Lorraine R. Inouye
Mayor

Norman K. Hayashi
Director

Tad Nagasako
Deputy Director

Planning Department

County of Hawaii • 25 Aupuni Street, Room 109 • Hilo, Hawaii 96720 • (808) 961-8288

November 12, 1992

Mr. Brian Choy, Director
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, HI 96813

Dear Mr. Choy:

Final Environmental Assessment (Negative Declaration)
Applicant: GTE Hawaiian Tel Company
Request: Establishment of Interisland Submarine Fiber Optic Cable
Tax Map Key: 6-2-2:8 & Portion of 6

Enclosed please find four (4) copies of the Final Environmental Assessment and applicable comments for the establishment of interisland submarine fiber optic cable and related improvements. The proposed development would affect the minimum 40-foot shoreline setback area of the County of Hawaii, therefore, triggering Chapter 343, HRS, relating to the Environmental Impact Statement.

We have completed the 30-day draft Environmental Assessment (Negative Declaration Anticipated) period; therefore, we are submitting these attachments as a Final Environmental Assessment (Negative Declaration) with the inclusion of all pertinent information. All documents and comments have been reviewed and it is determined that the proposed project will not have significant impacts on the environment. This determination is based on the contention that concerns and issues, as stated by reviewing agencies, in their correspondences, will be addressed and mitigated through conditions of the SMA Use Permit and Shoreline Setback review process, should the project be approved.

Comments on the Final EA should be submitted to:

Norman K. Hayashi
Planning Director
County of Hawaii
25 Aupuni Street
Hilo, HI 96720

1992-12-08-HI-FEA-GTE Hawaiian Tel Interisland Fiber Optic Cable System

DEC - 8 1992 FINAL

ENVIRONMENTAL ASSESSMENT for the

FILE COPY

GTE HAWAIIAN TEL INTERISLAND FIBER OPTIC CABLE SYSTEM Spencer Beach Park, Island of Hawaii

OCTOBER 1992

PREPARED FOR:

GTE Hawaiian Tel
1177 Bishop Street
Honolulu, Hawaii 96813

RMTC
R. M. Towill Corporation

420 Waiakamilo Rd., Suite 411
Honolulu, Hawaii 96817-4941
(808) 842-1133 • Fax: (808) 842-1937

ENVIRONMENTAL ASSESSMENT

FOR THE

GTE HAWAIIAN TEL
INTERISLAND FIBER OPTIC CABLE SYSTEM

SPENCER BEACH PARK, ISLAND OF HAWAII

Prepared for:

GTE HAWAIIAN TEL
1177 Bishop Street
Honolulu, Hawaii 96813

OCTOBER 1992

Prepared By:

R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

PROJECT SUMMARY

Project:	GTE Hawaiian Tel Interisland Fiber Optic Cable System
Applicant:	GTE Hawaiian Tel 1177 Bishop Street Honolulu, Hawaii 96814 Contact: Larry Hartshorn 546-2378
Accepting Authority:	County of Hawaii, Department of Planning
Tax Map Key:	6-2-02:8, por. 6
Location:	Spencer Beach Park
Project Area:	5,000 Square Feet
Owner (6-2-02:8):	Department of Parks and Recreation County of Hawaii 25 Aupuni Street Hilo, Hawaii 96820 961-8311
Owner (6-2-02: por. 6):	National Park Service U.S. Department of the Interior 300 Ala Moana Boulevard Honolulu, Hawaii 96850 541-2693
Agent:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817 842-1133
Existing Land Uses:	Recreational area, Beach Park
State Land Use District:	Conservation
General Plan Land Use Designation:	Open
County Zoning Designation:	Open, allows utility installations

SECTION 1
INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

The purpose of this study is to ascertain whether the anticipated impacts of establishing and operating a fiber optic cable landing facility will have a significant adverse impact upon the environment. A determination (Negative Declaration) that the anticipated impacts of the proposed project will not have a significant adverse effect upon the environment is sought.

GTE Hawaiian Tel proposes to develop an interisland submarine fiber optic cable system which will link the Islands of Kauai, Oahu, Maui, and Hawaii to supplement its existing interisland radio system. The system will include three interisland submarine cable segments with 5 landing sites (see Figure 1). The proposed landing sites are in the vicinity of Wailua Golf Course on Kauai; Kahe Point and Sandy Beach Park on Oahu; Mokapu Beach on Maui; and Spencer Beach Park on Hawaii. The purposes of the project are to provide additional capacity to accommodate projected interisland telecommunication traffic; to increase system integrity; and, to ensure additional path diversity.

GTE Hawaiian Tel is Hawaii's largest phone service provider. In 1990, Hawaiian Tel processed over 7 million calls per day, or over 4,800 calls per minute. Annually, this accounted for approximately 2.6 billion calls. The current level of service experienced by GTE Hawaiian Tel is at the forefront of a growth trend that has continued uninterrupted, since at least 1981, when Hawaii had almost 432,000 telephone access lines. Today that number has increased by almost 30 percent to over 555,000 lines (The State of Hawaii Data Book, 1990).

GTE anticipates that by 1993 its existing radio facilities will be unable to adequately process interisland phone transmissions, due to continuing and increasing levels of service demand. To overcome this limitation GTE proposes to carry out planning and implementation of a submarine fiber optic interisland cable network to handle the increasing volume of telephone traffic.

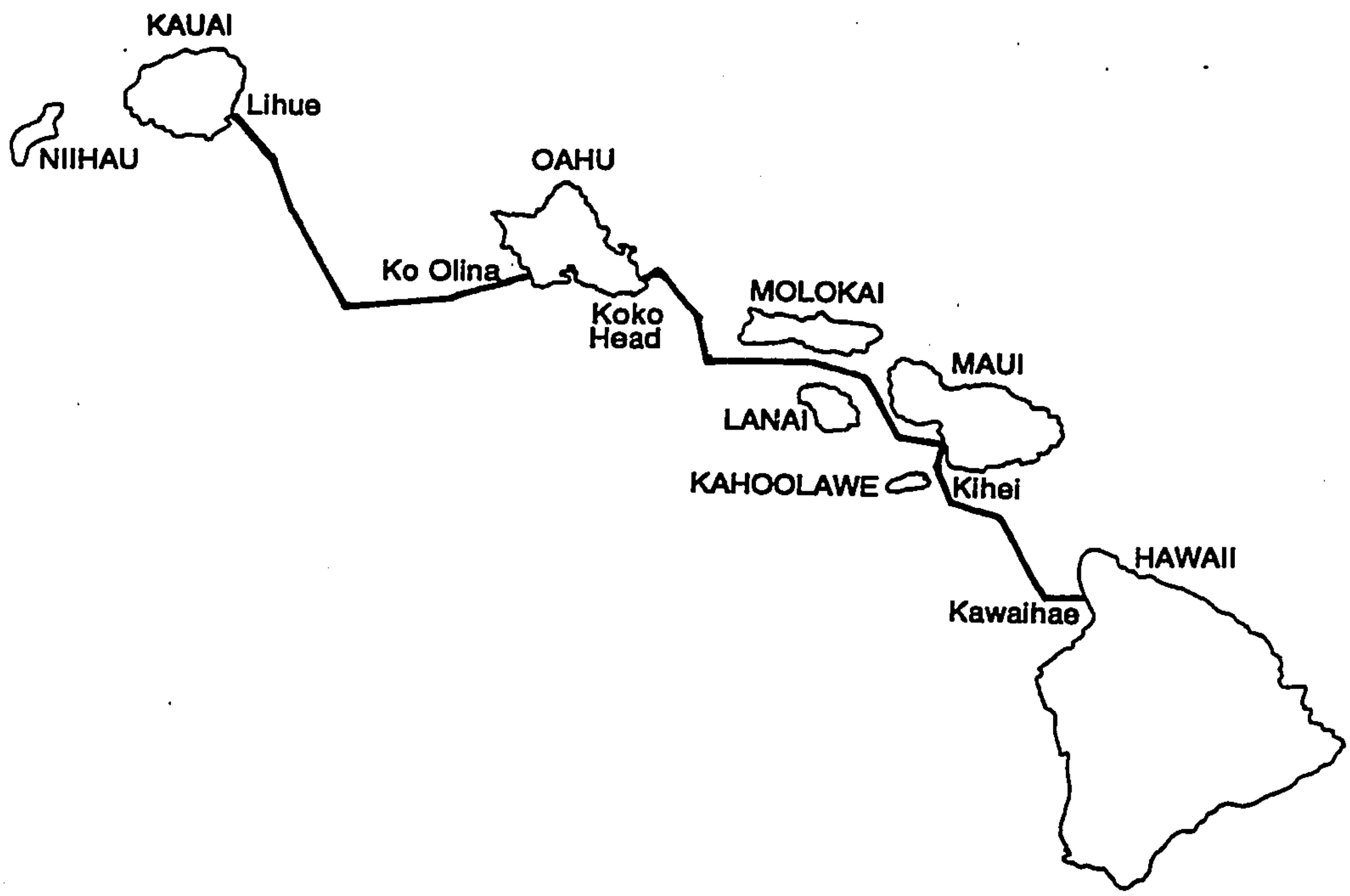

Figure 1
INTERISLAND SUBMARINE FIBER

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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JANUARY 1992

1.2 PROJECT LOCATION

The fiber optic cable landing facility for the Maui to Hawaii segment is proposed to be established at Spencer Beach Park. The facility only involves laying of the cable line from the shoreline to the nearest GTE overhead telephone facility. From there, the fiber optic cable will be routed on existing overhead telephone facilities to the nearest telecommunications substation.

Spencer Beach Park, which is owned by the County of Hawaii (see Figure 2), is located 1,000 feet directly south of the Kawaihae Harbor Breakwater, South Kohala District, Tax Map Key: 6-2-02: 8. Kailua-Kona is located 30 miles to the south and Waimea Town is located 10 miles to the east.

From Spencer Beach Park the cable will be buried within the Spencer Road right-of-way which leads to Akoni Pule Highway and be installed overhead within the Akoni Pule Highway and Queen Kaahumanu Highway rights-of-way to the applicant's central office located approximately one-half mile south of the Akoni Pule Highway/Queen Kaahumanu Highway Intersection (see Figure 3).

Surrounding land uses include the Puukohola Heiau National Historic Site owned by the United States of America and abuts Spencer Beach Park to the north, and vacant lands owned by the Queen Emma Foundation to the east and south. Kawaihae Harbor is located to the north and is a deep water port serving industrial and commercial uses and deep sea fishing activities. Shoreside of the harbor is the town of Kawaihae and harbor support uses.

Approximately 200 feet makai of the Puukohola Heiau and adjacent to the beach park access road is the Mailekini Heiau.

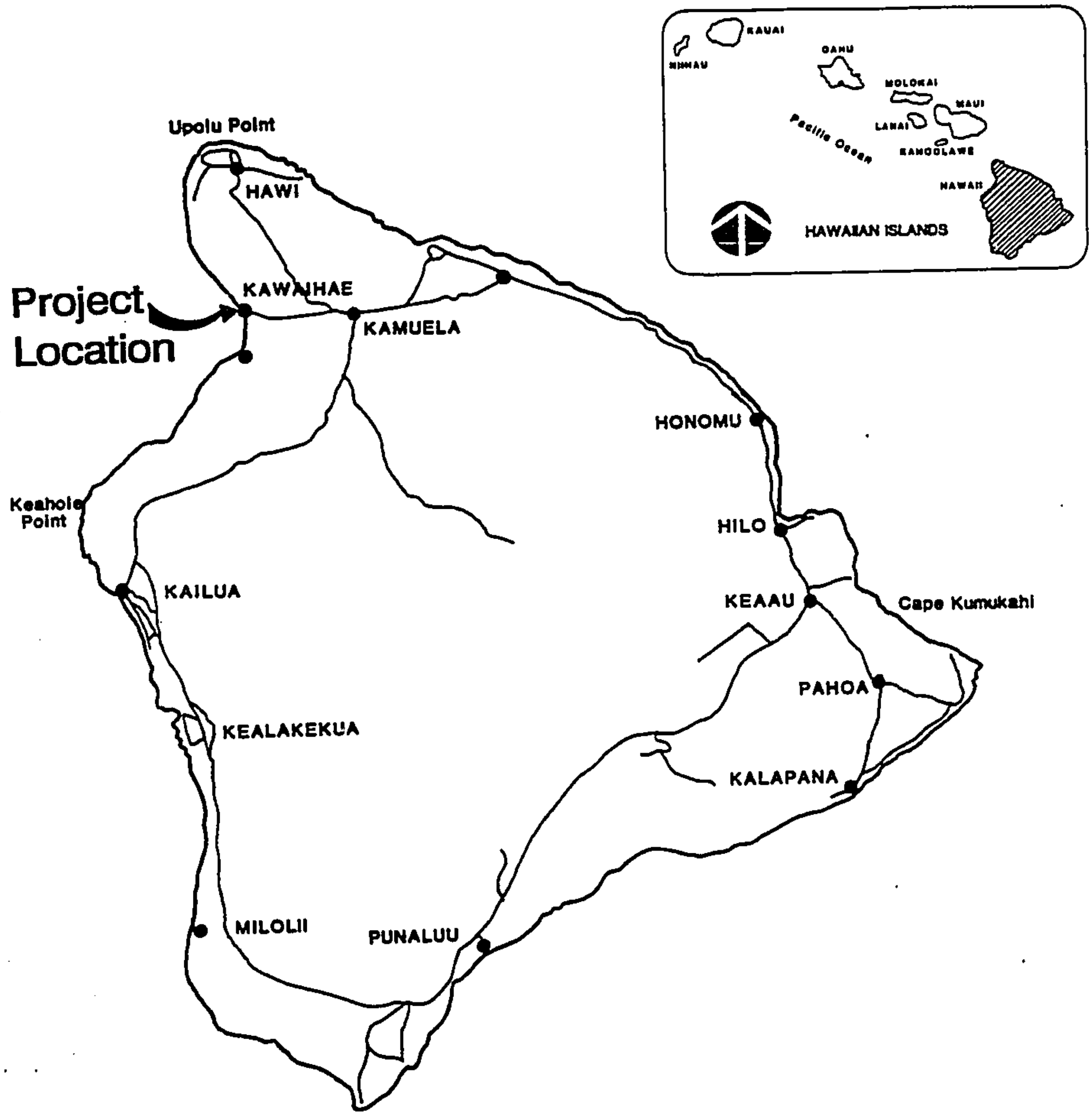

Figure 2
LOCATION MAP

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

0 15 30
MILES

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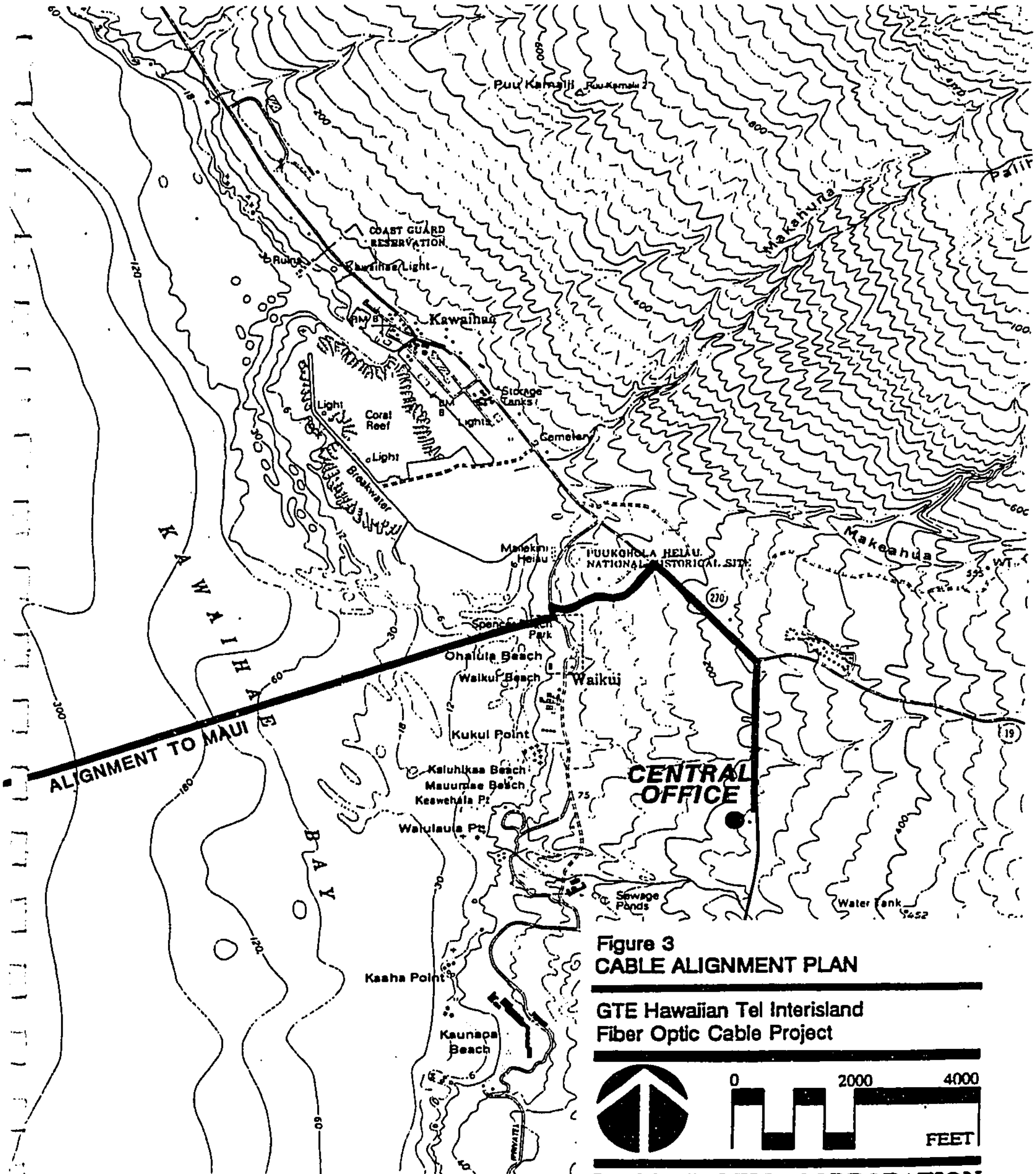

Figure 3
CABLE ALIGNMENT PLAN

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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SECTION 2

PROJECT BACKGROUND

2.1 CABLE TECHNOLOGY

The following is a discussion of existing telecommunication cable technology and how the determination was made to use fiber optics.

2.1.1 Copper and Fiber Optic Cables

The alternative to fiber optic cable is the use of copper wire cable. Copper wire cables function using a large number of plastic-coated copper wires housed within a plastic or synthetic outer casing. If necessary, steel or other protective materials would be added to ensure strength and resistance to abrasion and breakage. In order to receive a voice transmission an electrical signal must be sent through a pair of copper wires to a receiver, where the electrical signal is converted back into sound. A typical cable, approximately 4 inches in diameter (without the outer protective casing), would house 600 copper wires with the capacity of approximately 3,600 voice circuits.

The copper wire cable will also require use of a repeater to boost the electrical signal over long distances to ensure adequate signal strength at the receiving station. Repeaters will be necessary approximately every 6,000 feet and require a high voltage power source to operate. Repeater dimensions for a 1,200 voice circuit will be approximately 1 to 2 feet in diameter by 3 feet long. Therefore, to accommodate the 4-inch diameter copper cable described above, at least 3 repeaters would be required every 6,000 feet with a requisite power source supplying power to the cable.

In contrast, fiber optic technology relies on use of optical fibers and the transmission of light pulses which are converted into voice signals by the telephone company receiving station. The proposed fiber optic cable would contain approximately 12 fiber optic strands and would be housed in a plastic and steel casing no more than approximately 3 inches in diameter (see Figure 4). Like the copper cable, steel or other protective materials would be added as needed for strength. Each pair of fiber optic strands would be capable of handling

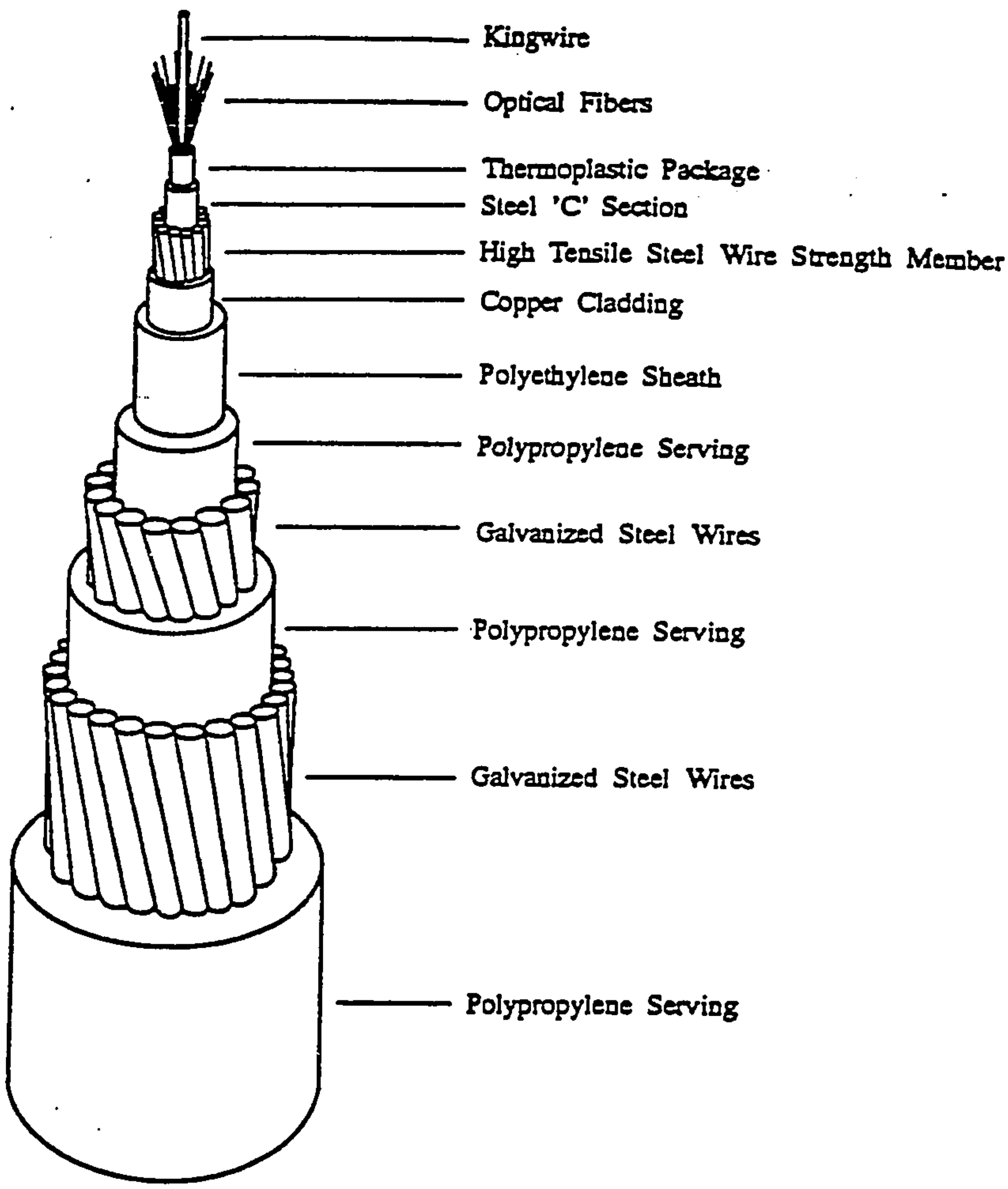

Figure 4
DOUBLE ARMOR FIBER OPTIC CABLE

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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JANUARY 1992

approximately 8,000 voice circuits, for a combined total on the order of 40,000 voice circuits (2 strands = 1 pair, 12 strands = 5 pairs working plus 1 pair spare, and 5 pairs x 8,000 voice circuits = 40,000 voice circuits. In addition, in order for a copper cable to achieve the capacity of a fiber optic cable, it would have to approach a diameter of approximately 8 to 10 feet, would require repeaters, and a high-voltage power line in addition to the copper cable.

Fiber optic technology was selected because:

- Fiber optic cables provide superior capacity and do not require high-voltage repeaters;

- The smaller diameter fiber cable ensures there will be minimal disturbance necessary to site the cable. There is less land needing to be graded, cleared and stockpiled in order to site a 3-inch diameter cable versus a 10' diameter cable;

- Sensitive areas that might otherwise be disturbed because of larger equipment and increased mobilization and noise problems would be greatly reduced; and

- Length of time on site would be greatly minimized. Sensitive public or open space areas would not require a lengthy stay by the construction team and therefore would minimize any hardships upon beach users including swimmers, fishermen, surfers and other users.

2.2 SUBMARINE CABLE ROUTE

The submarine cable route selection process involved identification of areas warranting study, based on a set of minimum evaluation criteria. The criteria includes rapid erosion, giant landslides, drowned coral reefs, seismic activity, dumping areas, ship and airplane wrecks, other cables, and the length of routes.

In August 1991 a study was conducted by Seafloor Surveys International (SSI) to preliminarily identify an ocean route for the GTE Hawaiian Tel Submarine Fiber Optic Cable System. The route selected was one that minimized potential hazards to the installation, and eased maintenance and operation of the cable over a projected 25 year lifetime.

The following provides a detailed description of each of these criteria:

2.2.1. <u>Rapid Erosion</u>

The greatest danger to this cable system, in the submarine portion of the route, is related to the geologically young age of the "Hawaiian Islands and the resulting extremely high erosion rates. The rapid erosion places large volumes of unconsolidated sediment into the shallow waters surrounding the islands. These sediment deposits move rapidly down the steep island slopes when they become unstable. This down-slope sediment movement can be initiated by earthquakes, storm runoff, and storm waves. Installation of cables on steep, sediment-covered submarine slopes should be avoided if possible. Where these slopes cannot be avoided, the cable should traverse as directly up the slope as possible" (SSI, August 1991).

2.2.2 <u>Giant Landslides</u>

Over the past several years, mapping of the Hawaiian Exclusive Economic Zone by the U.S. Geological Survey, using the long range Gloria sonar system, a relatively low-resolution, reconnaissance sonar, has discovered a series of large landslides surrounding the Hawaiian Islands (Moore, et.al., 1989). "The primary danger presently posed to the cable by these inactive landslides is their extremely rough surface. The seafloor in the slide areas are known to be littered with huge volcanic boulders. These boulders have been observed from submersibles to often be the size of a house. These slide surfaces pose a serious threat by producing unacceptable cable spans where the cable is draped over individual blocks, as well as the possibility of having the cable getting tangled if it had to be retrieved for repair" (SSI, August 1991).

2.2.3 Drowned Coral Reefs

A series of drowned coral reefs surrounding the islands are considered dangerous to the Interisland Fiber Optic Cable System. "Locally steep slopes associated with these reefs could cause unacceptable cable spans in areas where strong bottom currents can be expected" (SSI, August 1991).

2.2.4 Seismic Activity

"The greatest danger to the cable from earthquakes is not the actual fault displacement itself, but the possibility they will initiate movement of unstable sediment deposits on the slopes of the islands. Epicentral locations of earthquakes with magnitude 3 or larger in the Hawaiian region should be avoided by the fiber optic cable" (SSI, August 1991).

"Seismic activity in the Hawaiian Islands is concentrated in the vicinity of the active volcanoes on the Island of Hawaii, where it is primarily related to the on-going volcanic activity. There are also earthquakes related to the tectonic subsidence of the islands due to the load that the growing volcanoes is putting on the earth's crust. These tectonic earthquakes are also concentrated in the area surrounding the Island of Hawaii, where the greatest subsidence is taking place" (SSI, August 1991).

2.2.5 Dumping Areas

"Dredge Spoils disposal sites authorized by the U.S. Army Corp of Engineers are located close to all major island harbors and should be avoided by the cable route" (SSI, August 1991). Other dumping sites, including explosives ordinance, will also have to be avoided.

2.2.6 Ship and Airplane Wrecks

A complete, high resolution side-scan survey of the proposed cable route should be carried out to determine that the route is free of man-made hazards such as ship wrecks and lost airplanes. There have been numerous ships and airplanes lost at sea in the Hawaiian area which have never been located.

2.2.7 Other Cables

There are several other cables in the planning stage including Pac-Rim East (from Hawaii to New Zealand), HAW-5 (from California to Hawaii), the Hawaii deep water electric transmission cable (from Hawaii to Oahu via Maui), and the Tri-Island power cables (linking Maui, Molokai and Lanai). Aside from these commercial cables, the University of Hawaii plans to install a fiber optic cable for neutrino research offshore from Keahole Point north of Kailua, Kona.

Along parts of this route the cable will have to be laid in close proximity to other, presently existing communications cables. In these areas, the recommendations of the International Cable Protection Committee (ICPC) should be used as a guideline. At their 1985 Plenary Meeting in Sydney, Australia, ICPC recommended that no previously existing cable be crossed at less than a 45 degree angle, the closer the crossing can be to a right angle the better, and where possible a spacing of five miles should be maintained.

Prior to making final decisions on cable placement, ICPC also recommends that American Telephone and Telegraph (AT&T) be contacted to determine if there are conflicts with military or other government cables.

2.2.8 Length of Routes Less Than 200 Kilometers

All routes are designed to be less than 200 kilometers in length in order to be serviced by repeaterless cables. The fiber optic cable will operate on a single light transmission source generated from its Central Office and transmitted to a receiving Central Office. Since repeaters will not be required to retransmit the signal, no electrical power will need to be routed through the cable.

2.3 LANDING SITES SELECTION

In August of 1991 a study was conducted to select landing sites for the GTE Hawaiian Tel Fiber Optic Cable System connecting the islands of Kauai, Oahu, Maui, and Hawaii. A set of criteria was used to reduce the field of potential landing sites. The advantages and disadvantages of each site were evaluated to provide the basis for comparing the sites.

The following is a brief discussion of criteria for determining landing sites:

2.3.1 Shoreline/Nearshore Conditions

The shoreline and nearshore conditions are a consideration because the depth of the water from the landing site towards the ocean must be deep enough to protect the cable. Approximately 50 to 60 feet of water will be required before wave forces diminish to levels where wave action does not affect the cable. Areas with extensive shallow water far from shore (i.e.4,000'+) were considered difficult or suboptimal in providing protection during storms and other high wave conditions.

The composition of bottom conditions limits acceptable landing sites. Sandy bottoms are preferred in order to minimize any possible environmental impacts of anchoring, armoring, or trenching through rock or coral in order to securely fasten the fiber optic cable. Also if the ocean bottom has extensive sand deposits, especially adjacent to the shoreline the cable can eventually be covered by sand, providing maximum protection against wave forces.

2.3.2 Public Use Considerations

It is anticipated that impacts to public recreational areas will be minimal given the short-term and relatively minor requirements for installing a fiber optic cable. However, because of potential for conflicts with area users, landing sites in areas of major public use are considered a constraint to selection.

Areas of potential historical and archaeological significance in close proximity to cable landing sites are also considered a constraint to selection, due to the possibility of destroying a historic site.

2.3.3 Environmental/Natural Resource Considerations

The landing sites should not be within proximity to rare or endangered species or their habitats in order not to disturb them.

Impacts to shoreline and ocean water quality should be kept to a minimum. Sites which would require extensive ocean anchoring and cable protection work (i.e., shielding/dredging) and/or on-shore excavation in ground conditions which promote soil erosion should be avoided.

2.3.4 Alternative Landing Sites

Three possible Hawaii landing sites for the Big Island to Maui segment where underwater geology would be most suitable are Spencer Beach, Hapuna Beach, and Mauna Kea Beach. Spencer Beach is proposed as the preferred landing site because it has the most advantageous access to shoreline. A nearshore alignment is available which can avoid most of the reef and coral heads which lie alongside and within a sand channel leading away from the shoreline to the ocean. The site is also close to an existing GTE Hawaiian Tel Central Office which would allow for minimal construction work in order to site the cable.

Should Spencer Beach be removed from consideration, Hapuna Beach is recommended as an alternative site. Hapuna Beach possesses positive site features including a sandy bottom with available access to shore. Coral heads and finger coral are usually found in deeper water, and may potentially be crossed with minimal disturbance to the area. In addition, historic and archaeological sites are not expected to be discovered (Discussion with DLNR, Historic Sites Office). However, the single most important constraint with Hapuna Beach, is its heavy use by the public for scenic and recreational uses.

SECTION 3
CONSTRUCTION ACTIVITIES

3.1 GENERAL

Construction of the project will be accomplished in two phases. The first phase includes all construction activities on land and the second phase includes conducting all work necessary to prepare the landing site and actual landing of the interisland submarine cable.

The land-side construction activities involve the construction of a new manhole and the installation of 2,300 lineal feet of underground cable and ducts to Akoni Pule Highway.

The second phase of work entails the laying of the submarine fiber optic cable between Hawaii and Maui and connecting it to the fiber optic cable installed within the new manhole at the Spencer Beach landing site.

3.2 LAND-SIDE ACTIVITY

A new reinforced concrete manhole approximately 5'x10'x4' will be constructed on Spencer Beach Park (see Figure 5). The manhole will be the terminus of the land-side activities and shall be constructed to receive the submarine cable. Approximately 2,300 lineal feet of four, 4-inch diameter PVC ducts will be installed in a trench from the manhole to Spencer County Road and along the new proposed relocated Spencer Road to Akoni Pule Highway. The ductline will cut across the existing Spencer County Road and travel along the shoulder of the proposed relocated Spencer County Road until it reaches Akoni Pule Highway. Traffic will be affected during the trenching operations across Spencer County Road and may be detoured around the construction equipment. Traffic control procedures such as rerouting the traffic onto the shoulder of the road with the aid of necessary safety measures such as temporary traffic control devices (cones) and/or flagmen to direct traffic will be implemented.

The new underground ducts will be encased in a concrete jacket and buried under 3-4 feet of earth cover. Only one duct will be utilized while the others remain vacant and retained

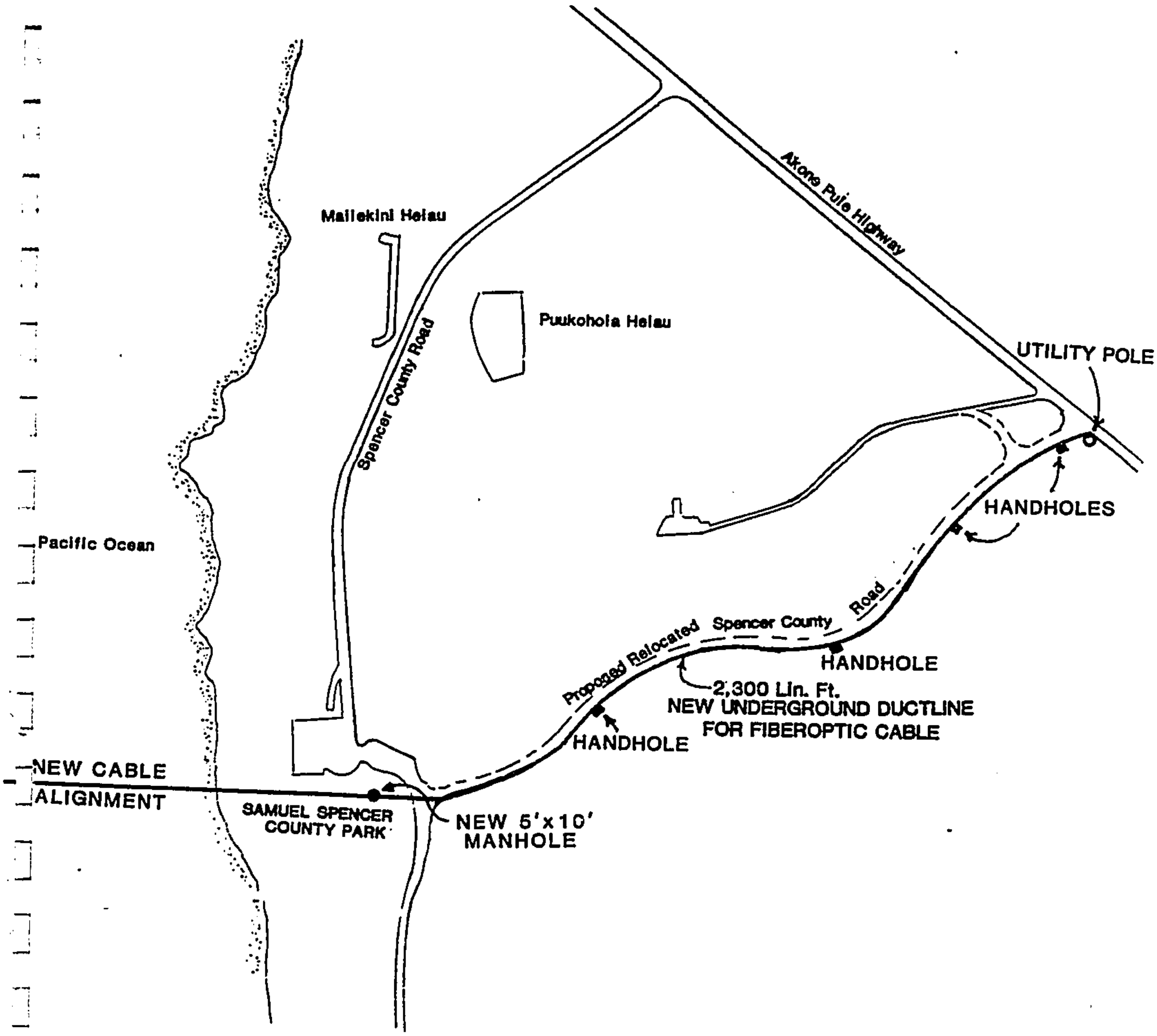

FIGURE 5
SITE PLAN

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

Not to Scale

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FEBRUARY 1992

should their future use be necessary. At Akoni Pule Highway the underground cable will be diverted upwards onto a utility pole and carried overhead on existing utility polelines to the central office located nearby on Queen Kaahumanu Highway. Approximately four, 4'x6'x6' deep reinforced concrete handholes will also be constructed along the ductline at 500' intervals.

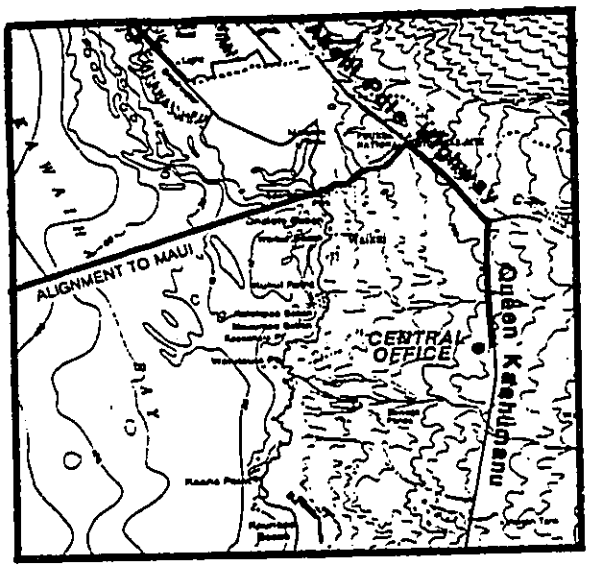
The area of Spencer Beach Park where the proposed trenching and underground duct line will traverse also has scattered trees. When sighting the trench and underground duct line alignment every effort will be made to try and avoid damaging the trees.

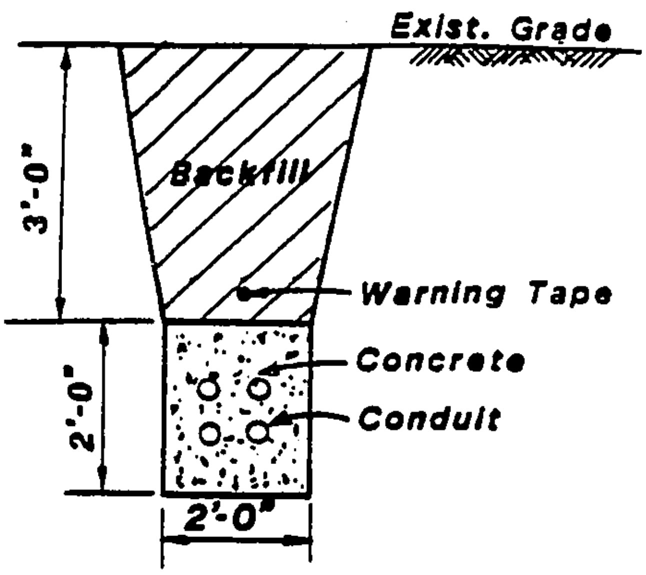
3.3 NEARSHORE ACTIVITY

A 200-foot long trapezoidal shaped trench will be excavated between the new manhole and the mean low water mark and four 6-inch steel conduits encased in concrete will be installed within the trench (see Figure 6B). Only one conduit will be used while the others will be plugged and retained should their future use be necessary. The trench will have a 2-foot base and be approximately 4 feet deep, with a 1:1 side slopes. Approximately 178 cubic yards of sand and rubble excavated from the trench will be stored on the beach adjacent to the cable easement for later use as backfill. The trench will be backfilled after the concrete jacket has cured.

Sand and rubble covering the proposed cable segment may need to be removed below the level of the prevailing tides. For this process, a backhoe, shovels, or other mechanical means will be used tc remove the upper layers. Remaining sand or rubble will be removed using a hydro-jet. If necessary, sandbags will be used to prevent sand from reentering the open trench. Rock outcrops and other hard substrate which cannot be avoided will also be removed using a backhoe or other similar mechanical means.

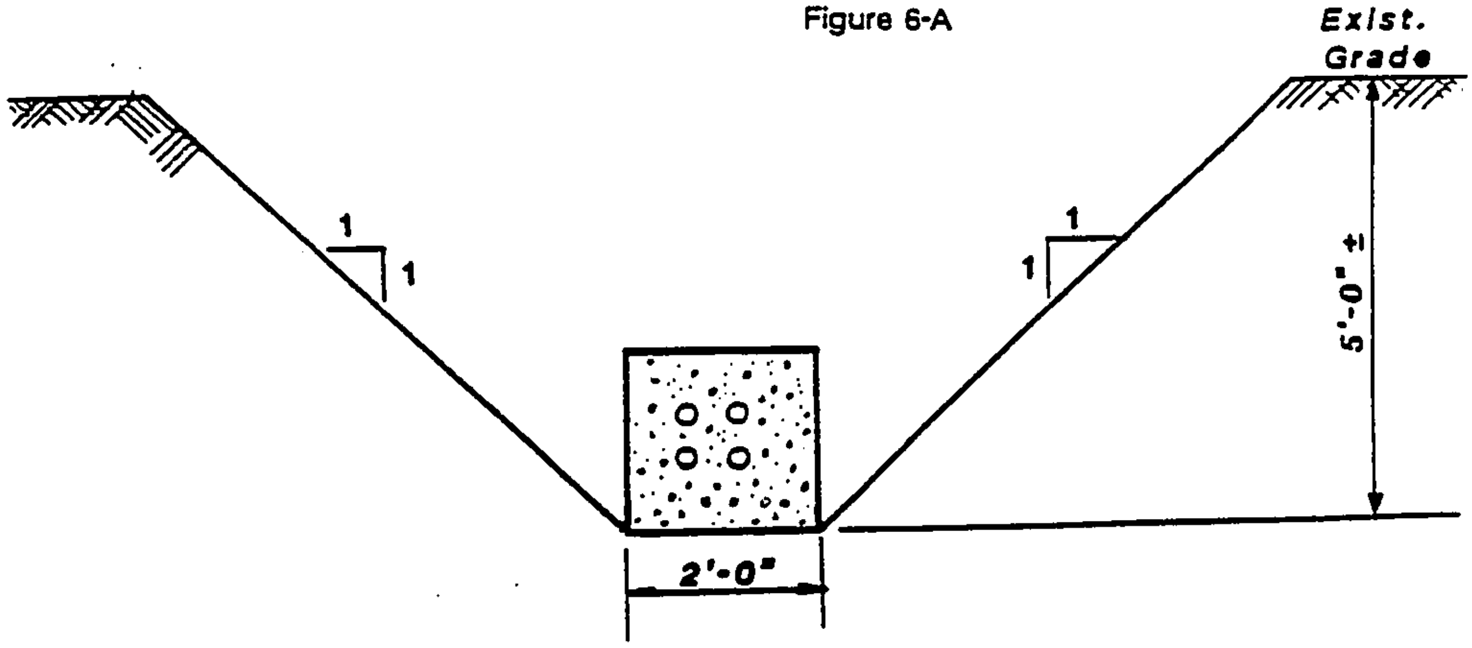
To reduce potential for turbidity due to construction, silt screens or filters will be used. Upon completion of construction activities, the work crew will make every reasonable effort to return the ground to existing preconstruction contours through use of on-site excavated materials for backfill.





NEW MANHOLE AT SPENCER BEACH TO AKONE PULE HIGHWAY

Figure 6-A



NEW MANHOLE TO OCEAN

Figure 6-B

Figure 6
TRENCH SECTIONS

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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FEBRUARY 1992

Two range targets (alignment guide) will be placed on land just prior to the landing of the cables to aid in the cable laying process. The range targets will be placed on temporary structures and will be removed following the cable landing. The range targets will not disrupt traffic movements along Spencer Road.

A cable laying ship provided by the cable vendor will serve as the primary means of laying the fiber optic cable. The following procedures describe the activities involved during the cable landing operations.

The ship's captain will approach the landing site using the range target to align the ship as it approaches the shore. The range targets will be placed by a cable receiving party according to previously surveyed coordinates. Once the ship approaches the shore landing to the minimum depth allowable, it will fix its position relative to the landing site using anchoring, tugboats, side-thrusters or other means. As the ship fixes its position, it will begin laying out cable.

The ship will lay cable while its personnel attach suspension floats at regular intervals to the cable. As the cable is lowered to the water, it will float, allowing it to be pulled toward shore using a winch, small motor boat, or other mechanical means.

The shore landing will be specially prepared to accept the cable. As the cable nears the shore, it will be fed into the steel conduit previously buried in the sand and the cable will be pulled to the new manhole. When the cable is secured in the manhole, it will be temporarily anchored while the divers readjust the suspension floats in the water to obtain a proper nearshore to shoreline alignment.

Once the cable is aligned, it will be permanently installed in the manhole and the divers will cut the remaining floats away, allowing the rest of the cable to sink to the ocean bottom.

Following this action, the cable ship will commence with cable laying operations to the next landing site. The ship will follow a prescribed survey route until it reaches the other landing site where the end of the cable can be similarly connected.

The proposed cable alignment at the landing site will be directed through a sand channel, which connects the beach to a large offshore sand deposit. The water depth in the sand channel is typically 10 to 15 feet and there are many large coral formations within the channel which rise vertically up from the channel bottom to within a few feet of the surface.

The sand, both in the inner channel and the offshore deposit, is relatively fine and has a high silt content. Besides the coral outcrops in the sand channel, there is also a 50-foot wide basalt shelf at the toe of the beach.

A straight line route was selected to avoid much of the coral formations in the channel. Most of the coral outcrops can be avoided by carefully maneuvering the cable between the formations. During the cable landing, the floats will be successively cut from the cable and allowed to sink. Several small boats may be used during the landing process to weave the cable into place between the coral formations prior to cutting the floats. All bends will be relatively gentle and well within the bending radius of the cable.

Coral, rock and other hard surfaces that cannot be avoided will have to removed or circumvented by various means such as:

1. Coral beds may need to be trenched to a width and depth of approximately 1 to 2 feet, or more, to accept the fiber optic cable. If necessary, tremie concrete can be poured into the trench where it can harden under water.

   If tremie concrete is used, it will provide a new surface for growth of coral and other marine organisms; or,

2. Shielded cable may be laid with split pipe fastened around the cable and then bolted to the hard rock or coral bed using pneumatic or mechanically driven bolts. This practice will result in minimal environmental impact since little or no coral will have to be displaced to site the cable.

In the area of the basaltic shelf, the cable will probably be pinned to the bottom, or trenched into the shelf. The water at the seaward boundary of the shelf is only about 3 feet deep.

3.4 SAFETY AND ENVIRONMENTAL CONSIDERATIONS

During the construction phase on the beach (approximately 1-2 calendar days in May-June 1993), the portion of the beach which contains the open trench will be barricaded from public entry. During the construction period, a security guard may be required at night and on weekends to ensure public safety and. integrity of the job site.

During the cable laying process (approximately 2 days), the nearshore waters will be closed to ocean activities (surfing, diving, boating, swimming) to ensure the safety of ocean users. The area that will be closed will be approximately 100-150 feet wide and 1,000-2,000 feet long. The actual area may be more or less depending on the tides. The period when the waters will be closed is not expected to be more than two days, weather permitting. This short-term "closure" of nearshore water areas will be achieved by publishing a notice to advise mariners to avoid the area. Further, during the cable laying process, project personnel will advise beach users to avoid the project site both on land and in the water via small powered water crafts.

All work shall be performed in conformance to all prevailing County, State, and Federal regulations regarding noise and dust control, the disposal of dirty or polluted water and construction debris and other environmental issues which may arise.

3.5 SCHEDULE AND ESTIMATED COST

The first phase (land-side activities) of the project is scheduled tentatively for February and March 1993. The second phase (installation of interisland cable and cable landing operations) is scheduled tentatively for April and May 1993. Construction cost for the first phase is estimated at $440,000.

SECTION 4
DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate

The project site and surrounding area is located on the lee side of the island and is generally warm and dry. The mean annual temperature is between 74 and 77 degrees Fahrenheit and the annual rainfall is between five and twenty inches, most of it occurring during winter months.

Impacts

The proposed project is not expected to impact the local climate of the project area and vicinity.

4.1.2 Topography, Geology and Soils

The project area lies at the base of two geologic formations, the Kohala Mountains and Mauna Kea Volcano. The predominant soil type for the area excluding the landing site consists of the Kawaihae Series particularly Kawaihae extremely stony very fine sandy loam, 6 to 12 percent slopes (KNC). The surface layer is dark reddish-brown extremely stony very fine sandy loam about two inches deep with hard pahoehoe lava bedrock beneath. Permeability is moderate, runoff is medium and erosion hazard is moderate (U.S. Department of Agriculture, Soil Conservation Service and University of Hawaii Agricultural Experiment Station, August 1972).

Soils at the landing site consist of beach land type made of sand and gravel.

Impacts

With respect to the segment of the cable to be installed subsurface, no long term surface impacts are anticipated since the project involves temporary excavation and filling with the same material. The excavated portions will be returned to its present status by reusing soil excavated for fill.

4.1.3 Hydrology

There are no perennial streams for the area. The major drainage features for the area is Makeahua Gulch to the north and an unnamed gulch approximately 2,000 feet to the south both of which are dry except for the rainy season.

Groundwater for the area is brackish and is not a source for domestic use.

Impacts

No adverse impacts are anticipated on surface water or groundwater since the project will not alter existing drainage patterns or have any long term water requirements. The project proposes the installation of a cable line within the shoreline area and does not affect any potable groundwater source.

It is anticipated that nearshore waters may become clouded during the trench excavation and backfilling operations. Silt or other types of filter screens to lessen turbidity effects may be erected to minimize this impact. Water collected during the dewatering process will be discharged on the beach adjacent to the work area.

4.1.4 Terrestrial Flora/Fauna

The area's flora is classified as lowland dry shrubland and typically contain plant species such as kiawe, piligrass, ilima, and fingergrass. Cattle pasture is the most common use for this type of plant environment. No rare or endangered species of plants are known to inhabit the site.

With respect to animal wildlife for the area, no rare or endangered animals are known to inhabit the site. Although a single siting of the hoary bat has been recorded at Spencer Beach Park, the area is a dry climate and sparse in vegetation and does not provide good habitats for rare animals known to exist in the area.

Impacts

Because the project area is not known to contain any rare plants or animals, adverse impacts are not anticipated. As part of the proposed development the exposed areas within the cable easement will be replanted.

4.1.5 Marine Flora and Fauna

Sea Engineering conducted a qualitative marine biological reconnaissance of Spencer Beach Park on 17 July 1991 and a quantitative sampling on 16 January 1992 (see Marine Environmental Analysis of Selected Landing Sites, Sea Engineering, Inc., and Environmental Assessment Co. Jan. 1992). The qualitative survey extended from shore to about the 90 foot isobath approximately 3,900 feet from shore. In this area three major zones or biotopes were defined. In general, the biotopes parallel the shore but in the proposed cable alignment, the most seaward biotope (the biotope of sand) extends into shallow water towards the beach. The presence of sand was an important factor in the selection of the proposed route. The biotopes recognized in the vicinity of the proposed cable alignment at Spencer Beach Park are: 1) the biotope of sand; 2) the biotope of emergent hard substratum and corals, and 3) the biotope of scattered corals. The biotope of emergent hard substratum and corals lies to the north and south of the proposed cable alignment. The biotope of sand is situated primarily seaward of the project area but encroaches as a 160 to 325 foot wide channel well into the study site to within 1400 feet of shore. Shoreward of the biotope of sand is the elongate biotope of scattered corals which is restricted to a sand channel that is oriented perpendicular to shore and cuts through the biotope of emergent hard substratum and corals. Inshore of the biotope of scattered corals on the proposed cable alignment is an area of sand that extends to the shoreline with a small area of scoured emergent hard substratum just seaward of the beach.

4.1.5.1 The Biotope of Sand

The biotope of sand lies principally seaward of the project site. It occurs as a "pie-shaped wedge" towards the shoreline in the area proposed for the cable alignment. As the name implies, the substratum in the biotope of sand is dominated by sand. Because of its shifting nature, the benthic species found in sand habitats are generally adapted for life on an unstable and frequently abrading environment. Many species that are found in this habitat will bury into the sand to avoid predators and the abrasion that occurs with storm waves. Thus many species in the sand biotope are cryptic and difficult to see; among those are many of the molluscs and crustaceans such as the kona crab (Ranina serrata). Hence, without considerable time spent searching in the sand many species in the sand habitat will not be seen. The biotope of sand is best developed at greater depths; where it enters the shallow water, many of the characteristic species become less abundant. Therefore, the inshore boundary of this biotope is arbitrarily shown well offshore (see Figure 7) despite the presence of considerable sand shoreward of this point.

Because of constraints with bottom time at the depth of which the biotope of sand is found as well as very poor water clarity on 16 January 1992, we did not quantitatively sample this biotope but rather utilized the data gathered in our qualitative reconnaissance of the habitat on 17 July 1991 in waters from 80 to 90 feet in depth. Species frequently seen in the biotope of sand include a number of molluscs: the helmet shell (Cassis cornuta), augers (Terebra crenulata, T. maculata and T. inconstans), the leopard cone (Conus leopardus) and flea cone (Conus pulicarius) as well as the sea hare (Brissus sp.), starfish (Mithrodia bradleyi), brown sea cucumber (Bohadschia vitiensis), opelu or mackeral scad (Decapterus macarellus), nabeta (Hemipteronotus umbrilatus), the goby-like fish (Parapercis schauslandi), uku or snapper (Aprion virescens), hihimanu or sting ray (Dasyatis hawaiiensis) and the weke or white goatfish (Mulloides flavolineatus). Undoubtedly, with greater searching, many more fish species would be encountered in this biotope.

4.1.5.2 The Biotope of Emergent Hard Substratum and Corals

Both to the north and south of the channel alignment is the biotope of emergent hard substratum and corals. This biotope may characterized as a hard substratum reef flat that is quite shallow, ranging from about 3 to 8 feet in depth. The biotope extends for a considerable distance both north and south of the study area. Although the proposed cable alignment does not cross this biotope, we sampled the biotope because of its proximity to the proposed alignment.

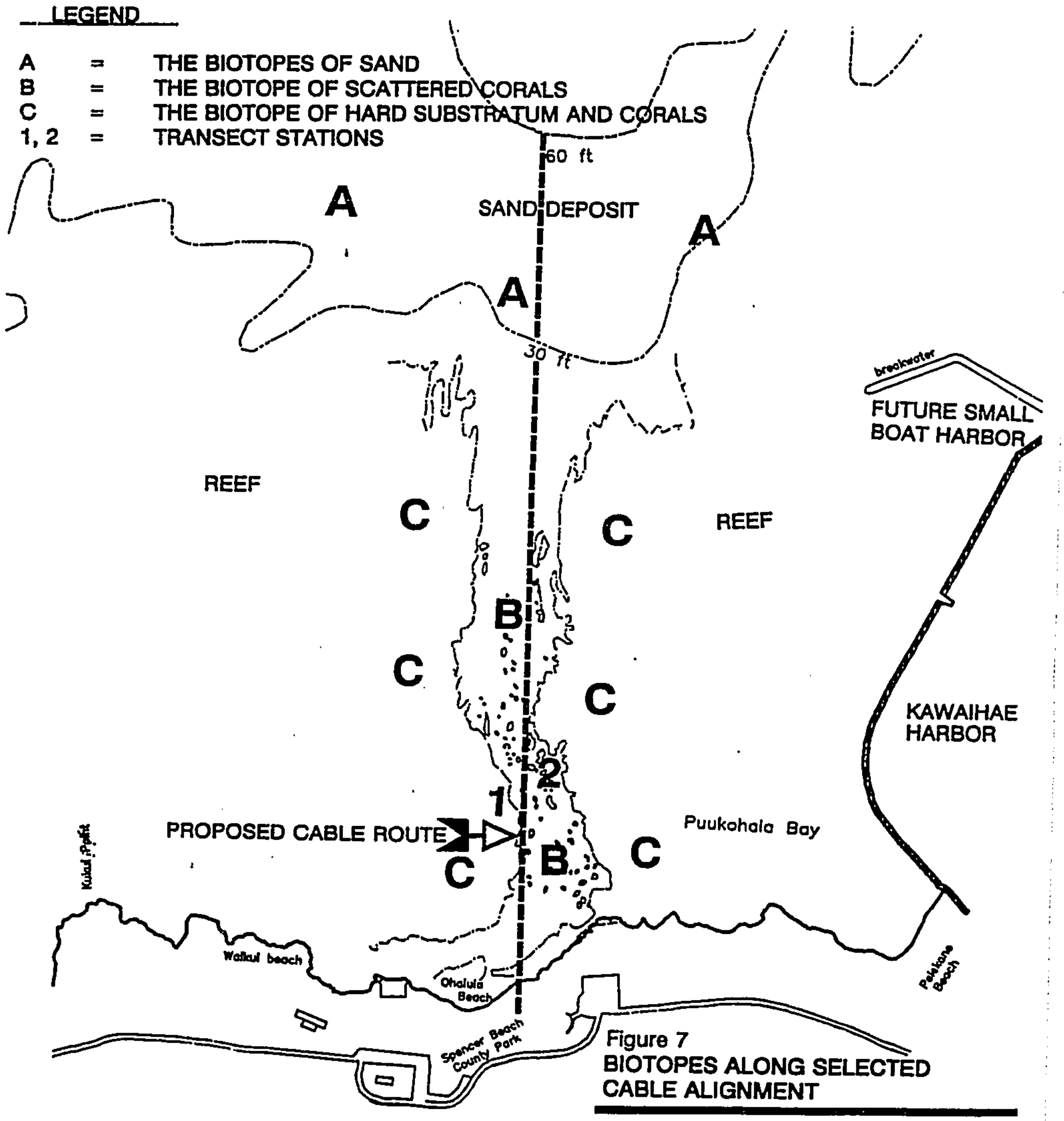

Figure 7
BIOTOPES ALONG SELECTED CABLE ALIGNMENT

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0 500 1000 FEET

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The substratum in the biotope of emergent hard substratum and corals is comprised of both basalt rock (pahoehoe) and limestone as well as corals. There are scattered depressions and small channels on this substratum; the depressions are from 3x3 feet to about 12x30 feet in dimensions and are up to 2 feet in depth. These depressions are spaced from 8 to 30 feet apart and between them are small channels no more than 4 feet in width, up to 15 feet in length and to about 1 foot in depth. The small channels have a general orientation approximately perpendicular to shore. The channels, depressions and corals provide ample cover for fishes and invertebrates yet, as noted in the Appendix, few organisms were seen in the quantitative survey.

4.1.5.3 The Biotope of Scattered Corals

The proposed cable alignment passes through the biotope of scattered corals. This biotope may be described as occurring in a sand channel that has an orientation perpendicular to shore. The dominant substratum in this biotope is sand; spaced from 2 to 75 feet apart are areas of corals. These coral "mounds" range in size from about 3x3 feet to 20x50 feet and are up to 8 feet in height. Common coral species seen in this biotope include Porites lobata, Porites compressa and Montipora verrucosa. Few macroinvertebrates are seen on the sand substratum but there are a number of burrows or holes created by a number of species including the commensal goby-shrimp, unidentified crustaceans, echinoderms, etc.

A survey station was established approximately 40 feet north of the proposed alignment in water about 15 feet in depth. The transect at this station sampled both the hard substratum with corals as well as the open sand substratum. The sand at this station had a surface layer of very fine sedimentary material over it; below this 0.25 inch layer was the usual coarser beach sand. Water visibility at the time of censuring was about 6 feet.

The results of the quantitative survey are provided in the Appendix. Common species included coral species (Porites lobata, Porites compressa and Montipora verrucosa), one macroinvertebrate species, the Hawaiian rock oyster (Spondylus tenebrosus), commensal gobies and shrimps, and other small unidentified burrows. The fish census noted four species, the most common of which were the alo'ilo'i or whitespot damselfish (Dascyllus albisella) and the small eleotrid (Asterropteryx semipunctatus).

In the vicinity of the survey station were seen the algae or limu (Desmia hornemannii and Cladymenia pacifica), corals (Porites evermanni, Leptastrea purpurea and Pocillopora meandrina), the christmas-tree worm (Spirobranchus gigantea), oak cone (Conus quin), the butterfly fish or kikakapu (Chaetodon auriga), lizard fish or 'ulae (Synodus binotatus), the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus) and goldring surgeonfish or kole (Ctenochaetus strigosus).

Inshore of the biotope of scattered corals (commencing 325 feet offshore) is an area of sand that extends from that point to within 80 feet of the shoreline. Inspection of this area on the 16 January 1992 survey noted no macrofauna present. Undoubtedly, with enough search time one would note fishes crossing this sand area such as juvenile jacks or papio (family Carangidae) as well as other species. Between the sand area and the shore in the vicinity of the proposed cable alignment is a small "finger" of emergent basalt (pahoehoe). This hard bottom commences about 15 feet offshore of the sand beach (about 3 feet deep) and continues seaward to a maximum extent of about 80 feet offshore in 8 feet of water. Most of this hard substratum was partially covered with a veneer of sand at the time of sampling and appeared to be quite scoured with no obvious macrobiota present in the area of the proposed alignment. However about 50 feet to the north the hard substratum rises further from the sand (i.e., is shallower) and has a veneer of microalgal species. In a short inspection of this area, the alga (Microdictyon setchellianum) was seen as well as the green sea urchin (Echinometra mathaei), the boring urchin (Echinostrephus aciculatum), the long spined urchin or wana (Echinothrix diadema), green wrasse or 'omaka (Stethojulis balteata) and the saddleback wrasse or hinalea lauwili (Thalassoma duperrey). Also noted were broken live loose fragments of the corals Porites lobata and Pocillopora meandrina.

The intertidal region at this proposed cable landing site is a sand beach. We did not encounter any fauna or flora on this beach.

Only one small green sea turtle (Chelonia mydas) was seen in the biotope of scattered corals about 900 feet from shore in about 15 feet of water during the 16 January 1992 survey. This turtle was estimated to be about 55cm in straight line carapace length. We were unable to determine if this turtle bore any unusual features (i.e., tumors, tags or deformities). Offshore of Spencer Beach Park appears to have appropriate shelter for green turtles (i.e., undercuts, ledges and caves) at a size and scale appropriate for green turtle resting areas. However we noted little macroalgae present in the area that could be utilized as forage (Balazs, 1980, Balazs et al. 1987). We saw no other turtles in the vicinity of the proposed cable landing site but one individual (Mr. Patrick Cunningham) familiar with the area noted that about one-quarter mile to the south small green turtles are frequently seen in the nearshore waters. We have found no information to suggest that nesting of sea turtles at Spencer Beach Park has occurred in historical times.

The biological survey of the proposed cable alignment at Spencer Beach Park did not find any rare or unusual species or communities other than the single threatened green sea turtle noted above. Another protected species, the humpback whale (Megaptera novaeangliae), was not seen offshore of the study area during the period of our field effort. As noted by Herman (1979), humpback whales tend to be found in regions remote from human activities and the proposed Spencer Beach Park cable alignment is in relatively close proximity to Kawaihae Harbor which has been the major commercial port serving West Hawaii for many years.

Impacts

The potential for impact to the shallow marine communities will probably be greatest with the construction phase of this proposed project. From the sea, the proposed cable alignment enters the shallows through the biotope of sand. As a substrate to support marine communities, sand is inappropriate for many coral reef forms because many species require a stable bottom (e.g.,corals and many of the associated invertebrates). Thus the species usually encountered in sand areas are usually those that are adapted to exist in an ever-changing, moving substratum. Similarly, much of the benthic production on coral reefs occurs on hard substratum, (i.e., macroalgae require a solid substratum for attachment). Because sand substrates are subject to movement, they may abrade and scour organisms on this substratum. Thus the characteristics of most species encountered in Hawaiian sand communities are (1) that they typically burrow into the substrate to avoid scouring, (2) that they frequently occur in low abundance which may be related to food resources, and (3) that they are mobile because of the shifting nature of the substratum and potential for burial. Since these forms are motile, deployment of the cable across such a substratum presents little chance of negative impact to resident species because they would probably "just move out of the way as the cable was deployed". Additionally since the substratum shifts, it is probable that the deployed cable will "sink into" the substrate. Personal observations made on other deployed cables shows them to often be partially buried by the natural movement of the sand.

As the cable enters the shallows offshore of Spencer Beach Park, there are areas where the scattered coral mounds will lie in the direct path of the cable. Cutting or trenching through these mounds, which are up to 8 feet above the surrounding bottom, would be difficult and would result in loss of the benthic community in the alignment path. Other impacts would be those associated with the generation of turbidity during the trenching process.

Spencer Beach Park was selected as the cable landing site based upon the assumption that the fiber optic cable would be routed as necessary to avoid the scattered coral mounds. The anticipated placement method was discussed in an earlier section of this chapter. At most, it is anticipated that trenching will only have to be undertaken in shallow water across approximately 50 feet of scoured pahoehoe adjacent to the beach. Since this scoured substratum supports few, if any, benthic organisms in the proposed path, there should be little or no impact to marine organisms.

Other construction methods to protect the cable in shallow water range from just laying the cable directly on the basalt shelf without any specific attachment, to placing it inside of a protective pipe that is bolted to the shelf. This strategy has been used at the Natural Energy Laboratory of Hawaii facility at Keahole Point, Hawaii to secure pipes coming ashore through a subtidal region that is frequently subjected to extreme high energy conditions. Bolting a pipe to the substratum significantly reduces the impact to surrounding benthic communities over the alternative of trenching and backfilling. This alternative may provide low impact to marine communities but it will have an obvious visual impact to any underwater observer. If the trenching and back- filling strategy is used, the tremie concrete cap will probably be colonized by corals, algae and other benthic forms. Studies on substrate selection in Hawaiian coral larvae have shown concrete to be second only to limestone/coral as an appropriate substratum for settlement (Fitzhardinge and Bailey-Brock 1989). Laying the cable directly on the basalt without attachment may result in cable abrasion, and is not an acceptable alternative.

Our 16 January 1992 survey noted considerable turbidity in the region of the proposed cable alignment. Offshore in the biotope of sand, visibility was less than 1 foot at the 80 foot depth. Inshore in the biotope of scattered corals, visibility was about 6 feet. For two days preceding the survey, considerable rainfall had occurred on the West Hawaii coast (Mr. Patrick Cunningham, personal communication). Our inspection of the mouth of Waimea Stream (which is intermittent in its lower reaches) revealed a large amount of water had reached the sea bringing a considerable amount of terrigeneous material with it. Waimea Stream is south of the project site but it is surmised that the stream was the source of much of the turbid water encountered in the study area because of the brown (possibly terrigeneous) color. The second source of turbidity was from surf on the reef. During the month of January 1992 there was a near-continuous westerly swell impacting this coastline. The high surf resuspends fine sediments making the water turbid. These occasional natural inputs of turbidity serve to reduce light levels and potentially impact benthic communities. The communities present in the vicinity of the proposed alignment have evolved under this occasional impact. Construction activities related to the cable landing probably would not begin to match the level of turbidity both in terms of scale or intensity that we encountered on our 16 January 1992 field effort.

We expect that there would be no direct impacts to the threatened green sea turtle or to endangered humpback whales (Megaptera novaeangliae). As far as the impact to humpback whales is concerned, if construction activities are restricted to the period between April through October, there would be no impacts because the whales are seasonal and are only in island waters from November through March. Even assuming that the cable deployment occurs when the whales are present in Hawaiian waters, it is anticipated that the impacts would be minimal. The cable laying ship should not be on site more than one or two days.

The most probable source of local impact to whales would be noise generation by the cable laying ship, the support tugs and the small boats. There are variable and conflicting reports as to the impact of vessel traffic on whales (Brodie, 1981; Matkin and Matkin, 1981; Hall, 1982; and Mayo, 1982). With respect to the response of individual humpback whales, there is sufficient information to demonstrate that boating and other human activities do have an impact on behavior (Bauer and Herman, 1985). Thus it is probably valid to assume that impact to whales could occur if individuals are within several kilometers of the deployment site. However, as noted above, these impacts are of short duration, and all activity will be concentrated in a small area. The potential impacts also need to be evaluated in light of the proximity of the site to Kawaihae Deep Draft Harbor, the second largest harbor on the island.

Sea turtles are permanent residents in inshore Hawaiian habitats. Although the potential exists for problems during the construction phase if it entails dredging, the generation of fine particulate material from dredging appears not to hinder the green turtle in Hawaiian waters; at West Beach, Oahu, green turtles moved from an offshore diurnal resting site about 3,300 feet offshore to a point about 600 feet from the construction site within days of the commencement of dredging and the generation of turbid water. The turtles appeared to establish new resting areas in the turbid water directly offshore of the construction site (Brock 1990a). The reason(s) for this shift in resting areas is unknown but may be related to the turtles seeking water of poor clarity to possibly lower predation by sharks (a major predator on green sea turtles).

Fishery Considerations. Access to the shoreline at Spencer Beach Park is excellent and has probably been since prehistoric times; the Kawaihae area was an important center in the Hawaiian culture. The beach at Spencer is heavily used by people interested in beach going and probably fishing. Fishermen catch fish both from shore as well as offshore from small boats. In all probability, some commercial fishing occurs offshore of the proposed cable alignment. We are unaware of any individuals that specifically and exclusively use Spencer Beach Park area for subsistence fisheries. Probably most of the fishing activity in and around Spencer Beach Park is by recreational fishermen. With most Hawaiian recreational fisheries, species targeted include papio and ulua (family Carangidae), o'io or bonefish (Abula vulpes), moi (Polydactylus sexfilis), goatfishes (family Mullidae), snappers (family Lutjanidae), surgeonfishes (family Acanthuridae), parrotfishes (family Scaridae), and a host of smaller species such as the aholehole (Kuhlia sandvicensis), aweoweo (Priacanthus cruentatus) and menpachi (Myripristes amaenus). Fishing methods used include nets, spears, traps as well as hook and line.

This survey noted a paucity of fishes or invertebrates. One reason for this may be related to the high turbidity present at the time of sampling. Turbidity may temporarily cause motile species to leave; when conditions improve, they may return. Some comparative information for the Spencer Beach area is available from a study carried out by Brock (1991) where three stations were established seaward of Kawaihae Small Boat Harbor in May 1991. The closest station to the proposed cable alignment is approximately 1,000 feet to the north in water 8 to 12 feet deep. A fish census at this station resulted in 26 species and 231 individuals encountered. The census methods were identical to those used here.

The standing crop of fishes on coral reefs is usually in the range of 2 to 200g/m^2 (Brock 1954, Goldman and Talbot 1975, Brock et al. 1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, the variation in standing crop appears to be related to the variation in local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in a lower estimated standing crop of fish (2 to 20g/m^2). Goldman and Talbot (1975) note that the upper limit to fish biomass on coral reefs is about 200g/m^2. The present study found extremely low estimated standing crops at both stations especially when viewed with respect to the availability of shelter space. It is probable that both fishing pressure as well as high turbidity have played a role in the low estimated biomass at these stations.

Water Quality Considerations. With any disturbance to the seafloor, sediment will be generated which will manifest itself as turbidity. This may occur through natural events such as storm surf resuspending fine material that had previously come into the area through natural events and settled, or by human activities including the directing of storm water runoff into the ocean or by underwater construction activities. Underwater construction may generate fine particulate material that could impact corals. The generation of fine sedimentary material could have a negative impact to corals and other benthic forms if it occurs in sufficient quantity over sufficient time. Studies (e.g., Dollar and Grigg 1981 noted above) have found that the impact must be at a high level and chronic to affect adult corals.

The small scale of the trenching activities that would be necessary to protect the cable in shallow water (if used) would probably produce little sediment. This statement is supported by the fact that only 50 lineal feet of hard substratum would be disturbed. The small scale and anticipated short duration of the project suggest a minimal impact. High water motion will keep fine particulate and sedimentary material suspended in the water column, reducing the settlement on benthic organisms in shallow water habitats thus assisting in the advection of this material out of these areas (less than 100m in depth) where corals are found.

The turbidity generated by the construction activity will be short in duration and relatively small in quantity. Numerous studies have provided observations showing the relationship between increased suspended or deposited sediment with reduced coral growth rates, cover and species diversity (Roy and Smith 1971, Maragos 1972, Loya 1976, Bak 1978, Randall and Birkeland 1978, Cortes and Risk 1985, Grigg 1985, Hubbard and Scaturo 1985, Kuhlman 1985, Muzik 1985, Hubbard 1987). In contrast, Glynn and Stewart (1973) found no correlation between these parameters on reefs off the Pacific side of Panama.

Turbidity is a an optical property that is related to the scattering of light by the suspended particles in the water column. The finer the particles, the longer they may remain in suspension (Ekern 1976) and if fine materials are associated with much water motion (waves, currents) the actual deposition rates in these turbid waters may be quite low. However, if the suspended particles (i.e., turbidity) is great enough to reduce light levels, impacts to corals may be low.

The deposition of sediment on coral reefs has been measured and correlated with the "condition" of the reef corals. Loya (1976) defined a "high" sedimentation rate as 15mg/cm^2/day and a "low" rate as 3mg/cm^2/day for Puerto Rican reefs. Low cover and species diversity were associated with reefs exposed to "high" sediment deposition rates. In contrast, "high" sediment deposit- ion rates on Guamian reefs was defined in the range of 160- 200mg/cm^2/day and this rate of deposition limited coral cover and diversity (here less than 10 species and 2% cover; Randall and Birkeland 1978). A "low" rate was defined as 32mg/cm^2/day and was associated with rich coral communities (more than 100 species and 12%+ coral cover). These comparisons demonstrate the relative nature of sedimentation rates; the rate considered to be low in Guam is more than twice the high rate from Puerto Rico. Reasons for this disparity relate to differences in how rates are measured (i.e., lack of a standardized methodology) as well as difficulty in relating environmental factors such as water motion and sediment deposition in sediment traps. Water motion may mitigate or enhance the deleterious effects of sedimentation on the diversity and cover of corals in a given area. Hopley and Woesik (1988) note a chronic sedimentation rate of 129mg/cm^2/day (7 month mean) did not negatively impact an Australian coral reef with high cover and species diversity.

These data suggest that if there is need to protect the proposed fiber optic cable in shallow water by small-scale trenching, the short term disturbance (probably less than two weeks) will be a minor impact.

4.1.6 Scenic and Visual Resources

The area is generally void of man-made structures except for telephone poles along main roads and beach park amenities such as toilet facilities. The Kawaihae Harbor and related shoreside facilities are visible towards the north and the two heiaus along the park access road. Views at the shoreline are towards mauka and along the shoreline north and south.

Impacts

No adverse impacts are anticipated on the beach park since the proposed cable will be located below surface until the Akoni Pule Highway, where it will be routed overhead on existing utility lines for routing towards the central office on Queen Kaahumanu Highway.

For seven to ten days there will be a temporary impact on the coastal views from construction activities. During the construction period, the beach portion of the project site will have construction equipment and a mound of sand from the excavated trench.

The beach will be returned to its existing condition at the conclusion of the cable installation. Excess material not utilized for fill will be removed. Therefore, after the cable is installed no long-term impact is anticipated.

4.1.7 Historic/Archaeological Resources

Cultural Surveys Hawaii conducted an archaeological assessment of the Spencer Beach Park cable landing site and the proposed duct line on January 1992 (see Archaeological Assessment of the Proposed Fiber Optic Cable Landing for Spencer Beach Park, Island of Hawaii, Cultural Surveys Hawaii, January 1992). The scope of work at the Spencer Beach Park landing site included sub-surface testing, survey, and review of pertinent literature.

"No significant archaeological resources were observed within the proposed fiber optic cable landing corridor in Spencer Beach Park. The corridor (actually the entire beach) was inspected for any surface sites, of which none exist. Testing of the beach deposits was accomplished by excavation of five test units. The test units were hand dug and the excavated material was screened through 1/4-inch mesh screen. Samples were collected of the cultural material present (midden and artifacts). Representative soil profiles and photographs were taken, after which the test units were backfilled" (Cultural Surveys, Jan. 1992).

"With respect to the proposed underground fiber optic cable duct line at Spencer Beach Park, no impact to archaeological resources is expected. The proposed duct line will traverse through heavily graded portions of Spencer Beach Park and new access road. Archaeological surveys has identified six sites within the new access road right-of-way" (Cultural Surveys Hawaii, Jan. 1992). These six sites were the subject of archaeological test excavations in February 1989 (Carter 1989).

"The results of Carter's test excavations demonstrated that only four of the sites were important for their informational content. In the process of determining that the four sites were likely to yield information important in prehistory or history, however, that potential was realized and the information was adequately recorded. Therefore, they are no longer significant" (Carter 1989).

In July 1992, following minor modification to the landside cable alignment, Cultural Surveys, again visited the site to assess potential for archaeological significance (see Figure 8). According to Cultural Surveys, "We do not anticipate any significant sub-surface cultural remains to be impacted by the newly proposed Fiber Optic Cable landing and duct line. The relocation of the landing area and park associated duct line, some forty feet north of the present original corridor, would appear to place them in areas even more disturbed than the original corridor. The cable landing area, within the beach, is closer to the existing bath house and its associated features (i.e., waterlines, sidewalk, and rock wall). The proposed duct line in the grassy lawn is also closer to the existing underground utility lines (i.e., sewer

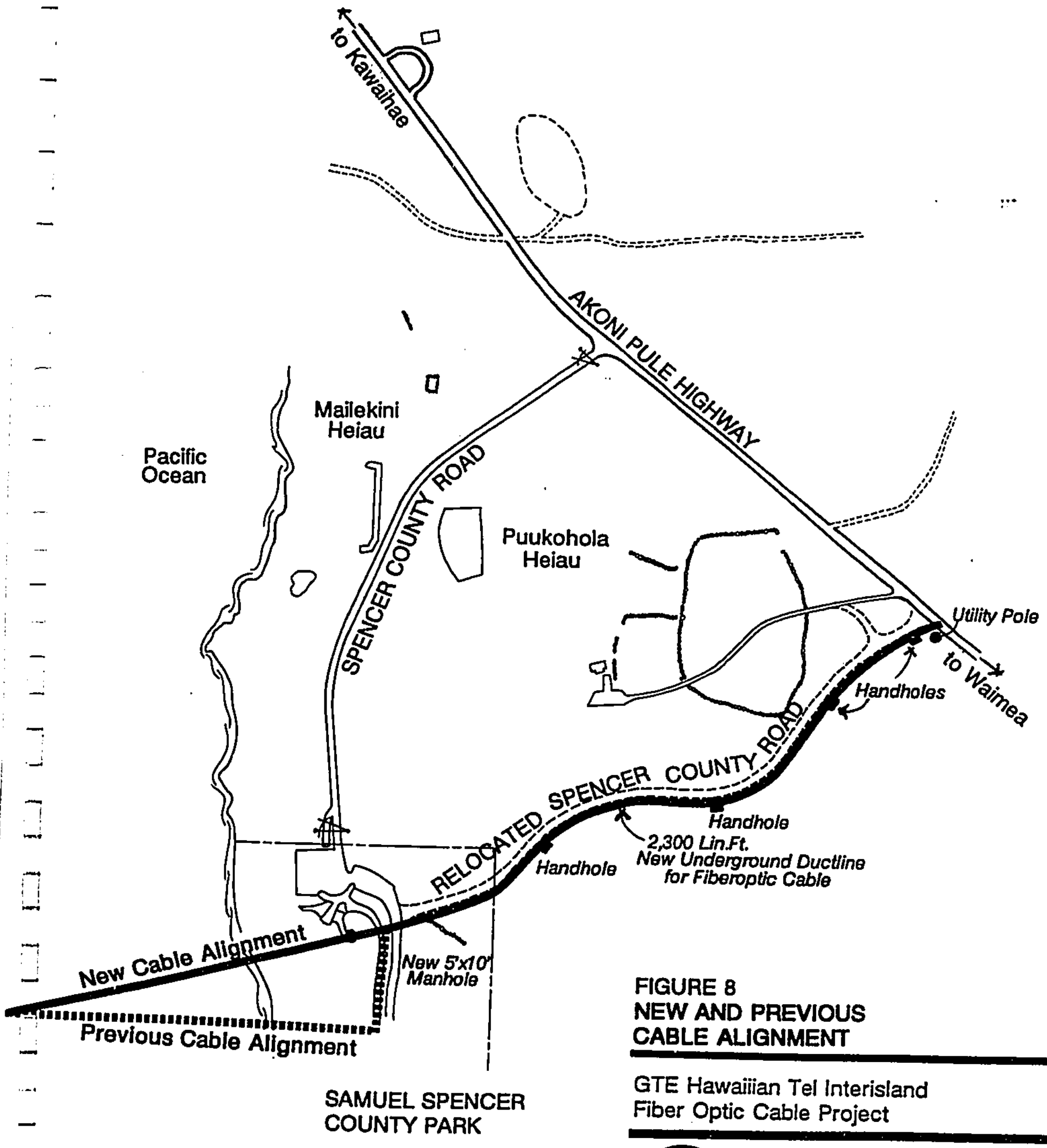

FIGURE 8
NEW AND PREVIOUS CABLE ALIGNMENT

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JUNE 1992

and electricity) and where the duct line exits the park, there is a cut and filled embankment with a storm drain outlet associated with the newly constructed access road. However no testing has taken place within the new corridor, either within the sandy beach area or on the grassy lawn portion of the park" (Cultural Surveys, July 19, 1992).

Impacts

No impacts are anticipated based on heavy disturbance of the beach park site which would have already destroyed any remains of significance. However, given that no subsurface testing has been undertaken along the new alignment segment, from above the beach landing towards Spencer County Road, it is recommended that after a staked alignment is identified, that subsurface testing be undertaken to accurately assess sub-surface conditions.

Subsurface testing will be undertaken in coordination with DLNR, Historic Preservation Division. Should any significant cultural remains be discovered, work in the immediate area will cease and the appropriate government agencies will be contacted.

4.1.8 Beach Erosion and Sand Transport

Spencer Beach Park is located immediately south of the Kawaihae Deep Draft Harbor and encloses one of the typical small pocket beaches along this coast. The beach within the park is Ohaiula Beach, and is approximately 400 feet long. Ohaiula Beach has been stable over the past 30 years and the vegetation line has experienced little erosion or accretion. Oceanward of the beach, a shallow, fringing reef extends offshore, and shelters the shoreline from waves. A narrow sand channel extends through the reef at the northern end of the beach and will serve as the nearshore route for the proposed fiber optic cable.

The nearshore fringing reef extends 2500 feet from the shore. The fringing reef is cut by a sand channel, which connects the beach to a large offshore sand deposit. The water depth at the seaward limit of the reef is approximately 20 feet. The water depth in the sand channel is typically 10 to 15 feet, and much of the reef is within a few feet of the surface. There are many large coral formations within the channel. The coral formations rise vertically up from the channel bottom to within a few feet of the surface.

Seaward of the fringing reef the bottom is entirely sand, out to at least the 100 foot depth, the limit of the visual survey. A prior R. M. Towill Corporation bathymetric survey shows a large reef formation south of the cable route, in water depths of 35 to 110 feet. The route was selected to avoid this formation, and the closest point of approach is 100 feet. The sand, both in the inner channel and the offshore deposit, is relatively fine and has a high silt content.

Impacts

The proposed project is not expected to negatively impact beach processes. The proposed cable route will seek to utilize the sand channel which passes through the shallow fringing reef, and therefore will not impair the ability of the reef from continuing to protect Ohaiula Beach. Seaward of the fringing reef it is expected that after laying the fiber optic cable that it will soon settle into the sand. Because of the small surface area of the cable and this settling action, no adverse impacts are anticipated. At the landing site, once all construction activities are completed, the work crew will make every reasonable effort to return the ground to existing preconstruction contours through use of excavated materials for backfill.

4.1.9 Noise From Construction Activity

During the construction phase of the project excavation work and cable laying equipment and machinery will be used which will be sources of noise.

Impacts

Noise generated from machinery can be mitigated to some degree by requiring contractors to adhere to State and County noise regulations. This includes ensuring that machinery are properly muffled. Some work at night may be required. Night activities include cable splicing, cable pulling, operation of machinery, etc.

Boats (tugs and a small craft) that are used during the construction period will also be a source of noise. The impact of noise from these vessels cannot be mitigated.

The noise impact will be temporary in nature and will not continue beyond the construction and cable laying period.

4.1.10 Air Quality

Construction vehicles are expected to emit pollutants in the area during construction. However, due to good offshore trades and wind circulation, the area is virtually free of urban air pollutants other than occasional automobile traffic from park users. Therefore, any amount of emissions generated from construction activities is anticipated not to exceed the governing air quality standards of the State Department of Health or the Environmental Protection Agency.

Impacts

Dust is anticipated to be generated during construction. However, the amounts will be minimal since the excavation will occur in sand and porous soil. In addition, the State Department of Health air quality standards require watering of excavation activities if dust generated is a problem. There are no residential uses in the area and any inconvenience to park users will be mitigated by watering the construction area. Water can be imported and sprayed by watering trucks.

4.1.11 Water Quality Nearshore Waters are Rated Class "A" by the State Department of Health

No adverse impacts will occur on surface or ground water since the project will not significantly alter existing drainage patterns or have any long term water requirements. The project proposes the installation of a cable line within the shoreline area and does not affect any potable groundwater sources.

4.2 SOCIO-ECONOMIC ENVIRONMENT

4.2.1 Population

Although the population within the Kawaihae area numbers 150, the population of Hawaii County as of 1989 was 122,300 and is projected to increase to 206,100 by 2010. In addition, telephone access lines connected for all islands, except Oahu, from 1981 to 1989 indicate an increase of 37% for business and residential connections or an average annual increase of 4.5%. This projected population increase of approximately 69% over the 1989 level and the growth in access line connections over the last eight years require that the County's communication system be upgraded and expanded to meet the future communication needs.

Impacts

No adverse impact on existing resident and worker populations of Kawaihae are expected.

4.2.2 Surrounding Land Use

Spencer Beach Park and the surrounding coastal land, which is owned by the Queen Emma Foundation, is primarily in recreational use. Lands mauka of the coastal beach areas are generally vacant. The Mauna Kea Resort is located about one mile to the south. The Puukohola National Historic Site is adjacent to the north of Spencer Beach Park. Kawaihae Harbor is less than 2,000 feet beyond the historic site.

Impacts

No major short- or long-term impacts are expected from the development of the proposed project. The cable route will be on vacant land when subsurface and be carried overhead within street rights-of-ways and will not adversely impact surrounding uses.

4.3 PUBLIC FACILITIES AND SERVICES

4.3.1 Transportation Facilities

The project site is accessible by the new Spencer County Road, which is owned by the United States of America. The new Spencer road connects to Akoni Pule Highway, a major thoroughfare which connects to Queen Kaahumanu Highway.

Impacts

No impacts on transportation facilities are anticipated.

With respect to construction within the Akoni Pule Highway and the Queen Kaahumanu Highway, all cable lines will be located within existing rights-of-way. These rights-of-way have sufficient width to permit unimpeded traffic flow during construction. Some coning of traffic may be necessary due to limited sight distance, but should not result in any major impacts on existing traffic flows.

4.3.2 Recreational Facilities

Although the landing site is located within an existing recreational facility, the installation and maintenance of the cable will not restrict recreational use of the park other than in the immediate area of construction and only during installation or repair.

Impacts

Construction will take approximately 7 to 10 days during which time the immediate area surrounding the cable landing site will have to be cordoned off to the public for safety reasons. The major portion of the park will not have to be closed and will continue to be accessible to the public. Upon completion of the installation, the park grounds will be restored to its original condition. No impacts on the cable are expected from park users since the cable will be buried in sufficient depth and encased in concrete.

SECTION 5

RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS AND POLICIES

5.1 THE HAWAII STATE PLAN

The Hawaii State Plan (Chapter 226, Hawaii Revised Statutes) provides a guide for the future of Hawaii by setting forth a broad range of goals, objectives, and policies to serve as guidelines for growth and development of the State. The proposed project is consistent with the Hawaii State Plan. The following objectives of the State Plan are relevant to the proposed project:

Section 226-10.5: Economy - Information Industry

The proposed project assists in the State's objective of positioning Hawaii as the leader in providing information services in the Pacific. The proposed project will continue development and expansion of Hawaii's telecommunications infrastructure and will help to accommodate future growth in the information industry.

Section 226-14 Facility Systems - In General

The proposed project supports the State's goals for achieving telecommunications systems necessary for Statewide social, economic, and physical objectives.

Section 226-18: Facility System - Energy/Telecommunications

The proposed project will help to ensure adequate and dependable telecommunication services for Hawaii by promoting efficient management of existing and proposed facilities, and by promoting installation of new telecommunications cables.

5.2 STATE FUNCTIONAL PLANS

The Hawaii State Functional Plan (Chapter 226) provides a management program to control and utilize Hawaii's natural resources to improve current conditions, and attend to various societal needs. The proposed project is consistent with the following objectives of the State Functional Plans:

Education Implementing Action A(4)(c):
The proposed project will help to ensure adequate telecommunication services necessary for Hawaii's schools.

Education Implementing Action B(3)(d):
The proposed project serves to promote and expand the appropriate use of telecommunications to deliver distance education as well as enhance the learning process and communication competencies of students.

Education Implementing Action(3)(e):
The proposed project enables school library media centers to effectively manage and provide access to information and knowledge through telecommunications.

5.3 STATE LAND USE LAW

The recommended route of the fiber optic cable from the shoreline up to Akoni Pule Highway is designated within the State Land Use Conservation District (see Figure 8A) and will require the approval of the Board of Land and Natural Resources. The purpose of the Conservation District is to preserve and manage major open space and recreational lands, and land of scenic and other natural resource value. This permit will be applied for as part of this project.

The balance of the cable route will occur either on Urban or Agricultural designated lands. Utility installations are permitted in these land use designations and therefore, no amendments will be sought in the current State Land Use classification.

5.4 COUNTY ZONING

The County of Hawaii zoning for the project site is Open which permits utility installations. The site is also within the Special Management Area (see Figure 9) and will require a Special Management Area Permit and a Shoreline Setback Variance. All required county permits will be obtained before construction begins.

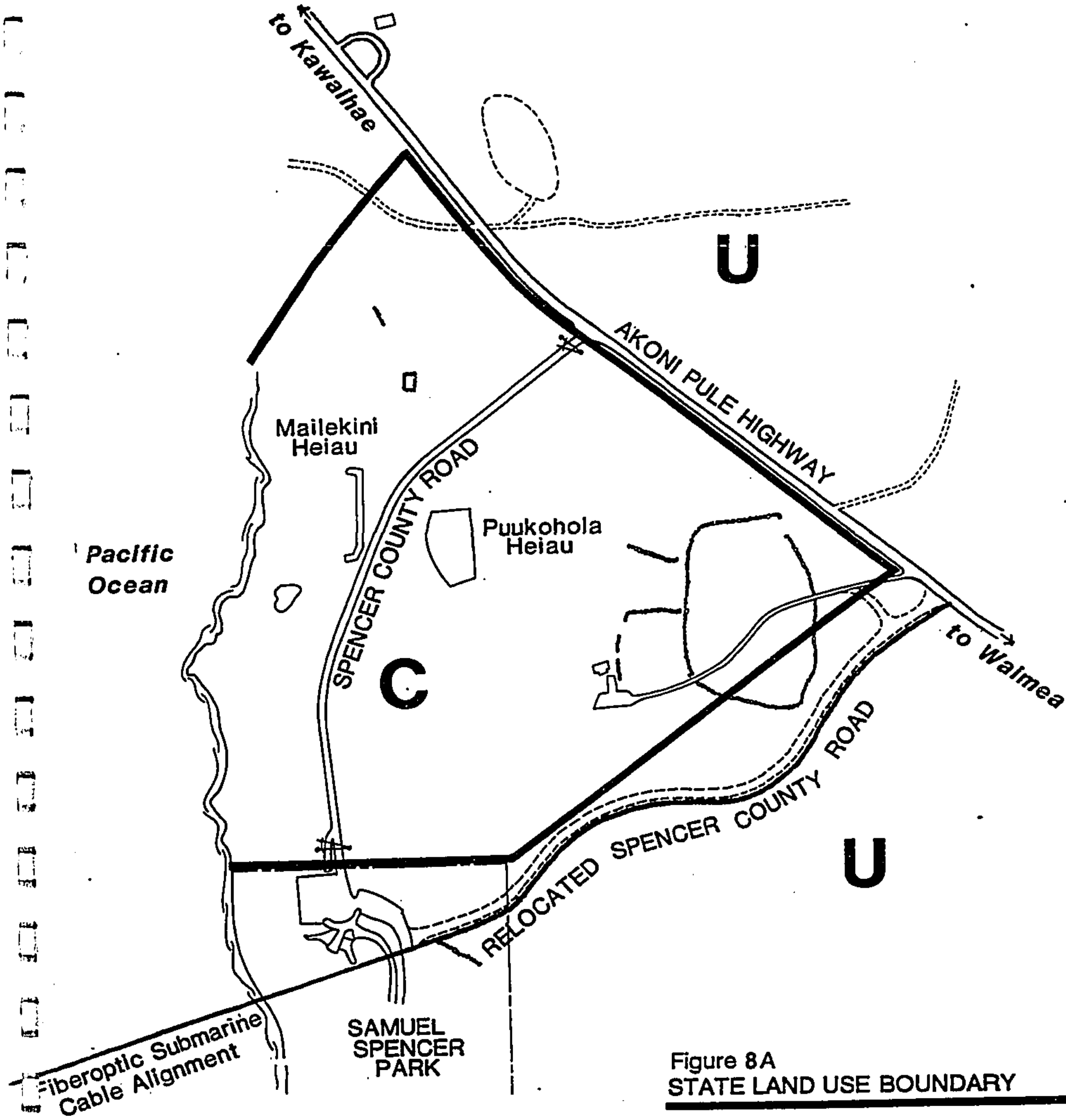


Figure 8A
STATE LAND USE BOUNDARY

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

0 200 400 800
FEET

R. M. TOWILL CORPORATION
JUNE 1992

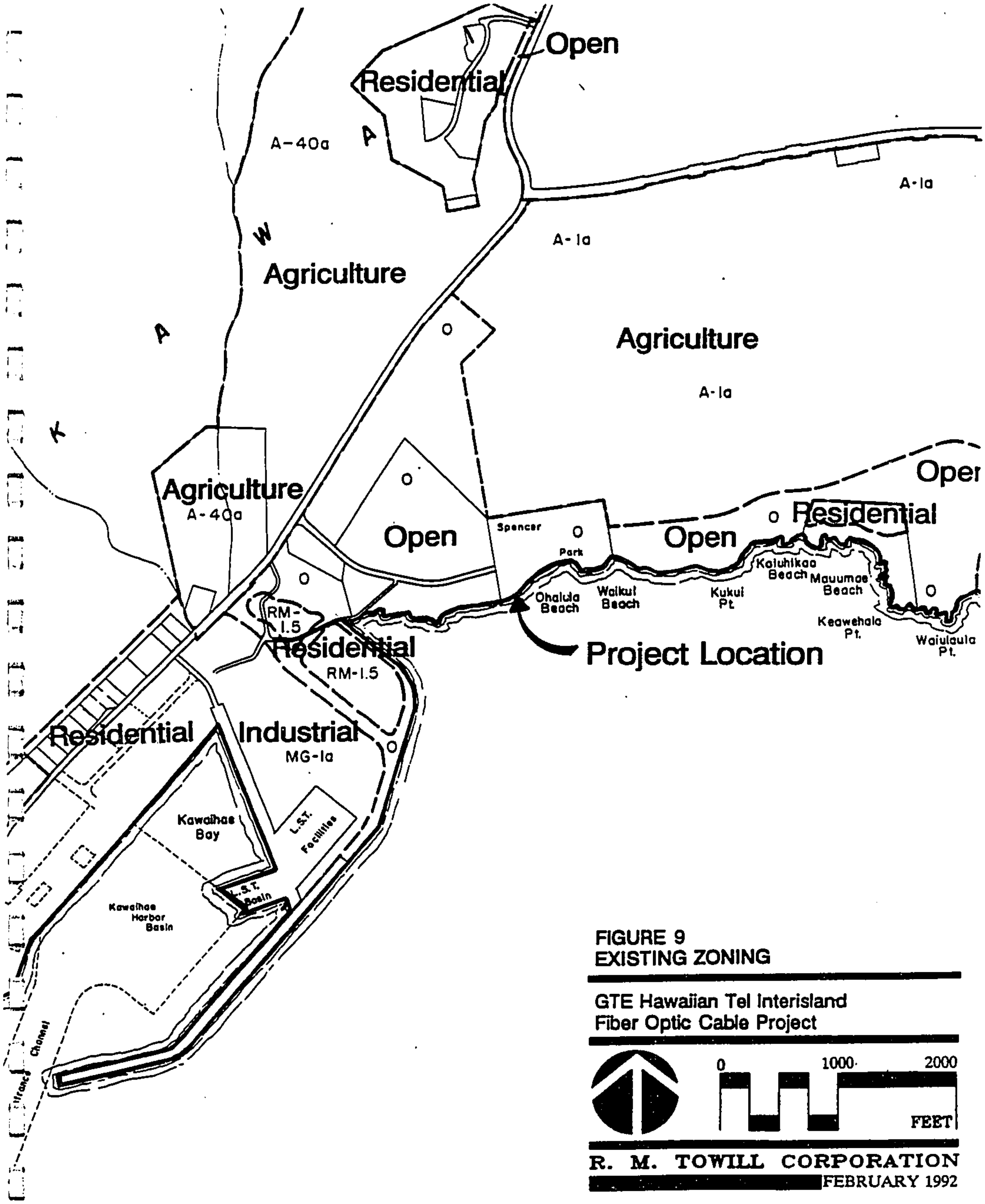


FIGURE 9
EXISTING ZONING

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

0 1000 2000
FEET

R. M. TOWILL CORPORATION
FEBRUARY 1992

5.5 COUNTY GENERAL/DEVELOPMENT PLANS

With respect to the Hawaii County General Plan, the Land Use Pattern Allocation Guide map indicates that the route of the cable installation is designated primarily within the Open Area (see Figure 10). Surrounding areas are designated for Medium Density Residential, Industrial and Urban Expansion. The cable project will assist in supporting the planned growth for the area and is compatible with planned uses.

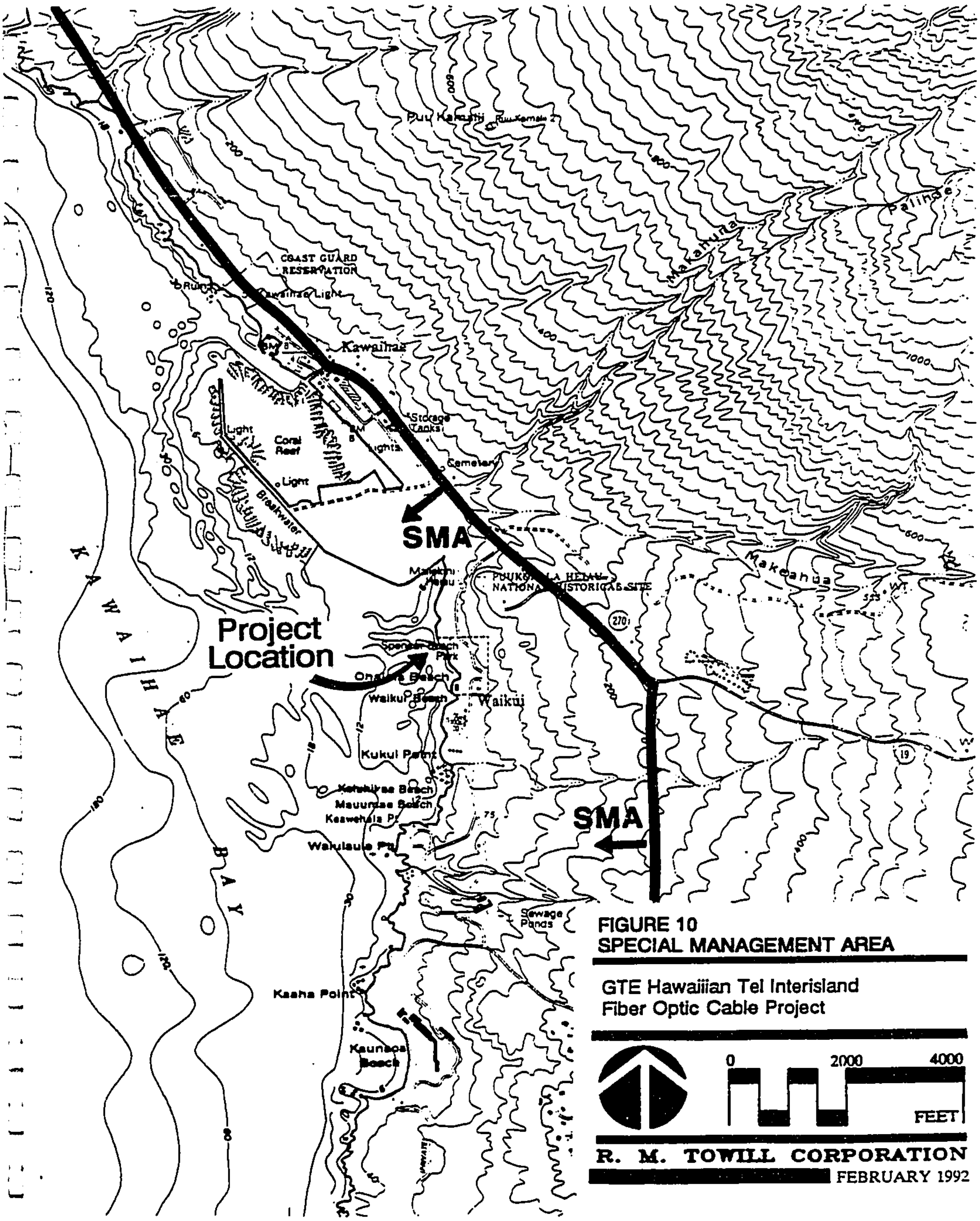


FIGURE 10
SPECIAL MANAGEMENT AREA

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

0 2000 4000 FEET

R. M. TOWILL CORPORATION
FEBRUARY 1992

SECTION 6
ALTERNATIVES TO THE PROPOSED ACTION

6.1 NO ACTION

The no action alternative will contribute to further degradation of current inadequate interisland telecommunications facilities. A primary disadvantage of this alternative would be that without the development of a interisland fiber optics cable GTE will not have sufficient capacity to meet all interisland traffic in 1993. Losses resulting from this alternative would include:

- Lost employment opportunities which would have been realized in connection with the cable laying procedure, maintenance and operation; and

- Lost tax revenues for County and State government from the cable vendor, and increased public and private telecommunication usage.

6.2 ALTERNATIVE SITES

In August of 1991, a study was conducted to evaluate sites and ascertain land use permit requirements. The study identified three possible landing sites for the Maui to Big Island segment of the fiber optic cable where underwater geology would be most suitable: Spencer Beach, Hapuna Beach, and Mauna Kea Hotel. The study recommends Spencer Beach as the landing site because the site exhibits adequate characteristics including a nearshore alignment that can avoid most of the reefs and coral heads which lie along side and within a small sandy channel leading away from the shoreline to the ocean.

Should Spencer Beach be removed from consideration, Hapuna Beach would be the alternate landing site. Hapuna Beach has favorable bottom conditions including a long sandy channel with good access to the shore. Compared to Hapuna Beach, it is anticipated that public concern would be lower at Spencer Beach. According to the county Planning Department, Hapuna Beach is heavily used and has a well organized constituency which opposes any development activity within the immediate area. If Hapuna Beach requires further consideration, it is recommended that the opposition be queried by a public dialogue involving the community and GTE Hawaiian Telephone, and state and county representatives.

6.3 ALTERNATIVE TECHNOLOGY

The following describes the alternatives to fiber optic cable technology:

6.3.1 Microwave Radio Systems

The use of additional or modification of Hawaiian Tel's existing interisland microwave radio systems is not a feasible alternative due to the linear arrangement of the main Hawaiian Islands. The linear arrangement of the main Hawaiian Islands limits the possible transmission paths between the islands and leads to transmission congestion. Problems associated with transmission congestion of microwave radio systems include:

- Introduction of interference to voice band data and voice transmission; and
- Loss of signal strength and signal reliability.

In comparison with microwave radio systems, fiber optic technology is the only means of providing the capacity necessary for interisland digital circuits without distortion in voice band data and transmission, and problems with signal strength and reliability.

6.3.2 Satellites

Satellites are not a feasible alternative based on the large interisland capacity requirements projected in the GTE Hawaiian Tel forecasts. Extreme disadvantages associated with use of satellites include:

- Transmission delays due to technical and atmospheric limitations involving the distance the radio waves must travel;

- Visual and aesthetic intrusion caused by the need for ground stations and radio antennas which must be constructed to accept the satellite transmissions; and

- Difficulties associated with "double hops" which occur when data must be retransmitted in order to establish a secure voice circuit.

In comparison with satellites, fiber optic technology is the only means of providing the capacity necessary for interisland digital circuits without transmission delays and major visual and aesthetic problems.

6.4 RECOMMENDED ACTION

The recommended action is to proceed with the establishment of a submarine fiber optic cable system with a landing at Spencer Beach Park. From there, the cable would be located underground or overhead within existing rights-of-way.

SECTION 7

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

No short-term exploitation of resources resulting from development of the project site will have long-term adverse consequences. The appearance of the land portion of the existing site will not be altered. The cable will be visible on the ocean bottom portion of the project site and will alter its appearance.

Once construction activities are completed there will be no affect on recreational activities, marine life, or wildlife.

Long-term gains resulting from development of the proposed project include provision of more effective State telecommunications systems (by means of fiber optic cables). The proposed project will maintain and enhance economic productivity by increasing telecommunications service between islands.

SECTION 8

IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES BY THE PROPOSED ACTION

Development of the proposed project will involve the irretrievable loss of certain environmental and fiscal resources. However, the costs associated with the use of these resources should be evaluated in light of recurring benefits to the residents of the region, the State of Hawaii and the County of Hawaii.

It is anticipated that the construction of the proposed project will commit the necessary construction materials and human resources (in the form of planning, designing, engineering, construction labor, landscaping, and personnel for management and maintenance functions). Reuse for much of these materials and resources is not practicable. Although labor is compensated during the various stages of development, labor expended for project development is non-retrievable.

SECTION 9

NECESSARY PERMITS AND APPROVALS

9.1 STATE

Department of Land and Natural Resources

- Conservation District Use Permit
- Right-of-Entry
- Establishment of Offshore Easement

Office of State Planning

- Coastal Zone Management Consistency Review

Department of Health

- Section 401, Water Quality Certification

Department of Transportation

- State Highway Rights-Of-Way

9.2 COUNTY OF HAWAII

Department of Planning

- Shoreline Management Area Permit
- Shoreline Setback Variance

9.3 FEDERAL

U.S. Army COE

- Corps of Engineers Section 404/Section 10

SECTION 10

CONSULTED AGENCIES AND PARTICIPANTS IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

10.1 STATE AGENCIES

Department of Land and Natural Resources

- Aquatic Resources Division
- Land Management Division
- Conservation and Environmental Affairs

Department of Transportation

Department of Health

Department of Business, Economic Development, and Tourism

Office of Environmental Quality Control (OEQC)

10.2 COUNTY OF HAWAII

Department of Planning

Mayor's Office

Councilman Russell Kokubun

10.3 FEDERAL AGENCIES

U.S. Dept. of the Interior, National Park Services

U.S. Army Corps of Engineers

U.S. Coast Guard

10.4 INDIVIDUALS AND GROUPS

The Ocean Recreation Council of Hawaii (Torch)

David Tarnas

SECTION 11

COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT

DE ARTMENT OF PUBLIC WORK.
COUNTY OF HAWAII
HILO, HAWAII

Memorandum

DATE Sept 25, 1992

TO Planning Director

FROM Robert K. Yanabu, Division Chief
Engineering Division

SUBJECT: SMA Use Permit Application (SMA 92-9)
Shoreline Setback Variance (SSV 92-3)
Applicant: GTE Hawaiian Tel Co.
Location: Kawaihae 2nd, South Kohala, Hawaii
TMK: 6-2-02:08 & Portion :06

We have reviewed the subject application and our comments are as follows:

1. Structures shall conform to all requirements of codes and statutes pertaining to building construction.

2. All development generated runoff shall be disposed of on site and shall not be directed toward any adjacent properties.

THP: sls

cc: Engineering - Hilo
Engineering - Kona
Planning - Kona

R. M. TOWILL CORPORATION

420 Waiakamilo Rd. #411 Honolulu, HI 96817-4941 (808) 842-1133 Fax (808) 842-1937

October 20, 1992

Robert K. Yanabu
Chief, Engineering Division
Department of Public Works
County of Hawaii
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Yanabu:

SUBJECT: Environmental Assessment Review of SMA Use Permit Application (SMA 92-9) and SSV Application (SSV 92-3) for GTE Hawaiian Tel to Land a Fiber Optic Cable at Spencer Beach Park, Kawaihae, Hawaii

Thank you for your letter dated September 25, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landing at Spencer Beach Park. We appreciated your review of this document.

As you have requested, the following will be undertaken:

1. Structures shall conform to all requirements of codes and statutes pertaining to building construction; and

2. All development generated runoff shall be disposed of on site, and shall not be directed toward any adjacent properties.

Once again, thank you for participating in the review of this important project.

Very truly yours,

Brian Takeda

Brian Takeda
Senior Planner

cc Norman Hayashi, Director of Planning, County of Hawaii
Patrick Mau, GTE Hawaiian Tel
Norman Ober, GTE Hawaiian Tel
RDE, KY, CK, SK RMTC

Police Department

Lorraine R. Inouye
Mayor

Victor V. Vierra
Chief of Police

Francis C. DeMorales
Deputy Chief of Police

County of Hawaii • 349 Kapiolani Street • Hilo, Hawaii 96720-3998 • (808) 961-2244 • Fax (808) 961-2702

OCT 22 PM 2 45

September 18, 1992

TO : NORMAN K. HAYASHI, PLANNING DIRECTOR

FROM : VICTOR V. VIERRA, CHIEF OF POLICE

SUBJECT: SPECIAL MANAGEMENT AREA USE PERMIT APPLICATION (SMA 92-9)
SHORELINE SETBACK VARIANCE APPLICATION (SSV 92-3)
APPLICANT: GTE HAWAIIAN TEL COMPANY
REQUEST: INTERISLAND FIBER OPTIC CABLE AND RELATED IMPROVEMENTS
THK: 6-2-2:8 & POR. OF 6

We recommend the landing facility at Spencer Beach Park be sufficiently enclosed by chain link fence or other means to discourage any type of possible vandalism.

LM:sk

cc: South Kohala Police

R. M. TOWILL CORPORATION

420 Waiakamilo Rd. #411 Honolulu, HI 96817-4941 (808) 842-1133 Fax (808) 842-1937

October 20, 1992

Victor V. Vierra
Chief of Police
Police Department
County of Hawaii
349 Kapiolani Street
Hilo, Hawaii 96720-3998

Dear Chief Vierra:

SUBJECT: Environmental Assessment Review of SMA Use Permit Application (SMA 92-9) and SSV Application (SSV 92-3) for GTE Hawaiian Tel to Land a Fiber Optic Cable at Spencer Beach Park, Kawaihae, Hawaii

Thank you for your letter dated September 18, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landing at Spencer Beach Park. We appreciated your review of this document. In accordance with your recommendation, we will ensure the project site will be sufficiently secured by use of chain link fencing or other means to discourage potential for vandalism.

Once again, thank you for participating in the review of this important project.

Very truly yours,

Brian Takeda
Senior Planner

cc Norman Hayashi, Director of Planning, County of Hawaii
Patrick Mau, GTE Hawaiian Tel
Norman Ober, GTE Hawaiian Tel
RDE, CK, SK RMTC

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:

September 21, 1992

Planning Division

Mr. Norman K. Hayashi
Director
County of Hawaii
Planning Department
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Hayashi:

Thank you for the opportunity to review and comment on the Shoreline Setback and Special Management Area Applications from GTE Hawaiian Tel Company for their Interisland Fiber Optic Cable and related improvements. The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. The proposed project involves work in waters of the United States; therefore, a DA permit is required. An application has been received from the applicant and will be processed.

b. According to the enclosed Federal Emergency Management Agency's Flood Insurance Rate Map Panel 155166 0139-C dated September 16, 1988, portions of the proposed site are located in Zone AE (areas inundated by the 100-year flood with base flood elevations of 8.0 to 9.0 feet above mean sea level); Zone X-unshaded (areas determined to be outside the 500-year flood plain); and Zone VE (Areas inundated by the 100-year coastal flood with velocity hazards, and a base flood elevation of 9.0 feet above mean sea level).

Sincerely,

Kisuk Cheung, P.E.
Director of Engineering

Enclosure

R. M. TOWILL CORPORATION

420 Waiakamilo Rd. #411 Honolulu, HI 96817-4941 (808) 842-1133 Fax (808) 842-1937

October 20, 1992

Kisuk Cheung, P.E.
Director of Engineering
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

SUBJECT: Environmental Assessment Review for SMA Use Application (SMA 92-9) and SSV Application (92-3), for GTE Hawaiian Tel to Land a Fiber Optic Cable at Spencer Beach Park, Kawaihae, Hawaii

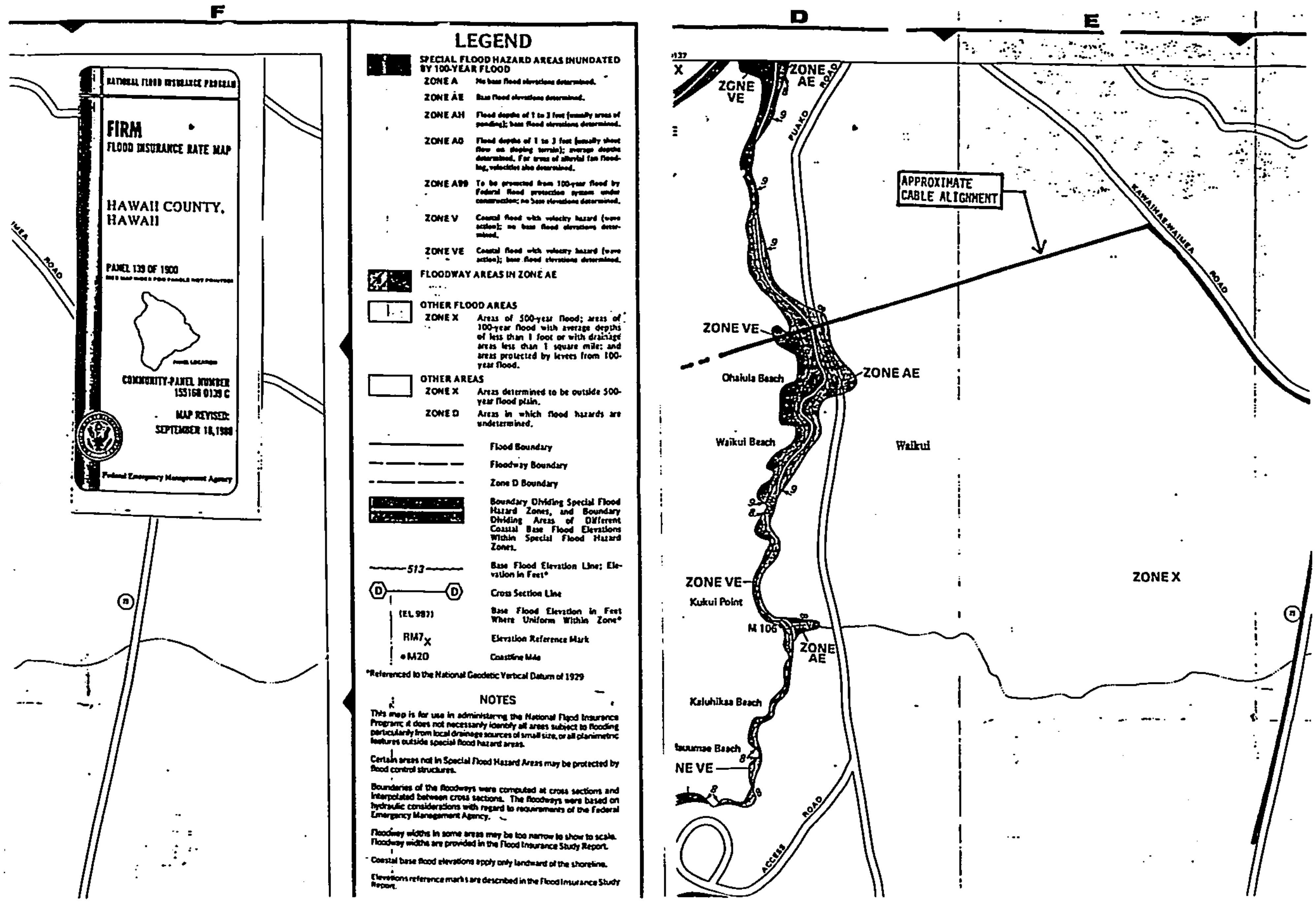
Thank you for your letter and attached FEMA Flood Insurance Rate Maps, dated September 21, 1992. Your department provided useful information which has assisted us in the filing of the Department of the Army permit. As always, we will continue to coordinate our permit requirements with the Corps.

Should you have any additional questions or comments please contact us at our above address.

Very truly yours,

Brian Takeda
Senior Planner

cc Norman Hayashi, Planning Director, County of Hawaii
Patrick Mau, GTE Hawaiian Tel
Norman Ober, GTE Hawaiian Tel
RDE, CK, SK RMTC



F
D
E
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
HAWAII COUNTY, HAWAII
PANEL 139 OF 1900
COMMUNITY-PANEL NUMBER 155166 0139 C
MAP REVISED: SEPTEMBER 18, 1988
Federal Emergency Management Agency
LEGEND
SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD
ZONE A
ZONE AE
ZONE AH
ZONE AO
ZONE A99
ZONE V
ZONE VE
FLOODWAY AREAS IN ZONE AE
OTHER FLOOD AREAS
ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.
OTHER AREAS
ZONE X Areas determined to be outside 500-year flood plain.
ZONE D Areas in which flood hazards are undetermined.
Flood Boundary
Floodway Boundary
Zone D Boundary
Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
513 Base Flood Elevation Line; Elevation in Feet*
Cross Section Line
(EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*
RM7X Elevation Reference Mark
•M2.0 Coastline Mile
*Referenced to the National Geodetic Vertical Datum of 1929
NOTES
This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding particularly from local drainage sources of small size, or all planimetric features outside special flood hazard areas.
Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.
Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.
Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.
Coastal base flood elevations apply only landward of the shoreline.
Elevations reference marks are described in the Flood Insurance Study Report.
APPROXIMATE CABLE ALIGNMENT
KAWAIHAE-WAIMEA ROAD
PUAKO ROAD
ACCESS ROAD
ZONE VE
ZONE AE
ZONE X
Ohaiula Beach
Waikui Beach
Waikui
Kukui Point
M 10.6
Kaluhikaa Beach
Mauumae Beach

REFERENCES

1. Atlas of Hawaii, Second Edition, Department of Geography, University of Hawaii, 1983.

2. GTE Hawaiian Tel Interisland Fiber Optic Cable System: Marine Environmental Analysis of Selected Landing Sites, Sea Engineering Inc., January 1992.

3. The Hawaii State Plan: Education, Department of Education, 1989.

4. Hawaii Interisland Submarine Fiber System Project: Desk Top Study, Seafloor Surveys International, August 1991.

5. U.S. Department of Agriculture, Soil Conservation Service and University of Hawaii Agricultural Experiment Station.

6. The State of Hawaii Data Book 1990: A Statistical Abstract, Department of Business, Economic Development, and Tourism, State of Hawaii, 1990.

7. Discussion with GTE Hawaiian Tel, December 1991, and January 1992.

8. The Hawaii State Plan, Chapter 226, Hawaii Revised Statutes.

9. Humpback Whales in Hawaiian Waters: A Study in Historical Ecology, L.M. Herman, 1979.

10. Prodigious Submarine Slides on the Hawaiian Ridge, J.G. Moore, 1989.

APPENDIX A

Marine Environmental Analysis of Selected Landing Sites

GTE Hawaiian Tel
Interisland Fiber Optic Cable System

MARINE ENVIRONMENTAL ANALYSIS OF SELECTED LANDING SITES

Prepared For:

R.M. Towill Corporation
420 Waiakamilo Rd., Suite 411
Honolulu, Hawaii 96817

Prepared By:

Sea Engineering, Inc.
Makai Research Pier
Waimanalo, Hawaii 96795

AND

Environmental Assessment Co.
1804 Paula Drive
Honolulu, Hawaii 96816

March 1992

91-85

TABLE OF CONTENTS

I. INTRODUCTION

GENERAL

GTE Hawaiian Tel is planning the installation of an Interisland Fiber Optic Cable System linking the islands of Kauai, Oahu, Maui and Hawaii. The site selection and evaluation process has been underway since early 1991, and Sea Engineering, Inc. has been retained over that period by the R.M. Towill Corporation to evaluate the marine considerations for potential landing sites and to assist in the preparation of the Environmental Assessments for the recommended landing sites. Dr. Richard Brock of the Environmental Assessment Company, a subconsultant to Sea Engineering, Inc., was responsible for characterizing the nearshore marine biological conditions along the cable routes and also assisted with the impact evaluation.

This report describes the nearshore marine selection process, the alternatives considered, the physical and biological characteristics of the nearshore cable routes, and the anticipated marine environmental impacts.

Figure I-1 shows the interisland cable configuration and the recommended landing sites.

ROUTE SELECTION PROCESS

This report describes only the nearshore marine considerations of the selection process. Other considerations included land suitability, deep ocean conditions, public usage and terrestrial and marine impacts. A series of two Working Papers, prepared by the R.M. Towill Corporation (1991), describe in detail the overall selection process, the alternatives considered, and the rationale for the recommended routes.

The coastal sector boundaries for the potential cable landing sites were initially defined by two primary constraints:

1. The total cable length between central offices was limited to a maximum of 200 kilometers, and preferably to less than 185 km. Cable lengths over 200 km would require an expensive subsea repeater.

2. Proximity of the cable landing site to a central office was desirable, along with relatively easy access to the central office via available polelines, ductlines, or other GTE infrastructure.

Given these constraints, sectors of coastline were delineated which bounded the potential landing areas. An office evaluation of each coastal sector was then completed, utilizing existing literature, color aerial photographs, marine charts, coastal inventories prepared by state and Federal agencies, and personal knowledge of nearshore physical and biological

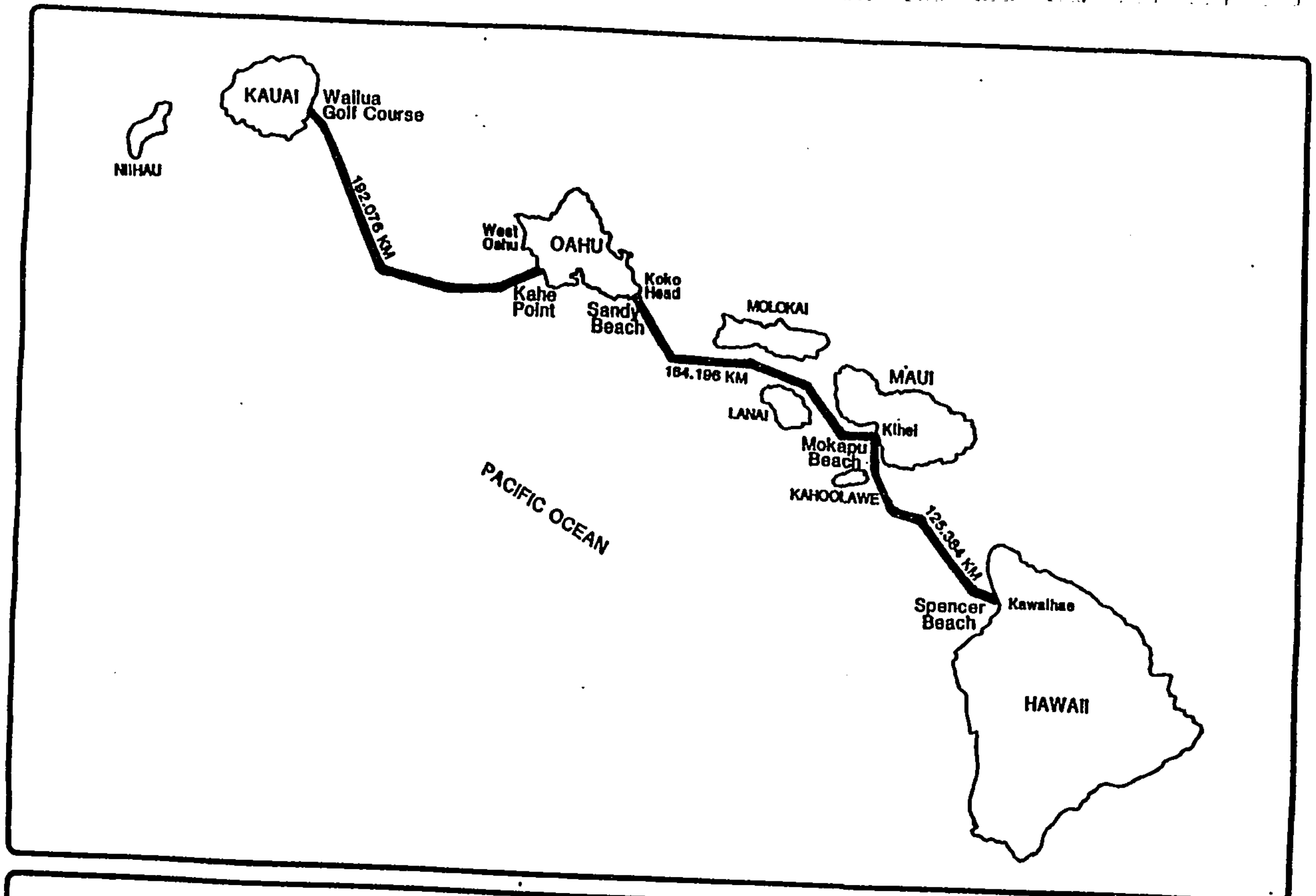


FIGURE I-1. SUMMARY OF RECOMMENDED GTE HAWAIIAN TEL FIBER OPTIC LANDING SITES – STATE OF HAWAII characteristics and uses. A one day field reconnaissance was then conducted in each sector to select three potential landing sites in each sector. If no suitable sites were found within the sector limits, the sector was enlarged as required.

Following the consolidation of all planning considerations mentioned above (terristrial and marine) a more detailed field study was conducted at each site by an ocean engineer and marine biologist. The objective of this phase was to select the primary and secondary route alternatives.The marine biologist was incorporated into this phase of the study to conduct a preliminary assessment of the selected alternatives and to ensure that there were no overriding environmental constraints.

After initial approval by the client of the recommended route, a detailed bathymetric survey was conducted at each site. During this survey, while accurate positioning equipment was available, a diver was towed along the route centerline, and his visual observations were correlated with the track line and the water depth. This step provided valuable information about the precise conditions along the route, and also ensured that there were no unexpected conditions in the nearshore area.

One additional field trip was made to each site, for the express purpose of describing the physical and biological characteristics of the route and adjacent areas, and to evaluate the potential environmental impacts.

The limit of the diving surveys was the 100 foot depth contour. However, the diving support vessels were equipped with fathometers, and tracklines were were run to the 180 foot depth to ensure that no steep ledges were encountered beyond the limit of the visual survey.

MARINE SELECTION CRITERIA FOR NEARSHORE
CABLE ROUTE EVALUATION

Throughout the cable route selection and evaluation process the primary objective was to find a suitable, safe cable route which would also result in the minimum environmental impacts possible in that sector.

Specific selection criteria included the following:

1. Sandy bottoms and coastlines were preferred, both for integrity of the cable and to minimize environmental impacts. Experience at other cable landing sites on Oahu (Makua Beach, Makaha Beach and Nanakuli Beach) indicates that cables on sandy bottoms tend to sink into the sand. No cable cross section is exposed, and wave forces on the cables are therefore minimal. In most of these areas, the winter surf and shorebreak can be very large, yet the numerous cables making landfall there have remained stable.

   Hawaii beaches are usually in a dynamic balance with a large offshore sand deposit, and the two are frequently linked by a continuous sand channel, thus providing the ideal configuration for a cable route. In addition to the engineering advantages, the environmental effects of a placing a cable on a sandy bottonm are much less than placing one across a diverse coral community.

2. Minimizing the horizontal distance from the shoreline to the 60 foot depth was another important factor. This is the zone of maximum wave forces, and the assumption was made that some form of cable protection or anchoring would be required when crossing any hard bottom inshore of the 60 foot contour. This distance is also an important factor in the cable landing process. The cable ship can approach shore to approximately the 50 or 60 foot depth, where it is then held in place by tugs. As the cable is towed to shore by a small boat or tug, floats are attached to the cable as it is paid out, so that it floats on the surface until the shore connection is secured. During this time, the cable position must be maintained along the route centerline. Strong currents or long distances make this process more difficult. The goal was to select a route where the distance from shore to the 60 foot contour was less than 4000 feet.

3. There is a semi-continuous ledge which drops off from the 60 foot contour, and extends through many of the coastal sectors of Hawaii. This ledge was formed during an ancient stand of the sea, and typically has a vertical drop of 30 feet or more. This ledge was present in the Kauai sector, both Oahu sectors and the Maui sector. It was therefore important to find a route which either avoided the ledge or passed through a channel in the ledge. Fortunately, the sand channels connecting the beaches to the deeper offshore deposits often bisect the ledge.

4. Routes were selected to avoid, to the maximum extent possible, environmentally sensitive areas or areas frequented by rare or endangered species. A specific example was the avoidance of areas used by green sea turtles for resting or forage. The marine biological consultant was an early participant in the study, so that environmental input was received during the initial route evaluations.

II. GENERAL OCEANOGRAPHIC CHARACTERISTICS

WINDS

The predominant winds in the Hawaiian Islands are the northeast trades, which are present approximately 70 percent of the time with an average speed of 13 mph. The frequency of tradewinds varies greatly with the season. They occur 90-percent of the time during the months of April to October. The winter season (November to March) is defined by a weakening of the high pressure system generating the tradewinds, and the frequency of occurrence decreases to approximately 50-percent. During the winter season, low pressure systems periodically displace the tradewinds, resulting in south or southwest winds known as "Kona" winds. Kona winds, which occur rarely in summer and 17-percent of the time in the winter, range from light and variable to gale or hurricane force.

PREVAILING WAVE CLIMATE

The general Hawaiian wave climate can be described by four primary wave types; the northeast tradewind waves, south swell, North Pacific swell and kona storm waves. These wave types and their general approach direction are shown on Figure II-2.

Tradewind waves may be present in Hawaiian waters throughout the year, but are most frequent in the summer season, between April and September, when they usually dominate the Hawaiian wave climate. They result from the strong and steady tradewinds blowing from the northeast quadrant over long fetches of open ocean. Typical deepwater tradewind waves have periods of 5 to 8 seconds and heights of 4 to 10 feet. During gale conditions tradewind waves may reach heights in excess of 20 feet.

South swell is generated by southern hemisphere storms, and is most prevalent during the months of April through October. These long, low waves approach from the southeast through southwest, with typical periods of 12 to 20 seconds and deepwater heights of 1 to 4 feet. Although their deepwater height is relatively low, the long period results in considerable shoaling near shore with resultant large breaker heights. The surf along the exposed south shores of the islands occasionally reaches heights of 15 feet.

North Pacific swell is produced by winter storms in the North Pacific Ocean and by mid-latitude low pressure areas. North swell may arrive in the Hawaiian Islands throughout the year, but is largest and most frequent during the winter months of October through March. North Pacific swell typically has periods of 12 to 20 seconds and deepwater heights of 5 to 15 feet. The approach direction is typically from the west-northwest through north-northeast. North Pacific swell results in some of the largest waves in Hawaiian waters.For expample, breaking wave heights approaching 50 feet were observed in December 1969.

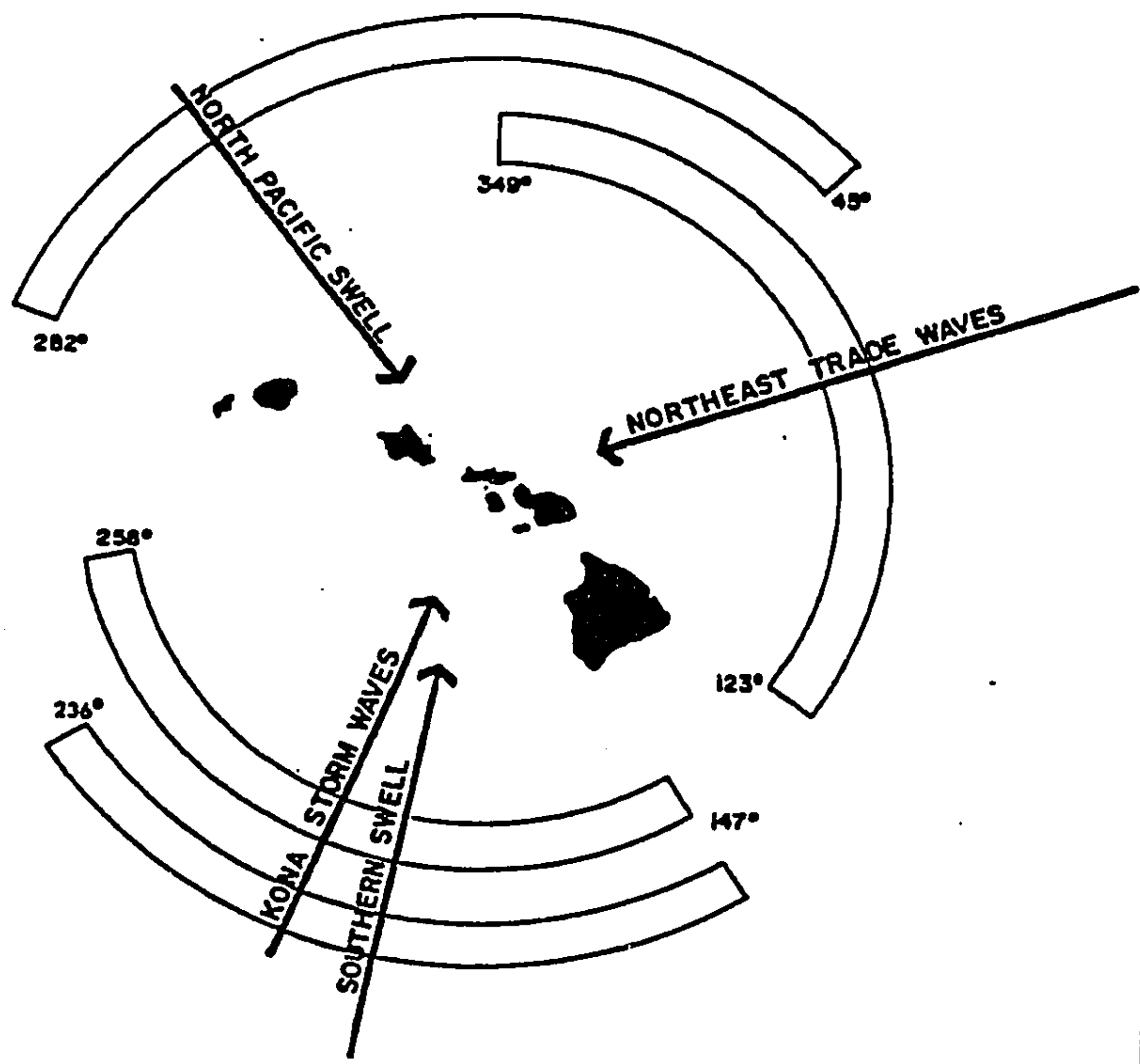


FIGURE II-1.
GENERALIZED WAVE TYPES
(Adapted From The Atlas of Hawaii)

Kona storm waves are generated by intense winds associated with local fronts or low pressure systems and typically have periods ranging from 6 to 10 seconds and typical heights up to 10 feet, but during severe storms heights can approach 20 feet. These waves are most common in late winter and early spring, approaching from the south to southwest.

Hurricane Storm Waves

Hurricanes form near the equator, and in the central North Pacific usually move toward the west or northwest. The primary hurricane season is July through September. These tropical storms or hurricanes usually pass south of the Hawaiian Islands, with a northward curvature near the islands. Late season tropical storms and hurricanes follow a somewhat different track, forming south of Hawaii and moving north toward the islands.

There are many recorded tropical storms or hurricanes which have approached the Hawaiian Islands during the past 35 years, and hurricane waves are generally selected as the design criteria for coastal projects. Most of these storms passed well south or west of the islands, or weakened in intensity as they reach Hawaii, but there have been notable exceptions. Hurricanes Hiki, Della, Nina and Fico passed within about 200 miles of the islands, Dot passed over Kauai, and Iwa passed with 30 miles of Kauai. Kauai.
The report Hurricanes in Hawaii (Haraguchi, 1984), prepared for the U.S. Army Corps of Engineers presents hypothetical model hurricanes for the Hawaiian Islands. The model Hawaiian Hurricane is defined as the probable hurricane that will strike the Hawaiian Islands in the future. The characteristics of the model hurricane are based on the characteristics of hurricanes Dot and Iwa. The predicted wave height and period for the model hurricane are calculated to be 31 feet and 12.0 seconds.

This is a worst case scenario; the actual likelihood of this occurring at one particular site is very low. It is more likely that the storm would pass at some distance, thus the wave height at a particular site would depend on the storm track and decay distance over which the waves travel.

TIDES

The tides in Hawaiian waters are semi-diurnal, with pronounced diurnal inequalities (i.e. two tidal cycles per day with the range of water levels being unequal). The average daily tidal range is approximately 2 feet, the maximum range is 2.8 feet.

COASTAL CURRENTS

Coastal currents in Hawaii are influenced by several factors: large scale oceanic currents, tidal currents, wind-driven currents, waves, and island topography. Hawaii is located in the region of the Pacific North Equatorial current, which generally flows to the west with north current speeds ranging from 0.1 to 1 knot. The current direction may vary from west southwest to north-northwest, and the average speed is estimated to be approximately 0.5 knots. Eddies may form in this current as it passes through the islands. Large scale eddies may also be caused by wind circulation patterns around the large mountains on the islands, and small scale eddies may be caused by local landforms.

In most nearshore locations in Hawaii, the tidal flow is the primary current component. Tidal currents are reversing and generally follow bathymetric contours. The maximum tidal current speed in most locations is 2 knots, with speeds of 0.3 to 1.0 knot being typical. Surface currents are modified by the prevailing winds. Past studies around Oahu have indicated that the top 5 to 15 feet of the water column is influenced during moderate trade wind conditions.

The circulation at any particular location is due to a combination of the above factors.

TSUNAMIS

Tsunami, or seismic sea waves, are primarily generated by submarine earthquakes and earth movement with magnitudes greater than about 6.5 on the Richter scale. Coastal and submarine landslides and volcanic eruptions can also generate tsunamis. The Hawaiian Islands are directly exposed to the major tsunami wave generating areas in the Pacific Ocean: the Kuril-Kamchatka-Aleutian region of the north and northwestern Pacific, the west coast of South America, and the seismically active southwest Pacific. Over 80 tsunamis have been observed in the Hawaiian Islands since 1813, and 22 of them resulted in significant damage. The most damaging occurred in 1946 when an earthquake in the East Aleutian Islands generated a tsunami which killed 173 people in Hawaii and caused $26 million in property damage in Hilo alone.

Tsunami wave periods vary from 5 minutes to over 1 hour. Tsunami wave heights in the deep ocean are only a foot or two and their passage is generally not noticeable. However, in coastal regions, the tsunami wave may be subject to extensive transformation by the shallow water processes of refraction and shoaling, and also resonance in bays and harbors, and it may result in a much amplified wave height at the shoreline. Procedures have been developed for the U.S. Army Corps of Engineers, Pacific Ocean Division to determine tsunami wave elevations along the coastlines of Hawaii for various frequencies of occurrence (Manual For Determining Tsunami Runup Profiles on Coastal Areas of Hawaii, 1978). Tsunami runup elevations computed for 50 and 100 year tsunamis in the landing site areas are presented in later sections of this report.

III. METHODOLOGY FOR MARINE BIOLOGICAL SURVEYS

GENERAL

The quantitative sampling of macrofauna of marine communities presents a number of problems; many of these are related to the scale on which one wishes to quantitatively enumerate organism abundance. Marine communities in the areas surveyed for this surveyed may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a Pocillopora meandrina coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, the sampling program was designed to delineate all major communities in the limits of the study areas and to quantitatively describe these communities. Thus a number of methods were used.

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, divers were slowly towed behind a skiff over most of the study site from shore seaward to at least the 80 foot contour. This exercise allowed the qualitative delineation of major biotopes based partially on the presence of large structural elements (e.g., amount of sand, hard substratum, fish abundance, coral coverage or dominant coral species). Within each of these, stations were established and quantitative studies were conducted, including a visual enumeration of fish, counts along benthic transect lines and cover estimates in benthic quadrats. Besides these quantitative measures, a qualitative reconnaissance was made in the vicinity of each station by swimming and noting the presence of species not encountered in the transects. All assessments were carried out using SCUBA.

Biotopes are defined by physical characteristics including water depth, relative exposure to wave and current action, and the major structural elements present in benthic communities. The latter include the amount of sand, hard substratum, and vertical relief present as well as the biological attributes of relative coral coverage, fish abundance, and dominant species of the coral community. Biotopes are named for the distinctive features of the zone. It should be noted that the boundaries of each zone are not sharp but rather grade from one to another; these are ecotones or zones of transition.

The locations of stations were subjectively chosen as being representative of a given biotope. Immediately following station selection, a visual census of fishes was undertaken to estimate their abundance. These censuses were conducted over a 4 x 25 meter corridor and all fishes within this area from the bottom to the water surface were counted. Data collected included the number of individuals of each species as well as an estimate of individual lengths of all fishes seen; the length data were later utilized in estimating the standing crop of fishes present at each station using linear regression techniques (Ricker 1975, Brock and Norris 1989). A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and note all fishes in the prescribed area (method modified from Brock 1954).

The 25m transect line was paid out as the census progressed, thereby avoiding any previous underwater activity in the area which could frighten wary fishes.

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g., coral mounds, sand flats and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a short transect (25m in length) has proven adequate in sampling many Hawaiian benthic communities (Brock and Norris 1989).

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels or puhis (family Muraenidae) and nocturnal species, e.g., squirrelfishes or ala'ihis (family Holocentridae), aweoweos or bigeyes (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus or rockfishes, family Scorpaenidae; the flat fishes or paki'is, family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count and to estimate sizes. Additionally, bias related to the experience of the diver conducting counts should be considered in making any com- parisons between surveys. In the present study, one individual carried out all of the visual censuses. In spite of these drawbacks, the visual census technique probably provides the most accurate nondestructive method available for the assessment of diurnally active fishes (Brock 1982).

After the assessment of fishes, an enumeration of epibenthic invertebrates (excluding corals) was undertaken using the same transect line as established for fishes. Exposed invertebrates usually greater than 2cm in some dimension (without disturbing the substratum) were censused in a 4 x 25m area. As with the fish census technique, this sampling methodology is quantitative for only a few invertebrate groups, e.g., some of the echinoderms (some sea urchins and sea cucumbers). Most coral reef invertebrates (other than corals) are cryptic or nocturnal in their habits making accurate assessment of them in areas of topographical complexity very difficult. This, coupled with the fact that the majority of these cryptic invertebrates are small, necessitates the use of methodologies that are beyond the scope of this survey (see Brock and Brock 1977). Recognizing constraints on time and the scope of this survey, the invertebrate censusing technique used here attempted only to assess those few macroinvertebrate species that are diurnally exposed.

Exposed sessile benthic forms such as corals and macrothalloid algae were quantitatively surveyed by use of quadrats and the point-intersect method. The point-intersect technique only notes the species of organism or substratum type directly under a point. Along the previously set fish transect line, 50 such points were assessed (once every 50cm). These data have been converted to percentages. Quadrat sampling consisted of recording benthic organisms, algae and substratum type present as a percent cover in six one-meter square frames placed at five-meter intervals along the transect line established for fish censusing (at 0, 5, 10, 15, 20 and 25m).

If macrothalloid algae were encountered in the 1 x 1m quadrats or under one of the 50 points, they were quantitatively recorded as percent cover. Emphasis was placed on those species that are visually dominant and no attempt was made to quantitatively assess the multitude of microalgal species that constitute the "algal turf" so characteristic of many coral reef habitats.

During the course of the fieldwork notes were taken on the number, size and location of any green sea turtles and other threatened or endangered species seen within or near to the study area. With green turtles, efforts were made to record the size (straight line capapace length) of the individuals seen as well as the presence of tags, tumors or any deformities. We also attempted to note the presence of appropriate resting and foraging areas for green turtles.

IV. SPENCER BEACH PARK, HAWAII

ALTERNATIVES CONSIDERED

Areas initially considered for the cable landing included the old Kona airport and the coastline of Kawaihae Bay. The Kona site was eliminated during the preliminary office study due to both marine and terrestrial concerns. The primary negative factor from the marine viewpoint was the nearshore rocky bottom, which would have necessitated at least 1000 feet of cable protection or anchoring, and the heavy recreational use of the area.

The Kawaihae coastal sector is shown in Figure IV-1. There are several pocket beaches within this sector. The rest of the coast is rocky, with low cliff formations along the waterline. As in the other sectors, the search for a suitable landing site concentrated on finding sand channels to avoid crossing extensive lengths of rocky bottom. Specific areas investigated in detail are discussed below.

1. Hapuna Beach: At this site, a cable route could be selected which would provide a sand bottom out to the 50 or 60 foot depth. However, from that point to approximately the 80 foot depth, a distance of 1500 to 2000 feet, the route would cross several areas of prolific coral growth. The bottom in this zone consists of large beds of coral bounded by relatively small, by comparison, sand channels. The coral mounds rise 8 to 10 feet above the bottom, with a high degree of vertical relief on the actual mounds as well. In this area, approximately one-half to three-quarters of the route would be located on the coral beds. Seaward of the 80 foot depth, the bottom consists of limestone rock and coral rubble, with relatively low vertical relief.

2. Mauna Kea Beach: Bottom conditions at this site were almost identical to those at Hapuna, except that the inshore boundary of the coral beds is located at approximately the 45 foot depth. The zonation was similar, with the coral mounds giving way to the relatively flat limestone bottom at a depth of 75 feet.

The rest of the Kawaihae Bay shoreline, from Puako to Kawaihae Harbor, was also investigated during the first field visit, but no other candidate sites were found. Consideration was given to routing the cable up onto the Kawaihae Harbor breakwater, but this alternative was discarded because it would require crossing a shallow reef. The cable would also then be subject to damage by the commercial and industrial activities at the harbor, and by future improvements.

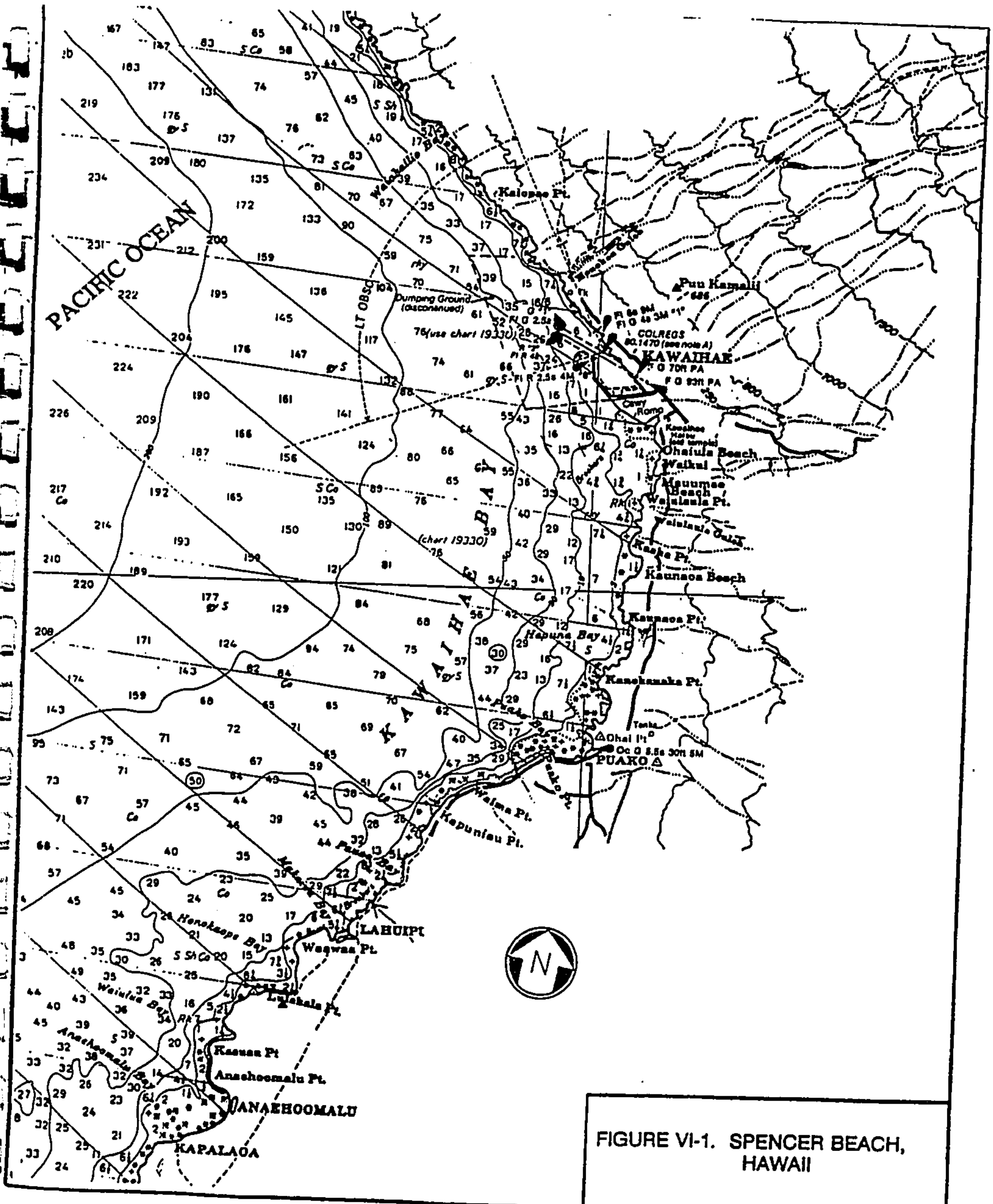


FIGURE VI-1. SPENCER BEACH, HAWAII

DESCRIPTION OF THE SELECTED ROUTE

General Description

Spencer Beach Park was selected as the recommended cable landing site. The park is located immediately south of the Kawaihae Deep Draft Harbor. Spencer Beach Park encompasses one of the typical small pocket beaches along this coast. The beach within the park is Ohaiula Beach, and is approximately 400 feet long. A shallow, fringing reef extends offshore, and shelters the shoreline from waves. A narrow sand channel extends through the reef at the northern end of the beach. Facilities at the beach park include restrooms, picnic tables, showers, tennis courts, a pavilion, a parking lot, a camping area and a lifeguard tower.

Shoreline History

Ohaiula Beach at Spencer Beach Park has been stable over the past 30 years. The vegetation line has experienced little erosion or accretion.

Existing Usage

Spencer Beach Park is a popular park used for tennis, camping, picnicking, swimming, and snorkeling. Facilities at the park include restrooms, picnic tables, showers, tennis courts, a pavilion, a parking lot, a camping area and a lifeguard tower.

Kawaihae Harbor, which lies just to the north, is the second largest harbor on the island. In was constructed in 1958 by blasting and dredging a coral reef platform. The extensive reef off Spencer Beach Park is a continuation of the reef off the harbor. The material removed from the reef for the harbor basin was used for landfill around the perimeter of the basin. An 850 foot long breakwater extends southeast from the main harbor and was constructed in anticipation of a future small boat harbor. The entrance channel and basin for the future harbor were blasted through the reef in 1969 and 1970. At present, the U.S. Army Corps of Engineers plans to begin construction of the harbor in January 1992. Plans are for a 90-boat facility.

A Hawaiian temple, the Puukohola Heiau, is located on the coast at the souteast corner of the harbor perimeter, at the mouth of the intermittently flowing Makeahua Stream. The heiau lies offshore of the beach and is buried under silt. It is listed in the Federal Register of Historic Places. The heiau is located approximately 1200 feet north of the proposed cable route.

Physical Characteristics of the Selected Route

Figure IV-2 shows the proposed cable route, and the characteristics of the surrounding area. The dominant feature of the nearshore area is the fringing reef, which extends 2500 feet out from the shore. As shown in the figure, the reef is cut by a sand channel, which connects the beach to a large offshore sand deposit. The water depth at the seaward limit of the reef is approximately 20 feet. The water depth in the sand channel is typically 10 to 15 feet, and much of the reef is within a few feet of the surface. There are many large coral formations within the channel, also shown on the figure. The channel boundaries and the coral formations within the channel were carefully digitized from a 1 inch = 200 foot aerial photograph, and then corrected for scale errors. The coral formations rise vertically up from the channel bottom to within a few feet of the surface.

Seaward of the fringing reef the bottom is entirely sand, out to at least the 100 foot depth, the limit of the visual survey. The R.M. Towill bathymetric survey shows a large reef formation south of the cable route, in water depths of 35 to 110 feet. The route was selected to avoid this formation, and the closest point of approach is 100 feet. The sand, both in the inner channel and the offshore deposit, is relatively fine and has a high silt content.

This cable route is the only location along this coast where large expanses of offshore coral formations do not have to be crossed. Disadvantages are the coral outcrops in the sand channel and a 50 foot wide basalt shelf at the toe of the beach.

The problem of the coral outcrops can be overcome by carefully selecting the initial route and then adjusting the cable prior to cutting the floats so as to avoid the coral. As shown in Figure IV-2, the selected route avoids most of the formations in the channel.

There is a 50 foot wide basalt shelf at the toe of the beach, extending out to approximately the 3 foot water depth.

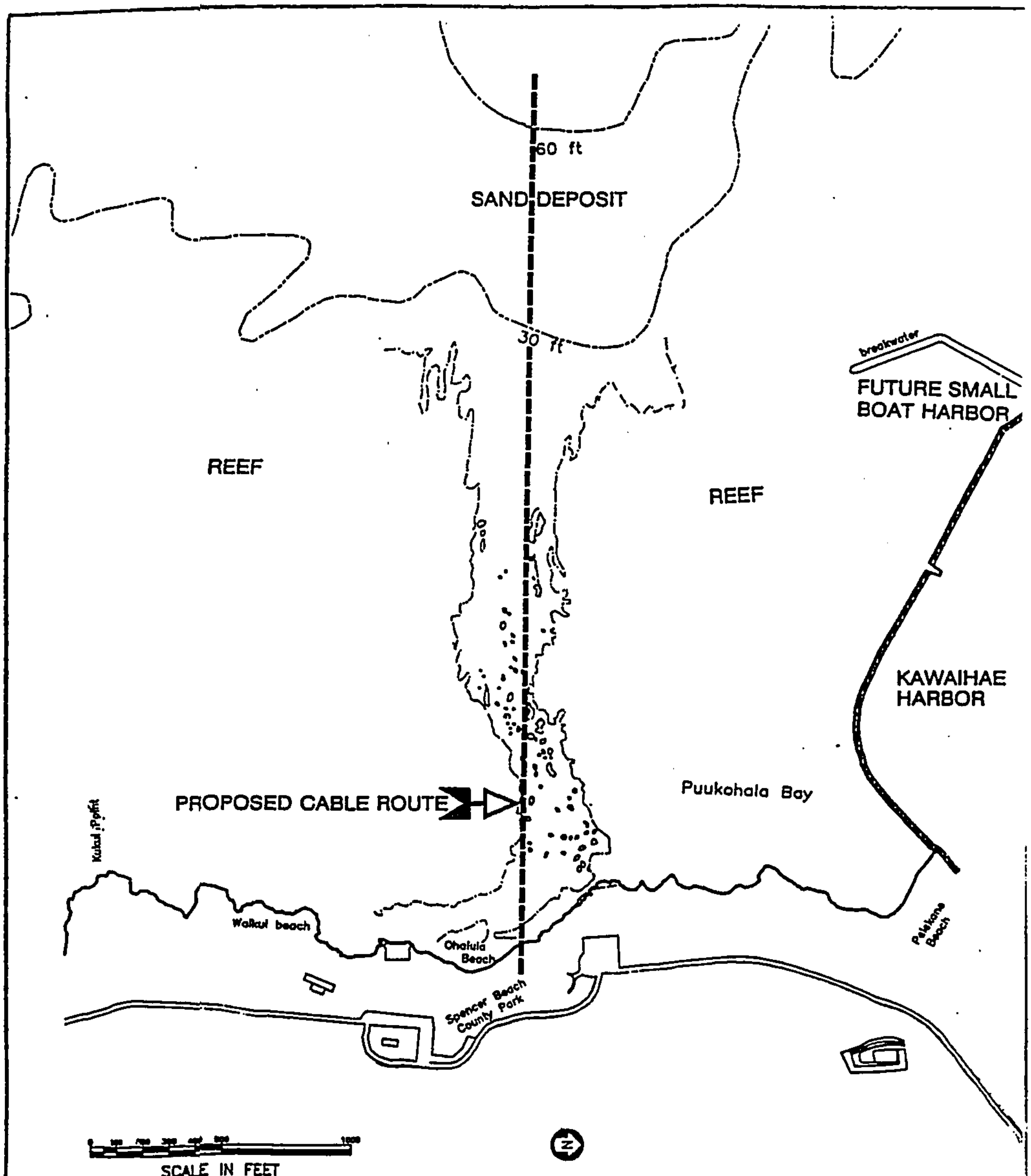


FIGURE VI-2. PHYSICAL CHARACTERISTICS OF SELECTED ROUTE

OCEANOGRAPHIC CONDITIONS

The coast in this area is sheltered from the northeast tradewind waves, but is exposed to wave approach from the northwest, west and southwest. North Pacific swell diffracts and refracts around the islands, and the portion of the energy reaching this site depends upon the approach direction. Kona storm waves and south swell, however, directly approach the coast. Kona wave periods range from 6 to 10 seconds, and wave heights may be as great as 10 feet. South swell periods range from 12 to 20 seconds, and deepwater heights range from 1 to 4 feet.

Wave data measured in Kaunaoa Bay and Mauna Lani are summarized in Table IV-1 (Sea Engineering, 1989). The data indicate that over 75 percent of the wave periods concentrate in the period band from 10 to 16 seconds, with the most frequent period around 13 seconds. Over 90 % of the waves recorded are less than 3 feet high. The design waves will be generated by a hurricane passing to the south and west of the island.

The inshore waters are frequently turbid, due to resuspension of silt and fine sediments by wind and waves (ORCA, Ltd, 1984). Infrequent storm water runoff from usually dry streambeds in the area initially carries silt and debris into Kawaihae Bay. Wind borne coral dust from the dredging stockpiles at Kawaihae Harbor also adds to the sediment load.

Nearshore currents are relatively weak. Six months of current measurements off the Mauna Lani Hotel, approximately six miles south of the landing site, indicated that the nearshore currents (inside the 40 foot contour) had an average speed of less than 0.1 knot. (Sea Engineering, 1989). The resultant flow was a weak net transport to the southwest.

The estimated 50 and 100 year tsunami elevations for this coastline are 5.9 and 8 feet, respectively.

DESCRIPTION OF THE PROPOSED PROJECT

The cable landing process for this site will be similar to that for other sites, except that the 2000 feet of cable closest to shore will require more careful placement than normal. The cable ship will be held in place approximately 4000 offshore during the cable pull. Once the shore end of the cable is secured, it is anticipated that the cable will be attached to a temporary anchor at the seaward head of the sand channel. The floats will then be cut from that point seaward, and the ship can move offshore and proceed with the deep water cable laying. The cable section through the sand channel will still be floating, and several small boats will be used to pull the cable into place prior to cutting the floats. This process can be completed incrementally, adjusting and then sinking one section of cable before moving on the the next. As can be seen from Figure IV-2, there are not too many adjustments that have to be made, and all bends will be well within the allowable bending radius of the cable.

Wave conditions inside the sand channel are mild, even during large surf on the outer reef. Most or all of the energy is dissipated during the initial breaking process. The cable should sink into the sand bottom and remain stable. Depending upon the cable vendor, some split pipe casing may or may not be used as insurance against abrasion.

Some type of protection will likely be required where the cable crosses the 50 foot wide basalt shelf. Casing the cable and then anchoring the split pipe is one possibility, but it is more likely that the cable will be trenched through the rock. This will be a small scale manual operation, removing only enough material to place the cable in a small trench. The trench will then be backfilled with tremie concrete to match the surrounding grade and material.

TABLE VI-1.
WAVE DATA MEASUREMENTS

PERCENT FREQUENCY HISTOGRAM OF WAVE HEIGHT AND PERIOD

(1/13/89 - 4/12/89)

HEIGHT (FEET)	WAVE PERIOD (SEC.) 0.0- 2.0	2.0- 4.0	4.0- 6.0	6.0- 8.0	8.0-10.0	10.0-12.0	12.0-14.0	14.0-16.0	16.0-18.0	18.0-20.0	TOTAL
0.0- 0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5- 1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0- 1.5	0.0	5.6	0.7	0.4	3.4	9.0	10.9	7.1	0.7	0.0	37.8
1.5- 2.0	0.0	0.4	0.0	0.4	0.7	9.0	11.6	4.9	1.5	0.4	28.8
2.0- 2.5	0.0	0.7	1.1	0.7	0.4	3.4	7.5	2.2	0.4	0.0	16.5
2.5- 3.0	0.0	0.0	1.5	0.0	0.7	1.5	2.6	2.6	0.4	0.0	9.4
3.0- 3.5	0.0	0.0	0.0	0.4	0.7	0.4	0.4	0.7	0.7	0.0	3.4
3.5- 4.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.4	0.0	0.0	2.6
4.0- 4.5	0.0	0.0	0.0	0.0	0.7	0.4	0.4	0.0	0.0	0.0	1.5
TOTAL	0.0	6.7	3.4	1.9	7.9	23.6	34.5	18.0	3.7	0.4	100.0

THE TOTAL NUMBER OF DATA = 267
THE RANGE OF WAVE HEIGHTS (FEET) : 1.0 - 4.3
THE RANGE OF WAVE PERIODS (SEC.) : 2.0 - 19.7

PERCENT FREQUENCY HISTOGRAM OF WAVE HEIGHT AND PERIOD

PERCENT FREQUENCY (%)
(4/12/89 - 7/25/89)

HEIGHT (FEET)	WAVE PERIOD (SEC.) 0.0- 2.0	2.0- 4.0	4.0- 6.0	6.0- 8.0	8.0-10.0	10.0-12.0	12.0-14.0	14.0-16.0	16.0-18.0	18.0-20.0	TOTAL
0.0- 0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5- 1.0	0.0	0.6	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	1.0
1.0- 1.5	0.0	10.0	1.6	2.6	2.3	3.2	20.9	23.2	4.8	0.0	68.5
1.5- 2.0	0.0	1.0	2.9	1.3	0.6	1.0	7.7	9.3	0.6	0.3	24.8
2.0- 2.5	0.0	0.0	0.6	0.0	0.0	0.0	1.6	1.9	1.0	0.0	5.1
2.5- 3.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
3.0- 3.5	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
TOTAL	0.0	11.6	5.8	3.9	2.9	4.2	30.5	34.4	6.4	0.3	100.0

THE TOTAL NUMBER OF DATA = 311
THE RANGE OF WAVE HEIGHTS (FEET) : 1.0 - 3.1
THE RANGE OF WAVE PERIODS (SEC.) : 2.0 - 19.7

PERCENT FREQUENCY HISTOGRAM OF WAVE HEIGHT AND PERIOD

PERCENT FREQUENCY (%)
(1/13/89 - 7/25/89)

HEIGHT (FEET)	WAVE PERIOD (SEC.) 0.0- 2.0	2.0- 4.0	4.0- 6.0	6.0- 8.0	8.0-10.0	10.0-12.0	12.0-14.0	14.0-16.0	16.0-18.0	18.0-20.0	TOTAL
0.0- 0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.5- 1.0	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.5
1.0- 1.5	0.0	8.0	1.2	1.6	2.8	5.9	16.3	15.7	2.9	0.0	54.3
1.5- 2.0	0.0	0.7	1.6	0.9	0.7	4.7	9.5	7.3	1.0	0.3	26.6
2.0- 2.5	0.0	0.3	0.9	0.3	0.2	1.6	4.3	2.1	0.7	0.0	10.4
2.5- 3.0	0.0	0.0	0.9	0.0	0.3	0.7	1.2	1.2	0.2	0.0	4.5
3.0- 3.5	0.0	0.0	0.2	0.2	0.3	0.2	0.2	0.3	0.3	0.0	1.7
3.5- 4.0	0.0	0.0	0.0	0.0	0.5	0.0	0.5	0.2	0.0	0.0	1.2
4.0- 4.5	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.0	0.0	0.0	0.7
TOTAL	0.0	9.3	4.7	2.9	5.2	13.1	32.4	26.8	5.2	0.3	100.0

THE TOTAL NUMBER OF DATA = 578
THE RANGE OF WAVE HEIGHTS (FEET) : 1.0 - 4.3
THE RANGE OF WAVE PERIODS (SEC.) : 2.0 - 19.7

THE WAVE HEIGHT IS THE SPECTRALLY BASED SIGNIFICANT WAVE HEIGHT.
THE WAVE PERIOD IS THE PERIOD ASSOCIATED WITH THE SPECTRAL PEAK.

MARINE BIOLOGICAL SETTING

The qualitative reconnaissance of Spencer Beach Park was carried out on 17 July 1991 and the quantitative sampling of this site was done on 16 January 1992. The qualitative survey extended from shore to about the 90 foot isobath approximately 3,900 feet from shore. In this area three major zones or biotopes were defined. In general, the biotopes parallel the shore but in the proposed cable alignment, the most seaward biotope (the biotope of sand) extends into shallow water towards the beach. The presence of sand was an important factor in the selection of the proposed route. The biotopes recognized in the vicinity of the proposed cable alignment at Spencer Beach Park are the biotope of sand, the biotope of emergent hard substratum and corals and the biotope of scattered corals. The biotope of emergent hard substratum and corals lies to the north and south of the proposed cable alignment. The boundaries of these biotopes are given in Figure VI-3. The biotope of sand is situated primarily seaward of the project area but encroaches as a 160 to 325 foot wide channel well into the study site to within 1400 feet of shore. Shoreward of the biotope of sand is the elongate biotope of scattered corals which is restricted to a sand channel that is oriented perpendicular to shore and cuts through the biotope of emergent hard substratum and corals. Inshore of the biotope of scattered corals on the proposed cable alignment is an area of sand that extends to the shoreline with a small area of scoured emergent hard substratum just seaward of the beach.

The Biotope of Sand

The biotope of sand lies principally seaward of the project site. It occurs as a "pie-shaped wedge" towards the shoreline in the area proposed for the cable alignment. As the name implies, the substratum in the biotope of sand is dominated by sand. Because of its shifting nature, the benthic species found in sand habitats are generally adapted for life on an unstable and frequently abrading environment. Many species that are found in this habitat will bury into the sand to avoid predators and the abrasion that occurs with storm waves. Thus many species in the sand biotope are cryptic and difficult to see; among those are many of the molluscs and crustaceans such as the kona crab (Ranina serrata). Hence, without considerable time spent searching in the sand many species in the sand habitat will not be seen. The biotope of sand is best developed at greater depths; where it enters the shallow water, many of the characteristic species become less abundant. Therefore, the inshore boundary of this biotope is arbitrarily shown well offshore in Figure VI-3 despite the presence of considerable sand shoreward of this point.

Because of constraints with bottom time at the depth of which the biotope of sand is found as well as very poor water clarity on 16 January 1992, we did not quantitatively sample this biotope but rather utilized the data gathered in our qualitative reconnaissance of the habitat on 17 July 1991 in waters from 80 to 90 feet in depth. Species frequently seen in the biotope of sand include a number of molluscs: the helmet shell (Cassis cornuta), augers (Terebra crenulata, T. maculata and T. inconstans), the leopard cone (Conus leopardus) and flea cone (Conus pulicarius) as well as the sea hare (Brissus

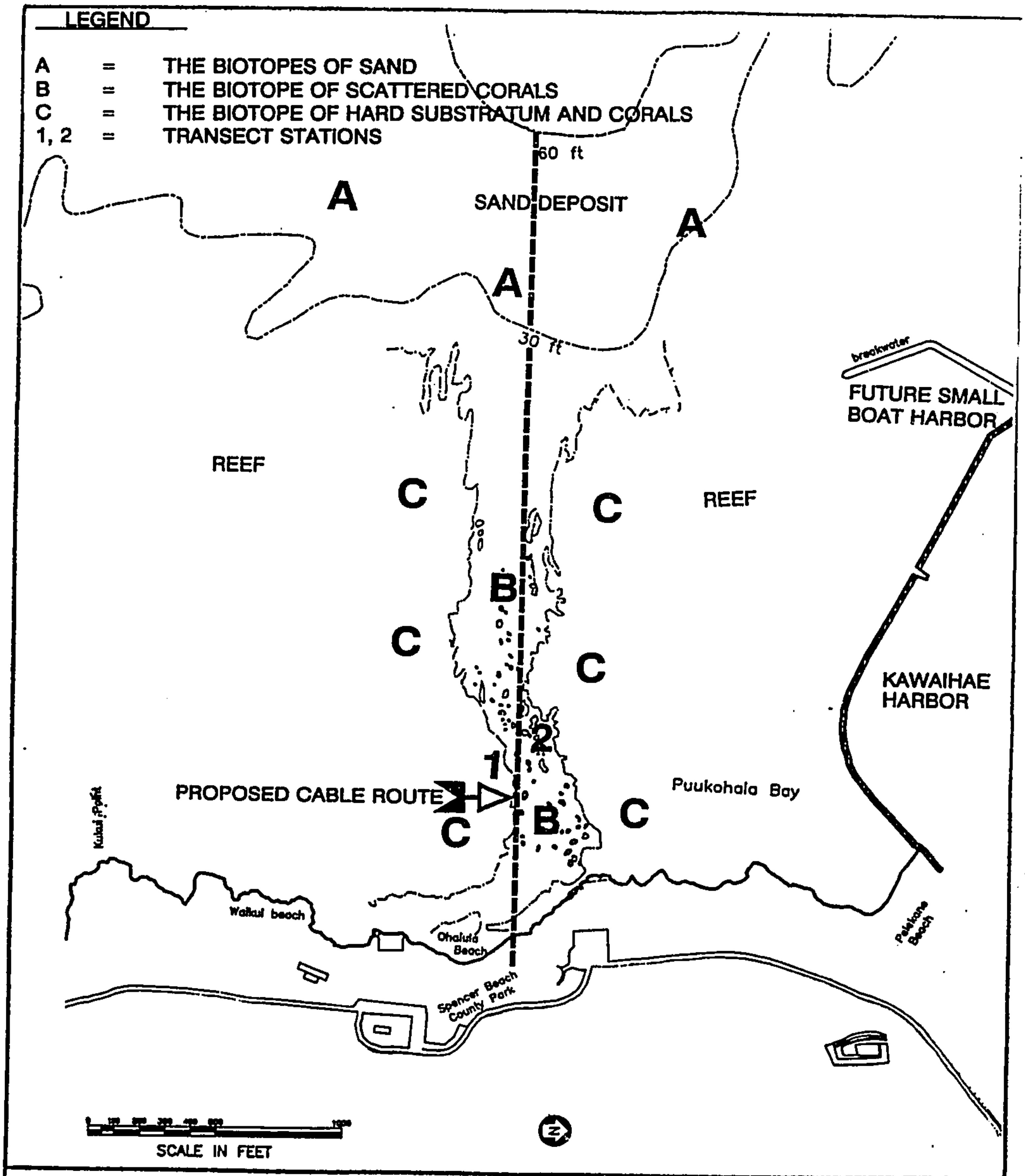


FIGURE VI-3. BIOTOPES ALONGS SELECTED CABLE ALIGNMENT sp.), starfish (Mithrodia bradleyi), brown sea cucumber (Bohadschia vitiensis), opelu or mackeral scad (Decapterus macarellus), nabeta (Hemipteronotus umbrilatus), the goby-like fish (Parapercis schauslandi), uku or snapper (Aprion virescens), hihimanu or sting ray (Dasyatis hawaiiensis) and the weke or white goatfish (Mulloides flavolineatus). Undoubtedly, with greater searching, many more fish species would be encountered in this biotope.

The Biotope of Emergent Hard Substratum and Corals

Both to the north and south of the channel alignment is the biotope of emergent hard substratum and corals. This biotope may characterized as a hard substratum reef flat that is quite shallow, ranging from about 3 to 8 feet in depth. The biotope extends for a considerable distance both north and south of the study area. Although the proposed cable alignment does not cross this biotope, we sampled the biotope because of its proximity to the proposed alignment.

The substratum in the biotope of emergent hard substratum and corals is comprised of both basalt rock (pahoehoe) and limestone as well as corals. There are scattered depressions and small channels on this substratum; the depressions are from 3x3 feet to about 12x30 feet in dimensions and are up to 2 feet in depth. These depressions are spaced from 8 to 30 feet apart and between them are small channels no more than 4 feet in width, up to 15 feet in length and to about 1 foot in depth. The small channels have a general orientation approximately perpendicular to shore. The channels, depressions and corals provide ample cover for fishes and invertebrates, yet as noted below, few organisms were seen in the quantitative survey.

Station 1 was established approximately 650 feet offshore about 30 feet south of the proposed cable alignment at a point where the proposed alignment occurs directly adjacent to the hard substratum of the biotope of hard substratum and corals in water ranging from 3 to 7 feet in depth. The substratum at this station is as described above for the biotope. The results of the quantitative survey are presented in Table IV-1. Two algal species (Porolithon gardineri and Galaxaura acuminata) occurred at a mean coverage of 5.3 percent. Four coral species (Porites lobata, P. (Synaraea) convexa, P. compressa and Pocillopora damicornis) were present in the quadrat survey with a mean estimated coverage of 10.4 percent. Three macroinvertebrate species were encountered in the 4 x 25m census area; these species were the ubiquitous green sea urchin (Echinometra mathaei), the slate pencil urchin (Heterocentrotus mammillatus) and the pearl oyster (Pinctado marginifera). The results of the fish census made at Station 1 are presented in Appendix C. In total eleven fish species (36 individuals) were censused and the standing crop was estimated to be $8g/m^2$. The most abundant fish species at Station 1 include the saddleback wrasse or hinalea lauwili (Thalassoma duperrey) and the small eleotrid (Asterropteryx semipunctatus). The saddleback wrasse contributed most to the estimated biomass.

In the vicinity of Station 1 were seen the corals (Pavona duerdeni, Montipora flabellata, M. verrucosa, Fungia suctaria) the black sea urchin (Tripneustes gratilla), the moa or boxfish (Ostracion meleagris) and the sharpback puffer (Canthigaster jactator).

TABLE IV-2.

Summary of the benthic survey conducted in the biotope of hard substratum and corals approximately 650 feet offshore of Spencer Beach Park, Hawaii on 16 January 1992. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Pact C. A short summary of the fish census is given in Part D. Water depth is 3 to 7 feet; mean coral coverage is 10.4 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number					
	0m	5m	10m	15m	20m	25m
Algae						
Galaxaura acuminata						5
Porolithon gardineri	4	5	4	6	4	4
Corals						
Porites lobata	3.5		37	1.2	4	
Porites (Synaraea) convexa						13
Porites compressa	3					0.2
Pocillopora damicornis	0.2					
Sand			9			
Rubble		40	3			
Hard Substratum	89.5	54.8	47	92.8	92	77.8

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Porolithon gardineri	12
Corals	
Porites lobata	4
Porites compressa	2
Cyphastrea ocellina	2
Sand	12
Rubble	12
Hard Substratum	56

TABLE IV-2.
Continued

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Pinctado marginifera	1
Phylum Echinodermata	
Echinometra mathaei	154
Heterocentrotus mammillatus	1

D. Fish Census (4 x 25m)
11 Species
36 Individuals
Estimated Biomass = $8 g/m^2$

The Biotope of Scattered Corals

The proposed cable alignment passes through the biotope of scattered corals. This biotope may be described as occurring in a sand channel that has an orientation perpendicular to shore. The dominant substratum in this biotope is sand; spaced from 2 to 75 feet apart are areas of corals. These coral "mounds" range in size from about 3x3 feet to 20x50 feet and are up to 8 feet in height. Common coral species seen in this biotope include Porites lobata, Porites compressa and Montipora verrucosa. Few macroinvertebrates are seen on the sand substratum but there are a number of burrows or holes created by a number of species including the commensal goby-shrimp, unidentified crustaceans, echinoderms, etc.

Station 2 was established approximately 40 feet north of the proposed alignment in water about 15 feet in depth. The transect at this station sampled both the hard substratum with corals as well as the open sand substratum. The sand at this station had a surface layer of very fine sedimentary material over it; below this 0.25 inch layer was the usual coarser beach sand. Water visibility at the time of censusing was about 6 feet.

Table IV-2 presents the results of the quantitative survey carried out at Station 2. The quadrat survey noted three coral species (Porites lobata, Porites compressa and Montipora verrucosa) having a mean coverage of 17.9 percent. Only one macroinvertebrate species was noted at this station; this was the Hawaiian rock oyster (Spondylus tenebrosus). However on the sand were seen the burrows of the commensal gobies and shrimps occurring in a density of about $3/m^2$ but no shrimps (Alpheus sp.) were seen. Other smaller unidentified burrows occurred in at a density of about $8/m^2$. The fish census noted four species (44 individuals) in the 4 x 25m census area (Supplemental Table IV-2A). The most common fishes were the alo'ilo'i or whitespot damselfish (Dascyllus albisella) and the small eleotrid (Asterropteryx semipunctatus). The standing crop of fishes at this station was estimated at $4 g/m^2$.

In the vicinity of Station 2 were seen the algae or limu (Desmia hornemannii and Cladymenia pacifica), corals (Porites evermanni, Leptastrea purpurea and Pocillopora meandrina), the christmas-tree worm (Spirobranchus gigantea), oak cone (Conus quin), the butterfly fish or kikakapu (Chaetodon auriga), lizard fish or 'ulae (Synodus binotatus), the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus) and goldring surgeonfish or kole (Ctenochaetus strigosus).

TABLE IV-3.

Summary of the benthic survey conducted in the biotope of scattered corals approximately 850 feet offshore of Spencer Beach Park, Hawaii on 16 January 1992. Results of the 6m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth is 15 feet; mean coral coverage is 17.9 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	0m	5m	10m	15m2	0m	25m
Corals						
Porites lobata	·53	1				
Porites compressa	9	43				
Montipora verrucosa	1.4					
Sand/mud	36.6	50	96	95	100	100
Rubble			4			
Hard Substratum		6		5		

B. 50-Point Analysis

Species	Percent of the Total
Corals	
Porites lobata	10
Porites compressa	8
Montipora patula	2
Pocillopora damicornis	2
Sand	68
Rubble	4
Hard Substratum	6

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Spondylus tenebrosus	1
Unidentified Burrows in Sand	
Psilogobius-Alpheus burrows	3/m^2 in sand
Unidentified small burrows	8/m^2 in sand

TABLE IV-3
Continued.

D. **Fish Census (4 x 25m)**

4 Species
44 Individuals
Estimated Biomass = $4g/m^2$

Inshore of the biotope of scattered corals (commencing 325 feet offshore) is an area of sand that extends from that point to within 80 feet of the shoreline. Inspection of this area on the 16 January 1992 survey noted no macrofauna present. Undoubtedly, with enough search time one would note fishes crossing this sand area such as juvenile jacks or papio (family Carangidae) as well as other species. Between the sand area and the shore in the vicinity of the proposed cable alignment is a small "finger" of emergent basalt (pahoehoe). This hard bottom commences about 15 feet offshore of the sand beach (about 3 feet deep) and continues seaward to a maximum extent of about 80 feet offshore in 8 feet of water. Most of this hard substratum was partially covered with a veneer of sand at the time of sampling and appeared to be quite scoured with no obvious macrobiota present in the area of the proposed alignment. However about 50 feet to the north the hard substratum rises further from the sand (i.e., is shallower) and has a veneer of microalgal species. In a short inspection of this area, the alga (Microdictyon setchellianum) was seen as well as the green sea urchin (Echinometra mathaei), the boring urchin (Echinostrephus aciculatum), the long spined urchin or wana (Echinothrix diadema), green wrasse or 'omaka (Stethojulis balteata) and the saddleback wrasse or hinalea lauwili (Thalassoma duperrey). Also noted were broken live loose fragments of the corals Porites lobata and Pocillopora meandrina.

The intertidal region at this proposed cable landing site is a sand beach. We did not encounter any fauna or flora on this beach.

One small green sea turtle (Chelonia mydas) was seen in the biotope of scattered corals about 900 feet from shore in about 15 feet of water during the 16 January 1992 survey. This turtle was estimated to be about 55cm in straight line carapace length. We were unable to determine if this turtle bore any unusual features (i.e., tumors, tags or deformities). Offshore of Spencer Beach Park appears to have appropriate shelter for green turtles (i.e., undercuts, ledges and caves) at a size and scale appropriate for green turtle resting areas. However we noted little macroalgae present in the area that could be utilized as forage (Balazs, 1980, Balazs et al. 1987). We saw no other turtles in the vicinity of the proposed cable landing site but one individual (Mr. Patrick Cunningham) familiar with the area noted that about one-quarter mile to the south small green turtles are frequently seen in the nearshore waters. We have found no information to suggest that nesting of sea turtles at Spencer Beach Park has occurred in historical times.

The biological survey of the proposed cable alignment at Spencer Beach Park did not find any rare or unusual species or communities other than the single threatened green sea turtle noted above. Another protected species, the humpback whale (Megaptera novaeangliae), was not seen offshore of the study area during the period of our field effort. As noted by

Herman (1979), humpback whales tend to be found in regions remote from human activities and the proposed Spencer Beach Park cable alignment is in relatively close proximity to Kawaihae Harbor which has been the major commercial port serving West Hawaii for many years.

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Impacts with Construction

The potential for impact to the shallow marine communities will probably be greatest with the construction phase of this proposed project. From the sea, the proposed cable alignment enters the shallows through the biotope of sand. As a substrate to support marine communities, sand is inappropriate for many coral reef forms because many species require a stable bottom (e.g.,corals and many of the associated invertebrates). Thus the species usually encountered in sand areas are usually those that are adapted to exist in an ever-changing, moving substratum. Similarly, much of the benthic production on coral reefs occurs on hard substratum, (i.e., macroalgae require a solid substratum for attachment). Because sand substrates are subject to movement, they may abrade and scour organisms on this substratum. Thus the characteristics of most species encountered in Hawaiian sand communities are (1) that they typically burrow into the substrate to avoid scouring, (2) that they frequently occur in low abundance which may be related to food resources, and (3) that they are mobile because of the shifting nature of the substratum and potential for burial. Since these forms are motile, deployment of the cable across such a substratum presents little chance of negative impact to resident species because they would probably "just move out of the way as the cable was deployed". Additionally since the substratum shifts, it is probable that the deployed cable will "sink into" the substrate. Personal observations made on other deployed cables shows them to often be partially buried by the natural movement of the sand.

As the cable enters the shallows offshore of Spencer Beach Park, there are areas where the scattered coral mounds will lie in the direct path of the cable. Cutting or trenching through these mounds, which are up to 8-feet above the surrounding bottom, would be difficult and would result in loss of the benthic community in the alignment path. Other impacts would be those associated with the generation of turbidity during the trenching process.

Spencer Beach Park was selected as the cable landing site based upon the assumption that the fiber optic cable would be routed as necessary to avoid the scattered coral mounds. The anticipated placement method was discussed in an earlier section of this chapter. At most, it is anticipated that trenching will only have to be undertaken in shallow water across approximately 50 feet of scoured pahoehoe adjacent to the beach. Since this scoured substratum supports few, if any, benthic organisms in the proposed path, there should be little or no impact to marine organisms.

Other construction methods to protect the cable in shallow water range from just laying the cable directly on the basalt shelf without any specific attachment, to placing it inside of a protective pipe that is bolted to the shelf. This strategy has been used at the Natural Energy

Laboratory of Hawaii facility at Keahole Point, Hawaii to secure pipes coming ashore through a subtidal region that is frequently subjected to extreme high energy conditions. Bolting a pipe to the substratum significantly reduces the impact to surrounding benthic communities over the alternative of trenching and backfilling. This alternative may provide low impact to marine communities but it will have an obvious visual impact to any underwater observer. If the trenching and back- filling strategy is used, the tremie concrete cap will probably be colonized by corals, algae and other benthic forms. Studies on substrate selection in Hawaiian coral larvae have shown concrete to be second only to limestone/coral as an appropriate substratum for settlement (Fitzhardinge and Bailey-Brock 1989). Laying the cable directly on the basalt without attachment may result in cable abrasion, and is not an acceptable alternative.

Our 16 January 1992 survey noted considerable turbidity in the region of the proposed cable alignment. Offshore in the biotope of sand, visibility was less than 1 foot at the 80 foot depth. Inshore in the biotope of scattered corals, visibility was about 6 feet. For two days preceding the survey, considerable rainfall had occurred on the West Hawaii coast (Mr. Patrick Cunningham, personal communication). Our inspection of the mouth of Waimea Stream (which is intermittent in its lower reaches) revealed a large amount of water had reached the sea bringing a considerable amount of terrigeneous material with it. Waimea Stream is south of the project site but it is surmised that the stream was the source of much of the turbid water encountered in the study area because of the brown (possibly terrigeneous) color. The second source of turbidity was from surf on the reef. During the month of January 1992 there was a near-continuous westerly swell impacting this coastline. The high surf resuspends fine sediments making the water turbid. These occasional natural inputs of turbidity serve to reduce light levels and potentially impact benthic communities. The communities present in the vicinity of the proposed alignment have evolved under this occasional impact. Construction activities related to the cable landing probably would not begin to match the level of turbidity both in terms of scale or intensity that we encountered on our 16 January 1992 field effort.

We expect that there would be no direct impacts to the threatened green sea turtle or to endangered humpback whales (Megaptera novaeangliae). As far as the impact to humpback whales is concerned, if construction activities are restricted to the period between April through October, there would be no impacts because the whales are seasonal and are only in island waters from November through March. Even assuming that the cable deployment occurs when the whales are present in Hawaiian waters, it is anticipated that the impacts would be minimal. The cable laying ship should not be on site more than one or two days.

The most probable source of local impact to whales would be noise generation by the cable laying ship, the support tugs and the small boats. There are variable and conflicting reports as to the impact of vessel traffic on whales (Brodie, 1981; Matkin and Matkin, 1981; Hall, 1982; and Mayo, 1982). With respect to the response of individual humpback whales, there is sufficient information to demonstrate that boating and other human activities do have an impact on behavior (Bauer and Herman, 1985). Thus it is probably valid to assume that impact to whales could occur if individuals are within several kilometers of the deployment site. However, as noted above, these impacts are of short duration, and all activity will be concentrated in a small area. The potential impacts also need to be evaluated in light of the proximity of the site to Kawaihae Deep Draft Harbor, the second largest harbor on the island.

Sea turtles are permanent residents in inshore Hawaiian habitats. Although the potential exists for problems during the construction phase if it entails dredging, the generation of fine particulate material from dredging appears not to hinder the green turtle in Hawaiian waters; at West Beach, Oahu, green turtles moved from an offshore diurnal resting site about one 3,300 feet offshore to a point about 600 feet from the construction site within days of the commencement of dredging and the generation of turbid water. The turtles appeared to establish new resting areas in the turbid water directly offshore of the construction site (Brock 1990a). The reason(s) for this shift in resting areas is unknown but may be related to the turtles seeking water of poor clarity to possibly lower predation by sharks (a major predator on green sea turtles).

Fishery Considerations

Access to the shoreline at Spencer Beach Park is excellent and has probably been so since prehistoric times; the Kawaihae area was an important center in the Hawaiian culture. The beach at Spencer is heavily used by people interested in beach going and probably fishing. Fishermen catch fish both from shore as well as offshore from small boats. In all probability, some commercial fishing occurs offshore of the proposed cable alignment. We are unaware of any individuals that specifically and exclusively use Spencer Beach Park area for subsistence fisheries. Probably most of the fishing activity in and around Spencer Beach Park is by recreational fishermen. With most Hawaiian recreational fisheries, species targeted include papio and ulua (family Carangidae), o'io or bonefish (Abula vulpes), moi (Polydactylus sexfilis), goatfishes (family Mullidae), snappers (family Lutjanidae), surgeonfishes (family Acanthuridae), parrotfishes (family Scaridae), and a host of smaller species such as the aholehole (Kuhlia sandvicensis), aweoweo (Priacanthus cruentatus) and mempachi (Myripristes amaenus). Fishing methods used include nets, spears, traps as well as hook and line.

This survey noted a paucity of fishes or invertebrates. One reason for this may be related to the high turbidity present at the time of sampling. Turbidity may temporarily cause motile species to leave; when conditions improve, they may return. Some comparative information for the Spencer Beach area is available from a study carried out by Brock (1991) where three stations were established seaward of Kawaihae Small Boat Harbor in May 1991. The closest station to the proposed cable alignment is approximately 1000 feet to the north in water 8 to 12 feet deep. A fish census at this station resulted in 26 species and 231 individuals encountered. The census methods were identical to those used here.

The standing crop of fishes on coral reefs is usually in the range of 2 to 200g/m^2 (Brock 1954, Goldman and Talbot 1975, Brock et al. 1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, the variation in standing crop appears to be related to the variation in local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in a lower estimated standing crop of fish (2 to 20g/m^2). Goldman and Talbot (1975) note that the upper limit to fish biomass on coral reefs is about 200g/m^2. The present study found extremely low estimated standing crops at both stations especially when viewed with respect to the availability of shelter space. It is probable that both fishing pressure as well as high turbidity have played a role in the low estimated biomass at these stations.

Water Quality Considerations

With any disturbance to the seafloor, sediment will be generated which will manifest itself as turbidity. This may occur through natural events such as storm surf resuspending fine material that had previously come into the area through natural events and settled, or by human activities including the directing of storm water runoff into the ocean or by underwater construction activities. Underwater construction may generate fine particulate material that could impact corals. The generation of fine sedimentary material could have a negative impact to corals and other benthic forms if it occurs in sufficient quantity over sufficient time. Studies (e.g., Dollar and Grigg 1981 noted above) have found that the impact must be at a high level and chronic to affect adult corals.

The small scale of the trenching activities that would be necessary to protect the cable in shallow water (if used) would probably produce little sediment. This statement is supported by the fact that only 50 lineal feet of hard substratum would be disturbed. The small scale and anticipated short duration of the project suggest a minimal impact. High water motion will keep fine particulate and sedimentary material suspended in the water column, reducing the settlement on benthic organisms in shallow water habitats thus assisting in the advection of this material out of these areas (less than 100m in depth) where corals are found.

The turbidity generated by the construction activity will be short in duration and relatively small in quantity. Numerous studies have provided observations showing the relationship between increased suspended or deposited sediment with reduced coral growth rates, cover and species diversity (Roy and Smith 1971, Maragos 1972, Loya 1976, Bak 1978, Randall and Birkeland 1978, Cortes and Risk 1985, Grigg 1985, Hubbard and Scaturo 1985, Kuhlman 1985, Muzik 1985, Hubbard 1987). In contrast, Glynn and Stewart (1973) found no correlation between these parameters on reefs off the Pacific side of Panama.

Turbidity is a an optical property that is related to the scattering of light by the suspended particles in the water column. The finer the particles, the longer they may remain in suspension (Ekern 1976) and if fine materials are associated with much water motion (waves, currents) the actual deposition rates in these turbid waters may be quite low. However, if the suspended particles (i.e., turbidity) is great enough to reduce light levels, impacts to corals may be low.

The deposition of sediment on coral reefs has been measured and correlated with the "condition" of the reef corals. Loya (1976) defined a "high" sedimentation rate as 15mg/cm^2/day and a "low" rate as 3mg/cm^2/day for Puerto Rican reefs. Low cover and species diversity were associated with reefs exposed to "high" sediment deposition rates. In contrast, "high" sediment deposit- ion rates on Guamian reefs was defined in the range of 160- 200mg/cm^2/day and this rate of deposition limited coral cover and diversity (here less than 10 species and 2% cover; Randall and Birkeland 1978). A "low" rate was defined as 32mg/cm^2/day and was associated with rich coral communities (more than 100 species and 12%+ coral cover). These comparisons demonstrate the relative nature of sedimentation rates; the rate considered to be low in Guam is more than twice the high rate from Puerto Rico. Reasons for this disparity relate to differences in how rates are measured (i.e., lack of a standardized methodology) as well as difficulty in relating environmental factors such as water motion and sediment deposition in sediment traps. Water motion may mitigate or enhance the deleterious effects of sedimentation on the diversity and cover of corals in a given area. Hopley and Woesik (1988) note a chronic sedimentation rate of 129mg/cm^2/day (7 month mean) did not negatively impact an Australian coral reef with high cover and species diversity.

These data suggest that if needed as a means for protecting the proposed fiber optic cable in shallow water, the short term disturbance (probably less than two weeks) created by small-scale trenching will be a minor impact.

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SUPPLEMENTAL TABLE IV-2A

Results of the quantitative visual censuses conducted at two locations offshore of Spencer Beach Park, Hawaii on 16 January 1992. Each entry in the body of the table represents the total number of individuals of each species seen; totals are presented at the foot of the table along with an estimate of the standing crop (g/m^2) of fishes present at each location.

FAMILY AND SPECIES	STATION NUMBER 1	2
MULLIDAE		
Mulloides flavolineatus		8
POMACENTRIDAE		
Dascyllus albisella		16
Abudefduf abdominalis	2	
Stegastes fasciolatus	3	
LABRIDAE		
Thalassoma duperrey	9	
Stethojulis balteata	4	
SCARIDAE		
Scarus sordidus	1	
BLENNIIDAE		
Cirripectus variolosus	1	
ELEOTRIDAE		
Asterropteryx semipunctatus	8	13
GOBIIDAE		
Psilogobius mainlandii		7
ACANTHURIDAE		
Acanthurus triostegus	2	
A. dussumieri	1	
Ctenochaetus strigosus	4	
ZANCLIDAE		
Zanclus cornutus	1	
Total Number of Species	11	4
Total Number of Individuals	36	44
Estimated Biomass (g/m^2)	8	4

APPENDIX B

Archaeological Assessment of the Proposed Fiber Optic Cable Landing for Spencer Beach Park, Island of Hawaii

Archaeological Assessment of the Proposed Fiber Optic Cable Landing for Spencer Beach Park, Island of Hawai'i

TMK 6-2-01:8, 6 (por)

by

Douglas F. Borthwick, B.A.
Hallett H. Hammatt, Ph.D.

Prepared for

R.M. Towill Corp.

Cultural Surveys Hawaii
January 1992

Abstract

At the request of R.M. Towill Corp., Cultural Surveys Hawaii conducted an archaeological assessment for a proposed Fiber Optic Cable Landing at Spencer Beach Park, South Kohala, Hawai'i. The assessment included surface survey, sub-surface testing, and review of pertinent literature.

The proposed corridor is situated entirely within the active beach zone of the park.

No surface sites, other than modern beach park-associated structures (cement barbeques and open air showers) are within the proposed corridor. The sub-surface testing indicated that no significant intact, undisturbed (or non-mixed) cultural layer(s) exist within the cable corridor.

Background literature review did indicate that the Spencer Beach Park area w as within the coastal habitation zone of the *ahupua'a* of Kawaihae 2. The beach park is also relatively close (1,500 ft.) to the major religious sites of Pu'u Kohola and Mailekini *heiau* , and thus it would have been part of the late prehistoric/early historic political and population center of the Kawaihae area.

The beach park and its facilities have altered the landscape to a considerable degree which is evident within the portions of the beach that were tested. Based on the shallow beach deposits and observed absence of undisturbed beach strata no further archaeological investigations appear warranted. However, it is recommended that a qualified professional archaeological firm be contracted to be available for on-site inspections in the unlikely event significant cultural material is unearthed during construction.

Table of Contents

List of Figures

Introduction

A. Project Area Description

Cultural Surveys Hawaii conducted archaeological assessments for four proposed fiber-optic cable landing sites on three of the Hawaiian islands. The proposed sites are located on O'ahu at Sandy Beach Park and Kahe Point Beach Park, on Hawai'i at Spencer Beach Park, and on Kaua'i at the Wailua Golf course.

The assessments were requested by R.M. Towill Corp. and included background research and on-site inspections to determine the potential for encountering archaeological resources at the four proposed cable landing sites. Sub-surface testing was carried out at the Spencer and Sandy Beach Park Sites to gather additional information on stratigraphy.

Individual reports treat each of the proposed cable landing sites. Contained in each report are site-specific scopes of work, field methods, a review of previous research pertinent to the individual landing site, research results, and recommendations for mitigation of existing cultural-archaeological resources.

The proposed Spencer Beach Park Fiber Optic Cable Landing Site (Figs. 1-4) is a narrow (20-foot) corridor within the northern section of 'Ōhai'ula Beach. The corridor is within the active beach zone, including the proposed telephone pole (i.e., Pole #12) terminus.

Spencer Beach Park, named after Samuel Mahuka Spencer who was Hawai'i County Chairman from 1924 to 1944, is located within the district of South Kohala on the dry leeward coast of Hawai'i Island. Average annual rainfall

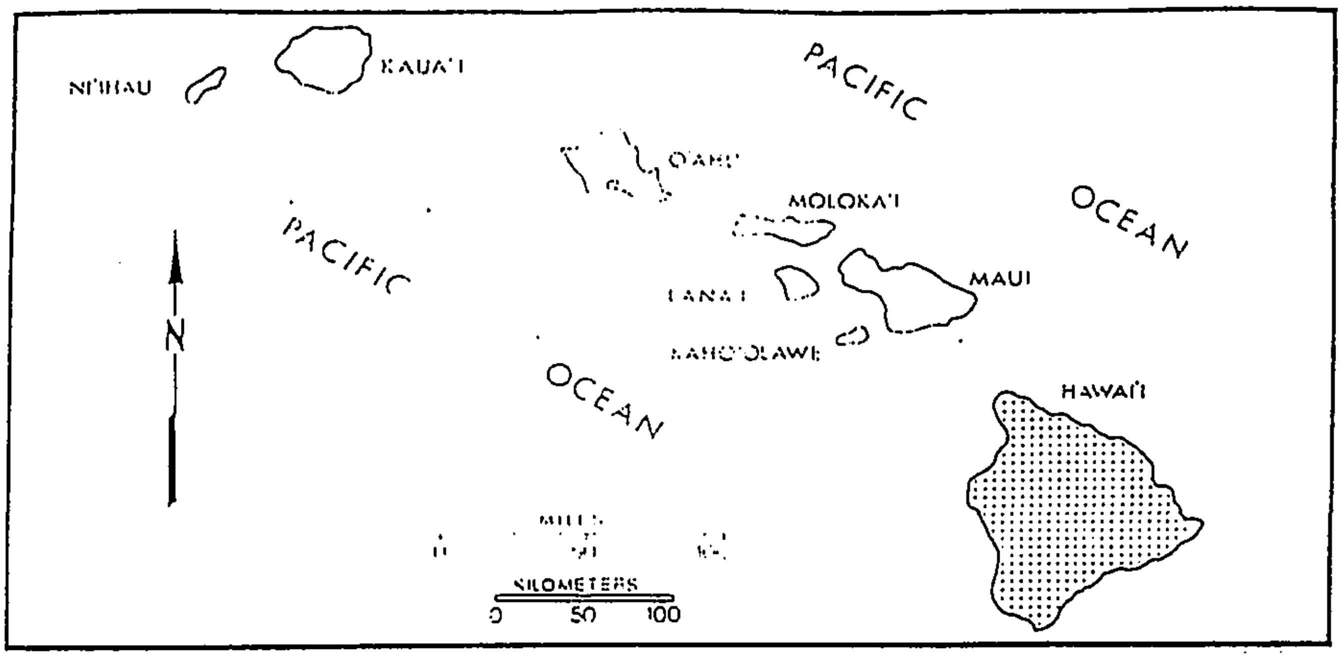

Fig. 1 State of Hawai'i

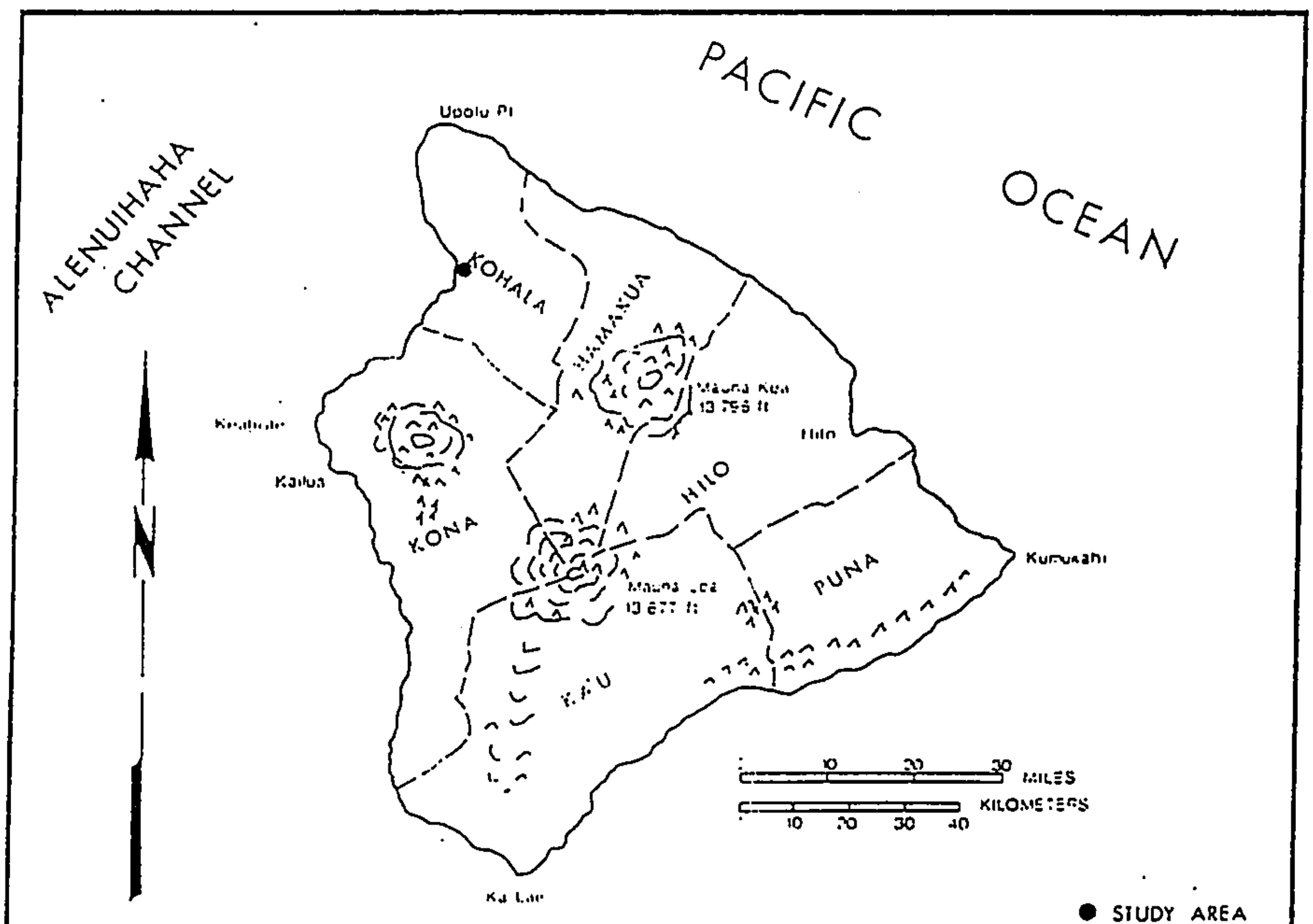

Fig. 2 General Location Map, Hawai'i Island

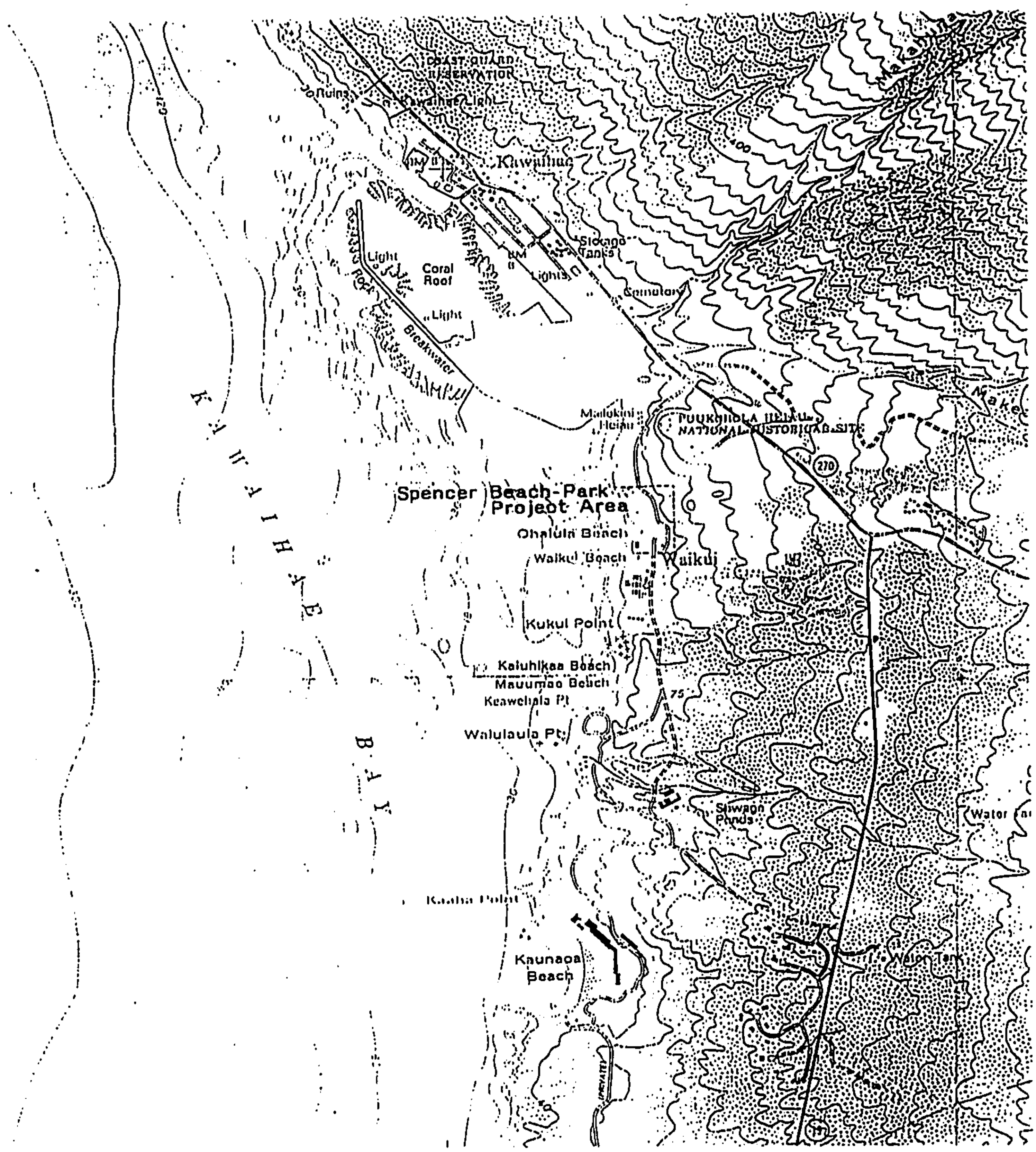

Fig. 3 USGS Kawaihae Quad Showing Proposed Cable Landing Site, Spencer Beach Park

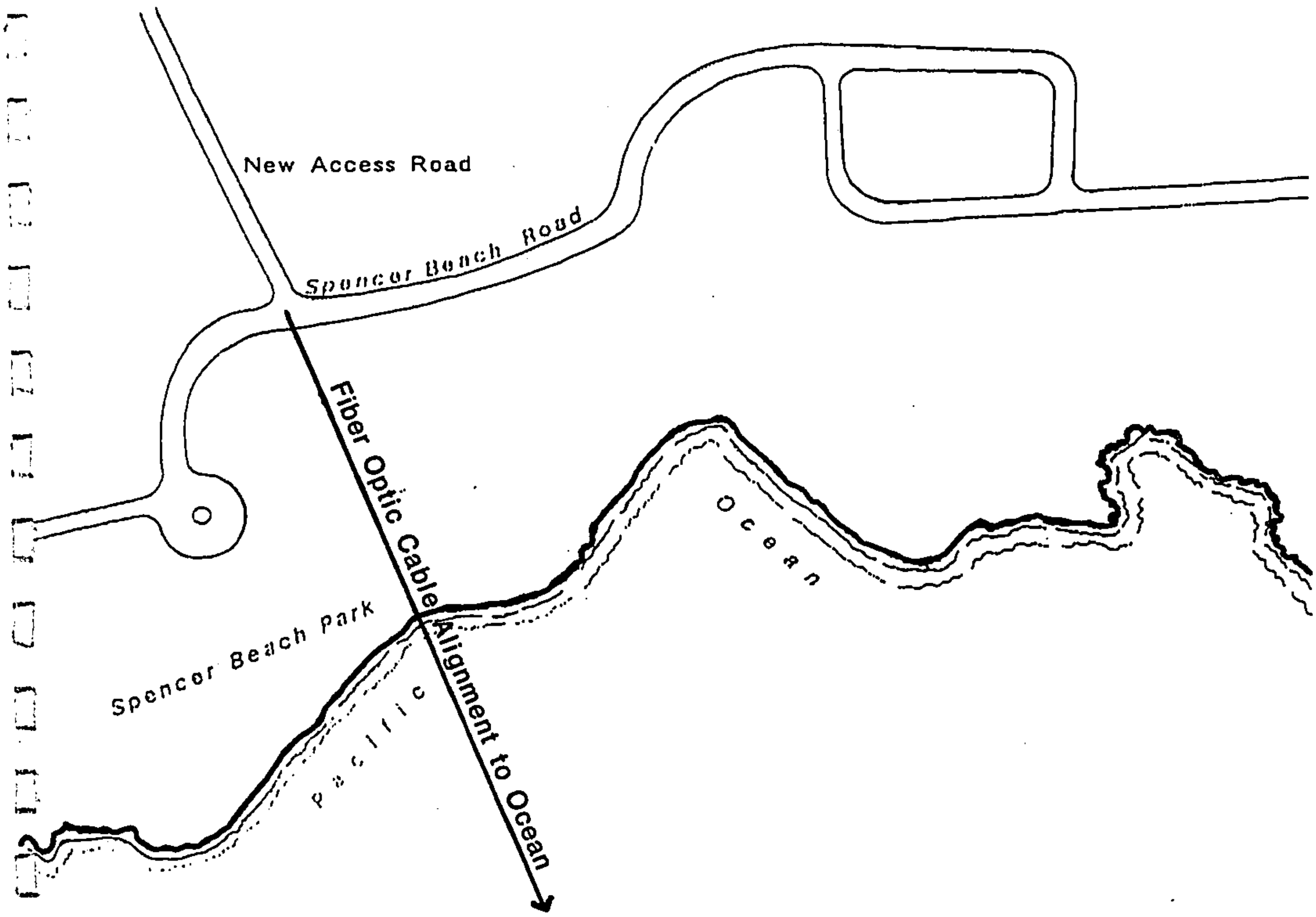

Fig. 4 Project Area Locational Map, Showing Proposed Cable Landing Corridor

is less than 10 inches per year. Soils in the vicinity are classified as aridisols and are part of the Kawaihae series (KNC). These soils are characterized as excessively drained and extremely stony to very rocky (Soil Conservation Service, 1973:6, 51). However, the actual landing site corridor, as mentioned previously, is within an active coralline sand beach which overlies the rocky substrata. The only vegetation along the corridor includes three large kiawe (*Prosopis pallida*) trees growing out of the sandy beach deposits. The place name for the main beach at the Park is ʻŌhaiʻula which literally means "red ʻōhai shrub" (Pukui, Elbert and Mookini 1974:168). The ʻōhai shrub lands are characterized as "lowland dry shrublands which are relatively intolerant to grazing pressure and fire and are replaced by alien dominated communities" (Wagner, Herbst, Sohmer 1990:72). This appears to be the case at Kawaihae as the only known remaining community of ʻōhai is on Leeward Molokai (*Ibid.*)

B. Scope of Work and Methods

Specific to the Spencer Beach Park cable landing site, the scope of work included investigation restricted to beach deposits. Cultural Surveys Hawaii's responsibility is confined to the short section (approximately 100 ft.) from the water line to Pole 11 (see Appendix B). The fiber optic cable would then connect to the existing overhead utility lines.

The corridor (actually the entire beach) was inspected for any surface sites, of which none exist. However, some associated park improvements, cement is less than 10 inches per year. Soils in the vicinity are classified as aridisols and are part of the Kawaihae series (KNC). These soils are characterized as excessively drained and extremely stony to very rocky (Soil Conservation Service, 1973:6, 51). However, the actual landing site corridor, as mentioned previously, is within an active coralline sand beach which overlies the rocky substrata. The only vegetation along the corridor includes three large kiawe (*Prosopis pallida*) trees growing out of the sandy beach deposits. The place name for the main beach at the Park is ʻŌhaiʻula which literally means "red ʻōhai shrub" (Pukui, Elbert and Mookini 1974:168). The ʻōhai shrub lands are characterized as "lowland dry shrublands which are relatively intolerant to grazing pressure and fire and are replaced by alien dominated communities" (Wagner, Herbst, Sohmer 1990:72). This appears to be the case at Kawaihae as the only known remaining community of ʻōhai is on Leeward Molokai (*Ibid.*)

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The corridor (actually the entire beach) was inspected for any surface sites, of which none exist. However, some associated park improvements, cement barbeque pits, picnic benches and open air showers are situated within the active beach zone. Testing of the beach deposits was accomplished by excavation of five test units. The test units were hand dug and the excavated material was screened through ¼-inch mesh screen. Samples were collected of the cultural material present (midden and artifacts). Representative soil profiles and photographs were taken, after which the test units were backfilled.

C. Implications of Previous Research

The Kawaihae area has been the focus of several detailed surveys of the historical and ethnographic record; the reader is invited to refer to these (Kelly 1974; Kelly and Nakamura 1981; Barrere 1983, Clark and Kirch 1983; Clark 1986; and Hammatt et al., 1991) for a more comprehensive overview. There have also been two reconnaissance-level surveys of areas surrounding Spencer Beach Park, both conducted by Lloyd Soehren: one in 1964, the other in 1980.

The previous research suggests that the Spencer Beach Park area (ʻŌhaiʻula and Waikui Beaches) supported at least a few permanent residences. The evidence includes proximity to the major religious and residential area of Kawaihae (Puʻukohola and Mailekini *heiau*), historic maps (Duperry 1819, Jackson 1883, and Loebenstein 1903), and the archaeological record(s).

Spencer Beach Park is located some 1,500 feet south of the *heiau* Puʻukohola and Mailekini. The beach at Spencer Park would have been an excellent canoe landing, offering easy access to these major religious structures.

Kawaihae, in general, had been well-known as a residence of kings. Alapaʻi

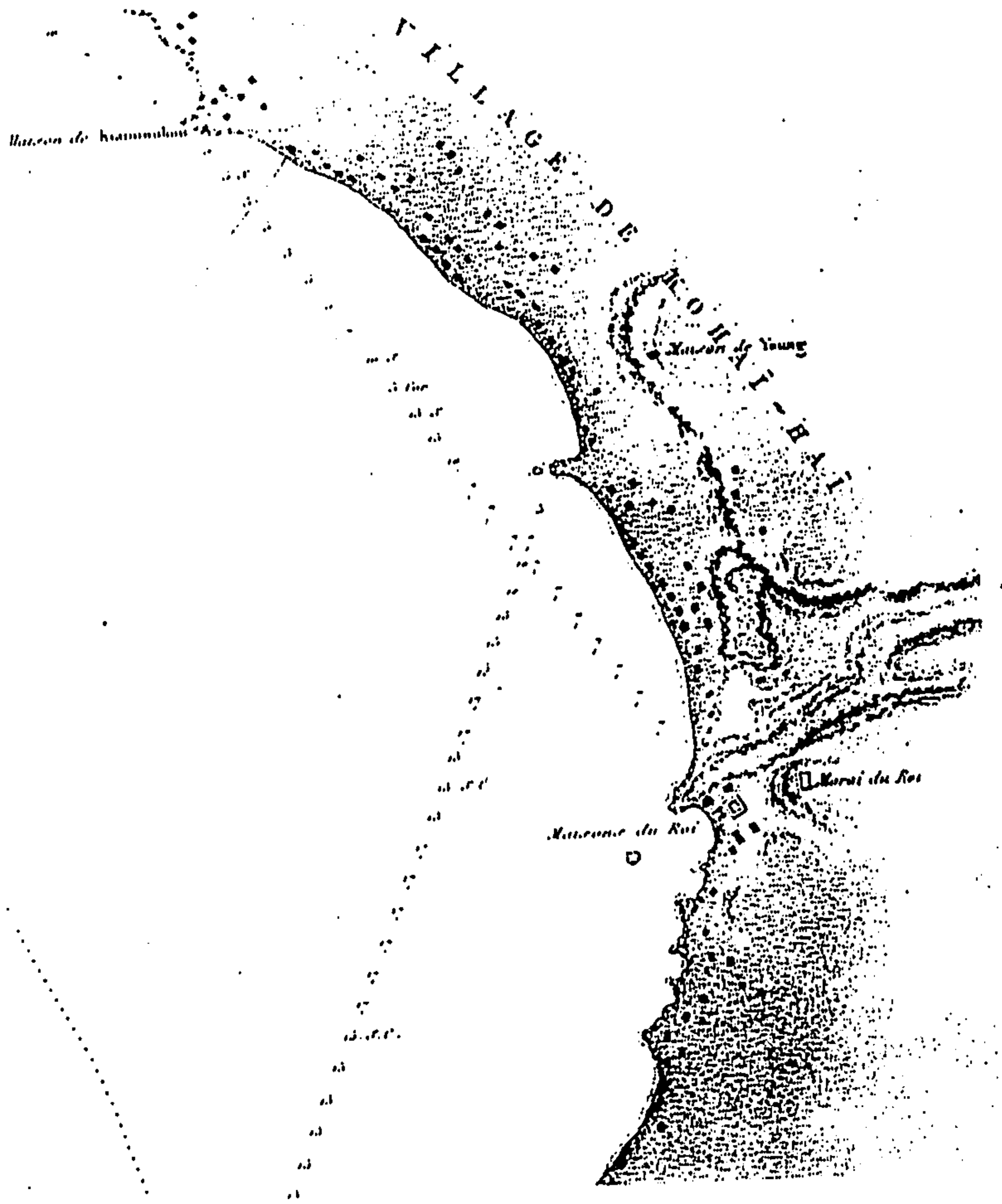

Fig. 5 Chart of the Bay of Kawaihae by Duperry under the French Captain de Freycinet, August 1819

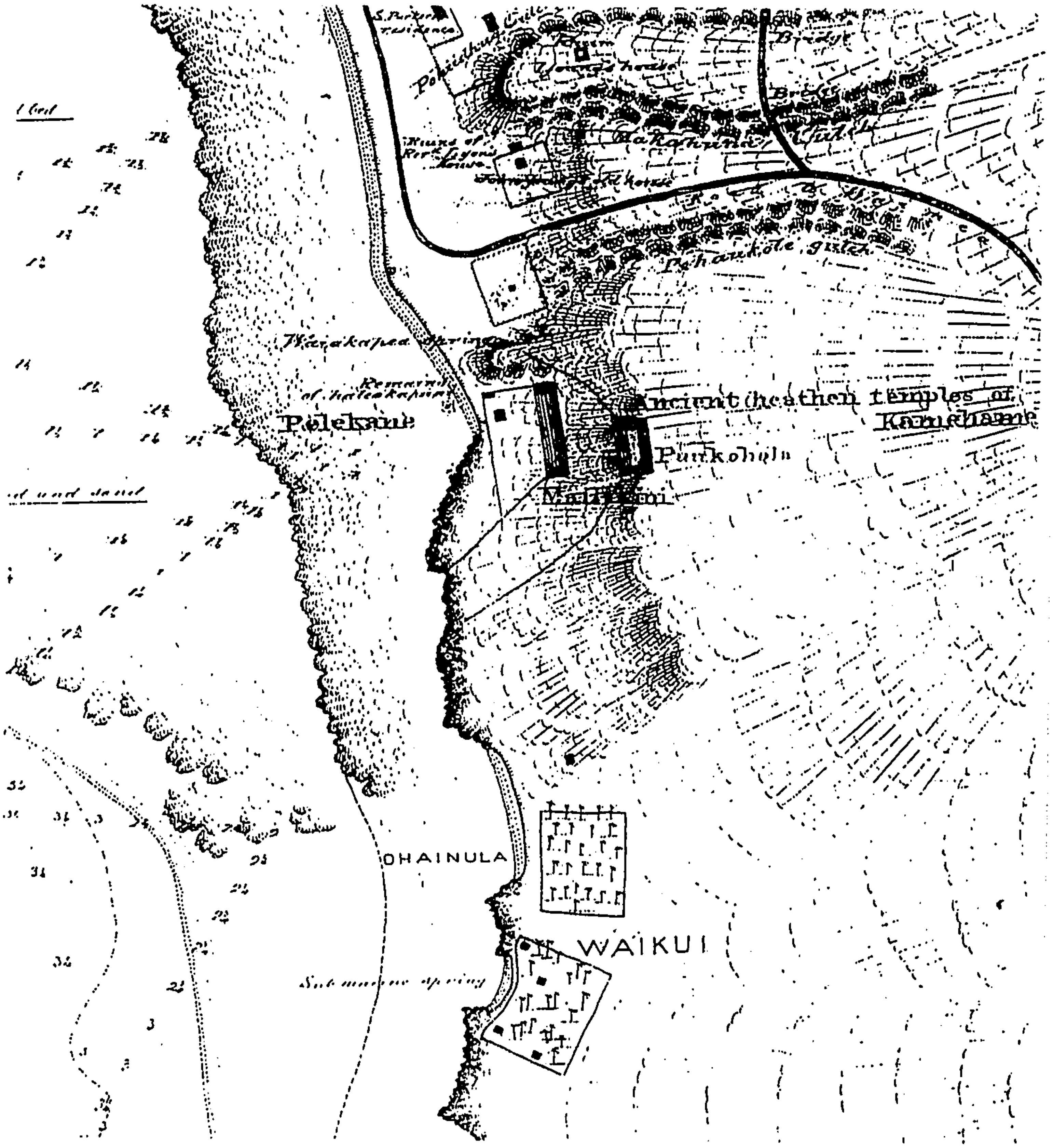

Fig. 6 Portion of Jackson's Map of Kawaihae, July 1883, Showing Spencer Beach Park ('Ōhai'ula) Area

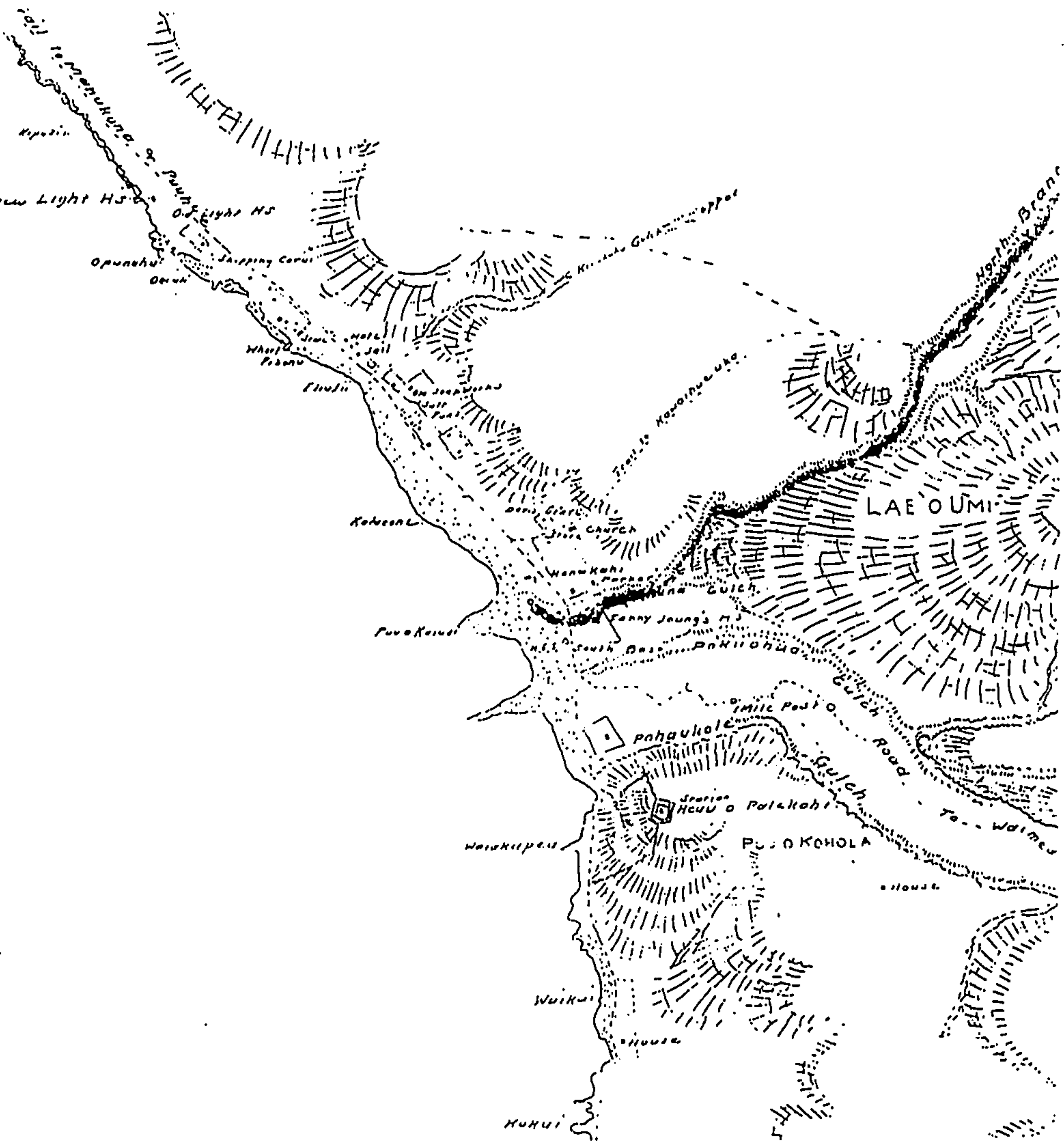

Fig. 7 Portion of Loebenstein's Map of Kawaihae, 1903

moved to Kikiakoʻi in Kawaihae and appointed his son Keaweʻopala to be his successor at Mailekini *heiau* in 1754 (Kamakau 1961:77-78). Kamehameha I and his entourage lived at Puʻukohola during its construction (renovation) *ca.* 1790. After the assassination of Keoua-Kuahuʻula in 1790, Kamehameha I become *aliʻinui* of Hawaiʻi Island and he occasionally "retired to the tabu district of Mailekini below Puʻu Kohola" (Kamakau 19761:350). The Kawaihae coast also included the residences of Kalanimoku (Kamehameha I's treasurer and war leader), Keʻeaumoku (Kamehameha I's general), John Young (Governor of Hawaii, 1802-1812), Kuakini (Governor of Hawaiʻi under Liholiho, Kamehameha II), and was the birthplace of Queens Kalama (wife and half-sister of Liholiho), and Emma (wife of Alexander Liholiho, Kamehameha IV).

In general, the residence of chiefs was below Puʻu Kohola (the "King's Residence" designated State site #50-10-04-2297) in the *ahupuaʻa* of Kawaihae 2 (Hikina) in which Spencer Beach Park is also located. Clearly, the beach of ʻŌhaiʻula (Spencer) would have been intensively utilized in association with these chiefly residences.

A map made during the early historic period (DuPerry 1819, Fig. 5) shows at least seven (7) major structures (*i.e.* permanent habitation sites) along the shore in the vicinity of the present-day Spencer Beach Park. Jackson's 1883 map of Kawaihae (Fig. 6) shows two large walled enclosures within the Waikui area, one with four interior structures. The large enclosures appear to be walled (fenced) coconut groves with associated habitation sites. The 1903 Loebenstein map (Fig. 7), of the same area, shows the same two enclosures, with the southern one containing a house structure. The Loebenstein map also shows the Kawaihae-Puako Trail, of which part later became the "old Kawaihae-Puako Road." The trail is indicated between the enclosures and the beach. This series of maps indicates a fairly large population, *ca.* 1819, which gradually declined over time, but still included permanent habitation into the early 20th century.

Historic occupation and associated agriculture in an area just *mauka* of Spencer Beach Park is reported in Soehren's two reports (Soehren 1964, 1980). These reports discuss the survey of over 400 acres, situated between the coast and Queen Ka'ahumanu Hwy. Soehren reported on over 100 sites that include a wide range of site types. Sites included temporary to permanent habitation features, historic graves, and agricultural features. Historic house sites, graves, and agriculture that Soehren reported were, in part, associated with the Laau family. The reports include information from Michael Laau which indicated that farming in the area utilized both spring water and runoff from streams. Irrigation ditches (*'auwai*) *makai* of Ka'ahumanu Hwy were noted. Michael Laau also related that farming lasted until the end of World War II (*ca.* 1945). Soehren did not record any sites within Spencer Beach Park; the closest site (E5-25 Bishop Museum system) was described as a "well preserved house site...with historic artifacts, located on the slope behind the Spencer Beach Park bathhouse on the east side (*mauka*) of the road" (Soehren 1964).

Archaeological research for the proposed Waimea-Kawaihae Highway included a focus issue of the settlement patterns in the Kawaihae and Waimea areas. This is summarized in Jeff Clark's Ph.D. dissertation (Clark 1986). In his compilation of chronometric determinations, Clark suggests that there was very little occupation at Kawaihae before the 15th century and that

> the dates provide no evidence of an early coastal occupation prior to the settlement of the uplands. In fact, the inland sites are slightly earlier than the dates for the coast, although the difference is probably not significant. (*Ibid.*)

However, it should be noted there are relatively few radiocarbon dates, with the majority of dated sites utilizing volcanic glass.

In general, the previous research indicates that the Kawaihae area contained permanent coastal habitation and major religious sites. The coastal zone in the Kawaihae area may not have been occupied by substantial numbers until the 15th century. The uplands, Waimea area, were also substantially occupied by this time or earlier. Kawaihae, because of its excessively dry climate, was not known for its agriculture and relied heavily on trade from more agriculturally productive lands like Waimea and North Kohala. However, some agriculture was practiced, even into historic times.

Spencer Beach Park itself was developed over a relatively long period of time. The park area, with an existing pavilion, was given to the County of Hawai'i by the Territory of Hawai'i in 1937. In 1969 the "new" stone bath house was completed along with other improvements (Glen Miyao, Hawai'i County Parks and Recreation, per comm. 8/12/92). Park Maintenance Supervisor William DeRego reported that Mauna Lani Resort had recently (1991) finished a stone wall which separates the sand beach from the grassed area of the park. Mauna Lani also deposited "many loads of sand" to increase the sand area. Mr. DeRego indicated that regular high winter surf washes the entire beach area up to the new wall, and went beyond that prior to the Mauna Lani wall. Mr. DeRego also indicated that the old Kawaihae-Puako Road went through the park (sandy area) where the utility poles (*i.e.* poles 11 and 12) are today. The old road, in part, followed an older (pre-historic) Kawaihae-Puako Trail. Portions of this trail are supposed to extend between the park's northern boundary and Mailekini *heiau*, however we did not confirm this as it would be well outside of the proposed corridor.

Survey Results

Five test units were dug within the beach sand deposits of Spencer Beach Park. The test units were dug on the seaward side(s) of utility poles 11 and 12, with Pole 11 as the proposed cable landing terminus. All areas seaward of the utility poles as well as the poles themselves are within the active beach zone.

All test unit excavations revealed similar stratigraphic profiles. The stratigraphy clearly indicated mixed strata due to both mechanical and wave action. Test units were 50 cm. squares which averaged 50 cm. deep. The stratigraphic sequence includes four (4) strata (I, II, III, and IV) with one trench containing a fifth stratum.

Strata I and II were very pale brown to white medium to fine coralline sand. Based on informant information Stratum I is of recent deposition, associated with Mauna Lani Resort construction activities. Stratum II represents ʻŌhaiʻula beach sand.

Stratum III consists of a mixed layer of beach sand and dark reddish brown gravelly sandy loam soil. Mixing has created a mottled, marbled, and bedded sand layer which contains historic artifacts, waterworn pebbles and cobbles, and what appears to be shell midden. The midden component is difficult to distinguish from the mix of naturally occurring waterworn shell component in this mixed layer. However, the occurrence of historic era artifacts, including fragments of what appears to be Budweiser Beer bottle glass, indicates considerable mixing which is probably due to both wave and mechanical action. Mechanical activities would have included intensive land grading and construction for the park and park facilities with high surf action mixing into existing sand layers. After such activities wave action and purposeful sand redeposition would have restored the beach sand as a clearly definable surface layer. As noted previously, cement barbeques, and showers with underground water lines exist within close proximity to the proposed cable corridor and this probably also attributed to the mixed layering.

Stratum IV consists of very dark brown to dark reddish brown gravelly sandy loam which directly overlies bedrock. No artifacts or midden were observed in this layer which essentially becomes the soil matrix in which the uppermost bedrock boulders sit. The bedrock layer includes a conglomerate of angular to rounded basalt gravel (pebbles to boulders) that can, with much effort, be broken loose, exposing a pahoehoe substrata (*i.e.*, actual bedrock).

The testing revealed that the beach deposits within the proposed cable corridor are generally shallow (average 50 cm.), indicating insufficient depth for human burials, besides being in the active beach zone. Stratigraphically, the testing indicated no intact undisturbed cultural layer(s), though cultural material was present within mixed strata. Cultural material present included historic era artifacts and a midden component. In some cases both the artifacts and midden showed evidence of being reworked by wave action as marine shells and some glass fragments were water-rounded.

Summary and Recommendations

No significanct archaeological resources were observed within the proposed fiber optic cable landing corridor in Spencer Beach Park. The corridor is within the active beach zone of the park and when the cable is attached to Pole #11 it will become part of the existing overhead utility lines (see Appendix B).

Background research indicates that the Spencer Beach Park area (ʻŌhaiʻula/Waikui) was part of the coastal Kawaihae 2 residential zone from pre-historic times (*i.e.*, pre-1778) and well into historic times (*ca.* 1945). The *ahupuaʻa* of Kawaihae 2 which contains the *heiau* of Puʻukohola and Mailekini was given to heirs of John Young at the time of the Mahele (*ca.* 1850). Presently, it is part of the Queen Emma Foundation.

The park itself has a long history and much construction and land alteration has taken place, the latest within the last two years. This latest phase of construction and land alteration includes a new access road, seawall, landscaping, and beach sand deposition.

Recommendations

Based on the results of this archaeological assessment which includes survey, sub-surface testing, and review of pertinent literature, it is felt that no further survey or data recovery work is necessary. Clearly, there are no surface sites to be impacted. Subsurface testing indicated shallow sandy and mixed strata which contain some cultural materials of midden and historic artifacts. However, the mixed components, including modern beer bottle glass, water-rounded glass fragments, and marine shells, indicate that no intact, undisturbed cultural layer(s) exist within the active beach zone where the proposed cable corridor is situated.

Though no further research is recommended specific to the corridor examined, any alternative corridor alignment should be investigated.

Cultural Surveys Hawaii does recommend that a qualified professional archaeological firm be contracted to be available for on-site monitoring in the unlikely event significant cultural material is unearthed during construction of the fiber optic cable landing site.

Cultural surveys would also recommend that the National Park Service be notified about the proposed fiber optic cable landing project. Though the project is outside of the National Park's boundary and no direct impacts are foreseen, notification would allow for any of their concerns to be addressed. These concerns could include possible impact to *Hale o ka Puni Heiau*, from a submarine cable. This heiau is situated just offshore in waters fronting *Mailekini Heiau* (see Figure #13).

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Appendix A - Photo Appendix Fiber Optic Cable Landing Site (Beach Area)

Fig. 8 Spencer Beach Park Pole #12 in Foreground, Pole 11 in Background (View to North)

Fig. 9 Photo Showing Pole 11, Proposed Cable Landing Terminus (View to West)

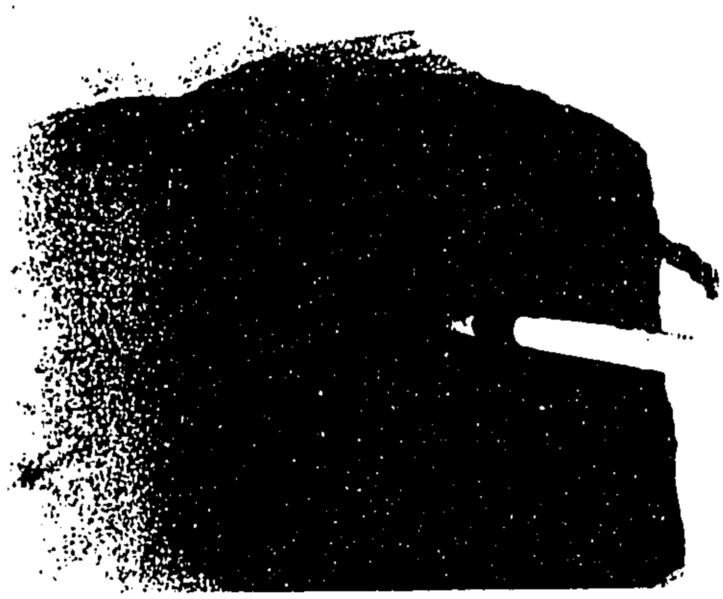

Fig. 10 Stratigraphic Profile showing Beach Sand Overlying Mixed Layers and Bedrock Bottom

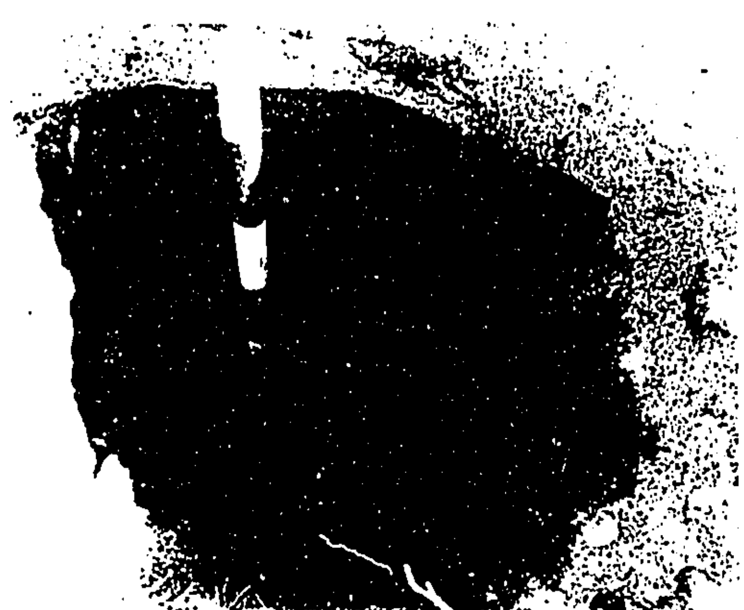

Fig. 11 Typical Stratigraphic Profile of Test Unit Within Spencer Beach Park

Appendix B - Proposed Underground Ductline
Spencer Beach Park to Akone Pule Hwy

Cultural Surveys Hawaii was requested to assess the potential impacts to archaeological resources for a proposed underground fiber optic cable duct line at Spencer Beach Park. The proposed duct line will extend eastward, from utility pole #11 (Fig. #4) through the park, then within the newly completed Spencer Beach Park Access Road right-of-way to Akone Pule Highway (Fig. #12). The request for this assessment was made after both fieldwork and the original report were completed. To address the additional request it was decided that an addendum section dealing specifically with the duct line would be sufficient.

The proposed duct line will traverse through heavily graded portions of Spencer Beach Park and new access road. The park area through which the duct line will be excavated has been graded and planted in grass. The grading cut on the mauka (eastern) side of the park is up to 6 feet.

The duct line will then stay within existing road right-of-ways, adjacent to the edge of asphalt pavement. The roadways include a portion of the "old" access road immediately adjacent to the park, then an approximately 2,000 foot long section within the newly constructed Spencer Beach Park Access Road.

The new access road was constructed so that the existing road, between *Mailekini* and *Pu'u Kohola Heiau*(s) can be shut down and the roadway be incorporated into the *Pu'u Kohola Heiau* National Historic site complex.

Archaeological surveys had identified six sites within the new access road right-of-way (r.o.w.). These six sites were the subject of archaeological test excavations in February 1989 (Carter 1989).

In summarizing the findings and assessing the individual sites after the test excavations, Carter states:

"The objectives initially proposed by Gary Somers have been met for this project. Based on surface data it was impossible to assess the significance of these features. Therefore, test excavations were conducted to obtain additional data to make such an assessment. The results of the test excavations demonstrated that Features T1, T2, T3 and T4 were important for their informational content and that Features T5 and T6 were not significant. In the process of determining that Features T1, T2, T3 and T4 were likely to yield information important in prehistory or history, however, that potential was realized and the information was adequately recorded. Therefore, they are no longer significant. Since Features T5 and T6 were not significant and Features T1, T2, T3 and T4 are no longer significant, no further data recovery at these features is warranted." (Carter 1989; 23,24)

Based on the above information concerning the new access road r.o.w., and our observation of major land modifications associated with Spencer Beach Park and existing "older" roadway(s), Cultural Surveys Hawaii does not anticipate any impact to archaeological resources within the proposed duct line corridor. However, a finalized corridor has yet to be determined. Therfore we recommend that a survey of the cable route take place, after the route has been determined and staked (surveyed) on the ground.

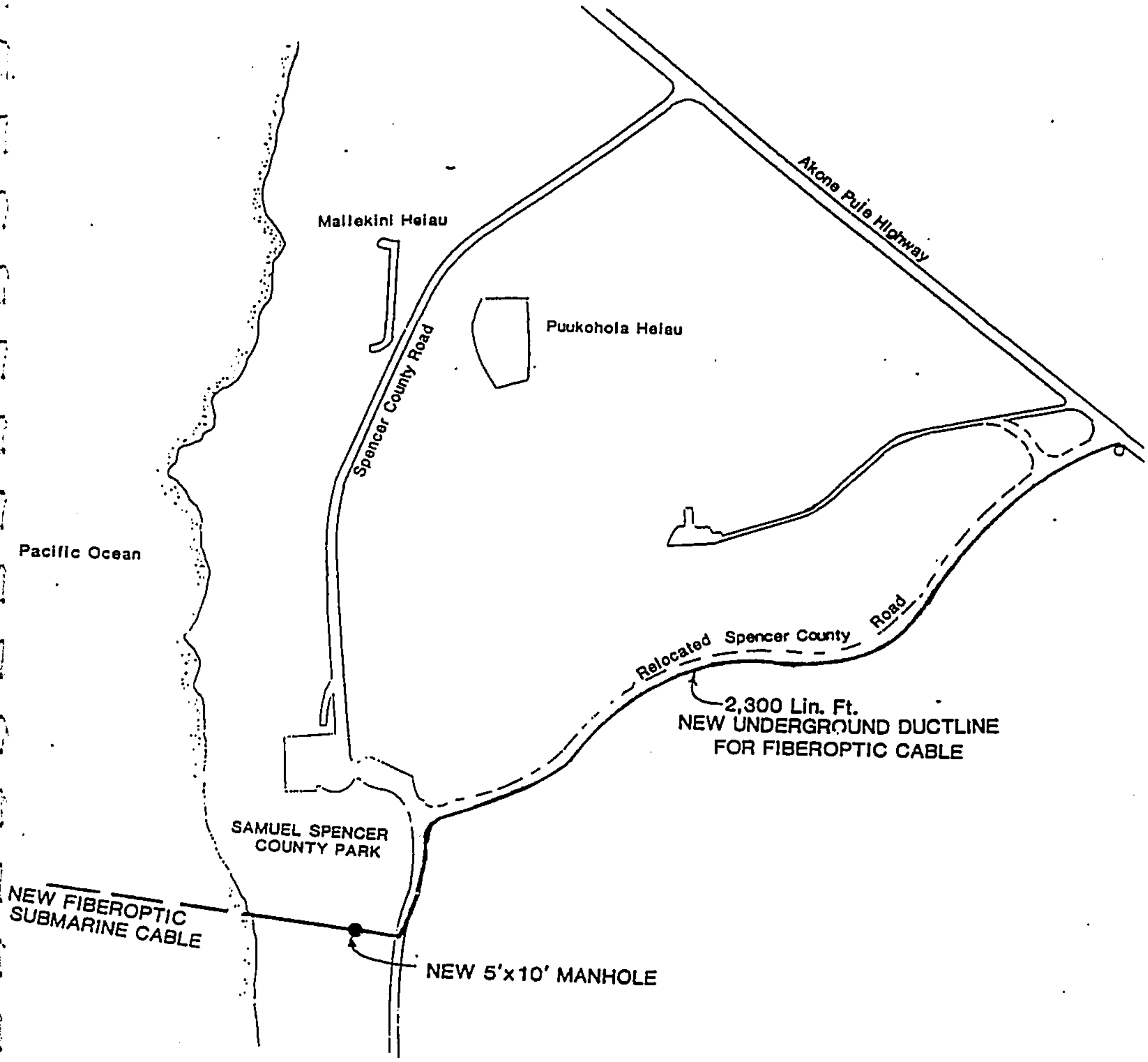

Fig. 12 Proposed Duct Line Route, From R.M. Towill Corp.

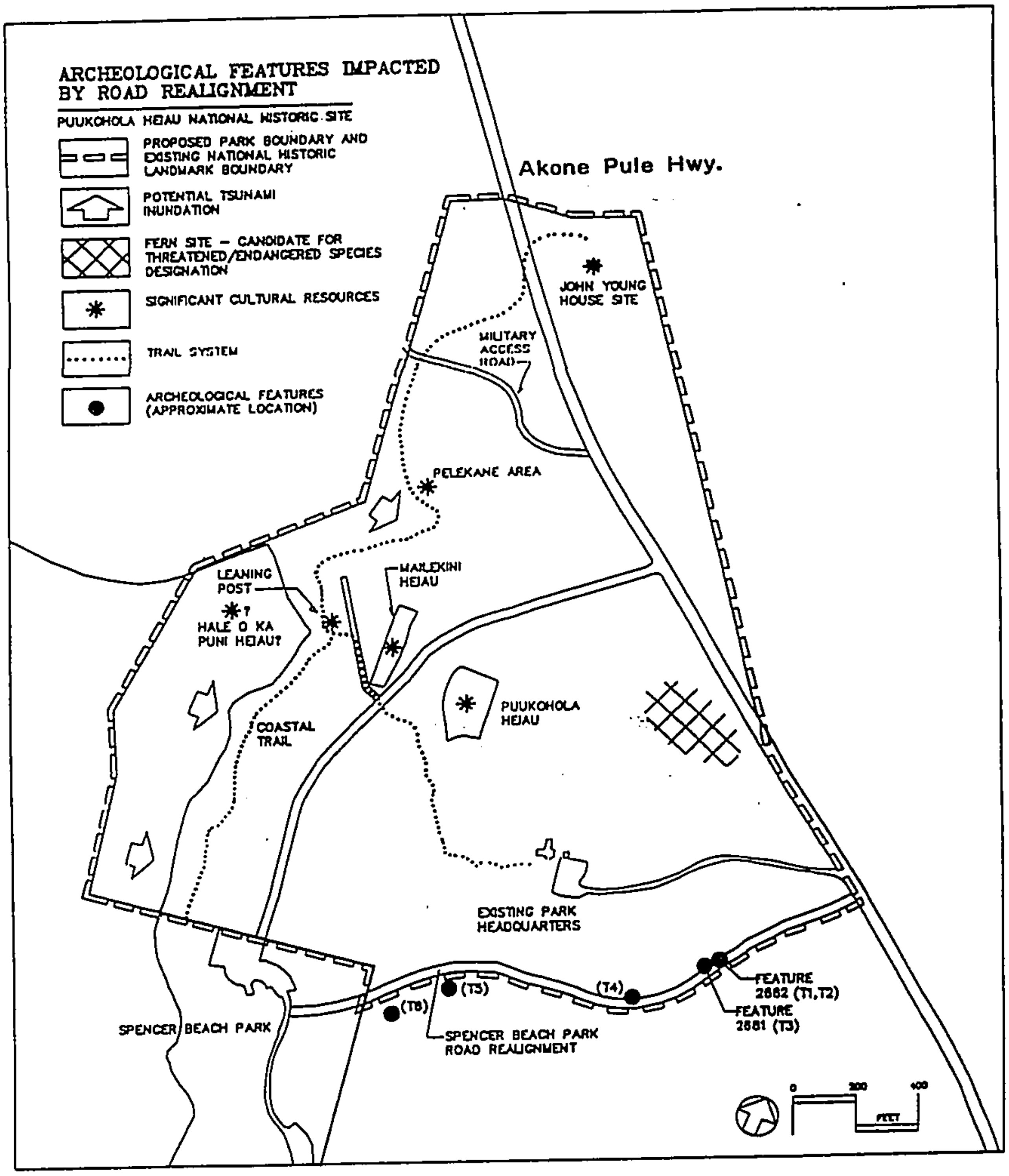

Fig. 13 Archaeological Sites Impacted by New Spencer Beach Park Access Road and Showing Major Sites and Boundary for *Pu'u Kohola Heiau* National Historic Park (From Carter 1989: Figure 2)

Fig. 14 Grassed Beach Park Area, Showing Major Grading Cut on Right Side of Photograph (View to North)

Fig. 15 View of New Access Road Cut (Background) and Associated Beach Park Improvements (View to East)

APPENDIX C

Field Inspection of Spencer Beach Park for New Fiber Optic Cable Alignment Section

CULTURAL SURVEYS HAWAII
Archaeological Studies

Hallett H. Hammatt, Ph.D.
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July 19, 1992

Mr. Brian Takeda
R.M. Towill Corporation
420 Waiakamilo Road, #411
Honolulu, HI 96817

Subject: Field Inspection of Spencer Beach Park, for Fiber Optic Cable, South Kohala, Hawai'i Island

Dear Sir:

Cultural Surveys Hawaii conducted, at your request, a field inspection for the newly proposed Fiber Optic Cable route at Spencer Beach Park, South Kohala, Hawai'i Island. Cultural Surveys Hawaii had previously completed the archaeological assessment for the Spencer Beach Park Cable landing site (Borthwick and Hammatt, January 1992). However, subsequent to the completion of that report changes in the actual route or cable corridor have been proposed.

The newly proposed corridor is to be located approximately forty (40) feet north from the previously assessed corridor. The new corridor, like the original corridor, will include the landing site within the sandy beach deposits of the park, then traverse through the grassy lawn area (as an underground duct line), then as an approximately 2,000 foot long underground duct line within the new Spencer Beach Park access road right-of-way to Akoni Pule Highway.

During the original assessment five (5) test units were excavated within the sandy beach deposits at the park. No intact (i.e., undisturbed) cultural layers were observed. The excavations indicated that the beach deposits were generally shallow (average 50 cm.) but did contain some midden and artifacts. However, the cultural materials observed included modern bottle glass, some of which was water-rounded, indicative of an active beach where wave action regularly reworks the beach deposits. The mixed strata observed was also indicative of the amount of land alteration that has taken place at Spencer Beach Park, the latest (wall building and new sand deposition) within the last two years.

The grassy lawn area of the beach park was not tested during the assessment as existing overhead utilities lines were to be utilized. Though the degree of land modifications (major grading and underground utilities) appear to preclude the existence of any intact sub-surface cultural deposits within the park lawn, affirmation of this assumption is neccessary.

The proposed duct line within the newly completed park access road right-of-way does not pose a threat to any archaeological resources. The access road was the subject of archaeological survey and excavations after which all previously recorded sites (total of six) within the right-of-way were deemed no longer significance (Carter 1989:23,24). Presently no sites exist in the graded and filled right-or-way.

In summation, we do not anticipate any significant sub-surface cultural remains to be impacted by the newly proposed Fiber Optic Cable landing and duct line. The relocation of the landing area and park associated duct line, some forty feet north of the present original corridor, would appear to place them in areas even more disturbed than the original corridor. The cable landing area, within the beach, is closer to the existing bath house and its associated features (i.e., waterlines, sidewalk, and rock wall). The proposed duct line in the grassy lawn is also closer to the existing underground utility lines (i.e., sewer and electricity) and where the duct line exits the park, there is a cut and filled embankment with a storm drain outlet associated with the newly constructed access road. However no testing has taken place within the new corridor, either within the sandy beach area or on the grassy lawn portion of the park.

Thus, we recommend that after the actual corridor is set, as a staked line, archaeological testing take place prior to any ground disturbance to accurately assess sub-surface conditions.

This letter report should be viewed as an addendum to the archaeological assessment (Borthwick and Hammatt, January 1992) which contains information including project location maps, implications of previously research, historical maps and general recommendations.

Sincerely,

Douglas F. Borthwick
Hallett H. Hammatt, Ph.D.

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