LINDA CROCKETT LINGLE
Mayor

BRIAN W. MISKAE
Planning Director

COUNTY OF MAUI
PLANNING DEPARTMENT
250 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

November 30, 1992

RECEIVED
'92 DEC -9 A10:09
OFC. OF ENVIRON. QUALITY CONTROL

Brian Choy
Office of Environmental Quality Control
465 South King Street
Honolulu, Hawaii 96813-2910

Dear Mr. Choy:

Re: Notice of Determination

GTE HAWAIIAN TEL, requesting an Environmental Assessment Determination for a Shoreline Setback Variance for a subground duct-line at Mokapu Beach, TMK 2-1-0:62 for the proposed interisland fiberoptic cable. (92/EA-07, 92/SSV-03, 92/SMA-17)

Please be advised that the Maui Planning Commission at its November 24, 1992, meeting determined a Negative Declaration for the proposed duct-line project. You will find enclosed four (4) copies of the environmental assessment and staff report relative to the subject matter.

Should you have any questions on the report or decision, please contact Ms. Elizabeth Anderson of my staff.

Very truly yours,

BRIAN MISKAE
Planning Director

Enclosures

cc: Patrick Mau, GTE

FINAL

ENVIRONMENTAL ASSESSMENT for the

GTE HAWAIIAN TEL
INTERISLAND FIBER OPTIC CABLE SYSTEM
Mokapu Beach, Island of Maui

DECEMBER 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

MOKAPU BEACH, ISLAND OF MAUI

Prepared for:

GTE HAWAIIAN TEL
1177 Bishop Street
Honolulu, Hawaii 96813

DECEMBER 1992

Prepared By:

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

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APPENDIX A - Marine Environmental Analysis of Selected Land Sites
APPENDIX B - Archaeological Assessment

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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: Patrick Mau, Project Engineer 546-2378
Accepting Authority:	County of Maui Department of Planning
Tax Map Key:	2-1-8:62
Location:	Mokapu Beach, Maui
Project Area:	10,600 Square Feet
Owner:	McCormack Properties 841 Bishop Street Penthouse, Davies Pacific Center Honolulu, Hawaii 96813 Contact: Mr. Peter Nottage, Senior Vice-President 539-9600
Agent:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817 Contact: Colette Sakoda 842-1133
Existing Land Uses:	Beach park with recreational and resort uses
State Land Use District:	Urban
Community Plan Land Use Designation:	____________
County Zoning Designation:	H-2 (Hotel)

SECTION 1
INTRODUCTION

1.1 PURPOSE AND OBJECTIVES

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

GTE anticipates that by 1993 its existing interisland 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 and data traffic.

1.2 PROJECT LOCATION

The recommended landing site for the Maui to Oahu segment and Maui to Big Island segment of the interisland fiber optic cable system is Mokapu Beach (TMK 2-1-8: 62).

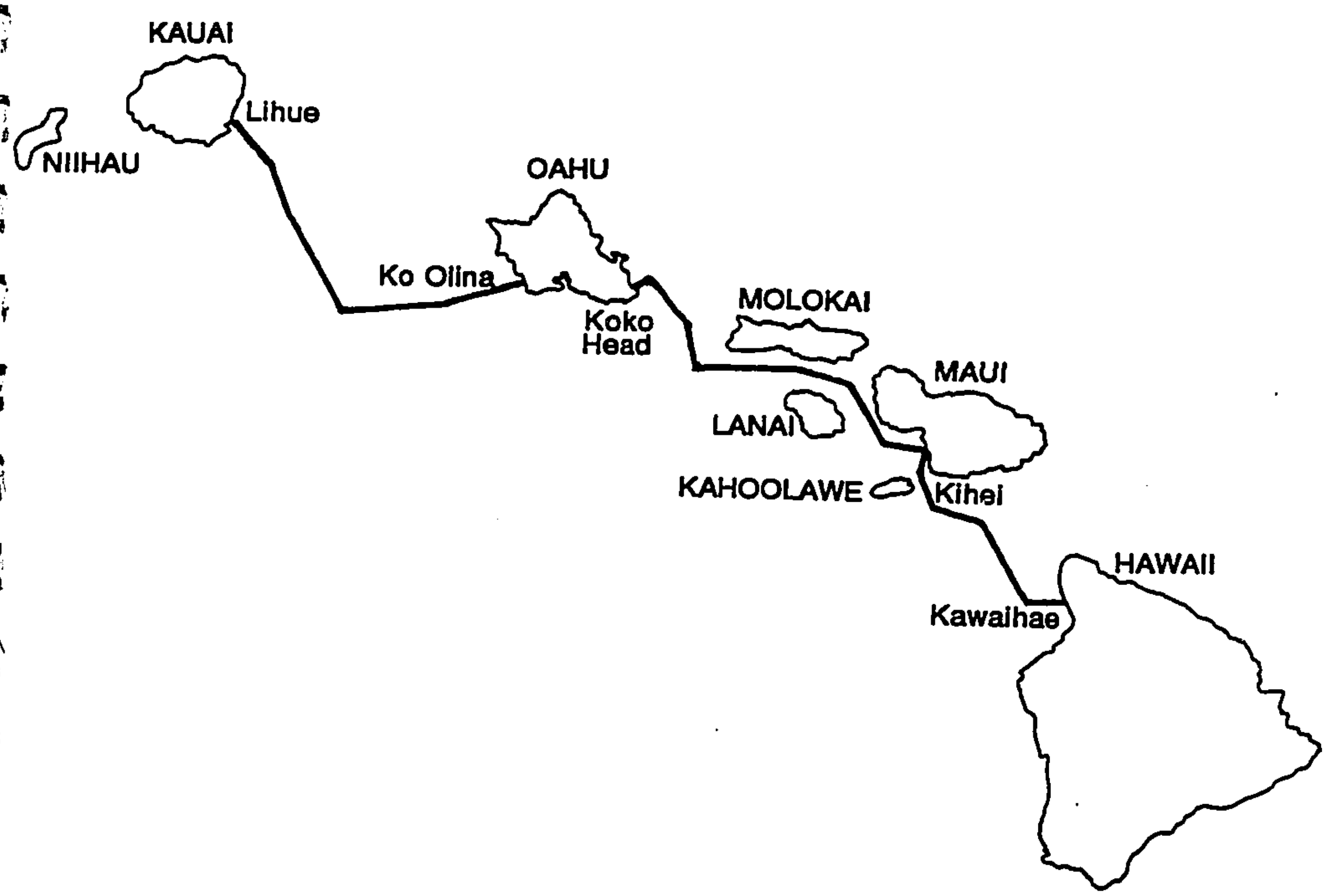

Figure 1
INTERISLAND SUBMARINE FIBER

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

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JANUARY 1992

Mokapu Beach is located along the West Coast of the Island of Maui (see Figure 2). Mokapu Beach is one of five beaches that are part of the Wailea resort complex. The word mokapu is an abbreviated form of moku kapu and means "sacred island." "Prior to World War II, Mokapu was a small rock island offshore from the beach. Sea birds such as the kolea gathered on it in the evenings, and on the rocky point nearby. The birds would feed mauka in Kula during the day and then return to the shoreline for the night. The flocks were immense, making Mokapu a popular hunting area. During the war, however, the rock island was almost entirely destroyed by explosives detonated during combat demolition exercises. So little remains of Mokapu today that it is simply another rock among the others nearby" (Beaches of Maui County, J. Clark, 1980).

Mokapu Beach is a short, wide pocket of white sand with beach rock exposed in the center of the beach. The sandy inshore bottom has a gentle slope to the deeper waters offshore. A study of the ocean bottom along the proposed cable alignment at the landing site indicates a continuous sandy ocean bottom from the beach seaward to the 180-foot depth.

The sand is medium to fine grained, with a noticeable increase in silt content closer to shore. The sand deposit appears to be thick and there are no protruding rock outcrops or coral formations in the deposit. There are patchy growths of Halimeda, coralline algae, extending seaward from the 90-foot water depth. Although this growth presents a different biological environment, the underlying bottom is still sand.

The flat and sandy ocean bottom provides an ideal landing condition as the cable will eventually be covered by sand providing protection against wave action.

The proposed project landing site is located on the northern side of Mokapu Beach. The landing site is undeveloped with little vegetation.

From Mokapu Beach the cable will be installed within an underground duct line to Wailea Alanui Road. The cable will then be pulled through existing underground ducts connecting Manhole 100A to Manhole 75 at Kilohana Avenue. The cables will then be routed overhead onto existing utility poles along Kilohana Avenue and Piilani Highway to the Central Office (CO) on 210 Halona Street in Kihei. Figure 3 shows the proposed alignment of the GTE Hawaiian Tel cable from the shore landing to the GTE CO (further site description is provided in Section 3).

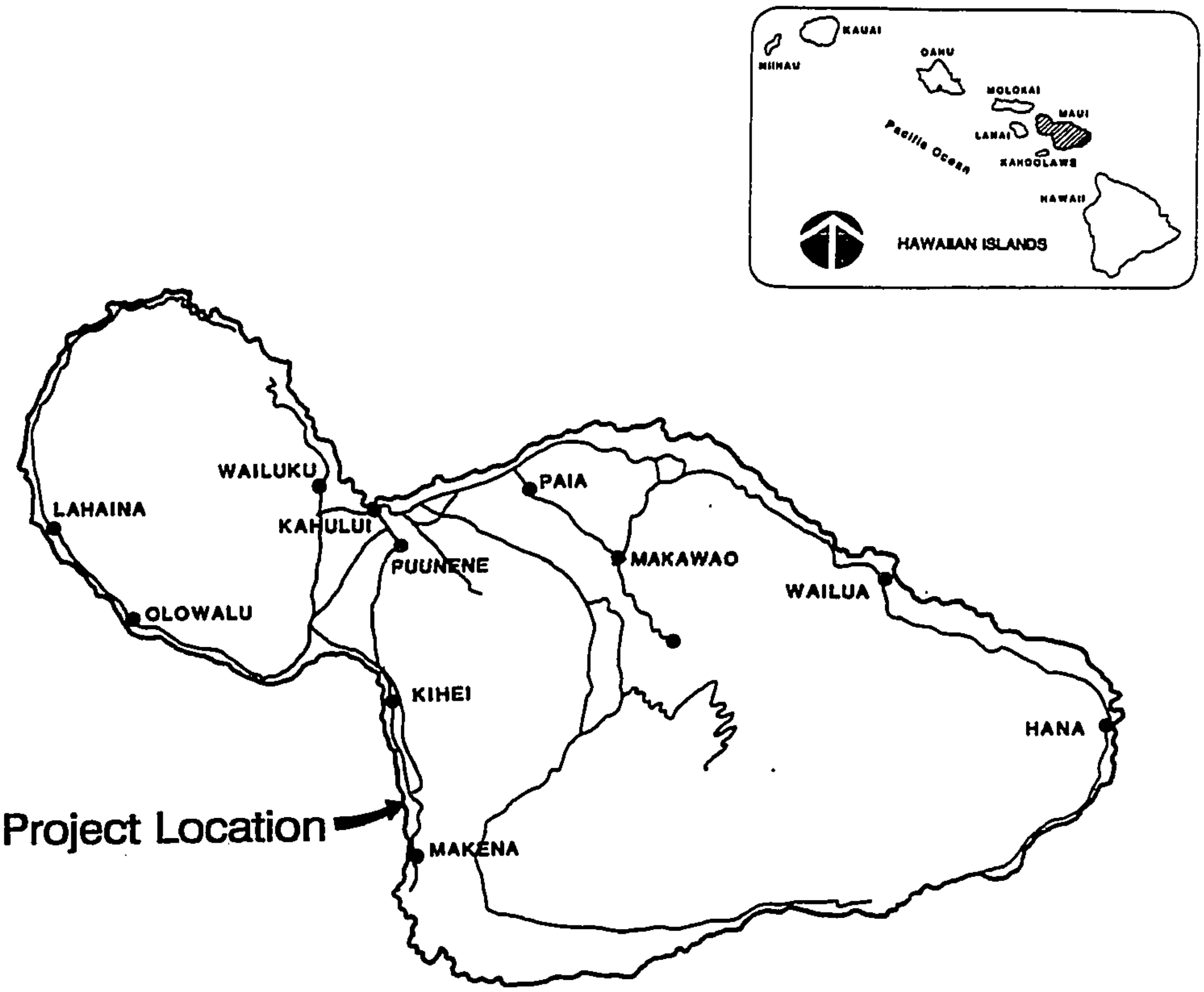

Figure 2
LOCATION MAP

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

0 7 14 MILES

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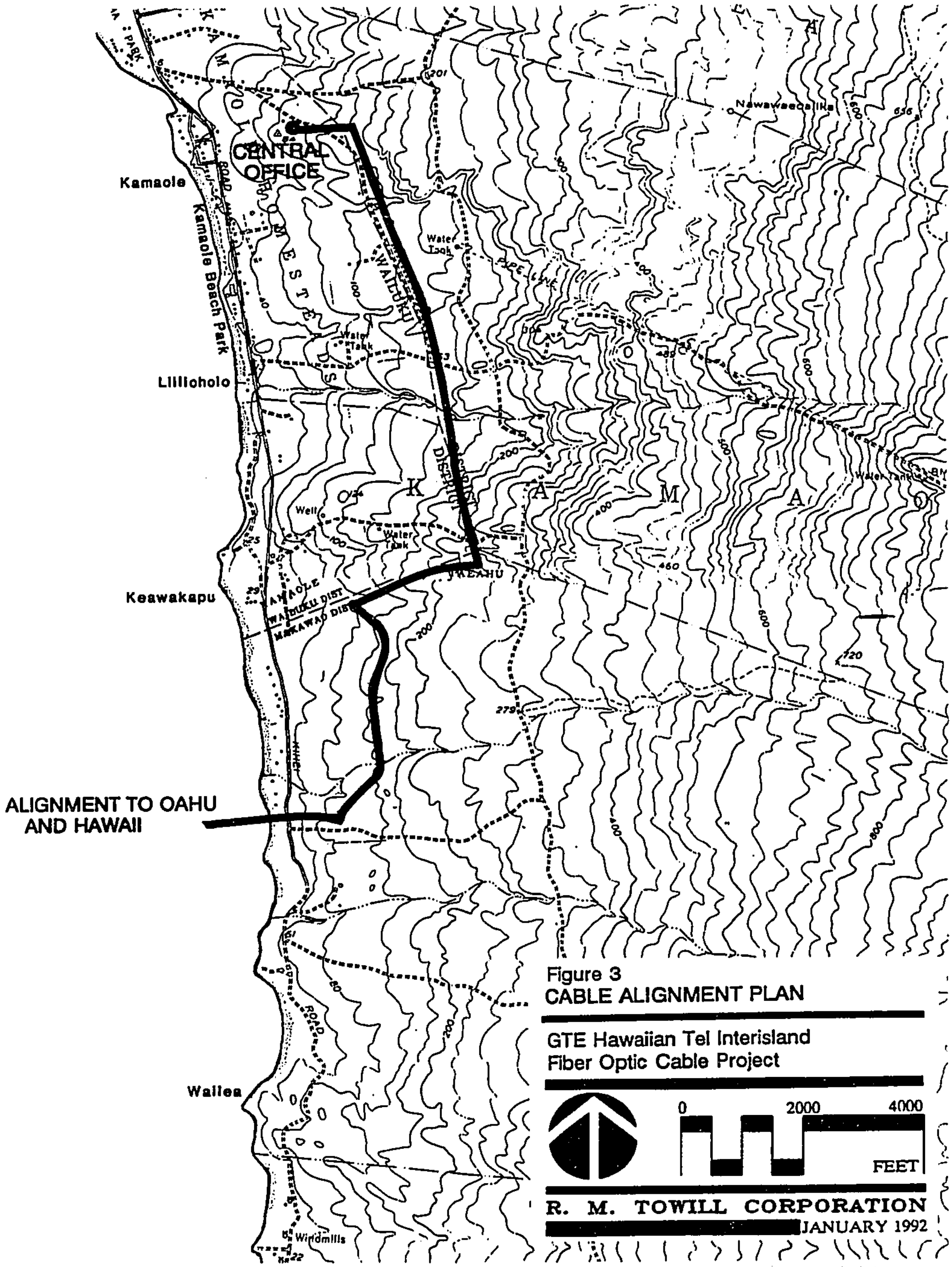

Figure 3
CABLE ALIGNMENT PLAN

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

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SECTION 2

PROJECT BACKGROUND

2.1 CABLE TECHNOLOGY

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

2.1.1 Copper and Fiber Optic Cables

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

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

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

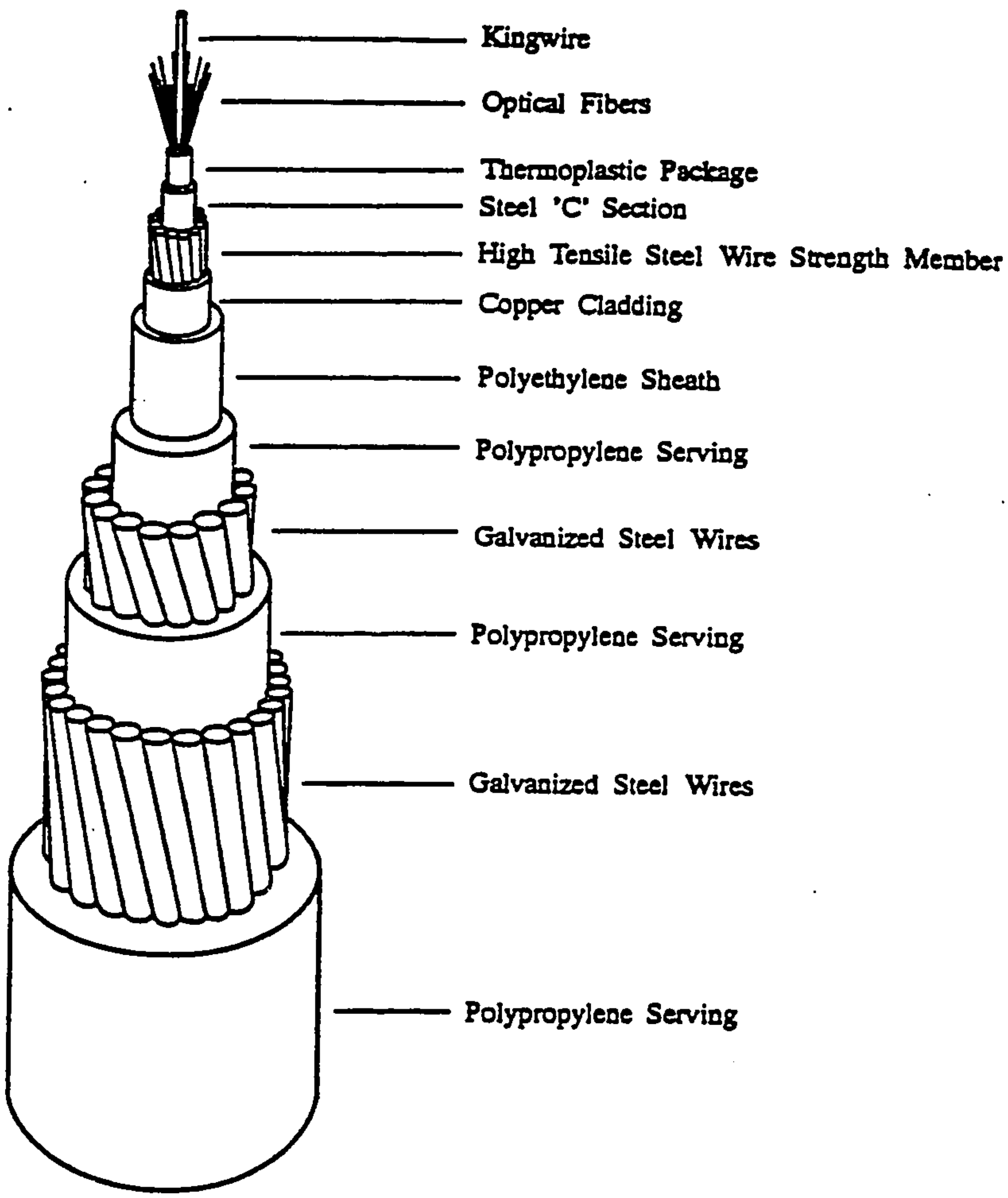

Figure 4
DOUBLE ARMOR FIBER OPTIC CABLE

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

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

Fiber optic technology was selected because:

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

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

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

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

2.2 SUBMARINE CABLE ROUTE

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

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

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

2.2.1. 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

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

2.2.6 Ship and Airplane Wrecks

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

2.2.7 Other Cables

There are several other cables in the planning stage including PacRimEast (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, Austràlia, 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 due to the 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 difficulties 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 for the Maui to Oahu segment and the Maui to Big Island segment of the fiber optic cable where underwater geology would be most suitable are as follows: Mokapu Beach, Keawakapu Beach, and Kamaole Beach. Mokapu Beach is proposed as the preferred landing site because it has the best available accessway through a lengthy bench reef which extends parallel to shore. This reef system extends across both of the other proposed landing sites. This opening at Mokapu Beach would allow the fiber optic cable to access the shore landing without having to cross a major section of reef and/or hard bottom.

Further site investigation of Kamaole Beach Park and Keawakapu Beach indicate continued presence of the reef band for a long distance. Off Kamaole Beach, the coral begins in shallow water (30 feet), and extends seaward to the 90 foot depth for several hundreds of feet. Keawakapu Beach has a similar condition, but is further constrained by difficult access to the shoreline from a parking lot which would have to undergo major demolition and repair in order to access the beach.

SECTION 3
CONSTRUCTION ACTIVITIES

3.1 GENERAL

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

The land-side construction activities involve the construction of: 1) a new 5 feet by 10 feet manhole at the Mokapu Beach landing site; 2) seven 4 feet by 6 feet handholes; and 3) the installation of approximately 3,100 feet of underground ducts and cable from the landing site to Manhole 100A at Okolani Drive (see Figure 5).

The work also includes pulling approximately 5,600 feet of cable through existing underground ducts connecting Manhole 100A to Manhole 75 and installing 11,200 feet of overhead cable on existing utility poles from Manhole 75 to the central office located at 210 Halona Street.

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

3.2 LAND-SIDE ACTIVITY

A new 5'x 10'x 6' deep reinforced concrete manhole will be constructed within an easement near the southwestern corner of the Ten Wailea Beach resort property.

The new manhole will be terminus of the land-side activities and will be constructed to receive the submarine cable. Four 4-inch diameter PVC ducts will be installed in a trench from the new manhole along the southern boundary of the Ten Wailea Beach property, mauka toward and across Wailea Alanui Drive. After crossing Wailea Alanui Drive, the

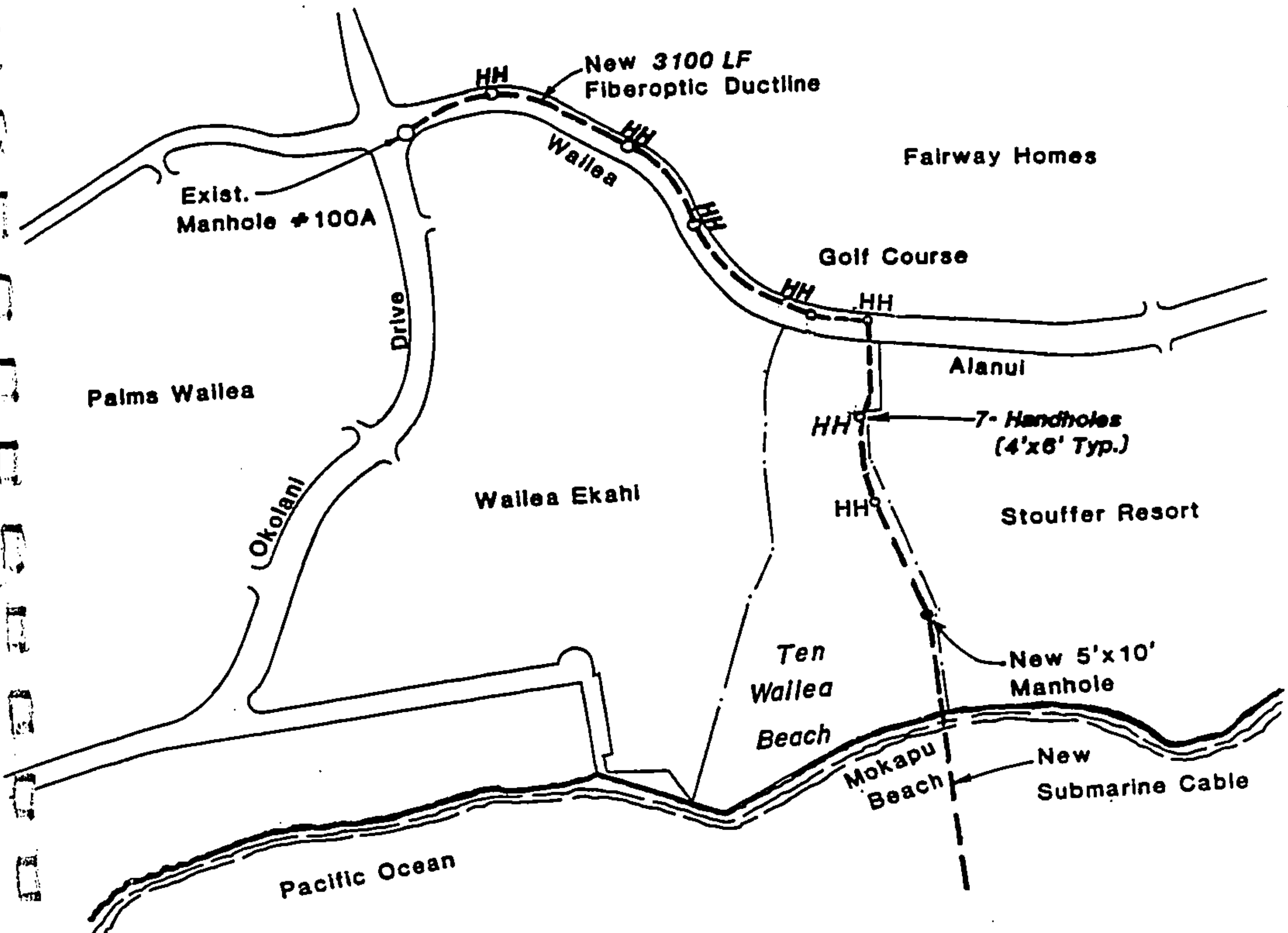

Figure 5
SITE PLAN

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

Not to Scale

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JANUARY 1992

cables will be directed north toward Okolani Drive along the mauka shoulder of the highway adjacent to the golf course (Figure 5). The duct line will be located approximately 2-feet off the edge of the pavement and the conduits will be encased in concrete and buried under 3-feet of earth cover (see Figure 6A).

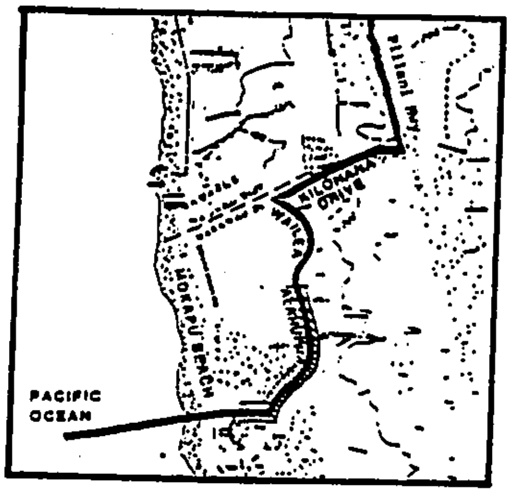
Only two of the four PVC ducts will be utilized, with one duct receiving the Oahu end of the interisland cable, and one duct receiving the Big Island end of the interisland cable. The remaining two ducts will remain vacant and retained should their future use become necessary.

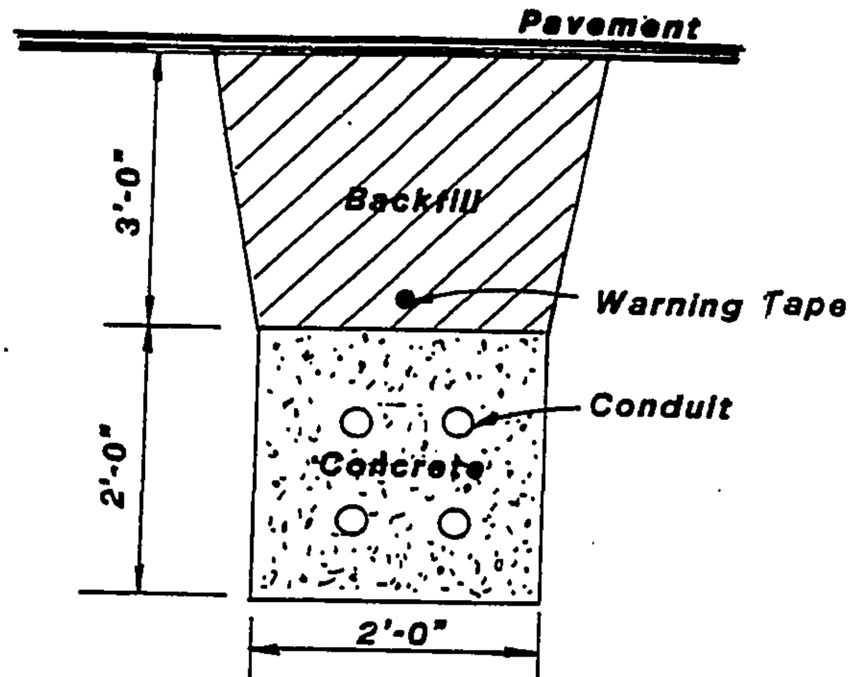
Approximately seven 4 feet by 6 feet concrete handholes will be constructed along the duct line about 500 feet apart. At the intersection of Okolani Drive, the ducts will be directed makai across Wailea Alanui Drive to an existing manhole (No. 100A). The cable will then be pulled through existing underground ducts connecting Manhole 100A to Manhole 75 at Kilohana Avenue. The cables will then be routed overhead onto existing utility poles along Kilohana Avenue and Piilani Highway to the central office at 210 Halona Street.

3.3 NEARSHORE ACTIVITY

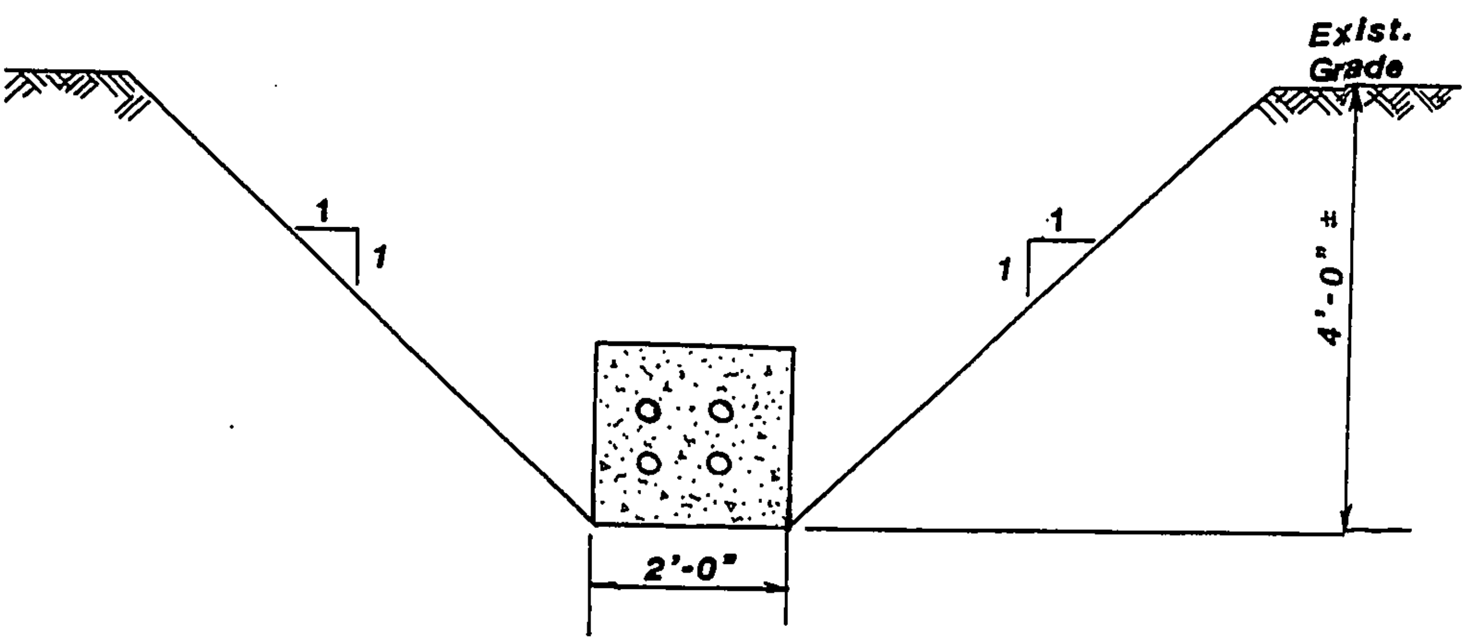
A 200-foot long trapezoidal shaped trench as indicated in Figure 6B will be excavated between the new manhole and the mean low water mark and four 6-inch steel conduits encased in concrete installed within the trench. The trench will have a 2-foot base and will be approximately 4 feet deep, with a 1:1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

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





NEW MANHOLE TO EXIST. MANHOLE NO.100A



NEW MANHOLE TO OCEAN

Figure 6
TRENCH SECTIONS

GTE Hawaiian Tel Interisland Fiber Optic Cable Project

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JANUARY 1992

To reduce the potential for turbidity due to construction related work, silt screens or filters will be utilized within the nearshore construction area. 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 or concrete for backfill.

3.4 CABLE LANDING PROCESS

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

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 cable ship will approach the landing site observing the land based visual alignment guides (range targets) which the ship's captain will use 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. Upon landing, the cable will be fed into a steel duct line that has been 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.

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

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

3.5 SAFETY AND ENVIRONMENTAL CONSIDERATIONS

During the construction phase on the beach (approximately 7-10 calendar days in May-June 1993), the portion of the beach which contains the open trench will be barricaded from public entry. During the construction period, a security guard may be required at night and on weekends to ensure public safety and integrity of the job site.

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

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

3.6 SCHEDULE AND ESTIMATED COST

The first phase (land-side activities) of the project is scheduled tentatively for February and March 1993. The second phase (installation of interisland cable and cable landing operations) is scheduled tentatively for April and May 1993. Construction cost for the first phase is estimated at $655,000.

SECTION 4

DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate

The project site is located on the leeward side of Maui which is typically hot, dry and sunny. The mean annual temperature is between 71.5 and 78 degrees Fahrenheit. The area averages 15 inches of rain annually. August and September are normally the hottest and driest months and January through March are the coolest and wettest.

Winds are generally from the northeast except during the winter months when storms are usually accompanied by south winds. The Kihei-Makena shoreline areas are also subject to unpredictable local winds from Kalama Park to Cape Kinau. These winds are created as the trades increase in velocity as they travel between the West Maui Mountains and Haleakala and meet the eddy current of the trades deflected along the southeast slopes of Haleakala (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

Geologically, the area is described as the coastal flank of the western slope of the massive, but extinct, volcano, Haleakala. The underlying structure of the land form is rock formed by the cooling of lava flows down the slope from the crater when active. The most recent flows (last eruption recorded in 1790), range from a few inches to a few feet in thickness at variable depths below the soil mantle (Makena Series) which has built up over the ages by alluvial action.

The project area has sedimentary rocks which consist of alluvium, dune sand, colluvium, mudflow deposits, and lagoonal deposits. The predominant soil type for the area excluding the landing site consists of the Makena Series particularly Makena loam, stony complex, 3 to 15 percent slopes (MXC). In a representative profile the surface layer, about 4 inches thick, is very dark brown loam that has platy structure. The subsoil, about 19 inches thick, is very dark grayish-brown and dark yellowish-brown silt loam that has prismatic structure. The substratum is dark yellowish-brown cobbly silt loam. The soil is mildly alkaline in the surface layer and subsoil. On the Makena part of the complex, permeability is moderately rapid, runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is about 1.8 inches per foot of soil. On the Stony land part, permeability is very rapid and there is no erosion hazard.

Soils at the landing site are classified as Beaches. Beaches (BS) occur as sandy, gravelly, or cobbly areas. They are washed and rewashed by ocean waves. The beaches consist mainly of light-colored sands derived from coral and seashells.

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. All reasonable efforts will be taken to ensure that excavated portions are returned to present preconstruction contours 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 two unnamed gulches to the north, both of which are dry except for the rainy season.

Groundwater for the area is basal water floating on salt water.

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 Makena Series of soils are used for pasture and wildlife habitat. Vegetation at the project site consists of bristly foxtail, haole koa, feather fingergrass, ilima, and kiawe. No rare or endangered species of plants were found on the site. The majority of the existing flora and fauna of the project site consists mainly of introduced species.

With respect to animal wildlife for the area, no rare or endangered animals are known to inhabit the site. The area has a hot, dry climate and sparse vegetation and 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

A qualitative reconnaissance of Mokapu Beach was carried out on 26 June 1991 and a quantitative sampling conducted on 4 December 1991. The findings are summarized here with the complete study appended to this document. The qualitative survey extended from shore to about the 90 foot isobath approximately 2,800 feet from shore. In this area three major zones or biotopes were defined as follows: sand and Halimeda beds, biotope of sand, and the biotope of basalt rock and corals. In general, the biotopes parallel the shore, but along the proposed cable alignment, the biotope of sand extends shoreward from the deeper offshore biotope of sand and Halimeda beds. Thus the biotope of sand bisects the nearshore biotope of basalt rock and corals. Figure 7 shows the boundaries of the biotopes as well as the quantitative transect stations. The biotope of sand and Halimeda beds is at depths in excess of 80 feet (about 2,600 feet from shore) and continues seaward to well outside of the study area. To both the east and west of the proposed cable alignment are basalt rock headlands. Between these is an 325 foot sand shoreline that is the central part of Mokapu Beach. Offshore and subtidally of these rock headlands is the biotope of basalt

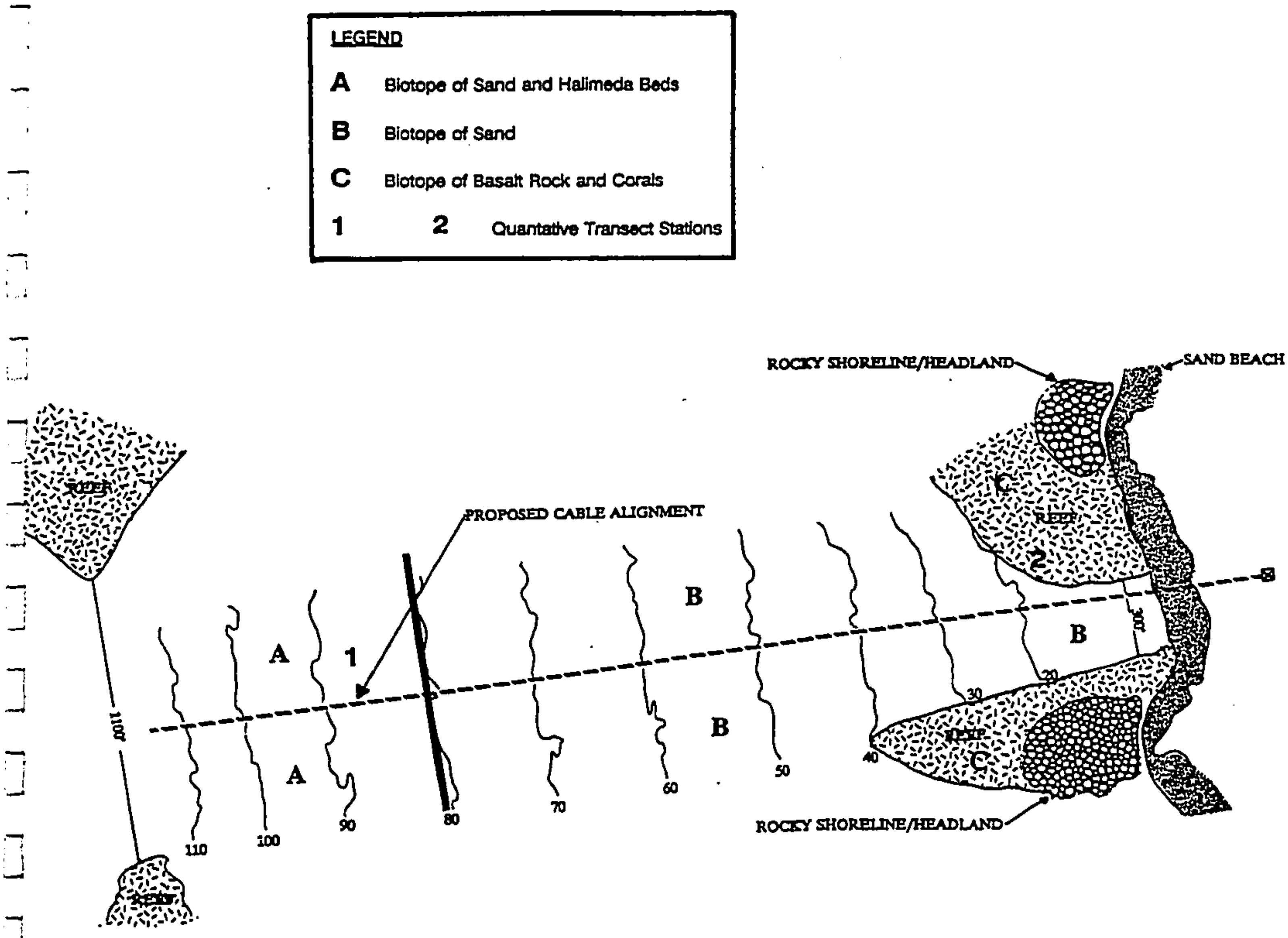

Figure 7
BIOTOPES ALONG SELECTED CABLE ALIGNMENT

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rock and coral. On the western side this biotope extends more than 400 feet offshore and on the eastern side in excess of 550 feet seaward.

4.1.5.1 The Biotope of Sand and Halimeda Beds

The biotope of sand and Halimeda beds is found at depths greater than 80 feet. This biotope may be characterized by a relatively flat sand substratum with little rubble present. A dominant feature of this biotope is the presence of beds of the alga, Halimeda opuntia. These beds range in size from 6 to 25 feet in width, 3 to 30 feet in length and rise no more than 6 inches from the substratum. These Halimeda patches are spaced from 5 to over 50 feet apart. In the area examined, the sand has a large number of fragments of the bivalve, Pinna muricata suggesting that somewhere in the near vicinity is probably a large "bed" of this species. Pinna muricata is usually found forming large beds that may cover hundreds of square meters of sand bottom in deeper water (Kay 1979, Brock and Chamberlain 1968).

The results of the fish census are presented in the Appendix; only five species (11 individuals) were encountered in the census area having an estimated biomass of $2g/m^2$. The most common fishes were the alo'ilo'i or whitespot damselfish (Dascyllus albisella) and the serranid (Anthias thompsoni). Other than a small piece of metal, there was very little local shelter for fishes at this station.

4.1.5.2 The Biotope of Sand

The biotope of sand lies shoreward of the biotope of sand and Halimeda beds and it extends uninterrupted to the beach in the area of the proposed cable alignment. As the name implies, the substratum in the biotope of sand is dominated by sand. Because of its shifting nature, the benthic species found in sand habitats are generally adapted for life on an unstable and frequently abrading environment. Many species that are found in this habitat will bury into the sand to avoid predators and the abrasion that occurs with storm waves. Thus many species in the sand biotope are cryptic and difficult to see; among those are many of the molluscs and crustaceans such as the kona crab (Ranina serrata). Hence, without considerable time spent searching in the sand, many species in the sand habitat will not be seen. The biotope of sand is best developed at greater depths; where it enters the shallow water, many of the characteristic species become less abundant.

Because of the dispersed and cryptic nature of many of the species resident to the biotope of sand we did not quantitatively sample this biotope but rather carried out a qualitative reconnaissance of the habitat in waters from 30 to 80 feet in depth. Species noted in this overview of the biotope include a number of molluscs: the helmet shell (Cassis cornuta), augers (Terebra crenulata, T. maculata and T. inconstans), the leopard cone (Conus leopardus) and flea cone (Conus pulicarius) as well as the sea hare (Brissus sp.), starfish (Mithrodia bradleyi), brown sea cucumber (Bohadschia vitiensis), opelu or mackeral scad (Decapterus macarellus), nabeta (Hemipteronotus umbrilatus), the goby-like fish (Parapercis schauslandi), the lizard fish or 'ulae (Synodus binotatus), the flatfish or paki'i (Bothus mancus), uku or snapper (Aprion virescens), goatfish or malu (Parupeneus pleurostigma) and the weke or white goatfish (Mulloides flavolineatus).

A short survey was made of the sand beach at the point of the proposed cable landing; no macrofauna was seen although one ghost crab hole (probably Ocypode ceratophthalmus) was present on the beach. A short visual appraisal was made of the rocky intertidal that lies to the east and west of the proposed alignment. The substratum of the rocky intertidal is primarily a pahoehoe (basalt) bench with scattered basalt boulders. On the emergent rocks were seen the grey littorine snail (Littorina pintado) and the prosobranch mollusc, Siphonaria normalis; slightly lower down on the rocks are the black snail or pipipi (Nerita picea). Algae seen include limu hulu'ilio (Giffordia breviarticulata) and the encrusting coralline alga (Porolithon onkodes). Also present are a number of unidentified microalgal species that form a fine "turf". We noted the black rock crab or ama'ama (Grapsus grapsus) on the basalt boulders and the small hermit crabs (Calcinus herbstii and C. elegans) in the shallows.

4.1.5.3 The Biotope of Basalt Rocks and Corals

The biotope of basalt rocks and corals is not in the path of the proposed cable alignment but at the closest point, lies within 80 feet of it. The substratum of this biotope is primarily basalt rock with corals on it. There is a small amount of sand present in this biotope and as the waves pass, the sand roils and must scour the substratum. Much of the basalt is in the form of boulders with a mean diameter of about 2 feet. Many of the corals are found on the boulders up away from the depressions with sand. Common species on the boulders include the coral Pocillopora meandrina, sea urchins, wrasses, surgeon fishes and damselfishes.

No green sea turtles were seen during this survey of Mokapu Beach. There was little algae present that could serve as appropriate forage for green turtles although several sites were seen in the biotope of basalt rocks and corals that could serve as resting sites. We have found no information to suggest that nesting of sea turtles on Mokapu Beach has occurred in historical times.

The biological survey of the proposed cable alignment at Mokapu Beach did not find any rare or unusual species or communities. Another protected species, the humpback whale (Megapteranovaeangliae) was not seen offshore of the study area during the period of our field effort.

Impacts

Potential impacts are summarized below. 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 and Halimeda beds. The cable will have little negative impact to the communities in the biotope of sand and Halimeda beds because the majority of the substratum is sand. It is expected that a cable deployed over a Halimeda bed would probably sink into the substratum between the individual algal fronds and present little impact.

A major consideration in the selection of the route is the presence of sand because deployment through sand offers little chance of negative impact to benthic communities relative to the impact that could occur to benthic communities situated on hard substratum. The proposed cable alignment at Mokapu Beach is through a sand channel to the shoreline. Little impact to surrounding marine communities would result if this proposed route is utilized.

Another concern may be with disturbance to threatened or endangered species. If construction activities are restricted to the period between April through October, the endangered humpback whale (Megaptera novaeangliae) would not be impacted because it is only in Hawaiian waters on a seasonal basis (November through March).

Assuming that deployment of the cable occurs during the period of time that humpback whales are in island waters, it is anticipated that the impacts to whales would be minimal. The deployment of the cable from shallow water (i.e., the 60 foot isobath) to shore should not take longer than one day. In general, this deployment is done by bringing the cable laying ship into about the 60 foot isobath; from this point to shore the cable is buoyed up using floats and small craft are used to maneuver the cable into the appropriate alignment and into shore.

The probable source of local impact to whales would be the production of noise by the cable laying ship and smaller vessels used to bring it ashore. There are variable and conflicting reports as to the impact of vessel traffic on whales. Evidence from the northwest Atlantic and northeast Pacific suggest behavioral changes by whales in response to vessels, but they may show considerable fidelity to specific areas despite vessel traffic (major shipping, trawler activity, etc.; Brodie 1981, Matkin and Matkin 1981, Hall 1982, Mayo 1982). In contrast Jurasz and Jurasz (1980) found a sharp decline in humpback whale numbers in Glacier Bay, Alaska with increases in vessel activity. In a short term study, Bauer (1986) found no correlation between vessel and whale numbers as well as no net movement offshore at Olowalu, Maui in 1983-84. However, a six year study suggested a major offshore movement of mother-calf pods off Maui with increased vessel traffic (Glockner-Ferrari and Ferrari 1985, 1987). This study alone cannot be used to determine whether the observed reductions in sighting around Maui is correlated with vessel traffic; there is no consistent baseline information or comparative studies on humpback whale habitat utilization around Maui which may corroborate the trends reported by Glockner-Ferrari and Ferrari (Tinney 1988).

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 1986). Thus it is probably valid to assume that impact to whales could occur if individuals are within several kilometers of the cable deployment. However as noted above the impacts (here noise) are not expected to last for more than one day, and all activities will be concentrated in a very small area.

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, green turtles moved from an offshore diurnal resting site about one kilometer offshore to a point about 200m 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 construction activity that generates fine particulate material will 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 (long-term) 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 event 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 2200 mt 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.

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 construction activities that would be necessary to protect the cable in shallow water would probably produce little sediment. This statement is supported by the fact that trenching would probably be confined to an area directly adjacent to the shoreline and through it, and would be carried out in a sand substratum. The small scale and anticipated short duration of the project suggest a minimal impact.

High water motion will keep fine particulate and sedimentary material suspended in the water column, reducing the settlement on benthic organisms in shallow water habitats thus assisting in the advection of this material out of these areas (less than 100m in depth) where corals are found.

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 amount of suspended particles (i.e., turbidity) is great enough to reduce light levels, some impact to corals may occur.

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

In addition, through the use of silt curtains at the cable manhole, adverse effects due to turbidity can be minimized by leaving a barrier of sand in place at the water's edge until the day of the cable pull.

4.1.6 Scenic and Visual Resources

Mokapu Beach has a hotel on the south end and the rest of the area is generally void of man-made structures. Views out of the site will remain unchanged, and Haleakala will be visible and views of the ocean from the site will be retained.

Impacts

No adverse impacts are anticipated on the beach since the proposed cable will be located entirely below surface. From there the cable will be routed through duct lines located alongside Wailea Alanui Road until it reaches the intersection of Kilohana Avenue and connects to the nearest existing telephone pole for further routing towards the Central Office (CO) on Halona Street.

For seven to ten days there will be a temporary impact on the coastal views from construction activities. During the construction period, the beach portion of the project site will have construction equipment and a mound of sand from the excavated trench. Following the installation of the duct line, the ground surface will be restored to its original condition. The beach will be returned to its existing condition at the conclusion of the cable installation.

Therefore, after the cable is installed no long-term visual impacts are anticipated.

4.1.7 Historic/Archaeological Resources

There are no known features of historic or archaeological significance in the vicinity of Mokapu Beach (Atlas of Hawaii, 1983, and Archaeological Assessment of the Proposed Fiber Optic Cable Landing at Mokapu Beach, Paeahu Ahupuaa, Honuaula, Maui, 1992 - see Appendix B). Due to the extensive explosives detonated during combat demolition exercises during World War II any visible remains would have been destroyed.

Impacts

No short or long term impacts are expected from the development of the proposed project. However, should any unidentified cultural remains be uncovered during cable installation, work in the immediate area will cease and the appropriate government agencies contacted for further instructions.

4.1.8 Beach Erosion and Sand Transport

Mokapu Beach is crescent-shaped, approximately 800 feet long and 85 feet wide. The inshore bottom is gently sloping and extends into deeper water offshore. There are reefs extending seaward from both the headlands.

Mokapu Beach, as described in 1991 by Makai Ocean Engineering and Sea Engineering, has undergone net erosion over the past 42 years. Between 1949 and 1988 the east end of the beach eroded 40 feet and the west end eroded 85 feet. Mokapu Beach is subject to extensive damage due to severe Kona Storms and the passage of hurricanes to the south. The erosion at Mokapu Beach is not chronic and occurs only during severe storms. The beach is currently undergoing the slow process of recovery.

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 graded materials or concrete for backfill.

4.1.9 Nearshore Conditions

The proposed cable landing site is approximately in the middle of Mokapu Beach. On land, the cable will cross some private property before reaching the public park easement. Selection of the route was determined by two overriding factors:

1. Although the sandy beach is 800 feet long, basalt rock and/or fringing reef extend toward the center of the beach from each headland. As a result, there is only a 300 foot length in the center of the beach where the sand extends continuously seaward.

2. Similarly, there is only one gap in the almost continuous offshore coral reef that parallels the south Maui coastline. At its narrowest, in approximately 120 feet of water, this gap is 1100 feet wide.

Figure 8 shows the location of these features and the proposed route. Orienting the route to avoid the two features described above results in the entire nearshore cable alignment being on a sandy bottom. The sand is medium to fine grained, with a noticeable increase in silt content closer to shore. The sand deposit appears to be thick; there are no protruding rock outcrops or coral formations in the deposit. There are patchy growths of Halimeda, a coralline algae, extending seaward from the 90 foot water depth. Although this growth presents a different biological environment, the underlying bottom is still sand. Fathometer runs along the route centerline indicates that the bottom is flat and probably sandy to at least the 180 foot depth.

The selected route has ideal physical conditions for a cable landing. In addition to the sand bottom, the 50 foot contour is only 1600 feet offshore, which will result in a short cable pull during the landing process. The only disadvantage is the proximity to a fish haven established by the State Department of Land and Natural Resources. The fish haven is located off Keawakapu Beach, in water depth of approximately 90 feet. The closest point of approach of the cable to the fish haven is 660 feet.

4.2 SOCIO-ECONOMIC ENVIRONMENT

4.2.1 Population

Although the population within the Wailea area number 1,124, the population of Maui County as of 1989 was 122,300 and is projected to increase to 206,100 by 2010 (The State of Hawaii Data Book, 1990). This projected population increase of 83,800 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 Wailea are expected.

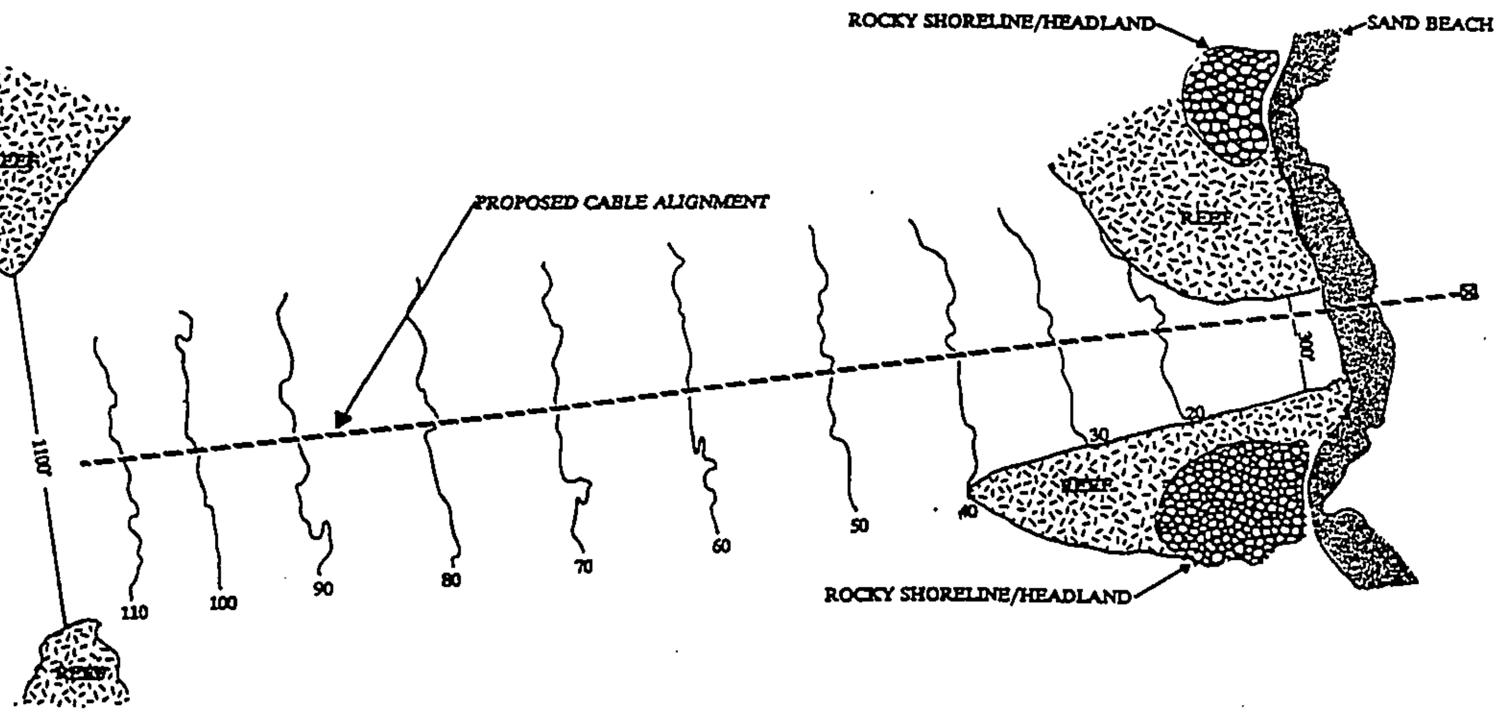

Figure 8
PHYSICAL CHARACTERISTICS OF SELECTED ROUTE

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4.2.2 Surrounding Land Use

The Ten Wailea property occupies the northern end of Mokapu Beach and is privately owned by McCormack Properties. The site is proposed for future condominium development although it is currently vacant except for two storage buildings. The coastal properties south of this site include the Stouffer Wailea Resort. To the north of this site are multi-family and single family homes. Lands mauka of the coastal beach areas are generally developed with single family homes and a golf course.

Impacts

Short term impacts in the form of construction activity for the installation of the duct lines and the laying of the fiber optic cable are anticipated for 7 to 10 days. Following the installation of the duct lines and the installation of the fiber optic cable, the ground will be restored. No long term impacts are expected from the proposed project. The cable route will be subsurface on vacant land and overhead within street right-of-ways and will not adversely impact surrounding uses.

4.3 PUBLIC FACILITIES AND SERVICES

4.3.1 Transportation Facilities

The project site is served by Wailea Alanui Road. The cable will follow an existing subground duct line along Wailea Alanui Road to an existing manhole (No. 100A). The cable will then be pulled through existing underground ducts connecting Manhole 100A to Manhole 75 at Kilohana Avenue. The cables will then be routed overhead onto existing utility poles along Kilohana Avenue and Piilani Highway to the Central Office (CO) at 210 Halona Street.

Impacts

The proposed project is expected to have no major impact on existing traffic. Construction will take seven to ten days during which equipment will be placed along side Wailea Alanui Road. Sufficient space is available so that an adequate thoroughfare can be maintained.

4.3.2 Recreational Facilities

The principal recreational amenity in the vicinity of the project site is Mokapu Beach. The beach is used for swimming, sunbathing, bodysurfing, surfing, snorkeling, and picnicking (see Figure 9).

Impacts

No long term impacts are expected from the development of the proposed project. However, development will temporarily impact land and water recreation uses on the northern part of Mokapu Beach. During construction the northern part of the site will have to be closed to the public for safety reasons. Construction will take seven to ten days. This impact will be short term, lasting only until construction is completed.

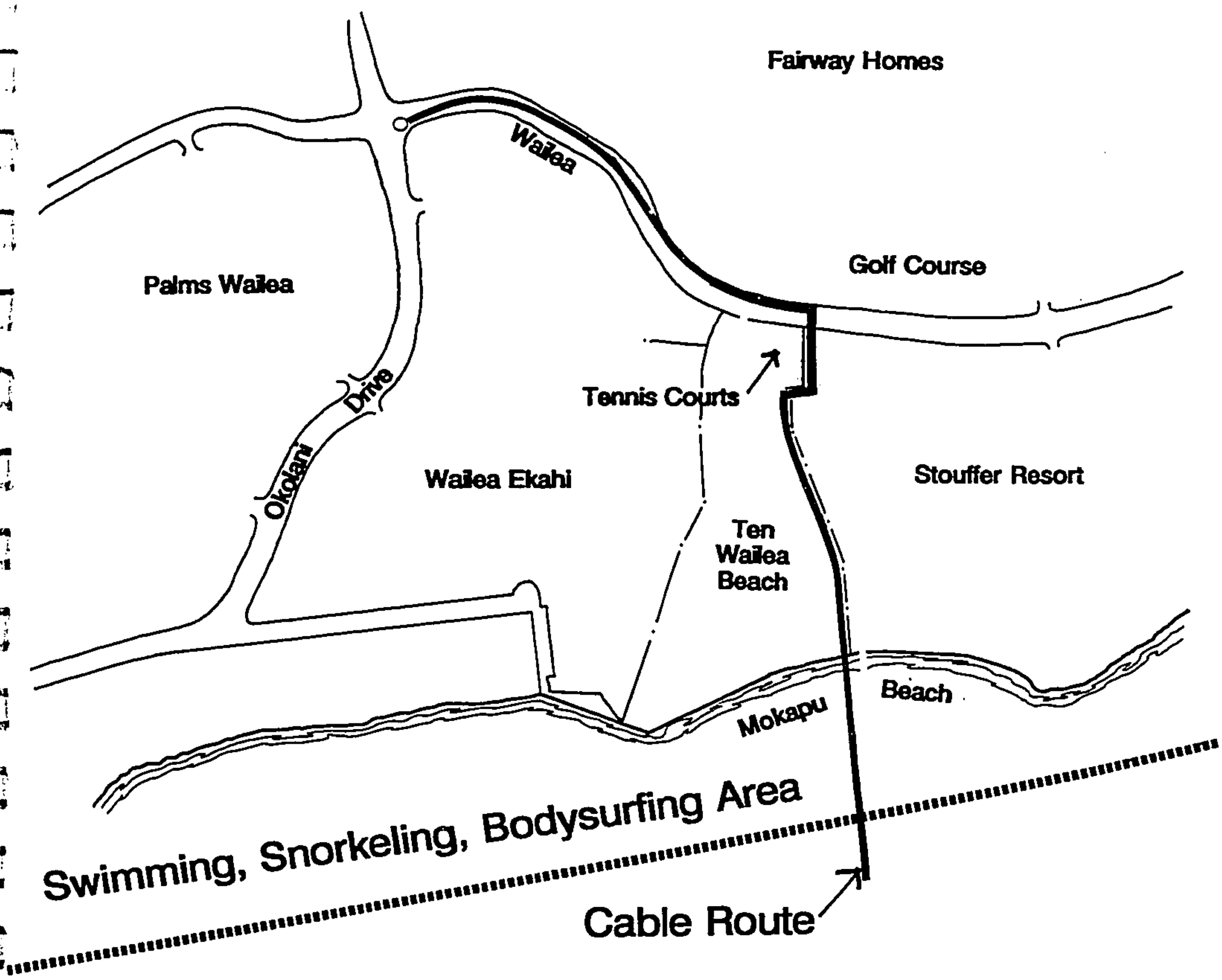

Figure 9
PUBLIC USES

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Not to Scale

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SECTION 5

PROBABLE IMPACTS OF THE PROPOSED PROJECT AND MITIGATING MEASURES

5.1 SHORT-TERM IMPACTS

The short-term adverse impacts that cannot be avoided include noise from construction activity, dust, traffic congestion, aesthetics, restricted access, and siltation of nearshore waters. The specific impacts and mitigating measures proposed are described below.

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

Boats (tugs and a small craft) that are used during the construction period will also be a source of noise. The impact of noise from these vessels cannot be mitigated. The noise impact will be temporary in nature and will not continue beyond the construction and cable laying period.

5.1.2 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 factor affecting air quality in the area is vehicular traffic.

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.

5.1.3 Water Quality

Nearshore waters are rated Class "A" by the State Department of Health. Shallow waters experience considerable turbidity even when surf is minimal. 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.

It is anticipated that the nearshore waters may be clouded during the trench excavation and backfilling operations. Silt screens to lessen turbidity effects will be erected to minimize this impact. Adverse effects due to turbidity can be minimized by leaving a barrier of sand in place at the water's edge until the day of the cable pull. Turbidity is typically only generated on one or two days on a cable pull into a sandy beach.

5.2 LONG-TERM IMPACTS

There are no long-term adverse impacts that can be associated with this proposed action. As much as practicable, the project site will be restored to existing conditions after completion of the cable laying activity.

SECTION 6

RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS AND POLICIES

6.1 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 providing information services in the Pacific. The proposed project will continue the 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 and use of existing and proposed facilities and by promoting installation of new telecommunications cables.

6.2 STATE FUNCTIONAL PLANS

The Hawaii State Functional Plan (Chapter 226) provides a management program that allows judicious use of the State's natural resources to improve current conditions and attend to various societal issues and trends. The proposed project is generally consistent with the

State Functional Plans. The following objectives of the State Functional Plans are relevant to the proposed project:

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

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.

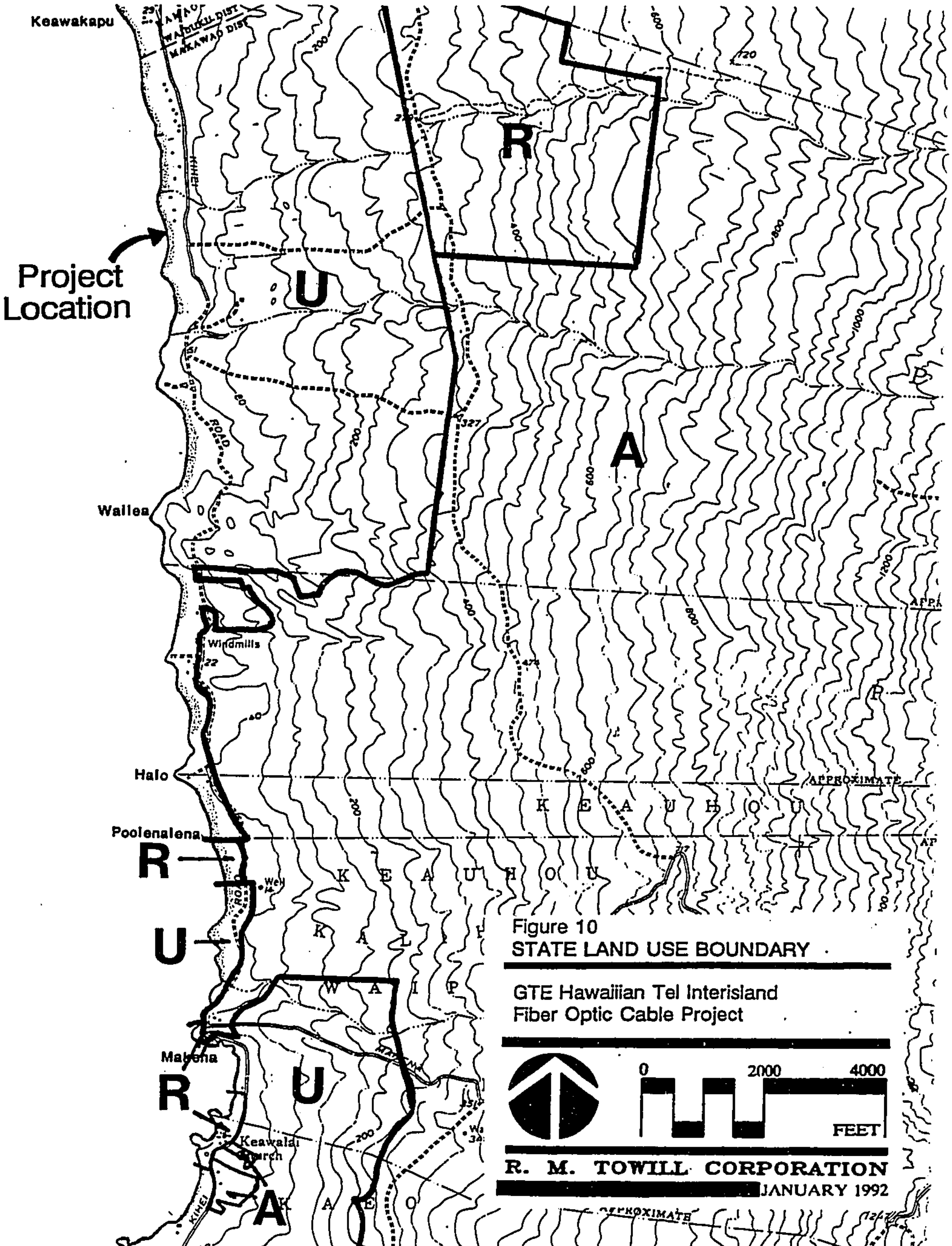
Education Implementing Action(3)(e):
The proposed project enables school library media centers to effectively manage and provide access to information and knowledge through telecommunications.

6.3 STATE LAND USE LAW

The State of Hawaii Land Use District classifications designate Mokapu Beach as "Urban", and the surrounding areas as "Rural", "Urban" and "Agricultural" (see Figure 10). The "Urban" classification is defined as "areas characterized by city-like concentrations of people, structures, streets and other related uses." "The purpose of the residential district is to allow for a range of residential densities." "The purpose of the agricultural districts 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.

6.4 COUNTY ZONING

Zoning for the Mokapu Beach area is hotel (H-2). The areas surrounding Mokapu Beach are zoned apartment (A-1), open space or golf course (O,) resort commercial (B-R), residential (R-3 and R-1)), and hotel (H-1) (see Figure 11).


Keawakapu
Project Location
Wailea
Windmills
Halo
Poolenalena
Makena
Keawalai Church
R
U
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K E A U H O U
APPROXIMATE
Figure 10
STATE LAND USE BOUNDARY
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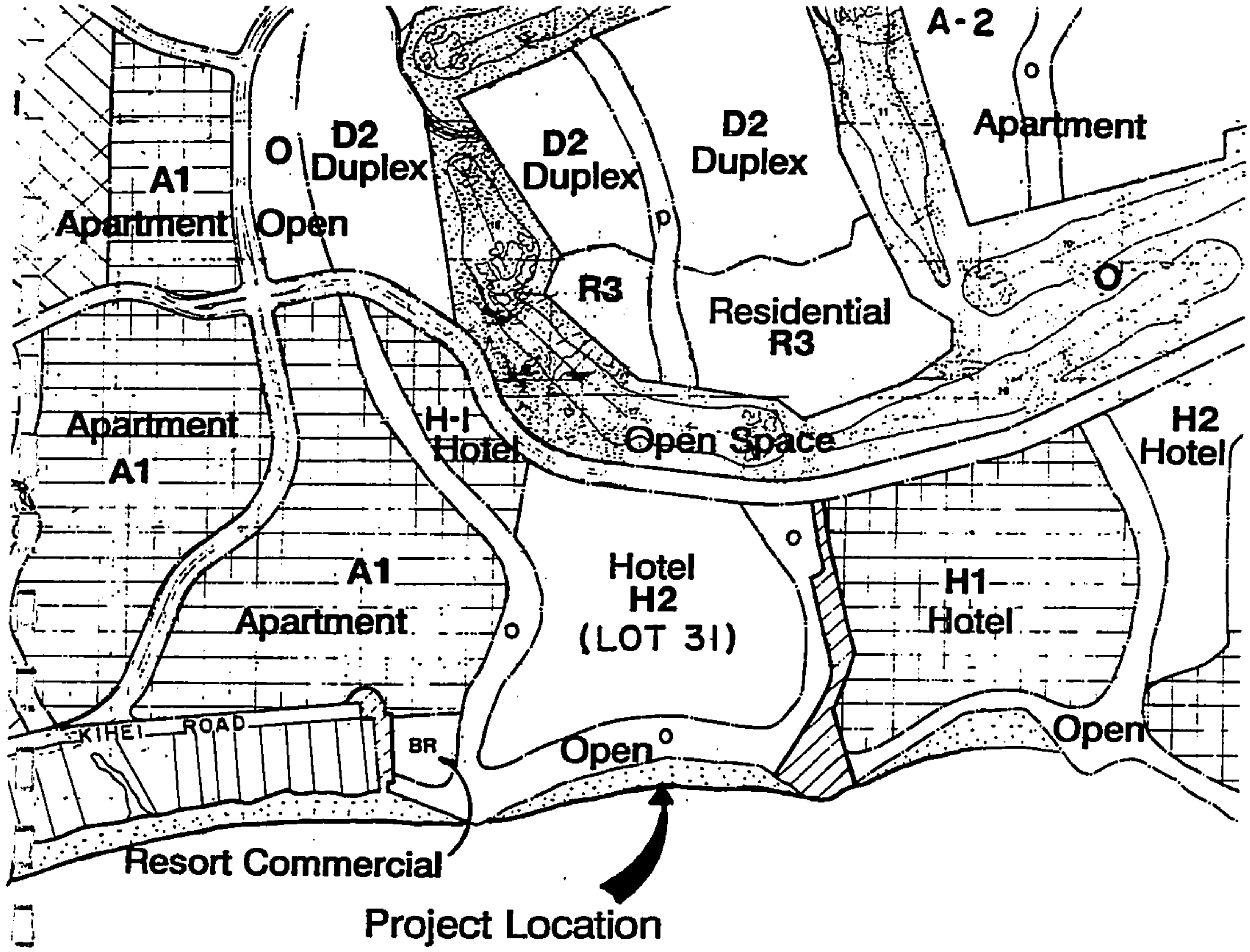

Figure 11
EXISTING ZONING MAP

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A zoning change will not be required for development of the proposed project.

6.5 COUNTY OF MAUI GENERAL PLAN

The General Plan of the County of Maui provides a statement of long range social, economic, environmental, and design objectives for the Island of Oahu and a statement of policies necessary to meet these objectives. A specific objective of the General Plan relating to the proposed project is to provide public utilities which will meet community needs. The proposed project is generally in conformance with the goals and objectives of the County General Plan.

6.6 KIHEI-MAKENA COMMUNITY PLAN

The Kihei-Makena Community Plan was adopted on June 24, 1980 as Ordinance No. 1052, mandated by the Maui County General Plan and Charter of Maui County (1977).

The Community Plan provides a scheme for implementing objectives and policies, as related to development within the specific Kihei-Makena region until the year 2000. The plan outlines the sequence, standards, and patterns of future development.

The Community Plan does not specifically address the need for additional telecommunications, except indirectly in a recommendation concerning population. The recommendation of the Community Plan is to "coordinate all future developments with provisions for adequate services to ensure that infrastructure development and public services keep pace with defacto (total) population demands".

6.7 COASTAL ZONE MANAGEMENT, SMA RULES AND REGULATIONS

The County of Maui has designated the shoreline and certain inland areas of Maui 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 County of Maui (see Figure 12). A SMA permit will be necessary for development of the

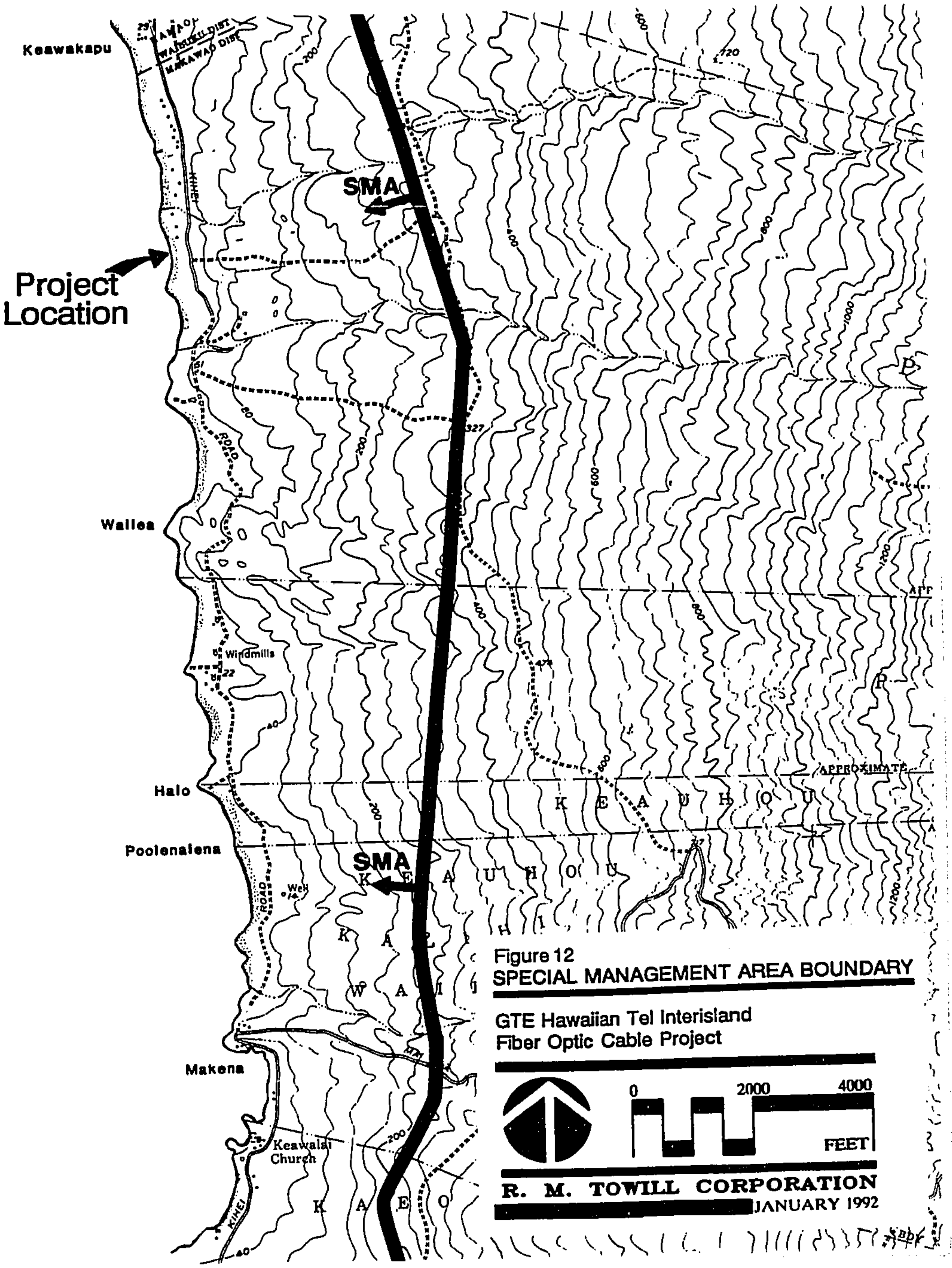

Figure 12
SPECIAL MANAGEMENT AREA BOUNDARY

GTE Hawaiian Tel Interisland
Fiber Optic Cable Project

R. M. TOWILL CORPORATION
JANUARY 1992

proposed project. Review of the project under SMA criteria will be conducted during the processing of the SMA permit with the Department of Planning, County of Maui.

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 County of Maui submitted for approval by the County of Maui.

SECTION 7

ALTERNATIVES TO THE PROPOSED ACTION

7.1 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 Kihei-Makena Community Plan's objective of providing adequate services to ensure that infrastructure development and public services keep pace with defacto (total) population demands.

7.2 ALTERNATIVE SITES

The area initially considered for the Maui cable landing included the consideration of two landing sites. One in west Maui in the Lahaina area with a second landing site in the Kihei-Wailea area. The purpose of the two sites was for the linking of Maui to Oahu via Lahaina, and the linking of Maui to Hawaii via Kihei. Based on the distance between Maui and Oahu, it was decided to provide for a single landing site on Maui in the Kihei-Wailea area. The alternative landing sites investigated included the following:

7.2.1 Kamaole Beach Parks I, II, & III

Disadvantages at this location include the lack of offshore sand deposits and the finding of a coral belt that parallels the beach. The fringing reef is approximately 3500 feet wide and is environmentally sensitive.

7.2.2 Keawakapu Beach

This beach provide a potential cable route, however, the same coral reef that fronts the Kamaole Beaches exist here. Further, recreational use and the difficulty of heavy equipment access to that part of the beach precluded further consideration of this site.

7.2.3 Ulua Beach Park

This beach is further south of the proposed cable landing site. The coral reef that starts in Kihei continues at this point. Access to the beach is limited and is used by local residents as well as visitors. For these reasons, this beach was eliminated from further consideration.

7.3 ALTERNATIVE TECHNOLOGY

The following describes the alternatives to fiber optic cable technology:

7.3.1 Microwave Radio Systems

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

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

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

7.3.2 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.

7.4 RECOMMENDED ACTION

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

SECTION 8

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 9

IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES BY THE PROPOSED ACTION

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

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 10

NECESSARY PERMITS AND APPROVALS

10.1 STATE

Department of Land and Natural Resources

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

10.2 COUNTY OF MAUI

Department of Planning

Shoreline Management Area Permit

Shoreline Setback Variance

10.3 U.S. ARMY COE

Corps of Engineers Section 404/Section 10

10.4 PRIVATE

Access Easement

SECTION 11

CONSULTED AGENCIES AND PARTICIPANTS IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

11.1 FEDERAL AGENCIES

- U.S. Army Corps of Engineers
- U.S. Coast Guard

11.2 STATE AGENCIES

- Department of Land and Natural Resources
- Office of the Chairperson
  - Aquatic Division
  - Land Management Division
  - Conservation and Environmental Affairs
- Department of Transportation
- Department of Health
- Department of Business, Economic Development, & Tourism
- Office of State Planning
  - Office of Coastal Zone Management

11.3 COUNTY OF MAUI

- Department of Public Works
- Department of Planning
- Mayor's Office
- Managing Director
- Councilman Herbert Kihune

11.4 PRIVATE

- Wailea Resort Company
- Stouffers Wailea Beach Hotel
- McCormack Properties
- Kihei Community Association
- Makena Homeowners Association

SECTION 12

COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813
Telephone: 587-3822

'92 SEP -2 P1:50

September 1, 1992

Mr. Brian Miskae
Planning Director
County of Maui Planning Department
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Miskae:

Subject: Final Environmental Assessment (92/EA-07), Applications for Special Management Area Permit (92/SM1-17) and Shoreline Setback Variance (92/SSV-03); GTE Hawaiian Tel Interisland Fiber Optic Cable System; TMK 2-1-08: 62

We have reviewed the subject applications and Final Environmental Assessment transmitted by your memorandum dated August 17, 1992 and confirm that the subject parcel, TMK 2-1-08: 62, is within the State Land Use Urban District.

It is our understanding that although the entire parcel contains 10.57 acres, the proposed project will involve a 10,600 square foot portion of the parcel.

Additionally, on page 42 of the Final Environmental Assessment, under Section 6.3, the surrounding area as designated in Figure 10 is the State Land Use Rural District and not "Residential" as stated.

We have no further comments to offer at this time.

Thank you for the opportunity to provide comments on this matter. If you should have any questions, please feel free to contact me or Leo Asuncion at 587-3822.

Sincerely,

ESTHER UEDA
Executive Officer

EU:th

EXHIBIT 7

R. M. TOWILL CORPORATION

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

December 14, 1992

Esther Ueda
Executive Officer
Department of Business, Economic Development, and Tourism
Land Use Commission
Room 104, Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Dear Ms. Ueda:

SUBJECT: Special Management Area Permit and Shoreline Setback Variance Environmental Assessment for Mokapu Beach, Maui, TMK: 2-1-08: 62

Thank you for your letter dated September 1, 1992, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landing at Mokapu Beach, Maui. We appreciated your review of this document.

We have noted your comment concerning the "rural" state land use designation for the surrounding area identified in Figure 10 of the Environmental Assessment.

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

Very truly yours,

Brian Takeda
Senior Planner

Enclosures
cc Patrick Mau, GTE Hawaiian Tel
CK RMTC

LINDA CROCKETT LINGLE
Mayor
GEORGE N. KAYA
Director
CHARLES JENCKS
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
LAND USE AND CODES ADMINISTRATION
250 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

AARON SHINMOTO, P.E.
Land Use and Codes Administration
E. MILLER
Wastewater Reclamation Division
RALPH NAGAMINE, P.E.
Engineering Division
BRIAN HASHIRO, P.E.
Solid Waste Division
MELVIN HIPOLITO
Highways Division

'92 SEP -9 A11:56
RECEIVED

September 8, 1992

MEMO TO: Brian Miskae, Planning Director

FROM: George N. Kaya, Director of Public Works

SUBJECT: GTE Hawaiian Telephone Requesting a GTE Fiber Optic Cable Landing at Mokapu Beach, Wailea, TMK: 2-1-08:62 92/EA-07, 92/SM1-17, 92/SSV-03

We have reviewed the above request and offer the following comment:

1. That permits for work within the County right-of-way and grading will be required. All our other concerns can be addressed when the above permits are processed through the County.

AS/sn

cc: Engineering Division

EXHIBIT 12

R. M. TOWILL CORPORATION

400 Waiakamilo Rd. #411 Honolulu, HI 96817-4941 (808) 848-1133 Fax (808) 848-1937

December 14, 1992

George Kaya
Director of Public Works
County of Maui
Department of Public Works
Land Use and Codes Administration
250 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Kaya:

SUBJECT: Special Management Area Permit and Shoreline Setback Variance Environmental Assessment for Mokapu Beach, Maui, TMK: 2-1-08: 62

Thank you for your memorandum dated September 8, 1992, to Mr. Brian Miskae, relating to the proposed GTE Hawaiian Tel Fiber Optic Cable landing at Mokapu Beach, Maui. We appreciated your review of this document.

We have noted your comment concerning our need to file permits for grading and work within the County right-of-way. We understand any concerns of the Department of Public Works may be addressed subsequent to our filing of these permits with you.

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

Very truly yours,

Brian Takeda
Senior Planner

Enclosures
cc Patrick Mau, GTE Hawaiian Tel
CK RMTC

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

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 PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

'92 SEP 18 P12:42

REF:OCEA:SKK

SEP 17 1992

FILE NO.: 93-090
DOC. ID.: 1392

The Honorable Brian Miskae, Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Miskae:

SUBJECT: I.D. No. 92/EA-07; 92/SM1-17; 92/SSV-03
TMK: 2-1-8: 062
Project Name: GTE Fiber Optic Cable Landing
Applicant: GTE Hawaiian Telephone

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the materials you submitted and have no comments.

Our Division of Aquatic Resources indicates that the subject document mentions 4 conduits planned of which 2 conduits would be employed for use and the other two remaining for future use. This means that subsequent laying of additional cables will require retrenching and covering of the alignment. 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 should be considered for minimizing environmental damage. Consolidating cable easements now and in the future would minimize intrusion into Hawaii's nearshore environment.

EXHIBIT 8

The Historic Preservation Division notes that Page 12 of the EA (4.1.8) states that known historic sites are not present in the vicinity of Hokapu Beach. Although this is a correct statement, this document should have referred to an archaeological report that was specifically prepared for this project instead of citing the Atlas of Hawaii. A copy of the report (Hammatt and Folk 1992. Archaeological Assessment of the Proposed Fiber Optic Cable Landing at Hokapu Beach, Paeahu Ahupua'a, Honua'ula, Maui) was submitted to our office for review and comments. We concurred with the finding that no historic sites are present and that the proposed cable landing will have "no effect" on significant historic sites.

For this EA to be an accurate document, the section on Historic/Archaeological Resources (4.1.8) should be revised with a reference to the archaeology report. This report should also be included as an appendix.

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

Very truly yours,

WILLIAM W. PATY

cc: DAR, HPD

R. M. TOWILL CORPORATION

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

December 14, 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 Permit and Shoreline Setback Variance Environmental Assessment for Mokapu Beach, Maui, TMK: 2-1-08: 62

This is in response to your letter to the County of Maui, Department of Planning, dated September 17, 1992. Our reply is based on our previous response to you concerning the SMA/SSV for Kahe Point Beach Park (TMK: 9-2-3: 15) and Sandy Beach Park (TMK: 3-9-12: 02), forwarded on July 30, 1992 (attached).

We note you have indicated you have no comments, but provide information pertinent to the following:

LAYING OF CABLES FOR PRESENT AND FUTURE USE
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 site fiber optic cables as close to central offices as possible. 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). Each of

the proposed landing sites, including the Mokapu Beach landing, were largely based on this important consideration.

HISTORIC PRESERVATION
Thank you for confirming the "no effect" determination for the Mokapu Beach landing. As you have requested we have incorporated a reference to the archaeological report in Section 4.1.8 of the Environmental Assessment, concerning historic/archaeological resources.

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

Enclosures
cc Patrick Mau, GTE Hawaiian Tel
CK RMTC

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

Brian Takeda
Senior Planner

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

Wailea

Wailea Resort Company, Ltd.

161 Wailea Ike Place
Wailea, Maui, Kihei, Hawaii 96753-9599
(808) 879-4461 • FAX (808) 874-6295

November 5, 1992

Planning Department
County of Maui
250 S. High Street
Wailuku, HI 96793

Attention: Ms. Elizabeth Anderson

Subject: GTE Hawaiian Tel Interisland Fiber Optic Cable System Landing Site
Mokapu Beach, Wailea, Maui
TMK: 2-1-08:62

Dear Ms. Anderson:

We appreciate this opportunity to comment on the Draft Environmental Assessment prepared for the subject project. Upon review of this document, we have some concerns over the land activities that are being proposed.

The document is unclear whether new duct lines will be needed for this project. Upon discussion with the project consultants, R.M. Towill Corporation, they stated that existing duct lines would be used. We have been in receipt of the preliminary plans from the consultants which seems like new lines are to be trenched 26 inches from the curbing on the mauka side of Wailea Alanui and is within the Wailea Blue Golf Course. We need to receive some clarification as to what is actually being proposed.

If trenching occurs within the Blue Golf Course, we would like the applicant or consultant to address the potential impacts on golf play during the construction activities in this area. We would also like to inform the applicant and the consultant that they may encounter some of our irrigation lines during trenching in this area and request that the applicant or consultant address the issue of potential damage to existing utilities on our property.

We understand that trenching across Wailea Alanui will be necessary. We would like to request that the applicant reconsider the tentative time schedule for the land activities. It would be more favorable to schedule the construction at a time where the least amount of disruption takes place. As currently stated in the EA, a tentative schedule has been set for February and March for the land construction activities. As Wailea is a destination resort,

EXHIBIT 9

we would like to state that the months of December through March are the busiest months of the year. It would be more beneficial to have this phase of construction scheduled between June and August, whereby there is less traffic and disruptions and it is the slower months for visitors.

The potential noise problem is an issue that we feel may need to be addressed more thoroughly, especially if there is a potential for the use of noise generating equipment during the night.

Thank you for this opportunity to comment. Should you have any questions regarding this subject, please do not hesitate to contact me at 875-0105.

Very truly yours,

Clyde Murashige
Clyde Murashige
Vice President

CM:mn

Wailea

Wailea Resort Company, Ltd.

161 Wailea Ike Place
Wailea, Maui, Kihei, Hawaii 96753-9699
(808) 879-4461 • FAX (808) 874-6896

November 23, 1992

Planning Commission
c/o Ms. Elizabeth Anderson
Planning Department
County of Maui
250 S. High Street
Wailuku, HI 96793

Subject: GTE Hawaiian Tel Interisland Fiber Optic Cable System Landing Site
Mokapu Beach, Wailea, Maui
TMK: 2-1-08:62

Dear Planning Commissioners:

On behalf of Wailea Resort Company, Ltd. (WRCL) and Wailea Beach Hotel Company, Ltd. (owners of Stouffer Wailea Beach Resort), we are pleased to be given the opportunity to comment on the subject SMA request.

We would like to state that we are in general support of this project and the benefits that technology has to offer our resort and the community. However, as with any construction project, we do have some concerns:

1 • Traffic in the vicinity of Wailea Alanui and Okolani Drive intersection and trenching across (mauka-makai) Wailea Alanui Drive has the potential of being a problem. We would like to request that the construction generated traffic be minimized as much as possible.

2 • Considering that Wailea is a destination area for tourist and part-time residents, notably during the winter season, the beaches will likely be quite busy. Vacationers at the Stouffer Wailea Beach Resort (SWBR) will be impacted by the construction activity on Mokapu beach which fronts SWBR as well as the activity going through McCormack's property which is along the northern boundary of SWBR.

3 • Trenching along the mauka side of the curbing along Wailea Alanui is a concern to WRCL as construction activity in this area will impact golf play on the Wailea Blue Golf Course. We are requesting that the applicant consult with WRCL as to scheduling

10

and the magnitude of the impact that construction will have in this area.

Although some impact will be unavoidable, perhaps the best solution would be to minimize the impact(s) as much as practicable. We would like to request that the applicant consider scheduling their construction activity during a time when the least disruption will take place. Typically the visitor trend has a peak period of December through March and a slack period from June through August.

Thank you for your consideration. If you have any further questions or wish additional clarification, please do not hesitate to call my office.

Very truly yours,

Clyde Murashige

CM:mn

cc: Barry Rand
Clark Champion
Jacques Van Seters, SWBR

GTE Hawaiian Tel

Beyond the call

GTE Hawaiian Telephone Company Incorporated
P O Box 2700 · Honolulu, HI 96841 · (808) 546-4511

December 8, 1992

Mr. Clyde Murashige, Vice President
Wailea Resort Company, Ltd
161 Wailea Iki Place
Wailea, Maui, Hawaii 96753-9599

Dear Mr. Murashige,

Subject: GTE Hawaiian Tel Interisland Fiber Optic Cable System
Landing Site, Mokapu Beach, Wailea, Maui, TMK: 2-1-08:62

We are in receipt of two letters dated November 5 and November 23 forwarded to us from the Maui County Planning Department regarding the subject project. We would like to offer the following responses to your inquiry.

1. Location of Ductlines

We apologize that the environmental assessment did not clearly delineate the location of the ductlines. The ductlines will be placed on the mauka side of Wailea Alanui, between the curb and the street trees. We do not anticipate that the construction work will affect golf play.

2. Utility Locations

We will coordinate the construction work with your office and will put our contractors on notice that there is the potential for unearthing utility lines.

3. Project Schedule

Because of the concerns raised regarding Wailea being a resort destination, we will schedule the construction activities to take place during the summer months. If we find that we cannot meet your request, we will coordinate our activities closely with your office.

Noise Impact

We do not anticipate the need for work at night. If night work required, we will confine the work to early evening hours.

Traffic Impacts

All efforts will be taken to minimize traffic disruptions during construction. At the maximum, a single lane may be closed to accommodate construction equipment.

Impact on Stouffer Wailea Beach Resort

For the most part, the visitors at the Stouffer Wailea Beach Resort (SWBR) should be minimally impacted as most work will be on the Wailea 10 property. During the cable laying activity, however, access across the beach will be closed for *approximately two days. This closure is necessary to ensure* public safety. As the installation draws closer and more definite, *we will coordinate with the SWBR to advise them of* the beach closure.

Thank you for your comments. We will forward to your office our final construction plans as they become available. Should you have questions, please call me or Pat Mau (Exchange Planning) at 546-2378.

Sincerely,

Larry Hartshorn

Larry Hartshorn
Manager - Exchange Planning

cc: County of Maui
R. M. Towill Corporation

REFERENCES

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9. Hawaii State Plan, Chapter 226

10. The State of Hawaii Data Book 1990: A Statistical Abstract, Department of Planning Economic Development, State of Hawaii, 1990.

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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

Prepared For:

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

Prepared By:

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

AND

Environmental Assessment Co.
1804 Paula Drive
Honolulu, Hawaii 96816

February 1992

91-85

CORRECTION

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

GTE Hawaiian Tel
Interisland Fiber Optic Cable System

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TABLE OF CONTENTS

I. INTRODUCTION

GENERAL

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

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

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

ROUTE SELECTION PROCESS

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

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

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

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

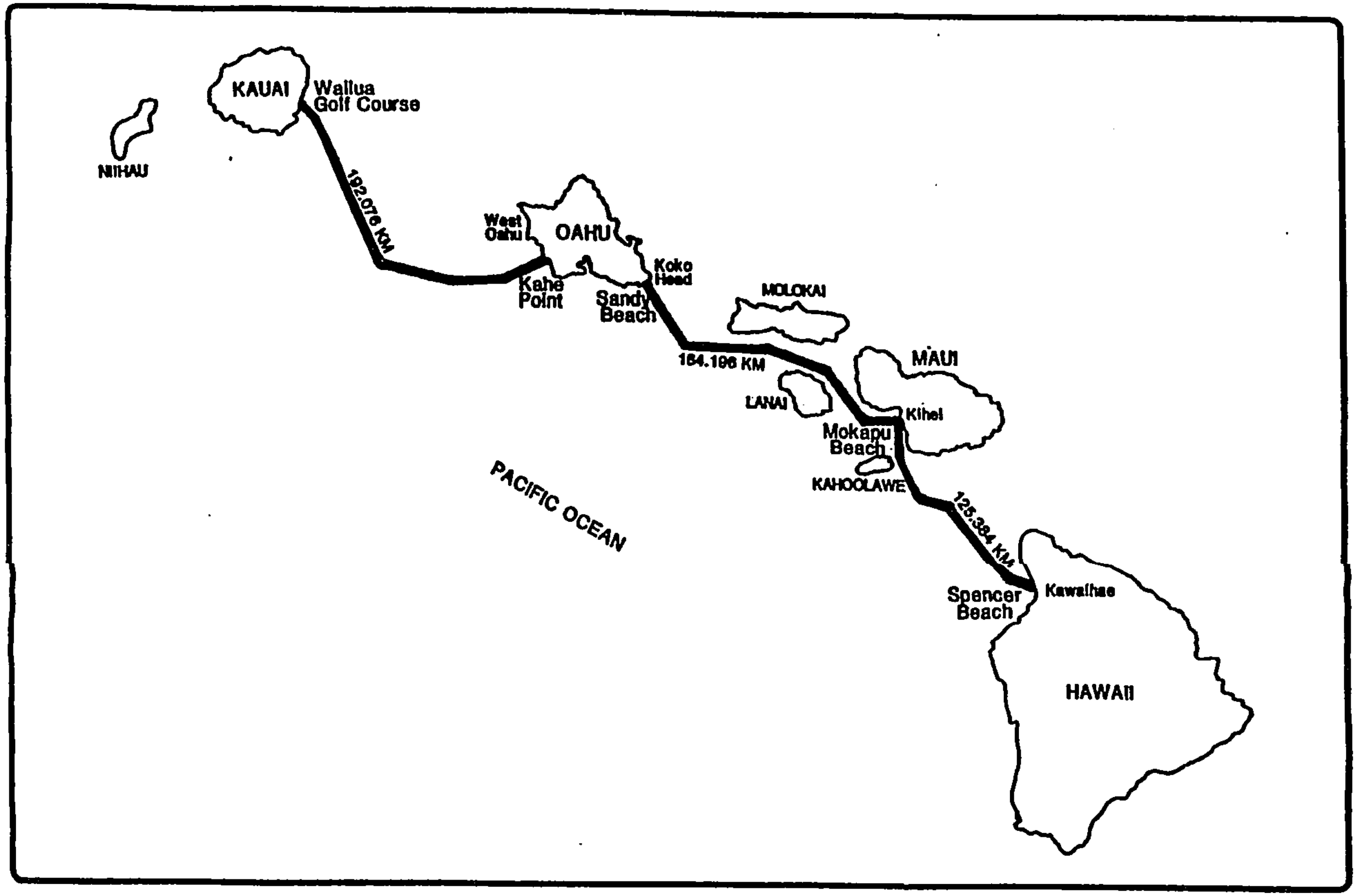


FIGURE I-1. SUMMARY OF RECOMMENDED GTE HAWAIIAN TEL FIBER OPTIC LANDING SITES – STATE OF HAWAII characteristics and uses. A one day field reconnaissance was then conducted in each sector to select three potential landing sites in each sector. If no suitable sites were found within the sector limits,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

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.

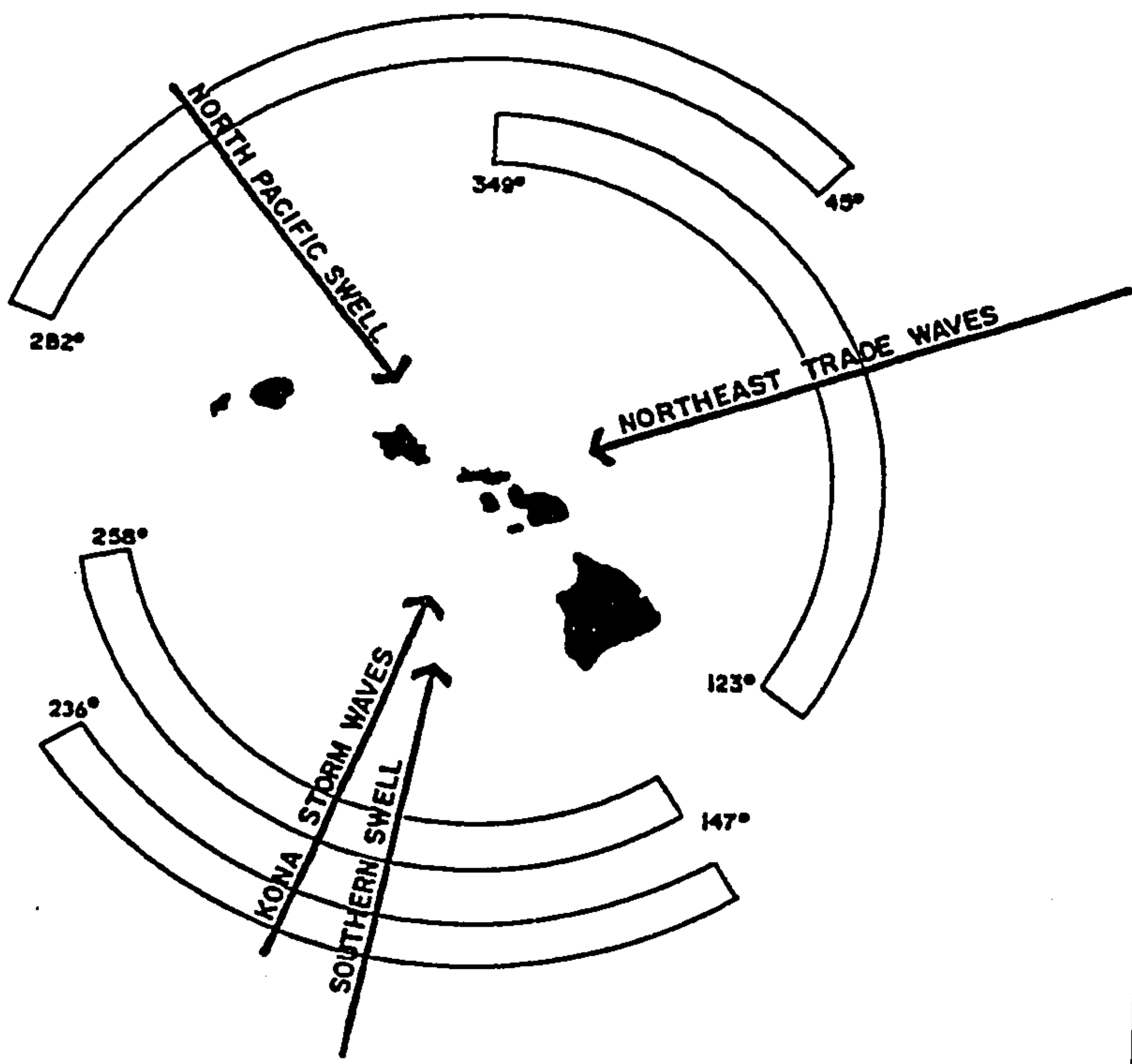


FIGURE II-1.
GENERALIZED WAVE TYPES
(Adapted From The Atlas of Hawaii)

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. Kauai.
The report Hurricanes in Hawaii (Haraguchi, 1984), prepared for the U.S. Army Corps of Engineers presents hypothetical model hurricanes for the Hawaiian Islands. The model Hawaiian Hurricane is defined as the probable hurricane that will strike the Hawaiian Islands in the future. The characteristics of the model hurricane are based on the characteristics of hurricanes Dot and Iwa. The predicted wave height and period for the model hurricane are calculated to be 31 feet and 12.0 seconds.

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

TIDES

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

COASTAL CURRENTS

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

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

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

TSUNAMIS

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

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

III. METHODOLOGY FOR MARINE BIOLOGICAL SURVEYS

GENERAL

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

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

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

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

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

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

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

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

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

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

IV. MOKAPU BEACH, MAUI

ALTERNATIVES CONSIDERED

The coastal sector investigated for the Maui cable landing extended from the old Kihei Pier to Ulua Beach, a distance of approximately 6.0 miles. Much of the shoreline in the northern half of the sector is sandy beach, with interspersed rocky outcrops. Significant erosion has occurred along this coastline, and shore protection structures are common. The two mile length at the south end of the sector consists of crescent shaped sand beaches bounded by rocky headlands. The sector is shown in Figure IV-1.

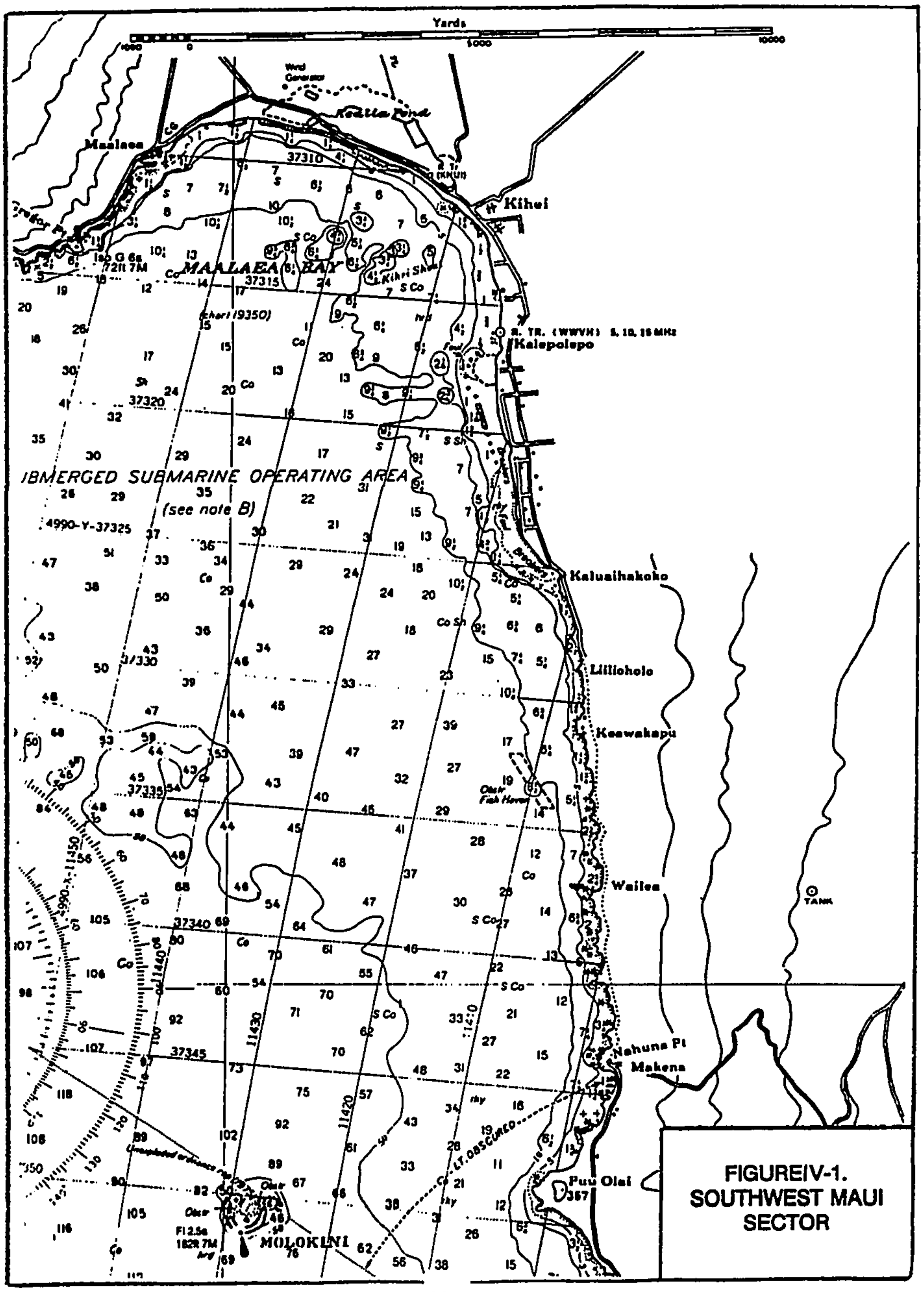
In the Kihei area, the 60-foot depth contour is located approximately 9000 feet offshore. This distance decreases in the southern part of the sector, and the 60 foot depth contour is only is only 2000 feet offshore in the Wailea area.

Specific sites investigated during the initial reconnaissance included Kihei Memorial Park, The three Kamaole Beach Parks, Keawakapu Beach and Mokapu Beach. The sector initially extended only to Keawakapu Beach, but when a suitable site could not be found in the area, the sector was extended south to Ulua Beach.

Most of this coastline has similar bottom characteristics, with the variation between sites primarily due to the width of the various zones. Most sites typically have sand deposits extending from the shoreline out to a water depth of 30 to 70 feet. Seaward of the sand deposit, a very irregular rock and coral bottom typically drops off slowly to the 90 foot water depth. In general, there is extensive coral coverage in this zone. The coral band terminates at a near vertical ledge which drops to the 150 foot depth. This configuration was noted all along this coast, so the search for a suitable landing site concentrated on locating a sandy channel through the coral band, and avoiding the vertical ledge. In general, conditions for a cable landing were worst at the north end of the sector, and improved gradually with distance to the south.
Specific sites considered but not selected for a landing site are discussed below.

1. <u>Kihei Memorial Park</u>

This was an area of interest because the aerial photographs showed extensive offshore sand deposits. However, the sand extends out only to about the 45 to 50 foot depth. The sand then gives way to rock and coral bottom, with some of the coral mounds rising to within 30 feet of the surface. Vertical relief is on the order of 10 to 12 feet. The coral band is several thousand feet wide, with water depth slowly increasing with distance seaward. The offshore limit of the coral band is in approximately 90 feet of water, where a steep ledge drops to the 150 foot depth. Disadvantages of this site include the steep ledge, the wide band of coral that would have to be crossed, the distance to the 60 foot contour, and the extensive use of the old pier site as an anchorage for recreational and charter boats.



FIGUREIV-1.
SOUTHWEST MAUI
SECTOR

2. Kalama Beach Park

The shoreline at Kalama Beach Park has been subject to severe erosion, and is now protected by a massive rock revetment. Unlike the other areas along this sector, there is no inshore band of sand, and the revetment gives way to a rock and coral bottom. The top of the ledge (90 foot water depth, approximately 6500 feet from shore) defines the seaward boundary of the coral zone. Disadvantages of this site include the ledge, the wide band of coral, the lack of any significant inshore sand deposits and the onshore revetment.

3. Kamaole Beach Parks

The Kamaole Beach Parks are three small pocket beaches, separated by rock headlands. Kamaole I is 1800 feet long, Kamaole II is 1200 feet long, and Kamaole III is 900 feet long. The beaches are directly exposed to wave approach from the south, and are subject to severe erosion during Kona storms and hurricanes. At Kamaole II, there have been instances where all the sand was scoured from the beach by severe Kona storms. Kamaole III has extensive outcroppings of beachrock at the water's edge. The bottom off the beaches is sand to the 30 foot depth, with a 2000 to 3000 foot wide band of coral seaward of the sand. The coral coverage is extensive, with high vertical relief. The coral band terminates at a ledge at the 50 foot depth. The ledge drops almost vertically to the 90 foot depth. Disadvantages of this site include the ledge, the coral band, and the potential instability of the shoreline sand during Kona storms.

4. Keawakapu Beach

Off Keawakapu, the sand bottom extends from the shoreline to the 70 foot water depth. Seaward of the sand, a coral ridge rises to the 40 foot depth before giving way to a steep offshore slope. Private homes line most of the beach, and the most likely cable landing site would be at the east end, at Keawakapu Beach Park. There is a pronounced gully in this area, and it appears likely that the landing site would be subject to severe flooding and localized beach erosion during periods of heavy rainfall. Offshore, in water depths varying from 70 to 110 feet, there is an artificial fish haven. The haven consists of old car bodies and concrete blocks placed by the Department of Land and Natural Resources. The designated area as shown on nautical charts is approximately 3,300 feet long by 600 feet wide. The location of the fish haven can be seen on Figure V-1. Disadvantages of this area include the potentially unstable shoreline, the coral ridge, and the fish haven which lies across any cable route through this area.

5. Ulua Beach

Mokapu Beach, described below, was selected as the landing site due to favorable offshore conditions. Ulua Beach was investigated to determine how far to the south the favorable conditions extended, in order to have the widest range of landing options. The sand channel through the coral band is only 1100 feet wide off Mokapu Beach, and conditions off Ulua Beach are typical of the areas described above. A wide band of rock and coral lies seaward of the nearshore sand deposit, and terminates in a steep ledge at 90 feet. The rocky headland and associated reef between Mokapu Beach and Ulua Beach prevents the cable from being routed at an angle through the sand channel to make landfall on Ulua Beach.

DESCRIPTION OF THE SELECTED ROUTE

General Description

Mokapu Beach is a crescent-shaped, wide, calcareous sand beach bounded by rocky headlands. The beach is approximately 800 feet long, and 85 feet wide. The inshore bottom is sandy and gently sloping, with the sand extending to deeper water offshore. There is no fringing reef directly off the beach, but there are reefs extending seaward from both the headlands.

Shoreline History

Mokapu Beach has undergone net erosion over the past 42 years. This beach was included in a statewide aerial photographic analysis conducted by Makai Ocean Engineering and Sea Engineering, Inc.(1991). The study results indicate that between 1949 and 1988, the east end of the beach eroded 40 feet and the west end eroded 85 feet. This coastal sector is subject to extensive damage due to severe Kona storms and the passage of hurricanes to the south. For example, at Keawakapu Beach, located just east of Mokapu Beach, a 1959 Kona storm scoured all sand from the beach, leaving only exposed beachrock. Additional damage was caused by storms in the winter of 1962-1963, by a severe Kona storm in January 1980, and by Hurricane Iwa in 1982. The erosion at Mokapu Beach is not chronic, and apparently occurs only during the severe storms. The beach is currently undergoing the slow process of recovery, but as a very general approximation, the beach seems to rebuild more slowly than others in this sector.

Existing Usage

Mokapu Beach is a popular beach for swimming, snorkeling, SCUBA diving, bodysurfing and occasionally board surfing. At the east end, a landscaped minipark includes a paved parking lot and a public access to the shoreline. The Stouffer Wailea Beach Hotel is located directly behind the beach. Condominiums and resort hotels of the Wailea resort complex occupy much of the backshore area.

Physical Characteristics of the Selected Route

The proposed cable landing site is approximately in the middle of Mokapu Beach. On land, the cable will cross some private property before reaching the public park easement. Selection of the route was determined by two overriding factors:

1. Although the sandy beach is 800 feet long, basalt rock and/or fringing reef extend toward the center of the beach from each headland. As a result, there is only a 300 foot length in the center of the beach where the sand extends continuously seaward.

2. Similarly, there is only one gap in the almost continuous offshore coral reef that parallels the south Maui coastline. At its narrowest, in approximately 120 feet of water, this gap is 1100 feet wide.

Figure V-2 shows the location of these features and the proposed route. Orienting the route to avoid the two features described above results in the entire nearshore cable alignment being on a sandy bottom. The sand is medium to fine grained, with a noticeable increase in silt content closer to shore. The sand deposit appears to be thick; there are no protruding rock outcrops or coral formations in the deposit. There are patchy growths of Halimeda, a coralline algae, extending seaward from the 90 foot water depth. Although this growth presents a different biological environment, the underlying bottom is still sand. Fathometer runs along the route centerline indicates that the bottom is flat and probably sandy to at least the 180 foot depth.

The selected route has ideal physical conditions for a cable landing. In addition to the sand bottom, the 50 foot contour is only 1600 feet offshore, which will result in a short cable pull during the landing process. The only disadvantage is the proximity to a fish haven established by the State Department of Land and Natural Resources. The fish haven is located off Keawakapu Beach, in water depth of approximately 90 feet. The closest point of approach of the cable to the fish haven is 660 feet.

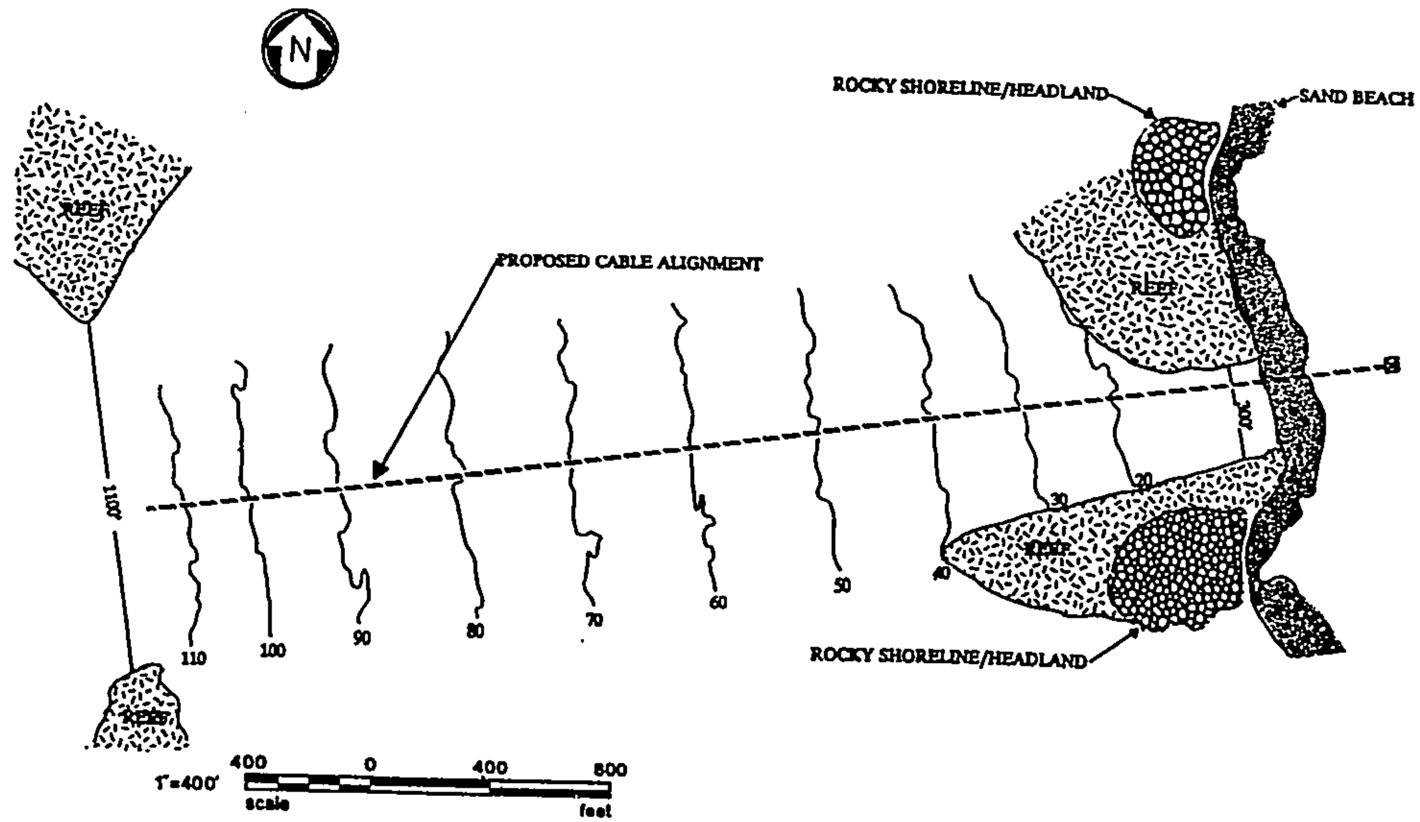


FIGURE IV-2. PHYSICAL CHARACTERISTICS OF SELECTED ROUTE

OCEANOGRAPHIC CONDITIONS

Mokapu Beach is sheltered from the tradewinds and tradewind generated waves. Nearshore, the prevailing winds are generally diurnal onshore-offshore sea breezes caused by the heating and cooling of the land. Offshore the tradewinds blow north to south after being funneled between Haleakala and the West Maui mountains. The project site is directly exposed to Kona winds blowing from the south or southwest.

Due to the orientation of the coastline, and the protection provided by the other islands and the rocky headlands, the beach is primarily vulnerable to south swell and Kona storm or hurricane waves. There is no fringing reef offshore so the beach is exposed to the full force of these waves. The beach is therefore dynamic and subject to episodes of severe storm erosion. Storms during the winter of 1962 - 1963, and in 1980 and 1982 caused severe erosion to beaches along this coast. Many beaches have not yet recovered from the erosion damage.

No current data exists for the nearshore area off Mokapu Beach, or the adjacent areas. A northerly setting current has been reported by the U.S. Coast Pilot (National Oceanic and Atmospheric Administration, 1977). It is presumed that the coastal currents along the southwest coast of Maui follow patterns similar to the currents further north in the vicinity of Lahaina, with the prevailing currents being semi-diurnal reversing tidal currents with a resultant weak net transport to the north.

Nearshore waters are rated Class "A" by the State Department of Health. Several past studies in the general area (off Kihei, Keawakapu, Kamaole and Wailea) by Aecos (1989), Environmental Consultants, Inc.(1977) and M & E Pacific (1979) have included limited, site specific water quality measurements. Typically the sampling programs have not collected sufficient data to allow calculation of a geometric mean, but most of the areas sampled would probably exceed the criteria for Total N and nitrite plus nitrate. These high levels are partially attributable to ground water seepage along the coast, but human activities and development (fertilizer application, cesspool seepage, etc.) can also augment the naturally high levels. The relatively high silt content of the nearshore bottom would lead to the conclusion that turbidity levels would be high during periods of high surf, when the finer bottom sediments would be resuspended.

The estimated 50 and 100 year tsunami elevations 200 feet inland along this coastline are 5.8 and 7.5 feet.

DESCRIPTION OF THE PROPOSED PROJECT

The cable landing process for Mokapu Beach should be relatively simple. Preparing the trench across the backshore portion of the beach will be the most significant preparatory task. Depending upon the depth of excavation, temporary sheetpiling may or not be used to stabilize the trench. It is anticipated that a sand "dam" will be left in place at the seaward end of the trench to prevent generation of turbidity in the nearshore waters. Preliminary construction work on the beach should not exceed a time period of two weeks.

The cable ship should be able to approach to within 2000 feet of shore for the actual cable pull. Positioning of the cable before cutting the floats is not critical as long as the reefs to the north and south of the shore landing site are avoided. There are no other obstacles along the route. After securing the cable to the onshore manhole and cutting the floats, the sand "dam" will either be excavated or the cable will be waterjetted down to the elevation of the beach toe (probably -3 to -5 feet). The sheetpile will then be removed and the beach restored to its natural condition. This should complete the marine work, as no offshore protection, anchoring or trenching should be required on the sand bottom.

MARINE BIOLOGICAL SETTING

The qualitative reconnaissance of Mokapu Beach was carried out on 26 June 1991 and the quantitative sampling of this site was done on 4 December 1991. The qualitative survey extended from shore to about the 90 foot isobath approximately 2,800 feet from shore. In this area three major zones or biotopes were defined. These biotopes are the biotope of sand and Halimeda beds, the biotope of sand and the biotope of basalt rock and corals which lies both to the east and west of the proposed cable alignment. In general, the biotopes approximately parallel shore but along the proposed cable alignment, the biotope of sand extends shoreward from the deeper offshore biotope of sand and Halimeda beds uninterrupted to the beach. Thus the biotope of sand bisects the nearshore biotope of basalt rock and corals. Figure V-3 shows the boundaries of the biotopes as well as the quantitative transect stations. The biotope of sand and Halimeda beds is at depths in excess of 80 feet (about 2,600 feet from shore) and continues seaward to well outside of the study area. To both the east and west of the proposed cable alignment are basalt rock headlands; between these is an 325 foot sand shoreline that is the central part of Mokapu Beach. Offshore and subtidally of these rock headlands is the biotope of basalt rock and coral; on the western side this biotope extends more than 400 feet offshore and on the eastern side in excess of 550 feet seaward.

The Biotope of Sand and Halimeda Beds

The biotope of sand and Halimeda beds is found at depths greater than 80 feet. This biotope may be characterized by a relatively flat sand substratum with a little rubble present. A dominant feature of this biotope is the presence of beds of the alga, Halimeda opuntia. These beds range in size from 6 to 25 feet in width, 3 to 30 feet in length and rise no more than 6 inches from the surrounding substratum. These Halimeda patches are spaced from 5 to over 50 feet apart. In the area examined, the sand has a large number of fragments of the bivalve, Pinna muricata suggesting that somewhere in the near vicinity is probably a large "bed" of this species. Pinna muricata is usually found forming large beds that may cover hundreds of square meters of sand bottom in deeper water (Kay 1979, Brock and Chamberlain 1968).

Station 1 was established at a depth of 87 feet approximately 2,700 feet offshore on the proposed cable alignment. The substratum at this station is as described above. Table V-1 presents the results of the quantitative sampling at Station 1. The quadrat survey noted the alga Halimeda opuntia with a mean coverage of 6.8 percent; two corals (Montipora verrucosa and Porites lobata) were found on rubble having a mean coverage of 0.07 percent. Another species in the transect area that appeared in the 50-point analysis is the bryozoan, Steginoporella magnilabris. The invertebrate census noted one helmet shell (Cassis cornuta), a large mantis shrimp (Lysiosquilla maculata) and one banded shrimp (Stenopus hispidus). The results of the fish census are presented in Appendix B; only five species (11 individuals) were encountered in the census area having an estimated biomass of $2g/m^2$. The most common fishes were the alo'ilo'i or whitespot damselfish (Dascyllus albisella) and the serranid (Anthias thompsoni). Other than a small piece of metal, there was very little local shelter for fishes at this station.

In the vicinity of Station 1 was seen the orange bryozoan (Schizoporella decorata), harp shell (Harpa harpa), augers (Terebra maculata, T. crenulata, T. inconstans), the 'ulae or lizard fish (Synodus binotatus), orangespot surgeonfish or na'ane'a (Acanthurus olivaceus), goatfish or malu (Parupeneus pleurostigma), smooth puffer or keke (Arothron hispidus) and deepwater puffer (Lagocephalus lagocephalus).

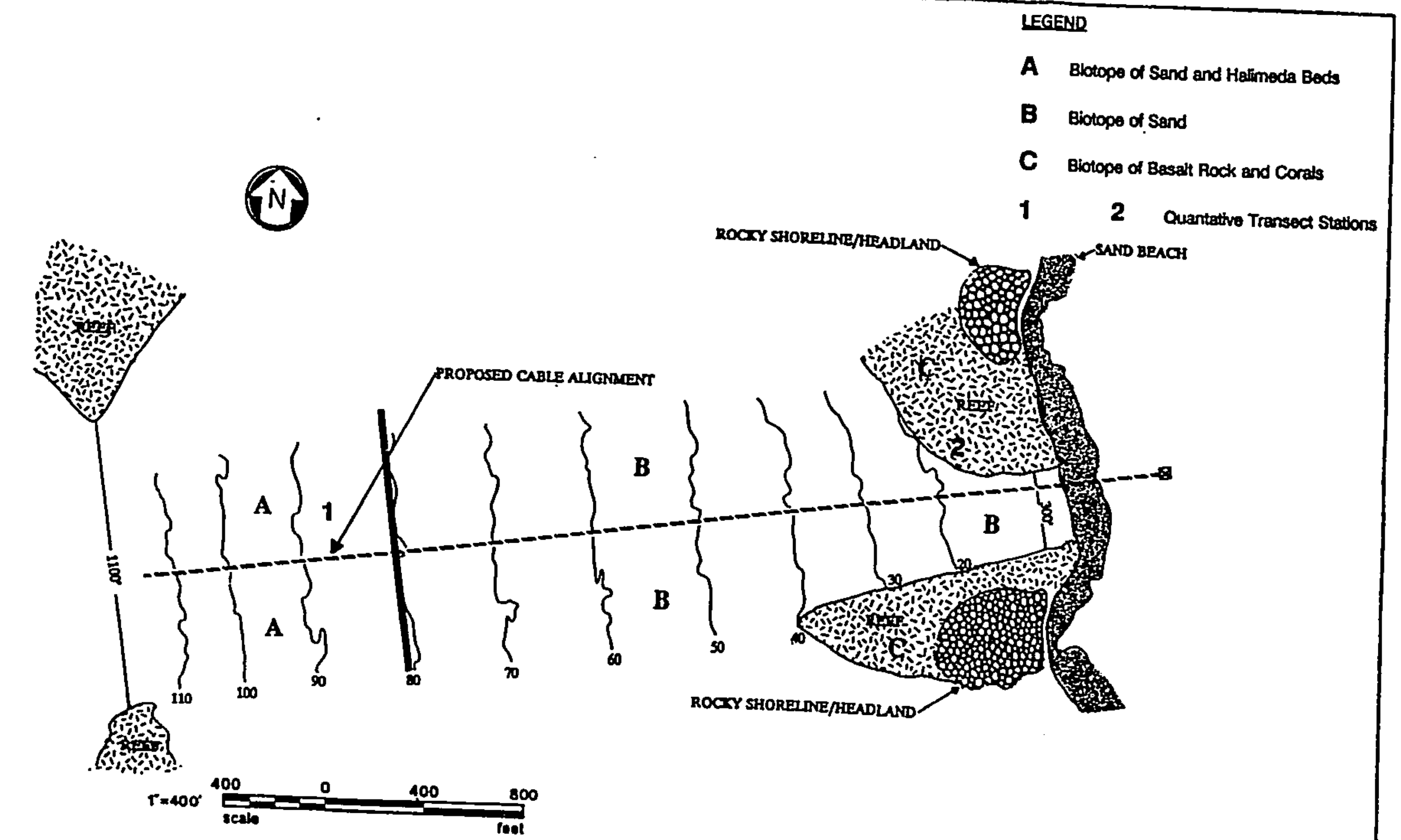


FIGURE IV-3. BIOTOPES ALONG SELECTED CABLE ALIGNMENT

TABLE IV-1.

Summary of the benthic survey conducted in the biotope of sand and Halimeda beds. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth is 87 feet; mean coral coverage is 0.07 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	0m	5m	10m	15m	20m	25m
Algae						
Halimeda opuntia	1	9	17			14
Corals						
Montipora verrucosa	0.3					
Porites lobata					0.1	
Bryozoans						
Steginoporella magnilabris	0.7					2
Sand	98.7	90.3	83	100	99.9	84

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Halimeda opuntia	2
Bryozoans	
Steginoporella magnilabris	2
Sand	96

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Cassis cornuta	1
Phylum Arthropoda	
Lysiosquilla maculata	1
Stenopus hispidus	1

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

The Biotope of Sand

The biotope of sand lies shoreward of the biotope of sand and Halimeda beds and it extends uninterrupted to the beach in the area of the proposed cable alignment. As the name implies, the substratum in the biotope of sand is dominated by sand. Because of its shifting nature, the benthic species found in sand habitats are generally adapted for life on an unstable and frequently abrading environment. Many species that are found in this habitat will bury into the sand to avoid predators and the abrasion that occurs with storm waves. Thus many species in the sand biotope are cryptic and difficult to see; among those are many of the molluscs and crustaceans such as the kona crab (Ranina serrata). Hence, without considerable time spent searching in the sand, many species in the sand habitat will not be seen. The biotope of sand is best developed at greater depths; where it enters the shallow water, many of the characteristic species become less abundant.

Because of the dispersed and cryptic nature of many of the species resident to the biotope of sand we did not quantitatively sample this biotope but rather carried out a qualitative reconnaissance of the habitat in waters from 30 to 80 feet in depth. Species noted in this overview of the biotope include a number of molluscs: the helmet shell (Cassis cornuta), augers (Terebra crenulata, T. maculata and T. inconstans), the leopard cone (Conus leopardus) and flea cone (Conus pulicarius) as well as the sea hare (Brissus sp.), starfish (Mithrodia bradleyi), brown sea cucumber (Bohadschia vitiensis), opelu or mackeral scad (Decapterus macarellus), nabeta (Hemipteronotus umbrilatus), the goby-like fish (Parapercis schauslandi), the lizard fish or 'ulae (Synodus binotatus), the flatfish or paki'i (Bothus mancus), uku or snapper (Aprion virescens), goatfish or malu (Parupeneus pleurostigma) and the weke or white goatfish (Mulloides flavolineatus). With greater effort many more fish species would be encountered in this biotope.

A short survey was made of the sand beach at the point of the proposed cable landing; no macrofauna was seen although one ghost crab hole (probably Ocypode ceratophthalmus) was present on the beach. A short visual appraisal was made of the rocky intertidal that lies to the east and west of the proposed alignment. The substratum of the rocky intertidal is primarily a pahoehoe (basalt) bench with scattered basalt boulders. On the emergent rocks were seen the grey littorine snail (Littorina pintado) and the prosobranch mollusc, Siphonaria normalis; slightly lower down on the rocks are the black snail or pipipi (Nerita picea). Algae seen include limu hulu'ilio (Giffordia breviarticulata) and the encrusting coralline alga (Porolithon onkodes). Also present are a number of unidentified microalgal species that form a fine "turf". We noted the black rock crab or ama'ama (Grapsus grapsus) on the basalt boulders and the small hermit crabs (Calcinus herbstii and C. elegans) in the shallows.

The Biotope of Basalt Rocks and Corals

The biotope of basalt rocks and corals is not in the path of the proposed cable alignment but at the closest point, lies within 80 feet of it. The substratum of this biotope is primarily basalt rock with corals on it. There is a small amount of sand present in this biotope and as the waves pass, the sand roils and must scour the substratum. Much of the basalt is in the form of boulders with a mean diameter of about 2 feet. Many of the corals are found on the boulders up away from the depressions with sand. Common species on the boulders include the coral Pocillopora meandrina, sea urchins, wrasses, surgeonfishes and damselfishes.

Station 2 was established about 300 feet offshore in the biotope of basalt rocks and corals which lies west of the proposed cable alignment. Water depth at this station ranges from 10 to 12 feet and the visibility at the time of sampling was no more than 10 feet probably due to passing waves "stirring up" fine material on the bottom. The substratum at Station 2 is as described above; Table V-2 presents the results of the quantitative survey carried out at Station 2. The quadrat survey noted a small amount of the alga, Desmia hornemanni) and eleven species of corals having a mean coverage of 16.9 percent. The corals present included Porites lobata, P. compressa, P. evermanni, P. (Synarea) convexa, Pocillopora meandrina, P. damicornis, Montipora verrucosa, M. patula, M. flabellata, M. verrilli and Pavona varians. Porites lobata was the dominant coral species. The invertebrate census noted five species including two polychaetes (Loimia medusa and Spirobranchus gigantea) and three sea urchin species. Both the black sea urchin (Tripneustes gratilla) and the slate pencil urchin (Heterocentrotus mammillatus) were very abundant. Sixteen species of fishes (71 individuals) were encountered in the fish census. The most abundant fishes were the banded goatfish or moano (Parupeneus multifasciatus), the damselfish (Chromis vanderbilti) and the saddleback wrasse or hinalea lauwili (Thalassoma duperrey). The standing crop of fishes was estimated to be 11g/m^2; the most important contributors to this biomass were the moano or banded goatfish (Parupeneus multifasciatus), the black damselfish (Stegastes fasciolatus) and the saddleback wrasse or hinalea lauwili (Thalassoma duperrey).

In the vicinity of Station 2 were seen the soft coral (Palythoa tuberculosa), corals (Leptastrea purpurea and Pocillopora eydouxi), blue goatfish or moano kea (Parupeneus cyclostomus), red hawkfish or piliko'a (Cirrhitops fasciatus), spotted wrasse (Macropharyngodon geoffroy), goatfish or malu (Parupeneus pleurostigma), whitebar surgeonfish or maikoiko (Acanthurus leucoparieus) abd the triggerfish or humuhumu (Rhinecanthus rectangulus).

TABLE IV-2.

Summary of the benthic survey conducted in the biotope of basalt rock and corals approximately 325 feet offshore of Mokapu Beach, Maui on 4 December 1991. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Pact C. A short summary of the fish census is given in Part D. Water depth is 10 to 12 feet; mean coral coverage is 16.9 percent (quadrat method).

A. **Quadrat Survey**

	Quadrat Number					
Species	0m	5m	10m	15m	20m	25m
Algae						
Desmia hornemanni			0.1			
Corals						
Porites lobata	8	6	13	7	4	6
Porites evermanni			7			
Porites compressa					4	
Porites (Synarea)convexa					0.5	
Pocillopora damicornis			0.1		0.5	
Pocillopora meandrina		2.5	4.5	2.5	0.5	4
Montipora verrucosa			3	3	2	
Montipora patula					4	
Montipora flabellata					5	
Montipora verrilli	7	5				
Pavona varians			2.5			
Sand		9		6		
Basalt Rock	92	75.5	71.9	74.4	80	89.5

B. **50-Point Analysis**

Species	Percent of the Total
Corals	
Porites lobata	8
Porites evermannni	2
Porites compressa	2
Pocillopora meandrina	4
Montipora verrilli	2
Sand	8
Basalt Rock	74

TABLE IV-2.
Continued.

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

Species	Number
Phylum Annelida	
Loimia medusa	2
Spirobranchus gigantea	7
Phylum Echinodermata	
Tripneustes gratilla	105
Heterocentrotus mammillatus	92
Echinometra mathaei	17

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

16 Species
71 Individuals
Estimated Biomass = $11 g/m^2$

No green sea turtles were seen during this survey of Mokapu Beach. There was little algae present that could serve as appropriate forage for green turtles although several sites were seen in the biotope of basalt rocks and corals that could serve as resting sites. We have found no information to suggest that nesting of sea turtles on Mokapu Beach has occurred in historical times.

The biological survey of the proposed cable alignment at Mokapu Beach did not find any rare or unusual species or communities. Another protected species, the humpback whale (Megapteranovaeangliae) was not seen offshore of the study area during the period of our field effort.

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 and Halimeda beds. We expect that the cable will have little negative impact to the communities in the biotope of sand and Halimeda beds because the majority of the substratum is sand. It is expected that a cable deployed over a Halimeda bed would probably sink into the substratum between the individual algal fronds and present little impact.

As a substrate to support marine communities, sand is inappropriate for many coral reef forms because many species require a stable bottom. 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., most macroalgae require a solid substratum for attachment). Because sand substrates are subject to movement, they may abrade and scour organisms on this substratum. Thus the characteristics of most species encountered in Hawaiian sand communities are; (1) that they typically burrow into the substrate to avoid scouring, (2) that they frequently occur in low abundance which may be related to food resources, and (3) that they are mobile because of the shifting nature of the substratum and potential for burial. Since these forms are motile, deployment of the cable across such a substratum presents little chance of negative impact to resident species because they would probably "just move out of the way as the cable was deployed". Additionally since the substratum shifts, it is probable that the deployed cable will sink into the substrate. Personal observations made on other deployed cables shows them to often be partially buried by the natural movement of the sand.

A major consideration in the selection of the route is the presence of sand because deployment through sand offers little chance of negative impact to benthic communities relative to the impact that could occur to benthic communities situated on hard substratum. The proposed cable alignment at Mokapu Beach is through a sand channel to the shoreline. We expect little impact to surrounding marine communities if this proposed route is utilized.

It is expected that a shallow trench will be dug in the beach sand where the cable comes ashore. The construction of this trench will generate some temporary turbidity which may impact surrounding communities. With any construction adjacent to benthic communities situated on hard substratum is the concern over possible impacts to corals because of their sessile nature and usual slow growth characteristics.

Another concern may be with disturbance to threatened or endangered species. If construction activities are restricted to the period between April through October, the endangered humpback whale (Megaptera novaeangliae) would not be impacted because it is only in Hawaiian waters on a seasonal basis (November through March).

Assuming that deployment of the cable occurs during the period of time that humpback whales are in island waters, it is anticipated that the impacts to whales would be minimal. The deployment of the cable from shallow water (i.e., the 60 foot isobath) to shore should not take longer than one day. In general, this deployment is done by bringing the cable laying ship into about the 60 foot isobath; from this point to shore the cable is buoyed up using floats and small craft are used to maneuver the cable into the appropriate alignment and into shore.

The probable source of local impact to whales would be the production of noise by the cable laying ship and smaller vessels used to bring it ashore. There are variable and conflicting reports as to the impact of vessel traffic on whales. Evidence from the northwest Atlantic and northeast Pacific suggest behavioral changes by whales in response to vessels, but they may show considerable fidelity to specific feeding areas despite vessel traffic (major shipping, trawler activity, etc.; Brodie 1981, Matkin and Matkin 1981, Hall 1982, Mayo 1982). In contrast Jurasz and Jurasz (1980) found a sharp decline in humpback whale numbers in Glacier Bay, Alaska with increases in vessel activity. In a short term study, Bauer (1986) found no correlation between vessel and whale numbers as well as no net movement offshore at Olowalu, Maui in 1983-84. However, a six year study suggested a major offshore movement of mother-calf pods off Maui with increased vessel traffic (Glockner-Ferrari and Ferrari 1985, 1987). This study along cannot be used to determine whether the observed reductions in sighting around Maui is correlated with vessel traffic; there is not consistent baseline information or comparative studies on humpback whale habitat utilization around Maui which may corroborate the trends reported by Glockner-Ferrari and Ferrari (Tinney 1988).

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 1986). Thus it is probably valid to assume that impact to whales could occur if individuals are within several kilometers of the cable deployment. However as noted above the impacts (here noise) are not expected to last for more than one day, and all activities will be concentrated in a very small area.

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, green turtles moved from an offshore diurnal resting site about one kilometer offshore to a point about 200m 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 construction activity that generates fine particulate material will 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 event 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 Mokapu Beach is excellent; the beach is heavily used by people interested in sunbathing, swimming, snorkeling and SCUBA diving. Apparently SCUBA dive tours use this beach for "shore dives". Also, fishing occurs in the waters fronting Mokapu Beach. 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. During our field survey we noted several boats fishing in the offshore waters using a drift-fishing, hook and line technique. We are unaware of any individuals that specifically and exclusively use Mokapu Beach for subsistence fisheries. Probably most of the fishing activity in and around Mokapu Beach from the shoreline is by recreational fishermen. With most Hawaiian recreational fisheries, species targeted include papio and ulua (family Carangidae), o'io or bonefish (Abula vulpes), moi (Polydactylus sexfilis), goatfishes (family Mullidae), snappers (family Lutjanidae), surgeonfishes (family Acanthuridae), parrotfishes (family Scaridae), and a host of smaller species such as the aholehole (Kuhlia sandvicensis), aweoweo (Priacanthus cruentatus) and mempachi (Myripristes amaenus). Fishing methods used include nets, spears, traps as well as hook and line.

The present study found a low abundance of fish species of interest to fishermen in the Mokapu Beach stations. The paucity of fishes may be related to fishing pressure as well as a lack of shelter space (particularly in the offshore sand bottom areas. The standing crop of fishes was estimated to be $2g/m^2$ at Station 1 on a sand substratum and $11g/m^2$ in the biotope of basalt rocks and corals. Standing crop estimates of fishes on coral reefs have been found to range from about 2 to $200g/m^2$ (Brock 1954, Goldman and Talbot 1975, Brock et al. 1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, the variation in standing crop appears to be related to the variation in local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in a lower estimated standing crop of fishes (i.e., 2 to $20g/m^2$).

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 construction activities that would be necessary to protect the cable in shallow water would probably produce little sediment. This statement is supported by the fact that trenching would probably confined to an area directly adjacent to the shoreline and through it and would be carried out in a sand substratum. The small scale and anticipated short duration of the project suggest a minimal impact.

High water motion will keep fine particulate and sedimentary material suspended in the water column, reducing the settlement on benthic organisms in shallow water habitats thus assisting in the advection of this material out of these areas (less than 100m in depth) where corals are found.

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 amount of suspended particles (i.e., turbidity) is great enough to reduce light levels, some impact 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 deposit- ion rates on Guamian reefs was defined in the range of 160- 200mg/cm^2/day and this rate of deposition limited coral cover and diversity (here less than 10 species and 2% cover; Randall and Birkeland 1978). A "low" rate was defined as 32mg/cm^2/day and was associated with rich coral communities (more than 100 species and 12%+ coral cover). These comparisons demonstrate the relat- ive nature of sedimentation rates; the rate considered to be low in Guam is more than twice the high rate from Puerto Rico. Rea- sons 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 tenching will be a minor impact.

Mitigation Measures

As described in an earlier section (Description of the Proposed Project) of this chapter, no cable protection, anchoring or trenching is anticipated in the nearshore waters. However, a cable path will have to be trenched across the beach. As described earlier, this trench will "daylight" where the beach toe intersects the nearshore bottom (approxmiately at the 3 to 5 foot water depth).

Adverse effects due to turbidity can be minimized by leaving a barrier of sand in place at the water's edge until the day of the cable pull. Once the cable is pulled ashore, up and over the "dam" and into the trench, it can then be water jetted down to the design elevation. Turbidity is typically only generated on one or two days on a cable pull into a sandy beach.

APPENDIX A.

Results of the quantitative visual censuses conducted at three locations offshore of Sandy Beach, Oahu on 7 January 1992. Each entry in the body of the table represents the total number of individuals of each species seen; totals are presented at the foot of the table along with an estimate of the standing crop (g/m^2) of fishes present at each location.

FAMILY AND SPECIES	STATION NUMBER 1	2	3
MURAENIDAE			
Gymnothorax meleagris	1		
Gymnomuraena zebra		1	
HOLOCENTRIDAE			
Myripristes amaenus	8		
FISTULARIIDAE			
Fistularia commersoni			1
APOGONIDAE			
Apogon kallopterus	4		
MULLIDAE			
Parupeneus pleurostigma	17	1	1
P. multifasciatus	38	17	8
CHAETODONTIDAE			
Forcipiger flavissimus		2	
Chaetodon fremblii	1	2	
C. kleini	9		
C. ornatissimus	2	2	
C. multicinctus	1	2	
POMACANTHIDAE			
Centropyge potteri	13		
POMACENTRIDAE			
Dascyllus albisella	68		
Plectroglyphidodon imparipennis		4	15
P. johnstonianus	2	3	
Chromis vanderbilti	40	122	
C. hanui	28		
Stegastes fasciolatus			3
CIRRHITIDAE			
Paracirrhites arcatus	4	4	
Cirrhitops fasciatus	1	3	

APPENDIX A. Continued.

FAMILY AND SPECIES	STATION NUMBER 1	2	3
LABRIDAE			
Bodianus bilunulatus		1	
Cheilinus bimaculatus	5		
Pseudocheilinus octotaenia	1		
Thalassoma duperrey	7	38	15
T. ballieui		1	1
Coris venusta	1	1	1
C. gaimard		1	1
Pseudojuloides cerasinus	14		
Stethojulis balteata	3		6
Macropharyngodon geoffroy	12	2	
Anampses chrysocephalus			1
A. cuvier			1
SCARIDAE			
Scarus perspicillatus			4
S. sordidus		4	3
S. psittacus		3	4
PARAPERCIIDAE			
Parapercis schauslandi	3		
MALACANTHIDAE			
Malacanthus hoedtii	1		
BLENNIIDAE			
Plagiotremus ewaensis		1	
GOBIIDAE			
Ptereleotris heteropterus	2		
ACANTHURIDAE			
Acanthurus triostegus		1	32
A. achilles	3		
A. leucoparieus			1
A. nigrofuscus	8	26	27
A. nigroris	4	13	
A. olivaceus	3	4	
A. dussumieri		2	1
Ctenochaetus strigosus			3
ZANCLIDAE			
Zanclus cornutus		2	

APPENDIX A. Continued.

FAMILY AND SPECIES	STATION NUMBER 1	2	3
BALISTIDAE			
Rhinecanthus rectangulus		2	2
Melichthys vidua		1	
Sufflamen bursa	3	1	
MONACANTHIDAE			
Cantherhines dumerilii	1		
CANTHIGASTERIDAE			
Canthigaster coronata	2		
C. jactator	1		1
Total Number of Species	34	30	22
Total Number of Individuals	311	267	132
Estimated Standing Crop (g/m^2)	44	43	74

APPENDIX B.

Results of the quantitative visual censuses conducted at two locations offshore of Mokapu Beach, Maui on 4 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
SERRANIDAE		
Anthias thompsoni	3	
APOGONIDAE		
Apogon kallopterus		1
MULLIDAE		
Parupeneus multifasciatus		15
CHAETODONTIDAE		
Chaetodon lunula		1
POMACENTRIDAE		
Dascyllus albisella	5	
Plectroglyphidodon imparipennis		1
P. johnstonianus		4
Chromis vanderbilti		12
Stegastes fasciolatus		7
CIRRHITIDAE		
Paracirrhites arcatus		
Cirrhitops fasciatus		
LABRIDAE		
Hemipteronotus baldwini	1	
Thalassoma duperrey		11
Coris venusta		2
Stethojulis balteata		4
BLENNIIDAE		
Cirripectes variolosus		1

APPENDIX B.
Continued.

FAMILY AND SPECIES	STATION NUMBER 1	2
ACANTHURIDAE		
Acanthurus triostegus		7
A. nigrofuscus		1
A. dussumieri		1
Naso unicornis	1	
OSTRACIONIDAE		
Ostracion meleagris		2
CANTHIGASTERIDAE		
Canthigaster coronata	1	
C. jactator		1
Total Number of Species	5	16
Total Number of Individuals	11	71
Estimated Standing Crop (g/m^2)	2	11

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APPENDIX B

Archaeological Assessment of the Proposed Fiber Optic Cable Landing at Mōkapu Beach, Paeahu Ahupua'a, Honua'ula, Maui (TMK 2-1-08:62)

by

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William H. Folk, B.A.

Prepared for

R.M. Towill Corp.

Cultural Surveys Hawaii
March, 1992

Abstract

Cultural Surveys Hawaii conducted an archaeological assessment for a proposed Fiber Optic Cable Landing at Mōkapu Beach, Honuaʻula, Maui (TMK 2-1-08:62). The assessment included surface survey, sub-surface testing, and review of pertinent literature.

Cultural Surveys Hawaii conducted an archaeological surface survey of a corridor of land on the island of Maui extending from the ocean to Wailea Alanui Drive through the property known as TMK 2-1-08:62 for the proposed fiber-optic transmission cable. No surface archaeological sites were found. Previous archaeological studies on the property in 1987 conducted subsurface testing along the shoreline sand beach and dune deposits with negative findings of Hawaiian cultural material. A midden scatter located during that study was excavated at that time.

Introduction

A. Project Description

Cultural Surveys Hawai'i conducted archaeological assessments for five proposed fiber-optic cable landing sites on four 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, on Kaua'i at the Wailua Golf course, and on Maui at Mōkapu Beach.

This report treats the Mōkapu Beach cable landing site on Maui (Fig. 1-4).

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 five 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.

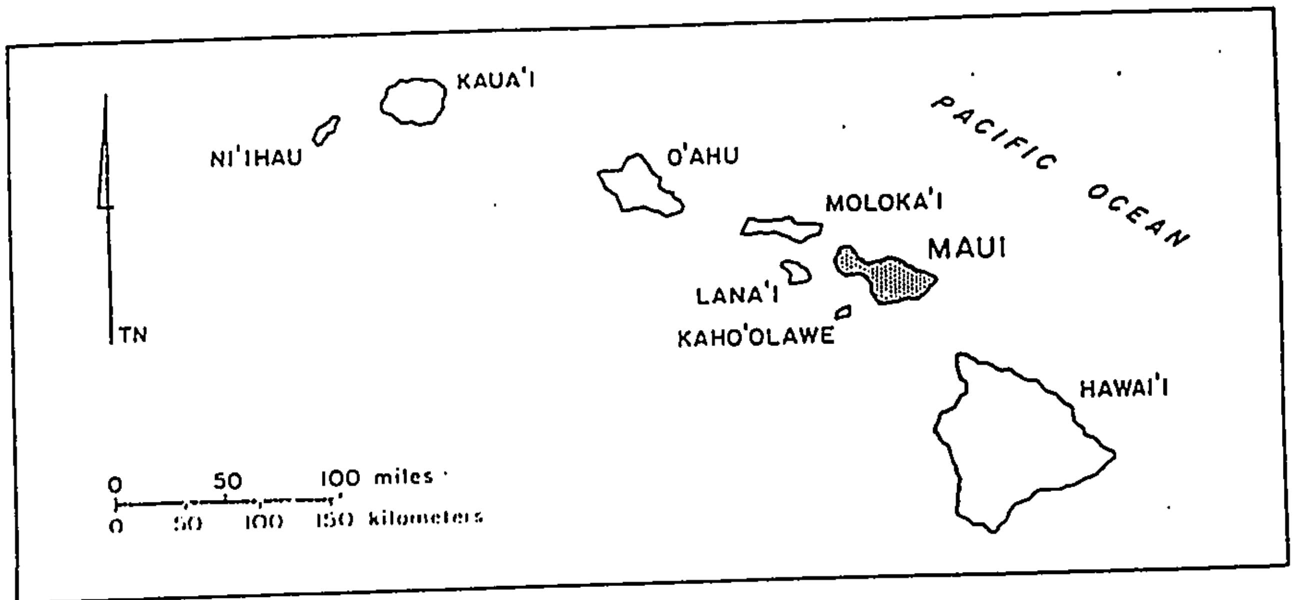

FIGURE 1
Map of the State of Hawai'i

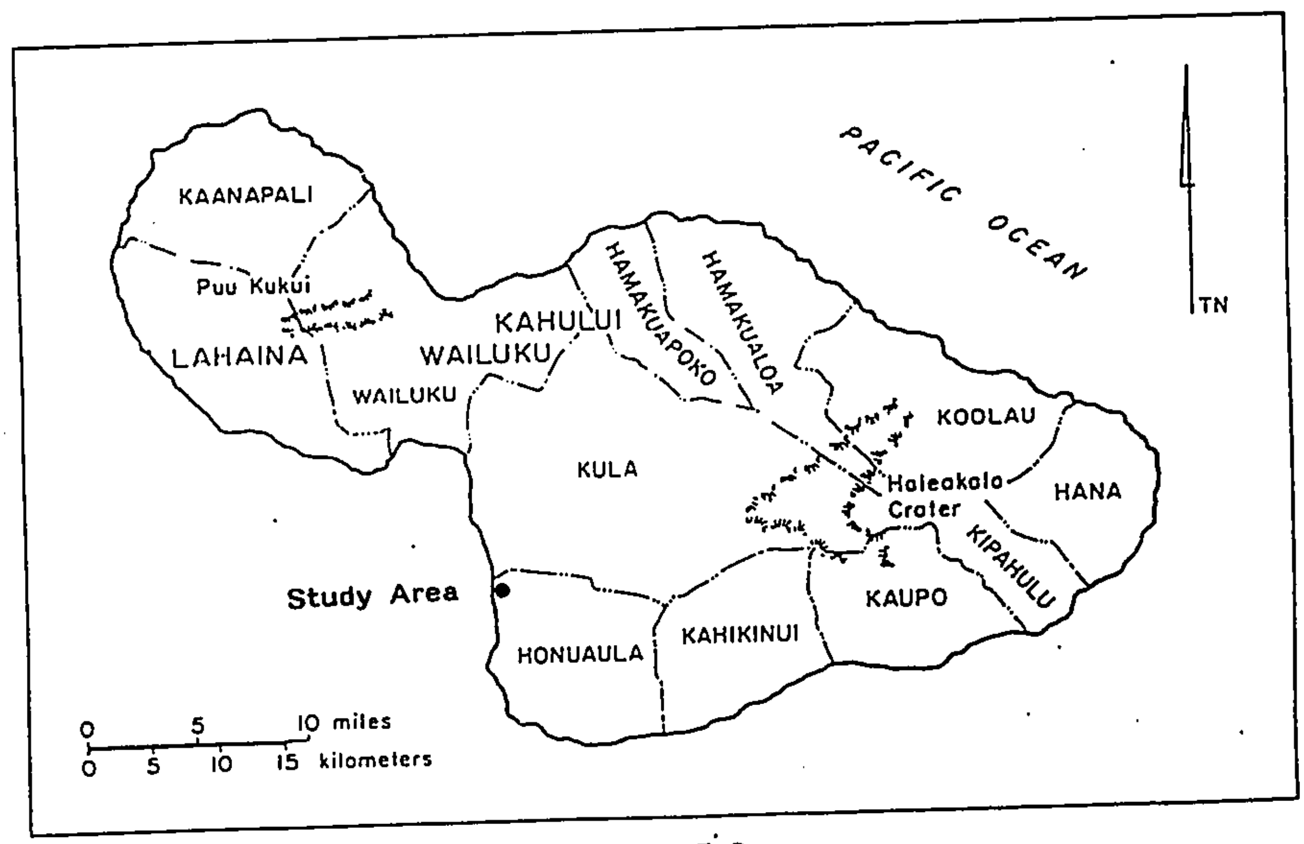

FIGURE 2
General Location Map, Maui Island

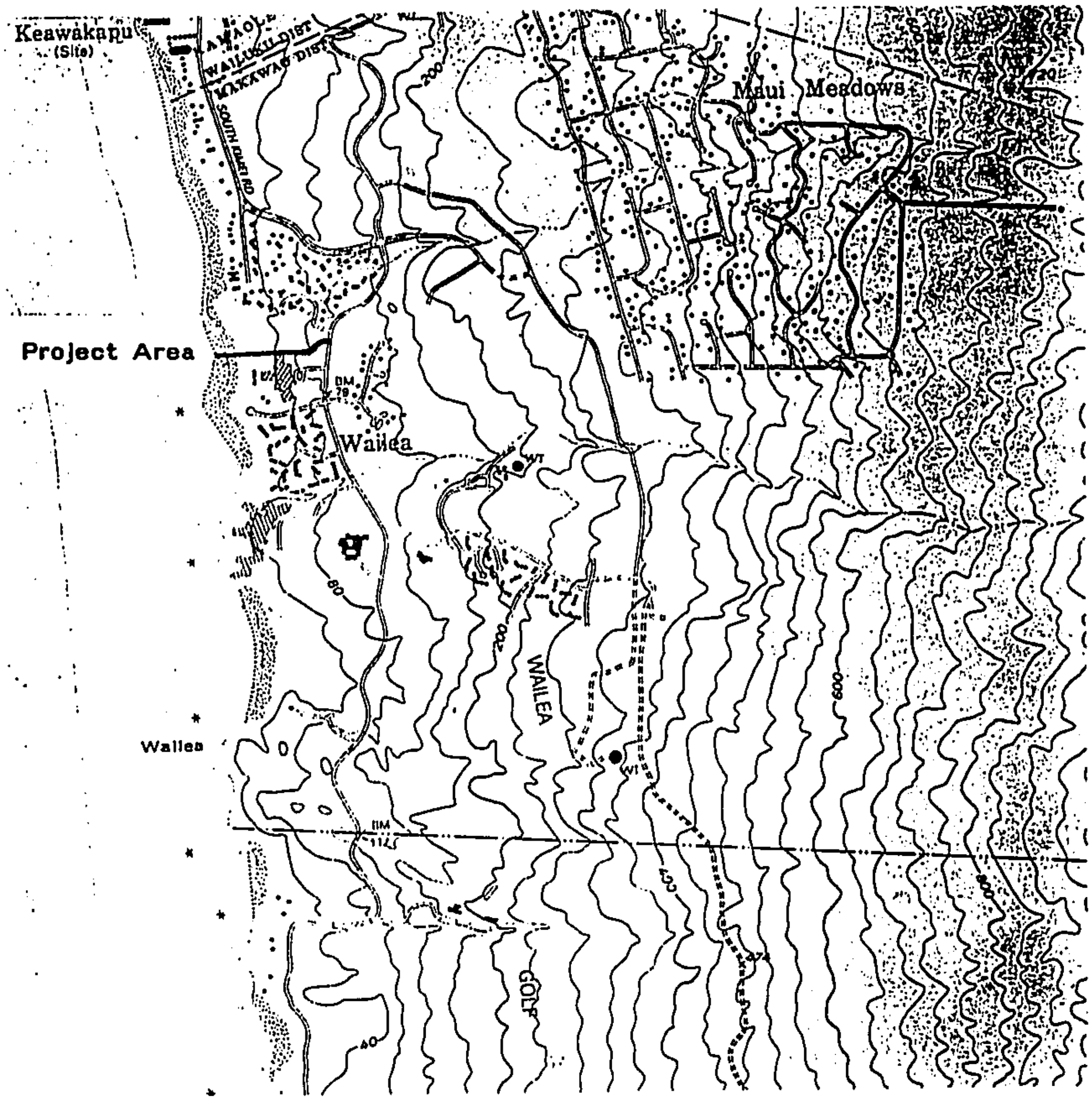

Figure 3 USGS Topographical Map, 7.5 Minute Series, Mākena Quadrangle. Showing Proposed Cable Landing Site Corridor at Mōkapu Beach.

B. Scope of Work

The scope of work at the cable landing site at Mōkapu, Maui consisted of the following:

A. A field check of the cable landing site and a corridor - up to one hundred feet wide - from the beach to Wailea Alanui Drive, including the profile of the wave cut bank along the shoreline.

B. A review of previous archaeological studies and historical research in the Wailea area.

Historic Background

A. Natural History

The project area is situated within the traditional land unit of Paeahu ("row [of] heaps," Pukui, *et al.*, 1974) in Honua'ula district on the west coast of East Maui Mountain (Haleakala). The shoreline Paeahu area is hot and dry, receiving annual rainfall of 10 inches to 20 inches, predominantly in the winter months of November through March.

Landform in the area consists of stony, Makena loam of 3% to 15% slope overlain along the shoreline by beach and dune sand deposits. These soils were used for pasture and wildlife habitat. The naturalized vegetation consists predominantly of exotic species of xerophytic trees and scrubs, grasses and a variety of noxious weeds. Remaining native plants include *ilima* (Sida fallax) and *koali* (Ipomoea sp.).

B. Cultural History

Events and activities in pre-contact Paeahu *ahupua'a* are generally unknown. In the post-contact or historic period, summarized by Barrère, the ahupua'a of Paeahu became government lands following the Mahele of 1848 and recipients of Land Commission Awards (*kuleana*) in the *ahupua'a* include nine individuals. According to Barrère the location of these *kuleana* are unknown although some may have been in the upland "Irish potato region" (Barrère, 1975:32).

There are no known references to habitation, agriculture or *kuleana* in the immediate area of the project area, where the active sand dune environment is generally not suitable for agriculture. However, the well developed sand beach and coral growth on the rocky sea bottom would suggest habitation along this coast line in pre-contact times. The presence of burials here is not expected certainly in line with traditional land use patterns.

C. Previous Archaeological Research

A considerable amount of archeological research for the Wailea area has been generated during the past two decades for the extensive development in this region of Maui. In general this research began in the late 1960s when Patrick Kirch (1969) conducted a reconnaissance survey of Alexander and Baldwin property surrouding Wailea. Kirch's survey was followed by piece work all about the Wailea area by Barrera (1974), Cleghorn (1976), Cordy (1977), Schilt and Dobyns (1980), Rosendahl (1981a - 1981e), Walker *et al.* (1985), and Spear (1987).

In 1987 an archaeological reconnaissance and limited subsurface testing (Walker & Haun, 1987) was conducted within the property (TMK 2-1-08:62) that is the subject of this study at Mōkapu beach in Wailea. The subsurface testing included seven (7) coring holes in the sand beach and dune deposit paralleling the shoreline. No cultural deposits were found during this testing. A surface midden scatter along the north edge of the property was tested and determined to be a habitation site remnant and that this work was sufficient to gather all available archaeological data from that site.

Survey Results

The proposed cable landing and corridor (refer to Fig.4) was walked over for its length and inspected for surface sites. No surface sites exist. The mauka portion of the proposed corridor has been bulldozed and is for the most part filled and graded for equipment baseyard and construction field office use. The *makai* end of the corridor at the shoreline has also been bulldozed and graded, thus the dune sand at that locality has been removed and replaced with crushed coral and is being used as a parking area.

Summary and Recommendations

Background research does not indicate the presence of archaeological sites within the proposed fiber optic cable landing site and proposed cable corridor to Wailua Alanui Drive at the *mauka* edge of the subject property. Recent archaeological investigations have, in general, confirmed that where sites may have been they are no longer present. No further archaeological study is recommended based on the disturbed nature of all deposits remaining within the proposed cable corridor.

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Appendix A - Photo Appendix Fiber Optic Cable Landing Site and Duct Line, Mōkapu Beach, Maui

Figure 4 Cable Landing Site at Mōkapu Beach Maui

Figure 5 *Makai* End of Proposed Cable Corridor Facing *Mauka*

Figure 6 Cable Corridor Facing *Mauka* Showing Previously Bulldozed Terrain

Figure 7 Proposed Cable Corridor Facing *Makai* Showing Previously Bulldozed Terrain

Figure 8 *Mauka* Portion of Cable Corridor Showing Graded Area, Facing *Makai*

Figure 9 *Mauka* Portion of Cable Corridor Showing Graded Area, Facing North

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0087 B

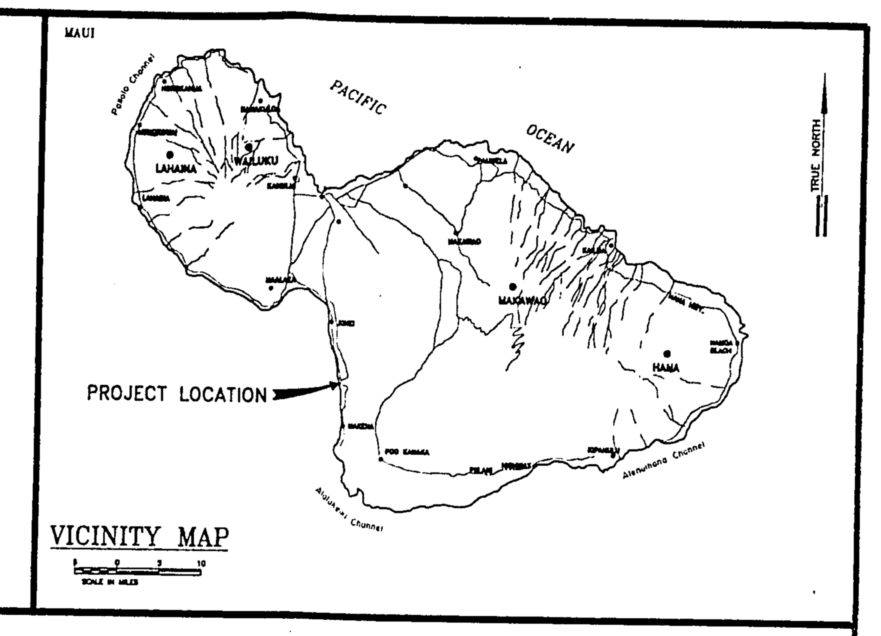
GTE HAWAIIAN TEL
INTERISLAND FIBER OPTIC CABLE
PROJECT AT MOKAPU BEACH

Wailea, Maui, Hawaii

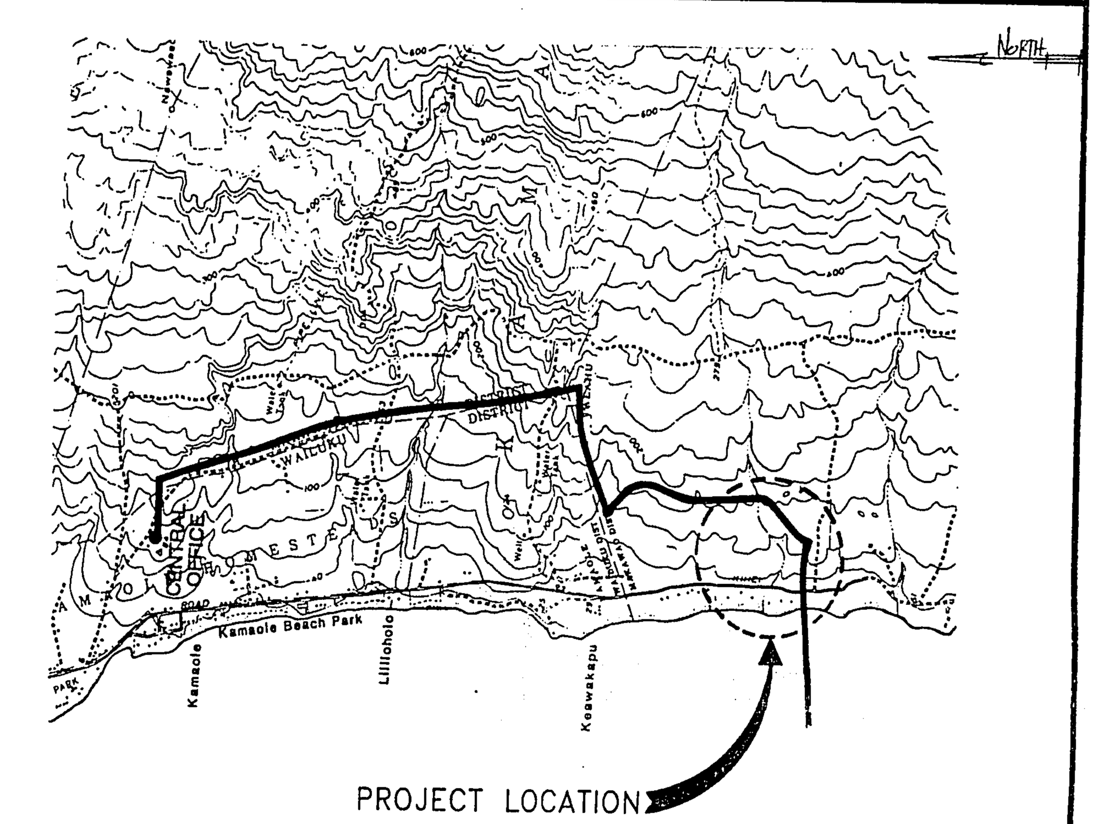
R. M. TOWILL CORPORATION

ENGINEERS • PLANNERS • SURVEYORS • PHOTOGRAMMETRISTS • CONSTRUCTION MANAGERS

TMK: 2ND. TAX. DIV., 2-1-8:62



VICINITY MAP



LOCATION MAP
NOT TO SCALE

INDEX TO DRAWINGS

SHEET NO.		DESCRIPTION
1	–	TITLE SHEET & INDEX
2	–	CONSTRUCTION NOTES
3	–	PLAN & PROFILE (STA 0+00 TO STA 4+00)
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6	–	MANHOLE DETAILS
7	–	HANDHOLE DETAILS
8	–	MISC. DETAILS
9	–	TRAFFIC PLAN (NOT INCLUDED IN THIS SET)

GTE Hawaiian Tel

APPROVED:

GTE HAWAIIAN TEL

CHIEF, DIVISION OF HIGHWAYS, DEPARTMENT OF TRANSPORTATION
STATE OF HAWAII (Approval Granted for Work within State Right-of-Way)
I.D. No. Letter of Approval No. HWY-

Dated: / /

PRELIMINARY SUBMITTAL

SHEET 1 OF 9 SHEETS

0087 B

C:\WPEXEC\DRAWINGS\GTE\GTESHTB 06/09/92 08:12

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0081 C

GENERAL NOTES

1. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITIES, APPURTENANCES AND STRUCTURES SHOWN ARE BASED ON AVAILABLE RECORDS, AND ARE APPROXIMATE ONLY, AND VERIFIED WHENEVER POSSIBLE BY FIELD SURVEYS. NO GUARANTEE IS MADE ON THE ACCURACY OR COMPLETENESS OF SAID INFORMATION. THE CONTRACTOR SHALL BE RESPONSIBLE TO VERIFY THE LOCATION AND INVERTS OF ALL EXISTING UTILITIES SHOWN ON THE PLANS AND SHALL PROTECT SUCH UTILITIES AT ALL TIMES. DAMAGE TO EXISTING UTILITIES AS A RESULT OF CONSTRUCTION ACTIVITIES SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE. PERSONNEL INJURY RESULTING FROM CONTACT WITH THE EXISTING UTILITIES SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

2. THE CONTRACTOR SHALL VERIFY AND CHECK ALL DIMENSIONS AND DETAILS SHOWN ON THE DRAWINGS PRIOR TO THE START OF INSTALLATION. ANY DISCREPANCY SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER FOR CLARIFICATION.

3. THE CONTRACTOR SHALL NOTIFY ALL AGENCIES TO VERIFY THE ACTUAL LOCATION OF ALL UTILITIES IN THE PROJECT AREA PRIOR TO EXCAVATING. THE CONTRACTOR SHALL COORDINATE ALL WORK.

4. EXISTING UTILITIES CROSSING THE GTE-HTCO DUCT LINE SHALL REMAIN IN SERVICE AND IN PLACE. IF RELOCATED FOR THE CONTRACTOR'S CONVENIENCE, INTERRUPTION OF SERVICE SHALL BE KEPT TO A MINIMUM AND SHALL BE DONE AT THE CONTRACTOR'S EXPENSE AND ONLY WITH THE APPROVAL OF THE ENGINEER.

5. WHEN TRENCH EXCAVATION IS ADJACENT TO OR UNDER EXISTING STRUCTURES OR FACILITIES, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPERLY SHEETING AND BRACING THE EXCAVATION AND STABILIZING THE EXISTING GROUND TO RENDER IT SAFE AND SECURE FROM POSSIBLE SLIDES, CAVE-INS AND SETTLEMENT, AND FOR PROPERLY SUPPORTING EXISTING STRUCTURES AND FACILITIES WITH BEAMS, STRUTS OR UNDERPINNING TO FULLY PROTECT IT FROM DAMAGE.

6. THE CONTRACTOR SHALL BE REQUIRED TO GIVE NECESSARY PRECAUTIONS TO PROVIDE SAFETY TO THE PUBLIC DURING TRENCHING AND BACKFILLING ACTIVITIES.

7. CONTRACTOR SHALL PROTECT TREES AND SHRUBS AND MAKE PROVISIONS TO RESTORE AND/OR REPLACE DAMAGED TREES AT HIS OWN EXPENSE.

8. THE CONTRACTOR SHALL PRUNE ANY TREE THAT IS OBSTRUCTING A CLEAR VIEW OF THE TARGETS. SUCH PRUNING WILL BE LIMITED TO THE MINIMUM EXTENT NECESSARY.

9. RIGHT-OF-WAYS SHOWN ON THESE PLANS ARE APPROXIMATE ONLY.

10. THE CONTRACTOR SHALL CLOSE OFF A PORTION OF THE BEACH TO THE PUBLIC. BARRICADES SHALL BE PLACED AROUND THE WORK SITE FOR THE ENTIRE EXCAVATION PERIOD. A SECURITY GUARD WILL BE REQUIRED DURING NON-WORKING HOURS TO ENSURE THAT UNAUTHORIZED PERSONNEL DO NOT ENTER THE WORK SITE.

11. THE CONTRACTOR SHALL HYDRO-JET AND TONE TO LOCATE EXISTING UTILITIES PRIOR TO EXCAVATION.

12. IF HISTORIC REMAINS SUCH AS ARTIFACTS, SHELL OR CHARCOAL DEPOSITS, BURIALS, AND STONE PLATFORMS, PAVINGS, OR WALLS ARE FOUND DURING CONSTRUCTION, THE CONTRACTOR SHALL STOP WORK IN THE IMMEDIATE AREA AND CONTACT THE HISTORIC SITES SECTION AT 548-7460 IMMEDIATELY.

13. ALL WORK SHOWN ON PLANS SHALL BE DONE BY THE CONTRACTOR UNLESS OTHERWISE NOTED AS GTE-HTCO WORK.

NOTES FOR CONSTRUCTION WITHIN STATE RIGHT-OF-WAY

1. THE CONTRACTOR SHALL OBTAIN A CONSTRUCTION PERMIT FROM THE STATE'S HIGHWAY DISTRICT ENGINEER AT 727 KAKOI STREET PRIOR TO THE COMMENCEMENT OF WORK WITHIN STATE HIGHWAY RIGHT-OF-WAY.

2. CONSTRUCTION AND RESTORATION OF ALL EXISTING HIGHWAY FACILITIES WITHIN STATE RIGHT-OF-WAY SHALL BE DONE IN ACCORDANCE WITH ALL APPLICABLE SECTIONS OF THE "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION," DATED 1985, AND THE "SPECIFICATIONS FOR INSTALLATION OF MISCELLANEOUS IMPROVEMENTS WITHIN STATE HIGHWAYS," DATED MAY 1, 1984 OF THE STATE HIGHWAYS DIVISION.

3. THE CONTRACTOR SHALL PROVIDE, INSTALL, AND MAINTAIN ALL NECESSARY SIGNS, LIGHTS, FLARES, BARRICADES, MARKERS, CONES, AND OTHER PROTECTIVE FACILITIES AND SHALL TAKE ALL NECESSARY PRECAUTIONS FOR THE PROTECTION AND FOR THE CONVENIENCE AND SAFETY OF PUBLIC TRAFFIC. ALL SUCH PROTECTIVE FACILITIES AND PRECAUTIONS TO BE TAKEN SHALL CONFORM WITH THE "ADMINISTRATIVE RULES OF HAWAII GOVERNING THE USE OF TRAFFIC CONTROL DEVICES AT WORK SITES ON OR ADJACENT TO PUBLIC STREETS AND HIGHWAYS" ADOPTED BY THE DIRECTOR OF TRANSPORTATION, AND THE CURRENT U.S. FEDERAL HIGHWAY ADMINISTRATION'S "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS, PART VI - TRAFFIC CONTROL FOR HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATION." IF LANE CLOSURES ARE REQUIRED DURING CONSTRUCTION, A TRAFFIC CONTROL PLAN SHALL BE INCORPORATED INTO THE CONSTRUCTION PLANS AND MUST BE APPROVED BY THE DEPARTMENT OF TRANSPORTATION SERVICES PRIOR TO THE ISSUANCE OF THE PERMIT.

4. NO MATERIAL AND/OR EQUIPMENT SHALL BE STOCKPILED OR OTHERWISE STORED WITHIN HIGHWAY RIGHTS-OF-WAY EXCEPT AT LOCATIONS DESIGNATED IN WRITING AND APPROVED BY THE DISTRICT ENGINEER.

5. LONGITUDINAL DRAINAGE ALONG THE HIGHWAY SHALL BE MAINTAINED.

6. APPROVAL OF PERMIT CONSTRUCTION PLANS SHALL BE VALID FOR A PERIOD OF ONE YEAR THEREOF FROM THE DATE OF NOTIFICATION OF APPROVAL TO THE APPLICANT. IN THE EVENT CONSTRUCTION DOES NOT COMMENCE WITHIN THE ONE-YEAR PERIOD, THE APPLICANT WILL BE REQUIRED TO RESUBMIT HIS CONSTRUCTION PLANS FOR DIVISION'S REVIEW AND APPROVAL.

7. ALL REGULATORY, GUIDE AND CONSTRUCTION SIGNS AND BARRICADES SHALL BE OF HIGH INTENSITY REFLECTIVE SHEETING.

8. ALL GRASSED AREAS MUST BE RESTORED TO THE SATISFACTION OF THE DISTRICT ENGINEER OR HIS REPRESENTATIVES.

TRAFFIC CONTROL PLAN NOTES

1. TRAFFIC CONTROL DEVICES SHALL BE INSTALLED SUCH THAT THE SIGN OR DEVICE FARTHEST FROM THE WORK AREA SHALL BE PLACED FIRST. THE OTHERS SHALL THEN BE PLACED PROGESSIVELY TOWARD THE WORK AREA.

2. REGULATORY AND WARNING SIGNS WITHIN THE CONSTRUCTION ZONE THAT ARE IN CONFLICT WITH THE TRAFFIC CONTROL PLANS SHALL BE REMOVED OR COVERED. ALL SIGNS SHALL BE RESTORED UPON COMPLETION OF THE WORK.

3. ALL CONSTRUCTION WARNING SIGNS SHALL BE PROMPTLY REMOVED OR COVERED WHENEVER THE MESSAGE IS NOT APPLICABLE OR NOT IN USE.

4. CONES OR DELINEATORS SHALL BE EXTENDED TO A POINT WHERE THEY ARE VISIBLE TO APPROACHING TRAFFIC.

5. THE BACKS OF ALL SIGNS USED FOR TRAFFIC CONTROL SHALL BE APPROPRIATELY COVERED TO PRECLUDE THE DISPLAY OF INAPPLICABLE SIGN MESSAGES (I.E., WHEN SIGNS HAVE MESSAGES ON BOTH FACES).

6. AT THE END OF EACH DAY'S WORK OR AS SOON AS THE WORK IS COMPLETED, THE PERMITTEE SHALL REMOVE ALL TRAFFIC CONTROL DEVICES NO LONGER NEEDED TO PERMIT FREE AND SAFE PASSAGE OF PUBLIC TRAFFIC. REMOVAL SHALL BE IN THE REVERSE ORDER OF INSTALLATION.

GTE HAWAIIAN TELEPHONE COMPANY (HTCO) NOTES

1. THE CONTRACTOR SHALL EXERCISE EXTREME CAUTION WHEN THE EXCAVATION AND INSTALLATION CROSSES OR IS CLOSE TO EXISTING UNDERGROUND TELEPHONE AND SIGNAL CABLE FACILITIES AND MAINTAIN ADEQUATE CLEARANCE FOR HIS EQUIPMENT WHILE WORKING CLOSE TO AND/OR UNDER THE OVERHEAD FACILITIES. ANY DAMAGE TO THE EXISTING UNDERGROUND OR OVERHEAD FACILITIES SHALL BE REPAIRED BY GTE-HTCO AND PAID FOR BY THE CONTRACTOR.

2. SHOULD IT BECOME NECESSARY, ANY WORK REQUIRED TO RELOCATE UNDERGROUND OR OVERHEAD FACILITIES SHALL BE DONE BY GTE-HTCO AND PAID FOR BY THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COORDINATION.

3. CONTRACTOR TO OBTAIN EXCAVATION PERMIT FROM GTE-HTCO RECORDS SECTION AT 3239 UALENA STREET AT LEAST 2 WEEKS PRIOR TO START OF CONSTRUCTION.

4. CONTRACTOR SHALL CONTACT GTE-HTCO INSPECTOR AT 834-6382 A MINIMUM OF 72 HOURS PRIOR TO START OF WORK.

5. SHOULD FIELD CONDITIONS AND CONSTRUCTION PROCEDURES REQUIRE THAT UTILITY POLES BE BRACED, THE CONTRACTOR SHALL CONTACT GTE-HTCO. INSPECTOR FOR POLE BRACING INSTRUCTIONS AT LEAST 72 HOURS IN ADVANCE. JAMES PAI, AREA CONSTRUCTION SUPERVISOR AT 834-6258.

6. AT THE END OF EACH DAY'S WORK OR AS SOON AS THE WORK IS COMPLETED, THE PERMITTEE SHALL REMOVE ALL TRAFFIC CONTROL DEVICES NO LONGER NEEDED TO PERMIT FREE AND SAFE PASSAGE OR PUBLIC TRAFFIC. REMOVAL SHALL BE IN THE REVERSE ORDER OF INSTALLATION.

PUBLIC HEALTH, SAFETY AND CONVENIENCE

1. THE CONTRACTOR SHALL OBSERVE AND COMPLY WITH ALL FEDERAL, STATE AND LOCAL LAWS REQUIRED FOR THE PROTECTION OF PUBLIC HEALTH AND SAFETY AND ENVIRONMENTAL QUALITY.

2. THE CONTRACTOR, AT HIS OWN EXPENSE, SHALL KEEP THE PROJECT AND ITS SURROUNDING AREAS FREE FROM DUST NUISANCE. THE WORK SHALL BE IN CONFORMANCE WITH THE AIR POLLUTION STANDARDS AND REGULATIONS OF THE STATE DEPARTMENT OF HEALTH. THE CITY AND COUNTY OF HONOLULU AND THE STATE OF HAWAII SHALL REQUIRE SUPPLEMENTARY MEASURES AS NECESSARY.

3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF SILT SCREENS, CLEANING AND REMOVAL OF ALL SILT AND DEBRIS GENERATED BY HIS WORK AND DEPOSITED AND ACCUMULATED WITHIN THE OCEAN AND SHORELINE, DOWNSTREAM WATERWAYS, DITCHES AND DRAIN PIPES AND ON PUBLIC AND PRIVATE ROADWAYS. THE CONTRACTOR AGREES TO REIMBURSE THE CITY AND COUNTY OF HONOLULU AND THE STATE OF HAWAII FOR ALL COSTS EXPENDED IN PERFORMANCE OF THE ABOVE WORK IF REQUIRED FOR PUBLIC HEALTH AND SAFETY, OR MADE NECESSARY BY NON-PERFORMANCE BY THE CONTRACTOR.

4. THE CONTRACTOR SHALL PROVIDE, INSTALL AND MAINTAIN ALL NECESSARY SIGNS, LIGHTS, FLARES, BARRICADES, MARKERS, CONES AND OTHER PROTECTIVE FACILITIES AND SHALL TAKE ALL NECESSARY PRECAUTIONS FOR THE PROTECTION, CONVENIENCE, AND SAFETY OF THE PUBLIC.

5. THE CONTRACTOR SHALL SUBMIT A NOISE POLLUTION CONTROL PLAN WHEN APPLYING FOR A CONSTRUCTION PERMIT.

ENGINEER SM.					
DRAFTSMAN FP.					
CHECKED BY KTY.	REVISION	DATE	BRIEF	BY	APPROVED

KENNETH T. YAMADA
LICENSED PROFESSIONAL ENGINEER
No. 4153-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE DATE

R. M. TOWILL CORPORATION
PLANNERS • ENGINEERS • SURVEYORS • PHOTOGRAMMETRISTS
CONSTRUCTION MANAGERS
420 Waiakamilo Road Honolulu Hawaii 96817-4941

G.T.E. HAWAIIAN TEL.
INTERISLAND FIBEROPTIC CABLE
PROJECT AT MOKAPU BEACH
Wailea, Maui, Hawaii

CONSTRUCTION NOTES

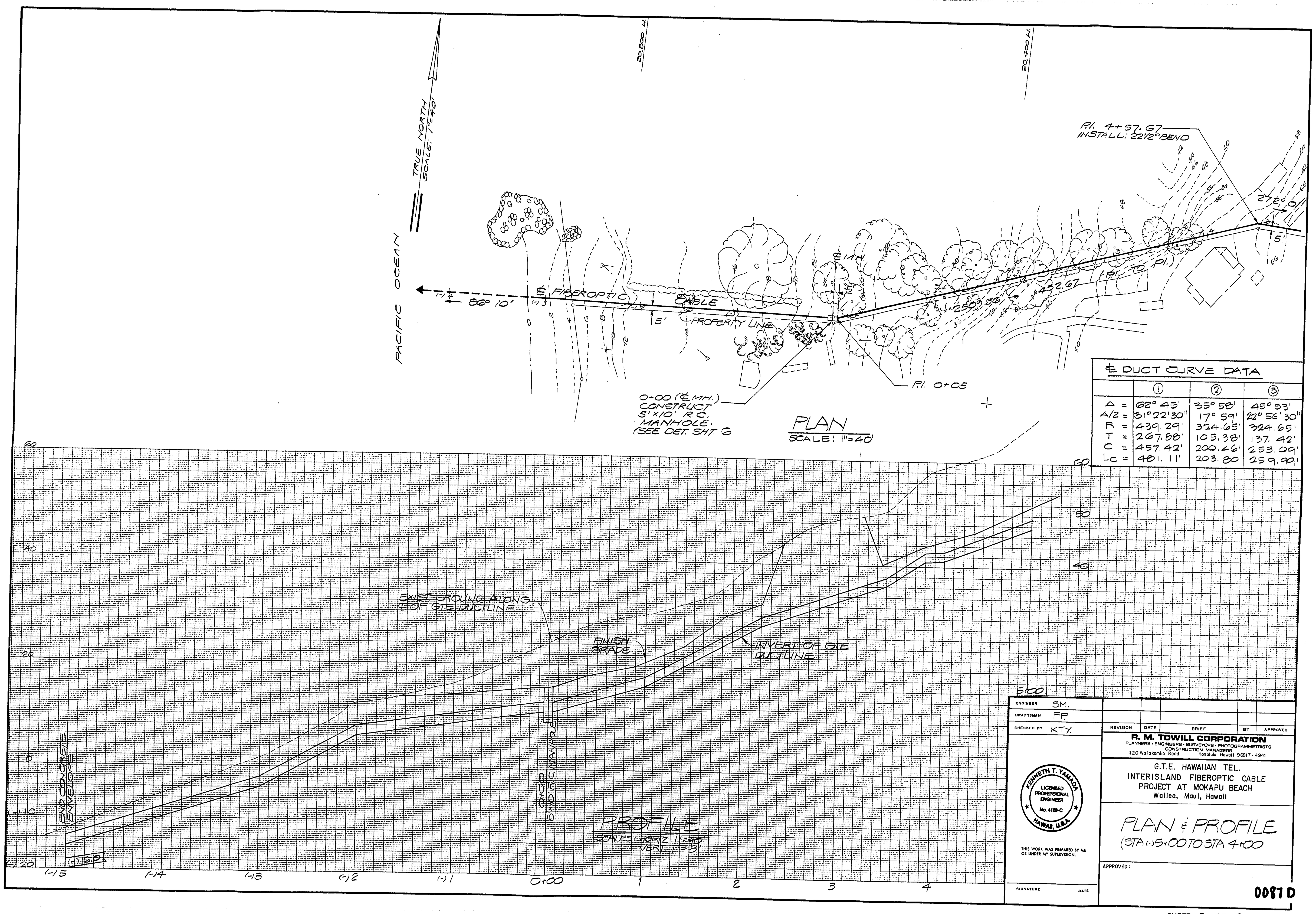
APPROVED :

0087 C

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0087D



℄ DUCT CURVE DATA

	①	②	③
Δ =	62° 45'	35° 58'	45° 53'
Δ/2 =	31° 22' 30"	17° 59'	22° 56' 30"
R =	439.29'	324.65'	324.65'
T =	267.88'	105.38'	137.42'
C =	457.42'	200.46'	253.09'
Lc =	481.11'	203.80	259.99'

ENGINEER SM.
DRAFTSMAN FP.
CHECKED BY KTY.

REVISION	DATE	BRIEF	BY	APPROVED

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420 Waiakamilo Road Honolulu Hawaii 96817-4941

KENNETH T. YAMADA
LICENSED PROFESSIONAL ENGINEER
No. 4159-C
HAWAII, U.S.A.

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SIGNATURE DATE

G.T.E. HAWAIIAN TEL.
INTERISLAND FIBEROPTIC CABLE
PROJECT AT MOKAPU BEACH
Wailea, Maui, Hawaii

PLAN & PROFILE
(STA (-)5+00 TO STA 4+00

APPROVED :

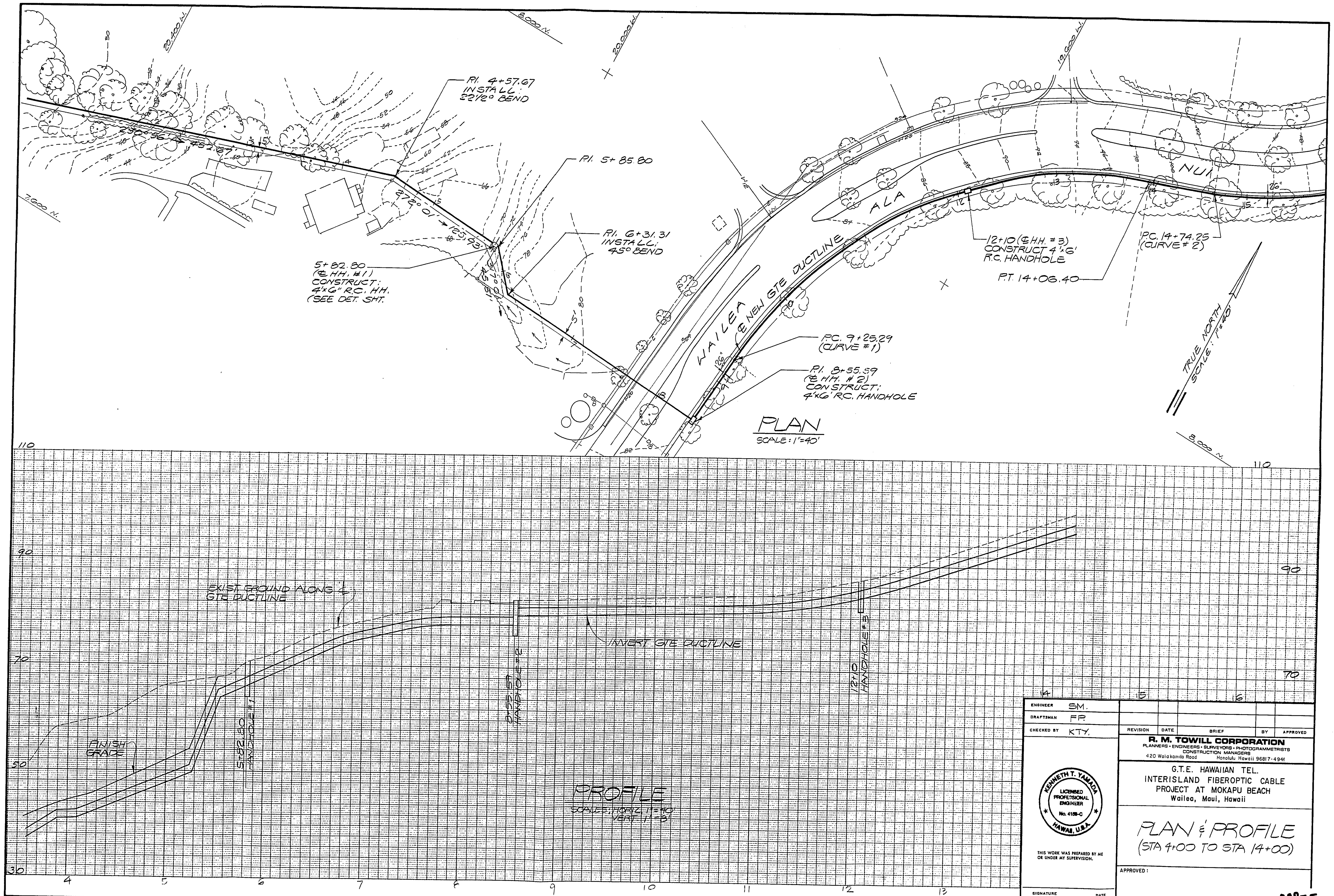
0087 D

SHEET 3 OF 9 SHEETS

OVERSIZED
DRAWING/MAP

PLEASE SEE
35MM ROLL

0081E



ENGINEER	SM.
DRAFTSMAN	FP.
CHECKED BY	KTY.

REVISION	DATE	BRIEF	BY	APPROVED

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G.T.E. HAWAIIAN TEL.
INTERISLAND FIBEROPTIC CABLE
PROJECT AT MOKAPU BEACH
Wailea, Maui, Hawaii

KENNETH T. YAMADA
LICENSED PROFESSIONAL ENGINEER
No. 4158-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE DATE

PLAN & PROFILE
(STA 4+00 TO STA 14+00)

APPROVED:

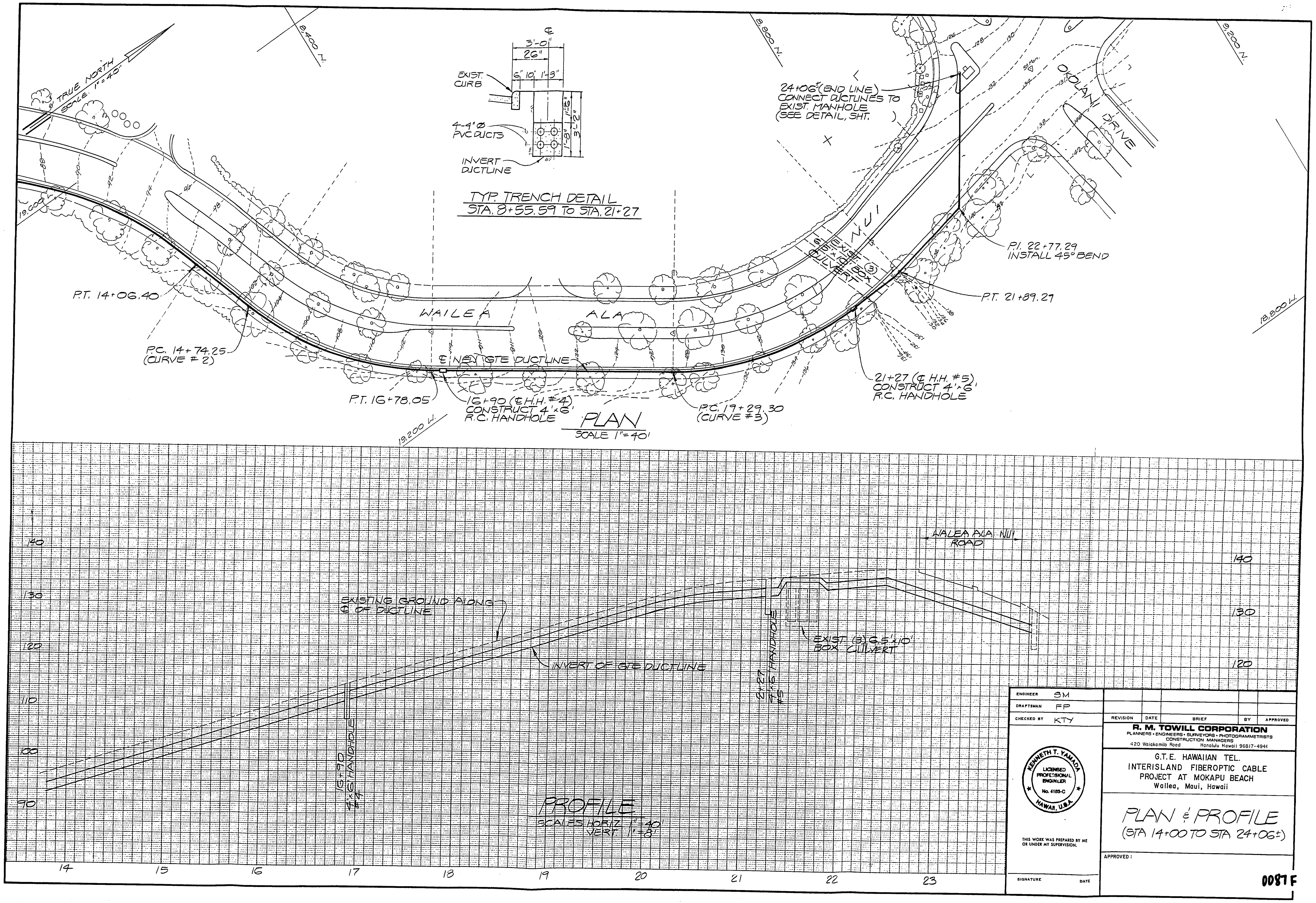
D087E

SHEET 4 OF 9 SHEETS

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0087F

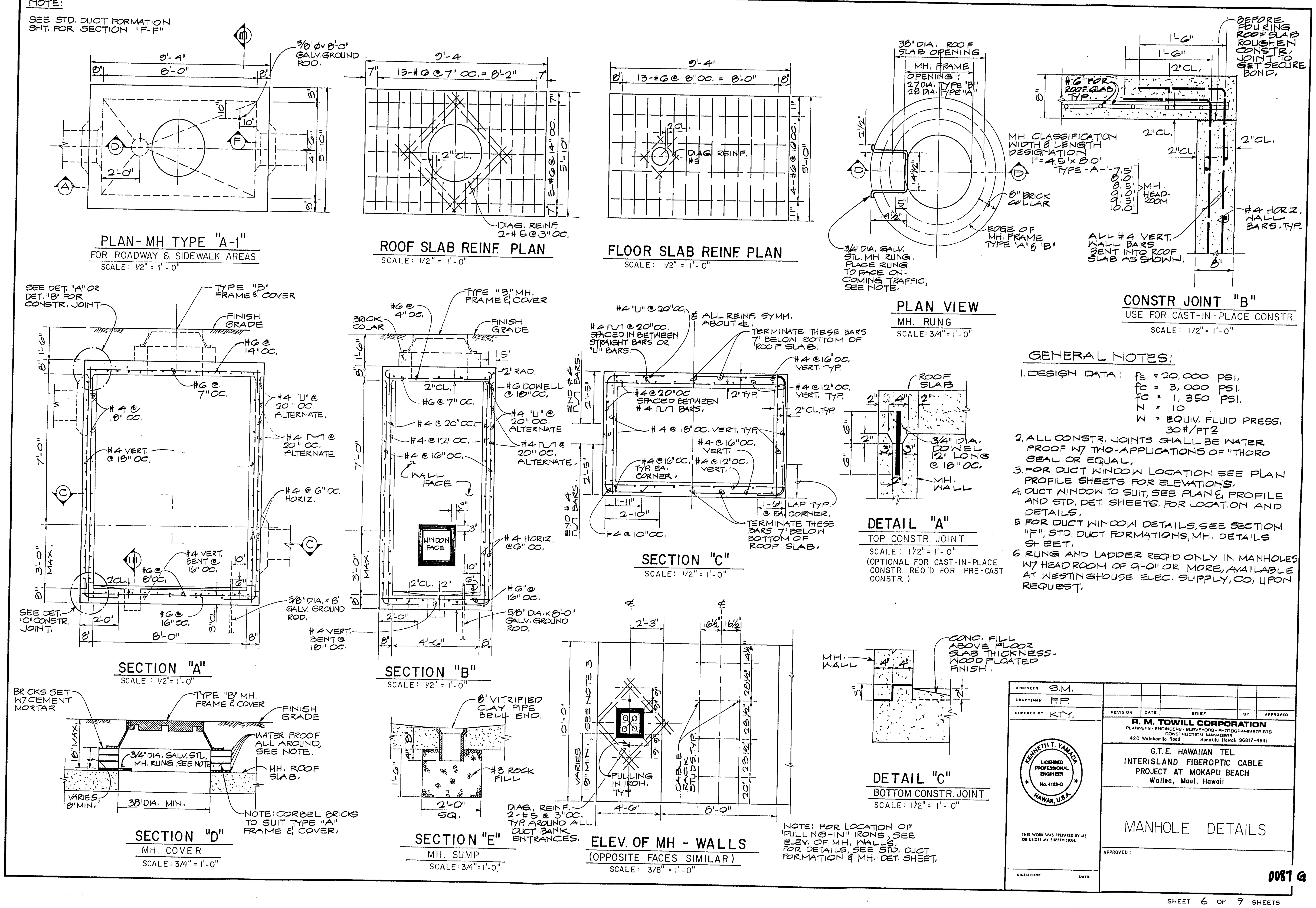


SHEET 5 OF 9 SHEETS

OVERSIZED
DRAWING/MAP

PLEASE SEE
35MM ROLL

00871G


NOTE:
SEE STD. DUCT FORMATION SHT. FOR SECTION "F-F"
PLAN - MH TYPE "A-1"
FOR ROADWAY & SIDEWALK AREAS
SCALE: 1/2" = 1'-0"
ROOF SLAB REINF. PLAN
SCALE: 1/2" = 1'-0"
FLOOR SLAB REINF. PLAN
SCALE: 1/2" = 1'-0"
PLAN VIEW
MH. RUNG
SCALE: 3/4" = 1'-0"
CONSTR JOINT "B"
USE FOR CAST-IN-PLACE CONSTR.
SCALE: 1 1/2" = 1'-0"
SECTION "A"
SCALE: 1/2" = 1'-0"
SECTION "B"
SCALE: 1/2" = 1'-0"
SECTION "C"
SCALE: 1/2" = 1'-0"
DETAIL "A"
TOP CONSTR. JOINT
SCALE: 1 1/2" = 1'-0"
(OPTIONAL FOR CAST-IN-PLACE CONSTR. REQ'D FOR PRE-CAST CONSTR.)
GENERAL NOTES:
1. DESIGN DATA: fs = 20,000 PSI. fc = 3,000 PSI. fc = 1,350 PSI. N = 10 W = EQUIV. FLUID PRESS. 30#/FT2
2. ALL CONSTR. JOINTS SHALL BE WATER PROOF W/ TWO-APPLICATIONS OF "THORO SEAL" OR EQUAL.
3. FOR DUCT WINDOW LOCATION SEE PLAN PROFILE SHEETS FOR ELEVATIONS.
4. DUCT WINDOW TO SUIT, SEE PLAN & PROFILE AND STD. DET. SHEETS FOR LOCATION AND DETAILS.
5. FOR DUCT WINDOW DETAILS, SEE SECTION "F", STD. DUCT FORMATIONS, MH. DETAILS SHEET.
6. RUNG AND LADDER REQ'D ONLY IN MANHOLES W/ HEAD ROOM OF 9'-0" OR MORE, AVAILABLE AT WESTINGHOUSE ELEC. SUPPLY, CO. UPON REQUEST.
SECTION "D"
MH. COVER
SCALE: 3/4" = 1'-0"
SECTION "E"
MH. SUMP
SCALE: 3/4" = 1'-0"
ELEV. OF MH - WALLS
(OPPOSITE FACES SIMILAR)
SCALE: 3/8" = 1'-0"
NOTE: FOR LOCATION OF "PULLING-IN" IRONS, SEE ELEV. OF MH. WALLS. FOR DETAILS, SEE STD. DUCT FORMATION & MH. DET. SHEET.
DETAIL "C"
BOTTOM CONSTR. JOINT
SCALE: 1 1/2" = 1'-0"
ENGINEER S.M.
DRAFTSMAN F.P.
CHECKED BY K.T.Y.
REVISION DATE BRIEF BY APPROVED
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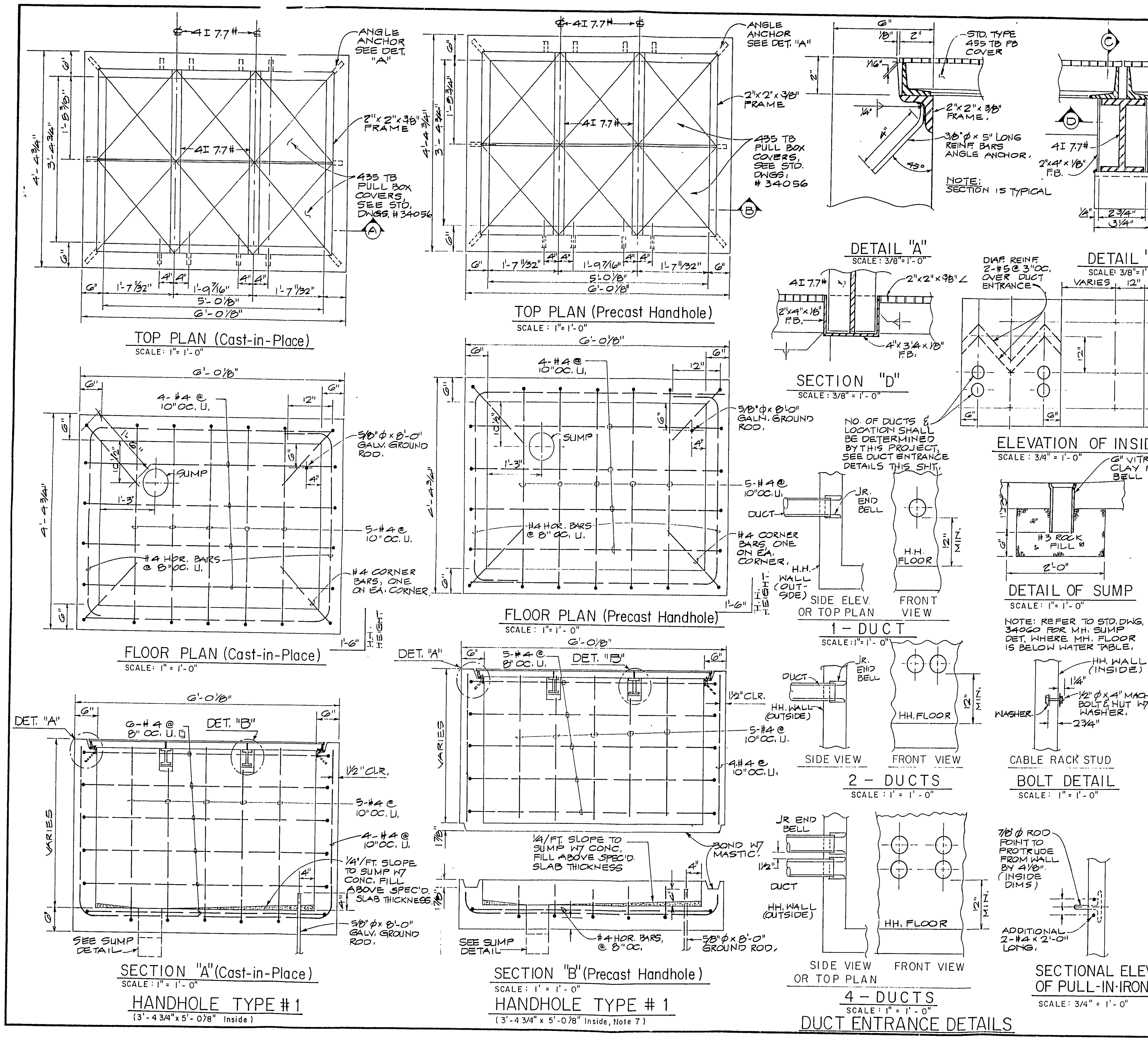
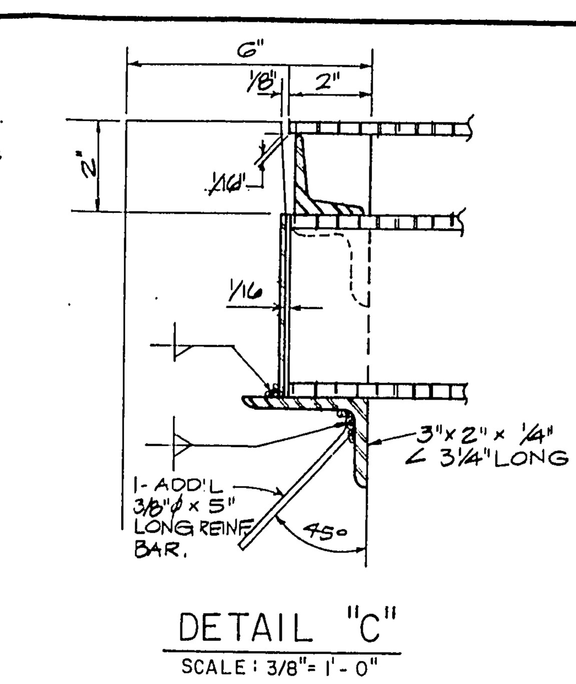
Wailea, Maui, Hawaii
KENNETH T. YAMADA LICENSED PROFESSIONAL ENGINEER No. 4153-C HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.
MANHOLE DETAILS
APPROVED:
SIGNATURE DATE
0087 G
SHEET 6 OF 9 SHEETS

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

D087H





GENERAL NOTES:

1. CONC. FINISH: FLOORS - WOOD FLOATED FINISH - EXPOSED WALL SURFACES AND EDGES - SMOOTH AND FREE FROM DEFECTS.
2. CONC. TO DEVELOP COMPRESSIVE STRENGTH = 3000 PSI. IN 28 DAYS.
3. STEEL WORK, ALL STRUCTURAL STEEL SHALL BE HOT-DIP GALVANIZED AFTER FABRICATION.
4. FOR DUCT LINE CONSTRUCTION STANDARDS, SEE STD. DWG. NO. 34028.
5. THESE HANDHOLES ARE DESIGNED FOR INSTALLATION IN AREAS OTHER THAN ROADWAYS.
6. MAX. LOADING FOR HANDHOLE W/ 435 TB. CHECKERED STEEL PLATE COVERS = 4,500 LBS.
7. SECTION "B" IS A 2-SECTION PRECASTED HANDHOLE WHICH MAY BE USED IN PLACED OF SECTION "A" (TYPE #1-HANDHOLE). THE 2-SECTIONS SHALL BE BONDED W/ A MASTIC WHEN INSTALLED TO PREVENT WATER ENTRY.

ENGINEER	SM.
DRAFTSMAN	PP.
CHECKED BY	KTY.

REVISION	DATE	BRIEF	BY	APPROVED

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Wailea, Maui, Hawaii

KENNETH T. YAMADA
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No. 4183-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE DATE

HANDHOLE DETAILS

APPROVED:

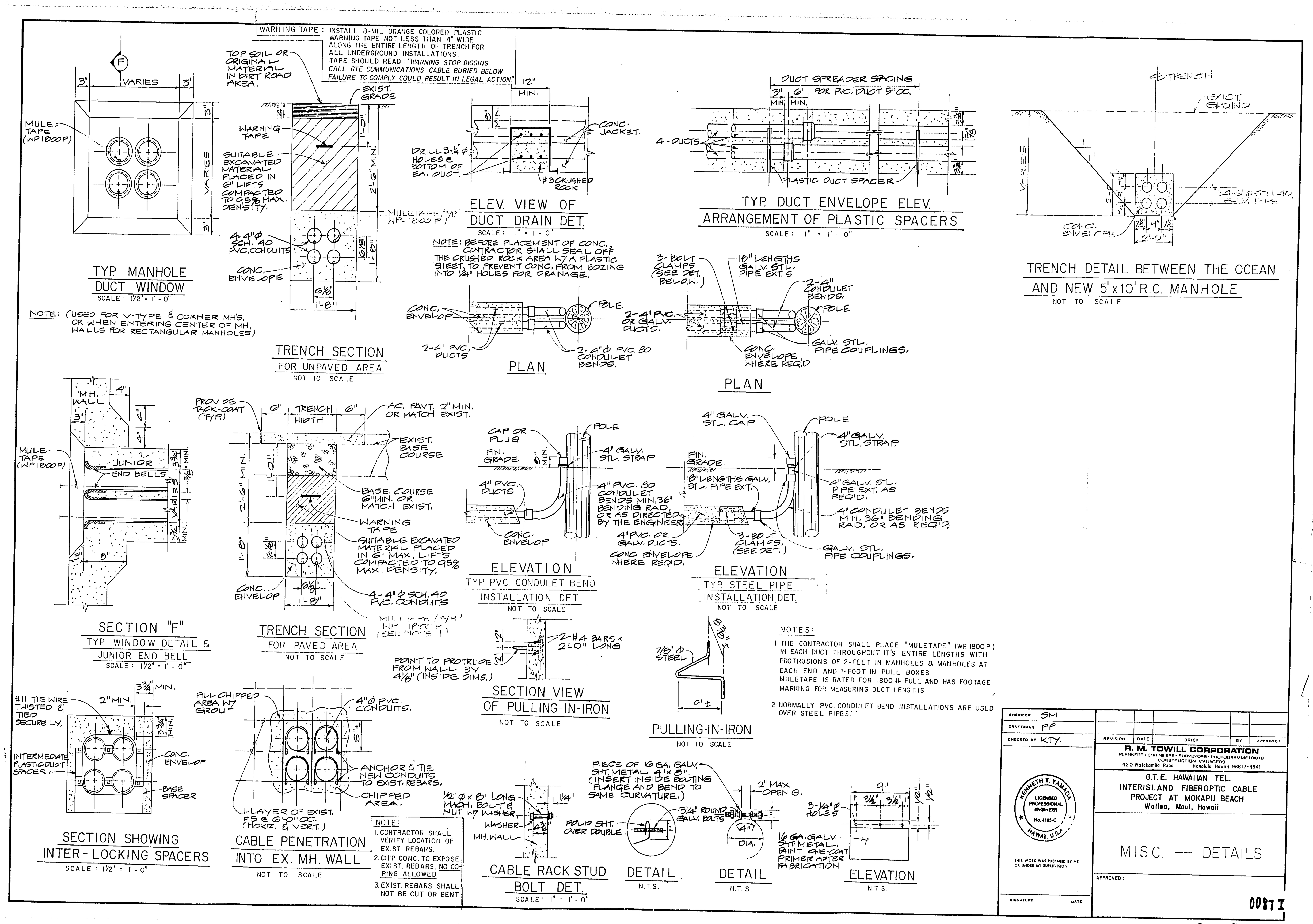
0087H

SHEET 7 OF 9 SHEETS

OVERSIZED DRAWING/MAP

PLEASE SEE 35MM ROLL

0081I



SHEET 8 OF 9 SHEETS