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GOVERNOR OF HAWAII



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95 MAR -9 P4:16 DEPARTMENT OF LAND AND NATURAL RESOURCES

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QUALITY CONTROL

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HONOLULU, HAWAII 96809
OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

MAR 9 1995

MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY DIRECTOR
GILBERT S. COLOMA-AGARAN

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LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

Ref. LM-GYT

Gary L. Gill, Director
Office of Environmental Quality Control
220 South King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

**Subject: Request for Direct Grant of Easement for a Drainage Improvement Project at Lalamilo, South Kohala, Hawaii
Tax Map Key:3rd/6-6-01:por. 01,
Applicants: Mauna Kea Properties, Inc.**

In accordance with the requirements of Chapter 343, Hawaii Revised Statutes, and Chapter 200 of Title 11, Administrative Rules, a Final Environmental Assessment has been prepared for the subject project.

Notice of availability of the Draft Environmental Assessment for the project was published in the January 8, 1995 OEQC Bulletin. Five letters of comment were received during the 30-day public comment period which were addressed by the consultant and included in the final environmental assessment.

As the proposing agency, we are forwarding herewith, one copy of the OEQC Bulletin Publication form, and four copies of the Final Environmental Assessment. We have determined that there will be no significant impacts as a result of the project and, therefore, are filing the

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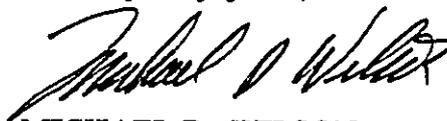
Gary L. Gill
Direct Grant of Easement for
Drainage Purposes to
Mauna Kea Properties, Inc.
February 24, 1995
Page 2

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OFFICE OF THE
CHAIRMAN

Final Environmental Assessment as a negative declaration. We respectfully request that public notice of the Final Environmental Assessment be published in the next scheduled OEQC Bulletin.

Very truly yours,



MICHAEL D. WILSON
Chairperson

c: Hawaii Land Board Member
Land Management Administrator
Hawaii District Land Office
Arthur Pizzinat
Anne L. Mapes

1995-03-23-HI-FAA-Drainage Improvement for Kalaheo MAR 23 1995

Final Environmental Assessment

Drainage Improvements

for

Mauna Kea Properties

*Ouli, South Kohala, Hawaii
TMK Third Division, 6-6-01: Portion 2*

*Applicant:
Mauna Kea Properties, Inc.*

*Accepting Agency:
Department of Land and Natural Resources*

*Applicant's Agent:
Belt Collins Hawaii*

February 1995

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1. INTRODUCTION

This section presents background and a detailed description of the proposed action.

1.1 PURPOSE AND CONTENT OF THIS DOCUMENT

This Environmental Assessment (EA) has been prepared to support an application for the granting of drainage easements in the State Agriculture District by the State of Hawaii to Mauna Kea Properties, Inc. (hereinafter, "the applicant") the landowner of the Mauna Kea Resort. The purpose of the requested easement is to enable the applicant to construct privately-funded drainage improvements on State-owned land to alleviate intermittent flooding of the State-owned Queen Kaahumanu Highway and properties owned by the applicant above and below the highway. This EA is also intended to support a Conservation District Use Permit application for the clearing of boulders and debris from an unnamed gulch within the Conservation District, and, subject to a determination by the Hawaii County Planning Department, a Special Management Area permit for the clearing activities. This EA also addresses the impacts associated with the replacement of existing drainage culverts situated within the Urban District under Queen Kaahumanu Highway.

This EA complies with the provisions of Hawaii Revised Statutes (HRS) Chapter 343 and Title 11, Department of Health, Chapter 200, Environmental Impact Rules, Sections 11-200-5 through 11-200-11. It is triggered by Section 11-200-6 paragraph b-1-A, which states that an EA is required when an action involves the use of land owned by the State or County, paragraph b-1-B, which concerns the use of Conservation District lands, and paragraph b-2-B, which concerns the use of state or county funds. Discussion of the culvert replacement is included pursuant to Section 11-200-7(2) and (3), which require, respectively, that separate but related actions be treated as a single action if they represent a necessary precedent for a larger project, or a commitment to a larger project. Agencies

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consulted during its preparation include the Department of Land and Natural Resources, State of Hawaii; the County of Hawaii Planning Department; and the County of Hawaii Water Supply Department.

1.2 REGIONAL SETTING

The drainage easement areas constitute non-contiguous portions of the ahupua'a of Lalamilo situated on the mauka side of the Queen Kaahumanu Highway, and a portion of the ahupua'a of Ouli, all situated in South Kohala on the Island of Hawaii (see Figure 1). The applicant's property is situated approximately 24 miles north of the Keahole Airport and 3 miles south of Kawaihae harbor. It is identified as tax map key Third Division, Zone 6, Section 6, Plat 1, portion of Parcel 2, as depicted in Figure 2.

1.3 OVERVIEW

The need for the requested drainage easements derives from the limited hydraulic capacity of two 36-inch highway culverts and the capacities of the natural gulches above and below these culverts. The 36-inch culverts are located under the Queen Kaahumanu Highway at road stations 64+00 and 73+00 (see Figure 3). Analyses conducted by Tom Nance Water Resource Engineering have determined that the highway culverts drain areas of 165 acres and 400 acres, respectively, with corresponding peak storm runoff rates of 415 and 890 cubic feet per second (CFS). However, the highway culvert capacities are just 62 and 70 CFS, respectively.

Since 1983, the two culverts have been substantially overtopped by stormwater runoff on three occasions, each time creating traffic hazards and considerable property damage. When the culvert at station 64+00 is overtopped, water flows south along the Queen Kaahumanu Highway, joins with water overtopping the culvert at station 73+00, and flows across the highway into the Fairways South residential development.

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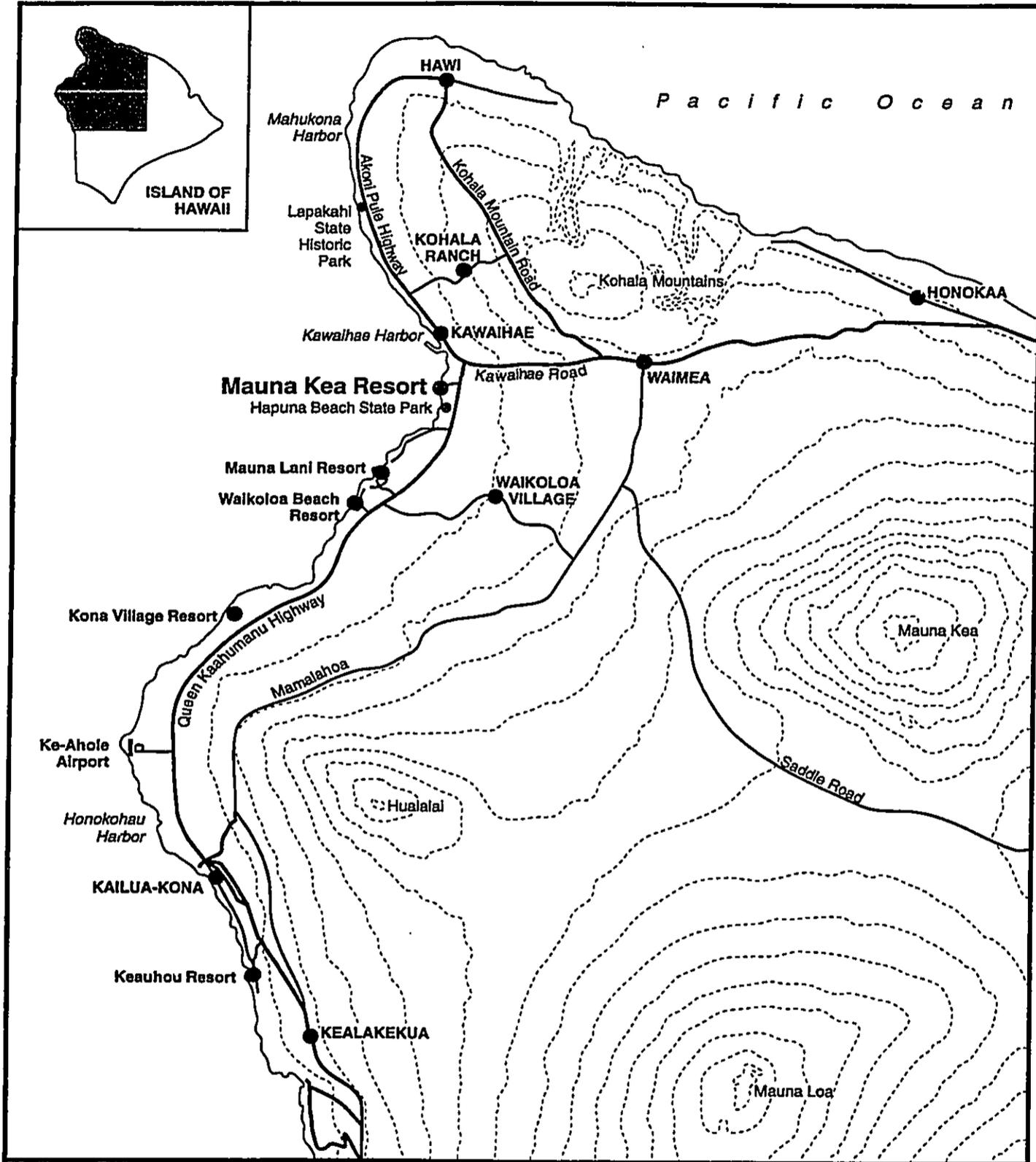


Figure 1
REGIONAL LOCATION MAP

Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
Prepared By: Belt Collins Hawaii
August 1994

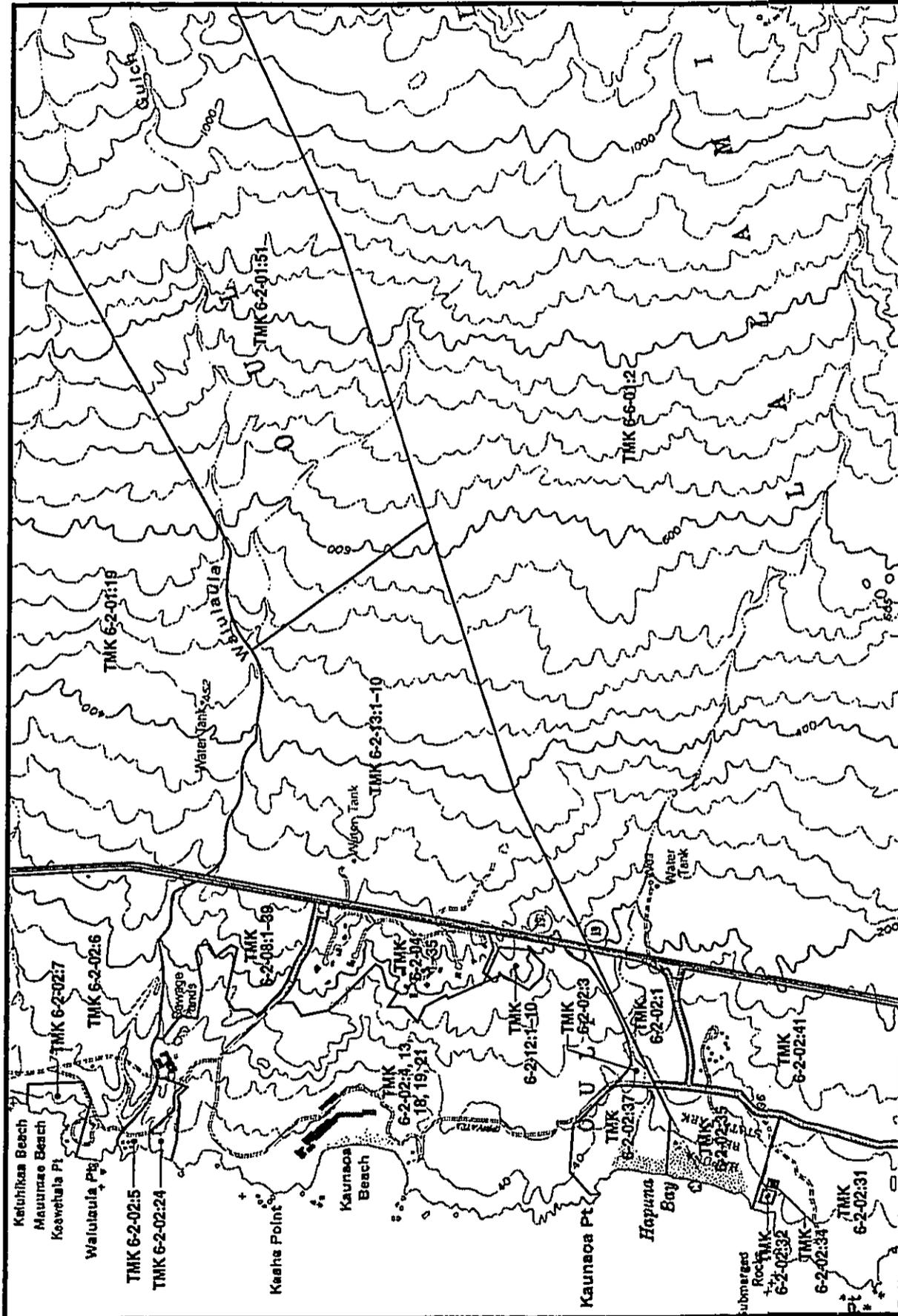
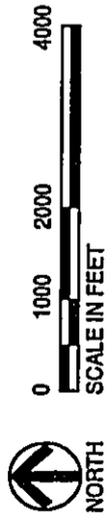


Figure 2
TAX MAP KEY

Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
 Prepared By: Belt Collins Hawaii
 August 1994



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1.4 REQUESTED GOVERNMENT ACTION

The requested government action is the granting of three drainage easements to the applicant to allow drainage improvements to be made on State-owned property in the Agriculture District. The drainage improvements would divert runoff to a deep natural gulch which is ultimately tributary to a 13-foot highway culvert at road station 110+23 near the Hapuna State Park access road. The applicant will also seek a Conservation District Use Permit for the clearing of debris from an unnamed gulch near the Hapuna State Park access road. Finally, the applicant will participate in a State Department of Transportation project to replace the highway culverts at stations 64+00 and 73+00 with larger culverts.

1.5 DESCRIPTION OF THE OVERALL DRAINAGE IMPROVEMENT PROJECT

The overall drainage improvement project consists of the three components described as follows:

Component 1: Construction of three diversion ditches. The first diversion ditch will be approximately 520 feet in length, extending from an elevation of about 410 feet above mean sea level (MSL) to an elevation of about 455 feet MSL (Ditch No. 1). It will include a desilting basin at its makai end, sized to retain a 2-year, 24-hour storm. The second ditch will be approximately 780 feet in length, extending from an elevation of about 495 feet above mean sea level (MSL) to an elevation of about 530 feet MSL (Ditch No. 2). The third ditch will be approximately 1,180 feet in length, extending from an elevation of about 560 feet above mean sea level (MSL) to an elevation of about 600 feet MSL (Ditch No. 3). Typical cross-sections of the three ditches are presented in Figure 4.

The three proposed diversion ditches will capture runoff from approximately 200 acres of a 400-acre basin tributary served by the culvert at roadway station 73+00. The runoff will be directed south into the natural gulch which drains to a 13-foot pipe culvert at

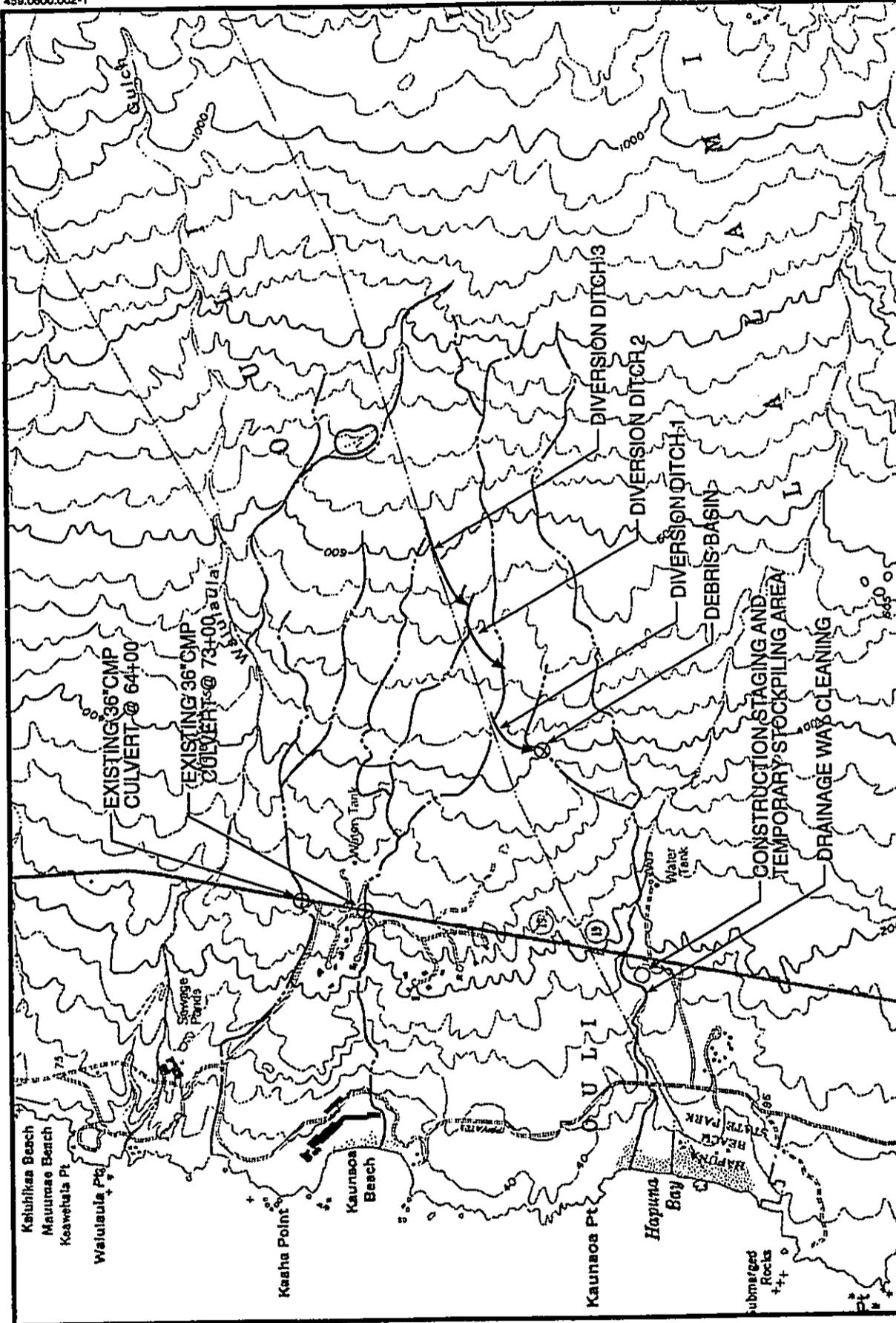
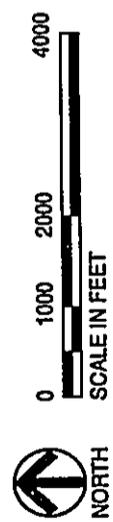
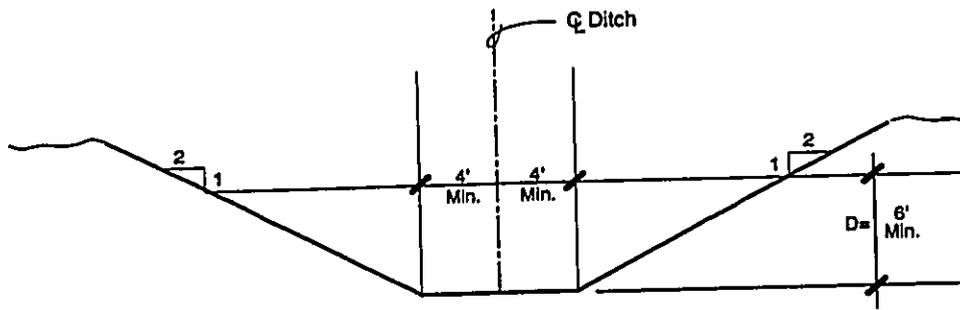


Figure 3
GENERAL LOCATION OF PROJECT COMPONENTS

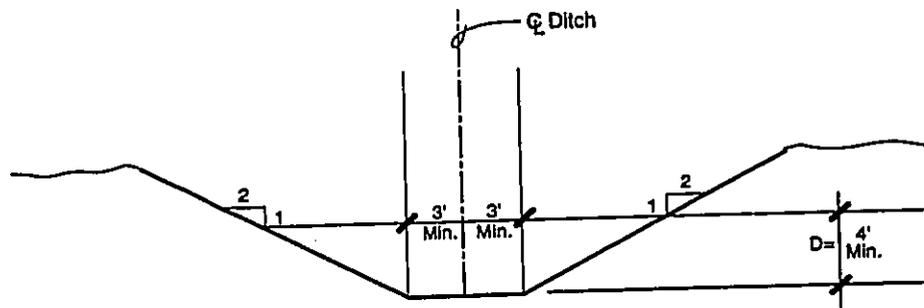
Information Source: Tom Nance Water Resource Engineering



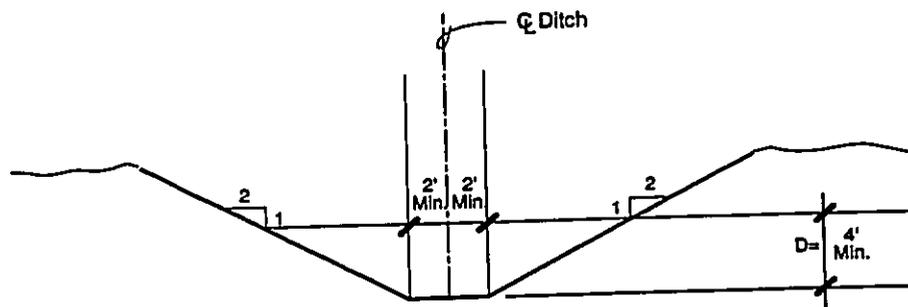
Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
 Prepared By: Balt Collins Hawaii
 August 1994



TYPICAL DITCH SECTION NO. 1



TYPICAL DITCH SECTION NO. 2



TYPICAL DITCH SECTION NO. 3

Figure 4
TYPICAL DITCH CROSS SECTIONS

Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
Prepared By: Belt Collins Hawaii
August 1994

Source: Tom Nance Water Resource Engineering

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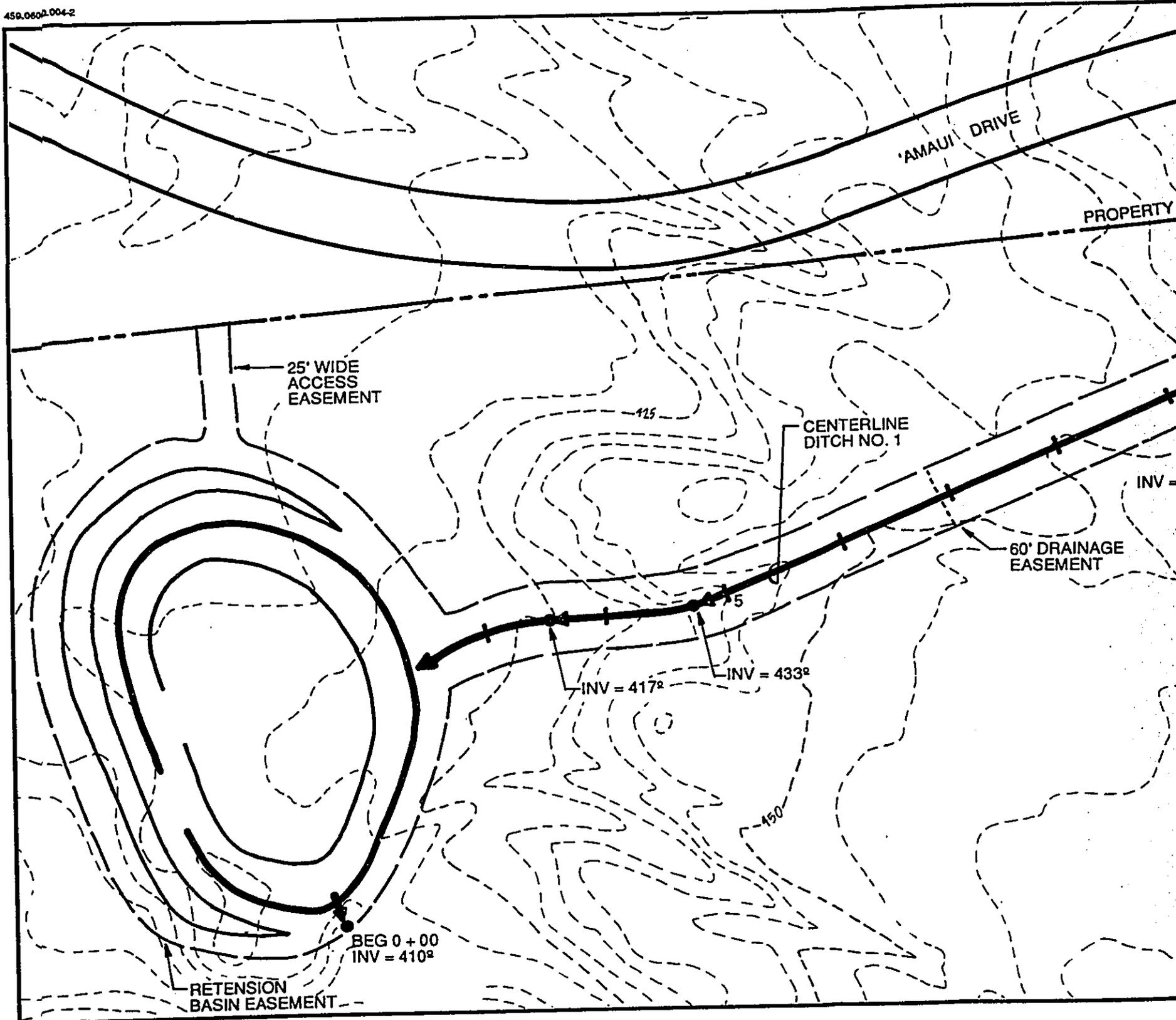
road station 110+23 near the Hapuna State Park access road. The balance of the 400-acre basin tributary served by the culvert at station 73+00, comprised of the 200 acres below the proposed diversion ditches, will continue to drain to the culvert at station 73+00. A separate construction project (component 2, discussed below) is proposed to increase the capacity of the culvert at station 73+00, as well as at station 64+00.

The specific alignment of Ditch No. 1 is presented in Figure 5. The 520-foot long ditch will be designed to have a base width of 8 feet, side slopes of 2:1, and a minimum depth of 6 feet. The width of the requested easement needed to accommodate the ditch will be 60 feet and the overall easement area will be 3.85 acres, which includes a 2.89 acre desilting basin and a 25-foot wide access easement extending approximately 100 feet into state-owned land from the applicant's property boundary. Ditch No. 1 is the lowest elevation and widest of the three proposed diversion ditches.

The alignment of Ditch No. 2 is presented in Figure 6. This 780-foot long ditch will be designed to have a base width of 6 feet, side slopes of 2:1, and a minimum depth of 4 feet. The width of the requested easement needed to accommodate the ditch will be 50 feet and the overall easement area will be 1.09 acres. This easement area includes a 25-foot wide access easement extending approximately 180 feet into state-owned land from the applicant's property boundary.

The alignment of Ditch No. 3 is presented in Figure 7. The 1,180-foot long ditch will be designed to have a base width of 4 feet, side slopes of 2:1, and a minimum depth of 4 feet. The width of the requested easement needed to accommodate the ditch will be 40 feet and the overall easement area will be 1.11 acres. No additional access roadway easement is required for this diversion ditch because the proposed easement abuts the applicant's property boundary. Ditch No. 3 is the highest elevation and the narrowest of the three proposed diversion ditches.

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Source: Tom Nance Water Resource Engineering, July 19, 1994.



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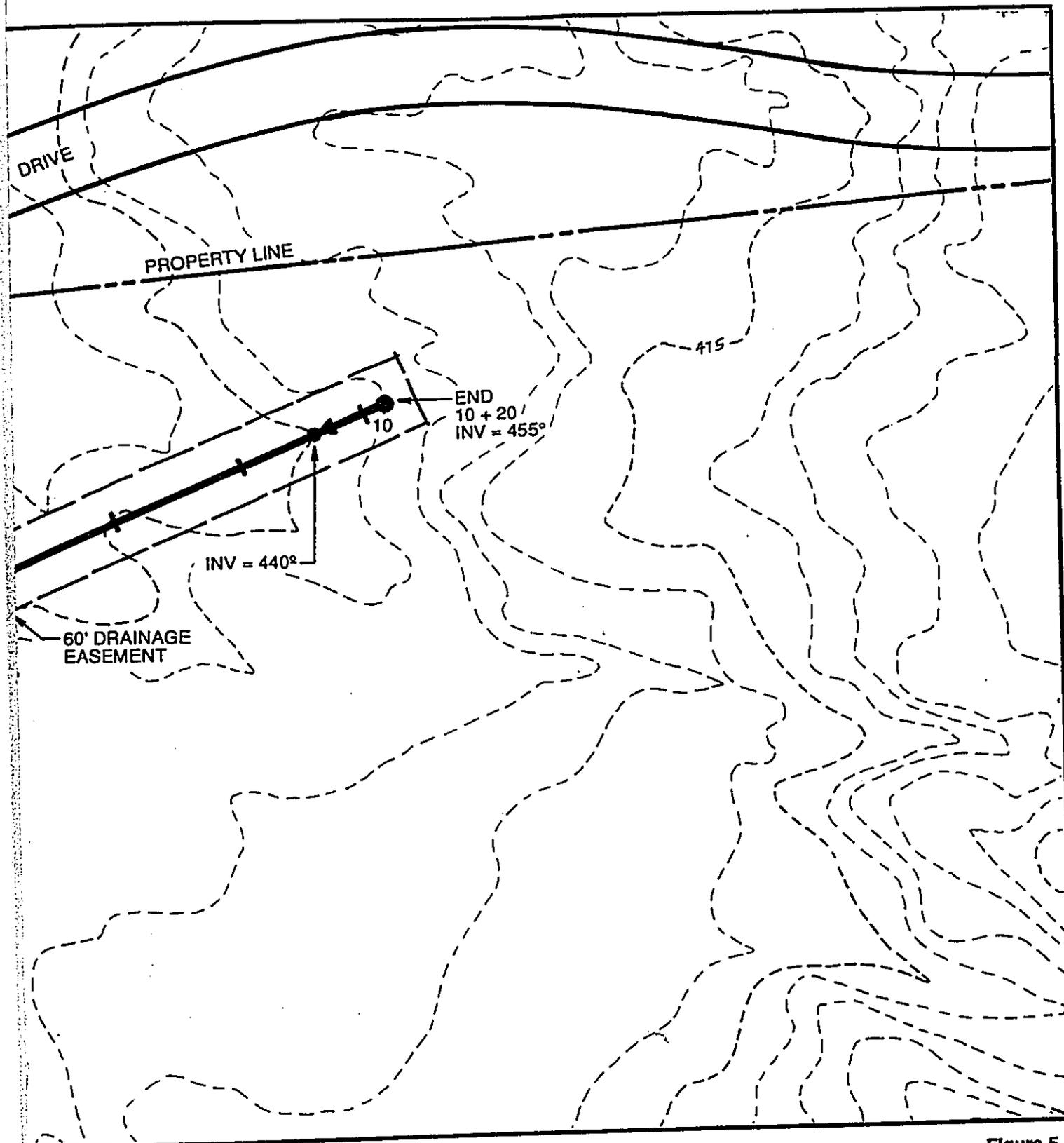
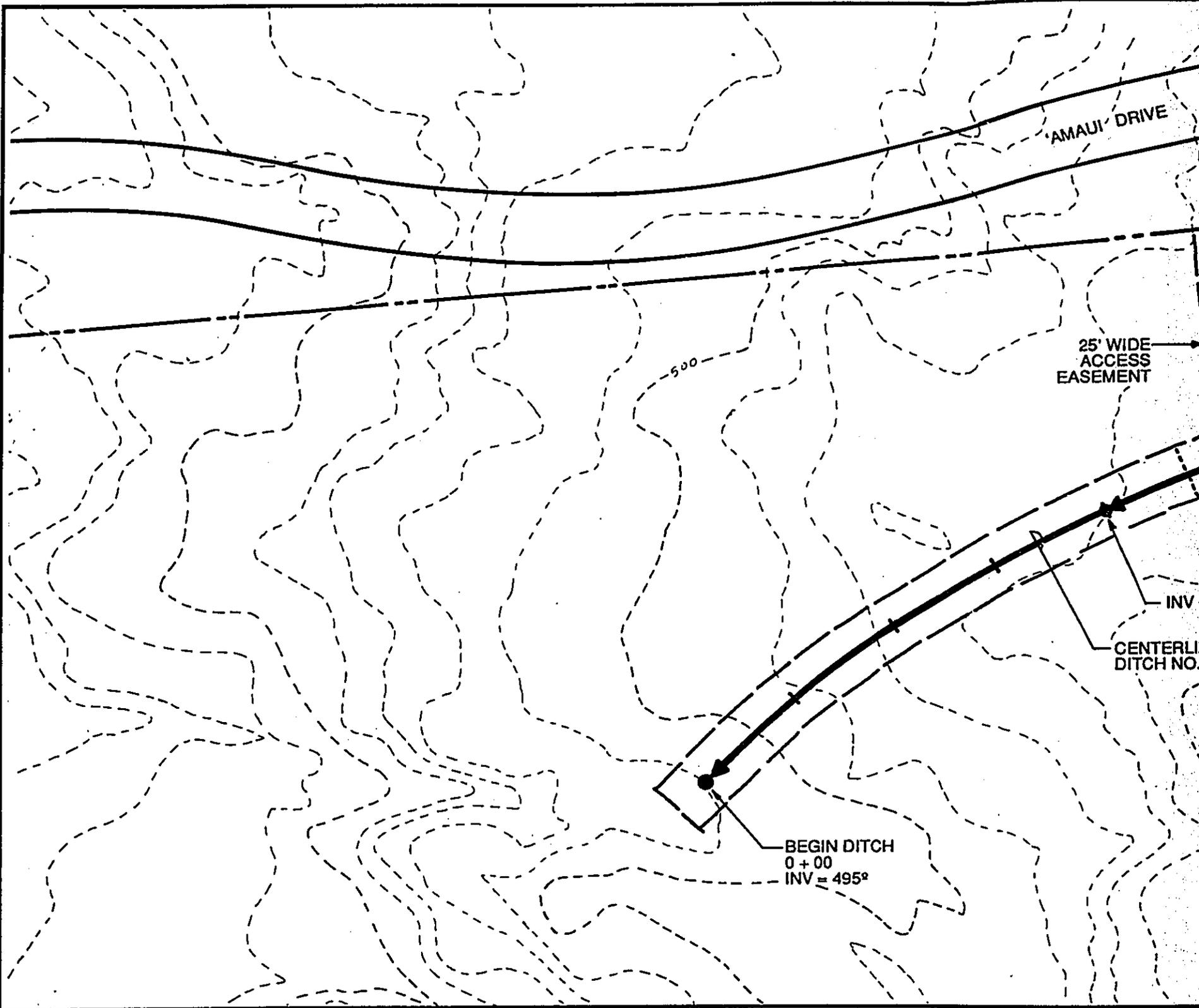


Figure 5
ALIGNMENT OF DITCH NO. 1

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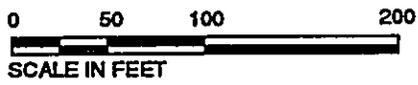
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Source: Tom Nance Water Resource Engineering, July 19, 1994.



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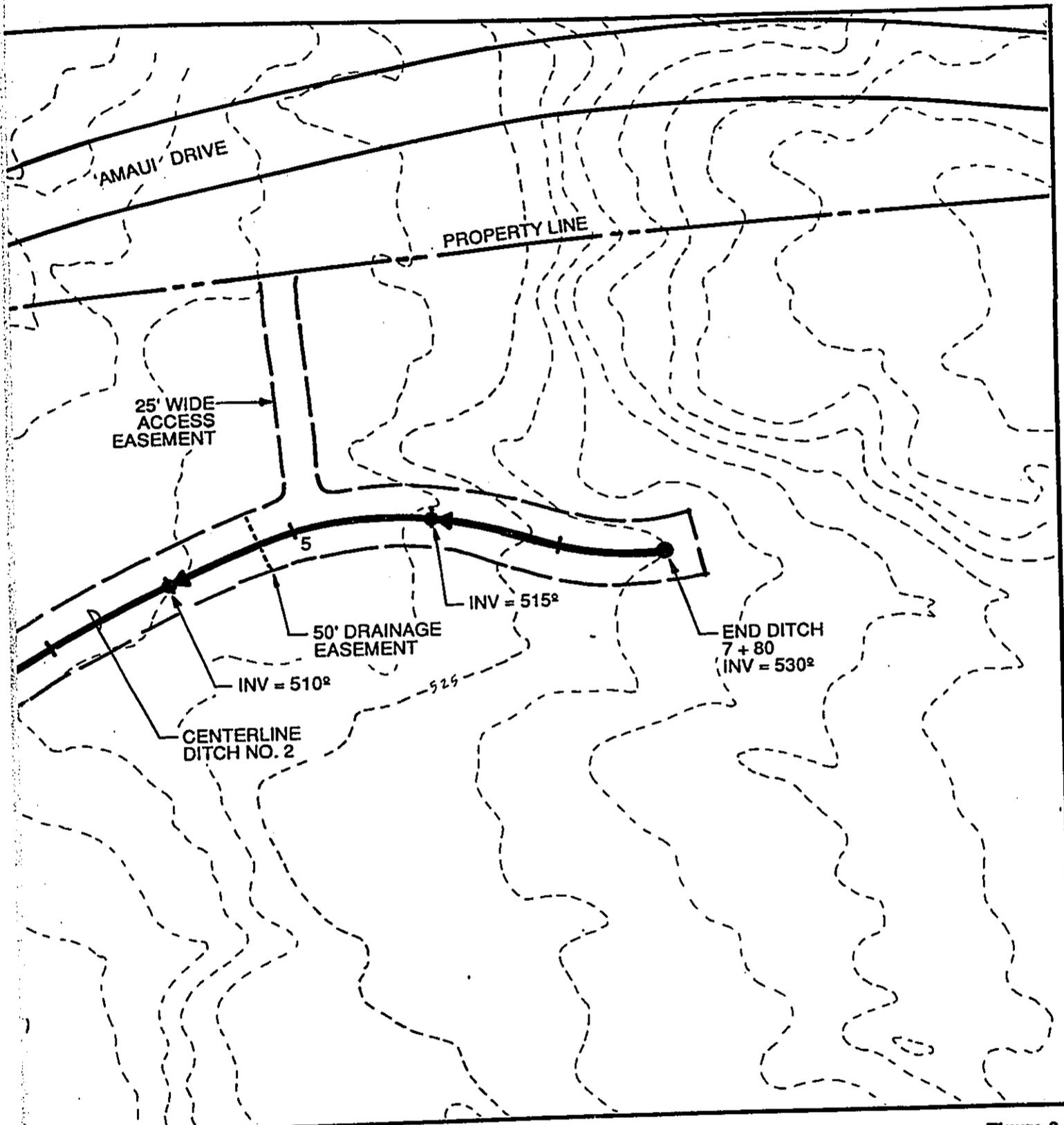
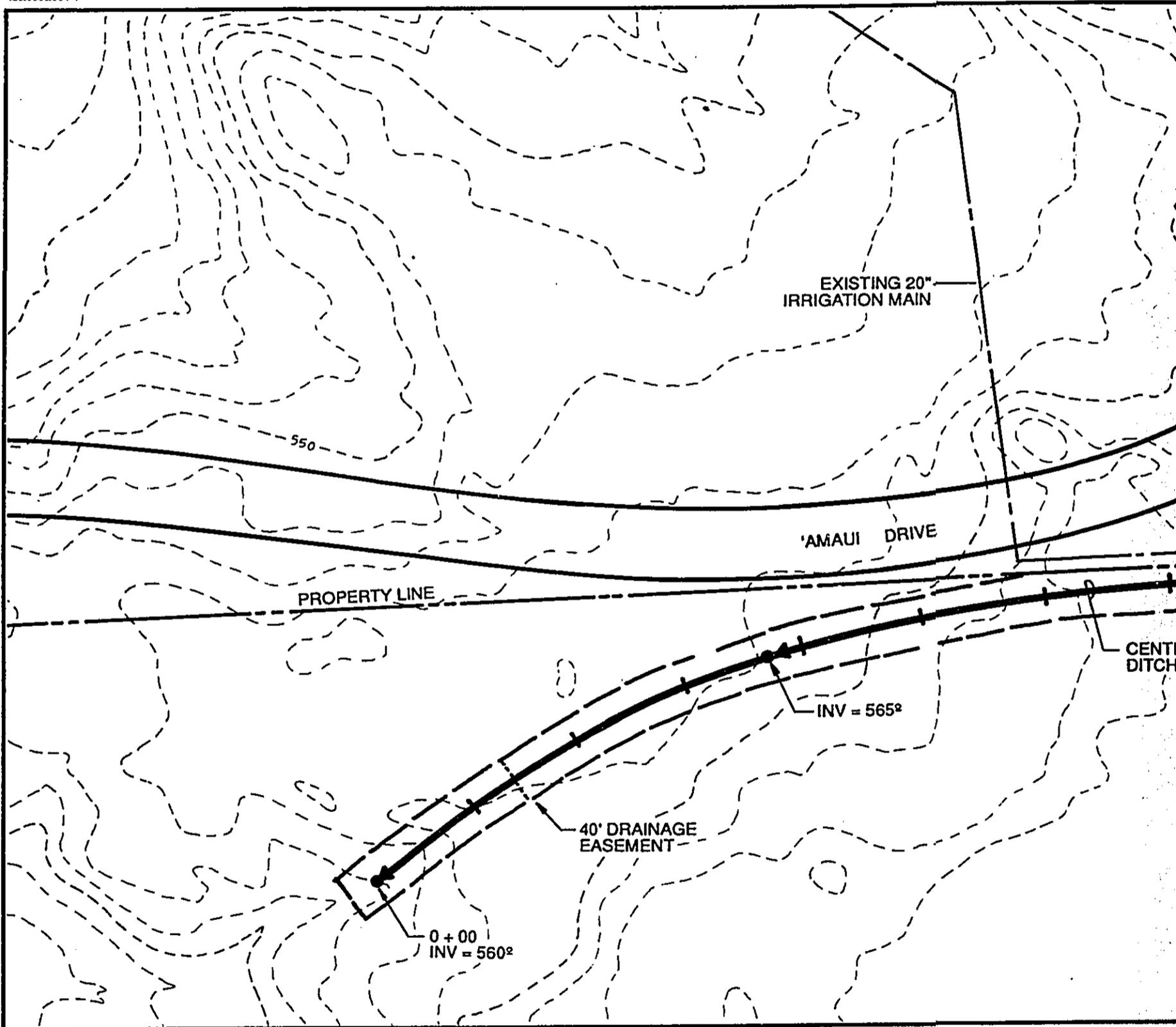


Figure 6
ALIGNMENT OF DITCH NO. 2

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August 1994

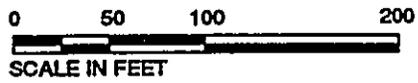
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Source: Tom Nance Water Resource Engineering, July 19, 1994.



NORTH



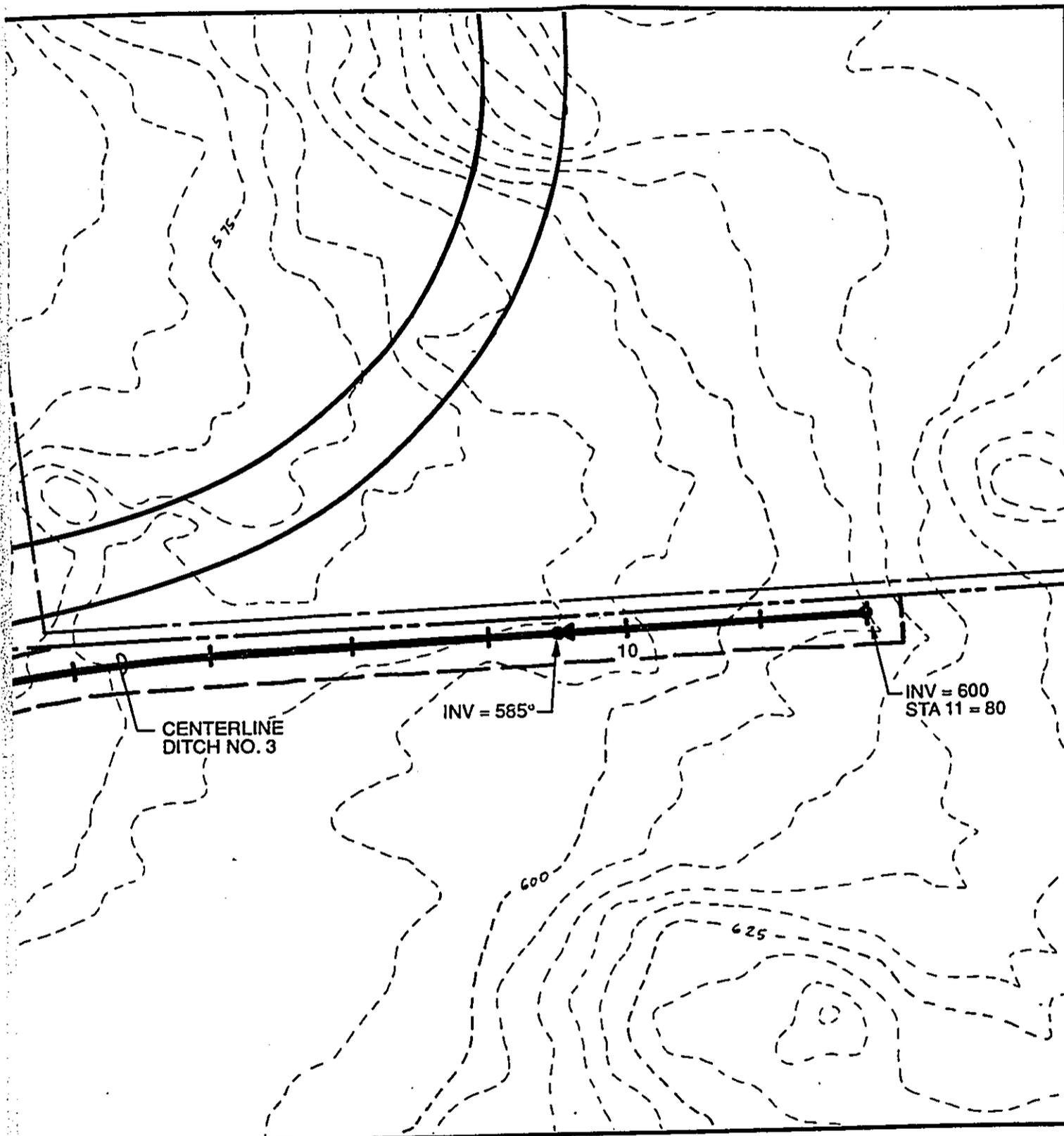


Figure 7
ALIGNMENT OF DITCH NO. 3

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August 1994

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As evidenced in Figure 3, the proposed ditches will generally parallel the existing road serving the South Kohala Resort mauka access road. Ditches No. 3 and No. 2 will direct runoff to an unnamed tributary which will be subsequently intercepted by Ditch No. 1; facilitating the diversion of runoff to a separate gulch which terminates at the northern edge of Hapuna Beach.

In order to minimize the potential for increased levels of turbidity at Hapuna Bay resulting from the proposed diversion of runoff, a desilting basin is proposed at the makai end of Diversion Ditch No. 1. This basin will be designed to retain the volume of a 2-year, 24-hour storm. For the 200-acre diverted area, this amounts to 14 acre-feet. The stilling effect created by the desilting basin will enable silt and debris trapped in the storm runoff to settle to the bottom of the basin before the runoff enters the Hapuna gulch.

The three ditches and the desilting basin will be excavated with a D-8 or D-9 bulldozer, equipped with a ripper. No blasting will be required. A smaller bulldozer may be utilized for final shaping of the ditch and basin surfaces. If excavation exposes a sufficient amount of natural rock in the ditches and basin, no additional rock lining will be required. However, for ditch sections without rock substrata, a lining will be created with rocks from the excavation.

Construction access to the excavation sites will be provided by the existing South Kohala Resort's mauka access road. Excavation of the three ditches and the debris basin will require approximately three to four weeks. Excess excavated material will be delivered to a site designated by the Department of Land and Natural Resources on State land. All costs for construction and subsequent maintenance of the drainage ditches and basin will be borne by the applicant. Subsequent maintenance will require periodic site visits to clear the diversion ditches and the desilting basin of debris. Access will be from the same locations used for construction.

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Component 2: Replacement of the two 36-inch highway culverts (road station 64+00 and 73+00) with twin 60-inch pipe culverts at each of the two locations. The project will involve the replacement of the existing 36-inch highway culverts at stations 64+00 and 73+00 (see Photo Plates 1 and 2) with twin 60-inch culverts at each station. The proposed culvert expansion at station 64+00 will be sufficient to accommodate peak flow from the 165-acre basin tributary it drains. The proposed culvert expansion at station 73+00 will accommodate runoff from that portion of the 400-acre basin tributary not diverted by the proposed diversion ditches discussed above.

Replacement of the existing corrugated metal pipe culverts passing beneath Queen Kaahumanu Highway with larger concrete masonry culverts will require a 17-foot wide trench excavated perpendicular to the highway's right-of-way at each of the two roadway stations. Within the highway's paved area, the trench will be repaved to match the existing pavement of the highway and will conform to Department of Transportation specifications. Figures 8 and 9 present section views of the existing culverts and their proposed replacements.

This component has joint Federal/State/applicant funding; 80%/10%/10%, respectively. The State Department of Transportation will contribute the design and construction management. The applicant will contribute cash. Work on this project will be dependent upon State budget priorities.

Component 3: Debris removal from unnamed gulch. This component involves the removal of collected boulders and debris from a 300 foot-long portion of an unnamed gulch makai of the existing 13-foot highway culvert at road station 110+23 at Queen Kaahumanu Highway, near the entrance road to Hapuna State Park. This project is an integral part of the overall drainage improvement project. If intermittent flow in the gulch is interrupted by debris and large boulders, flooding of the area makai of the highway above Hapuna State Park could occur.



Plate 1. View of 36" culvert at Station 64 + 00 looking makai from mauka side of Queen Kaahumanu Highway.



Plate 2. View of 36" culvert at Station 73 + 00, looking makai from mauka side of Queen Kaahumanu Highway.

CORRECTION

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



Plate 1. View of 36" culvert at Station 64 + 00 looking makai from mauka side of Queen Kaahumanu Highway.

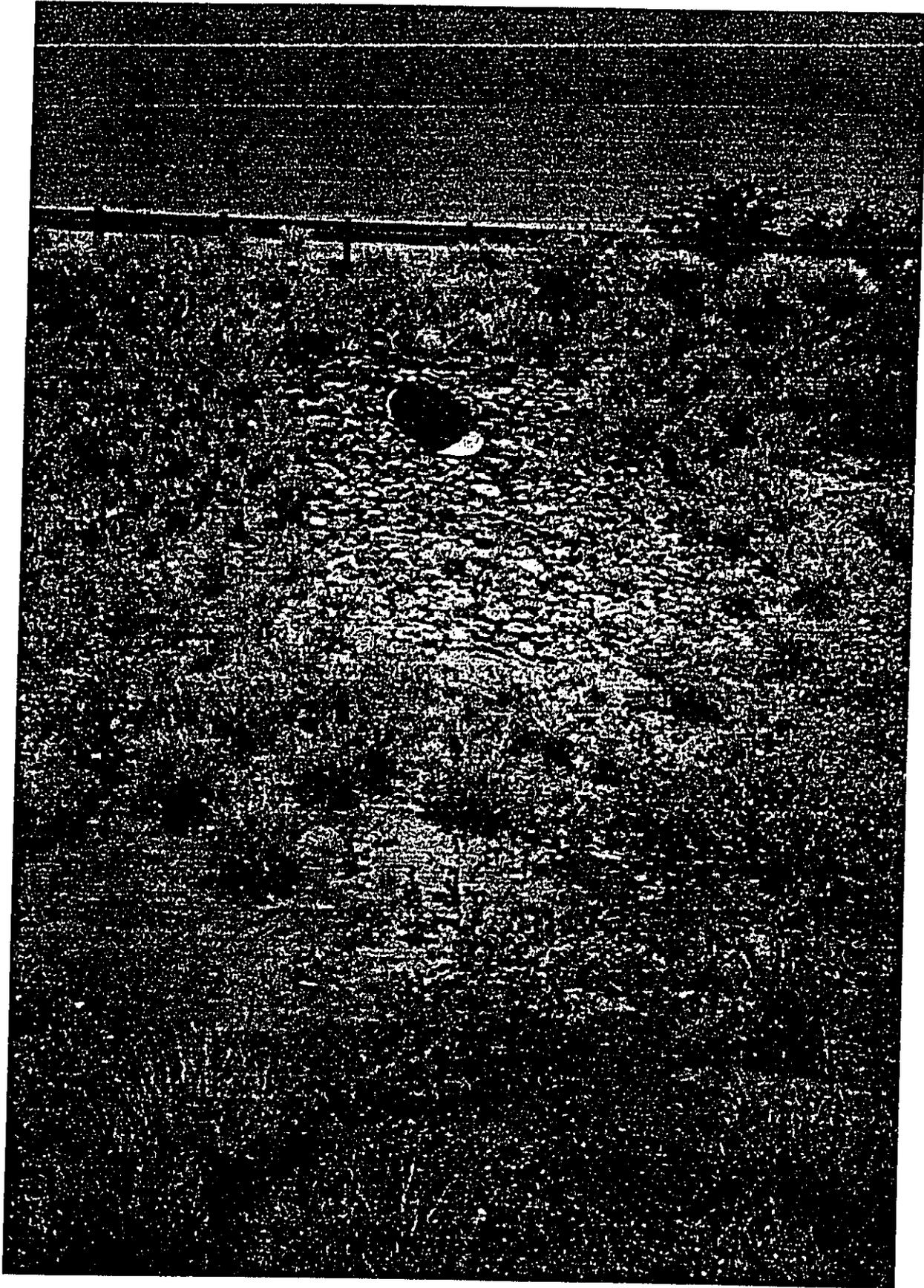
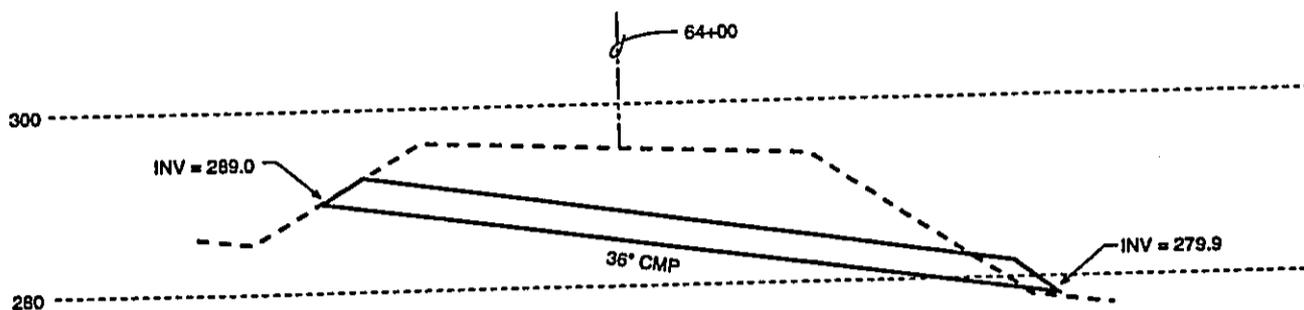
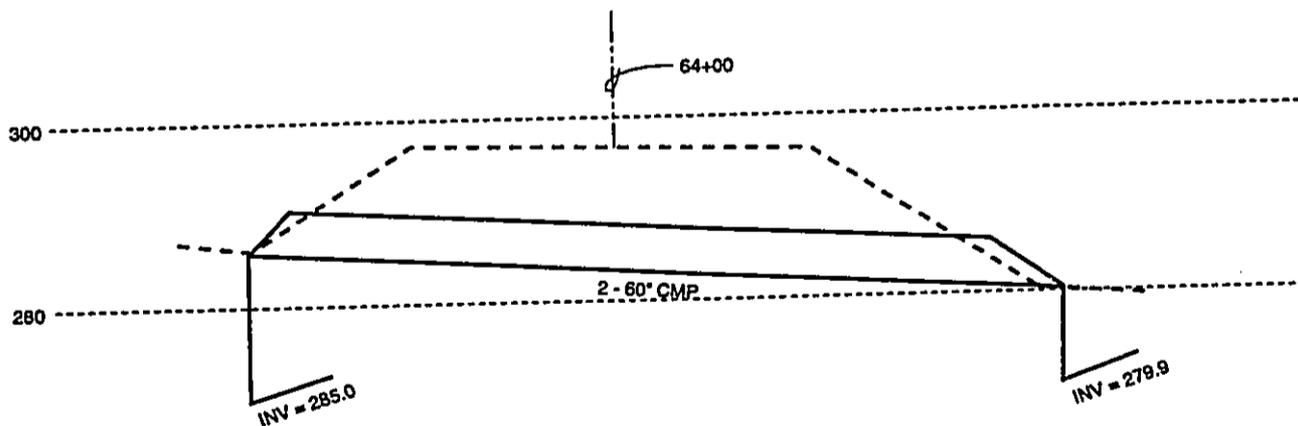


Plate 2. View of 36" culvert at Station 73 + 00, looking makai from mauka side of Queen Kaahumanu Highway.

459.0600.001-4



SECTION @ 64+00—EXISTING 36" CMP CULVERT



SECTION @ 64+00—PROPOSED 2 - 60" CMP CULVERTS

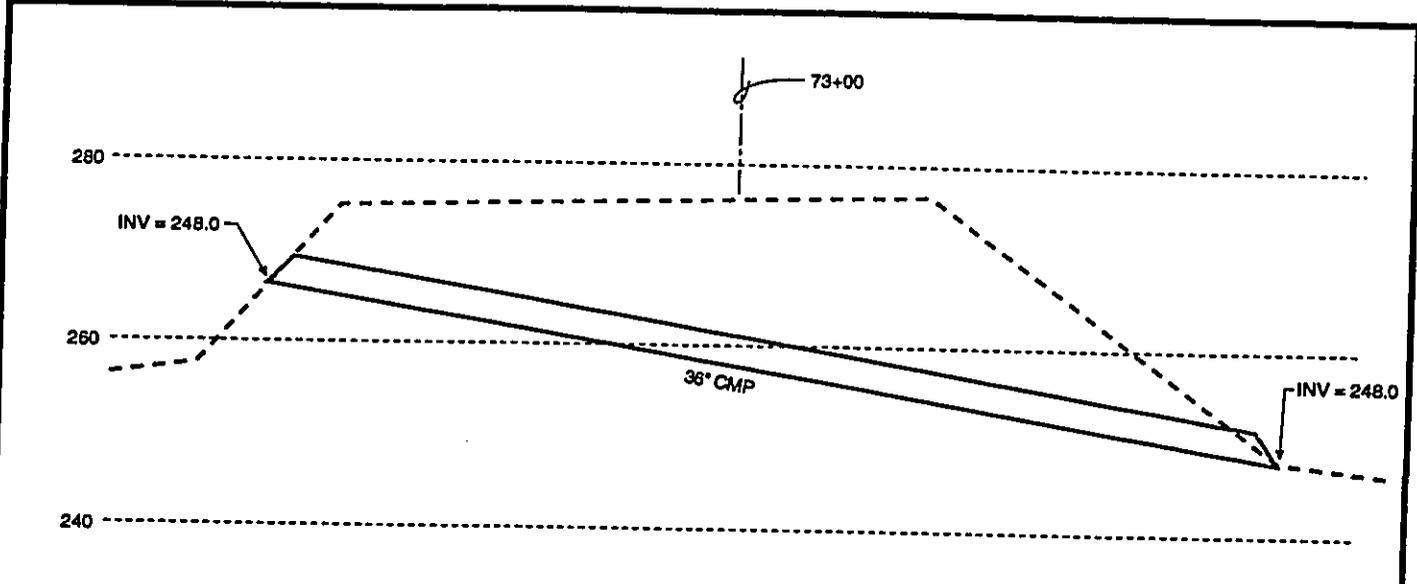
Source: Tom Nance Water Resource Engineering, 1993

Figure 8
SECTION OF ROAD STATION 64+00 CULVERT

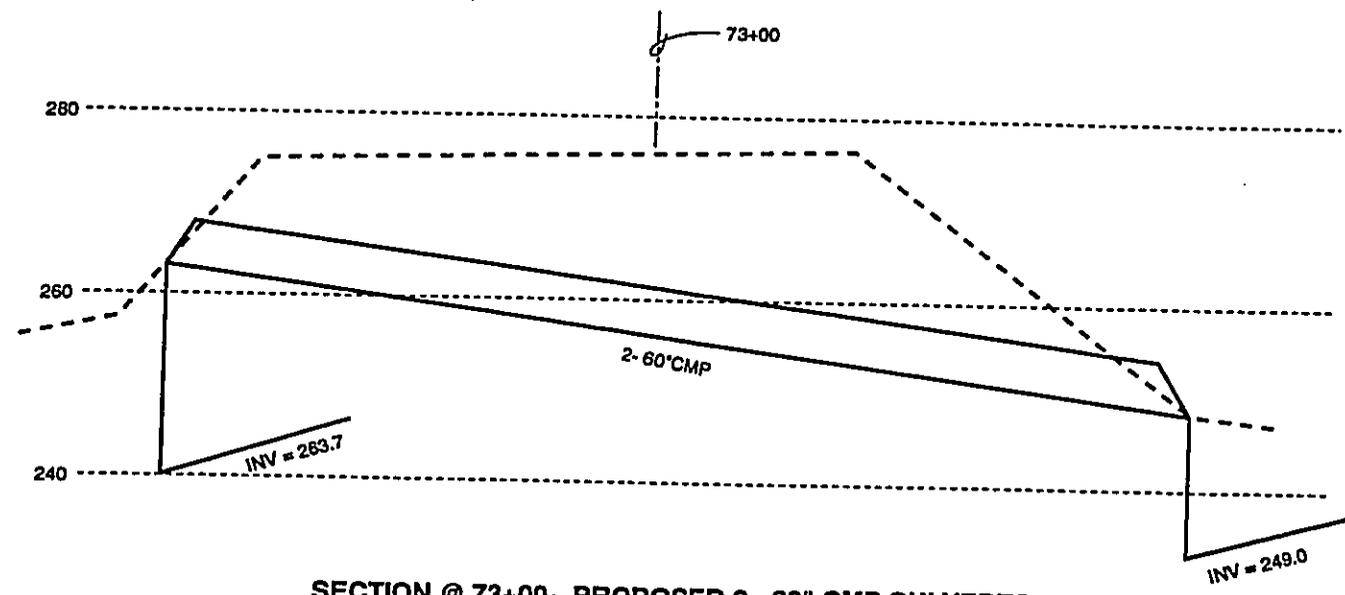
Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
Prepared By: Belt Collins Hawaii
August 1994

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459.0600.001-5



SECTION @ 73+00—EXISTING 36" CMP CULVERT



SECTION @ 73+00—PROPOSED 2 - 60" CMP CULVERTS

Source: Tom Nance Water Resource Engineering, 1993

SECTION OF ROAD STATION 73+00 CULVERT

Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
Prepared By: Belt Collins Hawaii
August 1994

Scale: 1" = 20'

Figure 9

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This project is located on state-owned land in the Conservation District and the Special Management Area. As indicated in Figure 10, access to the area of the gulch to be cleared will be provided from the Hapuna State Park entrance road by a temporary 24-foot wide graded access road. A 1.2-acre area adjacent to the gulch will serve as staging area for equipment and will be the site of stockpiled debris taken from the gulch. The project will also include the trimming of vegetation overhanging the gulch.

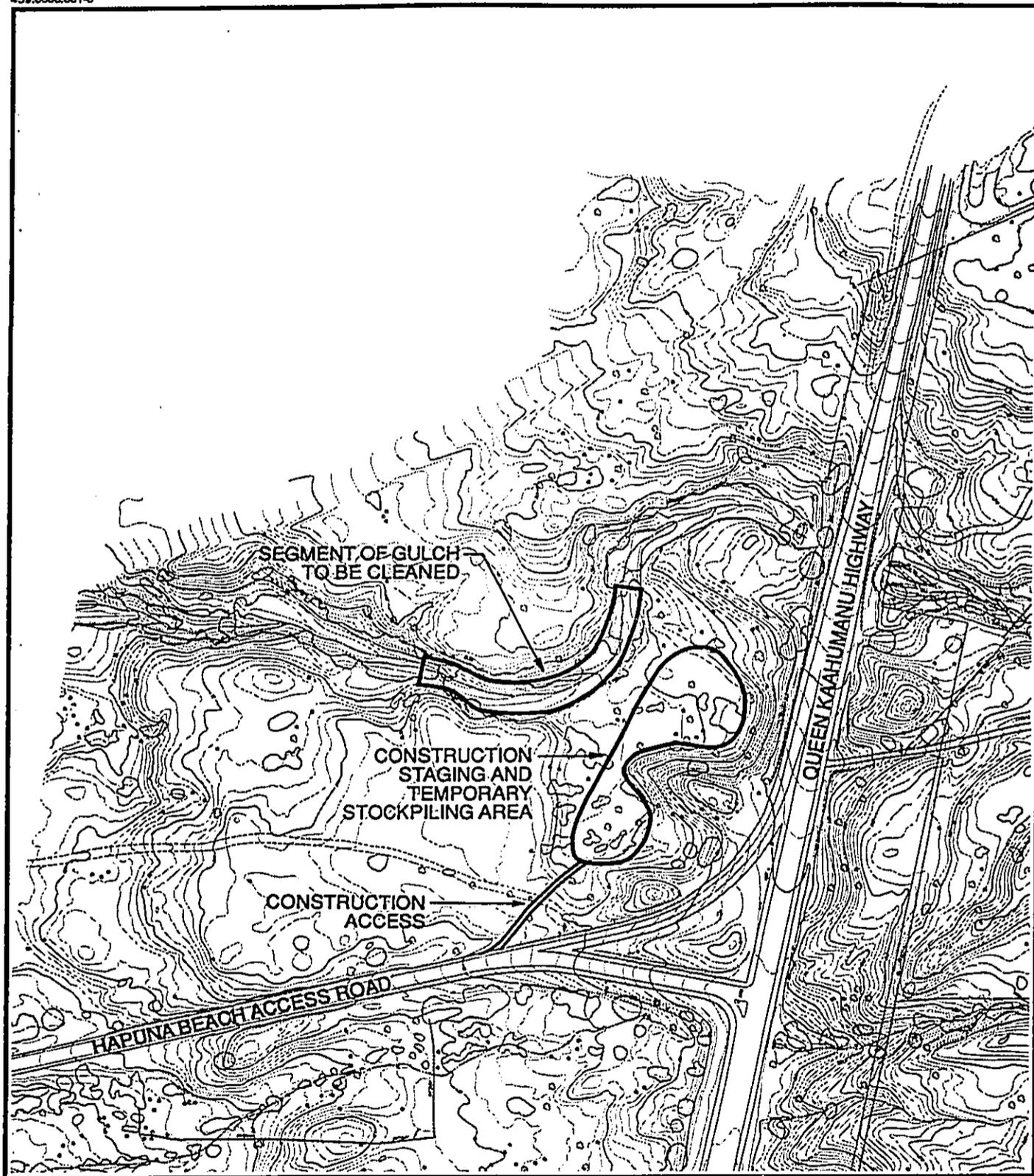
2. CHARACTERISTICS OF THE PROJECT AREA

This section discusses the socioeconomic and environmental setting of the proposed project. How construction and operation of the project may impact the environment and specific recommendations to mitigate any potentially negative impacts are discussed in Section 3.

2.1 REGIONAL SOCIAL AND ECONOMIC CONDITIONS

The project sites are situated in United States Census Tract 217. According to the 1990 census, this census tract had a population of 9,140. Primary residential areas in the census tract include the town of Waimea, Waikoloa Village, Kawaihae, Kawaihae Village, Puako, and the resort/residential communities at the Mauna Kea, Mauna Lani, and Waikoloa resort destination areas.

Due to the relatively limited population of the area, information concerning economic conditions is generally aggregated by the State to an islandwide perspective. In Hawaii County, the civilian labor force increased from 43,550 in 1980 to 61,550 in 1990. During the same period, civilian unemployment decreased from 6.2% to 3.8%. In 1990, the service industry employed 31% of Hawaii County's labor force. Wholesale and retail trades employed nearly 28%, while total agricultural employment (wage, salary, and self-employed) accounted for about 12%. (source: DBED&T, 1992 Data Book)



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SCALE IN FEET

Figure 10
LOCATION OF GULCH DEBRIS REMOVAL

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Prepared By: Belt Collins Hawaii
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2.2 ENVIRONMENTAL CONSIDERATIONS

2.2.1 Geology and Topography

The Lalamilo and Ouli ahupua'a are located on the lower northwestern flank of Mauna Kea, the second oldest of five volcanoes that make up the island. The project sites are underlain primarily by pahoehoe lava from Mauna Kea's Hamakua Volcanic Series.

Elevations of the project areas extend from about 200 feet above MSL to 600 feet above MSL. Slopes average 6 to 12 percent. In general, the land area is characterized by a gently sloping prehistoric lava flow interspersed with erosional gulches (see Photo Plate 3).

2.2.2 Soils and Agricultural Potential

A single soil type been identified on the lands within which the proposed project is situated. Kawaihae extremely stony very fine sand loam, 6 to 12 percent slope (KNC) typically has a thin surface layer, about 2 inches. Beneath the surface layer is a 30 inch layer of stony silt loam and loam. The bedrock of hard pahoehoe lava begins at a depth of about 33 inches. Permeability of the upper soil layer is moderate, runoff is medium, and the erosion hazard is moderate. It is not agriculturally significant, as determined by the State Department of Agriculture.

As discussed in the Detailed Land Classification, Island of Hawaii, University of Hawaii, Land Study Bureau, 1972, the mauka lands of the Kaupulehu ahupua'a are classified as "E", which indicates lack of suitability for agricultural purposes.

2.2.3 Surface Water and Drainage

There are seven existing surface water features situated in the general vicinity of the overall drainage improvement project. Of the six located mauka of the highway, three

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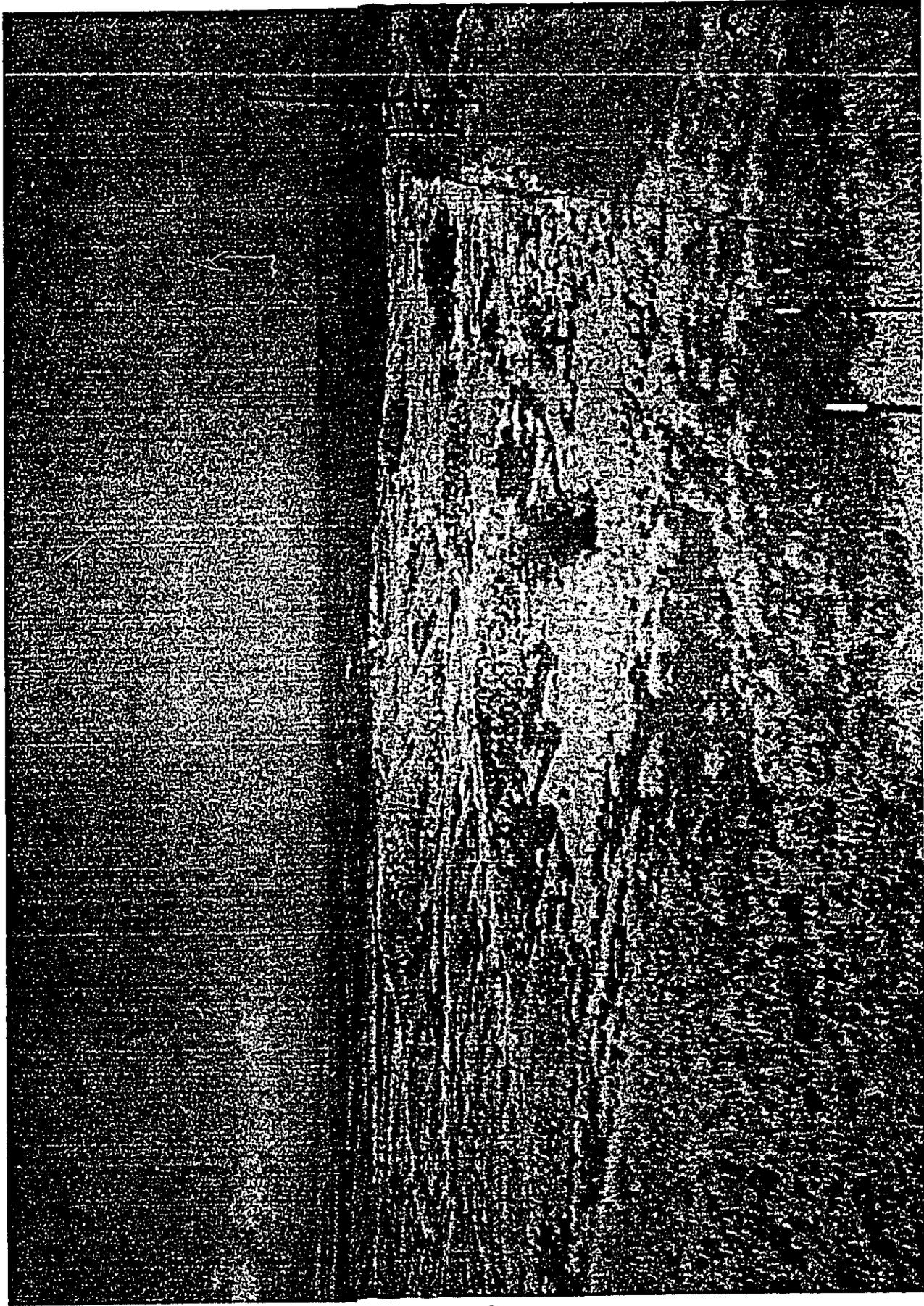


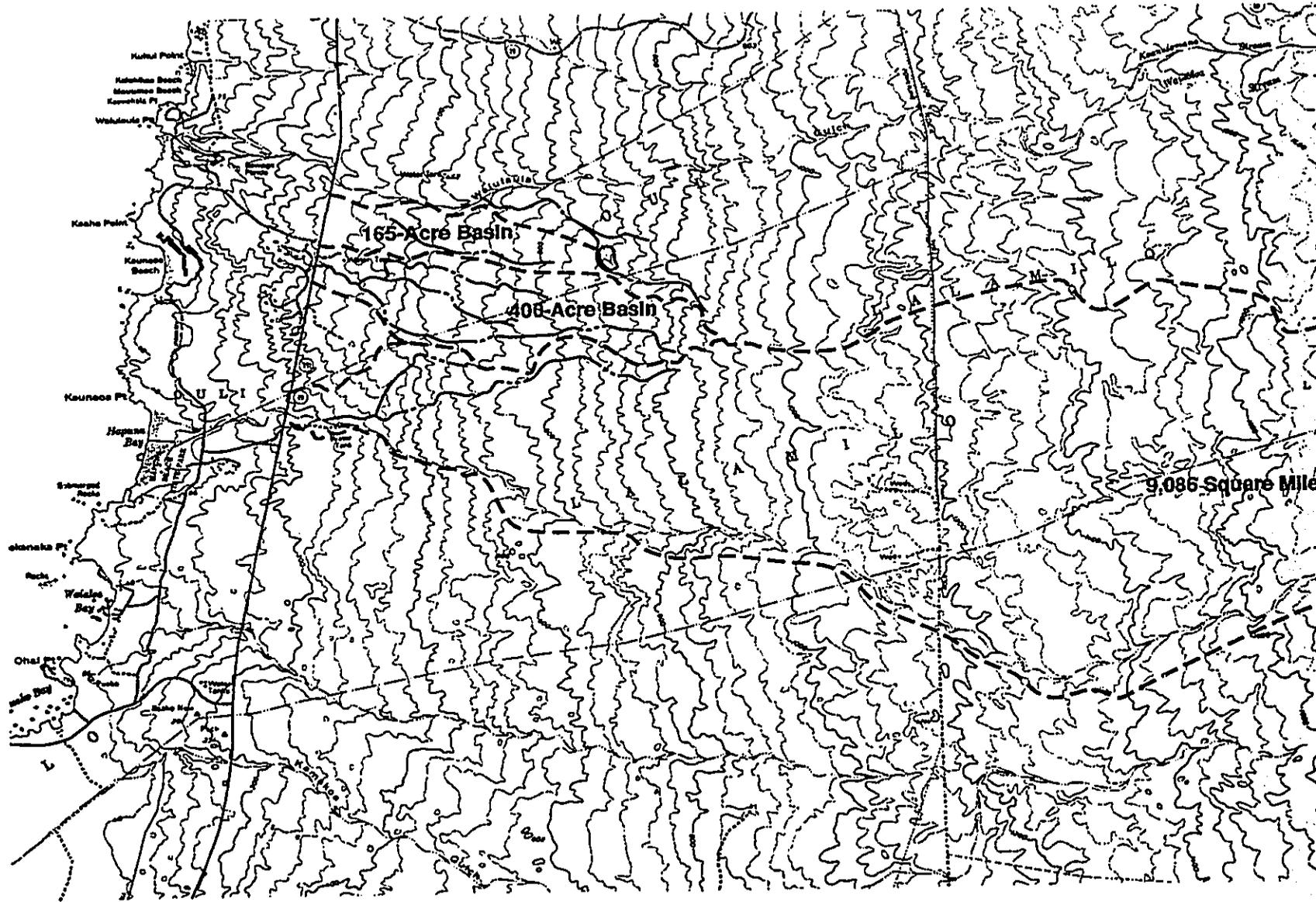
Plate 3. Typical character of topography and vegetation type at diversion ditch project area. This view was taken at an elevation of 600 feet above mean sea level near the South Kohala Resort access road, looking makai at the area where ditch No. 3 is to be located.

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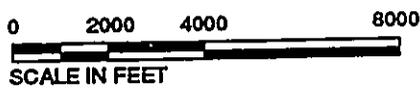
are golf course water features, two are irrigation reservoirs, and one is a wastewater treatment retention pond. The large irrigation reservoir in the center of the South Kohala Resort golf course is situated along a natural gulch and provides irrigation water for the Mauna Kea Resort golf course makai of the highway. The large irrigation feature at the apex of the South Kohala Resort property provides irrigation water for the South Kohala Resort golf course. The seventh water feature is situated makai of the highway and is a golf course feature.

As discussed above, analyses conducted by Tom Nance Water Resource Engineering have determined that highway culverts 64+00 and 73+00 drain areas of 165 acres and 400 acres, respectively, with corresponding peak storm runoff rates of 415 and 890 cubic feet per second (CFS). Figure 11 depicts the regional drainage basins.

The following information concerning drainage summarizes a report prepared by Tom Nance Water Resource Engineering in March 1993 (see Appendix A). According to Nance, establishing appropriate storm rainfall amounts is the heart of the problem for any drainage design in the area. The only published rainfall frequencies are in the outdated "Rainfall Frequency Atlas of the Hawaiian Islands" (U.S. Weather Bureau Technical Paper No. 43). No storm rainfall data in this part of South Kohala was available for the preparation of Technical Paper No. 43. The frequencies that were included were based on comparisons with other areas of similar average annual rainfall. Unfortunately, this does not satisfactorily represent actual storm rainfall probabilities. Figure 12 compares these published rainfall frequencies with actual rainfalls as reported by the applicant's staff for three storm events: 12/26/83 (6 inches in 4-5 hours); 1/16 to 1/17/84 (1.59 inches in two short duration rainfalls, one for 5 minutes and the other for 20-25 minutes); and 9/14 to 9/15/92 (5.5 inches in two and a half hours). Two of these three storm events are approximately two times greater than the published 100-year rainfall amounts for the same durations. Because the fraction of rainfall resulting in runoff increases in greater rainfall events, the difference in resulting runoff is even greater than the difference in rainfall.



Source: Tom Nance Water Resource Engineering



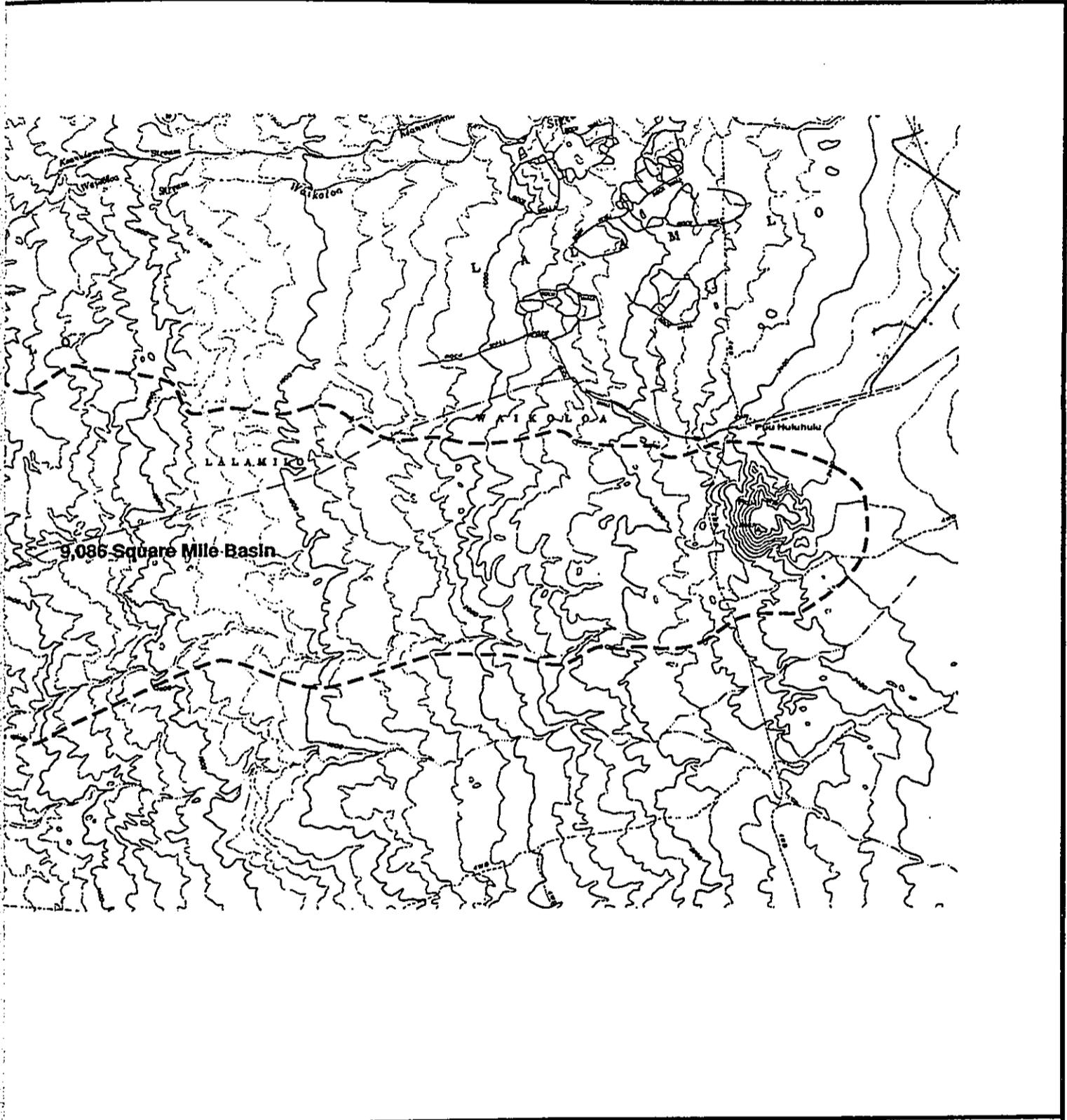


Figure 11
REGIONAL DRAINAGE BASINS

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Prepared By: Belt Collins Hawaii
August 1994

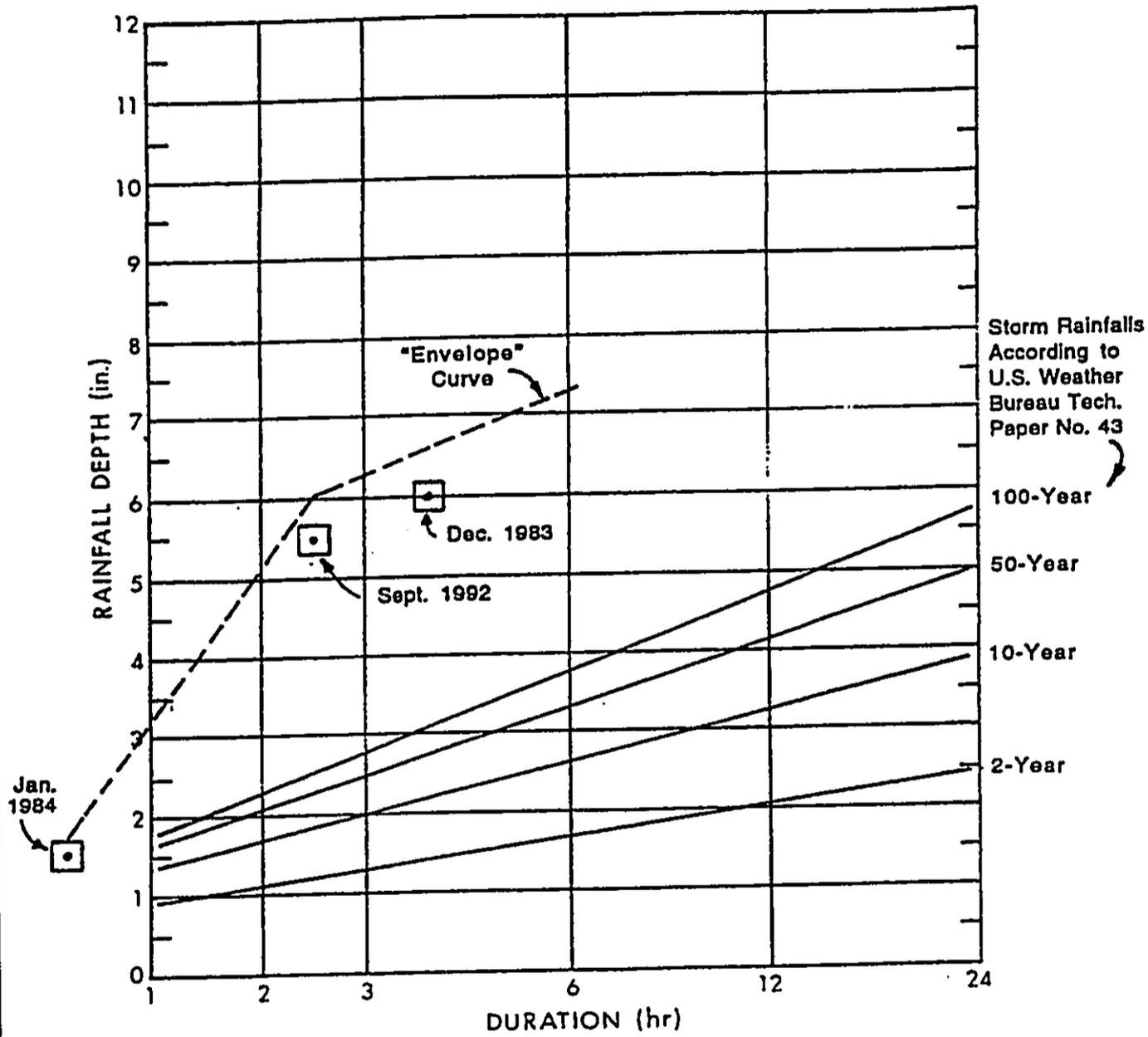


Figure 12
RAINFALL AMOUNTS AS A FUNCTION OF STORM DURATION
Mauna Kea Resort Drainage Way Improvements Draft Environmental Assessment
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Source: Tom Nance Water Resource Engineering, 1993

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This difference alone is the reason why flood damage occurred during the three events cited.

2.2.4 Groundwater and Hydrology

According to the Final Environmental Impact Statement for the South Kohala Resort, (Belt Collins and Associates, 1987), calculations of the total groundwater flow have established a probable range of from 3.0 to 7.0 million gallons per day (mgd) per coastal mile. At distances of more than four miles inland of the shoreline, groundwater is of potable quality and wells have been developed to supply the domestic water requirements of the coastal region.

The drainage improvements are generally located within the Mauna Kea-Waimea aquifer system which is part of the basal, unconfined aquifer in the flank lavas of Mauna Kea (Harding Lawson Associates, 1991). Data from five existing wells in the vicinity of the project indicate that water sources are suitable only for irrigation.

Erosional gulches which form the natural drainageways in the region are intermittent and rarely contain surface flow. Stormwater flows are typically limited to relatively rare high-intensity rainfalls.

2.2.5 Natural Hazards

Potential natural hazards include lava flow and tsunami inundation, earthquakes, and flooding. The project area is situated in Lava Flow Hazard Zone 8 (on a scale of 1-9 where 1 is the zone of greatest risk). The potential for lava flow inundation is very low. Because of the project's general elevation (between 200 and 600 feet above MSL), the potential for tsunami inundation is also considered to be very low.

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Due to continuing volcanic activity at Kilauea volcano and periodic activity at Mauna Loa, the entire island of Hawaii is frequently subjected to earthquakes. For the purpose of structural design, the island is classified as a Zone 3 area. The County building code requires that all new structures be designed to resist forces that might be expected in Zone 3 areas.

As shown in Figure 13, the project area is situated with the Flood Insurance Rate Map (FIRM) zone X, areas determined to be outside the 500 year flood plain. However, the makai portion of the gulch extending to Hapuna Bay is identified as Zone AE, a floodway area with a base flood elevation determined to be 113 feet at the mauka limit of the FIRM's detailed study area.

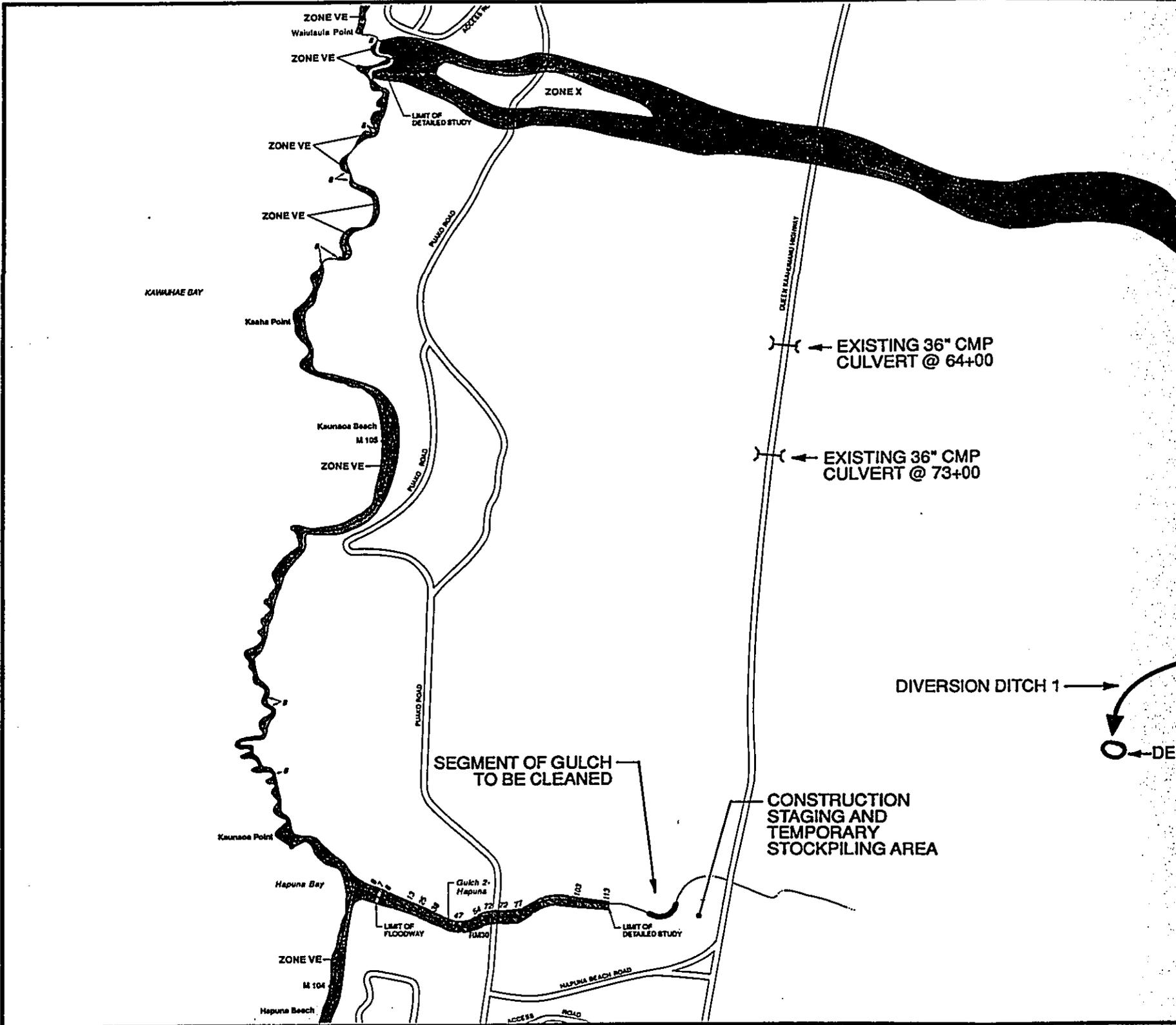
2.2.6 Climate and Meteorology

The region's climate is generally warm and dry. Rainfall below the 1,000 foot elevation averages less than 9 inches per year. The mean annual temperature in the region is about 78 degrees F. with relatively small daily and seasonal variations. Local wind conditions are characterized by on-shore breezes at night and off-shore breezes during the day.

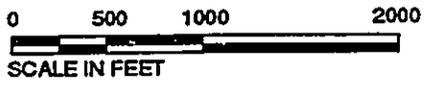
2.2.7 Air and Noise Quality

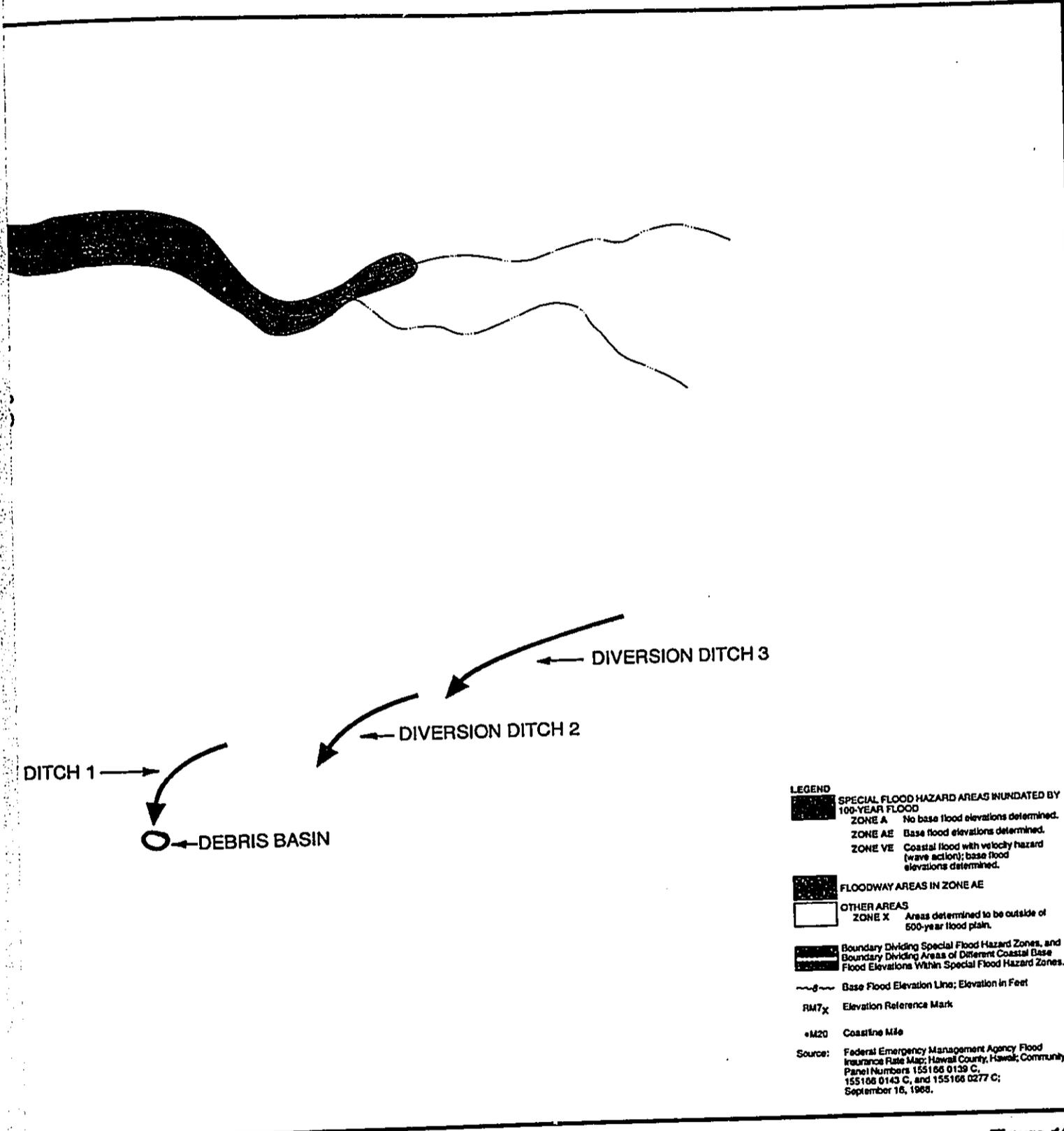
The area's air quality is generally good due to the relative lack of human activity or development. Existing air quality is impacted by vehicular traffic on the Queen Kaahumanu Highway. In addition, during seasonal conditions when the northeastern trade winds diminish and are replaced by southerly, or Kona winds, volcanic fumes from eruptive activity at Kilauea volcano on the southeastern flank of Mauna Loa are blown around the southern portion of the island and up the leeward coast. During these conditions, a heavy volcanic haze known as vog is readily visible.

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NORTH





**Figure 13
FLOOD INSURANCE RATE MAP**

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August 1994

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The existing noise quality of the area is generally characterized by the sound of the wind blowing through the vegetation, except in the vicinity of Queen Kaahumanu Highway, where traffic noise predominates.

2.2.8 Visual Attributes

The view presented in Photo Plate 3 is typical of the entire project area. Looking makai, the ocean is generally visible from the top of any of the small rolling hills that characterize the area. Looking mauka, Mauna Kea and Hualalai mountains are visible in the distance.

2.2.9 Flora and Fauna

A botanical field survey of the study area was conducted in July 1994 to determine the presence of any threatened or endangered plant species. The findings of the survey are presented as Appendix B to this document. Following is a summary of the survey.

The upland diversion ditches 1, 2, and 3, as well as the service access easements and retention basin will be sited on mixed grassland with scattered kiawe trees (Prosopis palladia). Two native grasses, pili grass (Heteropogon contortus) and Eragrostis atropioides, along with the introduced or alien buffel grass (Cenchrus ciliaris) from the most abundant plant cover. The three grass species are codominant, meaning they occur in about equal numbers. The native grasses generally tend to occur on the stonier soils and rocky outcroppings, while the buffel grass prefers the swale areas with somewhat deeper soils. The grasses form low, rounded clumps, 1 to 2 feet tall, with about 40% to 60% cover. Widely scattered through the grassland are small trees of kiawe, 10 to 12 feet tall. In the gulch areas, they tend to be taller (18 to 20 feet) and line the sides of the gulches.

Smaller shrubs of 'ilima (Sida fallax), 'uhaloa (Waltheria indica), and koa-haole

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(Leucaena leucocephala), 1 to 2 feet tall, are found scattered throughout this grassland. Both subspecies of pau o Hi'iaka (Jacquemontia ovalifolia ssp. ovalifolia and sandwicensis) form low mats among the tussocks of grass. Herbaceous species associated with the grassland include hairy spurge (Chamaesyce hirta), 'ihi (Portulaca pilosa), threadstem carpetweed (Molluga cerviana), partridge pea (Chamaecrista nictitans), and coat buttons (Tridax procumbens).

With regard to the unnamed gulch situated between the Hapuna Beach Access Road and the beach, the vegetation includes medium to large sized kiawe trees, 18 to 25 feet tall, which line the gulch, and shrubs of koa-haole. Filling in the matrix between the woody components is a dense cover of buffel grass about 3 feet high. In some places, fountain grass (Pennisetum setaceum) may be locally abundant.

The vegetation surrounding the 36-inch culvert at road station 54+00 consists on the highway's makai side of a small stand of kiawe trees with buffel grass and on the highway's mauka side of buffel grass and scattered koa-haole shrubs. A few plants of pluchea (Pluchea symphytifolia), castor bean (Ricinus communis), and golden crownbeard (Verbesina encelioides), a native shrub with winged, papery fruit capsules, are also found on the mauka side of the highway.

At road station 73+00, the mauka basin behind the culvert is covered with an assemblage of buffel grass with scattered patches of koa-haole shrubs, 6 to 12 feet tall, and kiawe saplings, 6 to 8 feet tall. Other species found here include hairy spurge, 'ilima, 'uhaloa, and spiny amaranth (Amaranthus spinosus). Plant cover is about 60%. On the makai side of the highway, the area around the culvert supports a dense cover of buffel grass and a small stand of kiawe trees.

None of the plants found during the survey are a listed, proposed, or candidate threatened and endangered species (U.S. Fish and Wildlife Service 1989, 1990, 1994a, and

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1994b). All of the plants can be found in similar environmental habitats throughout the Hawaiian Islands. No sensitive native plant-dominated communities occur on the site. A very recent survey of a portion of the state-owned land below the 380 foot elevation by Char (1994) recorded similar findings.

The fauna of the general area was surveyed in conjunction with the 1987 Final EIS for South Kohala Resort (BCA, 1987). The results of the survey confirmed the presence of exotic bird species and goats in the area. No threatened or endangered species were encountered. Several species of exotic birds were recorded in the area, the most abundant of these being the Japanese White-eye (*Zosterops japonicus*). The short-eared owl or Pueo (*Asio flammeus sandwichensis*) is relatively common in the area and could occur within the study area, although none has been observed. No mongoose (*Herpestes auro-punctas*), rats, mice, cats, or dogs were recorded but may also inhabit the area. Similarly, no evidence of the endemic and endangered Hawaiian Hoary Bat (*Lasirus cineris semotus*) was found.

2.2.10 Aquatic Biota

A biological assessment of the unnamed gulch and the brackish pool at its terminus at Hapuna Beach was conducted to evaluate potential impacts to native stream biota that could result from the proposed drainage improvements. The August 1994 study by Pacific Aquatic Environmental, included as Appendix C to this document, is summarized below.

A small brackish pool (Photo Plate 4) is located at the mouth of the unnamed gulch adjacent to the Hapuna Beach Prince Hotel. The pool appears to have been scoured out by high flows associated with storm runoff emanating from the gulch. However, because surface flow is so infrequent it is apparent that the pool is maintained by groundwater flow. In addition, near-shore salinity measurements taken in Hapuna Bay indicate groundwater flow (Nance 1994). During the survey, the brackish pool was



Plate 4. Brackish pool at makai end of unnamed gulch near Hapuna Beach Prince Hotel.

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estimated to be 40 x 45 feet in area with a maximum depth of about 4 feet, and was separated from the ocean by approximately 450 feet of sandy beach. A small amount of fresh water was being discharged into the brackish pool from a pipe that ran beneath the hotel swimming pool.

Water temperature in the pool ranged from 29 degrees C in the deeper areas to 31 degrees C in the shallows. The pH was slightly alkaline (8.5). Salinity, measured at 13.1 parts per thousand, was less than half of nearby seawater (Nance 1994).

The only aquatic biota found in the study area occupied the brackish pool. Four native species of fish were observed: 'o'opu 'akupa (Eleotris sandwicensis), 'o'opu naniha (Stenogobius hawaiiensis), aholehole (Kuhulia sandwicensis), and 'ama'ama (Mugilidae). Of these species, the 'o'opu (goby) and aholehole are endemic to the Hawaiian Islands. Once introduced fish species, liberty molly (Poecilia sphenops), was also observed. The lack of young 'o'opu observed during the assessment suggests that the pool has been isolated from the ocean for some time. Had the pool been recently connected to the sea, some younger fish would have likely been observed. No permanent fish habitat was observed in the pool or anywhere in the unnamed gulch.

Upstream of the brackish pool, the gulch was dry, thereby lacking habitat for aquatic biota. The proposed diversion ditch channels were also dry.

With regard to aquatic invertebrates (insects and crustaceans), one species of native insect, the ubiquitous dragonfly (Pantela flavescens), and one introduced damselfly species (Ischnura ramburi) were found in the area of the pool. No federally listed Category 1 or 2 Candidate Endangered Megalagrion damselfly species were encountered within or adjacent to any of the drainages or the brackish pool. A single species of native prawn, 'opae'oeha'a (Macrobrachium grandimanus) was captured in the brackish pool.

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2.2.11 Historic and Archaeological Resources

An archaeological inventory survey of the study area was conducted in August 1994 to determine the presence of historic or archaeological resources. The complete report of the surveying archaeologist is attached as Appendix D to this EA. The inventory survey was conducted in accordance with current standards for inventory-level survey required by the Department of Land and Natural Resource's State Historic Preservation Division (DLNR-SHPD).

Seven sites containing a total of 15 component features were identified during the inventory survey. One of the sites (#5665) had been previously identified during an earlier study of historic and prehistoric trails in the area (Kaschko and Rosendahl 1982). The remaining sites were newly identified. The sites included the following formal feature types: alignment, cairn, overhang, rock-ring, and trail. Probable functional types were assigned for most features and included temporary habitation, agriculture, transportation, marker, and an indeterminate function. The sites are considered by the consulting archaeologist to be in poor to fair condition. Figure 14 presents the location of the seven identified sites. Table 1 summarizes the sites, their general significance assessments, and their recommended general treatment.

Based on federal and state criteria, of the seven sites identified near the project area, five are assessed as no longer significant and require no further work. Three of these five sites (19695, 19698, and 19699) lack cultural deposits and potable remains; they have been measured, described, and photographed, and their locations have been plotted. The data collected from them during the survey are considered sufficient recovery of significant information. The remaining two of these five sites (5665 and 19700) are trail remnants. Normally, prehistoric trails are assigned a cultural value and are recommended for preservation. Both of these trail remnants, however, are short remnant spans with other portions not well preserved. It is recommended that no further archaeological work occur

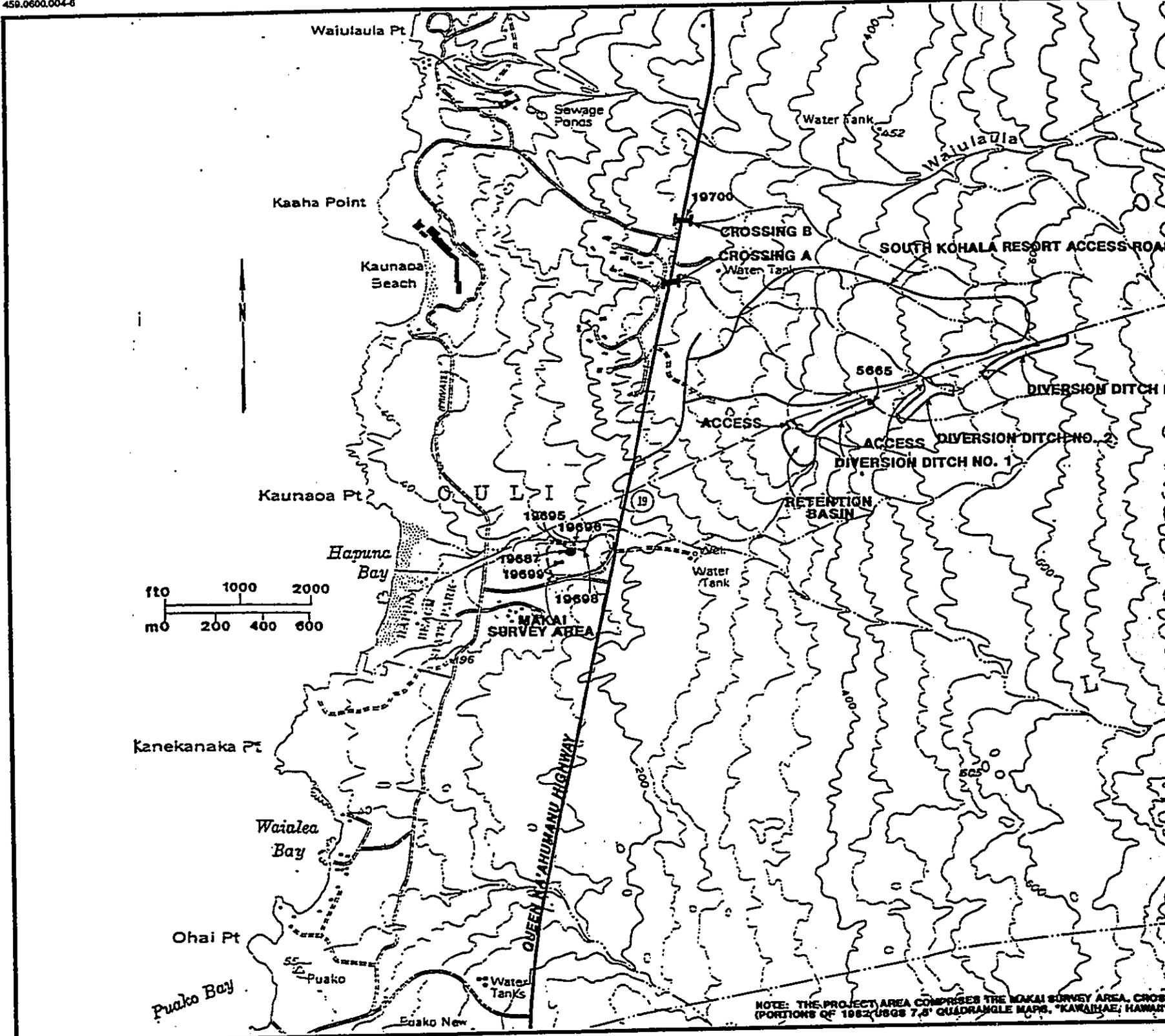
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at the trail locations within the project area. Preservation of sites 5665 and 19700 (within the project area) is not essential; it is recommended, however, that the more preserved portions of Site 5665 be considered for inclusion into development landscaping.

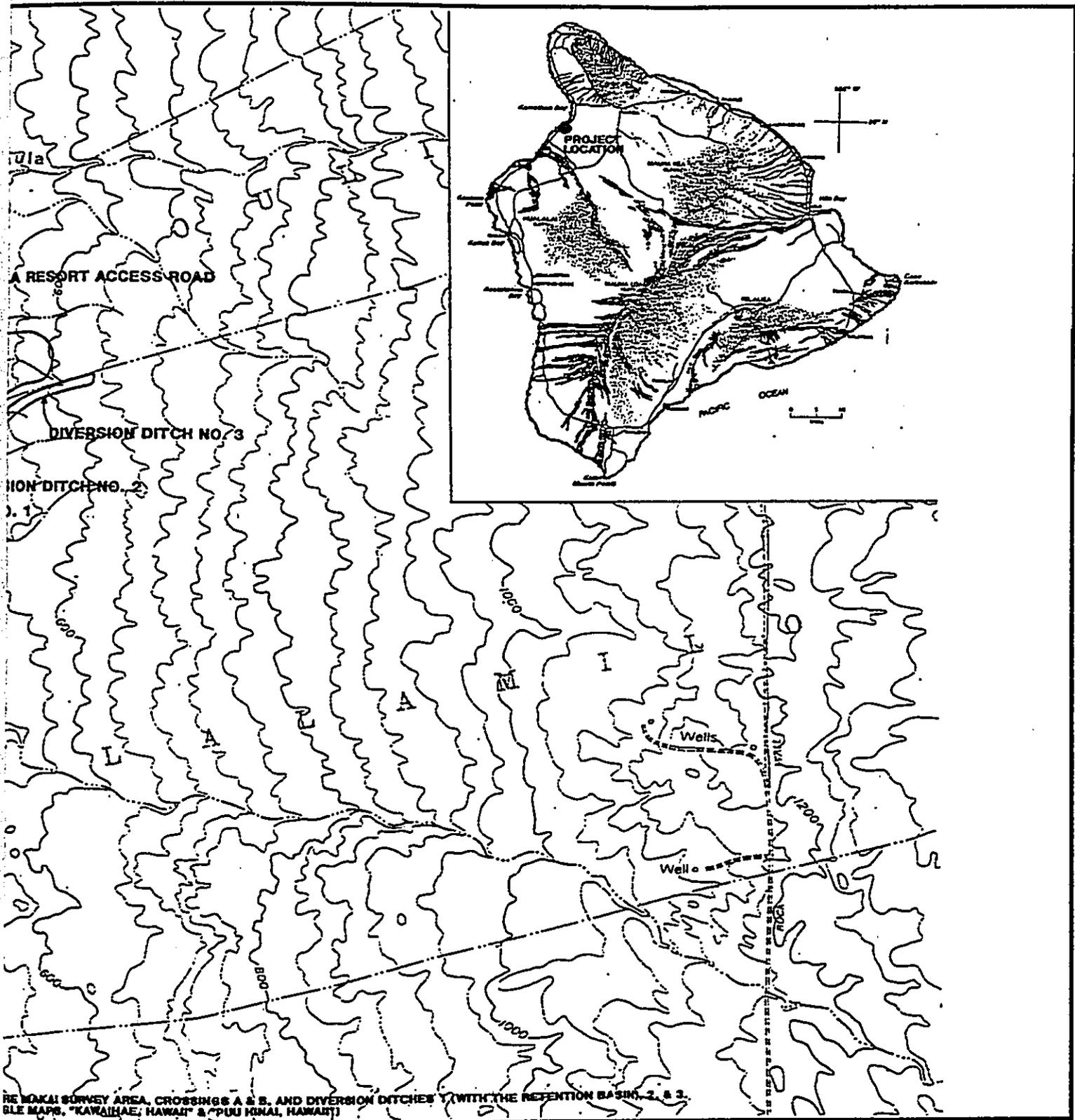
Table 1: Summary of Archaeological Sites, General Significance, and Recommended Treatment

<u>Site Number</u>	<u>Formal Type</u>	<u>Functional Interpretation</u>	<u>General Significance Assessment</u>	<u>Recommended Treatment</u>
5665	Complex		Cultural Value/ No Longer Signif.	No Further Work
A B	Trail Cairn (5)	Transportation Marker		
19695	Overhang	Indeterminate	No Longer Signif.	No Further Work
19696	Overhang	Temp. Habitation	Important Information Content	Further Data Collection
19697	Complex		Important Information Content	Further Data Collection
A B C	Terrace C-Shape Cairn	Agriculture Temp. Habitation Marker		
19698	Rock Ring (2)	Indeterminate	No Longer Signif.	No Further Work
19699	Alignment	Indeterminate	No Longer Signif.	No Further Work
19700	Trail	Transportation	Cultural Value/ No Longer Signif.	No Further Work

The remaining two sites (19696 and 19697) are assessed as significant for information content and are recommended for further data collection. Test units were placed at both sites and the unit at Site 19696 contained an apparently intact cultural layer. At Site 19697, a possible temporary habitation-agriculture complex, further test



Source: Interim Report: Archaeological Inventory Survey, Mauna Kea Properties Drainageway Project; Paul H. Rosendahl, Ph D., Inc.; August 1994.



RE MAUNALEI SURVEY AREA, CROSSINGS A & B, AND DIVERSION DITCHES (WITH THE RETENTION BASIN, 2, & 3. SOURCE MAPS, "KAWAII MAE, HAWAII" & "PUU HINA, HAWAII")

Figure 14
ARCHAEOLOGICAL SITES IDENTIFIED NEAR THE PROJECT AREA

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 Prepared By: Bett Collins Hawaii
 August 1994

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excavations at Feature A may yield analyzable pollen samples. However, it should be noted both of these sites are located makai of the project area and will not be impacted by construction activity.

2.2.12 Access

There is presently no public access to the drainage improvement areas because they are located in undeveloped state land. However, access to the project area can be accomplished on foot from portions of the South Kohala Resort access road nearest the proposed project sites.

2.2.13 Wastewater and Solid Waste Disposal

The South Kohala Resort property contains a 0.4 MGD wastewater treatment plant, situated approximately 1,000 feet makai of the proposed desilting basin. There are no solid waste disposal facilities with the general area of the project.

2.2.14 Electrical Power and Communications

Electrical power on the island of Hawaii is provided by the Hawaii Electric Light Company (HELCO), a subsidiary of Hawaiian Electric. The general area is presently served by a 69-KV power line connecting the Waikoloa substation with the Waimea-Kawaihae line.

2.2.15 Public Facilities

Public facilities serving the South Kohala region, including schools, health care facilities, police, highways, and fire services are discussed in the South Kohala Resort Final EIS (BCA, 1987).

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3. SUMMARY OF MAJOR IMPACTS RESULTING FROM THE PROPOSED ACTION AND RECOMMENDED MEASURES FOR MITIGATION OF NEGATIVE IMPACTS

This section addresses the socioeconomic and environmental consequences of the proposed project. The process of designing the project's various components has included meeting with government officials to identify regulatory requirements and an analysis of the subject property to identify existing or potential constraints that may impact the project. Thus, the project as it is described in Section 1 represents the applicant's efforts to avoid significant environmental impacts to every extent practicable.

To determine potential impacts, a study area was defined around the alignment of the proposed project. The study area extends 100 feet to each side of the diversion ditch alignments. The study area also includes the area within which the desilting basin will be sited.

This section discusses the identifiable socioeconomic impacts in the North Kona district as well as physical impacts within the study area. Where potential impacts are deemed to be significant, this section recommends a course of action for reducing or eliminating any negative consequences. Recommended 'mitigation measures' are presented in bold face (bold face) type.

3.1 SOCIAL AND ECONOMIC CONSIDERATIONS

The proposed drainage improvements, in and of themselves, will not have a significant impact upon the socioeconomic character of the area. The project will not generate any direct increase in population. Construction of the proposed project will provide a limited number of short-term construction jobs which are expected to be filled from the existing labor pool. Thus, no new construction jobs are foreseen. A direct impact of the proposed project will be the elimination of occasionally hazardous flooding

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conditions in the area. Therefore, the proposed project will have a positive benefit for residents of the area and motorists utilizing the highway during and immediately after periods of heavy rainfall.

3.2 GEOLOGY AND TOPOGRAPHY

The proposed drainage improvements will have no impact upon the geology of the region. Impacts upon topography will be limited to the construction of the diversion ditches and desilting basin, resulting in the excavation of approximately 1.75 acres of land. However, this impact is not viewed as significant. Replacement of the existing culverts will impact an already disturbed area.

3.3 SOILS AND AGRICULTURAL POTENTIAL

The proposed drainage improvements will not result in a substantial loss of any soils or excavated lava rock, nor will they impact any land identified under the state's classification system known as Agricultural Lands of Importance to the State of Hawaii (ALISH).

3.4 SURFACE WATER AND DRAINAGE

The proposed drainage improvements will have a significant positive impact upon drainage in the area. A portion of the surface runoff that presently overtops the existing culverts during exceptionally intense rainfall will be diverted to a natural gulch south of the Mauna Kea and South Kohala resort areas. Replacement of the existing highway culverts with larger culverts will eliminate overtopping and permit larger volumes of water to flow down existing natural gulches to the ocean. Elimination of overtopping at the highway culverts will resolve occasional flooding of the highway and surrounding properties.

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3.5 GROUNDWATER AND HYDROLOGY

The proposed drainage improvements will have no impact on the underlying groundwater aquifer.

3.6 NATURAL HAZARDS

The proposed drainage improvements may potentially be impacted by earthquakes and volcanic activity associated with Hualalai volcano. However, because the improvements constitutes a modification to a natural gulch and existing culvert system, that has presumably withstood previous seismic events, it is unlikely that future earthquakes will result in negative impacts. With regard to volcanic activity and lava flows, inundation of the proposed facilities would result in physical damage but would not threaten human lives. Because the proposed drainage improvements are specifically intended to mitigate existing flooding, the future likelihood of flooding with the project in place would be reduced, resulting in a benefit to property owners in the area.

As depicted in Figure 13, the proposed diversion ditches and culvert replacements are located in Flood Insurance Rate Map (FIRM) Zone X, and will, therefore, have no impact upon known flood hazard areas or floodways. The portion of the unnamed gulch which is proposed for debris clearing is beyond the limit of the FIRM's detailed study, as evidenced in Figure 13. Because the proposed diversions will result in only a 2.8% increase in peak flow, potential impacts upon the Floodway Zone AE makai of the debris removal area resulting from the proposed diversions are not expected to be significant.

3.7 CLIMATE AND METEOROLOGY

Construction and period maintenance of the diversion ditches will have no impact upon climatic conditions.

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3.8 AIR AND NOISE QUALITY

The proposed project may be classified as an "indirect source" of air pollution as defined in the federal Clean Air Act of 1977 due to the potential for increased vehicular traffic associated with construction workers utilizing the South Kohala access road to enter the project areas. However, because of the minimal number of workers required for the project, the actual increase in vehicles utilizing the service road and the resulting impact on air quality will be negligible.

Excavation of the proposed diversion ditches and desilting basin will result in short-term impacts upon air quality, principally in the form of dust generated by the stockpiling of top soil and the movement of construction vehicles. Exhaust emissions from construction vehicles will also have a short-term impact on air quality. To ensure that fugitive dust is adequately controlled, the construction site accessways and stockpiles will be frequently watered by a tanker truck.

Because of the relatively low density of human activity in the area, the ambient noise quality of the area where the diversion ditches are to be excavated is undermined only by vehicular traffic along the adjacent South Kohala Resort access road. Construction of the proposed project will produce a short-term negative impact on noise quality. Periodic clearance of debris from the desilting basin will, on the other hand, have no measurable impact. The anticipated low volume of vehicular traffic on the adjacent access road will have no appreciable impact on noise quality. Due to the presence of vehicular noise along the highway, construction noise impacts resulting from replacement of the highway culverts are expected to be minimal.

3.9 VISUAL ATTRIBUTES

The proposed project will have no significant impact upon the regions visual

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attributes. Because of the undulating character of the area, and because the proposed diversion ditches will all be constructed at and below grade, they will not be visible from the nearest points accessible to the public (the South Kohala Resort Access Road and the resort golf course). The proposed culvert replacements will also not be visible due to their location underneath the Queen Kaahumanu Highway. Finally, removal of debris from the unnamed gulch leading to Hapuna Beach will not impact mauka-makai views in the area. Because the section of the gulch to be cleared is concealed by a grove of kiawe trees, the cleared area resulting from debris removal and vegetation trimming will not be visible.

3.10 FLORA AND FAUNA

Development of the proposed drainage improvements will result in the loss of some vegetation in the immediate vicinity of the proposed diversion ditch easements. However, the loss of this vegetation is not considered to be significant because it is commonly found throughout the region and in similar environmental conditions around the state. Mitigation measures to minimize the impact are, therefore, not warranted. The native grasses in the area will re-establish themselves naturally along the diversion ditches.

According to the consulting botanist, there is little of botanical interest on the areas to be impacted by the project. Given the limited nature of the project, and the findings of the botanical survey, the proposed drainage improvements are not expected to have a significant negative impact on the botanic resources of the area.

No bird or mammal habitats have been identified in the study area. Although birds and mammals do frequent the area, the proposed project is unlikely to impact them. No significant impacts are anticipated.

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3.11 AQUATIC BIOTA

Impacts to native fish observed in the brackish pool are not expected to be significant. Increases in storm runoff in the gulch resulting from channel improvements should be negligible compared to existing intermittent runoff. Sediment runoff will increase due to the excavation of unlined diversion ditches. However, construction of the diversion ditches will only increase total watershed area by about 3.4%, and peak flow by about 2.8% (Nance 1993). In addition, the retention basin planned below the lowest of the three diversion ditches should hold most of the excess sediment. Therefore, no adverse effects to the coral reef in Hapuna Bay are expected to result from increased sediment runoff.

Because the gulch is dry above the brackish pool, no stream invertebrates are present. Thus, no impacts will occur. No adverse impacts to the 'opae'oeha'a identified in the brackish pool, or any other invertebrate species, are anticipated.

3.12 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Based upon the findings of the Inventory Survey, no significant archaeological resources will be impacted by the proposed project will have. Nevertheless, if subsurface archaeological resources are discovered during the course of grading, construction will be halted and an archaeologist will be consulted to determine the significance of the discovery, according to procedures established by the Historic Preservation Division of the DLNR.

3.13 ACCESS

Upon completion of excavation, access to the diversion ditches will be restricted and limited to maintenance personnel.

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3.14 WASTEWATER DISPOSAL

The proposed facilities will not generate any wastewater.

3.15 SOLID WASTE DISPOSAL

This proposed drainage improvements will have no direct impact upon solid waste collection or disposal in the South Kohala area. Graded, grubbed, and excavated material from the diversion ditches will be retained on the property. Excavated material will be stockpiled at an appropriate distance from the diversion ditches

3.16 ELECTRICAL POWER AND COMMUNICATIONS

The proposed drainage improvements will not require electrical transmission or communications facilities.

3.17 PUBLIC FACILITIES

The proposed drainage improvements will not affect the existing or future operation of schools, health care facilities, police or emergency facilities. Replacement of the highway culverts will, however, have a short term impact upon traffic flow along the Queen Kaahumanu Highway. A 17-foot wide excavation trench which will contain the new culverts must cross the highway's 300-foot right-of-way.

To mitigate the short-term impact that construction will have upon traffic flow, excavation at each of the two crossings (roadway stations 64+00 and 73+00) will occur in two segments. This may require the temporary closure of one traffic lane to allow excavation to the highway's center line. Once this portion of the culvert is replaced and the trench refilled, the lane will be reopened to traffic while the opposite lane is closed to

February 1995

allow completion of the crossing. However, it is likely that two-way traffic will be continued throughout the construction phase by utilizing the highway shoulder area as a temporary by-pass. The trench will be repaved to match the existing pavement of the highway and will conform to Department of Transportation specifications. Once trenching is completed within the highway's right-of-way, the trench will be filled to match the surrounding landscaping. Signage and a flagman will likely be used to control traffic flow during construction of the crossing. Construction of the trench across the highway is expected to require approximately 6 working days.

3.18 RECREATIONAL RESOURCES

The proposed diversion ditches and culvert replacement will have no impact upon shoreline recreation facilities. The diversion of additional runoff to the gulch that terminates at Hapuna Bay will not impact beach goers because it will not physically alter the gulch's current configuration at the shoreline.

3.19 COASTAL WATERS

The creation of diversion ditches to provide flood relief to property owners in the vicinity of Queen Kaahumanu Highway and to motorists utilizing the highway during storm events could result in a temporary negative impact upon turbidity in near shore waters at some point in the future. On the first few occasions that the newly excavated diversion ditches are flushed with surface runoff, turbidity levels along the coast might increase beyond what is typically experienced during heavy rainfall. However, once remanent top soil has been flushed out of the ditches, turbidity levels similar to current runoff conditions will be reestablished. Hydrologic analyses indicate that the area of the drainage basin served by the unnamed gulch will only increase about 3.4% as a result of the proposed drainage improvements and peak flow will increase about 50 cubic feet per second (about 2.8%). From a long term point of view, this will result in a negligible impact to the

February 1995

brackish pool and the ocean from storm runoff.

The proposed desilting basin will contribute to the reduction of particulate matter suspended in surface runoff. However, it cannot be designed to eliminate all particulates. Given the volume of surface water that could potentially occur during a storm of exceptional intensity, not all sediment would be captured in the desilting basin. As a result, short-term turbidity impacts may occur in coastal waters with the project. Construction of the proposed improvements will assist in the reduction of flooding, thereby reducing potential hazards to people and property.

4. ALTERNATIVES CONSIDERED

Conceptual planning for infrastructure development includes a determination of the most cost-effective alternative available. Such a determination typically includes an analysis of environmental impacts. This section discusses the alternatives that were considered during the early design stages of the project.

The three components of the drainage improvement project are not independent actions. Thus, they must be treated systemically. For example, if the diversion ditches were not constructed (i.e., No Action), the proposed culverts would need to be doubled in size: four 60-inch culverts would be required at each of the two roadway stations. If the diversion ditches were constructed but the culverts were not replaced (i.e., No Action), overtopping of the culverts would still occur. If no improvements were implemented, flooding would continue in the future.

In view of this consideration, there are no practical alternatives to the proposed project. The location of the diversion ditches represents the best means of diverting surface runoff from the drainage basins impacting the subject property to the adjacent drainage basin that is capable of accommodating the additional volume of surface runoff.

February 1995

The diversion ditches are proposed at a location that is considered to be the furthest makai where they can collect the most surface runoff. If located further mauka, they would collect less runoff and could not divert it to the adjacent drainage basin. Similarly, if they were shortened in length or reduced in width, they would not collect an adequate amount of runoff and would necessitate the construction of even larger culverts at roadway stations 64+00 and 73+00 than what are proposed. As proposed, the replacement culverts have been sized to accommodate the envelope curve presented in Figure 11.

Finally, the location of the proposed culvert replacements can not be changed. If new culverts were added and the existing culverts were left as is, overtopping of the existing culverts would still occur. In addition, the new culverts would require extensive linkages to the existing stormwater drainage system at the Mauna Kea property. The cost of this alternative would be prohibitive.

5. DETERMINATION

Based upon the information available and the proposed design of the physical components of the proposed project, it has been determined that excavation of the diversion ditches and replacement of the highway culverts as described herein would result in positive socioeconomic benefits and would not have a significant negative impact upon the environment. The preparation of this EA is in full compliance with the environmental disclosure process, as defined in Chapter 343, Hawaii Revised Statutes, and Chapter 200, Department of Health Environmental Impact Statement Rules. Therefore, no environmental impact statement is required for the proposed action.

6. FINDINGS AND REASONS SUPPORTING DETERMINATION

In designing the components of the proposed project, the applicant has considered the sum effects of the project on the quality of the environmental and socioeconomic

February 1995

conditions in the area to be impacted, including its cumulative effects. The applicant has considered every phase of the proposed project, the expected consequences, both primary and secondary, and short-and long-term effects of the proposed action. As a result of these considerations, it is determined that:

- a. The proposed project does not involve an irrevocable commitment to loss or destruction of any significant natural, historical, archaeological, or cultural resource.
- b. The proposed project increases the range of beneficial uses of the environment.
- c. Approval of the requested action would be consistent with the goals, policies, and courses of action of the Hawaii County General Plan.
- d. The proposed project does not adversely affect the economic or social welfare of the community, county, or state.
- e. The proposed project does not involve substantial secondary impacts, such as population changes that are not already contemplated and accommodated by the Hawaii County General Plan.
- f. The proposed project does not increase the demand for public services or facilities that are not already contemplated.
- g. The proposed project does not have a negative impact upon public health.
- h. The proposed project does not involve substantial degradation of the natural environment.
- i. The proposed project does not substantially affect rare, threatened, or endangered species or habitats.
- j. The proposed project does not detrimentally affect air or water quality or ambient noise levels.
- k. The proposed project does not substantially affect an environmentally sensitive area such as a flood plain, tsunami zone, special management area, erosion-prone area, geologically hazardous land, estuary, coastal waters, or inland waters.

February 1995

- l. The proposed project does not involve a larger commitment for further actions.
- m. The proposed project represents a benefit for property owners in the area and motorists using the state highway.

The proposed project has been designed to be compatible with the locality and surrounding area and is appropriate to the physical conditions characterizing the area. The mitigation measures proposed will ensure that the existing environmental character of the area will be preserved. The applicant will be responsible for, and comply with, all applicable statutes, ordinances, and rules of federal, state, and county governments.

7. PUBLIC AND AGENCY REVIEW OF DRAFT ENVIRONMENTAL ASSESSMENT

A notification of availability of the Draft EA was published on December 23, 1994 in the Bulletin of the Office of Environmental Quality Control. During the 30-day review and comment period, the Department of Land and Natural Resources, accepting agency for the EA, received five comment letters, all supportive of the project. These letters are included after the Reference Section of this document together with responses prepared by the applicant's agent, Belt Collins Hawaii. It should be noted that three of the five letters are from Mr. Michael W. Gibson, Esq. representing each of three separate community associations affected or potentially affected by flooding conditions.

8. REFERENCES

Belt Collins & Associates. 1987. Final Environmental Impact Statement, South Kohala Resort, South Kohala, Hawai'i.

Char & Associates. 1994. Botanical Resources Assessment - Mauna Kea Drainage Improvements, South Kohala District, Island of Hawaii.

February 1995

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- Hawai'i State Department of Business and Economic Development. 1990. The State of Hawai'i Data Book, 1990. Honolulu, Hawai'i.
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- Land Study Bureau, University of Hawai'i. 1972. Detailed Land Classification, Island of Hawai'i.
- Mullineaux, D.R., D.W. Peterson, and D.R. Crandell. 1987. "Volcanic Hazards in the Hawaiian Islands, in Volcanism in Hawai'i, R.W. Decker, T.L. Wright, and P.H. Stauffer, Eds., U.S. Geological Survey Project Paper 1350, pp. 599-621.
- Nance, T. 1994. Water chemistry data collected August 8, 1994 near Hapuna Beach Hotel.
- Nance, T. 1993. Drainage through South Kohala Resort, across Queen Kaahumanu Highway, and into Fairways South. Memorandum dated March 25, 1993 to Bill Mielcke, Mauna Kea Properties.
- Paul H. Rosendahl, Ph.D., Inc. August 1994. Archaeological Inventory Survey Mauna Kea Properties Drainageway Project.
- Pacific Aquatic Environmental, August 1994. Mauna Kea Drainageway Assessment, Lalamilo Ahupua'a, South Kohala District, Hawaii.
- U.S. Department of Agriculture, Soils Conservation Service. 1973. Soil Survey of the Island of Hawai'i, State of Hawai'i. Washington, D.C.



BELT COLLINS
H A W A I I

February 1, 1995
459.06/95P-31

Mr. Art Pizzinat, President
Mauna Kea South Fairways
Kawaihae, Hawai'i 96743

Dear Mr. Pizzinat:

**Response to Comments
Mauna Kea Drainage Project
Environmental Assessment**

Thank you for your letter of December 27, 1994 expressing your support for the above project. As required by state law, your comment letter together with this response will be included in the Final Environmental Assessment (EA) for the project which will be submitted to the Department of Land and Natural Resources for approval. If approval is granted, the procedure for acquiring an easement from the State of Hawaii for the land necessary to construct the drainage improvements can proceed.

Should you have any further comments or questions about the project, please feel free to contact me at (808) 521-5361.

Very truly yours,

Lee William Sichter

ASHFORD & WRISTON

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OF COUNSEL
Clinton R. Ashford

ALLIANCE FOR
THE STATE OF HAWAII
LAND MANAGEMENT
DIVISION

RECEIVED
DIVISION OF
LAND MANAGEMENT
HAWAII
JAN 10 1 12 PM '94

January 9, 1995

Department of Land and Natural Resources
Land Management Division,
Hawaii District Office
Post Office Box 936
Hilo, Hawaii 96721

ATTENTION: GLENN TAGUCHI

Re: Mauna Kea Properties Request For Direct Grant
Of Easement For A Drainage Improvement
Project

Dear Mr. Taguchi:

I am the attorney for the Mauna Kea Fairways South Association. During the past several years floodwaters crossing Queen Kaahumanu Highway have caused extensive damage to private homes and common area including roads in Fairways South.

My clients and I have been very concerned that unless changes are made soon to the current drainage situation, the flooding will continue to cause serious damage and possibly loss of life. Mauna Kea Properties has advised us that the proposed drainage easements within Lalamilo and Ouli will significantly diminish the risk of flooding in Fairways South.

It is our desire to support the request for a drainage easement and to encourage the implementation of the Mauna Kea Properties planned culvert and diversion system on an expedited basis.

Very truly yours,

Michael W. Gibson
Michael W. Gibson

MWG:aw

cc: Art Pizzinat
William Mielcke

0095701.WP

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BELT COLLINS
H A W A I I

February 1, 1995
459.06/95P-32

Mr. Michael W. Gibson, Esq.
Ashford & Wriston
P.O. Box 131
Honolulu, Hawaii 96810

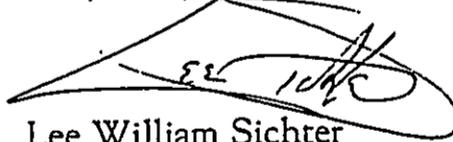
Dear Mr. Gibson:

**Response to Comments
Mauna Kea Drainage Project
Environmental Assessment**

Thank you for your letter of January 9, 1995 expressing your support for the above project. As required by state law, your comment letter together with this response will be included in the Final Environmental Assessment (EA) for the project which will be submitted to the Department of Land and Natural Resources for approval. If approval is granted, the procedure for acquiring an easement from the State of Hawaii for the land necessary to construct the drainage improvements can proceed.

Should you have any further comments or questions about the project, please feel free to contact me at (808) 521-5361.

Very truly yours,



Lee William Sichter

RECEIVED
DIVISION OF
LAND MANAGEMENT
HAWAII

Don Beattie
12243 Ladue Woods Drive
St. Louis, Mo. 63141

JAN 11 10 14 AM '95

1/11/95

Mr. Glen Taguchi
Dept. of Land and Natural Resources
Land Management Division, Hawaii District Office
P.O. Box 936
Hilo, Hawaii 96721-0936

Re: Mauna Kea Properties Request for Easements

Dear Mr. Taguchi,

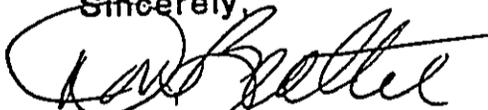
As a past president and current board member of the Mauna Kea South Fairways, I urgently recommend that the Mauna Kea Properties request for direct grant of easement for drainage improvements be approved.

The recent storms, which caused significant damage to some of the Fairways homes, could very easily have caused some fatalities if anyone had been unfortunate enough to have been caught in the torrent of waters rushing through the Fairways.

The current situation is a serious one and we trust that you will recognize the gravity of the situation and grant the necessary easements.

Thank you for your consideration in this matter.

Sincerely,



Don Beattie
Board Member, Mauna Kea South Fairways

cc: Mauna Kea Properties





BELT COLLINS
H A W A I I

February 1, 1995
459.06/95P-33

Mr. Don Beattie
12243 Ladue Woods Drive
St. Louis, Mo. 63141

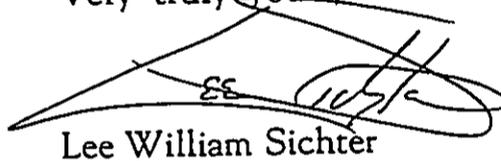
Dear Mr. Beattie:

Response to Comments
Mauna Kea Drainage Project
Environmental Assessment

Thank you for your letter of January 11, 1995 expressing your support for the above project. As required by state law, your comment letter together with this response will be included in the Final Environmental Assessment (EA) for the project which will be submitted to the Department of Land and Natural Resources for approval. If approval is granted, the procedure for acquiring an easement from the State of Hawaii for the land necessary to construct the drainage improvements can proceed.

Should you have any further comments or questions about the project, please feel free to contact me at (808) 521-5361.

Very truly yours,



Lee William Sichter

ASHFORD & WRISTON

RECEIVED

ATTORNEYS AT LAW

2000 W. ...
Honolulu, HI 96819

January 20, 1995

Department of Land and Natural Resources
Land Management Division,
Hawaii District Office
Post Office Box 936
Hilo, Hawaii 96721

ATTENTION: GLENN TAGUCHI

Re: Mauna Kea Properties Request For Direct Grant
Of Easement For A Drainage Improvement
Project

Dear Mr. Taguchi:

I am the attorney for the Mauna Kea Community Association. During the past several years floodwaters crossing Queen Kaahumanu Highway have caused extensive damage to private homes and common area including roads in Fairways South.

My clients and I have been very concerned that unless changes are made soon to the current drainage situation, the flooding will continue to cause serious damage and possibly loss of life. Mauna Kea Properties has advised us that the proposed drainage easements within Lalamilo and Ouli will significantly diminish the risk of flooding in Fairways South.

It is our desire to support the request for a drainage easement and to encourage the implementation of the Mauna Kea Properties planned culvert and diversion system on an expedited basis.

Very truly yours,

Michael W. Gibson
Michael W. Gibson

MWG:aw

cc: James Growney
William Mielcke
Katherine Augustine

0096991.WP

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BELT COLLINS
H A W A I I

February 1, 1995
459.06/95P-34

Mr. Michael W. Gibson, Esq.
Ashford & Wriston
P.O. Box 131
Honolulu, Hawaii 96810

Dear Mr. Gibson:

**Response to Comments
Mauna Kea Drainage Project
Environmental Assessment**

Thank you for your letter of January 20, 1995 expressing your support for the above project. As required by state law, your comment letter together with this response will be included in the Final Environmental Assessment (EA) for the project which will be submitted to the Department of Land and Natural Resources for approval. If approval is granted, the procedure for acquiring an easement from the State of Hawaii for the land necessary to construct the drainage improvements can proceed.

Should you have any further comments or questions about the project, please feel free to contact me at (808) 521-5361.

Very truly yours,



Lee William Sichter

REC'D 9:35A

1/30/95 ATT: Lee Stehler

ASHFORD & WRISTON

RECEIVED

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COUNSEL
Debra L. Foster
Debra L. Foster

January 20, 1995

Department of Land and Natural Resources
Land Management Division,
Hawaii District Office
Post Office Box 936
Hilo, Hawaii 96721

Imp

ATTENTION: GLENN TAGUCHI

Re: Manua Kea Properties Request For Direct Grant
Of Easement For A Drainage Improvement
Project

Dear Mr. Taguchi:

I am the attorney for the Fairways at Mauna Kea North. During the past several years floodwaters crossing Queen Kaahumanu Highway have caused extensive damage to private homes and common area including roads in Fairways South.

My clients and I have been very concerned that unless changes are made soon to the current drainage situation, the flooding will continue to cause serious damage and possibly loss of life. Mauna Kea Properties has advised us that the proposed drainage easements within Lalamilo and Ouli will significantly diminish the risk of flooding in Fairways South.

It is our desire to support the request for a drainage easement and to encourage the implementation of the Mauna Kea Properties planned culvert and diversion system on an expedited basis.

Very truly yours,

Michael W. Gibson

Michael W. Gibson

MWG:aw

cc: James Growney
William Mielcke
Katherine Augustine

0096991.WP

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CORRECTION

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LEGIBILITY
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IMMEDIATELY FOLLOWING

DOCUMENT CAPTURED AS RECEIVED

REC'D 9:35A

1/30/95 ATTN: Lee Steiner

ASHFORD & WRISTON RECEIVED

ATTORNEYS AT LAW

LAND MEASUREMENT

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January 20, 1995

Department of Land and Natural Resources
Land Management Division,
Hawaii District Office
Post Office Box 936
Hilo, Hawaii 96721

Handwritten initials

ATTENTION: GLENN TAGUCHI

Re: Manua Kea Properties Request For Direct Grant
Of Easement For A Drainage Improvement
Project

Dear Mr. Taguchi:

I am the attorney for the Fairways at Mauna Kea North. During the past several years floodwaters crossing Queen Kaahumanu Highway have caused extensive damage to private homes and common area including roads in Fairways South.

My clients and I have been very concerned that unless changes are made soon to the current drainage situation, the flooding will continue to cause serious damage and possibly loss of life. Mauna Kea Properties has advised us that the proposed drainage easements within Lalamilo and Ouli will significantly diminish the risk of flooding in Fairways South.

It is our desire to support the request for a drainage easement and to encourage the implementation of the Mauna Kea Properties planned culvert and diversion system on an expedited basis.

Very truly yours,

Signature of Michael W. Gibson

Michael W. Gibson

MWG:aw

cc: James Grouney
William Mielcke
Katherine Augustine

0096991.WP

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Kapaa, HI 96741

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HAWAIIAN ISLANDS OFFICE
Honolulu Tower, Suite 200E
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Honolulu, HI 96824

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BELT COLLINS
H A W A I I

February 1, 1995
459.06/95P-35

Mr. Michael W. Gibson, Esq.
Ashford & Wriston
P.O. Box 131
Honolulu, Hawaii 96810

Dear Mr. Gibson:

Response to Comments
Mauna Kea Drainage Project
Environmental Assessment

Thank you for your letter of January 20, 1995 expressing your support for the above project. As required by state law, your comment letter together with this response will be included in the Final Environmental Assessment (EA) for the project which will be submitted to the Department of Land and Natural Resources for approval. If approval is granted, the procedure for acquiring an easement from the State of Hawaii for the land necessary to construct the drainage improvements can proceed.

Should you have any further comments or questions about the project, please feel free to contact me at (808) 521-5361.

Very truly yours,

Lee William Sichter

Appendix A:

*Tom Nance Water Resources Engineering
Memo: 3/25/93*

March 25, 1993
93TN-050 (93-17)

MEMORANDUM

TO: Bill Mielcke
FROM: Tom Nance *TN*
SUBJECT: Drainage Through South Kohala Resort, Across Queen Kaahumanu Highway, and Into Fairways South

This memo establishes appropriate design flowrates at several of the Queen Kaahumanu Highway culverts and presents all relevant data for a recommended diversion ditch to reduce runoff to one of these culverts. To say it another way, this memo addresses "offsite" drainage issues which are also a concern to the State's Highways Division of DOT and the Land Management Division of DLNR. Internal improvements will also be needed in South Kohala Resort above the highway and in Fairways South below it. I plan to deal with these in a subsequent memo.

Tributary Basins to the Highway Culverts

There are three highway culverts of concern: (1) a 36-inch CMP at Road Station 64+00 which is a short distance to the north of the MKBH entrance road; (2) another 36-inch CMP at Station 73+00 to the south of the MKBH entrance road; and (3) the 13-foot diameter, circular structural plate culvert at Station 110+23 located to the north of the access road to Hapuna State Park. I've established the areas tributary to each of these culverts using MKP's 2-foot contour map within South Kohala Resort, DOT's 200-foot scale, 5-foot contour-maps covering the proposed new Waimea-Kawaihae Highway alignment, aerial photographs, the Kawaihae, Puu Hinal, Kamuela, and Nohonaoahae USGS quadrangle maps, and field reconnaissance. The resulting tributary areas are shown on Figure 1 and tabulated below:

Highway Culvert	Tributary Area	
	Acres	Square Miles
36-Inch CMP at Sta. 64+00	165	0.258
36-Inch CMP at Sta. 73+00	400	0.625
13-Foot Structural Plate at Sta. 110+23	5815	9.086

Two points on the delineation of these areas should be noted: (1) the USGS quadrangle maps do not provide anywhere near the topographic definition necessary to delineate the tributary basins, so using them in this manner can lead to significant errors; and (2) the tributary areas listed above and shown on Figure 1 are different than reported in BCA's December 1991 design report. Actually, the areas in BCA's report are greater than mine, perhaps surprising in view of the subsequent flood damage in September 1992. However, I am confident of the basins I have delineated. They are based on more complete topographic information and, with the exception of the upper end of the Hapuna basin, have been verified by extensive field work.

Memo To: Bill Mielcke
 March 25, 1993 -- 93TN-050
 Page two

Storm Rainfall Amounts

Establishing appropriate storm rainfall amounts is the heart of the problem for any drainage design in this area. The only published rainfall frequencies are in the outdated "Rainfall Frequency Atlas of the Hawaiian Islands" (U.S. Weather Bureau Technical Paper No. 43, 1962). No storm rainfall data in this part of South Kohala was available for the preparation of Technical Paper No. 43. The frequencies that were included were based on comparisons with other areas of similar average annual rainfall. Unfortunately, this does not satisfactorily represent actual storm rainfall probabilities.

Figure 2 compares these published rainfall frequencies with actual rainfalls as reported by MKP personnel for the following three storm events:

Dec. 26, 1983: 6.0 inches in four to five hours
 Jan. 16-17, 1984: 1.59 inches in two short duration rainfalls, one for five minutes and the other for 20 to 25 minutes.
 Sept. 14-15, 1992: 5.5 inches in two and a half hours

Two of these three storm events are approximately two times greater than the published 100-year rainfall amounts for the same durations. Because the fraction of rainfall resulting in runoff increases in greater rainfall events, the difference in resulting runoff is even greater than the difference in rainfall. This difference alone is the reason why the flood damage occurred.

Existing Culvert Capacities

I've analyzed culvert capacities based on as-built highway construction plans. Hopefully, the actual field conditions today are not significantly different. Relevant parameters and resulting capacities are tabulated below. The capacities of the two 36-inch culverts are very small in comparison to the runoff potential of their respective basins. Based on analyses presented subsequently, these culverts could only satisfactorily drain basins of 30 to 40 acres. Actual basin sizes are four and 10 times greater than this.

Parameter	36" CMP at Sta. 64+00	36" CMP at Sta. 73+00	13' Structural Plate at Sta. 110+23
Diameter	36"	36"	13.0'
Length, L (feet)	76	100	132
Upstream Invert Elevation	289.00	270.0	161.0
Downstream Invert Elevation	279.88	249.0	157.0
Slope, S_o	0.120	0.21	0.0303
Ratio of L ($100 S_o$)	6.33	4.76	43.6
Elevation of Roadway Centerline	295.8	277.8	188.5
Maximum Allowable Water Surface	295.2*	277.2*	184.5**
Maximum Headwater, HW	6.2	7.2	23.5
Maximum Flowrate Without Overtopping***	62 CFS	70 CFS	2250 CFS

- * Maximum level is defined by shoulder elevation at the culvert station.
- ** Maximum level is defined by the road elevation to the south at Station 111+30.
- *** Based on projecting entrance for all three culverts.

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Proposed Diversion of Stormwater Runoff

To reduce the quantity of runoff flowing through South Kohala Resort to the 36-inch culvert at highway Station 73+00, the diversion depicted on Figures 3 and 4 is recommended. It would intercept runoff from 200 acres of State land in Lalamilo which is now tributary to the 36-inch culvert. Diverted runoff would be conveyed to a deep natural drainageway which is ultimately tributary to the 13.0-foot highway culvert at road Station 110+23 near the Hapuna State Park access road. The total length of the proposed diversion channel is 5400 feet. However, only its lowest 1000 feet would be of significant size and design flowrate. The channel invert slopes are unavoidably steep; they vary from 4.0 to 7.5 percent over most of the length and would result in velocities of 7.7 to 10.8 feet per second. We might consider placing large natural boulders in the channel to act as energy dissipators in the channel segments that are not excavated into competent rock.

The proposed diversion would change the areas tributary to the highway culverts as tabulated below. Unfortunately, there is no feasible diversion for the basin tributary to the north culvert at road Station 64+00. I have evaluated possible diversions to the north to Waiulaula Gulch and to the south to Hapuna. All would be far more costly than simply replacing the undersized highway culvert with an appropriately sized one.

Highway Culvert	Present Tributary Area		Tributary Area With Proposed Diversion	
	Acres	Sq. Miles	Acres	Sq. Miles
36-Inch CMP at Sta. 64+00	165	0.258	No Change	
36-Inch CMP at Sta. 73+00	400	0.625	200	0.313
13-Foot Structural Plate at Sta. 110+23	5815	9.086	6015	9.398

Design Flowrates for the Highway Culverts and Proposed Diversion Channel

In my opinion, a prudent basis of design for the two smaller highway culverts would be to use the envelope curve on Figure 2 to define storm rainfall intensities and apply the SCS synthetic hydrograph technique. The envelope curve is simply 10 percent higher than the three storm rainfalls of record. I don't feel that we have sufficient data for a statistical analysis that would be any more reliable than this envelope. Presented in the table on the page following are all the relevant parameters and resulting peak flowrates for the basins tributary to the two 36-inch highway culverts and to the proposed diversion channel.

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Basis of Design For the Highway Culverts and Diversion Channel

Design Parameter	B a s i n				
	36-Inch CMP at Sta. 64+00	36-Inch CMP at Sta. 73+00		Proposed Diversion	
		Existing	With Proposed Diversion	at Sta. 30+00	at Sta. 0+00
Design Rainfalls (Inches): 5 min.	0.83	0.83	0.83	0.83	0.83
15 min.	1.70	1.70	1.70	1.70	1.70
1 hr.	3.15	3.15	3.15	3.15	3.15
2 hr.	5.15	5.15	5.15	5.15	5.15
3 hr.	6.30	6.30	6.30	6.30	6.30
6 hr.	7.35	7.35	7.35	7.35	7.35
Tributary Area (Sq. Mi.)	0.258	0.625	0.305	0.055	0.313
Watershed Length (feet)	7000	10,000	7000	2800	7700
Weighted CN	79	79	79	79	79
Watershed Slope	0.059	0.065	0.064	0.055	0.063
Lag Time (Hours)	0.640	0.811	0.614	0.317	0.668
Peak Runoff Rate (CFS)	415	890	510	120	500

- Notes:
1. Rainfalls of one- to six-hour duration are taken from the envelope curve on Figure 2; 5- and 15-minute rainfalls are 0.264 and 0.539 of the one-hour rainfall amount, respectively.
 2. All soils in the basin are Kawaihae soils which are Hydrologic Class C. SCS' CN values for various land uses on Class C soils are: range land (in poor condition), 86; large lot residential, 79; and golf course, 74.
 3. Lag time is calculated with the following SCS formula:

$$L = \frac{l^{0.8} (S = 1)^{0.7}}{1900 Y^{0.5}}$$

where: L = lag time (hours)
 l = watershed length (feet)

$$S = \frac{1000}{CN} - 10$$

Y = watershed slope (%)

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For the much larger basin tributary to the 13-foot culvert at Hapuna, it is questionable whether the envelope curve rainfalls which I applied to the two small-scale basins are also applicable to an area which is more than nine square miles in size. Available data from rain gages in Waikoloa, Waimea Town, and other areas peripheral to South Kohala Resort for the three storms since 1983 clearly indicate these intensities did not cover a broad area. With this reservation, computed peak flowrates for this basin based on three different analytical techniques are presented below. Calculations have been made for the existing basin area and with the additional area due to the proposed diversion.

Parameter	Hapuna Basin Tributary to the 13-Foot Culvert at Road Station 110+23	
	Existing Basin	Basin With Diversion
SCS Analytical Technique		
- Tributary Area (Square Miles)	9.086	9.398
- Weighted CN	70	70
Watershed Length	42,000	42,000
Lag Time (Hours)	1.403	1.403
Peak Runoff Rate (CFS)		
- Based on Figure 2 Rainfall	7,790	8,060
- Based on Tech. Paper No. 43 Rainfall	2,040	2,115
Regional Regression Technique		
- Two-Year, 24-Hour Rainfall (Inches)	2.70	2.70
- Peak Runoff Rate (CFS)	1,770	1,820

- Notes: 1. The upper end of the Hapuna Basin has Puu Pa soils of SCS Hydrologic Class B.
 2. The regional regression formula for the 100-year, peak runoff rate is:

$$Q_{100} = 34.3 (DA)^{0.77} (P_{242})^{2.28}$$

where: Q_{100} = peak rate (CFS)
 DA = basin area (sq. miles)
 P_{242} = two-year, 24-hour rainfall (inches)

The SCS method using the envelope curve rainfalls of Figure 2 results in unrealistic peak runoff rates. There is no record of the culvert ever being overtopped, although it surely would have been in December 1983 and September 1992 if rainfall approaching the amounts measured at Mauna Kea had prevailed over the entire Hapuna Basin.

Peak rates computed with the regional regression formula are only slightly less than those calculated by the SCS technique using the rainfalls in the Weather Bureau's Technical Paper No. 43. Peak rates by either technique are less than the 2250 CFS capacity of the highway culvert, even with the proposed diversion. The calculations also predict a 2.8 to 3.7 percent increase in the peak runoff rate due to the proposed diversion. The increase in tributary area would be 3.4 percent.

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Recommended Highway Culvert Modifications

Based on the foregoing calculations, no changes to the 13-foot structural plate culvert at road Station 110+23 would be needed to accommodate the proposed diversion. However, both 36-inch CMP culverts are significantly undersized, even with the benefit of the proposed diversion above the Station 73+00 culvert. The appropriate culvert sizes, based on the preliminary design parameters listed below, are twin 60-inch pipes at each location. For the culvert at road station 64+00, there is no significant stormwater detention above the highway to consider. In contrast, BCA's design has provided some detention at culverts in the South Kohala Resort roadways above the Queen Kaahumanu Highway culvert at Station 73+00. For particular storm hyetograph configurations, this detention will attenuate peak flowrates to some extent. However, other distributions of storm rainfall -- in particular if the rainfall peak occurs toward the end of the storm -- would reduce the beneficial effect of detention to insignificant levels. For the purpose of culvert sizing, particularly in view of the substantial sedimentation which accompanies storms in this area, it is not appropriate to take credit for peak flow reduction due to detention. Cost savings in possible culvert downsizing are very small in comparison to the damage due to uncontrolled overtopping.

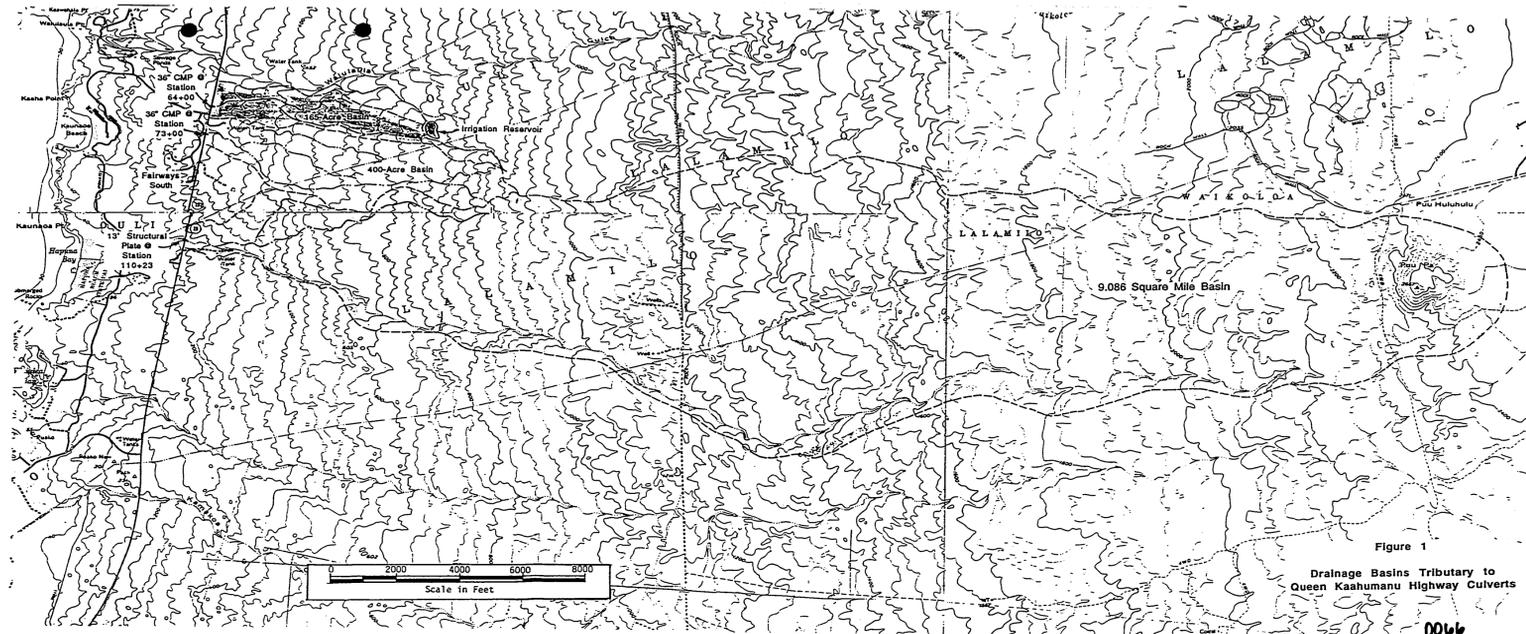
Parameter	Road Sta. 64+00	Road Sta. 73+00
Proposed Culvert Sizes	Two 60" CMP	Two 60" CMP
Length, L (Feet)	76	100
Upstream Invert Elevation (Feet)	285.00	263.70
Downstream Invert Elevation (Feet)	279.88	249.00
Slope, S_o	0.067	0.147
Ratio of $L/100 S_o$	11.3	6.8
Maximum Allowable Water Surface (Feet)	294.20	276.20
Maximum Headwater, HW (Feet)	9.2	12.5
Design Flowrate (CFS)	415	510
Maximum Flowrate (CFS)	480	600

Enclosures

**OVERSIZED
DRAWING/MAP**

**PLEASE SEE
35MM ROLL**

0066



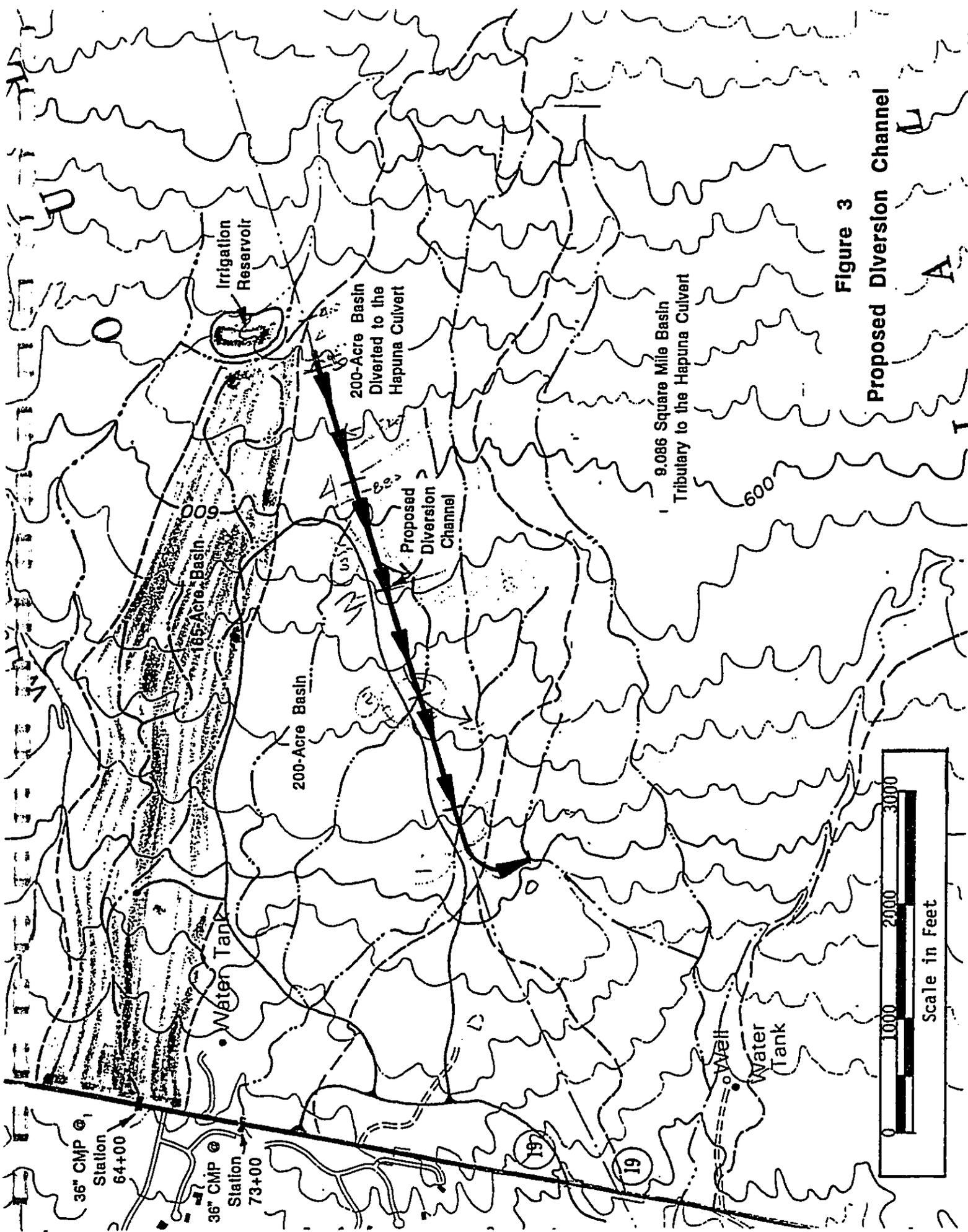
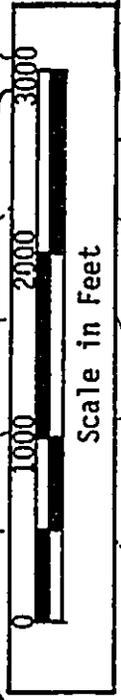
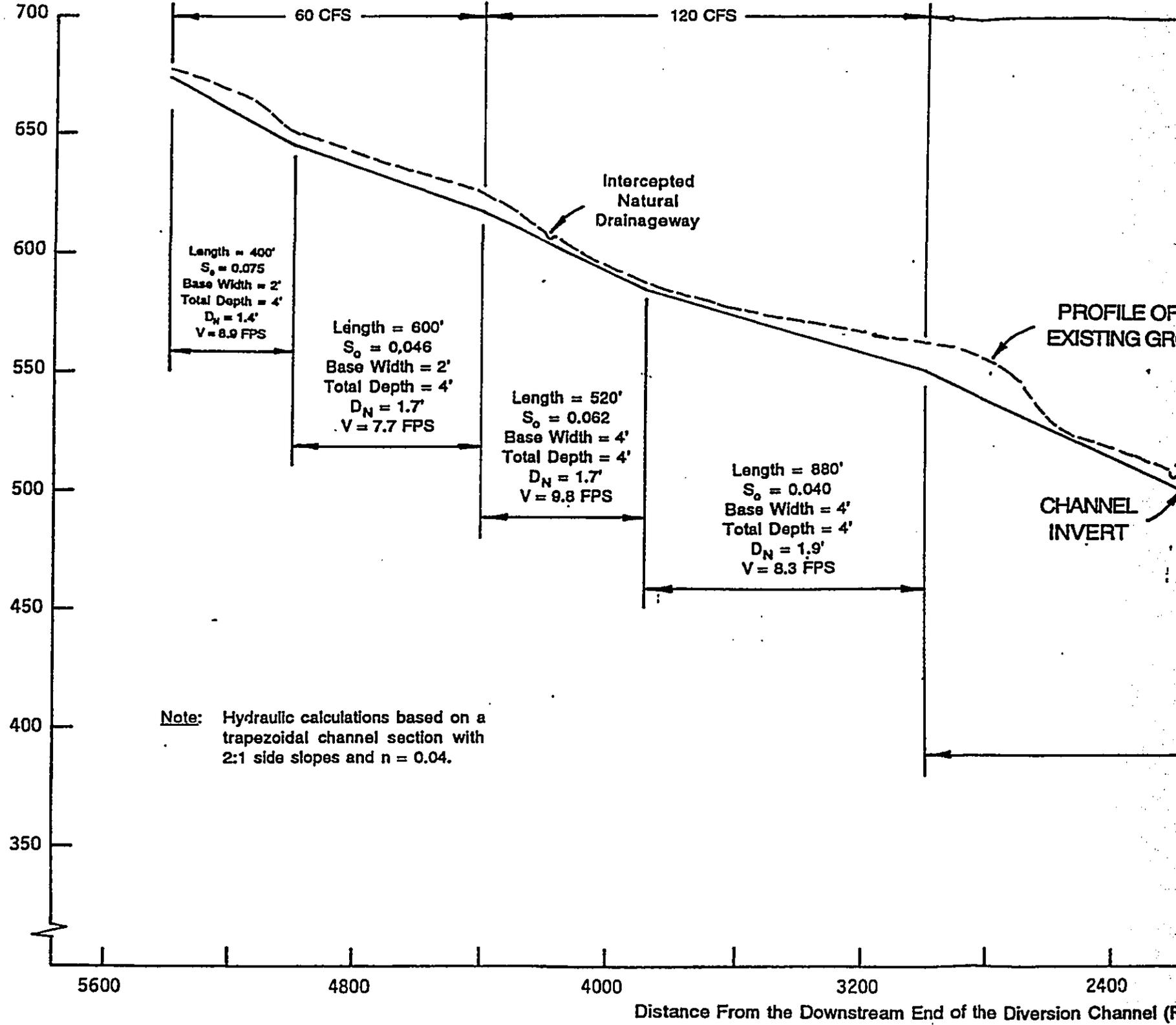


Figure 3
Proposed Diversion Channel



Elevation
(Ft. msl)

Recommended Design Flowrates



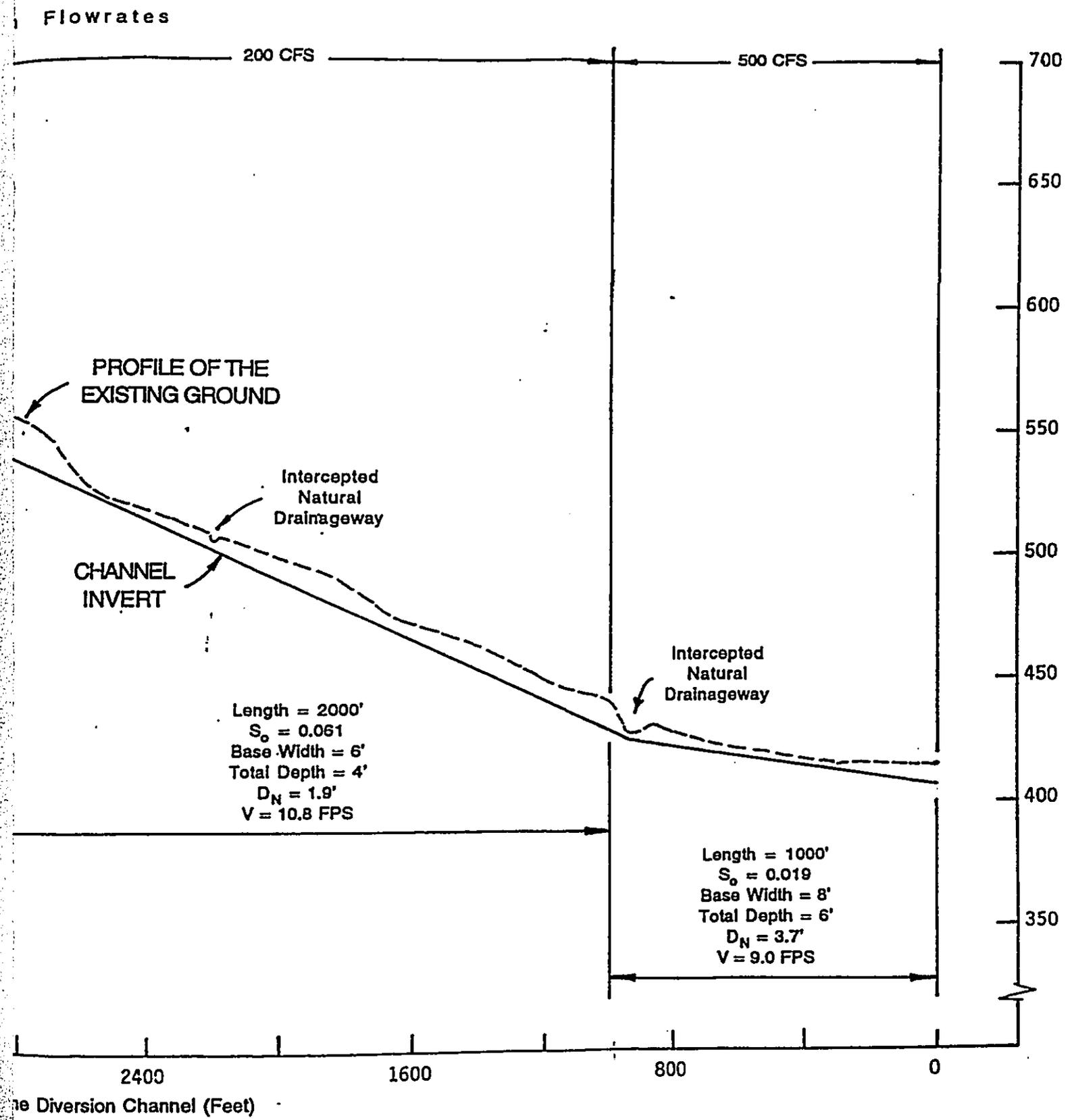


Figure 4
Profile of the Proposed Diversion Channel

Appendix B:

Botanical Resources Assessment

BOTANICAL RESOURCES ASSESSMENT
MAUNA KEA DRAINAGE IMPROVEMENTS
SOUTH KOHALA DISTRICT, ISLAND OF HAWAI'I

by

Winona P. Char
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Prepared for: BELT COLLINS HAWAII

July 1994

BOTANICAL RESOURCES ASSESSMENT
MAUNA KEA DRAINAGE IMPROVEMENTS
SOUTH KOHALA DISTRICT, ISLAND OF HAWAII

INTRODUCTION

The proposed drainage improvements will involve the construction of three diversion ditches and a retention basin on State-owned lands at Lalamilo, and replacement of two 36-inch highway culverts, at road stations 64+00 and 73+00, by twin 60-inch culverts at each location. In addition, a section of the large gulch located between the Hapuna Beach Park access road and the Hapuna Resort area will be cleaned to improve storm runoff flow through this portion of the gulch.

Field studies to assess the botanical resources found on the above mentioned areas as well as the construction access roads, construction staging and stockpile area, and the large gulch into which the diversion ditches will empty were made on 18 July 1994 by a team of three botanists. The primary objectives of the study were to describe the vegetation, search for threatened and endangered species as well as rare and vulnerable plants, and to identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, topography, exposure, drainage, etc. A corridor 100-foot wide was surveyed for the diversion ditches. The diversion ditches, for the most part, follow along the natural drainageway. The alignment for the ditches were staked prior to our field studies.

DESCRIPTION OF THE VEGETATION

The vegetation found on the three proposed upland diversion ditches and the two highway culvert areas are described below. The plant names used in the discussion follow the most recent treatment of the Hawaiian flora by Wagner et al. (1990).

Upland Diversion Ditches (and Other Easements)

The upland diversion ditches 1, 2, and 3 as well as the service access easements and retention basin will be sited on mixed grassland with scattered kiawe trees (Prosopis pallida). Two native grasses, pili grass (Heteropogon contortus) and Eragrostis atropioides, along with the introduced or alien buffel grass (Cenchrus ciliaris) form the most abundant plant cover; the three species are codominant, that is, they occur in about equal numbers. The native grasses generally tend to occur on the stonier soils and rocky outcroppings, while the buffel grass prefers the swale areas with somewhat deeper soils. The grasses form low, rounded clumps, 1 to 2 ft. tall, with about 40% to 60% cover. Widely scattered throughout the grassland are small trees of kiawe, 10 to 12 ft. tall. The kiawe trees become more numerous and taller, 18 to 20 ft. tall, in the gulch areas where they line the sides of the gulches.

Smaller shrubs of 'ilima (Sida fallax), 'uhaloa (Waltheria indica), koa-haole (Leucaena leucocephala), 1 to 2 ft. tall, are found scattered throughout this grassland. Both subspecies of pau o Hi'i'aka (Jacquemontia ovalifolia ssp. ovalifolia and sandwicensis) form low mats among the tussocks of grass. Herbaceous species associated with the grassland include hairy spurge (Chamaesyce hirta), 'ihi (Portulaca pilosa), threadstem carpetweed (Molluga cerviana), partridge pea (Chamaecrista nictitans), and coat buttons (Tridax procumbens).

A portion of the large gulch located between the State's Hapuna Beach property and the Hapuna Resort area to the north will be cleaned. Medium- to large-sized kiawe trees, 18 to 25 ft. tall, line the sides of the gulch. Shrubs of koa-haole, 6 to 12 ft. tall, are common. Filling in the matrix between the woody components, is a dense cover of buffel grass about 3 ft. high. In some places, however, fountain grass (Pennisetum setaceum) may be locally abundant.

A construction staging area and debris stockpile will be located south of the area to be cleaned. This staging area and debris stockpile will be sited on mixed grassland with only a very few, small kiawe trees. On this lower elevation portion of the drainage improvements, buffel grass is the most abundant of the grasses.

Highway Culverts

The vegetation surrounding the 36-inch culvert at road station 64+00 consists of a small stand of kiawe trees with buffel grass on the makai side. On the mauka side of the culvert is a shallow basin which supports buffel grass with scattered koa-haole shrubs, 3 to 5 ft. tall. A few plants of pluchea (Pluchea symphytifolia), castor bean (Ricinus communis), and golden crownbeard (Verbesina encelioides) are found here. Two plants of a'ali'i (Dodonaea viscosa), a native shrub with winged, papery fruit capsules, are also found in this area.

At road station 73+00, the mauka basin behind the culvert is covered by an assemblage of buffel grass with scattered patches of koa-haole shrubs, 6 to 12 ft. tall, and kiawe saplings, 6 to 8 ft. tall. Other species found here include hairy spurge, 'ilima, 'uhaloa, and spiny amaranth (Amaranthus spinosus). Plant cover is about 60%. The makai side of the culvert supports a dense cover of buffel grass and a small stand of kiawe trees.

DISCUSSION AND RECOMMENDATIONS

The areas to be impacted by the proposed drainage improvements are covered primarily by introduced species, although two native grasses, pili grass (Heteropogon contortus) and Eragrostis atropioides, are abundant on the upper elevation sections of the easement. Besides pili grass and Eragrostis, the following native species were also observed during our studies: 'ilima (Sida fallax), 'uhaloa (Waltheria indica), alena (Boerhavia repens), pa'u o Hi'i'aka (Jacquemontia ovalifolia ssp. ovalifolia, ssp. sandwicensis), 'aweoweo (Chenopodium oahuense), a'ali'i (Dodonaea viscosa), 'aki'aki (Sporobolus virginicus), pohuehue (Ipomoea pes-caprae), Pycnus polystachyos, and nena or kipukai (Heliotropium curassavicum). The last four species were found at the mouth of the large gulch where it empties onto a sandy beach.

None of the plants found during the field studies is a listed, proposed, or candidate threatened and endangered species (U.S. Fish and Wildlife Service 1989, 1990, 1994a, 1994b). All of the plants can be found in similar environmental habitats throughout the Hawaiian Islands. No sensitive native plant-dominated communities occur on the site. A very recent botanical survey of a portion of the State-owned land below 380 ft. elevation by Char (1994) recorded similar findings.

There is little of botanical interest on the areas to be impacted by the proposed project. Given the limited nature of the project, and the findings above, the proposed drainage improvements are not expected to have a significant negative impacts on the botanical resources.

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Appendix C:

Mauna Kea Drainageway Assessment

**MAUNA KEA DRAINAGEWAY ASSESSMENT
LALAMILO AHUPUA'A, SOUTH KOHALA DISTRICT, HAWAII**

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August 1994

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EXECUTIVE SUMMARY

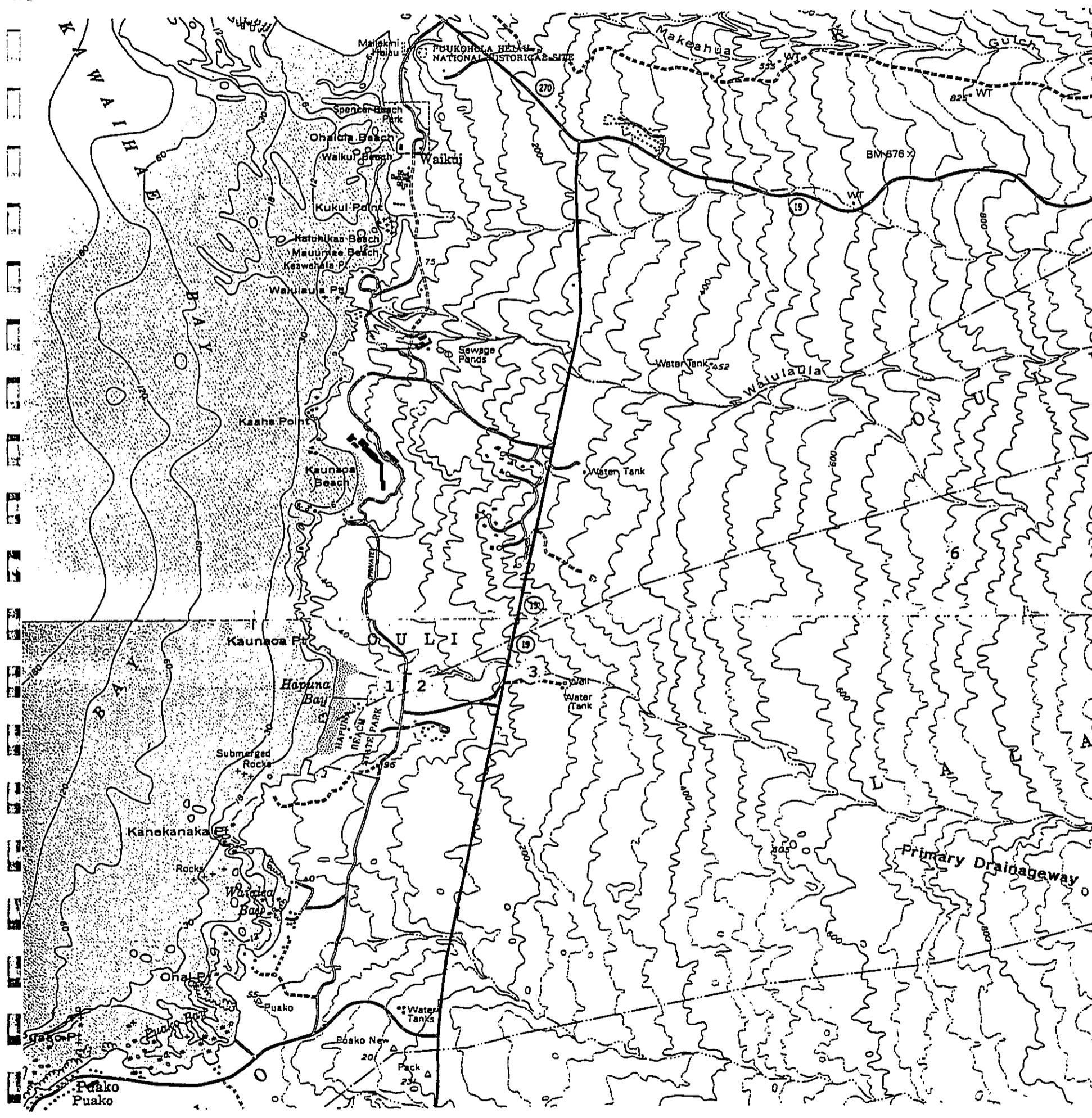
Mauna Kea Properties has proposed the construction of drainage improvements on State-owned land in the Lalamilo ahupua'a, South Kohala District, Hawaii (Figure 1). The proposed improvements would involve the construction of three diversion ditches that would transfer runoff from one drainage to a larger natural drainage to the south. Pacific Aquatic Environmental was retained by Belt Collins Hawaii to complete a Biological Assessment to evaluate potential impacts to native stream biota that could result from project completion.

The emphasis of the Biological Assessment was the large natural drainageway (Primary Drainageway - Figure 1) that empties into Hapuna Bay (the channel that would receive diverted runoff). The study area extended from a groundwater-supplied (Nance 1994) brackish pool at the mouth of the Primary Drainageway to the headwater region at higher elevations. The drainageway immediately to the north was also evaluated, with emphasis on the location of the proposed diversion ditches. Snorkeling observation, hand-netting of fish, and aerial-netting of flying aquatic insects were conducted in and adjacent to the brackish pool. Up-gradient of the brackish pool, sampling consisted of hiking in the stream channel and conducting visual observations.

The brackish pool contained four native fish species including two endemic gobies, *Eleotris sandwicensis* and *Stenogobius hawaiiensis*, and one introduced fish species. Native and introduced invertebrate species were also found in and adjacent to the brackish pool. The Primary Drainageway upstream of the brackish pool, and the drainageway that will be diverted, were dry and lacked habitat for aquatic biota. No aquatic organisms were observed within these drainages. In addition, no Category 1 or 2 Candidate Endangered *Megalagrion* damselfly species were present at any location within the study area.

Impacts to native stream biota resulting from the proposed improvements are not expected to be significant. Upstream of the brackish pool, the channels proposed for alteration do not support aquatic biota. In addition, no significant impacts to biota occupying the brackish pool are anticipated. Specifically, increases in storm runoff in the Primary Drainageway resulting from channel improvements would be negligible compared to existing runoff; watershed area would be increased by about 0.3 mi² (3.4%). Sediment runoff would increase due to the excavation of unlined diversion ditches (Nance 1993). However, a retention basin that would be installed below the lowest of the three diversion ditches would contain most of the excess sediment (Nance 1993). Therefore, no adverse effects to the coral reef in Hapuna Bay are expected as the result of increased sediment runoff.

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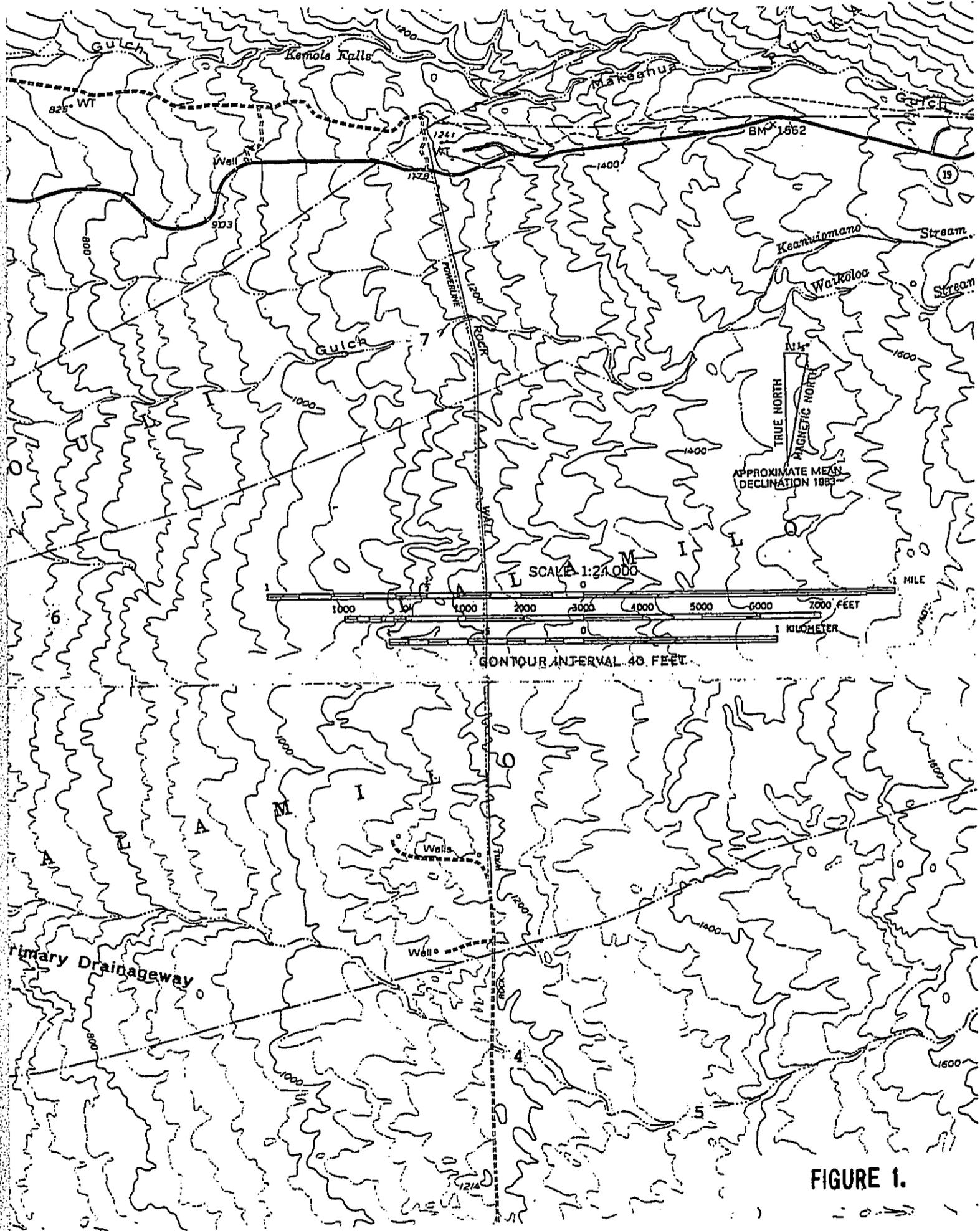


FIGURE 1.

1.0 INTRODUCTION

Mauna Kea Properties has proposed the construction of drainage improvements on State-owned land in the Lalamilo ahupua'a, South Kohala District, Hawaii. The proposed improvements would involve the construction of three diversion ditches that would transfer runoff from one channel to a larger natural drainageway to the south. Pacific Aquatic Environmental (PAE) was retained by Belt Collins Hawaii to complete a Biological Assessment to evaluate potential impacts to native stream biota that could result from project completion. The assessment was conducted on 28 and 29 July, 1994 by Ron Englund and Randall Filbert.

2.0 STUDY AREA

The focus of this Biological Assessment was a large natural drainageway (Primary Drainageway) that empties into Hapuna Bay adjacent to the Hapuna Beach Prince Hotel (Figure 1). This channel would receive diverted runoff if proposed improvements are completed. In addition to the Primary Drainageway, we examined several locations in the drainage system to the north (the channels from which flow would be diverted).

The drainages in this region, most of which are unnamed on US Geological Survey (USGS) quadrangle maps, originate in the upper regions of the Pu'u Pa cinder cone. Because these drainages are located on the leeward side of the island of Hawaii, they flow infrequently (i.e., after periods of heavy rain). For this assessment, 4.95 miles (to about 1400 ft) of the Primary Drainageway was surveyed. Although the Puu Hinai quadrangle map shows the Primary Drainageway extending far beyond an elevation of 1400 ft, the stream channel actually fans out and becomes indistinct above this elevation. The following paragraphs provide a description of sampling stations selected within the study area.

2.1 STATION 1 (Brackish Pool)

A small brackish pool (Photo 1) is located at the mouth of the Primary Drainageway adjacent to the Hapuna Beach Prince Hotel swimming pool (Figure 1, Table 7.1). This pool appears to have been scoured out by high flows associated with storm runoff emanating from the Primary Drainageway. However, because surface flow is so infrequent it is apparent that the pool is maintained by groundwater flow. In addition, near-shore salinity measurements taken in Hapuna Bay also indicate groundwater inflow (Nance 1994). Specifically, salinity measurements taken at the surface and the bottom of Hapuna Bay were 32.3 and 34.1, respectively. This discrepancy indicates the presence of groundwater inflow in the area.

During this survey the brackish pool, estimated to be 40 x 45 ft with a maximum depth of about 4 ft, was separated from the ocean by approximately 450 ft of sandy beach. A small amount of freshwater was being discharged into the brackish pool from a pipe that ran beneath the hotel swimming pool. However, flow from this drainage pipe does account for a substantial amount of the water contained in the pool (Nance 1994). Substrate in the pool is comprised of sand and

outcroppings of pahoehoe lava bedrock. Riparian vegetation consists mainly of introduced kiawe (*Prosopis pallida*) and fountain grass (*Pennisetum setaceum*).

2.2 STATIONS 2 THROUGH 5 (Primary Drainageway that empties into Hapuna Bay)

These stations were located in the Primary Drainageway between the brackish pool and the headwater region (Figure 1). Station 2 was located immediately upstream of the brackish pool, Station 3 was located on the mauka side of the Queen Kaahumanu Highway, Station 4 was located about 60 ft up-gradient of the Rock Wall (see Figure 1), and Station 5 was in the headwater region at an approximate elevation of 1320 ft (Table 7.1). These stations are shown in photographs 2 through 5. The intermittent channel, which flows only after infrequent, heavy storms was dry during this assessment. At lower elevations, riparian vegetation consists mainly of kiawe and fountain grass. At higher elevations, the fountain grass is replaced by another introduced grass species, buffel grass (*Cenchrus ciliaris*). Substrate throughout the channel is composed mostly of sand with sections of lava boulders and bedrock.

2.3 STATION 6 (Location of drainageway diversions)

This station was located in the area proposed for diversion: two small channels immediately north of the Primary Drainageway (Figure 1, Table 7.1). These intermittent channels were also dry during this assessment (Photo 6). Riparian vegetation and substrate composition are similar to those of the Primary Drainageway.

2.4 STATION 7 (Waiulaula Gulch: up-gradient of proposed diversions)

This station was located on Waiulaula Gulch on the makai side of the Rock Wall (Figure 1, Table 7.1). This section of channel contained small isolated puddles of water during this assessment. Riparian vegetation is more dense and includes shrub species not present at other stations. Substrate consists of sand and large cobble; cobble is located primarily in the mid-channel.

3.0 METHODS

3.1 GENERAL METHODS

At each station, altitude was measured, channel substrate was evaluated, and the dominant riparian vegetation was identified. Water temperature and pH were measured in the brackish pool. Temperature was measured with a hand-held thermometer, and pH was measured with a Corning PS-15 pH meter. Salinity data collected by Tom Nance (Nance 1994) were also incorporated into this report. Altitude was estimated using a combination of the USGS quadrangle maps (Kawaihae and Puu Hinai) and a Casio altimeter. The length of the Primary Drainageway that was surveyed during this assessment was calculated based on planimeter

readings taken from the Puu Hinai quadrangle map. Photographs were taken at each site to provide a characterization of channel conditions and to document field work.

3.2 FISH

Qualitative fish sampling consisted of three methods: snorkeling, hand netting, and above-water visual observation. The primary purpose of netting was to verify above-water observations. Total length was estimated for all fish species, and observations of spawning behavior or coloration were noted. Snorkeling point counts (i.e., Baker and Foster 1992) were not used because visibility was too low in the brackish pool (Station 1), and because the channel was dry at the remaining stations.

Up-gradient of the brackish pool sampling consisted of hiking in the stream channel and conducting visual observations.

3.3 AQUATIC INVERTEBRATES (insects and crustaceans)

Benthic (that live on the bottom of a body of water) invertebrates in the brackish pool were sampled using a combination of snorkeling, hand netting, and above-water observation. We used aerial hand-nets to capture adult aquatic insects; the adult stages of some stream insects, including the Category 1 and Category 2 Candidate Endangered *Megalagrion* species (Dodd et al. 1985), live above the water and in the surrounding riparian zone. In addition, visual observations were conducted along the entire drainageway corridor for insects.

4.0 RESULTS

4.1 FISH

Station 1 (brackish pool): The small pool near the Hapuna Beach Prince Hotel contained four native species of fish: 'o'opu 'akupa (*Eleotris sandwicensis*) (Photo 7), 'o'opu naniha (*Stenogobius hawaiiensis*), aholehole (*Kuhulia sandwicensis*) and, 'ama'ama (Mugilidae) (Table 7.2). Of these, the 'o'opu (goby) species and the aholehole are endemic to the Hawaiian islands. One introduced fish species, liberty molly (*Poecilia sphenops*), was also observed.

All 'o'opu observed in the brackish pool were adults ranging from 3 to 4.5 in. In contrast, the aholehole that were observed were small, ranging from 1 to 2.5 in. Most 'ama'ama ranged in size from 4 to 10 in, but a few individuals were estimated at 12 in. Female and male liberty mollies ranged from 2.5 to 3.5 in and 2.0 to 2.5 in, respectively, and were actively spawning during the time of this assessment.

Station 2 through 7: The Primary Drainageway upstream of the brackish pool (Stations 2 through 5) was dry, thereby lacking habitat for aquatic biota. The channels at Station 6 were

also dry. Although small isolated puddles of water were present in the channel at Station 7, no aquatic biota were observed.

4.2 MACROINVERTEBRATES

Aquatic Insects: No federally listed Category 1 or 2 Candidate Endangered *Megalagrion* damselfly species were encountered within or adjacent to any of the drainages evaluated during this study. However, an introduced damselfly, *Ischnura ramburi*, and a native dragonfly, *Pantela flavescens*, were found adjacent to the brackish pool (Table 7.2).

Crustaceans: A single species of native prawn, 'opae'oeha'a (*Macrobrachium grandimanus*) was captured in the brackish pool.

4.3 TEMPERATURE AND WATER CHEMISTRY

Water temperature in the brackish pool ranged from 29 °C in the deeper areas to 31 °C in the shallows, and pH was slightly alkaline (8.5). Salinity, measured at 13.1 ppt, was less than half that of nearby seawater (Nance 1994).

5.0 DISCUSSION

5.1.1 FISH

The Primary Drainageway as well as the channels proposed for diversion are intermittent streams that contain flow only following infrequent, heavy storms. Storm water flow in the stream channels in the Lalamilo ahupua'a is a relatively rare event.

The only aquatic biota found in the study area occupied the brackish pool. Four of the five fish species observed in the pool were native (3 endemic). The lack of young 'o'opu observed during this assessment suggests that the pool had been isolated from the ocean for some time. Had the pool recently been connected to the sea, we likely would have observed at least some young fish. Post-larvae that had entered the brackish pool in the past had likely been preyed upon by larger 'o'opu 'akupa and aholehole. Permanent fish habitat was not observed, or likely to be found, anywhere upstream of the brackish pool.

5.1.2 POTENTIAL IMPACTS TO NATIVE FISH

Impacts to native stream fish resulting from the proposed improvements are not expected to be significant. Upstream of the brackish pool, channels proposed for alteration do not support fish. In addition, no significant impacts on fish in the brackish pool are anticipated. Specifically, increases in storm runoff in the Primary Drainageway resulting from channel improvements should be negligible compared to existing runoff. Sediment runoff will increase due to the excavation of unlined diversion ditches. However, construction of diversion ditches will only

increase total watershed area by about 0.3 mi² (3.4%), and, a retention basin below the lowest of the three diversion ditches should hold most of the excess sediment (Nance 1993). Therefore, no adverse effects to the coral reef in Hapuna Bay are expected as the result of increased sediment runoff.

5.2.1 NATIVE AQUATIC INVERTEBRATES

One species of native insect, the ubiquitous dragonfly *Pantela flavescens*, and one introduced damselfly species, *Ischnura ramburi*, were found in the brackish pool area. No Candidate 1 and 2 Endangered species belonging to the genus *Megalagrion* were found during this assessment, and only one species of crustacean, the endemic 'opae'oeha'a, was encountered. Furthermore, no habitat suitable for *Megalagrion* damselflies was observed anywhere in the study area.

5.2.2 POTENTIAL IMPACTS TO NATIVE AQUATIC INVERTEBRATES

Because the channel is dry above the brackish pool, no impacts to native stream invertebrates will occur as the result of project completion. Because the proposed improvements will not adversely influence conditions in the brackish pool, impacts to the 'opae'oeha'a, or any other invertebrate species, are not anticipated.

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7.0 TABLES

Table 7.1. Description of sampling stations used for the Mauna Kea Drainageway Assessment 28-29 July, 1994.

Sampling station	Location	Date sampled	Elevation (ft)
1	Primary Drainageway (i.e., Hapuna Bay) brackish pool	7-28-94	0
2	Primary Drainageway immediately upstream of the brackish pool	7-28-94	5
3	Primary Drainageway upstream of the Queen Kaahumanu Highway	7-28-94	160
4	Primary Drainageway about 50 ft up-gradient the Rock Wall	7-29-94	1160
5	Primary Drainageway - headwater region	7-29-94	1320
6	Location of Drainageway diversions	7-29-94	700 to 800
7	Waiulaula Gulch immediately down-gradient from the Rock Wall	7-28-94	1160

Table 7.2. Aquatic biota observed and collected in the brackish pool during 28-29 July, 1994¹.

Scientific name	Common name	Biogeographical status ²
Fish		
<i>Eleotris sandwicensis</i>	'o'opu 'akupa	endemic
<i>Stenogobius hawaiiensis</i>	'o'opu naniha	endemic
Mugilidae	'ama'ama	indigenous
<i>Kuhulia sandwicensis</i>	aholehole	endemic
<i>Poecilia sphenops</i>	liberty molly	introduced
Crustaceans		
<i>Macrobrachium grandimanus</i>	'opae'oeha'a	endemic
Aquatic insects		
<i>Pantela flavescens</i>	dragonfly	introduced
<i>Ischnura ramburi</i>	damselfly	introduced

¹ All drainages were dry above the brackish pool

² From Devick et al. (1992); Devick (1991)



Photo 1: Primary Drainageway brackish pool



Photo 2: Primary Drainageway immediately upstream of the brackish pool (elevation 5 ft)

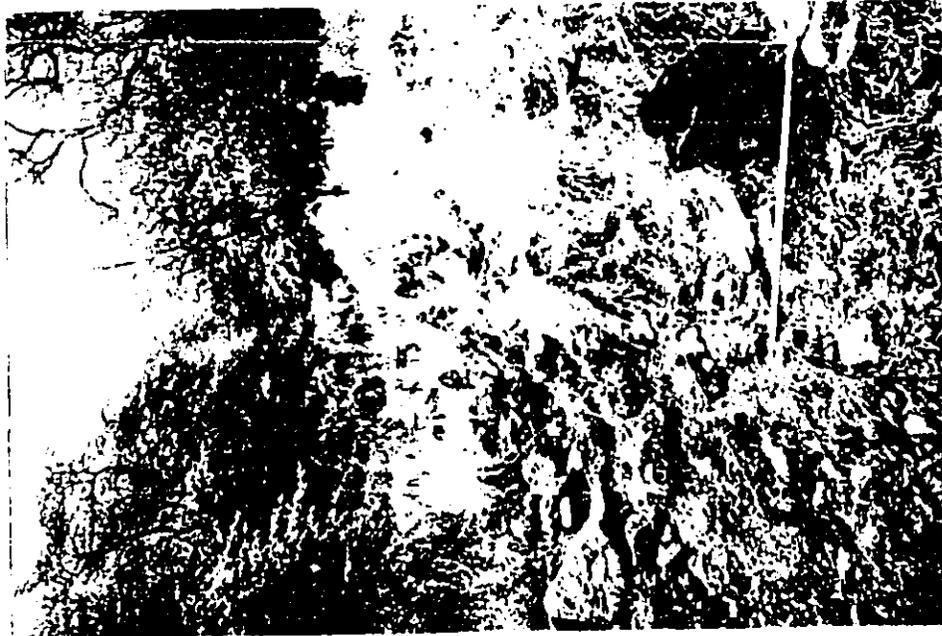


Photo 3: Primary Drainageway upstream of the Queen Kaahumanu Highway (elevation 160 ft)

DOCUMENT CAPTURED AS RECEIVED



Photo 4: Primary Drainageway about 50 ft up-gradient of the Rock Wall (elevation 1160 ft)



Photo 5: Primary Drainageway - headwater region (elevation 1320 ft)



Photo 6: Location of Drainageway diversions (elevation 700 to 800 ft)

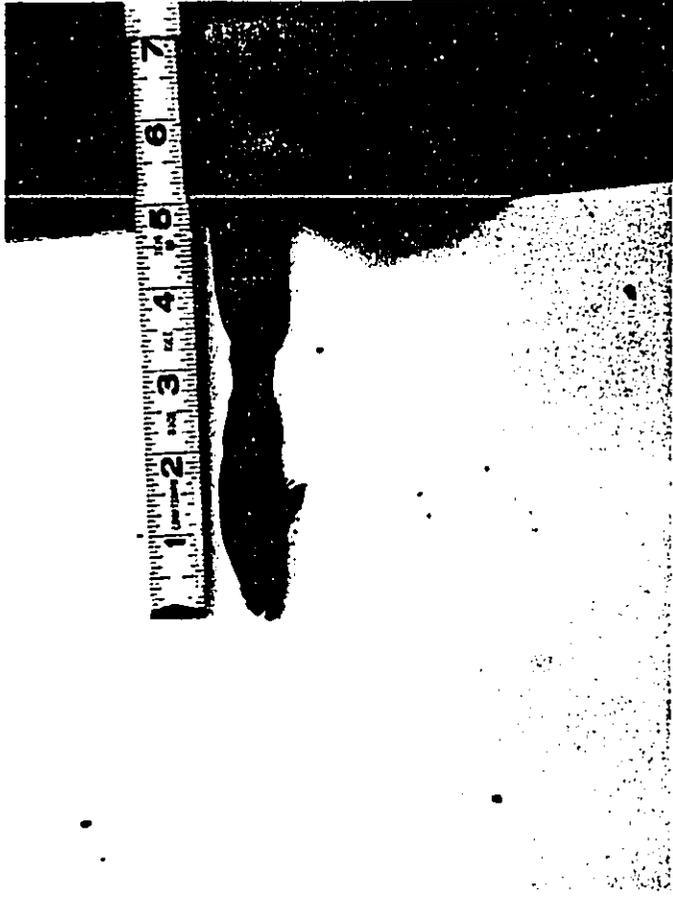


Photo 7: 'O'opu 'akupa (*Eleotris sandwicensis*) from brackish pool (7-28-94)

Appendix D:

*Archaeological Inventory Survey
Mauna Kea Properties
Drainage Improvement Project*

Report 1539-081294

**Interim Report:
Archaeological Inventory Survey
Mauna Kea Properties
Drainageway Project**

Lands of 'Ōuli and Lālāmilo
South Kohala District
Island of Hawai'i

BY

*James Head, B.A. • Projects Supervisor
and
Paul H. Rosendahl, Ph.D. • Principal Archaeologist*

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AUGUST 1994

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BACKGROUND

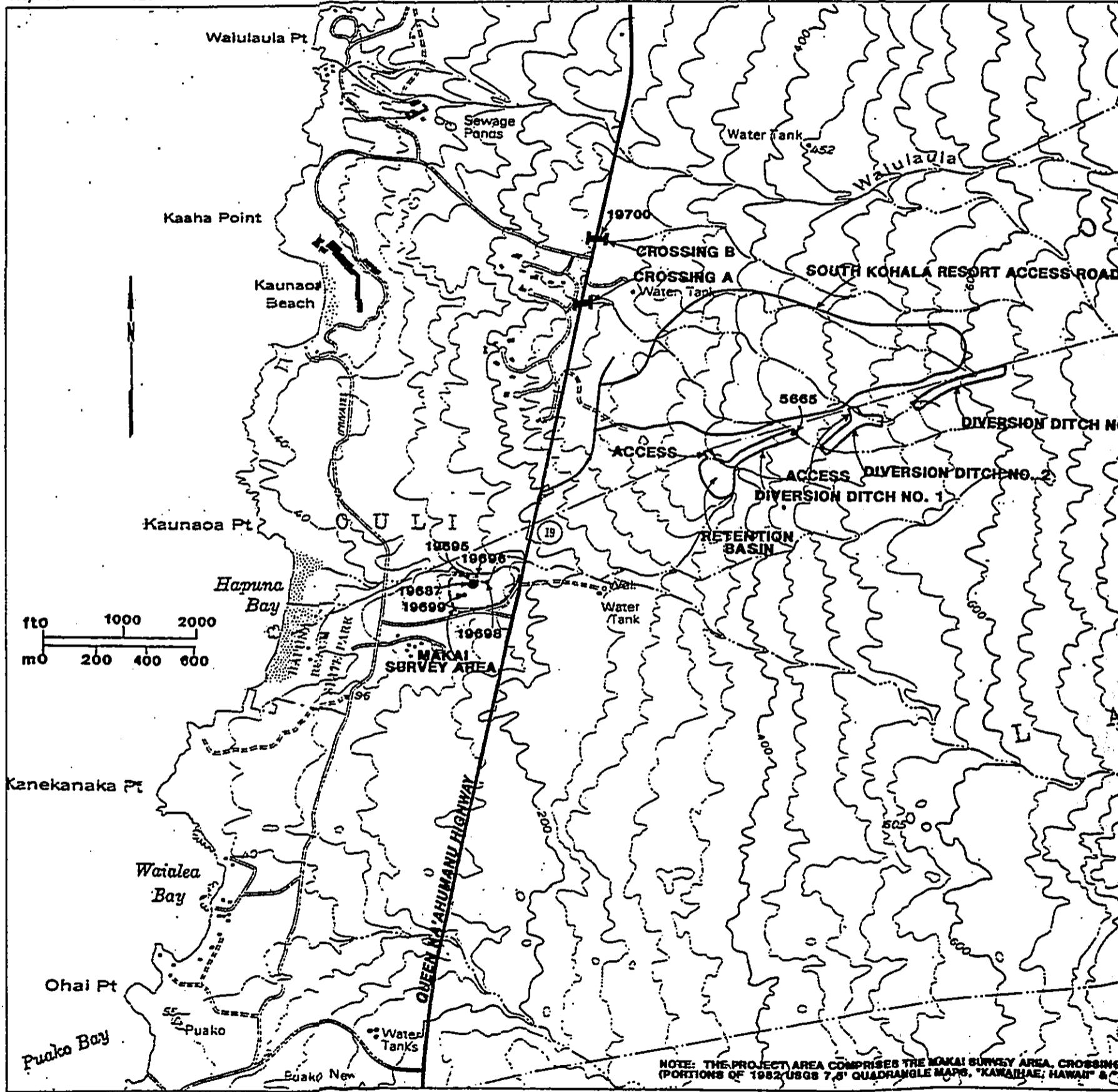
At the request of Mr. Ed Kuniyoshi of Belt Collins Hawaii (BCH), on behalf of their client, Mauna Kea Properties, Inc. (MKP), Paul H. Rosendahl, Ph.D., Inc. (PHRI) recently conducted an archaeological inventory survey of the proposed Mauna Kea Properties Drainageway project area, situated in the Lands of Ōuli and Lālāmilo, South Kohala District, Island of Hawai'i (Figure 1). The project area consists of six separate areas that together have a total length of c. 2,440 m (8,000 ft); the areas are situated on both the inland and seaward sides of Queen Ka'ahumanu Highway, in the vicinity of the Mauna Kea Beach and South Kohala Resorts. The present survey was done in connection with the preparation of an Environmental Assessment (EA). The overall objective of the survey was to provide information sufficient to satisfy all current historic preservation regulatory review requirements of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) and the Hawaii County Planning Department (HCPD).

The basic purpose of an inventory survey is to identify all features of potential archaeological significance present within a project area. An *inventory survey* comprises an initial level of archaeological investigation. It is conducted basically to determine the presence or absence of archaeological resources. It indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. Finally, it permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further work as might be necessary. Such work could include further data collection—additional data collection involving detailed recording of sites and features, and selected limited excavations; and possibly subsequent *mitigation—data recovery* research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The basic objectives of the survey were fourfold: (a) to identify all sites and site complexes present within the project area; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the general scope of any subsequent further data collection and/or other mitigation work that might be necessary or appropriate.

Based on a review of readily available background literature, basic familiarity with the general project area, extensive familiarity with the current requirements of review authorities, and discussions with Mr. Kuniyoshi of BCH, the following specific tasks were determined to constitute an adequate scope of work to comply with current inventory-level survey requirements:

1. Review archaeological and historical literature relevant to the project area, and conduct historical documentary research (emphasis on readily available literature and documentary sources) and informant interviews with any appropriate and available local informant sources;
2. Conduct 100%-coverage, variable-intensity ground survey of the entire project area, to find and record (a) previously identified sites and (b) any previously unidentified sites and features;



NOTE: THE PROJECT AREA COMPRISES THE MAKAI SURVEY AREA, CROSSING (PORTIONS OF 1982 USGS 7.5' QUADRANGLE MAPS, "KAWAII, HAWAII" & C)

Figure 1. Project Area and Site Location Map

3. Conduct limited subsurface testing at selected sites and features in order to (a) determine the presence or absence of potentially significant subsurface cultural deposits and features, (b) obtain suitable samples for palynological (pollen) analyses, and (c) obtain suitable samples for radiocarbon age determination; and
4. Analyze field and historical research data, and prepare appropriate reports.

The field work for the inventory survey was conducted July 25-27, 1994 and August 2-5, 1994 under the direction of Projects Supervisor James Head, B.A. Assisting on the project were Field Archaeologists Michael Halpren, M.A., along with Field Technicians Earl Fujishige, B.A., and Christopher Kitchens. Principal Archaeologist Dr. Paul H. Rosendahl provided overall guidance for the project.

The inventory survey was carried out in accordance with current standards for inventory-level survey required by DLNR-SHPD. The significance of all archaeological remains identified within the project area were assessed based on the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60), and on criteria used by the State of Hawai'i (DLNR 1989). The State Historic Preservation Office uses these criteria for evaluating cultural resources. The evaluation was guided by two bulletins prepared by the National Register of Historic Places (NRHP) entitled "Guidelines for Evaluating and Documenting Traditional Cultural Properties" (*Bulletin 38*, Parker and King 1990) and "How to Apply the National Register Criteria for Evaluation" (*National Register Bulletin 15*). The National Register Criteria embody four types of cultural value: Criteria A through D. Criteria A and B define significance through *association*; Criterion C defines significance through *design or construction* value; and Criterion D defines significance in terms of *information* value. Sites may be considered significant under one or more of these criteria. Significance criteria are discussed in detail later in this report.

SUMMARY OF FINDINGS

The project area consists of six separate areas ranging in elevation from c.35 to 180 m (120 to 600 ft) AMSL (above mean sea level). The terrain in the areas, in general, slopes gently westward toward the ocean.

Seven sites with 15 component features were identified during the current project (Figure 1; Table 1). One of the sites (5665) had been previously identified during an earlier study of historic and prehistoric trails in the area (Kaschko and Rosendahl 1982). The remaining sites were newly identified. The sites were in poor to fair condition, and included the following formal feature types: alignment, cairn, overhang, rock-ring, and trail. Probable functional types were assigned for most features. Functional types present include temporary habitation, agriculture, transportation, marker, and indeterminate.

As part of the inventory survey, three subsurface test units (2 sq m total) were excavated at three sites. One 0.50 by 1.0 m test unit was placed at Site 19695, and another unit of the same size was placed at Site 19697. A 1.0 by 1.0 m test unit was placed at Site 19696. All units were found to contain silty brown, loamy soil with numerous stones. The unit at Site 19696 yielded charcoal samples as well as ecofactual samples. The charcoal samples were sent to Beta Analytic, Inc. of Miami, Florida, for radiocarbon dating analysis. The subsurface findings will be discussed in detail in the final report for this project.

Table 1. Summary of Identified Sites and Features

*SIHP Site No.	Formal Site/Feature Type	Tentative Functional Interpretation	#CRM Value Mode Assess.			+Field Work Tasks		
			R	I	C	DR	SC	EX
5665 A B	Complex (6)** Trail Cairn (5)	Transportation-marker Transportation Marker	M	L	L	+	-	-
19695	Overhang	Indeterminate	L	L	L	+	-	+
19696	Overhang	Temporary habitation	M	L	L	+	-	+
19697 A B C	Complex (3) Terrace C-shaped alignment Cairn	Temp. habitation-agriculture Agriculture Temporary habitation Marker	M	M	L	+	-	+
19698	Rock ring (2)	Indeterminate	L	L	L	+	-	-
19699	Alignment	Indeterminate	L	L	L	+	-	-
19700	Trail	Transportation	M	L	L	+	-	-

* State Inventory of Historic Places (SIHP) numbers. SIHP numbers are five-digit numbers prefixed by 50-10-05 and -11 (50=State of Hawaii; 10=Island of Hawaii; 05=USGS 7.5' series quad map ["Kawaihae, Hawaii"] ["Pu'u Hina, Hawaii"] 1982).

Cultural Resource Management Value Mode Assessment:

—Nature

R = scientific research

I = interpretive

C = cultural

—Degree

H = high

M = moderate

L = low

+ Field Work Tasks Completed:

DR = detailed recording (scaled drawings, photographs, and written descriptions)

SC = surface collections

EX = test excavations

** Number of component features within complex

GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Sites identified during this survey were assessed for significance based on the National Register Criteria for Evaluation, as outlined in the Code of Federal Regulations (CFR Title 36, Part 60). The Department of Land and Natural Resources - State Historic Preservation Division (DLNR-SHPD) uses these criteria for evaluating cultural resources. To be assessed as significant a site must possess integrity of location, design, setting, materials, workmanship, feeling, and association and must be characterized by one or more of the following four criteria:

- (A) It must be associated with events that have made a significant contribution to the broad patterns of our history;
- (B) It must be associated with the lives of persons significant in the past;
- (C) It must embody distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction; or
- (D) It must have yielded or may be likely to yield, information important in prehistory or history.

Sites were assessed for cultural significance using: (a) guidelines prepared by the National Park Service (National Register Bulletin 38: "Guidelines for Evaluating and Documenting Traditional Cultural Properties; Parker and King 1990), and (b) guidelines established by the State of Hawaii ("Draft Rules Governing Procedures for Historic Preservation Review" [DLNR Draft Rules 1989])(see Category E, Table 2). The Hawaii State guidelines utilize an additional fifth criteria (E) which defines significant cultural resources as ones that "have an important traditional cultural contribution or value to the native Hawaiian people or to other ethnic groups of the state" (DLNR Draft Rules 1989:A:10).

Most archaeological sites are initially evaluated as significant under Criterion D. After the evaluative process of an inventory survey, or the data recovery process of a mitigation program, the research potential of some sites may be exhausted (i.e., after extensive mapping, testing, surface collection, historical research, etc.). In these cases, the sites may maintain their information content *value* but lose their information content *significance*. Hence, the sites would be considered as "No Longer Significant" (NLS)(see Table 2).

To further facilitate client management decisions regarding the subsequent treatment of resources, the general significance of all archaeological remains identified during the survey were also evaluated in terms of three cultural resource management value modes, which are derived from the previously mentioned federal evaluation criteria. Sites were evaluated in terms of potential scientific research, interpretive, and/or cultural values. *Research value*.

Table 2. Summary of General Significance Assessments and Recommended General Treatments

#SIHP Site No.	Significance Category						Recommended Treatment			
	A	B	C	D	E	NLS	FDC	NFW	PID	PAI
19695	-	-	-	-	-	+	-	+	-	-
19698	-	-	-	-	-	+	-	+	-	-
19699	-	-	-	-	-	+	-	+	-	-
Subtotal:	0	0	0	0	0	3	0	3	0	0
19696	-	-	-	+	-	-	+	-	-	-
19697	-	-	-	+	-	-	+	-	-	-
Subtotal:	0	0	0	2	0	0	2	0	0	0
5665	-	-	-	-	+	+	-	+	-	-
19700	-	-	-	-	+	+	-	+	-	-
Subtotal:	0	0	0	0	2	2	0	2	0	0
Total:	0	0	0	2	2	5	2	5	0	0

* State Inventory of Historic Places (SIHP) numbers. SIHP numbers are five-digit numbers prefixed by 50-10-05 and -11 (50=State of Hawaii; 10=Island of Hawaii; 05=USGS 7.5' series quad map ["Kawaihae, Hawaii"] ["Pu'u Hinal, Hawaii"] 1982).

General Significance Categories:

- A = Important for historical contribution to significant events and/or broad patterns of history;
- B = Important for association with the lives of important individuals in history;
- C = Excellent example of site type at local, region, island, State, or National level (PHRI=interpretive value);
- D = Important for information content, further data collection necessary (PHRI=research value);
- E = Culturally significant (PHRI=cultural value);
- NLS = No longer significant, significant data collected, important for information content only, no further data collection necessary (PHRI=research value, SHPD=no longer significant)

Recommended General Treatments:

- FDC = Further data collection necessary (detailed recording, surface collections, and limited excavations, and possibly subsequent data recovery/mitigation excavations);
- NFW = No further work of any kind necessary, sufficient data collected; no preservation potential;
- PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work);
- PAI = Preservation "as is", with no further work (and possible inclusion into landscaping), or possibly minimal further data collection necessary

refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and inter-regional levels of organization. *Interpretive value* refers to the potential of archaeological resources for public education and recreation. *Cultural value* refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values. See Table 1 for individual assessments of sites.

Based on the above federal and state criteria, of the seven sites identified in the project area, five are assessed as no longer significant and require no further work. Three of these sites (19695, 19698, and 19699) lack cultural deposits and portable remains; they have been measured, described, and photographed, and their locations have been plotted. The data collected from them during the present survey are considered sufficient recovery of significant information. Two of the five sites (5665 and 19700) are trail remnants. Normally, prehistoric trails are assigned a *cultural value* (Criterion E) and are recommended for preservation. Both of these examples (within the project area), however, are short remnant spans with other portions not well preserved. It is recommended that no further archaeological work occur at the trail locations within the project area. Preservation of Sites 5665 and 19700 (within the project area) is not essential; it is recommended, however, that the more preserved portions of Site 5665 be considered for inclusion into development landscaping.

Two sites (19696 and 19697) are assessed as significant for information content and are recommended for further data collection. Test units were placed at both sites and the unit at Site 19696 contained an apparently intact cultural layer. At Site 19697, a possible temporary habitation-agriculture complex, further test excavations at Feature A may yield analyzable pollen samples.

It should be noted that the above assessments and treatment recommendations are based on a surface and limited subsurface inventory survey of the project area. There is always the possibility, however remote, that potentially significant subsurface cultural remains will be encountered in the course of future archaeological investigations or subsequent development activities. In such situations, archaeological consultation should be sought immediately.

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