DEPARTMENT OF LAND UTILIZATION

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

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DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

September 21, 1992

DEPARTMENT OF LAND UTILIZATION
92/SMA-41 (JT)
92/SV-004 (JT)

CHAPTER 343, HRS
Environmental Assessment/Determination
Negative Declaration

Recorded Owner	:	GTE Hawaiian Tel
Applicant	:	City & County of Honolulu
Agent	:	R.M. Towill Corporation
Location	:	92-301 Farrington Highway (Kahe Point Beach Park) - Honouliuli
Tax Map Key	:	9-2-3: portion 15
Request	:	To install a GTE Hawaiian Tel Interisland Fiber Optic Cable Landing site at Kahe Point Beach Park.
Determination	:	Environmental Impact Statement (EIS) Not Required

We have reviewed the comments received during the 30-day public comment period which began on July 23, 1992. The applicant has responded to the eight comments received and has incorporated them in the final environmental assessment (EA). On the basis of the EA, we have determined that this project will not have significant environmental effect and have issued a negative declaration.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the EA

APPROVED Donald Clegg
DONALD A. CLEGG
Director of Land Utilization

DAC:ct

a:gtekahe.jht

162

1992-10-08-OA-FEA-GTE Hawaiian Tel OCT. 8 1992

Interisland Fiber Optic Cable System, Kahe Point

FINAL

ENVIRONMENTAL ASSESSMENT for the

GTE HAWAIIAN TEL
INTERISLAND FIBER OPTIC CABLE SYSTEM
Kahe Point Beach Park, Island of Oahu

AUGUST 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

FINAL

ENVIRONMENTAL ASSESSMENT

FOR THE

GTE HAWAIIAN TEL
INTERISLAND FIBER OPTIC CABLE SYSTEM

KAHE POINT BEACH PARK, OAHU, HAWAII

Prepared for:

GTE HAWAIIAN TEL
1177 Bishop Street
Honolulu, Hawaii 96813

AUGUST 1992

Prepared By:

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

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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:	City and County of Honolulu Department of Land Utilization
Tax Map Key:	9-2-3:15
Location:	Kahe Point Beach Park, Waianae, Oahu
Lot Area:	4.47 Acres
Owner:	Department of Parks and Recreation City & County of Honolulu 2015 Kapiolani Boulevard Honolulu, Hawaii 96826 523-4183
Agent:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817 Contact: Brian Takeda 842-1133
Existing Land Uses:	Recreational Area, Beach Park
State Land Use District:	Urban
General Plan Land Use Designation:	Preservation
County Zoning Designation:	P-2 (General Preservation)

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 Beach Park 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 telecommunication capacity to accommodate projected interisland telecommunication traffic; to increase system integrity; and, to provide 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).

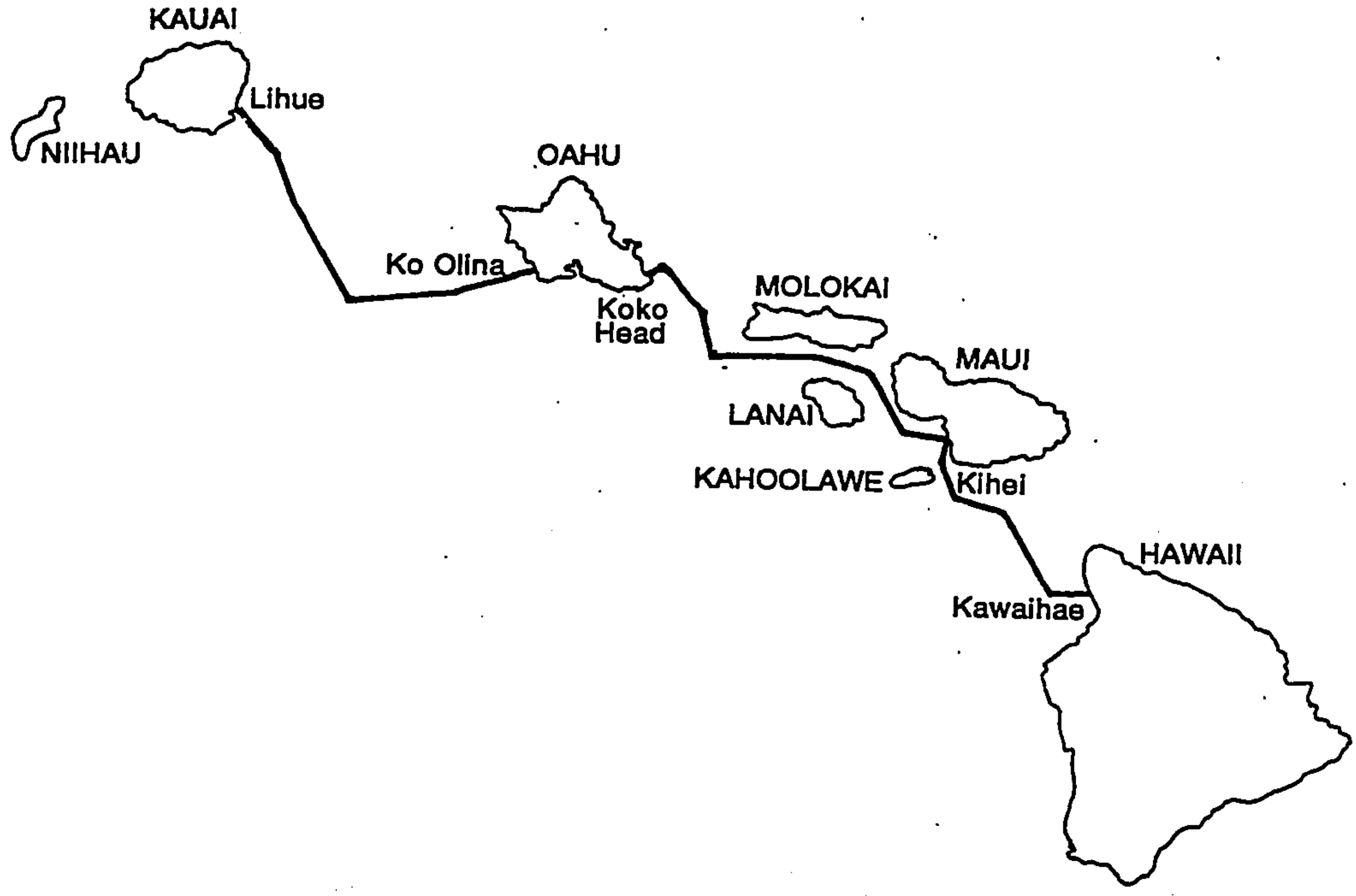

Figure 1
INTERISLAND SUBMARINE FIBER

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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JANUARY 1992

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.

1.2 PROJECT LOCATION

The proposed landing site for the Oahu to Kauai segment of the submarine interisland fiber optic cable system is Kahe Point Beach Park. Kahe Point Beach Park is located along the southwest coast of Oahu, to the north of Barbers Point (see Figure 2). The shoreline in this area is rocky, consisting primarily of low limestone sea cliffs approximately 15 to 20 feet high. The proposed landing site is within a developed beach park. Existing features of Kahe Point Beach Park include two comfort stations, a pavilion, camping and picnic area with barbecues, fourteen marked camping sites with parking, and access via the Kahe Point Beach Park Access Road.

Figure 3 illustrates the proposed alignment of the GTE Hawaiian Tel submarine cable from the landing site to the GTE Hawaiian Tel Central Office (CO). A new reinforced concrete manhole will be constructed at Kahe Point Beach Park approximately 300 feet makai of Farrington Highway. From the new manhole the cable will be installed in a trench to Manhole No. 3455 located on the mauka shoulder of Farrington Highway. The trench will cut across the Park's access road and Farrington Highway. From Manhole No. 3455 the fiber optic cable will be pulled through existing ducts to connect to the CO at 92-1389 Aliinui Drive within the Ko' Olina development.

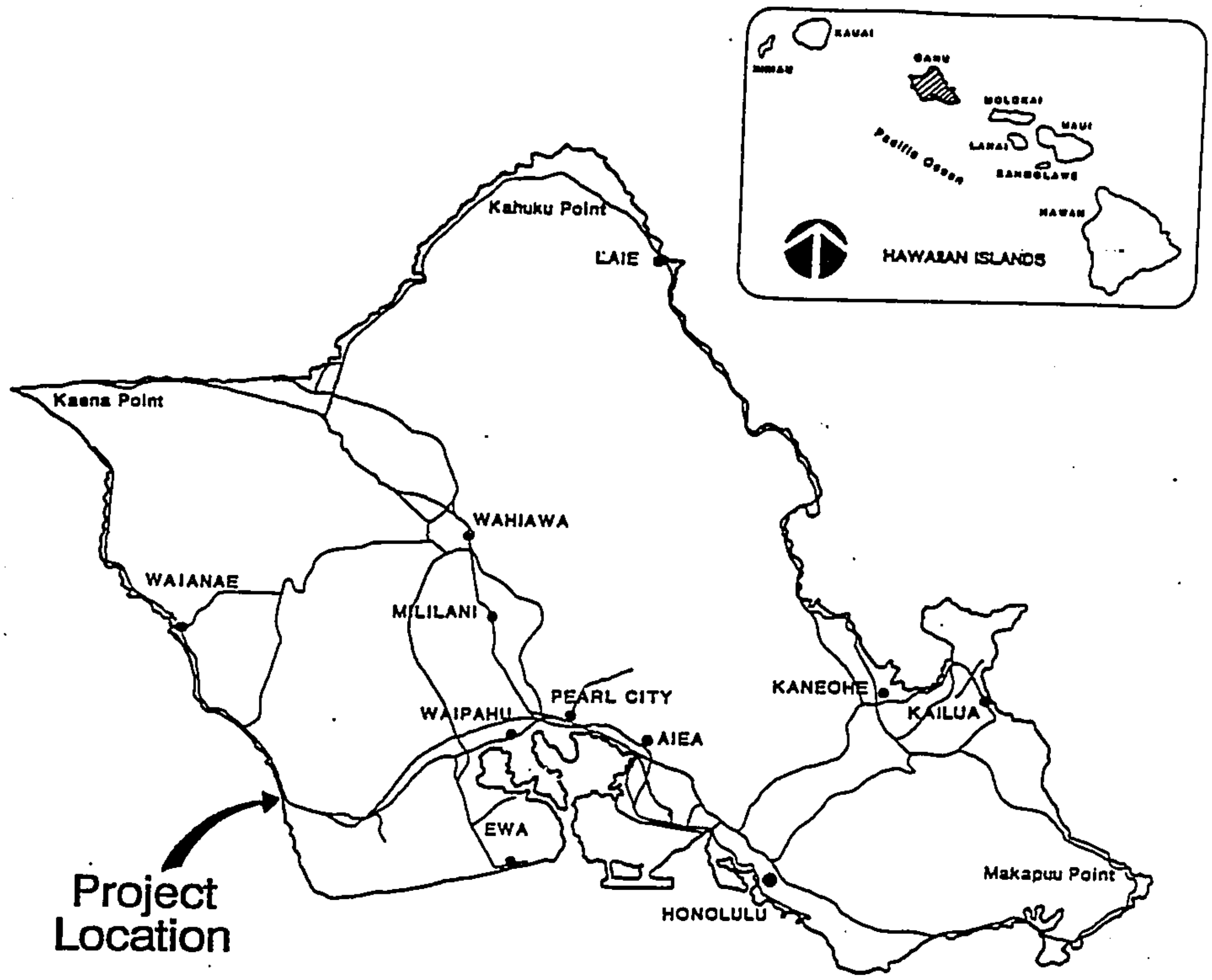

Figure 2
LOCATION MAP

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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MILES

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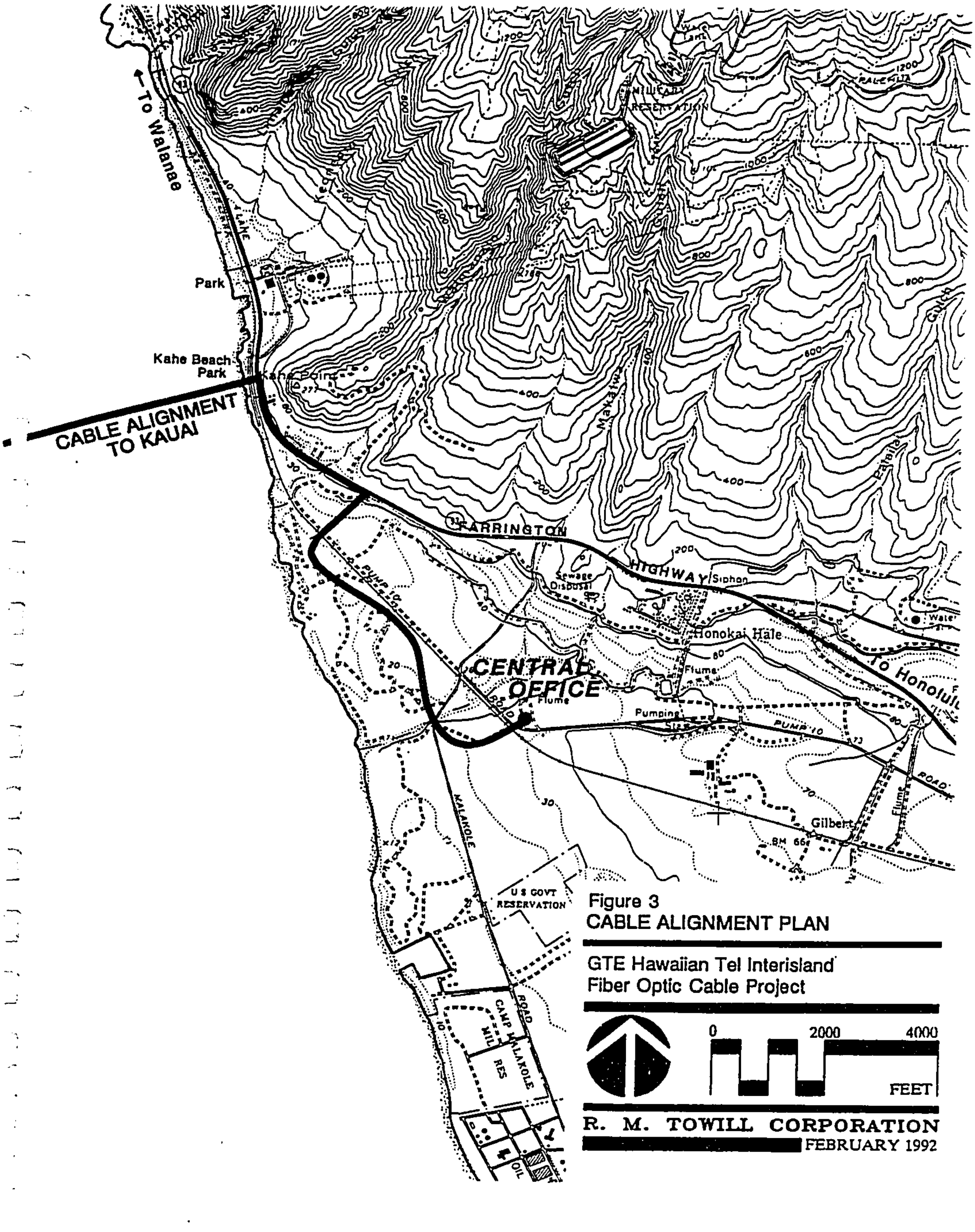

Figure 3
CABLE ALIGNMENT PLAN

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 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 copper cable, approximately 4" 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

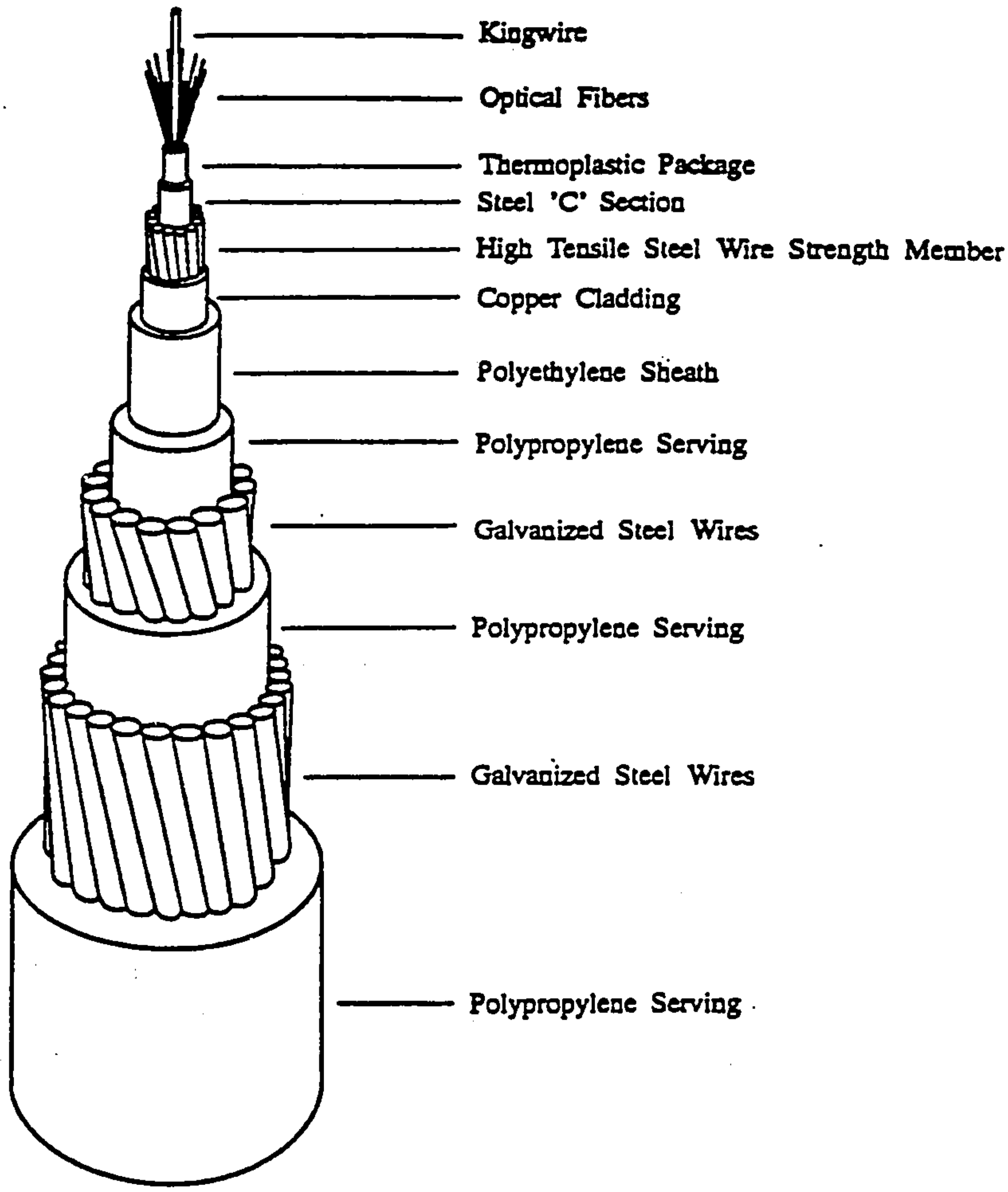

Figure 4
DOUBLE ARMOR FIBER OPTIC CABLE

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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JANUARY 1992

handling 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 an 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-foot in 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. Rapid Erosion

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 Giant Landslides

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

"A large, presently inactive, explosive dump is located west of Oahu. This dump will have to be avoided by the fiber optic cable. Navy authorities maintain this area has not been used for ordinance disposal since shortly after World War II. However, they advise against laying cables through the area" (SSI, August 1991).

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

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 landing sites were identified for the Oahu to Kauai segment of the fiber optic cable where underwater geology would be most suitable: Kahe Point Beach Park, Pokai Bay, and Nanakuli Beach Park. Kahe Point Beach Park was selected as the preferred landing site because the site exhibits positive characteristics including nominal land side conditions, workable nearshore waters, and low public use. Another positive site feature of Kahe Point Beach Park is the low likelihood for discovery of archaeological/historic sites (Discussion with DLNR, Historic Sites Office).

Should Kahe Point Beach Park be removed from consideration, Pokai Bay would be the alternate landing site. The proximity of Pokai Bay to a small boat harbor could create potential problems due to future harbor expansion and/or marine dredging. Pokai Bay also has potential for discovery of archaeological remains in the backshore area according to the Department of Land and Natural Resources Historic Sites Office.

SECTION 3

CONSTRUCTION ACTIVITIES

3.1 GENERAL

Construction of the project will be accomplished in two phases. The first phase involves all land side construction activities; and the second phase includes 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 at Kahe Beach Park and approximately 350 feet of underground ducts and cable from the landing site to the new manhole to an existing manhole (No. 3455) located on the mauka side of Farrington Highway (see Figure 5). From Manhole No. 3455 the fiber optic cable will be pulled through 11,000 feet of existing underground ducts to connect to the GTE Hawaiian Tel Central Office (CO) at 92-1389 Aliinui Drive.

The second phase involves landing the submarine fiber optic cable, pulling the cable through the steel ducts and connecting it to the new manhole at Kahe Point.

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

3.2 LAND-SIDE ACTIVITY

A new 5-foot x 10-foot x 6-foot deep reinforced concrete manhole will be constructed at Kahe Beach Park approximately 300 feet makai of Farrington Highway.

The new manhole will be the terminus of the land-side activities and it shall be constructed to accept the submarine cable. Seaward of the manhole, two six-inch diameter steel conduits encased in concrete will be embedded within the limestone cliff and rock outcropping fronting the ocean. Boring and trenching equipment will be utilized during the installation of the conduits. Landside of the manhole, four 4-inch diameter PVC ducts will be installed in a trench from the new manhole to Manhole 3455 located on the mauka shoulder of Farrington Highway. The duct lines will be encased in concrete and buried

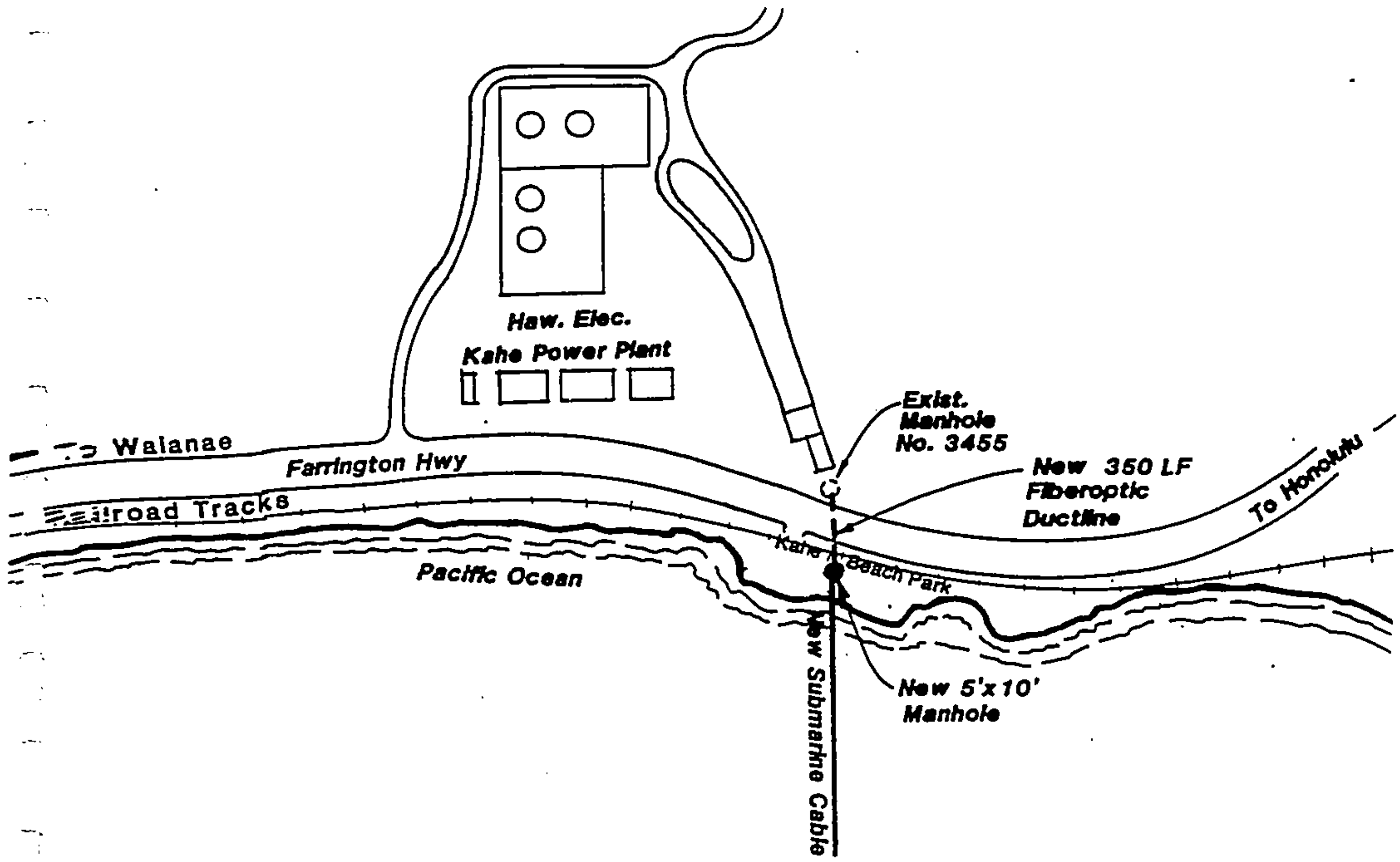

Figure 5
SITE PLAN

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

Not to Scale

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FEBRUARY 1992

under 3 feet of earth cover. The trench will cut across the Kahe Beach Point Park Access Road, a railroad right-of-way, and Farrington Highway and traffic will be detoured around the construction equipment during the trenching operations. Traffic control procedures such as rerouting the traffic onto the shoulder of the highway with the aid of necessary safety measures such as temporary traffic control devices (cones) and/or use of flagmen to direct traffic will be implemented during work activity. Two-way traffic on Farrington Highway will be maintained at all times. Approximately two weeks will be required to complete the trenching work within the Farrington Highway right-of-way.

The Kahe Point Beach Park Access Road may be partially closed to vehicular traffic during construction. The existing railroad tracks and ties removed during the trenching operations shall be restored after work within the railroad right-of-way is completed.

3.3 NEARSHORE ACTIVITY

The second work phase involves landing the submarine fiber optic cable and establishing a connection to the new manhole at Kahe Point.

Removal of additional sand and rubble at the end of the steel conduits below the level of the prevailing tides may be required. For this process, manual or mechanical means will be used to remove the upper layers. Remaining sand or rubble will be removed using a hydro-jet. If necessary, and bags will be used to prevent sand from reentering the open trench. Rock outcrops and other hard substrate which cannot be avoided will be also removed using similar methods.

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

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

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 two range targets 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 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.

A study of the ocean bottom along the proposed cable alignment at the landing site indicates the following characteristics:

Immediately offshore, there is a 380-foot wide band of hard bottom, consisting of alternative ridges and channels, with scattered boulders and coral with vertical relief of about 3 to 4 feet. The water depth at the seaward end of this band is approximately 15 feet. Seaward of this point, there is a 100-foot wide transition zone, with the bottom consisting of a flat sand bottom with interspersed limestone and coral outcrops. Vertical relief through this zone is 2 to 4 feet. The water depth at the seaward end of the transition zone is 18 to 20 feet. The percentage of sand in the transition zone increases proceeding seaward.

CORRECTION

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

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An extensive deposit of medium grained calcareous sand begins approximately 500 feet offshore and continues for approximately 2,200 feet to the 70-foot depth. There are no exposed outcrops of limestone or coral in the deposit. The ocean bottom from the 70-foot depth to the 100-foot depth comprises of limestone, scattered coral, and coral rubble with sand.

Depending on subsurface conditions, the cable may need to be curved around fixed underwater obstacles such as coral heads, finger coral, and rock outcrops. Coral, rock and other hard surfaces that cannot be avoided will have to be removed or circumvented using various methods such as:

1. Coral and limestone 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. The impacts can be minimized depending on the depth of trenching necessary to accommodate the relatively narrow diameter of the cable. 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.

The cable will be anchored in shallow water with a hard rock or coral bottom to prevent abrasion resulting from wave action. Under this situation the cable will be exposed to abrasion from movement against hard surfaces caused by weather or geologically (tsunami) induced wave action. In deeper water, cable movement is significantly reduced and the need for wave related abrasion protection is less of a concern. According to Seafloor Surveys International, in deeper waters trenching is generally unnecessary since there are no man-made activities capable of dredging the cable off the ocean floor and damaging it (only for wave related abrasion protection is less of a concern. According to Seafloor Surveys International, in deeper waters trenching is generally unnecessary since there are no man-made activities capable of dredging the cable off the ocean floor and damaging it (only commercial trawlers would pose this concern and none are located in Hawaiian waters in the vicinity of the proposed cable alignment).

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

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.

3.4 CABLE LANDING PROCESS

The cable landing process includes the use of the landslide range targets (alignment markers) to assist in the alignment of the cable as it is being installed. The cable laying ship may be assisted by two tugboats to maintain proper alignment of the cable ship. This assistance is essential to ensure that the cable is placed within the cable easement. Once the cable laying ship is properly aligned, the cable will be towed from the ship by one of the tugs to a transfer location nearshore. At this location, the leading end of the cable will be attached to a wire rope connected to land based pulling equipment (i.e., winch) and pulled ashore. Once the cable is placed within the steel conduit, the leading end of the cable will be secured within the manhole and spliced together with cable emanating from the central office.

Once the cable has been secured, the open trench will be backfilled and all reasonable efforts will be taken to restore the beach to its original preconstruction condition.

3.5 SAFETY CONSIDERATIONS

During the construction phase on the beach (approximately 2-7 calendar days, May-June

During the cable laying process (approximately 2 days depending on the weather conditions), 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.

3.6 SCHEDULE AND ESTIMATED COST

The first phase (land-side activities) of the project is scheduled tentatively for March and April 1993. The second phase (installation of interisland cable and cable landing operations) is scheduled tentatively for May and June 1993. Construction cost for the first phase is estimated at $243,550.

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 south-western side of Oahu which is generally warm and dry. The mean annual temperature is between 72 and 79 degrees Fahrenheit and the annual rainfall is about 20 inches, most of it occurring during winter months. The prevailing winds are tradewinds blowing from a northeasterly direction. Winds from a southeasterly direction (Kona winds) may be expected 5-8 percent of the time (Atlas of Hawaii, 1983).

Impacts

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

4.1.2 Topography, Geology, Soils

The project area lies at the base of the Waianae mountain range. The predominant soil type for the area excluding the landing site, as described in the August 1972 U.S. Department of Agriculture, Soil Conservation Service publication, "Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii," consists of the Lualualei Series particularly Lualualei extremely stony clay, 3 to 35 percent slopes. There are many stones on the surface and in the profile. It is impractical to cultivate this soil unless the stones are removed. Runoff is medium to rapid, and the erosion hazard is moderate to severe.

Soils at the landing site consist of rock land. Rock land (rRk) is made up of areas where exposed rock covers 25 to 90 percent of the surface. The rock outcrops and very shallow soils are the main characteristics.

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 in the subject area. The major drainage features for the area are Waimanalo Gulch to the east, Keaneoio Gulch to the north and Makaiwa Gulch to the south all of which are dry except for the rainy season.

Groundwater for the area is brackish and is not a source for domestic use (Atlas of Hawaii, 1983).

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.

4.1.4 Terrestrial Flora/Fauna

The area's flora is classified as lowland dry shrub and typically contain species such as kiawe, koa haole, bristly foxtail, uhaloa, milo, and fingergrass. Homesites, military installations, and pastures are the most common uses 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. The area has a dry climate and sparse vegetation does not provide good habitats for rare animals.

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 carried out a qualitative reconnaissance of the Kahe Point Beach Park cable route on 21 June 1991 and a quantitative sampling of this site was done on 6 December 1991 (see Marine Environmental Analysis of Selected Landing Sites, Sea Engineering, Inc., and Environmental Assessment Co., Jan. 1992). To obtain an overall perspective on the extent of the major communities 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. During the course of the field work 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.

Benthic communities in the vicinity of the project site are situated on hard shore substratum. "Coral coverage may locally (over areas up to $10m^2$) exceed 75 percent; mean coverage is about 15 percent (Sea Engineering, January 1992). Diversity and abundance of fish in the area is high due to the plentitude of coral and the warm water outfall from the Hawaiian Electric Power Plant. Invertebrate species richness and abundance is similarly high. The intertidal bench supports normal tidal zone marine life, including starfish, crabs, small fishes, algae, and sea urchins.

"The biological survey did not find any rare or unusual species or communities. There were no sightings of green sea turtles in the area. "To the south of the beach park (i.e., offshore of Paradise Cove and West Beach) are known concentrations of green sea turtles. Some shelter (caves, ledges and undercuts) at sizes and scales appropriate for green sea turtle resting areas were seen in the region adjacent to shore and macroalgal species were encountered both subtidally and intertidally which are known forage for green turtles. No information was discovered to suggest that nesting of sea turtles in the vicinity of Kahe Point Beach Park has occurred in historical times. Another protected species, the humpback whale, also was not seen offshore of the study area" (Sea Engineering, January 1992). As noted by Herman (1979), humpback whales tend to be found in regions remote from human activities and the proposed Kahe Point cable alignment is in relatively close proximity to the Barbers Point Harbor which is becoming an important commercial port for Oahu.

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 a substrate of sand, where most of the organisms are mobile. 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" (Sea Engineering, January 1992).

"In the shallower areas along the route, there are areas where the cable will cross hard substratum and there is a greater possibility of impact to benthic and fish communities. Impacts associated with these construction activities primarily include removal of benthic communities in the cable path, and the generation of turbidity which may impact surrounding communities. The small scale of the proposed activities that would be necessary to protect the cable in shallow water would produce little sediment, and over a relatively short period of time. Turbidity from the construction will be a minor impact" (Sea Engineering, January 1992).

We expect that there would be no direct impacts to the threatened green sea turtle or to endangered humpback whales. 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 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 the Barbers Point Harbor which is becoming an important commercial port for Oahu.

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 1991a). 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).

4.1.6 <u>Scenic and Visual Resources</u>

Kahe Point Beach Park has the Hawaiian Electric Power Plant to the north end and the rest of the area is generally void of man-made structures. Except for light poles along Farrington Highway, the beach park has amenities such as two comfort stations, a pavilion, camping and picnic equipment, and fourteen marked camping sites with parking.

<u>Impacts</u>

No long term adverse impacts are anticipated on the beach park since the proposed cable will be located below surface. From there the cable will be routed by duct lines under Farrington Highway to connect to the GTE Hawaiian Tel Central Office (CO) at 92-1389 Aliinui Drive.

For two to seven 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 Kahe Point Beach Park cable landing site on February 1992 (see Archaeological Assessment of the Proposed Fiber Optic Cable Landing for Wailua, Kauai, Cultural Surveys Hawaii, Feb. 1992). "The scope of work included inspection of the proposed landing site (Kahe Point Beach Park) and the proposed duct line along Farrington Highway. The landing and duct line corridor were inspected for any surface sites. Two areas of interest were noted within the Beach Park portion but none along the proposed duct line. The two areas within the Beach Park include a sea cave and associated crevices, and an extant section of fairly well preserved Oahu Railway and Land Company (O.R. & L.) tracks.

No subsurface testing was undertaken in association with this assessment. This was due to a number of facts which include: (1) The sea cave and crevices in the park can easily be avoided; (2) The O.R. & L. right-of-way is listed as a national registered site (50-80-9714) and a mitigation plan to get by it must be approved by the Historic Sites Division of the Department of Land and Natural Resources (DLNR); (3) Sub-surface testing along the approximately 2,500 feet long duct line within Farrington Highway is not only beyond the scope of this assessment, but based on the observed degree of land alteration associated with the highway's construction (massive cut and fill), it would appear that no archaeological resources of significance remain within the actual right-of-way itself" (Cultural Surveys Hawaii, Feb. 1992).

Impacts

"Only two areas of interest would be impacted by the proposed route, the rail line and the sea cave and fissures. If the cable is routed to the south of the sea cave then no impact is foreseen for the cave and fissures. However, if the proposed cable route will impact the cave and fissures then an archaeological survey, including sub-surface examinations, should be conducted *prior to construction*. It is recommended that DLNR be consulted to assess if any impact can be made on this section of rail line. If impact is allowed on the rail line an archaeologist should be present during excavation" (Cultural Surveys Hawaii, Feb. 1992).

"The proposed underground duct line within Farrington Highway (right-of-way) from Kahe Point to Ko'olina Resort, appears to contain no significant archaeological resources. However, once the actual route with a surveyed and staked centerline is chosen, it is recommended that if portions of the duct line are outside of the highway right-of-way, a survey be conducted to properly assess the staked route" (Cultural Surveys Hawaii, Feb. 1992).

4.1.8 Beach Erosion and Sand Transport

"The shoreline in this area is rocky, consisting primarily of low limestone sea cliffs approximately 15 to 20 feet high and is not subject to the typical processes of coastal erosion and accretion. The shoreline therefore has been stable in recent history. The cliff appears to be erodible, and there are large pieces of fallen limestone at the base of the cliffs. Also at the foot of the cliffs, at the waterline, there is a narrow limestone bench that terminates in a drop into 3 to 5 feet of water. The nearshore bottom off Kahe Point Beach Park is irregular with areas of hard rock bottom, alternating with patches of sand. Further offshore, a sandy bottom predominates" (Sea Engineering, January 1990).

Impacts

The proposed project is not expected to impact beach processes. Upon completion of construction activities, the construction crew will make every reasonable effort to return the ground to existing preconstruction contours through use of existing 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 may 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

Air quality of the proposed project area is good due to low emission levels and the almost continual presence of tradewinds or on-shore breezes. The major factors affecting air quality in the area are vehicular traffic and the Hawaiian Electric Power Plant.

Impacts

During the excavation process, loose sand and dirt may be cast into the air by wind. The release of sand into the air can be prevented by requiring the contractor to periodically wet down the work area. The areas that are used for the placement of the range targets will also be exposed during the construction period. The target sites should be similarly wetted to control fugitive dust. The work site will be returned to its original state after the cable laying process is completed.

Operation of construction vehicles is expected to temporarily contribute carbon monoxide pollutants in the project vicinity.

4.1.11 Water Quality

Nearshore waters are rated Class "A" by the State Department of Health. Offshore waters are very clear with excellent underwater visibility over reef slopes. Water temperature and salinity are normal for ocean water with evidence of fresh water inflow along the shore.

Impacts

It is anticipated that the nearshore waters may be clouded during the trench excavation and backfilling operations. Silt screens may be erected by the construction crew to lessen and minimize effects of turbidity. Water collected during the dewatering process will be discharged on the beach adjacent to the work area.

4.2 SOCIO-ECONOMIC ENVIRONMENT

4.2.1 Population

Although the population within the Waianae area numbers 10,246, the population of Honolulu County as of 1989 was 841,600, and is projected to increase to 999,500 by 2010 (The State of Hawaii Data Book, 1990). This projected population increase of 157,900 over the 1989 level requires that the County's communication system be upgraded and expanded to meet future communication needs.

Impacts

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

4.2.2 Surrounding Land Use

Kahe Point Beach Park is owned by the City and County of Honolulu and is primarily in recreational use. The Hawaiian Electric Power Plant is located mauka of Kahe Point Beach Park, across Farrington Highway, and its outfall pipes are located just north of the Park. Barbers Point is located five miles south of Kahe Point Beach Park.

Impacts

No short or long term impacts are expected from the development of the proposed project. The proposed cable will be routed by duct lines subsurface and will not adversely impact surrounding uses.

4.3 PUBLIC FACILITIES

4.3.1 Transportation Facilities

The project site is served by Kahe Point Beach Park Access Road. Trenching through the roadway and Farrington Highway will involve excavation of the pavement and subsurface, placement of the conduits within the exposed trench, and restoring the roadway and Farrington Highway to their original condition after installation of the cables.

The construction of the trench across Kahe Point Beach Park Access Road and Farrington Highway will affect traffic. Traffic may be detoured around the construction equipment. Traffic control procedures such as rerouting the traffic onto the shoulder of the highway with the aid of necessary safety measures such as temporary traffic control devices (cones) and/or use of flagmen to direct traffic will be implemented during work activity. Two-way traffic on Farrington Highway will be maintained at all times. Approximately two weeks will be required to complete the trenching work within the Farrington Highway right-of-way.

The Kahe Park Access Road may be partially closed to vehicular traffic during construction. The City and County of Honolulu, Department of Transportation Services, operates The Bus on a supply and demand basis, subject to availability of resources. Existing public transit service to the vicinity is provided by the City, with Route 51 between Honolulu and Makaha passing on Farrington Highway fronting the project area.

Impacts

The proposed project is expected to have no impact on the existing traffic or bus services, after completion of construction activities. Construction will take approximately two to seven days.

4.3.2 Recreation 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 two to seven 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 generally 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 serves to assist in the State's objective of positioning Hawaii as the leader in 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 State of Hawaii Land Use District classifications designate Kahe Point Beach Park as "Urban", and the surrounding areas as "Urban" and "Agriculture" (see Figure 6). The "Urban" classification is defined as "areas characterized by city-like concentration of people, structures, streets and other related uses." The purpose of the agriculture district is to maintain a strong agricultural economic base and to prevent unnecessary conflicts among incompatible uses." The proposed project does not require any amendments in the current State Land Use classification.

5.4 COUNTY ZONING

Zoning for the Kahe Point Beach Park area is general preservation (P-2). The areas surrounding Kahe Point Beach Park are zoned intensive industrial (I-2), restricted agriculture (AG-1), general agriculture (AG-2), and country (see Figure 7).

5.5 CITY AND COUNTY OF HONOLULU GENERAL PLAN

The General Plan of the City and County of Honolulu provides a statement of long range social, economic, environmental, and design objectives for the Island of Oahu and a

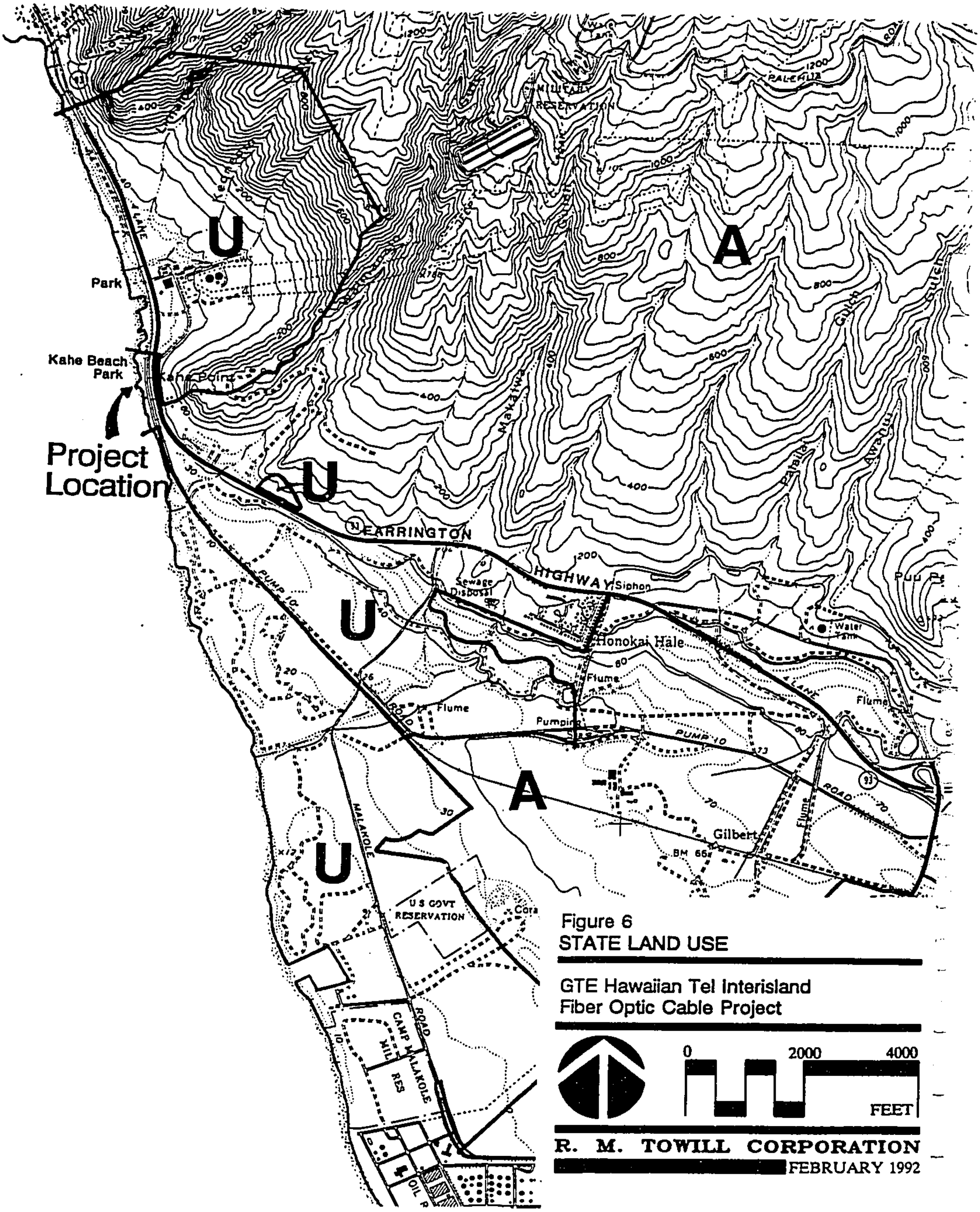

Figure 6
STATE LAND USE

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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FEBRUARY 1992

statement of policies necessary to meet these objectives. A specific objective of the General Plan relating to the proposed project is the maintenance and expansion of existing utilities systems. The proposed project is generally in conformance with the goals and objectives of the City and County General Plan.

5.6 SPECIAL MANAGEMENT AREA

The City and County of Honolulu has designated the shoreline and certain inland areas of Oahu as being within the Special Management Area (SMA). SMA areas are felt to have a sensitive environment and should be protected in accordance with the State's coastal zone management policies. The project area is within the SMA Boundary as defined by the City and County of Honolulu (see Figure 8). A SMA permit will be necessary for development of the proposed project. Review of the project under SMA criteria will be conducted during the processing of the SMA permit with the Department of Land Utilization (DLU), City and County of Honolulu.

The proposed project, portions of which are within the shoreline setback area, is also subject to the provisions of the Shoreline Setback Rules and Regulations of the City and County of Honolulu. Figure 9 shows the certified shoreline and shoreline setback line in the area where the project crosses the shoreline setback area. A Shoreline Setback Variance Permit will be required.

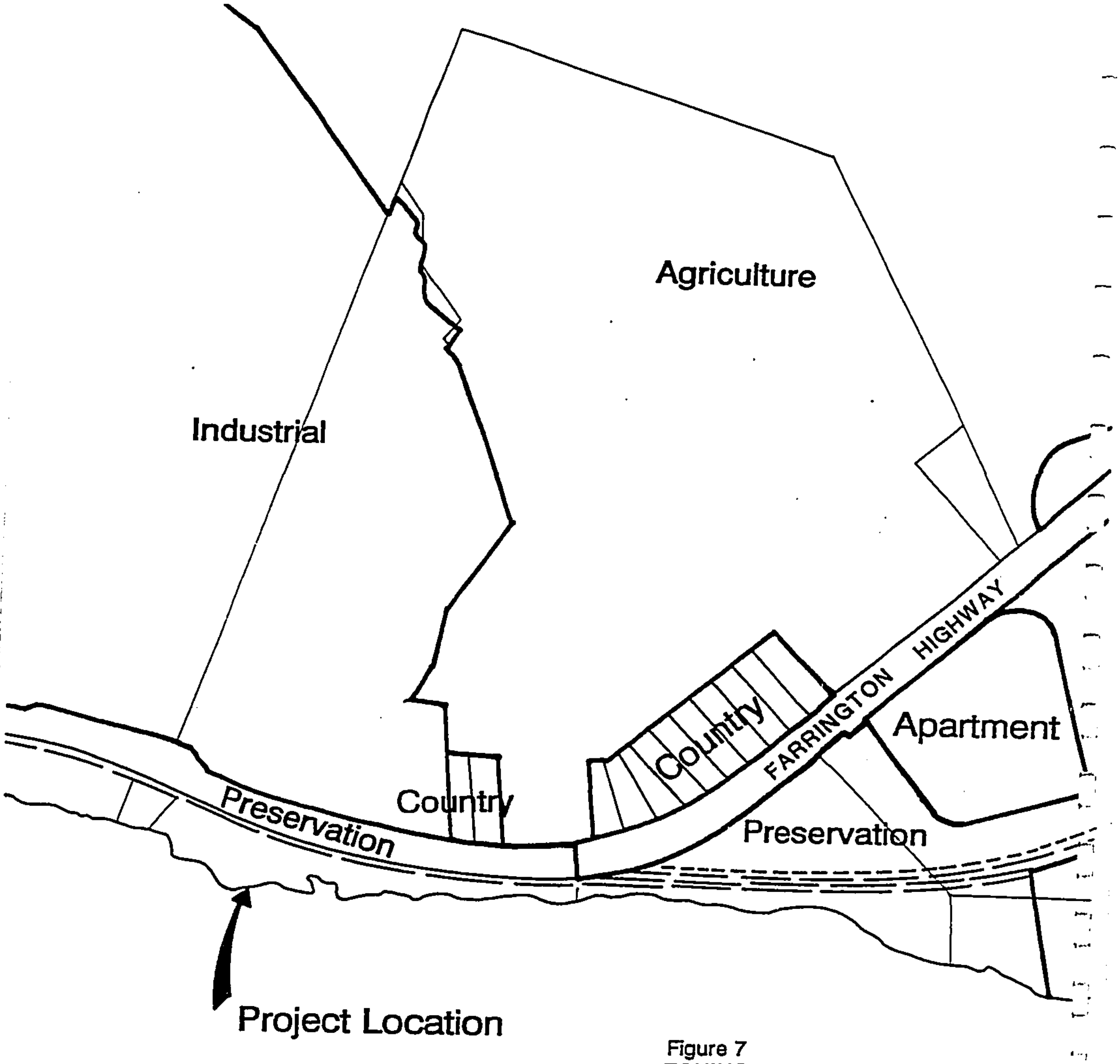

Figure 7
ZONING

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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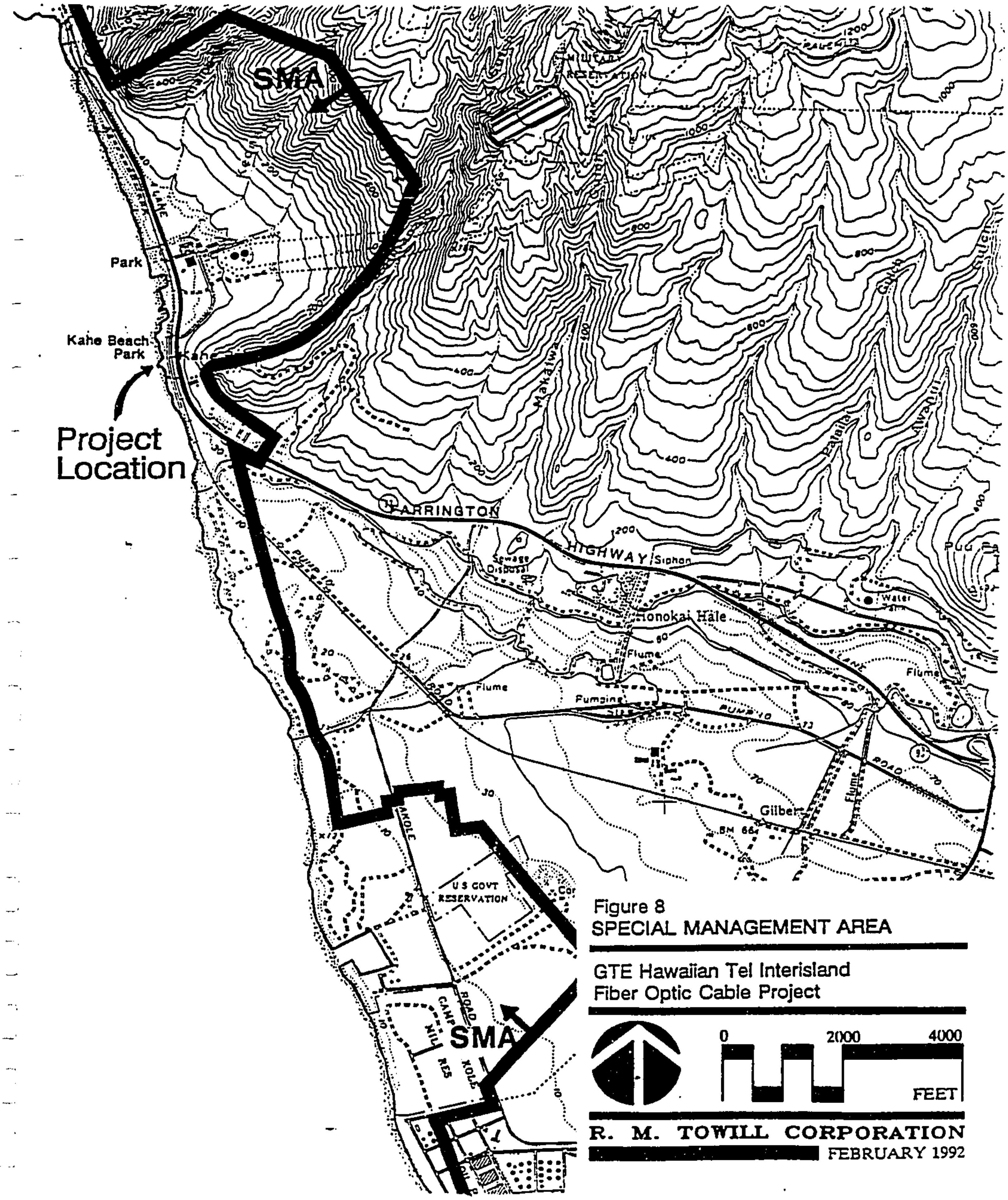

Figure 8
SPECIAL MANAGEMENT AREA

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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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 City and State governments from the cable vendor, and increased public and private telecommunication usage; and
- Lost attainment of the City and County of Honolulu General Plan's objective of expansion of existing utilities systems.

6.2 ALTERNATIVE SITES

The area considered for the leeward Oahu cable landing extended from the Barbers Point Naval Air Station to Pokai Bay, a distance of approximately 14 miles. Existing facilities which limit the selection of cable route areas include cooling water intakes and discharges for the Kahe Generating Station, a U.S. Navy underwater test range, an ocean outfall for domestic sewage, and a small boat harbor.

The coastline south of Kahe Point was excluded from further consideration during the office study due to extensive resort, commercial shipping, industrial and military use. Activities include a major resort development, a deep draft harbor, and offshore oil moorings and associated underwater pipelines. This existing usage precludes a cable landing anywhere along the coastline between Kahe Point and Ewa Beach.

The following is a discussion of the areas initially considered but not selected:

6.2.1 Camp Malakole

Camp Malakole has an "uneven, irregular bottom out to the 70 foot depth, requiring cable protection, trenching or anchoring for a 4,000 foot distance" (Sea Engineering, January 1990). Other constraining factors are the potential for discovery of archaeological remains and damage from increasing shipping activities around Barbers Point Harbor.

6.2.2 Nanakuli Beach Park

Nanakuli Beach Park has optimal nearshore conditions which include a sand channel extending all the way to shore and deep water near shore. However the area is unavailable due to an existing U.S. Navy submarine test range (FORACS Range) which has several cables running offshore. "Discussions with the range manager indicated that the Navy would not permit placement of a cable across their existing cables, due to their requirements for cable maintenance and possible expansion of the range. An incoming fiber optic cable would cross most, if not all, of the hydrophone cables. This site was therefore eliminated from further consideration" (Sea Engineering, January 1992).

6.2.3 Pokai Bay

One disadvantage of Pokai Bay is its proximity to the Waianae Small Boat Harbor which could create potential problems due to future harbor expansion and/or marine dredging. Other constraining factors are the potential for discovery of archaeological remains in the backshore area and public use impacts.

Pokai Bay is a heavily used recreational area. The north half of the beach is restricted to military personnel, and there are three surf sites off the military beach. The waters in the south half of the bay are calm due to the protection offered by the breakwater. According to AECOS (1978), Pokai Bay Beach Park has the best protected and most stable sand beach along the entire Waianae coast. Activities include swimming, wading and canoe paddling. The heavy recreational use of the bay has resulted in past conflicts between swimmers and boaters. State boating regulations now separate the two activities.

6.2.4 Ulehawa Beach

"A sand channel off the beach park corresponds to the mouth of Ulehawa Stream. Inshore the sand channel is winding and irregular, with a typical width of 150 to 200 feet. The sand channel terminates approximately 300 feet offshore. The bottom between the inshore limit of the sand channel and the beach is scoured limestone shelf, with pronounced surge channels and ridges. The irregularity of the bottom in this zone increases with distance toward shore. Because of the bottom conditions and the shape of the sand channel, cable protection would probably be required out to the 40 foot water depth, 2000 feet offshore. At this point, the channel opens into a large sand deposit. The area just off the beach would present a particular problem due to the vertical relief, and extensive trenching would probably be required to prevent bridging of the cable across the surge channels" (Sea Engineering, January 1990).

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 distortion 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 Kahe Point 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 City and County of Honolulu.

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 CITY AND COUNTY:

Department of Land Utilization

- 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 FEDERAL AGENCIES

U.S. Army Corps of Engineers

U.S. Coast Guard

10.2 STATE AGENCIES

Department of Land and Natural Resources

- Office of the Chairperson
- Aquatic Division
- Land Management Division
- Conservation and Environmental Affairs

Office of State Planning

- Office of Coastal Zone Management

Department of Transportation

Department of Health

Department of Business and Economic Development

10.3 CITY AND COUNTY OF HONOLULU

Department of General Planning

Department of Land Utilization

Department of Public Works

Department of Parks and Recreation

Mayors Office

Councilman John Desoto

Councilwoman Donna Kim

SECTION 11

COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT

92-00206

JOHN WAIHEE
GOVERNOR OF HAWAII

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

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

REF:OCEA:SKK

JUN 16 1992

FILE NO.: 92-724
DOC. ID.: 839

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The Honorable Donald Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

SUBJECT: Special Management Area Use Permit (SMP) and Shoreline Setback (SSV) Environmental Assessments for Sandy Beach Park and Kahe Point Beach Park, Oahu, Hawaii, TMK: 3-9-12: 2 and 9-2-3: 15

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the submitted environmental assessments and have the following comments.

Brief Description:

The City and County of Honolulu, Department of Land Utilization is processing SMA and SSV applications for the proposed project and is soliciting review and comments. The applicant proposes to install an interisland submarine fiber optic cable system to provide additional telecommunications capability. The proposed Oahu sites where the subject cable would come ashore would be at the eastern end of Sandy Beach Park and near the western end of Kahe Point Beach Park.

The fiber optic cable is approximately three inches in diameter without any casing armoring. The applicant proposes to bring a cable ship as close as possible to shore, and use land-based equipment to pull the cable's leading end to shore. Once onshore the leading end would be pulled through steel piping encased in concrete and attached to landward cable ends. The cable would then be either buried (within a trench covered with cement or covered (with split pipe sections bolted to the substrate) to protect it in shallow water depths. At Sandy Beach, it is expected that the first 950 feet of cable (from shore) would have to be protected in this fashion. At Kahe Point, this length is estimated at 500 feet. In-water work for laying the cable is expected to take 2 days at each site.

The applicant's consultant performed substrate characterization and aquatic resources inventory for both alignments. For Sandy Beach, the shoreline to the 20-foot isobath (600 feet), is hard bottom, flat limestone with boulders (1 to 4 feet in diameter). The seaward 100 to 150 feet fraction of this area is characterized by ledges having vertical relief between 3 and 7 feet in height.

The next 350 feet is characterized by flat limestone with scattered coral heads and sand (maximum depth is 32 feet). For Kahe Point, the shoreline to about the 15 feet depth (380 feet) is hard bottom with ridges, channels, and scattered boulders and coral heads. Vertical relief is 3 to 4 feet in height. The next 100 feet is characterized by sand, limestone and coral with vertical relief between 2 and 4 feet in height (maximum depth is 20 feet). At about 500 feet from shore along the alignment, there is a large sand deposit which the applicant proposes to use in its cable alignment.

Division of Aquatic Resources Comments:

Several concerns arise with respect to these applications. The documents provided describe trenching and or covering of the cable in nearshore waters with a split pipe over fairly long distances (950 feet for Sandy Beach and 500 feet for Kahe Point).

In another request for comments on similar county applications, the AT&T company proposed bringing to shore submarine fiber optic cables at Keawaula (Yokohama) Bay. In this application, the applicant anticipated that excavation work would only extend 50 feet seaward of the shoreline.

In order to minimize turbidity and reduce impacts to marine habitat, the GTE applications should clarify the reason as to why their cable systems require more construction effort seaward of the shoreline. The Division would also favor covering the cable using split pipe rather than trenching, as it would involve less impacts to aquatic resources.

The subject documents mention 4 conduits planned for the Sandy Beach site (of which only one is planned for present use) and 2 conduits for the Kahe Point site (of which only one is planned for present use). If trenching and covering with cement is used, subsequent laying of additional cables means retrenching and additional coverings. If feasible, the applicant should consider laying the cables required for present and future use to minimize disruption and excessive adverse impacts from construction.

Finally, consolidating submarine cable alignments merits consideration for minimizing environmental damage. The subject documents mention the planned deployment of other cables (Pac-Rim East, HAW-5, Hawaii deep water electric cable, etc.). The applicant should consider using the AT&T

alignment for its Kauai to Oahu cable. They could also consider using the existing cable easement in Hanauma Bay for its Maui to Oahu cable (This easement is established for submarine cable use for both AT&T and GTE). Consolidating cable easements now and in the future would minimize intrusion into Hawaii's nearshore environments.

Historic Preservation Division Concerns:

Our office has reviewed and concurred with the recommendations of the archaeological assessments for these projects. These recommendations are faithfully reproduced in the Final Environmental Assessments. The historic preservation review process is complete for the Sandy Beach Park project. We look forward to reviewing detailed plans for the Kahe Point Beach Park project as these are developed.

Office of Conservation and Environmental Affairs Comments:

For your information, a Conservation District Use Application (CDUA) and land disposition are required for the proposed cable landings on State beaches and submerged land. In addition, to reduce the impact of cabling on the shoreline and nearshore environment, we recommend that any future cable easements be located in areas which have already been disturbed such as Makaha, Makapuu, and Yokohama, ect.

Thank you for your cooperation in this matter. Please feel free to call Sam Lemmo at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Very truly yours,

for John P. Keppeler II

WILLIAM W. PATY

R. M. TOWILL CORPORATION

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

July 30, 1992

William W. Paty
Chairperson
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Paty:

SUBJECT: Special Management Area Use Permit (SMP) and Shoreline Setback Variance (SSV) Environmental Assessments for Sandy Beach Park and Kahe Point Beach Park, Oahu, Hawaii, TMK: 3-9-12: 2 and 9-2-3: 15

This is in response to your letter to the City Department of Land Utilization, dated June 16, 1992, which was forwarded to us by them. We wish to offer you the following comments:

GENERAL COMMENTS

The following points should be clarified regarding the description of the fiber optic cable landing activity:

- The 3" diameter of the fiber optic cable includes cable armoring which surrounds the 12-fiber optic strands in the cable center. Split pipe armoring will be used to provide additional cable protection and to help anchor the cable to the ocean bottom.
- Once the cable ship assumes a position close to shore, small surface vessels such as boston whalers or motorized inflatable boats (e.g., zodiacs), will pull the cable from the ship to an awaiting shore party, which will place the cable in the manhole.

DIVISION OF AQUATIC RESOURCES COMMENTS

Selection of both Sandy Beach and Kahe Point are largely based on GTE Hawaiian Tel's requirement that the fiber optic cables be located as close as practicable to the phone company's Central Offices. This is necessary because of the need to ensure protection and reliability for the interisland communications service the fiber optic cable will provide. Each Central Office is designed and constructed to ensure safety and security from both man-made and natural hazards (e.g., terrorist activity, vandalism, major storms, and seismic

disturbances). The Sandy Beach and Kahe Point Beach sites are in good proximity to GTE Hawaiian Tel Central Offices, and addresses this need for security.

SITE LOCATION
Although both the AT&T (Keawaula Bay) and GTE Hawaiian Tel projects involve landing a submarine fiber optic cable on shore, they differ in construction needs due to nearshore conditions. Keawaula (Yokohama) Bay has a sandy nearshore area, whereas both Sandy and Kahe Point Beach have relatively rocky shorelines. At Keawaula, once the cable was deployed there was good opportunity for it to sink into the substrate and be covered by the naturally occurring shifting of the substratum (sand deposits). This is obviously not possible if the substratum is rock, which is the case at Sandy and Kahe Point Beach. The rocky substratum will require that either trenching, or split pipe anchoring be implemented to protect the cable.

CONSTRUCTION EFFORT
The greatest danger to a cable system is the submarine portion of the route, and this necessitates more construction effort than the landside portion. Protection of the cable and public safety are the major factors for ensuring the fiber optic cable is covered or anchored in nearshore waters. Approximately 50 to 60 feet of water will be required before wave forces diminish to levels where wave action does not affect the cable. Until the cable reaches this depth it must be protected. Trenching is preferred, because it provides maximum protection against wave forces and is best for public safety. Public safety is at risk if the cable is left exposed along the nearshore, because someone could trip over it or hit their foot against it. Therefore, GTE Hawaiian Tel must do trenching or cable armoring at Sandy Beach and Kahe Point Beach, in order for the cable and public safety to be protected.

Wherever feasible, however, split pipe will be utilized to minimize turbidity and reduce potential for impacts to marine habitat. We note that in utilizing both trenching and split pipe, that the operations will be short term, will be based on the need for public safety and protection for the cable, and will not constitute a long-term adverse impact.

NEED FOR FUTURE CAPACITY
Future capacity was a major determinant in utilizing fiber optic technology. The proposed cable has a projected 20-year+ service life and is designed to meet GTE Hawaiian Tel's projections for growth well into the 21st century. This is based on GTE Hawaiian Tel's best forecasting capability and is itself an effort to minimize need for additional cables and unnecessary disturbance to the environment.

The use of additional conduits at each of the landing sites are intended for future use beyond the service life of the proposed cable. Should future expansion be required above expectations for growth, the additional conduits will help minimize need for extensive shoreside construction activity to again site a new fiber optic cable.

CONSOLIDATION OF CABLE ALIGNMENTS
Consolidation of cable alignments was considered, but is constrained by the need to locate the cable landing sites as near to Central Offices as possible. The only island where this was not feasible was Kauai, due to poor coastline conditions near the Lihue Central Office. The nearshore area consisted of numerous rock and coral outcrops and would have required extensive cable trenching, anchoring, and armoring. In addition, a steep underwater offshore ledge and a high and steep on-shore bank would have resulted in need for major site excavation activities.

HANAUMA BAY MARINE LIFE CONSERVATION DISTRICT (MLCD)
Use of the old cable easement in Hanauma Bay is not recommended due to the construction work required to lay a new cable. The old cable and easement has since been covered by coral and sediments which are now part of the Hanauma Bay Marine Life Conservation District, established in 1967. In order to utilize this site, major coral and rock outcrops would have to be demolished, much as they were when the old cable was deployed. In addition, there has already been strong public interest and demand for greater environmental protection of Hanauma Bay, and any request for ocean construction and temporary closure of the beach would probably be viewed negatively.

HISTORIC PRESERVATION DIVISION COMMENTS

Thank you for confirming that the historic preservation review process is complete for the Sandy Beach Park project. We are presently working with the Department of Land and Natural Resources, Historic Preservation Division, concerning archaeological recommendations for the Kahe Point Beach project.

OFFICE OF CONSERVATION AND ENVIRONMENTAL AFFAIRS COMMENTS

A CDUA and land disposition are being filed for the proposed landings on State beaches and submerged lands. We agree that when practical cable easements should be located in areas which have already been disturbed such as Makaha, Makapuu, and Yokohama. However, as noted, the landing sites were selected based on specific criteria which required locations which could not be the same as those which have already been utilized.

Thank you for this opportunity to respond. Should you wish to make any additional comments please contact us at our above address.

Very truly yours,

Brian Takeda
Senior Planner

cc Joan Takano, DLU, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
SK, CK, RDE, KY RMTC

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU HAWAII 96843

June 18, 1992

'92 JUN 19 PM 1 55

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: FOR KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM DATED MAY 11, 1992 REGARDING THE SPECIAL MANAGEMENT AREA USE PERMIT, (SMP), (92/SMA-41 & 42), AND SHORELINE SETBACK VARIANCE, (SV), (92/SV-004 & 005), ENVIRONMENTAL ASSESSMENTS FOR THE PROPOSED GTE HAWAIIAN TEL INTERISLAND FIBER OPTIC CABLE SYSTEM, SANDY BEACH PARK, TMK: 3-9-12: 2 AND KAHE POINT BEACH PARK, TMK: 9-2-03: 15

We have no objections to the proposed Fiber Optic Cable System projects at Sandy Beach Park and Kahe Point Beach Park.

For areas where the proposed projects may affect our existing water facilities, the construction drawings should be submitted for our review and approval.

If you have any questions, please contact Bert Kuioka at 527-5235.

R. M. TOWILL CORPORATION
420 Waiakamilo Rd. #411 Honolulu HI 96817-4941 (808) 842-1133 Fax (808) 842-1937

July 20, 1992

Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

SUBJECT: Environmental Assessment Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter dated June 18, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landings at Sandy Beach Park and Kahe Point Beach Park. We appreciated your review of these documents.

As requested, you will be provided with construction drawings for the Sandy Beach and Kahe Point Beach Park sites should any construction activities involve existing water facilities.

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

Very truly yours,

Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

JOHN WAIHEE
GOVERNOR

92-00204

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

REX D. JOHNSON
DIRECTOR

DEPUTY DIRECTORS
JOYCE T. OMINE
AL PANG
JEANNE K. SCHULTZ
CALVIN M. TSUDA

IN REPLY REFER TO
STP 8.4715

(3)

'92 JUN 17 AM 10 14

June 5, 1992

Mr. Donald A. Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

SUBJECT: Special Management Area Use Permit (SMP) and Shoreline Setback Variance (SV) Environmental Assessments

We reviewed the subject environmental assessment and do not believe that GTE Hawaiian Tel's proposal to develop an interisland submarine fiber optic cable system to link the island of Kauai, Oahu, Maui, and Hawaii will adversely impact our transportation facilities. However, all plans for work within the State highway rights-of-way must be submitted to our Highways Division for review and approval.

We have relocated all of our Pokai Bay boating facilities to the Waianae Boat Harbor and are, therefore, uncertain of any plans for future harbor expansion in this bay as stated on Page 13, last paragraph, of the environmental assessment report.

We appreciate this opportunity to provide comments.

Sincerely,

Rex D. Johnson
Director of Transportation

R. M. TOWILL CORPORATION

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

July 20, 1992

Rex D. Johnson, Director
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Johnson:

SUBJECT: Environmental Assessment Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter dated June 5, 1992, concerning the subject proposal. We appreciated your review of the documents. As requested, your State Highways Division will be provided with construction drawings of all work to be conducted within the State highway rights-of-way, for review and approval.

We have also noted your point of clarification regarding the uncertain future of harbor expansion at Pokai Bay, Waianae.

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

Very truly yours,

Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

Engineers Planners Photogrammetrists Surveyors Construction Managers

72-20186

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

(4)

REPLY TO ATTENTION OF:

June 12, 1992

'92 JUN 15 PM 3 48

Planning Division

Mr. Donald A. Clegg
Director of Land Utilization
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Thank you for the opportunity to review and comment on the Special Management Area Use Permit (SMP) and Shoreline Setback Variance (SV) environmental assessments and applications for the proposed GTE Hawaiian Tel Interisland Fiber Optic Cable System at Sandy Beach Park (TMK 3-9-12:2) and Kahe Point Beach Park (TMK 9-2-3:15), Oahu. 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 permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

a. Representatives from the R. M. Towill Corporation have met with the Operations Division and are aware that a Department of the Army permit is required. File number PO92-078 has been assigned to this project. Should you have any questions, please contact the Operations division at 438-9258 and cite the file number.

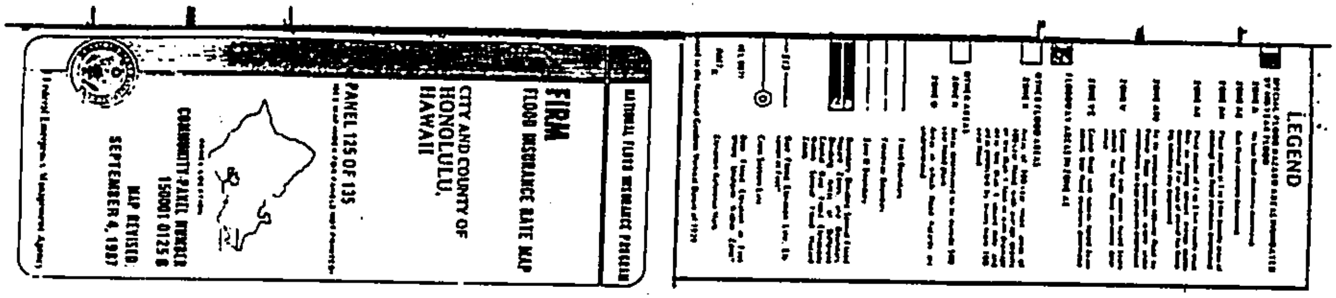
b. According to the Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM), Panel 150001-0125-B, dated September 4, 1987 (copy enclosed), the Sandy Beach Park project site is located in Zone AE (areas inundated by the 100-year flood, with a base flood elevation of 13.0 feet above mean sea level); Zone D (areas in which flood hazards are undetermined); and Zone VE (areas inundated by the 100-year coastal flood with velocity hazards and a base flood elevation of 13 feet above mean sea level).

c. According to the FIRM, Panel 150001-0130-C, dated September 28, 1990 (copy enclosed), the Kahe Point Beach Park project site is located in Zone D.

Sincerely,

Kisuk Cheung, P.E.
Director of Engineering

Enclosures



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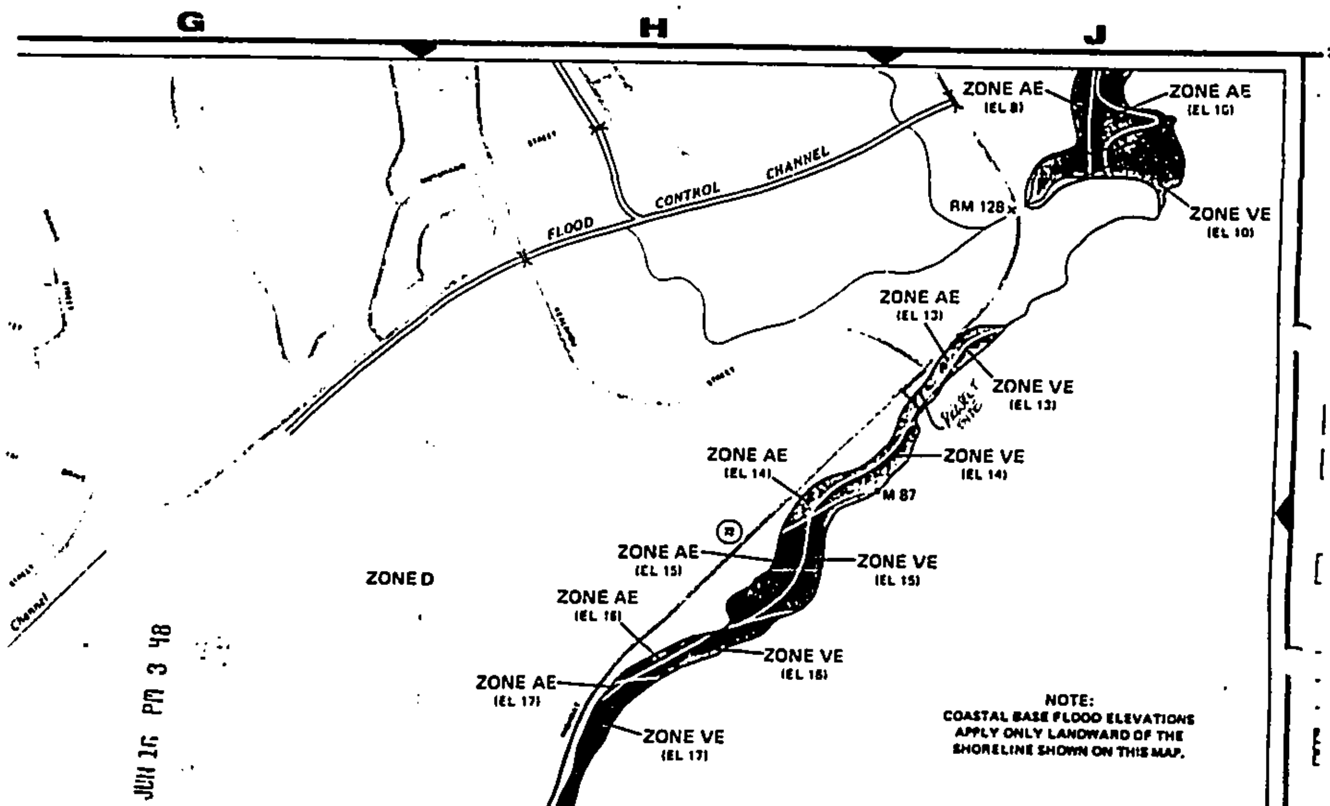

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R. M. TOWILL CORPORATION

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

July 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 Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter and attached FEMA Flood Insurance Rate Maps, dated June 12, 1992. Your department provided useful information which will assist us when we are ready to file the Department of the Army permit.

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

Very truly yours,

Brian Takeda

Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

JOHN WAIHEE
GOVERNOR OF HAWAII

'92 JUN 15 AM 10 00

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

(5)

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

In reply, please refer to:

June 9, 1992

92-176/epo

Mr. Donald A. Clegg
Director, Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Special Management Area Use Permit (SMP)
Shoreline Setback Variance for GTE Hawaiian
Tel Interisland Fiber Optic Cable System
Sandy Beach Park and Kahe Point Beach Park,
Oahu
TMK: 3-9-12:2 and 9-2-3:15

Thank you for allowing us to review and comment on the subject request. We have no comments to offer at this time.

Sincerely,

JOHN C. LEWIN, M.D.
Director of Health

R. M. TOWILL CORPORATION

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

July 20, 1992

John C. Lewin, M.D.
Director
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

SUBJECT: Environmental Assessment Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter dated June 9, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landings at Sandy Beach Park and Kahe Point Beach Park. We appreciated your review of these documents.

Should you have any additional questions or comments please do not hesitate to direct them to our above address.

Very truly yours,

Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

Engineers Planners Photogrammetrists Surveyors Construction Managers

LU 6/92-4268

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

TE-2061
PL92.1.159

June 4, 1992

'92 JUN 5 AM 10 39

MEMORANDUM

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: JOSEPH M. MAGALDI, JR., DIRECTOR

SUBJECT: GTE HAWAIIAN TEL INTERISLAND FIBER OPTIC CABLE SYSTEM, ENVIRONMENTAL ASSESSMENT
TMK: 3-9-12: 2; 9-2-03: 15

This is in response to your memorandum dated May 11, 1992 requesting our comments on the subject environmental assessment.

We have no objections to the proposed project; however, the Honolulu Public Transit Authority should be contacted regarding the temporary relocation of the bus stop at the intersection of Kalanianaole Highway and Kealahou Avenue.

Construction plans for all work within the City's right-of-way should be submitted to our department for review.

Should you have any questions, please contact Lance Watanabe of my staff at local 4199.

JOSEPH M. MAGALDI, JR.

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

July 20, 1992

Joseph M. Magaldi, Jr., Director
Department of Transportation Services
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Magaldi:

SUBJECT: Environmental Assessment Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter dated June 4, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landings at Sandy Beach Park and Kahe Point Beach Park. We appreciated your review of these documents.

As you have requested the following will be undertaken as soon as the necessary information is available:

1. The Honolulu Public Transit Authority will be contacted regarding the temporary relocation of the bus stop at the intersection of Kalanianaole Highway and Kealahou Avenue; and

2. Construction plans will be submitted to DTS for all work within the City & County of Honolulu right-of-way for review.

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

Very truly yours,

Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

LU5/92-4091

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

C. MICHAEL STREET
Acting Director and Chief Engineer

ENV 92-121

92 MAY 29 AM 10 27

May 27, 1992

MEMORANDUM

TO: MR. DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: C. MICHAEL STREET, ACTING DIRECTOR AND CHIEF ENGINEER

SUBJECT: ENVIRONMENTAL ASSESSMENT (EA)
GTE HAWAIIAN TEL INTERISLAND FIBER OPTIC CABLE SYSTEM
TMK:3-9-12:2 & 9-2-3:15

We have reviewed the subject EA and have the following comments:

1. Utility locations in City property should be identified.
2. Will utility easements or right-of-ways be required to be acquired for the proposed project?

C. Michael Street
C. MICHAEL STREET
Acting Director and Chief Engineer

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

July 20, 1992

C. Michael Street
Acting Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Street:

SUBJECT: Environmental Assessment Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter dated May 27, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landings at Sandy Beach Park and Kahe Point Beach Park. We appreciated your review of these documents.

As you have requested, the following will be provided to your Department as soon as the necessary information is available:

1. Utility locations on City property which will affect the proposed cable alignment will be identified; and

2. Utility easements or right-of-ways that will be required for the subject proposal will also be identified.

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

Very truly yours,

Brian Takeda
Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

LU 5/92 4C,

DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU HAWAII 96813

'92 MAY 26 AM 8 58

May 21, 1992

TO: DONALD A. CLEGG, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: WALTER M. OZAWA, DIRECTOR

SUBJECT: SPECIAL MANAGEMENT AREA USE PERMIT (SMP)
AND SHORELINE SETBACK VARIANCE (SV)
ENVIRONMENTAL ASSESSMENTS (EA)
PROJECT: GTE HAWAIIAN TEL INTERISLAND FIBER OPTIC CABLE
LOCATION: SANDY BEACH PARK AND KAHE POINT BEACH PARK
TAX MAP KEY: 3-9-12: 2 AND 9-2-03: 15
PROJ. REF. NO.: 92/SMA-41(JT); 92/SMA-42(JT); 92/SV-004(JT) & 92/SV-005(JT)

We have reviewed the EA and have no objection to the application for a SMP and SV for the proposed GTE Hawaiian Tel interisland fiber optic cable system.

Should you have any questions, please contact Lester Lai of our Advance Planning Branch at extension 4696.

For WALTER M. OZAWA, Director

WMO:ei

R. M. TOWILL CORPORATION

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

July 20, 1992

Water Ozawa, Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Ozawa:

SUBJECT: Environmental Assessment Reviews for GTE Hawaiian Tel to Land a Fiber Optic Cable at Sandy Beach Park and Kahe Point Beach Park, Oahu

Thank you for your letter dated May 21, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landings at Sandy Beach Park and Kahe Point Beach Park. We appreciated your review of these documents.

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

Very truly yours,

Brian Takeda
Senior Planner

cc Donald Clegg, C&C Honolulu
Patrick Mau, GTE Hawaiian Tel
RDE, CK, SK RMTC

JOHN WAIHEE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JOHN P. KEPPELER II
DONA L. HANAIKE

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

REC'D MAY 2 5 1992

May 18, 1992

Mr. Brian Takeda, Senior Planner
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, HI 96817-4941

LOG NO: 5017
DOC NO: 0738t

Dear Mr. Takeda:

SUBJECT: Archaeological Assessment of the Proposed Fiber Optic Cable Landing for West O'ahu
Honouliuli, 'Ewa, O'ahu
TMK: 9-1

We concur with the recommendations of this assessment. If the cave and fissures will be affected by the proposed cable route or if the route does not follow the Farrington Highway right-of-way then it will be necessary to complete an archaeological inventory survey to determine the presence or absence of historic sites and collect sufficient information to assess their significance. If significant historic sites are found, and the project is determined to have an "adverse effect" on these sites, then it will be necessary to mitigate these effects.

If you anticipate any work within the OR&L right-of-way please contact Ken Umemoto at the Department of Transportation (543-2702).

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:amk

REFERENCES

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

2. Beach Changes on Oahu as Revealed by Aerial Photographs, Dennis Hwang, July 1981.

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APPENDIX A

Marine Environmental Analysis of Selected Landing Sites

GTE Hawaiian Tel
Interisland Fiber Optic Cable System

MARINE ENVIRONMENTAL ANALYSIS OF SELECTED LANDING SITES

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March 1992

91-85

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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 pole lines, duct lines, 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

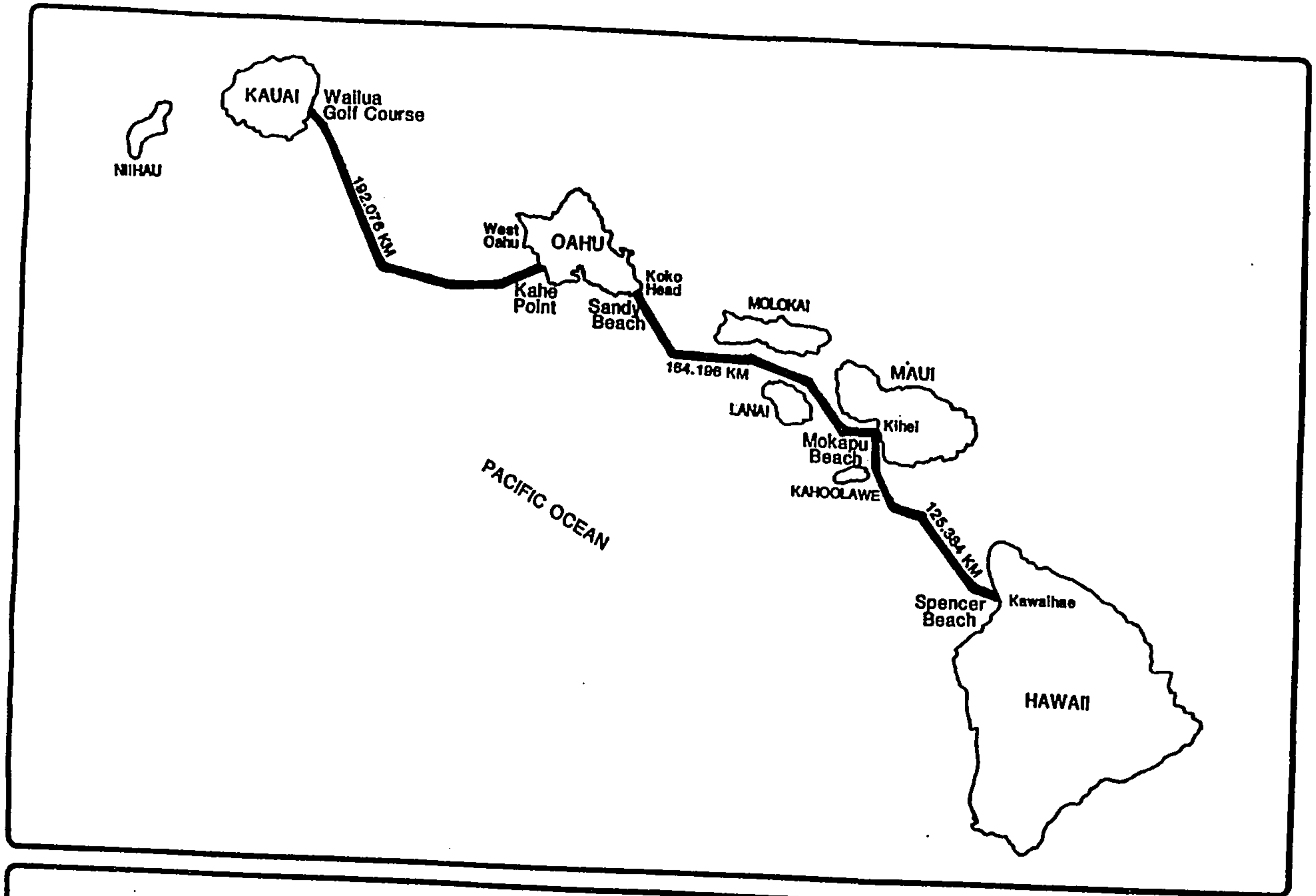


FIGURE I-1. SUMMARY OF RECOMMENDED GTE HAWAIIAN TEL FIBER OPTIC LANDING SITES - STATE OF HAWAII characteristics and uses. A one day field reconnaissance was then conducted in each sector to select three potential landing sites in each sector. If no suitable sites were found within the sector limits,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

Following the consolidation of all planning considerations mentioned above (terrestrial 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 track lines 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 bottom 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 example, breaking wave heights approaching 50 feet were observed in December 1969.

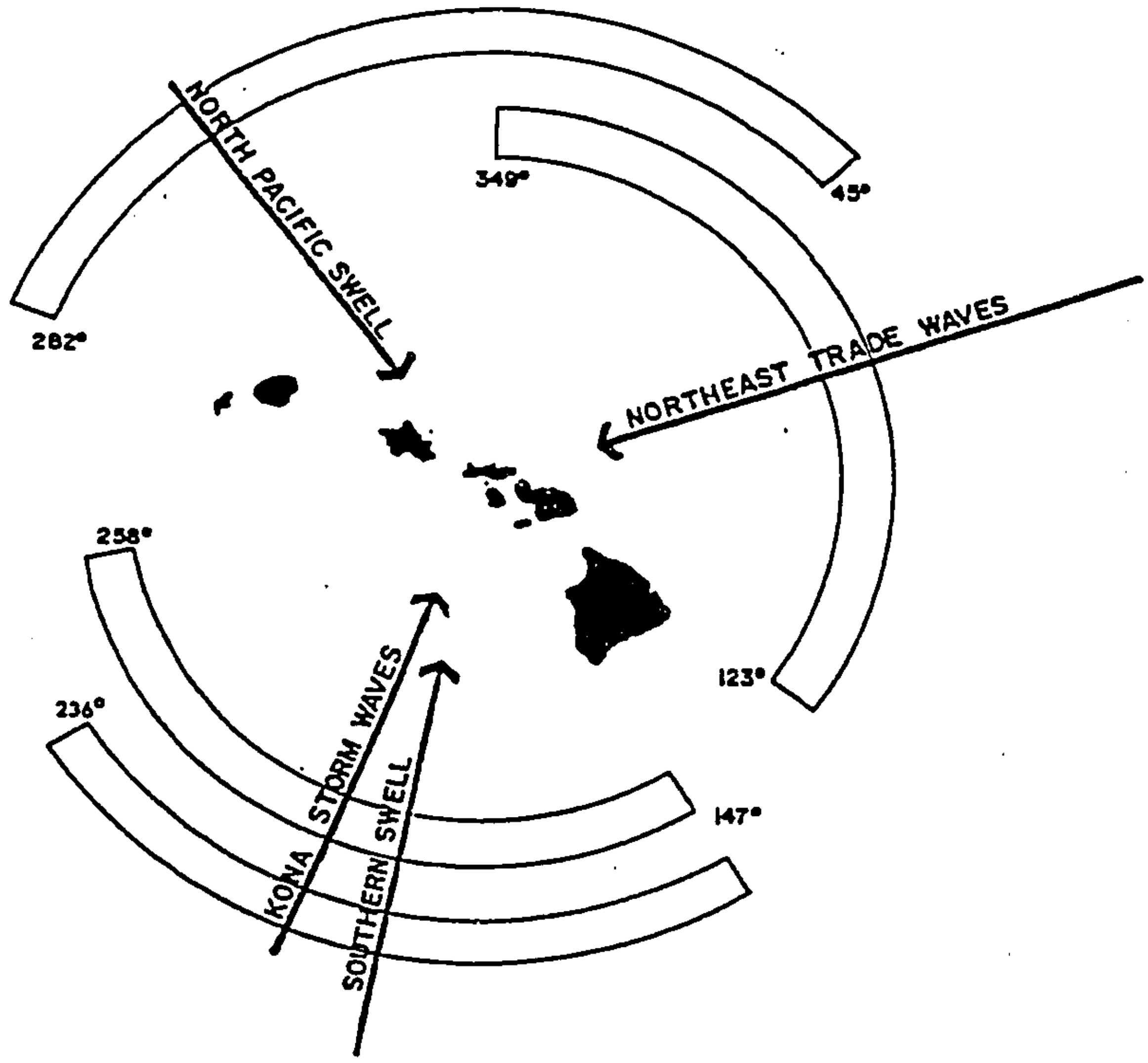


FIGURE II-1.
GENERALIZED WAVE TYPES
(Adapted From The Atlas of Hawaii)

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.
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 quadrants. 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 comparisons 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 censured 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 censuring 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 quadrants 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. Quadrant 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 censuring (at 0, 5, 10, 15, 20 and 25m).

If macrothalloid algae were encountered in the 1 x 1m quadrants 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 carapace 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. KAHE POINT BEACH PARK, OAHU

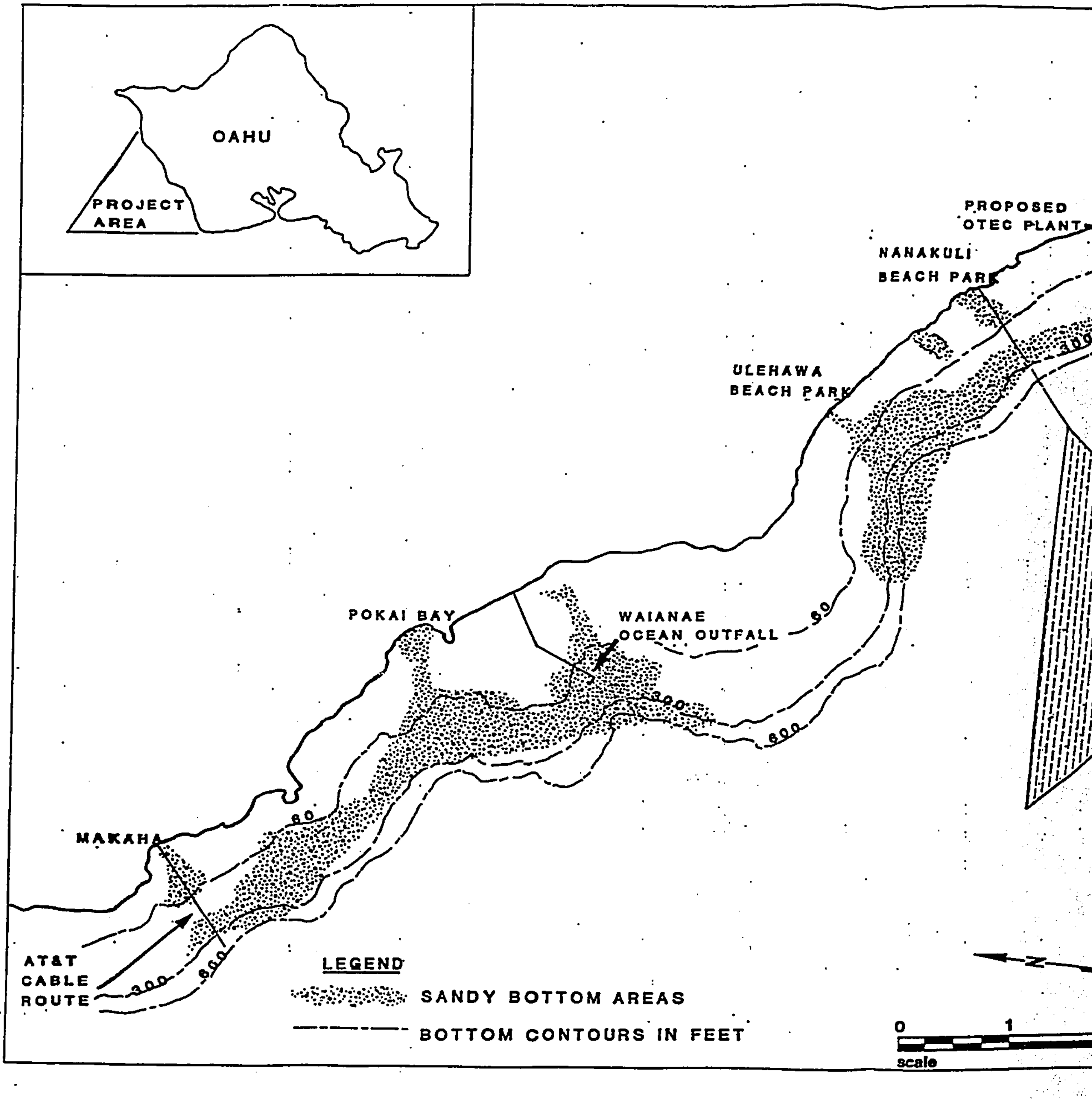
ALTERNATIVES CONSIDERED

The coastal sector considered for a potential landing site initially extended from Pokai Bay to the Barbers Point Naval Air Station, a distance of approximately 14 miles. The coastline south of Kahe Point was excluded from further consideration during the office study due to extensive resort, commercial shipping, industrial and military use. Activities include a major resort development, a deep draft harbor, and offshore oil moorings and associated underwater pipelines. This existing usage precludes a cable landing anywhere along the coastline between Kahe Point and Ewa Beach.

Figure IV-1 shows the coastline from Barbers Point Harbor to Pokai Bay, along with the known sand deposits and existing uses of the area. In general, the offshore use of even this section of coastline is surprisingly heavy. Existing facilities which limit the selection of cable route areas include cooling water intakes and discharges for the Kahe Generating Station, a U.S. Navy underwater test range, an ocean outfall for domestic sewage, and a small boat harbor. Kahe Point was the selected site and is described in detail in the following sections of this report. The other candidate sites investigated during the field and office studies are described below.

1. Nanakuli Beach: Nanakuli Beach Park offers ideal conditions for a cable landing, with a sand channel extending from the beach out to an extensive offshore deposit. The bottom is sand out to at least the 100 foot depth. There are some scattered coral formations at the 50 to 60 foot depth, but they are not extensive, and a cable route could be selected which misses the coral. The U.S. Navy, however, operates a submarine test range (FORACS Range) in the area. One of the receiving towers is located at the south end of Nanakuli Beach, and several subsea cables connect the tower to a series of underwater hydrophones. Discussions with the range manager indicated that the Navy would not permit placement of a cable across their existing cables, due to their requirements for cable maintenance and possible expansion of the range. An incoming fiber optic cable would cross most, if not all, of the hydrophone cables. This site was therefore eliminated from further consideration.

2. Ulehawa Beach Park: A sand channel off the beach park corresponds to the mouth of Ulehawa Stream (see Figure IV-1). Inshore the sand channel is winding and irregular, with a typical width of 150 to 200 feet. The sand channel terminates approximately 300 feet offshore. The bottom between the inshore limit of the sand channel and the beach is scoured limestone shelf, with pronounced surge channels and ridges. The irregularity of the bottom in this zone increases with distance toward shore. Because of the bottom conditions and the shape of the sand channel, cable protection would probably be required out to the 40 foot water depth, 2000 feet offshore. At this point, the channel opens into a large sand deposit. The area just off the beach would present a particular problem due to the vertical relief, and fairly


OAHU
PROJECT AREA
PROPOSED OTEC PLANT
NANAKULI BEACH PARK
ULEHAWA BEACH PARK
POKAI BAY
WAIANAE OCEAN OUTFALL
MAKAHA
AT&T CABLE ROUTE
60
300
600
LEGEND
SANDY BOTTOM AREAS
BOTTOM CONTOURS IN FEET
0
1
scale

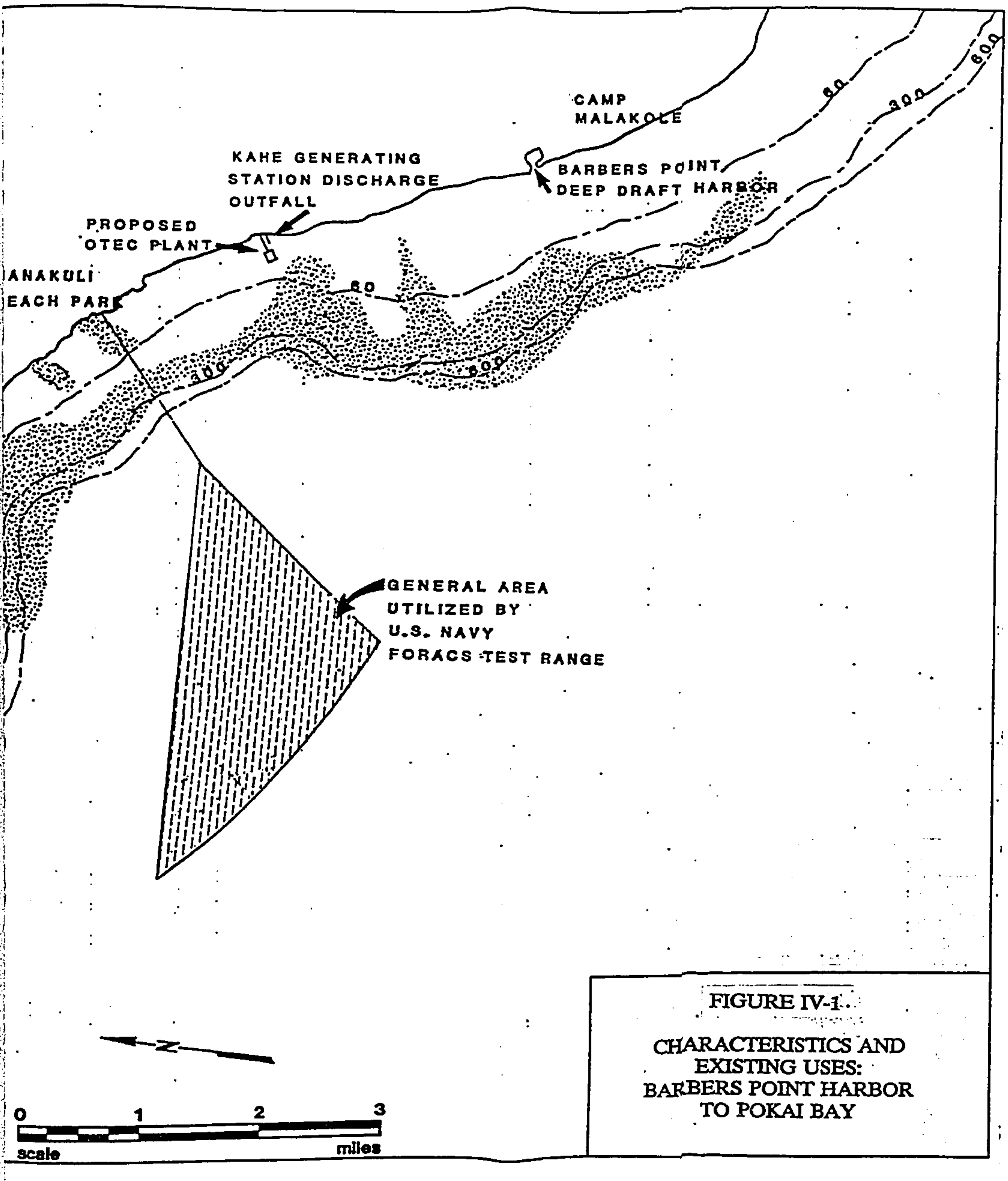


FIGURE IV-1

CHARACTERISTICS AND EXISTING USES: BARBERS POINT HARBOR TO POKAI BAY extensive trenching would probably be required to prevent "bridging" of the cable across the surge channels.

3. Pokai Bay: Pokai Bay is a former small boat harbor, which has been replaced by the Waianae Small Boat Harbor, located one-half mile to the north. Pokai Bay is now a recreational beach, administered as a public park by the City and County of Honolulu. The large offshore sand deposit shown on Figure VI-1, is connected to the sand beach by a well defined sand channel. There are a few scattered limestone outcrops inside the old breakwater, but the vertical relief is low. The physical characteristics of this site are excellent, and a fiber optic cable would require little or no protection on the sand bottom.

   Pokai Bay, however, is a heavily used recreational area. The north half of the beach is restricted to military personnel, and there are three surf sites off the military beach. The waters in the south half of the bay are calm due to the protection offered by the breakwater. According to AECOS (1978), Pokai Bay Beach Park has the best protected and most stable sand beach along the entire Waianae coast. Activities include swimming, wading and canoe paddling. The heavy recreational use of the bay has resulted in past conflicts between swimmers and boaters. State boating regulations now separate the two activities. In spite of the physical advantages, Pokai Bay was not selected as the recommended site due to its heavy recreational usage, the distance from the Central Office as compared to Kahe Point, and potential archaeological sensitivity of the backshore area.

DESCRIPTION OF THE SELECTED ROUTE

General Description

The Kahe Point landing site is located in Kahe Point Beach Park on the southwest coast of Oahu, north of Barbers Point. The shoreline in this area is rocky, consisting primarily of low limestone seacliffs approximately 15 to 20 feet high. There are large pieces of fallen limestone at the base of the cliffs. Also at the foot of the cliffs, at the waterline, there is a narrow limestone bench that terminates in a vertical drop into 3 to 5 feet of water. There is easy access to the ocean only in a small rocky cove at the southern end of the park. The nearshore bottom off Kahe Point Beach Park is irregular with areas of hard rock bottom, alternating with patches of sand. Further offshore, a sandy bottom predominates. The Kahe Generating Station is located immediately north of the park. The ocean water used for cooling by the generating station is discharged through two twelve foot diameter pipelines. The outfall terminates in a water depth of 27 feet. North of the station, there is a 2500 foot long sand beach known as Kahe Beach.

Shoreline History

The coast at the landing site is composed of limestone seacliffs approximately 15 to 20 feet high that are not subject to the typical processes of coastal erosion and accretion. The shoreline therefore has been stable in recent history.

Existing Usage

Kahe Point Beach Park occupies the backshore of the landing site area. Facilities at the beach park include two comfort stations, a pavilion, camping and picnic equipment, and 14 marked camping sites with parking. Access to the ocean for swimming is possible only in a small rocky cove south of the park area and immediately south of the power plant intake basin. This cove is also a popular surf break for novice surfers. The park is primarily used for picnicking, pole fishing, diving, and snorkeling.

Immediately to the north lies the Hawaiian Electric Power Plant and Hawaiian Electric Beach Park. The plant discharges cooling water through dual 12 foot diameter pipes extending 600 feet offshore to the 25 foot water depth. The cable landing site is located approximately 600 feet south of this outfall. A major resort, Ko Olina, is being developed along the coastline between the beach park and Barbers Point Harbor. The shoreline consists primarily of low limestone seacliffs and benches. There is one natural swimming cove in the resort area, and four man made swimming lagoons and beaches have been constructed in the limestone shoreline.

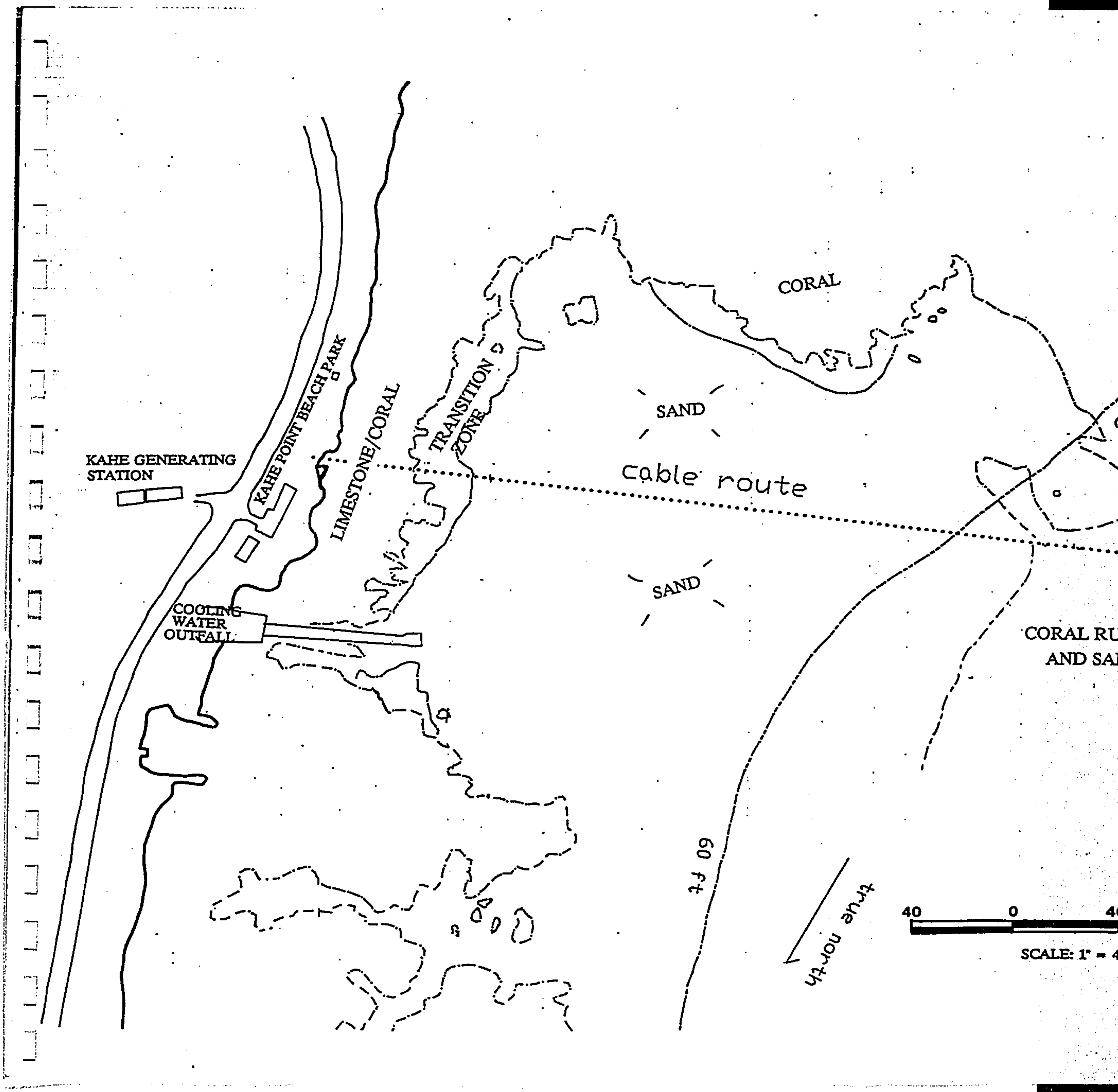
Physical Characteristics of the Selected Route

The bottom characteristics of the selected route and the surrounding area are shown in Figure IV-2. Immediately offshore, there is a 380 foot wide zone of hard bottom, consisting of alternating ridges and channels, with scattered boulders and coral. Vertical relief is roughly 3 to 4 feet. The water depth at the seaward end of this band is approximately 15 feet. The inshore half of this band has less coral and less vertical relief, with more exposed and scoured limestone bottom. Photo 5 shows the bottom characteristics of the inshore half of this zone. Photo 6 shows a ridge and channel formation typical of the seaward half of this zone. The channels are typically scoured limestone and the ridges have moderate to extensive coral growth.

Seaward of the inshore zone, there is a 100 foot wide transition zone, with the bottom consisting of a flat sand bottom with interspersed limestone and coral outcrops. Vertical relief through this zone is 2 to 4 feet. The water depth at the seaward end of the transition zone is 18 to 20 feet. Photo 7 shows typical conditions in the transition zone, with the coral formations rising 2 to 4 feet above the surrounding sand bottom. The percentage of sand in the transition zone increases with distance seaward.

The inshore boundary of an extensive sand deposit is located approximately 500 feet offshore. From this point to the 70 foot depth, a distance of approximately 2,200 feet, the bottom consists of medium grained calcareous sand. There are no exposed outcrops of limestone or coral in the deposit.

From the 70 foot depth to at least the 100 foot depth (the seaward limit of the diving reconnaissance) the bottom consists of limestone, scattered coral, and coral rubble with sand. Vertical relief is on the order of 1 to 3 feet. Typical conditions are shown in Photo 8. At approximately 80 feet, there is a limestone outcrop which protrudes into the area from the Barbers Point side of the route. This outcrop rises 10 to 15 feet above the flat bottom, and the proposed route was oriented to avoid this obstacle. The route shown misses this ledge by approximately 200 feet. It is anticipated that a side scan sonar survey will be conducted by the cable vendor prior to cable placement, and the precise route for the area where the water depth exceeds 70 feet will be selected to avoid as much of the hard bottom in this zone as possible. The cable could be shifted slightly to the north in this zone; it is unlikely that it will be shifted any closer to the ledge.



CORAL
SAND
SAND
KAHE POINT BEACH PARK
LIMESTONE/CORAL
TRANSITION ZONE
KAHE GENERATING STATION
cable route
COOLING WATER OUTFALL
CORAL RU
AND SA
60 ft
true north
40
0
SCALE: 1" = 4

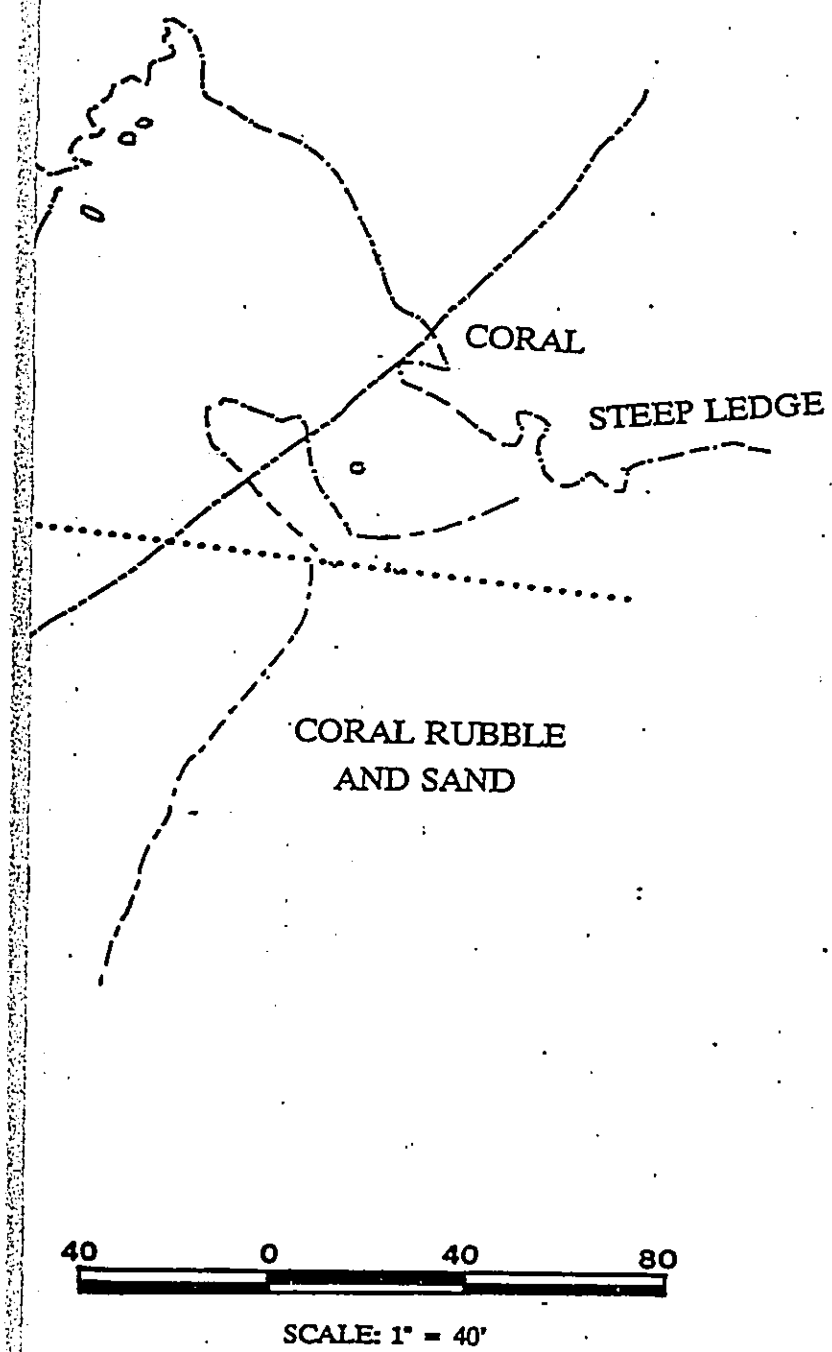


FIGURE IV-2
BOTTOM CHARACTERISTICS ALONG
SELECTED CABLE ROUTE

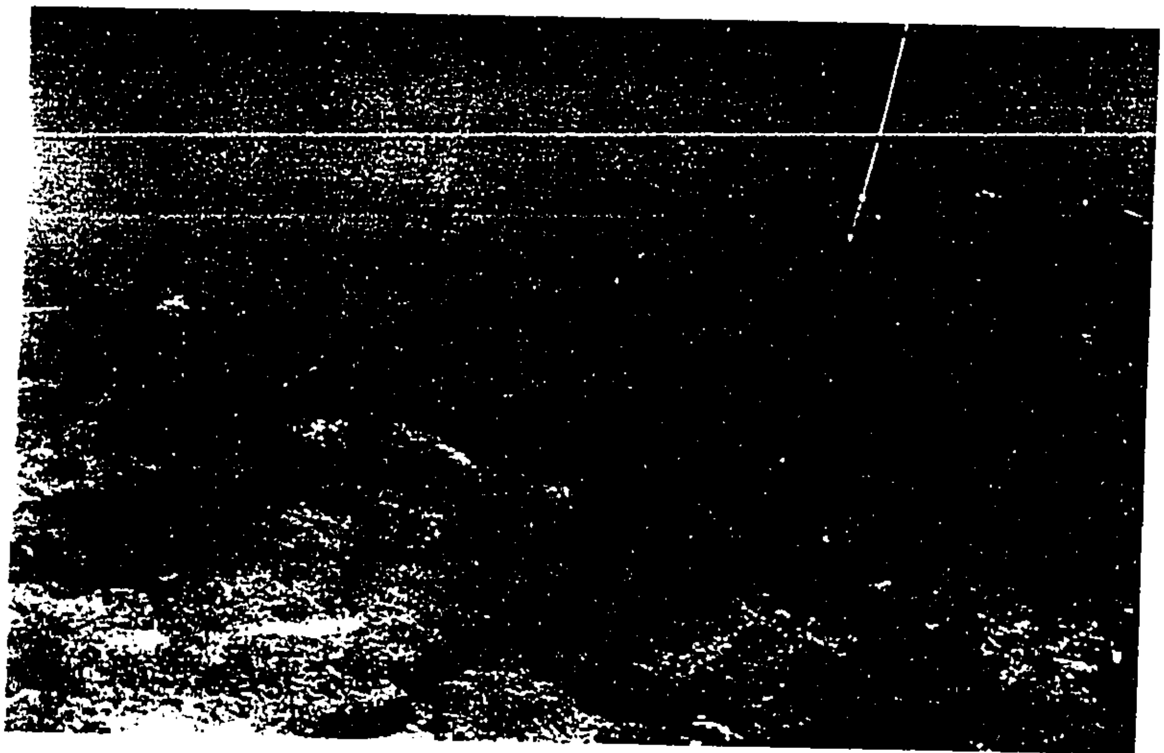


PHOTO 5. NEARSHORE CONDITIONS: SCOURED LIMESTONE, SCATTERED BOULDERS AND CORAL FORMATIONS. WATER DEPTH IS APPROX. 10-FEET.

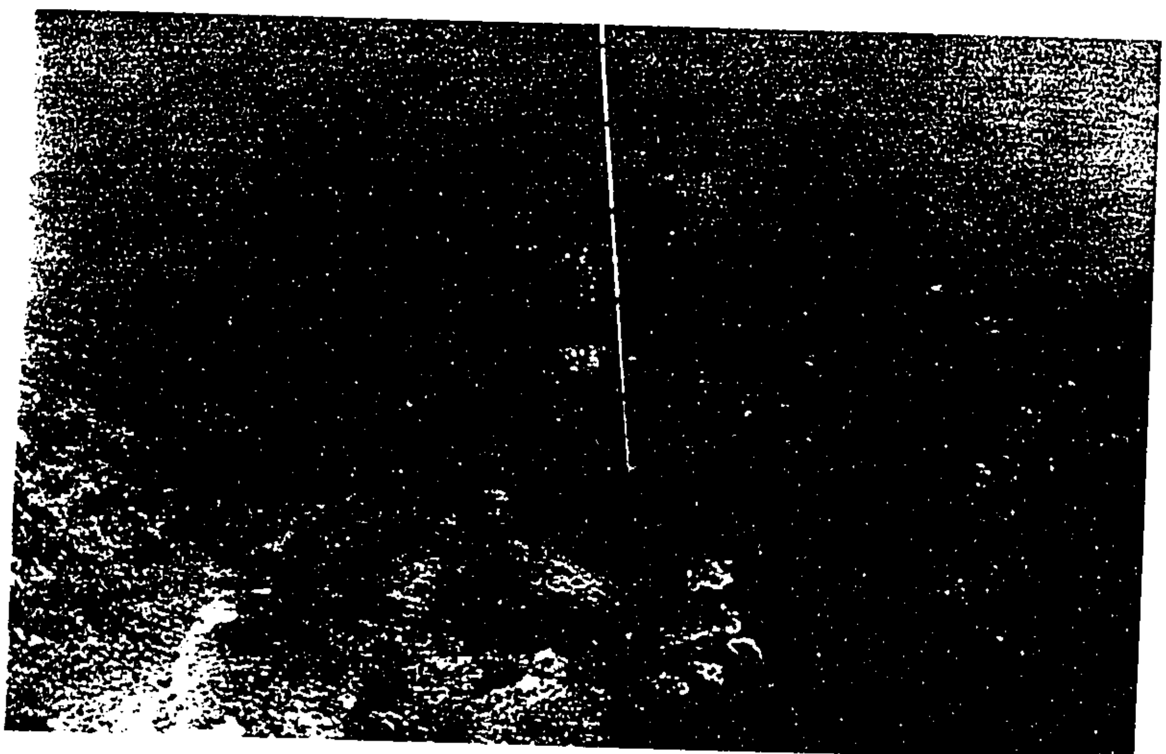


PHOTO 6. TYPICAL CONDITIONS IN SEAWARD HALF OF THE HARD BOTTOM ZONE; RIDGE AND CHANNEL FORMATION. WATER DEPTH IS APPROX. 15-FEET.

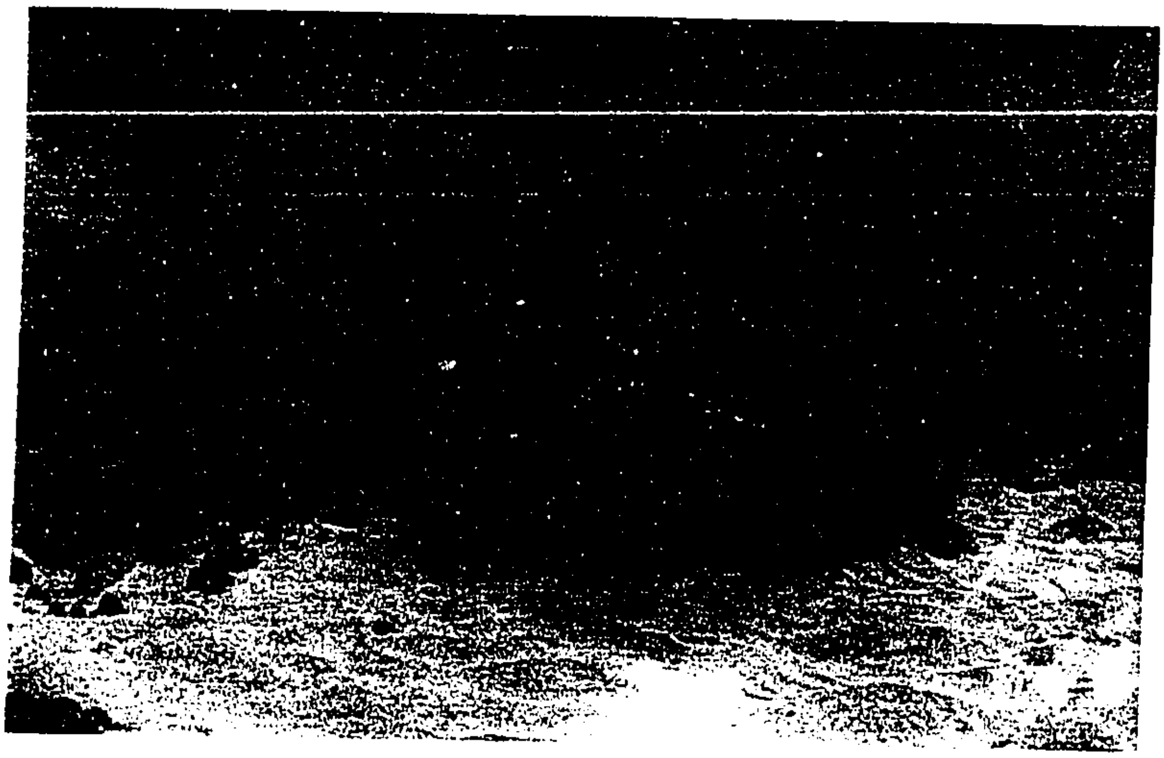


PHOTO 7. TYPICAL VIEW OF INSHORE TRANSITION ZONE, WHERE THE LIMESTONE AND CORAL BOTTOM GIVES WAY TO SAND DEPOSIT. DEPTH IS APPROX. 20-FEET.

PHOTO 8. TYPICAL BOTTOM CONDITIONS IN THE OFFSHORE ZONE OF CORAL RUBBLE. WATER DEPTH IS APPROX. 80-FEET.

OCEANOGRAPHIC CONDITIONS

Kahe Point is located west of the Waianae mountain range in southwest Oahu. The mountains are large enough to form a lee from the tradewinds, and the effect of the tradewinds is moderate.

Currents along this coast are dominated by reversing tidal flows, that usually flow parallel to the nearshore bottom contours. Currents flow to the south during flood tide, and to the north during ebb tide. The tidal currents, however, do not always reverse and may flow in the same direction for several tidal cycles. Surface currents may be modified by prevailing winds. Tradewinds tend to deflect surface currents offshore, while Kona winds would direct surface currents onshore. The typical currents are strong along this coast, frequently exceeding one knot.

This coastline is directly exposed to south swell, kona storm waves, and westerly north Pacific swell. Design wave heights would occur during the passage of hurricanes to the south of Oahu. The leeward coast of Oahu suffered extensive property damage during the passage of Hurricane Iwa in 1982.

This area is also subject to tsunami inundation. Runup from the 1946 and 1957 tsunamis reached 12 and 11 feet above sea level at Kahe Beach, north of the power plant. The estimated inundations 200 feet inland for 50 and 100 year tsunamis are 8 and 11 feet above mean sea level for this coastal area.

Nearshore waters are class "A" in the Department of Health water quality regulations.

DESCRIPTION OF THE PROPOSED PROJECT

The fiber optic cable will be double armored in the nearshore zone to resist chafing and abrasion. Additional protection will be required from the shoreline out to a water depth of 20 feet, located 500 feet offshore, where the cable enters the extensive offshore sand deposit. The exact protection method used will depend upon the selected cable vendor, but one of the two following work sequences is most likely:

1. Complete the initial shore landing with no preparatory work on the bottom. Divers would then remove localized high spots and other obstructions to obtain a relatively uniform channel next to the cable. The cable would then be shifted into this channel, and split pipe casing installed around the inshore 500 feet of the cable. This casing is supplied in 39-inch lengths and is bolted in place around the cable. Sections are connected by articulated ball joints to allow conformance to varying bottom terrain. The casing will also be bolted to the bottom at intervals to prevent movement. This method would involve the use of a small work boat and a dive team equipped with either hydraulic or pneumatic tools. Since the excavation would be done by hand, and only where needed, this method would result in the minimum environmental impact.

2. The second method would utilize a barge equipped with a crane and clamshell bucket to remove high spots, boulders and other obstructions prior to the cable landing. The cable would then be laid in the prepared channel, and divers would install the split pipe casing and bolt it to the bottom as described above. The use of a clamshell bucket would clear a wider path (approximately 5 feet) than the above method, and the associated environmental effects would be correspondingly greater.

No blasting or extensive trenching is anticipated during the cable protection process. It is assumed that no cable protection will be required beyond the 25 foot water depth.

The estimated duration of the nearshore protection work is 15 to 20 working days, at an approximate cost of $120,000.

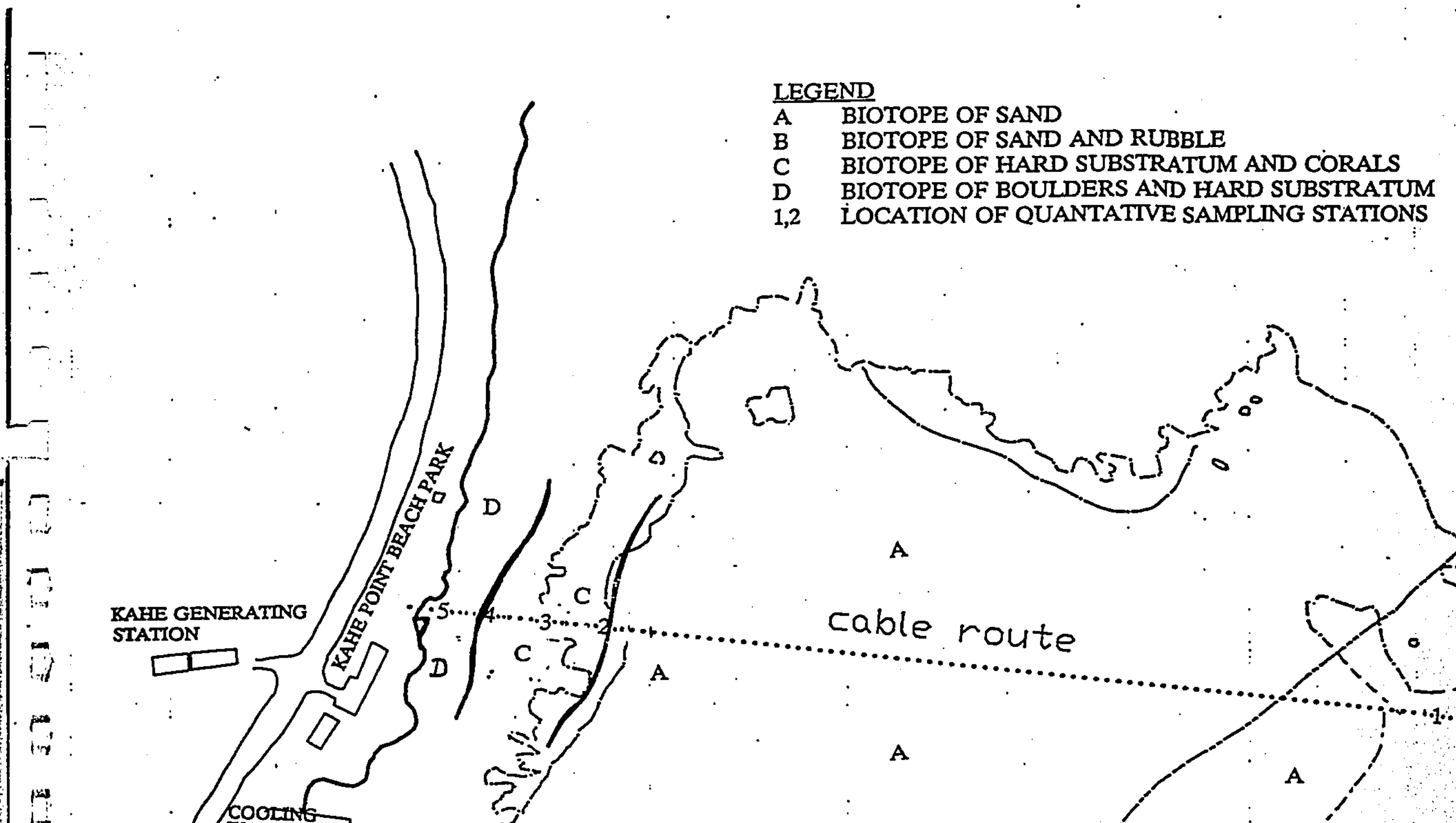
MARINE BIOLOGICAL SETTING

The qualitative reconnaissance of Kahe Point Beach Park was carried out on 21 June 1991 and the quantitative sampling 6 December 1991. The qualitative survey extended from shore to about the 90 foot isobath approximately 4,000 feet from shore. In this area four zones or biotopes were defined. The biotopes recognized in the vicinity of the proposed cable alignment at Kahe Point Beach Park are the biotope of sand, the biotope of sand and rubble, the biotope of emergent hard bottom and corals, and the biotope of boulders and hard substratum adjacent to the shoreline. The boundaries of these biotopes are shown in Figure IV-3.

The biotope of sand dominates the area of the proposed project coming to within 500 feet of the shoreline. The biotope of rubble and sand occurs as a band that commences at about the 75 foot water depth and continues to about 100 feet in the vicinity of the proposed cable alignment. Seaward of the biotope of sand and rubble one again encounters the biotope of sand at depths beyond the scope of this survey. Shoreward of the biotope of sand is the biotope of emergent hard substratum and corals; this substratum appears to primarily be limestone. Sandwiched between this biotope and the rocky shoreline is the biotope of boulders and hard bottom.

The Biotope of Sand

The biotope of sand lies principally seaward of the project site but extends to within 500 feet of the shoreline in the vicinity of the proposed alignment (Figure IV-3). 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


LEGEND
A BIOTOPE OF SAND
B BIOTOPE OF SAND AND RUBBLE
C BIOTOPE OF HARD SUBSTRATUM AND CORALS
D BIOTOPE OF BOULDERS AND HARD SUBSTRATUM
1,2 LOCATION OF QUANTATIVE SAMPLING STATIONS
KAHE GENERATING STATION
KAHE POINT BEACH PARK
COOLING WATER OUTFALL
cable route
60 ft
true north
40
0
SCALE: 1
A
B
C
D
1
2
3
4
5

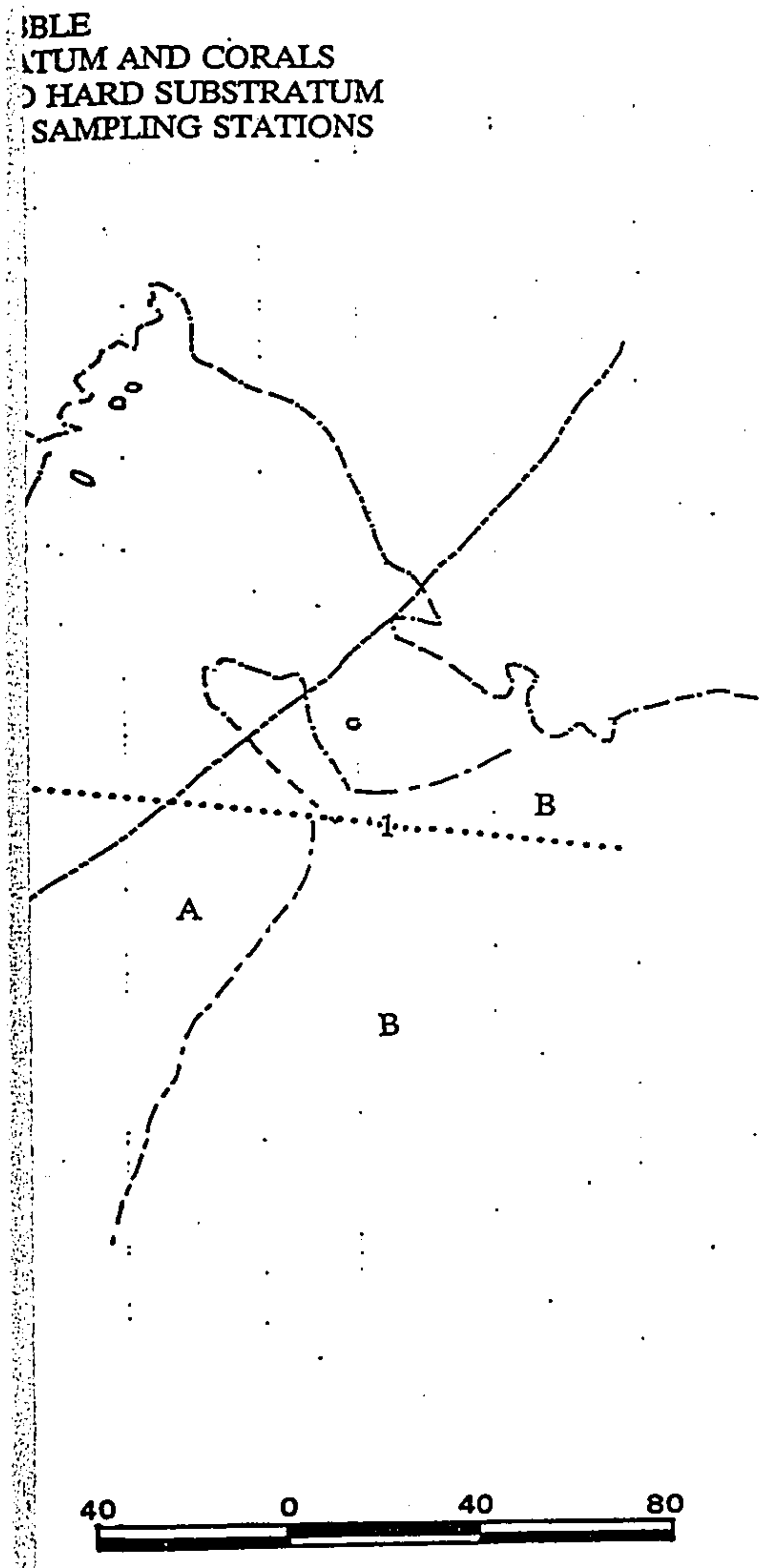


FIGURE IV-3
BIOTOPES ALONG SELECTED
CABLE ALIGNMENT

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. Benthic communities on sand substrates usually have their greatest development at depths below which wave impact occurs (below 100 feet). Because of constraints with bottom time at these depths, only a qualitative survey was done. Species commonly seen in the deeper regions of 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), the Kona crab (Rania serrata), opelu or mackerel 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. Most of these species become less evident in the shallower portions of this biotope.

The Biotope of Rubble and Sand

The biotope of rubble and sand is situated in a "band" or zone that is encountered at depths from 75 to about 100 feet and about 2,900 to 4,000 feet offshore. The substratum in this biotope is a mix of sand and coral rubble; larger rubble pieces have some coral growth present. The mean size of the rubble in this biotope is about 8 inches in diameter; the largest pieces were on the order of about 2 feet in diameter. About 200 feet south of Station 1 is a limestone "bench" that rises 15 to 20 feet from the seafloor. This bench continues almost uninterrupted to the Barbers Point Harbor entrance channel. Station 1 was established in 72 to 75 feet of water to sample this biotope approximately 3,400 feet offshore and about 200 feet north of the massive lime- stone bench noted above. The orientation of the transect line at this station was approximately parallel to shore. The results of the quantitative survey are presented in Table IV-1. The quadrant survey noted one coral species present on the rubble in the transect site having a mean coverage of 0.05 percent. Two macroinvertebrate species were present; these were the Chinese horn shell (Cerithium sinensis) and the long-spine sea urchin or wana (Echinothrix diadema). Because of a general lack of cover, only seven species of fishes (409 individuals) were encountered at Station 1; these are detailed in Appendix A. However, a school of approximately 400 mackerel scad or opelu (Decapterus macarellus) was in the transect area. These fish comprised 99.4 percent of the standing crop which was estimated to be 771 g/m^2.

TABLE IV-1.

Summary of the benthic survey conducted in the biotope of rubble and sand approximately 3,400 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant 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 72 to 75 feet; mean coral coverage is 0.05 percent (quadrant method).

A. Quadrant Survey

Species	Quadrant Number					
	0m	5m	10m	15m	20m	25m
Algae						
Neomeris annulata				0.1		
Corals						
Montipora verrucosa	0.3					
Sand	66.7	100	93	69.9	96	96
Rubble	3		7	30	4	4
Hard Substratum	30					

B. 50-Point Analysis

Species	Percent of the Total
Sand	92
Rubble	8

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Cerithium sinensis	1
Phylum Echinodermata	
Echinothrix diadema	1

(TABLE CONTINUED ON NEXT PAGE)

D. Fish Census (4 x 25m)

7 Species
409 Individuals
Estimated Biomass = $771 g/m^2$

In the vicinity of Station 1 near the projecting limestone bench were seen kala holo (Naso hexacanthus), orangeband surgeonfish or na'ena'e (Acanthurus olivaceus), threespot chromis (Chromis verator), snapper or uku (Aprion virescens), sergeant major or mamo (Abudefduf abdominalis), yellowfin goatfish or weke'ula (Mulloides vanicolensis) and the blue goatfish or moano kea (Parupeneus cyclostomus). In the rubble and sand were seen small coral colonies (Pocillopora meandrina and Porites lobata), the arc-eye hawksfish or piliko'a (Paracirrhites arcatus), lei triggerfish or humuhumu lei (Sufflamen bursa) and the bridled triggerfish or humuhumu mimi (Sufflamen fraenatus).

The Biotope of Emergent Hard Substratum and Corals

Along the shoreline fronting the project site is the biotope of emergent hard substratum and corals. This biotope commences about 500 feet offshore in water 21 to 23 feet in depth and continues as a "band" about 400 feet wide terminating about 100 feet from shore in water about 8 feet deep. This biotope may be characterized by emergent hard substratum that rises from 3 to 6 feet above the sand. On the seaward edge the hard substratum occurs as "spurs" or fingers that project up to 30 feet seaward into the sand.

The substratum in the biotope of emergent hard substratum and corals is comprised of limestone. The spurs along the seaward edge of this biotope continue shoreward as ridges; these ridges are from 3 to 15 feet in width and from 6 to 30 feet in length where they project out into the sand. In the sand the spurs are spaced from 3 to 75 feet apart. These ridges continue in a shoreward direction where small, hard substratum channels occur between the ridges. The channels have a general orientation that is perpendicular to shore and are from 4 to 15 feet in width, 2 to 4 feet in depth and are up to 40 feet in length.

Station 2 was established approximately 400 feet offshore in the zone of transition between the biotope of sand and the biotope of emergent hard bottom and corals. The area is characterized by a mix of sand and hard substratum occurring as ridges projecting seaward as described above. The transect line at this station had an orientation perpendicular to shore. Table IV-2 presents the results of the quantitative study carried out at Station 2. The quadrant survey noted one algal species (Desmia hornemannii), a soft coral (Palythoa tuberculosa) and five coral species (Porites lobata, Montipora verrucosa, M. patula, Leptastrea purpurea and Pocillopora meandrina) having a mean coverage of 9.3 percent. The dominant coral in this area is Porites lobata in terms of coverage. The macroinvertebrate census noted four species including one polychaete (Spribranchus giganteus and three echinoderms (the black sea urchin or Tripneustes gratilla, the green sea

TABLE IV-2.

Summary of the benthic survey conducted in the ecotone between the biotope of emergent hard bottom and corals and the more seaward biotope of sand approximately 400 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant sampling of the benthic community (expressed in per- cent 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 ranges from 18 to 23 feet; mean coral coverage is 9.3 percent (quadrant method).

A. Quadrant Survey

Species	Quadrant Number					
	0m	5m	10m	15m	20m	25m
Algae						
Desmia hornemannii	0.5					
Soft Corals						
Palythoa tuberculosa				1		
Corals						
Porites lobata	19			26		
Montipora verrucosa	1			0.3		
M. patula	3					
Leptastrea purpurea	0.8			0.7		
Pocillopora meandrina	0.1			5		
Sand		100	100		94	100
Hard Substratum	74.6			67		

B. 50-Point Analysis

Species	Percent of the Total
Corals	
Porites lobata	12
Porites compressa	2
Montipora verrucosa	4
Hard Substratum	82

(TABLE CONTINUED ON NEXT PAGE)

TABLE IV-2.
Continued.

C. **Invertebrate Census (4 x 25m)**

Species	Number
Phylum Annelida	
Spirobranchus giganteus	18
Phylum Echinodermata	
Echinometra mathaei	26
Culcita novaeguineae	2
Tripneustes gratilla	9

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

28 Species
181 Individuals
Estimated Biomass = 35 g/m^2

urchin or Echinometra mathaei and the cushion starfish or Culcita novaeguineae. Twenty-eight fish species (181 individuals) were censured at Station 2. The results of this census are presented in Appendix A. Common fishes at Station 2 include the damselfish (Chromis vanderbilti), saddleback wrasse or hinalea lauwili (Thalassoma duperrey) and the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus). The standing crop of fishes at this station was estimated to be 35 g/m^2; species contributing heavily to this biomass include the many bar goatfish or moano (Parupeneus multifasciatus), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), brown surgeon- fish or ma'i'i'i (Acanthurus nigrofuscus), parrotfish or uhu (Scarus sordidus), pinktail triggerfish or humuhumu hi'ukole (Melichthys vidua) and the lei triggerfish or humuhumu lei (Sufflamen bursa). In the vicinity of Station 2 were seen the mackerel scad or opelu (Decapterus macarellus), moorish idol or kihikihi (Zanclus cornutus), ringtail wrasse or po'ou (Chelinus rhodochrous), long spine sea urchin or wana (Echinothrix diadema) and the coral (Pavona varians).

Station 3 was established about 25 feet shoreward of the terminal end of the transect line for Station 2. The orientation of the transect line at Station 3 was again perpendicular to shore, commencing in water approximately 18 feet deep (about 290 feet offshore) and terminating at a depth of 10 feet approximately 210 feet offshore. This station was situated in the area of greatest coral growth in the biotope of emergent hard substratum and corals. Table IV-3 presents the results of the quantitative survey carried out at Station 3. The quadrant survey noted two algal species (Amansia glomerata and Desmia hornemannii) with a mean coverage of 0.7 percent. One soft coral (Palythoa tuberculosa) and six coral species

TABLE IV-3.

Summary of the benthic survey conducted in the biotope of emergent hard bottom and corals approximately 290 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant 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 ranges from 10 to 18 feet; mean coral coverage is 30.2 percent (quadrant method).

A. Quadrant Survey

	Quadrant Number					
Species	0m	5m	10m	15m	20m	25m
Algae						
Desmia horemannii	2					
Amansia glomerata						2
Soft Corals						
Palythoa tuberculosa		1			0.2	1
Corals						
Porites lobata	42	27	7.5	7	1	10
Montipora verrucosa	3	3	14		13	0.8
M. patula	2		8		9	1.5
M. flabellata	1	2.5		11		
Pocillopora meandrina		5.5	2	5	3.5	
Leptastrea purpurea					0.8	
Sand					5	
Rubble		3				
Hard Substratum	50	58	68.5	77	67.5	84.7

B. 50-Point Analysis

Species	Percent of the Total
Soft Corals	
Palythoa tuberculosa	2

(TABLE CONTINUED ON NEXT PAGE)

TABLE 3.
Continued.

Species	Percent of the Total
Corals	
Pocillopora meandrina	2
Porites evermanni	2
P. lobata	14
Montipora flabellata	2
M. patula	4
M. verrucosa	8
Hard Substratum	66

C. **Invertebrate Census (4 x 25m)**

Species	Number
Phylum Mollusca	
Conus ebreus	1
Pinctado marginifera	1
Phylum Echinodermata	
Echinostrephus aciculatum	17
Tripneustes gratilla	22
Echinothrix diadema	2
Echinometra mathaei	59

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

29 Species
289 Individuals
Estimated Biomass = 52 g/m^2

CORRECTION

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

TABLE 3.
Continued.

Species	Percent of the Total
Corals	
Pocillopora meandrina	2
Porites evermanni	2
P. lobata	14
Montipora flabellata	2
M. patula	4
M. verrucosa	8
Hard Substratum	66

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Conus ebreus	1
Pinctado marginifera	1
Phylum Echinodermata	
Echinostrephus aciculatum	17
Tripneustes gratilla	22
Echinothrix diadema	2
Echinometra mathaei	59

D. Fish Census (4 x 25m)

29 Species
289 Individuals
Estimated Biomass = 52 g/m^2

were also encountered. The coral coverage was estimated to be 30.2 percent. The census of macroinvertebrates noted six species including two molluscs the pearl oyster (Pinctado marginifera) and the hebrew cone (Conus ebreus) and four echinoderms including the boring sea urchin (Echinostrephus aciculatum), the black urchin (Tripneustes gratilla), the long-spine urchin or wana (Echinothrix diadema) and the green urchin (Echinometra mathaei). In the fish census 29 species (289 individuals) were seen. The most abundant species include the manybar goatfish or moano (Parupeneus multifasciatus), the damselfish (Chromis vanderbilti), the saddleback wrasse or hinalea lauwili (Thalassoma duperrey) and the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus). The biomass of fish at Station 3 was estimated to be 52 g/m^2 and the species contributing heavily to this standing crop include the manybar goatfish or moano (Parupeneus multifasciatus), the saddleback wrasse or hinalea lauwili (Thalassoma duperrey), the redlip parrotfish or palukaluka (Scarus rubroviolaceus) and the orangebar surgeonfish or na'ena'e (Acanthurus olivaceus). In the vicinity of Station 3 were seen the corals (Pavona duerdeni and P. varians), the brown sea cucumber (Actinopyge mauritana) and the christmas wrasse or 'awela (Thalassoma fuscum).Station 4 was established to sample the inshore reaches of the biotope of emergent hard substratum and corals. The transect at this station was laid perpendicular to the shoreline commencing about 25 feet shoreward of the previous station (about 185 feet offshore in water approximately 10 feet deep) and terminating in water about 8 feet deep at a distance of 104 feet from shore. There are fewer corals present in this inshore area probably due to the greater wave impact that occurs in shallower water. Thus the substratum has a more "barren" appearance as one approaches the shoreline.

Table IV-4 presents the results of the quantitative survey carried out at Station 4. One algal species (Desmia hornemannii) was found in the quadrant survey as well as a soft coral (Palythoa tuberculosa); neither contributed more than 0.2 percent to the benthic cover. Seven coral species (Porites lobata, Pocillopora meandrina, Montipora verrucosa, M. flabellata, M. patula, Leptastrea purpurea and Cyphastrea ocellina) were found in the quadrant survey. These corals contributed 8.9 percent to mean benthic coverage. The invertebrate census noted four echinoderm species; these were the black boring urchin (Echinometra oblongata), the green urchin (Echinometra mathaei), the black sea urchin (Tripneustes gratilla) and the boring urchin (Echinostrephus aciculatum). The most abundant macroinvertebrate species was the green sea urchin (Echinometra mathaei - 2.7 individuals/m^2). The results of the fish census are presented in Appendix A. In total 25 species (147 individuals) were censured and the most common species include the manybar goatfish or moano (Parupeneus multifasciatus), the saddleback wrasse or hinalea lauwili (Thalassoma duperrey) and the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus). The biomass of fish at Station 4 was estimated to be 89 g/m^2 and three species (the manybar goatfish or moano - Parupeneus multifasciatus, the spectacled parrotfish or uhu uliuli-

TABLE IV-4.

Summary of the benthic survey conducted in the biotope of emergent hard bottom and corals commencing approximately 186 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant 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 ranges from 8 to 10 feet; mean coral coverage is 8.9 percent (quadrant method).

A. Quadrant Survey

	Quadrant Number					
Species	0m	5m	10m	15m	20m	25m
Algae						
Desmia hornemannii				0.1		
Soft Corals						
Palythoa tuberculosa	1					
Corals						
Porites lobata	4.5	7	4	3	2.5	
Pocillopora meandrina		0.3	1.5	3.5		1
Montipora verrucosa	0.3		1	2		
M. flabellata			1	2		
M. patula		3				
Leptastrea purpurea			8	4.5	2.5	1.5
Cyphastrea ocellina		0.2				
Hard Substratum	94.2	89.5	84.5	84.9	95	97.5

B. 50-Point Analysis

Species	Percent of the Total
Corals	
Montipora flabellata	2
M. verrucosa	2
Leptastrea purpurea	2
Pocillopora meandrina	2
Porites lobata	8

(TABLE CONTINUED ON NEXT PAGE)

TABLE IV-4.
Continued.

C. Invertebrate Census (4 x 25m)

Species	Number
Hard Substratum	84
Phylum Echinodermata	
Echinometra oblongata	1
Echinometra mathaei	274
Tripneustes gratilla	11
Echinostrephus aciculatum	4

D. Fish Census (4 x 25m)

25 Species
147 Individuals
Estimated Biomass = 89 g/m^2

Scarus perspicillatus and the orange bar surgeonfish or na'ena'e - Acanthurus olivaceus) contributed heavily to this standing crop. Species encountered in the vicinity of Station 4 include the cone shell (Conus lividus), coral (Pavona varians), wrasse (Macropharyngodon geoffroy) and blenny (Cirripectus vanderbilti).

The Biotope of Boulders and Hard Bottom

As the name implies, the substratum of this biotope is comprised of limestone over which boulders are scattered. These boulders are both round (mean diameter about 2.5-3 feet) and in the form of slabs which have a mean size of about 2 feet wide, 4 feet long and about 1 foot thick. Across the limestone substratum are potholes or depressions with a mean diameter of about 2 feet spaced from 5 to 18 feet apart; also present are shallow channels from 2 to 8 feet in width, up to 25 feet in length and to about 1 foot in depth. These channels are spaced from 10 to 35 feet apart and have a general orientation that is perpendicular to shore.

Station 5 was established approximately 50 feet offshore in water from 4 to 6 feet in depth to sample the biotope of boulders and hard bottom. The transect line for this station was established parallel to shore along the 4 to 6 foot isobath. The results of the quantitative survey carried out at Station 5 are presented in Table IV-5. The quadrant survey noted one algal species (Amansia glomerata) and one soft coral colony (Palythoa tuberculosa) as well

TABLE IV-5.

Summary of the benthic survey conducted in the biotope of hard bottom and boulders commencing approximately 50 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant 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 ranges from 4 to 6 feet; mean coral coverage is 0.05 percent (quadrant method).

A. Quadrant Survey

	Quadrant Number					
Species	0m	5m	10m	15m	20m	25m
Algae						
Amansia glomerata		2	3			
Soft Corals						
Palythoa tuberculosa			0.1			
Corals						
Pocillopora meandrina	0.1				0.1	
Montipora verrucosa					0.1	
Rubble			1			
Hard Substratum	99.9	98	98.9	97	99.8	100

B. 50-Point Analysis

Species	Percent of the Total
Hard Substratum	100

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mosllusca	
Drupa morum	1
Conus lividus	1

(TABLE CONTINUED ON NEXT PAGE)

TABLE IV-5.
Continued.

Species	Number
Phylum Echinodermata	
Echinometra oblongata	9
E. mathaei	97
Actinopyge mauritana	1

D. Fish Census (4 x 25m)

25 Species
142 Individuals
Estimated Biomass = 79 g/m^2

as two coral species (Pocillopora meandrina and Montipora verrucosa). The mean coverage by corals was estimated to be 0.05 percent. The invertebrate census noted two molluscs, the drupe (Drupa morum) and the cone shell (Conus lividus) as well as three echnioderm species (the black boring urchin - Echinometra oblongata, the green urchin - Echinometra mathaei and the brown sea cucumber - Actinopyge mauritana. The fish census encountered 25 species and 142 individual fishes in the 4 x 25m census area. The most common fishes were the manybar goatfish or moano (Parupeneus multifasciatus), the brown damselfish (Stegastes fasciolatus) and the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus). The standing crop of fishes at Station 5 was estimated to be 79 g/m^2 and the most important species contributing to this biomass were the saddleback wrasse or hinalea lauwili (Thalassoma duperrey), the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), the brown damselfish (Stegastes fasciolatus) and the manybar goatfish or moano (Parupeneus multifasciatus). In the vicinity of Station 5 were seen the unicornfish or kala (Naso unicornis) and the blackspot sergeant or kupipi (Abudefduf sordidus).

The intertidal region at this proposed cable landing site is situated on a limestone bench with large boulders present; the boulders are from 4 to 8 feet in diameter. Just shoreward of the boulders that lie on the bench is a steep, near vertical cliff of limestone that is about 15 feet in height. Only a short reconnaissance was made of the intertidal at this site. This qualitative inspection noted the algae (Pterocladia capillacea and Sargassum polyphyllum) along with the snails Nerita picea and Littorina pintado. Other species present include the chiton (Acanthochiton armata).

No green turtles were seen during our survey work in the waters fronting the Kahe Point Beach Park. To the south of the beach park (i.e., offshore of Paradise Cove and West Beach) are known concentrations of green sea turtles (Brock 1990a). Some shelter (caves, ledges and undercuts) at sizes and scales appropriate for green sea turtle resting areas were seen in the region adjacent to shore (i.e., the biotope of emergent hard substratum and corals) and macroalgal species were encountered both subtidally (Amansia glomerata) and intertidally (Pterocladia capillacea and Sargassum porphyllum) which are known forage for green turtles (Balazs, 1980, Balazs et al. 1987) yet no turtles were encountered. We have found no information to suggest that nesting of sea turtles in the vicinity of Kahe Point Beach Park has occurred in historical times.

The biological survey of the proposed cable alignment at Kahe Point Beach Park did not find any rare or unusual species or communities. Another protected species, the humpback whale (Megaptera novaeangliae), was not seen offshore of the study area during the period of our field effort, but they are known to at least pass through the area. As noted by Herman (1979), humpback whales tend to be found in regions remote from human activities and the proposed Kahe Point cable alignment is in relatively close proximity to the Barbers Point Harbor which is becoming an important commercial port for Oahu.

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 well as the biotope of sand and rubble. 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 many of 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 is brought into the shallows offshore of Kahe Point Beach Park, the cable will first encounter hard substratum about 500 feet offshore; from this point shoreward, the deployment of the cable will present a greater opportunity for impact to benthic and fish communities. The construction techniques selected to protect the cable will play a large role in the range of impacts possibly encountered; at one end of the spectrum would be the development of an excavated channel in which the cable is laid and covered with stone and/or tremie concrete and at the other would be the "no action" alternative. At this site it is expected that the subtidal construction of a trench would entail excavation using hand techniques and only across the intertidal would excavation be undertaken with a backhoe and bucket. Impacts to marine communities with these activities will include those associated with the removal of benthic communities in the trench path and the generation of turbidity which may impact surrounding communities. The utilization of hand techniques lessens direct impact to benthic communities because trench width can be carefully controlled.

With any construction is the concern are over possible impacts to corals because of their sessile nature and usual slow growth characteristics. One potential impact to corals would be the removal of the entire benthic community in the alignment path by trenching. If trenching were to occur over all hard substratum in water less than 100 feet in depth, how much coral would be lost? Table IV-6 presents an estimate of the actual loss of coral (expressed in the number of square meters lost) in the alignment path if all hard substratum were to be trenched. This estimate is based on the measured linear distance of hard substratum crossed by the cable on the proposed alignment and the known percent coverage by coral in the biotopes crossed where corals exist. These losses are calculated for four arbitrary trench widths which are 0.3m wide trench = 5.5 square meters of coral lost, 0.5m widetrench = 9.3 square meters of coral lost, 1.0m wide trench = 18.4 square meters of coral lost and with a 1.5m wide trench 27.5 square meters of coral would be lost.

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, the impacts are minimal because the whales are seasonal and are only in island waters from November through March. Even assuming that the cable deployment occurs when whales are present in Hawaiian waters, impacts should be non-existent or minimal. The cable ship will not be on site more than one or two days. After departure of the cable ship, all work will be within 500 feet of shore. There will be no blasting during the construction of the cable protection.

TABLE IV-6.

Table estimating the loss of living coral on hard sub- stratum (expressed in square meters) if the proposed alignment at Kahe Point Beach Park, Oahu is trenched at one of four arbitrary widths (0.3m, 0.5m, 1m and 1.5m). These calculations are based on the estimates of coral cover derived from this study and measured linear distances that the cable would cross hard substratum in water between shore and the 100 foot isobath. Calculated losses for each trench width are given in the body of the table in terms of square meters.

Biotope	Mean Percent Coral Cover	Distance Traversed on Hard Substrate	Arbitrary Width of Destruction 0.3m	0.5m	1.0m	1.5m
Biotope of Sand and Rubble	0.05	27m	0.04	0.07	0.1	0.2
Biotope of Sand	0	0m				
Biotope of Emergent Hard Substratum and Corals						
a. Outer	9.3	55m	1.5	2.6	5.1	7.7
b. Middle	30.2	33m	3.0	5.0	10.0	14.9
c. Inner	8.9	34m	0.9	1.5	3.0	4.5
Biotope of Boulders and Hard Bottom	0.05	31m	0.05	0.08	0.2	0.2
Total Destruction of Coral in m^2			5.5	9.3	18.4	27.5

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 should be considered in light of the proximity of the cable landing site to the Barbers Point Deep Draft Harbor and the Kahe Generating Station.

Sea turtles are permanent residents in inshore Hawaiian habitats thus 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).

Any trenching activity performed by dredge will generate fine particulate material that serves to lower light levels and in the extreme, bury benthic communities. Sedimentation has been implicated as a major environmental problem for coral reefs. Increases in turbidity may decrease light level resulting in a lowering of primary productivity. When light levels are sufficiently decreased, hermatypic corals (i.e., the majority of the corals found on coral reefs) will eject their symbiotic unicellular algae (zooxanthallae) on which they depend as source of nutrition. However, in nature corals will eject their zooxanthallae and survive (by later acquiring more zooxanthallae) if the stress is not a chronic (longterm) perturbation.

Perhaps a greater threat would be the simple burial of benthic communities that may occur with high sediment loading and concurrent low water movement. Many benthic species including corals are capable of removing sediment settling on them by ciliary action and the production of mucous, but there are threshold levels of deposition where cleaning mechanisms may be overwhelmed and the individual becomes buried. However, the impact of sedimentation on Hawaiian reefs may be overstated. Sedimentation from land derived sources (usually the most massive source) is a natural phenomenon usually associated with high rainfall events. Dollar and Grigg (1981) studied the fate of benthic communities at French Frigate Shoals in the Northwest Hawaiian Islands following the accidental spill of 2200mt of kaolin clay. These authors found that after two weeks there was no damage to the reef corals and associated communities except where the organisms were actually buried by the clay deposits for a period of more than two weeks.

Fishery Considerations

Access to the shoreline at Kahe Point Beach Park is possible but there is a 12 to 20 foot high limestone "cliff" and/or boulders that one must cross before entering the water in the immediate vicinity of the proposed cable landing site. Despite this impediment, many people climb down on to the limestone bench and either fish or enter the sea. This section of coastline has probably been used since prehistoric times. The beach park is heavily used by people interested in beachgoing, SCUBA shore diving, surfing (on the northern end of the beach park (when the swell is present) as well as 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 Kahe Point Beach Park area for subsistence fisheries. Probably most of the fishing activity in and around Kahe Point 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 general paucity of fishes of commercial or recreational interest in the inshore waters at sizes appropriate for exploitation. Many of the individual fish encountered were small suggesting that the Kahe Point area may receive considerable fishing pressure. The encounter of a school of mackerel scad or opelu (Decapterus macarellus) at Station 1 is a "chance encounter" because opelu are a coastal pelagic species that wander over large areas and encountering such a school in a $100m^2$ transect site is not a common event. This chance encounter increased the estimated standing crop at Station 1 from 4 g/m^2 to 771 g/m^2.

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, or to chance encounters such as happened at Station 1, 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 estimated standing crops in ranges frequently seen at other Hawaiian reef localities (i.e., from 40 to 80 g/m^2).

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 (principally dredging) will 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. The turbidity generated by the construction activities will be short in duration and relatively small in quantity. This statement is supported by the fact that at a maximum, less than 590 lineal feet of hard substratum would be disturbed. The small scale and anticipated short duration of the project suggest a minimal impact. Other than where substratum was completely removed (i.e., in the path of the dredge) impacts to benthic communities from dredging at the West Beach project (within a kilometer of the present proposed cable landing site) that took 19 months to complete were minimal (Brock 1990b).

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 300 feet in depth) where corals are found.

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 occur.

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 deposition 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 (probably removing less than 10m^2 of coral) will be a minor impact.

APPENDIX D.

Results of the quantitative visual censuses conduct- ed at five locations offshore of Kahe Point Beach Park, Oahu on 6 December 1991. 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	3	4	5
MURAENIDAE					
Gymnothorax meleagris	1	1			
SYNODONTIDAE					
Saurida gracilis		1			
AULOSTOMIDAE					
Aulostomus chinensis			1		
FISTULARIIDAE					
Fistularia commersoni					1
CARANGIDAE					
Decapterus macarellus		400			
Scomberoides laysan					1
MULLIDAE					
Mulloides flavolineatus				7	1
Parupeneus pleurostigma				2	1
P. multifasciatus		6	14	30	34
P. cyclostomus			1		1
CHAETODONTIDAE					
Forcipiger flavissimus		1			
Chaetodon fremblii			1		
C. unimaculatus				2	
C. lunula					1
C. ornatissimus					1
C. multicinctus		2	7	2	

APPENDIX D.
Continued.

FAMILY AND SPECIES	STATION NUMBER 1	2	3	4	5
POMACANTHIDAE					
Centropyge potteri		1			
POMACENTRIDAE					
Dascyllus albisella	8				
Plectroglyphidodon imparipennis					3
P. johnstonianus	4	6			
Chromis vanderbilti	85	167			
Stegastes fasciolatus				1	18
CIRRHITIDAE					
Paracirrhites arcatus	2	4	4	2	
P. forsteri		1			
Cirrhitops fasciatus		3	3		
LABRIDAE					
Cheilinus rhodochrous			1		
C. bimacula		1			
Hemipterontus baldwini		1			
Thalassoma duperrey	14	22	19	15	
T. ballieui		1			
Gomphosus varius	1		1	1	
Coris venusta		1			
Stethojulis balteata			1	1	
Macropharyngodon geoffroy			1		
SCARIDAE					
Calotomus carolinus		1	1	2	
Scarus perspicillatus				11	
S. sordidus		2			
S. psittaceus					3
S. rubroviolaceus		1	1		
BLENNIIDAE					
Exallis brevis				1	

APPENDIX D - Continued

FAMILY AND SPECIES	STATION NUMBER 1	2	3	4	5
GOBIIDAE					
Gnathelepis anjerensis	1				
PARAPERCIDAE					
Parapercis schauslandi	3				
ACANTHURIDAE					
Acanthurus triostegus				1	1
A. leucoparieus					5
A. nigrofuscus		32	37	45	39
A. olivaceus			5	4	
A. dussumieri		1	1		1
A. mata					1
Ctenochaetus strigosus		1	1	8	3
Zebrasoma flavescens				1	5
Naso lituratus		1	2	1	1
N. unicornis			1		
ZANCLIDAE					
Zanclus cornutus			1	1	2
BOTHIDAE					
Bothus pantherinus	1				
BALISTIDAE					
Rhinecanthus rectangulus			1	1	1
Melichthys vidua		1	1		
Sufflamen bursa	1	2	1	1	
SCORPAENIDAE					
Scorpaenopsis diabolus				1	
MONACANTHIDAE					
Pervagor melanocephalus			1		
Cantherhines sandwichiensis		1			
OSTRACIIDAE					
Ostracion meleagris		1			
CANTHIGASTERIDAE					
Canthigaster jactator		3	2	1	1
C. amboinensis					1
Total Number of Species	7	28	29	25	25
Total Number of Individuals	409	181	289	147	142
Estimated Biomass (g/m^2)	771	35	52	89	79

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APPENDIX B

Archaeological Assessment of the Proposed Fiber Optic Cable Landing for West Oahu, Kahe Point, Honouliuli, Oahu

Archaeological Assessment of the Proposed Fiber Optic Cable Landing for West O'ahu Kahe Point, Honouliuli, O'ahu

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Prepared for

R.M. Towill Corp.

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Abstract

At the request of R.M. Towill Corp., Cultural Surveys Hawaii conducted an archaeological assessment for a proposed Fiber Optic Cable Landing at Kahe Point Beach Park, Ewa, Oahu. The assessment included surface survey of the proposed landing site and underground duct line, and review of pertinent literature.

Surface sites observed included a sea cave and associated trash and basalt boulder filled crevices, and a portion of the Oahu Railway and Land Co. railroad tracks. No sites were observed along the proposed duct line which is to be within Farrington Hwy right-of-way (r.o.w.).

Background literature review suggests that the proposed cable landing site is within area not intensively utilized for habitation or agricultural during pre-historic times (i.e. pre 1778). The landing site itself (shoreline to highway) contains two areas of interest, the partially filled crevices at the shoreline and the O. R. & L tracks. The crevices can basically be avoided, however, the rail right-of-way parallels the coast and is between the coast and Farrington Hwy. Mitigation to avoid adverse impacts to the rail line should be worked out with the Historic Sites Division of the Department of Land and Natural Resources.

Recommendations include: (1) further investigations of the sea cave and crevices if the proposed landing corridor cannot avoid them; (2) a mitigation plan to avoid undue disturbance to the O.R. & L. right-of-way; and (3) survey of a staked center line of the proposed underground duct line if it is to be located (in whole or part) outside of the highway r.o.w.

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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 Kahe Point Beach Park Fiber Optic Cable Landing Site (Figs. 1-4) is a narrow (20-foot) corridor within the northern section of the park with a proposed duct line extending southward within Farrington Hwy. right-of-way to Ko'olina Resort.

The Kahe Point Beach Park is located within the district of Ewa on the dry leeward coast of Oahu. Average annual rainfall is less than 20 inches per year.

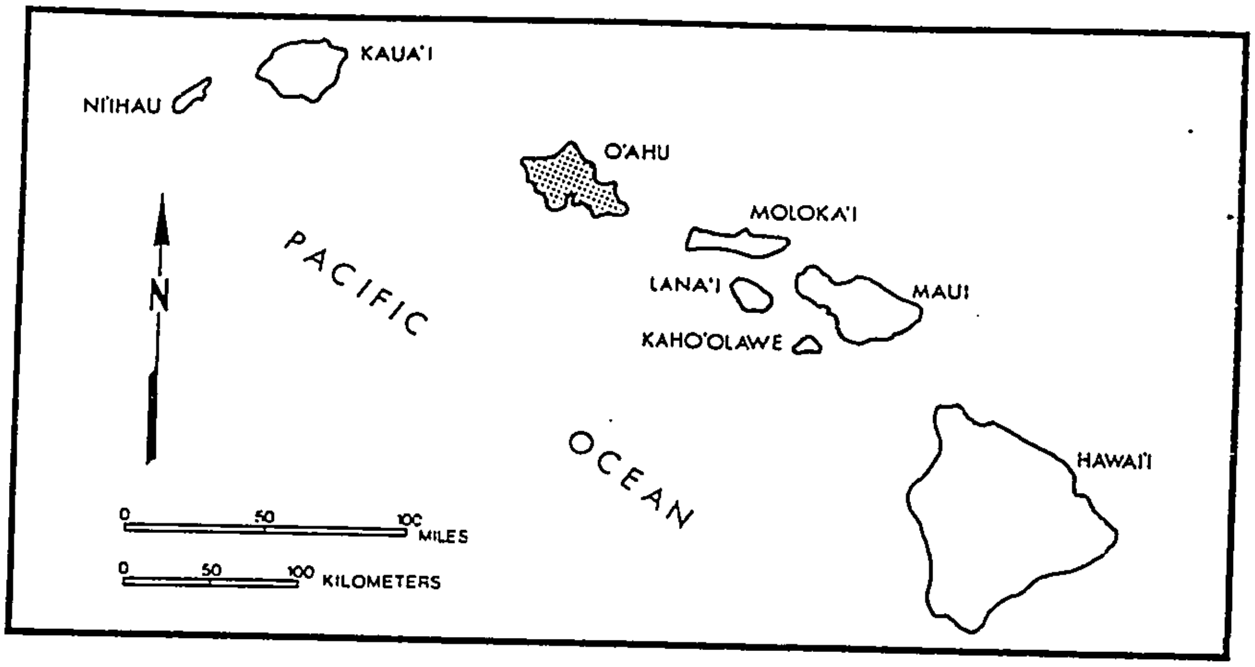

Fig. 1 State of Hawai'i

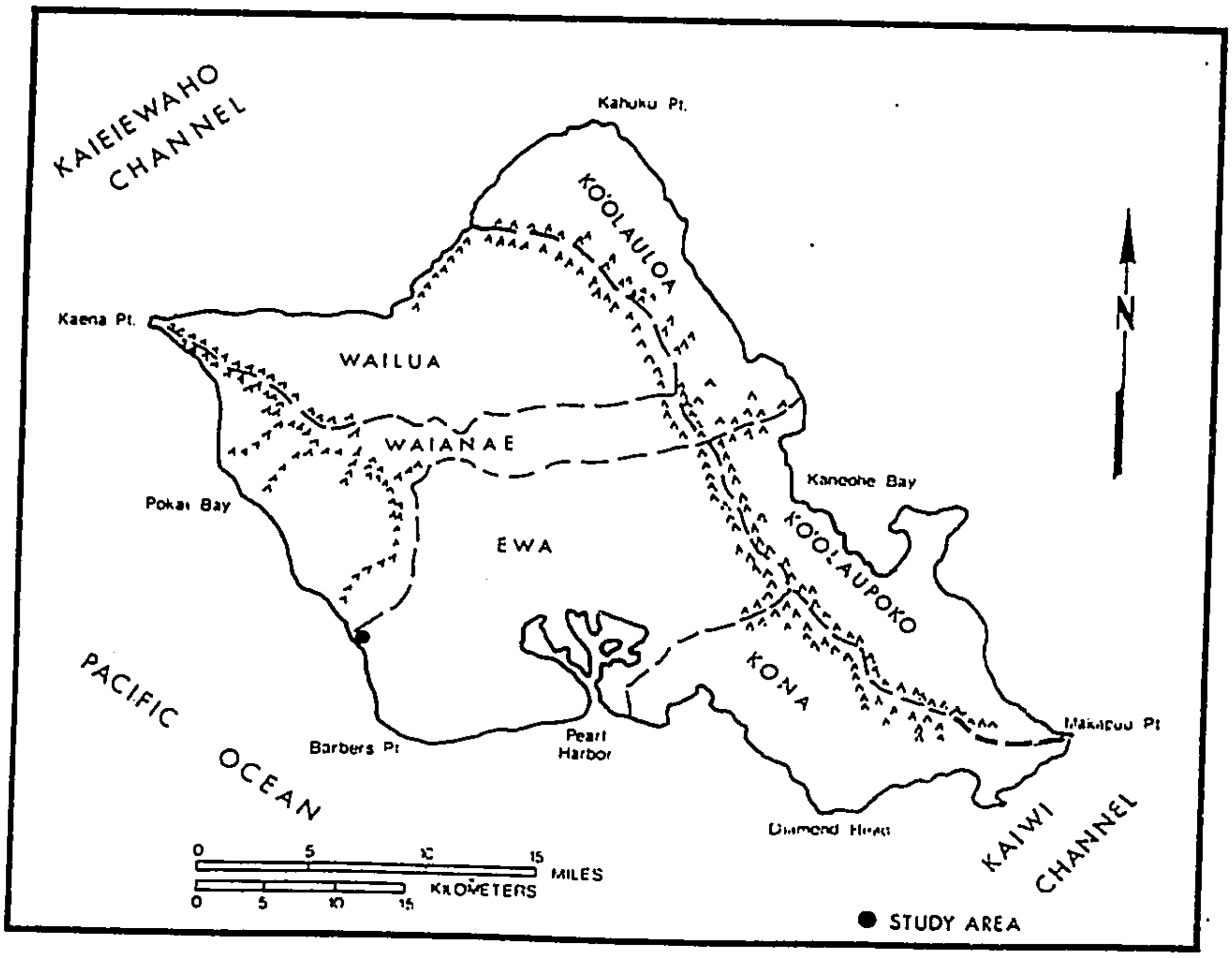

Fig. 2 O'ahu Island Location Map

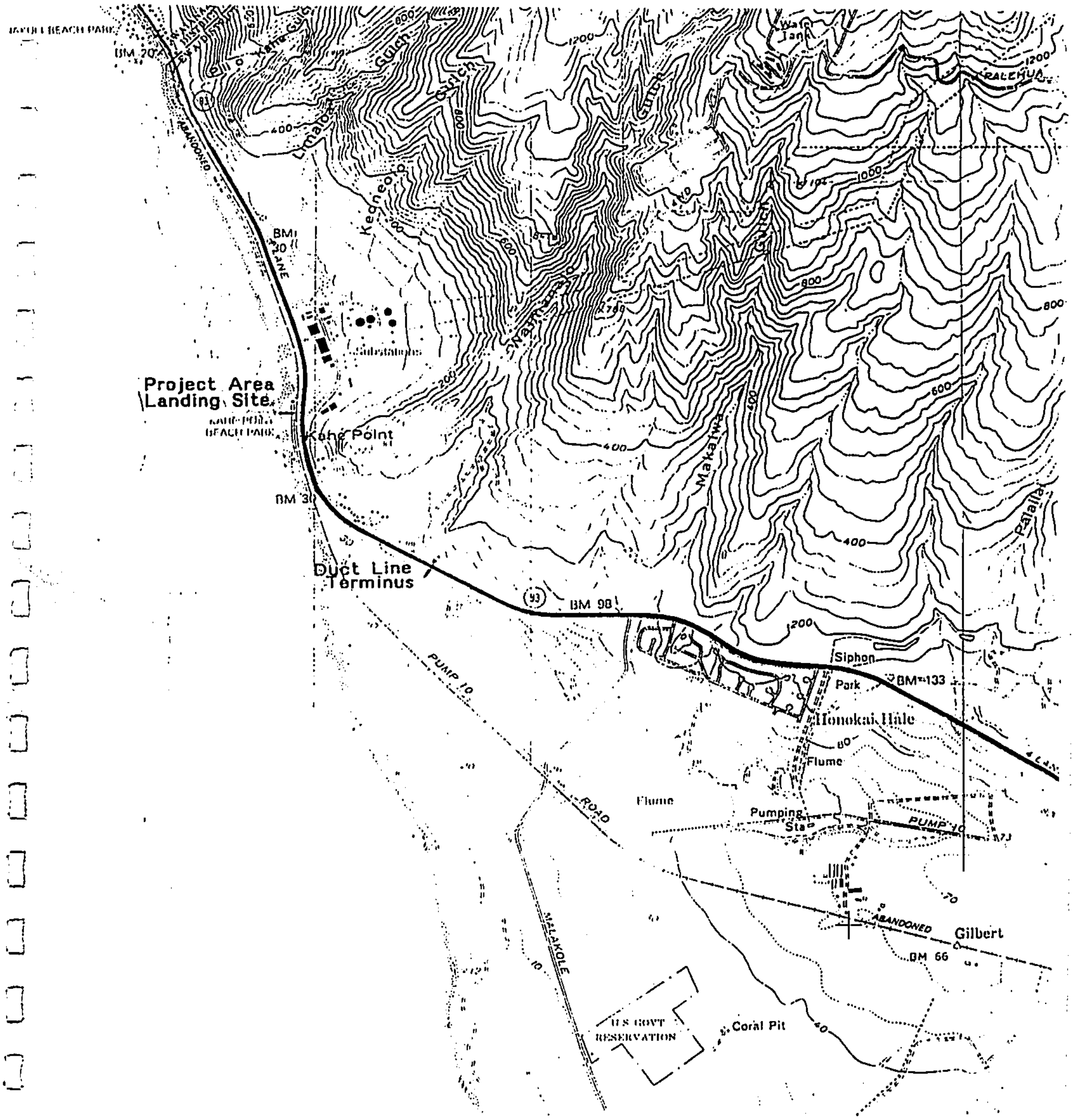

Fig. 3 USGS 'Ewa Quad Showing Project Location

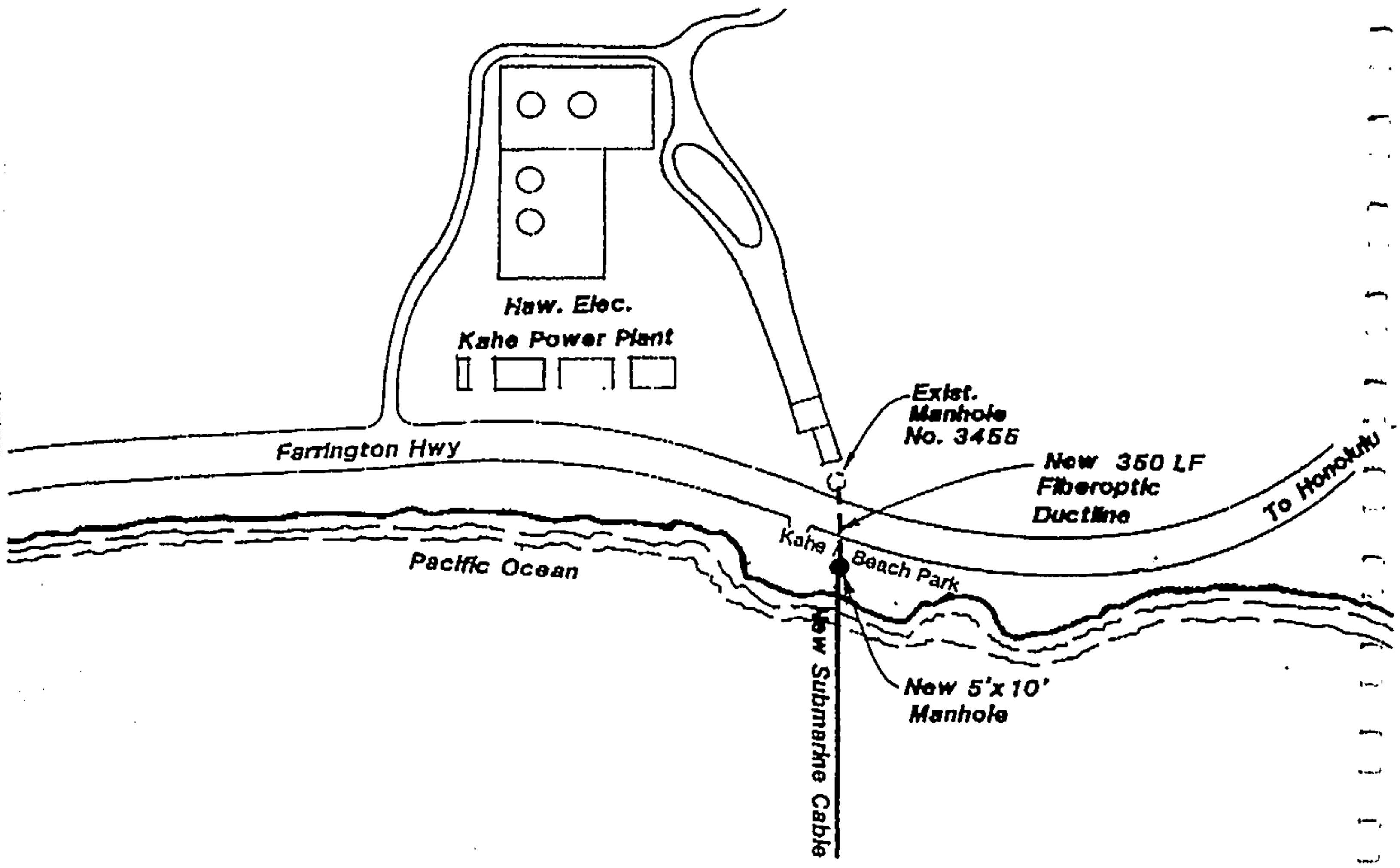

Fig. 4 Project Area Map From R. M. Towill Corp.

Topography within the Beach Park is raised reef limestone ("cr." Foot et.al. 1972) and soils along Farrington Hwy are part of the Lualualei series ("LPE," ibid). The only vegetation near the corridor are a few kiawe trees (*prosopis paladium*) and a single Indian Coral tree.

B. Scope of Work and Methods

Specific to the Kahe Point Beach Park assessment, the scope of work included inspection of the proposed landing site (Kahe Pt.) and the proposed duct line along Farrington Hwy. The fiber optic cable would then connect to existing underground utility lines at the Ko'olina Resort.

The landing and duct line corridor were inspected for any surface sites. Two areas of interest were noted within the Beach Park portion but none along the proposed duct line. The two areas within the Beach Park include a sea cave and associated crevices, and an extant section of fairly well preserved Oahu Railway and Land Co. (O.R. & L.) tracks.

No subsurface testing was undertaken in association with this assessment. This was due to a number of facts which include: (1) The sea cave and crevices in the park can easily be avoided; (2) The O.R. & L. right-of-way is listed as a national registered site (50-80-12-9714) and a mitigation plan to get by it must be approved by the Historic Sites Division of the Department of Land and Natural Resources; (3) Sub-surface testing along the approximately 2,500 ft. long duct line within Farrington Hwy is not only beyond the scope of this assessment, but based on the observed degree of land alteration associated with the highway's construction (massive cut and fill), it would appear that no archaeological resources of significance remain within the actual right-of-way itself.

Previous Archaeological Research

McAllister in his *Archaeology of Oahu* (1933) records no sites within two miles of Kahe Point. Sterling and Summers (1978) similarly record no sites and oddly not even a single reference to the Kahe Point area *per se*. The nearest places for which there is any traditional lore are Pilio Kahe about a mile north at the Wai'anae/'Ewa boundary and to Ko'olina in Waimānalo ('Ewa) about a mile to the south.

In July of 1984 Cultural Surveys Hawaii performed an archaeological reconnaissance of a parcel of land at the Hawaiian Electric Kahe Point Power Plant and determined that "the entire property [surveyed in 1984] has been graded and filled with quarried rock with a loose soil cover" (letter from Dr. Hammatt to Dames and Moore; August 6, 1984:1). While no archaeological remains were observed, it was noted that "if any archaeological remains existed here [the 1984 project area] they would have been destroyed by the activities described above" (Hammatt, 1984:1).

We are aware of a burial discovered in the sandy beach deposits in the vicinity of the Kahe Power Plant outfall pipe. On 28 December 1989, children found a burial 300 ft. north of Kahe Beach Park. A forensic report summarizes the police report and this burial has been designated State Site #80-12-4061. This appears to be a prehistoric burial (Bath, 1989: Site File on file for State Site 80-12-4061).

In 1989 Cultural Surveys Hawai'i conducted a reconnaissance survey of the six-acre HECO Kahe Training Facility, within a portion of the Kahe Substation, *mauka* of Farrington Hwy. One agricultural terrace wall was located during this survey. The report indicates that "within the whole Kahe Power Plant area this is the only site known extant.

In 1990, Cultural Surveys Hawai'i conducted an archaeological inventory survey of 1,900 acres for the proposed Makaīwa Hills Development project. The Makaīwa survey was conducted on the southern facing slope of the Wai'anae Mountains *mauka* of Farrington Hwy. There was a total of 34 sites or site complexes located during this survey. One of these sites, 50-80-12-2893, located adjacent to Farrington Hwy contains habitation features as well as associated petroglyphs. Preservation and protection measures have already been implemented for this site complex, however any work near its location (i.e. adjacent to Farrington Hwy/Ko'olina Resort exit) should take into account the preservation status of this site.

The same report (Hammatt, Robins, Stride, McDermott, 1991) contains a review of archaeological research and an overall settlement pattern for the large *ahupua'a* of Honouliuli in which Kahe Point is situated. The reader is referred to that report for a detailed discussion of these topics.

Land Use

The following is a brief overview of traditional and historic land use, based on the references just mentioned, concerning the Kahe Point area of Honouliuli.

The apparent total absence of traditional references to the Kahe Point area suggests that there was little if any permanent habitation in the immediate area. The presence of a fishing shrine or *koa*, Site 1433, along the coast south of Kahe Beach Park is a testimony however to the prehistoric utilization of a particularly good fishing locality. Temporary fishing camps with possibly a few scattered permanent habitations right along the coast would probably have been the extent of traditional Hawaiian occupation in the area.

In recent years, Hawaiian occupation sites at the Ko Olino development to the south and Hawaiian Homes lands at Nanakuli to the north have been foci of archaeological research. The low rainfall within the present project area (20"/year) would have offered little inducement for numbers of Hawaiians to have created permanent habitations with the necessary agricultural resources.

However, based on a chronology developed at the Ko'olina project (Davis and Haun, 1987) the shoreline areas of Honouliuli were probably utilized as early as A.D. 420-620. Site -2893, just *mauka* of Farrington Hwy, was dated to A.D. 1400-1665. These dates suggest that the shoreline area of Honouliuli contained one of the earliest sites on the Leeward coast and that the inland portions of the *ahupua'a* were utilized by A.D. 1400.

Most of the accounts of the traditional history of Honouliuli (ex. Kelly, 1979) make no reference to the vicinity of Kahe Point. The history of western Honouliuli is dominated by the establishment of the 41,000 acre Honouliuli (Campbell) Ranch in 1877. The ranch encompassed most of the *ahupua'a*. Whether the Campbell Ranch ranged cattle as far north as Kahe Point is unclear. The O.R.& L. tracks were extended past Kahe Point circa 1895.

The Kahe Point Hawaiian Electric Power Plant property was acquired in 1960 from Campbell Estate. Construction of the first unit began in 1962 and power generation began in 1963.

Kahe Point Beach Park was acquired in 1954 and consists of 4.7 acres of land on the *makai* side of Farrington Hwy. Improvements include a comfort station and pavilion which were built in 1962. The present parking lot was completed in 1968. Beach park use is heavy including temporary shelter for homeless families.

Results of Fieldwork

On March 9, 1992 David Shideler and Michael Pfeffer conducted an on-site field inspection of the proposed cable landing site and duct line. The landing site is within Kahe Point Beach Park while the duct line will be within Farrington Hwy right-of-way. The survey was conducted with the aim of identifying and locating all known sites and potential sites that might be impacted by the cable route. No archaeological sites were observed within the landing corridor or along Farrington Hwy. The corridor (20 feet wide) for the cable landing would be through the existing limestone bench, which Kahe Point Park is built on. The area has been entirely graded and improved for the beach park.

Similarly, the proposed duct line is within a previously heavily impacted area (bulldozed, graded, fill, etc.) of the corridor of Farrington Hwy. The duct line is proposed to extend from Kahe Point to the Ko'olina turnoff where it will attach to an existing underground duct.

Three areas of interest were located during the survey: 1) A fishing shrine (*koa*); 2) an extant portion of the old Oahu Rail and Land Company, complete with ties, rails, and a rail crossing sign; and 3) a sea cave with several rock filled crevasses that may contain burials or other cultural matter.

The first area of interest is the fishing shrine, or *koa*, which is located outside of the proposed cable route. The shrine is thought to be one of the only *koa* that still exists on the island of O'ahu and is listed as a State Site (50-80-12-1433). The shrine is located approximately 1,000 feet (300 meters) to the south of the proposed cable route and no impact is foreseen on the site.

The second area of interest is a portion of the old Oahu Rail and Land Company right-of-way (50-80-12-9714) which is in an excellent state of preservation. The line runs along parallel to the coast and cuts across the proposed cable route. The line itself which is listed on the National Register, runs continuously from the intersection of Lualualei Road with Farrington Hwy in Nānākuli to 200 ft. east of where it intersects with Fort Weaver Road in Honouliuli. Just north of the proposed cable route (10 meters) is a railroad crossing sign that is still in excellent condition. It is recommended that care be taken to preserve the railroad line and associated features (the sign) if possible during construction of the cable route.

The third area of interest is a small sea cave and several associated fissures, or deep cracks, in an exposed portion of ancient reef/limestone shelf. At the point where the proposed cable is to exit the Pacific Ocean there is a sea cave located approximately 5 meters below the ground level. The cave floor is covered with a small boulders, part of a built-up beach that is constantly washed by the prevailing swell and there are no cultural deposits in the cave. There are also several large fissures located on the western edge of the sea cave that may contain cultural material. The fissures angle up from the sea cave and are located 2 to 4 meters below the ground level. The fissures are filled with a deposit of modern trash, however beneath the modern trash there is a loose layer of water worn boulders that may be cultural in origin. While the rocks probably have been washed into the cracks during large storms, there is a possibility that they have been artificially placed into the cracks. This may indicate the presence of burials in the fissures. If the cable route is to impact the cave and/or fissures an archaeological inventory survey (i.e. testing) of the trash-filled cracks should take place prior to construction. If the cable is routed to the south of the cave, then no impact would be foreseen to the cave or fissures.

Summary and Recommendations

The area to be impacted by the proposed fiber optic cable route was examined and surveyed by Cultural Surveys Hawai'i to determine the extent of any cultural deposits and/or sites in the area. Three areas of interest were noted and described above. Of the three, only two would be impacted by the proposed route, the rail line and the sea cave and fissures. If the cable is routed to the south of the sea cave then no impact is foreseen for the cave and fissures. However, if the proposed cable route will impact the cave and fissures then an archaeological survey, including sub-surface examination, should be conducted prior to construction. The rail line is in an excellent state of preservation and is listed on the National Register (50-8-12-9714). It is recommended that the cable route have little or no impact on the extant portion of the rail line and the state must be consulted to determine if any impact can be made on this section of rail line. If impact is allowed on the rail line an archaeologist should be present during excavation.

The proposed underground duct line within Farrington Hwy (right-of-way) from Kahe Point to Ko'olina Resort, appears to contain no significant archaeological resources. However, once the actual route with a surveyed and staked centerline is chosen, it is recommended that if portions of the duct line are outside of the highway right-of-way, a survey be conducted to properly assess the staked route.

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Photo Appendix

Fig. 5 Proposed Corridor Route. View to West

Fig. 6 Proposed Corridor Route. View to Northeast.

Fig. 7 Sea Cave. View to Northeast.

Fig. 8 Sea Cave With Reference Point (Indian Coral Tree). View to Northeast.

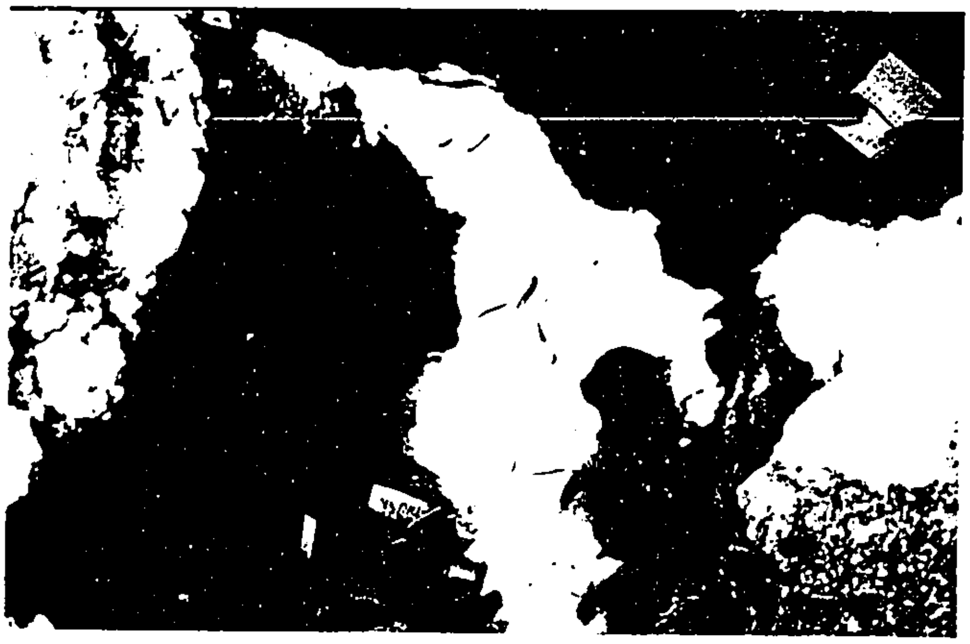

Fig. 9 Crevice With Modern Fill and Possible Modification. View to Northeast.

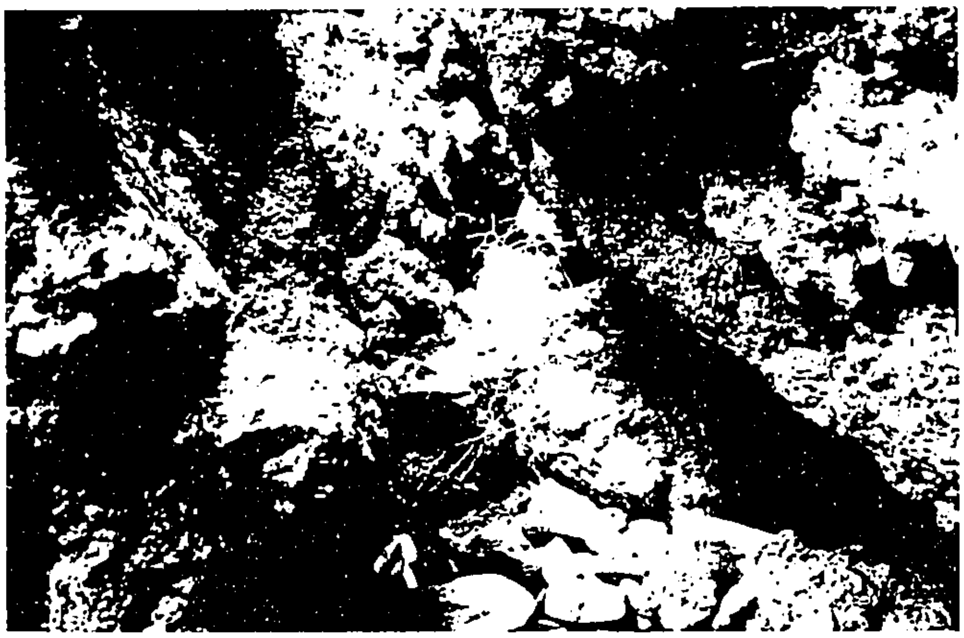

Fig. 10 Second Crevice With Modern Fill and Possible Modification. View to Northwest.

Fig. 11 View of Extant Oahu Railway and Land Company Track. View to Northwest.

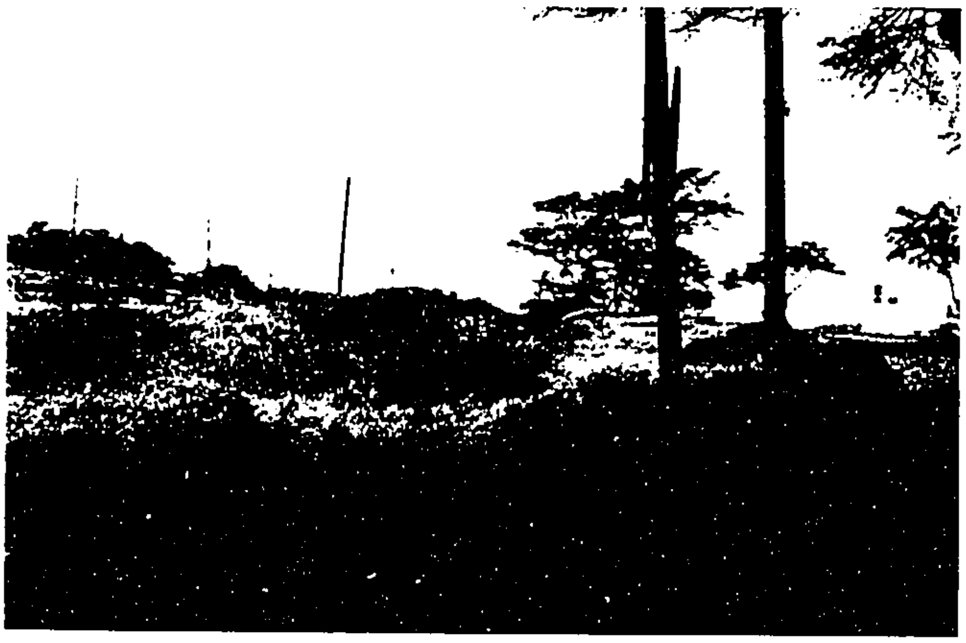

Fig. 12 Oahu Railway and Land Company Track With Extant Railroad Crossing Sign in Foreground. View to Southeast.