species include ‘ala‘ala wai nui (*Plectranthus parviflorus*), kalamoho lau li‘i (*Pellaea ternifolia*), and kumuniu (*Doryopteris decipiens*). Other species that may be present include tree tobacco.



Figure 6. 'A'ali'i shrubland in the project area.

2.2.5 Dryland Forest .5-3%

Because of severe degradation, this vegetation type exists only as very small pockets of remnant native tree species, sometimes existing as scattered lone individuals (Figure 7). Typical species include lama, hao, wiliwili, and 'ohe makai (*Polyscias sandwicensis*). Other species that may be present include 'a'ali'i, 'aiea, maiapilo (*Capparis sandwichiana*), and nehe (*Melanthera lavarum*). These pockets are typically surrounded by expanses of bare a'a. Other species that may occur in these areas include tree tobacco and kiawe.



Figure 7. Dryland forest in the project area.

2.2.6 Native Coastal Strand 0.5-3%

This vegetation type is typified by an open canopy, with the dominant species being naupaka kahakai (*Scaevola taccada*) (Figure 8). Other woody species include ‘a‘ali‘i, kiawe, tree tobacco, and pluchea (*Pluchea indica*). Individuals of other native species such as naio (*Myoporum sandwicensis*), hala (*Pandanus tectorius*), nohu (*Tribulus cistoides*), and maiapilo can be found in this vegetation type.



Figure 8. Native coastal strand in the project area.

2.2.7 Nonnative Coastal 0.5-3%

This vegetation type is dominated by a canopy of kiawe (Figure 9). Bare ground makes up most of the understory with occasional thickets of golden crown-beard (*Verbesina encelioides*), scarlet spiderling (*Boerhavia coccinea*), and khaki weed (*Alternanthera pungens*). Populations of tree tobacco exist in more open areas.



Figure 9. Nonnative coastal vegetation in the project area.

2.2.8 Special Status Flora

Special-status flora refers to plant species listed by the U.S. Fish and Wildlife Service (USFWS) and the State of Hawai‘i as threatened, endangered, or candidate. Based on pre-field research and previous surveys, seven special-status species have previously been recorded in the project area: ‘aiea, ‘ohai, *Vigna o-wahuensis*, *Melanthera kamolensis*, ‘awikiwiki (*Canavalia pubescens*), *Bonamia menziesii*, and ‘ihi. Of these, only ‘aiea was recorded during the field surveys. No special-status plant species were found adjacent to any of the proposed roads, watering stations, hunter check-in stations, or any other proposed added infrastructure, and therefore these species are not expected to be negatively affected by project activities directly. However, negative impacts related to future land use could occur. The actions of this management plan enhance the viability of these species.

The seven special-status species previously recorded in the project area are discussed below:

‘Aiea: This species has been found during field surveys as scattered individuals primarily in the northeast portion of the project area. Future management of these individuals should focus on protecting them from ungulates and fire, and promoting the establishment of a viable, reproducing population. Kanaio NAR?

‘Ohai: This species has only been found previously in the Pu‘u Pimoe crater. Individuals in this population have an arborescent habit, and it is possible that future taxonomic treatment may recognize these individuals as representing a rare subspecific taxon within an already endangered species. Future management of these individuals should focus on protecting them from ungulates and fire. Recovery at Kanaio NAR?

Vigna o-wahuensis: This species has been recorded previously near the coastal Hoapili Trail, and critical habitat exists in that area for this species. This species has also been recorded in an Army National Guard (ANG) enclosure in the southeast portion of the project area. Future management of these individuals should focus on protecting them from ungulates and fire.

Melanthera kamolensis: This species has been previously recorded in an ANG enclosure in the southeast portion of the project area. Future management of these individuals should focus on protecting them from ungulates and fire.

Canavalia pubescens: This species has been previously recorded scattered widely throughout the project area, including in the ANG enclosure. Future management of these individuals should focus on protecting them from ungulates and fire.

Bonamia menziesii: This species was previously recorded in a single locality off of the main mauka- makai road in the project area. Future management of plants in this locality should focus on protecting them from ungulates and fire.

‘Ihi: This species was previously recorded in a single locality off of the Hoapili Trail in the southeastern corner of the project area. Future management of any plants found in this locality should focus on protecting them from ungulates and fire.

2.3 FAUNA

The fauna observed in the project area includes species that are endemic, indigenous, migratory, and nonnative introductions. The endemic, indigenous, and migratory species often require specific niche habitats and are frequently locally abundant where they occur. The nonnative introduced species tend to be more generalist and often occupy a range of habitats.

Bird species observed in the project area are species commonly found in low-elevation dry forest, shrubland, and lava fields in southeast Maui (Table 1). Chukar Partridge (*Alectoris chukar*) was not observed in the area during the survey effort but are known to inhabit adjacent lands.

Table 1. Birds Observed by SWCA in and near the Project Area

Common Name	Scientific Name	Status*	MBTA
African silverbill	<i>Euodice cantans</i>	NN	
Black francolin	<i>Francolinus</i>	NN	
Cattle egret	<i>Bubulcus ibis</i>	NN	X
Common myna	<i>Acridotheres tristis</i>	NN	
Eurasian skylark	<i>Alauda arvensis</i>	NN	X
Great frigatebird	<i>Fregata minor</i>	I	X
Gray francolin	<i>Francolinus pondicerianus</i>	NN	
Hawaiian short-eared owl	<i>Asio flammeus sandwichensis</i>	I	X
House finch	<i>Haemorhous mexicanus</i>	NN	X
Japanese bush warbler	<i>Horornis diphone</i>	NN	
Japanese white-eye	<i>Zosterops japonicus</i>	NN	
Mourning dove	<i>Zenaida macroura</i>	NN	X
Northern cardinal	<i>Cardinalis</i>	NN	X
Northern mocking bird	<i>Mimus polyglottos</i>	NN	X

Common Name	Scientific Name	Status*	MBTA
Nutmeg mannikin	<i>Lonchura punctulata</i>	NN	
Pacific golden-plover	<i>Pluvialis fulva</i>	M	X
Ring-neck pheasant	<i>Phasianus colchicus</i>	NN	
Zebra dove	<i>Geopelia striata</i>	NN	
Total		18	9

* Status: I = indigenous, NN = nonnative permanent resident, M = migrant.

Three special-status seabirds could transit over the project area while traveling to and from their upland nesting sites: Hawaiian petrel (*Pterodroma sandwichensis*), Newell’s shearwater (*Puffinus auricularis newelli*), and band-rumped storm-petrel (*Oceanodroma castro*). No suitable nesting sites for these species are present in the project area. These species nest inland in the mountainous interior of Maui (Mitchell et al. 2005). These species may fly over the project area at night while travelling to and from their upland nesting sites to the ocean. Special-status seabirds are discussed further in Section 2.3.6.

Special-status fauna refers to wildlife species listed by the USFWS and the State of Hawai‘i as threatened, endangered, or candidate. Five endangered special-status fauna species may occur in the project area based on previous surveys, presence of suitable habitat, and the USFWS species records (USFWS 2016): Hawaiian hoary bat, Hawaiian goose, Blackburn’s sphinx moth, yellow-faced bee, and orangeblack Hawaiian damselfly (USFWS 2018). Of these, only the Blackburn’s sphinx moth was recorded during the field surveys. These species and the three special-status seabirds are discussed in detail below.

2.3.1 Hawaiian Hoary Bat

The potential for the presence of Hawaiian hoary bat was assessed based on the presence of suitable habitat observed during the field surveys. Hawaiian hoary bats are known to occur in native, nonnative, agricultural, and developed landscapes (U.S. Department of Agriculture [USDA] 2009; USFWS 1998). Hawaiian hoary bats forage in open, wooded, and linear habitats with a variety of vegetation types. These animals are insectivores and are regularly observed foraging over streams, reservoirs, and wetlands up to 300 feet (100 m) offshore (USDA 2009). Hawaiian hoary bats typically roost in trees greater than 16 feet (5 m) with dense canopy foliage or in subcanopy when canopy is sparse, with open access for launching into flight (Gorresen et al. 2013; USDA 2009). Hawaiian hoary bats have been documented roosting in kiawe and hala, and may roost in trees such as hao, wiliwili, lama, milo, alahe‘e, keahi, ‘aiea, and ohe makai in the pasturelands, invaded pasturelands, dryland forest, native coastal strand, nonnative coastal, and ‘a‘ali‘i shrubland vegetation types. However, direct effects to bats would occur only if a juvenile bat that is too small to fly but too large to be carried by a parent were present in a tree that was cut down. To prevent direct impacts to the Hawaiian hoary bat, the following measures are recommended:

1. Do not trim or remove trees taller than 15 feet (4.6 m) between June 1 and September 15, when juvenile bats that are not yet capable of flying may be roosting in the trees.
2. Use barbless wire for all fence construction to avoid entanglement of Hawaiian hoary bat.

2.3.2 Hawaiian Goose

The Hawaiian goose occupies various habitat types ranging from beach strand, shrubland, and grassland to lava rock at elevations ranging from coastal lowlands to alpine areas (Banko 1988; Banko et al. 1999). The geese eat plant material, and the composition of their diet depends largely on the vegetative composition of their surrounding habitats. Most Hawaiian goose food items are leaves and seeds of grasses and sedges, leaves and flowers of various herbaceous composites, and various fruits of several species of shrub (Banko et al. 1999; Black et al. 1997). They appear to be opportunistic in their choice of

food plants as long as the plants meet their nutritional demands (Banko et al. 1999; Woog and Black 2001). The Hawaiian goose has an extended breeding season, with eggs reported from all months except May, June, and July, although most nest during the rainy (winter) season between October and March (Banko et al. 1999; Kear and Berger 1980).

The Hawaiian goose was not observed during the field surveys; however, suitable habitat for nesting and foraging was noted during the surveys. The invaded pasturelands, pasturelands, native coastal strand, non native coastal, and ‘a‘ali‘i shrubland vegetation types are suitable for Hawaiian goose foraging.

The Hawaiian goose has been observed nesting under lantana, ‘a‘ali‘i, and Christmas berry and could nest in the koa haole forest, pasturelands, ‘a‘ali‘i shrubland, dryland forest, native coastal strand, and invaded pasture vegetation types in the project area. To prevent impacts to the Hawaiian goose, the following measures are recommended:

1. If a Hawaiian goose is observed in the area during construction activities, all activities within 100 feet (30 m) of the species should cease, and work should not continue until the species leaves the area on its own accord.
2. If a Hawaiian goose nest is discovered, all activities within 150 feet (46 m) of the nest should cease, and the USFWS DOFAW biologist should be contacted. Work should not resume until directed by the USFWS the DOFAW biologist.
3. In areas where the Hawaiian goose is known to occur, post and implement reduced speed limits, and inform project personnel about the presence of the Hawaiian goose.

2.3.3 Blackburn’s Sphinx Moth

Three Blackburn’s sphinx moth larvae were observed on tree tobacco in two separate areas in the project area. One was observed on November 15, 2017, along the path of a proposed road, and two were observed on January 22, 2018, along the Hoapili Trail. Approximately 3,800 acres of designated Blackburn’s sphinx moth critical habitat occurs in the project area.

The primary constituent elements required by Blackburn’s sphinx moth larvae for foraging, sheltering, and maturation are the two documented native host plant species in the genus *Nothocestrum*, also known as ‘aiea (*N. latifolium* and *N. breviflorum*) (USFWS 2005). Only *N. latifolium* was observed in the project area. At lower elevations, Blackburn’s sphinx moth larvae are found most often on the nonnative tree tobacco; they have also been found on tobacco (*Nicotiana tabacum*), eggplant (*Solanum melongena*), tomato (*S. lycopersicum* var. *cerasiforme*), and the indigenous pōpolo (*S. americanum*) (USFWS 2005). The larvae descend from their host plants and search for suitable soil before pupating. They are most likely to pupate within 33 feet (10 m) of the larval host plant, although they may transit farther over paved and hardened surfaces to find a suitable site to enter the ground. The pupal stage of moth has been suggested to last up to 1 year (Zimmerman 1958); however, no data exist to support this suggestion.

Captive reared moths emerged within 6 weeks (Rubinoff and San Jose 2010). The Blackburn’s sphinx moth larvae can be found in all the vegetation types within the project area. The following measures are recommended during construction to avoid effects to the Blackburn’s sphinx moth:

1. A survey for potential larval host plants for Blackburn’s sphinx moth (particularly tree tobacco) should be conducted by biologists before construction/vegetation clearing. Results of the survey should be provided to the USFWS.
2. If host plants are found, surveys for Blackburn’s sphinx moth should be performed according to the most recent USFWS guidance, and preferably during the wet season (January to April), roughly 4 to 8 weeks following a significant rainfall event. Results of the survey should be provided to the USFWS. Any necessary follow-up actions should be coordinated with the USFWS.

2.3.4 Yellow-faced Bee

The yellow-faced bee is known to occur within coastal habitats that include rocky shoreline with naupaka and tree heliotrope (*Tournefortia argentea*) with either landscaped vegetation, kiawe, or bare rock (USFWS 2018). The bees are restricted to an extremely narrow corridor, typically 10 to 20 m (32 to 64 feet) wide, and do not occur on sandy beaches or inland, even on landscaped native plants on hotel grounds. The yellow-faced bee has been observed entering holes in coral rubble deposited on shore, and this may be their primary nesting site and a limiting factor on their distribution. The yellow crazy ant (*Anoplolepis gracilipes*) was often found in close proximity, but almost never on plants visited by the yellow-faced bee. Host plants for the yellow-faced bee recorded during the field surveys include naupaka, ilima, pua kala, and naio in the native coastal strand vegetation type. In addition, this species may also use 'akoko (*Chamaesyce* spp.) and tree heliotrope if found. Threats to the yellow-faced bee include habitat destruction and modification from nonnative plants, ungulates, and fire, and predation by nonnative ants and wasps. The following recommendations are provided to avoid impacts to the yellow-faced bee:

1. If an action occurs in or adjacent to known occupied yellow-faced bee habitat, a buffer area around the habitat may be required and can be worked out on a site-specific basis with the USFWS.
2. Do not create fires or disturb woody debris.
3. Restrict vehicles to existing roads and trails to minimize disturbance to nesting sites.
4. Use educational signs to inform people of the presence of the yellow-faced bee.
5. Use sturdy animal-proof garbage containers to reduce attracting nonnative pests (e.g., ants) to the area.

2.3.5 Orangeblack Hawaiian Damselfly

The orangeblack Hawaiian damselfly was once Hawai'i's most abundant damselfly and is known to occur within the anchialine pool, coastal, lowland dry, and lowland mesic ecosystems (USFWS 2016). This species was common near standing or very slow-moving bodies of water, garden pools, large reservoirs, pools of an intermittent stream, fishponds, and freshwater marshes (USFWS 2018).

Past and present land use and water management practices (e.g., agriculture, urban development, groundwater development, and destruction of perched aquifers and surface water resources) as well as feral ungulates (pigs, goats, axis deer) have contributed to the modification and destruction of the orangeblack Hawaiian damselfly habitat. Nonnative plant species can eliminate open water habitat of the orangeblack Hawaiian damselfly. Predation by nonnative fish, frogs, and nonnative aquatic invertebrates on the orangeblack Hawaiian damselfly is also a significant threat.

No suitable habitat for the orangeblack Hawaiian damselfly was observed during the field surveys. The orangeblack Hawaiian damselfly is known to breed in anchialine ponds near the La Perouse Lighthouse approximately 1,400 feet south of the project area (Polhemus et al. 1999). Because of the close proximity of the orangeblack Hawaiian damselfly to the project area, the damselfly may be attracted to pooled water within the project area during rain events. The following recommendations are provided to avoid impacts to orangeblack Hawaiian damselfly:

1. If an action occurs in or adjacent to occupied orangeblack Hawaiian damselfly habitat, a buffer area around the habitat may be required and can be worked out on a site-specific basis with the USFWS.
2. Educational signs should be installed near occupied habitats to inform people of the presence of the orangeblack Hawaiian damselfly.

3. The USFWS-recommended standard Best Management Practices (USFWS 2018) should be incorporated into the project description to minimize the degradation of water quality and impacts to fish and wildlife resources.
4. All suitable aquatic habitat should be protected from human disturbance by adhering to the following measures:
 - a) Vehicles should be restricted to existing roads and trails near suitable orangeblack damselfly aquatic habitat.
 - b) Trash and other waste should be prevented from entering wetlands, streams, or anchialine pools.
 - c) Actions that may result in the introduction of nonnative fish or other nonnative predators to streams, ponds, marshes, and anchialine pools should be avoided.
 - d) The use of herbicides or pesticides near aquatic habitats should be avoided.
 - e) Actions that may alter the water quality and quantity of aquatic habitats, such as groundwater withdrawal and increased stormwater runoff, should be avoided.

2.3.6 Seabirds

The band-rumped storm-petrel, Hawaiian petrel, and Newell's shearwater constitute the seabirds group. Because these species share similar habitat needs and biological characteristics, they are discussed here as a single group.

The project area does not provide suitable nesting or foraging habitat for these seabirds. However, breeding individuals may fly over the project area at night while travelling between upland nesting and ocean foraging sites. Disorientation and fallout as a result of light attraction could occur for individuals attracted to nighttime construction lighting. To minimize potential impacts to seabirds, the following measures should be followed:

1. Construction activity should be restricted to daylight hours as much as practicable during the seabird peak fallout period (September 15 to December 15) to avoid the use of nighttime lighting that could attract seabirds.
2. All outdoor lights should be shielded to prevent upward radiation. This has been shown to reduce the potential for seabird attraction.
3. Outside lights not needed for security and safety should be turned off from dusk through dawn during the fledgling fallout period (September to December).

2.3.7 Ungulates

A 2017 aerial survey using Forward Looking InfraRed (FLIR) technology to assess the ungulate population found well-established populations of ungulates in the area. A total of 3,076 ungulates were observed in the area during two days of aerial surveys: 2,616 goats (*Capra hircus*), 318 axis deer (*Axis axis*), 117 cows (*Bos taurus*), and 25 pigs (*Sus scrofa*).

The survey results confirm the presence of a thriving game mammal population which can provide favorable hunting opportunities throughout the year. However, in order to reduce the impact to natural and cultural resources in the area, initial management hunts must be executed.



Figure 10. FLIR survey results.

3 Cultural Resources

The lands resting within the boundaries of the KFWA possess abundant evidence of human settlement and use stretching back to the period before Western contact. This rich cultural landscape contains both traditional Hawaiian archaeological features, including coastal villages, religious sites, trails, shelters, planting areas, and human burials, as well as later post-contact structures such as ranching era boundary walls and historic house sites. One of the primary purposes in creating the KFWA is to ensure the protection of these cultural resources from further damage by humans and ungulates.

3.1 Traditional Life

Situated within the rain shadow of the volcanic peak of Haleakalā and scarred by multiple lava flows, the ahupua‘a of Kanaio, Kalo‘i, Kaunuahe, and Papaka Kai may appear today to be barren and inhospitable. Archaeological evidence, however, suggests that during the pre-contact period these land divisions were home to a thriving Native Hawaiian population. Most traditional settlement appears to have been focused along the coastline where the nearshore waters offered an abundance of marine resources.

The remains of small fishing communities can be seen at the coves of Alaha-Wahene and Waialio, while remnants of individual residences are scattered along the shore. When archaeologist Winslow Metcalf Walker visited the abandoned village of Waialio in the 1920s he found fifteen house foundations, one of which still had its grass roof in place, as well as animal pens, canoe sheds and other walled enclosures. The inhabitants of these oceanside settlements gathered shellfish along the rocky shoreline and fished the rich offshore waters. They obtained drinking water from brackish wells and submarine springs located offshore.

Coastal trails (ala kahakai) linked these shoreline settlements, while ala pi‘i (ala meaning path or trail and pi‘i meaning “to go inland”) gave their residents access to the upper slopes where crops such as ‘uala (sweet potato, *Ipomoea batatas*), uhi (yam, *Dioscorea spp.*), and dryland kalo (taro, *Colocasia esculenta*) were grown. These mauka (inland) to makai (seaward) trails also connected isolated *kīpuka* (pockets of older lava completely encircled by younger lava flows) that possessed well-developed soils and appear to also have been utilized as dryland planting areas.

Ala loa (“long trails”), trails of regional significance, served to cover extensive distances and connect major settlements. The post-contact Hoapili Trail (constructed in the 1840s by order of Governor Hoapili to link the shoreline settlements from Honua‘ula to Kaupō), which passes through the makai portion of the KFWA, may roughly follow the original coastal ala loa built during the traditional period. A number of archaeological sites lie along the course of this well-defined trail. The mauka boundary of the KFWA is marked by the present Pi‘ilani Highway, which likely corresponds to the traditional inland ala loa connecting farming settlements. In this upland area rainfall was sufficient to support more extensive dryland fields as well as residence areas.

3.2 Post-Contact History

Traditional life in Kanaio and its neighboring ahupua‘a remained relatively unchanged during the early years following Western contact. The settlements of rural south Maui were far removed from the centers of dramatic cultural change such as the growing whaling port of Lāhainā. With time, however, introduced disease began to affect the area, contributing to the decline of rural Native Hawaiian populations. This was exacerbated by economic migration as young people left their ancestral homes to look for work in the towns. Eventually, the coastal settlements within the KFWA were abandoned and some of the land given over to cattle grazing. Cattle ranching became the dominant economic activity in the region beginning in

the 1840s. Several ranches, including the Kahikinui, ‘Ulupalakua, Haleakala, and Kaupo Ranch, grazed cattle within the KFWA.

During the Second World War, the United States Army and Marine Corps utilized portions of the ahupua‘a of Kanaio, including the area around Pu‘u Pimoe, for live fire training, though the area was never bombarded by ship. In 1965, the Hawaii Army National Guard obtained a permit from ‘Ulupalakua Ranch to use a portion of Kanaio ahupua‘a as a live-fire and maneuver training ground. This became the Kanaio Training Area (KTA). The KTA measured approximately 4,707 acres in extent and covered most of the eastern half of the current KFWA. (Live) fire training within the KTA was primarily limited to a zone around the Pu‘u Pimoe cinder cone and all live firing was done towards the sea into the Pu‘u Pimoe flow zone inland of the Hoapili Trail. Exercises using high explosives were permanently suspended at KTA in 1981 and use of the area by the Hawaii Army National Guard was gradually phased out. From the 1980s to early 2000s, various unexploded ordnance (UXO) clearance operations were undertaken within the KFWA. The Hoapili Trail and adjacent areas were swept for ordnance. Several fenced enclosures were established as permanent off-limit areas that were judged as too unsafe to sweep for UXO.

3.3 Cultural Sites

Archaeological investigations conducted within the limits of the KFWA have identified an abundance of archaeological sites and features of various ages and functions. These studies provide a broad picture of the cultural landscape of this portion of the ahupua‘a of Kanaio, Kalo‘i, Kaunuahane, and Papaka Kai.

The majority of archaeological studies undertaken have been concentrated within the boundaries of the former KTA or along and makai of the Hoapili Trail. The cultural resources identified date to both the pre- and post-contact periods. They include features related to habitation, agriculture, animal husbandry and travel, as well as ceremonial and burial sites.

Archaeological sites located along the coast makai of the Hoapili Trail include the remains of fishing villages, isolated coastal residences, fishing shrines, wells, shelter caves, and trails, as well as the heiau of Keawanaku within the ahupua‘a of Kaunuahane and a cluster of burial sites at Ki‘ipuna alongside the Hoapili Trail.

Within the more mauka portion of the KFWA, several subsurface lava tubes show evidence of both habitation and human burial. The twin cinder cones of Pu‘u Pimoe and Pu‘u Pohakea appear to have been favored burial areas. Other sites within the more mauka area appear related to dryland agriculture as well as inland settlement (both pre and post-contact).

4 MANAGEMENT GOALS

The Kanaio region of southern Maui is one of the last remaining stretches of lowland dry forest left in the State of Hawai‘i. This area contains six known endangered species; several species of concern (rare, threatened, and endangered species, or in marked decline on Maui, such as taxa included in the Plant Extinction Prevention Program); and a multitude of culturally important resources, including burial grounds and cultural practice areas such as heiau and caves. To protect these resources from further damage by humans, cattle and ungulates (including feral ungulates, primarily goats), the proposed KFWA will legally allow and expand opportunities for public hunting; aid in directing human traffic in the area; and curtail damage from activities such as illegal off-road vehicles, unauthorized cattle grazing, and other human-caused disturbances, degradation, and destruction (including a legacy of impacts as a result of military training). The *1993 Kanaio Natural Area Reserve Biological Inventory and Management Recommendations* was the main reference in the development of these goals.

To ensure the protection and viability of these resources, three distinct management goals and their related actions have been defined, as shown in Table 2.

Table 2. Management Goals

Goals	Actions
<p>Goal 1 Ensure the protection of important, threatened, or endangered species and cultural resources</p>	<ul style="list-style-type: none"> • Pu'u Pimoe fence • Makai lower boundary fence • Monitor public access • Annual vegetation monitoring • Fire management • Monitor condition of cultural resources
<p>Goal 2 Provide consistent processes for actions within the Game Management Area</p>	<ul style="list-style-type: none"> • 5-Year Game Management Plan • Ensure quality hunting opportunities and game species viability • Ungulate population surveys and management program • After implementation and achievement of 5-yr plan, maintain ungulate populations at those agreed to numbers.
<p>Goal 3 Guide public use of the area, including hunting</p>	<ul style="list-style-type: none"> • DOCARE enforcement to reduce human impacts on cultural and natural resources • Wildlife Coastal Resource Protection Zone public use • Post signs and information about the area's sensitive resources to guide recreational use • Educate hunters regarding sensitivity of cultural sites

4.1.1 Proposed Infrastructure Improvements

To assist in the protection and long-term management of biological and cultural resources located within the KFWA, DOFAW is proposing to implement various infrastructure improvements. These improvements will all be located within the mauka KFWA Game Management Area, although they will help to protect both the Game Management Area and the Wildlife Coastal Resource Protection Zone.

4.1.2 Existing Access Roads

At present there are two existing access roads leading from the Pi'ilani Highway down into the KFWA. The first of these roads is the main Kanaio Beach Road whose entry off of Pi'ilani Highway is located near the center of the KFWA. The Kanaio Beach Road extends down to the coast. A shorter branch road leads past Pu'u Pimoe almost to Pu'u Pohakea (the Pohakea Road). The second access road is the 'Ulupalakua Ranch Road that enters from Pi'ilani Highway at the northwestern corner of the KFWA. This road extends down to approximately 520 feet in elevation before bending west and continuing outside the boundary of the KFWA (Figure 2). The upper third of this road is already paved, and therefore will not be affected by management actions and road maintenance activities.

The entire Kanaio Beach Road, the Pohakea Road, and the lower section of the 'Ulupalakua Ranch Road are unpaved and require a four-wheel drive vehicle to access them. DOFAW does not intend to improve these existing roads to any major degree. Instead, it will perform minor maintenance and install occasional pull-offs/turn-arounds on stretches of road located within the Game Management Area.

These roads will allow DOFAW crews to access and monitor the KFWA.

Currently there is an existing ranch gate at the top of the Ulupalakua access road, and DOFAW intends to keep this gate installed to help control access into the KFWA Game Management Area, DOFAW intends to install a hunter check-in station at the entrance to the Ulupalakua Ranch. Under DOFAW management, Department of Conservation and Resources Enforcement (DOCARE) officers will increase presence and issue citations for off-road driving and other activities detrimental to the natural and cultural resources of the KFWA. The hunter check-in stations will monitor traffic into the KFWA, provide a centrally located area for data collection and provide hunters with educational materials informing them about the fragile natural and cultural resources within the area.

4.1.3 Proposed Roads

A proposed contour road would stretch from the existing Ulupalakua Ranch Road to the existing Kanaio Beach Road (Figure 1). The road will improve hunter access to the area and provide a fire break to support wildfire suppression efforts. The road is intended to be accessed by four-wheel drive vehicles only and is not intended for other recreational use.

4.1.4 Water Stations

A total of six water tanks are proposed to be constructed within the KFWA Game Management Area. The tanks will serve as water stations to support game bird species such as Gray Francolin (*Francolinus pondicerianus*), Black Francolin (*Francolinus*), and Ring-necked Pheasant (*Phasianus colchicus*).

The footprint of these tanks will be no more than 10 feet (3 m) in radius (20 feet in diameter). All of these tanks will be located immediately adjacent to either existing or planned access roads: one along the Pohakea Road just north of Pu‘u Pohakea (Water Tank 1), one along the Kanaio Beach Road (Water Tank 2), one along the Papaka Kai-Kaloi Road near its junction with the Kanaio Beach Road (Water Tank 3), one along the ‘Ulupalakua Ranch Road (Water Tank 4), one at the junction of the ‘Ulupalakua Ranch Road and the Papaka Kai-Kaloi Road (Water Tank 5), and one at the point where the ‘Ulupalakua Ranch Road crosses the western boundary of the KFWA (Water Tank 6).

4.1.5 Fences

The Army National Guard built a 20-acre enclosure in the southeast corner of the area. The fence was built in an effort to establish a viable population of ‘ohai (*Sesbania tomentosa*). Currently the enclosure is maintained by DOFAW personnel and is an effective ungulate barrier.

DOFAW proposes to erect two ungulate exclusion fences. The first and longest of these fence lines will extend along the boundary separating the KFWA Game Management Area from the KFWA Wildlife Coastal Resource Protection Zone. This fence line is intended to restrict ungulate access to the coast and therefore protect the numerous biological resources and cultural sites located in the Wildlife Coastal Resource Protection Zone. A second ungulate exclusion fence is planned to encircle Pu‘u Pimoe. This fence line will serve to protect listed native plant species and cultural resources on the pu‘u (cinder cone). All of the materials used in fence construction will be flown in and dropped at designated staging areas.

5 PUBLIC HUNTING

Currently there is unmanaged and unregulated poaching of ungulates in the KFWA area, which poses potential impacts to the resources but also compromises public safety. The implementation of a regulated hunting program that ensures public safety and optimal hunting opportunities is the main objective for the area. The KFWA will provide quality hunting opportunities for licensed hunters to pursue both game birds and game mammals.

A hunter check-in stations will be installed at the one access roads just off of Piilani Highway. The west access point will be regulated by a gate and access will be regulated by DOFAW. Hunters who are granted access by DOFAW will check in after entering the gate. The east access point will not have a gate, but hunters will need to check in before accessing the area. Hunting methods for the area will include shotgun for game bird species and archery for game mammals.

Signage at the entrance points off of Piilani Highway will provide information on designated hunting areas and natural and cultural resources in the area. Additional information will be available in the check-in station with the hunter sign-in sheet.

5.1 GAME BIRD MANAGEMENT

Game birds such as Ring Neck Pheasant and Gray Francolin and other game bird species are common in the area. In order to enhance and maintain these existing populations of game birds. Six birds water stations will be installed throughout the KFWA (Figure 2). The water stations will hold up to four hundred gallons of water to feed the wildlife guzzlers. The water stations and supplemental feeding will help to sustain the game bird populations through the dry season. To ensure the stations support only game birds the stations will be enclosed within an ungulate proof fence (Figure 3). Game bird hunting seasons and regulations will follow existing game bird guidelines in Title 13, Chapter 122 Rules Regulating Game Bird Hunting, Field Trials and Commercial Shooting Preserves. All rules and regulations will be enforced by DOCARE.

In addition to enhancing game bird populations these water stations will attract predator species such as mongoose, rats, and feral cats. These stations will provide an easy opportunity for predator species to hunt birds when they visit the available food and water at these stations. These non-native species have caused considerable negative impact to Hawaii's native ecosystems. Therefore, DOFAW will implement agency approved humane predator control methods to prevent and inadvertent support for predator species.

In State of Hawai'i game management areas, the viability of game bird populations is assessed based on annual harvest data. DOFAW will also implement standard survey methodology to determine populations levels and nesting and brooding success. Surveys will be conducted prior to the start of the fall game bird season and after the conclusion of the main nesting and brooding period.



Figure 11. Water Station

5.2 5-YEAR GAME MANAGEMENT PLAN

A 5-year game management plan will be put into action to ensure a viable population and reduce the potential impacts to natural and cultural resources. The plan will provide public hunters with the opportunity to reduce the feral goat population under a managed system that requires animal harvesting benchmarks. If hunters are not successful at meeting the annual benchmarks of the plan, DOFAW will implement removal efforts to cull the population to the acceptable levels. The following are guidelines for hunting.

GAME MAMMALS PRESENT

1. Axis Deer, Feral Goats, and Feral Pigs

MEANS OF TAKE (MAMMALS)

1. Archery/Crossbow
2. Shotgun – initially conducted to control feral goats for the first 5 years.
 - a. February

APPLICATIONS

1. \$5 online
2. Hunters will be required to apply for the May through October season.
 - a. Application will allow a hunter to pursue Axis deer, feral goats and feral pigs.
 - b. Depending on interest, hunters will be assigned a weekend by a public drawing.
 - c. 10–15 hunters per “Weekend” – Can be adjusted

3. A valid State of Hawaii hunting license will be required to hunt goats during the February through April period.

AXIS DEER

1. Current population size
 - a. 318 Axis deer (2017 survey)
 - b. 318 Axis deer (targeted)
2. Season
 - a. May through October
 - b. Fridays, Saturdays, Sundays and Mondays – “Weekend”
 - c. “Weekend” assigned by public drawing
3. Tag Fees (open for discussion)
 - a. Either sex
 - i. \$25 for resident
 - ii. \$125 for non-resident
 - b. Doe tag
 - i. \$20 for resident
 - ii. \$100 for non-resident
4. Bag limits
 - a. One (1) either sex tag per hunter per season
 - b. Number of doe tags per hunter per season to be determined based on current and accepted population levels and expected harvest levels
 - c. Daily bag limit = Two (2) per hunter per day
 - d. Season limit based on current and accepted population levels and expected harvest levels

Feral Goats – Initial 5-year plan to reduce population to appropriate levels

1. Current population size
 - a. 2,616 feral goats (2017 survey)
 - b. 500 feral goats (targeted)
2. Season
 - a. February through April
 - i. Fridays, Saturdays, Sundays and Mondays – “Weekend”
 - ii. No limit on hunter numbers during these months
 - iii. Shotgun season during the month of February (proposed)
 - b. May through October
 - i. Fridays, Saturdays, Sundays and Mondays - “Weekend”
 - ii. “Weekend” assigned by public drawing
3. Tag fees
 - a. None during the initial 5 years of the area open to hunting
4. Bag limits
 - a. No bag limits for the first 5 years

Beginning feral goat population – 2,616 (2017 survey)

After Year	Population level
	2,616 (2017 survey)*
1	2,000***
2	1,600***
3	1,200***
4	800***
5	500***

A survey will be conducted to obtain current population levels.

Any excess animals over the yearly targeted population level will be removed via staff control conducted by State employees.

To assist in the initial control of the feral goat population, a shotgun season may be proposed for the first 5 years. Shotgun season would run concurrently with the archery season during the month of February.

Feral Goats – After initial 5-years

1. Season
 - a. May through October
 - b. Fridays, Saturdays, Sundays and Mondays – “Weekend”
 - c. “Weekend” assigned by drawing
2. Tag fees – (open for discussion)
 - a. Either sex
 - i. \$15 for resident
 - ii. \$30 for non-resident
 - b. Nanny tag
 - i. \$10 for resident
 - ii. \$25 for non-resident
3. Bag limits – after 5-year period
 - a. One (1) either sex tag per hunter per season
 - b. Number of nanny tags per hunter per season to be determined based on current and accepted population levels and expected harvest levels
 - c. No daily bag limits.
 - d. Season limit to be determined based on current and accepted population levels and expected harvest levels.

FERAL PIGS

1. Season
 - a. May through October
 - b. Fridays, Saturday, Sundays and Mondays - “Weekend”
 - c. “Weekend” assigned by public drawing
2. Bag limit
 - a. None

6 NATURAL RESOURCE MANAGEMENT

Since the early 1990s there have been several biological surveys conducted in the KFWA. The surveys found isolated pockets of endangered species in a predominantly altered landscape. Each survey noted that the impacts to the natural resources are caused by illegal cattle grazing, feral ungulates, and illegal dirt bike and off-road vehicle activity. These threats to the natural resources significantly damage vegetation, resulting in erosion and the introduction and establishment of invasive species. In order to mitigate these threats to the natural resources in the area, the management plan includes the following:

- Pu‘u Pimoe fence to protect ‘ohai (*Sesbania tomentosa*), critical habitat, and cultural features on the pu‘u: The 1993 Kanaio Natural Area Reserve Biological Inventory and Management Recommendations suggests small fenced enclosures as a necessary first step to effectively preserve native vegetation.
- Removal of illegal cattle grazing operations: Current grazing operations are illegal and DOFAW will coordinate with DOCARE to develop a plan to provide notice to the individuals to initiate the removal of their cattle. Sufficient time will be allowed for individuals to remove their animals. All cattle remaining after the designated deadline will be removed by DOFAW.
- Enforcement to address illegal dirt bike and off-road activity: Signs will be posted at access points and near Pu‘u Pimoe. DOCARE presence in the area will be increased to enforce violations and deter illegal activities, such as poaching, dirt bike riding, and off-road vehicles, that impact natural and cultural resources.
- Fencing critical habitat on Pu‘u Pimoe and the lower Makai boundary: A contour fence line will be installed to protect the significant number of cultural sites near the Hoapili Trail.

The management actions listed in Table 3 are expected enhance the status of the natural resources and prevent further damage to cultural resources in the KFWA. These actions also ensure compatibility with public hunting opportunities and other recreational uses of the area.

Table 3. Threats and Management Actions to Protect Natural Resources within the KFWA

Threat	Threat Level	Preventative Measures
<i>Ungulate Impacts</i>		
Trampling and erosion caused by ungulates	High	Removal of illegal cattle grazing.
		Reduction of feral ungulates through increased hunting. 5-Year Game Management Plan
		Fencing to restrict ungulate access to sensitive areas around Pu‘u Pimoe. Manage invasive species in enclosure fences.
<i>Human Impacts</i>		
Dirt bike and off-road driving	High	DOCARE enforcement.
		Monitoring of human activities within the Wildlife Area.
Pedestrian traffic	Medium	Hunter and recreation outreach information about the natural resources in the area. Increase awareness of invasive species.
<i>Wildfires</i>		
	High	Maintenance of existing roads and installation of proposed contour road.
		Fuels reduction buffer along roads.

7 FIRE MANAGEMENT

As noted in the 1993 biological survey and following surveys, the area is significantly altered by decades of cattle grazing, unmanaged feral ungulate populations, and damaging human activities. These negative environmental impacts have displaced the native vegetation and introduced invasive nonnative species to the area. These species flourish in the dry Kanaio climate and are evolved to thrive in a system ungulate presence.

7.1 FIRE MANAGEMENT ACTIONS

1. Install proposed road: Connect the lower section of the ranch road to the existing beach access road. The new road will serve as a fuel break and provide access for fire fighters and machinery.
2. Existing road improvements: Minimal improvements in areas of severe erosion that could prevent access by fire personnel.
3. Fuels reduction and monitoring: Conduct annual brushing and herbicide treatment of the existing roads to buffer the roads and mitigate fire hazard. Well-buffered roads can serve as effective fire breaks and reduce impacts to natural and cultural resources.
4. Develop Wildfire Response Plan: DLNR fire team will develop a strategic response and suppression plan in coordination with agencies and private landowners.
5. Community outreach: Coordinate with Ulupalakua Ranch to inform the community on the best practices to prevent wildfires in KFWA.
6. Identify water sources: The area does not hold surface water and water would have to be hauled in for fire suppression by ground crews. DOFAW will coordinate with interested parties to obtain water support for fire suppression efforts in the KFWA
7. Allow, limited to the cooperating landowner, for a limited time and areas, cattle grazing to reduce fuel loads.

8 ACCESS ROADS

The two existing access roads, Kanaio Beach Road and the Ulupalakua Ranch Road, access the area along the northern boundary off of Piilani Highway (Figure 1). Kanaio Beach is currently open and allows unrestricted access from the highway down to the coast. The Ulupalakua Ranch Road is gated and public access is strictly regulated by the ranch. Should the ranch parcel be included into the KFWA, the gate would remain and access would be regulated by DOFAW; access would only be granted to a small number of hunters on weekends (Friday through Monday) The existing roads will not be improved by widening or grading. However, on steep sections where heavy erosion occurs DOFAW will install turn-out berms to divert water off the road. These sections will be determined during the wet season and the berms will be installed during the dry season. In areas heavily impacted by illegal off-roading and other activities, DOFAW plans to block those paths. Pu'u Pimoe is heavily impacted by illegal off-roading and the proposed fence will exclude both ungulates and illegal off-road activities. When the KFWA is established, DOCARE presence will increase to enforce management rules and further deter illegal off-road driving and other activities detrimental to the natural and cultural resources of the KFWA.

One additional road is proposed for the KFWA. The Papa Kai Kaloi Road will extend from the Ulupalakua Ranch Road to the Kanaio Beach Road. The proposed road route has been surveyed to ensure no impacts to biological and cultural resources would occur during road construction. Construction will be limited to one dozer and the road footprint will not exceed 12 feet (3.5 m). To minimize surface

impacts, the road depth will not exceed 1 foot and DOFAW machine operators will be informed of biological and cultural resources in the area.

9 CULTURAL RESOURCES MANAGEMENT

As evidence of its rich history, the KFWA contains a substantial number and variety of traditional Hawaiian and post-contact cultural resources. Many of these cultural sites have been damaged by trampling and erosion caused by the passage of cattle, goats, and other ungulates. Human activities, such as the mechanized clearing of vegetation undertaken during the ranching period to increase available pasturage and more recent illegal dirt bike and off-road driving, have also directly impacted archaeological sites.

Guided by this management plan, DOFAW’s stewardship of the KFWA is intended to reduce the active threats to these cultural resources. This program of protection and long-term management involves reducing damage from feral ungulates, removing illegal cattle grazing, preventing off-road driving, controlling public access, and educating those individuals who enter the preserve as to the significance and fragility of the area’s cultural sites. The establishment of the KFWA will help to preserve and protect the physical remains of the area’s rich cultural history.

9.1 CULTURAL RESOURCES MANAGEMENT ACTIONS

The actions to mitigate the identified threats to cultural resources in the area (Table 4) align with the measures to protect the natural resources. The highest density of cultural sites in the area is located near the Hoapili Trail and the fence line will ensure protection of cultural resources. For cultural sites above the fence, the immediate management of the ungulate population and elimination of illegal off-road activities will prevent further impacts to those cultural sites. In addition, hunter education and community outreach to inform the public about the rich cultural history of an area like the KFWA and how to avoid disturbance to these culturally significant sites.

Table 4. Threats and Management Actions to Protect Cultural Resources.

Threat	Threat Level	Preventative Measures
<i>Ungulate Impacts</i>		
Trampling and erosion caused by ungulates	High	Removal of illegal cattle grazing.
		Reduction of feral ungulates through increased hunting.
		Fencing to restrict ungulate access to sensitive areas around Pu'u Pimoe and the coastal zone.
<i>Human Impacts</i>		
Dirt bike and off-road driving	High	Control of access to the KFWA. DOCARE enforcement. Monitoring of human activities within the Wildlife Area.
Pedestrian traffic	Medium	Education of hunters entering the preserve as to the cultural sensitivity of the area.

10 WILDLIFE COASTAL RESOURCE PROTECTION ZONE

The Wildlife Coastal Resource Protection Zone ensures the conservation of cultural and natural resources in the area. In 2003, the National Park Service conducted a reconnaissance survey from La Perouse Bay to Kanaloa Point. The intent of the survey was to determine the feasibility to add the coastal zone to the national park system. The survey noted the area is the greatest concentration of known archeological sites in the coastal area. The study also noted significant impacts to coastal vegetation by humans from off-

road vehicles and campsites. Feral ungulates are also causing damage to native coastal vegetation communities. Although it was determined to have limited feasibility to be a national park, they recommended management of the area to protect the cultural and natural resources in the coastal zone.

The historic Hoapili Trail runs the length of the protection zone and the trail is a favorite among tourists. A 2005 study of the impacts of human use at the Hoapili Trail head parking area estimated over 200,000 people visit the area annually.

A small anchialine pool community is located on the furthest southwest point of the Wildlife Coastal Resource Protection Zone. Anchialine pools are land-locked bodies of water that are adjacent to the ocean. These pools are fed indirectly through underground connections to the ocean. These pools are support unique ecosystem and species specially adapted to the varying salinity (Hawaii Heritage 1989).

The construction of a lower boundary makai fence line will be the first and most important step in the resource management actions for this section of the KFWA. The fence will enable DOFAW staff to remove all ungulates in the coastal zone. The boundary fence will also prevent vehicular traffic to the coast. The coast will be open to pedestrians who want to access the coast to go fishing or hiking.

Management actions to protect the Wildlife Coastal Resource Protection Zone are listed in Table 5.

Table 5. Threats and Management Actions to Protect the Wildlife Coastal Resource Protection Zone

Threat	Threat Level	Management Actions
<i>Natural Impacts</i>		
Trampling and erosion caused by ungulates		Makai Fence construction
	High	Zero Tolerance area: aerial shoot to remove all ungulates once makai fence is complete.
<i>Human Impacts</i>		
Off-road driving	High	Manage access to the coastal zone. DOCARE enforcement at Hoapili Trail head.
		Makai fence to restrict vehicle traffic to the coast.
Pedestrian traffic	High	Hoapili Trail maintenance and additional signage to deter off-trail hiking.
		Increase DOFAW and DOCARE presence at trail head.
		Limit camping to designated areas with permit only.

11 SUCCESS MEASURES

An effective management plan requires methods to measure progress, which will then guide management decisions over time. KFWA is a mixed-use area; therefore, the methods will differ between the coastal zone and the upper hunting area. Success of the plan is determined by the progress toward the overall management goals.

11.1 GOAL 1: ENSURE THE PROTECTION OF IMPORTANT, THREATENED, OR ENDANGERED SPECIES AND CULTURAL RESOURCES

1. Year 1 and 2: Complete the Makai Wildlife Coastal Resource Protection Zone fence and the Pu‘u Pimoe exclosure fence.
 - a. Zero tolerance (ZT) in both fenced areas for ungulates. Complete removal of ungulates in the Wildlife Coastal Resource Protection Zone. Bi-annual ungulate survey of fenced units to ensure ZT achieved and maintained.
 - b. Establish photo-point locations within the Pu‘u Pimoe fence. Quarterly photo point monitoring within Pu‘u Pimoe fence to document management efforts. Annual vegetation survey in the Pu‘u Pimoe fence.
 - c. Annual Vegetation Monitoring: Survey along existing and proposed roads monitoring stations every 100 meters.

11.2 GOAL 2: PROVIDE CONSISTENT PROCESSES FOR ACTIONS WITHIN THE KFWA

- a. 5-Year Game Management Plan: Annual aerial ungulate surveys will determine if annual benchmarks are achieved. If annual ungulate benchmarks are not reached, DOFAW will cull the population with aerial shooting.
- b. Complete improvements of all existing roads and complete the proposed road. Maintain vegetation buffer for all roads during the dry season.
- c. Begin installation of 6 game bird water stations in year 1.
- d. Annual survey assessment of game bird populations:
 - Game bird harvest data analysis to compare hunter take against population estimate.
 - Remote cameras installed at water stations will provide year-round game bird population sample.
 - Ground surveys for game birds
 - Evaluate current management goals and objectives to determine success.
- e. Ability to modify management strategies based on current and prior survey and harvest data..ie. Bag limits.
- f. Quarterly/annual meeting with GMAC/Maui GMAC rep. And other members of the public to review and discuss upcoming seasons and projects.

11.3 GOAL 3: GUIDE PUBLIC USE OF THE AREA, INCLUDING HUNTING

- a. Reduction in off-road and off-trail damage to cultural and natural resources. Consistent DOCARE enforcement of violations. Annual review of enforced violations should show a downward trend by year 3.
- b. Installation of the hunter check-in station in year 1. Check-in station to provide access guidelines, data collection and information on sensitive resources in the area.
- c. Additional signage on Hoapili Trail and existing roads.
- d. Monthly assessment of human use at the Hoapili Trail head to determine impacts to Wildlife Coastal Resource Protection Zone.

12 MANAGEMENT BUDGET

The management budget was calculated using figures from the Hawaii Department of Land and Natural Resources – Division of Forestry and Wildlife, and the Pittman-Robertson Wildlife Restoration Program, Game Management Program FY12-FY16. The calculations were based on Maui county game management five-year estimates. The budget assumes no contractors will be hired for actions such as the makai fence construction and all actions will be completed by Department of Land and Natural Resources staff.

Table 6. KFWA Five Year Management Budget

Management	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Makai Fence	\$250,000	\$160,000	\$100,000	\$50,000	\$50,000	\$610,000
Pu'u Pimoe Fence	\$60,000	\$45,000	\$30,000	\$30,000	\$30,000	\$195,000
Water Stations	\$40,000	\$25,000	\$15,000	\$15,000	\$15,000	\$110,000
Roads	\$50,000	\$30,000	\$20,000	\$20,000	\$20,000	\$140,000
5-Year Hunter Game Management	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$100,000
DOCARE Enforcement	\$50,000	\$20,000	\$20,000	\$20,000	\$20,000	\$130,000
Coastal Resource Protection Actions	\$80,000	\$50,000	\$50,000	\$30,000	\$30,000	\$240,000
Total	\$550,000	\$350,000	\$255,000	\$185,000	\$185,000	\$1,525,000

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APPENDIX A

Kanaio Forestry and Wildlife Area Plant List

Table A-1 provides a checklist of native plant species observed by SWCA from November 11, 2017, to August 17, 2018, in the project area for the proposed Kanaio Forestry and Wildlife Area Project. The plant names are arranged alphabetically by family and then by species into three groups: dicots, monocots, and pteridophytes. The taxonomy and nomenclature of the flowering plants are in accordance with Wagner et al. (1999), Wagner and Herbst (2003), and Staples and Herbst (2005). Recent name changes are those recorded in Wagner et al. (2012).

Table A-1. Checklist of Native Plants Observed in the Project Area of the Kanaio Forestry and Wildlife Area from November 11, 2017, to August 17, 2018

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status
DICOTS			
Apocynaceae	<i>Rauvolfia sandwicensis</i> A.DC.	hao	E
Araliaceae	<i>Polyscias sandwicensis</i> (A.Gray) Lowry & G.M.Plunkett	'ohe, 'ohe kukulu'ae'o, 'ohe makai, 'ohe'ohe (Ni'ihau), 'oheokai	E
Asteraceae	<i>Melanthera lavarum</i> (Gaudich.) W.L.Wagner & H.Rob.	nehe	E
Capparaceae	<i>Capparis sandwichiana</i> DC.	maiapilo, pilo, pua pilo	E
Convolvulaceae	<i>Ipomoea indica</i> (Burm.) Merr.	koali 'awa, koali 'awahia, koali lā'au (Ni'ihau), koali pehu	I
Cucurbitaceae	<i>Sicyos pachycarpus</i> Hook. & Arn.	kūpala, 'ānunu	E
Ebenaceae	<i>Diospyros sandwicensis</i> (A.DC.) Fosberg	lama, ēlama	E
Fabaceae	<i>Erythrina sandwicensis</i> O.Deg.	wiliwili	E
Fabaceae	<i>Sophora chrysophylla</i> (Salisb.) Seem.	māmane, mamani	E
Goodeniaceae	<i>Scaevola taccada</i> (Gaertn.) Roxb.	naupaka kahakai, huahekili, naupaka kai, auaka (Ni'ihau)	I
Lamiaceae	<i>Plectranthus parviflorus</i> Willd.	'ala'ala wai nui, 'ala'ala wai nui pua kī, 'ala'ala wai nui wahine, spurflower	I
Malvaceae	<i>Sida fallax</i> Walp.	'ilima	I
Malvaceae	<i>Thespesia populnea</i> (L.) Sol. ex Corrêa	milo, portia tree	I
Menispermaceae	<i>Cocculus orbiculatus</i> (L.) DC.	huehue, hue, hue'ie, 'inalua	I
Myoporaceae	<i>Myoporum sandwicense</i> A.Gray	naio, naeo, naieo, bastard sandalwood	I
Piperaceae	<i>Peperomia blanda</i> var. <i>floribunda</i> (Miq.) H.Huber	'ala'ala wai nui	I
Rubiaceae	<i>Psydrax odorata</i> (G.Forst.) A.C.Sm. & S.P.Darwin	alahe'e, 'ōhe'e, walahe'e	I
Sapindaceae	<i>Dodonaea viscosa</i> Jacq.	'a'ali'i, 'a'ali'i kū makani, 'a'ali'i kū ma kua, kūmakani	I
Sapotaceae	<i>Sideroxylon polynesianum</i> (Hillebr.) Smedmark & Anderb.	keahi	I
Solanaceae	<i>Nothoecstrum latifolium</i> A.Gray	'aiea, hālena	E
Sterculiaceae	<i>Waltheria indica</i> L.	'uhaloa, 'ala'ala pū loa, hala 'uhaloa, hi'aloa, kanakaloa	I?
Thymelaeaceae	<i>Wikstroemia monticola</i> Skottsb.	'ākia, kauhi	E
Zygophyllaceae	<i>Tribulus cistoides</i> L.	nohu, nohunohu	I
MONOCOTS			
Pandanaceae	<i>Pandanus tectorius</i> Parkinson ex Z	hala, pū hala, screwpine	I?
PTERIDOPHYTES			

Family	Scientific Name and Authorship	Hawaiian and/or Common Name	Status
Pteridaceae	<i>Doryopteris decipiens</i> (Hook.) J.Sm.	kumuniu, 'iwa'iwa, manawahua	E
Pteridaceae	<i>Pellaea ternifolia</i> (Cav.) Link	kalamoho lau li'i, laukahi, kalamoho	I

Note: P-Polynesian introduced, P?- probably Polynesian introduced but possibly introduced in historic times, I- indigenous, I?- probably indigenous but possibly naturalized, E- endemic, E?- probably endemic but possibly naturalized (see pg. 126-127 in Wagner et al. 1999), X- non-native, X*- non-native cultivated.