



EXECUTIVE CHAMBERS

HONOLULU

GEORGE R. ARIYOSHI
GOVERNOR

March 1, 1984

Ms. Letitia N. Uyehara
Interim Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Uyehara:

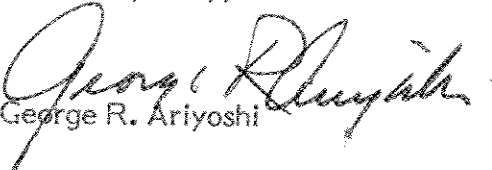
Based on the recommendation of your office, I am pleased to accept the environmental impact statement for the renovation of the Upper Hamakua Ditch and construction of access roads in South Kohala, Hawaii, as a satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes.

This environmental impact statement will be a useful tool in deciding whether this project should be allowed to proceed. My acceptance of the statement is an affirmation of its adequacy under applicable laws and does not constitute an endorsement of the proposal.

When the decision is made regarding this action, I expect the proposing agency to carefully weigh the societal benefits against the environmental impact which will likely occur. This impact is adequately described in the statement, and, together with the comments made by reviewers, provides a useful analysis of alternatives to the proposed action.

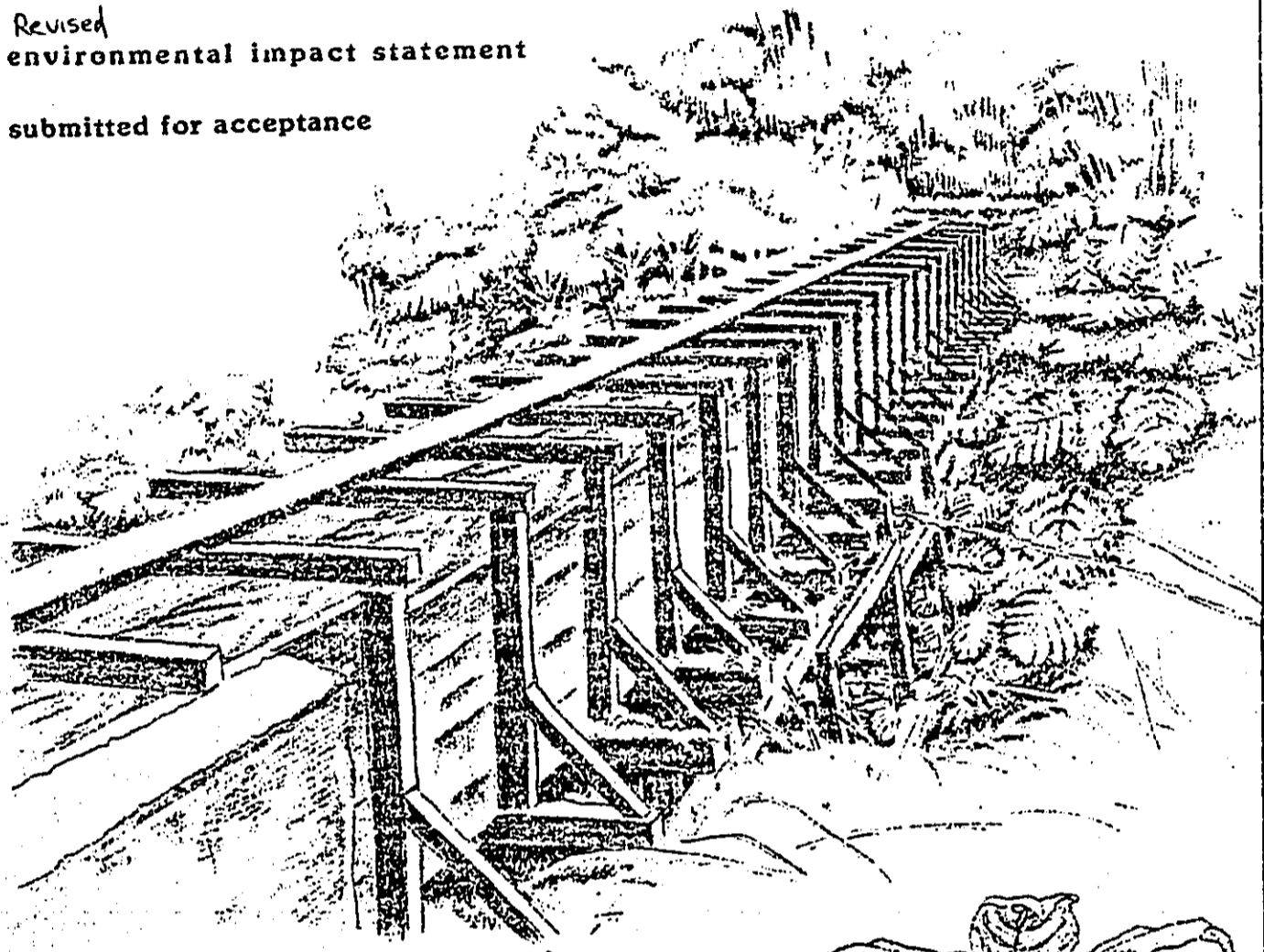
With warm personal regards, I remain,

Yours very truly,


George R. Ariyoshi

cc: Honorable Susumu Ono

Revised
environmental impact statement
submitted for acceptance



**RENOVATION OF UPPER HAMAKUA DITCH
AND CONSTRUCTION OF ACCESS ROADS**

South Kohala, Hawaii

**division of water and land development
department of land and natural resources
state of hawaii**



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Revised
ENVIRONMENTAL IMPACT STATEMENT

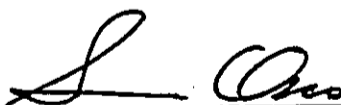
Submitted for Acceptance

Renovation of Upper Hamakua Ditch and Construction of Access Roads
South Kohala, Hawaii

January, 1984

Prepared by

Division of Water and Land Development
Department of Land and Natural Resources



SUSUMU ONO, Chairperson
Board of Land and Natural Resources

SUMMARY

Renovation of Upper Hamakua Ditch and Construction of Access Roads

This statement describes a project in the South Kohala District of the County of Hawaii, to rehabilitate and reconstruct portions of the Upper Hamakua Ditch and to construct access roads to facilitate present, as well as future repairs. Wherever the roads are built, the vehicular access will significantly improve the deployment of emergency repair crews, and also will enable more frequent inspection and maintenance which could forestall major failures of the system.

The Upper Hamakua Ditch collects surface runoff from the southeast slopes of Kohala Mountain and conveys the water to the storage components of the Waimea Irrigation System. The system serves the farmers of Lalamilo and Puukapu, including those on Hawaiian Home Lands. The ditch portion of concern is located above elevation 3,000 feet on the upper rims of precipitous canyon walls, in a high rainfall region exposed to the northeast trades, but often enshrouded in fog. The highlands are covered with native vegetation, primarily 'ohia, 'olapa and hapu'u; but at least three species of plants under review for endangered status were found along proposed road routes.

The ditch improvements proposed for this project include repair of 500 feet of concrete lining in several reaches south of the head of Alakahi canyon, and reconstruction of a wooden flume supported by a wooden trestle which crosses Waima stream. The proposed access roads total 5,700 feet in length, in three different segments. The project will not alter flows to any natural drainageway.

The probable impacts of the project are associated with the construction and continued presence of the access roads: initial loss of vegetation, introduction of exotics onto an open path in the forest, and erosion. The adverse effects can be kept to a minimum by design, construction, and maintenance practices, but cannot be avoided completely.

In general, vegetation loss can be minimized through judicious route selection. Known locations of flagged individuals of rare species can be avoided using available alternate routes. Exotics in the new open path will pose a problem, as they do along any trail in native forests, including the existing path along the UHD. Erosion can be kept to a minimum by engineering measures, but vegetative measures to prevent extensive soil loss should be restricted to the use of on-site mulch.

Because of low density of wildlife and the small acreage to be dedicated to the access roads, the impact on wildlife habitat is not significant. On the other hand, the economic loss to the farmers of Waimea and to the State will be considerable if the Upper Hamakua Ditch is allowed to deteriorate through inaction.

The value of the crops grown with water from the system is well in excess of \$2 million and includes nearly two-thirds of the Chinese cabbage, celery, head lettuce and romaine lettuce grown in the State.

The State funds available for this construction total \$215,000.

Renovation of Upper Hamakua Ditch, Construction of Access Roads

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ENVIRONMENTAL IMPACT STATEMENT

Renovation of Upper Hamakua Ditch and Construction of Access Roads

I. Purpose and Need for Action:

The Upper Hamakua Ditch has served as a water collection and conveyance device since early in this century. Although maintenance has been continuous since then, repairs have been limited to those which could be performed by hand, with tools and materials transportable by men or pack animals. Accelerating, cumulative damages and deterioration require action with modern equipment now. Access roads are required to enable this type of corrective measure, as well as to provide vehicular paths for future maintenance.

II. Project Description:

Public funds¹ have been appropriated for the repair and rehabilitation of the Upper Hamakua Ditch (UHD) and intakes and the construction of access roads. The funds will be spent to extend the life and restore the capacity of the UHD before further damage occurs. Renovation work will be limited to improving the conveyance function of the ditch; nothing is contemplated to increase the diversion capacity of the system.

The Upper Hamakua Ditch is in need of repair in many segments, but for this project, several items have been targeted as having the most impact in maintaining the UHD as a functioning unit (see Figure 1).

Renovation of Upper Hamakua Ditch

- a. In the reach of the UHD just south of the head of Alakahi Canyon, within a length of 3,500 feet, nearly 500 feet of concrete lining has been torn loose and must be replaced as soon as possible. Redesign of some sections, and complete reconstruction in others may be appropriate.
- b. At the head of Waima Canyon, a wooden flume spanning nearly ninety feet and supported by a wooden trestle, is in danger of collapse.

Construction of Access Roads

- a. Just west of the head of Alakahi Canyon, from the end of the existing road, 2,500 feet northward along the ditch;

¹"Renovation of Upper Hamakua Ditch, Waimea Irrigation System, South Kohala, Hawaii," Supplemental Appropriations Act of 1982 amending Act 1, First Special Session Laws of Hawaii, 1981.

- b. Just south of Alakahi Canyon, 1,700 feet leading to and along the most severely damaged ditch sections previously mentioned;
- c. South of Waima canyon, 1,500 feet from the intake of the 60 mg reservoir to the wooden flume noted above.

The estimated cost of the project is \$215,000, including engineering and contingencies. The UHD is the sole collection and conveyance facility for the Waimea Irrigation System (WIS). The WIS provides irrigation water to the farmers of Lalamilo and Puukapu, including those on Hawaiian Home Lands. As an essential component of the WIS, the UHD directly affects the livelihood of a significant portion of the South Kohala district, especially near the town of Waimea.

If the project helps to assure the continued functioning of the UHD, the funds spent will have provided a measure of stability to the agricultural community in and around Waimea by lessening at least one aspect of the uneasiness associated with fears of failure of the irrigation system. However, the economic and social benefits cannot be obtained by dollars alone; environmental costs are also involved. For the two proposed access roads near Alakahi canyon, native vegetation will have to be cleared. The same is true of the third access road, although the ditchside vegetation near the head of Waima also includes a substantial stand of bamboo.

The Upper Hamakua Ditch is a state-owned facility, located on State land. The ditch was constructed early in this century. In 1914, J. D. Tucker, the Commissioner of Public Lands, Territory of Hawaii, recognizing the construction and operation of the UHD, granted to the Hawaiian Irrigation Company, Limited, "...a license, right, privilege and authority to use and occupy...all of those pieces or parcels of said (public) lands of Puukapu, Kohala, Hawaii, designated as the Upper Hamakua Ditch Right of Way and Storage Reservoirs" (Ref. 13). In 1954, Governor Samuel Wilder King set aside the "...segment of the Upper Hamakua Ditch lying within the Kohala Forest Reserve...and also all government-owned water rising, flowing or captured in that portion of said Kohala Forest reserve, containing an area of 4547 acres, more or less,...which portion comprises the watershed for said segment of the Upper Hamakua Ditch;..." (Ref. 14).

The proposed renovation is scheduled to begin in 1984.

III. Alternatives:

Since the objective of the project is to extend the life of an existing facility, there are no alternatives to repairing damaged portions of the ditch. The alternative to providing vehicular access is "no action". Major repairs would continue to be performed with manual labor working with materials carried in man-packs, or with men, materials and equipment flown in by helicopter. The difficult terrain

and vegetation may preclude even the use of helicopters, and the present state of the UHD is evidence that unsupported manual labor cannot keep up with the needed repairs.

An obvious alternative to repair is the installation of pipe or new ditch sections within the existing conveyance facility, either with cast-in-place material, or with preformed sections. Implementation of this scheme, however, would be hampered by the lack of access, whether on the ground or through the air, since the new sections would have to be large enough to replace the capacity provided by the seven-foot wide UHD.

IV. Description of the Environment:

Location. The project is on the island of Hawaii along the southeast slope of Kohala Mountain, on the wet uplands above the deep canyons of Kawainui, Alakahi, Koiawe, and Waima (see Figure 1). The streams in the canyons mentioned are all tributary to Waipio Stream.

Boundaries and jurisdictions. The site is in the South Kohala district, near the Hamakua district boundary. The common boundary separates the canyons from the uplands. The work will be done on lands under Executive Order No. 1660 to the Hawaii Irrigation Authority and identified by tax map key 6-3-01:4.

Land Classification and Use. The project is in a State Land Use District (Ref. 1) designated as "conservation" (C), "protective" (P) subzone. The objective of such subzones is to protect valuable resources in restricted watersheds, provide sanctuaries for biota, as well as to protect archaeological and physical features and sites (Ref. 2). The area is also shown as "conservation" by the County of Hawaii" (Ref. 3).

The project is entirely within the Kohala Forest Reserve, but outside of a natural area reserve designated as Puu O Umi. The establishment of the N.A.R. by the State Board of Land and Natural Resources (Ref. 5) requires the approval of the Governor through issuance of an executive order.

Economy. At a time when the rest of the county is contemplating such exotic projects as additional telescopes on Mauna Kea, the implementation of geothermal energy plants, and even a launching pad for satellite rockets, the economy of Waimea, South Kohala, still revolves around the availability of water from the wet slopes of Kohala Mountain. Waimea has grown around the intersection of Mamalahoa Highway and the Waimea-Kawaihae Road. A fairly large shopping center at the intersection attests to the urban area's growth. Kamuela Airport, two miles south, continues to serve the community, although at reduced levels of traffic. Keahole Airport and the new Kailua to Kawaihae Highway appear to have preempted the position of the small air terminal in Kamuela. The areal dominance of the cattle ranching enterprises is still evident from the

air, as well as from the ground, giving way to plots of diversified agriculture only on the east and west flanks of Waimea town. The district of South Kohala has doubled in population from 2,310 persons to 4,607, between 1970 and 1980 (Ref. 4).

Physical Features. Kohala Mountain is the oldest mass on the Big Island. The Upper Hamakua Ditch runs southward along the eastern slopes, roughly parallel to the northwest-southeast trend of the volcano's major rift zone. The UHD was constructed on the wet uplands to capture the runoff from the forested slopes before the discharges plunge into the deeply gouged fingers of the tributaries of Waipio Stream. Land slope perpendicular to the UHD flow is about ten feet in one hundred. The Amalu soils of the uplands are strongly acidic, highly permeable, poorly drained, mucky silt loam underlain by clay loam. In parts, the soil and subsoil sit over a thin, discontinuous sheet of ironstone. The ashy gray soil formed in place from andesites of the Hawi volcanic series. The Kahua soils near the head of Waima canyon are similar to the Amalu soils, but are dark brown instead of ashy gray. The silty clay loam also dehydrates irreversibly into fine gravel-size aggregates. Both of the soils are highly corrosive to unprotected steel and concrete because of their strongly acid character (Ref. 7). The Hawi lavas form a protective cap over the easily eroded Pololu basalts exposed in the walls of the canyons of Kawainui, Alakahi, Koiawe, and Waima (Ref. 8).

On a fairly steep, continuous slope about 1000 ft. to 2000 ft. southeast of Kawaiki Intake, evidence remains of a recent landslide nearly 100 feet wide which began 200 feet uphill from the ditch and continued for another 200 feet downhill. Further southeast, a few local bogs with standing water dot the terrain on the downhill (east) side of the UHD. One open pit of undetermined depth can also be seen here.

The slide, bogs and pit are outside of the present project limits. Closer to and west of Alakahi canyon, a 75-foot drop-off collects surface runoff which enters a lava tube apparently destined to cross beneath one of the proposed roads. The wet area in and around the opening supports some rare plants (see below).

Climate. The range in elevation included in the project area is from 3000 feet to nearly 4000 feet. Precipitation is high at those elevations, with nearly 113 inches a year along the east rim of Koiawe canyon and more than 140 inches at the head of Alakahi canyon (Ref. 9). Climatic conditions can also be described as cool (mean temperatures in the low sixties at Kamuela Airport, 1000 feet lower in elevation), and gloomy, with visibility-limiting fog descending from above or swept upward from the canyons, often with striking suddenness.

Biota. The Upper Hamakua Ditch is located within "Prime Forest Land" meeting the "National Standard" designation as defined in the "Prime Forest Lands Inventory" (Ref. 10). The ditchside vegetation at higher elevations is predominantly 'ohi'a-lehua and hapu'u, with a scattering of 'olapa. The trees at the high, wet lands are noticeably shorter than the specimens of the same species growing at lower, drier

elevations. In the vicinity of Alakahi, a parallel row of planted Sugi does well beside the ditch. Some of the trees are quite close to the lined ditch, but removal of any is not anticipated. Ginger is abundant and has overgrown the trail in places; and even at high elevations, some exotic grasses can be noticed underfoot, along the ditchside trail.

At lower, drier locations, 'olapa are more numerous and taller than at higher elevations. Near the head of Waima canyon, bamboo chokes out other plants in places.

Native trees and shrubs include the most conspicuous 'ohia and 'olapa, but consist also of alani, ohelo-kau-la'au, manono, and kanawao. Hapu'u, likewise, are the most obvious native terrestrial ferns, but 'ama'u, 'ama'uma'u, uluhe and swordfern are common. Native epiphytes include Adenophorus sp., Polypodium pellucidum, and 'ekaha. Sphagnum and Peperomia abound on the wet, acid ground.

Three species of plants under review for endangered status were found within the project area. Clermontia drepanomorpha, Tetraplasandra aff. Kohalae, and Diplazium molokaiense are described in Appendix E4. Four clermontia are located immediately north of the end of the existing road, along the proposed access road west of the head of Alakahi canyon. The three plants closest to the preliminary road alignment have been flagged. The collected diplazium is believed to be from this same habitat. Along the same route, north of Alakahi Stream, near a concrete flume, one tetraplasandra is ensconced amid the row of sugi trees. Five more tetraplasandra were located near the proposed road south of the head of Alakahi canyon.

Except for the frequently encountered hoofprints of feral pigs near the bamboo grove, evidence of fauna was not detected on the initial engineering reconnaissance. Avi-fauna, particularly, was notable by its absence. During a later wildlife survey field reconnaissance, no native birds were found, but two red-billed leiothrix and one Japanese white-eye were encountered.

Appendix E3 is a report on a reconnaissance to determine the probable impacts of the project on wildlife and their habitats. Although no native birds were found during the survey, common species such as elepaio, apapane and amakihi are known to be present. No endangered forest birds are known to inhabit the project area. In the past, Koloa ducks have been released on Kohala Mountain (Ref. 12). The project is also within a public hunting area (Ref. 6).

Archaeological features. No archaeological sites are believed to be endangered by the proposed project. Any sites or artifacts which may have been present could have been destroyed during the initial construction of the Upper Hamakua Ditch. The extreme wetness, cold, and mucky soil of the land would probably have discouraged selection of the site for human habitation, but would not necessarily preclude the siting of religious or other ceremonial structures on the highlands overlooking the awe-inspiring vista of spectacular canyons and ridges.

The UHD originally extended beyond the district of South Kohala, into the Hamakua district, but serves now as the collection and conveyance device for transmitting surface runoff to storage and distribution facilities of the Waimea Irrigation System. During May, 1983, the WIS served 67 accounts representing a total of 466 acres in cultivation which drew 34 million gallons of water collected by the UHD. As presently functioning, the UHD consists of 45,400 feet of lined and unlined ditches, tunnels, and flumes (see appendix E2 for a more detailed inventory) between Kawainui Intake and Puu Pulehu Reservoir (Figure 2). The WIS includes a 60 M.G. reservoir and 28,000 feet of 24-inch and 18-inch transmission mains. The 120 M.G. capacity of Puu Pulehu Reservoir will be added to the system soon with the installation of a pump and 8,000 feet of 16-inch pipeline (Ref. 18).

Besides the State's Waimea Irrigation System, two other water systems divert water from the southern and eastern slopes of Kohala Mountain to serve the South Kohala district. The County (domestic water system) takes flows from Kohakohau and Waikoloa Streams and stores the discharges in two fifty million gallon and one eight million gallon reservoirs before treating and distributing the water to its customers. Parker Ranch uses its private system to divert water from Alakahi, Kohakohau, and Waikoloa Streams, upstream from the corresponding State and County diversion intakes.

V. Relationship to Land Use Plans, Policies, Controls:

The project's location in a forest reserve (FR) and conservation district (CD) has been mentioned. The legal authority for establishment of reserves is found in Title 12, Subtitle 4, Chapter 183 of the Hawaii Revised Statutes. Subtitle 5, Aquatic Resources and Wildlife, also applies since the project site is a native bird habitat as well as a public hunting area. Subtitle 6, Section 195D-5 protects endangered species and their ecosystems. Title 13, Chapter 205 renamed the FR (more properly the forest and water reserve zones) "conservation districts".

Neither the project concept (extending the life and usefulness of an existing water facility), objectives (repairing and providing access for future repairs before further damages ensue), nor actual implementation (construction) are in conflict with the intent of the plans, policies and controls applicable to the site. The statutes, however, do contain specific provisions prohibiting damaging and removal of timber (Section 183-17), and the taking, killing, or possessing of wild birds (Section 191-13), without the approval of the Department of Land and Natural Resources.

The water collection and conveyance function of the ditch is a permitted use in the conservation use, protective subzone. The repairing and constructing of access for maintenance and repairs are accessory uses in the subzone. They are necessary adjuncts without which the permitted use cannot be sustained.



The Department of Hawaiian Home Lands has prepared a report for development of lands under its jurisdiction at Puukapu (Ref. 16). The alternative plans discussed in the report require the development of water sources for implementation and would argue for conservation of water resources presently captured by existing facilities on Kohala Mountain.

An agricultural water study (Ref. 17) conducted by the U. S. Soil Conservation Service recommends construction of 145 million gallons of additional storage plus a network of distribution mains, and likewise encourages the conservation and management of water resources through maintenance of existing facilities.

VI. The Probable Impact of the Proposed Action on the Environment:

Probable Impacts and Associated Mitigative Measures. The major impacts which can be expected from implementation of the project are all associated with clearing of the route for the access road, namely (a) loss of vegetation, (b) presence of an open swath in the forest, and (c) erosion. Since no work will be done to increase the diversion capacity of the system, streamflow to the Waipio valley network will not be altered except for a possible temporary increase in discharge while ditch water is diverted away from construction.

Loss of vegetation. Assuming that even with an 8-foot wide travel way, up to 20 feet may be cleared because of the dimensions of suitably powered construction equipment, the cleared area would be nearly half an acre for each 1000 feet of access road. For the 2500 feet and 1700 feet road segments proposed near Alakahi, a total of about 1.9 acres of vegetation may be lost. In terms of numbers, the predominant loss in the tree population would be with the 'ohi'a-lehua, followed by 'olapa. Losses in the understory would involve mostly hapu'u. Low level vegetation loss would be most numerous among the uluhe (false staghorn), common swordfern, and in the grasses. Alternative routes are available to avoid the located clermontia. As presently envisioned, no sugi needs to be removed for the road; hence, the lone tetraplasandra also will be protected. The group of five tetraplasandra lies outside of the proposed route of the access road.

In the 1500 feet segment south of Waima canyon, about 0.8 acres could be cleared, but the plants most affected in numbers would be bamboo, with some loss of 'ohi'a, 'olapa, and hapu'u. In actual construction, very little vegetation may be lost since a wide cleared trail parallels the Upper Hamakua Ditch up to the wooden flume crossing Waima stream. Construction activity will also create a temporary disturbance for any nearby animals, and removal of vegetation could destroy habitat for resident wildlife.

Presence of an open path in the forest. Although the present Upper Hamakua Ditch system includes a fairly wide trail for maintenance purposes, clearing for construction of access roads will most likely create a wider swath in the forest than now exists. The

danger in the presence of such a cleared area is in the possible concomitant creation of an ecological niche for one or more life forms not now present in significant numbers on Kohala mountain. The exotic could be introduced during or after construction, and there is no way that such introduction can be totally prevented. Similarly, the impacts of the open swath on fauna and remaining flora are difficult to gage, and may never be fully known until they occur.

Erosion hazard. Two extremes can be described to illustrate the erosion hazards for the project. Where the ditch, and hence the proposed road, are perpendicular to the natural surface drainage, runoff uphill of the UHD collects in the system. The proposed roads west of Alakahi and south of Waima are of this type. These roads, where possible, will be constructed on the downhill side of the ditch. Sacrifice of one or two Sugi on the downhill side may be preferable to placing the road on the uphill side of the ditch, where collection and concentration of runoff, and hence of erosion of road material into the ditch will place an additional burden on the ditch system. Where routing on the downhill side is precluded by proximity to cliffs, density of trees, or other factors not apparent as yet, design of the uphill side roadway must include provisions for the attenuation of the effects of surface runoff. In either case, placement of the road may be dictated by the allowable proximity of moving vehicles to the UHD, since the unreinforced lining of the ditch may not be able to withstand the loads transmitted through the soil by maintenance vehicles passing too close to the UHD.

The proposed road south of Alakahi, if constructed parallel to the ditch, will be in the same direction as the natural surface drainage, i.e., along the slope of the ground. Erosion of road material into the ditch may not pose a problem, unless the road crosses the ditch at some point. Collection of runoff in roadside swales may create unacceptably deep drainage ways. Design mitigation measures should provide for frequent dispersal of runoff before accumulated discharges become unmanageable. Additional engineering measures including crushed cinder paving, berms, settling basins, flat slopes on cuts and fills, and permanent drainage structures can be utilized wherever appropriate, to lessen erosion. Vegetative measures employed to complement the above must, of necessity, be restricted to the use of on-site plant types and salvaged, on-site mulch.

Erosion hazard ratings computed by standards promulgated by the City and County of Honolulu are well below the threshold severity rating number deemed acceptable. Soil loss for the worst condition in the project is estimated at 172 tons per acre per year (if the roadway is bare soil) and the severity rating number is 2855. The severity rating which Honolulu considers as a tolerable maximum consideration of environmental damage is 50,000. The published standards clearly place no constraints on implementation of the project nor do they delimit the extension of the roadways. One hundred seventy-two tons of soil per acre per year, however, would be an unacceptable loss from a maintenance road, and material other than bare soil will have to be considered, particularly near existing or potential drainageways along the proposed

road south of Alakahi. Cinder paving of the travel way and mulching or planting of remaining cleared areas can significantly reduce the already low hazard.

In contrast to the relatively gradual loss through erosion, landslides could produce anything from minor inconveniences to sudden destruction of the UHD. Although extensive earthwork is not anticipated, drainage must be provided to avoid lubricating the interface between the suspected ironstone layer and upper soil strata.

Because the saturated Kohala Mountain soils dry irreversibly to an extremely light, granular material with changed characteristics as a planting medium and road bed material, dehydration may be as bad as, if not worse than wetness. Measures to retain optimum moisture include keeping the work (cleared) area as small as practical, and timely paving of prepared road beds with cinder aggregate and covering of cuts and fills with mulch.

In this project, especially for the access roads, specifying equipment and construction practices may be more important than calling for design choices. In the typical project, a field survey is followed by design selection and production of construction drawings. A contractor then builds the road according to the route and dimensions shown and the materials specified in the contract documents. Payment for this method would probably be by the lineal feet of roadway completed.

A more flexible alternative may be to provide construction drawings showing a generalized route, with greater responsibility placed on field decisions. Within the general route selected by the designer, the field engineer would point out specific directions dictated by the particular terrain and vegetation, as well as by equipment limitations. Only the smaller types of earth moving equipment² could be allowed on the site, and land disturbance could be kept to a minimum. Although this method would probably require a longer construction period, this proposed project may be ideal for just such a process, since clearing, earth moving, and cinder paving could be kept to a minimum by the field engineer.

Short-term uses vs. long-term productivity. The reliability which repairs and access roads could provide to the Upper Hamakua Ditch and hence to the diversified agricultural economy of Kamuela, would be gained at the expense of some loss of vegetation. For all intents and purposes, the proposed roads would be paths dedicated to access, from which re-growth would be prevented.

Irreversible and Irretrievable commitment of resources. Plants destroyed during construction would be lost forever. The portions of the forest dedicated to access purposes, while technically reversible to a forested state, most likely could not be returned to their original, preconstruction condition.

² For example, a wheel loader with minimum width bucket and backhoe attachment.

Besides the usual commitment of labor, fuel and material to repair the ditch, this project will likely require the use of cinder material for the access roads. Arrangements have been made to acquire cinders from Puu Kawaiwai, a cinder cone previously quarried for coarse aggregates. Puu Kawaiwai is off the Kohala-Waimea Road, about three miles west of the junction of the road with the Kawaihae-Waimea Road.

Probable adverse effects which cannot be avoided. In summary, the probable impacts are (a) the immediate loss of some vegetation during construction, (b) the creation and continuation of an open swath in the forest, and (c) initial and possible continuing erosion. While every adverse effect listed may be kept to a minimum by thoughtful design and judicious construction practices, each will occur to some degree if this project is undertaken.

Other Government Interests. The annual production of the Lalamilo-Puukapu farm belt is about 17 million pounds, valued at over \$2 million, with nearly 70% of the crops grown represented by Chinese cabbage, celery, head lettuce and romaine. The four major crops in the belt account for 95% of the Big Island's output and nearly two-thirds of the State's entire production (Ref. 15). The loss of this production, with an impact not only on the State's economy, but also on the food supply, because of inattention to the Upper Hamakua Ditch, is unthinkable.

Unless consideration is given to a large-scale project to install a new collection and conveyance facility to replace the Upper Hamakua Ditch, there are no alternatives to repairing the ditch and providing access routes to keep up with the damages which occur during storms, and with the deterioration which mounts with time.

Future improvements and cumulative impacts. Extensions of the proposed access road are being considered up to Kawaiki Intake, near the head of Kawainui canyon. Cumulative effects are expected to be no different in kind than those discussed for the present project.

The completed access roads will facilitate repairs of the ditch. More frequent inspections and rapid deployment of repair crews and materials will be possible where access roads are available. The benefits of the proposed project may be immeasurable to the farming communities of Lalamilo and Puukapu which rely on the Upper Hamakua Ditch for collection of their irrigation water, and to the people of the State who consume the agricultural products produced in Waimea, South Kohala.

VII. EIS Preparation and Consultation:

Respondents and commentors. The following parties offered comments or responded to solicitations for comments on the EIS or on the conservation district use application:

1. Albert K. Ozaki, Kamuela, Hawaii
2. Honolulu Poi Co., Ltd., James I. Tottori, Chairman of the Board
3. Natural Area Reserve System, DLNR, Robert Lee
4. Division of State Parks, DLNR, Roy K. C. Sue, Administrator
5. Department of Hawaiian Home Lands, Georgiana K. Padeken, Chairman
6. Planning Department, Hawaii County, Sidney Fuke, Director
7. U.II. Manoa Environmental Center, Doak C. Cox, Director
8. Office of Environmental Quality Control, Letitia N. Uyehara, Director
9. U.S. Fish and Wildlife Service, William R. Kramer, Project Leader, Office of Environmental Services
10. Department of Agriculture, Jack K. Suwa, Chairman, BOA
11. Pacific Ocean Division, Corps of Engineers, Kisuk Cheung, Chief, Engineering Division
12. U.S. Soil Conservation Service, Francis C. H. Lum, State Conservationist

Preparers of the Impact Statement. The assessment, preparation notice, and environmental impact statement were prepared by the Division of Water and Land Development (DOWALD) of the Department of Land and Natural Resources. DOWALD is indebted to the Division of Forestry and Wildlife (DOFAW) for its expertise and advice, especially to Libert K. Landgraf, Administrator, Dr. Carolyn Corn, Botanist, John Giffin, Wildlife Biologist, and also to Joyce Davis, of Hilo, Hawaii, retained under contract to DOFAW.

VIII. Reproduction of Comments and Responses:

Comments and responses are included in Appendix E1.

IX. Summary of Unresolved Issues:

If, as presently anticipated, route selection of the access roads is made in the field, vegetation loss cannot be determined till then. However, one advantage of the field design is the option to avoid plant removal for economic as well as for environmental reasons.

The extent of intrusion by exotics into the project site will not be known until well after the project is completed, but as noted previously, the existing ditchside trail is quite wide and is not without evidence of non-native plants far beyond the project limits.

In overview, the density of wildlife appears to be low, the primary types of wildlife (pigs and introduced birds) are detrimental to native forest ecosystems, reconnaissance surveys indicate that alternative routes are available around flagged rare plants, the project site is not a pristine native forest, and the economic loss to the farmers of Waimea and to the State will be considerable if the Upper Hamakua Ditch is allowed to deteriorate through inaction.

X. List of Necessary Approvals:

Conservation District Use Application (CDUA). A CDUA was filed in May, 1983 and should be acted upon before the end of November. A public hearing was held during October. Applicant has requested a 90-day extension; approval is expected before the end of February 1984.

Department of Health. Approval of construction plans anticipated in early 1984.

Board of Land and Natural Resources. Right-of-entry request for removal of cinders from Puu Kawaiwai Cinder Pit, South Kohala, approved on July 22, 1983.

References

1. STATE LAND USE DISTRICT MAP H-25
2. REGULATION NO. 4, Department of Land and Natural Resources, State of Hawaii
3. LAND USE PATTERN ALLOCATION GUIDE MAP, COUNTY OF HAWAII GENERAL PLAN, Ordinance No. 439 as amended (originally approved Dec. 22, 1971)
4. STATISTICS BY DISTRICTS, 1981, Report CTC-47, Hawaii State Census Statistical Areas Committee, Sept. 1981
5. "RECOMMENDED N.A.R.", March 1978, Department of Land and Natural Resources, State of Hawaii
6. CONSERVATION DISTRICT INVENTORY, NORTH HAWAII - ISLAND OF HAWAII, State of Hawaii, Department of Land and Natural Resources, 1977
7. SOIL SURVEY OF ISLAND OF HAWAII, STATE OF HAWAII, U. S. Department of Agriculture, SCS, and University of Hawaii Agricultural Experiment Station, Dec. 1973
8. GEOLOGY AND GROUNDWATER RESOURCES OF THE ISLAND OF HAWAII, H. T. Stearns and G. A. MacDonald, Hawaii Division of Hydrography, 1946
9. MEDIAN RAINFALL STATE OF HAWAII, Circular C88, State of Hawaii, Department of Land and Natural Resources, 1982
10. PRIME FOREST LANDS INVENTORY, State of Hawaii, DLNR, U. S. Forest Service, 1981
11. HAWAII WILDLIFE PLAN (Draft, Jan. 1982), DLNR, Division of Forestry and Wildlife
12. HAWAII'S ENDANGERED WATERBIRDS, Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior, and Division of Fish and Game, DLNR, State of Hawaii, 1970
13. TERRITORY OF HAWAII GENERAL LICENSE NO. 847 (To Hawaiian Irrigation Company, Limited), May 27, 1914
14. EXECUTIVE ORDER NO. 1660, SETTING ASIDE LAND FOR PUBLIC PURPOSES, (S.W. King, Governor, T.H.), Dec. 6, 1954
15. DEVELOPMENT PLAN AND PRELIMINARY ENGINEERING REPORT, LALAMILO AGRICULTURAL PARK, DLNR, Division of Water and Land Development, prepared by Okahara, Shigeoka and Associates, Inc., Feb. 1981.

16. PUUKAPU DEVELOPMENT PLAN, Department of Hawaiian Home Lands, State of Hawaii, November 1982
17. HAMAKUA AREA AGRICULTURAL WATER STUDY, U.S. Department of Agriculture, Soil Conservation Service, August 1980
18. NEGATIVE DECLARATION FOR REHABILITATION OF PUU PULEHU RESERVOIR, DLNR, Division of Water and Land Development, June 1982

APPENDIX E-1

COMMENTS AND RESPONSES

241

Handwritten mark

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED



PROJECT OFFICES

WAIMEA OFFICE

P. O. BOX 125
KAMUELA, HAWAII 96743

KEAUKAHA OFFICE

P. O. BOX 833
HILO, HAWAII 96720

STATE OF HAWAII

DEPARTMENT OF HAWAIIAN HOME LANDS

P. O. BOX 1879
HONOLULU, HAWAII 96805

January 16, 1984

PROJECT OFFICES

MAUI OFFICE

P. O. BOX 22
KAHOOLAUI, MAUI 96732

MOLOKAI OFFICE

P. O. BOX 198
HOOLEHUA, MOLOKAI 96729

KAUAI OFFICE

P. O. BOX 332
LIHUE, KAUAI 96766

DEPT. OF WATER &
LAND DEVELOPMENT

STATE OF HAWAII

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

SUBJECT: Environmental Impact Statement (EIS) for the
Renovation of Upper Hamakua Ditch and Construction
of Access Roads
Waimea, South Kohala, Hawaii

Reference is made to your letter of November 22, 1983 requesting our
comments on the EIS for the subject project.

The Department of Hawaiian Home Lands has reviewed the EIS for the
subject project and finds this renovation beneficial to all users of the
Waimea Irrigation System. At this time, the Department wishes to express
its support for this program and commends the Department of Land and
Natural Resources for taking steps to execute this project with minimal
damage to the natural environment.

Thank you for the opportunity to comment on this EIS.

Sincerely yours,

Georgiana K. Padeken
Georgiana K. Padeken
Chairman

GKP:RF:CW:eah

cc: William Vincent, Manager, West Hawaii District Office

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
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CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

JAN 25 1984


Honorable Georgiana K. Padeken
Chairman, Department of Hawaiian
Home Lands
P. O. Box 1879
Honolulu, Hawaii 96805

Dear Ms. Padeken:

Renovation of Upper Hamakua Ditch and
Construction of Access Roads, Waimea,
South Kohala, Hawaii

Thank you for your generous expression of support for this project. Your continuing assistance and cooperation in improving the Waimea Irrigation System is most appreciated and will work to the benefit of all who utilize the water resources of South Kohala.

Very truly yours,


SUSUMU ONO
Chairperson of the Board



RECEIVED

34 JAN 11 AIO: 03

University of Hawaii at Manoa

DIV. OF WATER &
LAND DEVELOPMENT

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

January 6, 1984

RE:0395

Ms. Letitia N. Uyehara, Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Ms. Uyehara:

Draft Environmental Impact Statement
Renovation of Upper Hamakua Ditch and Construction
South Kohala, Hawaii

The above cited DEIS is a well researched and concisely written document disclosing the potential environmental impacts associated with the construction of access roads and the renovation and reconstruction of the Upper Hamakua Ditch in South Kohala, Hawaii.

This Environmental Center review has been prepared with the assistance of Paul Ekern, Agronomy and Soils/WRRC; Joseph Halbig, Geology-UH Hilo; Charles Lamoureux, Botany; Sheila Conant, General Science and Jacquelin Miller and Mark Ingoglia, Environmental Center. The following comments are offered for your consideration:

Soils

Due to the high rainfall and steep topography associated with the project site, the issue of potential land slides or land slips should be addressed.

Road Design

Due to the general wet, boggy characteristics of the proposed site, it is apparent that the construction of stable roads to withstand equipment traffic in all seasons and weather conditions will be difficult but necessary. Road construction activities should be limited to low rainfall seasons to reduce soil erosion. Care should be taken to identify which seasonal dry periods are appropriate noting that upland and lowland wet seasons may be different. Work should be halted when wet periods occur during construction. After grading, cinders should be applied as rapidly as possible to each section of the road.

AN EQUAL OPPORTUNITY EMPLOYER

January 6, 1984

The suggested "more flexible alternative" (p. 8), for the road construction procedure, of delegating to the field engineer the responsibility for determining the specific directions of the road way so as to minimize both the earth moving equipment requirements as well as the land disturbance seems highly desirable. We suggest that in any case mitigative measures cited in this EIS to reduce environmental impacts, be made a part of the construction contract. This would assure that contractors, and field engineers, comply with the recommended environmentally necessary procedures. Also, construction workers should be briefed on why and how proper conservation practices need to be carried out due to the sensitive nature of the proposed project site.

Fauna and Flora

The threatened Newell Shearwater Puffinus auricularis newelli may inhabit the project area periodically. Because of their threatened status it would be wise to check with the U.S. Fish and Wildlife Service to see if any particular concerns need to be addressed or mitigative measures taken during construction activities.

To reduce soil erosion, use of salvaged mulch or plantings is mentioned (p. 8). The source and methods of salvaging mulch and on-site plants needs further discussion to assure that further erosion is not caused in the process. A combination of both methods would be most effective since mulch would reduce initial erosion, while proper plantings of native species most appropriate for disturbed soils in that particular ecosystem will ensure quick regrowth and reduce long term erosion. A short list of which species are to be used for revegetation should be included in the REIS.

Yours truly,



Doak C. Cox
Director

cc: Robert T. Chuck, DLNR ✓
Paul Ekern
Joseph Halbig
Charles Lamoureux
Jacquelin Miller
Mark Ingoglia

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

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BOARD OF LAND & NATURAL RESOURCES

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DEPUTY TO THE CHAIRMAN

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FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

FEB 9 1984

Dr. Doak C. Cox, Director
Environmental Center
University of Hawaii
2550 Campus Road
Crawford 317
Honolulu, Hawaii 96822

Dear Dr. Cox:

Renovation of Upper Hamakua Ditch and Construction
of Access Roads, South Kohala, Hawaii

Thank you for the thoughtful suggestions offered on our EIS submitted for comments. Our responses follow the headings you have used in your letter to the OEQC:

Soils

We have had to clear landslide debris from our ditch in the past. The most obvious scar from recent activity can be seen near elevation 4000 feet. The slide, which began uphill of the ditch, stripped surface material of uniform depth from a fairly steep continuous slope south of Kawaiki Intake, on terrain where trees are stunted and vegetation is relatively sparse. On the other hand, above Alakahi Canyon, near-vertical cuts over six feet high have stood beside the ditch for decades. Our plans are to construct the road along existing grades. We, therefore, do not anticipate such extensive earthwork where the roadway cuts or fill may be a potential cause for landslides.

Road Design

Our irrigation district manager who operates the irrigation system will be the field engineer on this project. He is totally familiar with the precipitation patterns and the wet, boggy characteristics of the proposed project site. Further, our field engineer guided our design engineer and the botanical survey team in their field investigation phase of the project, and is totally aware of the engineering and environmental considerations of the roadway design. We have every confidence that he will direct and manage the construction activities in a responsible manner. Your suggestions on the weather and timely application of cinders are well taken.

Dr. Doak C. Cox

-2-


FEB 9 1984

Fauna and Flora

The U. S. Fish and Wildlife Service, in their letter to us, has not mentioned the Newell Shearwater as a species potentially affected by our project.

We are reluctant to provide a list of "approved" plants for revegetation for fear that this might encourage the uprooting of plants plentiful in one sector for transplanting in another where they may be scarce or even absent. Only mulch from surfaces cleared for the roadway will be used; revegetation will be with adjacent plants. One obvious difficulty, of course, will be in having our field people recognize and not promote the spread of resident exotics.

Very truly yours,


SUSUMU ONO
Chairperson of the Board



COUNTY OF HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720
(808) 961-8288

STATE OF HAWAII
LAND AND NATURAL RESOURCES

RECEIVED

DIVISION OF WATER & LAND DEVELOPMENT

HERBERT T. MATAYOSHI
Mayor

SIDNEY M. FUKU
Director

DUANE KANUHA
Deputy Director

December 21, 1983

DEC 27 1983

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Conservation District Use Application for
Renovation of Upper Hamakua Ditch
and Construction of Access Roads,
South Kohala, Hawaii, HA-5/17/83-1588
TMK: 6-3-1:4

We have reviewed the subject environmental impact statement (EIS) and have the following comments to offer.

1. Page 8 of the EIS contains a reference to erosion hazard standards of the City and County of Honolulu and erosion hazard ratings computed by these standards for the proposed project. It would be helpful to the reviewer if these standards and an explanation of what they mean were included in the text. Also, Hawaii County's Public Works Department could provide more informed comments on the possible erosion hazards of this project.
2. In a letter dated April 3, 1983 from Roy K. C. Sue, State Parks Administrator to Mr. Robert Chuck, Manager-Chief Engineer of the Division of Water and Land Development, DLNR, Mr. Sue states "... the wooden flume at the head of Waimea Canyon may be of historical/engineering significance. An evaluation of the structure should be undertaken."

Has such an evaluation already been done and if not, is one being planned?

3. In a letter dated March 29, 1983 from Mr. Albert Ozaki, he states "... there were no mentioning of the 90-foot flume to be replaced, although the 50 foot was listed. Both flumes need to be replaced."


Mr. Susumu Ono, Chairman
Page 2
December 21, 1983

Contrary to Mr. Ozaki's statement, it is our understanding that it is indeed a 90 foot wooden flume which is to be repaired rather than a 50 foot flume. Although the EIS does not mention a second flume, if a second does exist, is it also being considered for repair?

4. Page 8 of the document Botanical Survey of Three Proposed Roadways Along the Upper Hamakua Ditch, Hawaii by Carolyn A. Corn states that one specimen of the fern Diplazium Molokaiense was collected during the survey "... possibly from area 2 near the lava tube." This lava tube is not mentioned anywhere in the EIS, either under physical features or archaeological features, and might be more fully discussed. The possible existence of other such major physical features might be discussed as well.

Thank you for the opportunity to comment on this environmental impact statement. Please contact our office should you have any questions.

Sincerely,


SIDNEY FUKE
Planning Director

GU:emf

cc: Roland Higashi
Glen Taguchi



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
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CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

JAN 30 1984

Mr. Sidney Fuke, Director
Planning Department
County of Hawaii
25 Aupuni St.
Hilo, Hawaii 96720


Dear Mr. Fuke:

Renovation of Upper Hamakua Ditch and Construction
of Access Roads, South Kohala, Hawaii

Thank you for your comments on our conservation district use application for the above project. Our responses correspond to your numbered comments.

1. Erosion hazard. The severity rating number we refer to is the one found in "Soil Erosion Standards and Guidelines", City and County of Honolulu. Our copy is undated. The "universal soil loss equation" which Honolulu uses is that developed by the U. S. Soil Conservation Service. Application of the equation to other areas of the State can be found in "Erosion and Sediment Control Guide for Hawaii", U.S. Department of Agriculture, SCS, March 1981.
2. Waima Flume. The 90-foot wooden flume crossing Waima Stream was constructed by us (DOWALD) recently and, therefore, is not of historical significance and we have informed the Division of State Parks of this fact.
3. Number of Flumes. As Mr. Ozaki states, there are two flumes; and as you surmised, both need to be worked on. On this job, the 90-foot flume crossing Waima Stream will be replaced, but because of lack of funds, work on the second flume, 3,700 feet further upstream, is scheduled to be done at a later date. Appendix E-2 lists both wooden flumes.
4. Lava tube. As you note, lava tube is discussed, except by reference only in the Botanical Report, Appendix E-4. Our botanists, design engineer and field engineer all seem to feel that the road can be aligned to avoid any impact on the lava tube and plants around the sub-ecosystem. If other major physical features such as the lava tubes are discovered, we will take steps to avoid any impact on these features.

Very truly yours,


SUSUMU ONO
Chairperson of the Board

679

Orwell



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United States Department of the Interior

83 DEC 5 P 3 FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU, HAWAII 96850
A10: 06

IN REPLY REFER TO:
ES
Room 6307

DIV. OF WATER &
LAND DEVELOPMENT

DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

DEC 2 1983

Mr. Susumu Ono
Chairperson, Board of Land
and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Re: EIS for Renovation of Upper
Hamakua Ditch and Construc-
tion of Access Roads, South
Kohala, Hawaii

Dear Mr. Ono:

We have reviewed the subject EIS and find that, in general, it adequately addresses fish and wildlife resources within our jurisdiction. We suggest that the following specific comments be addressed in greater detail:

- a. The EIS does not address impacts of the proposal on stream fauna and aquatic resources in Waipio or Waimanu Valleys (refer to our letter of August 2, 1983).
- b. The plant Diplazium molokaiense should be added to appendix B of the botanical report. The exact locality of D. molokaiense should be determined and illustrated on project maps. This very rare fern was previously unknown from the Island of Hawaii and, as such, deserves careful attention.
- c. The common Melaleuca in Hawaii is M. quinquenervia, not M. leucadendra.

Sincerely yours,

William R. Kramer
Acting Project Leader
Office of Environmental Services

cc: NMFS - WPPO
HDF&W
HDAR
EPA, San Francisco



Save Energy and You Serve America!

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES
EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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STATE PARKS
WATER AND LAND DEVELOPMENT

DEC 2 8 1983

Mr. William R. Kramer
Project Leader
Office of Environmental Services
Fish & Wildlife Service
U.S. Department of the Interior
300 Ala Moana Blvd.
Honolulu, Hawaii 96850

Dear Mr. Kramer:

Renovation of Upper Hamakua Ditch and
Construction of Access Road

Thank you for your thoughtful comments on our EIS for the above project. We will make the appropriate corrections to our botanical report and will conduct additional field work to determine the location of the fern D. Molokaiense. A revised botanical report will be forwarded to you upon its completion.

Please be assured that the work will not alter the historic flow patterns of Waipio and Waimanu Valley streams, except to temporarily increase the flow in Waipio as ditch water is diverted away from construction.

Very truly yours,

/s/ SUSUMU ONO

SUSUMU ONO
Chairperson of the Board



United States
Department of
Agriculture

Soil
Conservation
Service

P.O. Box 50004
Honolulu, Hawaii
96850

January 4, 1984

Ms. Letitia N. Uyehara
Interim Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

DIVISION OF WATER &
LAND DEVELOPMENT

84 JAN 9 4:15

RECEIVED

Dear Ms. Uyehara:

Subject: EIS for the Renovation of Upper Hamakua Ditch and Construction of Access Roads, South Kohala, Hawaii

We reviewed the subject document and feel that it is quite factual and well written.

As is brought out in the document, there will be some erosion problems but most of these can be controlled by proper design, construction, and maintenance.

Repair of the Upper Hamakua Ditch was recommended in the Hamakua Agricultural Water Study that was sponsored by the Hawaii State Department of Land and Natural Resources and the Mauna Kea Soil and Water Conservation District.

We support this project and feel that it is needed to maintain and improve the agricultural viability of the area.

Sincerely,

Francis C. H. Lum

FRANCIS C.H. LUM
State Conservationist

cc:
Mr. Robert T. Chuck ✓
Manager-Chief Engineer
Division of Water and Land Development
Department of Land and Natural Resources
P.O. Box 373
Honolulu, HI 96809



The Soil Conservation Service
is an agency of the
Department of Agriculture

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

SUSUMU ONO, CHAIRMAN
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EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

JAN 12 1984

Mr. Francis C. H. Lum
State Conservationist
Soil Conservation Service
P. O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Lum:

EIS for the Renovation of Upper Hamakua
Ditch and Construction of Access Roads,
South Kohala, Hawaii

Thank you for your supportive comments for our project.
Please be assured that we will do our utmost to maintain erosion
controls during construction of our access roads.

Your continued assistance and cooperation on our project
are appreciated.

Very truly yours,

A handwritten signature in cursive script, appearing to read "Susumu Ono".

SUSUMU ONO
Chairperson of the Board



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

December 20, 1983

DIV. OF WATER &
LAND DEVELOPMENT

83 DEC 27 4 8 : 48

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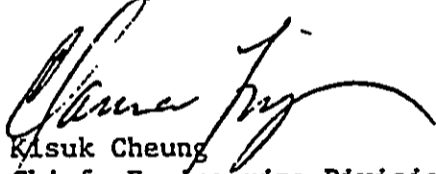
Mr. Robert T. Chuck
Division of Water and Land Development
Department of Land and Natural Resources
P. O. Box 373
Honolulu, Hawaii 96809

Dear Mr. Chuck:

Thank you for the opportunity to review and comment on the environmental impact statement for Renovation of Upper Hamakua Ditch and Construction of Access Roads. The following comments are offered:

- a. If any fill is proposed in Alakahi Stream, a Department of the Army permit may be needed. We would like to review the construction plans when they are available.
- b. The project site for the proposed ditch improvements and construction of access roads, located entirely within the Kohala Forest Reserve area, is designated Zone C or area of minimal flooding. According to the Flood Insurance Study for the County of Hawaii prepared by the Federal Insurance Administration, Zone C areas are outside of the regulatory flood plains (see enclosure 1).

Sincerely,


Kiasuk Cheung
Chief, Engineering Division

Enclosure

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT

P. O. BOX 373
HONOLULU, HAWAII 96809

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DEPUTY TO THE CHAIRMAN

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LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

January 6, 1984

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
Pacific Ocean Div., Corps of Engrs.
Ft. Shafter, Hawaii 96858

Dear Mr. Cheung:

Renovation of Upper Hamakua Ditch
and Construction of Access Roads

Thank you for your comments on our EIS for the above.

As shown on our construction plans, we will not be filling
Alakahi Stream.

Very truly yours,

ROBERT T. CHUCK
Manager-Chief Engineer

LA:jes
cc: D&C Branch, DOWALD

GEORGE R. ARIYOSHI
GOVERNOR



JACK K. SUWA
CHAIRMAN, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
DEPUTY TO THE CHAIRMAN

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83 DEC 8 9:30

DIV OF WATER &
LAND DEVELOPMENT

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822

December 5, 1983

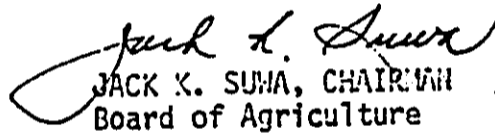
MEMORANDUM

TO: Ms. Letitia N. Uyehara, Interim Director
Office of Environmental Quality Control

SUBJECT: Environmental Impact Statement (EIS) for
Renovation of Upper Hamakua Ditch and
Construction of Access Roads
Department of Land and Natural Resources
TMK: 6-3-01: 4 South Kohala, Hawaii

The Department of Agriculture has reviewed the subject document and supports the proposed improvements to the Upper Hamakua Ditch. These improvements will help to ensure a reliable irrigation water supply to agricultural activities in the Lalamilo and Puukapu areas.

Thank you for the opportunity to comment.


JACK K. SUWA, CHAIRMAN
Board of Agriculture

cc: Mr. Robert T. Chuck
DONALD

"Support Hawaiian Agricultural Products"

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
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DEPUTY TO THE CHAIRMAN

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WATER AND LAND DEVELOPMENT

JAN 9 1984


Honorable Jack K. Suwa
Chairman, Board of Agriculture
P. O. Box 22159
Honolulu, Hawaii 96822

Dear Mr. Suwa:

Environmental Impact Statement for
Renovation of Upper Hamakua Ditch and
Construction of Access Roads

Thank you for your supportive comments on our proposed
project.

Very truly yours,


SUSUMU ONO
Chairperson of the Board

The following parties responded to solicitations for comments on the EIS submitted for review, but did not offer substantive remarks.

State of Hawaii

1. Director, Department of Transportation
2. Office of the Adjutant General, Department of Defense
3. Deputy Director for Environmental Health, Department of Health
4. State Public Works Engineer, Department of Accounting and General Services

Federal

1. Headquarters 15th Air Base Wing (PACAF), Hickam Air Force Base, Hawaii
2. Headquarters, Naval Base, Pearl Harbor
3. Commander, Fourteenth Coast Guard District

County of Hawaii

1. Director, Department of Research and Development
2. Director, Department of Parks & Recreation

The following comments were received prior to our filing of the EIS submitted for review with the Environmental Quality Commission.

RECEIVED

83 MAR 31 A 8:55

Kamuela, Hawaii
March 29, 1983

Mr. Robert T. Chuck
Manager-Chief Engineer
Div. of Water & Land Development
P. O. Box 373
Honolulu, Hawaii 96809

DIV. OF WATER &
LAND DEVELOPMENT

Dear Bob:

Thank you for your letter of March 23rd, together with a copy of the draft environmental assessment for the UHD project. It was very thoughtful of you and your staff to give me an opportunity to provide comments on subject project.

The draft is well documented, covering all phases of the environment. My comments are of minor nature, for it may have been unintentionally overlooked.

1. The replacement of the flumes; there were no mentioning of the 90-foot flume to be replaced, although the 50-foot was listed. Both flumes needs to be replaced.
2. On same section, par. and page (c), the 50-foot flume is located 5,400 feet upstream of the 60 mg reservoir intake and not 1,500 feet. The 90-foot flume is 1,700 feet upstream of same reservoir intake.

Other than the above minor descriptions, the access roads will require one crossing of the UHD near Alakahi Intake and should the proposed access road be constructed by the 60 mg reservoir intake, this will also require a crossing of the UHD.

If I can be of any assistance, please feel free to give me a call.

Very truly yours,



ALBERT K. OZAKI

cc; Albert Kawabata
Waimea Office



HONOLULU POI CO., LTD.

288 LIBBY STREET
HONOLULU, HAWAII 96819

PHONE (808) 848-2431

March 31, 1983

Mr. Robert T. Chuck
Manager-Chief Engineer
Division of Water and Land Development
Department of Land & Natural Resources
P. O. Box 373
Honolulu, Hawaii 96809

DIV. OF WATER &
LAND DEVELOPMENT

03 APR 4 10:58

RECEIVED

SUBJECT: RENOVATION OF UPPER HAMAKUA DITCH AND
CONSTRUCTION OF ACCESS ROAD

Dear Mr. Chuck:

Thank you very much for your letter of March 24, 1983 and for sending me a copy of the draft environmental assessment for the proposed renovation of Upper Hamakua Ditch (UHD) and construction of access roads.

As you know, repair of the UHD is of vital importance to myself and the rest of the farmers in the Kamuela area, for it is on this system we farmers depend for an assured supply of irrigation water. When the repairs are made, we hope that loss of water through seepage and/or diversion of flow will be reduced so that our periodic problems with drought will for the most part be behind us or at least be minimized.

Maintenance of the ditch components after the project is completed is of prime importance and as the last paragraph of Section VI, page 6, points out, completed access roads will make this job easier.

I am sure that all of the farmers in Kamuela will join me in thanking your office for going ahead with this job and being mindful of the maintenance work that will need to be put in place after the project's completion.

Very truly yours,

HONOLULU POI CO., LTD.

James I. Tottori

James I. Tottori
Chairman of the Board

cc: Mr. Susumu Ono

JIT/vyk



RECEIVED

APR 13 12:44

DIVISION OF WATER &
LAND DEVELOPMENT

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF STATE PARKS
P. O. BOX 621
HONOLULU, HAWAII 96809

April 11, 1983

MEMORANDUM

TO: Mr. Robert Chuck, Manager-Chief Engineer
Division of Water and Land Development

FROM: Roy K. C. Sue, State Parks Administrator

SUBJECT: RENOVATION OF UPPER HAMAKUA DITCH AND
CONSTRUCTION OF ACCESS ROADS, DOWALD
KOHALA FOREST RESERVE, SOUTH KOHALA,
HAWAII, TMK 6-3-04

Thank you for the opportunity to comment on the above subject.
Our comments are as follows:

Recreational Concerns:

There are no known existing recreation concerns except public hunting which of course is under the jurisdiction of the Division of Forestry and Wildlife. The area may have potential as a scenic drive/overlook within native vegetation but these are no known objections to the subject project.

Historic Sites Concerns:

Our records do not indicate the presence of historical, cultural, architectural and/or archaeological resources on this property which are listed on the Hawaii Register and/or the National Register of Historic Places, or that have been determined eligible for inclusion on the National Register of Historic Places.

However, the wooden flume at the head of Waimea Canyon may be of historical/engineering significance. An evaluation of the structure should be undertaken.

In the event that any unanticipated sites or remains such as artifacts, shell, bone or charcoal deposits; human burials; rock or coral alignments, pavings, or walls are encountered during construction, please inform the applicant to stop work and contact this office at 548-7460 immediately.

Handwritten signature of Roy K. C. Sue in cursive.
ROY K. C. SUE

cc: State Parks

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED



APR 6 AM: 01

DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER & LAND DEVELOPMENT
P. O. BOX 621
HONOLULU, HAWAII 96809

April 4, 1983

SUSUMU ONG, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES
EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

MEMORANDUM

TO: Robert T. Chuck
Division of Water and Land Development

FROM: Robert Lee
NARS

SUBJECT: Draft Environmental Assessment on Upper Hamakua Ditch Project

The following two comments are offered to bring the NARS portion of the subject draft in better perspective.

1. The Puu O Umi Natural Area Reserve mentioned on page 2 has been approved for establishment by the Land Board. That action now requires the approval of the Governor by the issuance of an executive order.
2. The NAR is beyond the area of the project, but it may be helpful to the reader if the NAR is identified in Fig. 1. We have maps of the reserve, including a DAGS survey map, which you are welcome to use.

A handwritten signature in cursive script, appearing to read "Robert Lee".

Robert Lee

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

RECEIVED
APR 6 11:01

DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER & LAND DEVELOPMENT
P. O. BOX 621
HONOLULU, HAWAII 96809

STATE OF HAWAII

April 4, 1983

MEMORANDUM

TO: Robert T. Chuck
Division of Water and Land Development

FROM: Robert Lee
NARS

SUBJECT: Draft Environmental Assessment on Upper Hamakua Ditch Project

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1. The Puu O Umi Natural Area Reserve mentioned on page 2 has been approved for establishment by the Land Board. That action now requires the approval of the Governor by the issuance of an executive order.
2. The NAR is beyond the area of the project, but it may be helpful to the reader if the NAR is identified in Fig. 1. We have maps of the reserve, including a DAGS survey map, which you are welcome to use.

A handwritten signature in cursive script, appearing to read "Robert Lee".

Robert Lee

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

DOWN



RECEIVED

680

13 MAY 23 P 1: 25

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

PROJECT OFFICES
MAUI OFFICE
P. O. BOX 22
KAHULUI, MAUI 96732

MOLOKAI OFFICE
P. O. BOX 196
HOOLEHUA, MOLOKAI 96729

KAUAI OFFICE
P. O. BOX 332
LIHUE, KAUAI 96766

PROJECT OFFICES
WAIMEA OFFICE
P. O. BOX 125
KAMUELA, HAWAII 96743
KEAUKAHA OFFICE
P. O. BOX 833
HILO, HAWAII 96720

May 24, 1983

STATE OF HAWAII
LAND AND NATURAL RESOURCES

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

SUBJECT: Renovation of Upper Hamakua Ditch (UHD) and
Construction of Access Road

This is in response to your letter of March 24, 1983. Your draft environmental assessment for this proposed project is a very thoughtful document and reflects careful consideration of the benefits of the project and the consequences on fauna, flora and erosion in the area.

As your document points out, "the benefits of the proposed facility may be immeasurable to the farming communities of Lalamilo and Puukapu", (Pg. 6) who rely on the water collected by the UHD for their crops. In view of the recent drought, improvements to any part of the catchment, transmission and storage components of the water system must be welcomed by farmers and, particularly, Hawaiian Homes farmers in the area. Our concern, therefore, is that these badly needed improvements be made quickly to the UHD and that the problem of constructing additional storage be addressed as soon as possible.

Your report indicates that considerable care will be taken in the planning, construction and location of access roads. This will assist in keeping erosion to a minimum and reduce the danger to avi-fauna habitats and indigenous vegetation.

We trust these comments are helpful, and remain

Sincerely yours,

Georgiana K. Padeken
Georgiana K. Padeken
Chairman

RECEIVED
MAY 31 11: 59
DEPT. OF WATER & LAND RESOURCES

GKP:RF:BB:oa

cc: William Vincent, Waimea Project Office

Downward

600

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

August 16, 1983

PROJECT OFFICES

MAUI OFFICE
P.O. BOX 12
KAHULUI, MAUI 96732

MOLOKAI OFFICE
P. O. BOX 196
HOOLEHUA, MOLOKAI 96729

STATE OF HAWAII
KAUAI OFFICE
P. O. BOX 332
LIHUE, KAUAI 96766

PROJECT OFFICES
WAIMEA OFFICE
P. O. BOX 125
KAMUELA, HAWAII 96743
KEAUKAHA OFFICE
P. O. BOX 833
HILO, HAWAII 96720

MEMORANDUM

TO: The Honorable Susumu Ono, Chairman
Board of Land and Natural Resources
FROM: Georgiana K. Padeken, Chairman
Hawaiian Homes Commission
SUBJECT: Renovation of Upper Hamakua Ditch, CPO-2276

Reference is made to your request of July 14, 1983, for comments relative to the subject project.

The Department of Hawaiian Home Lands has reviewed the proposal and fully supports the Division of Water and Land Development on this project.

The upper Hamakua Ditch has been in need of repair for quite some time with access almost impossible without the construction of the much needed access roads. The proposed project will alleviate much of the problems during the drought seasons for the entire Waimea area.

Please call Gordon Wong at 548-2685 if you require assistance in this matter.

GKP:RF:GW:oa

RECEIVED
AUG 22 8:37
STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

P.E.
GEORGE R. ARIYOSHI
GOVERNOR



STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
550 HALEKAUWILA STREET
ROOM 301
HONOLULU, HAWAII 96813

Letitia Uyehara
Interim Director
TELEPHONE NO.
548-6915

AUG 2 1983

August 4, 1983

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Conservation District Use Application for the
Renovation of the Upper Hamakua Ditch and
Construction of Access Road, Kohala Forest
Reserve, Hawaii (CDUA #1588)

Thank you for providing us the opportunity to review this
Conservation District Use Application. Our major concern
regarding this project is the construction of the access
road, and the possible erosion which it may cause. The
other segment of this project involves renovation of an
existing ditch which if handled properly should present
only minor environmental effects.

Sincerely,

Letitia N. Uyehara

Letitia N. Uyehara
Interim Director

STATE OF HAWAII
LAND AND NATURAL RESOURCES

13 AUG 5 P 1:31

RECEIVED

207



United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P. O. BOX 50109
HONOLULU, HAWAII 96850

IN REPLY REFER TO:

ES
Room 6307

AUG 02 1983

STATE OF HAWAII
NATURAL RESOURCES

Mr. Susumu Ono
DC

AUG 4 1983

Mr. Susumu Ono
Chairman, Board of Land
and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Re: Conservation District Use
Application No. HA-1588
Upper Hamakua Ditch, Hawaii

Dear Mr. Ono:

We have reviewed the subject CDDA and offer the following comments for your consideration:

- a) There are no resident listed or proposed endangered or threatened species of plants within the areas affected by the ditch renovation.
- b) Hawaiian hoary bats (Lasiurus cinereus semotus), duck (Anas wyvilliana) and hawk (Buteo solitarius) are known to occur within the project area; however, there is little chance that the ditch or access road construction will affect them.
- c) A candidate endangered plant species, Clermontia drepanomorpha, may lie in the path of the proposed road. Although candidate status affords this species no formal legal protection, care should be exercised to avoid destroying individual plants.
- d) We anticipate secondary and indirect impacts to this fragile bog ecosystem. The widening of existing trails and the opening of new roadways invites increased exotic plant introductions. Although difficult to control, care should be taken to minimize the amount of disturbance.
- e) Consideration should be given to protection of appropriate flows into the principal streams of Waipio and Waimanu Valleys.



Save Energy and You Serve America!

We appreciate this opportunity to comment.

Sincerely yours



William R. Kramer
Project Leader
Office of Environmental Services

cc: NMFS-WPPO
HDF&W
HDAR

COPY

PLANNING DEPARTMENT
25 AUPUNI STREET

COUNTY OF HAWAII
HILO, HAWAII 96720

29 All: 03

PLANNING DEPARTMENT

July 26, 1983

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

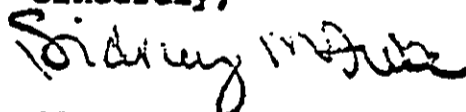
Conservation District Use Application for
Renovation of Upper Hanakua Litch and Construction
of Access Roads at Kohala Forest Reserve, Hawaii
TMK: 6-3-1:4, HA-5/17/83-1568

We have reviewed the subject application and have no comments regarding the proposed renovation and access road construction at this time. We do look forward to reviewing the projects' environmental impact statement upon completion of the first draft.

The proposed project does not fall within Hawaii County Special Management Area and thus is not subject to SMA permitting requirements.

Thank you for the consenting opportunity. Please do not hesitate to contact us should you have any questions.

Sincerely,



SIDNEY FUKU
Director

GU:lyv

cc: Len Bautista
Glenn Taguchi
Roland Higashi
DLNR, Div. of Water & Land Development ✓

APPENDIX E-2

INVENTORY OF UPPER HAMAKUA DITCH
FROM KAWAINUI INTAKE TO PUU PULEHU RESERVOIR

Appendix E-2

Inventory of Upper Hamakua Ditch from Kawainui Intake to Puu Pulehu Reservoir.

	Ditch (feet)	Tunnel (feet)	In-stream (feet)	Concrete Flume (feet)	Wood Flume (feet)	Total (feet)
Kawainui Intake to Alakahi Intake	8,150	1,220	160	110		9,640
Alakahi Intake to Koiawe Intake	5,450	590	6,820	50		12,910
Koiawe Intake to Waima Intake	230	5,440	2,060	50	50	7,830
Waima Intake to 60 MG Intake	2,080	460			90	2,630
60 MG Intake to Puu Pulehu Reservoir	7,280	2,550	2,320	60	--	12,210
Totals	23,190	10,260	11,360	270	140	45,220

Reference: UPPER HAMAKUA DITCH, 1963, DLNR, a map prepared by A. Ozaki, scale: 1"=500'.

U. S. GEOLOGICAL SURVEY TOPOGRAPHIC MAPS, KAMUELA QUADRANGLE (1956), AND KUKUIHAELE QUADRANGLE (1957), HAWAII, SCALE: 1:24000

APPENDIX E-3

UPPER HAMAKUA DITCH WILDLIFE SURVEY

UPPER HAMAKUA DITCH WILDLIFE SURVEY

Kohala Mountain, Island of Hawaii

Purpose of Survey: Field reconnaissance to determine the impact of proposed ditch renovations and road construction on wildlife species and their habitats. Request for assistance from Division of Water and Land Development.

Date: July 28, 1983

Location: Upper Hamakua Ditch in the vicinity of Alakahi and Waima gorges

Time: 9:00 a.m. to 3:30 p.m.

Weather: Light rain and fog in the morning, overcast in the afternoon.

**Wildlife Survey
Team Member:** Jon Giffin, Wildlife Biologist

Results: The survey was conducted along portions of the Upper Hamakua Ditch where renovations of waterways and construction of access roads are proposed by the State Division of Water and Land Development. Three different sites were examined, but they will all be treated as one for purposes of this discussion. Conditions for hearing birds were poor due to falling rain.

Feral pigs (*Sus scrofa*) are the only large mammal found in the project area. This species is classified as a game animal by the Division of Forestry and Wildlife and is currently open for public hunting. Prime pig habitat occurs along the entire length of the Upper Hamakua Ditch. Animal numbers are high, possibly reaching a density of 125 pigs per square mile. Ditch and pipeline trails serve as main access routes for hunters entering the forest. Evidence of pig activity was found along the ditch, but no animals were encountered.

The avifauna in the Kohala Forest Reserve consists of both native and introduced species. Native bird populations are low within the project area. This is probably due to unsuitable habitat conditions. Trees are typically short in stature and soils are saturated with water. No native birds were found during the survey, but common species such as the elepaio, (*Chasiempis sandwichensis*), apapane (*Himatione sanguinea*), and amakihi (*Hemignathus virens*) are known to be present. Endangered forest birds are rarely found in the Kohala mountains and none of these species are known to inhabit the project area.

Introduced birds are common and can usually be seen along the ditch. Only two Red-billed leiothrix (Leiothrix lutea) and one Japanese white-eye (Zosterops japonicus) were encountered during the survey.

The koloa or Hawaiian duck (Anas wyvilliana) is the only endangered species known to inhabit the project area. These birds normally restrict their activities to forest seeps, ponds and streams. However, koloa occasionally use the ditch for loafing and possibly for feeding. Young birds have been seen swimming in the ditch, but were probably washed there during storms. No koloa were encountered while in the field. The value of the ditch as koloa habitat is minimal. It lacks the quiet pools, shoreline vegetation, natural bottom and food items preferred by these birds.

A map showing the location of the project sites and a preliminary wildlife species list are appended to this project.

Conclusions:

No significant impact on wildlife or their habitats is anticipated by the proposed projects. Feral pigs and introduced birds are the primary types of wildlife occupying the project sites. Both are considered detrimental to native forest ecosystems. Ditch and road improvements pose no threat to native forest birds or the endangered Hawaiian duck. Their primary habitat will not be affected.

Prepared by:

Jon G. Giffin
Wildlife Biologist
on August 22, 1983

Preliminary Wildlife Species List for the Upper Hamakua Ditch Project Area
based on Results of the 1979 Hawaii Forest Bird Survey by the U. S. Fish
and Wildlife Service.

Game Mamals

Feral pig (Sus scrofa)

Native Forest Birds

Elepaio (Chasiempis sandwichensis)

Apapane (Himatione sanguinea)

Amakihi (Hemignathus virens)

Introduced Forest Birds

Japanese white-eye (Zosterops Japonicus)

Melodious laughing thrush (Garrulax canorus)

Red-billed leiothrix (Leiothrix lutea)

Introduced Field Birds

Northern cardinal (Richmondena cardinalis)

Skylark (Alauda arvensis)

Native Waterfowl

Hawaiian duck* (Anas wyvilliana)

* Denotes endangered species

APPENDIX E-4

BOTANICAL REPORT

A BOTANICAL SURVEY OF THREE PROPOSED ROADWAYS
ALONG THE UPPER HAMAKUA DITCH, HAWAII

Division of Forestry and Wildlife
Department of Land and Natural Resources
Honolulu, Hawaii

September, 1983

ABSTRACT

Three sections of a proposed road along the upper Hamakua ditch system were surveyed on 28-29 July 1983 for rare, endangered and threatened plants. Three species, Clermontia drepanomorpha, Tetraplasandra aff. kohalae, and Diplazium molokaiense, which are under review for endangered status (15 December 1980, Federal Register) were found within and bordering the project site. The habitat of Clermontia drepanomorpha is limited to the first 200 feet of the area 2 proposed road. A total of six Tetraplasandra aff. kohalae plants were found near the proposed roadways in areas 1 and 2. One plant of Diplazium molokaiense was collected, possibly near the lava tube in area 2. These plants probably can be avoided and bypassed in road construction.

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A BOTANICAL SURVEY OF THREE PROPOSED ROADWAYS
ALONG THE UPPER HAMAKUA DITCH, HAWAII

by
Carolyn A. Corn

INTRODUCTION

A botanical survey was conducted on 28-29 July 1983 of a proposed road alignment along three portions of the upper Hamakua ditch. The project site is located in the Kohala Mountains of the island of Hawaii (fig. 1). Three sections of the ditch system are scheduled for improvements (fig. 2). They are: area 1 (3750-3830 feet elevation), area 2 (3850-3900 feet elevation), and area 3 (3020-3040 feet elevation).

At the request of the Division of Water and Land Development, Department of Land and Natural Resources, Dr. Carolyn Corn and Joyce Davis conducted a two-day botanical survey to: (1) identify localities where rare, endangered or threatened plants occur, and (2) prepare a checklist of vascular plants found along the proposed alignment, including a vegetation description.

The three proposed roadways generally follow the present trail system, except at the beginning of each section. Included in the areas surveyed are periodic turnarounds approximately 20 feet in diameter (fig. 3, 4, and 5).

METHODS

A standard width of 20 feet on either side of the road's proposed centerline was surveyed for endangered and threatened plants listed in the Federal Register, (15 December 1980). This width was reduced to a total of 15 feet where the proposed road is sandwiched between the ditch and a row of sugi trees in area 2 near the former ditchman's house (fig. 4). (Centerline is defined as either the trail where the alignment follows it, or as a flagged line where the alignment deviates from the present trail.)

Three maps of the project were drawn using 1964-1965 aerial photographs and a transfer scope (fig. 3, 4, and 5). The scale given in each of these three figures is the length of the ditch, trail, and road alignments, rather than width, which is enlarged for illustration purposes.

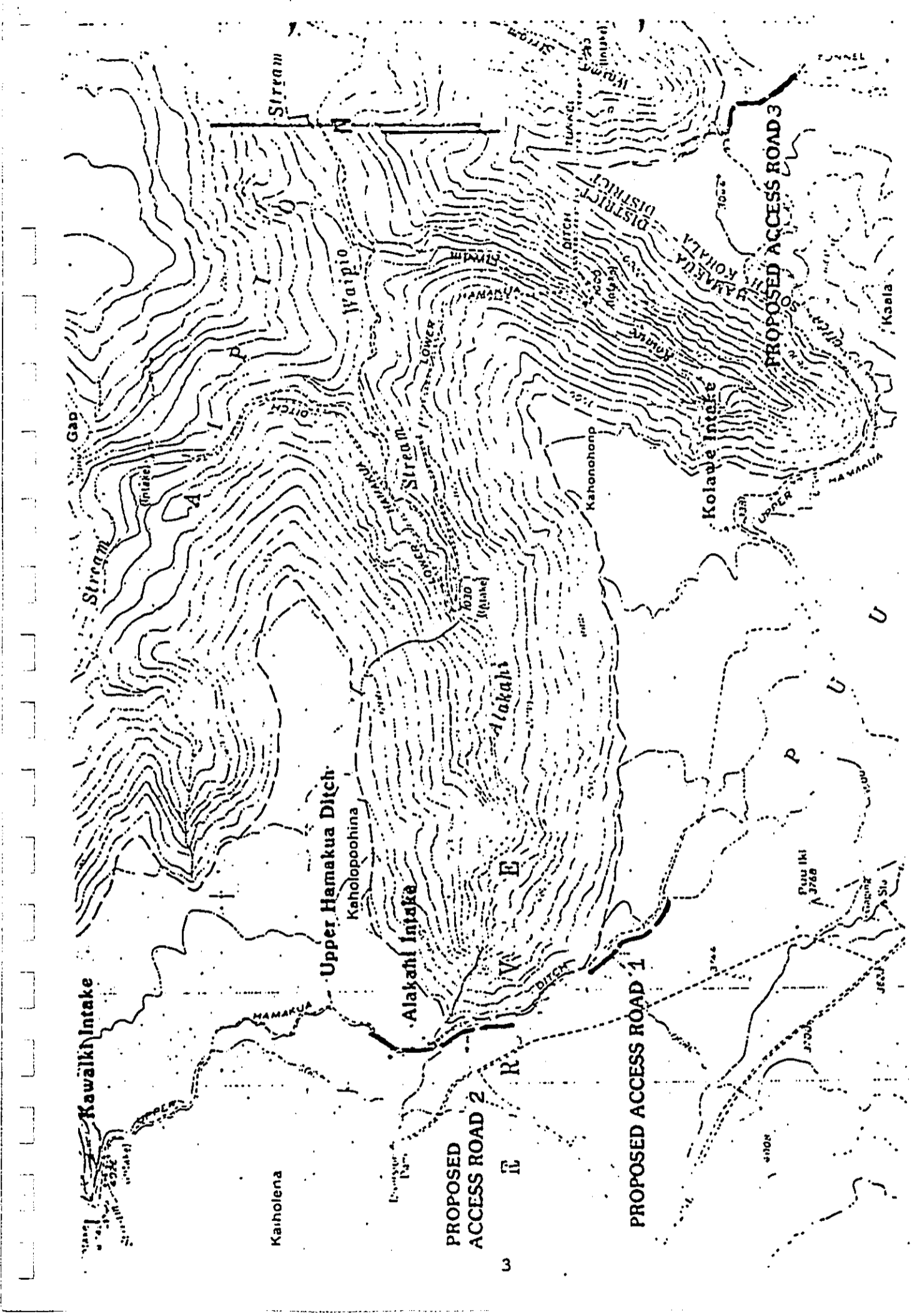


Figure 2. Proposed roadways along the Upper Hamakua ditch, island of Hawaii.

AREA I

- LEGEND
- ▨ NATIVE VEGETATION
 - - - PROPOSED ROAD ALIGNMENT
 - UPPER HAMAKUA DITCH
 - == PRESENT ROAD
 - · - · - DRAINAGE SYSTEM
 - · - · - VALLEY WALL
 - 1 TETRAPLASANDRA AFF. KOHALAE
 - TURNAROUND

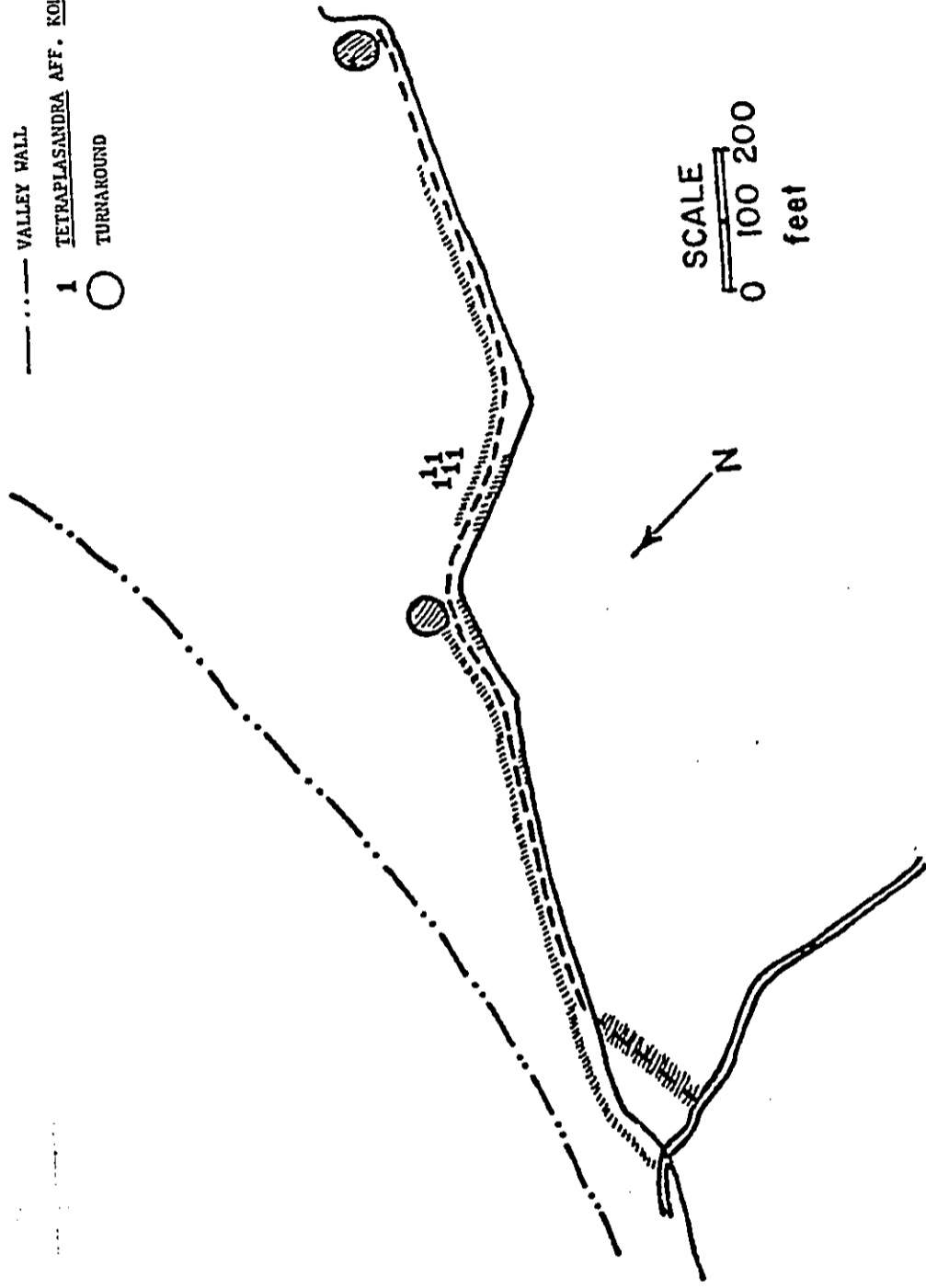
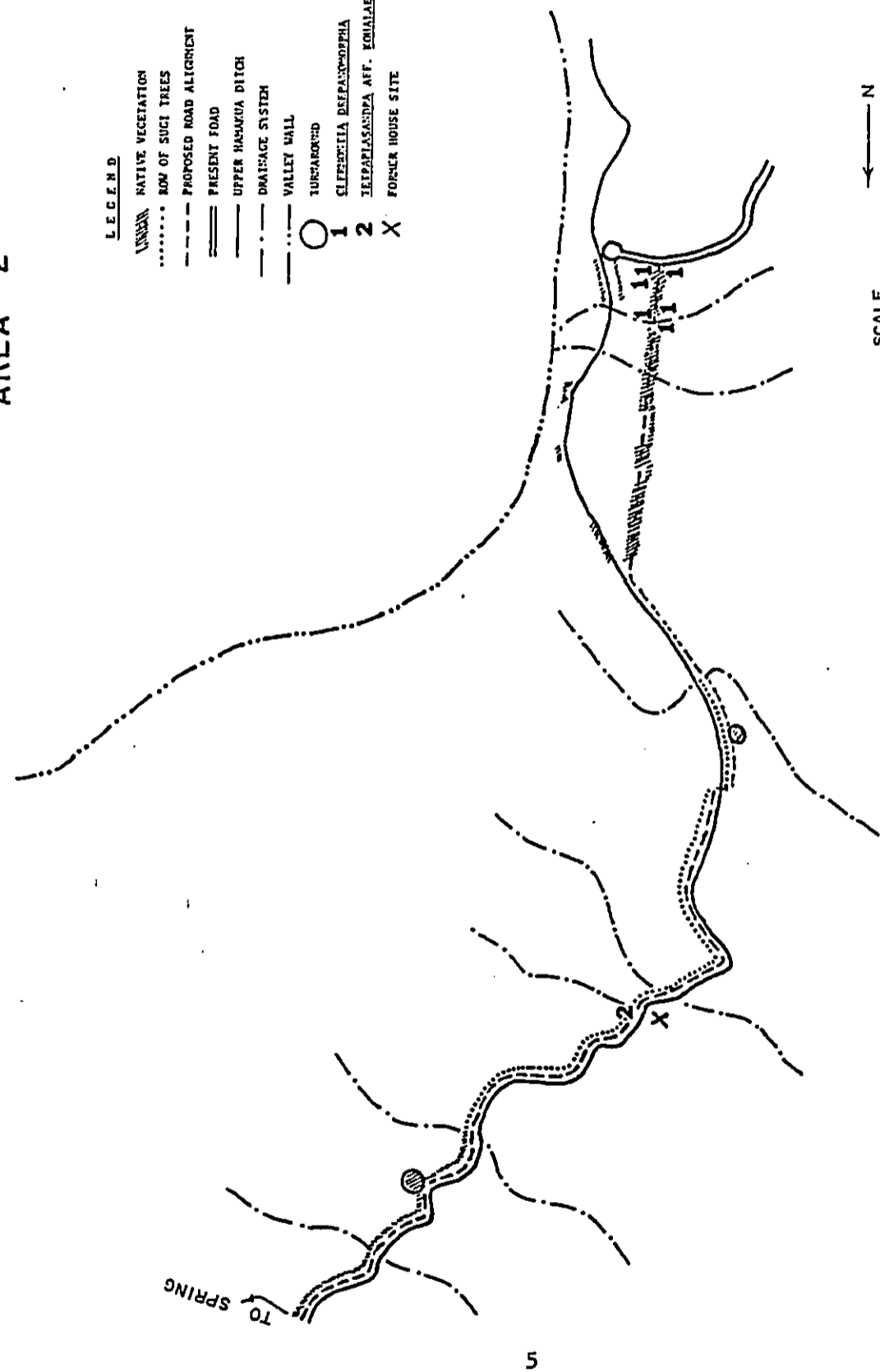


Figure 3. Proposed road alignment in area 1 (3750-3830 feet elevation).

AREA 2

- LEGEND**
- NATIVE VEGETATION
 - ROW OF SUCI TREES
 - - - - - PROPOSED ROAD ALIGNMENT
 - ==== PRESENT ROAD
 - UPPER HAWAIIA DITCH
 - - - - - DRAINAGE SYSTEM
 - VALLEY WALL
 - TUSCARORND
 - 1 CLEPOMELLA DESEPARANDOPPHA
 - 2 TELAPALASANDPA AFF. KOHALAE
 - X FOSLUK HOUSE SITE



SCALE
0 100 200
feet

N

Figure 4. Proposed road alignment in area 2 (3850-3900 feet elevation).

AREA 3

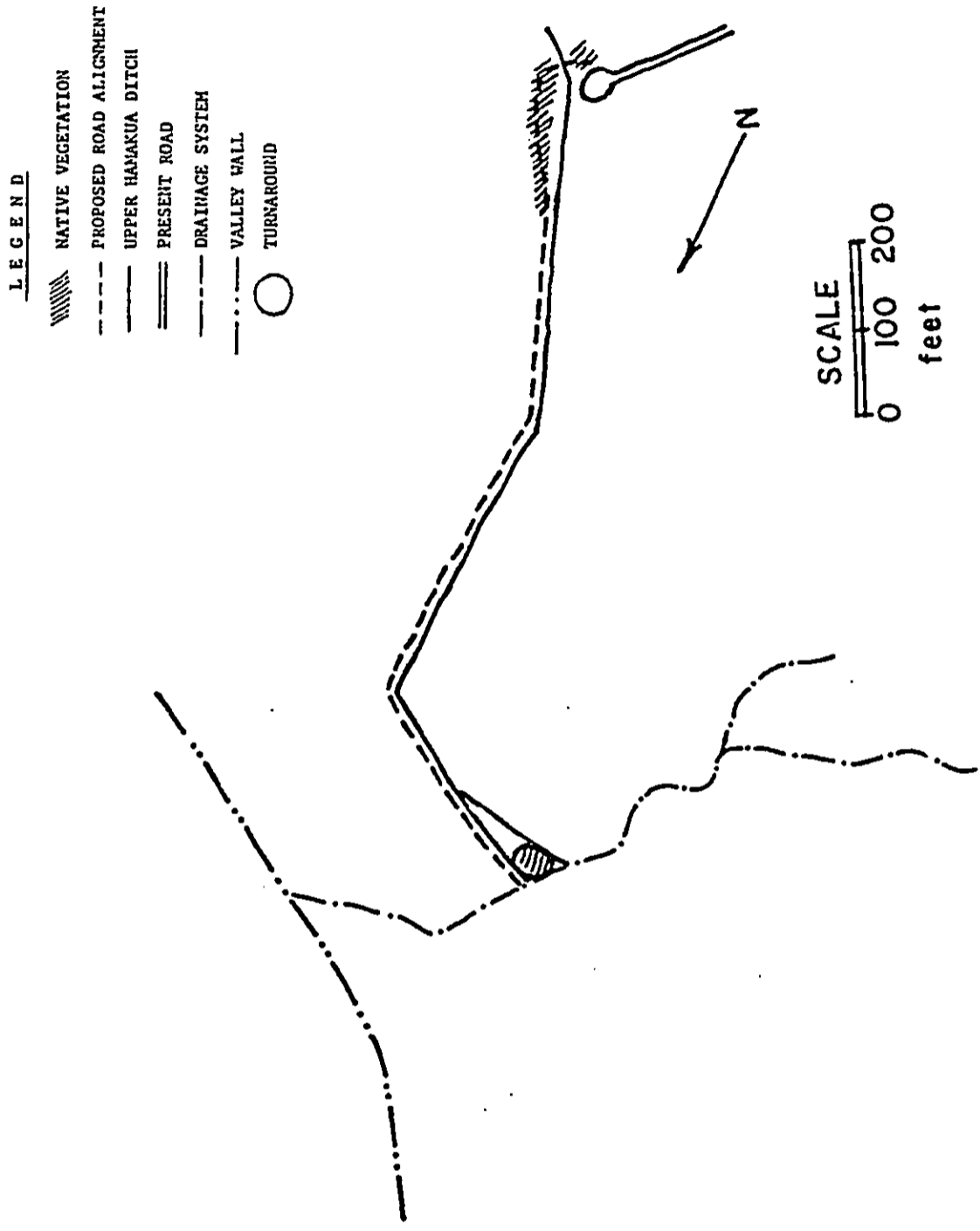


Figure 5. Proposed road alignment in area 3 (3020-3040 feet elevation).

RESULTS

The native vegetation is composed of low to medium sized trees and shrubs, such as 'ohia (Metrosideros polymorpha), 'olapa (Cheirodendron trigynum), alani (Pelea clusiaefolia, Pelea sp.), 'ohelo-kau-la'au (Vaccinium calycinum), manono (Gouldia spp.), and kanawao (Broussaisia arguta). The high average rainfall and cloud cover creates favorable habitat for many ferns and bryophytes. The common native, terrestrial ferns include: 'ama'u (Sadleria pallida), 'ama'uma'u (S. cyatheoides), hapu'u (Cibotium glaucum and C. chamissoi), uluhe (Dicranopteris linearis), and swordfern (Nephrolepis cordifolia). Common native, epiphytic ferns are: Adenophorus spp., Polypodium pellucidum, and 'ekaha (Elaphoglossum sp.). Sphagnum moss and Peperomia spp. are also abundant in the ground layer of some areas.

Exotic vegetation occurs primarily along the ditch trail (fig. 3, 4, and 5). Various grasses, herbs, introduced ferns, sedges (Cyperus spp.), rushes (Juncus spp.), and ginger (Hedychium coronarium and H. gardnerianum) dominate. Near the former ditchman's house, planted sugi or Japanese cedar (Cryptomeria japonica) create a windbreak (fig. 4). In area 3 planted ginger and bamboo are naturalized. A complete checklist and summary of vascular plants growing within and near the project area is given in Appendices A and B. Appendix C gives additional vegetation descriptions.

Candidates for Endangered Status

Three plant species, Clermontia drepanomorpha, Tetraplasandra aff. kohalae, and Diplazium molokaiense, which are under review for endangered status (15 December 1980 Federal Register) are located within or immediately adjacent the project area. Descriptions of these plants follow.

Clermontia drepanomorpha Rock

This Kohala clermontia (family Lobeliaceae) is endemic to the mountains of Kohala, Hawaii. Historically it is recorded as occurring along the Alakahi and Kawainui gorges of the upper Hamakua ditch trail at approximately 4000-5000 feet elevation. About six fertile plants were seen near the beginning of the proposed road alignment of area 2 (fig. 4). Several clermontia plants without flowers or fruit were seen near the proposed road that may also be this species.

This small tree 10 to 20 feet in height is rarely epiphytic and often grows in wetter spots with sphagnum moss, wawae'iole (Lycopodium cernuum), alani (Pelea spp.), 'olapa,

and Metrosideros. It has milky sap and variable foliage clustered near the branch tips. The linear dark green leaves, which are sparsely hispid with a prominent reddish midrib, are glabrous above and lighter in color beneath. The leaf blades are 3 to 7 inches long, 0.5-1.5 inches wide, entire at the base, and have marginal teeth along the upper two thirds of the leaf. It is one of the finest clermontias (Rock, 1919) recognizable by the long drooping inflorescence and large dark purple flowers, followed by bright-yellow fruits about the size of a golf ball. Joseph Rock (1913) says "...birds are very fond of its...fruits, which they hollow out until only the skin remains on the stalks."

Tetraplasandra aff. kohalae Skottsberg

This 'ohe tree (family Araliaceae) is endemic to the Kohala Mountains of the island of Hawaii. Specimens are described from only one tree (Sherff, 1955), which was collected during the Hawaiian Bog Survey on 7 September 1938 by Lucy Cranwell, Olaf Selling and Carl Skottsberg. Its location is recorded as the "Upper Hamakua ditch trail at (the) head of Alakahi Valley at (the) second house." In this survey, a single large tree of Tetraplasandra was found opposite the burned down ditchman's house at the head of Alakahi Valley. Although no mature flowers or fruits were available to confirm its identification, the locality matches the site description on the type specimen label. The tree is large and old, occurring within the row of sugi trees just across a bridge (fig. 4). Five additional trees, tentatively identified as belonging to the same taxon, occur just outside the proposed road in area 1 (fig. 3). Trees from both localities had immature inflorescences making positive identification difficult.

This species has compound, pinnate leaves with petioles 3-4.5 inches long. The flowers occur on umbels which mature into a drupe almost 1 inch long and 3/8 inch wide.

Diplazium molokaiense W. J. Robins.

This fern (family Athyriaceae) has not been recorded previously from the island of Hawaii. One specimen was collected during this survey, possibly from area 2 near the lava tube. This species has been collected from five other Hawaiian Islands, i.e. Kauai, Oahu, Molokai, Maui, and Lanai.

No common name is known for the fern, which was described by William Hillebrand (1888) as a very rare Asplenium. Robinson (1913) states that Diplazium fronds are "...more firm in texture and coarser in habit than the species of Athyrium". The fern fronds are pinnate, 6-12 inches in length and originate from a creeping rootstock. A few basal scales, which are dark brown in color tend to fall off.

DISCUSSION

Three species under review for endangered status, Clermontia drepanomorpha, Tetraplasandra aff. kohalae, and Diplazium molokaiense, are found within and adjacent to the project area. The Kohala clermontia (C. drepanomorpha) plants were seen along the first portion of the proposed area 2 route. They are within the native forest habitat (fig. 4) which has a more diverse and somewhat different native species composition than the other areas surveyed. A number of Stenogyne vines and some Labordia shrubs were also seen here. This Kohala clermontia habitat extends from the present road northward approximately 200 feet. The area is unique from other areas surveyed because of a wet drainage system, a nearby outcropping of rocks, and a large lava tube. Just mountainside of the road's centerline is a 75 foot drop-off where a flowing stream enters a lava tube at right angles to the proposed road alignment. Some very boggy soil is also present. This portion of the proposed road might be realigned instead along the present ditch system where the vegetation is mostly exotic. This would lessen the impact upon the limited, specialized native habitat. Three Kohala clermontias closest to the proposed centerline were flagged. The Hawaii Division of Forestry and Wildlife has several slides of this species on file which can be used to help recognize this species.

One large tree of 'ohe (Tetraplasandra aff. kohalae) is opposite the burned down ditchman's house within the single row of planted sugi trees. Since most of these trees are scheduled to be left standing, this 'ohe does not appear to be blocking the road alignment. However, care should be taken to minimize the effects of road and bridge construction upon this plant. Five additional 'ohe trees that occur together near area 1 can be avoided in road construction since they grow outside the proposed alignment. This clump of 'ohe trees can be recognized by blue flagging which is hanging on or near one of these trees.

Although the 'ohe trees and Kohala clermontias occur within or adjacent the project site, the individual plants can probably be avoided with minimal or no extra road costs.

RECOMMENDATIONS

1. Avoid impacting the C. drepanomorpha, T. aff. kohalae, and Diplazium molokaiense plants found along or adjacent to the project site. If the proposed road could be realigned along the existing ditch trail at the beginning of area 2 where exotic plants occur, there should be little to no impact upon the Kohala clermontias.

2. Care needs to be taken that the equipment and rock used in the project are free of weeds that may become naturalized.

3. Wherever possible it would be wise to limit the spread of the ginger inland. This could be done in spots by placing the road over the inland edge of the ginger patches.

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APPENDIX A
VASCULAR PLANT CHECKLIST
FOR THREE PROPOSED ROADWAYS
ALONG THE UPPER HAMAKUA DITCH, HAWAII

by

Joyce Davis

Nomenclature of flowering plants and gymnosperms follows St. John 1973, List and Summary of the Flowering Plants in the Hawaiian Islands. Nomenclature of ferns and fern allies follows W. H. Wagner (unpublished), except where indicated by annotation.

Symbols

Status

- E - Endemic, native only to the Hawaiian Islands
- I - Indigenous, native to the Hawaiian Islands and elsewhere
- X - Exotic, introduced, not native to the Hawaiian Islands
- P - Introduced by Polynesians
- U - Uncertain

Abundance Ratings

- A - Abundant
- C - Common
- F - Frequent
- O - Occasional
- R - Rare

* - Designates plants listed in the December 15, 1980 Federal Register: "Endangered and Threatened Wildlife and Plants: Review of Plant Taxa for Listing as Endangered or Threatened Species".

l - Plant(s) growing outside proposed road

Pltg. - Planting

	<u>Status</u>	<u>Abundance</u>
LYCOPSIDA		
Lycopodiaceae		
<u>Lycopodium cernuum</u> L.	I	A-C
Wawae'iole	E	R
<u>Lycopodium phyllanthum</u> H. & A.		
Wawae'iole	I	C
<u>Lycopodium venustulum</u> Gaud.		
Wawae'iole		
PTEROPSIDA		
<u>FILICINAE</u>		
Adiantaceae		
<u>Pityrogramma calomelanos</u> (L.) Link	X	O
Gold fern	I	O
<u>Pteris cretica</u> L.		
Owali, Cretan brake		
Aspidiaceae		
<u>Ctenitis rubiginosa</u> (Brack.) Copel.	E	F
Pauoa		
Aspleniaceae		
<u>Asplenium contiguum</u> Lam.	I	F
<u>Asplenium lobulatum</u> Mett.	I	R
<u>Asplenium polyodon</u> Forst.	I	O
Athyriaceae		
<u>Athyrium japonicum</u> (Thunb.) Copel.	X	C
<u>Athyrium microphyllum</u> (Sw.) Alston	E	C
'Akolea	E	C
<u>Athyrium sandwichianum</u> Presl		
Ho'i'o	E	R
* <u>Diplazium molokaiense</u> W. J. Robins.		
Blechnaceae		
<u>Blechnum occidentale</u> L.	X	O
Occidental blechnum	E	C
<u>Sadleria cyatheoides</u> Kaulf.		
'Ama'uma'u	E	C
<u>Sadleria pallida</u> H. & A.		
'Ama'u		

	<u>Status</u>	<u>Abundance</u>
Davalliaceae		
<u>Nephrolepis cordifolia</u> (L.) Presl Narrow leaved sword fern, ni'ani'au	I	C
Dennstaedtiaceae		
<u>Microlepia strigosa</u> (Thunb.) Presl Palapalai	I	O
Dicksoniaceae		
<u>Cibotium chamissoi</u> Kaulf. Hapu'u -'i'i	E	F
<u>Cibotium glaucum</u> (Smith) H. & A. Hapu'u pulu	E	A
Elaphoglossaceae		
<u>Elaphoglossum alatum</u> Gaud. 'Ekaha	E	F
<u>Elaphoglossum hirtum</u> (Sw.) C. Chr. var. <u>micans</u> (Mett.) C. Chr. 'Ekaha	E	O
Gleicheniaceae		
<u>Dicranopteris linearis</u> (Burm.) Underw. Uluhe	I	C
<u>Hicriopteris pinnata</u> (Kunze) Ching Uluhe-lau-nui	I	O
<u>Sticherus owhyensis</u> (Hook.) Ching Hawaiian sticherus	E	O
Grammitidaceae		
<u>Adenophorus pinnatifidus</u> Gaud. Pai, huna palai	E	C
<u>Adenophorus tamariscinus</u> (Kaulf.) Hook. & Grev. var. <u>montanus</u> (Hilleb.) L. E. Bishop	E	C
<u>Adenophorus tamariscinus</u> (Kaulf.) Hook. & Grev. var. <u>tamariscinus</u>	E	C
<u>Adenophorus tripinnatifidus</u> Gaud.	E	O-F
<u>Grammitis hookeri</u> (Brack.) Copel.	E	R
<u>Grammitis tenella</u> Kaulf. Kolokolo	E	O
<u>Xiphopteris saffordii</u> (Maxon) Copel. Kihi	E	O
Hymenophyllaceae		
<u>Mecodium recurvum</u> (Gaud.) Copel. 'Ohi'a-ku	E	F
<u>Spaerocionium</u> sp.	E	F
<u>Vandenboschia davallioides</u> (Gaud.) Copel. Kilau	E	O

	<u>Status</u>	<u>Abundance</u>
Lindsaeaceae		
<u>Sphenomeris chinensis</u> (L.) Maxon Pala'a	I	F
Ophioglossaceae		
<u>Ophioglossum pendulum</u> L. var. <u>falcatum</u> (Presl) Fosb. Lau-kahi, adder's tongue	I	R
Polypodiaceae		
<u>Pleopeltis thunbergiana</u> Kaulf. 'Ekaha-'akolea	I	O
<u>Polypodium pellucidum</u> Kaulf. var. <u>pellucidum</u> 'Ae	E	F
Thelypteridaceae		
<u>Christella dentata</u> (Forssk.) Brownsey & Jermy Oak fern	X	C
<u>Pneumatopteris sandwicensis</u> (Brack.) Holttum Ho'i'o-kula	E	O
<u>GYMNOSPERMAE</u>		
Taxodiaceae		
<u>Cryptomeria japonica</u> (L. f.) D. Don Sugi, Japanese cedar	X	Pltg.
<u>ANGIOSPERMAE</u>		
<u>DICOTYLEDONEAE</u>		
Apocynaceae		
<u>Alyxia olivaeformis</u> Gaud. Maile	E	O
Aquifoliaceae		
<u>Ilex anomala</u> H. & A. Kawa'u	E	F

	<u>Status</u>	<u>Abundance</u>
Araliaceae		
<u>Cheirodendron trigynum</u> (Gaud.) Heller	E	C
var. <u>acuminatum</u> Skotts.		
'Olapa	E	R
* <u>Tetraplasandra</u> aff. <u>kohalae</u> Skotts.		
'Ohe		
Celastraceae		
<u>Perrottetia sandwicensis</u> Gray ¹	E	R
Olomea		
Betulaceae		
<u>Alnus nepalensis</u> D. Don	X	Pltg.
Nepal alder		
Caryophyllaceae		
<u>Drymaria cordata</u> (L.) Willd.	X	C
Drymaria, pipili		
Compositae		
<u>Ageratum conyzoides</u> L.	X	O
Ageratum, maile-hohono	X	R
<u>Cirsium vulgare</u> (Savi) Tenore		
Bull thistle	E	R
<u>Dubautia plantaginea</u> Gaud.		
Na'ena'e	X	F
<u>Erechtites valerianaefolia</u> (Wolf) DC.		
Valerian -leaved fireweed	X	O
<u>Erigeron bonariensis</u> L.		
Hairy horseweed	X	O
<u>Eupatorium riparium</u> Regel		
Spreading mistflower, Hilo pamakani	X	O
<u>Hypochoeris radicata</u> L.		
Gosmore, hairy cat's ear	X	O
<u>Pluchea odorata</u> (L.) Cass.		
Shrubby fleabane, sour bush	X	O
<u>Sonchus oleraceus</u> L.		
Sow thistle	X	F
<u>Youngia japonica</u> (L.) DC.		
Oriental hawksbeard		

	<u>Status</u>	<u>Abundance</u>
Cruciferae		
<u>Cardamine flexuosa</u> With. f. <u>umbrosa</u> (Gren. & Godr.) O. E. Schulz	X	F
Epacridaceae		
<u>Styphelia tameiameia</u> (Cham.) F. Muell. <u>brownii</u> (Gray) St. John Pukiawe	E	R
Ericaceae		
<u>Vaccinium calycinum</u> Sm. 'Ohelo-kau-la'au, tree 'ohelo	E	C
Geraniaceae		
<u>Geranium carolinianum</u> L. var. <u>australe</u> (Benth.) Fosb. Carolina crane's bill	X	C
Gesneriaceae		
<u>Cyrtandra platyphylla</u> Gray	E	O
var. <u>membranacea</u> Rock	E	R
<u>Cyrtandra</u> sp.		
Gunneraceae		
<u>Gunnera eastwoodae</u> St. John 'Ape'ape	E	R
Guttiferae		
<u>Hypericum mutilum</u> L. St. Johnswort	X	F
Labiatae		
<u>Phyllostegia vestita</u> Benth.	E	R
<u>Stenogyne cranwelliae</u> Sherff	E	O
<u>Stenogyne calaminthoides</u> Gray var. <u>waimeana</u> Sherff	E	F
Leguminosae		
<u>Trifolium repens</u> L. White clover	X	O

	<u>Status</u>	<u>Abundance</u>
Lobeliaceae		
* <u>Clermontia drepanomorpha</u> Rock	E	O
Kohala clermontia		
<u>Clermontia parviflora</u> Gaud. ex Gray	E	R
var. <u>intermedia</u> Skottsb.		
<u>Clermontia</u> sp.	E	R
<u>Cyanea</u> aff. <u>pilosa</u> Gray ¹	E	R
<u>Lobelia</u> aff. <u>hypoleuca</u> Hbd.	E	R
<u>Trematolobelia</u> aff. <u>kohalaensis</u> St. John	E	R
Koli'i		
Loganiaceae		
<u>Labordia hedyosmifolia</u> Baill.	E	O
var. <u>hedyosmifolia</u>		
Kamakahala		
Loranthaceae		
<u>Korthalsella complanata</u> (v. Tiegh.) Engler	E	R
Hulumoa		
Lythraceae		
<u>Cuphea carthagenensis</u> (Jacq.) MacBride	X	F
Tarweed, pukamole		
Malvaceae		
<u>Modiola caroliniana</u> (L.) G. Don	X	C
Modiola		
Melastomataceae		
<u>Melastoma</u> aff. <u>malabathricum</u> L.	X	R
Malabar melastome, Indian rhododendron		
Moraceae		
<u>Ficus macrophylla</u> or <u>rubiginosa</u>	X	Pltg.
Fig, banyan		
Myrsinaceae		
<u>Myrsine lessertiana</u> A. DC.	E	C
Kolea-lau-nui		
<u>Myrsine sandwicensis</u> A. DC.	E	C
Kolea-lau-li'i		

	<u>Status</u>	<u>Abundance</u>
Myrtaceae		
<u>Melaleuca leucodendra</u> (Stickm.) L. Paper bark	X	Pltg.
<u>Metrosideros polymorpha</u> Gaud. var. <u>glaberrima</u> (Levl.) St. John Lehua-hamae	E	C
<u>Metrosideros polymorpha</u> Gaud. var. <u>incana</u> (Levl.) Rock f. <u>incana</u> 'Ohi'a-lehua	E	R
<u>Metrosideros polymorpha</u> Gaud. var. <u>macrophylla</u> (Rock) St. John 'Ohi'a-lehua	E	R
<u>Metrosideros polymorpha</u> Gaud. var. <u>polymorpha</u> 'Ohi'a-lehua	E	O
<u>Psidium cattleianum</u> Sabine Waiawi, strawberry guava	X	R
Onagraceae		
<u>Epilobium cinereum</u> A. Rich. Willow herb, pukamole	X	O
Oxalidaceae		
<u>Oxalis corniculata</u> L. Yellow wood sorrel	I	O
Piperaceae		
<u>Peperomia cookiana</u> C. DC.	E	O
<u>Peperomia hawaiensis</u> C. DC. 'Ala'ala-wai-nui	E	C
<u>Peperomia hypoleuca</u> Miq. var. <u>pluvigaudens</u> (C. DC.) Yuncker	E	C
<u>Peperomia lilifolia</u> C. DC. var. <u>lilifolia</u>	E	C
<u>Peperomia lilifolia</u> C. DC. var. <u>nudilimba</u> (C. DC.) Yuncker	E	F
<u>Peperomia membranacea</u> H. & A. var. <u>puukukuiana</u> Yuncker	E	F
Plantaginaceae		
<u>Plantago major</u> L. Common plantain, lau-kahi	X	C

	<u>Status</u>	<u>Abundance</u>
Polygonaceae		
<u>Polygonum punctatum</u> Ell. var.	X	C
<u>parviflorum</u> Fassett		
Kamole, knotweed	X	R
<u>Rumex</u> sp.		
Dock		
Rosaceae		
<u>Rubus hawaiiensis</u> Gray	E	O
'Akala	X	F
<u>Rubus rosaefolius</u> Sm.		
Thimbleberry		
Rubiaceae		
<u>Coprosma pubens</u> Oliver	E	F
Pilo	E	F
<u>Gouldia hillebrandii</u> Fosb.		
var. <u>hawaiiensis</u> Fosb.		
Manono	E	O
<u>Gouldia terminalis</u> (H. & A.) Hbd. var.		
<u>antiqua</u> Fosb. f. <u>kehena</u> Fosb.		
Manono	E	F
<u>Gouldia terminalis</u> (H. & A.) Hbd. var.		
<u>purpurea</u> Fosb.		
Manono	E	R
<u>Hedyotis acuminata</u> (C. & S.) Steud.	E	O
<u>Psychotria hawaiiensis</u> (Gray) Fosberg		
var. <u>hillebrandii</u> (Rock) Fosb.		
Kopiko		
Rutaceae		
<u>Pelea clusiaefolia</u> Gray subsp. <u>clusiaefolia</u>	E	O
var. <u>cuneata</u> St. John & Hume f. <u>cuneata</u>		
Alani, clusia-leaved	E	O
<u>Pelea</u> sp.		
Saxifragaceae		
<u>Broussaisia arguta</u> Gaud. var. <u>arguta</u>	E	C
f. <u>ternatea</u> St. John		
Pu'aha-nui, kanawao		

	<u>Status</u>	<u>Abundance</u>
Scrophulariaceae		
<u>Veronica plebeia</u> R. Br. Common speedwell	X	F
<u>Veronica serpyllifolia</u> L. Thyme-leaved speedwell	X	F
Umbelliferae		
<u>Hydrocotyle sibthorpioides</u> Lam. var. <u>sibthorpioides</u> Marsh pennywort	X	C
<u>Hydrocotyle verticillata</u> Thunb. Whorled marsh pennywort, pohepohe	X	O
Urticaceae		
<u>Pipturus brighamii</u> Skottsberg Mamaki	E	O
Verbenaceae		
<u>Verbena litoralis</u> HBK. Weed verbena	X	O
MONOCOTYLEDONEAE		
Araceae		
<u>Colocasia esculenta</u> (L.) Schott var. <u>antiquorum</u> (Schott) Hubb. & Rehd. Taro, kalo	P	Pltg.
Commelinaceae		
<u>Commelina diffusa</u> Burm. f. Honohono, day flower	X	C
Cyperaceae		
<u>Carex alligata</u> F. Boott var. <u>alligata</u> Hawaiian sedge	E	O
<u>Cyperus brevifolius</u> (Rottsb.) Hassk. Kyllinga	X	C
<u>Cyperus polystachyus</u> Rottb.	I	C
<u>Machaerina angustifolia</u> (Gaud.) Koyama 'Uki	I	O

	<u>Status</u>	<u>Abundance</u>
Gramineae		
<u>Axonopus affinis</u> Chase	X	C
Narrow-leaved carpetgrass		
<u>Deschampsia australis</u> Nees ex Steud.	E	O
<u>Digitaria</u> sp.	X	F
<u>Holcus lanatus</u> L.	X	F
Velvetgrass		
<u>Isachne distichophylla</u> Munro ex Hbd.	E	O
'Ohe		
<u>Panicum repens</u> L.	X	F
Wainaku grass		
<u>Paspalum conjugatum</u> Berg.	X	C-O
Hilo grass		
<u>Paspalum dilatatum</u> Poir	X	C
Paspalum grass, dallis grass		
<u>Paspalum urvillei</u> Steud.	X	C
Vaseygrass		
<u>Pennisetum clandestinum</u> Hochst. ex Chiov.	X	O
Kikuyugrass		
<u>Poa annua</u> L.	X	O
Annual bluegrass		
<u>Sacciolepis indica</u> (L.) Chase	X	C
Glenwoodgrass		
<u>Setaria geniculata</u> (Poir.) Beau.	X	C
Perennial foxtail		
<u>Setaria palmaefolia</u> (Koen.) Stapf	X	C
Palmgrass		
Bamboo (not collected)	X	Pltg.
Juncaceae		
<u>Juncus planifolius</u> R. Br.	X	O
<u>Juncus tenuis</u> Willd.	X	C
Slender rush		
Liliaceae		
<u>Smilax sandwicensis</u> Kunth	E	R
var. <u>sandwicensis</u>		
Hoi-kuahiwi		
<u>Cordyline terminalis</u> (L.) Kunth	P	Pltg.
Ti		
Orchidaceae		
<u>Liparis hawaiiensis</u> Mann ¹	E	R
'Awapuhi-a-kanaloa		

	<u>Status</u>	<u>Abundance</u>
Pandanaeae		
<u>Freycinetia arborea</u> Gaud. 'Ie'ie	E	O
Zingiberaceae		
<u>Hedychium coronarium</u> Koenig in Retz. White ginger	X	C
<u>Hedychium gardnerianum</u> Roscoe Kahili ginger	X	O

APPENDIX B
 VASCULAR PLANT CHECKLIST SUMMARY
 FOR THREE PROPOSED ROADWAYS
 ALONG THE UPPER HAMAKUA DITCH, HAWAII

by
 Joyce Davis

	No. taxa
Lycopsida	3
Pteropsida	
Filicinae	37
Gymnospermae	1
Angiospermae	
Dicotyledoneae	77
Monocotyledoneae	29
<u>Total</u>	<u>147</u>

Native Taxa	89
Endemic	75
Indigenous	14
Exotic Taxa	55
Polynesian Introductions	2
Uncertain Status	1
<u>Total</u>	<u>147</u>

Number of officially listed endangered taxa: 0

Number of candidate taxa for endangered or threatened status: 2
Clermontia drepanomorpha
Tetraplasandra aff. kohalae

APPENDIX C

VEGETATION DESCRIPTION OF THREE PROPOSED ROADWAYS
ALONG THE UPPER HAMAKUA DITCH TRAIL, HAWAII

by

Joyce Davis

The open, stunted rain forest is composed primarily of 'ohi'a lehua (Metrosideros polymorpha) and 'olapa (Cheirodendron trigynum) trees. Additional trees include: kawa'u (Ilex anomala), kolea (Myrsine lessertiana), pilo (Coprosma pubens), kopiko (Psychotria hawaiiensis), alani (Pelea clusiaefolia), and manono (Gouldia hillebrandii). The understory consists of 'ohelo-kau-la'au (Vaccinium calycinum), kanawao (Broussaisia arguta), kolea-lau-li'i (Myrsine sandwicensis), manono (Gouldia terminalis), mamaki (Pipturus brighamii), and 'akala (Rubus hawaiiensis). Terrestrial and epiphytic Clermontia shrubs (C. drepanomorpha and C. parviflora) are occasional and tall Cyrtandra platyphylla shrubs grow in a few areas. Vines, such as 'ie'ie (Freycinetia arborea) and maile (Alyxia olivaeformis) twine up some trees; native mints, Stenogyne waimeana and S. cranwelliae, form ground patches and occasionally climb shrubs. Common components of the understory are two tree ferns--hapu'u-pulu (Cibotium glaucum) and hapu'u-i'i (C. chamissoi). The groundcover consists of other ferns including ama'u (Sadleria spp.), 'akokea (Athyrium microphyllum), ho'i'o (Athyrium sandwichianum), ni'ani'au (Nephrolepis cordifolia), ho'i'o-kula (Pneumatopteris sandwicensis), palapala'i (Microlepia strigosa), and pala'a (Sphenomeris chinensis). Patches of uluhe (Dicranopteris linearis) are frequent; uluhe-lau-nui (Hicriopteris pinnata) and Hawaiian sticherus (Sticherus owhyhensis) also occur. Dense sphagnum moss forms continuous mats in some areas, commonly growing with wawae'iole (Lycopodium cernuum) and a native grass, 'ohe (Isachne distichophylla). Clumps of 'uki sedge, (Machaerina angustifolia), grow in the forest and open areas. Frequent terrestrial and epiphytic herbs, ala'ala-wai-nui (Peperomia spp.) grow with small ferns such as Adenophorus spp., Polypodium pellucidum, and Mecodium recurvum.

Several exotic taxa, which were planted a number of years ago, occur along the existing ditch trail. These include trees, such as Sugi pine (Cryptomeria japonica), paperbark (Melaleuca leucodendra), Nepal alder (Alnus nepalensis) and a

few banyans (Ficus sp.). Large patches of white ginger (Hedychium coronarium) and some kahili ginger (Hedychium gardnerianum) grow along the ditch and trail. Most of the exotics are restricted to the existing trails and adjacent areas. These common weeds include: valerian-leaved fireweed (Erechtites valerianaefolia), thimbleberry (Rubus rosaefolius), oriental hawksbeard (Youngia japonica), Carolina crane's bill (Geranium carolinianum var. australe), gosmore (Hypochoeris radicata), modiola (Modiola caroliniana), speedwell (Veronica spp.), knotweed (Polygonum punctatum var. parviflorum), pipili (Drymaria cordata), and honohono (Commelina diffusa).

Exotic grasses dominate the ditch trail and include the narrow-leaved carpetgrass (Axonopus affinis), velvetgrass (Holcus lanatus), Paspalum spp., Digitaria spp., and Setaria spp. A native grass, Deschampsia australis, grows in and along the ditch and forest. Sedges, such as kyllinga (Cyperus brevifolius), and rushes (Juncus spp.) are common in the trail.