Appendix D

Hawaii Community Wildfire Protection Plans (CWPP's)

Community Wildfire Protection Plan for Kahikinui, Island of Maui, Hawaii

Sponsored by the Department of Hawaiian Home Lands
September 2008

Written by Denise Laitinen

September 2008

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This Community Wildfire Protection Plan was made possible with the assistance of the Department of Hawaiian Home Lands. The author would like to extend a sincere mahalo nui loa to the following people and agencies for their assistance: Todd Gray and Mike Robinson of the Department of Hawaiian Home Lands; Maui County Fire Department; Hawaii State Division of Forestry and Wildlife; Maui County Civil Defense; Patrick V. Kirch, Professor of Anthropology and Integrative Biology, University of California, Berkeley; and the residents of Kahikinui and members of KOOK, particularly Chad Newman. A very special mahalo nui loa to Cheyenne Perry for researching and creating the GIS maps used in this project.

Cover photo: View of 2003 Kahikinui wildfire. Photo courtesy of the Maui County Fire Department.

Kahikinui Community Wildfire Protection Plan

Kahikinui Community Wildfire Protection Plan
Mutual Agreement Page

The Community Wildfire Protection Plan (CWPP) developed for Kahikinui, Maui, by the Department of Hawaiian Home Lands:

- Was collaboratively developed. Interested parties and federal land management agencies managing land in the vicinity of Kahikinui have been consulted.
- This Plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect Kahikinui.
- This Plan recommends measures to reduce the ignitability of structures throughout the area addressed by the Plan.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

Paul J Conry — 10/16/08

Paul J. Conry
State Forester, Division of Forestry and Wildlife

Date

10/20/2008

Jeff Murray
Fire Chief, Maui County Fire Department

Date

10/28/2008

Gen Iinuma, M.P.H.
Administrator, Maui County Civil Defense Agency

Date

Linda Chinn
Administrator, Land Management Division
Department of Hawaiian Home Lands

Date

September 2008

Executive Summary:

The community of Kahikinui in Maui County, on the leeward side of the Island of Maui, is under the jurisdiction of the Department of Hawaiian Home Lands (DHHL). Kahikinui is in a wildland urban interface (WUI) environment - that is where wild lands and houses meet. These interface areas pose the highest risk of loss of life and property due to wildland fire. The risk of wildland fire impacting homes in the WUI is determined by several factors, including the ignitability of fuels, structural ignitability, weather conditions, and topographical features, such as slope. Unlike other parts of the United States, wildfire is not a natural part of Hawaii's ecosystem. In Hawaii, wildfires destroy native plants, which can impact the watershed and the habitat of threatened and endangered native Hawaiian animals. Wildfires in Hawaii can also cause soil erosion, which has the potential to cause runoff that negatively impacts ocean reefs.

The overwhelming majority of wildfires in the state of Hawaii, and Kahikinui in particular, are caused by arson or human error. Human error includes errant fireworks, rubbish, cooking, or agricultural fires that get out of control in the wildland-urban interface, as well as vehicle-caused wildfires.

Principal stakeholders who have an interest in protecting Kahikinui from wildfire include the Maui County Fire Department, Department of Hawaiian Home Lands, which sponsored this CWPP, as well as the State Division of Forestry and Wildlife (DOFAW), Maui County Civil Defense Agency, Kahikinui Game Land Management Ohana (KGLMO), Living Indigenous Forest Ecosystems (LIFE), and the residents themselves who are members of Ka 'Ohana O Kahikinui (KOOK). These stakeholders were invited to participate in the development of this Plan.

A wildfire risk hazard assessment determined that the WUI areas in this community have a high risk of wildland fire. In recent years wildland fires in the area have threatened the 104 house lots of Kahikinui.

Meetings with community members and fire agency personnel identified 12 priority mitigation measures that can reduce the wildfire risk in Kahikinui, as well as improve community safety. These include: (1) improvement (i.e. grading and paving) of the main access road in the residential village, as well as improvement of the Jeep trail as a secondary emergency egress; (2) creation of a grazing buffer zone around the residential zone; (3) creation of static water resources, such as reservoirs and dip tanks, for fire suppression purposes; (4) creation of dedicated helicopter landing zones and creation of a contingency fund for helicopter use during wildfires; (5) the need to save nearby dryland forests; (6) reduction of fuel load along Piilani Highway; (7) reduction of fuel load around lessee homes; (8) identifying evacuation routes within the residential village; (9) increasing wildfire risk awareness among hunters; (10) developing a Community Emergency Operation Plan; (11) forming a Community Emergency Response Training (CERT) team and undergo training; and (12) renting/purchasing heavy equipment for fuel reduction projects.

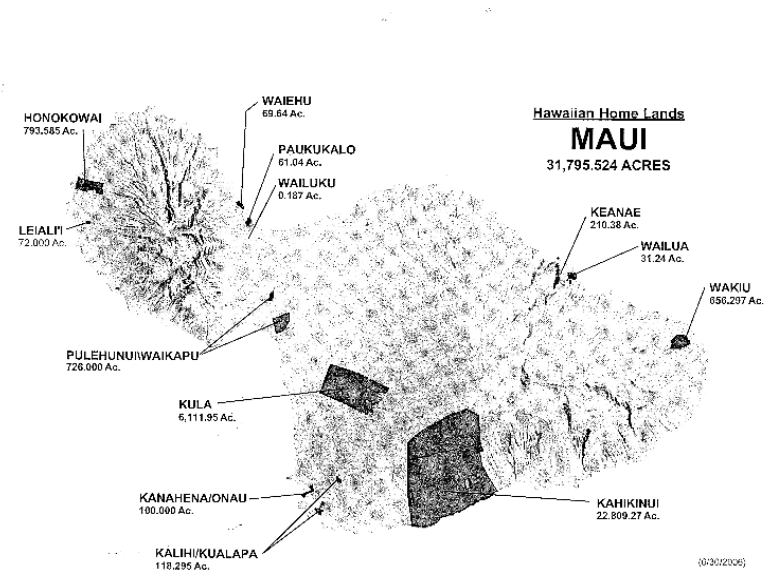
Background:

Kahikinui is located on the slopes of Haleakala on the leeward side of the Island of Maui. An arid, remote area, Kahikinui is more than a community. Historically, it encompassed an entire moku composed of several ahupua'a, a land division within Hawaiian culture extending from the ocean to the mountaintop.

For centuries the uplands of this region were a vast dryland forest, home to a sizable Native Hawaiian population in the pre-contact era. However, within the last two hundred years, particularly after the Great Mahele (land division) of 1848-1852, the area was deforested and became sparsely populated. Prior to the Great Mahele, the land was under the jurisdiction of Lot Kamehameha, who turned it over to

the Hawaiian government after 1852, the government in turn leased a great deal of the land to neighboring ranches.

After the annexation of Hawaii, Congress created *The Hawaiian Homes Commission Act of 1920* as a land trust. The purpose of the Act was the rehabilitation of native Hawaiians, those individuals of not less than one-half Hawaiian blood. The program offered 99-year leases for residential, agricultural, and pastoral homesteads on the islands of Kauai, Oahu, Maui, Molokai, and the island of Hawaii. When Hawaii became the 50th state in the U.S., one of the conditions of statehood was that the State of Hawaii would administer this program. [*Hawaiian Homes Commission Act of 1920,* www.capitol.hawaii.gov] The mission of DHHL is to manage the Hawaiian Home Lands trust effectively and to develop and deliver land to native Hawaiians [*DHHL 2007 Annual Report*, http://hawaii.gov/dhhl/publications/annual-report]. DHHL partners with others towards developing self-sufficient and healthy communities.



DHHL's 15 land holdings on Maui total 31,795 acres, of which the Kahikinui ahupua'a is the largest encompassing 22,809 acres.

The area for this CWPP encompasses the entire 22,809-acre Kahikinui ahupua'a from the forest reserve at the 10,000-foot elevation to sea level (mauka to makai). This CWPP encompasses only Kahikinui Hawaiian Home Lands TMK No.'s (2) 1-9-1:003, 007, 008 & 011. DHHL owns the entire moku with the exception of three kuleana parcels: two of which are at Lualailua and the other is at Manawainui. See Figure 1 for detail.

Figure 1: At nearly 22,809 acres, Kahikinui is the largest of DHHL's 15 land holdings on Maui and the only one to include an entire ahupua'a.

The area was used as ranch land for most of the 20th century. Little has changed at the beginning of the 21st century.

Since 1999, leases have been awarded to those willing to live in this remote area with the premise of eventually creating a self-sufficient community. To that end, a community group, Ka Ohana O Kahikinui (KOOK) a non-profit 501(c) corporation, was created. KOOK's purpose is to "develop, implement, and maintain a community-based land and natural resource management program; the documentation and registration of all historical and archeological sites in Kahikinui; the restoration and maintenance of those archeological sites determined to have cultural significance; and to develop self-sufficiency through subsistence homesteading." There are 104 subdivided lots in the residential area of the ahupua'a and although approximately 75 leases have been awarded, only nine families live in Kahikinui.

Infrastructure:

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Kahikinui is one of the few places on Maui that has not been touched by development or urbanization. Residents of Kahikinui have no running water and must haul water by personal truck or use limited catchment water. There are no fire hydrants within the residential area.

There are no energy utilities in the community with residents relying on generator and solar power. However, Sandwich Isles Communications Inc. installed underground phone cables that provide phone service to residents.

Left: gated front entrance to Kahikinui residential area from Piilani Highway. Right: the Hana-bound direction of Piilani Highway.

Piilani Highway (Route 31), a 20-foot wide two-lane paved highway, runs east to west at the 1,200-foot elevation dividing the ahupua'a into mauka (mountain side) and makai (ocean side) sections.

The main road from the highway to the residential village is a gated single-lane dirt road less than 14 feet in width that is accessible only by four-wheel drive vehicles. A portion of the main entrance road is paved and the side roads are unpaved. Standard fire trucks can not access the area due to the

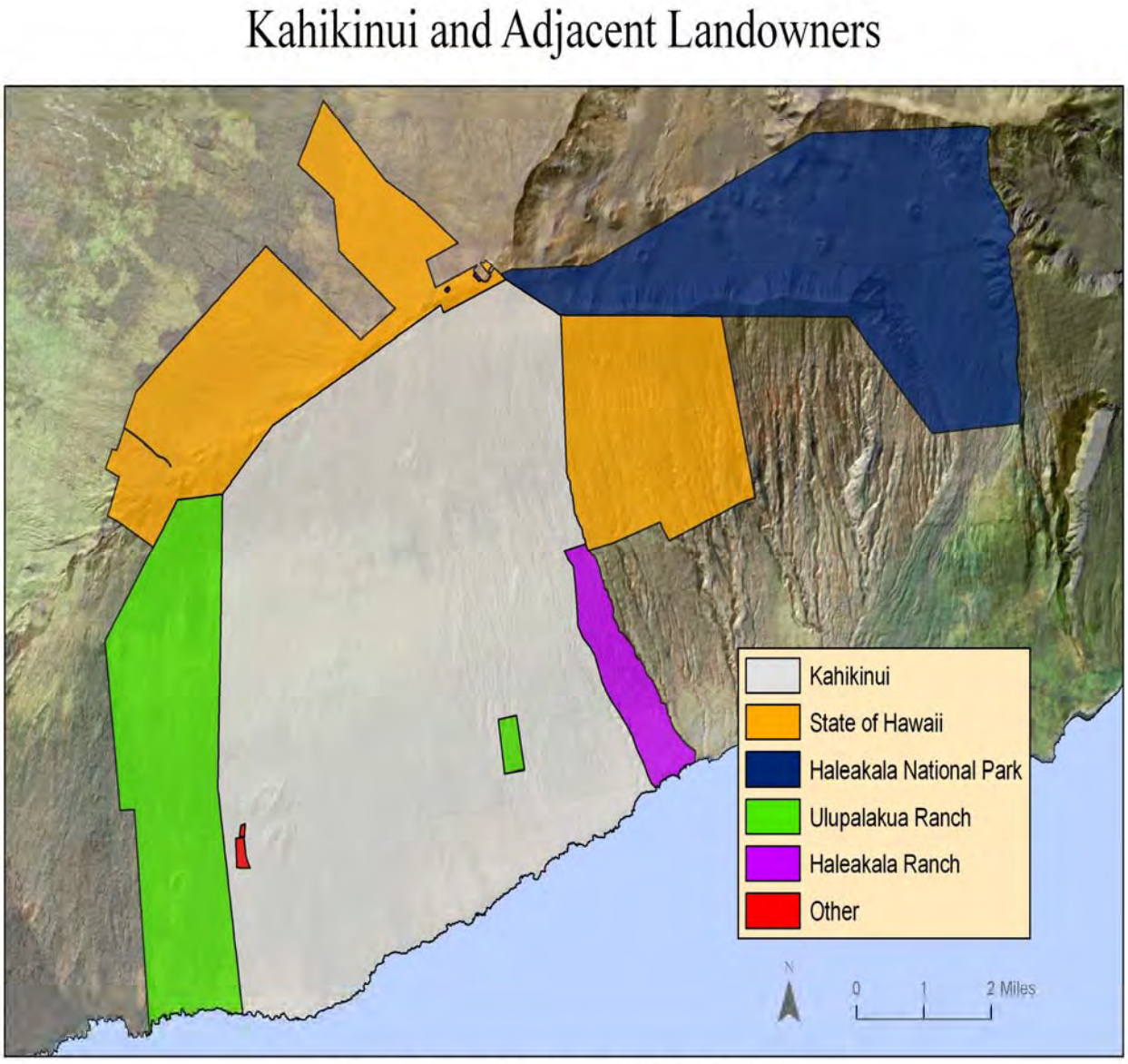
Left: side road within Kahikinui residential area. A portion of the main entrance road is paved and the side roads are unpaved. Right: main access road for the residents of Kahikinui. The road is so rugged it takes an hour to drive four miles from the house at the top of the residential area down to the highway. Rough road conditions have been an issue during past wildfire evacuations.

rough terrain. The road is so rugged that it takes an hour to travel four miles from the entrance of the community to the house at the highest elevation. The road is frequently washed out during periods of heavy rain making it difficult to travel. Residents periodically hold community workdays to cement pave the roughest sections of the road in spans of 50-100 feet long. There are four side roads stemming

from the main road, all of which are unmarked dirt roads. An unpaved single-lane Jeep trail runs westward and down along the west portion of the ahupua'a.

Upslope of the residential area, the forest tree line begins at the 5,000-foot elevation and continues up to the boundary of the ahupua'a at the 10,00-foot elevation. Adjacent landowners include Haleakala National Park, the State of Hawaii, Ulupalakua Ranch, and Haleakala Ranch. Figure 2 below illustrates landowner boundaries.

Figure 2: four major landowners neighbor Kahikinui Hawaiian Home Lands. Three kuleana parcels lie



Vegetation:

Kahikinui was once a vast expanse of dryland forest before being turned into grazing lands. Today, pockets remain of native Hawaiian koa and sandalwood trees. In fact, areas of Kahikinui are home to some of the best remnant dryland forest on island (Medeiros 1996). Efforts are underway by multiple

groups, such as Living Indigenous Forest Ecosystems (LIFE), to reforest sections of the ahupua'a during community workdays. Reforesting the land, especially at upper elevations, will enable trees to comb moisture from the clouds and bring much needed water to the area.

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Above: 'Oha wai, a tall tree with curved flowers, is one of the endangered plants located in Kahikinui. East Maui is one of only two places in the world where this plant is found. Photo credit: Clyde Imada for Hawaii's Biological Survey, Bishop Museum.

Kahikinui is also home to several endangered plants and animals, some of which are found nowhere else in the world. The southern slopes of Haleakala are the only place on Maui that 'Oha wai (*Clermontia lindseyana*) trees are found and one of two places in the world where it grows (the slopes of Mauna Kea on Hawaii Island being the other location). This tall tree relies on the native Hawaiian bird 'i'iwi for pollination.

The Blackburn's hawk moth (*Manduca blackburni*), which was once found on several Hawaiian Islands, is now found only on Maui in coastal and dry areas, including Kahikinui. The plants ko`oko`olau (*Bidens micrantha kalealaha*), asplenium-leaved diellia (*Diellia erecta),* the shrubs (*Neraudia sericea*) and Wawae`iole (*Phlegmariurus mannii*), and the Lanai sandalwood tree (*Santalum freycinetianum var. lanaiense*) are other endangered native Hawaiian plants found in Kahikinui.

Native vegetation in Kahikinui consists of open grasslands and pockets of dryland forest (see Figure 3). There are sizable expanses within Kahikinui covered in thick grasses or duff that dry out in the summer months. Invasive grasses and shrubs can be found throughout the ahupua'a (see Figure 4). Although the amount of gorse (*Ulex europaeus*) has increased in recent years, community members are taking a proactive stance to reduce it with periodic gorse removal projects. A known fire hazard (Amme 1983), gorse is an invasive shrub, dense in thickness that grows 3 to 10 feet in size.

Vegetation along the highway includes kiawe (*Prosopis pallida*) and a variety of grasses. Considered an invasive plant, kiawe grows as a moderately sized shrub and tree. Used as firewood, kiawe has a long burn time. Since there are no road shoulders, vegetation often grows right up to the road. Piilani Highway is the only road connecting the east end of Hana and the entire eastern slope of Haleakala with the rest of the island. Tourists often use this road to travel to Hana and are unfamiliar with wildfire risks to the region. It's possible for roadside fires to be started by catalytic converters and mufflers from cars and motorcycles.

With the exception of the highway corridor, the general public is not granted access to Kahikinui. Nor is camping allowed within the ahupua'a. Only hunting groups with licenses from DHHL are allowed access to hunt in the forest reserve. The nonprofit group Kahikinui Game Land Management Ohana (KGLMO) has a license to hunt in the forest reserve. KGLMO is more than a hunting club with many of its members performing hours of community service restoring trails in the community.

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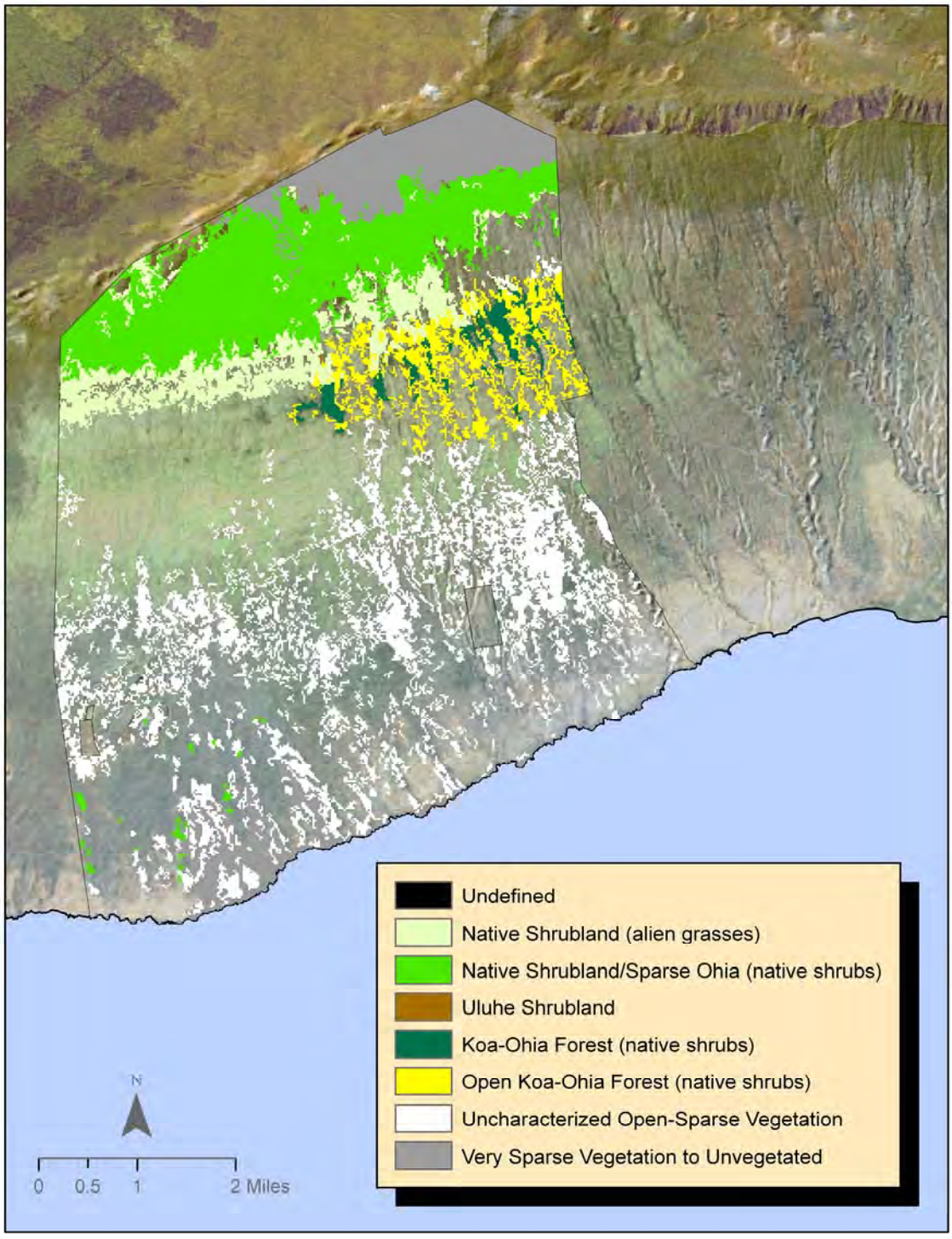
Kahikinui
Native Vegetation



Prepared for the Department of Hawaiian Home Lands by: C. Perry, February 2008
Data Sources: http://hawaii.gov/dbedt/gis/, http://hawaii.wr.usgs.gov/maui/data.html and http://hbmp.hawaii.edu/Public_data/HIGAP/

Figure 3: the dark green areas denote native ohia and koa forests while lime green areas represent native shrub land and alien grasses. Gold areas denote native shrubland with sparse ohia while grey areas depict very sparse vegetation.

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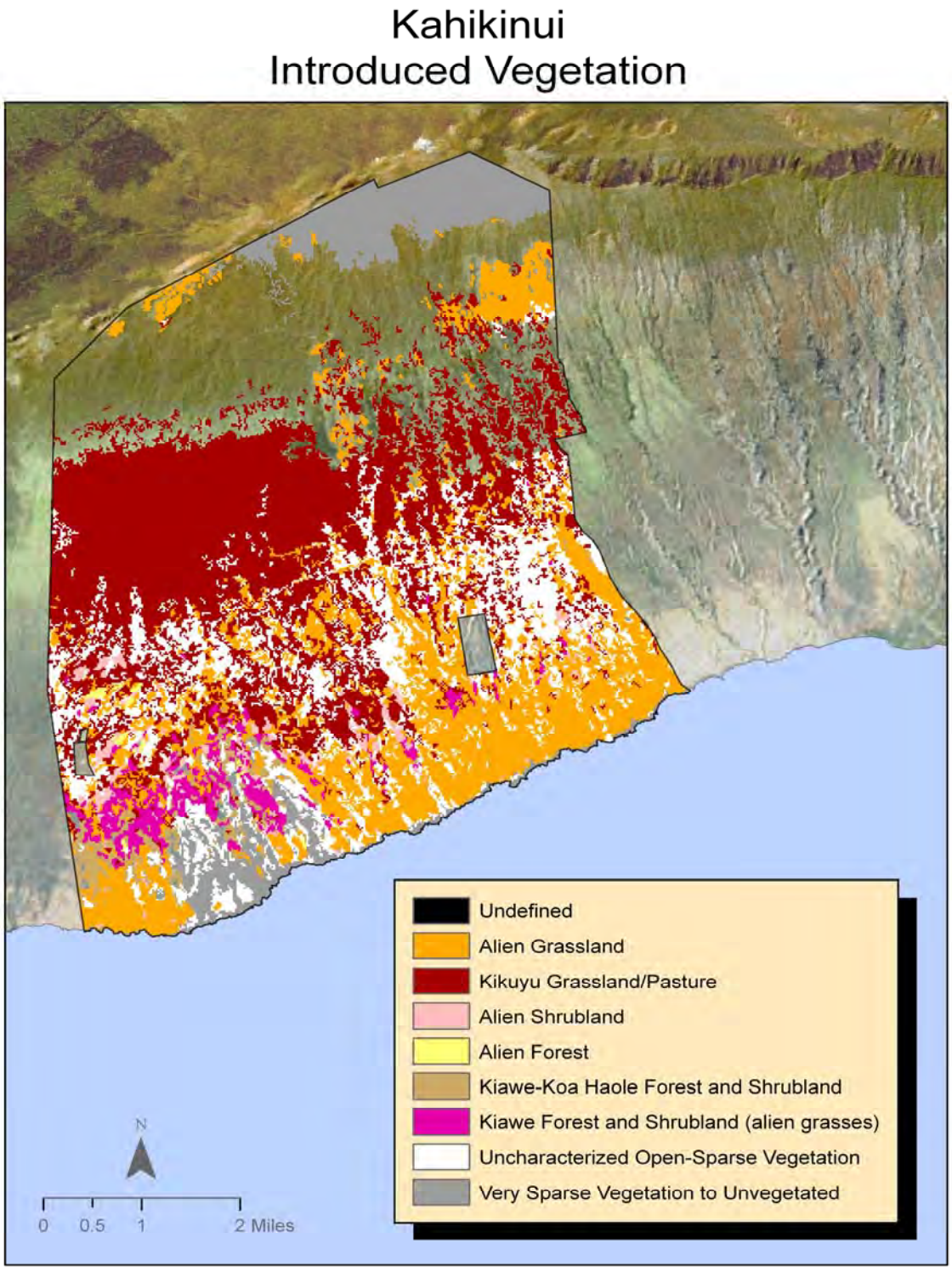

Figure 4: there are a variety of invasive grasses and shrubs found throughout Kahikinui. Red areas depict alien forests, while yellow depicts alien grasslands and orange highlights alien shrubs. White areas have uncharacterized sparse vegetation, while grey areas have little or no vegetation.

Archeology:

In addition to endangered plant life, there are thousands of archeological sites within the Kahikinui ahupua'a, including 26 heiau (sacred temples.) With its isolated and rugged location, Kahikinui is one of the few, if not the only place in Hawaii where the archeological landscape is still relatively untouched. Archeologists from around the country study Kahikinui for its rich archeological history. Remnants of dwellings and temples dating to the twelfth century have been documented in the ahupua'a and it is estimated there were roughly 8,000 Hawaiians living in the community in the 1700s.

The importance of this archeological treasure trove cannot be overstated. Nowhere else on Maui is an entire ahupua'a in relatively pristine archeological condition. While the community recognizes that preservation of life is foremost during wildfires, the use of dozers and other heavy equipment is a concern in fire suppression because many archeological sites are in close proximity to roadsides. Any future mitigation projects within the ahupua'a will need to keep archeological preservation in mind. Figure 5 shows just some of the recently documented archeological locations.

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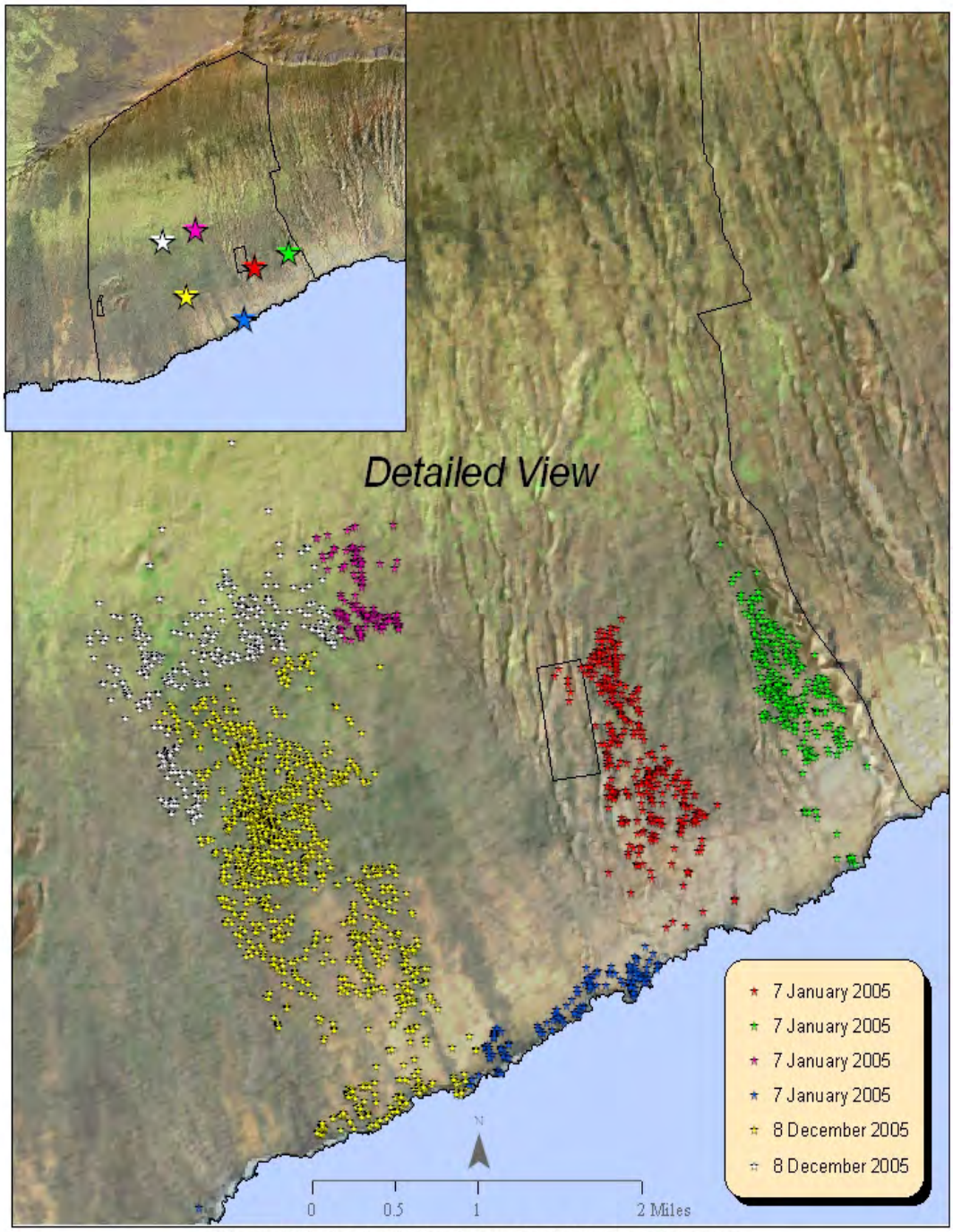
Archaeological Surveys



Prepared for The Department of Hawaiian Home Lands by: C. Perry, February 2008
Data Sources: Professor Patrick Kirch of the Oceanic Archaeology Laboratory, University of California, Berkeley; http://hawaii.gov/dbedt/gis/; and http://hawaii.wr.usgs.gov/maui/data.html

Fi(s. The inset map shows clusters of sites. For example: the red star signifies 359 sites in the Mehamenui portion; the yellow star represents 1,418 sites in Kipapa; the green star denotes 351 sites at Manawainui; the purple star denotes 146 sites at Nakeohu; the blue star represents 166 sites at Nakeohu; and the white star represents 419 sites at Kipapa.

Fire History:

Maui County Fire Department is responsible for fire suppression in the district. The nearest fire station is in Kula, 19 miles away (a nearly 45-minute drive) and houses two apparatus: a pumper with a 750-gallon tank capacity and a utility truck (Chevy Blazer). There are reported to be five reservoir ponds in Kahikinui (condition unknown) that have the potential to hold approximately one million gallons of water when full.

According to Maui County Fire Department data, between January 2000 and December 2006 17 wildfires in Kahikinui burned more than 7,500 acres. Of these blazes, 14 were of undetermined cause, 2 were caused negligently, and 1 was unintentional.

Given the area's arid conditions, rough terrain, and strong winds, wildfires in Kahikinui can grow rapidly. In September 2006 four separate roadside fires were reported at 11 p.m. on a Saturday night. The fires quickly spread and became one large fire. By Monday the wildfire had grown to 5,500 acres, requiring the suppression efforts of three helicopters and 60 firefighters. The blaze forced the closure of Piilani Highway between Ulupalakua and Oheo Gulch and came dangerously close to several homes.

A 2,500-acre fire in July 2003 burned for more than a month in inaccessible terrain and could only be suppressed with the use of helicopters.

In the 2006 fire, residents self-evacuated before police notified them they had to leave. Residents in the lower portion of Kahikinui were able to evacuate, but a resident in the upper portion of Kahikinui had to be evacuated by helicopter because flames had blocked the main entrance road as he tried to escape.

In terms of natural or man-made disasters, wildfires are the most frequent threat to Kahikinui. Given the rugged location, wildfires can spread quickly, burning thousands of acres and threatening area homes. In contrast, tsunamis would have little impact on the community since residents are upland, and while the region is susceptible to hurricanes and earthquakes, these events occur quite rarely. However, flash floods are an issue in the area as they wash out sections of the main road in the residential area.

Stakeholders:

Stakeholders are individuals or groups who have a high level of interest in the protection of their assets from wildfire. The residential portion of Kahikinui encompasses 1,340 acres and lies within a wildland urban interface zone. In addition to community members and fire response agencies, landowners that border Kahikinui, such as Haleakala National Park, Ulupalakua Ranch, Haleakala Ranch, and the State of Hawaii have an interest in reducing the wildfire risk in Kahikinui. Contact information for principal stakeholders is listed below.

Federal:

Haleakala National Park / Hawaii Volcanoes National Park
Joe Molhoek, Pacific Island Fire Management Officer
P.O. Box 52
HNP, HI 96718
(808) 985-6042
Joe_Molhoek@nps.gov

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State:

Department of Hawaiian Home Lands
Linda Chinn, Administrator, Land Management Division
P.O. Box 1879
Honolulu, HI 96805
(808) 620-9450

Department of Hawaiian Home Lands
Maui District Office
655 Kaumualii Street, Suite 1
Wailuku, HI 96793
(808) 760-5120

Department of Land and Natural Resources: Division of Forestry and Wildlife
Wayne Ching, State Protection Forester
1151 Punchbowl Street, Room 325
Honolulu, HI 96813
(808) 587-4173
Wayne.F.Ching@hawaii.gov

County:

Maui County Department of Fire and Public Safety
Fire Chief Jeff Murray
200 Dairy Road
Kahului, HI 96732
(808) 270-7561
Jeff.Murray@co.maui.hi.us

Maui County Civil Defense Agency
Gen Iinuma, M.P.H., Administrator
200 High Street, 1st Floor
Wailuku, HI 96793
(808) 270-7285
gen.iinuma@co.maui.hi.us

Community:

Ka 'Ohana O Kahikinui (KOOK)
'Aimoku Pali Sr., KOOK Board President
P.O. Box 1132
Kula, HI 96790
(808) 760-3028

Additional Stakeholders:

Haleakala Ranch

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Greg Friel
529 Kealaloa Avenue
Makawao, HI 96768
(808) 572-1500

Kahikinui Game Land Management Ohana (**KGLMO)**
Kawika Davidson, KGLMO President
685 Akaku Street
Wailuku, HI 96793
(808) 269-0699

Leeward Haleakala Watershed Restoration Partnership
Art Medeiros, Ph.D., Coordinator
P.O. Box 652
Makawao, HI 96768
auwahi@yahoo.com

Living Indigenous Forest Ecosystems (**LIFE)**
Walter Kanamu
President
27 Ho'ehaili Way
Wailuku, HI 96793
(808) 760-8224

Sandwich Isles Communications Inc.
Rodney Kaulupali, General Manager
1001 Bishop Street, Pauahi Tower, 27th floor
Honolulu, HI 96813
(808) 524-8400

Ulupalakua Ranch
Sumner Erdman
HC 1 Box 901
Kula, HI 96790
(808) 878-1202

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Base Map of Kahikinui:

The areas containing critical human infrastructure i.e. houses, are in the residential area of the ahupua'a. Areas of community importance include: The Kahikinui House, Hale Pili, Hale Malama, Sandwich Isles Communications Center, various archeological sites, and native forests. Figure 6 depicts the boundary of the community.

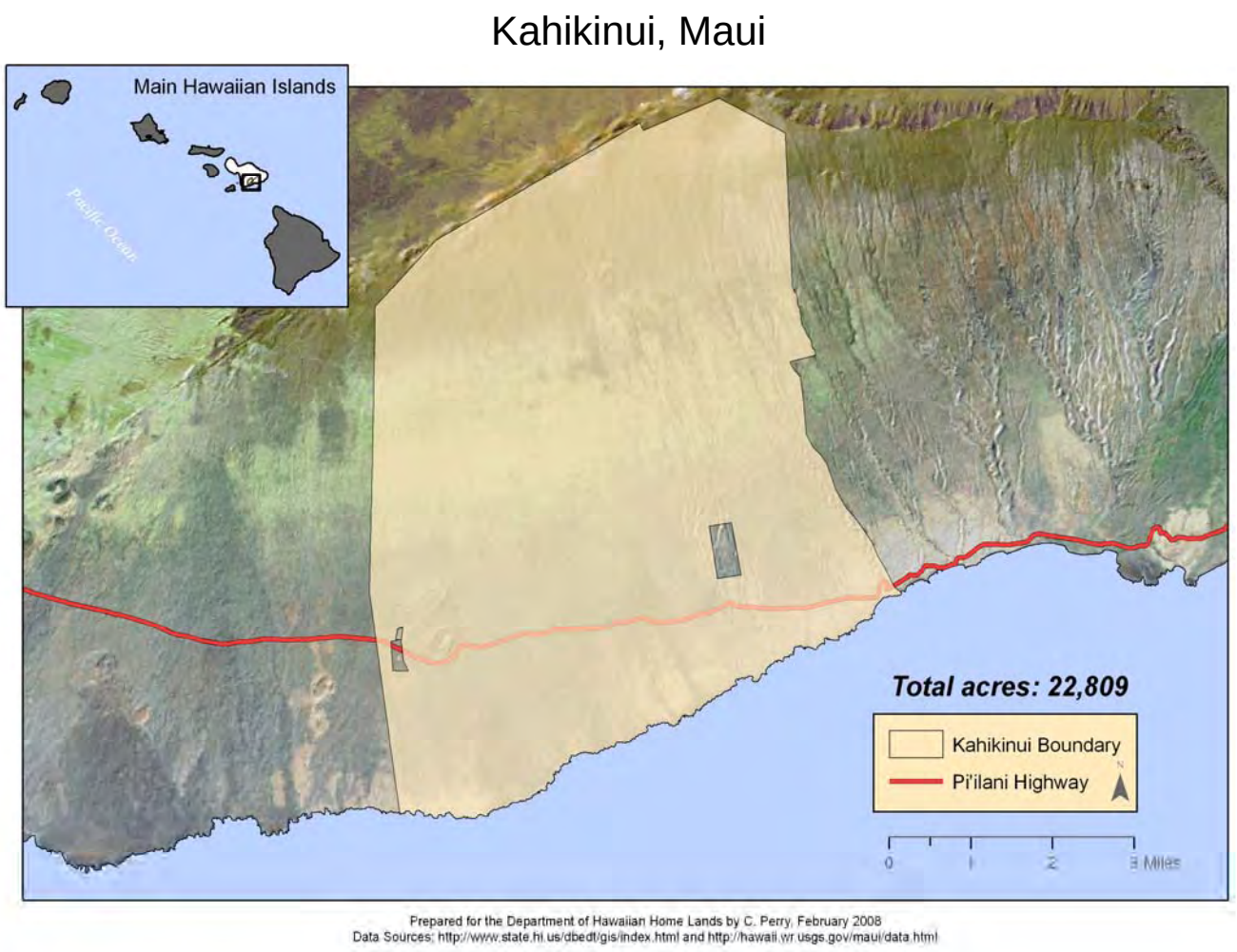

Figure 6: area of consideration for the Kahikinui CWPP.

Fire Risk Assessment for Kahikinui:

The Kahikinui community encompasses an entire ahupua'a from sea level to an elevation of 10,000 feet. There are no commercial districts within the community. The residential area of Kahikinui is composed of 104 houses lots spread out across approximately 1,340 acres ranging from the 1,200- to 4,200-foot elevation on the mauka side of the highway. Lots vary between 10 and 17 acres. Of the 104 house lots, 75 leases have been awarded and 9 families live in Kahikinui. There are 25 structures within the residential village, including the Sandwich Isles Communications Center (a windowless structure serving as an equipment substation) and an outdoor pavilion made of stone pillars and a metal roof that serves as the community center.

The Hale Pili, a three-walled meeting area with a metal roof on the makai side of the highway; Hale Malama, a structure for community use; and the historic Kahikinui House round out the additional structures in the CWPP project area. There are no schools, commercial businesses, industrial facilities,

gas stations, or other facilities within the area. St. Ynez church, abandoned in the 1860s, is not in use today.

Structures within the Kahikinui residential village are composed of post and pier or concrete slab construction. While some houses have non-combustible siding, the majority of houses have

Left and right: houses within the residential area of Kahikinui. Some are post and pier construction while others are built on a concrete slab. The majority of homes have at least 30 feet of defensible space around the house.

noncombustible roofing and combustible (wood) siding. Since the entire ahupua'a is on the side of a volcanic mountain, the residential village is by definition on a slope with hilly areas and gulches throughout the ahupua'a. Rugged hills and steep ravines are a concern because they can channel fire within the community. Some structures are within 30 feet of steep slope, and while slope in some areas can be as steep as 20-30%, most houses are built on a flat area within the lot. The majority of the homes have at least 30 feet of defensible space, although some structures have vegetation growing within 30 feet of the structure.

Lot numbers are visible on the front gates of driveways making them easily identifiable in case of an emergency. Driveways for house lots average more than 300 feet long and driveway entrances tend to be paved with cement for only the first 20-50 feet. Some house lots have locked metal gates at the driveway entrances. Locked gates have the potential to hinder first responders from accessing the property in times of emergencies. However most emergency vehicles would be unable to enter individual house lots, as the main road is only accessible by four-wheel drive vehicles.

There are vast open grasslands as far as the eye can see in Kahikinui that harken from the days when the land was used for ranching. Wild cattle, goats, and pigs can be found in the forested area of the ahupua'a above the house lots and are actively managed by licensed groups, such as KGLMO. There is no organized grazing within the residential area although grazing occurs outside the residential area. Neighboring Ulupalakua and Haleakala Ranches conduct grazing to the east and west of the ahupua'a respectively.

Rolling hillsides spread as far as the eye can see in Kahikinui. The open lands are filled with native and invasive shrubs and grasses.

There is no county water system and therefore no fire hydrant system in Kahikinui. Residents rely on catchment water and haul their own water for drinking and household purposes. Residents can usually only haul about 200 gallons of water at a time given the rough terrain and weight of the water. Five inactive reservoirs are within the ahupua'a and have the potential to be improved and

used for fire suppression purposes. There are also no energy utilities in the community, with residents relying on generators and solar power for electricity.

Given its dry and isolated location, there is a great deal of wildland urban interface in Kahikinui. The area receives an average of 15 inches of rainfall annually and is buffeted by strong winds that shear around Haleakala. Vegetation includes koa and sandalwood trees found in the upper forest, as well as iliahi and wilwili trees. There is an abundance of native and invasive shrubs and grasses in the area, including scrub kiawe, kikuyu grass, lantana, and gorse. Homes throughout the Kahikinui residential area contain mature vegetation, including trees, shrubs, and plants. Some homesteaders have planted dozens of native koa trees around their property.

A Hawaii Wildland Fire Risk and Hazard Severity Assessment based on the Assessment in Appendix A of NFPA 1144, *Standard for Protection of Life and Property from Wildland Fire*, was conducted by the Hawaii Firewise Coordinator and the past president of KOOK on November 27, 2007 to identify the level of wildland fire risk of Kahikinui. The Firewise Coordinator and Maui Fire Department personnel also conducted a wildfire hazard assessment in July 2003.

Maui Fire Department personnel from Kula station and a Kahikinui resident survey the land during a wildfire hazard assessment in July 2003.

Using a pre-established point system, the Wildland Fire Risk and Hazard Severity Assessment is a tool used to determine the level of wildfire risk to a home or community. Points are assigned regarding overall terrain and location, road width, local fire history, prevailing winds and seasonal weather, geographical contours, native vegetation, water availability, location of fire suppression resources, as well as the combustibility of building materials, including roof, siding, and attached items, such as decks, fencing, or an additional unit. The combined points in all these categories are added together and the overall risk is determined by whether the score falls in the low-, medium-, high-, or extreme-risk point range. Given the rugged terrain, strong winds, lack of water, difficulty in traversing egress routes, and preponderance of high-intensity burning vegetative fuels in close proximity to structures, Kahikinui scored in the high-risk range of the Wildland Fire Risk and Hazard Severity Assessment, a copy of which can be found in Appendix A.

This Plan focuses on structures within the wildland urban interface in Kahikinui. Overgrown vegetation, structures with combustible building materials, and limited ingress into the community all contribute to unsafe fire conditions.

Community Assets at Risk:

Assets at risk are valued resources that can be damaged or destroyed by wildfire. In addition to ensuring firefighter safety and protecting residents and visitors, the following assets warrant consideration in pre-incident planning: watersheds; forest reserves; wildlife; rare and endangered plants and animals; scenic, cultural, and archeological sites; and structures.

The following were identified as valued resources within the Kahikinui community that would be adversely affected by wildfire.

Commercial resources:

- Sandwich Isles Communications Center

Historical resources:

- The Kahikinui House and the ruins of St. Ynez church are historical resources. The State of Hawaii classifies buildings over 50 years old as historical structures in accordance with National Park Service Administrative Rule Chapter 6E.

Natural resources:

- Kahikinui is home to thousands of archeological sites, including 26 documented heiau.

- Native Hawaiian endangered animals found in Kahikinui include the Blackburn's hawk moth (*Manduca blackburni*), which is found only on Maui in coastal and dry areas. Native Hawaiian owls are known to have nesting spots in upper elevations of the ahupua'a.

- Endangered native plants found in the ahupua'a include ko`oko`olau (*Bidens micrantha kalealaha*), mint (*Phyllostegia mollis*), asplenium-leaved diellia (*Diellia erecta*), shrubs such as Wawae`iole (*Phlegmariurus mannii*), and the Lanai sandalwood tree (*Santalum freycinetianum var. lanaiense*). Kahikinui is one of two places in the world where the tree 'Oha wai (*Clermontia lindseyana*) can be found.

- Remnant forests of sandalwood, koa, and iliahi trees are considered by the community to be both an economic and natural resource. Members of the Leeward Haleakala Watershed Restoration Partnership are working on mapping the GPS coordinates of these natural resources. While the location of such natural resources may be known to residents and Ulupalakua Ranch employees, (and therefore known to need protection during a wildfire), responding Maui County firefighters may not know the locations of these important resources.

Economic resources

- Cattle: both wild and those grazed by neighboring ranches, when managed properly, can be considered an economic resource.

The mix of flammable vegetation, including kiawe trees is a concern since firebrands, consisting of burning embers and small burning matter, can travel up to a mile when strong winds are present. Kiawe trees are known carriers of firebrands. The grasses found within Kahikinui are high-intensity fuels, which burn quickly and can rapidly spread fire to other fuels, such as kiawe. The high-fire hazard in this area is demonstrated by a history of large wildfires in the region. Open lands filled with a mixture of flammable grasses and kiawe trees encompass Kahikinui. While most homes have fire resistant roofing, a number of homes in the Kahikinui residential village have wood siding and lanais (decks), further enhancing the fire problem.

Previous mitigation efforts undertaken in Kahikinui

Kahikinui residents and KOOK members are well aware of the wildfire risk to their community and in recent years have been taking steps to reduce that risk.

September 2008

In August 2003 the community held a multi-agency meeting to explore the idea of developing a fire plan for the community. Meeting attendees included representatives from the Maui County Fire Department, Hawaii State Division of Forestry and Wildlife (DOFAW), Department of Hawaiian Home Lands, Ulupalakua Ranch, and Haleakala National Park.

Firewise presentations were made to the KOOK Board of Directors, as well as the general community in the Fall 2003. A Firewise workshop was held for Kahikinui residents in December 2003. Seven residents attended, as well as personnel from Maui County Fire Department and DOFAW.

In April 2004 a community workday was held during which fuel load reduction (brush clearing) occurred along the main road, as well as along cement areas of interior roads within the community. During the same event a buffer zone of defensible space was created around Hale Pili on Piilani Highway. Eighteen lessees participated in this workday.

KOOK members have been in discussions with the County of Maui Department of Public Works Highways base yard to assist in roadside brush cutting, particularly between mile markers 22 and 26.

The Maui DOFAW office donated two three-foot by four-foot reflectorized Smokey Bear signs to KOOK to increase awareness of the wildfire hazard in the community, particularly to tourists driving through the area. One of these signs is posted at the 21 mile marker and the other is posted at the main entrance to the Kahikinui residential village.

In the past, KOOK members have applied for DHHL grant funding to create an emergency contingency fund for helicopter support from private helicopter companies in the event of a wildfire. Given Kahikinui's remote location and topography, as well as the size of recent wildfires, it is strongly recommended that such a contingency fund be established. Helicopters provide crucial initial response to wildfires in isolated areas and their use in tactical operations can prevent small fires from becoming large dangerous conflagrations. Should KOOK get the funding for such a fund, the Maui County Fire Department and the selected helicopter company would need to establish a Memorandum of Agreement (MOA) with the understanding that this contingency fund would only be used for fire suppression in Kahikinui.

Community Concerns for Kahikinui:

DHHL commissioned the CWPP because the agency is concerned about wildfire negatively impacting the community. Wildfires can potentially be caused by human error along the highway, i.e. tossed cigarettes, errant fireworks, and catalytic converters of cars parked in dry grasses. Wildfires can damage structures, as well as negatively impact the watershed, degrade native forests and wildlife habitat, and destroy cultural and historic areas. Multiple meetings with community members and fire

agencies specifically on this CWPP held in November and December 2007 identified the most pressing wildfire concerns in Kahikinui. These include in order of priority:

1. Need to improve main access road within community, as well as improve the Jeep trail for use as a secondary emergency egress and fire break road.
2. Need for a buffer zone around the residential village.
3. Need of additional water resources for fire suppression.
4. Need for dedicated landing zones for helicopters for fire suppression purposes.
5. Need to save dryland forests.
6. Need for buffer zones along Piilani Highway, cutting grass back 10-20 feet from roadsides.
7. Need for continuing public education: remind residents to create and maintain 30-100 feet of defensible space around their home.
8. Identify evacuation routes.
9. Need for campfire protection measures.
10. Need for development of a Community Emergency Operation Plan.

10a. Need for a Community Evacuation Plan.

11. Residents want to become better prepared to deal with emergencies.

11a. Need for better communications among residents during emergencies, i.e. use of ham radios.

12. Need for equipment/machinery to use in fuel mitigation projects, such as a chipper; a truck to haul the chipper to Kahikinui; a tractor mower (one of the lessees has volunteered use of his tractor); and a low boy to haul tractor from Wailuku to Kahikinui.

Recommended Action for Kahikinui:

Multiple meetings with community members and fire agencies specifically on the CWPP process in November 2007 identified the most pressing fire concerns in Kahikinui. These include in order of priority:

1. Improvement of, i.e. paving, main entrance road in residential village. Improvement of Jeep access trail as a secondary means of emergency egress.
2. Creation and maintenance of a buffer zone / fuel break around entire 1,340-acre residential settlement.

A fuel break of such size would require tremendous man-hours and maintenance. It is therefore recommended that KOOK consider partnering with a neighboring ranch to graze a buffer zone around the residential settlement.

2a. Creation and maintenance of a fuel break along fence line being installed by Art Medeiros of the Leeward Haleakala Watershed Restoration Partnership.

3. Increase utilization of current reservoirs and/or installation of dip tanks. These water resources could be fed by seasonal rains from nearby gulches and/or runoff from the Communications Center.

3a. Developing wells or damming narrow gulches are other possibly means of increasing water reservoir resources.

3b. Installation of a fog catcher to catch water in the upper forest area.

4. Creation of dedicated landing zones for helicopters for fire suppression purposes.

4a. Creation of a contingency fund to hire private government-certified helicopters during wildfires.

5. To save dryland forests during wildfires, KOOK members are encouraged to meet with Maui County Fire Department officials for pre-incident planning meetings to make fire officials aware of sensitive ecological areas.

6. Work with Maui County Department of Public Works to ensure Piilani Highway roadsides are mowed, particularly in the dry summer months. (Maui County Fire Department Chief said he would contact DPW and make this request.) When KOOK members conduct community workdays clearing roadside brush, it should be cleared a minimum of 10-20 feet.

7. Reduction of fuel load around individual properties. Increase awareness among homesteaders of the need to create defensible space with Firewise tips in community newsletter. Hold a fire prevention awareness event at least once a year.

8. Install metal reflectorized signs showing evacuation routes within the residential village.

9. Increase awareness among hunters of risk of wildfires from guns and/or campfires through informational sessions and outreach with KGLMO members.

10. Develop a Community Emergency Operation Plan. This would include identifying points of contact for ham radio operators, as well as learning how to use ham radios and the purchase of the equipment. [KOOK members may wish to contact the Ocean View Disaster Preparedness Committee in Hawaiian Ocean View Estates (HOVE) on the Island of Hawaii who instituted a similar plan utilizing block captains and ham radio operators for their community.]

11. Community Emergency Response Training (CERT) is recommended for KOOK members.

11a. Build a fire tower lookout on Lot #75. Such a fire tower would require staffing by a predetermined agency or group and the securing of funding for such staff.

12. KOOK may want to look into the feasibility of using grant funding to rent a chipper and tractor mower during periodic community workdays.

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Based on the results of the community wildfire hazard risk assessment, priority ratings have been selected for Kahikinui. The community recommendations for the type and method of treatment for the surrounding vegetation are listed in the following table.

Community at risk	Type of Treatment	Method of Treatment	Overall Priority
Kahikinui	**Mechanical**	Improvement of main access road. Improvement of Jeep trail as a secondary emergency egress.	Very High
	Mechanical / Grazing	Buffer zone around residential village.	Very High
	Mechanical	Need for additional water resources.	Very High
	Mechanical	Creation of dedicated helicopter landing zones.	High
	Hand Labor	Save dryland forest.	High
	Mechanical / Chemical / Hand Labor	Creation/maintenance buffer zone along Piilani Highway.	High
	Hand Labor / Chemical	Creation of defensible space around community homes.	High
	Education	Identify evacuation routes with signage.	Medium
	Public Education and Outreach	Need for campfire protection measures.	Medium
	Public Education and Outreach	Develop a Community Emergency Operation Plan.	Medium
	Public Education and Outreach	Community CERT training.	Medium
	Mechanical	Need for equipment/machinery to use in fuel mitigation projects.	Medium

Community, federal agencies, and private landowners surrounding Kahikinui were invited to submit projects that provide protection and reduce wildland fire risk. The following table displays a list of projects based on recommendations from community and fire-related organizations.

Community, structure or area at risk	Project	Agency	Funding Needs	Timetable	Community Recommendation
Kahikinui	Improvement of main access road. Improvement of Jeep trail as a secondary emergency egress.	**DHHL/ Others**	**Cooperative & Grant Funding** **Estimated cost: $4 million** DHHL intends to budget $100,000 annually for Kahikinui road improvement. Total estimated cost of road improvement is $4 million.	2008-2011	Yes
	Grazing of buffer zone around residential village.	**KOOK / neighbor ranches**	**Cooperative Funding** **Estimated cost: _____)** NRCS can do cost	2008-2010	Yes

			sharing of creating fuel breaks. (Contact Neil Fujiharata, NRCS)		
	Need for improving current reservoirs and installing additional water resources.	**Multiple agencies**	**Cooperative & Grant Funding** **Estimated cost: $20,000 per dip tank**	2008-2010	Yes
	Creation of dedicated helicopter landing zones.	**DHHL / KOOK / Private**	**Cooperative & Grant Funding** **Estimated cost: $**	2008-2010	Yes
	Creation of buffer zone along Piilani Highway	**Maui County / KOOK**	**County / Grant Funding** **Estimated cost: $**	2008-2010	Yes
	Creation of defensible space around community homes	**KOOK**	**Individual** **Estimated cost: $ minimal**	2008-2010	Yes
	Identify and clearly mark evacuation routes with metal reflectorized signage.	**DHHL / KOOK**	**Cooperative & Grant Funding** **Estimated cost: $**	2008-2010	Yes
	Need for campfire protection measures.	**KOOK / KGLMO**	**Estimated cost: $**	2008-2010	Yes
	Develop a Community Emergency Operation Plan. Purchase ham radios; build and staff fire tower.	**DHHL / KOOK / private**	**Grant Funding** **Estimated cost of radios: $** **Estimated cost of building fire tower: $**	2008-2010	Yes
	Community CERT training.		**Free to community members**	2008-2010	Yes
	Need for equipment/ machinery to use in fuel mitigation projects.	**KOOK / private**	**Grant Funding** **Estimated cost: $**	2008-2010	Yes

Reduce Structural Ignitability:

As part of its fire prevention education efforts, Firewise provides recommendations to reduce structural ignitability. Individuals and the Kahikinui community can reduce structural ignitability throughout the community by taking the following measures.

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• Create a buffer zone of defensible space around a property of at least 30 to 100 feet. Remove flammable vegetation and combustible growth within 30 feet of the house.

• Prune tree limbs 6 – 10 feet above the ground.

• Space trees and shrubs ten feet apart in the yard.

• Make sure that plants closest to the house are low-lying. And whenever possible use native Hawaiian or succulent plants.

• Routinely remove dead leaves and other organic matter from the yard.

• Sweep and/or clean gutters, eaves, and roofs regularly to prevent the build-up of leaves and other matter.

• Use fire-resistant building materials for the roof, siding, and decks, such as metal, stucco, tile, brick, and cement.

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Appendix A:

Please see below the Hawaii Wildland Fire Risk and Hazard Severity Assessment Form conducted for Kahikinui, Hawaii.

Hawaii Firewise Wildland Fire Risk & Hazard Severity Assessment Form

Assign a value to the most appropriate element in each category and add the point totals. This assessment was adapted from Appendix A of NFPA 1144, Standard for Protection of Life and Property from Wildland Fire. When assessing a home or community, look at the overall terrain and site location, local area fire history, prevailing winds and seasonal weather (keep Kona wind conditions in mind), property contours, native vegetation, irrigation requirements, as well as the combustibility of roof, siding, and attached items, such as lanai, fencing, or an ohana unit.

Area Assessed: Kahikinui, Maui Hawaii
Assessment Conducted by: Denise Laitinen, Firewise Coordinator 11/27/07

Element A. Means of Access	Possible Points	Points Given	NOTES
1. Ingress and egress			
a. Two or more roads in/out	0		
b. One road in/out	7	7	
2. Road width			
a. Greater than 24 ft.	0		
b. Greater than 20 ft. but less than 24 ft.	2		
c. Less than 20 ft.	4	4	
3. Road condition			
a. Surfaced road, grade less than 5%	0		
b. Surfaced road, grade greater than 5%	2		
c. Non-surfaced road, grade less than 5%	2		
d. Non-surfaced road, grade greater than 5%	5	5	
4. Fire service access to community or home			
a. Driveway is less than 300 ft. with turnaround space for fire trucks	0		
b. Greater than 300 ft. with turnaround	2	2	
c. Less than 300 ft. with no turnaround	4		
d. Greater than 300 ft. with no turnaround	5		
5. Driveway is at least 12 ft. wide with 15-foot vertical clearance	0	0	
a. Driveway is ‹12 ft. wide with ‹15-ft. clearance	3		
6. Street signs			
a. Present (4 inches in size and reflectorized)	0		
b. Not present	5	5	
B. Vegetation			
1. Type of vegetation within 100 ft. of structure or to property line, whichever is closer			
a. Light: grasses less than 12 inches high	5		
b. Medium: light brush and small trees; guinea and fountain grass (high intensity fuel)	10	10	
c. Heavy: dense brush, timber, hardwoods	20		
d. Slash: timber harvesting or landscape residue, compost piles, etc	25		
2. Defensible space around the home/community			
Fuelbreaks			
a. Trees are spaced 10 ft. apart, low flammability plants are low lying and	0		

carefully spaced. Ladder fuels have been removed.			
b. Fuel breaks exist: i.e. driveways, pools, gravel walkways, lawns within 30 ft. of structure	0	0	varies
c. Area around structure has no fuel breaks	3		
Fuel Treatment (has homeowner created defensible space?)			
a. Vegetation 100 ft.+ from structure or to property line	1		
b. Vegetation 71-100 ft. from structure	3		
c. Vegetation 30-70 ft. from structure	5		
d. Vegetation 0-30 ft. from structure	7	7	varies
e. Vegetation has not been maintained	10		
C. Topography within 300 feet of structure			
1. Slope 0-9%	1		
2. Slope 10%-20%	4		
3. Slope 21%-30%	7	7	varies
4. Slope 31%-40%	8		
5. Slope greater than 41%	10		
D. Additional rating factors that may apply (highest total points = 20)			
1. Area has history of fire occurrence (arson, ag burning)	0-5	4	
2. Area subject to strong dry, winds	0-5	5	
3. Separation of adjacent structures that may contribute to fire spread (i.e. ohana unit within 30 ft.)	0-5	0	
4. Topographic features that adversely affect wildland fire behavior	0-5	4	
E. Roofing Assembly			
1. Class A roof (asphalt shingle, clay tile, metal)	0	0	
2. Class B roof (treated wood shake)	3		
3. Class C roof (wood shake)	15		
4. Nonrated or Debris on roof (leaves, needles, etc.)	25		
F. Building construction			
1. Materials (predominate)			
a. Fire-resistive siding, eaves, & lanai and/or fencing (stucco, masonry, stone)	0		
b. Fire resistive siding; combustible lanai and/or fencing	5		
c. Combustible siding, lanai and/or fencing	10	10	
2. Windows, skylights			
a. Window panes are small in size, double paned or tempered glass	0		
b. Windows are single pane, and/or large in size	3	3	
c. Skylights: tempered glass with metal framing	0		
d. Skylights: plastic with vinyl framing	2		
3. Building setback relative to 30% slope			
a. Structure is more than 30 ft. away from slope	1	1	
b. Structure is less than 30 ft. from slope	5		
4. Eaves, soffits, exposed openings into structure			
a. Wire mesh no bigger than 1/8" on vents, chimneys, exposed areas under house	0		
b. Vents, chimneys, and/or space under house is large enough for embers to enter	3	3	

G. Available Fire Protection			
1. Water Source Available			
a. Pressurized water source availability			
Hydrants (500 gpm) are ‹1,000 feet apart	0		
Hydrants (250 gpm) are 1,000 ft. apart	1		
b. Non-pressurized water source availability (catchment)			
More than 250 gpm continuous for 2 hours	3		
Less than 250 gpm continuous for 2 hours	5		
c. Water unavailable	10	10	
3. Organized Response Resources			
a. Fire station is 5 or less miles from structure	1		
b. Fire station is more than 5 miles from structure	3	3	
H. Placement of Gas and Electric Utilities			
1. Both utilities are underground	0		
2. One utility is underground, one aboveground	3	3	Phone underground
3. Both are above ground	5		

Total points: **93**

Totals for Home or Subdivision: (total for all above points)

Hazard Assessment:		**Total Points:**	
1. Low Hazard	**0-37**	**3. High Hazard**	**68-110**
2. Moderate Hazard	**38-67**	**4. Extreme Hazard**	**111+**

Appendix B: Project List 2010-2012

Agencies and private landowners surrounding Kahikinui were invited to submit projects that provide wildfire protection and reduce risk. The following table displays a list of recommended projects.

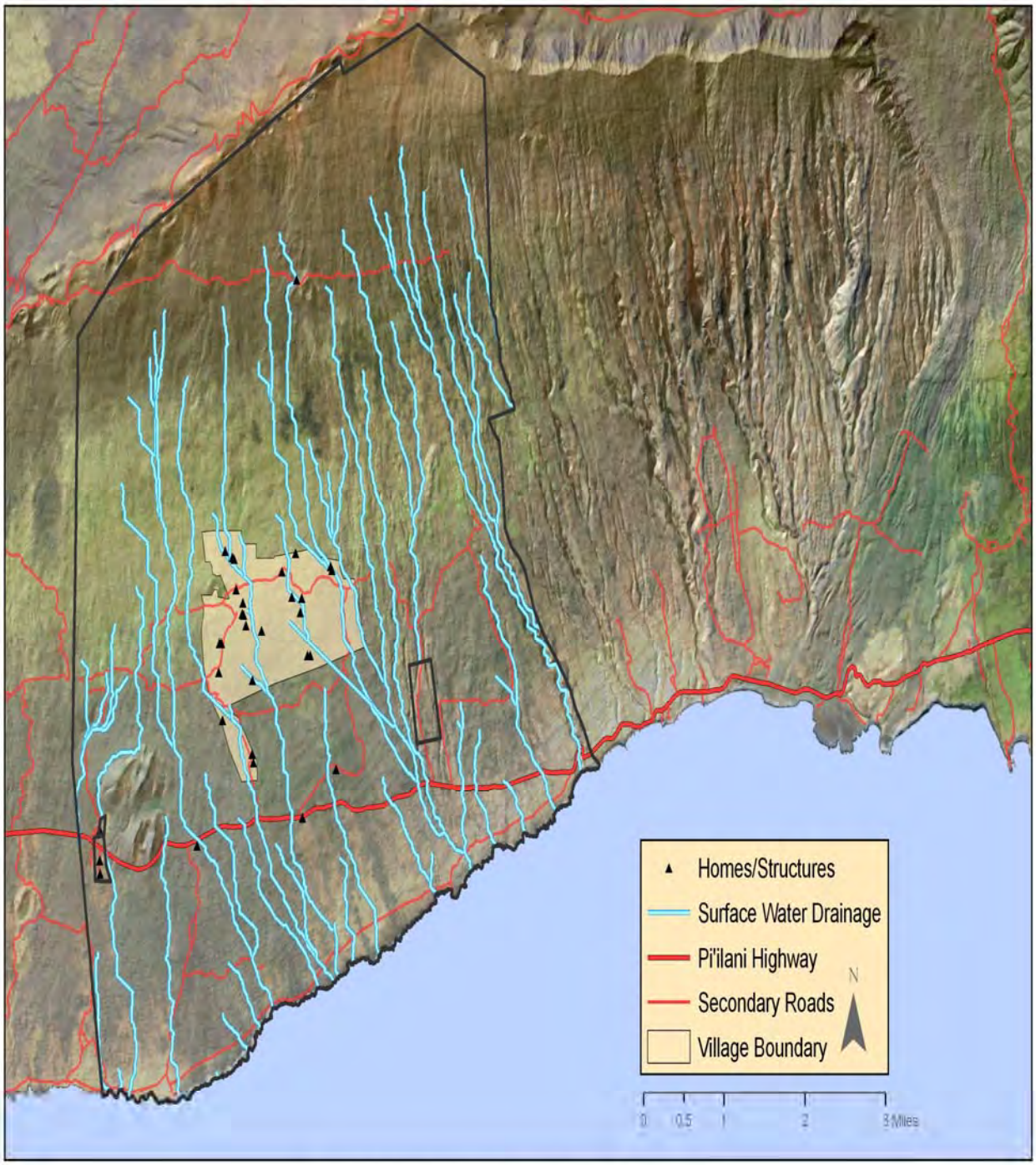
Community or area at risk	Project	Agency	Funding Needs	Timetable	Community Recommendation?
Kahikinui	Improvement of main access road. Improvement of Jeep trail as a secondary emergency egress.	**Others**	**Cooperative & Grant Funding Estimated cost: $4 million** DHHL intends to budget $100,000 annually for Kahikinui road improvement. Total estimated cost of road improvement is $4 million.	2008-2011+	Yes
	Maintenance grazing	**DHHL /**	**Cooperative Funding**	2010-	Yes

	of buffer zone around residential village.	**KOOK / neighbor ranches**	**Estimated cost: _____)** NRCS can do cost sharing of creating fuel breaks. (Contact Neil Fujiharata, NRCS)	2012+	
	Need for additional water resources. Maintenance of water sources.	**Multiple agencies**	**Cooperative & Grant Funding Estimated cost: $20,000 per dip tank**	2010-2012+	Yes
	Maintenance of dedicated helicopter landing zones.	**KOOK / Private**	**Cooperative & Grant Funding Estimated cost: $**	2010-2012+	Yes
	Maintenance of buffer zone along Piilani Highway.	**Maui County / KOOK**	**County / Grant Funding Estimated cost: $**	2010-2012+	Yes
	Maintenance of defensible space around homes.	**KOOK**	**Estimated cost: $**	2010-2012+	Yes
	Campfire safety awareness program.	**KOOK / KGLMO**	**Estimated cost: $**	2010-2012+	Yes
	Maintenance of Community Emergency Operation Plan. Maintenance of ham radios, fire tower.	**KOOK / private**	**Grant Funding** **Estimated cost of radios: $ Estimated cost of fire tower: $**	2010-2012+	Yes
	Refresher of Community CERT training.		**Free to community members**	2010-2012	Yes
	Maintenance of equipment/ machinery for fuel mitigation projects.	**KOOK / private**	**Grant Funding** **Estimated cost: $**	2010-2012	Yes

Appendix C: Kahikinui Surface Water Drainage & Watershed Boundaries Maps

September 2008

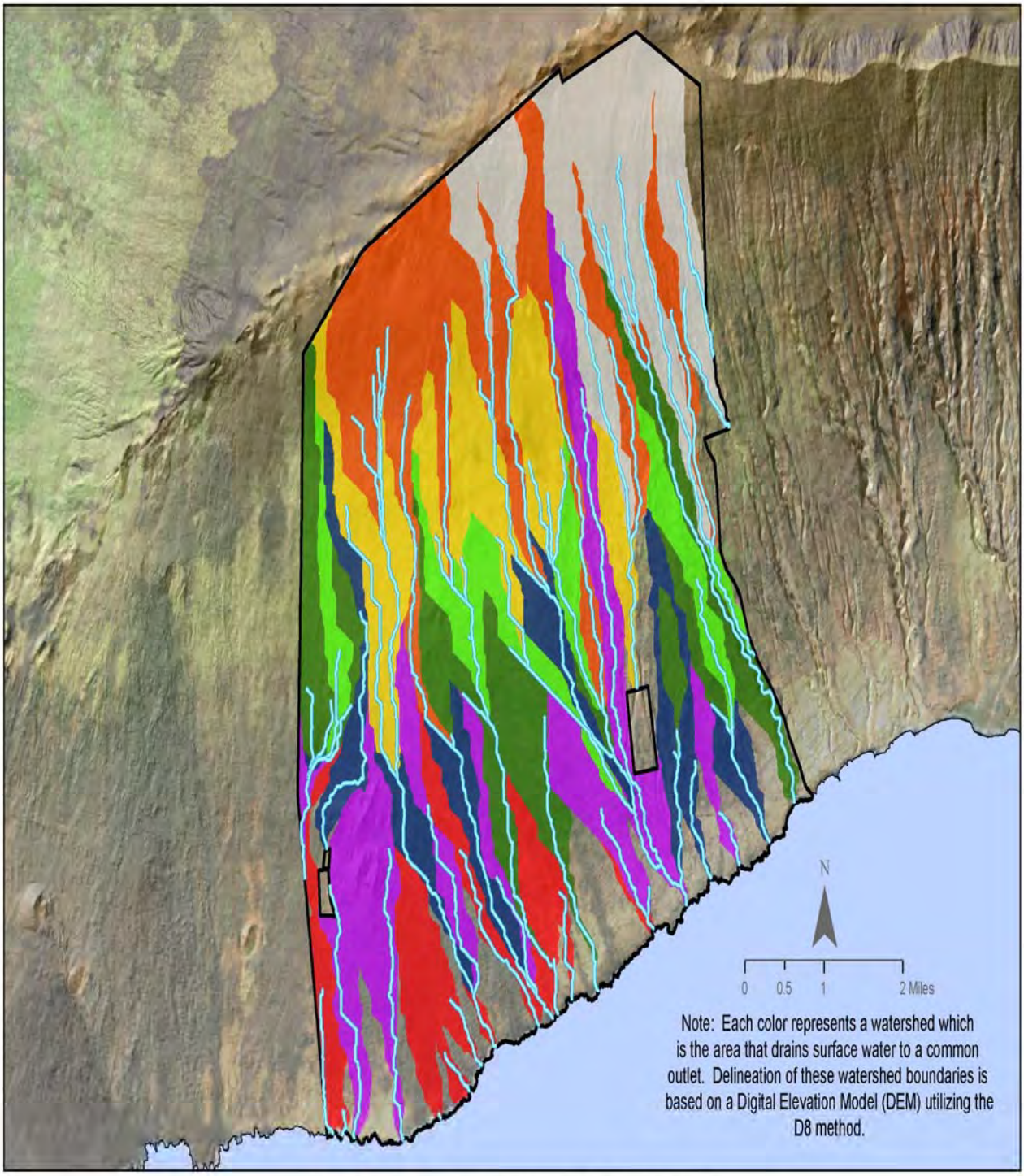
Kahikinui Surface Water Drainage



Prepared for the Department of Hawaiian Home Lands by: C. Perry, February 2008
Data Sources: http://hawaii.gov/dbedt/gis/, http://hawaii.wr.usgs.gov/maui/data.html and DEM: USGS National Elevation Dataset (NED)

September 2008

Kahikinui Watershed Boundaries

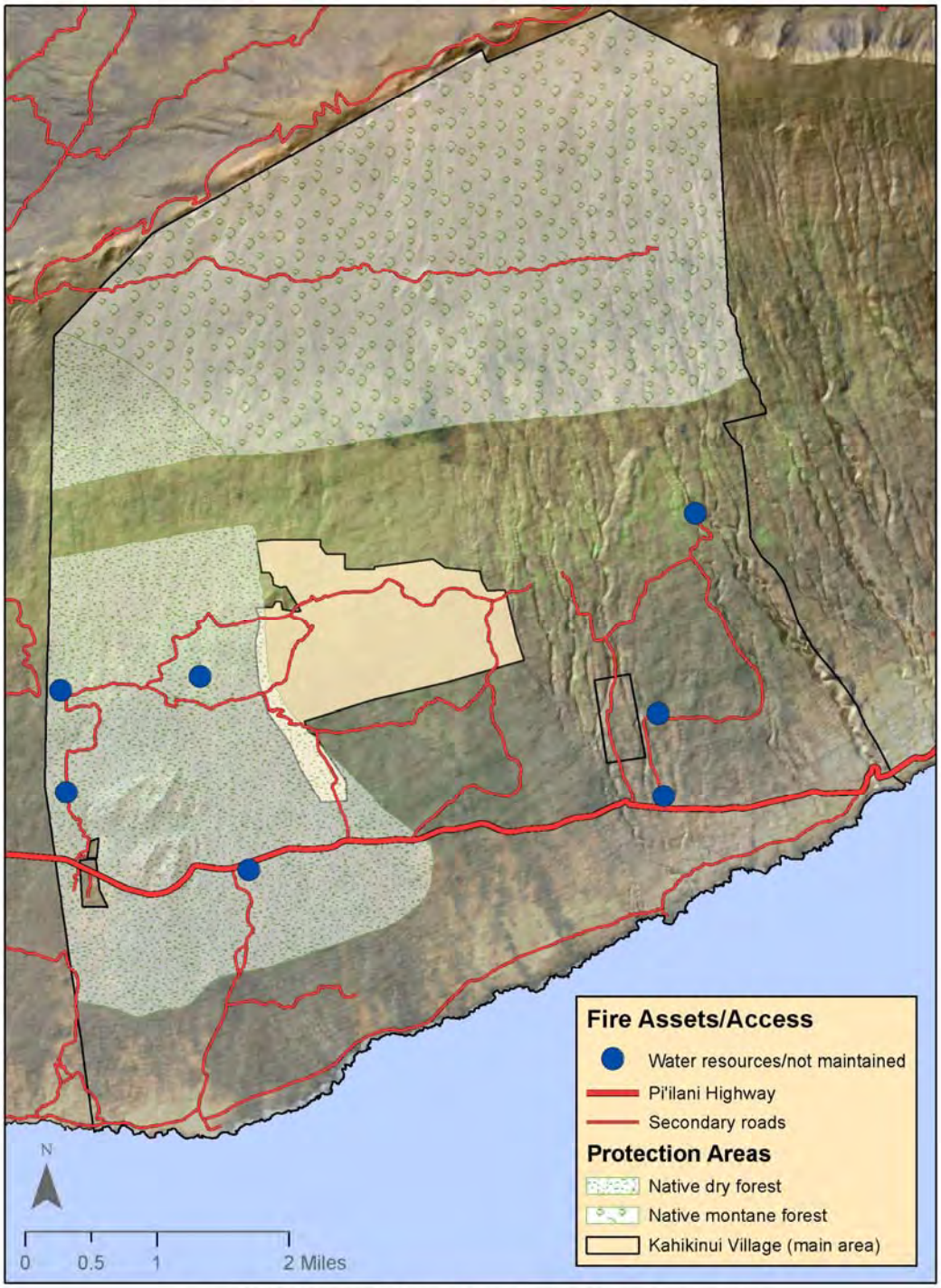


Prepared for the Department of Hawaiian Home Lands by: C. Perry, February 2008
Data Sources: http://hawaii.gov/dbedt/gis/, http://hawaii.wr.usgs.gov/maui/data.html and DEM: USGS National Elevation Dataset (NED)

September 2008

Appendix D: Maps of Fire Assets and Protection Areas & Possible Fuels Buffer

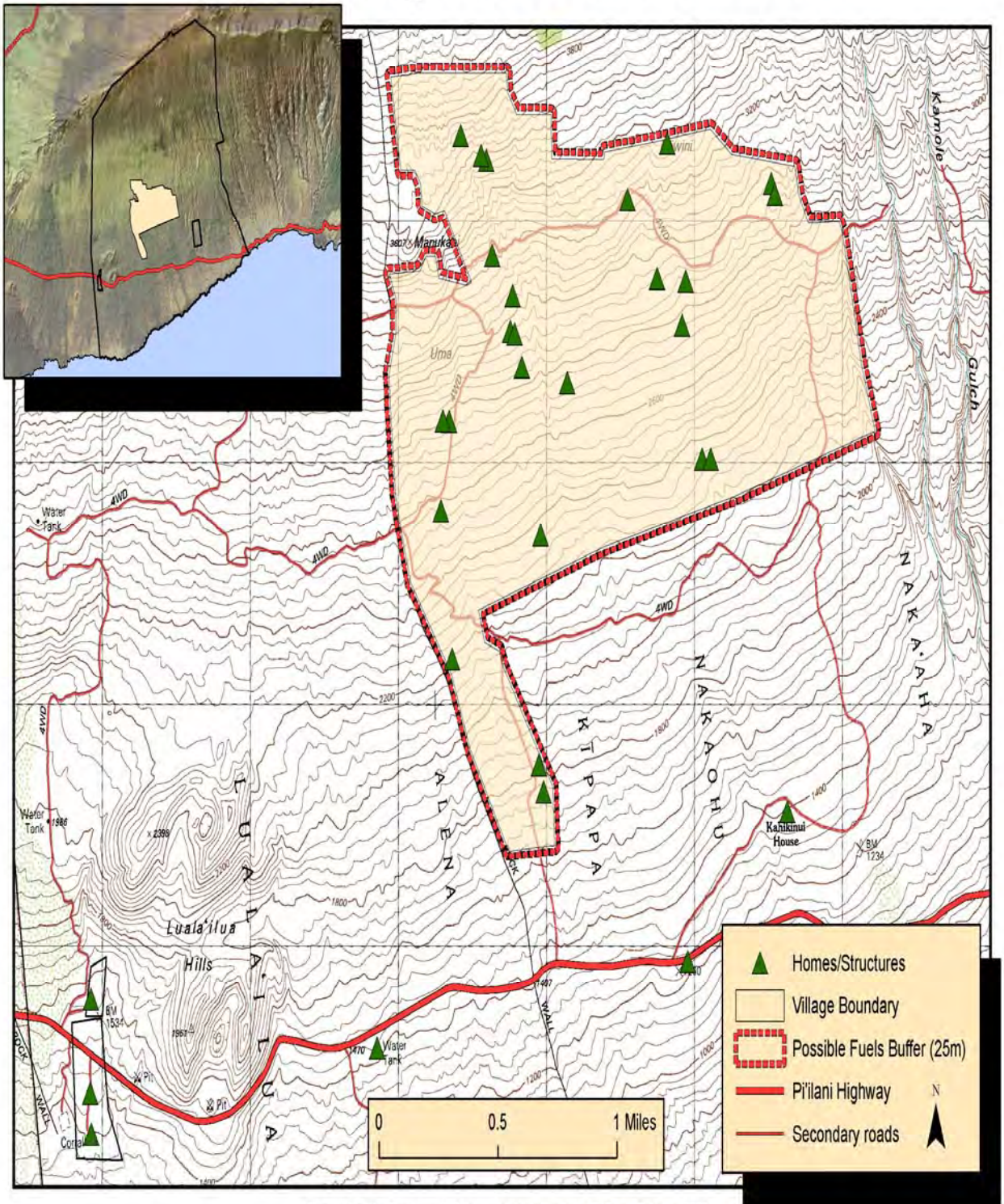
Fire Assets/Access and Protection Areas



Prepared for the Department of Hawaiian Home Lands by: C. Perry, February 2008

September 2008

Kahikinui Village and Possible Fuels Buffer



Prepared for the Department of Hawaiian Home Lands by: C. Perry, February 2008

Data Sources: http://www.state.hi.us/dbedt/gis/index.html and http://hawaii.wr.usgs.gov/maui/data.html

September 2008

Appendix E: List of Potential Grant Resources

Below is a list of potential grant sources to help fund mitigation projects described within this CWPP. The list is by no means exhaustive and community groups seeking potential grant funding should research additional grant-funding sources available to them.

Grant Program	Deadline	Contact Information	Matching Funds Required?
State Fire Assistance Grants. Funds target hazard mitigation in the wildland urban interface for mitigating risks of hazardous fire conditions through hazardous fuels reduction, information and education, and homeowner and community defensible space treatments.	**September 11, 2008 for 2009-2010 competitive funding**	Division of Forestry and Wildlife Attn: Wayne Ching, 1151 Punchbowl St., Rm. # 325 Honolulu, HI 96813 (808) 587-4173 Fax: (808) 587-0160 http://www.state.hi.us/dlnr/dofaw/fmp/wui0809.htm	Yes: 50/50 match
FM Global Prevention Grants Through their new Fire Prevention Grant Program, fire departments, national, state, regional, local and community organizations can apply for funding to support a wide array of fire prevention, preparedness and control efforts, including: • Pre-fire planning for commercial, industrial and institutional facilities • Fire and arson prevention and investigation • Fire prevention education and training programs	Awarded quarterly.	www.fmglobal.com/page.aspx?id=01060200 or email: firepreventiongrants@fmglobal.com	No
Department of Homeland Security (DHS) DHS grants include: Citizen Corps is the Department of Homeland Security's grassroots initiative that encourages citizens to play a role in hometown security through personal preparedness and coordinated by over 1,200 local Citizen Corps Council nationwide. Grant funding supports Citizen Corps Councils in efforts to engage citizens in personal preparedness, exercises, ongoing volunteer programs, and surge capacity response, in order to better prepare citizens to be fully aware, trained, and practiced on how to prevent, protect/mitigate, prepare for, and respond to all threats and hazards. This program provides funding on a formula basis to all 56 states and territories. Other Homeland Security Grant Programs include:		www.dhs.gov/xgovt/grants/index.shtm MG Robert Lee Adjutant General 3949 Diamond Head Rd. Honolulu, HI 96816-4495 808-733-4246 www.scd.state.hi.us	

• Infrastructure Protection Program •Regional Catastrophic Preparedness Grant Program			
Rural Fire Assistance Grants (RFA) The Dept. of the Interior receives an appropriated budget each year for a rural fire assistance (RFA) grant program. This funding enhances the fire protection capabilities of rural and volunteer fire departments through training, equipment purchases, and fire prevention work on a cost-shared basis. This program is primarily for rural departments serving populations under 10,000 that have responsibilities to provide mutual aid to Dept. of Interior lands (e.g., Tribal, National Parks etc.) The DOI assistance program targets rural and volunteer fire departments that routinely help fight fire on or near DOI lands. One of these four agencies administers those lands: Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), U.S. Fish and Wildlife Service (FWS) and the National Park Service (NPS).	Varies by state	Hawaii Volcanoes National Park Joe Molhoek Pacific Island Fire Mgmt. Officer PO Box 52, HNP, HI 96718 (808) 985-6042 Joe_Molhoek@nps.gov	The maximum award is $20,000. This year RFA grants will require 90/10 cost-share.

Community Wildfire Protection Plan for Kauai, Hawaii

Sponsored by the Kauai Fire Department
June 2009

Written by Denise Laitinen

Table of Contents:

This Community Wildfire Protection Plan was made possible with the assistance of the Kauai Fire Department. The author would like to extend a sincere mahalo nui loa to the following people and agencies for their assistance: Chief Robert Westerman and Captain David Bukoski of the Kauai Fire Department, Roland Licona of the Department of Hawaiian Home Lands, and Kawika Smith of Hawaii State Division of Forestry and Wildlife. A very special mahalo nui loa to Francisco Garcia of Kauai Fire Department for his fire data assistance and Garrett Johnson of Kauai County GIS for researching and creating the GIS maps used in this project. Unless otherwise noted, all photographs courtesy of Denise Laitinen.

Cover photo: View of August 2005 Wailua wildfire. Photo courtesy of Kauai Fire Department.

June 2009

Kauai Community Wildfire Protection Plan
Mutual Agreement Page

The Community Wildfire Protection Plan (CWPP) developed for the Island of Kauai, Hawaii by the Kauai Fire Department:

Was collaboratively developed. Interested parties and federal land management agencies managing land on Kauai Island have been consulted.

This Plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect Kauai.

This Plan recommends measures to reduce the ignitability of structures throughout the area addressed by the Plan.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

_____ _____

Paul J. Conry **Date**
Administrator, Division of Forestry and Wildlife

_____ _____

Robert Westerman **Date**
Fire Chief, Kauai Fire Department

_____ _____

Mark Marshall **Date**
Administrator, Kauai County Civil Defense Agency

Executive Summary:

Covering roughly 622 square miles, the Island of Kauai is the smallest of the four main Hawaiian Islands in terms of geographical size, as well as population with more than 63,000 inhabitants. Yet it has the highest concentration of endangered and threatened native Hawaiian plants and animals in the state.

Dominated by the sugar cane industry for more than a century, today on Kauai acre upon acre of once active agricultural land now lies fallow or is subject to residential development. With the exception of small industrial and commercial zones, virtually the entire Island of Kauai is in a wildland urban interface (WUI) environment—that is the line area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuel. These interface areas pose the highest risk of loss of life and property due to wildland fire.

Satellite map of Kauai. The island is 33 miles long and 25 miles wide although the bulk of the island's interior is inaccessible. Image courtesy of Kauai Fire Department.

The risk of wildland fire impacting homes in the WUI is determined by several factors, including the ignitability of fuels, structural ignitability, weather conditions, and topographical features, such as slope. Unlike other parts of the United States, wildfire is not a natural part of Hawaii's ecosystem. In Hawaii, wildfires destroy native plants, which can impact the watershed and the habitat of threatened and endangered native Hawaiian animals. Wildfires in Hawaii can also cause soil erosion, which has the potential to cause runoff that can negatively impact ocean reefs.

The overwhelming majority of wildfires in the state of Hawaii, and Kauai in particular, are caused by human error. Human error includes errant fireworks, rubbish, cooking, and agricultural fires, as well as vehicle-caused wildfires.

Principal stakeholders who have an interest in protecting Kauai from wildfire include the Kauai Fire Department, the State Division of Forestry and Wildlife (DOFAW), Kauai County Civil Defense Agency, Department of Hawaiian Home Lands (DHHL), U.S. Fish & Wildlife Service (USFWS), large landowners and farmers, such as Grove Farm and Kauai Coffee Company, as well as residents themselves. These stakeholders were invited to participate in the development of this Plan.

A wildfire risk hazard assessment determined that the WUI areas around the island have a high risk of wildland fire. Since 2000, roughly 30% of all fires that occur annually on Kauai are wildfires. These wildfires have closed major highways, and threatened homes.

This CWPP encompasses the entire island of Kauai. Community meetings were held in June 2008 in Kapa'a, Waimea, and Lihue. Interagency fire service meetings were held between June 2008 and June 2009. Meetings with community members and fire agency personnel identified 12 priority mitigation measures that can reduce the wildfire risk on Kauai, as well as improve community safety. These include: 1) Installing and maintaining firebreaks along the Wailua Corridor; 2) Reducing fuel load along the Wailua Corridor; 3) Implementing grazing practices in Anahola and increasing grazing around the perimeter of Wailua Homesteads; 4) Maintaining and increasing the use of current reservoirs around the island; 5) Continuing general public fire prevention education, such as the need for defensible space particularly in Kokee, Anahola, Wailua, Hanamaulu, Koloa, Waimea, and Kapa'a;
6) Implementing community chipping days to encourage fuel load mitigation and green waste recycling;
7) Increasing the use of fire-resistant building materials in new residential development; 8)

Implementing Firewise recommendations in the planning process, such as multiple means of ingress/egress and fuel-breaks around all new residential subdivisions; 9) Creating secondary emergency access roads in residential areas where necessary; 10) improving communication between state, federal, and county agencies during wildfires; 11) purchasing a refurbished light-response brush truck to be staged in Kokee; and 12) installation of fire hydrants or stand pipes in Kokee.

Background:

Kauai is a place of extremes. The oldest (and northernmost) of the main Hawaiian Islands, Kauai is home to one of the wettest places on earth—the 5,148-foot Mt. Wai'ale'ale, which receives 460 inches of rain a year. A mere 15 miles away on the leeward coast, Kekaha receives only 20 inches of rain annually and experience strong trade winds.

Because the central interior of Kauai is home to steep inaccessible mountains, including Mt. Wai'ale'ale, Kawaikini, (5,243 feet), and the Na Pali coast (17 miles long with 4,000-foot cliffs), residential, commercial, industrial, and agricultural activities are found along the perimeter of the island. Due to the rugged 17-mile long Na Pali coastline, which encompasses 6,175 acres on northwest side of the island and is inaccessible to vehicles, there are no roads around the entire island. Rather the route around the island is one of a horseshoe shape ending at either end of the Na Pali Coast.

In addition to being shaped by geographic features, Kauai's economic history has also shaped the landscape of the island. Driving around the perimeter of the island on the one main highway (known as Kuhio Highway on the east side and Kaumuali'i Highway on the west), one encounters vast expanses of open land juxtaposed with small towns where the homes are sited in close proximity to each other.

Slope around the island varies by geography, although the overall terrain in the region naturally slopes from the mountains down to the sea. Gulches, as well as hills several hundred feet in elevation, dot the countryside. Because Kauai is the oldest of the main Hawaiian islands, rain has eroded mountains to steep cliffs, especially in the island's center. Some subdivisions, such as Hanapepe Residence Lots in Hanapepe and Wailua Riverview Estates in Wailua, have steep ridges bordering their community. Others, such as Lawai have gulches running through their communities.

Vegetation zones vary between grasslands, mixed forest, high-intensity developed, scrub/shrub, bare land, estuarine shrub/scrub, and low-intensity developed, among others. Communities and subdivisions on Kauai are often separated by vast expanses of open grasslands containing high-intensity burning fire fuels, including grasses and shrubs. Many of the grasses, such as molasses grass (*Melinis minutiflora*) and bear grass (*Schizachyrium condensatum*), are fire-adapted and increase wildfire potential in the areas they invade.

Above left and right: Former sugar cane fields lie fallow across the island. Overgrown with grasses, these area pose a wildfire risk to the communities they surround.

The sugar cane industry, which shaped the residential, agricultural, and economic face of Kauai for 125 years, has died out in the past 20 years. Gay and Robinson Inc., the last sugar producer on the island, announced in September 2008 that it was ceasing sugar cane operations on Kauai after 119 years.

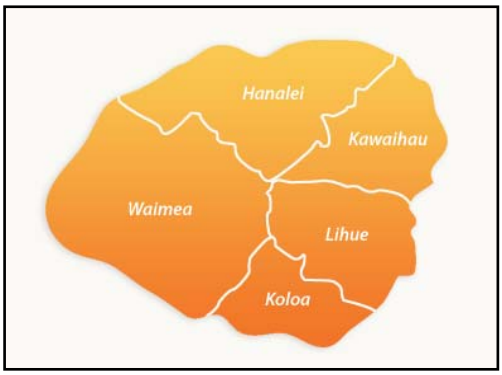
Lands that were once maintained for sugar cane production now lie fallow or have been sold and turned into residential developments. Many of these fallow fields are overgrown with vegetation and surround existing and/or new subdivisions.

Above: Recent residential development in Poipu. More than 4,000 residential units are planned for Poipu, which has a current population of 1,000 permanent residents.

The increase in residential development has led to an interesting juxtaposition: decades-old plantation neighborhoods with modest homes built on small lots are now adjacent to “gentleman farms”–large lots with even larger homes. Many of these newer homes, particularly in areas such as Poipu and Hanalei, are vacation rentals or second homes that are not occupied on a regular basis.

New development combined with year-round balmy weather and spectacular scenery has led to an increase in Kauai’s population. In 2006, the last year for which data is available, an estimated 63,004 people lived on Kauai, an increase of 7 percent from the 2000 Census count of 58,463 residents.

There are five districts on Kauai: Waimea, including the town of Waimea, Hanapepe, Kekaha, and Kokee State Park; Koloa, encompassing Koloa and Poipu; Lihue, including Lihue and Hanamaulu; Kawaihau, encompassing the towns of Kapa’a, Wailua, Kealia, and Anahola; and Hanalei, which includes the towns of Princeville, Kilauea, Ha’ena, and Hanalei.



Map showing the 5 districts of Kauai. Map courtesy of: http://www.hawaiis.com.

Although the town of Lihue (on the southeast coast) is the government seat of the island and home to the island’s main airport and retail centers, it is not the most populous. The largest town population-wise is Kapa’a, six miles to the north of Lihue. About 10,000 people call Kapa’a home. Many of Kapa’a’s residents must drive along Kuhio Highway, known as the Wailua Corridor, to travel between Lihue and Kapa’a for work and shopping. Lihue is the second largest town on Kauai (5,900 residents). Other populated areas include Hanamaulu (3,500 residents) and Wailua Homesteads (4,500 residents). Further up the coast from Kapa’a on the east side, Anahola has roughly 2,250 residents**.** On the southwest side of the island, Kalaheo has an estimated 4,100 residents. Former plantation towns on the southwest side, such as Hanapepe (2,500 residents), Koloa (1,800 residents), and Waimea (1,800 residents) have smaller populations. Poipu, with its concentration of resorts and vacation rentals, has an estimated year-round population of 1,000.

Figure 1 shows the population density of Kauai. Population densities center around towns such as Kapa'a and Lihue.

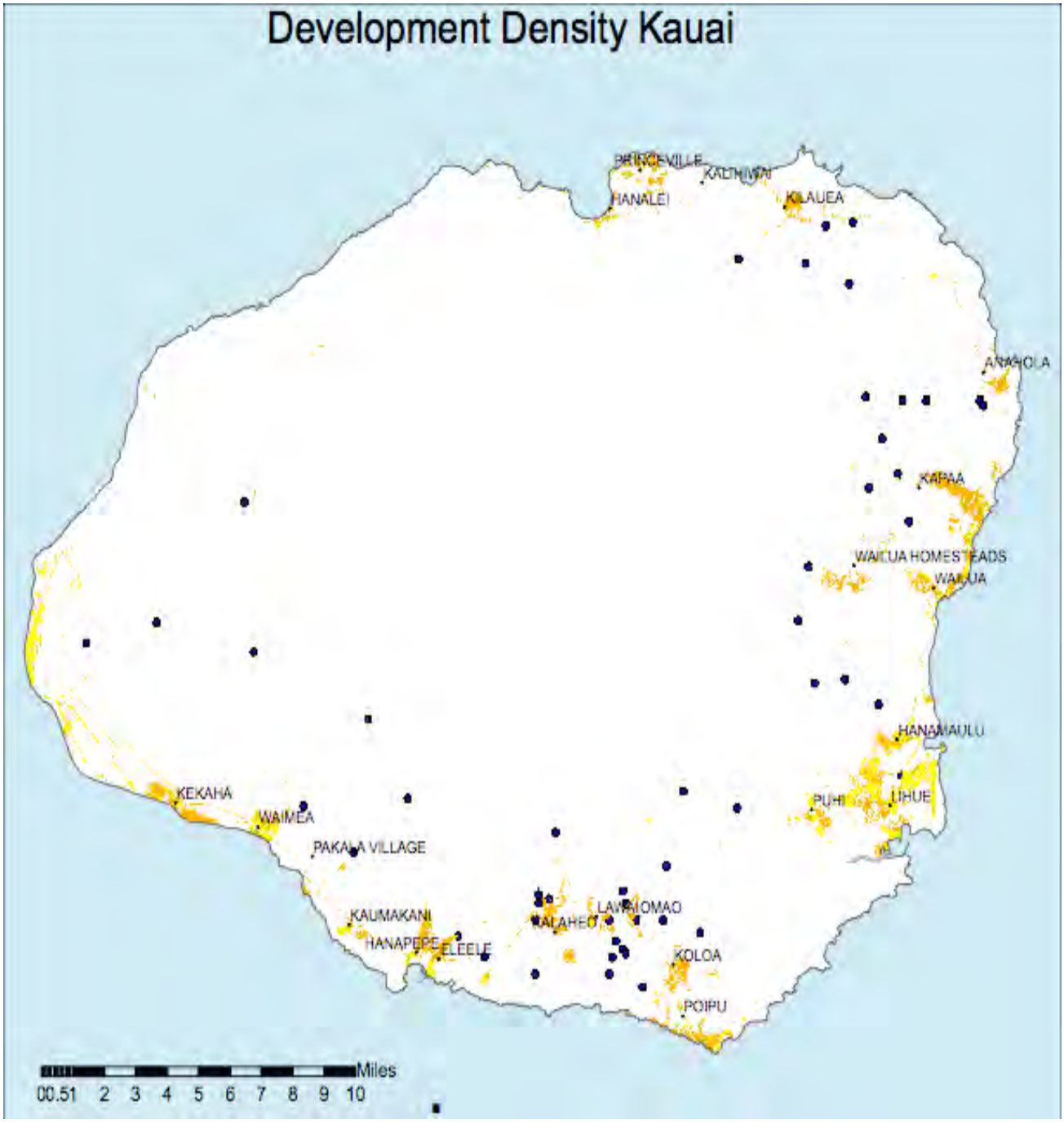


Figure 1: Map illustrating the population density of Kauai. Light yellow represents high-density developed areas while dark yellow represents low-density developed areas. The dots represent dams. Map courtesy of Kauai County GIS.

Figure 2 depicts the largest landowners on Kauai. The State of Hawaii is the largest landholder. Other large landowners include Alexander & Baldwin (including Kauai Coffee Company), Grove Farm, and the Department of Hawaiian Home Lands (DHHL), among others. Although depicted as state land, DHHL owns 20,000 acres on Kauai. Their land holdings include 15,000 acres in the Waimea district, 5,000 in Anahola, and 400 acres in Wailua.

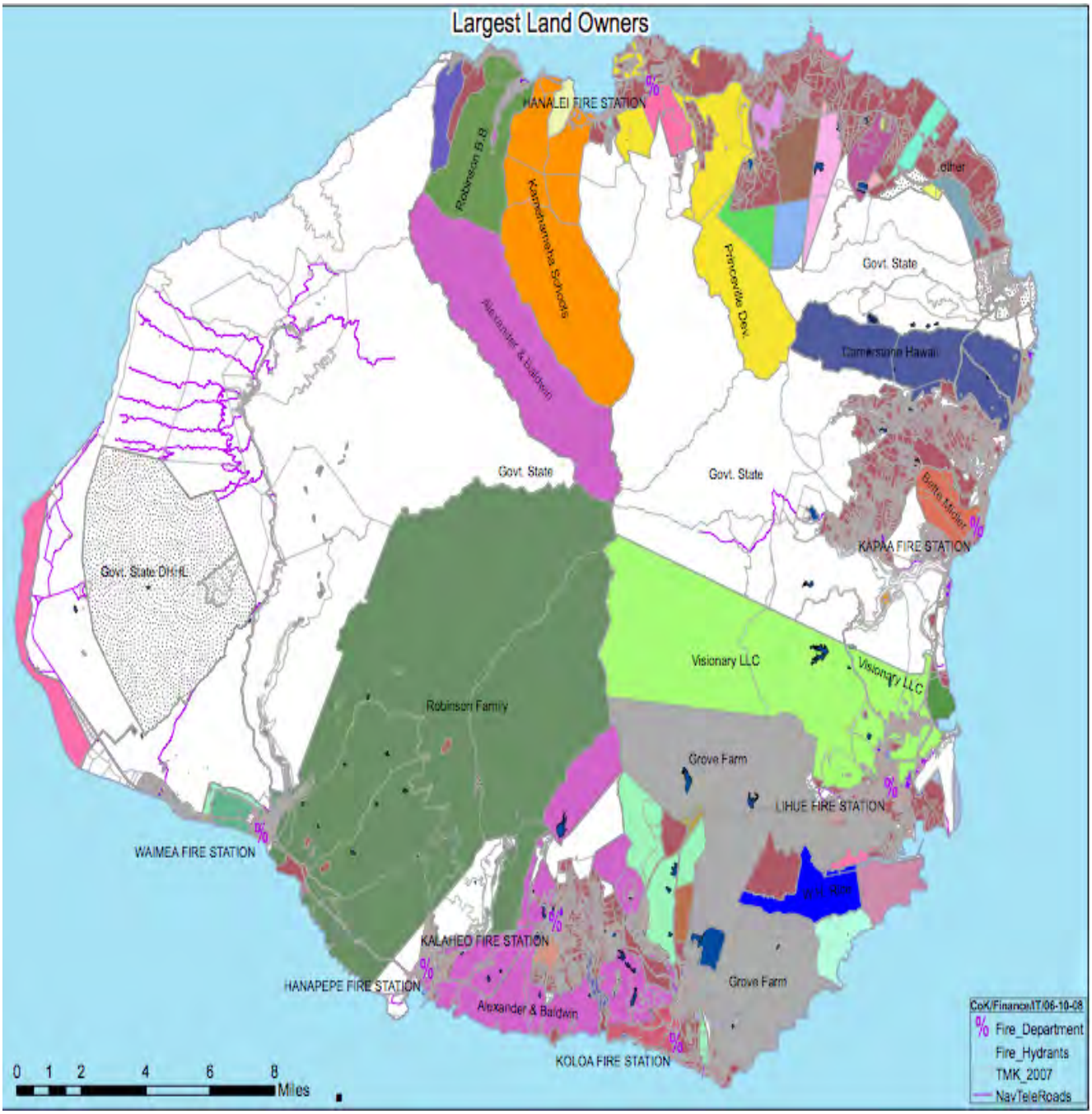


Figure 2: Map showing major landowners on Kauai. White areas represent Hawaii State government lands; grey: Grove Farm; dark green: the Robinson Family; purple: Alexander & Baldwin; light green: Visionary LLC; medium blue: W.H. Rice; orange: Kamehameha schools; dark orange: Bette Midler; yellow: Princeville Development; dark blue: Cornerstone Hawaii. Fire station locations are also shown. Map courtesy of Kauai County GIS.

One of the largest private landowners on island is Grove Farm Kauai with 40,000 acres. Its holdings include the former sugar mill lands of Koloa Mill and Lihue Plantation.

As sugar cane production ceased in the mid-1990s in eastern Kauai, a majority of former Grove Farm sugar lands were leased for cattle ranching, tree farming, and the growing of diversified agricultural

crops such as corn, bananas, and taro. It also built residential developments, including the Puakea subdivision in Lihue, pictured below.

Grove Farm is concerned about the threat of wildfires on its property and stringently requires that all lessees maintain the leased property and the roads therein. According to Mike Tresler, senior vice-president of Grove Farm, the company has evicted lessees who have allowed brush to become overgrown or who have not maintained the roads. In some instances, Grove Farm has brought in cattle ranchers to graze areas when vegetation became overgrown or grew too close to utility poles.

Left: entrance sign to Puako section of the Puakea subdivision in Lihue. Right: typical house in Puako subdivision. Built on former sugar cane lands, Puako was recently developed by Grove Farm Kauai, which has diversified its holdings since the demise of the sugar cane industry.

Despite the demise of the sugar cane industry, agriculture is still a vital part of Kauai's economy. Seed corn, grown primarily in West Kauai and exported to the U.S. mainland, is the island's number one crop in terms of economic value. Other important crops include guava, taro, and coffee. In fact, the largest coffee estate in the U.S. is found on Kauai. Located on the southwest side of the island, Kauai Coffee Company grows 3.5 million pounds of coffee annually (60% of the state's total coffee production) on 3,400 acres. Kauai Coffee Company allows small-scale ranchers to graze in gulches around their property.

Small livestock operations operate around the island raising poultry and hogs for local consumption. Cattle are also raised on Kauai for beef export to the U.S. mainland.

Aside from agriculture, the island's main industry is tourism. Kauai is rich in natural beauty with its steep mountain cliffs, white sand beaches, native forests, and cascading waterfalls. There are numerous state and county parks around the island, including Kokee State Park, Wailua River State Park, and Na Pali Coast State Park. Kokee State Park and Wailua River State Park are situated within the island's wildland urban interface.

While there are no national parks on Kauai, the island is home to the national headquarters of the National Tropical Botanical Gardens (NTBG). The NTBG preserves, conserves, and perpetuates biological resources, such as rare and native Hawaiian plants, as well as cultural and historical resources. Its holding on Kauai include a series of gardens, such as the McBryde Garden and Allerton Garden in Lawai Valley on the south side and the nearly 1,000-acre Limahuli Garden and Preserve on the north shore in Limahuli Valley in Ha'ena. The gardens in Ha'ena and Lawai Valleys contain archeological resources while McBryde Garden is home to the largest ex situ collection of native Hawaiian flora in existence. NTBG also manages the Breadfruit Institute, which with 120 varieties makes it the largest collection of breadfruit in the world.

There are also three national wildlife refuges on Kauai, including Hanalei National Wildlife Refuge, Huleia National Wildlife Refuge, and Kilauea National Wildlife Refuge, all of which are managed by the U.S. Fish and Wildlife Service (USFWS).

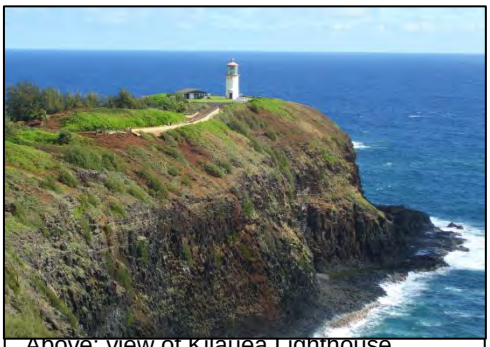
Encompassing 917 acres in Hanalei Valley on Kauai's north shore, the Hanalei National Wildlife Refuge was established under the Endangered Species Act to conserve five endangered water birds that rely on the Hanalei Valley for nesting and feeding habitat: the koloa (Hawaiian duck), 'alae ke'oke'o (Hawaiian coot), 'alae'ula (Hawaiian moorhen), ae'o (Hawaiian stilt), and nene (Hawaiian goose). Twenty-seven additional species of native Hawaiian birds and 18 nonnative bird species also use the Refuge.

View of taro fields in Hanalei. While the taro fields are quite lush, the surrounding hillsides are prone to wildfires. Due to the rugged terrain, unattended campfires in this area can spread quickly. Photo credit: tripadvisor.com

Hanalei Valley is surrounded by steep hillsides. Taro farming has been an important crop in Hanalei Valley for 1,000 years. Nearly two-thirds of the state's six million pounds of taro is grown in Hanalei**.** Given the large amounts of water required for taro farming and an annual average rainfall of 62 inches, the risk of wildfire is minimal in the Hanalei Valley area. However, wildfires can and do occur in the surrounding hillsides. Although the area is generally high in moisture, vegetation can dry out in the summer months and during periods of drought, lead to increased wildfire risk.

In August 2008, 50 acres burned in a remote area of Hanakapiai Valley closing the Kalalau Trail, a popular hiking trail. Kauai Fire Department personnel rescued 28 day-hikers via Hanakapiai Beach during the wildfire. The beach is only accessible by the Kalalau Trail or by boat. The blaze may have started by a campfire. Unattended campfires in the Hanakapiai Valley are of concern to officials because of the rugged terrain.

Down the coast from Hanalei Valley, Kilauea Point National Wildlife Refuge juts out into the ocean on Kauai's north shore. The 203-acre refuge encompasses Crater Hill, Makolea Point, as well as the 106-year-old Kilauea Lighthouse, which is on the National Register of Historic Places. The sea cliffs provide nesting areas for native Hawaiian seabirds, including the endangered nene, as well as native Hawaiian plants. Wildfires have occurred in the area in recent years, including one fire started by discarded smoking materials just outside the entrance to the Refuge in 2000.



Above: View of Kilauea Lighthouse. Photo credit: tripadvisor.com

Located on the southwest side of the island by the Menehune Fish Pond, the 241-acre Huleia National Refuge is a flat valley along the Huleia River bordered by a steep wooded hillside. Thirty-one species of birds can be found here. A registered National Historic Landmark, the USFWS purchased the land from Grove Farm in 1973 to provide wetlands for endangered Hawaiian water birds that rely on the Huleia River Valley for nesting and feeding habitat.

Both Hanalei and Huleia Refuges are in river valleys surrounded by steep wooded hillsides. Both Refuges are closed to the public to protect the endangered birds and their habitat. Since the Refuges are private, the threat of human-caused wildfires is reduced. However, it is possible that wildfires that

start beyond the borders of the refuges, can have a debilitating effect. To address this concern, the USFWS has developed fire plans for all three Kauai refuges.

In addition to agriculture and tourism, the military also has a presence on Kauai. The U.S. Navy's Pacific Missile Range Facility (PMRF) at Barking Sands on the western shore past Waimea, is one of the largest employers on the island. Covering nearly 2,385 acres, PMRF is the biggest testing and training missile facility of its kind in the world. PMRF has its own fire department, and there is an established Memorandum of Understanding (MOU) between the County of Kauai and PMRF for assistance in wildland firefighting. PMRF has contract helicopter services which can assist, for a fee, on large wildland and forest fires.

PMRF is surrounded by 6,000 acres of former sugar cane lands. PMRF is undertaking an Agriculture Preservation Initiative working with the State and County to ensure that the lands remain designated for agricultural use.

Infrastructure:

Kauai has well-established infrastructure. The vast majority of roads in subdivisions and municipalities around the island observed during the wildfire hazard assessment are paved. A main highway, Kuhio Highway (Highway 560) on the east side and Kaumuali'i Highway (Highway 50) on the west, runs along the perimeter of the island up to the inaccessible Na Pali coastline.

Above: Roadway in Wailua. Collector roads, such as this one, are required to be at least 56 feet wide in accordance with Kauai County Code.

The County and State maintain the roads. Major roadways on Kauai are greater than 24 feet in width. In fact, Section 9-2.3 of the Kauai County Code, *General Standards for Streets*, mandates that major undivided thoroughfares be at least 80 feet in width while divided thoroughfares be at least 88 feet. Major streets are to be 60 feet wide, collector streets are required to be 56 feet wide, minor streets 44 feet wide, and dead-end streets must be 40 feet wide. Dead end streets longer than 150 feet are required to have room for fire department apparatus to turn around. Private subdivisions must adhere to this code as well.

Property owners on Kauai are required to be connected to the County water system and homes are not allowed to have catchment systems.

All areas of Kauai are on the electric grid. Utilities are above-ground in older neighborhoods and subdivisions. The Kauai Planning Department is responsible for requiring utilities to be placed underground in new residential developments.

Vegetation:

The vast majority of land on Kauai is classified as conservation or agricultural. Figure 3 illustrates state land use zoning on Kauai.

Kauai has more native Hawaiian endangered and threatened plants than any other major Hawaiian island. Ninety-five of the 97 native Hawaiian plant species listed as threatened or endangered as designated under the *U.S. Endangered Species Act* are found on Kauai. [*www.fws.gov/pacificislands/publications/listingplants.pdf*] This is more than three times the number of endangered and threatened plants found on any other Hawaiian island.

In September 2008, the U.S. Secretary of the Interior issued a proposal planning to add 48 additional plants, animal, and insect species found only on Kauai to the federal endangered species list. The proposal also recommended adding 27,674 acres as designated critical habitat for the 48

Kolea is a threatened shrub found only in the forests of Kauai. Photo © M. LeGrande.

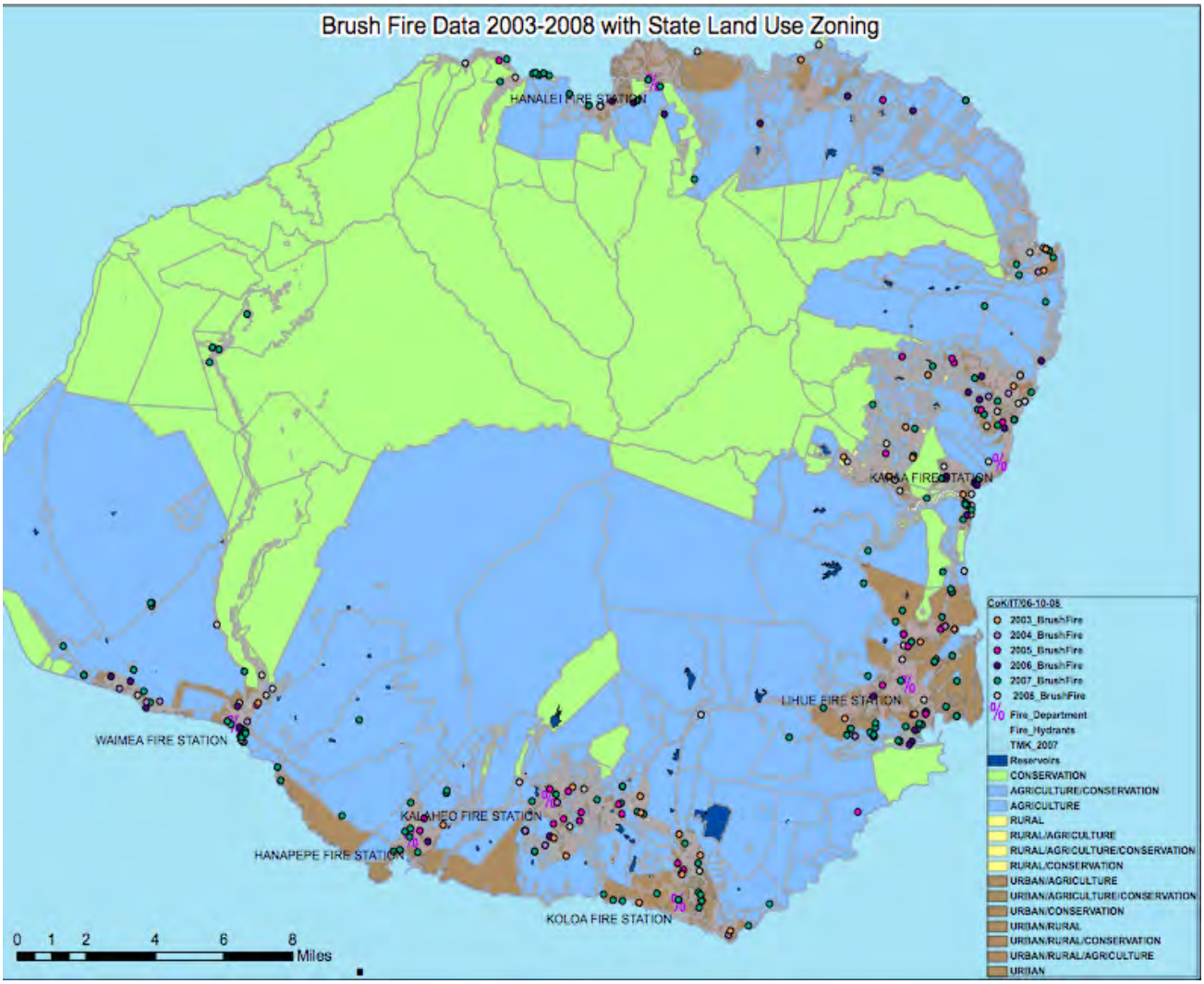


Figure 3: Land use zoning on Kauai The green, blue, and brown areas represent conservation, agriculture, and urban land classifications respectively. Yellow areas are classified as rural. The past five years of wildfire data are also indicated. Map courtesy of Kauai GIS.

species. All but 1,646 of the proposed 27,674 acres are already designated as critical habitat for other species. There is roughly 52,500 acres of critical habitat designated on Kauai. Figure 4 illustrates the location of the critical habitats in relation to recent wildfires.

In 2008, Alexander & Baldwin entered into a 10-year agreement with The Nature Conservancy to manage over 7,000 acres in Wainiha Valley extending into Alakai Swamp and Mt. Wai'ale'ale. This extensive management will help protect the 127 species of rare plants and native forest birds. Some of the endangered plants on Kauai are so rare that there are less than 100 known plants still in existence. Indeed, it is believed that there are only seven mature 'Olulu (*Brighamia insignis*) plants

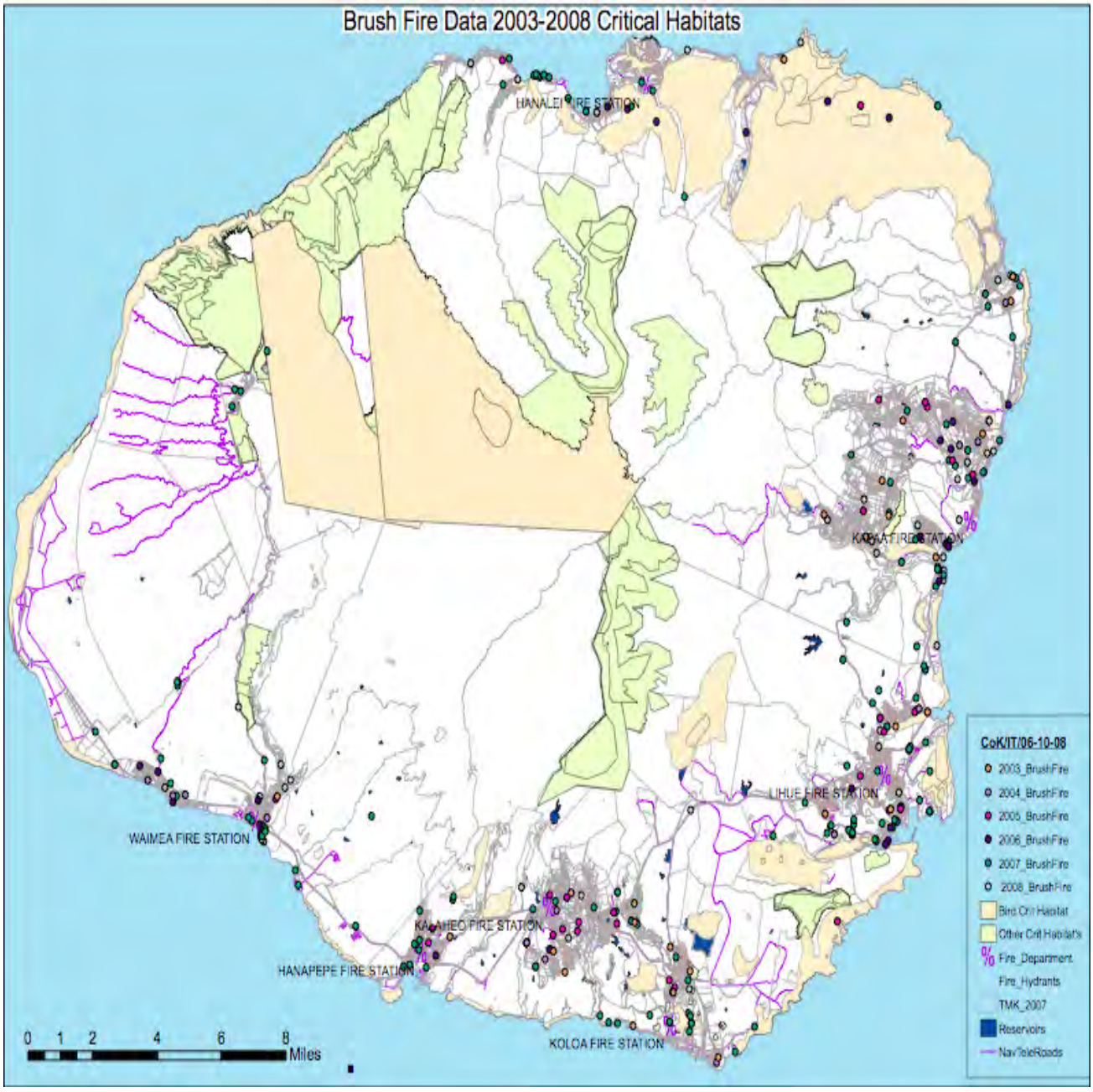


Figure 4: Map depicts areas designated as critical habitats for plants and animals on Kauai, as well as the location of wildfires in recent years. Areas highlighted in peach are bird habitats and those cream in color are other critical habitats. Map courtesy of Kauai County GIS.

remaining in the wild–all found in two locations on Kauai.

Kuawawaenohu (*Alsinidendron lychnoides*) a small flowering plant is found in only three valleys on Kauai with each population having about 10-20 plants.

'Olulu plant. Once found on all four major Hawaiian islands, today it's estimated there are only 7 plants in the wild – all found on Kauai. Photo courtesy of Arkive: © Bill Coster.

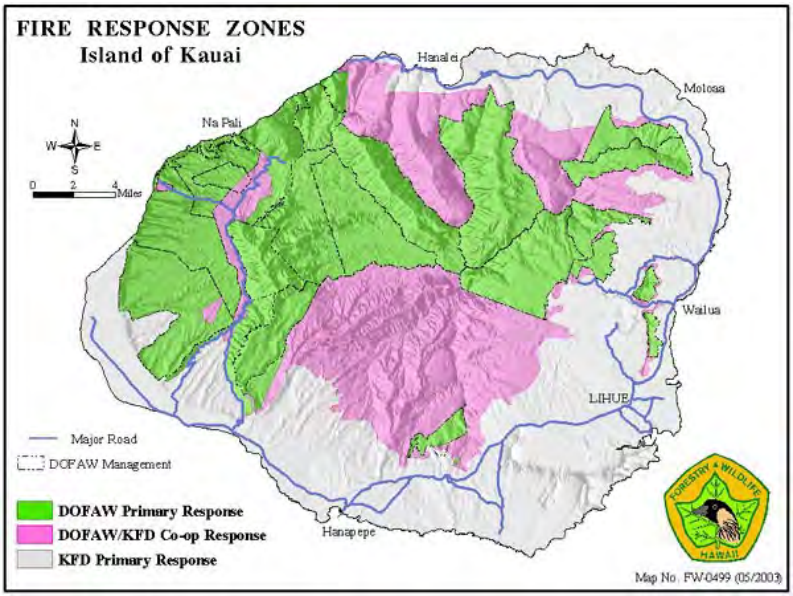
More prevalent than the previous two mentioned plants, Kolea (*Myrsine linearifolia*) is a perennial shrub that can reach 26 feet in height. It can be found in eight locations around Kauai, with the largest number of shrubs found in Kalalau Valley.

Kokee alone contains 57 rare or endangered plant species. Many plants and animals depend on this unique ecosystem for subsistence. State forestry officials maintain 15 plant exclosures. In addition, they maintain the Kokee Rare Plant Facility, where they propagate more than two dozen rare and endangered plant species. Given Kokee's remote location, wildfires have the potential to cause tremendous harm to the native forest ecosystem.

Above left: The Kauai Cave Wolf Spider, an endangered native Hawaiian animal, relies on the endangered Kauai Cave Amphipod for food. Above right: The Hawaiian Hoary Bat is considered Hawaii's only native land mammal. Photo credit: www.earthsendangered.com.

There are also several species of native Hawaiian animals that can be negatively impacted by wildfire. The akepa (*Loxops coccineus*), a small honeycreeper found in forests above 3,000 feet, eats primarily spiders and insects. The Kauai Cave Wolf Spider (*Adelocosa anops*) or Pe'e Pe'e Maka 'Ole is an endangered animal whose main food source is another endangered animal, the Kauai Cave Amphipod (*Spelaeorchestia koloana*). The Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) is considered to be Hawaii's only native land mammal. The hoary bat roosts in trees in forests and open pastures making it susceptible to wildfires.

Marine life found in coastal waters can also be impacted by wildfires. Soil erosion caused by wildfires can lead to runoff, which can eventually end up in the ocean. The resulting sedimentation in the ocean and on coral can negatively impact reefs and local traditional practices for gathering food from the ocean.



Fire Department Resources:

The Kauai Fire Department (KFD) is the primary responder to all wildfires. Existing mutual aid agreements between KFD and other fire agencies

Wildfires on Kauai can lead to soil erosion and r
impacting the reefs and marine mammals. Left p
photo: Jeffrey L. Cooper © 2007.

allow for cooperative responses on fires of mutual concern.

KFD has mutual aid agreements with PMRF, Lihue Airport Crash Fire/Rescue Department and DOFAW. KFD receives grant funding from DOFAW of which the funds can be utilized to organize, train, and equip KFD fire personnel.

A total of 125 personnel staff 7 fire stations around Kauai, with 32-37 firefighters on duty across the island at any given time. An eighth fire station planned for Kealia is scheduled to be built in 2011. Figure 6 shows station wildfire response data per fire station. Between 2003 and 2008 Station #2 (Kapa'a) responded to the most wildfires—170, while station #3 (Lihue) responded to 127 wildfires.

Figure 5: Fire response map for the island of Kauai shows the areas of responsibility for the different fire fighting agencies on island. KFD is the primary responder to all fires. Fire Resource Map courtesy of DOFAW.

Above: Various apparatus of the Kauai Fire Department. Photo credit: left and right pictures DHHL Ronald Licona, center picture KFD.

Left: Poipu fire station. Photo credit: Denise Laitinen. Right: PMRF helicopter providing water drops during an Anahola wildfire. Photo credit: DHHL Ronald Licona.

KFD has 21 apparatus and 14 light trucks, including 11 engines, 7 with slip-on 300-gallon units, 4 tankers, 3 mini-pumpers, 2 Hummers, 2 rescue trucks, and 2 hazardous material vehicles, including an incident command vehicle.

DOFAW has 23 personnel trained for wildland firefighting on Kauai. Their wildland firefighting equipment includes 3 water tenders, a 400-gallon slip-on unit for initial response, two 100-gallon slip-on units for ATVs for initial response, two water pumps, one backhoe, two dozers, one grader, and two portable 1,500-gallon dip tanks. The heavy equipment, (i.e. both dozers, grader, and backhoe) is based in Kokee with the remainder kept at the Lihue base yard.

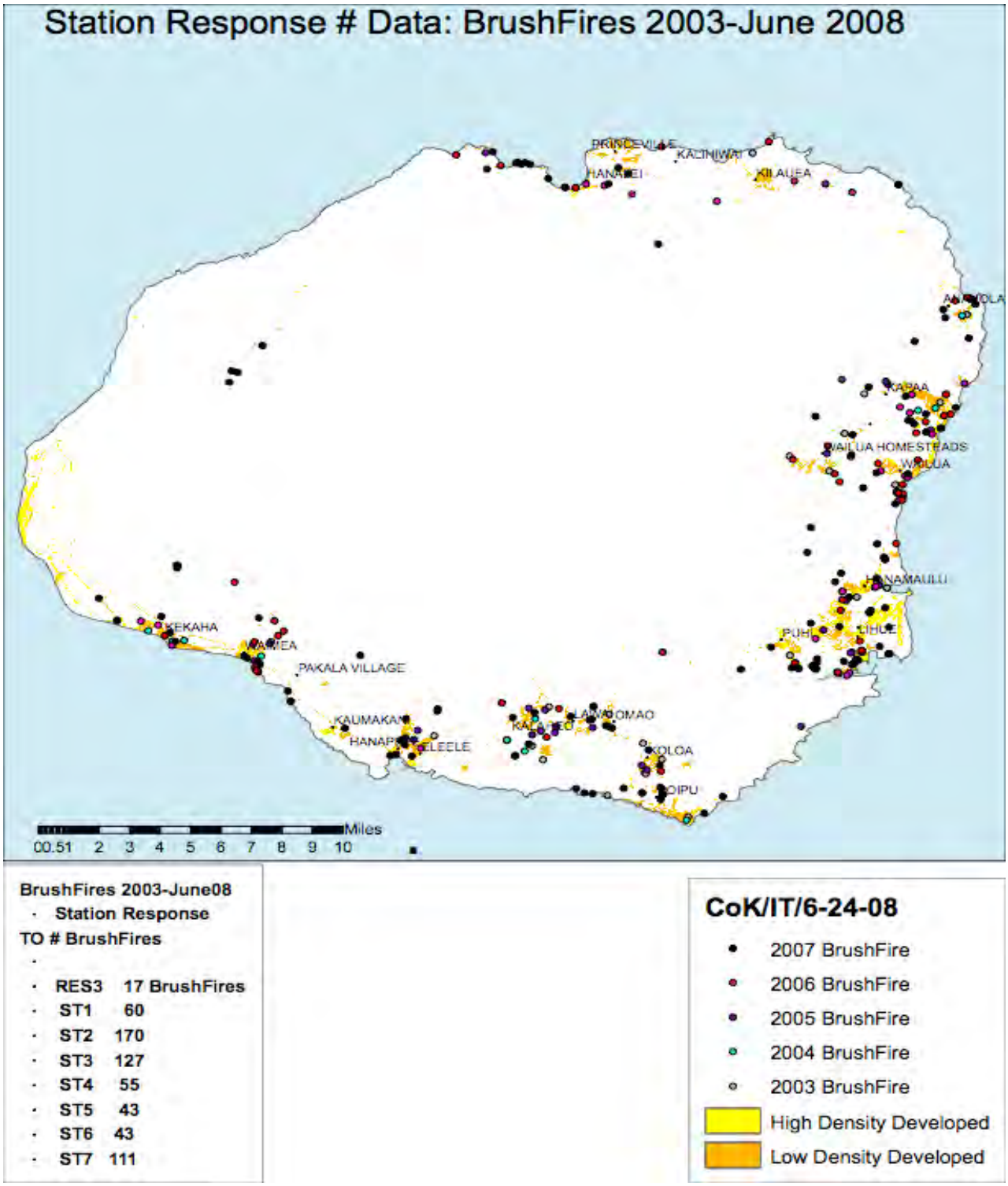


Figure 6: Map illustrating wildfires on Kauai between 2003-2008 and the number of responses per station. Map courtesy of Kauai County GIS.

The most common injury complaints by firefighters in the course of suppressing wildfires on Kauai are dehydration and exhaustion. While not a serious injury on its own, exhaustion can lead to motor skills impairment and slower response to changing conditions. Heart related problems and vehicle accidents

are the two leading causes of line of duty deaths for firefighters nationwide. The more wildfires a community experiences, the higher the probability of one of these situations occurring.

Wildfires on Kauai have been responsible for one death. Since Kauai Fire Department does not have its own rescue helicopter, it contracts with an outside company, Inter-Island Helicopters, for assistance to suppress wildfires. On Christmas Day 2005, a helicopter pilot was killed when his aircraft crashed while conducting water drops on a Hanamaulu wildfire.

Fire History:

Between January 2000 and September 2008 there were 837 wildfires on Kauai[1]. Annual wildfire totals range from a low of 61 wildfires in 2004 to a high of 134 wildfires in 2007, see Table 1.

Wildland, brush, and grass fires tend to spike from May through September with the highest numbers in the summer months of July and August.

[1] [wildfire totals include three categories of fire data collected by KFD: brush or grass fires; forest or wildland fires; and grass fires.]

Table 1: Kauai Fires 2000-2008 per KFD

Year	Number of wildfires [Brush, grass, forest, and wildland fires]	Total # of fires	Percentage of wildfires to total # of fires
2000	101	264	38%
2001	102	262	39%
2002	80	256	31%
2003	103	282	36%
2004	61	207	29%
2005	98	283	35%
2006	76	281	27%
2007	134	336	40%
2008	82	237	34%
Totals:	**837**	**2,408**	**34 percent**

Of note is the large number of wildfires, as well as overall increase of the total number of fires, during 2007. One possible reason for the higher than normal number of wildfires is the higher than normal rain levels the preceding winter, which in turn led to increased levels of fuel load in the wildland urban interface.

Of the 837 wildfires, 45 were larger than 10 acres in size listed in Table 2. Four of the five largest wildfires since 2000 have all occurred in the Kawaihau district. The largest wildfire was a 640-acre blaze in 2003 in Kealia. The second and third largest wildfires both occurred in Wailua: a 2005 fire burned 500 acres and a 2007 blaze burned 300 acres. 2005 also saw the fourth largest wildfire break out in Anahola and burn 270 acres. The fifth largest wildfire burned 200 acres in Hanamaulu in 2006.

A review of the frequency of wildfires shows that Kawaihau and Lihue districts also have the most number of wildfires. Figure 7 shows wildfires per town for the last eight years. Lihue town has the highest number of wildfires—91 since 2000. Anahola came in second with 89 wildfires while nearby Wailua had 83 fires. The remaining top 5 towns, Waimea and Kapa'a, are closely matched: Waimea had 69 wildfires while Kapa'a had 68 fires. Koloa had a surprisingly large number of wildfires: 56. The most frequent cause of the largest wildfires is "other cause" or "undetermined".

Lihue, Anahola, Wailua, Waimea, Kapa'a, and Koloa are all towns surrounded by large tracts of open lands. Maps depicting the ignition component of fuels and the spread component of these fuels can be found in Appendix A.

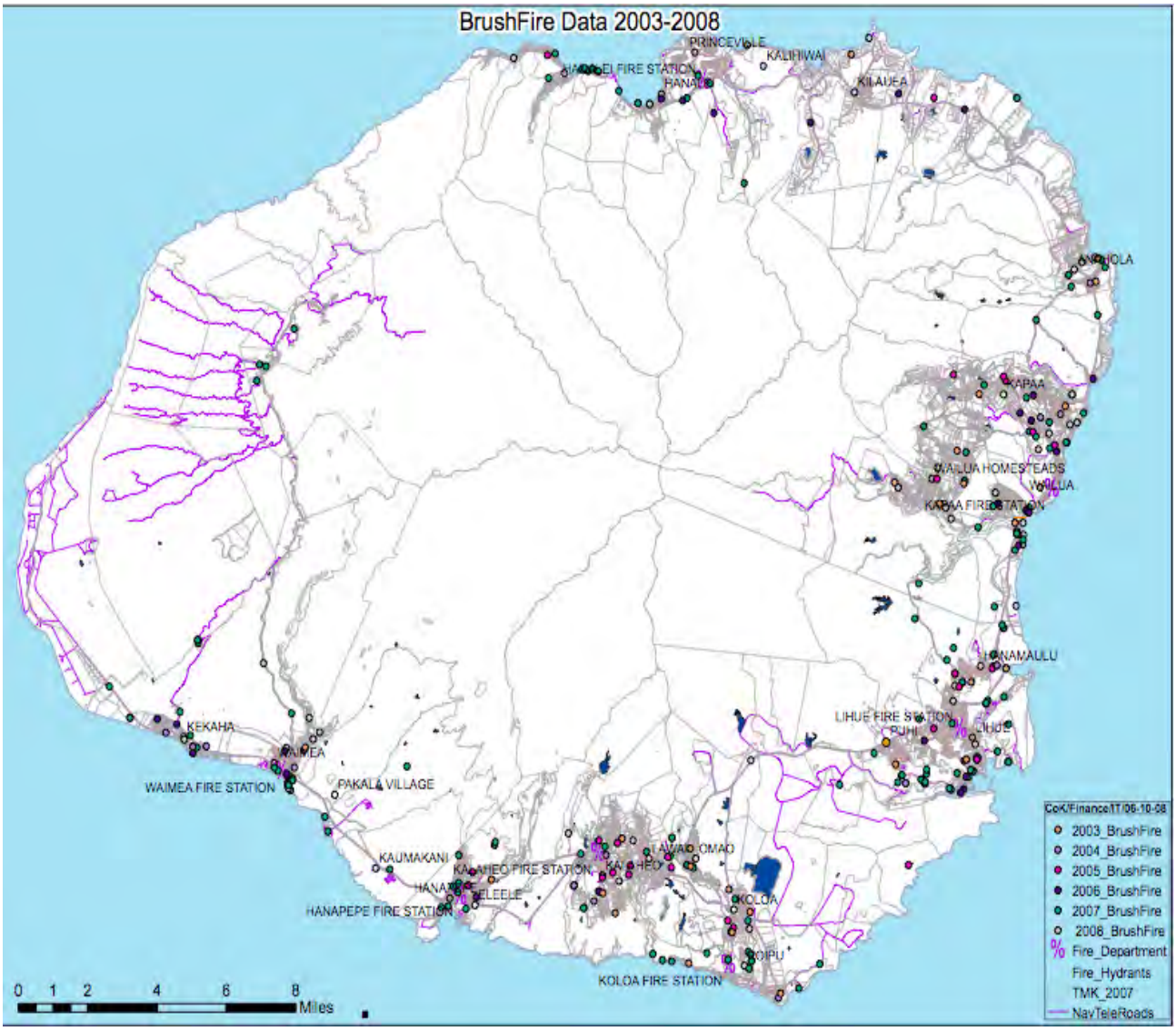


Figure 7: Map illustrating wildfires on Kauai from 2003 to 2008 and fire station locations. Map courtesy of Kauai County GIS.

Table 2: Wildfires Larger than 10 acres on Kauai 2000-2008

(Items in bold represent wildfires larger than 200 acres in size.)

	Date	City	Fire Cause	Acreage burned
1.	3/19/00	Kokee	Undetermined	10

2.	5/7/00	Kealia	Incendiary	12
3.	6/10/00	Kilauea	Other Cause	10
4.	8/6/00	Koloa	Undetermined	40
5.	8/8/00	Puhi	Debris, vegetation burning	10
6.	9/3/00	Puhi	Undetermined	10
7.	9/26/00	Kealia	Equipment	60
8.	5/11/01	Koloa	Smoking	12
9.	5/14/01	Moloaa	Undetermined	10
10.	6/23/01	Anahola	Other Cause	40
11.	9/3/01	Kealia	Other Cause	100
12.	11/25/01	Kealia	Other Cause	105
13.	10/14/02	Koloa	Debris, vegetation burning	20
14.	1/17/03	Lihue	Debris, vegetation burning	10
15.	3/5/03	Waimea	Open/outdoor fire	10
16.	5/26/03	Poipu	Undetermined	12
17.	**7/19/03**	**Kealia**	**Other Cause**	**640**
18.	8/19/03	Lihue	Incendiary	10
19.	9/9/03	Mana	Equipment	40
20.	2/14/04	Anahola	Incendiary	10
21.	7/2/04	Kokee	Incendiary	20
22.	7/6/04	Anahola	Other Cause	20
23.	7/20/04	Anahola	Undetermined	10
24.	7/25/04	Anahola	Undetermined	30
25.	6/3/05	Niumalu	Undetermined	50
26.	6/15/05	Waimea	Undetermined	80
27.	**6/15/05**	**Anahola**	**Misuse of fire**	**270**
28.	7/7/05	Princeville	Undetermined	10
29.	**8/21/05**	**Wailua**	**Undetermined**	**500**
30.	**1/3/06**	**Hanamaulu**	**Undetermined**	**200**
31.	1/5/06	Lihue	Undetermined	50
32.	7/18/06	Poipu	Undetermined	15
33.	3/31/07	Wainiha	Other Cause	30
34.	6/20/07	Wailua	Undetermined	40
35.	**6/30/07**	**Wailua**	**Undetermined**	**300**
36.	7/5/07	Hanamaulu	Undetermined	80
37.	7/5/07	Kapa'a	Undetermined	30
38.	7/8/07	Puhi	Undetermined	30
39.	7/9/07	Lihue	Undetermined	10
40.	7/17/07	Pakala	Debris, vegetation burning	30
41.	7/26/07	Niumalu	Undetermined	75
42.	9/5/07	Hanapepe	Open/outdoor fire	10
43.	9/12/07	Hanamaulu	Other Cause	10
44.	9/12/07	Lihue	Undetermined	10
45.	**10/15/07**	**Poipu**	**Undetermined**	**200**

Table 3: Wildfires per town 2000-2008

Town	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Anahola	**4**	**16**	**6**	**7**	**19**	**8**	**14**	**8**	**7**	**89**
Anini	0	0		1	0	0	0	1	1	**3**
Ele'ele	2	1	3	5	0	1	2	2	1	**17**

Haena	1	1	3	1	0	2	3	1	2	**14**
Hanalei	1	1	3	1	1	0	3	5	1	**16**
Hanamaulu	3	4	2	6	2	3	4	5	5	**34**
Hanapepe	4	3	3	3	1	6	6	7	4	**37**
Hanapepe Heights	2	0	0	0	0	0	0	2	0	**4**
Huleia Valley	0	0	1	0	0	0	2	0	0	**3**
Kalaheo	7	8	6	3	7	11	3	5	3	**53**
Kalihiwai	1	0	0	0	0	0	1	0	0	**2**
Kapaa	3	8	6	6	8	11	8	9	9	**68**
Kapahi	1	3	0	0	0	3	1	0	0	**8**
Kapaia	1	1	1	1	0	2	2	5	0	**13**
Kauai County	0	0	0	0	0	0	0	0	1	**1**
Kaumakani	1	1	1	1	0	1	0	1	2	**8**
Kawelo	0	0	0	0	0	0	0	0	0	**0**
Kealia	8	4	1	2	1	2	1	2	3	**24**
Kekaha	0	3	3	6	5	4	8	6	1	**36**
Kilauea	7	4	3	4	1	2	3	0	3	**27**
Kipu	4	0	0	1	0	0	0	0	0	**5**
Kokee	2	1	1	3	1	2	1	5	5	**21**
Koloa	19	7	6	4	1	7	1	7	4	**56**
Koolau	0	0	0	1	0	0	0	0	0	**1**
Lawai	1	2	4	0	0	1	0	4	0	**12**
Lihue	14	10	6	11	4	10	10	21	5	**91**
Lumahai	2	0	5	2	1	0	1	6	0	**17**
Makaweli & Makaweli Valley	0	2	0	1	0	0	0	0	0	**3**
Mana	0	0	0	4	0	1	1	1	1	**8**
Moloaa	1	1	1	2	0	1	3	1	2	**12**
Na Pali Coast	0	0	0	0	0	1	0	0	0	**1**
Nawiliwili	2	1	1	0	2	3	1	4	3	**17**
Niumalu	0	0	0	3	3	3	3	4	2	**18**
Numila	2	0	0	1	0	1	0	0	0	**4**
Omao	5	4	3	2	0	1	0	2	1	**18**
Pakala	0	0	0	1	0	0	0	3	0	**4**
Poipu	4	3	4	10	2	0	4	10	1	**38**
Polihale	0	0	0	0	0	1	0	0	0	**1**
Port Allen	0	0	1	0	1	0	0	0	0	**2**
Princeville	2	1	2	1	1	1	0	1	0	**9**
Puhi	7	1	5	4	2	2	0	7	1	**29**
Wailua	5	11	9	13	2	10	8	12	13	**83**
Waimea	5	7	3	5	7	12	5	8	17	**69**
Wainiha	0	0	1	1	0	0	1	1	1	**5**
Waipouli	0	0	1	0	0	0	0	0	1	**2**
TOTALS:	**121**	**109**	**96**	**116**	**72**	**113**	**100**	**156**	**100**	**983**

DOFAW maintains separate wildfire data and their wildfire totals vary from those kept by KFD because they only respond to wildfires on state land. Wildfires responded to by both agencies may be counted in each agency's respective statistics.

According to DOFAW data, their personnel have responded to 19 wildfires since 2000. Of those, 11 wildfires were larger than a half-acre in size and 8 fires were smaller than a quarter-acre. The two largest wildfires were both in Kalepa: a 310-acre blaze in 2005 and a 220-acre fire in 2007. A 2003

wildfire burned 50 acres in Kekaha. Table 4 lists wildfires reported by DOFAW since 2000 with the three largest fires in bold. Table 4 also shows the response zone (refer to Figure 5).

Nine fires occurred in Kokee State Park. Puu Ka Pele Forest Reserve had 5 fires, 3 occurred in Kalepa, and one each in the Na Pali Forest Reserve and Kekaha.

Although fire cause is not included in DOFAW fire reports, they do record the type of fuel burned. The most commonly burned fuels are: koa, eucalyptus, and haole koa. Guinea and molasses grass, java plum, silk oak, pine trees, and waiawi were other vegetation types that burned during fires. Figure 8 illustrates the locations of wildfires responded to by DOFAW staff.

Table 4: Kauai wildfires from 2000-2008 per DOFAW

	Date	**Location**	**Acreage burned**	**Response zone (green, pink or white)**
1.	8/1-3/07	Kalalau Valley, Na Pali Forest Reserve	1	green
2.	7/24-26/07	Puu Ka Pele Forest Reserve	1	pink
3.	**6/30-7/3/07**	**Kalepa**	**220**	N/A
4.	5/4-06/07	Kalepa	12	N/A
5.	2007	Kokee State Park – Makai Hunter Check Station	.1	pink
6.	2007	Kokee State Park, Polihale Ridge Rd.	.1	pink
7.	2007	Kokee State Park – Halemanu Rd.	.25	pink
8.	6/10-11/06	Puu Ka Pele Forest Reserve – Pua Lua Reservoir	.2	pink
9.	**8/21-26/05**	**Kalepa Forest Reserve**	**310**	white/green
10.	9/15-16/05	Kokee State Park – Kukui Trail	.1	pink
11.	3/8-9/04	Kokee State Park – Faye Rd.	.1	pink
12.	**9/9-10/03**	**Niu Ridge, Kekaha Game Management Area**	**50**	white
13.	6/30-7/1/03	Kokee State Park	.50 ace	green
14.	6/25/03	Kokee State Park	.20 acre	green
15.	3/21-23/03	Makaha Ridge Puu Ka Pele Forest Reserve	2	green
16.	6/17-19/02	Kokee State Park	.5	green
17.	10/21-23/01	Puu Ka Pele Forest Reserve	<.1	green
18.	3/19-4/4/00	Makaha, Puu Ka Pele Forest reserve	5	green
19.	3/13/00	Kokee State Park	.1	pink

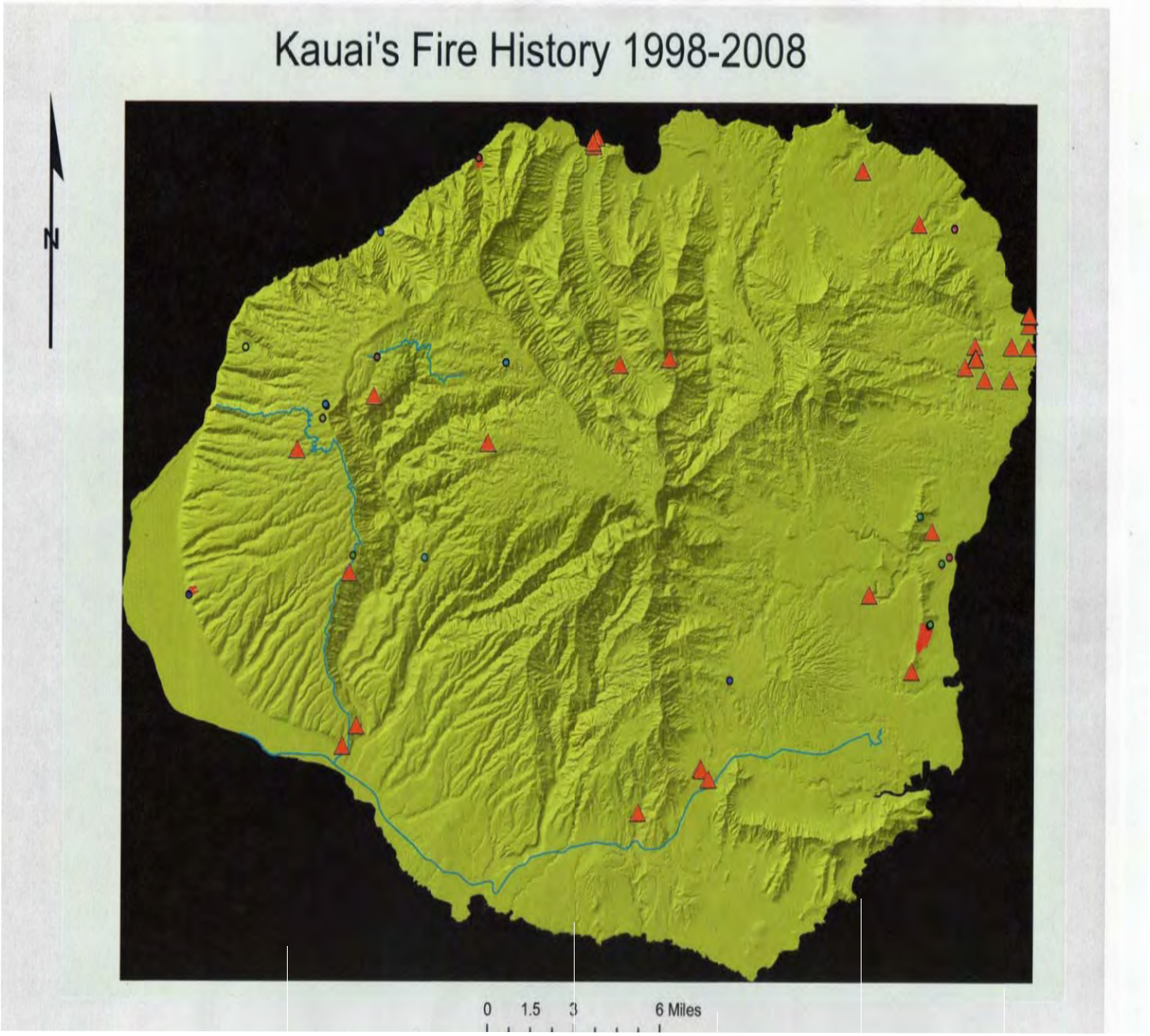


Figure 8: Map illustrating the location of wildfires responded to by DOFAW staff. Map courtesy of DOFAW.

As the charts above illustrated, Lihue, Anahola, Kapa'a/Wailua, Waimea, and Koloa have the highest wildfire occurrences on Kauai. These wildfires have threatened homes and residents, closed major highways to traffic, and strained fire response agencies resources. Although the official cause of the majority of wildfires is undetermined, anecdotal evidence suggest that the majority of wildfires are human-caused.

Human-caused fires are particularly troublesome because they can be prevented. Kauai fire officials described an event in the late 1990s during which witnesses on a boat at sea saw a suspect set fires in Kokee at night. The witnesses saw headlights coming down the mountain, saw the vehicle stop and

shortly thereafter, a fire was observed. The car travelled down the mountain stopping periodically, and at every stop flames erupted. They quickly contacted the authorities, however the suspect reached the main highway and fled before he could be apprehended.

Because the wildfires were spotted quickly, they were extinguished before they could grow out of control. Given the late hour and remote location, these remote area fires could have spread quickly with serious consequences.

In 2008 a lost hiker set a signal fire along the fence line of a native plant enclosure. The hiker was rescued by helicopter, but not before several species of plants were burned. The fire burned five acres.

Arson and human-caused wildfires are also a concern in Anahola, because on several occasions they have come dangerously close to homes. In 2001 there were three wildfires in Anahola greater than 40 acres in size, all juvenile arson related. The juveniles responsible for setting the wildfires were eventually apprehended by the police.

A September 2001 fire in Anahola, which started in an abandoned vehicle on Kealia Road, burned 100 acres. Soon after, in November 2001, another wildfire scorched 105 acres in Anahola, threatening several homes.

Above left and right: A June 15, 2005 wildfire burned 270 acres and came dangerously close to homes in Anahola. Photo credit: Kauai Fire Department.

Large wildfires are an issue because they take fire department resources away from other parts of the island. According to fire officials, at one point during the suppression of the November 2001 Anahola fire, there were no firefighters at Kapa'a, Koloa, Kalaheo, and Waimea fire stations.

"When several engine companies are taken out of their home districts to suppress fires in Anahola, large areas of the island are left without adequate or timely fire, rescue, and emergency medical protection," Battalion Chief Bob Kaden said in media reports on the fire. (*The Garden Island Newspaper*, November 27, 2001.)

Fire resources and personnel were strained yet again on June 15, 2005 when wildfires erupted at opposite ends of the island within hours of each other.

A blaze broke out around noon on June 15, 2005 off of Waimea Canyon Road, burning 80 acres. A few hours later another wildfire started in Anahola. The Anahola fire, which burned 270 acres, came close to several homes. Media reports described tall guinea grass in close proximity to many homes in the Anahola area.

On January 5, 2006, three wildfires were intentionally set by youth within a two-hour period in the early morning hours in Anahola and burned approximately 3 acres. According to press reports, the blaze came within 100 feet of several homes.

On the same day a 50-acre wildfire off Ahukini Road near the Lihue airport threatened 300 rental cars in an inventory overflow lot. Fortunately, fire department personnel were able to knock down the blaze before it reached the rental cars and the gasoline stored in the gas tanks. Tall guinea grass reportedly surrounded the parking area.

Above left: An August 2005 wildfire in Wailua burned 500 acres. The cause of the blaze, the second largest on the island in the past 10 years, was undetermined. Fires of this magnitude strain resources and personnel across the island. Photo credit: Kauai Fire Department.
Above right: Helicopter suppression of an Anahola wildfire. Photo credit: Roland Licona, DHHL.

While fire crews were dealing with the Anahola and Ahukini Road wildfires, another blaze broke out in Hanamaulu under the Kapule Highway Bridge. Although this fire was small in size—fire report data list it under an acre in size—the additional strain on fire department resources and personnel was a burden.

On June 30, 2007, four fires occurred in one day in Hanapepe, Hanalei, Lihue, and Wailua. While the wildfires in Hanapepe, Lihue, and Hanalei were small (an acre or smaller), the Wailua fire burned 300 acres in just a few hours. According to press reports, this fire was less than a mile from a wildfire that had burned 40 acres the preceding week.

Wildfires in the Wailua area are of special concern because they can shut down Kuhio Highway, known as the Wailua Corridor, the main roadway connecting the west and east sides of the island. Kapa'a is the largest residential town on the island with commercial and residential traffic dependent on traveling between Lihue and Kapa'a.

When the Wailua Corridor is closed to traffic due to wildfire, as has happened several times in the past, it has a tremendous impact on residents and tourists alike. When wildfires cause the closure of Kuhio Highway it disrupts the transportation of goods and services around the island, prevents residents from traveling to and from work, and prevents visitors from reaching their departing flights at the airport. Perhaps most importantly, Kuhio Highway closures can prevent people from reaching the emergency room of the island's largest medical facility, Wilcox Memorial Hospital in Lihue.

Another wildfire concern on Kauai is the illegal dumping of trash and cars, particularly in Anahola.

Abandoned vehicles can still contain gasoline and flammable liquids, and compounds in the vehicle frame, upholstery, and tires can become toxic when burned. During a 2004 wildfire hazard assessment of Anahola, Kauai Fire Department personnel estimated there may be over 100 abandoned vehicles in the open fields surrounding Anahola. When driving the perimeter of the open fields these vehicles are hard to see in the dense overgrown brush, thus posing a hidden danger. Removing the cars is problematic because they are considered hazardous materials and require Environmental Protection Agency (EPA) oversight. According to DHHL personnel, during a July 2004 wildfire in Anahola, several abandoned cars caught fire and explosions could be heard when the car tires exploded.

Above left and right: abandoned cars discovered after a wildfire in Anahola. The vehicles pose a serious threat to fire crews battling blazes. Photo credit: Roland Licona, DHHL.

Dumped trash can also pose problems when wildfires break out. The trash itself can contain a host of unknown hazards, including chemical and/or biological matter that can impact the health of responding fire crews and area residents. The sheer physical size and/or location of the trash is also a concern as it has hindered firefighters from responding to at least one fire.

During an April 2005 wildfire near the Anahola Kahala Point Coast Guard light beacon responding fire crews needed to move household appliances from the access road in order for apparatus to reach the fire. One apparatus suffered a flat tire responding to the fire. The combination of large quantities of abandoned vehicles and illegally dumped trash plus large amounts of overgrown brush and a high rate of fire occurrence, make Anahola especially vulnerable when wildfires erupt.

Above left: Discarded rubbish is an issue in Anahola where it has hindered firefighters' ability to reach wildfires. Above right: Discarded rubbish and appliances litter a fire scene at a June 20, 2001 fire. Photo credit: Roland Licona, DHHL.

Stakeholders:

Stakeholders are individuals or groups who have a high level of interest in the protection of their assets from wildfire. In addition to community members and federal, state, and county fire response agencies, major landowners have an interest in reducing the wildfire risk on Kauai. Contact information for principal stakeholders is listed below.

Federal:

U.S. Fish & Wildlife Service
Shannon Smith, Refuge Manager
Kaua'i National Wildlife Refuge Complex
P.O. Box 1128, Kilauea, HI 96754
(808) 828-1413
Shannon_smith@fws.gov

U.S. Navy Pacific Missile Range Facility (PMRF)
Barking Sands Fire Department
Robert Cecconi, Fire Chief
P.O. Box 399, Kekaha, HI 96752
(808) 335-4867
robert.cecconi@navy.mil

State:

Department of Land and Natural Resources: Division of Forestry and Wildlife
Wayne Ching, State Protection Forester
1151 Punchbowl St., Rm. #325, Honolulu, HI 96813
(808) 587-4173
Wayne.F.Ching@hawaii.gov

Department of Hawaiian Home Lands
Roland Licona, Kauai District Supervisor
3060 Eiwa St., Rm. #203, Lihue, HI 96766
(808) 274-3132
Roland.e.licona@hawaii.gov

County:

Kauai County Fire Department
Robert Westerman, Fire Chief
3083 Akahi St., Lihue, HI 96766
(808) 241-4982
rwesterman@kauai.gov

Kauai County Civil Defense Agency
Mark Marshall, Administrator
3990 Kaana St., #100, Lihue, HI 96766
(808) 241-1800
mmarshall@kauai.gov

Kauai Planning Department
Bryan Mamaclay, Planner
4444 Rice St., Rm. #473, Lihue, HI 96766

(808) 241-6677
bmamaclay@kauai.gov

Community:

Grove Farm Kauai
Mike Tresler, Senior Vice President
3-1850 Kaumualii Highway, Lihue, HI 96766-7069
(808) 245-3678
mtresler@grovefarm.com

Kauai Coffee
Greg Williams
P.O. Box 530, Kalaheo, HI 96741
(808) 335-0052
gwilliams@kauaicoffee.com

Garden Isle RC&D
Laurie Ho, Coordinator
Garden Isle Resource Conservation and Development Council (RC&D)
3083 Akahi St., #204, Lihue, HI 96766
(808) 246-0091
Laurie.Ho@hi.usda.gov

Forestry Management Consultants-Hawaii
Stephen E. Smith
P.O. Box 351, Lawai, HI 96765-0351
(808) 332-5200
forestry@hawaiiantel.net

Hui O Laka, Kokee Natural History Museum
Marsha Erickson / Michelle Hoohano
P.O. Box 100, Kekaha, HI 96752
(808) 335-9975
Kokeemuseum@earthlink.net

Kokee State Park Advisory Council
Canen Ho`okano, Chair
ku_nahau@msn.com
kokeeadvisory@gmail.com
www.kokeeadvisory.org

Bill Cowern
P.O. Box 649, Lawai, HI 96765
treefarm@halekua.com

Base Map of Kauai:

Figure 9 shows a base map for the island of Kauai. Towns, major highways, and major tourist destination areas, such as the Poipu resort area and the Coconut Coast near Kapa'a are shown. State parks and forest reserves are illustrated in shades of pink and red.

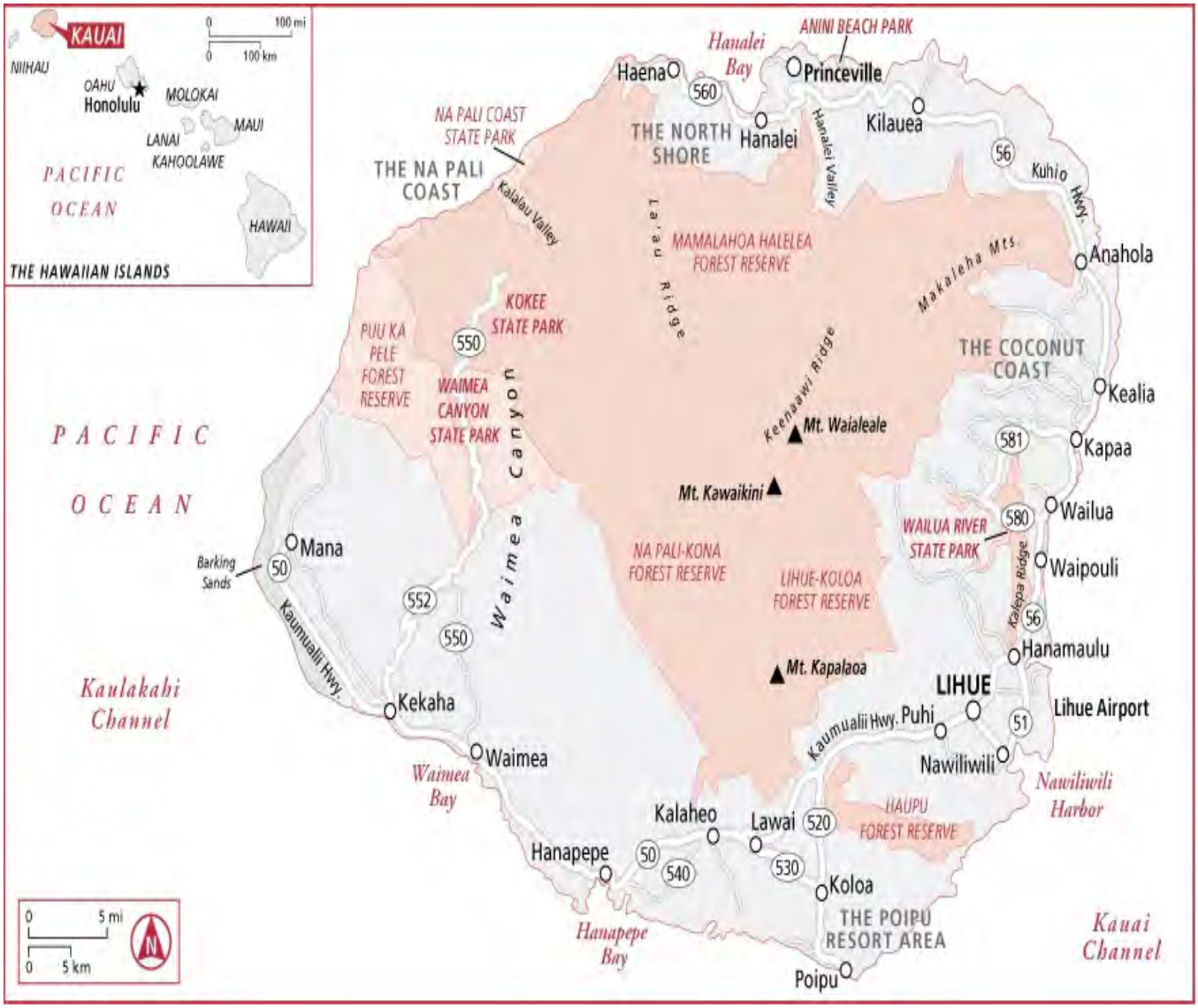


Figure 9: Base map of Kauai, showing the locations of towns, forest reserves, and highways. Map credit: frommers.com

Fire Risk Assessment for Kauai:

A wildfire hazard assessment was conducted to identify the level of wildfire risk for communities on Kauai. The Hawaii Wildland Fire Risk and Hazard Severity Assessment was used for this CWPP, which is based on the Assessment in Appendix A of NFPA 1144, *Standard for Protection of Life and Property from Wildland Fire*.

Using a pre-established point system, the Hawaii Wildland Fire Risk and Hazard Severity Assessment is a tool used to determine the level of wildfire risk to a home or community. Points are given regarding overall terrain and location, road width, local area fire history, prevailing winds and seasonal weather, geographical contours, native vegetation, water availability, location of fire suppression resources, as well as the combustibility of building materials, including the roof, siding, and attached items, such as decks, fencing, or an unit. The combined points in all these categories are added together and the overall risk is determined by whether the score falls in the low-, medium-, high-, or extreme-risk point range. Given the ignitability of individual structures, preponderance of open tracts of land full of overgrown fire fuels in close proximity to structures and communities, lack of water in reservoirs, and high rate of human-caused fires, the communities on Kauai scored in the high-hazard range in the wildfire hazard assessment.

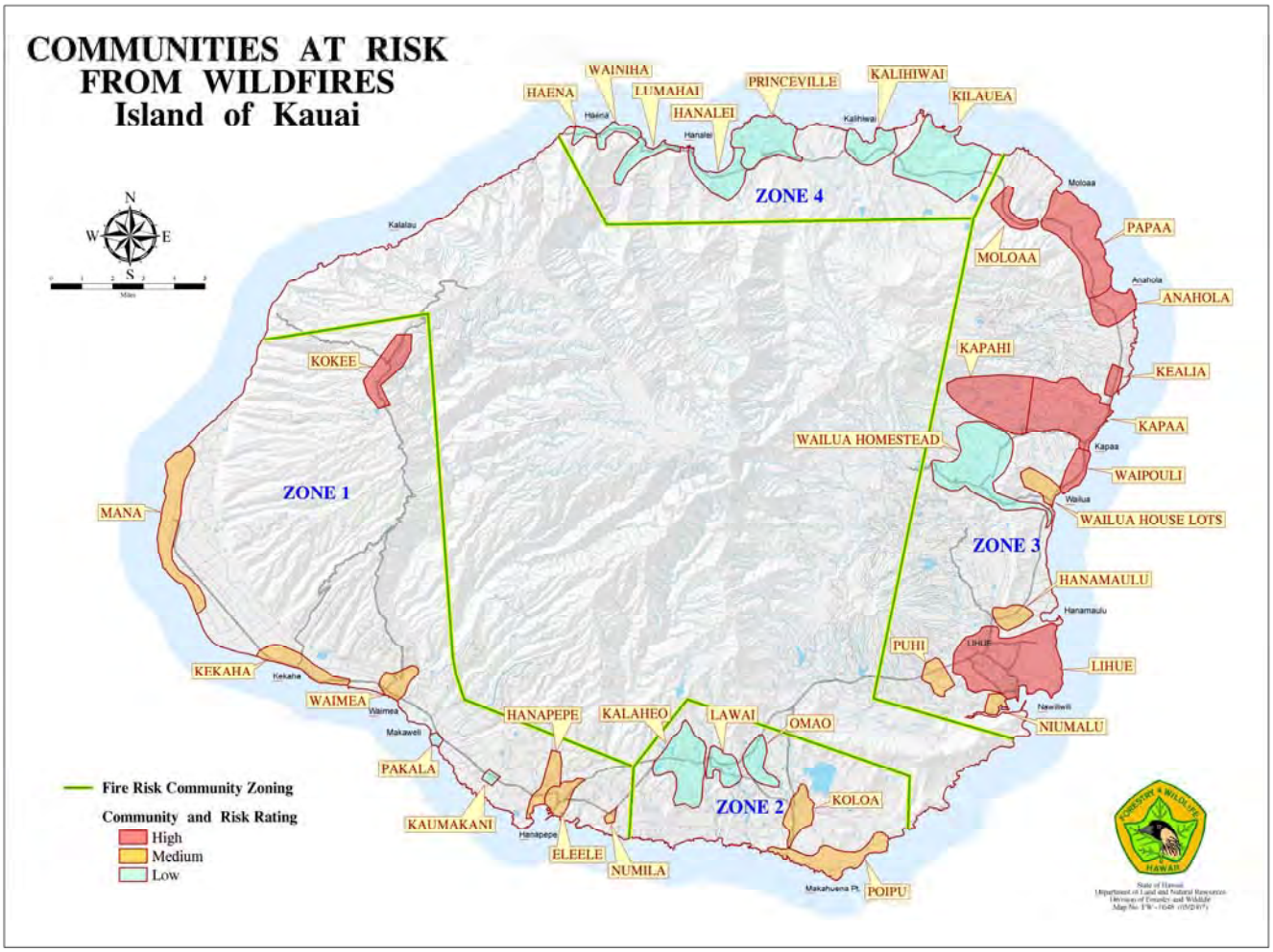


Figure 10: Kauai DOFAW staff created the above map illustrating communities at risk from wildfires based on the 2001 Federal Register: "*Urban Wildland Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire,"* (Volume 66, Number 160). Map courtesy of DOFAW.

While the island as a whole shares certain common characteristics, the communities within it vary tremendously and deseve separate description in terms of slope, size, and water availablity. Figure 10 illustrates the communities at risk from wildfires around Kauai. The island is broken down by district with descriptions provided below.

Common characteristics around the island:

With the exception of the higher elevations, such as Kokee which are cooler, most of Kauai experiences year round warm weather with temperatures ranging from the mid-60s to high-80s. Relative humidity is usually above 50 percent year round. Rainfall tends to be evenly spread out throughout the year with the least amount of rainfall occurring in the summer months.

In 2008, Kauai experienced lower than normal rainfall. Mt. Wai'ale'ale received only 352 inches of rain, 83% of its normal level. Reduced rainfalls result in a higher-than-normal risk of wildfires, especially in the dry summer months.

Streets are paved and more than 20 feet wide (see Infrastructure). With the exception of extremely rural and remote areas, such as Kokee, roads are well marked with metal reflectorized signs.

Four percent of the island's land classified as urban has been developed although there is growth in non-urban lands. Kauai's Comprehensive Zoning Ordinance stipulates that no building can be taller than 55 feet (4 stories). Minimum setbacks to property lines are generally allowed for residential construction. The Comprehensive Zoning Ordinance requires a setback of 10 feet from the front of a property, 5 feet or one-half the wall height from the side, and 10 feet from the rear.

While there is no one housing standard for the entire island, the older plantation towns around Kauai (Kalaheo, Koloa, Kekaha, Kapa'a, Hanamaulu, Lawai, and Waimea to name a few) tend to share similar characteristics. The neighborhoods have homes on small lots (10,000-12,000 square feet.) Houses tend to be single story, with metal or other Class A type roofing and combustible siding, have small louvered windows, and are of post and pier or concrete construction. Driveways are short (less than 100 feet) and paved with little or no turn around space for fire apparatus. Driveways are usually 10-12 feet wide with 15 feet vertical clearance. Ornamental vegetation around yards is well established and the maintenance of such vegetation varies greatly depending on the homeowner. Utilities are above ground.

In older neighborhoods fire hydrants tend to be 1,000 feet apart or have a standpipe connected to a 3-inch pipeline. Agriculturally zoned subdivisions are also allowed to have stand pipes. However, new subdivisions are required to have one fire hydrant every 300 feet with an 8-inch line per Kauai Department of Water Supply standards.

It is important to note that in recent years the reservoirs around Kauai have been allowed to run dry. In March 2006 the Kaloko Dam (an earthen dam) near Kilauea breached and the resulting mudflow destroyed homes, closed the highway, and severely impacted the island as a whole. Seven fatalities also occurred. State and federal agencies conducted assessments of all dams and reservoirs on Kauai after the Kaloko dam break. Some reservoir owners voluntarily drained their reservoirs while others were allowed to run dry. While dam safety is an important issue, officials would be wise to address the consequences of allowing these dams to remain dry.

Hanalei District

Hanalei district on Kauai's north shore encompasses the towns of Hanalei, Princeville, Wainiha, Kilauea, Moloa'a, and Ha'ena, and

small neighborhoods in between.

Cultural, natural, and historical resources in this district include the Kilauea Point National Wildlife Refuge and Lighthouse, Na Pali Coast, Kalalau Trail, Makana Peak, Manininiholo Dry Cave, Waikanaaloa and Waikapalae Wet Caves, and the Waioli Mission House.

The district is home to Kula High and Intermediate school, three elementary schools, one middle school, and smaller private schools.

View of Hanalei Bay. Photo credit: tripadvisor.com

The Robinson Family, Kamehameha Schools, Alexander & Baldwin, Department of Hawaiian Home Lands, and Princeville Corporation are some of the larger landholders in the district.

There is one fire station in the district, adjacent to the Princeville Shopping Center. Nearby is Princeville airport that serves as a hub for helicopter tour companies. There is a steep drop in elevation between Princeville and Hanalei town. A one-lane bridge across Hanalei River at the bottom of this ridge is the only means of access to Hanalei and Ha'ena.

There are gently rolling hills in the area surrounded by steep mountain ridges. The land slopes from the mountains to the ocean. Normal trade winds blow from the east-northeast averaging 5 – 15 mph.

Kuhio Highway, a two-lane paved major highway maintained by the State Department of Transportation, is the only major road connecting Kauai's north / northeast shore with the rest of the island. Kuhio Highway dead-ends at Ke'e Beach at the base of the Na Pali coastline. Residential and commercial development tends to be on the makai (ocean) side of the highway, with smaller amounts of residential and agricultural development on the mauka (mountain) side of the highway.

Along the coastal areas of Hanalei, Princeville, and Anini lot sizes are small (usually less than an acre). Residential areas mauka of the highway tend to be larger in size. There are several horse ranches and public riding stables in the district and some property owners have livestock, including horses, sheep, and/or goats. There are several active commercial agricultural operations in the district, which are well irrigated. However, a great deal of former agricultural lands are being developed with large up-scale homes that do not practice any agriculture.

Hanalei church. Photo credit: www.tripadvisor.com

High-end residential development around the luxury resorts in Princeville is in sharp contrast to the more modest homes found in surrounding towns. As of June 2009, real estate listings for single family homes in the Hanalei district range from $400,000 - $20,000,000+. Vacation home rentals are prevalent in the area, especially in Hanalei, Princeville, and Anini.

Although there is a strong anti-development sentiment in the Hanalei district, in recent years several subdivisions have been built on former agricultural land. These newer subdivisions tend to have house lots larger than an acre (often 5 – 10 acres) with well-maintained landscaping. Driveways are typically paved, at least 12 feet wide with15 feet vertical clearance, are often more than 300 feet long, and are usually gated. The majority of homes have Class A (non-combustible) roofing and wood siding.

Roads are paved and greater than 20 feet in width. There are several subdivisions in the district (Princeville Ag lots, Seawind Farms in Moloa'a, Kilauea Ag subdivision, and others) that has only one

means of egress and ingress. Utilities are aboveground in older neighborhoods and underground in newer ones. Side streets in the district are paved and marked with metal reflectorized signs.

Additional development is planned for Hanalei district. Princeville Corporation's master plan calls for conservation and residential development for the hundreds of acres of undeveloped land it owns on the north shore. However, this residential development is low-density and requires residents to utilize cattle grazing as a means of fuel reduction. In Hanalei, they plan to expand the taro field. There is also a plan to dedicate 8 - 12 acres as a wetland preserve.

The main plan also calls for an agricultural subdivision east of the highway between the existing gates of Princeville and Anini Vista, past the Prince Clubhouse and Spa. This latest subdivision will have 17 lots ranging from 10-30 acres each. Lot owners will be required to devote one-half to one-third of their land to cattle grazing.

Kawaihau District

The Kawaihau district comprises the towns of Kealia, Waiopouli, Wailua, Anahola, and Kapa'a. Natural and cultural resources include Nounou Mountain ridge commonly called Sleeping Giant, Opaekaa Falls, Keahua Forestry Arboretum, the Fern Grotto, and Wailua Falls. As the only navigable river in Hawaii, Wailua River is a popular kayaking location for tourists and locals alike. And as one of the first areas on Kauai inhabited by migrating Polynesians thousands of years ago, the Wailua River Valley is rich in archeological sites as well.

View of coastline in Kapa'a, which is often referred to as the Coconut Coast.

Schools in the Kawaihau district include Kapa'a Educational Complex; Kapa'a High, Intermediate, and Elementary Schools; Kamehameha School campus; and private schools.

There is one fire station in the district, in Kapa'a.

The largest landowner by far in this area is the State of Hawaii. Cornerstone Hawaii, Grove Farm, Bette Midler, and the Department of Hawaiian Home Lands are also large landowners.

There are gently rolling hills in the area surrounded by steep mountain ridges. The land slopes from the mountains to the ocean.

Downtown Kapa'a. Shops on the makai side of the street are a few hundred feet of the ocean. Behind the businesses on the mauka side of the street are large empty fields filled with overgrown brush.

There are large open fields of overgrown brush in Wailua and Kapa'a. In several areas, this brush continues up hillsides to homes. The brush also comes close to the roadsides. Normal trade winds blow from the east-northeast averaging 5 – 15 mph.

Kuhio Highway, a two-lane paved major highway maintained by the State Department of Transportation, is the only major road connecting Kauai's east shore with the rest of the island. A section of the highway is three lanes wide in front of the prison and golf course. Commercial development tends to be along the highway, with residential and agricultural development on the mauka (mountain) side and inland of the highway.

Overgrown grass and kiawe along the mauka side of the Wailua Corridor between Wailua and Lihue.

On the makai side of the Wailua Corridor there are hotels and a golf course while the mauka side is vast open fields of overgrown brush. The island's only prison is directly across from the golf course on the mauka side of the highway. Surrounded by fields of brush, the prison has come close to evacuating inmates during previous wildfires.

DHHL manages 5,000 acres of land in Anahola, 3,000 of which are used for grazing. They also manage the 71-acre Pi'ilani Mai Ke Kai subdivision, which contains 172 houses with lots averaging 10,000 square feet. Houses within Pi'ilani Mai Ke Kai are typically single story with Class A roofing and combustible siding. Driveways are short – less than 100 feet and unpaved. Several homes are within 30 feet of overgrown brush. Slope in Anahola averages 0 – 20 percent and the average annual rainfall is 45 inches. During the summer the community receives about 2 inches of rain a month.

According to DHHL officials, a 500,000-gallon water tank was built in Anahola in 1999. There is also a 150,000-gallon tank, which is interconnected to a second 500,000-gallon gravity-fed water tank in the farm area that can be used only in the event of an emergency.

Smoke from a backyard fire can be seen from the Wailua Bypass Road.

DHHL is acutely aware of the wildfire risk in Anahola and the threat it poses to homestead lot owners. In 2001, Anahola experienced 16 wildfires, far more than another other town on Kauai that year. As a result, DHHL and Kauai Fire Department staff met and discussed fire prevention efforts in light of the fires affecting Anahola. In March 2002, the Fire Chief sent a letter to the Hawaiian Homes Commission regarding the department's concerns about wildfires in Anahola. The letter also contained mitigation suggestions, including the need to provide access to gated lands; maintaining access roads; clearing roadsides; preventing the dumping of trash and green waste; as clearing defensible space around structures. Some progress was made, however, a great deal more work needs to be done.

In 2004, Anahola once again experienced more wildfires when 19 fires occurred. As a result, KFD staff called DHHL regarding the levels of thick brush surrounding the community. In response, DHHL applied for and received a $50,000 FEMA grant to mow and maintain fuel breaks around the community. DHHL is currently in the process of implementing that grant.

DHHL also owns 400 acres in Wailua on the mauka side of the highway, which is slated for development. Plans call for 700 homestead lots for native Hawaiians, a school, community center, parks, and infrastructure improvements. DHHL plans for commercial development on the makai side of

the highway are currently on hold.

There are several small-scale farming and livestock operations in the district.

While homes in this district are generally built on flat land, the communties themselves are built in and atop river valleys and foothills with steep ridges. Homes in subdivisions at the top of valleys, such as Wailua Riverview Estates and Kapa'a Heights tend to be entirely owner-occupied. Roads are paved, with metal road signs. While the occasional wood shake roof is seen, the majority of houses have Class A roofing with wood siding. Several homes are made of concrete block. Almost all driveways are paved and less than 100 feet long with no turn around space for fire apparatus. As of June 2009, real estate listings for single family homes in the Kawaihau district range from $375,000 to $2,500,000.



Left: View of homes on Kawaihau Road in Kawaihau, adjacent to Kapa'a. Open field of overgrown brush lay mauka of downtown Kapa'a. The brush grows up the hillsides to the homes. Center and right: View of Wailua Valley homes. Some homes have large amounts of vegetation around them, while other lot owners conduct small-scale grazing.

Houses vary in level of defensible space. However, those homes closest to undeveloped areas have kiawe and overgrown grasses growing in close proximity.

There are several resorts and hotels in Kapa'a. This side of the island is often called the Coconut Coast. Condominiums and vacation rentals are prevalent along the coast. In recent years development has focused on catering to the tourism industry with the building of time-shares, condominiums, and vacation homes.

Another proposed development for the district is the 2,021-acre Kealanani Project north of the Kealia River and mauka of the highway. Plans call for 190 agricultural lots ranging from 3 – 100 acres. One hundred low-income house and lot packages will be developed at a later date. Lots will have separate domestic and agricultural water systems with domestic water coming from onsite wells and agricultural water coming from old sugar irrigation system. Unlike other recent upscale development on agricultural land, Kealanani developers are mandating that property owners use their land for agricultural purposes. Tea and cacao are the main crops to be grown in these lots although property owners can choose alternate crops if they wish.

Lihue District

Encompassing the towns of Lihue, Hanamaulu, Puhi, and Nawiliwili, Lihue District is home to the island's governmental and commercial seat. Lihue district is also home to several natural and cultural resources, including the Grove Farm Homestead Museum, Huleia National Wildlife Refuge, the Menehune Fishpond, Nawiliwili Harbor, and Lydgate State Park.

Schools in the area include the main campus of Kauai Community College in Puhi, Kauai High School and Intermediate School, a middle school, two elementary schools, and several private schools.

Kauai's only hospital, main shipping port, and airport are all in Lihue. There is one fire station for the district, in central Lihue.

Major landowners include Grove Farm, Visionary LLC, and W.H. Rice.

There are gently rolling hills in the area surrounded by steep mountain ridges and river valleys. The land slopes from the mountains to the ocean. There are large open fields of overgrown brush in Hanamaulu and Kapaia. In several areas, this brush continues up hillsides to homes. The brush also comes close to the roadsides. Normal trade winds blow from the east-northeast averaging 5 – 15 mph. Average annual rainfall in district varies from 49 inches in Hanamaulu to 58 inches in Puhi.

In Lihue, Kuhio Highway connects with Kapule Highway and Kaumuali'I Highway. In Hanamaulu, Kuhio Highway veers mauka and runs inland to upper Lihue while Kapule Highway runs parallel with the coast closer to shore and airport. Kalpule Highways runs a little over four miles and changes to Nawiliwili Road in Nawiliwili. Kuhio Highway is the main road through downtown Lihue and changes to Kaumuali'i Highway at Rice Street.



Left: A ball field in a Hanamaulu neighborhood. The ballpark is surrounded by dense overgrown kiawe. The tall trees are the vegetation separating the ball field from neighborhood houses. Center: the house next to the ball field. Although the lot is small, there is a great deal of overgrown vegetation between the house and the ballpark. Right: dead end street on Wailua side of Hanamaulu. Overgrown grasses and kiawe borders the neighborhood.

Commercial development tends to be along the highways, with residential and agricultural development on the mauka (mountain) side and inland of the highway.

Unlike the resort towns of Poipu, Princeville, and Kapa'a the majority of homes are owner-occupied although some in Nawiliwili are used as vacation rentals. As of June 2009, real estate listings for single family homes in the Lihue district range from $343,000 - $768,000.

Subdivisions are built on or next to former agricultural lands. Homes in Lihue Town Tract Camp, Lihue and Hanamaulu Homes, Hanamaulu are typical district subdivisions in that houses are single or double story built on 10,000-12,000 square-foot lots. It's common for house lots to be separated by concrete or metal fences. Driveways are short, usually less than 50 feet, and paved with 15-foot vertical clearance. In Hanamaulu the side streets tend to be narrow with cars parking along both sides of the street. On the Wailua side of Hanamaulu Homes, the side streets dead end with no turn around space for fire apparatus. These dead end streets have dense overgrown brush within 30 feet of homes at the end of the street. Similarly, Lihue Town Tract Camp has vast open fallow fields around the subdivision.

Homes vary between post and pier and concrete slab construction. Some homes have wood siding while others are made of concrete block. Almost all the homes have Class A roofing. Homes vary in levels of defensible space.

Homes in Puhi, such as Hokulei Estates are similar to those described above, while homes on rural streets, such as those near the Menehune Fishpond and in Niumalu are larger in size with larger lots.

Puakea Golf Course surrounds most of the Puakea subdivision in Lihue developed by Grove Farm, although there are some parts where overgrown grasses and brush come within 100 feet of homes. Beyond the golf course is acres of open fields. Because Puakea is a new subdivision, the vegetation on individual lots is not yet fully grown in.

Roads are paved and greater than 20 feet in width. Utilities are aboveground in older neighborhoods and underground in newer ones. Side streets in the district are paved and marked with metal reflectorized signs.

Koloa

Koloa District on Kauai's south shore includes the towns of Omao, Kalaheo, Lawai, Koloa and Poipu. Koloa is the oldest sugar plantation town in the state, while nearby Poipu's beaches and resorts make it one of the top tourist destinations on Kauai. The Spouting Horn in nearby Lawai, as well as the renowned National Tropical Botanical Gardens are just some of the natural and cultural resources in the area.

Typical plantation-style house found on Kauai. This house is in Koloa.

The area includes Kalaheo School and two private schools. The district is served by fire stations in Poipu and Kalaheo.

Spouting Horn in Lawai is a popular tourist destination on Kauai.

Alexander & Baldwin and Grove Farm are two of the largest landowners in the district.

The area surrounding Koloa and Poipu is mostly flat with slope ranging from 0-10 percent, while Kalaheo and Lawai tend to be steeper with slope ranging upwards of 20 percent. Koloa averages about 65 inches of rain annually while Poipu receives an average of 44 inches. Normal trade winds blow from the east-northeast averaging 5 – 15 mph.

Poipu and Koloa are accessible by two roads off of Kaumuali'i Highway: Maluhia Road and Koloa Road. The tree tunnel, a well-known landmark on Kauai, runs along the first mile of Maluhia Road from the Highway. Both Maluhia Road and Koloa Road are two-lane paved major streets. There are a couple ranches and vast fallow cane fields along Maluhia Road. Some of the former cane lands are slated for development, such as the proposed Poipu Aina Estates that are planned within sight of the Poipu sugar mill.

There is ranching and residential development along Koloa Road. Some lots along Koloa Road are 10-12,000 square feet, while others are much larger.

Commercial development is centralized in downtown Koloa and a few shopping centers in Poipu.

Because Koloa is one of the oldest towns on the island, (it dates back to 1835) houses tend to be small, single-story, and close together. Like other plantation towns, it is common for houses to be separated by concrete or metal fences. Driveways are short, usually less than 50 feet, and paved with 15-foot vertical clearance. Homes vary between post and pier and concrete slab construction. Some homes have wood siding while others are made of concrete block. Almost all the homes have Class A roofing. Homes vary in levels of defensible space, although many homes seen during the wildfire hazard assessment had vegetation growing next to or actually up on the house. As of June 2009, real estate listings for single family homes in the Koloa district range from $685,000 - $1,700,000 with the higher end homes found in Poipu.

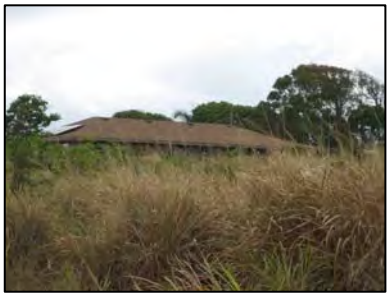
Above: Fallow cane fields are being developed into upscale housing developments in Koloa and Poipu. From Maluhia Road a realtor's flag can be seen waving in the foreground to promote sales in Poipu Aina Estates with the defunct sugar mill in the background.

Homes in Koloa, Lawai, and Kalaheo have above ground utilities, hydrants and setbacks. Newer homes in Poipu have underground utilities. Road signage is metal and reflectorized, however house

Above left and center: Built in 1835, old Koloa town contains retail shops, a post office, churches, and a community center. Right: A new subdivision Koloa Creekside Estates, is being built a few hundred feet down the street from the red wood building featured in the left and center pictures.

numbers vary in size and color.

More recently homes have been built further away from historic Koloa center. These homes are on slightly larger lots and tend to be larger in size and often two stories in height. The immediate area around the home may be cleared but they often have overgrown fields filled with kiawe and brush within 50-100 feet of the house.



Above left: Homes on the outskirts of historic Koloa center. These newer homes have defensible space within 30 feet of the house but are surrounded by open fields of overgrown brush. Center and right: The same house as seen from the front and side. The front entrance ad sides have 30 feet of defensible space but beyond that there is thick overgrown grasses and kiawe trees.

Condominiums, time-shares, and vacation rental homes are the predominant housing in Poipu. Lot sizes become smaller as you get closer to the ocean. Since most properties are vacation rentals, they tend to be maintained by landscaping services so vegetation rarely becomes overgrown.

Above left: Former sugar cane fields around Poipu are slated for development and ground breaking has already occurred in several subdivisions. Above right: subdivision in Kalaheo built mauka of the highway.

Neighborhoods in Lawai and Kalaheo along Koloa Road and the highway more closely resemble the plantation towns of Hanamaulu and Wailua than the resort area of Poipu. However, homes along the coastline in Poipu and parts of Lawai tend to be upscale vacation rentals. It was observed during the wildland hazard assessment that the majority of these vacation rentals homes have wood shake roofs. Although directly on the ocean, these homes are across the street from open fields of overgrown grasses. While these wood shake roofs pose a threat due to the overgrown grasses, this area, Kukuiula is slated for development and groundbreaking is evident. It is anticipated that when Kukuiula is developed the lack of fuel load will reduce the fire risk of the wood shake roofs.

A substantial amount of development is planned for the Koloa district, primarily in Poipu. Although the current year round population of Poipu is 1,000 people, more than 4,000 residential units are proposed for former agricultural lands. Plans call for resorts, time-shares, condominiums, and single-family residences.

Waimea District

The Waimea District covers the west side of Kauai, including the towns of Kekaha, Port Allen, Waimea, Kokee, Hanapepe, and Ele'ele. These communities are primarily agricultural although tourism also contributes to the local economy.

One of Kauai's most well known and most-visited sites – Waimea Canyon (also known as the Grand Canyon of the Pacific) is on the west side. Additional cultural, historical, and natural resources include Kokee State Park and the breathtaking Kalalau Lookout, Russian Fort Elizabeth, Hanapepe Valley Lookout, the Salt Pond, and the 17-mile-long Polihale beach, the longest beach in Hawaii.

Hanapepe averages about 30 inches of rain annually. Further up the coast, Kekaha and Waimea average 20 and 21 inches of rainfall a year respectively. During the summer months Kekaha and Waimea may see only a half-inch of rain a month.

Frequently referred to as the "Grand Canyon of the West", Waimea Canyon is one of Kauai's most well known scenic vistas. A mile wide, 10 miles long, and more than 3,500 feet deep Waimea Canyon offers spectacular views of its canyons and waterfalls.

Above left: View of Hanapepe town and surrounding agricultural land from the scenic overlook on Kaumuali'i Highway. The canyon in the forefront is Hanapepe River. Above right: View of Waimea town from Waimea Canyon Drive.

The district experiences typical 10-15 mph trade winds from the east/northeast, although winds can gust much higher in Kekaha.

Kauai Coffee Company, Pioneer Seed Company, the U.S. Navy's Pacific Missile Range Facility at Barking Sands, and Syngenta are all major employers in Waimea District. Kekaha Sugar Mill, which for generations influenced all aspects of life in West Kauai, including development, banking, transportation, housing and utilities closed in 2000. The town is still struggling since the mill's closing.

The State of Hawaii, DHHL, and the Robinson Family are the largest landowners in the district. DHHL owns 15,000 acres in this district almost all of which is agricultural or conservation land. However, a 49-lot subdivision was recently developed on 20 acres in Kekaha. In 2005, DHHL awarded 40 homestead leases with most lessees native Hawaiians from the nearby island of Niihau.

Kaumuali'i Highway, a paved two-lane highway maintained by the State Department of Transportation, is the one and only major thoroughfare connecting west side towns with the rest of the island. The highway ends in Mana but a smaller road continues to Polihale State Park where the road ends at the base of the Na Pali coastline. Residential developments have been built on the mauka and makai side of the highway.

The district is home to Waimea High School, Ele'ele Elementary, Island School, Kekaha School, St. Teresa's School, and Waimea Canyon School. Kauai Community College and the University of Hawaii also have satellite offices in the Waimea district. Waimea is also home to a Veteran's Hospital, West Kauai Medical Center, and the West Kauai Technology and Visitor Center. There are commercial areas in Waimea, Ele'ele, and Port Allen.

In recent years Hanapepe town, established along the banks of the Koula River, has marketed itself as an artistic center, although many of the storefronts along Hanapepe Road have remained vacant since the demise of the sugar cane industry.



Above left: plantation home in Makaweli. Note the wood shake roof and vegetation within 10 feet of the home. Above center and right: View of houses above Hanapepe town. Note the dense dried vegetation on the hillside.

Waimea district has two fire stations: one in Waimea and another in Hanapepe.

As former sugar plantations towns, neighborhoods in Kekaha, Waimea, Hanapepe, and Ele'ele, all tend to be in densely developed areas, composed of 8,000 – 12,000 square-foot lots with modest homes. House types vary between post and pier construction and concrete slab. Homes tend to be single-story with small louvered windows, Class A roofing and wood siding, although some homes are made of concrete block. There were several homes in Hanapepe Residence Lots and Hanapepe Heights that had wood shake roofs. A smattering of newer homes are two-stories high.

Driveways are 10-12 feet wide with 15-foot vertical clearance. Driveways in these neighborhoods are also paved and less than 100 feet in length with no turnaround space for fire apparatus. House numbers are displayed on mailboxes or the sides of houses. The communities have above ground utilities, paved roads, hydrants, and setbacks.

These neighborhoods are surrounded by open areas, either agricultural or former sugar cane lands.

Although there are several vacation rentals in Waimea ad Kekaha, the majority of homes in the Waimea district are owner-occupied. As of June 2009, real estate listings for single family homes in the Waimea district range from $495,000-$1,900,000.

For the most part, homes have defensible space because the lots are small. However, a visual inspection of neighborhoods throughout the district found homes with vegetation growing within 10 feet of the structure, sometimes abutting the house.



Above left: typical home in Kekaha. On the other side of the street is overgrown brush that extends for several acres (Center photo). Above right: View of Hanapepe Residence Lots in Hanapepe.

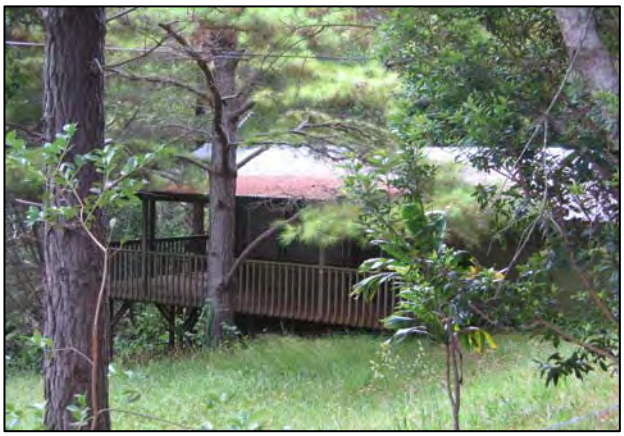
Waimea and Kekaha neighborhoods tend to have at least two means of ingress and egress except for the homes along the bottom of Waimea Canyon Drive. Hanapepe Residence Lots in Hanapepe only have one means of ingress/egress (Moi Road). There are gulleys on either side of Moi Road with kiawe and grasses coming up to the roadside.

At the 3,600-foot-elevation above Waimea, Kokee is home to Kokee State Park, Kokee Museum, Waimea State Park, NASA Tracking Station, Kokee Air Force Station, Kalalau Lookout, YWCA Camp Slogett, Kokee Methodist Camp, a Boy Scout Camp, Kokee Hongwanji, and Camp Hale Koa. Kokee State Park is 15 miles from Waimea and it takes the fire department about 30-45 minutes to respond due to the windy steep roads in the area.


From sea level, two roads can access Kokee, Kokee Road in Kekaha, and Waimea Canyon Drive in Waimea. However the two roads merge just before the 7 mile-marker, about halfway up the mountain, with the two-lane windy and narrow Waimea Canyon Drive as the only means of ingress/egress for Kokee. Side roads are unpaved, steep, have no signage, and many require four-wheel drive to navigate.

Above left: cabin in Kokee. The majority of cabins are owned by the State of Hawaii and leased to those who submit an application. Some cabins are inhabited year round, while others are used as vacation homes. Above right: cabin in Kokee. The cabin has wood shingles and the wood shake roof is covered in dried pine needles.

Above left: cabin in Kokee. The cabin is built on a slope with dried vegetation gathering under the wooden lanai. Overgrown grass and unpruned trees dot the property. Above right: The remains of a Kokee cabin destroyed in an April 2005 fire. Because the nearest fire station is at the bottom of Waimea Canyon (a 30+ minute drive), the cabin was completely involved by the time fire personnel arrived on scene. Fortunately, the fire did not spread to the nearby woods.



In addition to being home to the largest concentration of rare and endangered native Hawaiian plants on Kauai. Kokee is also home to more than 90 cabins on state land that are leased. Some of these leases have been in the same family for generations.

The cabins in Kokee tend to be on flat land, with some built into the hillsides. While some cabins have metal roofs, several have wood shake roofs, wood siding, and dense vegetation close to the structure. Most driveways are unpaved and vary in length (some are less than 50 feet while a few are longer than 300 feet) with limited turnaround space for fire apparatus. House numbers are nonexistent, although some have signs with the cabin name. Utilities are above ground.

Unattended campfires pose a fire threat in Kokee. Response time from Waimea fire station is at least 45 minutes. This is problematic for a response that is needed to keep the fire from rapidly spreading. Dead and down trees and branches from the 1992 Hurricane Iniki have contributed to the concentrated fuel load.

Lack of water resources is also an issue. Aerial water drops is one of the most effective tools in fire suppression given the rough terrain. Water resources are limited in the Waimea district.

Community Assets at Risk:

Assets at risk are valued resources that can be damaged or destroyed by wildfire. In addition to ensuring firefighter safety and protecting residents and visitors, the following assets warrant consideration in pre-incident planning: watersheds; forest reserves; wildlife; scenic, cultural, and archeological sites; ranchlands; and structures.

The following were identified as valued resources within Kauai that would be adversely affected by wildfire.

Commercial / community resources:

Resorts, shopping centers, schools, community centers, churches, restaurants, industrial parks, and retail establishments.

Natural / Cultural Resources:

National Tropical Botanical Gardens, Kilauea Lighthouse and National Wildlife Refuge, Huleia National Wildlife Refuge, Bell Stone, Alakai Swamp, Tree Tunnel (Koloa), Waikanaloa Wet Cave, Russian Fort Elizabeth, Waimea Canyon, county parks and beaches including Polihale Beach State Park, Kokee State Park, Lydgate State Park, and Wailua River Valley, as well as rare and endangered plants and animals, and cultural and archeological features.

These resources are critical for a number of reasons. Not only are the natural resources home to rare and endangered native Hawaiian plants and animals, they are also attracting thousands of tourists a year to Kauai.

In 2006, the Kauai Open Space Commission catalogued places of importance to the people of Kauai. This list was developed during the public-input process of the Public Access, Open Space, and Natural Resources Management Fund Commission (Open Space Commission).

While this list identifies many places around Kauai dear to its residents for cultural, historic, religious, natural, and other reasons it is by no means definitive – it simply reflects the data collected at that time. Some areas are listed more than once for specific areas within that locale.

Above: View from Kalalau lookout, one of the places listed as important to the people of Kauai.

Not all areas on the list are in the wildland urban interface. However, it is of interest to note that the first 32 places on the list are in Kapa'a, Kauai's largest residential town situated in the heart of the wildland urban interface. Nearly one third of the list, are in Anahola, a town with the second highest rate of wildfire incidents on the island. Below is a list of the top ten places on the list; the full list can be found in Appendix B.

Places of Importance to the People of Kauai

Number	Quad Map	Site Name
1	Kapaa	Nukolii
2	Kapaa	Kalepa Point
3	Kapaa	Kalepa Forest Reserve
4	Kapaa	Wailua River Valley
5	Kapaa	Opaekaa Falls
6	Kapaa	Wailua River Valley
7	Kapaa	Wailua River Valley
8	Kapaa	Wailua River Valley
9	Kapaa	Wailua River Valley
10	Kapaa	Wailua River Valley

Community Concerns for Kauai:

Community meetings specifically on the CWPP process held in June 2008 through June 2009 with community members and fire agencies identified the most pressing fire concerns on Kauai. They include, in order of priority:

1. Fuel load reduction along Wailua Corridor;
2. Fuel load reduction surrounding communities, such as Anahola and Wailua Homesteads;
3. Fuel load reduction along roadsides, in community open areas, and individual homes;
4. Complete lack and/or low level of water in reservoirs around Kauai;
5. Lack of public awareness of the wildfire threat on Kauai. Need to educate current and future residents about wildfire risks in the community;
6. Green waste recycling to prevent illegal dumping;
   6a. Reduce amount of illegally dumped trash in Anahola;
7. Develop regional and local planning and development standards that require communities' and subdivision designs to consider and/or mitigate fire risk;
8. Structures' design, materials, placement, and landscaping that promotes or does not mitigate fire risk;
9. Additional evacuation routes from communities that only have one means of ingress/egress; and.
10. Increase/integrate communication equipment between state, federal, and county agencies.
11. Additional fire apparatus staged in Kokee for quick response.
12. Additional water resources in Kokee, such as fire hydrants or stand pipes.

CWPP Recommendations:

Feedback from community members and fire service agencies during the CWPP process led to 12 recommendations listed below.

1. Installing and maintaining firebreaks along the Wailua Corridor.

2. Fuel load reduction along the Wailua Corridor.

3. Implementing grazing practices in Anahola and increasing grazing around the perimeter of Wailua Homesteads.

4. Maintaining and increasing the use of current reservoirs around the island.

5. Continued public education on fire prevention issues, such as creating defensible space particularly in Kokee, Anahola, Wailua, Hanamaulu, Koloa, Waimea, and Kapa'a.

6. Implement community chipping days to encourage fuel load mitigation and green waste recycling.

7. Increased use of fire-resistant building materials in new residential development.

8. Implementation of Firewise recommendations in the planning process, such as fuel-breaks around all new residential subdivisions and multiple means on ingress/egress.

9. Creation of secondary emergency access roads in residential areas where necessary.

10. Integrate and increase radio communications between federal, state, and county fire response agencies. May require purchasing additional radios for Public Works and other county departments to use during wildfire suppression.

11. Purchase of refurbished light-response brush truck to be staged in Kokee.

12. Installation of fire hydrants or stand pipes in Kokee.

Recommended Action for Kauai:

Given its importance as a vital transportation link between two of the most populated areas on the island, the Wailua Corridor is an area that is extremely vulnerable to wildfires. The closure of the road during wildfires has a tremendous negative impact on the Kapa'a community and the island as a whole. Constructing and maintaining fuel breaks along the Corridor can possibly slow the spread of wildfires when they occur.

Reducing the fuel load along the Wailua corridor will also help reduce the potential spread of wildfires in the area. The vast majority of land around the Wailua Corridor is former agricultural land primarily owned by the State of Hawaii and other large landowners. Large landowners will need to address community concerns when implementing fire breaks near communities

With its high rate of wildfires, vast tracts of open lands, and large piles of dumped trash and abandoned vehicles, the Anahola area is a concern to fire officials. During interagency meetings as part of the CWPP process, DHHL officials indicated they were amenable to grazing around Hawaiian homesteads in Anahola. Issues facing ranchers wanting to graze in the Anahola include insurance, lack of water resources, and length of stay for animals in fields (need to make it effective to pay for fencing.)

Limited grazing has been done around Wailua Homesteads in the past. Grant funding would help expand the size of the area being grazed, as well as the frequency of the grazing. This will go a long way toward reducing the fuel load around the Wailua Homesteads community.

Kauai Fire Chief Westerman would like to see current reservoirs maintained and used rather than installing dip tanks around the island. Many reservoirs are being allowed to go dry because land is no longer being farmed.

Continued public education about wildfire prevention is crucial. During the development of this CWPP, the author frequently asked Kauai residents how many wildfires they thought occurred annually on the island. No one ever answered more than 12 wildfires a year even though there were 82 wildfires on Kauai in 2008 and 134 fires in 2007.

Given the steady influx of residents from other parts of the U.S. who are unfamiliar with the fire regime of Hawaii, it is important to constantly remind people of the wildfire threats in their community. Chief Westerman noted that the increase in "gentlemen's farms" come with their own wildfire hazards, pointing out that gentleman farmers in Kilauea own 8-10 acres with wooden structures on their farms.

Public education on wildfire safety education could also include an awareness campaign about the hazards of illegal trash dumping. Abandoned cars and trash piles are an issue in Anahola. However, it was noted during the CWPP process that trash (boxes, cars, etc.) are left behind by tenant farmers on A&B land.

Communities around Kauai could benefit from communal chipping programs and green waste recycling.

An island-wide chipping program was suggested by members of the Kauai Planning Commission during the development of the CWPP. It was suggested that such a program be implemented by the

Kauai Fire Department and other County agencies (Environmental Management) to benefit those communities wanting to reduce their fuel load.

Another recommendation of this CWPP is to increase the use of fire-resistant building materials in new residential development. The Kauai Planning Department is responsible for regulations regarding residential development on Kauai. The County as a whole can mandate that fire-resistant building materials be used in all new residential construction. Homeowner associations in individual communities can also require the use of fire-resistant building materials through their CC&Rs (Codes, Covenants and Restrictions). At least four homeowner associations in communities on the west side of Hawaii Island have adopted Firewise construction recommendations as part of their CC&Rs.

Given the rapid rate of development Kauai has recently experienced, the Kauai Planning Department may want to explore the possibility of implementing Firewise recommendations in the planning process, such as fuel breaks around all new residential subdivisions. The creation of secondary emergency access roads in existing residential areas and/or planning multiple means on ingress/egress in new residential subdivisions is also recommended.

When large-scale wildfires occur on Kauai, multiple state and county agencies respond. However, not all the agencies may be able to communicate with each other. Kauai Department of Public Works are frequently called in to assist with heavy equipment during wildfires but their staff have little or no wildland fire training and are often do not have radios. During a June 2009 wildland interagency meeting, the lack of standardized radio communications (all responding agencies being able to communicate via radios on the same frequency) was cited as a concern. Ensuring that all responding agencies have the proper radio equipment and are versed in using it properly will help minimize the potential risk inherent in lack of communication during a fire.

Given Kokee's remote location and high preponderance of threatened and endangered plants and animals, quick response to wildfires is vital. However, the nearest fire station is more than 15 miles away in Waimea and with the windy uphill roads it takes nearly 45 minutes for fire crews to respond. There are no fire hydrants in Kokee. The Kokee Advisory Council would like to explore the possibility of purchasing a light-response brush truck and install fire hydrants or stand pipes in the area to facilitate faster fire response.

Based on the results of the community risk assessment, priority ratings have been selected for Kauai and areas of community importance. The community recommendations for the type and method of treatment for the surrounding vegetation are listed in the following table.

Community, structure or area at risk	**Type of Treatment**	**Method of Treatment**	**Overall Priority**
Wailua	Mechanical / Chemical	Installing and maintaining fuel breaks along Wailua Corridor	Very High
Wailua	Mechanical / Chemical	Fuel load reduction	Very High

	/ Hand Labor	along Wailua Corridor	
Island-wide	Mechanical/Chemical/ Hand Labor	Reduction of fuel load along roadsides, community open areas, and individual homes	High
Anahola, Wailua, Koloa, Princeville	Animal	Grazing	High
Island-wide	Mechanical / Political	Maintaining and increasing use of current reservoirs	High
Island-wide	Public Education and Outreach	Continued fire prevention education and outreach, including arson prevention education	High
Island-wide	Mechanical	Implement community chipping days to encourage fuel load reduction	High
Island-wide	Planning / Political	Increase use of fire-resistant building materials in new residential development. Incorporation of fuel breaks and multiple means of ingress/egress in all new residential development.	Medium
Island-wide	Mechanical	Creation of secondary emergency ingress/ egress roads in existing neighborhoods where necessary.	Medium
Island-wide	Mechanical / Political	Increase effective integrated radio communication between state and county fire suppression agencies.	Medium
Kokee	Mechanical	Purchase a brush truck to be staged in Kokee for fast response to wildfires.	Medium
Kokee	Mechanical	Install fire hydrants/stand pipes in Kokee.	Medium

Community organizations, federal agencies, and private landowners around Kauai were invited to submit projects that provide protection and reduce wildfire risk. The following table displays a list of projects based on recommendations from community and/or fire-related organizations.

Community, structure, or area at risk	**Project**	**Agency**	**Funding Needs**	**Timetable**	**Community Recommen-dation**
Wailua	Installing and maintaining fuel	Multiple agencies:	Cooperative Funding	2009 - 2014	Yes

	breaks along Wailua Corridor	state and county	$500,000		
Wailua	Fuel load reduction along Wailua Corridor	Multiple Agencies: county	Cooperative Funding $500,000	2009 - 20014	Yes
Island-wide	Reduction of fuel load along roadsides, community open areas, and individual homes	Multiple Agencies: state, county, and private	Cooperative Funding $850,000	2009 - 2014	Yes
Anahola, Wailua Homesteads, Koloa, Princeville	Grazing around subdivision perimeters to reduce fuel load	Multiple Agencies: state, county, and private	Cooperative Funding $200,000	2009 - 2014	Yes
Island-wide	Maintain and increase use of current reservoirs	Multiple Agencies: county and state	Cooperative Funding $	2009 - 2014	Yes
Island-wide	Continued fire prevention education and outreach, including arson prevention education	Multiple agencies: federal, state, county, and private	Cooperative Funding $45,000	2009 - 2014	Yes
Island-wide	Implement community chipping days to encourage fuel load reduction	Multiple agencies: state, county, and private	Cooperative Funding $175,000	2009 - 2014	Yes
Island-wide	Creation of development standards and community planning that requires the mitigation of wildfire risks	Multiple Agencies: county and state	Cooperative Funding $150,000 for outreach, any needed impact studies and education	2009 - 2014	Yes
Island-wide	Creation of secondary emergency ingress/egress roads	Multiple Agencies: state, county, and private	Cooperative Funding $750,000 if environment-al assess-ments required	2009 - 2014	Yes
Island-wide	Increased effective integrated radio communication between state and county fire suppression agencies	Multiple agencies	Cooperative Funding $80,000	2009 - 20013	Yes
Kokee	Purchase a brush truck to be staged in Kokee for fast	Multiple agencies	Cooperative Funding $75,000	2009-2013	Yes

	response to wildfires.				
Kokee	Install fire hydrants/stand pipes in Kokee.	Multiple agencies	Cooperative Funding $250,000	2009-2014	Yes

Reduce Structural Ignitability:

As part of its fire prevention education efforts, Firewise Communities Hawaii provides recommendations to reduce structural ignitability. Individuals and community groups around Kauai can reduce structural ignitability throughout the county by taking the following measures.

- Create a buffer zone of defensible space around a property of at least 30 feet or to the property line if the house has less than 30 feet of yard. Remove flammable vegetation and combustible growth within 30 feet of the house.

- Prune tree limbs 6 – 10 feet above the ground.

- Space trees and shrubs ten feet apart in the yard.

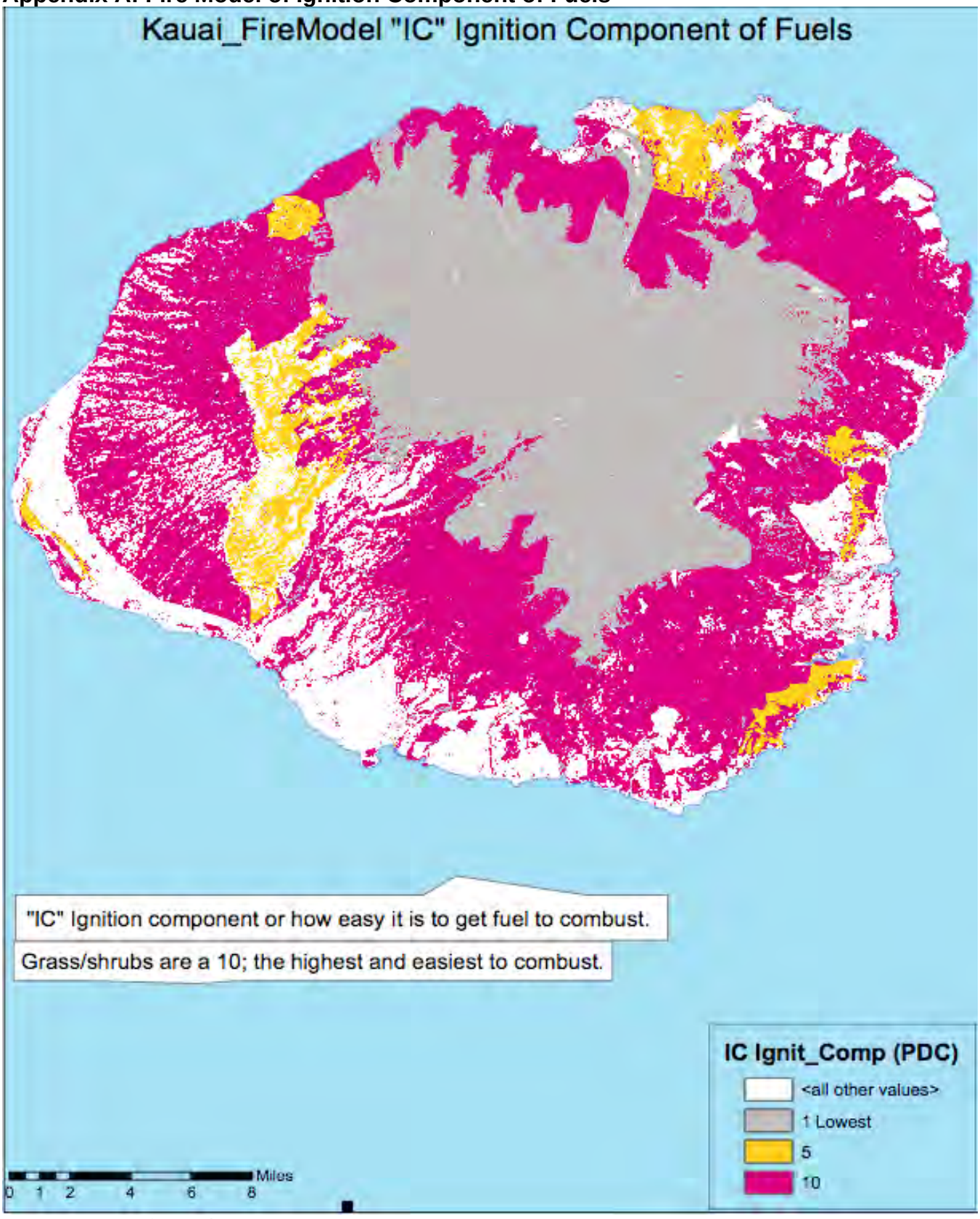
- Make sure that plants closest to the house are low-lying. Wherever possible use native Hawaiian or succulent plants.

- Routinely remove dead leaves and other organic matter from the yard.

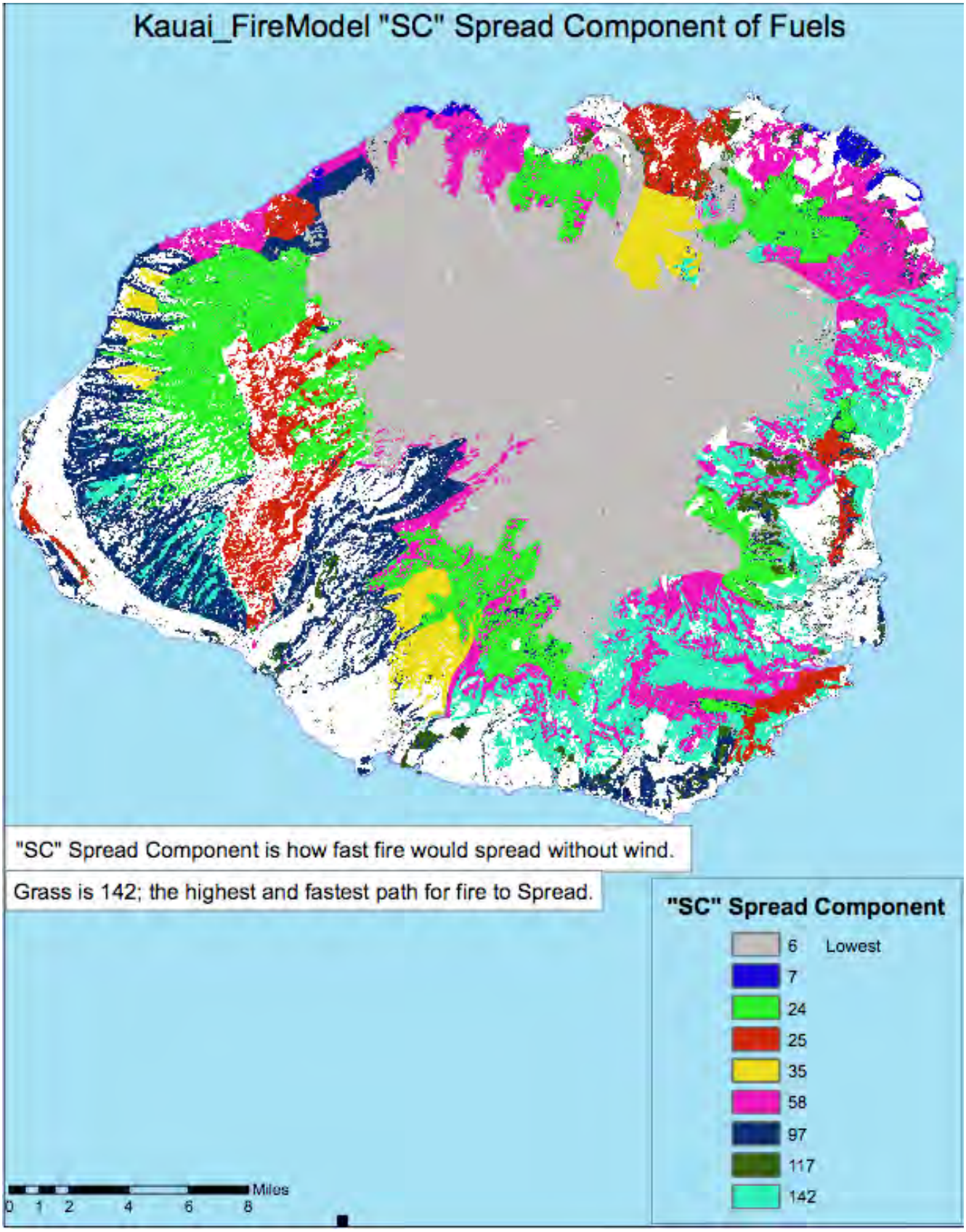
- Sweep and/or clean gutters, eaves, and roofs regularly to prevent the build-up of leaves and other matter.

- Use fire-resistant building materials for the roof, siding, and decks, such as metal, stucco, tile, brick, and cement.

Appendix A: Fire Model of Ignition Component of Fuels



Map courtesy of Kauai County GIS.



Map courtesy of Kauai County GIS.

Appendix B:

Places of Importance to the People of Kauai

Number	Quad Map	Site Name
1	Kapaa	Nukolii
2	Kapaa	Kalepa Point
3	Kapaa	Kalepa Forest Reserve
4	Kapaa	Wailua River Valley
5	Kapaa	Opaekaa Falls
6	Kapaa	Wailua River Valley
7	Kapaa	Wailua River Valley
8	Kapaa	Wailua River Valley
9	Kapaa	Wailua River Valley
10	Kapaa	Wailua River Valley
11	Kapaa	Wailua River Valley
12	Kapaa	Opaekaa Falls
13	Kapaa	Opaekaa Falls
14	Kapaa	Wailua River Valley
15	Kapaa	Wailua River Valley
16	Kapaa	Wailua River Valley
17	Kapaa	Nounou/Sleeping Giant
18	Kapaa	Nounou/Sleeping Giant
19	Kapaa	Waipouli Beach
20	Kapaa	Waipouli Beach
21	Kapaa	Waipouli Beach
22	Kapaa	Waipouli Beach
23	Kapaa	Waipouli Mauka
24	Kapaa	Kapaa Beach Park
25	Kapaa	Kapaa Cemetary
26	Kapaa	Kapaa Homesteads
27	Kapaa	Upper Kapahi Reservoir
28	Kapaa	Kahuna Road
29	Kapaa	Hoopii Falls
30	Kapaa	Hoopii Falls
31	Kapaa	Kealia Coast
32	Kapaa	Waipouli Mauka
33	Hanapepe	Numila Makai
34	Hanapepe	Puolo Point
35	Hanapepe	Puolo Point
36	Hanapepe	Puolo Point
37	Hanapepe	Puolo Point
38	Hanapepe	Puolo Point
39	Hanapepe	Paakahi Point
40	Hanapepe	Salt Pond Beach Park
41	Hanapepe	Salt Pond Beach Park
42	Hanapepe	Hanapepe River Valley
43	Hanapepe	Hanapepe River Valley
44	Hanapepe	Makaweli Mauka
45	Hanapepe	Kaumakani Makai

46	Hanapepe	Makaweli Landing
47	Hanapepe	Makaweli Landing
48	Hanapepe	Makaweli Landing
49	Hanapepe	Waimea River Valley
50	Koloa	Mahaulepu
51	Koloa	Mahaulepu
52	Koloa	Makawehi
53	Koloa	Koloa Mill
54	Koloa	Kaneiolouma
55	Koloa	Kaneiolouma
56	Koloa	Poipu Beach Park
57	Koloa	Waiohai Beach
58	Koloa	Kipu
59	Koloa	Haupu
60	Koloa	Haupu
61	Koloa	Haupu
62	Koloa	Waita Reservoir
63	Koloa	Waita Reservoir
64	Koloa	Waita Reservoir
65	Koloa	Waita Reservoir
66	Koloa	Kukuiula
67	Koloa	Kahili
68	Koloa	Kahili
69	Koloa	Kahili
70	Koloa	Haupu
71	Koloa	Haupu
72	Koloa	Kahili
73	Koloa	Lawai Mauka
74	Koloa	Lawai Mauka
75	Koloa	Lawai Mauka
76	Koloa	Lawai Mauka
77	Koloa	Lawai Mauka
78	Koloa	Lawai Homestead
79	Koloa	Lawai Homestead
80	Koloa	Lawai Homestead
81	Koloa	Lawai Kai
82	Koloa	Na Pali
83	Koloa	Wahiawa Bog
84	Koloa	Alexander Reservoir
85	Koloa	Alexander Reservoir
86	Koloa	Alexander Reservoir
87	Koloa	Alexander Reservoir
88	Koloa	Kalaheo Mauka
89	Koloa	Kalaheo Mauka
90	Lihue	Ahukini
91	Lihue	Nawiliwili
92	Lihue	Menehune Fishpond
93	Lihue	Menehune Fishpond
94	Lihue	Menehune Fishpond

95	Lihue	Kipu Falls
96	Lihue	Kipu Falls
97	Lihue	Haupu
98	Lihue	Haupu
99	Lihue	Kipu Kai
100	Lihue	Kipu Kai
101	Lihue	Kipu Kai
102	Lihue	Mahaulepu
103	Lihue	Mahaulepu
104	Lihue	Mahaulepu
105	Haena	Kokee
106	Haena	Na Pali State Park
107	Haena	Hanakapiai
108	Haena	Wainiha Mauka
109	Haena	Wainiha Mauka
110	Haena	Haena State Park
111	Haena	Haena State Park
112	Haena	Haena State Park
113	Haena	Haena State Park
114	Haena	Haena Park
115	Haena	Haena Mauka
116	Haena	Haena Point
117	Haena	Haena Point
118	Haena	Haena Point
119	Haena	Haena Point
120	Haena	Kepuhi Point
121	Haena	Kepuhi Point
122	Haena	Kepuhi Point
123	Haena	Wainiha
124	Kekaha	Niu Ridge
125	Kekaha	Niu Ridge
126	Kekaha	PMRF
127	Kekaha	PMRF
128	Kekaha	PMRF
129	Kekaha	PMRF
130	Kekaha	PMRF
131	Kekaha	PMRF
132	Kekaha	PMRF
133	Kekaha	PMRF
134	Kekaha	PMRF
135	Kekaha	PMRF
136	Kekaha	PMRF
137	Makaha Point	PMRF
138	Makaha Point	PMRF
139	Makaha Point	PMRF
140	Makaha Point	Makaha Ridge
141	Makaha Point	Milolii
142	Makaha Point	Milolii
143	Makaha Point	Milolii

144	Makaha Point	Milolii
145	Makaha Point	PMRF
146	Makaha Point	Kokee
147	Waimea Canyon	Kokee
148	Waimea Canyon	Kokee
149	Waimea Canyon	Kokee
150	Waimea Canyon	Kokee
151	Waialeale	Waialeale
152	Waialeale	Waialeale
153	Waialeale	Waialeale
154	Waialeale	Waialeale
155	Waialeale	Waialeale
156	Waialeale	Waialeale
157	Waialeale	Waialeale
158	Waialeale	Waialeale
159	Waialeale	Waialeale
160	Waialeale	Waialeale
161	Waialeale	Kilohana Crater
162	Eastern Kauai	Kealia Spaulding Monument
163	Eastern Kauai	Kalihiwai River Basin
164	Anahola	Kauapea
165	Anahola	Kilauea Stream
166	Anahola	Waiakalua Makai
167	Hanalei	Wainiha
168	Hanalei	Lumahai
169	Hanalei	Princeville Makai
170	Hanalei	Pinceville Makai
171	Hanalei	Black Pot
172	Hanalei	Black Pot
173	Hanalei	Hanalei River
174	Hanalei	Hanalei River
175	Hanalei	Waioli Stream
176	Hanalei	Waioli Stream
177	Hanalei	Princeville Makai
178	Hanalei	Princeville Makai
179	Hanalei	Princeville Makai
180	Hanalei	Princeville Makai
181	Hanalei	Princeville Makai
182	Hanalei	Anini Beach
183	Hanalei	Princeville Makai
184	Hanalei	Anini Beach
185	Hanalei	Hanalei River
186	Hanalei	Kilauea Point
187	Hanalei	Hanalei Homestead
188	Hanalei	Hanalei River
189	Hanalei	Princeville Mauka
190	Hanalei	Kalihiwai River Basin
191	Hanalei	Kalihiwai River Basin
192	Hanalei	Kalihikai Mauka

193	Hanalei	Kalihikai Mauka
194	Hanalei	Anini Beach
195	Hanalei	Kalihiwai Bay
196	Hanalei	Kalihiwai Bay
197	Hanalei	Kauapea
198	Hanalei	Puukumu Stream
199	Hanalei	Puukumu Stream
200	Hanalei	Puukumu Stream
201	Hanalei	Kalihiwai Reservoir
202	Hanalei	Kalihiwai River Basin
203	Hanalei	Kalihiwai River Basin
204	Hanalei	Kalihiwai River Basin
205	Hanalei	Kalihiwai River Basin
206	Hanalei	Moloaa Forest Reseve
207	Anahola	Anahola Bay
208	Anahola	Anahola Mauka
209	Anahola	Anahola Mauka
210	Anahola	Anahola Mauka
211	Anahola	Anahola Mauka
212	Anahola	Kamalomaloo
213	Anahola	Kealia Spaulding Monument
214	Anahola	Kealia Mauka
215	Anahola	Kealia Mauka
216	Anahola	Kealia Mauka
217	Anahola	Kealia Mauka
218	Anahola	Papaa Bay
219	Anahola	Papaa Bay
220	Anahola	Papaa Bay
221	Anahola	Papaa Bay
222	Anahola	Papaa Bay
223	Anahola	Papaa Bay
224	Anahola	Papaa Bay
225	Anahola	Papaa Mauka
226	Anahola	Papaa Mauka
227	Anahola	Papaa Mauka
228	Anahola	Aliomanu Mauka
229	Anahola	Aliomanu Mauka
230	Anahola	Anahola Mauka
231	Anahola	Aliomanu Mauka
232	Anahola	Moloaa Bay
233	Anahola	Moloaa Bay
234	Anahola	Moloaa Bay
235	Anahola	Moloaa Bay
236	Anahola	Moloaa Bay
237	Anahola	Moloaa Bay
238	Anahola	Moloaa Bay
239	Anahola	Moloaa Bay
240	Anahola	Moloaa Bay
241	Anahola	Waiakalua Mauka

242	Anahola	Pilaa Beach
243	Anahola	Pilaa Beach
244	Anahola	Pilaa Beach
245	Anahola	Pilaa Beach
246	Anahola	Waipake
247	Anahola	Waiakalua Reservoir
248	Anahola	Waiakalua Reservoir
249	Anahola	Waiakalua Reservoir
250	Anahola	Waiakalua Reservoir
251	Anahola	Pilaa Mauka
252	Anahola	Pilaa Mauka
253	Anahola	Pilaa Mauka
254	Anahola	Kaloko Reservoir
255	Anahola	Pilaa Mauka
256	Anahola	Pilaa Mauka
257	Anahola	Pilaa Mauka
258	Anahola	Pilaa Mauka
259	Anahola	Kaloko Reservoir
260	Anahola	Puukaele Reservoir
261	Anahola	Puukaele Reservoir
262	Anahola	Kaloko Reservoir
263	Anahola	Kaloko Reservoir
264	Anahola	Kaloko Reservoir
265	Anahola	Kilauea Bay
266	Anahola	Kilauea Bay
267	Anahola	Kilauea Bay
268	Anahola	Kilauea Falls
269	Anahola	Kilauea Falls
270	Anahola	Kilauea Falls
271	Anahola	Kilauea Falls
272	Anahola	Kilauea Falls
273	Anahola	Kilauea Falls
274	Anahola	Kilauea Makai
275	Anahola	Kilauea Mauka
276	Anahola	Kilauea Mauka
277	Anahola	Kilauea Mauka
278	Anahola	Kilauea Mauka
279	Anahola	Kilauea Mauka
280	Anahola	Kilauea Mauka
281	Anahola	Kilauea Mauka
282	Anahola	Kauapea
283	Anahola	Kauapea
284	Anahola	Kauapea
285	Anahola	Mokuaeae Isle
286	Anahola	Kauapea
287	Anahola	Kauapea
288	Anahola	Kauapea
289	Anahola	Kilauea Point
290	Anahola	Kauapea

291	Anahola	Kauapea
292	Anahola	Kauapea
293	Anahola	Kauapea
294	Anahola	Kauapea
295	Anahola	Kauapea
295	Anahola	Kauapea
297	Anahola	Kauapea
298	Anahola	Kauapea
299	Anahola	Kilauea Makai
300	Anahola	Kauapea
301	Anahola	Kauapea

Appendix C:

List of Potential Grant Resources

Below is a list of potential grant sources to help fund mitigation projects described within this CWPP. The list below is by no means exhaustive and potential community groups should also research grant-funding sources available to them.

Grant Program	Deadline	Contact Information	Matching Funds Required?
State Fire Assistance Grants. Funds target hazard mitigation in the Wildland Urban Interface for mitigating risks of hazardous fire conditions through hazardous fuels reduction, information and education, and homeowner and community defensible space treatments.	August 28, 2009 for 2010-2011 competitive funding	Division of Forestry and Wildlife Attn: Wayne Ching, 1151 Punchbowl St., Rm. # 325 Honolulu, HI 96813 (808) 587-4173 Fax: (808) 587-0160 www.dofaw.net	Yes: 50/50 match
FM Global Prevention Grants Through their new Fire Prevention Grant Program, fire departments, national, state, regional, local and community organizations can apply for funding to support a wide array of fire prevention, preparedness and control efforts, including: • Pre-fire planning for commercial, industrial and institutional facilities • Fire and arson prevention and investigation • Fire prevention education and training programs	Awarded quarterly	www.fmglobal.com or email: firepreventiongrants@fmglobal.com	No
Department of Homeland Security (DHS) • Citizen Corps is the Department of Homeland Security's grassroots initiative that encourages citizens to play a role in hometown security through personal preparedness. Grant funding supports Citizen Corps Councils in efforts to engage citizens in personal preparedness, exercises, ongoing volunteer programs, and surge capacity response, in order to better prepare citizens to be fully aware, trained, and practiced on how to prevent, protect/mitigate, prepare for, and respond to all threats and hazards. This program provides funding on a formula basis to all 56 states and territories. Other Homeland Security Grant Programs include: • Infrastructure Protection Program • Regional Catastrophic Preparedness		www.dhs.gov/xgovt/grants/index.shtm MG Robert Lee Adjutant General 3949 Diamond Head Rd. Honolulu, HI 96816-4495 808-733-4246 www.scd.state.hi.us	

Grant Program			
Hawaii Tourism Authority (HTA) Natural Resources Program In 2002, HTA established the Natural Resources Advisory Group to develop the Natural Resources Program. A Natural Resources Assessment was conducted including an inventory and assessment of natural resource areas around the state. Since 2005 HTA has awarded funds to those projects identified as priorities in the Assessment and to community-based natural resource projects.		Hawaii Tourism Authority 1801 Kalakaua Avenue Honolulu, HI 96815 (808) 973-2255	
Rural Fire Assistance Grants (RFA) The Dept. of the Interior receives an appropriated budget each year for a rural fire assistance (RFA) grant program. This funding enhances the fire protection capabilities of rural and volunteer fire departments through training, equipment purchases, and fire prevention work on a cost-shared basis. This program is primarily for rural departments serving populations under 10,000 that have responsibilities to provide mutual aid to Dept. of Interior lands (e.g., Tribal, National Parks etc.) The DOI assistance program targets rural and volunteer fire departments that routinely help fight fire on or near DOI lands. One of these four agencies administers those lands: Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), U.S. Fish and Wildlife Service (FWS) and the National Park Service (NPS).	Varies by state	Hawaii Volcanoes National Park Joe Molhoek Pacific Island Fire Mgmt. Officer PO Box 52, HNP, HI 96718 (808) 985-6042 Joe_Molhoek@nps.gov	The maximum award is $20,000. RFA grants may require 90/10 cost-share.

Community Wildfire Protection Plan for Northwest Hawaii Island

Sponsored by the Hawaii Wildfire Management Organization
a 501(c)(3) nonprofit organization

With generous support from the Fire Management Program of the Hawaii State Department of Land and Natural Resources, Division of Forestry and Wildlife

July 2007
Written by Denise Laitinen

Table of Contents:

Cover image: Northwest Hawaii CWPP boundary map, courtesy of the Hawaii Wildfire Management Organization. All photos in CWPP courtesy of Denise Laitinen unless otherwise noted.

Northwest Hawaii Community Wildfire Protection Plan
Mutual Agreement Page

The Community Wildfire Protection Plan (CWPP) developed for Northwest Hawaii by the Hawaii Wildfire Management Organization (HWMO):

- Was collaboratively developed. Interested parties and federal land management agencies managing land in the vicinity of Northwest Hawaii have been consulted.

- This plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect Northwest Hawaii.

- This Plan recommends measures to reduce the ignitability of structures throughout the planning area.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

_____ _____

Paul J. Conry **Date**
State Forester, Division of Forestry and Wildlife

_____ _____

Darryl Oliveira **Date**
Fire Chief, Hawaii Fire Department

_____ _____

Troy Kindred **Date**
Administrator, Hawaii County Civil Defense

Executive Summary:

The leeward or west side of Hawaii Island with its arid weather conditions and sprawling grasslands, interspersed with housing development is a wildland urban interface (WUI). The wildland/urban interface (WUI) is any area where wildlands abut houses or a development. This interface area poses the highest risk of loss of life and property due to wildland fire. The risk of wildland fire impacting structures in the WUI is determined by several factors, including the ignitability of fuels, structural ignitability, weather conditions, and topographical features, such as slope.

Unlike the contiguous United States, wildfire is not a natural part of Hawaii's ecosystem. In Hawaii, wildfires destroy native ecosystems, which impacts watersheds and traditional cultural activities. Wildfires have also caused the demise of or have fragmented the habitats that support native flora and fauna, many of which are listed as endangered or threatened. Sixty-five percent (65%) of Hawaii Island's dryland forest ecosystems have been lost primarily due to wildfire carried by invasive grasses. Consequently, Hawaii's dryland habitats are mere remnants of what was once referred to as the most diverse dryland ecosystem in the state. Wildfires in Hawaii also cause soil erosion, which negatively impacts our ocean reefs. Exposed soils pose a significant health hazard as well when the loose particulates are picked up in the wind and carried to populated areas.

The overwhelming majority of wildfires in Hawaii are caused by arson or human error. Human error includes errant fireworks, burning rubbish, cooking, or agricultural fires that get out of control in the wildland-urban interface, as well as vehicle-caused wildfires.

Principal stakeholders who have an interest in protecting Northwest Hawaii from wildfire include Hawaii Wildfire Management Organization, which sponsored this CWPP, Hawaii Fire Department, Hawaii County Civil Defense, Department of Land and Natural Resources Division of Forestry and Wildlife, Department of Hawaiian Home Lands, the U.S Army, the U.S. Fish and Wildlife Service, and large landowners. These decision makers were invited to participate in the development of this Plan.

A wildfire hazard assessment determined that WUI areas in Northwest Hawaii communities have a high risk of wildfire. Wildland fires occur frequently throughout Northwest Hawaii, threatening area residents. The largest wildfire in state history was in Northwest Hawaii in 1969 and burned more than 47,000 acres and a 2005 wildfire that burned 25,000 acres forced the evacuation of thousands of people. The continued invasion of non-native plant species, which are considered high-intensity burning fuels, increases the wildfire risk within Westside communities. Grazing traditionally assisted in reducing fuel loads and wildfire risk. However, due to a variety of circumstances, grazing has been reduced or eliminated in many areas, which has contributed to the accelerated wildfire risk in areas that were previously less prone to wildfire. The lack of reliable water resources for both ground and helicopter fire suppression crews have also compromised the rapid response to these disasters and have contributed to the increased fire spread. Communities vary in their access of water, with some communities relying on private water systems or catchment water basins, with others accessing county water.

Meetings with community members and fire agency personnel identified a variety of mitigation measures to reduce the chance of fires starting in Northwest Hawaii, as well as to attempt to minimize the impact of a wildfire. These measures include: 1) installation of pre-staged static water and helicopter dip tanks; 2) acquisition of adequate resources for first responders, including off-road tankers; 3) reduction of fuel loads and/or appropriate conversion of fuels along road sides, in community open areas, and individual homes; 4) adoption of development standards and community planning that requires the mitigation of wildfire risks; 5) creation of secondary emergency access roads and emergency egress signage within subdivisions; 6) development of emergency staging areas within

communities; 7) reduction and/or control of invasive species that possess inherent fire or ignition properties; 8) continued fire prevention education, including arson prevention; and 9) integration of communication equipment to increase effective firefighting response.

While homes and structures have been lost to wildfire in the past, Hawaii County has been fortunate in controlling wildland fires in and around communities. To date, there has been no loss of life contributed to wildfire disasters. However, the existing wildfire risk is severe given the fire history, rapid development of the region, and the increasing fire fuel load. The mitigation measures outlined in this CWPP will enable Northwest Hawaii communities to reduce their risk to wildfire and create a more efficient fire-protection plan. The mitigation measures listed above identify pro-active projects that communities and fire agencies can undertake to minimize losses from a major wildland fire.

Background:

This CWPP covers a broad expanse (451,086 acres) of the leeward side of Hawaii Island. Figure 1 depicts the Base Map of the Northwest Hawaii CWPP. The area included in this CWPP extends from Kohala (intersection of Akoni Pule Highway and Old Coast Guard Road) south to Hina Lina subdivision in Kailua-Kona and from sea level in the west, eastward to Kohala Mountain Road in Kohala, Pu'u Kapu in Waimea, Waiki'i, and the extensive state land holdings east of Mamalahoa Highway between Saddle Road and Kamehameha School land holdings. Covering an expanse from sea level to the 8,800-foot elevation, this CWPP encompasses the base of Mauna Loa, the world's largest volcano. The inhabited areas at potential risk to wildland fire include Kohala Ranch, Kohala by the Sea, Kohala Estates, Kawaihae, Kawaihae Village, Puako, Waimea, Pu'u Kapu, Waiki'i, Pu'uanahulu, Pu'u Wa'a Wa'a Waikoloa, Kona Palisades, Kealakehe, and Hina Lani, as well as vast areas of state and federal lands, and open grasslands.

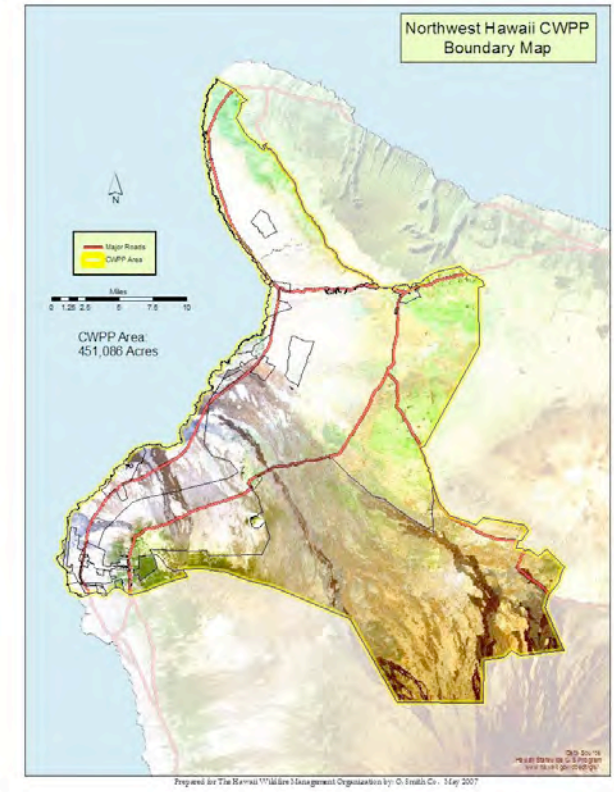


Figure 1: The Northwest Hawaii CWPP area of consideration is outlined in yellow and covers more than 451,086 acres.

There are five main roads in West Hawaii: Queen Kaahumanu Highway, Mamalahoa Highway, Akoni Pule Highway, Waikoloa Road, and Kohala Mountain Road. Queen Kaahumanu Highway (Route 19) runs north-south along the coast from Kona to Kawaihae as does Mamalahoa Highway (Route 190), which also runs north-south, upslope and parallel to Queen Kaahumanu Highway at an elevation ranging from 1,000 – 2,000 feet. In Kawaihae, Queen Kaahumanu Highway continues north as Akoni Pule Highway (Route 270), while Route 19 veers to the east – upslope to Waimea along Kawaihae Road. Kohala Mountain Road also runs north–south from Waimea to Hawi and is roughly parallel to Akoni Pule Highway at a higher elevation. Waikoloa Road runs east-west, connecting Queen Kaahumanu Highway and Mamalahoa Highway and is the primary access to the Waikoloa community. These five roads provide access to all the communities covered by this CWPP.

Within Northwest Hawaii there are several communities, including, from north to south, Kawaihae, Waimea, Puako, Pu'uanahulu, and Waikoloa. Communities covered by this CWPP vary in size from 100 single-family home subdivisions to more than 2,700 dwellings with single-family homes, condominiums, retail outlets, schools, historical sites, recreational areas, and commercial facilities. Some of the subdivisions in the coverage area are: Waiki'i, Puakea Ranch, Kohala by the Sea, Kohala Ranch, Kohala Estates, Kawaihae Village, Pu'u Kapu, Pu'u Lani Ranch Estates, Kona Palisades, Kealakehe, and Hina Lani Estates. In addition, there are several internationally known world-class resorts that draw thousands of visitors from around the world.

Within the CWPP boundary, county fire stations are located in Waimea, Puako, and Waikoloa with volunteer fire stations in Pu'uanahulu, Kohala Estates, Waiki'i, and Kona Palisades. A fire station in Kapa'au, while outside the boundary of the CWPP, is responsible for the northern most area included in the CWPP. Each county station has four personnel on duty and is manned 24 hours a day. Volunteer fire stations rely on volunteer personnel.

The Waikoloa county fire station houses a Type 1 engine, ambulance, and hazardous materials vehicle with no firefighting capability, as well as battalion chief quarters for West Hawaii. The South Kohala fire station, located on the Kohala Coast between Waikoloa and Puako, houses a Type 1 engine, 750-gallon tanker, ambulance, and a Type 3 helicopter. The Waimea fire station, near downtown Waimea, houses a Type 1 engine, a 750-gallon tanker, and an ambulance.

In addition to the communities and subdivisions, large landowners within the CWPP coverage area include Parker Ranch, Department of Hawaiian Home Lands, the State of Hawaii, Queen Emma Land Corporation, and Kamehameha Schools. The majority of Queen Emma land within the CWPP boundary area is leased to Parker Ranch for grazing. Figure 2 below illustrates the various large landowners within the Northwest Hawaii CWPP boundary.

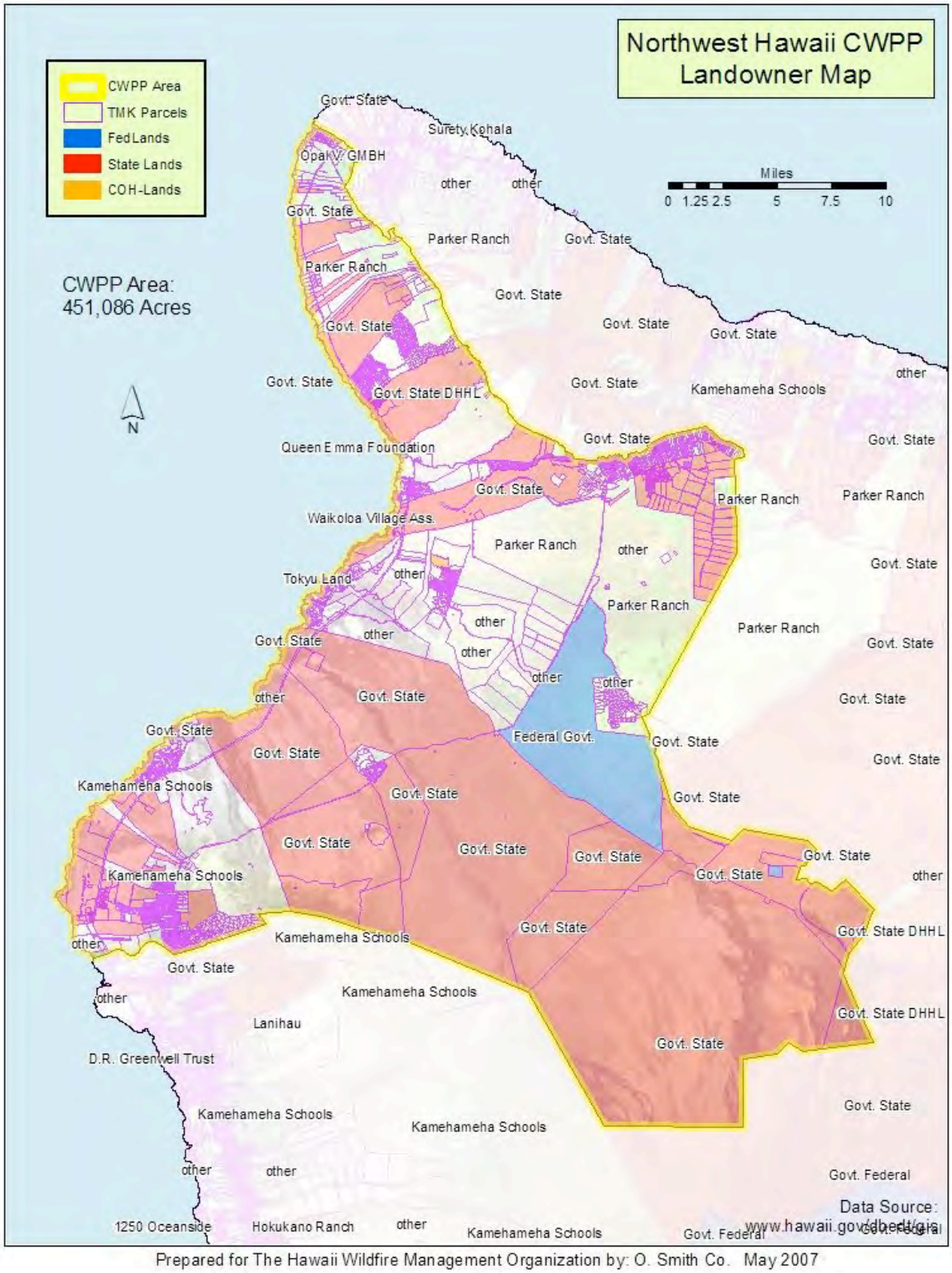


Figure 2: Map depicts major landowners within Northwest Hawaii CWPP coverage area. Reddish areas are state lands, while those in gold are county lands. Queen Emma Land Corporation, Kamehameha Schools, Parker Ranch, and the Department of Hawaiian Home Lands also own extensive land tracts.

As seen in Figure 3 below, land use in Northwest Hawaii varies between agricultural, conservation, rural, and urban. The majority of land, or 52 percent of the area within the CWPP boundary, is used for agricultural purposes.

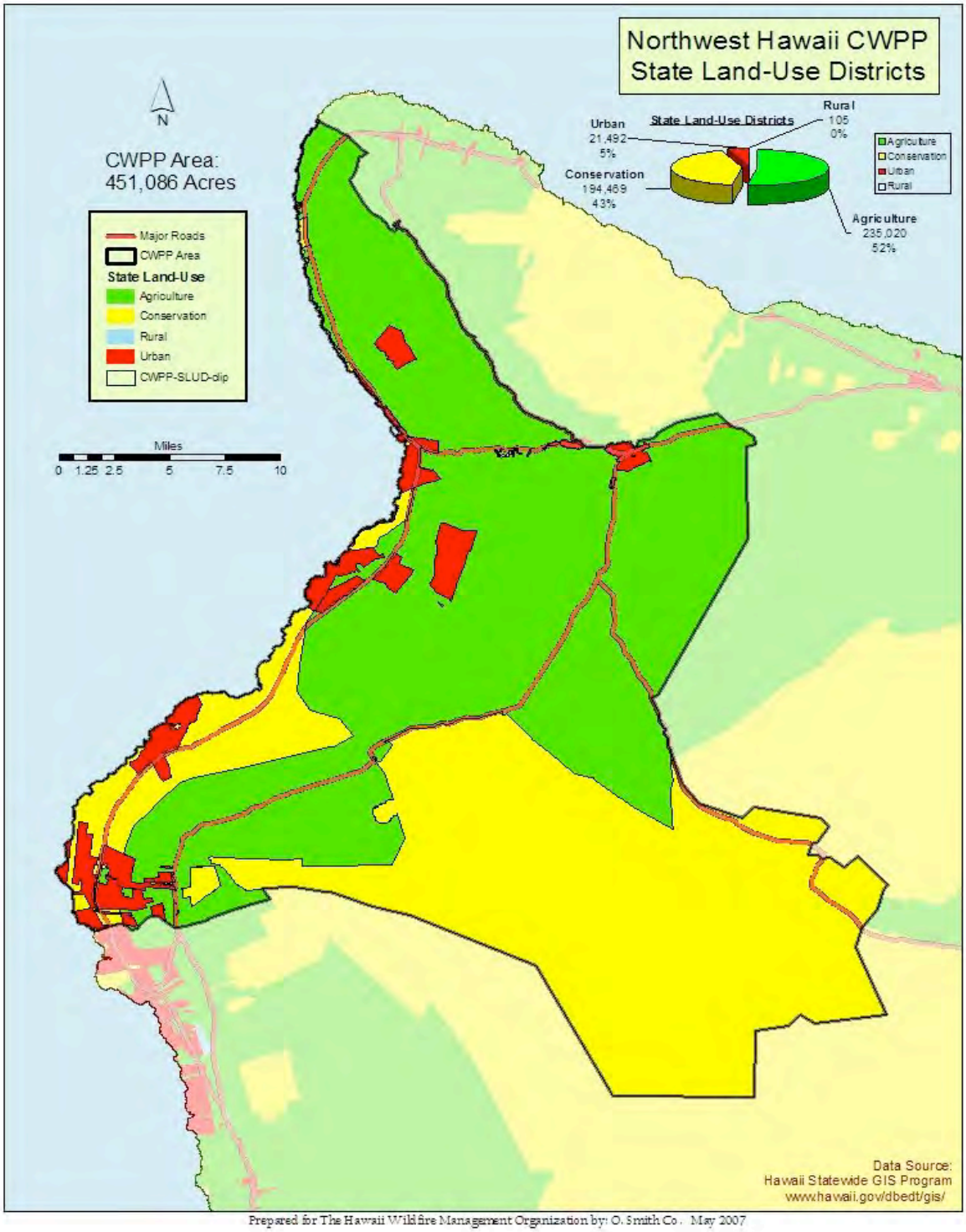


Figure 3: Map depicts land use districts within Northwest Hawaii. Green denotes agricultural areas (235,000 acres or 52 percent of CWPP area), yellow denotes conservation areas (194,469 or 43 percent of coverage area), blue denotes rural areas (0 percent), and red highlights urban areas (21,492 or 5 percent of CWPP area).

The CWPP area encompasses historical, archeological, and cultural sites and natural areas of importance. Examples of these sites are: Pu'ukohola Heiau National Historic Site; Puako Petroglyph Archeological Preserve; Lapakahi State Historical Park; county parks and beaches, including the popular Hapuna Beach State Recreation Area; and more than 3,000 acres of State land holdings, including Pu'u Wa'a Wa'a State Wildlife Preserve.

Northwest Hawaii receives an average rainfall of 10 – 20 inches a year. Communities along the coast receive less than 10 inches of rain while higher elevations receive more precipitation. The coverage area is notoriously dry and at times can be extremely dry. Kawaihae holds the state record for the least amount of annual rainfall (0.19 inch in 1953) and Puako has the distinction of the lowest average annual rainfall (1987-2000) at 8.93 inches.

Ridge along the southern boundary of Pu'u Lani Ranch Estates subdivision. The ridge is a fire concern due to its steep slope and the high-intensity burning vegetation growing on the ridge.

Slope within the region varies by geography, although the overall terrain in the region naturally slopes from the mountains down to the sea. Gulches, as well as volcanic vents or hills several hundred feet in elevation, dot the countryside. Some subdivisions, such as Pu'u Lani Ranch Estates, have steep ridges bordering their community, others, such as Kohala by the Sea and Waikoloa; have gulches running through their communities. These ridges and gulches are covered with invasive grasses and shrubs that are high intensity burning fuels.

Vegetation zones, as depicted in Figure 4 below, vary within Northwest Hawaii between grasslands, mixed forest, high-intensity developed, scrub/shrub, bare land, estuarine shrub/scrub, and low-intensity developed, among others. Communities and subdivisions in Northwest Hawaii are often separated by vast expanses of open grasslands containing high-intensity burning fire fuels, including grasses and shrubs. Large lava flows also dot the landscape, providing natural fuel breaks.

The dryland ecosystem in Northwest Hawaii was once referred to as the most diverse native dryland ecosystem in the state of Hawaii. Development, the lack of fine fuels mitigation, and continuous wildfires have caused the demise of much of these native forests, leaving pockets, or kipuka, of remnant plant communities dotting the countryside. Small kipukas of wili wili (*Erythrina sandwicensis*) and lama (*Diospyros sandwicensis*) trees in Waikoloa and along highway 190 are examples of these remnant forests. Attempts at reforestation are under way in Pu'u Wa'a Wa'a and Waikoloa. However, alien trees, shrubs, and grasses have invaded these kipuka. Many of the grasses, such as molasses grass (*Melinis minutiflora*) and fountain grass (*Pennisetum setaceum*), are fire-adapted and increase wildfire potential in areas they invade.

Lava flows dot the Northwest Hawaii landscape providing natural fire fuel breaks. However, invasive grasses, such as fountain grass (above) have spread across open lands and the lava flows reducing their effectiveness as fuel breaks.

The 1859 lava flow, which started from Mauna Loa and flowed westward to the sea, presently serves as a natural fuel break between the communities of Waikoloa and Pu'uanahulu. To the south of Pu'uanahulu, the 1801 lava flow traverses from the mountaintop of Hualalai to sea level in multiple areas. These flows, along with numerous smaller sparsely vegetated flows, serve as natural fuel breaks. However, the proliferation of fountain grass has compromised these fuel breaks. A prolific

non-native species, fountain grass is colonizing lava flows at an alarming rate, and as a result, enabling fire to burn on the fuel break. Fountain grass is so prevalent in Northwest Hawaii that complete eradication of the plant is unfeasible.

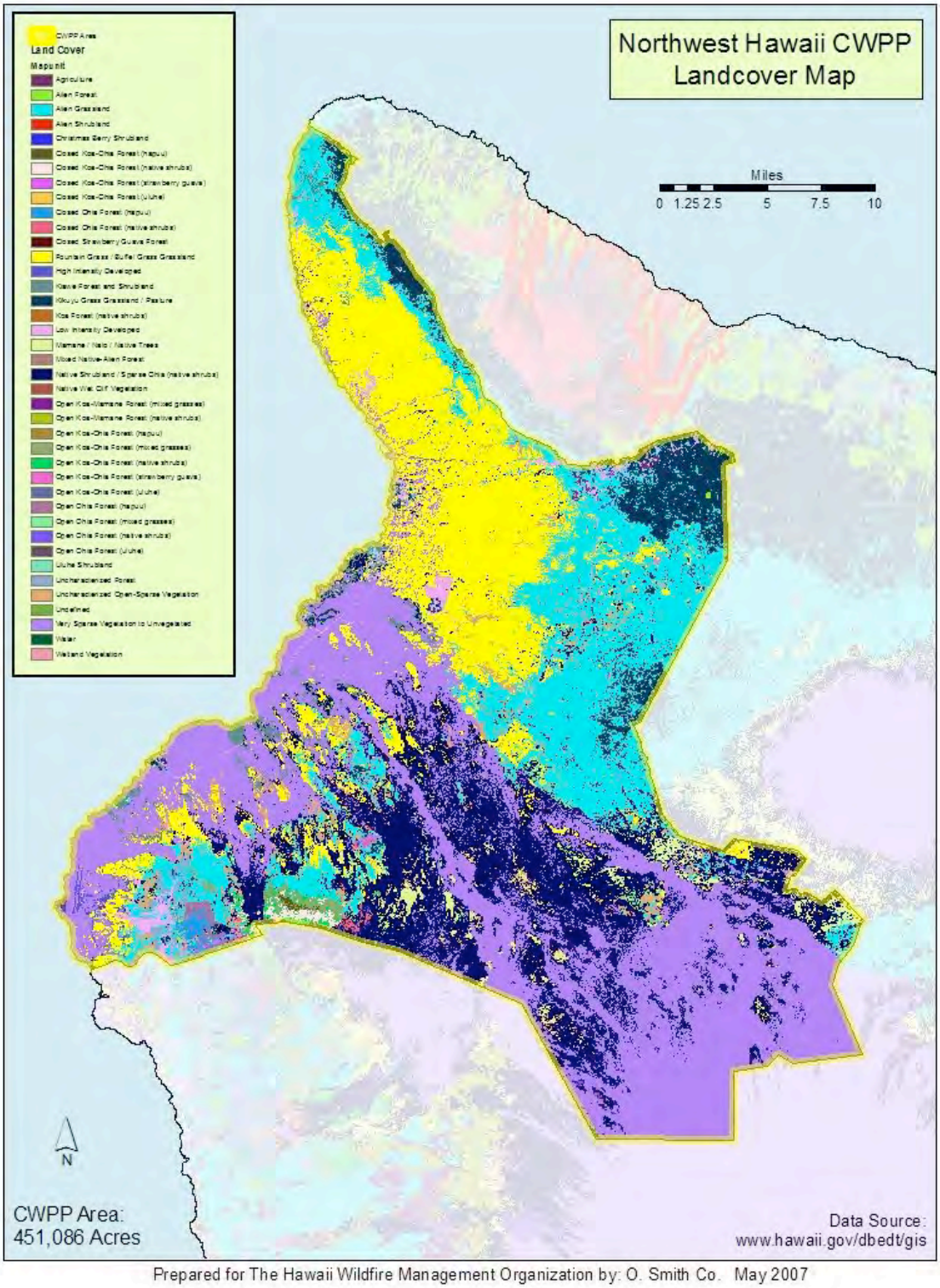


Figure 4: Land cover map of Northwest Hawaii depicting various vegetation zones. Yellow areas denote fountain grass, buffel grass, and/or gassland; purple denotes unvegetated or very sparse vegetation; light blue denotes alien grassland; and dark blue denotes native shrubland / sparse ohia (native shrubs).

Northwest Hawaii is home to more than 54 federally-listed endangered and threatened plant and animal species, including the Hawaiian duck, (*Anas wyvilliana*), Hawaiian goose (*Branta sandvicensis*), Hawaiian hawk (*Buteo solitarius*), Palila (*Loxioides bailleui),* Akepa (*Loxops coccineus coccineus*), Hawaii creeper (*Oreomystis mana*), ‘Ohai (*Sesbania tomentosa),* Hala pepe (*Pleomele hawaiiensis),* Po`e (*Portulaca sclerocarpa*), and Loulu (*Pritchardia affinis*). Figure 5 below shows a plant density map for endangered and threatened plants in Northwest Hawaii. Maps of native Hawaiian bird species locations and forest bird ranges in Northwest Hawaii can be found in Appendix A.

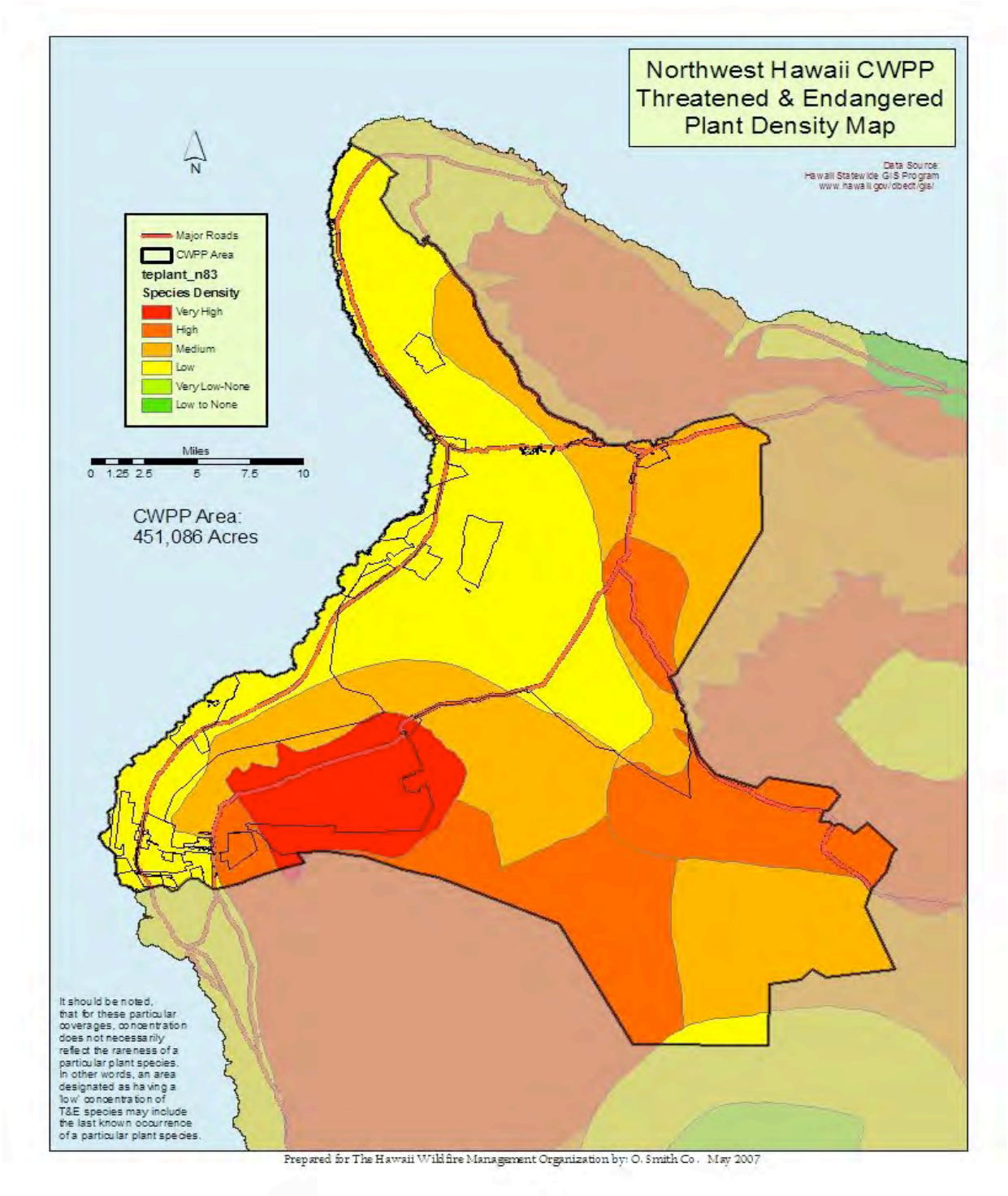


Figure 5: Map depicting endangered and threatened plant densities in Northwest Hawaii. Red zone denotes very high plant density, dark orange denotes high density, light orange is medium density, and yellow is low density of endangered plants.

Fire History:

Different agencies are responsible for fire suppression around the county, depending on fire location. Hawaii Fire Department is responsible for fire suppression in county residential areas while the State Division of Forestry and Wildlife is responsible for fire suppression on state lands. The Pohakuloa Training Area has an organized fire department that responds to fires on the Army's federal land while the National Park Service responds to fires on Park land. All of these agencies have a Memorandum of Understanding for mutual aid in fire suppression. Each organization maintains separate fire history statistics.

An August 2005 wildfire that started along Kawaihae Road in Waimea consumed 25,000 acres in West Hawaii and burned south all the way to Waikoloa Village. (Photo Credit: Wayne Ching).

Figure 6, below, is a fire history map for West Hawaii spanning from 1954 – 2005 with graphs depicting fire size and frequency. The graphs within the map can be found in Appendix B.

The fire history map also illustrates how fuels have been managed in the region. For example, grazing objectives in the Pu'u Wa'a Wa'a area are aimed at fine fuel reduction to minimize the wildfire threat. Wildfires in this area have been infrequent and small and as a result, damage to the dryland forest ecosystem has been less severe than in Pu'uanahulu. Comparatively, grazing was removed in Pu'u Anahulu (adjacent to Pu'u Wa'a Wa'a and separated by a lava flow) in the 1960s and since than, this area has experienced numerous large catastrophic fires that have decimated much of the native dryland habitat.

While the Waikoloa fire (above right) was burning, a wildfire started by a roadside vehicle ignited grasslands north of Kohala Ranch and jumped the Akoni Pule Highway, burning more than 1,500 acres. (Photo Credit: Wayne Ching).

In the past decade Northwest Hawaii has experienced at least 39 wildfires with 13 of those burning more than 1,200 acres. Average size for all wildland fires within the CWPP coverage area during the past 50 years is 2,835 acres with a median size of 400 acres. However, northwest Hawaii has experienced some of the state's largest wildfires, including a 1969 fire that burned 45,000 acres and a 2005 wildfire that encompassed an area from Waimea to Waikoloa burning 25,000 acres. In 2005 there were two simultaneous wildfires burning just days apart. The first fire was the large 25,000-acre Waikoloa conflagration and the second fire was the Akoni Pule Highway wildfire that consumed 1,500 acres. These two large wildfires burning in the same region put a tremendous strain on firefighting

A March 2006 wildfire, caused by a lightening strike, burned more than 300 acres in Pu'uanahulu and the state-owned Pu'u Wa'a Wa'a Forest Reserve. (Photo Credit: Wayne Ching).

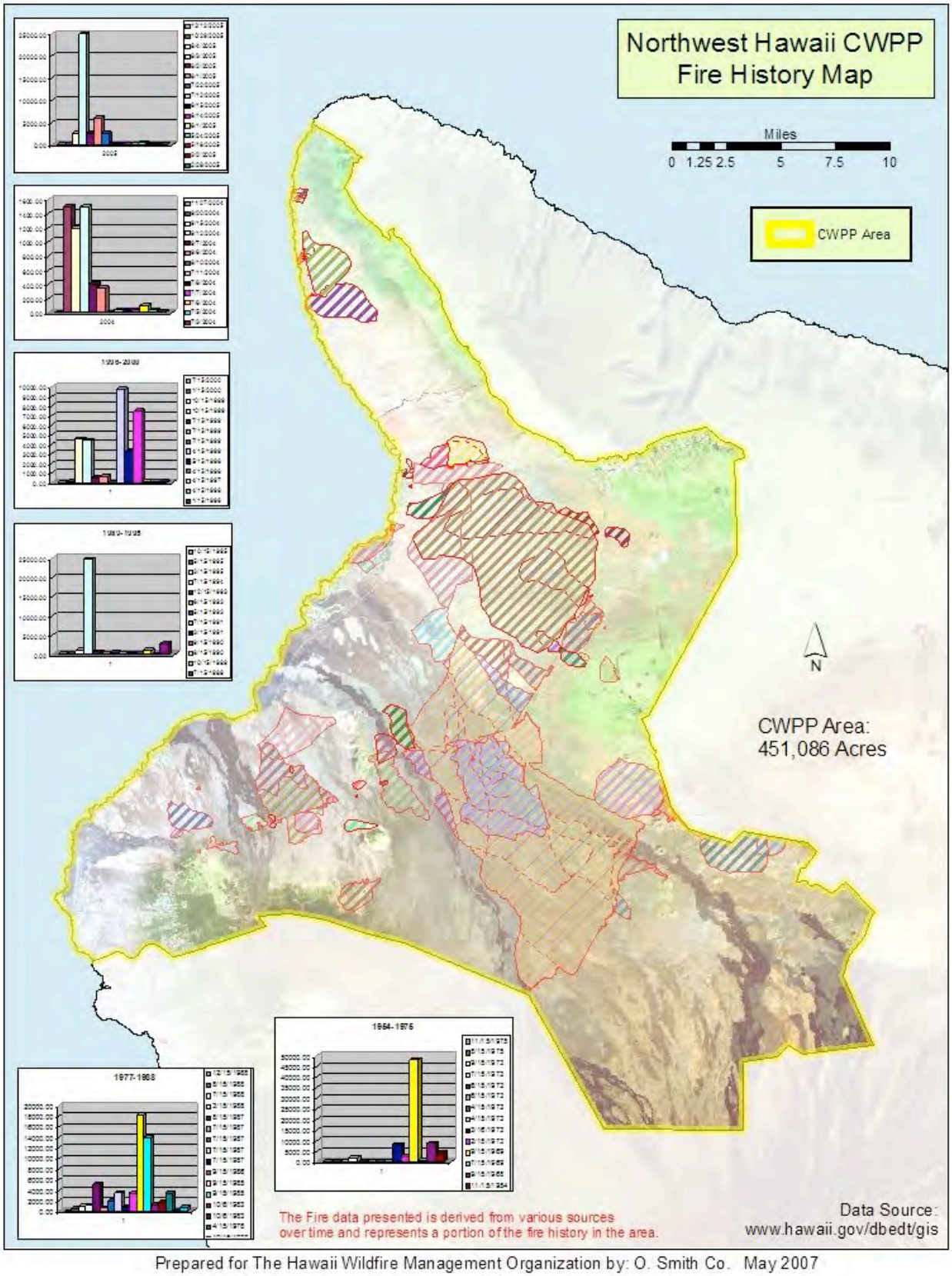
resources and in fact, resources from other islands were brought in to assist.

Wildfire ignition or fire starts are from various sources. Vehicular fire starts, such as the Akoni Pule Highway wildfire (where a vehicle was set on fire) are a common cause of fire starts. In many cases, catalytic converters and traffic accidents, account for most of the fire starts related to vehicles, including a 60-acre blaze just north of Pu'u Lani Ranch Estates that was started when a vehicle veered over a cliff and caught fire, igniting nearby brush. Human caused fire starts are also common. Agricultural escape burns, unauthorized residential burning, and arson are some examples of fires attributed to humans. The presence of an arsonist within the Waikoloa/Kohala area is a concern for local firefighters and the community. Hawaii County fire and police departments and the state Forestry and Wildlife Division have created a task force to apprehend the arsonist(s). While natural causes are the least likely sources of wildfire ignition, they do occur. A 300-acre fire in Pu'uanahulu was started by a lightening strike. Below is a chart showing wildfires in the CWPP coverage area from 1954 to 2005. The Hawaii Wildfire Management Organization is currently updating its fire history data. As this report is being written there has been a rash of wildfires in Northwest Hawaii that officials believe were intentionally set. Between January and mid July 2007 more than 14,000 acres burned within the CWPP coverage area.

West Hawaii Fire Data 1954 - 2005

DATE	ACREAGE	CITY
12/12/05	25.00	Kailua-Kona
10/29/05	35.00	Kailua-Kona
8/4/05	2500.00	Hawi
8/3/05	25000.00	Waikoloa
8/2/05	2500.00	Kawaihae
8/1/05	6000.00	Kamuela
7/22/05	2500.00	Kamuela
7/12/05	150.00	Hawi
6/15/05	100.00	Kamuela
6/14/05	50.00	Kamuela
6/1/05	1.00	Hawi
5/24/05	400.00	Kamuela
5/18/05	150.00	Hawi
3/2/05	10.00	Kamuela
2/28/05	7.00	Kawaihae
11/27/04	2.50	Kapaau
9/20/04	1500.00	Kamuela
9/15/04	1200.00	Kamuela
9/12/04	1500.00	Kamuela
9/7/04	400.00	Waikoloa
9/6/04	350.00	Waikoloa
8/10/04	5.00	Kamuela
7/11/04	40.00	Hawi
7/8/04	40.00	Hawi
7/7/04	40.00	Hawi
7/6/04	100.00	Kawaihae
7/5/04	40.00	Hawi
7/3/04	20.00	Kamuela
7/15/00	1.70	Waiki'i
1/15/00	70.55	Saddle Road Junction
10/15/99	4553.44	Pu'uanahulu

10/15/99	4382.84	Waikoloa
7/15/99	429.93	Saddle Road Junction
7/15/99	595.49	Waiki'i
7/15/99	4.13	Saddle Road Junction
4/15/99	9758.00	Pu'uanahulu
5/15/98	3287.52	Pu'uanahulu
4/15/98	7463.78	Waikoloa
4/15/97	102.27	Hualalai
4/15/96	113.52	Hualalai
1/15/96	84.46	Pu'uanahulu
10/15/95	196.84	Waiki'i
5/15/95	40.01	Waiki'i
3/15/95	1072.98	Hualalai
7/15/94	24714.92	Pu'uanahulu
12/15/93	745.40	Pu'uanahulu
6/15/93	107.61	Pu'uanahulu
5/15/93	352.78	Hualalai
7/15/91	193.78	Puako
3/15/91	46.28	Pu'uanahulu
9/15/90	98.00	Puako
8/15/90	1133.50	Waiki'i
10/15/89	13.17	Hualalai
7/15/89	2835.30	Kiholo Mauka
12/15/88	2.00	Hualalai
8/15/88	551.21	Pu'uanahulu
7/15/88	1064.98	Waikoloa
3/15/88	1160.26	Hualalai
8/15/87	5234.00	Waikoloa
7/15/87	676.24	PTA
7/15/87	1963.48	Waikoloa
7/15/87	3530.81	Pu'uanahulu
7/15/87	794.90	Puako
9/15/86	3486.01	Pu'uanahulu
9/15/85	18291.33	Waikoloa
9/15/85	13993.35	Waikoloa
10/6/83	1309.11	Saddle Road Junction
10/6/83	1817.41	Waikoloa
4/15/78	3510.01	PTA
10/15/77	97.38	PTA
9/15/77	854.69	PTA
11/15/75	44.40	Waiki'i
8/15/75	233.26	Waiki'i
9/15/73	53.45	PTA
7/15/73	2211.32	Pu'uanahulu
6/15/73	27.48	Pu'uanahulu
6/15/73	53.37	Pu'uanahulu
4/15/73	190.34	Hualalai
4/15/73	7.78	Hualalai
3/16/73	8120.77	Kawaihae
2/15/73	2800.04	Waiki'i
9/15/69	47974.79	Pu'uanahulu
7/15/69	984.22	Pu'uanahulu
9/15/68	8744.35	Pu'uanahulu
11/15/54	4179.65	Waiki'i



Prepared for The Hawaii Wildfire Management Organization by: O. Smith Co. May 2007

Figure 6: Fire history map of Northwest Hawaii, showing wildfires in the region from 1954 –2005. The imbedded graph charts depict fires in annual ranges by size and can be found in Appendix B.

Stakeholders:

Stakeholders are individuals or groups who have a high level of interest in the protection of their assets from wildfire. The CWPP area encompasses lands managed by federal, state, county, and private entities. Contact information for principal government stakeholders is listed below.

Federal:

Pohakuloa Training Area (U.S. Army)
Eric Moller
Deputy Fire Chief
USAG-HI, IFSO
Box 4607, Hilo, HI 96720
(808) 969-2441
mollereh@shafter.army.mil

Hawaii Volcanoes National Park
Joe Molhoek
Pacific Island Fire Mgmt. Officer
PO Box 52, HNP, HI 96718
(808) 985-6042
Joe_Molhoek@nps.gov

State:

Department of Land and Natural Resources: Division of Forestry and Wildlife
Wayne Ching
State Protection Forester
1151 Punchbowl St., Room 325, Honolulu, HI 96813
(808) 587-4173
Wayne.F.Ching@hawaii.gov

County:

Hawaii Fire Department
Fire Chief Darryl Oliveira
25 Aupuni St., Hilo, HI 96720
(808) 981-8394
Hcfdf1@co.hawaii.hi.us

County:

Hawaii County Civil Defense
Troy Kindred
Civil Defense Administrator
920 Ululani St., Hilo, HI 96720
(808) 961-8229
tkindred@co.hawaii.hi.us

Wildfire Risk Assessment for Northwest Hawaii:

In 2006, the Hawaii Wildfire Management Organization commissioned the Firewise coordinator to conduct a series of wildfire hazard assessments for a dozen West Hawaii communities, using the Hawaii Wildland Fire Risk and Hazard Severity Assessment based on the Assessment in Appendix A of NFPA 1144, *Standard for Protection of Life and Property from Wildland Fire*. These hazard assessments were conducted to identify the level of wildfire risk for the West Hawaii communities included in this CWPP.

HFD personnel, Dr. Kimbal of Puako Community Association, and Earl Spence (far right), a HWMO contractor, view a map of Puako before accompanying the Firewise coordinator in a wildfire hazard assessment of Puako.

Using a pre-established point system, the Hawaii Wildland Fire Risk and Hazard Severity Assessment is a tool used to determine the level of wildfire risk to a home or community. Points are given regarding overall terrain and location, road width, local area fire history, prevailing winds and seasonal weather, geographical contours, native vegetation, water availability, location of fire suppression resources, as well as the combustibility of building materials, including the roof, siding, and attached items, such as decks, fencing, or an unit. The combined points in all these categories are added together and the overall risk is determined by whether the score falls in the low-, medium-, high-, or extreme-risk point range. Given the ignitability of individual structures, preponderance of fuels in close proximity to structures, and lack of water, all the communities within Northwest Hawaii, with the exception of Pu'u Kapu, scored in the high-hazard range in the wildfire hazard assessment, while Pu'u Kapu scored in the medium-risk range.

While the Northwest Hawaii region as a whole shares certain common characteristics, the communities within it vary tremendously and deseve separate description in terms of slope, size, and water availablity. Therefore short descriptions excerpted from the wildfire hazard assessments are provided below.

Kohala Ranch and Kohala Estates

Kohala Ranch is a developed subdivision in Kohala, Hawaii that spans from the Akoni Pule Highway, near sea level, up to Kohala Mountain Road at the 3,300-foot elevation. It is comprised of 4,000 deeded acres, with lots ranging in size from a half-acre to more than 10 acres. Kahua Ranch borders Kohala Ranch. Cattle and sheep from Kahua and Ponoholo Ranches graze within the Kohala Ranch subdivision and help to reduce fuel load within the community.

The subdivision has underground utilities, paved roads, hydrants, and setbacks. There is one means of ingress and egress at the top and bottom of the subdivision (at Akoni Pule Highway and Kohala Mountain Road). Both entrances have a gate and guard shack with the Akoni Pule entrance staffed 24 hours a day and the Kohala Mountain Road entrance staffed 16 hours a day (unmanned from 10 pm – 6 am). Ala Kahua Road, a paved road on the south east side of the subdivision, leads to the neighboring subdivision of Kohala Estates but there is a locked gate separating the communities. A 12-foot wide equestrian trail with wood fencing on either side extends along the perimeter of the Heathers I section of the subdivision and the trail has been graded for 4-wheel drive vehicles. Several homes within the subdivision have locked gates blocking their driveways.

Kohala Estates is a developed subdivision directly south of and adjacent to Kohala Ranch. Lots were originally sold in 20-acre parcels, but have since been subdivided into 3-acre lots. Kohala Estates, which also starts at Akoni Pule Highway, is ungated and side streets within the subdivision are off Ala Kahua Drive. Since Ala Kahua Drive is gated directly below the volunteer fire station, this leaves the community with one means of ingress and egress from the subdivision.

Kiawewai gulch separates Kohala Ranch and Kohala Estates.

Kohala Estates has paved roads, with hydrants spaced less than 1,000 feet apart. Some utilities are underground and some are above ground. Road signage is metal and reflectorized, however house numbers vary in size and color. There is no organized grazing of animals within Kohala Estates.

Slope within both subdivisions varies between 10 to 20+ percent. Kiawewai gulch runs along the southern boundary of the subdivision between Kohala Ranch and Kohala Estates. Property lines from both subdivisions extend to the middle of the gulch. Kiawewai gulch is a fire hazard due to the kiawe/buffel grass vegetation.

There is a 100,000-gallon water tank on the Kohala Ranch side of the gulch, which feeds all the fire hydrants within Kohala Ranch and Kohala Estates. The tank is pressurized and if there is a loss of electricity, the tank becomes gravity fed. Kohala Ranch and Kohala Estates are not part of the Hawaii County water system. Kohala Ranch Water Company controls and supplies the water for Kohala Ranch, Kohala Estates, Kohala By the Sea, and DHHL Hawaiian Homes Residence Lots subdivisions (the latter subdivisions are just south of Kohala Ranch and Kohala Estates).

Kohala by the Sea

Kohala By The Sea (KBTS) is a developed gated community directly south of Kohala Estates. KBTS covers approximately 77 acres and the general topography is a gentle slope of 9 percent. However, there is a large gulch that runs through the middle of the community. This gulch is a particular fire hazard because of the kiawe trees and haole koa brush within it.

There are 73 lots within the subdivision with 42 homes either built or under construction. The community has underground utilities, paved roads, hydrants, and setbacks, as well as one functional point of egress and ingress. There is a paved road on the north side that ties into the adjacent community of Kohala Estates, which can be used as an escape route in case of emergency.

The KBTS community is surrounded and intermixed by bunchgrass, which produces fast moving and intense fire conditions. The strong onshore winds that persist everyday make this community prone to wildfires.

Kohala by the Sea residents, concerned about the threat of wildfire to their community, went through the steps to become the first nationally recognized Firewise Community in Hawaii. They are the only community in Hawaii to earn this distinction and have maintained recognition status for three consecutive years.

Kohala by the Sea residents during a 2005 Firewise community workday. Collaborative mitigation efforts helped the community achieve national recognition as part of the Firewise Communities USA program.

Kawaihae

Kawaihae is a community in the North Kohala district of Hawaii along the leeward coast. Akoni Pule Highway runs through the community, which includes a commercial harbor with a shipping terminal and fuel depot; Ka Ilima O Kawaihae Cultural Surf Park; Kawaihae Canoe Club and boat ramp; retail shopping centers and restaurants; Pu'ukohola National Heiau National Historic Site, an Industrial Park**,** Ke Hale O Kawaihae Transitional Housing, Kawaihae Village, Department of Hawaiian Home Lands Kawaihae Residence Lots, and Ke Hale O Kawaihae.

Ke Hale O Kawaihae is on the mauka side of Akoni Pule Highway, diagonally across from Pu'ukohola National Heiau National Historic Site just south of Kawaihae Harbor. The Kawaihae Industrial Park is three miles north of Ke Hale O Kawaihae, also on the mauka side of Akoni Pule Highway. The DHHL Kawaihae Makai Lots are on the makai side of Akoni Pule Highway across from the Industrial Park with the bulk of the Kawaihae Residence Lots just north of the Industrial Park on the mauka side of the highway.

Ke Hale o Kawaihae is a 24-unit facility that is part of Catholic Charities Transitional Housing Program. The program provides temporary housing to homeless families with children. There are no driveways or roads within this facility as the units are clustered around an unpaved parking lot directly off Akoni Pule Highway. Utilities are above ground along the highway. There is a power station directly south of the units on the same side of the highway. On either side and behind the units are open lands filled with grasses and brush, including fountain grass and kiawe. Units are of post and pier construction with combustible siding and non-combustible roofing.

Kawaihae Residence Lots are part of Hawaiian Home Lands. Congress created *The Hawaiian Homes Commission Act of 1920* as a land trust. The purpose of the Act was the rehabilitation of native Hawaiians, those individuals of not less than one-half Hawaiian blood. The program offered 99-year leases for residential, agricultural, and pastoral homesteads on the islands of Kauai, Oahu, Maui, Molokai, and the island of Hawaii. When Hawaii became the 50th state in the U.S., one of the conditions of statehood was that the State of Hawaii would administer this program.

The Makai Lots are directly north of the Kawaihae Canoe Club and across the highway from the Industrial Park. There are 22 house lots in the Makai Lots ranging from 15,000 to 23,489 square-feet. In the Makai Lots, one paved road, Honokoa Street, runs between Akoni Pule Highway and the ocean and accesses Akoni Pule Highway at either end. Utilities are above ground and there are hydrants along the road. Driveways are less than 100 feet long and at least 12 feet wide with 15-feet vertical clearance. There are thick groves of kiawe trees on the makai side of the highway. In addition to these Makai Lots there are 3 more house lots across from the harbor.

The 196 lots in the Residence Lots range between one-half acre to an acre in size. They have above ground utilities, paved roads, hydrants spaced less than 1,000 feet apart, and setbacks. Kalo'olo'o Drive, which starts at Akoni Puli Highway, is the main road in the Kawaihae Residence Lots, with side streets that dead end or loop around off of this main road. Road signage is metal and reflectorized, however individual house numbering is spotty to nonexistent. Driveway lengths vary in the Residence Lots, those that are shorter (less than 100 feet) tend to be paved with concrete, while longer driveways tend to be unpaved. Driveways are at least 12 feet wide with 15-feet vertical clearance. Only a few homes within the Residence Lots have locked gates blocking their driveways.

Slope in the community varies between 10 to 20+ percent. The Transitional Housing and Makai Lots are flat at or near sea level. The Industrial Park is on a slight hill above the Makai Lots. There are rolling hills throughout the Residence Lots with Kalo'olo'o Drive on a steep incline. There are gulches run to

the north and south of the Residence Lots. These gulches are a fire hazard due to the grasses and kiawe trees growing within them.

The Residence Lots are not part of the Hawaii County water system. A single company controls the water for Kohala Ranch, Kohala Estates, Kohala By the Sea, and Hawaiian Home House lots.

Kawaihae Village is just mauka of the intersection of Queen Kaahumanu Highway and Kawaihae Road. The village complex includes rental housing used by Mauna Kea Observatories for their employees.

Much of the land area owned by Queen Emma Lands on the north side of the Kawaihae Road, although not highly suitable for grazing, was fenced and the Ranch grazes this area to reduce the amount of fire fuel that could enhance wildfires. This grazing project is a collaborative effort, including Mauna Kea Soils and Water Conservation Services, Parker Ranch, Queen Emma Lands, and the State Department of Health.

Anekona Estates and Kanehoa in Waimea
Anekona Estates and Kanehoa are developed adjoining subdivisions on the south side of Kawaihae Road at the 1,800-foot elevation in Waimea. The Kanehoa subdivision has 44 homes with two empty lots. Lots in Kanehoa were originally 5 acres in size, although some have been subdivided into 2.5-acre lots. Several lots have two houses on property, which are considered condominiums by the Kanehoa Homeowners Association. The majority of homes are owner occupied. Lots in Anekona Estates appear to be at least a half-acre to acre in size.

Anekona Estates and Kanehoa subdivisions have underground utilities, paved roads, hydrants, and setbacks. There is a drainage ditch that separates the Anekona Estates and Kanehoa subdivisions.

Road widths within Anekona Estates and Kanehoa are 20 feet within the subdivisions. Kanehoa Homeowners Association is responsible for mowing the road shoulders within its subdivision, and schedules mowing according to rainfall. The majority of driveways within Anekona Estates are paved and several are gated. House numbering within Anekona Estates is inconsistent: varying in size, some are rusty and would be difficult to see at night or in smoky conditions.

Ouli Street is the only road in the Kanehoa subdivision. Ungated, Ouli Street exits onto Kawaihae Road and dead ends at the Waimea end of the subdivision with a small turnaround. There are road shoulders on either side of Ouli Street. There are two means of egress from Anekona Estates: Kanehoa Street and Anekona Street. Kanehoa Street exits onto Kawaihae Road and dead ends with no turn around space at a road barrier blocking entrance to Ouli Ekahi subdivision. Anekona Street exits onto Kawaihae Road where there is a gate, and merges into Kanehoa Street at the other end. Several homes within Anekona and Kanehoa subdivisions have locked gates blocking their driveways. There is road signage in Kanehoa but there is no street signage for side roads in Anekona Estates. House numbers vary in size and color.

There are gently rolling hills within both subdivisions and slope varies between 0 to 10 percent. Some houses are built on the top of hills while others are on flat land. Behind the subdivision is open hilly grasslands extending for several miles to the south to Waikoloa. There are open areas within both subdivisions with tall grasses.

Hydrants, spaced 1,000-feet apart within both subdivisions, are supplied by the Hawaii County Department of Water Supply (DWS). A storage tank for the county water system is located on Kawaihae Road at the 1,800-foot elevation near the Kanehoa subdivision. The tank is maintained by the DWS. Kanehoa subdivision has its own agricultural water system for irrigation. Three reservoirs are

located at the top of the subdivision and those residents that pay to use the reservoir can use this water. Residents within Kanehoa are oriented towards green growth for fire safety. There is a stream that runs through the subdivision through a series of ditches that runs sporadically and is available to all homeowners. This is in addition to the above-mentioned reservoirs.

Directly south of Anekona Estates is Ouli Ekahi, an affordable rental project of 33 units managed by the County of Hawaii (Housing and Community Development Corporation of Hawaii). There is a combination of houses and cottages. It has one road in and out of the subdivision with side streets at the end of the main entrance road. There are utilities above ground along the entrance road. Ouli Ekahi is separated from Anekona Estates by a road barrier. Lots are considerably smaller than Anekona or Kanehoa, averaging 10,000-square feet. Houses in Ouli Ekahi have metal roofing and combustible (wood) siding. Driveways are typically 12 feet wide with 15-foot vertical clearance. Several homes have fences, although the fences for the most part are non-combustible, i.e. of rock or metal with only one or two fences composed of wood. Most homes have defensible space because they lack vegetation.

House in Kanehoa subdivision. Built atop a slight hill, the front yard is covered in invasive grasses, a potential wildfire hazard.

In addition to area fuel load, strong winds, and minimal rainfall, there is an additional threat to these subdivisions. According to fire officials there is unexploded ordinance (UXO) in Waimea Anekona Estates, mostly small size mortar rounds and bullets. Some homes are built on unexploded ordinance. There have been explosions from UXO in residential areas during past wild fires. Per the Fire Chief's directive, no fire suppression field operations are allowed in designated UXO areas for safety reasons. It's believed there are UXO large enough to be fatal to dozer operators in the UXO areas.

Homes in all three subdivisions have Class A roofs, however some houses have wood siding and/or lanais, while others have non-combustible siding and/or lanais. Houses vary between post and pier and concrete slab construction. Some lots have defensible space around the house, while others have grasses growing right up to the house. Since Ouli Street is the only means of egress for many residents in Kanehoa, evacuation of residents and response by fire fighting personnel may be compromised if smoke or flames impede road access. According to Hawaii Fire Department personnel, some of the houses along the highway in Kanehoa are at risk because if a fire began along the highway, the wind would blow flames towards the houses.

Pu'u Kapu

Pu'u Kapu is a Department of Hawaiian Home Lands community in Waimea, on either side of Mamalahoa Highway in the South Kohala District covering an area of 11,949 acres. Pu'u Kapu I, on the Kona side of Mamalahoa Highway, is comprised of three distinct separate areas: Kuhio Village subdivision off Kamamalu Road, which contains 121 house lots; Farm lots, of which there are 75; and 204 Pastoral lots. Pu'u Kapu II is on the Kohala side of Mamalahoa Highway and borders the Kohala Forest. The information below focuses on Pu'u Kapu I.

House lots in Kuhio Village range from 10,000 square feet to an acre in size. Driveways in the subdivision are typically less than 100 feet, and few, if any, have turnarounds large enough for fire engine apparatus. Several driveways are gated or fenced. Driveways are typically at least 12 feet wide with 15 feet vertical clearance. House numbering is inconsistent and in many cases nonexistent. The majority of homes have metal roofs and wood siding. Roads are paved and there are multiple means to access Mamalahoa Highway, the main road through the Waimea community. Fire hydrants are spaced

throughout Kuhio Village subdivision. Utilities are above ground. Hawaii County is responsible for the maintenance and repair of roadways and shoulders in Kuhio Village.

Pu'u Kapu Farm lots are between Kuhio Village House lots and the Pastoral lots and range from 1.5 acres to 30 acres in size. The majority of the road system is built to county standards, with the exception of the partially paved substandard area on Kahilu Road that merges into Mana Road. There is more than one road to access the farm lots from Mamalahoa Highway. Some of the roads in the Farm lots area are paved single lane roads and some are unpaved dirt roads. Hawaii County is responsible for the maintenance and repair of roadways and shoulders in the Farm lots. Driveways tend to be longer than 300 feet and several are gated or fenced. House numbering is inconsistent or nonexistent. As in Kuhio Village, houses in the Farm lots tend to be constructed with metal roofs and combustible siding. Vegetation is denser in the Farm lots than in Kuhio Village House lots and some properties have windbreaks of eucalyptus or pine trees. Several lot owners raise horses, sheep, and/or goats. Fire hydrants are spaced throughout the farm lots and utilities are above ground. There are several active commercial agricultural operations in the farm lots, which are well irrigated.

The first phase of the Pu'u Kapu I pastoral lot leases were awarded in 1952 with the second phase being awarded in 1990. These lots, which range from 10 – 300 acres in size, are furthest away from Mamalahoa Highway and the Waimea fire station. Fire Road 7, an unpaved dirt road less than 24 feet wide that has access off of Mana Road, and Poliahu Road, a paved road 20 feet wide, are the main access roads to the Pastoral lots, with several side roads connecting to Fire Road 7. Access to DHHL Pastoral lots is gated on both Poliahu Road, shortly after the gate the road changes from paved to unpaved, and at the intersection of Mana Road and Fire Road 7. At the present time the gates to the Pastoral lots are unlocked.

Several Pastoral lot owners raise horses, cattle, goats, and/or sheep. Driveways within Pastoral lots are typically longer than 300 feet with room to stage firefighting apparatus. House numbering is not common in the Pastoral lots. With the exception of a few of the 100-acre lots, most people do not have access to electricity with homesteaders relying on generator, solar, or wind power. DHHL, via Sandwich Isle Communications, installed an underground fiber optic system with the capability of running underground lines should electricity become available. DHHL is responsible for maintaining the roads in the Pastoral lots. The agency does not mow the road shoulders.

Landowners in the Pu'u Kapu Pastoral lots graze cattle, goats, sheep, and/or horses, which helps to reduce fire fuel load (photo on right). However, not all lot owners manage their grazing to reduce fuels (photo on left).

There are no fire hydrants in Pu'u Kapu Pastoral lots. County potable water is available to a limited number of lots via a 4-inch main line. All lots awarded in 1952 have water via this 4-inch line. There is a Department of Water Supply 12,000-gallon tank on Fire Road 11 specifically for fire department use.

The Pu'u Kapu Pastoral Water Group has a 10,000-gallon tank opposite the 12,000-gallon tank near lot #78. There are two water meters near lots #15 and #20 that supply water to various homesteads. About 40 lots have their own water tanks that are fed through these meters with the tanks serving as the main source to individual lots and for fire protection. The majority of the lots issued in 1990 rely on catchment water. HWMO has installed a 5,000-gallon helicopter dip tank for the Pu'u Kapu community to serve as an additional water source for firefighting suppression.

For the most part, the community is on flat land, graded at less than 5 percent. The community experiences offshore winds in the morning and onshore winds in the afternoon. Normal trade winds blow north to south, although the area experiences strong, dry winds.

Puako

Puako is a developed community on the makai side of Queen Kaahumanu Highway in the South Kohala District. There are 150 homes in the Puako community with a mix of older (30-50 years old) and newer homes, incorporating varying degrees of fire-resistant construction materials. For instance, some of the older homes have wood shake roofs. Roughly one-third of the homes are owner occupied, one-third are long-term rentals, and one-third are vacation rentals. Driveways in Puako are typically less than 300 feet, and few, if any, have turnarounds large enough for fire engine apparatus. House numbering within Puako is inconsistent. While some homes have fire-resistant roofing and siding, others have wood shake roofs and wood siding. Many homes do not have defensible space around their property.

Homes in Puako range from older cottages to new, much larger models.

One road, Puako Beach Road, is a paved road less than 24 feet in width and is the main means of ingress and egress from the community. A secondary emergency access road, which is unpaved and can handle two-wheel drive vehicles traveling 25 miles per hour, is located behind the Catholic Church on the mauka side of Puako Beach Road and is locked and gated. Fire hydrants in Puako are less than 1,000 feet apart.

For the most part the community is on flat land, graded at less than 5 percent, although the terrain is at a slope at the transfer station and at the main entrance to Puako at Queen Kaahumanu Highway.

There is a kiawe forest running along the mauka boundary of the community from Queen Kaahumanu Highway down towards the community.

The community experiences offshore winds in the morning and onshore winds in the afternoon. Normal trade winds blow north to south, although the area experiences strong, dry winds.

The 100-foot fuel break on the mauka side of the Puako community created in 2003.

In 2003, the Hawaii Wildfire Management Organization provided technical assistance in the planning and creation of a 100-foot wide fuel break, which runs along the mauka side of the community from Hokuloa Church to the end of the subdivision lots. In 2004, HWMO worked with the Puako Community Association (PCA) to reimburse them for maintenance of the fuel break. PCA and the Puako community is working on several wildfire mitigation measures, including the maintenance of access lanes between private lots to enhance fire suppression efforts, increasing the width of the community fuel break to 300 feet and maintaining it annually, establishing a secondary emergency access routes from community through the Maui Lani resort, creating buffer zone around petroglyph areas, and enhancing defensible space around individual properties.

Waikoloa

Waikoloa Village is a developed community encompassing four square miles or 2,560 acres, between Queen Kaahumanu Highway and Mamalahoa Highway on Hawaii County's leeward coast. Waikoloa Village contains more than 2,700 homes, condominiums, and apartment units; a 122-acre golf course; a recreational complex; tennis courts and swimming pool; schools; churches; a shopping center and offices; as well as two small community parks. Waikoloa Village is surrounded by miles of open land filled with non-native vegetation, such as fountain grass.

There has been a sizable increase in development in recent years, with additional condominium complexes and subdivisions built within the community. For example, in 2006, developers Castle and Cook broke ground for the first phase of constructing 54 single-family homes and 175 condos and plans to develop another 520 additional condos and homes in the future. There are also plans for 1,200 affordable housing units to be built, in addition to numerous empty lots within the Village that may be built upon at any time. House lot sizes in Waikoloa Village range from 12,000-square-feet to 18,000-square-feet, with the 12,000-square-foot size being the norm. Driveways are less than 100 feet long with no turnaround space for fire apparatus, and several are less than 12 feet wide with 15-foot vertical clearance. The majority of homes are owner-occupied although some are used as vacation rentals. Road signage within the Village is metal and reflectorized. House numbers are displayed on mailboxes and painted on curbsides in front of homes.

The community has underground utilities, paved roads, hydrants, and setbacks. Waikoloa Road, which runs east west from Queen Kaahumanu Highway at sea level up to Mamalahoa Highway, is the main means of ingress and egress to the community. Waikoloa Road is a two-lane paved road greater than 24 feet wide. Roads within the Village are paved with some as much as 40 feet wide. Paniolo Avenue, a major thoroughfare through the community, is four lanes wide. During previous fires, the community had only one means of ingress and egress, which severely impacted the evacuation of thousands of residents. To address this concern, an emergency access road was recently built providing the community with an alternative means of egress

An emergency access road leading from Waikoloa Village to Queen Kaahumanu Highway was recently built to provide additional egress during wildfire emergencies.

in case of wildfire. The unpaved road, composed of compacted gravel, runs from Hulu Street, in a newly built part of western Waikoloa Village down to Queen Kaahumanu Highway. The road is gated and the fire department has an emergency access key.

Slope within the community varies between 0 to 20+ percent with rolling hills throughout the Village. There are gulches within the community filled with kiawe trees. Gulches can channel fire and kiawe trees are known to carry fire and create embers that can be easily carried onto residential properties. During a 2003 fire, the gulch next to the Baptist church carried fire through the community.

Water to fire hydrants, as well as residential and commercial properties within the Village is supplied by Hawaii County Department of Water Supply.

Pu'uanahulu

Pu'uanahulu is a community in the North Kona District, along the Mamalahoa Highway at the 2,200-foot elevation 18 miles north of Kona and 19 miles south of Waimea. The only road through the community, Mamalahoa Highway, runs northeast from Kona to Waimea. The community is composed of several houses along the highway; a church; a community complex, including a community center, equestrian ring, and volunteer fire station; a golf course, and the gated community of Pu'u Lani Ranch Estates (PLRE). The Baptist church is considered a historical landmark. Pu'u Wa'a Wa'a Ranch is directly south of the community.

The Baptist Church in Pu'uanahulu, on Mamalahoa Highway, is considered a historical landmark.

The Pu'u Wa'a Wa'a ahupua'a, directly south of Pu'uanahulu, contains more than 36,000 acres of state land and is an area rich in native Hawaiian plants and animals. At one time it was a Native Hawaiian dryland forest, but wildfires and grazing have destroyed much of the forest.

Houses along the highway have been established for at least 100 years. Pu'u Lani Ranch Estates is a gated community developed within the past 20 years. When approaching Pu'uanahulu from Kona on Mamalahoa Highway, there is a steep curve at the base of the ridge by Pu'u Wa'a Wa'a Ranch with the road winding around curves until the top of the hill at which is the entrance to PLRE and the Big Island Country Club. All the above-mentioned homes and enterprises are between the base of the ridge and the top of the hill.

Homes along the highway have above ground utilities, hydrants and setbacks. Mamalahoa Highway is the only means of ingress and egress from the community. The Big Island Country Club is behind the homes on the makai side of the highway and PLRE is behind the homes on the mauka side of the highway. Some landowners along the highway graze goats and/or horses on their property.

Typical house in Pu'u Lani Ranch Estates. This house has defensible space, although not all homes in the subdivision do.

Pu'u Lani Ranch Estates is a developed subdivision, the entrance of which is on Mamalahoa Highway. Built in phases since 1986, there are more than 146 lots in

the subdivision, and as of February 2007 there were 72 houses built. Lots are a minimum of one-acre parcels, with some lots being two acres in size. Within Pu'u Lani Ranch Estates there are several vacant lots with overgrown brush, many owned by mainland or international investors. Within PLRE there is a community clubhouse, tennis courts, and an equestrian facilities. The subdivision has underground utilities, paved roads greater than 20 feet in width, hydrants, and setbacks. There is one road for ingress and egress from the subdivision, which is gated. Several homes within the subdivision have locked gates blocking their driveways. Road signage is metal and reflectorized, however house numbers vary in size and color.

Driveways in PLRE must be paved using asphalt or concrete, or crushed. Driveways in PLRE tend to be less than 100 feet long, while driveways of homes along the highway tend to be longer and curved.

Diagonally across the highway from PLRE (on the makai side) is the Big Island Country Club, which includes a golf course, clubhouse, and undeveloped areas. Lynch Investments owns 400 acres and The Big Island Country Club owns the golf course, which is more than 100 acres.

There is one main road in and out of the golf course. A dirt road runs along the backside or makai boundary of the golf course, through the maintenance area connecting to Mamalahoa Highway. This road could be used as a secondary means of egress in case of emergency. Beyond the boundary of the golf course are grass filled rolling hills containing more than 3,000 acres of state land.

The unmaintained areas within the golf course contain 105 house lots that are slated for high-end residential construction. Lynch Investments owns these house lots and is moving forward in the construction permit process.

Within the PLRE subdivision slope is less than 20 percent. However those homes along the ridge are at a much higher risk from wildfire since the slope is nearly 100 percent in some places and is covered with high intensity fuels. Homes along the ridge are set back more than 30 feet from the slope. The steep ridge is covered with fountain grass, a high-intensity burning fuel, as well as silver oak, which is easily ignitable due to oily resins, and kiawe, which is known for having a long burn time. Firewise community workdays have been held in the past to decrease the fuel load at the base of the ridge to reduce wildfire risk from vehicle accidents.

Pu'uanahulu, including PLRE, is not part of the Hawaii County water system. The community came together several years ago to purchase the water system supplying the area and formed their own water company, Napu'u Water Inc. Two wells supply the community: one well at the PLRE clubhouse and one well at Pu'u Wa'a Wa'a ranch. Area residents must pay for this water, which is expensive. Because Napu'u Water Inc.'s predecessor supplied subsidized water for grazing in the area; grazers now pay premium prices for water. This may impact the viability of grazing, which will have an impact on reducing fuels in the area.

At the Big Island Country Club the hydrants within the golf course are not active (hydrants are the responsibility of Lynch Investments). Of Big Island Country Club's two wells, one is working and one is currently under repair.

North Kona: Hina Lani, Kona Palisades, Kealakehe

There are several miles of open grass lands south of Pu'uanahulu and north of Kona. The subdivisions of Kealakehe, Kona Palisaides, and Hina Lani are south of the grasslands and increase in proximity to the urban center of Kailua-Kona. While the wildfire risk is slightly lower in this region, due to increased industrial and residential development, it is still in the wildland urban interface. The area was originally

dryland forest, and there is still native flaura in the area, in addition to cultural sites, including refuge caves. The above communities span between Mamalahoa Highway and Queen Kaahumanu Highway.

Winds are typically north to north east trade winds averaging 5 – 15 mph, although the area does experience strong south winds on occasion. While homes in these subdivisions are generally built on flat land, the communties themselvves are built on steep grade, particularly Kona Palisades, which runds from 1,500 foot elevation to sea level in the span of less than four miles.

Houses in subdivisions in North Kona, such as the ones in Kealakehe, above, tend to be closer together than other communities.

House lots are smaller in size (10,000 – 15,000 square feet) than the more rural areas to the north. Driveways are also shorter, genreally only 50 to 100 feet in length, with no turnaround. Driveways are typically 12 feet wide with 15 feet of vertical clearance. Almost all homes in these subdivisions have non combustible roofing, although many have combustible siding and/or lanais. Houses vary in level of defensible space, with many homes using gravel and landscaping to create defensible space. However, those homes closest to undeveloped areas have kiawe growing in close proximity to the homes.

Community Assets at Risk:

Assets at risk are valued resources that can be damaged or destroyed by wildfire. In addition to ensuring firefighter safety and protecting residents and visitors, the following assets warrant consideration in pre-incident planning: watersheds; forest reserves; wildlife; scenic, cultural, and archeological sites; ranchlands; and structures. The following were identified as valued resources within Northwest Hawaii that would be adversely affected by wildfire.

Commercial / community resources:

Resorts, shopping centers, schools, community centers, churches, restaurants, industrial parks, and retail establishments.

Natural / Cultural Resources:

Pu'ukohola Heiau National Historic Site, Puako Petroglyph Archeological Preserve, Lapakahi State Historical Park, county parks and beaches including Hapuna Beach State Recreation Area, Wailea Bay, Spencer Beach Park, Pu'u Wa'a Wa'a State Wildlife Preserve, as well as native dryland forest, rare and endangered plants and animals, and cultural and archeological features, such as refuge caves. Importantly, the North Kohala coastline has the most numerous intact archeological sites in the state.

Houses and residences are at risk to wildfire in Northwest Hawaii. Overgrown vegetation close to homes and an increase of non-native high-intensity plants was found in every northwest Hawaii community. Northwest Hawaii as a whole has experienced tremendous development in recent years. Waikoloa Village already contains 2,700 single-family houses, condominiums, and apartment units and there are plans for nearly 2,000 additional homes and condominiums. New subsdivisions are being built on either side of Hina Lani in North Kona. Many new residents are from other parts of the United States and unfamiliar with the wildfire risks of Hawaii communities.

The majority of homes within residential areas in Northwest Hawaii have Class A roofing, however, several homes can be found in almost every subdivision with wood shake roofs. Many homes in West

side communities also have combustible siding and/or lanais (decks). Homes vary widely in defensible space regardless of socio-economic background, with lava serving as a natural fuel break on some lots and vegetation growing close to the home on other lots. Few driveways have turnaround access for emergency vehicles.

Community Concerns for West Hawaii:

Community meetings specifically on the CWPP process held in May 2007 with community members and fire agencies identified the most pressing fire concerns in Northwest Hawaii. They include, in order of priority:

1. Insufficient water infrastructure to adequately and quickly suppress wildfires;
2. Inadequate fire suppression resources, such as vehicles;
3. Fuel load along roadsides, in community open areas, and individual homes;
4. Regional and local planning and development standards that do not require communities' and subdivision designs to consider and/or mitigate fire risk
    4 a. Structures' design, materials, and placement and landscaping that promotes or does not mitigate fire risk;
5. Community egress and firefighting vehicle ingress during a wildfire;
    5a. Identification of evacuation route roads within subdivisions;
6. Lack of emergency access staging areas within subdivisions for evacuation purposes;
7. Need to reduce and/or control invasive species that possess inherent fire or ignition properties;
8. Arson;
7. Need to Increase/integrate communication equipment between state, federal, and county agencies; and
9. Lack of public awareness of the wildfire threat;
    9a. Need for awareness regarding restricting vehicle access and/or those vehicles with catalytic converters.

Recommended Actions for Northwest Hawaii:

Based on identified community concerns, the following recommendations are made to reduce the wildfire threat in Northwest Hawaii. The implementation of a multi-modal approach will increase firefighting efficiency, reduce fire fuels, and improve community and firefighter safety. Mitigation measures to reduce wildfire risk and/or impact in Northwest Hawaii include in order of priority:

1. Installation of pre-staged static water and helicopter dip tanks;
2. Acquisition of adequate resources for first responders, including off road tankers;
3. Reduction of fuel load and/or appropriate conversion of fuels along road sides, in community open areas, and individual homes. Appropriate conversion would include transition to vegetation with low ignition potential and low ability to carry fire, especially native plants;
4. Creation of development standards and community planning that requires the mitigation of wildfire risks at the regional, community/subdivision, and individual structure levels;
5. Creation/improvement of secondary access roads for those communities with only one means of ingress/egress; identification of evacuation route roads within subdivisions;
6. Development of emergency staging areas within communities and promoting awareness of such areas within the community, including holding mock disaster drills;
7. Reduction and/or control of invasive species that increase fire risk and, where appropriate, conversion to vegetation as described in priority number three;

8. Continued fire prevention education and outreach; including arson prevention education and the development of a fire danger rating system.
9. Integration of current and future communication equipment utilized by federal, state, and county fire suppression personnel to increase effective firefighting response.

Based on the results of the community risk assessment, priority ratings have been selected for Northwest Hawaii and areas of community importance. The community recommendations for the type and method of treatment for the surrounding vegetation are listed in the following table.

Community, structure or area at risk	**Type of Treatment**	**Method of Treatment**	**Overall Priority**
Kawaihae	Mechanical	Need for additional pre-staged static water and helicopter dip tanks	Very High
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Mechanical / Chemical / Hand Labor	Reduction of fuel load along roadsides, community open areas, and individual homes	Very High
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Mechanical	Acquisition of adequate resources for first responders, including off road tankers	High
Kohala by the Sea, Waimea Anekona, Puako, Pu'u Lani Ranch Estates	Mechanical / Chemical / Hand Labor	Creation of secondary emergency ingress/egress roads	High
Kohala, Pu'u Kapu, Waikoloa, Pu'u Lani Ranch Estates	Mechanical	Street signage identifying evacuation routes	High
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Mechanical	Development of emergency staging areas within communities, promoting awareness of such areas within the community, including holding mock disaster drills	High
Kohala, Kawaihae, Pu'u Kapu, Waimea,	Mechanical / Chemical / Hand Labor	Reduction and/or control of invasive species	High

Puako, Waikoloa, Pu'uanahulu, North Kona			
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Public Education and Outreach	Continued fire prevention education and outreach, including arson prevention education	Medium
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Mechanical / Political	Increase effective integrated communication between federal, state, and county fire suppression agencies	Medium

Community organizations, federal agencies, and private landowners in Northwest Hawaii were invited to submit projects that provide protection and reduce wildfire risk. The following table displays a list of projects based on recommendations from community and fire-related organizations. HWMO intends to assess the progress annually and invite agencies and landowners to submit projects that provide community protection.

Community, structure, or area at risk	**Project**	**Agency**	**Funding Needs**	**Timetable**	**Community Recommendation**
Kawaihae, leeward N Kohala coast, Pu'uanahulu; S Waimea, Pu'u Wa'a Wa'a, Waikoloa	Installation of pre-staged static water and helicopter dip tanks	Multiple Agencies: federal, state, county, and private	Cooperative Funding $128,000	2008 - 2009	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Reduction and/or conversion of fuel load along roadsides, community open areas, and individual homes	Multiple Agencies: county	Cooperative Funding $850,000	2008 - 20012	Yes
All communities and areas in the CWPP planning	Creation of development standards and community planning that	Multiple Agencies: county and state	Cooperative Funding $150,000 for outreach, any needed	2008-2009	

planning area	planning that requires the mitigation of wildfire risks		impact studies and education		
Kohala by the Sea, Waimea Anekona, Puako, Pu'u Lani Ranch Estates	Creation of secondary emergency ingress/egress roads	Multiple Agencies: federal, state, county, and private	Cooperative Funding $750,000 if environment-al assess-ments required	2008 - 2010	Yes
Kohala, Pu'u Kapu, Waikoloa, Pu'u Lani Ranch Estates	Street signage identifying evacuation routes	Multiple Agencies: federal, state, county, and private	Cooperative Funding $50,000	2008 - 2012	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Development of emergency staging areas within communities, promoting awareness of such areas within the community, including holding mock disaster drills	Multiple agencies: private	Cooperative Funding $33,000 for planning and outreach	2008 - 20010	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Reduction, control, and or conversion of invasive species	Multiple Agencies: federal, state, county, and private	Cooperative Funding $1,500,000 includes maintenance, grazing, and conversion projects	2008 - 2012	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Continued fire prevention education and outreach, including arson prevention education	Multiple agencies: federal, state, county, and private	Cooperative Funding $30,000	2008 - 2012	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa	Increased effective integrated communication between federal, state,	Multiple agencies	Cooperative Funding	2008 - 20011	Yes

Waikoloa, Pu'uanahulu, North Kona	and county fire suppression agencies				

Installation of pre-staged static water and helicopter dip tanks
Lack of water for fire suppression was identified as one of the most important challenges facing Northwest Hawaii communities. Pre-staged static water and helicopter dip tanks will greatly increase effective fire suppression and firefighting efficiency.

Acquisition of adequate fire suppression resources
Acquisition of additional fire suppression vehicles, particularly smaller off-road vehicles, may help fire fighting personnel reach remote fires quicker.

Reduction and/or appropriate conversion of fuel load
Reducing vegetation or appropriately converting fuels to species with low ignition potential in the vicinity of valued resources (houses, churches, community centers, cultural resources), in community common areas, and along road sides and fuel breaks will decrease fire risk to important resources and improve fire suppression capabilities. Whenever possible, fuels conversion should incorporate native plants.

Development standards and community planning that requires the mitigation of wildfire risks
Adopting development standards and community plans that mitigate wildfire risk will prevent many of the problems that set the stage for loss during fires and will greatly assist in suppression efforts and maximizing responder safety.

Creation / improvement of secondary access roads
Creation or improvement of secondary access roads to provide emergency egress should be pursued, secured, and improved where appropriate. Other secondary roads that may be used for fire suppression activities should be clearly signed and maintained.

In order to remain effective, the secondary emergency egress roads must be maintained on a regular basis. Funding should be secured to ensure that the roads are maintained at least twice a year. The organization that is determined to be responsible for the access roads may want to consider the purchase of a dozer or other equipment to maintain the roads.

Also, evacuation routes should be clearly identified within Northwest Hawaii subdivisions with signage posted marking these roads for express egress in case of emergency.

Development of emergency staging areas within communities
Recognizing that evacuation may not always be possible during a wildfire, community association and/or neighborhood groups may want to develop emergency staging areas within their community for times when evacuation is not possible. Once these staging areas are identified, communities should promote awareness of such areas within the community, as well as hold periodic mock disaster drills.

Reduction, control, and/or conversion of invasive species
Invasive grasses, such as molasses grass and fountain grass are high-intensity burning fuels that carry fire to other fuels. The ability of fountain grass to establish on barren lava flows compromises natural fire breaks for use by fire agencies. Proactive measures should be taken to mitigate the growth of fire fuels on these natural fuel breaks. Current strategies to address fine fuel build-up along roadsides should be continued, including developing vegetated fuel break corridors consisting of plants less likely to ignite or carry fire with an emphasis on native plants. It is recommended that community associations

in Northwest Hawaii adopt CCRs that address fire fuels build-up within their community. It is also strongly recommended that outreach efforts include alerting residents and developers to the wildfire risk caused by invasive grasses and ways to prevent their spread. Periodic inspection of the each home site and sanitation strategies should be suggested by the homeowners associations. Landscaping with fire resistant plant species and especially native plant species should be recommended by the homeowners associations.

Continued fire prevention education
Fire agencies in Hawaii County and the Hawaii Wildfire Management Organization have partnered with Firewise to promote community wildland fire awareness in wildland urban interface communities. The objective is to increase overall awareness of fire hazard issues that affect residents within the wildland urban interface. While a Firewise coordinator has provided much needed outreach in the community, funding for such a position has been intermittent. Stable funding for an outreach coordinator should be developed to ensure consistent fire prevention outreach. With a continued influx of residents from other parts of the United States who are unaware of Northwest Hawaii's unique fire risks, it is crucial to continue a comprehensive fire education and outreach campaign. This program should consist of the following:

a. Continued development and coordination of community meetings and outreach events. Coordination with other community groups, such as the local disaster preparedness committee and civic organizations, to provide wildland fire safety information on defensible space and fire-resistant Firewise building materials. Provide outreach at community events.

b. Develop educational materials specific to community fire threat and continue outreach in local publications. Continued outreach is needed with large numbers of new residents moving into the area.

c. Development of fire prevention outreach materials, including TV and radio public service announcements, posters, and handouts.

d. Development of arson prevention outreach materials, including TV and radio public service announcements, posters, and handouts.

e. Creation and promotion of a systematic fire danger rating system. Such a system has been in development for a couple of years and when finalized the fire danger rating system should be promoted in Northwest Hawaii, so residents know when fire hazards within their community are at their highest.

Increased effective communication between emergency personnel agencies during disaster
Fires, earthquakes, and hurricanes are among the risks that threaten Northwest Hawaii communities. It is imperative that current and future communication equipment utilized by federal, state, and county fire suppression agencies are integrated to increase effective firefighting response.

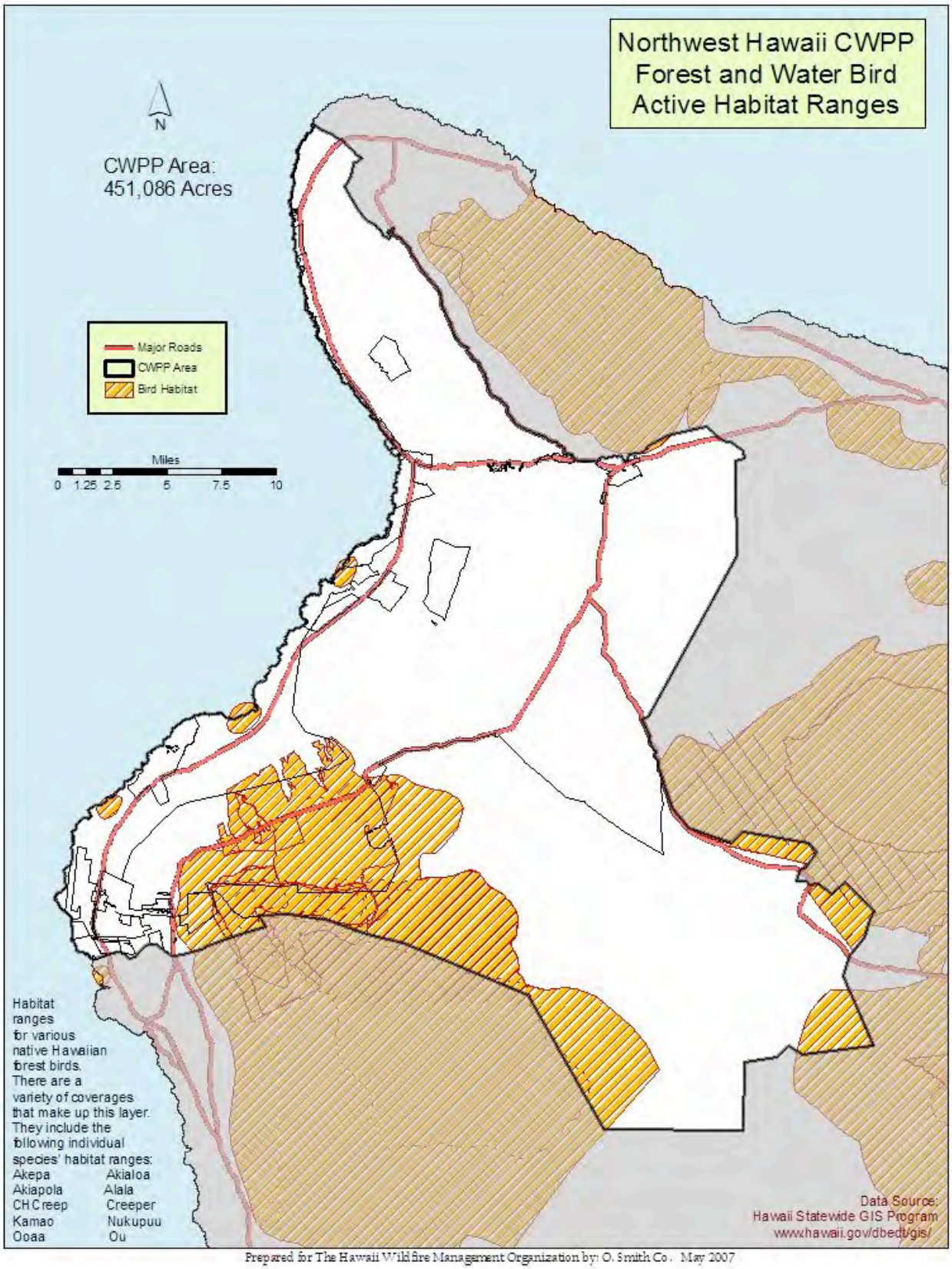
Reducing Structural Ignitability:

Individuals and community associations can reduce structural ignitability throughout their community by taking the following measures recommended by the Firewise program.

• Create a buffer zone of defensible space around a property of at least 30 feet or to the property line if the house has less than 30 feet of yard. Remove flammable vegetation and combustible growth within 30 feet of the house.
• Prune tree limbs 6 – 10 feet above the ground.
• Space trees and shrubs ten feet apart in the yard.
• Make sure that plants closest to the house are low-lying. And whenever possible use native Hawaiian or succulent plants.
• Routinely remove dead leaves and other organic matter from the yard.
• Sweep and/or clean gutters, eaves, and roofs regularly to prevent the build-up of leaves and other matter.
• Use fire-resistant building materials for the roof, siding, and decks, such as metal, stucco, tile, brick, and cement.

Appendix A: Native Hawaiian Bird Species and Forest Bird Ranges in West Hawaii

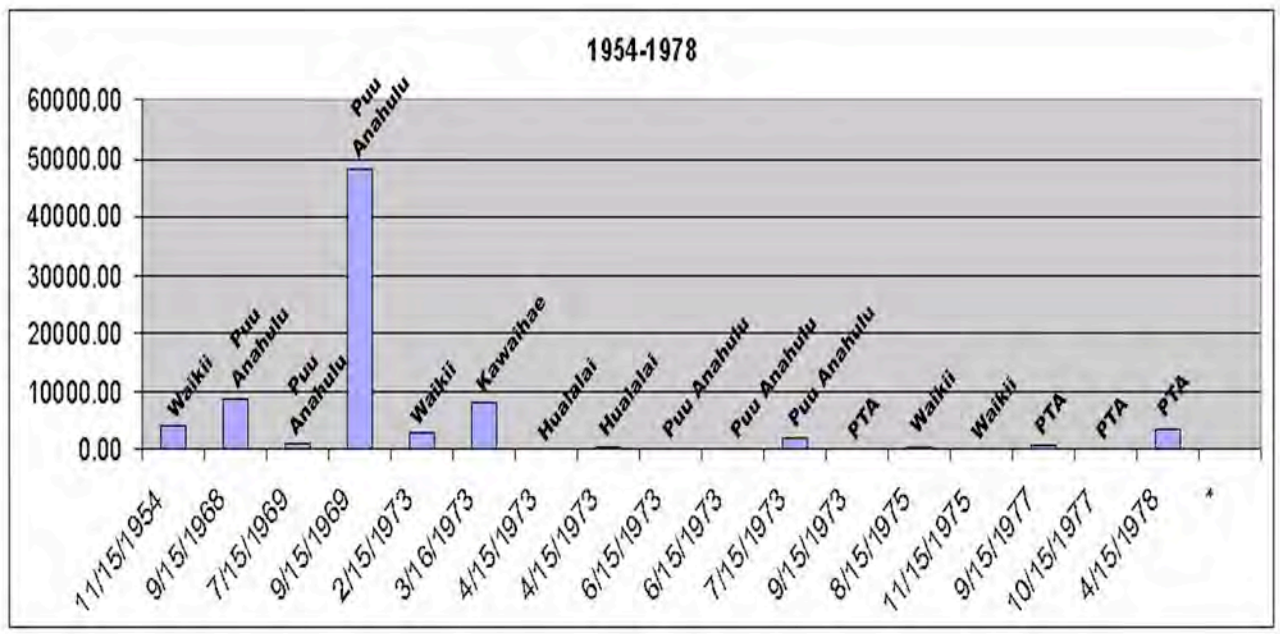
Prepared for The Hawaii Wildfire Management Organization by: O. Smith Co. May 2007

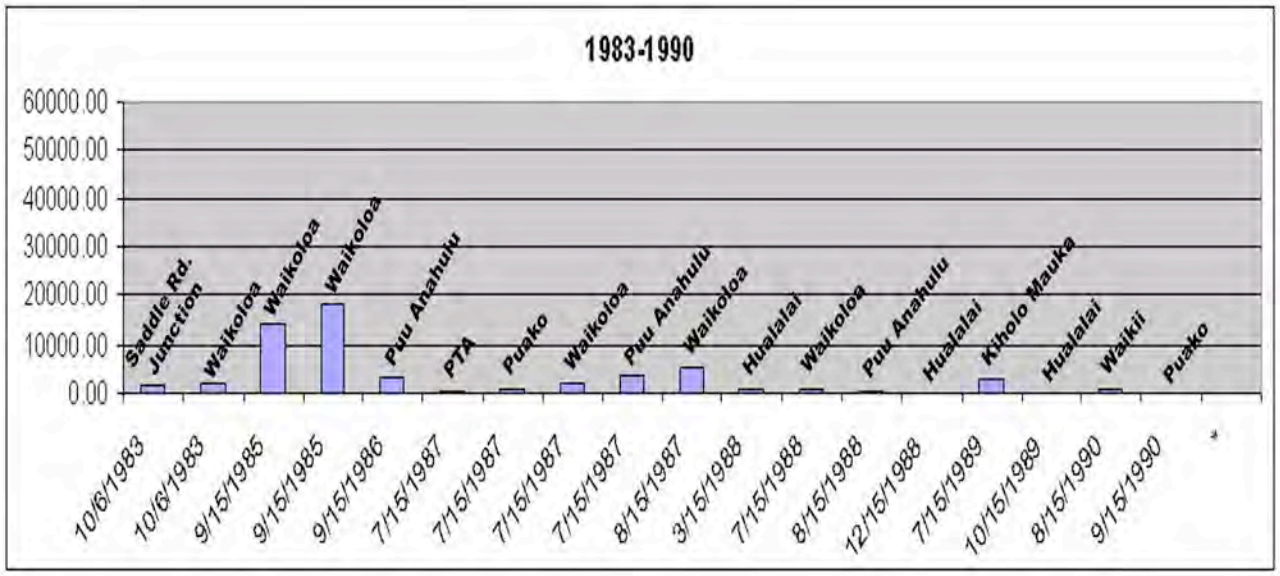


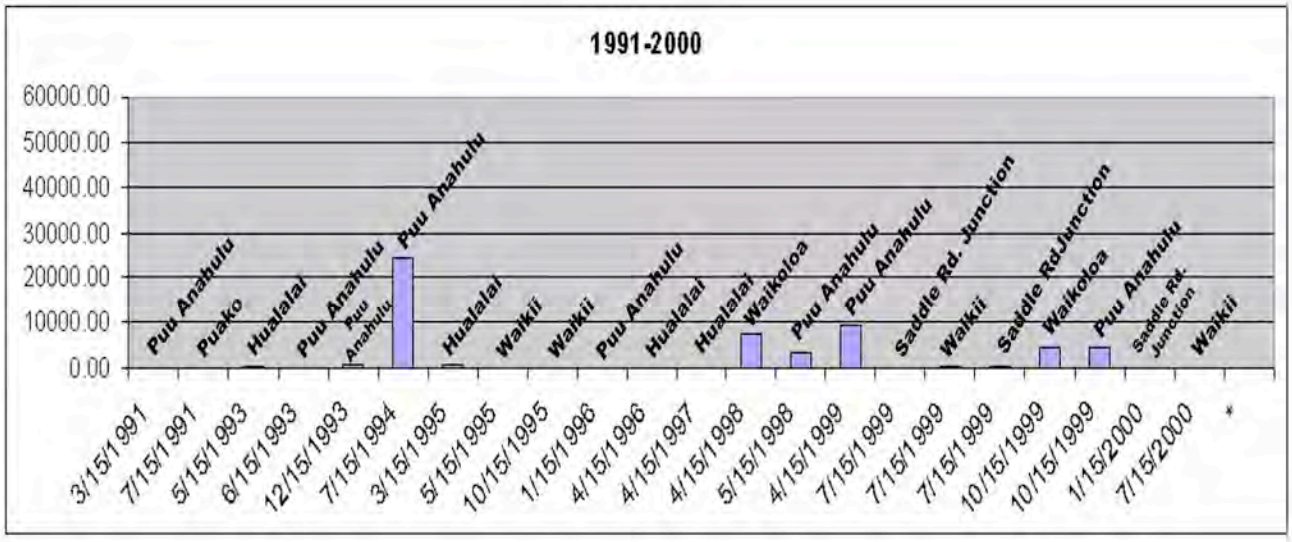
Prepared for The Hawaii Wildfire Management Organization by: O. Smith Co. May 2007

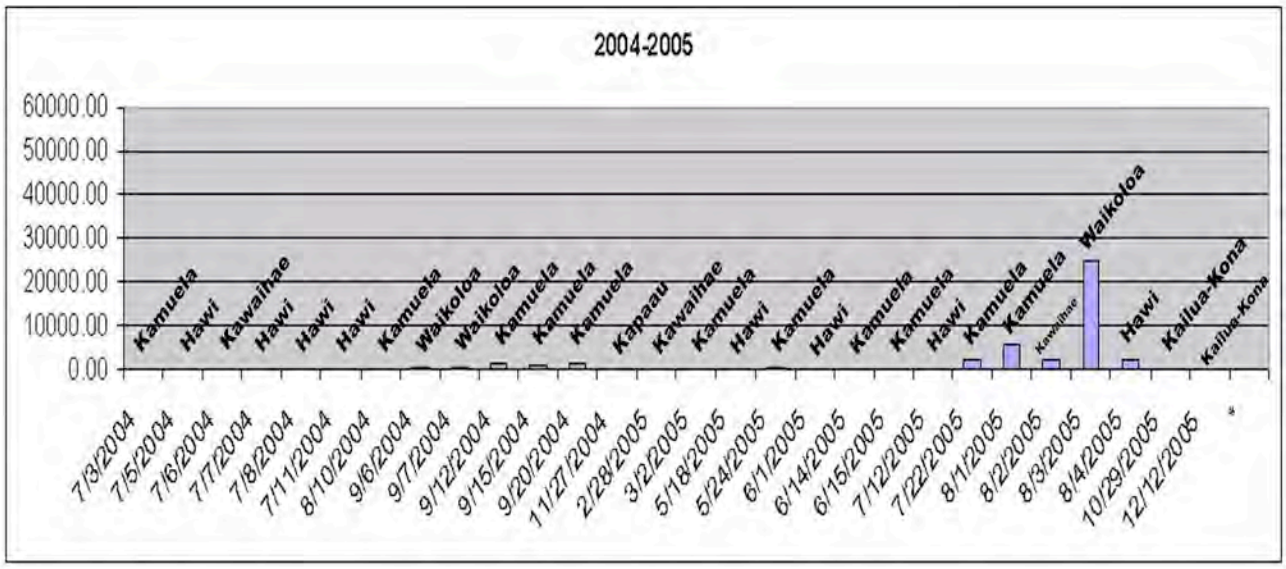
Appendix B: Fire History Graphs for Major Fires 1954 - 2005

Graphs from Northwest Hawaii Fire History map depict fire size for different periods of time. Data unavailable for the period 1978-1983.






1991-2000
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
Puu Anahulu
Puako
Hualalai
Puu Anahulu
Puu Anahulu
Puu Anahulu
Hualalai
Waikii
Waikii
Puu Anahulu
Hualalai
Hualalai
Waikoloa
Puu Anahulu
Puu Anahulu
Saddle Rd. Junction
Waikii
Saddle RdJunction
Waikoloa
Puu Anahulu
Saddle Rd. Junction
Waikii
3/15/1991
7/15/1991
5/15/1993
6/15/1993
12/15/1993
7/15/1994
3/15/1995
5/15/1995
10/15/1995
1/15/1996
4/15/1996
4/15/1997
4/15/1998
5/15/1998
4/15/1999
7/15/1999
7/15/1999
7/15/1999
10/15/1999
10/15/1999
1/15/2000
7/15/2000
*


2004-2005
60000.00
50000.00
40000.00
30000.00
20000.00
10000.00
0.00
Kamuela
Hawi
Kawaihae
Hawi
Hawi
Hawi
Kamuela
Waikoloa
Waikoloa
Kamuela
Kamuela
Kamuela
Kapaau
Kawaihae
Kamuela
Hawi
Kamuela
Hawi
Kamuela
Kamuela
Hawi
Kamuela
Kamuela
Kawaihae
Waikoloa
Hawi
Kailua-Kona
Kailua-Kona
7/3/2004
7/5/2004
7/6/2004
7/7/2004
7/8/2004
7/11/2004
8/10/2004
9/6/2004
9/7/2004
9/12/2004
9/15/2004
9/20/2004
11/27/2004
2/28/2005
3/2/2005
5/18/2005
5/24/2005
6/1/2005
6/14/2005
6/15/2005
7/12/2005
7/22/2005
8/1/2005
8/2/2005
8/3/2005
8/4/2005
10/29/2005
12/12/2005
*

Appendix C: Updated Project List 2009-2012

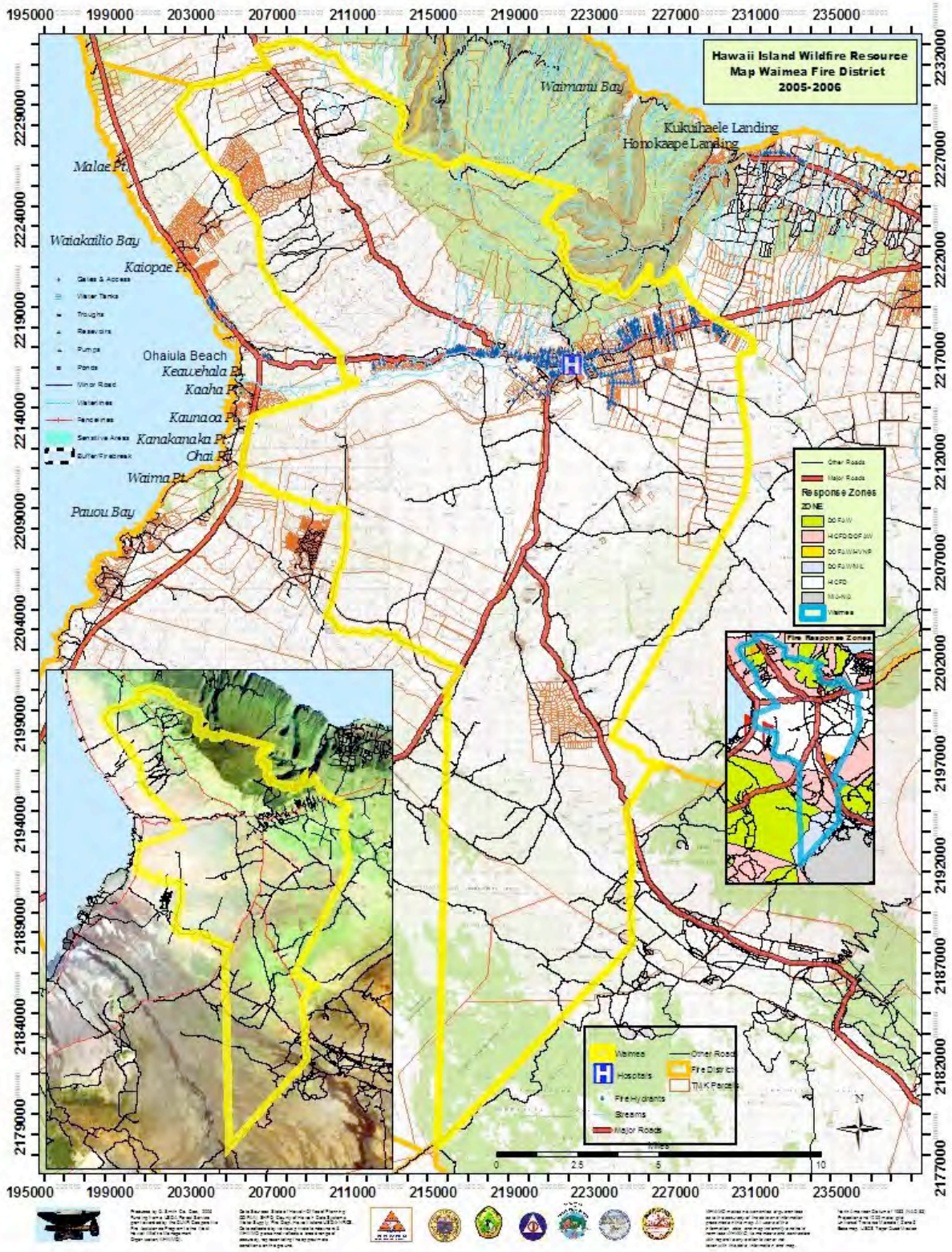
Federal agencies and private landowners in Northwest Hawaii were invited to submit projects that provide wildfire protection and reduce risk. The following table displays a list of recommended projects.

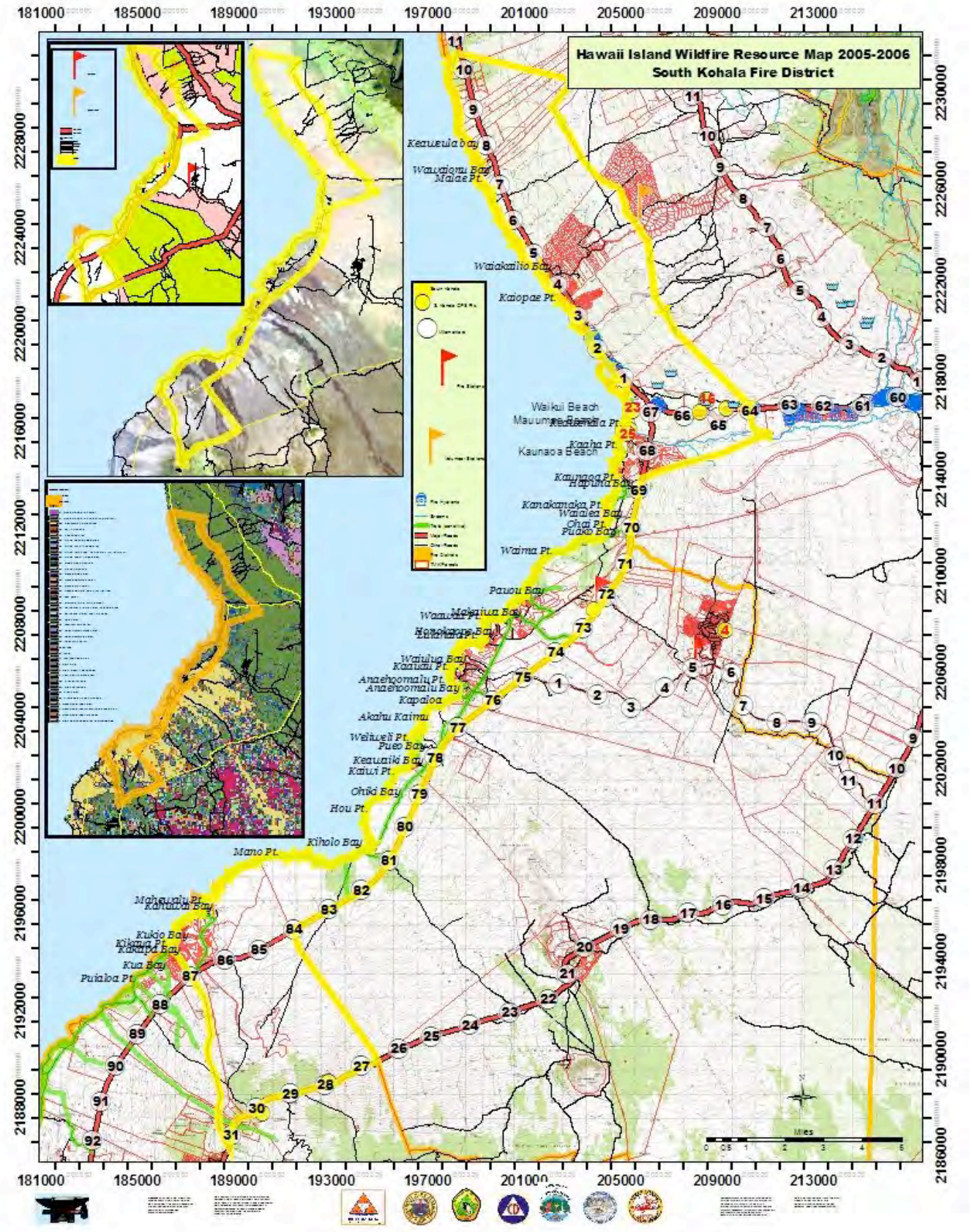
Community, structure, or area at risk	Project	Agency	Funding Needs	Timetable	Community Recommendation
Kawaihae, leeward N Kohala coast, Pu'uanahulu; S Waimea, Pu'u Wa'a Wa'a, Waikoloa	Installation of pre-staged static water and helicopter dip tanks	Multiple Agencies: federal, state, county, and private	Cooperative Funding $128,000	2008 - 2009	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Reduction and/or conversion of fuel load along roadsides, community open areas, and individual homes	Multiple Agencies: county	Cooperative Funding $850,000	2008 - 20012	Yes
All communities and areas in the CWPP planning area	Creation of development standards and community planning that requires the mitigation of wildfire risks	Multiple Agencies: county and state	Cooperative Funding $150,000 for outreach, any needed impact studies and education	2008-2009	
Kohala by the Sea, Waimea Anekona, Puako, Pu'u Lani Ranch Estates	Creation of secondary emergency ingress/egress roads	Multiple Agencies: federal, state, county, and private	Cooperative Funding $750,000 if environ-mental assess-ments required	2008 - 2010	Yes
Kohala, Pu'u Kapu, Waikoloa, Pu'u Lani Ranch Estates	Street signage identifying evacuation routes	Multiple Agencies: federal, state, county, and private	Cooperative Funding $50,000	2008 - 2012	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea	Development of emergency staging areas within	Multiple agencies: private	Cooperative Funding $33,000 for planning	2008 - 20010	Yes

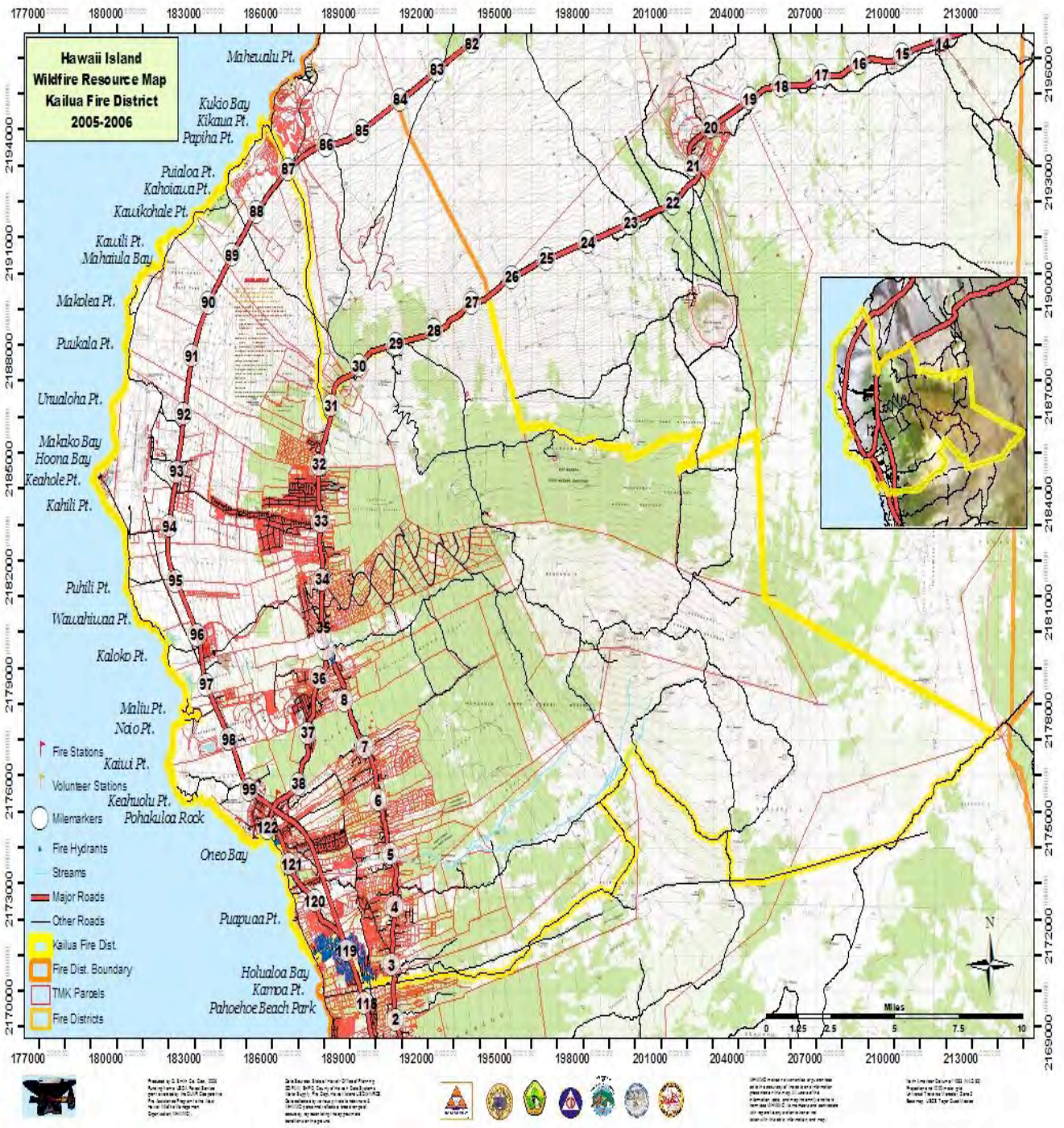
Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	communities, promoting awareness of such areas within the community, including holding mock disaster drills		and outreach		
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Reduction, control, and or conversion of invasive species	Multiple Agencies: federal, state, county, and private	Cooperative Funding $1,500,000 includes maintenance, grazing, and conversion projects	2008 - 2012	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Continued fire prevention education and outreach, including arson prevention education	Multiple agencies: federal, state, county, and private	Cooperative Funding $30,000	2008 - 2012	Yes
Kohala, Kawaihae, Pu'u Kapu, Waimea, Puako, Waikoloa, Pu'uanahulu, North Kona	Increased effective integrated communication between federal, state, and county fire suppression agencies	Multiple agencies	Cooperative Funding	2008 - 20011	Yes

Appendix D: Fire Resource Maps for Northwest Hawaii, Hawaii

Maps courtesy of Hawaii Wildfire Management Organization.




Hawaii Island Wildfire Resource Map 2005-2006
South Kohala Fire District
181000
185000
189000
193000
197000
201000
205000
209000
213000
2228000
2226000
2224000
2222000
2220000
2218000
2216000
2214000
2212000
2210000
2208000
2206000
2204000
2202000
2200000
2198000
2196000
2194000
2192000
2190000
2188000
2186000
Keauepula bay
Waiaiomu Bay
Malae Pt.
Waiakailio Bay
Kaiopae Pt.
Waikui Beach
Kaunaoa Beach
Kaaha Pt.
Kanakanaka Pt.
Waialea Bay
Ohai Pt.
Puako Bay
Waima Pt.
Pauou Bay
Anaehoomalu Pt.
Anaehoomalu Bay
Kapaloa
Akahu Kaimu
Weliweli Pt.
Pueo Bay
Keauaiki Bay
Kaiui Pt.
Ohiki Bay
Hou Pt.
Kiholo Bay
Mano Pt.
Kukio Bay
Kua Bay
Puialoa Pt.
Miles


Hawaii Island
Wildfire Resource Map
Kailua Fire District
2005-2006
Mahewalu Pt.
Kukio Bay
Kikaua Pt.
Papiha Pt.
Puialoa Pt.
Kahoiawa Pt.
Kaukohale Pt.
Kauili Pt.
Mahaiula Bay
Makolea Pt.
Puukala Pt.
Umualoha Pt.
Makako Bay
Hoona Bay
Keahole Pt.
Kahili Pt.
Puhili Pt.
Wawahiwaa Pt.
Kaloko Pt.
Maliu Pt.
Nao Pt.
Kaiwi Pt.
Keahuolu Pt.
Pohakuloa Rock
Oneo Bay
Puapuaa Pt.
Holualoa Bay
Kampa Pt.
Pahoehoe Beach Park
Fire Stations
Volunteer Stations
Milemarkers
Fire Hydrants
Streams
Major Roads
Other Roads
Kailua Fire Dist.
Fire Dist. Boundary
TMK Parcels
Fire Districts
N
Miles
0 1.25 2.5 5 7.5 10
177000 180000 183000 186000 189000 192000 195000 198000 201000 204000 207000 210000 213000
2196000 2194000 2193000 2191000 2190000 2188000 2187000 2185000 2184000 2182000 2181000 2179000 2178000 2176000 2175000 2173000 2172000 2170000 2169000

Appendix E: List of Potential Grant Resources

Below is a list of potential grant sources to help fund mitigation projects described within this CWPP. The list below is by no means exhaustive and potential community groups should also research grant funding sources available to them.

Grant Program	Deadline	Contact Information	Matching Funds Required?
State Fire Assistance Grants. Funds target hazard mitigation in the Wildland Urban Interface for mitigating risks of hazardous fire conditions through hazardous fuels reduction, information and education, and homeowner and community defensible space treatments.	September 7, 2007 for 2008-2009 competitive funding	Division of Forestry and Wildlife Attn: Wayne Ching, 1151 Punchbowl St., Rm. # 325 Honolulu, HI 96813 http://www.state.hi.us/dlnr/dofaw/fmp/wui0809.htm	Yes: 50/50 match
Rural Fire Assistance Grants (RFA) The Dept. of the Interior receives an appropriated budget each year for a rural fire assistance (RFA) grant program. This funding will enhance the fire protection capabilities of rural and volunteer fire departments through training, equipment purchases, and fire prevention work on a cost-shared basis. This program is primarily for rural departments serving populations under 10,000 and which have responsibilities to provide mutual aid to Dept. of Interior lands (e.g., Tribal, National Parks etc.) Te DOI assistance program targets rural and volunteer fire departments that routinely help fight fire on or near DOI lands.	Varies by state	Hawaii Volcanoes National Park Joe Molhoek Pacific Island Fire Mgmt. Officer PO Box 52, HNP, HI 96718 (808) 985-6042 Joe_Molhoek@nps.gov	The maximum award is $20,000. This year RFA grants will require 90/10 cost-share.

One of these four agencies administers those lands: Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), U.S. Fish and Wildlife Service (FWS) and the National Park Service (NPS).			
Volunteer Fire Assistance Grant (VFA): The VFA program, formerly known as the Rural Community Fire Protection program, is administered by state forestry agencies through 50-50 cost-sharing grants to local fire depts. in rural communities. The program's main goal is to provide federal financial, technical, and other assistance in the organization, training, and equipping of fire departments in rural areas with a population of 10,000 or less. Congressionally appropriated VFA funds are provided to the State forestry agencies through the USDA Forest Service. The State forestry agencies pass this money on to needful fire departments within their states. Any fire agency or volunteer fire department that serves a community of 10,000 or less may apply.		Wayne Ching Division of Forestry and Wildlife 1151 Punchbowl St.,Rm. # 325 Honolulu, HI 96813 (808) 587-4173 Fax: (808) 587-0160 wayne.f.ching@hawaii.gov	50/50 cost share.

Of note, Hawaii County Civil Defense is acquiring firefighting apparatus through a Department of Homeland Security grant, however, these grants are only available to government agencies.

Community Wildfire Protection Plan for Ocean View, Hawaii

Sponsored by Hawaii Volcanoes National Park
in collaboration with the Big Island Wildfire Coordinating Group

September 2006

Written by Denise Laitinen

Table of Contents:

Cover image: 2003-2004 fire resource map of Ocean View for pre-attack wildfire planning. Map courtesy of West Hawaii Wildfire Management Organization.

Ocean View Community Wildfire Protection Plan
Mutual Agreement Page

The Community Wildfire Protection Plan (CWPP) developed for Ocean View, Hawaii by the Hawaii Volcanoes National Park (HAVO):

- Was collaboratively developed. Interested parties and federal land management agencies managing land in the vicinity of Ocean View have been consulted.

- This plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect Ocean View.

- This Plan recommends measures to reduce the ignitability of structures throughout the area addressed by the Plan.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

_____ _____

Paul J. Conry **Date**
State Forester, Division of Forestry and Wildlife

_____ _____

Darryl Oliveira **Date**
Fire Chief, Hawaii County Fire Department

_____ _____

Troy Kindred **Date**
Administrator, Hawaii County Civil Defense

Executive Summary:

The community of Ocean View in Hawaii County on the island of Hawaii abuts Hawaii Volcanoes National Park (HAVO) and is in a wildland urban interface (WUI) environment - that is where wildlands and houses meet. This interface area poses the highest risk of loss of life and property due to wildland fire. The risk of wildland fire impacting homes in the WUI is determined by several factors, including the ignitability of fuels, structural ignitability, weather conditions, and topographical features, such as slope. Unlike the contiguous United States, wildfire is not a natural part of Hawaii's ecosystem. In Hawaii, wildfires destroy native plants, which impacts the watershed and the habitat of threatened and endangered native Hawaiian animals. Wildfires in Hawaii also cause soil erosion, which leads to runoff that negatively impacts our ocean reefs.

The overwhelming majority of wildfires in Hawaii are caused by arson or human error. Human error includes errant fireworks, rubbish, cooking, or agricultural fires that get out of control in the wildland-urban interface, as well as vehicle-caused wildfires.

Principal stakeholders who have an interest in protecting the community of Ocean View from wildfire include Hawaii County Fire Department, Hawaii Volcanoes National Park, which sponsored this CWPP, as well as the Big Island Wildfire Coordinating Group, composed of federal, state, and county agencies, including Hawaii County Civil Defense, Department of Land and Natural Resources, U.S Army, and the U.S. Fish and Wildlife Service. These decision makers were invited to participate in the development of this Plan.

A wildfire hazard assessment determined that WUI areas in this community have an extreme risk of wildfire. Wildland fires originating within the Park can threaten the nearby community of Ocean View, including homes along Lorenzo Road in Ka'u. Conversely, wildland fires caused by human error in the community could impact the Park. The community of Ocean View, which is directly down slope of an active volcano, is susceptible to fast-moving lava flows, earthquakes, tsunamis, hurricanes, and wildland fires. The community does not have municipal water with residents and businesses relying on catchment water basins. There has also been an increase in invasive, non-native plant species that are high-intensity burning fuels, further increasing the wildfire risk within the community.

Meetings with community members and fire agency personnel identified several mitigation measures to reduce the chances of a fire starting in Ocean View. These include: (1) creation of secondary emergency egress roads; (2) reduction of fuel load along roadsides; (3) reduction of invasive species that possess inherent fire or ignition properties, such as fountain grass; (4) need for additional pre-staged static water tanks; and (5) continued fire prevention education.

Hawaii County has been fortunate in controlling large wildland fires in the communities to date. However, given the fire history of the area and the fact that HAVO is home to the world's most active volcano, one need only look at the community's fire history and fuel load to understand the severe wildfire risk. The mitigation measures outlined in this Plan will enable the community of Ocean View to reduce their risk to wildfire and create more efficient fire-protection systems. The priority mitigation measures listed above identify pro-active projects the community and fire agencies can undertake to minimize losses from a major wildland fire.

Background:

Covering a swath from sea level to a 13,000-foot mountaintop, the 377-square miles (333,000 acres) of Hawaii Volcanoes National Park on the island of Hawaii encompasses Mauna Loa, the world's largest volcano, as well as Kilauea, the world's most active volcano. The Park's ecological zones include coastal strand, dry lowland, mesic and wet rain forest, seasonally dry montane, sub-alpine, and alpine. It is home to more than 50 federally-listed endangered, threatened, and candidate endangered species, as well as numerous rare species.

Continually erupting for nearly 23 years, Kilauea has made HAVO the state's largest tourist attraction with more than 2.5 million visitors annually. The primary tourist attractions within the Park are on the south of the Park, however, the bulk of Park lands extend north of Highway 11 for more than 40 miles as far west as Manuka State Park and as far north as the summit of Mauna Loa. In the past, lava flows within the Park have caused several wildland fires, some as large as 5,000 acres. Wildfires originating within the Park could threaten the homes along Lorenzo Road in Ka'u. Conversely, wildland fires caused by human error in Ocean View or along Lorenzo Road, could impact the Park.

To the west of the community of Volcano, Park lands containing the southwest rift zone of Mauna Loa are adjacent to Lorenzo Road. Lorenzo Road, which lies between mile marker 69 and 70 on Highway 11, is an unpaved road running north-south along the border of Park lands. There are only a handful of homes along the road but they are in a wildland urban interface area.

Park lands containing the southwest rift zone of Mauna Loa are also directly north and to the east of the community of Ocean View. Ocean View encompasses the 11,500-lot Hawaiian Ocean View Estates (HOVE) north of Highway 11 and Hawaiian Ranchos and Kula Kai View Estates subdivisions on the south side of Highway 11. Ocean View is bordered by the Manuka Natural Area Reserve to the west, the southwest rift zone to the north, the 1887 and 1907 lava flows to the east, and the Pacific Ocean to the south. Given its proximity directly down slope of an active volcano, which last erupted in 1984, Ocean View is susceptible to fast-moving lava flows, earthquakes, tsunamis, and hurricanes, in addition to wildfires. A 20-acre wildfire in January 2006, caused by fireworks, came dangerously close to several homes in HOVE.

Ocean View has experienced tremendous development in recent years. Many new residents are from other parts of the United States and unfamiliar with the wildfire risks of the community.

HAVO recently acquired 119,000 acres from Kahuku Ranch in Ka'u. Located at the 1,000 – 2,000 foot elevation, the area encompasses native Hawaiian forests, pasture lands, and three dormant volcanic craters. Park lands now stretch 50 miles from lower Puna to Ocean View. Given the right wind and fuel conditions wildland fire could travel the length of this land tract, causing substantial damage.

Fire History:

Ocean View Hawaii County FD Fire history 2004-2005	Date
Building fire	18-Mar-05 11:54:07
Building fire	16-Dec-04 08:20:13
Cooking fire, confined to container	26-Dec-05 17:04:18
Cooking fire, confined to container	21-Dec-05 17:43:28
Cooking fire, confined to container	22-Oct-05 05:38:53
Cooking fire, confined to container	07-Oct-05 17:39:12
Cooking fire, confined to container	24-Nov-04 15:52:15
Trash or rubbish fire, contained	22-Dec-05 10:32:30
Trash or rubbish fire, contained	07-Dec-05 13:39:10
Trash or rubbish fire, contained	04-Nov-05 17:51:28
Trash or rubbish fire, contained	30-Oct-05 14:21:23
Trash or rubbish fire, contained	06-Apr-05 17:59:41
Passenger vehicle fire	07-Oct-05 13:31:49
Passenger vehicle fire	09-Jul-05 23:59:25
Passenger vehicle fire	15-Apr-05 22:46:11
Natural vegetation fire, other	25-Oct-05 15:34:54
Forest, woods or wildland fire	09-Jun-05 13:11:21
Brush, or brush and grass mixture fire	13-Dec-05 15:01:35
Brush, or brush and grass mixture fire	22-Nov-05 09:42:26
Brush, or brush and grass mixture fire	19-Nov-05 15:03:49
Brush, or brush and grass mixture fire	12-Nov-05 17:22:02
Brush, or brush and grass mixture fire	05-Jul-05 08:57:33
Brush, or brush and grass mixture fire	05-Jul-05 08:49:31
Brush, or brush and grass mixture fire	30-Dec-04 14:27:40
Outside rubbish, trash or waste fire	07-Jul-05 18:27:01
Outside rubbish, trash or waste fire	16-Apr-05 06:12:27
Outside rubbish, trash or waste fire	08-Mar-05 09:28:30
Outside rubbish, trash or waste fire	14-Feb-05 18:59:28
Outside rubbish, trash or waste fire	22-Dec-04 17:25:51
Outside rubbish, trash or waste fire	14-Dec-04 18:07:27
Special outside fire, other	09-Nov-05 18:07:44
Unauthorized burning	20-Nov-05 12:45:39
Unauthorized burning	11-Nov-05 19:12:55
Barbecue, tar kettle	23-Nov-05 01:42:39
Barbecue, tar kettle	15-Oct-05 18:10:26
Barbecue, tar kettle	18-Dec-04 07:42:37
HAVO Fire History 2004 -2005	Date
Pinao – human cause	7/29/04
Kipuka Pepeaio - lightening	12/6/04
Kahuku - human cause	8/14/05

Above is a 2004-2005 fire history chart for the Ocean View community. Since Hawaii County Fire Department is responsible for fire suppression in residential areas and HAVO is responsible for fire suppression within the Park, each organization maintains separate fire history statistics. However, the two agencies have a Memorandum of Understanding for mutual aid in fire

suppression. Average size for all wildland fires in Ocean View responded to by Hawaii County Fire Department in the past two years was 3.2 acres. However, a 20-acre fire in HOVE in January 2006 came dangerously close to homes. Between 2004 and 2005 there were three fires within Park boundaries, the Kipuka Pepeaio fire that burned more than 600 acres, the Kahuku fire that burned less than 5 acres in Kahuku, and the Pinao fire that burned less than 1 acre. In past decade HAVO has experienced 54 fires within the Park with 5 of those burning more than 1,000 acres.

Stakeholders:

Stakeholders are individuals or groups who have a high level of interest in the protection of their assets from wildfire. HAVO shares approximately 10 miles of boundary with the communities of Ocean View and Lorenzo Road in wildland-urban interface areas. Additional lands adjoining or within Ocean View include those managed by federal, state, county, and private entities.

The State of Hawaii's Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) manages the Manuka Natural Area Reserve that runs the entire western length of Ocean View and the Ka'u Forest Reserve that lies above Lorenzo Road. The County of Hawaii owns several tracts of land within HOVE in Ocean View, ranging in size from one acre to 30 acres. The entire northern and eastern boundary of HOVE is Park land.

Community groups representing private landowners within the Ocean View community, such as the Ocean View Community Association (OVCA) are also concerned about the level of fire risk in the community. Contact information for principal stakeholders is listed below.

Federal:
Hawaii Volcanoes National Park
Joe Molhoek
Pacific Island Fire Management Officer
PO Box 52, HNP, HI 96718
(808) 985-6042
Joe_Molhoek@nps.gov

State:
Department of Land and Natural Resources: Division of Forestry and Wildlife
Wayne Ching
State Protection Forester
1151 Punchbowl St., Room 325, Honolulu, HI 96813
(808) 587-4173
Wayne.F.Ching@hawaii.gov

County:
Hawaii County Fire Department
Fire Chief Darryl Oliveira
25 Aupuni St., Hilo, HI 96720
(808) 961-8297
Hcfdf1@co.hawaii.hi.us

County:
Hawaii County Civil Defense
Troy Kindred
Civil Defense Administrator
920 Ululani St., Hilo, HI 96720
(808) 961-8229
tkindred@co.hawaii.hi.us

Base Map of Ocean View:

Figure 1 is a base map of the community of Ocean View and adjacent landowners. The inhabited areas at potential risk to wildland fire include HOVE, Hawaiian Ranchos, Kula Kai View Estates, and further to the east Lorenzo Road in Ka'u.

Areas containing critical human infrastructure, such as escape routes include HOVE and Ranchos. Within HOVE, the Community Center could be used as "defend in place" zone if deemed necessary by fire officials given wildfire conditions.

Areas of community importance include the OVCA Community Center and churches with HOVE; restaurants and retail establishments along Highway 11; Manuka Natural Area Reserve; native dryland forest; cultural and archeological features; and caves.

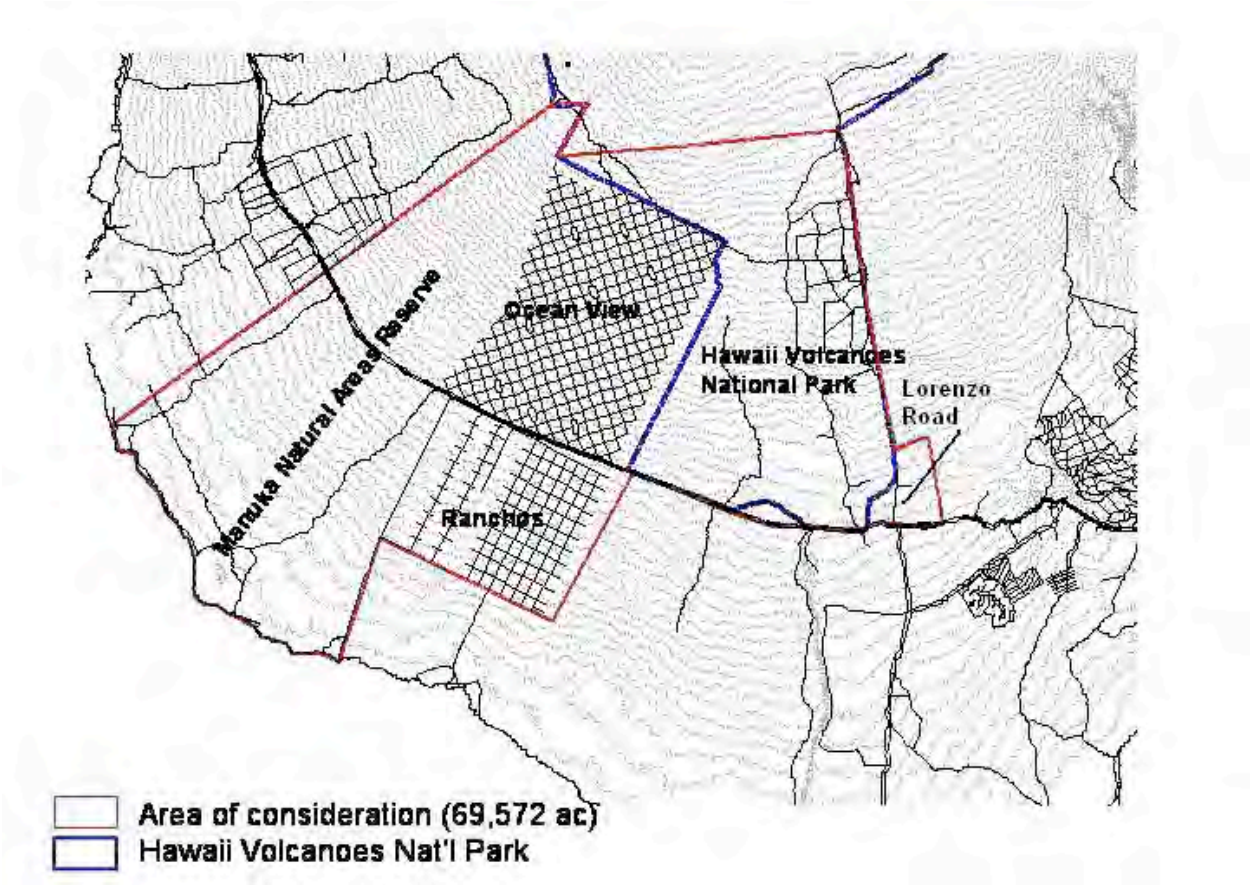


Figure 1: Area of consideration for the Ocean View CWPP is outlined in red covers more than 69,000 acres.

Fire Risk Assessment for Lorenzo Road and Ocean View:

Typical house lot within HOVE.

Ocean View encompasses the 11,500-lot Hawaiian Ocean View Estates (HOVE) north of Highway 11 and Hawaiian Ranchos and Kula Kai View Estates subdivisions on the south side of Highway 11. Ocean View is hilly with slope above 20 percent throughout the community. Classified as Zone 1 and 2 for volcanic activity (zones closest to an active volcano), a'a flows dominate large areas within the subdivisions.

Ocean View is bordered by Manuka Natural Area Reserve to the west, the southwest rift zone to the north, the 1887 and 1907 lava flows to the east, and the Pacific ocean to the south. There are scattered retail establishments along Highway 11 between HOVE and Hawaiian Ranchos. There are an estimated 6,000 residents in HOVE, which contains several churches and a community center used daily by various community groups. HOVE starts at the 2,000-foot elevation along Highway 11 up to the 7,000-foot elevation along the northern boundary of the subdivision.

Roughly 250 residents live in Hawaiian Ranchos and Kula Kai View Estates has roughly a dozen homes. There are multiple means of ingress and egress from Highway 11 to the HOVE and Ranchos subdivisions. Roads within the community are paved and 20 feet in width with shoulders. However, if Highway 11 were to be closed or compromised by wildland fire or lava, it would severely impact evacuation efforts.

To the east of Ocean View, Park lands containing the southwest rift zone of Mauna Loa are adjacent to Lorenzo Road, which lies between mile marker 69 and 70 on Highway 11. It is an unpaved road running north-south along the border of Park lands. There are only a handful of homes along the road but they directly border HAVO land and are in a wildland urban interface area.

Typical house on Lorenzo Road - note the lack of defensible space.

A county fire station comprised of both paid and volunteer members is located within HOVE. The station has a 33,000-gallon soft cover catchment tank that can be used as a dip tank for fire suppression; however, the tank must also service station needs, such as showering, cooking, etc. There is no municipal water in Ocean View with residents relying on catchment water. The nearest fire hydrant is 13 miles east in Discovery Harbor and to the west, the nearest hydrant is 20 miles away in Honaunau. The community receives 30-40 inches of rainfall during the year.

Pockets, or kipuka, of native dryland forest occur throughout Ocean View. At lower elevations, these kipuka have been invaded by alien trees, shrubs, and grasses. Many of the grasses, such as molasses grass (*Melinis minutiflora*) and fountain grass (*Pennisetum setaceum*) are fire-adapted and increase wildfire potential in areas they invade.

The 1887 and 1907 lava flows traverse HOVE and communities below the highway. These flows along with older sparsely vegetated flows serve as natural fuel breaks. However, the introduction of fountain grass has compromised these fuel breaks. A non-native species, fountain grass is becoming prevalent across the lava flow, enabling fire to travel on the fuel break. Fountain grass is so prevalent in Hawaiian Ranchos that complete eradication of the plant is unfeasible. Fountain grass is less prevalent in HOVE and the community is working proactively with DOFAW and HAVO to eradicate fountain grass along the roadsides and prevent its spread onto lava flows.

A Hawaii Wildland Fire Risk and Hazard Severity Assessment based on the Assessment in Appendix A of NFPA 1144, *Standard for Protection of Life and Property from Wildland Fire*, was conducted by the Hawaii Firewise Coordinator and HAVO firefighting personnel on April 12, 2006 to identify the level of wildfire risk for the communities of Ocean View, including Hawaiian Ocean View Estates, Hawaiian Ranchos, Kula Kai View Estates, and Lorenzo Road.

Using a pre-established point system, the Wildland Fire Risk and Hazard Severity Assessment is a tool used to determine the level of wildfire risk to a home or community. Points are given regarding overall terrain and location, road width, local area fire history, prevailing winds and seasonal weather, geographical contours, native vegetation, water availability, location of fire suppression resources, as well as the combustibility of building materials, including roof, siding, and attached items, such as decks, fencing, or an unit. The combined points in all these categories are added together and the overall risk is determined by whether the score falls in the low-, medium-, high-, or extreme-risk point range. Given the ignitability of individual structures, preponderance of fuels in close proximity to structures, and lack of water, Ocean View scored within the extreme-risk score range in the Assessment, a copy of which can be found in Appendix A.

Community Assets at Risk:

Assets at risk are valued resources that can be damaged or destroyed by wildfire. In addition to ensuring firefighter safety and protecting residents and visitors, the following assets warrant consideration in pre-incident planning: watersheds; forest reserves; wildlife; scenic, cultural, and archeological sites; ranchlands; and structures.

The following were identified as valued resources within the Ocean View community that would be adversely affected by wildfire.

Commercial / community resources:
OVCA Community Center, churches, restaurants, and retail establishments.
Natural Resources:
Manuka Natural Area Reserve, native dryland forest, rare and endangered plants and animals, cultural and archeological features, and caves.

This Plan focuses on structures within the wildland urban interface in Ocean View. Overgrown vegetation close to homes, an increase of non-native high-intensity plants, and a lack of water create unsafe fire conditions. In addition, all residential areas within Ocean View are experiencing rapid development. The majority of homes within Ocean View have Class A

roofing, however, several homes have combustible siding and/or lanais (decks). Homes also vary widely in defensible space, with lava serving as a natural fuel break on some lots and vegetation growing close to the home on other lots. Few driveways have turnaround access for emergency vehicles. Signage for interior roads within Ocean View subdivisions are metal and reflectorized.

Community Concerns for Ocean View:

Residents within HOVE recently formed a community disaster preparedness committee and are aggressively pursuing means to reduce disaster threats, including wildfire, within their community. Multiple meetings specifically on the CWPP process held between April and June 2006 with community members and fire agencies identified the most pressing fire concerns in Ocean View. They include, in order of priority:

1. Lack of water;
2. Effective communication between emergency personnel and residents during a wildfire or other disaster;
3. Community egress and firefighting vehicle ingress during a wildfire;
    3a. Identification of evacuation route roads within subdivisions;
4. Fuel load along roadsides;
5. Reduction of invasive species possessing inherent fire or ignition properties;
6. Public awareness of the wildfire threat; and
7. Strengthening of Hawaii County fire ordinances.

Recommended Action for Ocean View:

Based on identified community concerns, the following recommendations are made to reduce the wildfire threat in Ocean View. The implementation of a multi-modal approach will increase firefighting efficiency, reduce fire fuels, and improve community and firefighter safety. Mitigation measures to reduce wildfire risk in Ocean View include in order of priority:

1. Pre-staged static water tanks;
2. Increased communication to residents regarding evacuation during an emergency;
3. Creation/improvement of secondary access road; identification of evacuation route roads within subdivisions;
4. Reduction of fuel load along road sides and in common areas;
5. Reduction of invasive species that increase fire risk;
6. Continued fire prevention education and outreach; and
7. Strengthening of Hawaii County fire ordinances.

Based on the results of the community risk assessment, priority ratings have been selected for Ocean View and areas of community importance. The community recommendations for the type and method of treatment for the surrounding vegetation are listed in the following table.

Community, structure or area at risk	Type of Treatment	Method of Treatment	Overall Priority
Ocean View	Mechanical	Need for additional pre-staged static water tanks	Very High
		Improved communication between emergency personnel and residents regarding evacuation	Very High
Ocean View	Mechanical / Chemical / Hand Labor	Creation of secondary emergency ingress/egress roads	Very High
Ocean View	Mechanical	Street signage identifying evacuation routes	High
Ocean View	Mechanical	Reduction of fuel load along roadsides	High
Ocean View	Mechanical / Chemical / Hand Labor	Reduction of invasive species	High
Ocean View	Public Education and Outreach	Continued fire prevention education and outreach	High
Ocean View	Political	Strengthening of County fire ordinances	High
Lorenzo Road	Mechanical / Chemical / Hand Labor	Reduction of fuel load along roadsides	High
Lorenzo Road	Public Education and Outreach	Continued fire prevention education and outreach	High

Community organizations, federal agencies, and private landowners surrounding Ocean View were invited to submit projects that provide protection and reduce wildfire risk. The following table displays a list of projects based on recommendations from community and fire-related organizations. HAVO intends to assess the progress annually and invite agencies and landowners to submit projects that provide community protection.

Community, structure, or area at risk	Project	Agency	Funding Needs	Timetable	Community Recommendation
Ocean View	Creation of pre-staged static water tanks	Multiple Agencies: federal, state, county, and private	Cooperative Funding	2006 - 2007	Yes
Ocean View	Improved communication between emergency officials and residents regarding	Multiple Agencies: OVCA, County	Cooperative Funding	2006 - 2007	Yes

	evacuation				
Ocean View	Creation of secondary emergency ingress/egress roads	Multiple Agencies: federal, state, county, and private	Cooperative Funding	2006 - 2007	Yes
Ocean View	Street signage identifying evacuation routes	Multiple Agencies: federal, state, county, and private	Cooperative Funding	2006 - 2007	Yes
Ocean View	Reduction of fuel load along roadsides	Private	Cooperative Funding	2006 - 2007	Yes
Ocean View	Reduction of invasive species	HAVO	Cooperative Funding	2006 - 2007	Yes
Ocean View	Continued fire prevention education and outreach	Multiple agencies: federal, state, county, and private	Cooperative Funding	2006 - 2007	Yes
Ocean View	Strengthening of County fire ordinances	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Lorenzo Road	Reduction of fuel load along roadsides	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Lorenzo Road	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2006 - 2007	Yes

Pre-staged static water tanks
Given that residents rely on catchment water, the area experiences nominal rainfall, and there are no fire hydrants within Ocean View, lack of water for fire suppression was identified as one of the most important challenges facing the community. Pre-staged static water tanks will greatly increase effective fire suppression and firefighting efficiency.

Communication between emergency personnel and community members during disaster
Fires, earthquakes, and lava flows are among the risks that threaten the Ocean View community. These risks can be fast moving, necessitating quick dissemination of safety and evacuation information to residents. The creation of block captains and use of walkie-talkies is recommended for use to alert residents to fast moving dangers, such as wildfires.

Creation / improvement of secondary access roads
Creation or improvement of secondary access roads to improve emergency egress and facilitate fire suppression activities should be examined and implemented where appropriate. There are only two access road that connects Hawaiian Ranchos Subdivision and the adjacent subdivisions to Highway 11. Kula Kai and Lorenzo Road are each connected by a single access road to the highway. Positioning of secondary emergency access roads should be evaluated and appropriately implemented to allow for more effective fire suppression and emergency egress. Currently, there are two unpaved jeep trails to the east of HOVE that connect to Highway 11. Improving these access roads may provide residents with another escape route and improve emergency egress.

In order to remain effective, the secondary emergency egress roads must be maintained on a regular basis. Funding should be secured to ensure that the roads are maintained at least twice a year. The organization that is determined to be responsible for the access roads may want to consider the purchase of a dozer or other equipment to maintain the roads.

Also, evacuation routes should be clearly identified within the subdivision with signage posted marking these roads for express egress in case of emergency.

Reduction of fuel load
Reducing vegetation in the vicinity of valued resources (churches, Community Center, houses), in common areas and along road sides and fuel breaks will decrease fire risk to important resources and improve fire suppression capabilities.

Reduction of invasive species
Invasive grasses, such as molasses grass and fountain grass are high-intensity burning fuels that carry fire to other fuels. The ability of fountain grass to establish on barren ‘a’a flows compromises natural fire breaks provided by lava. Current efforts to eradicate roadside populations and prevent its spread to lava flows should be continued. It is recommended that the Ocean View Community Association adopt CCRs prohibiting fountain grass within the community. For Hawaiian Ranchos and other subdivisions where the grass is well established and eradication may be unfeasible, mapping the current distribution and density of individuals is needed to develop alternative strategies for reducing fire potential. Such alternatives may include containing the spread of the invasion or maintaining fountain grass “free” zones. It is also strongly recommended that outreach efforts include alerting residents and developers to the wildfire risk caused by invasive species and ways to prevent their spread (e.g. inspection, sanitation, landscaping with native species).

Continued fire prevention education
Fire agencies in Hawaii County have partnered with Firewise to promote community wildland fire awareness in wildland urban interface communities. The objective is to increase overall awareness of fire hazard issues that affect residents within the wildland urban interface. While a Firewise coordinator has provided much needed outreach in the community, funding for such a position has been intermittent. Stable funding for an outreach coordinator should be developed to ensure consistent fire prevention outreach. With a continued influx of residents from other parts of the United States who are unaware of Ocean View’s unique fire risks, it is crucial to continue a comprehensive fire education and outreach campaign. This program should consist of the following:

a. Continued development and coordination of community meetings and outreach events. Coordination with other community groups, such as the local disaster preparedness committee and civic organizations, to provide wildland fire safety information on defensible space and Firewise building materials. Provide outreach at community events.

b. Develop educational materials specific to community fire threat and continue outreach in local publications. The Firewise coordinator is currently providing monthly editorial to local publications in Ka'u and Ocean View on fire prevention. Continued outreach is needed with large numbers of new residents moving into the area.

c. Development of fire prevention outreach materials, including TV and radio public service announcements, posters, and handouts.

Strengthening of county fire ordinances
Currently, there is a county ordinance prohibiting open burning, although there is a caveat permitting cooking fires. Fire ordinances should be incorporated as part of the Uniform Fire Code adopted by the County and the language defining cooking fires should be strengthened. It is recommended that Hawaii County create and enforce citations of ordinance violations, giving the Hawaii County Fire Department the necessary "teeth" to enforce such ordinances. It is recommended that changes be made to federal, state, and county rules and regulations to support and promote proactive and preventative measures to reduce the threat of wildfire. County planning requirements should incorporate proactive fire prevention measures, such as mandating the use of residential fire sprinklers in all new single-family dwellings, the use of fire-resistant building materials for new home construction, and the creation of defensible space around communities and homes.

Reduce Structural Ignitability:

As part of its fire prevention education efforts, Firewise provides recommendations to reduce structural ignitability. Individuals and the Volcano community can reduce structural ignitability throughout the community by taking the following measures.

• Create a buffer zone of defensible space around a property of at least 30 feet or to the property line if the house has less than 30 feet of yard. Remove flammable vegetation and combustible growth within 30 feet of the house.
• Prune tree limbs 6 – 10 feet above the ground.
• Space trees and shrubs ten feet apart in the yard.
• Make sure that plants closest to the house are low-lying. And whenever possible use native Hawaiian or succulent plants.
• Routinely remove dead leaves and other organic matter from the yard.
• Sweep and/or clean gutters, eaves, and roofs regularly to prevent the build-up of leaves and other matter.
• Use fire-resistant building materials for the roof, siding, and decks, such as metal, stucco, tile, brick, and cement.

Appendix A:

Please see attached Hawaii Wildland Fire Risk and Hazard Severity Assessment Form.

Appendix B:

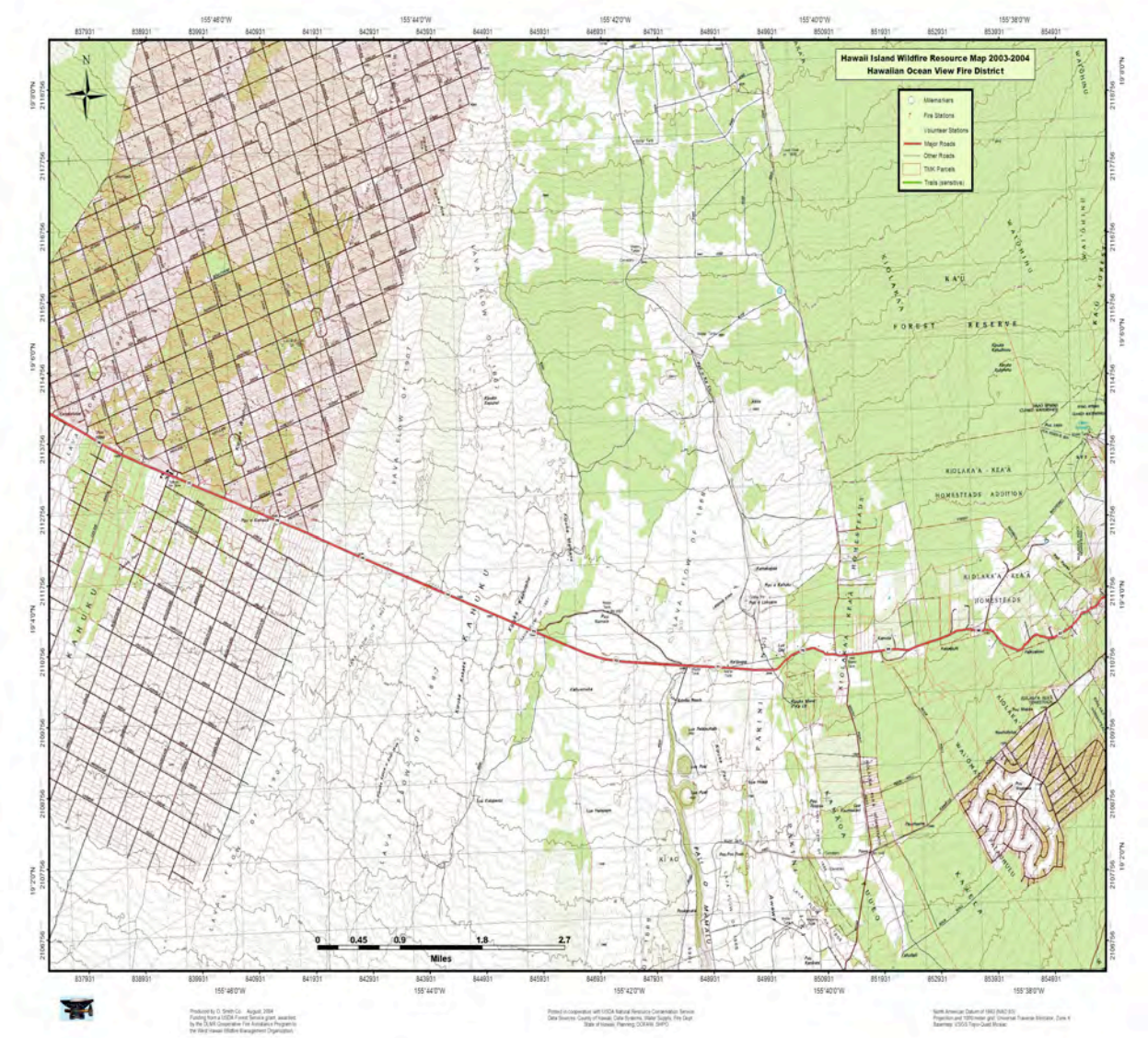
Updated Project List 2008-2009

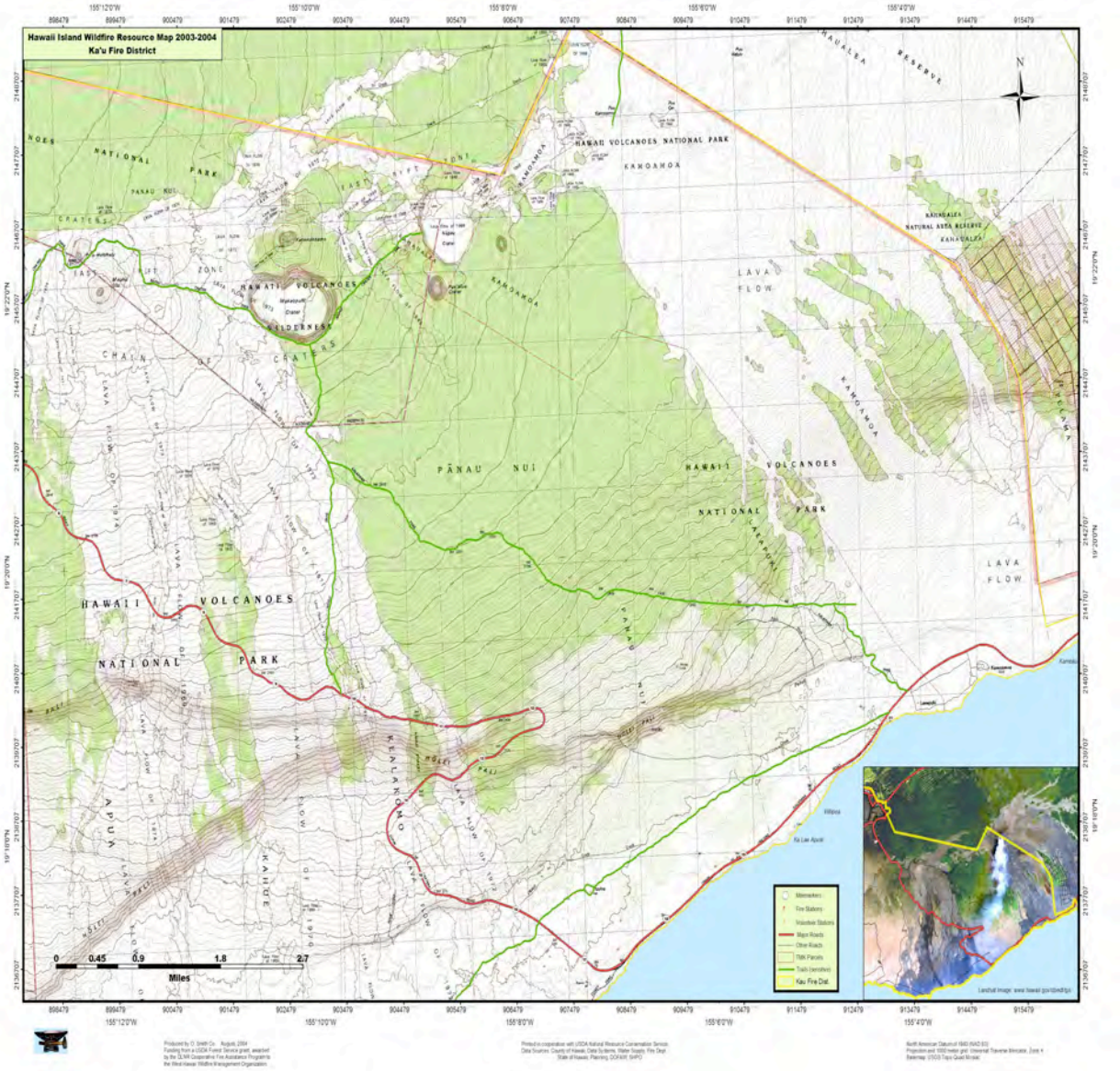
Federal agencies and private landowners surrounding Ocean View were invited to submit projects that provide wildfire protection and reduce risk. The following table displays a list of recommended projects.

Community, structure or area at risk	Project	Agency / landowner	Funding Needs	Timetable	Community recommendation
Ocean View	Creation / Maintenance of pre-staged static water tanks	Multiple Agencies	Cooperative Funding	2008-9	Yes
Ocean View	Improved communication between emergency officials and residents regarding evacuation	Multiple Agencies	Cooperative Funding	2008-9	Yes
Ocean View	Maintenance of secondary emergency access road	HAVO, Private	Cooperative Funding	2008-9	Yes
Ocean View	Maintenance of street signage identifying evacuation routes	Multiple Agencies	Cooperative Funding	2008-9	Yes
Ocean View, Lorenzo Road	Reduction of fuel load along roadsides	Multiple Agencies	Cooperative Funding	2008-9	Yes
Ocean View, Lorenzo Road	Reduction of invasive species	Multiple Agencies	Cooperative Funding	2008-9	Yes
Ocean View, Lorenzo Road	Continued fire prevention education and outreach	Multiple Agencies	Cooperative Funding	2008-9	Yes
Hawaii County	Strengthening of County fire ordinances	Multiple Agencies	Cooperative Funding	2008-9	Yes

Appendix C:

Pre-Attack Maps for Ocean View, Hawaii





Maps courtesy of West Hawaii Wildfire Management Organization.

Community Wildfire Protection Plan for Volcano, Hawaii

Sponsored by Hawaii Volcanoes National Park
in collaboration with the Big Island Wildfire Coordinating Group

September 2006

Written by Denise Laitinen

Table of Contents:

Cover photo: An a'a lava flow in Hawaii Volcanoes National Park sparks a wildfire.
Picture: Greg Funderburk, HAVO staff.

Volcano Community Wildfire Protection Plan
Mutual Agreement Page

The Community Wildfire Protection Plan (CWPP) developed for Volcano, Hawaii by the Hawaii Volcanoes National Park (HAVO):

- Was collaboratively developed. Interested parties and federal land management agencies managing land in the vicinity of Volcano have been consulted.

- This plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect Volcano.

- This Plan recommends measures to reduce the ignitability of structures throughout the area addressed by the Plan.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

_____ _____

Paul J. Conry **Date**
State Forester, Division of Forestry and Wildlife

_____ _____

Darryl Oliveira **Date**
Fire Chief, Hawaii County Fire Department

_____ _____

Troy Kindred **Date**
Administrator, Hawaii County Civil Defense

Executive Summary:

The community of Volcano in Hawaii County on the island of Hawaii abuts Hawaii Volcanoes National Park (HAVO) and is in a wildland urban interface (WUI) environment - that is where wildlands and houses meet. These interface areas pose the highest risk of loss of life and property due to wildland fire. The risk of wildland fire impacting homes in the WUI is determined by several factors, including the ignitability of fuels, structural ignitability, weather conditions, and topographical features, such as slope. Unlike other parts of the United States, wildfire is not a natural part of Hawaii's ecosystem. In Hawaii, wildfires destroy native plants, which impacts the watershed and the habitat of threatened and endangered native Hawaiian animals. Wildfires in Hawaii also cause soil erosion, which leads to runoff that negatively impacts ocean reefs.

The overwhelming majority of wildfires in Hawaii are caused by arson or human error. Human error includes errant fireworks, rubbish, cooking, or agricultural fires that get out of control in the wildland-urban interface, as well as vehicle-caused wildfires.

Principal stakeholders who have an interest in protecting Volcano from wildfire include Hawaii County Fire Department, Hawaii Volcanoes National Park, which sponsored this CWPP, as well as the Big Island Wildfire Coordinating Group, composed of federal, state, and county agencies, including Hawaii County Civil Defense, Department of Land and Natural Resources, U.S Army, and the U.S. Fish and Wildlife Service. These decision makers were invited to participate in the development of this Plan.

An assessment determined that WUI areas in this community have a high risk of wildland fire. Wildland fires originating within the Park via human or natural causes have threatened the community of Volcano, which encompasses the Volcano Village, the Volcano Golf Course Community, Mauna Loa Estates, and Ohia Estates. Conversely, wildfires caused by human error in neighboring towns, such as Volcano, could impact the Park. The community does not have municipal water with residents and businesses alike relying on catchment water basins. There has also been an increase in invasive, non-native plant species that are high-intensity burning fuels, further increasing the fire risk within the community.

Meetings with community members and fire agency personnel identified several priority mitigation measures to reduce the chances of a wildfire starting in Volcano. These include: (1) creation of secondary emergency egress roads; (2) reduction of fuel load along roadsides and in subdivision common areas; (3) reduction of invasive species that possess inherent fire or ignition properties; (4) need for additional pre-staged static water tanks; and (5) continued fire prevention education and outreach.

Hawaii County has been fortunate in controlling large wildland fires in the community to date. However, given the fire history of the area and the fact that HAVO is home to the world's most active volcano, one need only look at the community's fire history and fuel load to understand the severe wildfire risk. The mitigation measures outlined in this Plan will enable the community of Volcano to reduce its risk to wildfire and create more efficient fire-protection systems. The priority mitigation measures listed above identify pro-active projects the community and fire agencies can undertake to minimize losses from a major wildfire.

Background:

Covering a swath from sea level to a 13,000-foot mountaintop, the 377-square miles (333,000 acres) of Hawaii Volcanoes National Park on the island of Hawaii encompasses Mauna Loa, the world's largest volcano, as well as Kilauea, the world's most active volcano. The Park's ecological zones include coastal strand, dry lowland, mesic and wet rain forest, seasonally dry montane, sub-alpine, and alpine. It is home to more than 50 federally-listed endangered, threatened, and candidate endangered species, as well as numerous rare species.

Continually erupting for nearly 23 years, Kilauea has made HAVO the state's largest tourist attraction with more than 2.5 million visitors annually. The primary tourist attractions within the Park are on the south side of the Park, however, the bulk of Park lands extend north of Highway 11 for more than 40 miles as far west as Manuka State Park and as far north as the summit of Mauna Loa.

HAVO recently acquired 119,000 acres from Kahuku Ranch in Ka'u. Located at the 1,000 – 2,000 foot elevation, the area encompasses native Hawaiian forests, pasture lands, and three dormant volcanic craters. Park lands now stretch 50 miles from lower Puna to Ocean View. Given the right wind and fuel conditions wildland fire could travel the length of this land tract, causing substantial damage.

In the past, lava flows within the Park have caused several wildfires, some as large as 5,000 acres. Wildland fires originating within the Park have threatened the nearby community of Volcano, which encompasses Volcano Village, the Volcano Golf Course Community, including the Golf Course Subdivision, Mauna Loa Estates, and Ohia Estates. Conversely, wildland fires caused by human error in neighboring towns, such as Volcano, could impact the Park. The Kilauea Forest Reserve separates Volcano Village and the Golf Course Subdivision. To the east of Volcano Village is the Ola'a Forest Reserve, a land tract of Native Hawaiian forest largely untouched by invasive species.

Volcano has experienced tremendous development in recent years. Volcano Fairway Estates is a new subdivision currently under construction adjacent to the Volcano Golf Course and Country Club.

Fire History:

Below is a 2004-2005 fire history chart for Volcano. Since Hawaii County Fire Department is responsible for fire suppression in residential areas and HAVO is responsible for fire suppression within the Park, each organization maintains separate fire history statistics. However, the two agencies have a Memorandum of Understanding for mutual aid in fire suppression. Average size for all wildland fires responded to by Hawaii County Fire Department in Volcano during the past two years was 0.4 acres. Between 2004 and 2005 there were three fires within Park boundaries, the Kipuka Pepeaio fire that burned more than 600 acres, the Kahuku fire that burned less than 5 acres in Kahuku, and the Pinao fire that burned less than 1 acre. However, a 2002 wildfire burned more than 1,000 acres of Park land in eight hours on the

north side of Highway 11 in Volcano. The fire jumped Mauna Loa Strip Road, which runs in a north-south direction to the west of the Volcano Golf Course Subdivision and threatened several homes along the north boundary of the Golf Course Subdivision. In the past decade HAVO has experienced 54 fires within the Park with 5 of those burning more than 1,000 acres.

Volcano	
Hawaii County FD Fire history 2004-2005	Date
Building fire	15-May-05 23:54:04
Building fire	10-Oct-05 04:51:33
Trash or rubbish fire, contained	26-Feb-04 10:02:00
Trash or rubbish fire, contained	14-May-05 22:46:52
Fire in mobile property used as a fixed structure, other	24-Jul-04 02:12:37
Fire in mobile property used as a fixed structure, other	26-Jan-05 13:57:19
Passenger vehicle fire	29-Apr-05 19:32:27
Passenger vehicle fire	14-May-05 05:38:15
Passenger vehicle fire	30-Jul-05 22:02:24
Passenger vehicle fire	04-Nov-05 22:11:28
Forest, woods or wildland fire	23-Feb-05 09:55:31
Brush, or brush and grass mixture fire	04-Sep-05 16:37:39
Brush, or brush and grass mixture fire	29-Dec-05 14:07:14
Brush, or brush and grass mixture fire	30-Dec-05 18:44:55
Outside rubbish, trash or waste fire	07-Aug-05 14:22:56
Outside rubbish, trash or waste fire	25-Sep-05 13:58:47
Outside rubbish, trash or waste fire	21-Nov-05 16:08:11
Outside gas or vapor combustion explosion	18-Aug-05 12:28:57
Unauthorized Burning	14-Mar-05 20:39:43
Unauthorized Burning	23-May-05 10:01:00
Unauthorized Burning	27-Aug-05 15:35:39
Unauthorized Burning	25-Nov-05 22:48:50
HAVO Fire History 2004-2005	Date
Pinao – human cause	7/29/04
Kipuka Pepeaio - lightening	12/6/04
Kahuku - human cause	8/14/05

Stakeholders:

Stakeholders are individuals or groups who have a high level of interest in the protection of their assets from wildfire. HAVO shares nearly 11 miles of boundary with the Volcano community in wildland-urban interface areas. Additional lands adjoining Volcano include those managed by federal, state, county, and private entities.

The State of Hawaii's Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) manages the 'Ola'a Forest Reserve that lies adjacent to the Volcano

community. The state-owned Kilauea Forest Reserve separates Volcano Village and the Golf Course Subdivision. There are also several large-scale private landowners in the area, who in turn lease land to other organizations. For example, Kamehameha Schools leases land to Ohia Ranch and owns large tracts of land near Volcano Village. The Keauhou Bird Conservation Center - Hawaii Endangered Bird Conservation Program is located next to the Volcano Golf Course Subdivision. Contact information for principal stakeholders is listed below.

Federal:

Hawaii Volcanoes National Park
Joe Molhoek
Pacific Island Fire Management Officer
PO Box 52, HNP, HI 96718
(808) 985-6042
Joe_Molhoek@nps.gov

State:

Department of Land and Natural Resources: Division of Forestry and Wildlife
Wayne Ching
State Protection Forester
1151 Punchbowl St., Room 325, Honolulu, HI 96813
(808) 587-4173
Wayne.F.Ching@hawaii.gov

County:

Hawaii County Fire Department
Fire Chief Darryl Oliveira
25 Aupuni St., Hilo, HI 96720
(808) 961-8297
Hcfdf1@co.hawaii.hi.us

Hawaii County Civil Defense
Troy Kindred
Civil Defense Administrator
920 Ululani St., Hilo, HI 96720
(808) 961-8229
tkindred@co.hawaii.hi.us

Base Map of Volcano:

Figure 1 is a base map of the community of Volcano and adjacent landowners. The inhabited areas at potential risk to wildfire include Mauna Loa Estates, Ohia Estates, Volcano Village, and the Volcano Golf Course Community, which includes a golf course and subdivision.

Areas containing critical human infrastructure, such as escape routes and communication structures include Volcano Village and the Golf Course Community. Within Volcano Village, the Peter Lee School and the Cooper Community Center could be used as “defend in place” zones if deemed necessary by fire officials given wildfire conditions.

Areas of community importance include: Cooper Community Center, Volcano Winery, Kilauea Lodge and Restaurant, Shipman Ranch House, Lee House, Ola’a Forest Reserve, ‘Ola’a Rain Forest Tract, Thurston Rain Forest, Keauhou Ranch, Ohia Ranch, Keauhou Bird Conservation Center - Hawaii Endangered Bird Conservation Program, local bed and breakfasts, farms, restaurants, and schools.

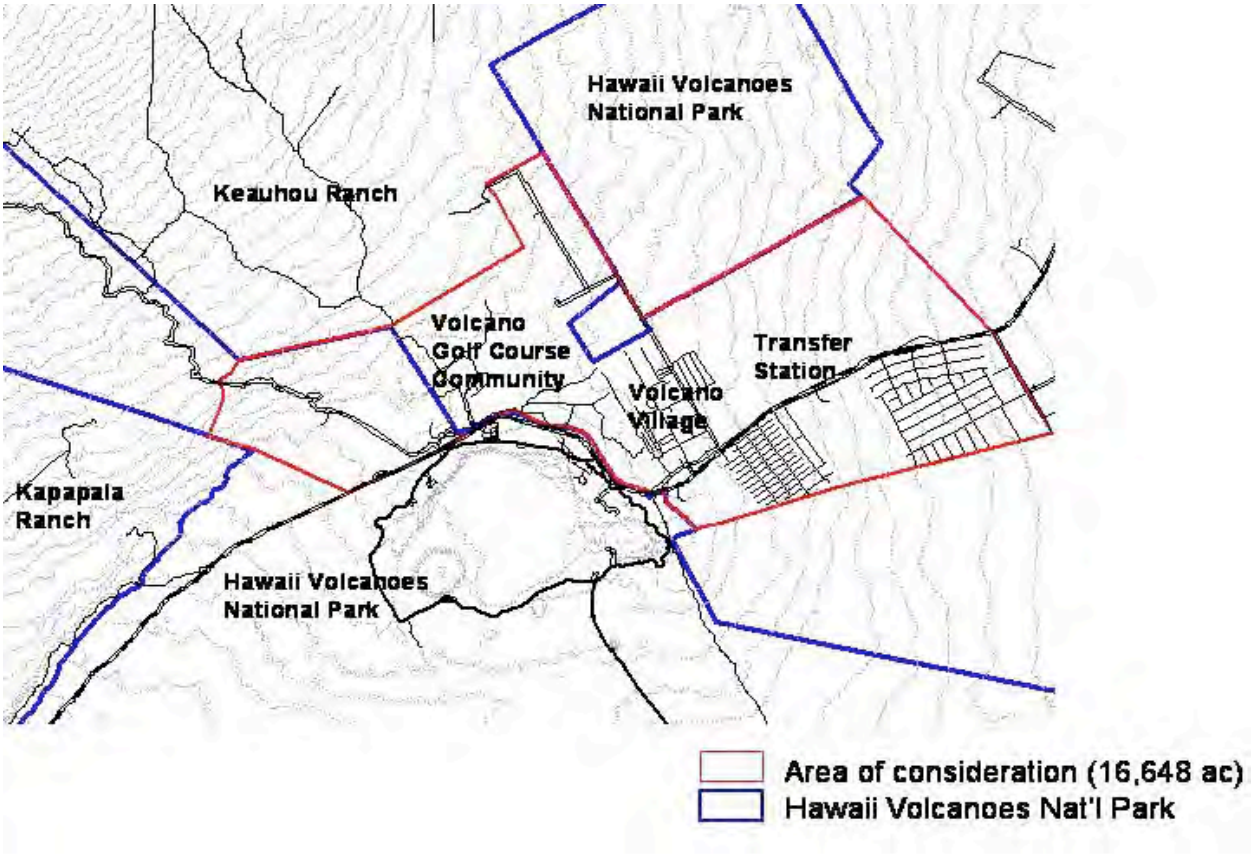


Figure 1: Area of consideration for the Volcano CWPP encompasses more than 16,000 acres and is outlined in red.

Fire Risk Assessment for Volcano:

The Volcano community, a federally listed community at risk, is at the 4,000-foot elevation and is composed of Volcano Village, including the commercial district within the Village, the Volcano Golf and Country Club and its neighboring subdivision to the east, Mauna Loa Estates and Ohia Estates to the southeast on the south side of Highway 11. There are several commercial agricultural farm lots north of the residential units in Volcano Village. Both the Village and the Golf Course Subdivision are densely populated with lots generally smaller than an acre. Houses are spaced slightly farther apart in Mauna Loa Estates and Ohia Estates. There are two main roads each out of Volcano Village and Mauna Loa Estates and one means of ingress and egress from the Golf Course Subdivision and Ohia Estates. Roads within Volcano Village are extremely narrow, roughly ten feet in width with little or no shoulders. Roads within Mauna Loa Estates, Ohia Estates, and the Golf Course Subdivision are 18 - 20 feet wide with shoulders. Volcano Village, Ohia Estates, and the Golf Course Subdivision have little to no slope within the community. There is a slight slope within Mauna Loa Estates, although most lots are on flat land. There is no municipal water in any of the residential or commercial areas of Volcano, with homeowners and businesses relying on catchment water. A volunteer fire station is located in Volcano Village at the Cooper Community Center and a County fire station is located within the Park at the Kilauea Military Camp. There is no community association for any of the subdivisions in Volcano.

Typical road width in Volcano Village.

Much of Volcano Village is within densely vegetated rain forest. The state-owned Kilauea Forest Reserve separates Volcano Village and the Golf Course Subdivision. To the east of Volcano Village is the state ‘Ola’a Forest Reserve and the Park’s ‘Ola’a Rain Forest Tract. These native rain forests provide critical habitat for a number of endangered plant and animal species.

Extensive land clearing has removed most of the native forest in the Volcano Golf Course Subdivision. Several fire-adapted alien grasses, such as bushy beardgrass (*Schizachyrium condensatum*), broomsedge (*Andropogon virginicus*), and molasses grass (*Melinis minutiflora*) have become widespread and increased the wildfire potential in the subdivision. The Faya tree (*myrica faya*) has also invaded the Golf Course Subdivision, pushing out native ohia (*Metrosideros polymorhpa*) trees. Its rapid invasion into common areas that were originally set-aside as defensible spaces in the event of wildfire has resulted in increased fuel loads and the conversion of open spaces to dense alien forest. Keauhou Ranch, owned by Kamehameha Schools, lies to the north of the Golf Course Subdivision. The recent cessation of cattle operations is expected to result in increased fuel loads of invasive fire-adapted grasses.

A Hawaii Wildland Fire Risk and Hazard Severity Assessment based on the Assessment in Appendix A of NFPA 1144, *Standard for Protection of Life and Property from Wildland Fire*, was conducted by the Hawaii Firewise Coordinator and HAVO firefighting personnel on April 26,

2006 to identify the level of wildland fire risk of Volcano Village, the Golf Course Subdivision, Mauna Loa Estates, and Ohia Estates.

Using a pre-established point system, the Wildland Fire Risk and Hazard Severity Assessment is a tool used to determine the level of wildfire risk to a home or community. Points are given regarding overall terrain and location, road width, local area fire history, prevailing winds and seasonal weather, geographical contours, native vegetation, water availability, location of fire suppression resources, as well as the combustibility of building materials, including roof, siding, and attached items, such as decks, fencing, or an unit. The combined points in all these categories are added together and the overall risk is determined by whether the score falls in the low-, medium-, high-, or extreme-risk point range. Given the ignitability of individual structures, preponderance of fuels in close proximity to structures, and lack of water, Volcano scored within the high-risk score range in the Assessment, a copy of which can be found in Appendix A.

Community Assets at Risk:

Assets at risk are valued resources that can be damaged or destroyed by wildfire. In addition to ensuring firefighter safety and protecting residents and visitors, the following assets warrant consideration in pre-incident planning: watersheds; forest reserves; wildlife; rare and endangered plants and animals; scenic, cultural, and archeological sites; ranchlands; and structures.

The following were identified as valued resources within the Volcano community that would be adversely affected by wildfire.

Commercial resources:

Volcano Winery, Kilauea Lodge and Restaurant, local bed and breakfasts, farms, restaurants, and schools.

Historical resources:

Shipman Ranch House and Lee House. There are several structures within the Village more than 50 years old. The State of Hawaii classifies buildings over 50 years old as historical structures in accordance with National Park Service Administrative Rule Chapter 6E.

Natural Resources:

Ola'a Forest Reserve, Ola'a Rain Forest Tract, Thurston Rain Forest, Keauhou Ranch, Ohia Ranch, Keauhou Bird Conservation Center - Hawaii Endangered Bird Conservation Program. Native Hawaiian plants and animals, including rare and endangered species.

This Plan focuses on structures within the wildland urban interface in Volcano. Overgrown vegetation, narrow streets, and a lack of water create unsafe fire conditions. While the majority of homes in Volcano have metal roofs, a large number of homes within Volcano Village, the Golf Course Subdivision, Ohia Estates, and Mauna Loa Estates have wood siding and lanais (decks), further enhancing the fire problem. House lots vary greatly in the degree of defensible space around the homes from little to no defensible space to more than 30 feet of clearance. Several driveways do not have 15 feet of vertical clearance for emergency vehicle access due

to overgrown vegetation. Fewer still have turnaround access for emergency vehicles. Signage for interior roads within the Village, Golf Course Subdivision, Mauna Loa Estates, and Ohia Estates is metal and reflectorized.

Houses within Volcano Village differ dramatically in their amount of defensible space. Both houses pictured above have metal roofs and wood siding.

In addition, all residential areas within Volcano are experiencing rapid development. A new subdivision, Volcano Fairway Estates, is being built adjoining Volcano Golf Course and Country Club. The developer and/or lot owners are often clear cutting individual lots and dumping the green waste in common areas within the community, greatly increasing the community's fire risk. Associated with land clearing is the increased potential for invasive plants to establish. Some of these invaders (e.g. fire-adapted grasses) may have the potential to increase fuel loads and alter fire regimes.

Community Concerns for Volcano:

Multiple meetings with community members and fire agencies specifically on the CWPP process between April and June 2006 identified the most pressing fire concerns in Volcano. These include in order of priority:
1. Lack of water;
2. Community egress and firefighting vehicle ingress during a wildfire;
3. Fuel load in common areas;
4. Reduction of invasive species possessing inherent fire or ignition properties; and
5. Public awareness of wildfire threat.

Recommended Action for Volcano:

Multiple meetings with community members and fire agencies specifically on the CWPP process between April and June 2006 identified the most pressing fire concerns in Volcano. These include in order of priority:
1. Lack of water;
2. Community egress and firefighting vehicle ingress during a brushfire;
3. Fuel load in common areas;
4. Reduction of invasive species possessing inherent fire or ignition properties; and
5. Public awareness of wildfire threat.

Based on the results of the community risk assessment, the following mitigation measures were identified to reduce wildfire risk in Volcano. The community and fire agencies collaborated to prioritize mitigation efforts in the following order of importance:

1. Creation of secondary emergency ingress/egress roads;
2. Reduction of fuel load along roadsides and in common areas;
3. Need for additional pre-staged static water tanks;
4. Reduction of invasive species; and
5. Continued fire prevention education and outreach.

Based on the results of the community risk assessment, priority ratings have been selected for Volcano and areas of community importance. The community recommendations for the type and method of treatment for the surrounding vegetation are listed in the following table.

Community, structure or area at risk	**Type of Treatment**	**Method of Treatment**	**Overall Priority**
Volcano Village	Mechanical	Creation of secondary emergency ingress/egress roads	Very High
Volcano Village	Mechanical / Chemical / Hand Labor	Reduction of fuel load along roadsides and in common areas	Very High
Volcano Village	Mechanical	Need for additional pre-staged static water tanks	High
Volcano Village	Mechanical / Chemical / Hand Labor	Reduction of invasive species	High
Volcano Village	Public Education and Outreach	Continued fire prevention education and outreach	High
Golf Course Community	Mechanical	Reduction of fuel load along roadsides and in common areas	High
Golf Course Community	Mechanical / Chemical / Hand Labor	Need for additional pre-staged static water tanks	High
Golf Course Community	Mechanical / Chemical / Hand Labor	Reduction of invasive species	High
Golf Course Community	Public Education and Outreach	Continued fire prevention education and outreach	High
Mauna Loa Estates	Mechanical / Chemical	Reduction of fuel load along roadsides	Medium
Mauna Loa Estates	Mechanical / Chemical	Reduction of invasive species	Medium
Mauna Loa Estates	Public Education and Outreach	Continued fire prevention education and outreach	High
Ohia Estates	Mechanical / Chemical	Reduction of fuel load along roadsides	Medium
Ohia Estates	Mechanical / Chemical / Hand Labor	Reduction of invasive species	Medium
Ohia Estates	Public Education and Outreach	Continued fire prevention education and outreach	High

Community Federal agencies and private landowners surrounding Volcano were invited to submit projects that provide protection and reduce wildland fire risk. The following table displays a list of projects based on recommendations from community and fire-related organizations. HAVO intends to assess the progress annually and invite agencies and landowners to submit projects that provide community protection.

Community, structure or area at risk	Project	Agency	Funding Needs	Timetable	Community Recommendation
Volcano Village	Creation of secondary emergency ingress/egress roads	HAVO	Cooperative Funding	2006 - 2007	Yes
Volcano Village	Reduction of fuel load along roadsides and in common areas	Private	Cooperative Funding	2006 - 2007	Yes
Volcano Village	Reduction of invasive species	HAVO	Cooperative Funding	2006 - 2007	Yes
Volcano Village	Need for additional pre-staged static water tanks	Multiple agencies: federal, state, county, and private	Cooperative Funding	2006 - 2007	Yes
Volcano Village	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Golf Course Community	Reduction of fuel load along roadsides and in common areas	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Golf Course Community	Need for additional pre-staged static water tanks	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Golf Course Community	Reduction of invasive species	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Golf Course Community	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Mauna Loa Estates	Reduction of fuel load along	Private	Cooperative Funding	2006 - 2007	Yes

	roadsides				
Mauna Loa Estates	Reduction of invasive species	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Mauna Loa Estates	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Ohia Estates	Reduction of fuel load along roadsides	Private	Cooperative Funding	2006 - 2007	Yes
Ohia Estates	Reduction of invasive species	Multiple agencies	Cooperative Funding	2006 - 2007	Yes
Ohia Estates	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2006 - 2007	Yes

Secondary road for ingress/egress

With narrow interior roads and only two roads connecting to the main highway, a secondary emergency access road for emergency vehicles is needed for more effective fire suppression. Currently there is an unpaved access road parallel to Mauna Loa Strip Road that runs along the western border of the golf course subdivision. This firebreak is on HAVO land and the Park maintains the road, removing overgrown vegetation twice a year. However, this fuel break dead ends behind golf course homes adjacent to the Volcano Winery. An additional access road is needed to connect the end of this fuel break to the interior roads within the Golf Course Subdivision to increase effective safe firefighting operations.

In order to remain effective, the secondary emergency access road must also be maintained on a regular basis. Funding should be secured to ensure that the road is maintained (cleared of overgrown vegetation) at least twice a year. The organization that is determined to be responsible for the access road may want to consider the purchase of a chipper to remove vegetation on the access road.

Reduction of fuel load

Reducing vegetation along roadsides will improve accessibility of emergency vehicles. Reduction of green waste in common areas within the community will also reduce the wildfire threat. The creation of fuel breaks in common areas, as well as green waste pick-up projects are recommended to reduce fuel load. It is also strongly recommended that outreach efforts include alerting residents and developers to the fire risk of dumping green waste. The organization that is determined to be responsible for fuel load reduction may want to consider the purchase of a chipper to remove vegetation. For examples of how communities in other states have developed effective green waste removal projects, please go to www.firewise.org.

Pre-staged static water tanks
Given that area residents rely on catchment water and there are no fire hydrants within Volcano, lack of water for fire suppression was identified as one of the most important challenges facing the community. Pre-staged static water tanks for ground and aerial fire suppression will greatly increase effective fire suppression and firefighting efficiency.

Reduction of invasive species
Invasive non-native plant species have the potential to alter fire regimes, and inhibit the recovery of native plants and animals from wildfire. Invasive fire-adapted grasses are high-intensity burning fuels that carry fire to other fuels. Faya trees rapidly displace native ohia trees as the dominant canopy tree after wildfire. Its invasion into common areas within the Golf Course Community has increased fuel loads, converted open areas to dense forest, and compromised defensible spaces used in wildfire suppression.

Continued fire prevention education
Fire agencies in Hawaii County have partnered with Firewise to promote community wildfire awareness in wildland urban interface communities. The objective is to increase overall awareness of fire hazard issues that affect residents within the wildland urban interface. While a Firewise coordinator has provided much needed outreach in the community, funding for such a position has been intermittent. Stable funding for an outreach coordinator should be developed to ensure consistent fire prevention outreach. With a new subdivision being built and a continued influx of residents from the mainland who are unaware of Volcano's unique fire risks, it is crucial to continue a comprehensive fire education and outreach campaign. This program should consist of the following:

1. Continued development and coordination of community meetings and outreach events. Coordination with other community groups, such as the local disaster preparedness committee and civic organizations, to provide wildland fire safety information on defensible space and Firewise building materials. Provide outreach at community events, such as the Kilauea Cultural Festival.

2. Develop educational materials specific to community fire threat and continue outreach in local publications. HAVO staff and the Firewise coordinator are currently providing monthly editorial to local publications on fire prevention. Continued outreach is needed with large numbers of new residents moving into the area. A handbook "How to Build in the Forest" is currently available to area residents. Handbook should be updated to include Firewise recommendations for defensible space and fire-resistant building materials.

3. Development of fire prevention outreach materials, including TV and radio public service announcements, posters, and handouts.

Reduce Structural Ignitability:

As part of its fire prevention education efforts, Firewise provides recommendations to reduce structural ignitability. Individuals and the Volcano community can reduce structural ignitability throughout the community by taking the following measures.

• Create a buffer zone of defensible space around a property of at least 30 feet or to the property line if the house has less than 30 feet of yard. Remove flammable vegetation and combustible growth within 30 feet of the house.

• Prune tree limbs 6 – 10 feet above the ground.

• Space trees and shrubs ten feet apart in the yard.

• Make sure that plants closest to the house are low-lying. And whenever possible use native Hawaiian or succulent plants.

• Routinely remove dead leaves and other organic matter from the yard.

• Sweep and/or clean gutters, eaves, and roofs regularly to prevent the build-up of leaves and other matter.

• Use fire-resistant building materials for the roof, siding, and decks, such as metal, stucco, tile, brick, and cement.

Appendix A:

Please see attached Hawaii Wildland Fire Risk and Hazard Severity Assessment Form.

Appendix B:

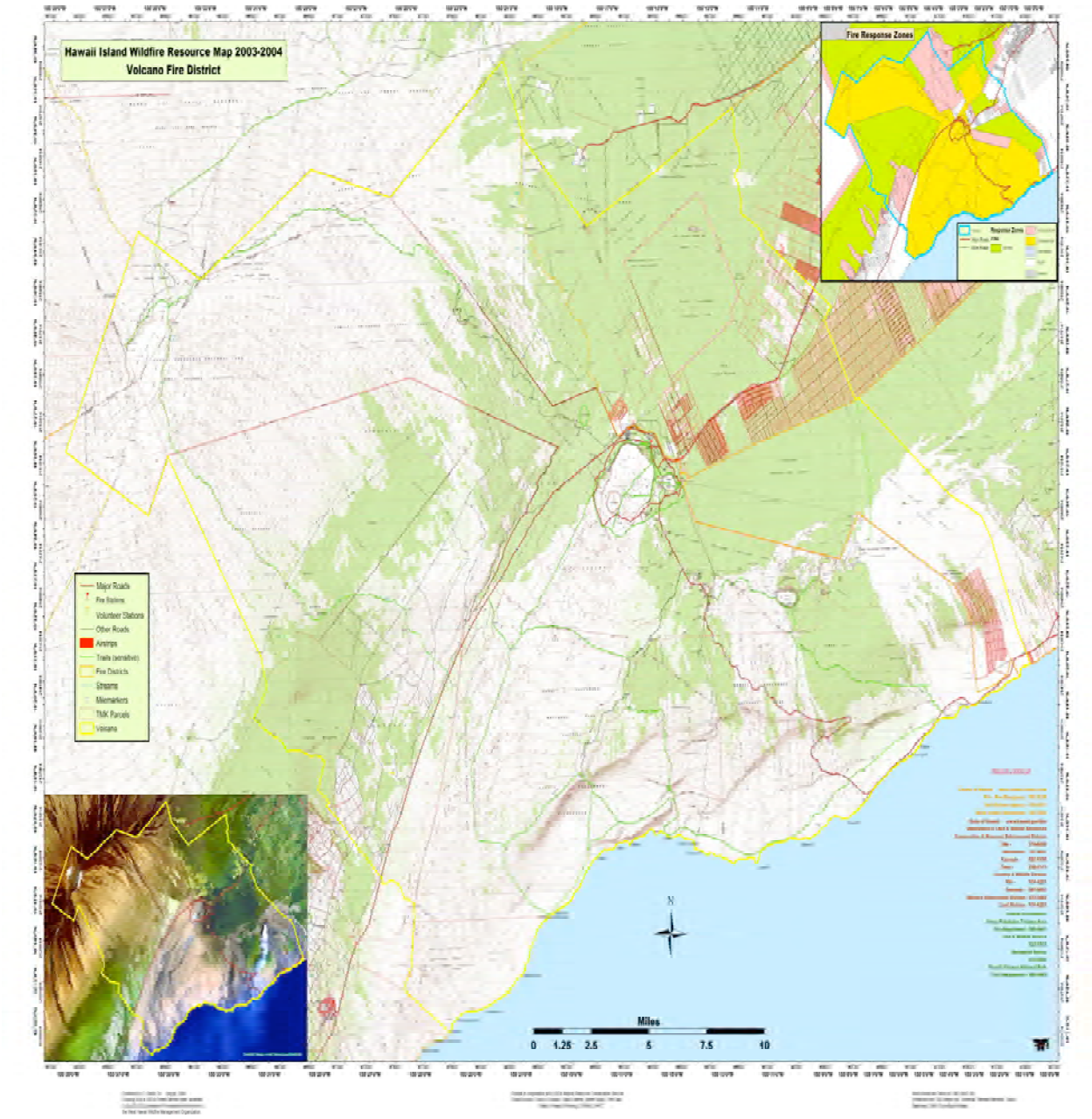
Updated Project List 2008-2009

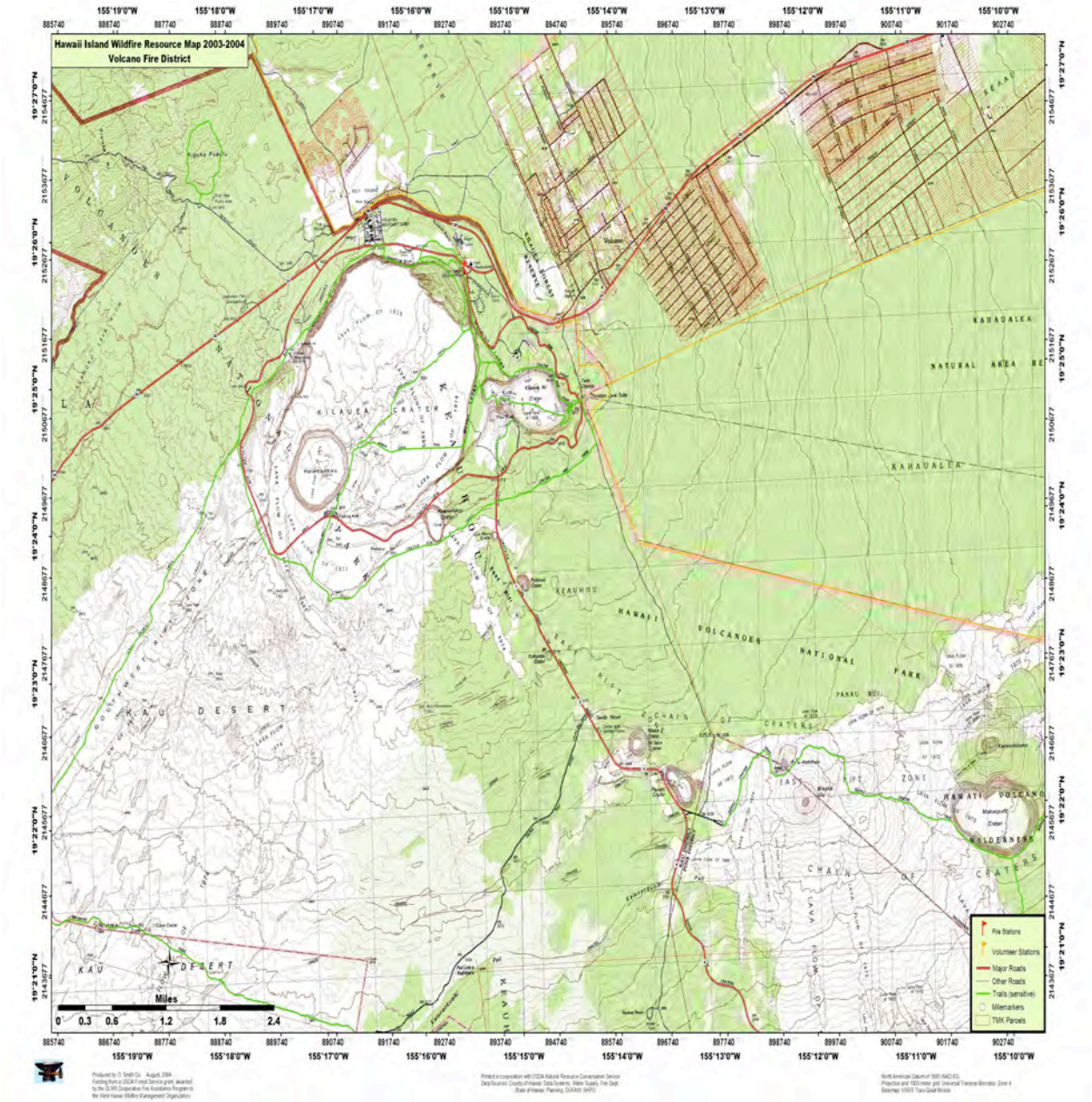
Federal agencies and private landowners surrounding Volcano were invited to submit projects that provide wildfire protection and reduce risk. The following table displays a list of recommended projects.

Community, structure or area at risk	Project	Agency / landowner	Funding Needs	Timetable	Community recommendation
Volcano Village	Maintenance of secondary emergency access road	HAVO	Cooperative Funding	2008-9	Yes
Volcano Village, Golf Course Community, Mauna Loa Estates, Ohia Estates	Reduction of fuel load along roadsides and in common areas	Private	Cooperative Funding	2008-9	Yes
Volcano Village, Golf Course Community, Mauna Loa Estates, Ohia Estates	Reduction of invasive species	HAVO, Private	Cooperative Funding	2008-9	Yes
Volcano Village, Golf Course Community, Mauna Loa Estates, Ohia Estates	Continued fire prevention education and outreach	Multiple Agencies	Cooperative Funding	2008-9	Yes

Appendix C:

Pre-Attack Maps for Volcano, Hawaii





Maps courtesy of West Hawaii Wildfire Management Organization.

Community Wildfire Protection Plan for Waihe'e, Hawaii

Sponsored by the Maui Coastal Land Trust
March 2007

Written by Denise Laitinen

Table of Contents:

Cover photo: View of Waihe'e Coastal Dunes and Wetlands Refuge. Photo courtesy of the Maui Coastal Land Trust.

Waihe'e Community Wildfire Protection Plan
Mutual Agreement Page

The Community Wildfire Protection Plan (CWPP) developed for Waihe'e, Hawaii by the Maui Coastal Land Trust (MCLT):

- Was collaboratively developed. Interested parties and federal land management agencies managing land in the vicinity of Waihe'e have been consulted.
- This plan identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will protect Waihe'e.
- This Plan recommends measures to reduce the ignitability of structures throughout the area addressed by the Plan.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:

_____ _____

Paul J. Conry **Date**
State Forester, Division of Forestry and Wildlife

_____ _____

Carl Kaupalolo **Date**
Fire Chief, Maui County Fire Department

_____ _____

Gen Iinuma, M.P.H. **Date**
Administrator, Maui County Civil Defense Agency

Executive Summary:

The community of Waihe'e in Maui County on the island of Maui abuts the Waihe'e Coastal Dunes and Wetlands Refuge (Refuge), which is owned and managed by the Maui Coastal Land Trust (MCLT). The Refuge and the community is in a wildland urban interface (WUI) environment - that is where wildlands and houses meet. These interface areas pose the highest risk of loss of life and property due to wildland fire. The risk of wildland fire impacting homes in the WUI is determined by several factors, including the ignitability of fuels, structural ignitability, weather conditions, and topographical features, such as slope. Unlike other parts of the United States, wildfire is not a natural part of Hawaii's ecosystem. In Hawaii, wildfires destroy native plants, which impacts the watershed and the habitat of threatened and endangered native Hawaiian animals. Wildfires in Hawaii also cause soil erosion, which leads to runoff that negatively impacts ocean reefs.

The overwhelming majority of wildfires in the state of Hawaii are caused by arson or human error. Human error includes errant fireworks, rubbish, cooking, or agricultural fires that get out of control in the wildland-urban interface, as well as vehicle-caused wildfires.

Principal stakeholders who have an interest in protecting Waihe'e from wildfire include the Maui County Fire Department, Maui Coastal Land Trust, which sponsored this CWPP, as well as the State Division of Forestry and Wildlife, Natural Resource Conservation Service, Maui County Civil Defense Agency, and the Waihe'e Community Association. These decision makers were invited to participate in the development of this Plan.

An assessment determined that WUI areas in this community have a high risk of wildland fire, with the Refuge having a higher risk than Waihe'e Village. Wildland fires originating within the Waihe'e Coastal Dunes and Wetlands Refuge via human or natural causes have threatened the community of Waihe'e, which encompasses Waihe'e Village, Waihe'e Baseball Park, Waihe'e Elementary School, Waihe'e Beach Park, and Yagi subdivision. Conversely, wildfires caused by human error in Waihe'e could impact the Refuge. There has been an increase in development in the area with the Department of Hawaiian Home Lands building the fourth phase of Waiehu Kou subdivision adjacent to MCLT lands.

Meetings with community members and fire agency personnel identified several priority mitigation measures to reduce the wildfire risk in Waihe'e. These include: (1) creation of a secondary emergency egress road (offsite of MCLT property); (2) creation of a community green waste compost pile to reduce green waste dumping on MCLT land; (3) reduction of and continued maintenance of fuel load in Field 9 in the Refuge; (4) improvement and maintenance of Kalepa Gulch Access Road and the Dunes Access Road off Kahekili Highway; and (5) continued fire prevention education and outreach. Because the Waihe'e Coastal Dunes and Wetlands Refuge is recognized as the primary source for wildland fires, the majority of these recommendations are based on this property.

Maui County has been fortunate in controlling wildland fires in the community to date. However, one need only look at the community's fire history and fuel load to understand the wildfire risk. The mitigation measures outlined in this Plan will enable the community of Waihe'e to reduce its risk to wildfire and create more efficient fire-protection systems. The priority mitigation measures listed above identify pro-active projects the community and fire agencies can undertake to minimize losses from a major wildfire.

Background:

Waihe'e is a small residential village along Maui's windward coast to the northwest of Wailuku, the county seat of Maui, and south of the remote village of Kahakuloa. Kahekili Highway is the only main through road in the community with homes, a school, two churches, and a county park on either side of the two-lane highway. There are roughly 60 to 65 structures in the community. The West Maui Mountains, including Waihe'e Valley and the state-owned West Maui Forest Reserve are on the north (mauka) side of Kahekili Highway with the Waihe'e Coastal Dunes and Wetlands Refuge on the south (makai) side. The Refuge stretches north to south from the ocean to the highway and east to west between Halewaiu Road and Waihe'e Point. Halewaiu Road runs north–south from Kahekili Highway to the ocean. On the lower portion of Halewaiu Road, directly across from the Refuge is Waiehu Golf Course. On the upper portion of Halewaiu Road there are homes buffering the Refuge. Across from these homes, on the other side of Halewaiu Road, a new Department of Hawaiian Home Lands subdivision, Waiehu Kou IV, is under construction. Waiehu Kou I, II, and III subdivisions lie just east of Waihe'e along Kahekili Highway adjacent to Waiehu Golf Course (outside the boundaries of this CWPP.) At the other end of the Refuge, near Waihe'e Point is the Yagi subdivision containing nearly a dozen homes.

The area is lies within a tsunami inundation zone, and is susceptible to hurricanes and earthquakes, in addition to wildfires.

MCLT manages the 277-acre Waihe'e Coastal Dunes and Wetlands Refuge that lies adjacent to the Waihe'e community. MCLT acquired the Refuge in 2004, and the former Waihe'e Dairy is now part of the Refuge. The mission of the Maui Coastal Land Trust, a local 501(c)(3) non-profit conservation organization, is to preserve and protect Maui's coastal lands for the benefit of the natural environment, as well as for current and future generations.

The Refuge encompasses 24 acres of coastal, spring-fed wetlands; 103 acres of dune ecosystem; more than 7,000 feet of marine shoreline; and more than 8 acres of riparian habitat for the recovery of native birds and native vegetation. The wetlands contained within the Refuge are the third largest wetlands on the island of Maui.

The Refuge is rich in archaeological and cultural resources, including ancient Hawaiian fishing villages, multiple heiau, an inland fishpond (loko kalo i`a), and extensive burial sites. The archeological resources have only been partly delineated, but appear to be one of the most productive sites remaining on Maui. There are at least 85 known archeological sites on the Refuge.

There is also an abundance of wildlife in the area. In recent years, at least six endangered bird and insect species, including the Hawaiian Stilt (Ae'o or Himantopus mexicanus knudseni), Hawaiian Coot ('Alae Ke'oke'o or Fulica Americana alai), the Hawaiian Duck (Koloa or Anas wyvilliana), and the Blakburn Sphinx Moth (Manduca blackburnii) have been reported in the Refuge. The Hawaiian Coot, Stilt, and Sheerwater ('Ua'u kani) use the Refuge as a breeding area. Endangered plants, such as creeping Naupaka (Scaevola coriacea), have recently been reintroduced to the Refuge.

Waihe'e Reef, just offshore of the Refuge, is one of the longest and widest reefs on Maui, an extensive marine ecosystem that parallels the shoreline along the northeast side of the property. This system provided an excellent fishing site in ancient Hawaii and is still a favorite among local fishermen. Although the general public is not allowed vehicle access to the Refuge, MCLT allows area fisherman to walk onto the Refuge to fish.

There are state, county, and federal easements on all parts of the Refuge except the 26.98-acre section known as Ironwoods. Essentially, this means that MCLT has agreements with federal, state, and county entities promising there will never be future development on the land.

A single-lane unpaved (dirt) road runs through the Refuge and in some portions it has vertical clearance of less than 15 feet. This road is accessible via Kahekili Highway at the Dunes Access Road, which has a locked gate, and via Kalepa Gulch Access Road off of the lower section of Halewaiu Road near the golf course, which also has a gate. The gate off Halewaiu Road is usually open during the day, providing access to a spot known as Roundtables and the entrance to the old Waihe'e Dairy site. The entrance to the Dairy is gated and locked at all times. MCLT staff, board members, and contractors have keys to the gates. The Kalepa Gulch Access Road leading to Roundtables and the old Dairy is frequently washed out and inaccessible. A September 2006 wildfire started in an open area of Guinea Grass between Roundtables and the Dairy off Kalepa Gulch Access Road, and came dangerously close to area homes.

MCLT staff unlocks the entrance gate to the Refuge at the Dunes Access Road off of Kahekili Highway.

The entrance from Kahekili Highway is a descending winding slope that leads to the Dairy site and then curves along the coast toward the wetlands and heiau, where the road is relatively flat. MCLT staff recently purchased a tractor that they use to mow the Dune Access Road on a regular basis to keep fuel load at a minimum and provide accessibility. MCLT staff also plan to spray the periphery of this access road on a regular basis to further reduce fire fuel load and to that end have purchased a 100-gallon spray unit.

There is also a one-lane unpaved road that runs behind the houses along the makai side of Kahekili Highway and the Refuge from Halewaiu Road to the sand dunes. This road serves as a fuel break between the homes and the area of the Refuge known as Field 9. MCLT staff mows the fuel break or contracts to have it mowed four times a year.

Left: the entrance to the fuel break that starts at Halewaiu Road and runs between the houses on the makai side of Kahekili Highway and Field 9 in the Refuge. Center: view of fuel break road. Right: rear view of houses along fuel break. Several properties have dense vegetation close to the houses.

Field 9 is a 26-acre section of the Refuge directly behind homes along the makai side of Kahekili Highway. It contains Guinea Grass **(**Panicum maximum) and other hazardous fuels, which were greater than five feet in height at the time the hazard assessment was conducted. Because of the dense fuel load and potential risk to area homes if a wildfire were to occur, MCLT applied for and received grant funding to mow Field 9. The field was mowed in October 2006 and fuel load growth in the area as of April 2007 was roughly two to three feet in height. MCLT may wish to consider using grazing animals in Field 9 as a cost-effective and efficient way to reduce fire fuel load in the area.



Left: end of fuel break access road between Field 9 and Waihe'e homes. Note height of fuel load in Field 9. Center: a small pond is behind the last house on the fuel break. Right: fuel load in Field 9 and the sand dunes in the Refuge. Fire fuels include grasses and kiawe trees, known carriers of firebrands.

There are three structures on the Refuge, all of which are several decades old dating back to the Waihe'e Dairy era and built of combustible materials and non-combustible roofing. One of the buildings, located next to the wetlands, is believed to be of C.W. Dickey design and is slated to be restored as a cultural educational center for MCLT providing working, interpretive, and meeting areas, as well as a kitchen and restrooms for student groups. The former Waihe'e Dairy caretakers' home, near the remnants of the old Dairy site, is a wood-frame house with combustible siding. It is rundown from years of being unused and in dire need of renovation. A caretaker currently lives in the house and recently initiated some renovations, as well as clearing defensible space around the structure. MCLT plans to completely remodel the caretaker's home. The third structure, commonly known as the doctor's house, which is situated near the Dairy's caretaker home, is in such disrepair it is slated to be demolished.



The three structures on the Waihe'e Coastal Dunes and Wetlands Refuge. Left: the C.W. Dickey home to be remodeled as MCLT's new cultural education center. Center: the old Waihe'e Dairy caretaker's house slated for renovation. Right: structure known as the doctor's house, which is slated to be demolished.

Section of the Refuge next to Waihe'e Beach Park, known as Ironwoods

In recent years, Waihe'e Beach Park, which is adjacent to the Refuge, has become a haven for homeless people, many of whom camp in the area. The part of the Refuge next to Waihe'e Beach Park is referred to as the Ironwoods section as it contains a large stand of Ironwood trees. In previous decades this area was used to grow sugar cane but is now covered with Ironwood (Casuarina Equisitefolia) and Haole Koa trees (Leucaena leucocephala). Guinea Grass (Panicum maximum) is the prevalent vegetation under the Ironwood trees and the ground is covered with about two inches of pine needles. The pine needles inhibit some plant growth but not that of the Guinea Grass. Waiehu Golf Course personnel recently cleared haole koa trees on their property closest to MCLT land. However, abandoned cars and trash in the area are a potential fire hazard, since there is a history of people burning abandoned cars. In February 2005, MCLT staff cleared 26 abandoned cars and 14 tons of garbage from the Ironwoods area alone. Given the strong onshore winds in the area, if a campfire or other fire originating at the Beach Park got out of

control, it could easily spread to the Refuge and neighboring homes. Conversely, roadside fires started along Kahekili Highway could impact the Refuge. There have been recent fires in the Refuge that came close to homes along Kahekili Highway. Fishermen burning bonfires with area driftwood are a concern because fishermen have unintentionally started at least one previous wildfire in the Refuge.

Left: a September 2006 wildfire that broke out on the Refuge was pushed toward Waihe'e homes by onshore winds. Center: Maui Fire Department personnel vehicles staged on the fuel break road between the Refuge and area homes to prevent flames from reaching the homes. Right: MFD personnel mop up the fire that burned more than two acres. The wildfire was caused by the arcing of an electrical line.

Fire History:

Maui County Fire Department is responsible for fire suppression in the district. The nearest fire station is in Wailuku, 4 miles away, and houses 2 apparatus a 1,500-gallon pumper and a recently acquired 300-gallon mini pumper with a CAPS system purchased specifically for handling wildfires in the Waihe'e/Kahakuloa district. Between January 2000 and October 31, 2006 there were 25 wildfires in Waihe'e. Of the 25 fires, 5 were intentional, 4 were unintentional, 1 is under investigation, and 15 were of undetermined cause. A total of 9 acres were burned. A 2-acre fire within the Refuge in September 2006 came dangerously close to several homes along the makai side of Kahekili Highway.

Stakeholders:

Stakeholders are individuals or groups who have a high level of interest in the protection of their assets from wildfire. The Refuge shares a half-mile of boundary with Waihe'e community homes in wildland-urban interface areas along Kahekili Highway, Wilipohaku Road, and Oki Place. When Waiehu Kou Phase IV is completed, the interface boundary will increase by another 1/4 to 1/2 mile. In addition to community members and the fire response agencies, those organizations with easements on the Refuge also have an interest in reducing the wildfire risk in Waihe'e. Contact information for principal stakeholders is listed below.

Federal:
National Resource Conservation Service (NRCS)
Ranae Ganske-Cerizo
210 Imi Kala St.
Wailuku, HI 96793
(808) 244-3100 X 107
ranae.Ganske@hi.usda.gov

NRCS Natural Resources Conservation Service

State:

Department of Land and Natural Resources: Division of Forestry and Wildlife
Wayne Ching
State Protection Forester
1151 Punchbowl St., Room 325, Honolulu, HI 96813
(808) 587-4173
Wayne.F.Ching@hawaii.gov

County:

Maui County Fire Department
Fire Chief Carl Kaupalolo
Maui County Department of Fire and Public Safety
200 Dairy Road
Kahului, HI 96732
(808) 270-7561
Carl.kaupalolo@co.maui.hi.us

Maui County Civil Defense Agency
Gen Iinuma, M.P.H.
Administrator
County of Maui Civil Defense Agency
200 High Street, 1st Floor
Wailuku, HI 96793
(808) 270-7285
gen.iinuma@co.maui.hi.us

Maui Coastal Land Trust
Dale Bonar
Executive Director
2371 Vineyard Street
P.O. Box 965
Wailuku, HI 96793
(808) 244-5263
dale@mauicoastallandtrust.org

Base Map of Waihe'e:

Figure 1 is a base map of the community of Waihe'e and adjacent landowners. The inhabited areas at potential risk to wildfire include Waihe'e Village, Waihe'e Baseball Park, Waihe'e Elementary School, Waihe'e Beach Park, and Yagi subdivision.

The areas containing critical human infrastructure i.e. houses, are along Kahekili Highway. Areas of community importance include: the Refuge, Waihe'e Elementary School, and St. Ann Church, and Waihe'e Protestant Church.

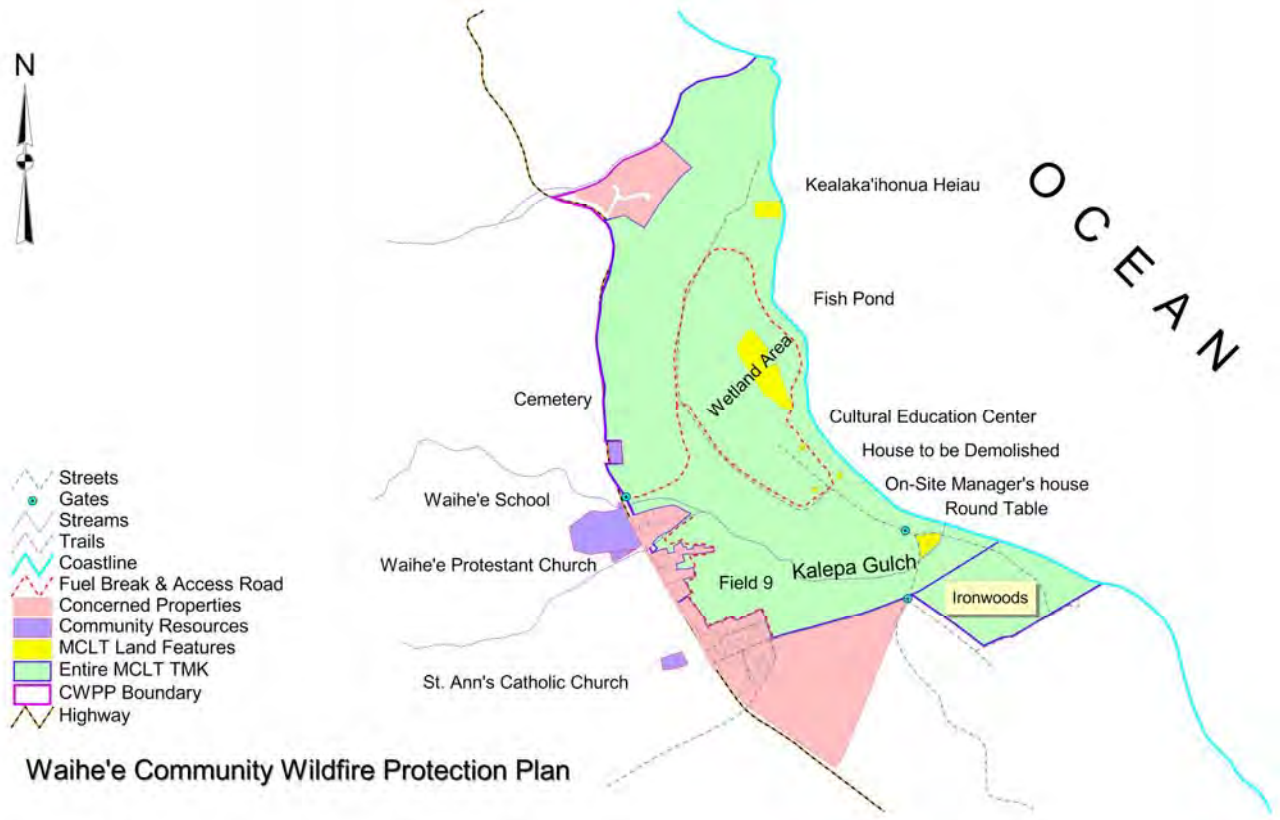


Figure 1: Area of consideration for the Waihe'e CWPP.

Fire Risk Assessment for Waihe'e:

The Waihe'e community is at sea level and is composed of Waihe'e Village, including Waihe'e Elementary School, Waihe'e Baseball Park, and the Refuge. There are no commercial districts within the Village. House lots along Kahekili Highway and the Yagi subdivision are between 8,000 to 12,000-square-feet with the average about 10,000-square-feet. Many of the structures are plantation-style homes that are several decades old. The majority of houses have noncombustible roofing and combustible (wood) siding. There is one road through the community, Kahekili Highway, which is greater than 24 feet in width with shoulders. Houses along Kahekili Highway have little to no slope. However, within the Refuge, there is a gently rising slope from the ocean to the Highway. The Refuge contains sand dunes, which reach heights of 200 feet, and run the length of the Refuge. On the makai side of the highway, the slope increases with the steep hills of the West Maui Mountains.

The community is connected to the county water system with fire hydrants spaced within 1,000-feet of each other on paved roads. There is a 2-1/2 inch water main across from Waihe'e Elementary School. MCLT recently installed a 2-inch above ground water line from Kahekili Highway to the old Dairy site. Water is accessible via a hose attachment at the caretaker's house. Road signage is metal and reflectorized, however house numbers vary in size and color. Utilities are above ground. There is an active community association in Waihe'e.

Given its rural location, there is a great deal of wildland urban interface in Waihe'e. The area receives an average of 20 inches of rainfall annually with winds from the northeast averaging 10 – 17 mph. The entire Refuge is protected wetlands and lowlands. Vegetation includes Haole Koa, Kiawe, and

Ironwood trees, as well as Guinea grass and other grasses. Homes throughout Waihe'e contain mature vegetation, including trees, shrubs, and plants. The wildlands in the Refuge provide critical habitat for a number of endangered plant and animal species. There has been recent development in the area with the construction of Waiehu Kou IV to the east and additional homes being built in Yagi subdivision.

A Hawaii Wildland Fire Risk and Hazard Severity Assessment based on the Assessment in Appendix A of NFPA 1144, *Standard for Protection of Life and Property from Wildland Fire*, was conducted by the Hawaii Firewise Coordinator, Maui County Fire Department personnel, and MCLT staff on August 17, 2006 to identify the level of wildland fire risk of Waihe'e.

Using a pre-established point system, the Wildland Fire Risk and Hazard Severity Assessment is a tool used to determine the level of wildfire risk to a home or community. Points are given regarding overall terrain and location, road width, local area fire history, prevailing winds and seasonal weather, geographical contours, native vegetation, water availability, location of fire suppression resources, as well as the combustibility of building materials, including roof, siding, and attached items, such as decks, fencing, or an additional unit. The combined points in all these categories are added together and the overall risk is determined by whether the score falls in the low-, medium-, high-, or extreme-risk point range. Given the ignitability of individual structures and preponderance of fuels in close proximity to structures Waihe'e scored within the high-risk score range in the Assessment, a copy of which can be found in Appendix A.

Community Assets at Risk:

Assets at risk are valued resources that can be damaged or destroyed by wildfire. In addition to ensuring firefighter safety and protecting residents and visitors, the following assets warrant consideration in pre-incident planning: watersheds; forest reserves; wildlife; rare and endangered plants and animals; scenic, cultural, and archeological sites; and structures.

The following were identified as valued resources within the Waihe'e community that would be adversely affected by wildfire.

Commercial resources:
Waihe'e Elementary School, St. Ann Church, Waihe'e Protestant Church.

Historical resources:
Structures within the Waihe'e Coastal Dunes and Wetlands Refuge that are more than 50 years old. The State of Hawaii classifies buildings over 50 years old as historical structures in accordance with National Park Service Administrative Rule Chapter 6E.

Natural Resources:
Waihe'e Coastal Dunes and Wetlands Refuge, including the archeological sites, fishponds, and heiau contained within, as well as the native Hawaiian endangered plants and animals.

This Plan focuses on structures within the wildland urban interface in Waihe'e. Overgrown vegetation, structures with combustible building materials, and limited ingress into the Refuge all contribute to unsafe fire conditions.

The mix of flammable vegetation, including Kiawe trees is a concern since firebrands, consisting of burning embers and small burning matter, can travel up to a mile when strong winds are present. Kiawe trees are known carriers of firebrands. The grasses found within the Refuge are high-intensity fuels, which burn quickly and can rapidly spread fire to other fuels, such as Kiawe. The high fire hazard in this

area is demonstrated by a history of wildfires in the region. Open lands filled with a mixture of flammable grasses and Kiawe trees border Waihe'e. While most homes have fire resistant roofing, a number of homes in Waihe'e have wood siding and lanais (decks), further enhancing the fire problem. House lots vary greatly in the degree of defensible space around the homes from little to no defensible space to more than 30 feet of clearance. Driveways tend to be less than 100 feet and most driveways are 12 feet wide with 15 feet of vertical clearance for emergency vehicle access. However, most driveways in the community do not have turnaround access for emergency vehicles. Some houses are built on concrete slab while others are of post and pier construction, with the houses about two feet off the ground.

Green waste dumping is an issue in Waihe'e, especially along the homes on the makai side of Kahekili Highway. A one-lane dirt road fuel break runs between the makai side homes and the Refuge. Residents will often carry their green waste to the Refuge and in fact, one resident was seen with a wheelbarrow full of green waste dumping the material on the Refuge while the wildfire hazard assessment was being conducted. Such dumping creates a fire hazard. Were a fire to break out in this area as it did in September 2006, the dried out piles of green waste would serve as additional fire fuel.

Green waste dumping is an issue in the Refuge. A Waihe'e resident was seen carting this wheelbarrow full of green waste from his home to the Refuge while the wildfire hazard assessment was being conducted.

Community Concerns for Waihe'e:

MCLT commissioned the CWPP because the organization is concerned about wildfire negatively impacting the Refuge and the community. Wildfires can potentially be caused by homeless people in the area; fisherman who walk onto the property; fires started by visitors; and the ignition potential of fire fuel load in Field 9. Multiple meetings with community members and fire agencies specifically on the CWPP process held in August 2006 identified the most pressing fire concerns in Waihe'e. These include in order of priority:

1. The need for a secondary access road on mauka side of Kahekili Highway for emergency egress in case of wildfire;
2. Green waste dumping;
3. Fuel load in Refuge areas closest to area homes;
4. Reduction of fuel load around individual properties, including structures on the Refuge;
5. Inaccessibility of Kalepa Gulch Access Road as it pertains to firefighting personnel; and
6. Public awareness of wildfire threat.

Recommended Action for Waihe'e:

Multiple meetings with community members and fire agencies specifically on the CWPP process in August 2006 identified the most pressing fire concerns in Waihe'e. These include in order of priority:

1. Creation and maintenance of mauka secondary access road for emergency evacuation purposes.
2. Green waste dumping education and creation of community compost pile for local residents;
3. Reduction of fuel load in Field 9 and other interface areas closest to area homes;
4. Creation of defensible space around community homes, as well as around structures on Refuge;
5. Improvement and maintenance of Kalepa Gulch Access Road for firefighting apparatus access;
6. Continued public education of wildfire threat; and
7. Tear down and removal of dilapidated doctor's house in old Waihe'e Dairy section of Refuge on property as it is a fire hazard.

Based on the results of the community wildfire hazard risk assessment, the following mitigation measures were identified to reduce wildfire risk in Waihe'e. Because the Waihe'e Coastal Dunes and Wetlands Refuge is recognized as the primary source for wildland fires, the majority of these recommendations are based on this property. The community and fire agencies collaborated to prioritize mitigation efforts in the following order of importance:

1. Creation of secondary emergency access road;
2. Reduction of green waste dumping and creation of community compost pile;
3. Reduction of fire fuel load in Field 9 and other interface areas;
4. Creation of defensible space around community homes, as well as around structures on Refuge;
5. Improvement of Kalepa Gulch Access Road as well as the Dune Access Road off Kahekili Highway;
6. Continued fire prevention education and outreach; and
7. Removal of unrepairable structures on Refuge that pose a fire hazard.

Based on the results of the community wildfire hazard risk assessment, priority ratings have been selected for Waihe'e and areas of community importance. The community recommendations for the type and method of treatment for the surrounding vegetation are listed in the following table.

Community, structure or area at risk	Type of Treatment	Method of Treatment	Overall Priority
Waihe'e Village	Mechanical	Creation of secondary emergency access road	Very High
Waihe'e Village / Refuge	Mechanical / Chemical / Hand Labor / Public Education	Reduction of green waste dumping on MCLT property by area residents	Very High
Waihe'e Village / Refuge	Mechanical / Chemical / Hand Labor	Reduction of fuel load in Field 9 and interface areas	High
Waihe'e Village / Refuge	Mechanical / Chemical / Hand Labor	Creation of defensible space around community homes, as well as structures on Refuge	High
Refuge	Mechanical / Chemical / Hand Labor	Improvement of Kalepa Gulch Access Road and Dune Access Road off Kahekili Highway	High
Waihe'e Village	Public Education and Outreach	Continued fire prevention education and outreach	High
Refuge	Mechanical	Removal of unrepairable structures on Refuge that pose a fire hazard.	High

Community, federal agencies, and private landowners surrounding Waihe'e were invited to submit projects that provide protection and reduce wildland fire risk. The following table displays a list of projects based on recommendations from community and fire-related organizations. MCLT intends to assess the progress annually and invite agencies and landowners to submit projects that provide community protection.

Community, structure or area at risk	Project	Agency	Funding Needs	Timetable	Community Recommendation
Waihe'e Village	Creation of secondary emergency ingress/egress road	Maui County/ Others	Cooperative Funding	2007-2008	Yes
Waihe'e Village / Refuge	Reduction of green waste dumping on MCLT property by area residents	Private	Cooperative Funding (estimated costs $14,000)	2007-2008	Yes
Waihe'e Village / Refuge	Reduction of fuel load in Field 9 and interface areas	Multiple agencies	Cooperative Funding (estimated costs $14,000)	2007-2008	Yes
Waihe'e Village / Refuge	Creation of defensible space around community homes, as well as structures on Refuge	Private	Cooperative Funding	2007-2008	Yes
Refuge	Improvement of Kalepa Gulch Access Road, Dune Access Road	MCLT	Cooperative Funding (estimated costs $15,000)	2007-2008	Yes
Waihe'e Village	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2007- 2008	Yes

Secondary emergency access road

With only one road running through the community, a secondary emergency access road is needed should Kahekili Highway be compromised during a wildfire or other disaster. According to long time area residents, there is an old cane road that runs on the mauka side of Kahekili Highway towards Waiehu that could be improved and utilized as an emergency evacuation route. MCLT does not own the land mauka of Kahekili Highway and the creation of such an access road is up to the discretion of the landowner.

In order to remain effective, the secondary emergency access road must also be maintained on a regular basis. Funding should be secured to ensure that the road is maintained (cleared of overgrown vegetation) at least twice a year. The organization that is determined to be responsible for the access road may want to consider the purchase of a chipper to remove vegetation on the access road.

Reduction of green waste dumping
Green waste dumping is a serious issue because the accumulated material can increase the risk of wildfire, as well as a wildfire's potential growth by providing fire fuel hidden from view. Many residents may be unaware that they are contributing to their community's fire risk by dumping green waste on the Refuge. An education campaign to increase the awareness of this fire risk, as well as the creation of a community compost pile where residents can take their green waste material will go a long way to resolving this issue. For examples of how communities in other states have developed effective green waste removal projects, please go to www.firewise.org.

Reduction of fuel load in Field 9 and other interface areas
Reducing vegetation in Field 9 and other interface areas in the Refuge will reduce the area's wildfire risk. MCLT has taken the initiative in this regard by applying for and receiving a grant to cover the cost of mowing the 26-acre Field 9. Mowing occurred in October 2006. Because Field 9 is one part of the Refuge that is closest to area homes along Kahekili Highway, it is imperative that this fuel load reduction be maintained on a regular basis. The use of grazing animals is a cost effective and efficient method of fuel load reduction used by other communities facing similar issues. MCLT may wish to consider the use of such grazing animals for fire fuel load reduction of Field 9.

Volunteers and MCLT staff have also cleared an additional 27 acres of brush in the wetlands area of the Refuge. MCLT plans to replant indigenous plant species in the recently cleared areas.

Creation of defensible space around community homes and Refuge structures
Creating defensible space around a home is a key component of being Firewise and greatly reduces the ignition potential of a house in the event of a wildfire. The section below on reducing structural ignitability details how homeowners can create defensible space.

Improvement of Kalepa Gulch Access Road
A potential fire in the lower area of the Refuge (near the homeless camp) would grow rapidly because Maui Fire Department would be unable to get apparatus onto the Refuge due to the inaccessibility of Kalepa Gulch Access Road, which is often washed out. The road should be improved and maintained so that it is accessible by Maui Fire Department apparatus and personnel. The Dune Access Road off Kahekili Highway can easily become overgrown with tall grasses, making the road hard to travail. Because the gate to this road and the access road at the dairy, on Kalepa Gulch Access Road, are always locked MCLT should also ensure on a regular basis (at least semi-annually) that Fire Department personnel on all shifts at the nearest fire station have copies of keys to the gates.

Continued fire prevention education
Fire agencies in Maui County have partnered with Firewise to promote community wildfire awareness in wildland urban interface communities. The objective is to increase overall awareness of fire hazard issues that affect residents within the wildland urban interface. While a Firewise coordinator has provided much needed outreach in the community, funding for such a position has been intermittent. Stable funding for an outreach coordinator should be developed to ensure consistent fire prevention outreach. With a new subdivision being built adjacent to the Refuge, it is crucial to continue a comprehensive fire education and outreach campaign to all area residents, including the Department of Hawaiian Home Lands. This program should consist of the following:

1. Continued development and coordination of community meetings and outreach events. Coordination with other community groups, such as the Waihe'e Community Association, local disaster preparedness committee and civic organizations, to provide wildland fire safety information on defensible space and Firewise building materials. Provide outreach at community events.

2. Develop educational materials specific to community fire threat and continue outreach in local publications. Continued outreach is needed.

3. Development of fire prevention outreach materials, including TV and radio public service announcements, posters, and handouts.

Removal of unrepairable structures on Refuge that pose a fire hazard.
A dilapidated structure known as the doctor's house in the Dairy portion of the Refuge is slated to be torn down, however no date for demolition has been set. Given fuel load in the area and the fact that the house was constructed of combustible material, in its current condition the house is a potential fire hazard. It's recommended that the house be scheduled for demolition as soon as possible, (within MCLT's budget and schedule) and that all building debris be removed from the site.

Reduce Structural Ignitability:

As part of its fire prevention education efforts, Firewise provides recommendations to reduce structural ignitability. Individuals and the Waihe'e community can reduce structural ignitability throughout the community by taking the following measures.

• Create a buffer zone of defensible space around a property of at least 30 feet or to the property line if the house has less than 30 feet of yard. Remove flammable vegetation and combustible growth within 30 feet of the house.

• Prune tree limbs 6 – 10 feet above the ground.

• Space trees and shrubs ten feet apart in the yard.

• Make sure that plants closest to the house are low-lying. And whenever possible use native Hawaiian or succulent plants.

• Routinely remove dead leaves and other organic matter from the yard.

• Sweep and/or clean gutters, eaves, and roofs regularly to prevent the build-up of leaves and other matter.

• Use fire-resistant building materials for the roof, siding, and decks, such as metal, stucco, tile, brick, and cement.

Appendix A:

Hawaii Firewise Wildland Fire Risk
& Hazard Severity Assessment Form

Assign a value to the most appropriate element in each category and add the point totals. This assessment was adapted from Appendix A of NFPA 1144, Standard for Protection of Life and Property from Wildland Fire.

When assessing a home or community, look at the overall terrain and site location, local area fire history, prevailing winds and seasonal weather (keep Kona wind conditions in mind), property contours, native vegetation, irrigation requirements, as well as the combustibility of roof, siding, and attached items, such as lanai, fencing, or an ohana unit.

Area Assessed: Waihee, Maui Hawaii

Assessment Conducted by: Denise Laitinen, Firewise Coordinator, B. C. Jeff Shaffer, Maui Fire Department

Element **A. Means of Access**	**Possible Points**	**Points Given**	**NOTES**
1. Ingress and egress			
a. Two or more roads in/out	0	0	In & out of the Reserve
b. One road in/out	7		
2. Road width			
a. Greater than 24 ft.	0		
b. Greater than 20 ft. but less than 24 ft.	2	2	
c. Less than 20 ft.	4		
3. Road condition			
a. Surfaced road, grade less than 5%	0		
b. Surfaced road, grade greater than 5%	2		
c. Non-surfaced road, grade less than 5%	2	2	
d. Non-surfaced road, grade greater than 5%	5		
4. Fire service access to community or home			
a. Driveway is less than 300 ft. with turnaround space for fire trucks	0		
b. Greater than 300 ft. with turnaround	2		
c. Less than 300 ft. with no turnaround	4	4	
d. Greater than 300 ft. with no turnaround	5		
5. Driveway is at least 12 ft. wide with 15-foot vertical clearance	0	0	
a. Driveway is ‹12 ft. wide with ‹15-ft. clearance	3		
6. Street signs			
a. Present (4 inches in size and reflectorized)	0		
b. Not present	5	5	Refuge roads have no signage
B. Vegetation			
1. Type of vegetation within 100 ft. of structure or to property line, whichever is closer			
a. Light: grasses less than 12 inches high	5		
b. Medium: light brush and small trees; guinea and fountain grass (high intensity fuel)	10	10	
c. Heavy: dense brush, timber, hardwoods	20		
d. Slash: timber harvesting or landscape residue, compost piles, etc	25		
2. Defensible space around the home/community			
Fuelbreaks			

a. Trees are spaced 10 ft. apart, low flammability plants are low lying and carefully spaced. Ladder fuels have been removed.	0		
b. Fuel breaks exist: i.e. driveways, pools, gravel walkways, lawns within 30 ft. of structure	0		
c. Area around structure has no fuel breaks	3	3	Some do, some do not
Fuel Treatment (has homeowner created defensible space?)			
a. Vegetation 100 ft.+ from structure or to property line	1		
b. Vegetation 71-100 ft. from structure	3		
c. Vegetation 30-70 ft. from structure	5		
d. Vegetation 0-30 ft. from structure	7	7	
e. Vegetation has not been maintained	10		
C. Topography within 300 feet of structure			
1. Slope 0-9%	1	1	
2. Slope 10%-20%	4		
3. Slope 21%-30%	7		
4. Slope 31%-40%	8		
5. Slope greater than 41%	10		
D. Additional rating factors that may apply (highest total points = 20)			
1. Area has history of fire occurrence (arson, ag burning)	0-5	1	
2. Area subject to strong dry, winds	0-5	5	
3. Separation of adjacent structures that may contribute to fire spread (i.e. ohana unit within 30 ft.)	0-5	1	
4. Topographic features that adversely affect wildland fire behavior	0-5	2	
E. Roofing Assembly			
1. Class A roof (asphalt shingle, clay tile, metal)	0	0	
2. Class B roof (treated wood shake)	3		
3. Class C roof (wood shake)	15		
4. Nonrated or Debris on roof (leaves, needles, etc.)	25		
F. Building construction			
1. Materials (predominate)			
a. Fire-resistive siding, eaves, & lanai and/or fencing (stucco, masonry, stone)	0		
b. Fire resistive siding; combustible lanai and/or fencing	5		
c. Combustible siding, lanai and/or fencing	10	10	
2. Windows, skylights			
a. Window panes are small in size, double paned or tempered glass	0		
b. Windows are single pane, and/or large in size	3	3	
c. Skylights: tempered glass with metal framing	0		
d. Skylights: plastic with vinyl framing	2		
3. Building setback relative to 30% slope			
a. Structure is more than 30 ft. away from slope	1	1	
b. Structure is less than 30 ft. from slope	5		
4. Eaves, soffits, exposed openings into structure			
a. Wire mesh no bigger than 1/8" on vents, chimneys, exposed areas under house	0		

b. Vents, chimneys, and/or space under house is large enough for embers to enter	3	3	
G. Available Fire Protection			
1. Water Source Available			
a. Pressurized water source availability			
Hydrants (500 gpm) are ‹1,000 feet apart	0	0	
Hydrants (250 gpm) are 1,000 ft. apart	1		
b. Non-pressurized water source availability (catchment)			
More than 250 gpm continuous for 2 hours	3	3	
Less than 250 gpm continuous for 2 hours	5		
c. Water unavailable	10		
3. Organized Response Resources			
a. Fire station is 5 or less miles from structure	1	1	
b. Fire station is more than 5 miles from structure	3		
H. Placement of Gas and Electric Utilities			
1. Both utilities are underground	0		
2. One utility is underground, one aboveground	3		
3. Both are above ground	5	5	
I. Structure Triage: In the event of a wildfire, this structure (check the one that most applies)			
1. Needs little or no protection			
2. Needs some protection			
3. Can not be saved			

Total points: **69**

Totals for Home or Subdivision: (total for all above points)

Hazard Assessment: **Total Points:**

1. Low Hazard	**0-37**	**3. High Hazard**	**68-110**
2. Moderate Hazard	**38-67**	**4. Extreme Hazard**	**111+**

Appendix B:

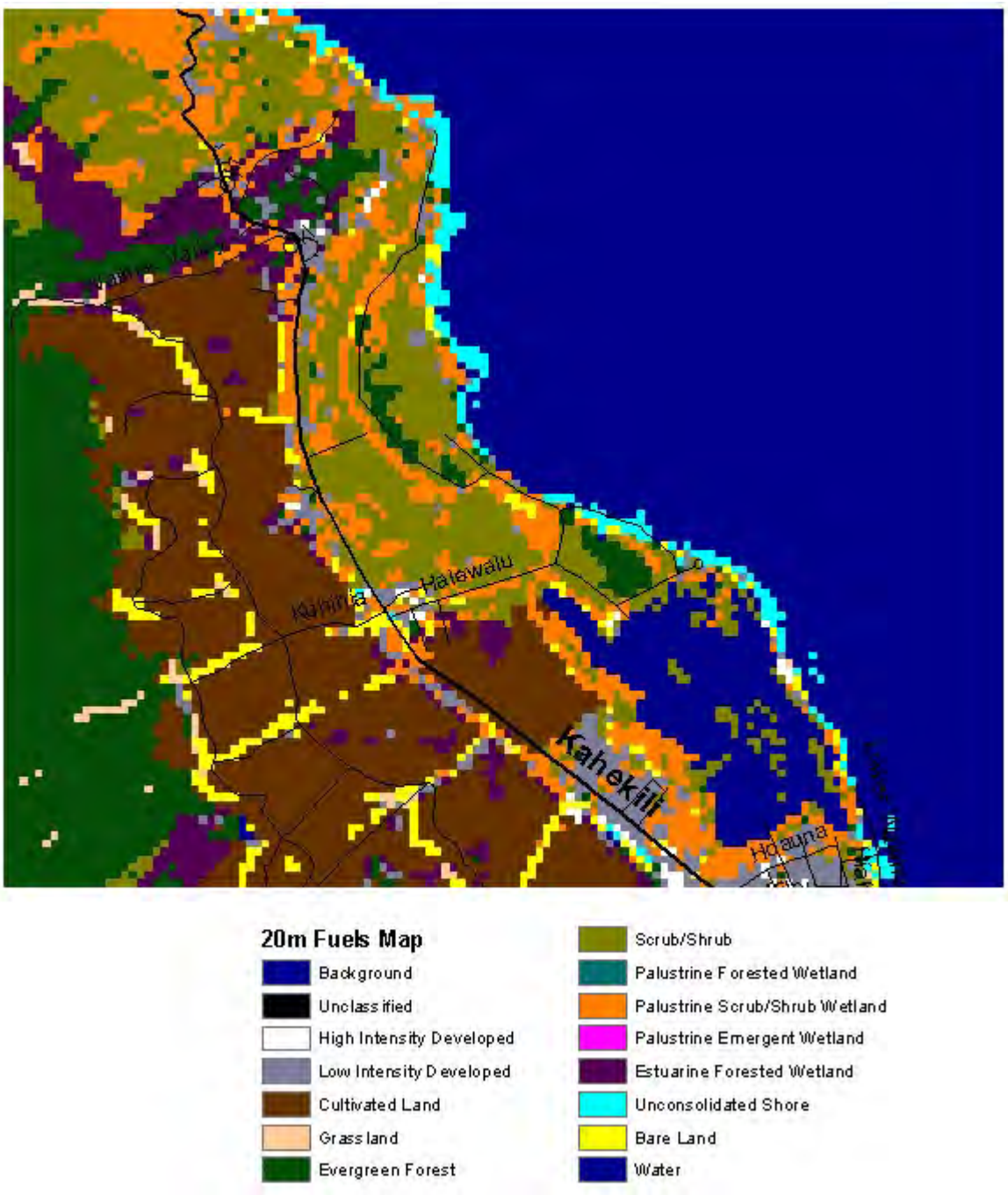
Updated Project List 2009-2010

Agencies and private landowners surrounding Waihe'e were invited to submit projects that provide wildfire protection and reduce risk. The following table displays a list of recommended projects.

Community, structure or area at risk	Project	Agency / landowner	Funding Needs	Timetable	Community recommendation
Waihe'e Village	Creation / maintenance of secondary emergency access road	MCLT/ Maui County/ Others	Cooperative Funding	2009-2010	Yes
Waihe'e Village / Refuge	Reduction of green waste dumping on MCLT property by area residents	Private	Cooperative Funding (estimated costs $1,200)	2009-2010	Yes
Waihe'e Village / Refuge	Reduction of fuel load in Field 9 and interface areas	Multiple agencies	Cooperative Funding (estimated costs $2,000)	2009-2010	Yes
Waihe'e Village / Refuge	Creation of defensible space around community homes, as well as structures on Refuge	Private	Cooperative Funding	2009-2010	Yes
Refuge	Improvement of Kalepa Gulch Access Road and Dune Access Road	MCLT	Cooperative Funding (estimated maintenance costs $5,000)	2009-2010	Yes
Waihe'e Village	Continued fire prevention education and outreach	Multiple agencies	Cooperative Funding	2009-2010	Yes

Appendix C:

Waihe'e Fire Fuels Map



Map courtesy of Pacific Disaster Center