



Affected Environment



Top left: Navigators' Heiau, N. Kohala; jeep trail, N. Kohala, bottom: old railroad alignment, N. Kohala. NPS photos

Chapter 3: The Affected Environment

Introduction

NATURAL SETTING

The following sections under Natural Setting describe aspects of the natural setting of the Ala Kahakai NHT that have a bearing on the experience of the trail but are not themselves affected by trail use: geologic processes, soils, climate, natural soundscape, air quality, and water resources (other than wetlands). They have potential for important effects on the trail user and are addressed in the alternatives, but are not impact topics addressed in chapter 4.

Geologic Processes

The Island of Hawai'i lies at the southeastern end of the Hawaiian archipelago. It is 76 miles wide, 93 miles long, and has an area of 4,030 square miles. It was built by the combined action of five volcanoes: Kohala (extinct), Mauna Kea (dormant, but potentially active), Hualālai (dormant, but potentially active), Mauna Loa (active), and Kīlauea (active, with potential for activity to change locations). The island's highest point is the top of Mauna Kea at 13,734 feet (NPS, 1992a).

Hawai'i has "shield" volcanoes that build up gradually with wide-based gentle slopes, rather than by rapid explosion. Hence, tapering slopes drop down off the summits of Mauna Kea and Mauna Loa on Hawai'i Island. Kīlauea, its most active volcano, has been spurting lava since 1983 with only a brief respite in early 1997. By 2005, it had added 570 acres to the island. More recent flows covered portions of the *ala loa* within Hawaii Volcanoes National Park, including Waha'ula Heiau at the terminus of the Ala Kahakai NHT. Older flows covered portions of the prehistoric trail along the west side of the island, and more recent, historic trails have sometimes been built over these flows.

Two types of lava pour from the volcanoes. Their Hawaiian names are used throughout the world: pāhoehoe and 'a'ā. Pāhoehoe is smooth, flowing in flat billows that wrinkle when the liquid flow beneath the cooling crust drags it forward. This smooth lava is easy to walk on. Trails are not usually constructed upon it, but footpaths are often worn into it. The fiery stream forms tubes under the crust, sometimes large enough to walk through. The ancient Hawaiians often used these tubes as burial chambers and shelter caves. The tubes also provide habitat for native invertebrates. 'A'ā lava is rough and knife-sharp, cast up in jagged rocks and boulders with solid interiors. It can cut through the soles of shoes. Prehistoric and historic trail builders used special trail construction techniques over this lava type.

Lava is the source of Hawai'i's black, red, and green sand beaches. Black sand is formed when an 'a'ā flow enters the sea causing explosions which may form clouds of liquid lava drops. These drops chill on contact with the water or air and become volcanic glass sand. Ocean currents deposit the sand in a sheltered indentation in the shoreline to make a beach. Erosion of littoral (shoreline) cones comprised of black or red volcanic matter often produces black or red sand beaches at the base of the cone. Green sand beaches result from the separation through erosion of grains of olivine from certain 'a'ā lava, which are then deposited on beaches. Wave action deposits large concentrations of the olivines on top of the other sands near the waterline (Clark: 71-72). The Black Sand Beach and Green Sand Beach in Ka'ū are on the Ala Kahakai NHT.

White sand is derived from calcareous skeletal material of corals and other invertebrate animals that live in shallow marine waters. Brown or gray sands are generally the result of the erosion or weathering of land (Clark: 71).

The Ala Kahakai NHT may be aligned on pathways near the water's edge, on inland pathways parallel to the shoreline, on sandy or pebbly beaches, or on cliff edges of varying heights above the water. From 'Upolu Point to South Point, approximately 20 percent of the shore is lined with over 20-foot high cliffs, 52 percent with five to 20-foot cliffs, and 25 percent is low-lying between zero and five feet in height along the shoreline. Of the low-lying shoreline, 12 percent is sandy, eight percent is pebbles (*'ili'ili*) or coral, and 55 percent is boulders or other large stones. From South Point to the eastern boundary of Hawai'i Volcanoes NP, approximately 36 percent is lined with over 20-foot high cliffs, 39 percent with five to 20-foot cliffs, and 25 percent is low-lying. Of the low-lying areas, there are only three small sand beaches in this 67-mile trail section (County of Hawaii, 1979).

The coast of Ka'u and South Kona varies in composition and height. Sections are formed of soil, other areas are pāhoehoe benches or 'a'ā cliffs of varying height. The cliffs are especially high where the major sets of faults are close to and parallel to the sea. Several cones are present along the shoreline and some have adjacent black sand beaches.

The low coastline of North Kona extends north from the end of the fault-controlled sea cliff of Kealakekua Bay to Kawaihae Harbor. The shoreline is highly irregular and has sea cliffs a few feet high. There are also pocket beaches found along bays between adjacent flows. The best beaches on the island are along the coast between Kailua-Kona and Kawaihae. The west and north slopes of the Kohala volcano from north of Kawaihae to Pololū Valley are marked by sea cliffs of moderate to low height. The coastal cliffs are interrupted by pockets of boulder beaches at the mouths of the intermittent gullies and small streams (County of Hawaii, 2001).

Tsunami and seasonal high waves have eroded parts of the western shoreline including sections



Kealakekua Bay, S. Kona, NPS photo

of the ancient *ala loa*. Portions of the sea edge of the Kona coast are sinking at a rate of about one-half foot to one foot per century (NPS, 1994). During the October 2006 earthquake, portions of the *pali* at Kealakekua Bay gave way and may have affected the trail.

Soils

The parent material for soil formation along the Ala Kahakai NHT is predominantly of recent volcanic origin. Different microclimates have produced a diversity of soil types, but red or brownish-red soils are widespread. Along the Ala Kahakai NHT some soils derived from coral occur (Knapp).

Climate

Generally, Hawai'i has two seasons: "summer," roughly between May and October when the sun is more nearly overhead, the weather warmer and drier, and the trade winds most persistent; and "winter," between about October and April, when the sun is in the south, the weather cooler, and the trade winds more often interrupted by other winds and by intervals of widespread clouds and rain (University of Hawaii).

Typical of all the islands, northeast winds (northeast trades) predominate. They bring

frequent rain showers to the northern and eastern coasts that are lined with sharp cliffs and feature waterfalls, lush rainforests, and heavy crashing surf. The west and southwest shores where the Ala Kahakai NHT is aligned are sunny, warm, and dry with pocket sand beaches and relatively quiet surf, although frequent high surf can occur in winter. West and southwest winds on these leeward “*kona*” or western and southern shores are infrequent, but are often associated with high winds with velocities of 30 to 40 miles per hour. The lowland leeward areas obtain their rainfall chiefly from a few winter storms, and only negligibly from tradewind showers. Their rainfall is strongly seasonal, their summers arid. Major winter storms bring with them very large storm waves that cause run-up on the shoreline and have removed some traces of the *ala loa*. Hurricanes are relatively uncommon. Since 1950, five hurricanes or tropical storms have caused damage on various islands in Hawai‘i, but only Hurricane Estelle in 1986 produced very high surf on the island of Hawai‘i (Businger, 1998).

Hawai‘i is within the tropics and throughout the year has relatively uniform day length, received solar energy, and temperature. Because of these attributes, the trail corridor receives at least two-thirds as much solar energy in the winter as the summer. On a clear day, nearly three-fourths of the incident solar energy penetrates to sea level. Along several substantial sections of the Ala Kahakai NHT, the user could be subjected to direct sun the year round and would need to be prepared against heat, sunburn, and dehydration.

Annual rainfall along the western and southern coastal edge of Hawai‘i Island along the Ala Kahakai NHT varies from less than 10 inches to nearly 60 inches. The wettest area along the trail is within Hawai‘i Volcanoes NP in the Puna District at the eastern park boundary at Kalapana with up to 60 inches, followed by the South Kona coast with over 40 inches, and then ‘Upolu point and the shoreline in the Ka‘ū District from Ka‘alela to Hawai‘i Volcanoes NP with nearly 40

inches. The driest areas are the South Kohala District with less than 10 inches and the North Kona District with less than 20 inches. The year-round average ocean temperature is nearly constant, fluctuating between 75 and 82 degrees F (24-28 degrees C).

Natural Soundscape

The natural soundscape of the Ala Kahakai NHT includes the entire symphony of sounds that might be heard in the coastal zone in areas where natural sounds can predominate: quiet, the crash of waves breaking on the shore, the sea heard in lava tubes, the buzz of insects, the calls of birds, the cries of seals hauled out on beaches, and the rustle of the wind blowing in the grass or through trees.

Of the four national parks along the route, only Hawai‘i Volcanoes NP has developed a draft soundscape plan identifying acoustical zones. Two of these zones would be found along the Ala Kahakai NHT within the park, the shoreline and the coastal zone. At the shoreline, sounds of surf and wave action dominate, along with shorebirds and seabirds, and strong trade winds blowing across tall coastal bluffs and low shoreline vegetation. In the coastal lowlands sounds of strong trade winds predominate, especially with uplift at the tops of the *pali* (cliff) (NPS 2004b).

Natural soundscapes have not been defined for the Ala Kahakai NHT. Trail landscapes outside of the national parks vary from highly urban along Ali‘i Drive to very rural in areas of South Kona, Ka‘ū, and Puna. Proximity to the coast, climate patterns, vegetation, and the presence or absence of birds and wildlife control different natural sound environments suggesting that there would be several acoustical zones along this 175-mile trail.

In many areas along the route, the natural soundscape is diminished or erased completely. Traffic and activity along Ali‘i Drive overwhelm natural sounds, even that of the waves breaking.

Aircraft fly over, land, and take off from Keahole International Airport, generating substantial noise. Commercial fishing boats, cruise ships, dive boats, and concentrations of anchored boats off the coast of Kailua and Kealahou also can generate audible noise on shore due to the use of engines, compressors and generators. Where there are concentrations of people, such as at beaches and campgrounds, the voices of people talking and shouting can be a noise source. In a very low ambient noise level natural soundscape, these noises sometimes can have greater impacts than in areas of higher ambient level soundscapes, such as urban environments.

Air Quality

According to the County of Hawaii, the island enjoys good air quality, but prevailing patterns of air circulation can cause local concentrations of pollutants. The diurnal land and sea breeze pattern prevailing on the leeward coast is self-contained within a limited area unlike the tradewinds on the windward coast which are part of a much larger circulation system (County of Hawaii, 1989). This leeward pattern can allow concentrations of pollutants to occur which exceed National Ambient Air Quality Standard (NAAQS).³⁸

The major source of pollution is Kīlauea Volcano. Currently the volcano emits between 1,000 and 2,000 tons of sulfur dioxide each day, as well as other gases, including hydrogen sulfide, hydrogen chloride, hydrogen fluoride, and trace metals like mercury (NPS, 2006). Monitoring of sulfur dioxide (SO₂) near Volcano House on the southern rim of Kīlauea in Hawai'i Volcanoes National Park reveals the NAAQS for SO₂, 24-hour average, were exceeded 110 times between 1991 and 2005. During the same period, the NAAQS 3-hour average for SO₂ was exceeded 84 times. Elevated SO₂ readings are directly related to wind direction, so that the standard is exceeded when the wind is blowing from where lava is vented toward Volcano House.

Concentrations of SO₂ and hydrochloric acid (HCL) were greatest near the ocean within the Ala Kahakai corridor where lava pours directly into the sea (NPS, 1995a).

Sulfur dioxide reacts chemically with sunlight, oxygen, dust particles, and water in the atmosphere to form a gas and aerosol known as volcanic smog or "vog." The vog not only creates a haze which obscures visibility, but it is very acidic, causing acid rain and affecting human health, cultural resources, and vegetation (NPS 2006). People downwind of the volcano have reported a wide range of problems, including reduced visibility, health complaints, and damage to crops (U.S. Geological Survey, 2000).

The trade winds blow the vog from its main source on the volcano to the southwest, where wind patterns send it up the island's Kona coast, affecting much of the trail corridor. There it becomes trapped by daytime (onshore) and nighttime (offshore) sea breezes. During "kona" winds from the west, much of the vog is concentrated on the eastern side of the island, away from the trail corridor.

Vog reduces visibility. Moisture in the air causes vog particles to enlarge, decreasing visibility still further. Vog may limit visibility for automobile drivers and air traffic. Although the volcano dominates total emissions, local human-influenced sources can also affect air quality and visibility, releasing nitrogen oxides, particulates, and other pollutants as well as sulfur dioxide (NPS 2006a). Notably, cement quarry operations directly across from the visitor contact station and the central part of Kaloko-Honokōhau NP. Construction of large developments such as the residential development at Kohanaiki or the proposed mixed use development of at Honokōhau Harbor have effects on air quality as well as power generating stations and automobiles.

³⁸ National Ambient Air Quality Standards for SO₂ (sulfur dioxide) are 0.03 parts per million (ppm) annual arithmetic mean, and 0.14 ppm maximum 24 hour concentration not to be exceeded more than once a year.

Water Resources

Fresh Water

Separated from the wet, windward side of the island by the Kohala Mountains, Mauna Kea, Hualālai, and Mauna Loa, the leeward side receives little rainfall on the shore. The route of the Ala Kahakai NHT is characterized by a lack of stream drainages and aridity. Any rainwater is quickly absorbed into the porous lava (NPS, 1992a), and large amounts of ground water percolate to the sea. Four or more miles inland of the shoreline, water is potable and wells supply domestic water to the coastal region. Closer to the shore, groundwater is brackish, but has been used successfully in recent years for golf course irrigation (Heard, 1990). Ancient Hawaiians captured fresh water that rises to the top of brackish water in anchialine pools and also collected pure, fresh water by placing gourds in caves (Chang, 1994).

Water Quality

In Hawai'i, water bodies are classified by their designated use according to the Hawaii Revised Statutes, Section 11, Chapter 54, which contains definitions and water quality standards for each water body type with respect to desired uses. Waters that do not meet the criteria for their designated uses are considered non-supportive and, if certain conditions are met, may be reported as impaired to the Environmental Protection Agency as required by the Clean Water Act, Section 303(d). Groundwater designations are being developed by the state of Hawai'i, but are not available at this time. Although Hawai'i does not officially recognize outstanding natural resource waters, national park managers have identified the wetlands, anchialine pools, and nearshore marine waters along the Ala Kahakai NHT as unique or pristine resources worthy of special attention. Inland surface waters of the trail corridor are designated "Class 2," which protects their use for recreational purposes, agricultural and industrial water supplies, and the support and propagation of aquatic life (NPS, 2005).



Honu'apo, Ka'ū, NPS photo

Except for the North Kohala district and Kawaihae and Honokōhau harbors, marine waters and marine bottom ecosystems occurring in the nearshore areas adjacent to the trail corridor are classed as "AA" and "I", respectively. These classifications prohibit pollution by humans and require maintenance of their natural wilderness character. The marine waters and benthic (occurring at the bottom of the ocean) ecosystems north of Kawaihae and within Kawaihae and Honokōhau harbors are classified as "A" and "II", respectively. These classifications protect their use for recreational and aesthetic enjoyment by regulating discharges and human alteration (NPS, 2005).

Water quality along this trail is degraded near urbanized areas such as Kawaihae harbor near Pu'ukoholā Heiau NHS, Honokōhau Harbor near Kaloko-Honokōhau NHP, and the along the developed coastline of Kailua-Kona. Adjacent to Pu'ukoholā Heiau NHS, Pelekane Bay and Kawaihae Harbor are listed as impaired water bodies due to sedimentation. Along the western coastline of the trail corridor, Spencer Park at 'Ōhai'ula Beach, Hāpuna Beach, Magic Sands Beach, and Kealakekua Bay, have demonstrated impairment for either turbidity, chlorophyll a, or both. Kailua Bay, south of Kaloko-Honokōhau, was listed for exceeding criteria for total

phosphorous (NPS, 2005). As of August 2004, the State of Hawaii, Department of Health, Environmental Planning Office has published their "Final 2004 List of Impaired Waters in Hawai'i" prepared under CWA Section 303(d).

A baseline water quality data inventory has been conducted for each of the four parks traversed by the Ala Kahakai NHT (NPS 1999, NPS 2000, NPS 2002). The Pelekane Bay watershed was identified in Hawaii's Unified Watershed Assessment as a Category I watershed, placing it as one of the state's watersheds in most urgent need of restoration. Soil erosion from the watershed has impaired water quality of Pelekane Bay. Data including physical and chemical parameters have been collected from four streams in the Pu'ukoholā Heiau NHP watershed by the US Geological Survey.

LAND USE

Land use is an aspect of the existing environment that will not be affected by the alternatives, but is important background information for trail administration and management. The state defines land use on each of the islands in four broad categories: agricultural, conservation, rural, and urban. Map 16 depicts these land use districts on the island of Hawai'i. The Hawaii County General Plan then allocates more specific uses within these districts. Map 17 depicts these allocations.

Land uses in the areas where the trail is aligned include unused open space, agriculture, recreation, residences, commercial, services (including resort hotels), social and cultural activities, transportation (airports and harbors), and private roads. Most of the more intensive uses are located along the coastal strip, creating a complex mix of land uses within the Ala Kahakai NHT corridor (County of Hawaii, 1999).

In North Kohala, land use along the trail corridor is mostly agricultural with some residential and recreational use. In South Kohala, land use is mainly comprised of resort developments, urban uses

associated with the town of Kawaihae, residential use, cultural and traditional uses, and recreational use in national, state, and county parks.

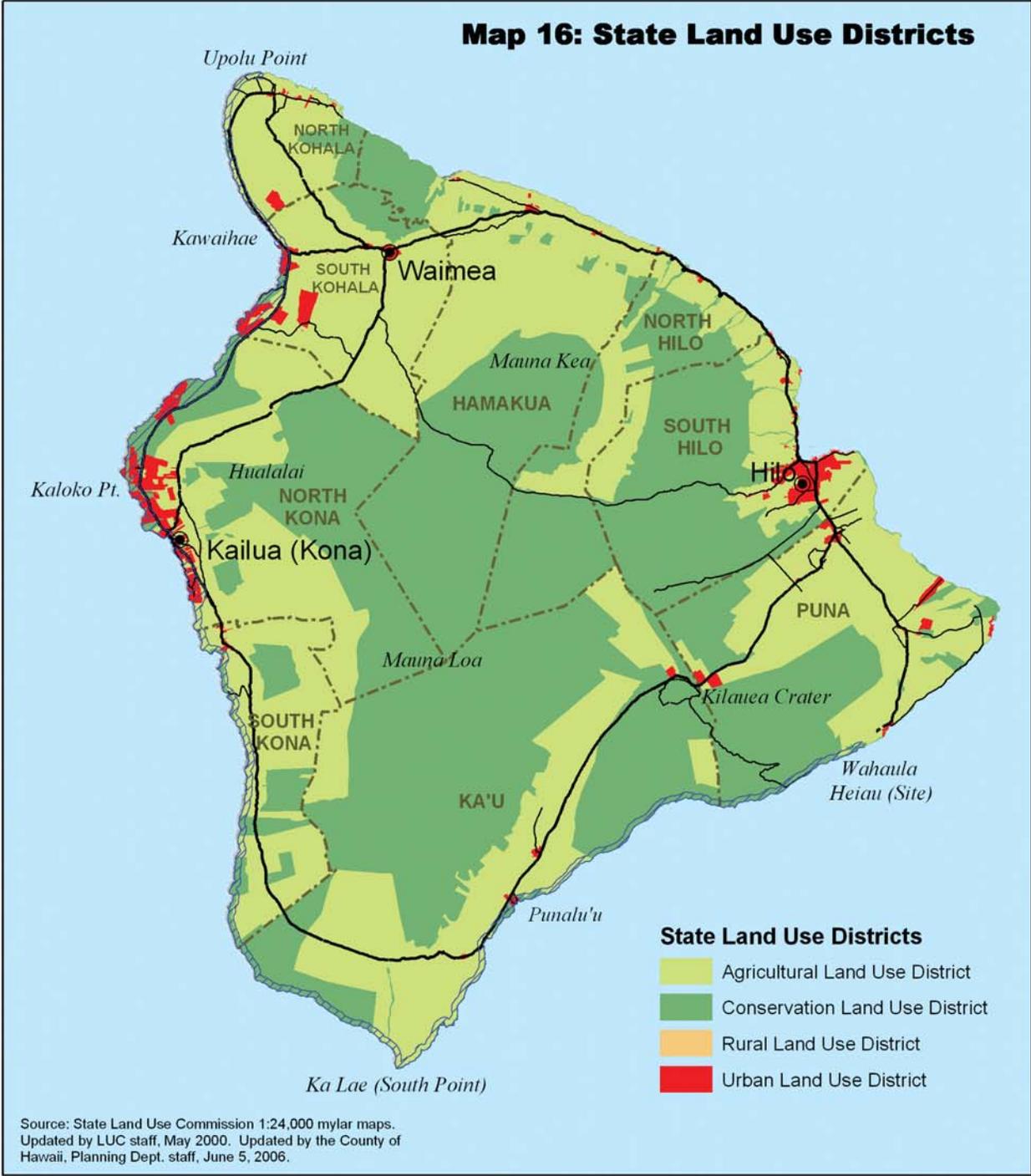
North Kona, the most highly developed and urbanized district, is a mix of resort, residential, manufacturing, warehousing, commercial, service, social and cultural, recreational, and transportation uses. This district contains Keahole Airport, the Natural Energy Laboratory of Hawai'i, Honokōhau Boat Harbor, the town of Kailua-Kona, several state and county beach parks, and one national park. Ali'i Drive, which follows the historic trail route from Kailua-Kona to Keauhou (about six miles) is paved and fully developed.

Land uses in South Kona and Ka'ū are mainly agricultural, open space, cultural and traditional uses, or recreational with some residential use and small communities such as Miloli'i and Punalu'u. These districts encompass two natural area reserves, a national park, a state park, and two county parks. The trail corridor in Puna is entirely within Hawai'i Volcanoes National Park.

Significant portions of the Ala Kahakai NHT corridor are zoned as Special Management Areas (SMAs) that provide overarching guidance through state law for managing coastal development. They are independently implemented by the county of Hawaii according to their own ordinances and rules. The SMA permit system regulates development within a geographically defined SMA extending from about 100 yards to several miles inland from the shoreline. According to a GIS query, the Ala Kahakai NHT corridor contains about 76,000 acres, of which approximately 30,000 acres are in SMAs. SMAs are shown on map 18.

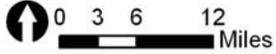
Land use zoning and permitted uses will not change as a result of any of the alternatives for management of the Ala Kahakai NHT, so it is not an impact topic discussed in chapter 4.

Map 16: State Land Use Districts



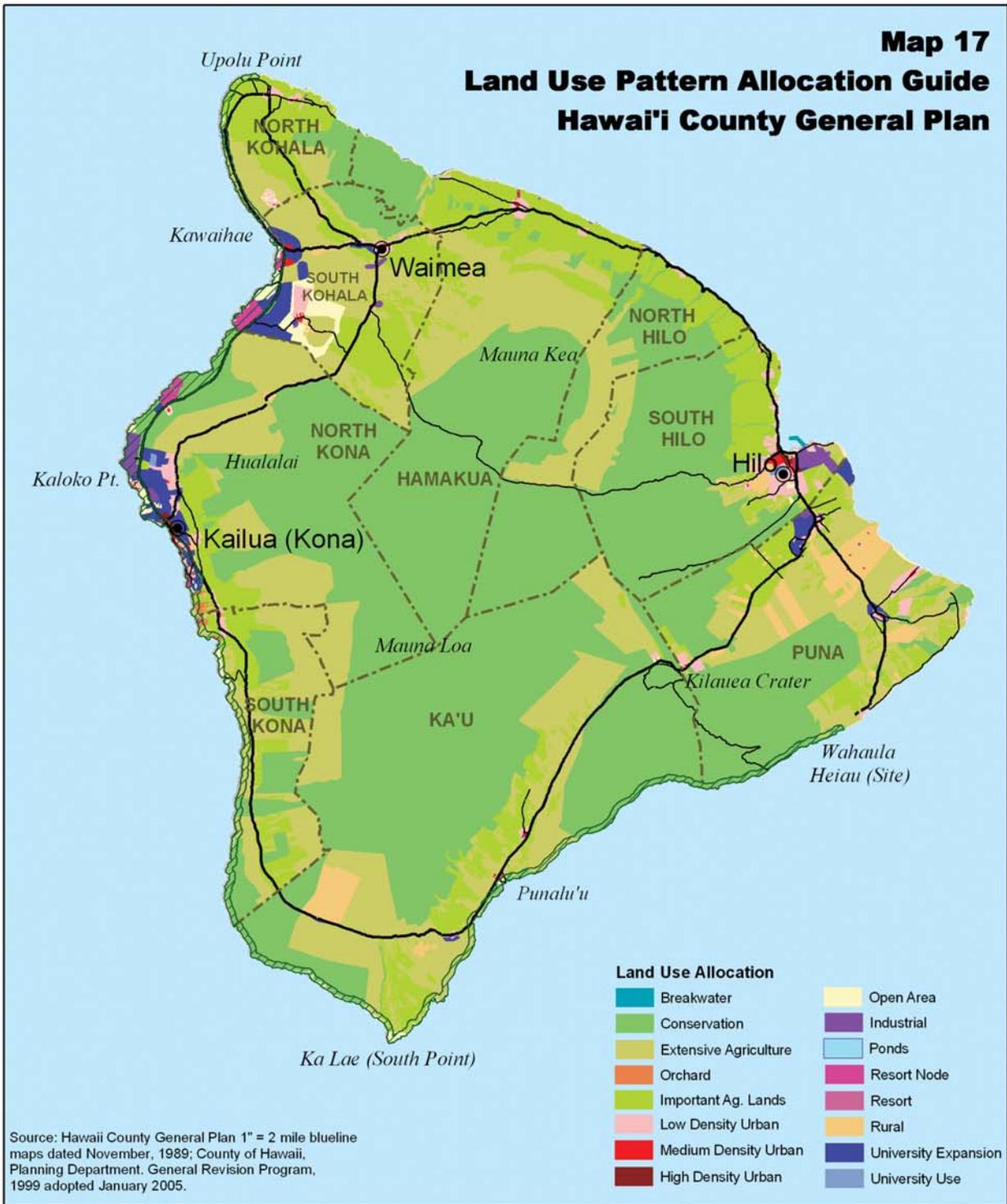
Legend

- Hawai'i Districts
- Ala Kahakai NHT Corridor
- Roads**
- Primary
- Secondary



Ala Kahakai National Historic Trail Working Map 12/21/06

Map 17 Land Use Pattern Allocation Guide Hawai'i County General Plan



Legend

- Hawai'i Districts
- Ala Kahakai NHT Corridor

Roads

- Primary
- Secondary



Ala Kahakai National Historic Trail Working Map 11/21/06

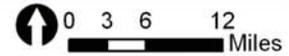
Map 18: Special Management Areas



Source: State of Hawaii, Office of Planning, digitized from 1998 blue-line maps.

Legend

- Coastal Zone Management Special Management Areas
- Hawai'i Districts
- Ala Kahakai NHT Corridor
- Roads**
- Primary
- Secondary



Ala Kahakai National Historic Trail Working Map 12/21/06

The Affected Environment

The natural environment is paramount to the vitality of the Native Hawaiian culture. The origins of geographic features, weather, plant and animal life, and mineral resources are deeply rooted in the Native Hawaiian cosmology. As evidenced in the *Kumulipo*, the Hawaiian creation chant, the Native Hawaiian view of the origin of species is akin to accepted modern understanding of evolution and is a significant part of both native spirituality as well as daily tasks.

Although the discussion below describes the trail environment in discrete categories of natural and cultural resources, for the Native Hawaiian these are intricately bound together. The spiritual world is not separate from the secular but everything has *mana* (spiritual power). The land itself is sacred. As an example, the mountains are of primary importance as being closest to the sky, the source of water and therefore of life. The upper reaches of the mountain were often *kapu* (off limits) except for specific types of gathering and only with the proper protocols. The Native Hawaiians revered these areas as *wao akua* (the forest of the gods), but also recognized their importance as the recharge areas of the watershed. Tampering with the forest in a harmful way would result in reduced water quality and a decline in the health of lowland areas. Even though most of the habitation and food production areas were located in the *kula* (upland) and *makai* (shoreline) reaches of the island, respect for the mountains was a part of the culture and a mandate of the gods.

CULTURAL RESOURCES AND VALUES

The cultural sites along a potential public trail in Hawai'i, such as the Ala Kahakai NHT, are especially vulnerable. Many are not readily apparent to the non-archeologist, and can be inadvertently damaged. Others can be looted. For that reason in a public document such as this, detailed listings of sites along the *ala loa* are not given. Examples of significant protected sites



Petroglyph, Kohanaiki, N. Kona, NPS photo

are summarized in table 3 (chapter 1) and described in Appendix C. They illustrate the range of significant sites available along the Ala Kahakai NHT. Map 3 shows the approximate locations of these sites.

The NPS *Cultural Resource Management Guideline* describes five categories of cultural resources: archeological resources, historic structures, cultural landscapes, ethnographic resources, museum objects. For this CMP, ethnographic resources, or those resources of significance to contemporary cultural groups, are included in all cultural resource types, and not singled out for separate discussion.

Archeological Resources

The NPS defines archeological resources as “the remains of past human activity and records documenting the scientific analysis of these remains” (NPS 1998c). The *ala loa* connected the lives of the people of the Hawai'i Kingdom. Therefore, found along the trail are archeological remains of housing areas, graves and small cemeteries, religious structures (*heiau*), *ahupua'a* (border cairns), shrines, fishing shrines (*ko'a*), and small agricultural shrines. Many of these structures remain in the form of stone platforms or low enclosures.

The larger sacrificial (*luakini*) temples associated with the *ali'i* (chiefs) are usually found at royal centers near the shore where population was clustered about the high chiefs. They are

rectangular platforms and/or enclosures of dry-laid volcanic stone which often exceed 1,200 square yards (1,000 m²) in area (Cordy 1997:17).

In addition, temporary shelters used by visitors, fishermen, and travelers are often found along this lateral trail. These usually take the form of small caves or small surface shelters of dry-laid volcanic stone (platforms, enclosures, C-shaped enclosures about 5-20 square yards (5-20 m²) in area (Cordy 1997:20). As with permanent house sites, these shelters number in the hundreds and probably in the thousands along the trail.

In many areas, petroglyphs (*ki'i pohaku*) are found along the trail. Two of the largest fields are found carved in the smooth *pāhoehoe* lava flows along the *ala loa* in South Kohala: the Puakō Petroglyph Archeological Preserve (within the Mauna Lani Resort) and the Waikoloa Petroglyph Preserve (Waikoloa Resort). Also along the *ala loa* are the Ka'ūpulehū Petroglyph Site (within the Kona Village Resort) in Kona and sites in Ka'ū at Pohue Bay and in Puna at Pu'u Loa (Hawai'i Volcanoes National Park). Smaller clusters of stone carvings are sometimes found associated with house sites and shelters along the trail (Dunbar 1997).

An overview and assessment of archeological sites at the three West Hawai'i parks—Pu'ukoholā Heiau NHS, Kaloko-Honokōhau NHP, and Pu'uhonua o Hōnaunau NHP (NPS 2004)—documents the full range of archeological site types at the three parks. Each park contains remnants of prehistoric and historic coastal (lateral) trails and roads and *mauka makai* trails that could be incorporated into the Ala Kahakai NHT. Associated with the trails are many sites that make these parks significant.

The overview and assessment at Pu'ukoholā Heiau NHS (NPS 2004: B-10) notes "at least one coastal trail as indicated in various historical sources, and there were undoubtedly trails leading to the upland areas of the *ahupua'a*. A major trail led from Kawaihae to the upland Waimea village of Kea'ali'i, as shown in an 1830

map of Waimea (Barrère 1983:31)." Specifically, the study notes a fragment of an old coast trail and the location of an Old Government Road.

Kaloko-Honokōhau NHP contains 450 sites with approximately 50% of the park surveyed. The inventory notes that at least one main coastal trail ran through the area, with several connecting branches running inland. Also, it notes that what is now known as the Māmalahoa Trail, probably constructed inland of the coastal settlement and 1840, was intended for horse use.

At Pu'uhonua o Hōnaunau NHP, the study notes: "[In traditional times] a coastal trail paralleled the shoreline, alternating between stepping stones and pavement depending on the surface and topography. Paved sections were sometimes built up into causeways to bridge low spots in the lava field. A branch trail circuited the village and chiefly residence area at the head of Hōnaunau Bay. Numerous trails extended inland from this coastal path... Like the coastal trail, the *mauka-makai* trails combined stepping stones with linear pavements" (NPS 2004: A-63). The 1871 Road (government road or Alanui Aupuni) was part of a government improvement of the coastal route from Kealakekua south to Ho'okena. It was either built on top of the older traditional foot trail, or replaced the traditional trail along a more direct route. That road and the 1868 Alahaka Ramp are listed as 2 of the 15 contributing features to the NRHP nomination. The *mauka-makai* Ki'ilea Trail is noted along with approximately 1500 other sites in the archeological resource inventory.

An archeological overview and assessment is underway now for Hawai'i Volcanoes NP and most likely will reveal information about coastal trails and their associated resources.

Traditional Cultural Properties (TCPs)

Because TCPs are identified and evaluated with the NRHP criteria, they tend to be physical, bounded places that a land manager can recognize as a kind of historic property. The trail itself as well as components of it may be

traditional cultural properties that could be determined to be eligible for listing on the NRHP. Shrines and offering places along the trail are still used in prayers and ceremonies. Battles that took place along several stretches of the trail are associated with named places. Other trail sections are noted for robbers who waylaid travelers. For example, in the Nīnole-Punalu‘u area of Ka‘ū district, stories describe Luahinekaikapu and her daughter capturing people traveling along the trail. In some areas, quarry sites for the manufacture of stone tools are found such as the one located along the *ala loa* at the Kona-Kohala border.

Anchialine pools are associated with the raising of bait for fishing, with deities, and with chiefly events. Man-made fishponds, both *loko kuapā* and *loko pu‘uone*, consisted of great mortarless seawalls constructed of volcanic basalt and coral to enclose natural lagoons. Most were associated with former chiefly residential complexes where, as traditional gathering places, they provided an important source of food, usually ‘*anae* (mullet) and ‘*awa* (milkfish). Several ponds have associated legends that have come down in the ancient oral traditions of the Hawaiian people.

Historic Structures

Historic and prehistoric structures are “constructed works consciously created to serve some human activity” (Hommon and Fairchild quoted in NPS 2004: 3). The List of Classified Structures (LCS)³⁹ documents structures within parks that meet significance criteria for eligibility to the NRHP. All four national parks on the island of Hawai‘i have completed inventories for the LCS.

Pu‘ukoholā Heiau NHS has 5 structures on the LCS, 4 of which are associated with trails: Pu‘ukoholā Heiau, Mailekini Heiau, John Young Homestead, and Leaning Post.



Mailekini Heiau, Pu‘ukoholā Heiau NHS, S. Kohala, NPS photo

Kaloko-Honokōhau NHP has 18 structures on the LCS, one of which is the Māmalahoa Trail and others associated with the coastal trail such as Kaloko Fishpond, Aimakapā Fishpond and House Site at Kaloko Fishpond.

Pu‘uhonua o Hōnaunau NHP has 22 sites on the LCS, 2 of which are related directly to the Ala Kahakai NHT: the Alahaka Ramp and the 1871 Trail. The trail is associated with several of the other structures such as the various *heiau*, and Ki‘ilea Village.

Eight of the 200 structures on the LCS in Hawai‘i Volcanoes NP are related to the coastal trail: ‘Āpua Point Ruins, Halapē Ruins, Halapē House Platform, Keauhou Ruins-Heiau Cave, Papalehau Ruins, Kālu‘e Ruins, Keauhou Landing Site, and Kūē‘ē Village Ruins.

Although not owned by the NPS, several other structures on the NRHP, such as Mo‘okini Heiau and Hulihe‘e Palace, listed on table 3 in chapter 1, deserve the kind of attention given to those on the LCS.

³⁹ “The LCS is a computerized, evaluated inventory of all historic and prehistoric structures having historical, architectural, or engineering significance in which the NPS has or plans to acquire any legal interest. Included are structures that individually meet the criteria of the National Register or are contributing elements of sites and districts that meet the Register criteria. Also included are other structures—moved, reconstructed, and commemorative structures and structures achieving significance within the last 50 years—that are managed as cultural resources because of decisions reached through the planning process” (NPS 1998c).

Cultural Landscapes

“Cultural landscapes are geographic areas that are the reflection of human adaptation and use of natural resources and are often expressed in the way land is organized, divided, settled, and used” (Hommon and Fairchild quoted in NPS 2004: 3). Cultural landscapes within the NPS are a category of cultural resources that need to be factored into the assessment of any property determined eligible for the National Register of Historic Places (NRHP). The NPS maintains a national database for cultural landscape inventories (CLI) for properties either on, or determined eligible for, listing on the national register, or, are being managed as a cultural resource through a park planning process.

At P u’ukoholā Heiau NHS, the entire National Historic Landmark district has been assessed, and a CLI completed for the property.

At Kaloko-Honokōhau NHP, the National Historic Landmark District has yet to be inventoried for the CLI database.

At Pu’uhonua o Hōnaunau NHP, three areas have been identified in the CLI database for further investigation.

At Hawai’i Volcanoes NP, 18 areas have been identified in the CLI database for further investigation, but none is within the coastal corridor.

Clearly, more inventories need to be completed to fully assess the cultural landscapes within these parks.

Although cultural landscapes may not easily fit into the national register process, they may continue to be culturally important to Native Hawaiians. “Numerous sites contain broader landscape values that derive their significance from the interrelationships among other cultural and natural resources such as plants, animals, minerals, landforms, and bodies of water that give the landscape meaning through their associations with a people’s history and cultural identity” (Evans 2001: 53). These landscape

values are often linked to the original landownership patterns reflected in the *ahupua’a* landownership patterns.

Although many of these sites may qualify as traditional cultural properties (TCPs), the national register process does not adequately document the entire range of resources significant to the Native Hawaiian population. For ethnographic landscapes “significance [is derived] from the roles they play in the associated communities’ own traditional histories, not those criteria of national, state, or local significance that make them eligible for inclusion on the NRHP” (Evans 2001: 54). Nearly every resource listed in table 3 (chapter 1), whether eligible for the NRHP or not, would qualify as a landscape significant to contemporary Hawaiians. Small and large, tangible and intangible, many more exist along the route of the Ala Kahakai NHT. The range of landscapes significant to Native Hawaiians needs to be recognized within the planning process for the Ala Kahakai NHT.

One approach to ensuring that Hawaiian values are incorporated into the management and interpretation of the Ala Kahakai NHT is to recognize the value of traditional place, including place names and analysis of traditions to provide site context, identification, and significance. The *Archeological Assessment and Overview for the Three West Hawai’i Parks* (NPS 2004) repeatedly emphasizes the non-archeological dimensions of the culture and the need to recognize cultural places: “localities identified in Hawaiian traditions (as documented in archival, historical, and ethnographic sources) and recognized as places of traditional value to Hawaiians” (NPS 2002: B-25). Especially emphasized in this report are place names.

The Hawaiian naming of places signifies a cultural identity, whether related to a resource, a physical landmark, or an event. These localities with traditional place names, places of cultural and historical events, and traditionally recognized natural features need to be recognized as cultural resources. The *Assessment and Overview* noted that “the documentation of the

‘ethnographic’ range of cultural resources was surprisingly incomplete, including compilation of place names and analysis of traditions to provide site context, identification, and significance” (NPS 2004:5). The report provides a framework for cultural resources in the three parks based on genealogies and traditional history.

Among the four national parks along the Ala Kahakai NHT, Hawaii Volcanoes NP is the only one to complete an ethnographic overview (Langlas, 2003). The study documents the traditional Native Hawaiian use of resources on park land, past and present, and makes policy recommendations to help the park better accommodate Native Hawaiian resource use while still protecting the resources. Part C of a companion volume, *Ethnographic Studies at Hawai'i Volcanoes National Park*, provides a list of Native Hawaiian place names and place name stories taken from documentary sources. This work will be helpful to management of the Ala Kahakai NHT.

Museum Collections

Museum collections are comprised of objects, specimens, and archives including human experience and natural history. The *West Hawai'i Parks Museum Management Plan* recommends that a centralized joint museum management program be established for the three West Hawai'i parks and the Ala Kahakai NHT beginning now at the administrative level and leading to a joint work/storage/use facility. Table 12 shows the current museum collection

summaries for each park based on the 2002 Collections Management Report. It does not include unaccessioned biological specimens and 150,000 pages of archives from Pu'ukoholā Heiau NHS. More biological specimens are expected as a result of the NPS Inventory and Monitoring Program.

It is not known which specimens and records at each of the parks might be associated with the Ala Kahakai NHT. The museum management plan anticipates that the NHT will generate substantial archival resources and additional archeological material that may be offered from private collections.

Each of the three West Hawai'i parks has a small storage area for specimens and various areas for storage of archival material, including at the Pacific West Regional Office -Honolulu. Hawai'i Volcanoes NP provides each of these parks help with managing museum collections.

CAVE RESOURCES

Lava tube caves are among the island's more important geological natural resources. The island has thousands of lava tubes, but only a few are large enough to be lava tube caves (County of Hawaii, 2001). Caves contain resources of cultural, spiritual, aesthetic, and scientific value. Native Hawaiians used caves for a variety of activities, including shelter, water collection, shrines, and work areas. Evidence of this use persists in many sites. In addition, lava tube caves served for centuries as burial sites for

Table 12: West Hawai'i Museum Collections

PARK	ARCHEOLOGY	ETHNOLOGY	HISTORY	ARCHIVES	BIOLOGY	TOTAL
Kaloko-Honokōhau NHP	656			264,000	243	264,899
Pu'ukoholā Heiau NHS	1,023	3	224	16	35	1,301
Pu'uhoonua o Hōnaunau NHP	16,208		25	146,060	10	162,303
Ala Kahakai NHT				10,100		10,100
TOTAL	17,887	3	249	420,176	288	438,603

Source: *West Hawai'i Parks Museum Management Plan*, p. 37

Native Hawaiians. Hundreds of burials have been recorded within lava tubes on the Island of Hawai'i. The traditional Hawaiian belief requires that such remains should not be disturbed, viewed, or even visited. The State of Hawaii Burial Council often requests that caves containing such remains be sealed off to prevent entry (County of Hawaii, 1996b). Caves are managed as cultural resources by the NPS.

The Hawaii Cave Protection Law (2002) states: "The cultural and spiritual resources within caves include human burials and other artifacts of Native Hawaiian use and their associated traditions. Scientific, biologic, and geologic resources include unique subterranean ecosystems inhabited by specialized organisms, associated native flora and fauna living within cave entrances, mineral and bedrock formations, and paleontological, or fossil deposits. Fossil deposits, which include remains of plants, animals, and surface debris preserved in caves, provide a unique record of the past climate and biota of the islands" (Section 1).

This Act defines a cave as "any naturally occurring void, cavity, recess, or system of interconnected passages large enough for human entry occurring beneath the surface of the earth or within a cliff or ledge, including the cave resources therein, regardless of whether an entrance exists or is natural or man-made. The term includes forms such as a lava tube [cave], natural pit, sinkhole,



Cave, S. Kona, NPS photo

underwater cave, or other feature that is an extension of the entrance" (Section 2, § -1). This Hawaiian law affects all caves along the Ala Kahakai NHT on nonfederal lands.

The Federal Cave Protection Law, from which the Hawaiian law is derived, affects all caves on federal property or on land administered by the federal government. It describes cave resources as "any material or substance occurring in caves on federal lands, including, but not limited to, biotic, cultural, mineralogic, paleontologic, geologic, and hydrologic resources"(section 4302). Due to the sensitive nature of cave resources, cave locations are not given out and all caves within the NPS are considered significant whether or not the cave has been inventoried.

National park resource overviews contained in the Vital Signs Monitoring Plan (NPS, 2005) indicate that two of the four national parks along the Ala Kahakai NHT have cave resources. Hawaii Volcanoes NP contains many miles of underground lava tube caves, some of which contain significant archeological resources, 'ohi'a (*Metrosiderous polymorpha*) or other plant roots, endemic, cave adapted insects, and microorganisms. Many caves contain special geologically significant features and mineral deposits. Currently most park caves are closed to public use because their resource values are not known. Once the status of resources is known and safety hazards are assessed, caves may be classified for use by researchers or the public. The park has inventoried resources in more than 10 caves.

Pu'u'honuā o Honaunau NHP contains several caves discussed in historical writings, some of which have been used as burial sites. Out of respect for traditional Hawaiian beliefs, park staff has not inventoried these caves for cultural or natural resources. However, the park plan states that caves without burials should be inventoried for natural and cultural resources. Security remains an issue and the park has worked to secure cave entrances to prevent unauthorized entry.

Caves may occur all along the corridor of the Ala Kahakai NHT outside of the national parks, but would especially be expected on pāhoehoe lands and probably most numerous in Ka'ū and Puna. Private individuals surveyed a series of caves in the Kīholo area between 1995 and 2001. A growing number of cave enthusiasts with a variety of interests are known to be exploring lava tubes in Hawai'i. Some ecotourism advocates see lava tubes as a unique and compelling tourist attraction (County of Hawaii, 1996b).

NATURAL RESOURCES AND VALUES

The following describes existing conditions of topics that are considered in chapter 4 as impact topics.

Wetlands (Anchialine Pools and Fishponds)

Anchialine pools are scattered along the coast of West Hawai'i within the Ala Kahakai NHT corridor from 'Upolu Point around South Point to Hilo. They are standing waters in rocky (lava) basins that vary in salinity and exhibit tidal fluctuations, although in most cases they lack a surface connection to the ocean. The pools are generally small (less than 100 square meter surface area) and shallow (less than one meter deep) [Maciolek & Brock:15]. The combination of an underground connection to the sea and the influx of fresh water from basal ground water results in brackish water conditions.

In geologic terms, they tend to be ephemeral. They may be created by one lava flow and then filled by the next one; they may be filled by sand and coral by high waves or uncovered in the same way. The pools also undergo a natural senescence, changed by encroaching vegetation and leaf litter. Native pool organisms have a survival strategy of rapidly recruiting to a new habitat and many species have the ability to survive in the subterranean water table until appropriate habitat again becomes available (Brock and Kam: 52, 56). Anchialine pools are unique natural features not found in any of the other 49 states (Chang; Hawaii Heritage

Program), and they may be the rarest aquatic habitat in the United States (Brock, 2005).

Within this environment, distinctive endemic (found only in Hawai'i) biota have evolved. In some cases, organisms inhabit only a particular pool or complex of pools. The most numerous species is 'ōpae'ula, red shrimp (*Halocaridina rubra*). These shrimp are hypogeal; that is, they occur not only in the sunlit part of the system, but also in the interconnected watertable below. Brock (1985:11) speculates that with the destruction of ponds (as through filling), these hypogeal species would not entirely disappear, but their populations would be significantly lower. Epigeal species, which require the sunlit part of the system (crustaceans, fishes, mollusks, and flora), would not survive pond destruction. A unique aspect of the flora of these ponds is the orange carbon-producing algae crust (*Lyngbya* spp. and *Schizothrix calcicola*) in the bottoms.

Anchialine pools are especially abundant along the western shore of the island. Kaloko-Honokōhau NHP is one of only three natural reserve sites with anchialine pools in the state of Hawaii and contains approximately 10% of the anchialine pools on Hawai'i Island (NPS, 2005). In 1985, approximately 600-650 ponds existed within the Ala Kahakai NHT corridor (Brock, 1985:2). There may be a similar number today; however, abundance is not the measure of health. Biological integrity of the pools is of primary importance.



Kaloko-Honokohau NHP, N. Kona, NPS photo

The introduction of non-native fish into the pools poses the most serious threat to the native invertebrates in the pools. Most likely, these fish are introduced by fishers (Chang, 1994; Maciolek & Brock, 1974), but some appear to result from the dumping of “pet fish” such as fantails and swordtails (Chai, 2006). These species may then colonize to other pools. Native fish that sometimes wash into the pools with waves do not pose a great threat to the shrimp because these fish cannot complete their life cycle in the pools. On the other hand, non-native fish, which can complete their life cycles in the pools, seriously impact shrimp populations (Brock, 1985:8; Chai, 2006). The major culprits are guppies (*Poecilia reticulata*), tilapia (probably *Oreochromis mossambicus*), topminnows (Family Poeciliidae—probably *Gambusia affinis* and *Poecilia mexicana*), and koi (*Cyprinus caprio*).

Many of the anchialine pools on the Kona coast are in a state of biological change primarily due to the presence of exotic fishes (Brock, 1985:16). In 1970, about 15% of the anchialine pools along the Kona coast contained non-native fish; in 1985, the number increased to about 46%; and today, about 95% of the pools along the Ala Kahakai NHT route have an alien fish problem that threatens the ecology of the pools (Brock, 2005).

Ancient Hawaiian settlements were associated with anchialine pools. Small pools provided potable water and bathing; larger pools were often adapted for fish culture (Maciolek & Brock, 1974). ‘Aimakapā and Kaloko fishponds in Kaloko-Honokōhau National Historical Park along the Ala Kahakai NHT are examples of the latter.

Marine Resources Related to Traditional Gathering

The West Hawai‘i coral reefs teem with life. Some typical species are *pāku‘iku‘i* (achilles tang, *Acanthurus achilles*), ‘*ala‘ihi* (various squirrelfishes, *Sargocentron* spp.), *u‘u* (various soldierfishes, *Myripristis* spp.), *moana* (*Parupeneus multifasciatus*), *po‘opa‘a* (various scorpionfishes,

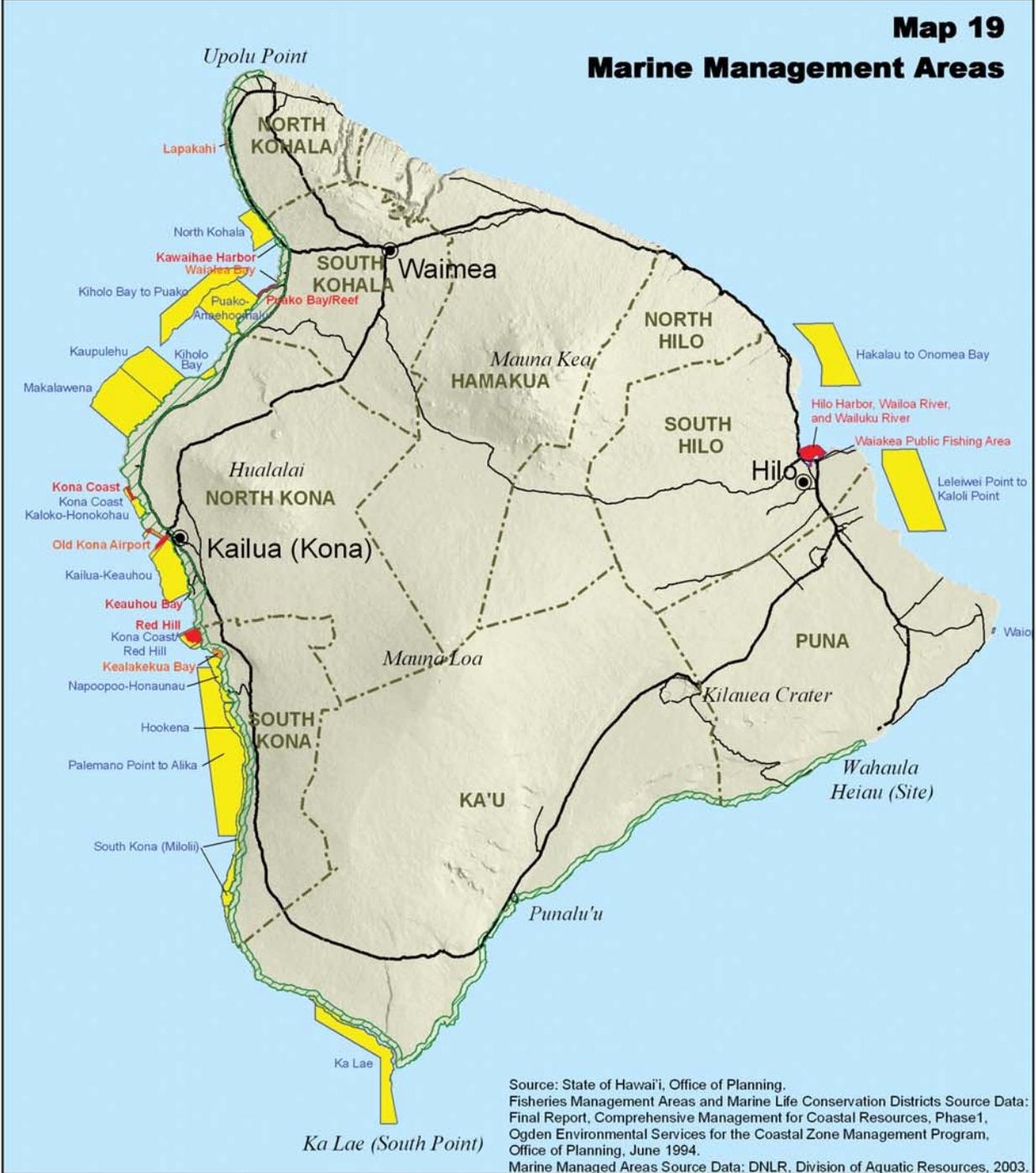
Sebastapistes spp.), *umaumale* (*Acanthurus triostegus*), and *kole* (yelloweyed or goldring surgeonfish, *Ctenochaetus strigosus*). Typical species found close to shore and in the onshore splash zone are *opihi* (limpets, *Cellana exarata*), *wana* (various species of urchins), and ‘*a‘ama* crab (*Grapsus grapsus tenuicrustatus*). The commercial collection of *opihi* has been observed to have a negative impact on abundance and availability of this resource for subsistence fishers⁴⁰ (Walsh 2006).

In response to concerns about localized overfishing and conflicts of use caused by aquarium fish collectors, Act 306 Session Laws of Hawaii 1998 created the West Hawaii Regional Fishery Management Area (FMA) covering 147 miles of the entire west coast of Hawai‘i Island from ‘Upolu Point to South Point. It is a network of Fish Replenishment Areas (FRAs) comprising 35 percent of the coastal waters. Aquarium collecting and fish feeding are prohibited in these areas. The West Hawaii Fisheries Council, comprised of a variety of stakeholders, including experienced traditional fishers, determined the FRA boundaries. The council also recommends to the DLNR guidelines for commercial fishing and collecting, commercial tours, night spearing, crossnetting, and other activities. Water quality related to inadequate toilet facilities may also be addressed.

Included in the West Hawai‘i Regional FMA are Four Marine Life Conservation Districts (MCLDs): Lapakahi, along the shoreline of the state historical park; Waialea Bay in the southern portion of Kawaihae Bay; Old Kona Airport, just west of Kailua-Kona; and Kealakekua Bay extending from Cook Point to Manini Beach Point about 18 miles south of Kailua-Kona. Marine Life Conservation Districts have more stringent guidelines than the FMAs and usually allow only limited fishing and other consumptive uses. They are popular as sites for snorkeling, diving, and underwater photography. Map 19, Marine Management Areas, depicts FMAS, MLCs, and Marine Managed Areas.

⁴⁰ Subsistence fishers are those who engage in limited fishing and gathering activities to feed their extended families identified with a specific region and associated through bloodlines and friendships which have developed over generations.

Map 19 Marine Management Areas



Legend

- Fisheries Management Areas
- Marine Managed Areas
- Marine Life Conservation Districts
- Hawai'i Districts
- Ala Kahakai NHT Corridor
- Roads**
 - Primary
 - Secondary



Ala Kahakai National Historic Trail Working Map 12/21/06

Native Ecosystems: Vegetation and Wildlife

The Ala Kahakai NHT corridor, encompassing the coastal settlement zone, includes the native ecological zones of *kahakai* (nearshore fisheries and shoreline strand) and *kula kai* (shoreward plains). Within these two zones, woodland communities on the face of the pali (cliff) and pond/wetland communities also may be found.

Vegetation

Within the Ala Kahakai NHT corridor in both of the major ecological zones, the dominant or characteristic plants are mainly alien (nonnative) species introduced to Hawai'i after western contact (1778). Rick Warshauer, a biologist with the U.S. Geological Survey, notes Hawai'i's native coastal flora "is vanishing at an alarming rate, as coastal development wipes out huge tracts of shoreline vegetation and concentrates public use, from traditional gathering to four-wheeling, into smaller and smaller spaces" (quoted in McNarie, 2004). Despite this fact, native plant communities can be lush and diverse if located away from disturbance by people, vehicles, and browsing ungulates (NPS 2006b). Immediately adjacent to the ocean, the strand vegetation is composed of hardy native species such as *naupaka kahakai* (*Scaevola serices*) and *pohuehue* (*Ipomoea pes-caprae*). The species assemblage of coastal plant communities varies with the substrate (dunes, coral rock, basalt, talus, or alluvium). Plants in this zone are shallowly rooted and do not appear to use brackish groundwater, depending instead on rainfall for their moisture needs" (Wagner, p. 54).

In the remote Ka'ū region, especially from Ka'alu'alu to Waikapuna, varied habitats—pāhoehoe and 'a'ā flats, drifted sand, anchialine pond shores, protected beaches, and spray-battered bluffs—support over 40 diverse species of native vegetation (NPS 2006b).

In Hawai'i Volcanoes NP, the coastal strand "contains[s] small scattered stands of dry and mesic forests on the faces of the pali. Younger flows are dominated by open stands of 'ohi'a. The

short native tree lama (in the ebony family) with an understory of the shrub alaha'e replaces 'ohi'a on older flows. A number of threatened, endangered, and candidate species include kauila, halapepe, 'ahakea, and 'ohe makai" (NPS 2004a).

Often, immediately behind this strand zone within the Ala Kahakai NHT corridor, the coastal plain contains alien-dominated vegetation characterized by *kiawe* (*Prosopis pallida*) forest, fountain grass (*Pennisetum setaceum*), opiuma (*Pithecellobium dulce*), or mixed alien shrublands of such weedy species as lantana or *koa-haole* (*Leucaena leucocephala*). In some sections, native lowland vegetation extends nearly to the sea. Open dry forest of 'ohi'a (*Metrosideros polymorpha*) might be seen, or stands of *pili* (*Heteropogon contortus*) grassland, 'ilima (*Sida fallax*) shrubland, and other low-lying native vegetation. Much of the trail runs across near-barren lava flows of various ages.

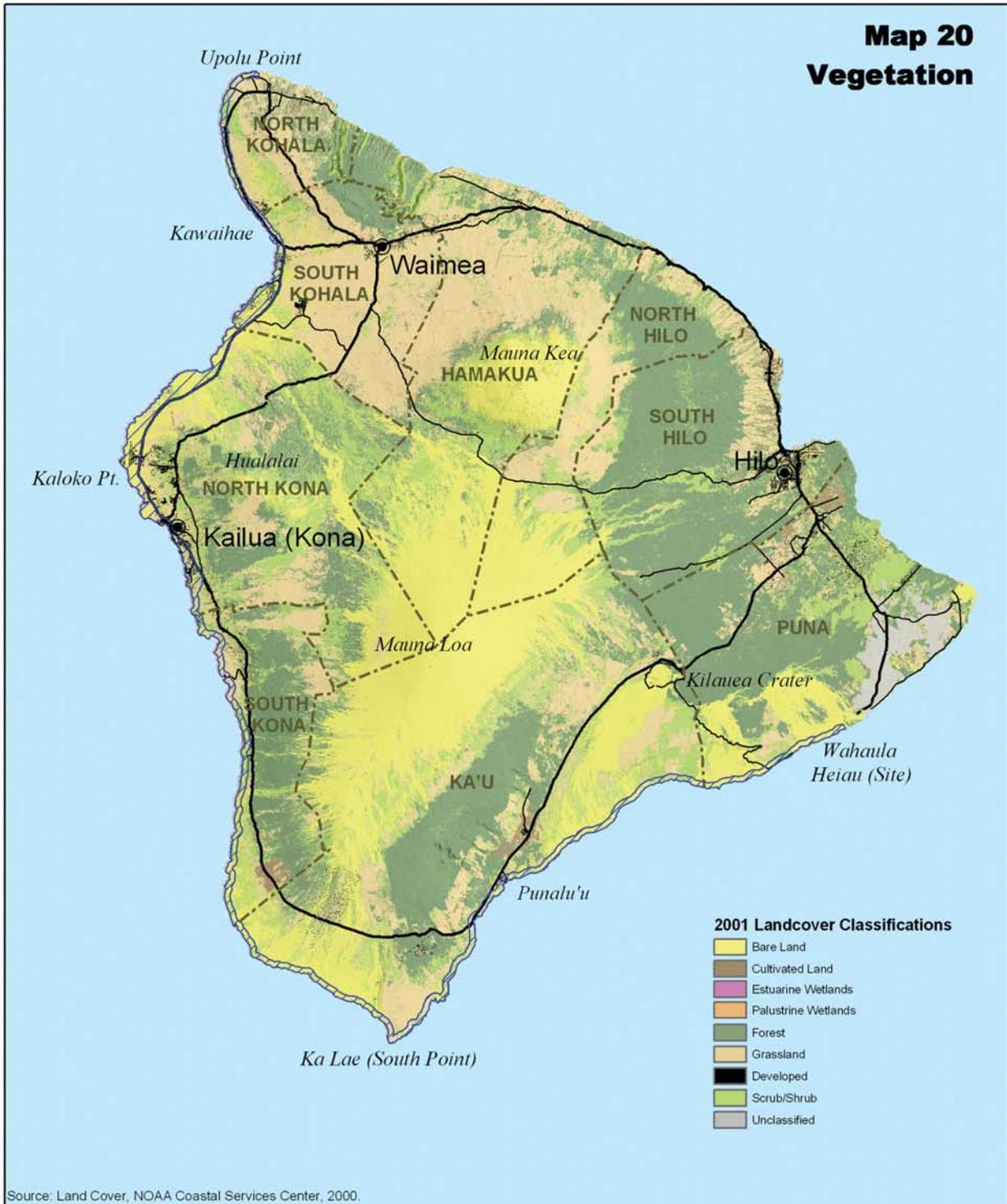
In Hawaii Volcanoes NP the coastal plain is dominated by alien grasslands with patches of alien shrubs. The dominant grasses are alien Natal redtop, thatching grass, molasses grass, beardgrass, and broomsedge. Native pili grass is an important component of the grasslands in some areas (NPS 2004a).

Around anchialine pools, wetlands with native sedges and other vegetation break the barren setting of volcanic flats (Hawaii Natural Heritage Program). Map 20 depicts vegetation land cover.



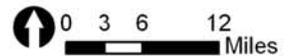
Pahu O Hi'iaka, NPS photo

Map 20 Vegetation



Legend

-  Hawai'i Districts
-  Ala Kahakai NHT Corridor
- Roads**
-  Secondary
-  Primary



*Ala Kahakai National Historic Trail
Working Map 12/21/06*

The NPS vital signs monitoring program notes that status and trend data is needed on the health of native vegetation and the spread of invasive species for all of the Pacific Island Parks (NPS, 2005). The four national parks through which the Ala Kahakai NHT passes have completed fairly extensive vegetation surveys indicating that vegetation cover in the parks is predominantly alien (Pratt).⁴¹

Even though alien species predominate along the Ala Kahakai NHT in the coastal plain, natives do occur along the way, sometimes in profusion. Examples are 'a'ali'i (*Dodonea viscosa*), 'akia (*Wikstroemia spp.*), 'ūlei (*Osteomeles anthyllidifolia*), and *Maiapilo* (*Capparis sandwichiana*), an endemic low night-blooming shrub seen along the Ala Kahakai NHT in North Kona. *Puakala* (*Argemone alba var glauca*), an endemic white poppy that blooms seasonally along the trail in South Kona, has medicinal value to Hawaiians. *Portulaca villosa* is an extremely rare endemic found along the shoreline of Ka'ū.

Some indigenous trees along the route are *milo* (*Thespesia populnea*), *kou* (*Cordia subcordata*) and *hala* (*Pandanus*). The Polynesians introduced plants for food, fiber, medicine, and other uses that are a part of the appearance of the coastline today. Those growing in the coastal zone along the corridor of the Ala Kahakai NHT include coconut (*Cocos nucifera*) and *noni* (*Morinda citrifolia*).

Threats to native vegetation are feral goats and pigs, cattle, alien plants, diseases, insects, rodents, and human actions such as development or trampling. The survival of native biota depends upon the existence of adequate protected habitat.

Wildlife

Non-listed protected marine mammals that may be found in the coastal waters along the trail include spinner dolphins (*Stenella longirostris*), spotted dolphins (*S. attenuata*), bottlenose dolphins (*Tursiops truncatus gilli*), false killer whales (*Pseudorca crassidens*), pilot whales (*Globicephala macrorhynchus*), melon headed whales (*Peponocephala electra*), and pygmy killer whales (*Feresa attenuata*) [U.S. Department of Commerce, National Oceanic and Atmospheric Administration].

With the exception of the Hawaiian bat (*Lasiurus cinereus semotus*), terrestrial mammals found along the Ala Kahakai NHT corridor are introduced species, and most are considered pests to humans and native vegetation. These mammals include feral goats, jackasses, and pigs, domestic dogs and cats, Indian mongoose, house mice, Polynesian rats, Norway rats, and roof rats. 'Aimakapā and 'Ōpae'ula⁴² Pond within Makalawena Marsh National Natural Landmark on private property are the two remaining ponds on this island which support a resident population of endangered non-migratory Hawaiian stilt. These ponds are the only areas on the island of Hawai'i listed as essential water bird habitat in the U.S. Fish and Wildlife Service *Hawaiian Waterbirds Recovery Program*. 'Ōpae'ula Pond is also the principal nesting site for the Hawaiian coot and the only known breeding area on the island of Hawai'i of the black-crowned night heron. Remains of an ancient Hawaiian fishpond are beneath the water surface.

Endemic birds such as the endangered Hawaiian hawk or 'io (*Buteo solitarius*) and Hawaiian short-eared owl or *pueo* (*Asio flammeus sandwichensis*) and indigenous birds such as wandering tattler (*Heteroscelus incanus*) and

⁴¹ For example, at Pu'ukoholā Heiau NHP about 73% (126 species) are alien, 36% (21 species) are indigenous (native to Hawai'i, but occurring naturally outside of Hawai'i), 3% (6 species) are endemic (occurring naturally in Hawai'i and found nowhere else), and 2% (4 species) are Polynesian introductions (brought to Hawai'i many centuries ago by the early Polynesian settlers). At Koloko-Honokōhau NHP invasive fountain grass (*Pennisetum setaceum*) is nearly ubiquitous (NPS, 2005). At Pu'uhonua o Hōnaunau NP, of 134 vascular plant species, nearly three-quarters (96 species) are alien to Hawai'i, about 17% (23 species) are indigenous, 4% (6 species) are endemic, and 1.1% (15 species) are Polynesian introductions.

⁴² The name 'ōpae'ula refers to the shrimp chum used for 'ōpelu fishing. This name came to replace the Hawaiian place name of Kapo'ikai wetlands (Springer).

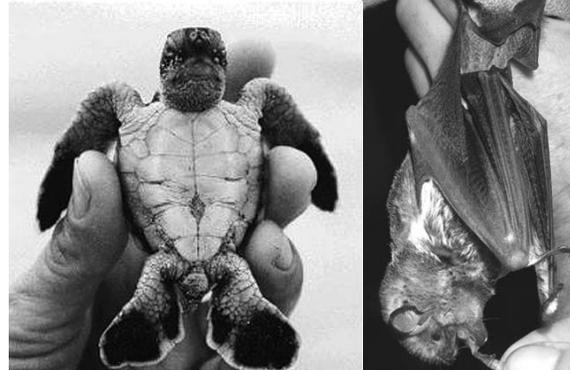
Pacific golden plover (*Pluvialis dominica fulva*) may be seen. In addition, a number of introduced bird species may occur. These include Indian black francolin, spotted dove, barred dove, skylark, Japanese white-eye, common Indian myna, warbling silverbill, ricebird, cardinal, and house finch. Seabirds such as the petrel and frigate bird can be seen from the trail. They are a part of oral stories and were used as food in traditional Hawaiian culture.

A wide variety of native and introduced invertebrates inhabit the Ala Kahakai NHT corridor. These include reptiles such as skink and geccos; insects such as ants, wasps, and bees; and mollusks such as snails and slugs. Scorpions and centipedes often inhabit *kiawe* forests and could cause discomfort to the trail user.

Special Status Species⁴³

Several protected marine species within the coastal strand zone can be viewed from the trail area. Threatened green turtles (*Chelonia mydas*) occur in all the coastal waters where they feed on intertidal and subtidal algae. Endangered hawksbill turtles (*Eretmochelys imbricata*) are also found in nearshore waters in fewer numbers and nest on isolated beaches in the Ka'ū District. There are scattered sightings of endangered Hawaiian monk seals (*Monachus schauinslandi*) in the nearshore waters and hauled out on beaches all along the trail area. During the winter breeding season from December through May, endangered humpback whales are present in coastal waters, primarily within depths of 100 fathoms (600 feet). The Ala Kahakai NHT in the North Kohala District provides good whale-viewing areas.

The U.S. Fish and Wildlife Service (USFWS) lists as federally endangered one mammal, four birds, one reptile, and two plants which may occur along the Ala Kahakai NHT corridor; as federally threatened, one reptile; and as candidates, one damselfly and one anchialine pool shrimp. In addition to the USFWS reported species, the NPS



Monk Seal, Hawksbill Turtle, Hoary Bat, NPS photos

lists among the four parks four endangered flowering plants; two endangered birds, one threatened, and one candidate; one endangered mammal; and two candidate anchialine pool shrimp. Appendix D lists specific species.

The Hawaiian Natural Heritage Program names as listed and candidate species, and species of concern 15 animal species, 13 invertebrate species, 31 plant species, and 13 natural communities. In addition, 13 plant critical habitats are listed. Appendix D lists specific species. Map 21 depicts threatened and endangered plant concentrations.

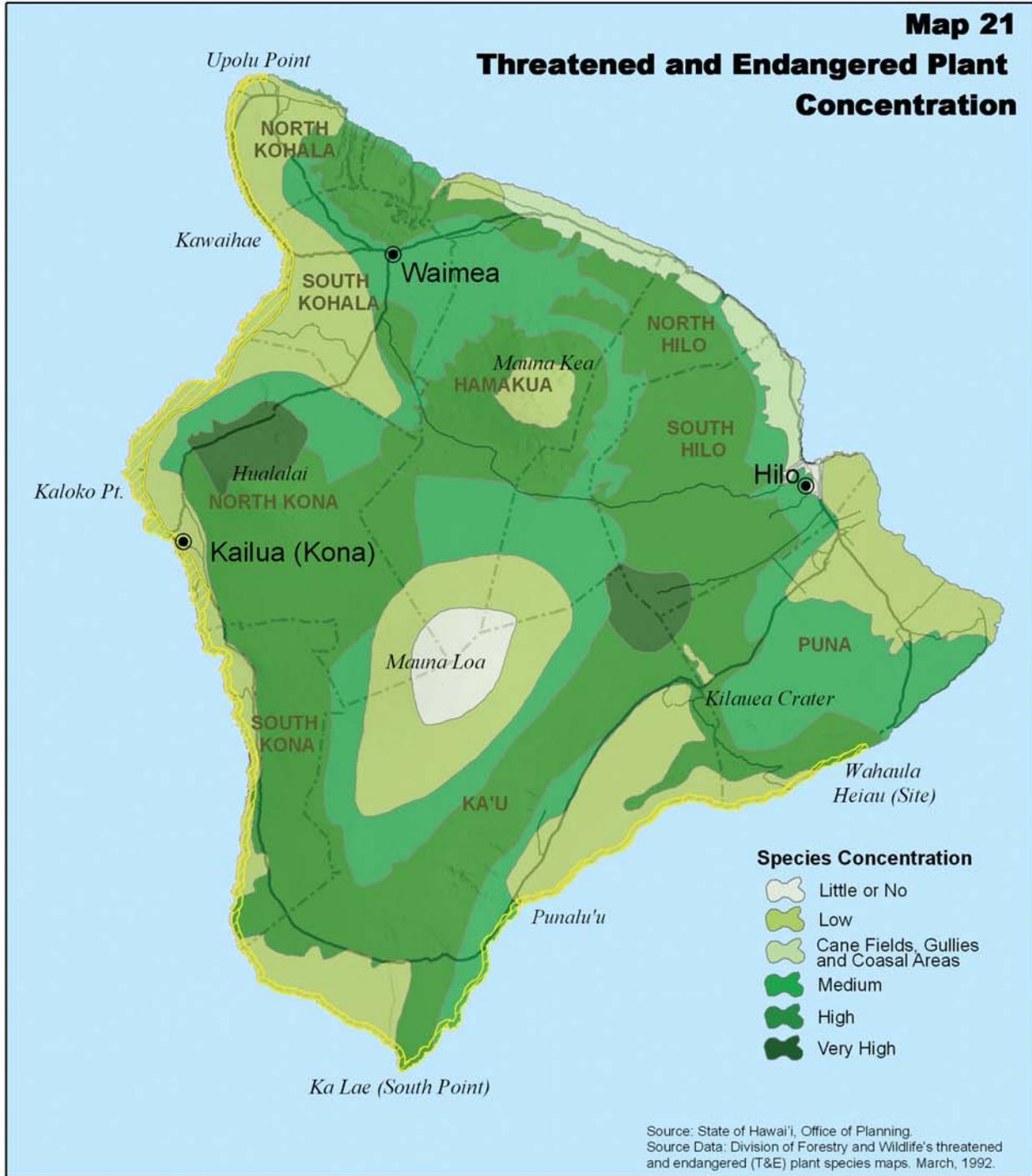
SCENIC AND VISUAL RESOURCES

The trail provides frequent unobstructed ocean to mountain vistas. Depending on the point of view, the trail's upland background is formed by the Kohala mountain range, Mauna Kea, Hualālai, Mauna Loa, and Kīlauea. Ancient and more recent lava flows are visible along the majority of the trail. Volcanic formations, such as Kahuku Pali (cliff) and Kuili cinder cone, provide visual interest.

⁴³ These include rare, threatened, and endangered species and species of concern.

Map 21

Threatened and Endangered Plant Concentration



Legend

- Hawai'i Districts
- Roads**
- Secondary
- Primary
- Ala Kahakai NHT Corridor



Ala Kahakai National Historic Trail Working Map 12/21/06

The trail offers a variety of visual experiences. It passes along the calm waters and white sandy coves of South Kohala and central and northern Kona, and crosses hot, barren lava fields that flank the shore. In central Kona, Kealakekua Bay is backed by a high cliff and green upland slopes. In Ka'ū, the trail passes the striking cliff and windswept, dry grassy plain of South Point the southernmost point in the United States.

The trail crosses or passes adjacent to black and green sand beaches and all of the island's few white sand beaches. In remote areas, rocky shorelines still abound with *ʻopihi* (limpet) and other favored shellfish species. The trail skirts around lagoons, anchialine pools, and fish ponds where the ancient Hawaiians practiced aquaculture.

The nearshore water is clear, and in some areas, threatened green sea turtles and brightly colored fish are visible from the high shore. In the winter months, whales can be seen. When Kīlauea erupts, volcanic haze (vog) can obscure scenic views. When prevailing winds blow away the haze, the islands of Maui, Kaho'olawe, and Molokai can be seen at great distance. The trail offers views of the full range of Hawai'i Island's seascapes.

WILDERNESS VALUES

Approximately fourteen miles of the Ala Kahakai NHT corridor are in the wilderness area within Hawai'i Volcanoes NP. Park wilderness values include maintaining ecological integrity and biological diversity. Management of wilderness areas requires use of the Minimum Requirement decision-making process and the Minimum Tool required as a result of applying that process. (See the Glossary for definitions.)

The wilderness area within Hawai'i Volcanoes NP is characterized by a treeless lava landscape of predominately non-native grasses. About half of this corridor has defined trails marked by *ahu* (stone cairns) and two campsites, Ka'aha and Halapē, with associated small, sandy beaches. Catchment tanks at shelters at each site provide the only potential for water along this part of

the trail. The shelters and catchment tanks predate the wilderness designation. The area is very rugged with little shade, even at the campsites. Earth cracks, thin crusts, and lava tubes are present. Rough surf and strong, unpredictable currents make swimming dangerous except at the few sheltered swimming sites along the coast. Between the western park boundary and Ka'aha unexploded World War II ordinance and ammunition may be present.

Clusters of archeological resources representing the remains of dense coastal habitation villages that were present at the time of European contact (ca 1778) require respect and protection. Thirteen village sites have been identified, seven of which have been covered or partially covered by lava flows. Of the six remaining village sites—Ka'aha, Halapē, Keauhou, 'Āpua Kūē'ē and, Kālu'e—the first four named are backcounty camp sites (Bonsey, 2004). The Wilderness Act requires that cultural resources within the wilderness areas be protected and maintained according to the pertinent laws and policies governing cultural resources, using management methods that are consistent with the preservation of wilderness character and values.



Top: Cultural site, N. Kohala, NPS photo
Bottom: 1950 Lava Flow, S. Kona, NPS photo

VISITOR EXPERIENCE

Recreational Resources

Present recreational use of the areas along the trail varies depending upon the ease of access and proximity to population centers. A few areas, especially in South Kohala and North Kona, receive intense use while others are rarely visited. The 2003 State Comprehensive Outdoor Recreation Plan (SCORP) reports overwhelming demand for more beach parks in Hawaii County, particularly in the Kona area. As demand increases, “there is a growing sentiment for residents to have preferred use of recreation areas over visitors and for the prevention of uses that limit access (perceived or actual) to the shoreline.” Commercial uses of shoreline areas by kayak companies, luxury liners, and other segments of the eco-tourism industry, may adversely affect fragile ocean resources or crowd out public use (DLNR 2003).

The diverse activities available to visitors include water activities such as swimming, body and board surfing, snorkeling and scuba diving, fishing, boating, kayaking, and outrigger canoe paddling; passive land recreation activities such as walking, photography, birdwatching and nature study, camping, sightseeing, picnicking, and sunbathing; and in limited locations, more active land recreation such as jogging. Horseback riding is not an activity along the coastal trails. A range of hiking experiences is available from short, easy walks to strenuous hikes with unsure footing across lava fields scorched by the sun. Visitors from Japan to the island of Hawai‘i seek opportunities for sightseeing, swimming, and sunbathing, while those from the U.S. mainland prefer those activities plus snorkeling and scuba (DLNR, 2003).

Respondents to a 2003 survey conducted as part of the SCORP noted a need, among others, for “cultural and historical parks that promote preservation and interpretation of archaeological and sacred sites, restoration of ancient fishponds, and workshops that perpetuate cultural traditions” (DLNR, 2003).



The trail corridor passes through a number of national, state, and county parks that provide recreation to the public, as illustrated in Table 13.

In addition, shoreline areas on private land are open to the public. For example, ‘Anaeho‘omalu Bay at Waikoloa Beach Resort is a popular beach “park” with public parking and restroom facilities. Other resorts in the region provide public shoreline access as well. Often these resorts contain segments of the historic *ala loa* or have developed a trail parallel to the shoreline that may become part of the Ala Kahakai NHT through agreements with the NPS.

No visitor opportunities exist today as part of the Ala Kahakai NHT. Although portions of the trail exist in the four national parks along the route, there is no information, interpretation, or educational materials related to the national trail available for the visitor. Some portions of the trail are marked as the state Ala Kahakai, but they are not managed as they would be under the action alternatives. Visitor opportunities related to information, orientation, interpretation, and education are addressed in the impacts section in chapter 4.

Table 13: Federal, State, and County Park Sites within the Ala Kahakai NHT Corridor

PARK	ACREAGE	DISTRICT
National Parks		
Pu'ukoholā Heiau National Historic Site	85	South Kohala
Kaloko-Honokōhau National Historical Park	1,178	North Kona
Pu'uhonua o Honaunau National Historical Park	182	South Kona
Hawai'i Volcanoes National Park	332,800	Ka'ū/Puna
State Parks		
Kohala Historic Sites State Monument (Mo'okini Heiau State Monument, Kamehameha I Birthsite State Monument, Kukuipahu Heiau)		North Kohala
Lapakahi State Historical Park	262.0	North Kohala
Hāpuna Beach State Recreation Area	61.8 (est.)	South Kohala
Keolonahihi State Historical Park	12.0	North Kona
Kīholo State Park Reserve		North Kona
Kekaha Kai State Park	1,642.5	North Kona
Old Kona Airport State Recreation Area	103.7	North Kona
Kealakekua Bay State Historical Park	184.9	South Kona
Napo'op'o Beach Park Section	73.6	
Ka'awaloa Section	111.3	
County Parks (Beach Parks only)		
Kapa'a Beach Park	26.34	North Kohala
Māhukona Beach Park	2.74	North Kohala
Spencer Park at 'Ōhai'ula Beach	13.36	South Kohala
Hale Halawai Community Center, Kailua	3.20	North Kona
La'aloa (White) Sands Beach Park	2.34	North Kona
Pāhoehoe Beach Park	0.66	North Kona
Kahulu'u Beach Park	4.23	North Kona
Disappearing (White) Sands Beach	2.35	North Kona
Ho'okena Beach Park	3.22	South Kona
Miloli'i Beach Park	1.18	South Kona
Punalu'u Beach Park	6.00	Ka'ū
Whittington Park	0.82	Ka'ū
Honu'apo—recently added and largely inaccessible to the public at this time	226.31	

Source: DLNR, State Comprehensive Outdoor Recreation Plan (SCORP), March 2003 amended by Hawaii County Parks and Recreation Department March 15, 2007

Public Health and Safety

Public health and safety is of great concern to the NPS and is addressed in the alternatives section of this document. It is not an impact topic in chapter 4 because it will be approached in the same way for all alternatives.

According to the Centers for Disease Control and Prevention, walking is one of the easiest, least expensive, and most widely available ways to reap meaningful health benefits. Trails, such as the Ala Kahakai NHT, provide places for people to be physically active and increase their wellness.

On the other hand, several aspects of the environment in the area of the Ala Kahakai NHT have potential to adversely affect the health and safety of trail users and trail staff: air quality, lava, fire, tsunami, poisonous insects, leptospirosis, pollution, flash floods and availability of potable water.

Air Quality

Vog may create health problems for trail users. Aside from sulfur dioxide, small amounts of several toxic metals, including selenium, mercury, arsenic, and iridium, have also been found in vog. During even moderate human activity, sulfur

dioxide can penetrate deeply into the airway and produce respiratory problems in some people. In absence of strong winds, sulfur dioxide emitted by Kīlauea can accumulate in the air and reach levels exceeding federal health standards. Between 1986 and 2000, this occurred more than 85 times within Hawai'i Volcanoes NP. Elevated SO₂ readings are directly related to wind direction, so that the standard is exceeded when the wind is blowing from where lava is vented toward Volcano House. Concentrations of SO₂ and hydrochloric acid (HCL) are greatest near the ocean (NPS, 1995a) within the Ala Kahakai NHT corridor where lava pours directly into the sea (U.S. Geological Survey). Trail users in Hawai'i Volcanoes NP can access a website to get up-to-date information on sulfur dioxide emissions: <http://www2.nature.nps.gov/air/webcams/parks/h/avoso2alert/havoalert.htm>

In addition, when hot lava reaches sea water, large clouds of mist are formed, called laze, which contain hydrochloric acid and other airborne contaminants harmful to human health. Map 22 depicts lave flows since 1961 and Map 23 depicts lava hazard zones.

Lava

Two of the Island of Hawai'i's five volcanoes, Mauna Loa and Kīlauea, have erupted repeatedly in this century. Another of these volcanoes, Hualalai, last erupted in 1801 and has the potential to erupt again within the next hundred years. Most eruptions of Hawaiian volcanoes are not explosive and are characterized by the relatively quiet outflow of very fluid lava. These eruptions can still be deadly, because the lava may erupt in huge volumes, and on steeper slopes fluid lava can rapidly travel many miles from its source. Erupting lava and lava flows could cover parts of the trail and affect trail users (<http://hvo.wr.usgs.gov/volcanoes/hualalai> and <http://pubs.usgs.gov/fs/fs074-97/>). See maps 22 and 23. Once lava cools, deep fissures can form. Once these are hidden by heavy vegetation, a trail user wandering from the trail could fall into a

lava crack and possibly disappear. Map 22 depicts the recent lava flows at Hawai'i Volcanoes NP.

Fire

Most wildland fires in the coastal area are carried by introduced, fire-promoting species and invasive species typically found along the Ala Kahakai NHT route. These fires can threaten trail user safety and fire smoke can cause breathing difficulty. Prescribed fire, a potentially a powerful tool to restore or rehabilitate damaged ecosystems or restore native species that benefit from fire, can also cause safety and health issues but is planned and trail users can be warned ahead of time.

Tsunami⁴⁴

A good portion of the Ala Kahakai NHT corridor, from North Kohala through South Kona and parts of Ka'ū, is within the tsunami evacuation zone as defined by the Pacific Disaster Center. (See map 23.) Tsunamis potentially destructive to the island of Hawai'i may originate anywhere around the rim of the Pacific Ocean, or they may be locally generated by earthquakes on or near this island. A tsunami produced by an earthquake on the coast of Chile will reach the Hawaiian Islands in about 15 hours, while one that originates in the Aleutian Islands will arrive in 4.5 to 5.5 hours. A locally generated tsunami gives much less warning; the waves may strike almost immediately after the earthquake occurs.

The most devastating tsunamis to hit the island of Hawai'i in this century occurred in 1946 and 1960. In both cases, the worst damage was inflicted on the northeastern coast of the island. The 1960 tsunami originated in Chile and advanced upon the island from the southeast with its effects greatest at Hilo. The arrival time of this tsunami was correctly predicted, but many people failed to heed the warnings, and authorities evacuated an insufficient area of Hilo. As a result, 61 lives were lost as waves up to 35 feet high crashed through homes. Whole city blocks were swept clean of all buildings, and 580 acres were flooded.

⁴⁴ Information on tsunamis is from <http://pubs.usgs.gov/gip/hazards/tsunamis.html>

The tsunamis of 1868 and 1975 were locally generated by earthquakes beneath the southern coast of the island beneath Kīlauea's south flank. The 1868 waves destroyed several coastal villages in the Ka'ū and Puna districts, most of which were never rebuilt. The 1975 tsunami claimed two lives and caused widespread damage along the Kalapana coast.

Locally generated tsunamis, such as those of 1868 and 1975, are potentially the most hazardous type, because the time between their origin and the arrival of the wave at the shoreline may be too brief to warn and evacuate people. In 1975, the first wave reached Punalu'u immediately after the earthquake; it arrived at Hilo in 20 minutes. Any earthquake strong enough to cause difficulty in standing or walking should be regarded as a tsunami warning to people in coastal areas, who should immediately head for higher ground.

Poisonous Insects

Centipedes — In Hawai'i, *Scolopendra subspinipes* is the only centipede of medical importance. When humans are bitten, two puncture wounds are evident, and reaction to the injected venom can range from slight swelling of the immediate area to massive swelling of the affected limb. With the latter, medical attention should be sought. Centipedes are generally found in damp, wet places, such as under wood piles or compost heaps; wearing closed-toe shoes can help prevent stings.

Scorpions — The sting of the sole Hawaiian scorpion species (*Isometrus maculatus*) produces severe pain and swelling at the site of the puncture although the swelling on occasions spreads over a wide area. Symptoms of a scorpion sting include shortness of breath, hives, swelling, muscle pain, and nausea, but these symptoms usually disappear after 24 hours. Application of diluted household ammonia and cold compresses to the area of the sting can relieve symptoms before seeing a doctor. In Hawaii, there have been no reported fatalities due to scorpion stings. Rarely seen, scorpions would be found in arid, warm regions of the

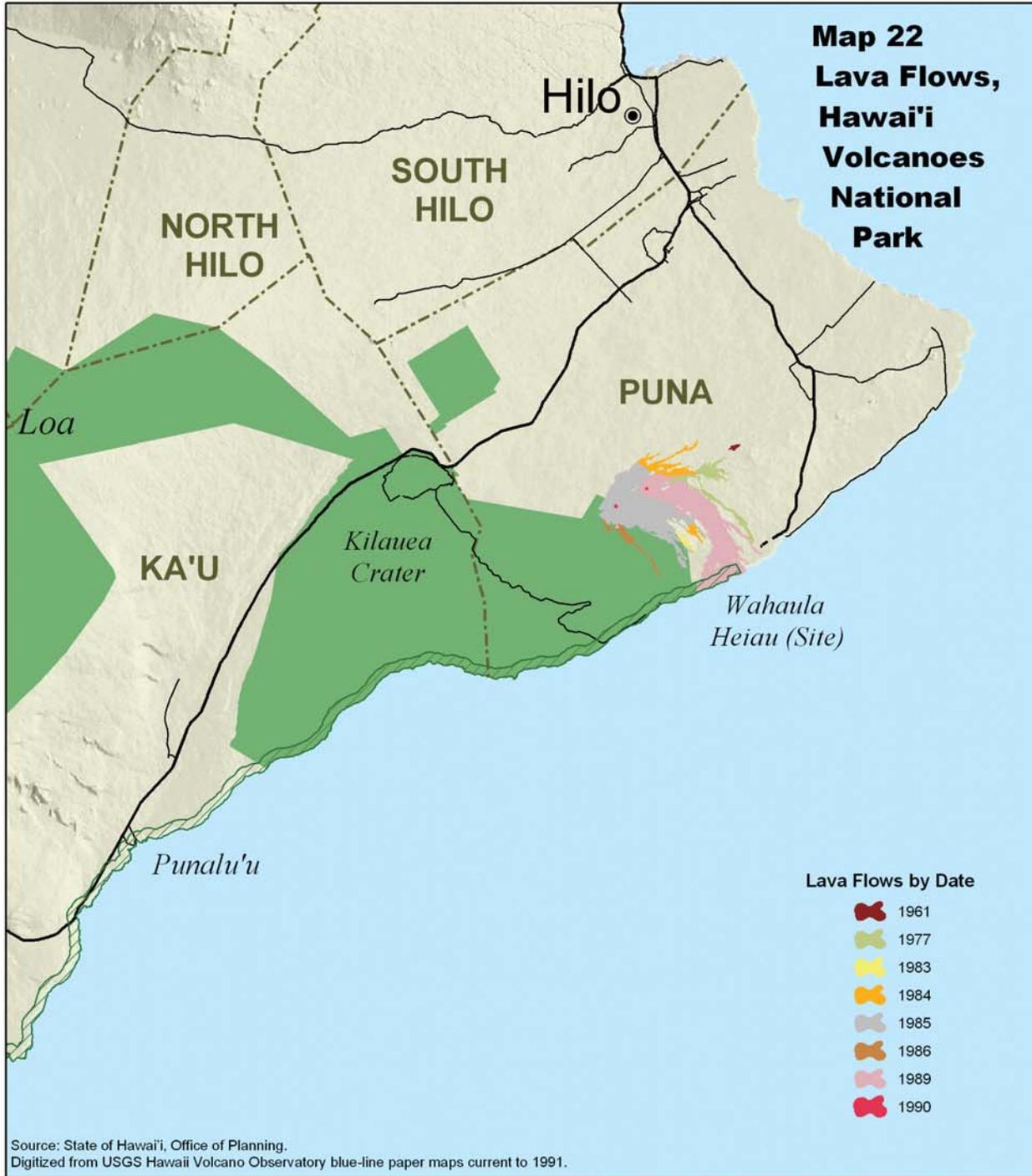
trail. Campers in dry areas should always check their boots before putting them on, and shake out sleeping bags and bed rolls.

Leptospirosis — Rats and mice as well as domestic animals carry a water-borne bacterium, *Leptospirosis*, which can cause flu-like symptoms and even death in humans. The bacteria can survive for long periods in fresh water or mud and enter the body through the eyes, nose, mouth, and broken skin. Warnings may need to be posted for trail users to avoid contact with water or mud that may have been contaminated with animal urine (Hawaii Department of Health).

Pollution — Unsanitary conditions are common at some popular beaches due to the lack of restrooms, trash receptacles, and potable water, raising the likelihood of water pollution. Other types of pollution are present in coastal areas in the form of hazardous materials, abandoned equipment, and unexploded ordinance remaining from the sugar industry and WWII related military operations (NPS 2005).

Flash Floods — Streams on the Kona coast of Hawai'i Island pose a danger because they can flash flood; a stream's water level can rise several feet in less than an hour during periods of intense rainfall. Flash floods occur because rainfall is intense, drainage basins are small, basins and streams are steep, and channel storage is limited. Heavy rain in the mountains may not be apparent along the shoreline where hikers would feel the effects. Streamflow generated during periods of heavy rainfall has led to loss of property and human lives in Hawai'i.

Availability of Potable Water — Many segments of the Ala Kahakai NHT, especially those in the Puna, Ka'ū and South Kona districts of the island, may not have readily available potable water. Approximately 40,000 to 50,000 residents on the island of Hawai'i presently use water catchment systems for their household water supply, and must go outside of their homes to acquire potable water. Many of these persons obtain their drinking water from public water spigot facilities provided by the Department of Water Supply, Hawaii County (County of Hawaii, 2006).



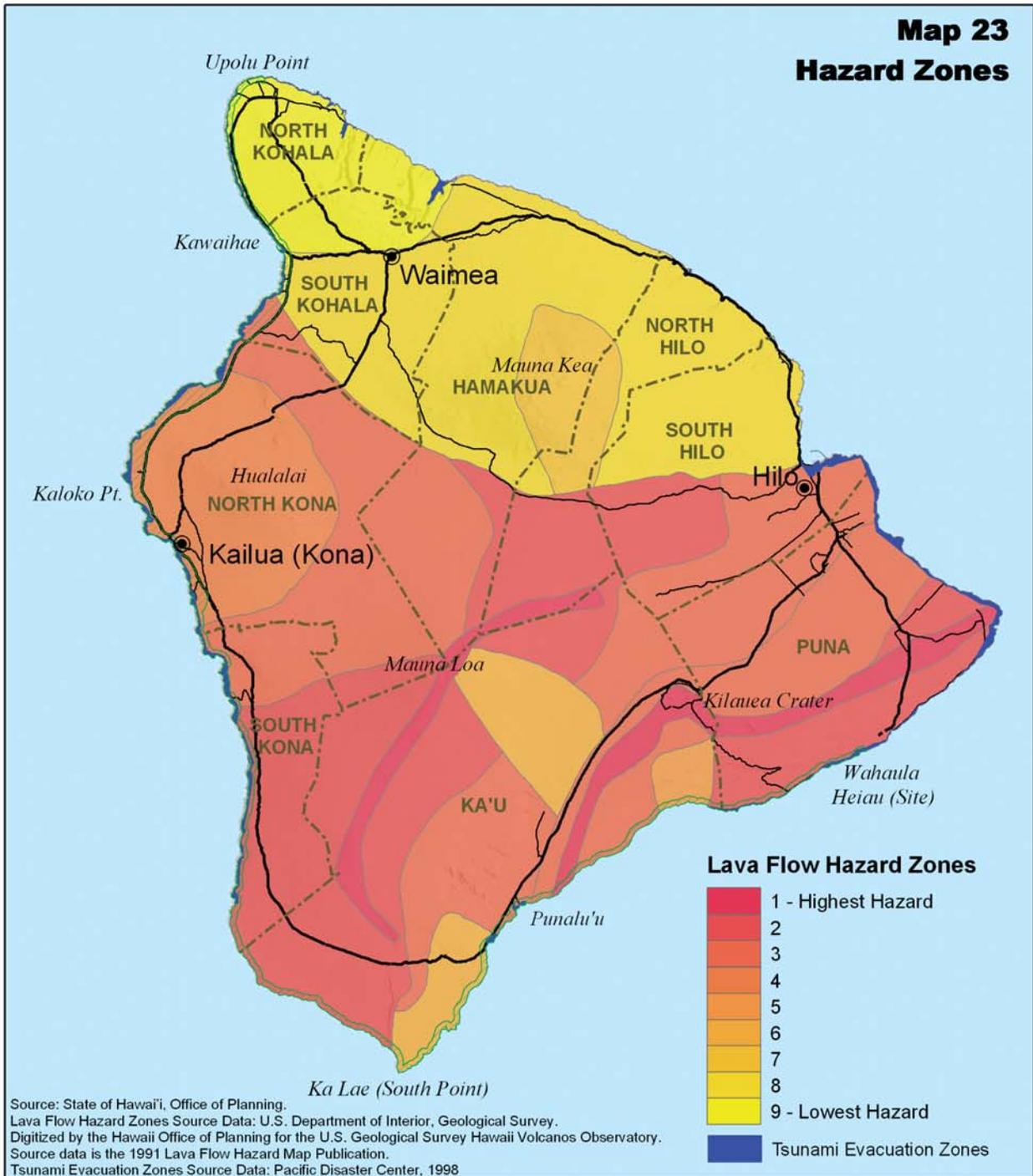
Legend

- Hawai'i Districts
- Roads**
- Primary
- Secondary
- Ala Kahakai NHT Corridor
- Hawai'i Volcanoes National Park



*Ala Kahakai National Historic Trail
Working Map 12/21/06*

Map 23 Hazard Zones



Legend

- Hawai'i Districts
- Roads**
- Primary
- Secondary
- Ala Kahakai NHT Corridor



Ala Kahakai National Historic Trail Working Map 12/21/06

SOCIO-ECONOMIC ENVIRONMENT

Population

Estimates vary, but roughly 100,000 individuals populated Hawai'i Island at the time of Captain Cook's arrival in 1779 (Cordy, 2000). In the year 2000, the resident population of the island was 148,677. This population was comprised of 46,904 White Alone (36%), 42,288 (28%) Two or More Races, 39,702 (28%) Asian Alone, 16,724 (11%) Native Hawaiian and Other Pacific Islander alone, 1695 (0.01%), Some Other Race Alone, 698 (0.004%) Black or African American Alone, 666 (0.004%), and American Indian and Alaska Native Alone. Together, in 2000, the census districts containing the Ala Kahakai NHT had a population of 41,843 or 28% of the total island population (County of Hawaii, 2005: Table 1.5- Resident Population, by Districts, Hawaii County).

In 2005, the island had a projected resident⁴⁵ population of 163,000. The projected de facto⁴⁶ population was 180,000, which includes 20,800 visitors.

As shown in Table 14, the state projects an annual 1% increase in resident population and an average 1.5% increase in de facto population during the 2005 to 2025 period.

Visitors

The visitor industry is an economic mainstay of the island of Hawai'i. Visits to the island have fluctuated between 232,850 in 1990 and 303,662 in 2004, averaging 288,497 for the period. (County of Hawaii, 2005). Generally, most visits to the islands occur in the summer months (June through August) and the winter months (December, January and February). The portion of these visitors who would use the Ala

Table 14: Resident and De Facto Population Projections, State and County of Hawaii: 2005-2025

YEAR	RESIDENT			DE FACTO		
	State Total	Hawaii County	Percent Change	State Total	Hawaii County	Percent Change
2005	1,277,950	163,000		1,406,650	180,800	
2010	1,346,600	176,750	1.1	1,490,500	196,500	1.7
2015	1,418,650	190,300	1.0	1,597,400	212,250	1.6
2020	1,489,500	203,050	1.0	1,663,450	226,800	1.3
2025	1,560,400	216,150	1.0	1,748,600	241,800	1.3

Source: *Resident and De Facto Population Projections, State and County of Hawaii: 2000 to 2030*, May 16, 2005, County of Hawaii Data Book Section 1: Population, <http://www.co.hawaii.gov/data>

Table 15: Attendance at Cultural Sites along the Ala Kahakai NHT Route

CULTURAL SITE	2002	2003	2004
Hawai'i Volcanoes National Park ⁴⁷	2,399,361	2,178,430	2,605,298
Hulihe'e Palace	26,784	26,192	31,496
Kaloko-Honokōhau National Historic Park	70,101	77,632	91,462
Pu'uhonua o Hōnaunau National Historical Park	377,125	596,961	819,221
Pu'ukoholā Heiau National Historic Site	60,851	103,040	101,092

Source: County of Hawaii Data Book Section 7.27: Tourism and Recreation, 2005

⁴⁵ Resident population is defined as the number of persons whose usual place of residence is in an area, regardless of physical location on the estimate or census date. It includes military personnel stationed or homeported in the area, but excludes persons of local origin attending school or in military service outside the area.

⁴⁶ The de facto population is defined as the number of persons physically present in an area, regardless of military status or usual place of residence. It includes visitors present, but excludes residents temporarily absent.

⁴⁷ Only a small portion of park visitors would actually experience the Ala Kahakai NHT route which is along the shoreline in a remote part of the park classified as wilderness. A portion of the trail was inundated by the latest lava flow from Kilauea.

Kahakai NHT cannot be predicted. However, trail visitor numbers could be substantial based on the number of visitors to existing sites along the trail route and those interested in shoreline use or hiking. Table 15 illustrates the number of visits for 2002 to 2004 to attractions covering nearly the length of the Ala Kahakai NHT corridor.

While playing golf or simply walking to the beach, guests at the Kohala resorts such as the Mauna Lani, Mauna Kea, and Waikoloa, and at the Kailua-Kona and Keauhou hotels would encounter the Ala Kahakai NHT. Mauni Lani Resort has preserved portions of the prehistoric and historic trail as a marked and interpreted shoreline trail.

Visitor Spending

In 2004, spending by visitors to the island of Hawai'i was the third highest among the islands at \$1.31 billion, of which U.S. West visitors spent \$590 million, U.S. East visitors spent \$420.4 million and Japanese visitors spent \$138.5

million. This represented a 5.1 percent increase from 2003 when the total for Hawai'i Island spending was \$1.25 billion (Hawaii, 2004).

The length of visitor stays was 6.63 days in 2003 and 6.68 days in 2004. However, the per person spending decreased from \$154.10 per day in 2003 to \$150.40 in 2004. Hawai'i comprised 9.3% of all international visitor days for the State and 14.9% of all domestic visitor days (Hawai'i, 2004).

Landownership

Tax records and tax key maps indicate that approximately 47% of the Ala Kahakai NHT route is government-owned land. The breakdown between federal, state, county and Hawaiian Home Lands is provided in Table 16. The remainder, or 53%, of the land through which the trail goes is privately owned.

Within the portion of the Ala Kahakai NHT classified as privately owned, approximately

Table 16: Government Lands along the Ala Kahakai NHT Route (In Miles and % of Total)

	PRIVATE TOTAL STUDY AREA	FEDERAL (1)	STATE (2)	COUNTY (3)	HAWAIIAN HOME LANDS	TOTAL GOV.
Miles	188	32	46	0.01	11	89
% of total	100%	17%	24%	<1%	6%	47%

Source: Parcel maps in GIS data base. Miles were calculated by drawing a line within the corridor one-quarter mile from the shoreline. The total miles by this method was 188, while the *Inventory of Public Shoreline Access* (1979) maps 210 mile, the number used in the following table. The *Feasibility Study* used the number of 175 miles as stated in the legislation authorizing the study.

- (1) Federal land including National Park and lighthouse sites
- (2) State land, including those encumbered by private leases, those under Executive Order to the county and old government roads assumed to be owned by the state
- (3) County land

Table 17: Property with Ancient Trails Described in the County of Hawaii Public Access to the Shoreline Inventory (based on 210⁴⁸ miles of shoreline)

	TOTAL STUDY AREA	FEDERAL	STATE	SUB-TOTAL GOVERNMENT	PRIVATE
miles	68.10	10.60	22.56	33.16	34.94
%of total miles	100%	16%	33%	49%	51%

⁴⁸ Although the Feasibility Study defines the trail length as 175 miles, the maps of the 1979 county Inventory of Public Shoreline Access shows the trail along 210 miles of shoreline.

15.49 miles of easements or dedications have been required by governmental action within the trail corridor. Of this total, approximately 11.08 miles are in place and/or recorded on deed documents. Approximately 4.41 miles are situated on parcels that have not been developed and may not be currently available for public use (Nishimura).

In addition, within the privately owned classification are several miles of "ancient trail" that are owned in fee simple by the state. In the ancient Hawaiian method of governance, these trails were open for the use of all the people. State law, the Highways Act of 1892, continues to protect the right of the public to use these trails. The source used to gain information of these trails for this CMP is the County of Hawaii, *Inventory of Public Shoreline Access* (1979) with additional information from the Nā Ala Hele inventory dated 2004. It is important to note that only those segments which traverse through government land or are part of the tax maps or old survey maps as public trails were part of that inventory. It is probable that more miles of "ancient trail," exist and could be identified as part of trail segment management planning.

Approximately 68 miles of the properties within the study area have ancient trails described in the *Inventory of Public Shoreline Access*. Table 17 provides a breakdown between federal, state and private ownership of these parcels. Approximately 32.62 miles (49%) are government owned while the remaining 34.94 miles (51%) are privately owned.

In summary, approximately 109 miles (52 percent) of trail along 210 miles of shoreline appear to be publicly owned or protected at this time, although most of these miles of trail are not ready for public use. An undetermined portion of the remaining mileage has potential for public ownership and use as "ancient trail" according to the 1892 Highways Act.

TRAIL OPERATIONS

The Ala Kahakai NHT is administered by the NPS superintendent using office space at the headquarters building of Kaloko-Honokōhau NHP. Funds are available to hire a second staff person, most likely a community planner. The superintendent relies on the four national park units to manage the trail within their boundaries. No nonfederal segments of trail or trail sites have been made official components of the national trail. Beyond responding to the basic administrative duties as required by the NPS, the superintendent is engaged in developing the framework for community-based management of the trail. Using its base budget augmented by NPS Challenge Cost Share Program funds, the trail superintendent has been able to contract for community engagement consultation, a cultural landscape study for North Kohala, and ethnographic and historic studies.



Top: "Ahu" boundary marker, N. Kohala, NPS photo
Bottom: Trail, Waikoloa, S. Kohala, NPS photo