Copy faxed 10/28/96

LINDA CROCKETT LINGLE
Mayor

DAVID W. BLANE
Director

GWEN OHASHI HIRAGA
Deputy Director

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

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October 28, 1996

Mr. Gary Gill, Director
Office of Environmental Quality Control
220 South King Street
Suite 400
Honolulu, Hawaii 96813

Dear Mr. Gill:

Subject: Final Environmental Assessment And Finding of No Significant Impact for Submarine Fiber Optic Cable Landing at Kaunakakai, Island of Molokai, Hawaii TMK 5-3-001:016

The Molokai Planning Commission has reviewed the comments received during the 30-day public comment period which began on September 8, 1996. The Molokai Planning Commission has determined that this project will not have significant environmental effect and has issued a negative declaration. Please publish this notice in the November 8, 1996 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final EA. Please contact Don Schneider at 243-7735 if you have any questions.

Very truly yours,

Gwen Ohashi Hiraga

for DAVID W. BLANE
Planning Director

DWB:DAS
Enclosures
cc: Clayton Yoshida
Project File
Brian Takeda
Don Schneider
(F:OEQCmol.final)

1996-11-08-MO-FEA-Submarine Fiber Optic Cable Landing at Kaunakakai,

NOV 8 1996

FILE COPY

PREPARED IN ACCORDANCE WITH REQUIREMENTS OF CHAPTER 343, HAWAII REVISED STATUTES

FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT (FONSI)

# Submarine Fiber Optic Cable Landing at Kaunakakai, Island of Molokai

HAWAIIAN ISLAND FIBER NETWORK (HI FiberNet)

OCTOBER 1996

PREPARED FOR:
GST Pacwest Telecom Hawaii, Inc.
91-238 Kalaeloa Blvd., Building One
Kapolei, Hawaii 96707

RMTC
R. M. TOWILL CORPORATION
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii • 96817-4941
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FINAL ENVIRONMENTAL ASSESSMENT AND
FINDING OF NO SIGNIFICANT IMPACT (FONSI)

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

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# PROJECT SUMMARY

| | |
|---|---|
| Project: | Hawaiian Island Fiber Network (HI FiberNet) |
| Applicant: | GST Pacwest Telecom Hawaii, Inc.<br>91-238 Kalaeloa Blvd., Suite 100<br>Kapolei, Hawaii 96707<br>Contact: Mr. Robert Volker, General Manager<br>Telephone: (808) 682-5266 |
| Agent: | R. M. Towill Corporation<br>420 Waiakamilo Road, Suite 411<br>Honolulu, Hawaii 96817<br>Contact: Brian Takeda or Chester Koga<br>Telephone: (808) 842-1133 |
| Accepting Authority: | County of Maui<br>Molokai, Planning Commission |

## PROJECT SITE
KAUNAKAKAI, MOLOKAI

| | |
|---|---|
| Tax Map Key: | 5-3-01:16 |
| Location: | Parcel 236, Kaunakakai, Kaunakakai, Molokai |
| Owner: | Molokai Ranch, Ltd. |
| Existing Land Uses: | Residential |
| State Land Use District: | Urban |
| Molokai Community Plan: | Park/Golf Course, Single Family Residential, Public/Quasi-Public, Business/Commercial, and Light Industrial |

## SECTION 1
## INTRODUCTION

### 1.1 PURPOSE AND OBJECTIVES

GST Pacwest Telecom Hawaii, Inc., a subsidiary of GST Telecom Inc., proposes to develop an interisland submarine fiber optic cable system which will link the Islands of Kauai, Oahu, Maui, Lanai, Molokai and Hawaii. The GST network will be largest in the State and the first to connect Molokai and Lanai with the other major islands.

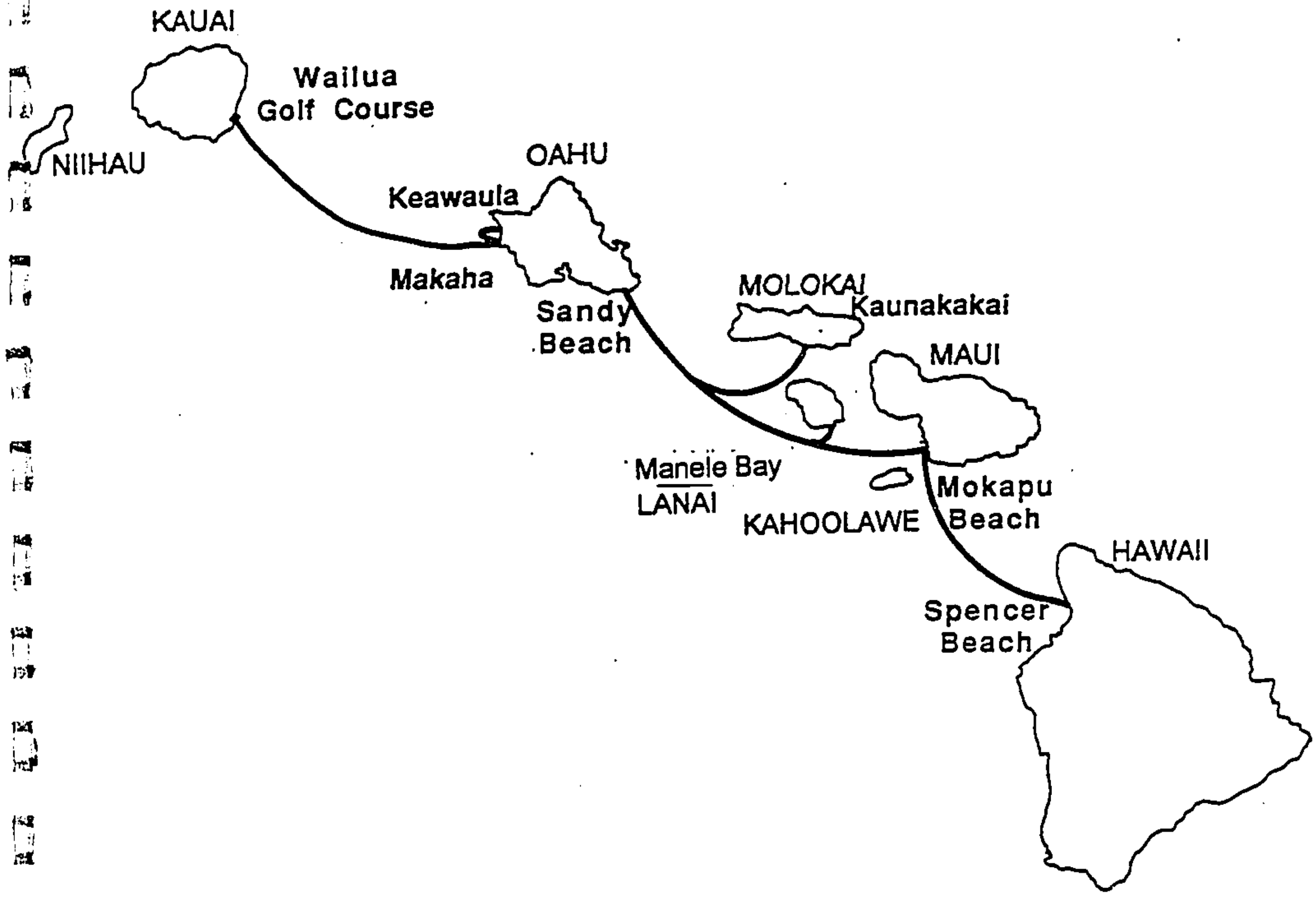
In the early 1990's, GTE Hawaiian Tel installed the first interisland fiber optic cable system to enhance its existing interisland radio system. Information for this environmental assessment is derived from earlier reports written for GTE Hawaiian Tel by R. M. Towill Corporation (*January 1993, Environmental Assessment for the GTE Hawaiian Tel Interisland Fiber Optic Cable System; Wailua Golf Course Kauai; Sandy Beach Park, Oahu; Mokapu Beach, Maui; Spencer Beach Park, Hawaii).*

The proposed system will include three interisland submarine cable segments with eight landing sites (**Figure 1-1**). The main system will include a 24 strand main cable with linkage from Waialua Golf Course, Kauai, to Makaha, Oahu; Makaha Beach to Keawaula, Oahu; Sandy Beach, Oahu, to Mokapu Beach, Maui; and, Mokapu Beach to Spencer Beach, Hawaii. On the Sandy Beach to Mokapu Beach segment, two branching units comprised of up to 8 fiber optic strands will "branch" off from this segment of the interisland system for landings at Kaunakakai, Molokai, and Manele Bay, Lanai.

The purposes of the proposed project are as follows:

- To provide the public with a viable, alternative to interisland telecommunications service that is now provided only by a single vendor. It is anticipated that additional competition will result in higher quality and competitive pricing which will benefit the public;

- Fiber optics will allow GST Pacwest Telecom Hawaii, Inc. to enhance service by increasing bandwidth capacity to serve customers. A fiber optic linkage has higher capacity bandwidth which would allow use of high technology services such as telemedicine and real time videotrafficing; and




Not to Scale

Figure 1-1
HAWAIIAN ISLAND FIBER NETWORK

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

R. M. TOWILL CORPORATION

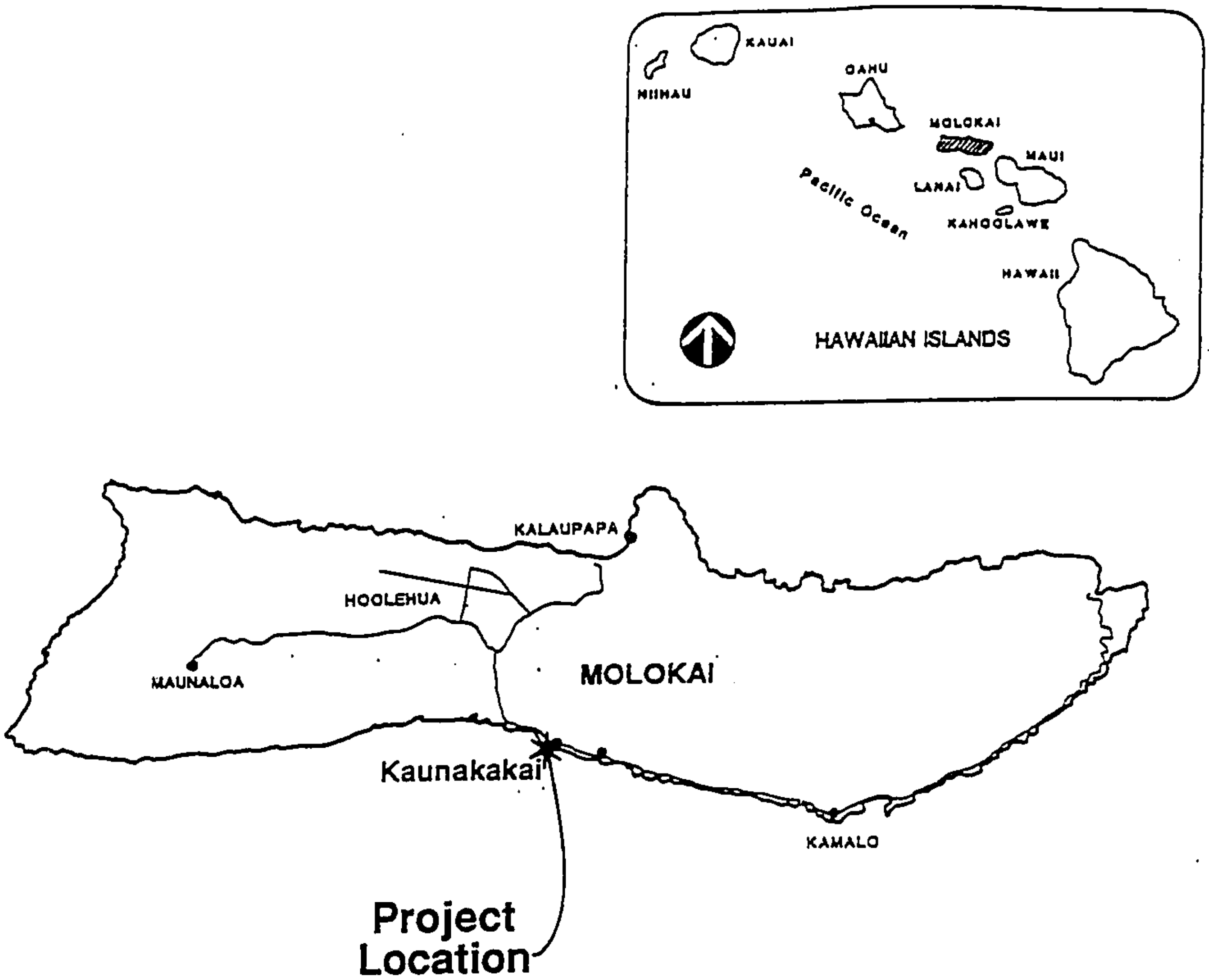
- To provide an alternative to the existing micro-wave system.

1.2 PROJECT LOCATION

The proposed landing site for the Island of Molokai is Kaunakakai (TMK: 5-3-1:16, parcel 236), a vacant residential lot located along the southern coast of the Island of Molokai (**Figure 1-2**). The lot is located makai of Beach Place between Kaunakakai Place and Pau Hana Inn.

To the west is Kaunakakai Harbor, a State-owned commercial barge harbor and recreational boating facility. The harbor was developed at a natural break within the mile-wide fringing reef. The harbor consists of a dredged natural channel with a 700-yard long mole terminating in a pier island. The harbor is the only State-owned facility where both large and small boats operate in the same general area. The pier island is constructed with a combination of fill land along the east face and pile supported structures along the west face. Commercial operations occur on the western side of the pier and small boat operations occur on the eastern and northwestern sides of the pier.

The fiber optic cable will be laid east of the harbor channel and along the eastern face of the shore (**Figure 1-3**). The cable will be installed in drill pipe and laid on the mudflat until it reaches an offshore depth of approximately 90 to 100 feet. The cable will then be buried ± 5 feet deep in substrate across the bottom of the channel entrance to the harbor to protect the cable from heavy boat traffic. Landside, the proposed cable will be routed subsurface from the landing site through a ductline leading to a proposed handhole at a new terminal building. The cable will be routed through one of four, 4" diameter PVC ductlines following existing public rights-of-way terminating in the vicinity of Molokai General Hospital.



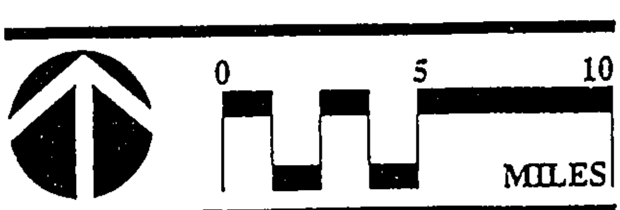




Figure 1-2
LOCATION MAP
Kaunakakai, Molokai

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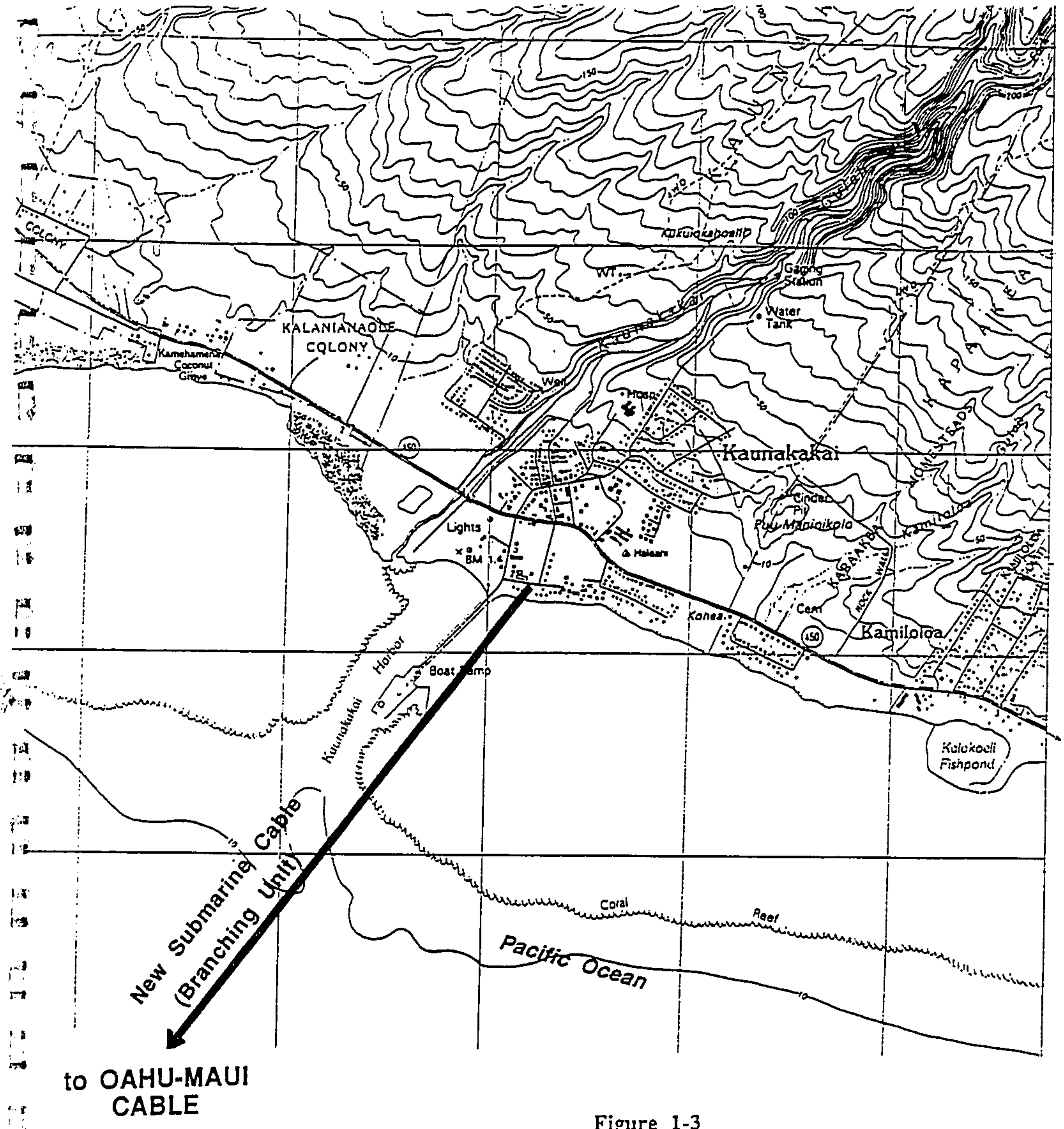
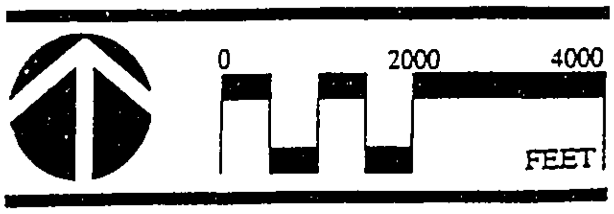



Figure 1-3
CABLE ALIGNMENT PLAN
Kaunakakai, Molokai

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# SECTION 2
# PROJECT BACKGROUND

## 2.1 CABLE TECHNOLOGY

The following is a discussion of existing telecommunications 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.

Copper wire cables 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. 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 8 fiber optic strands and would be housed in a plastic and steel casing no more than approximately 17 to 51 mm in diameter **(Figure 2-1)**. 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 approximately 8,000 voice circuits, for a combined total on the order of 32,000 voice circuits (2 strands = 1 pair, 8 strands = 4 pairs working, and 4 pairs x 8,000 voice circuits = 32,000 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 6 to 8 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;

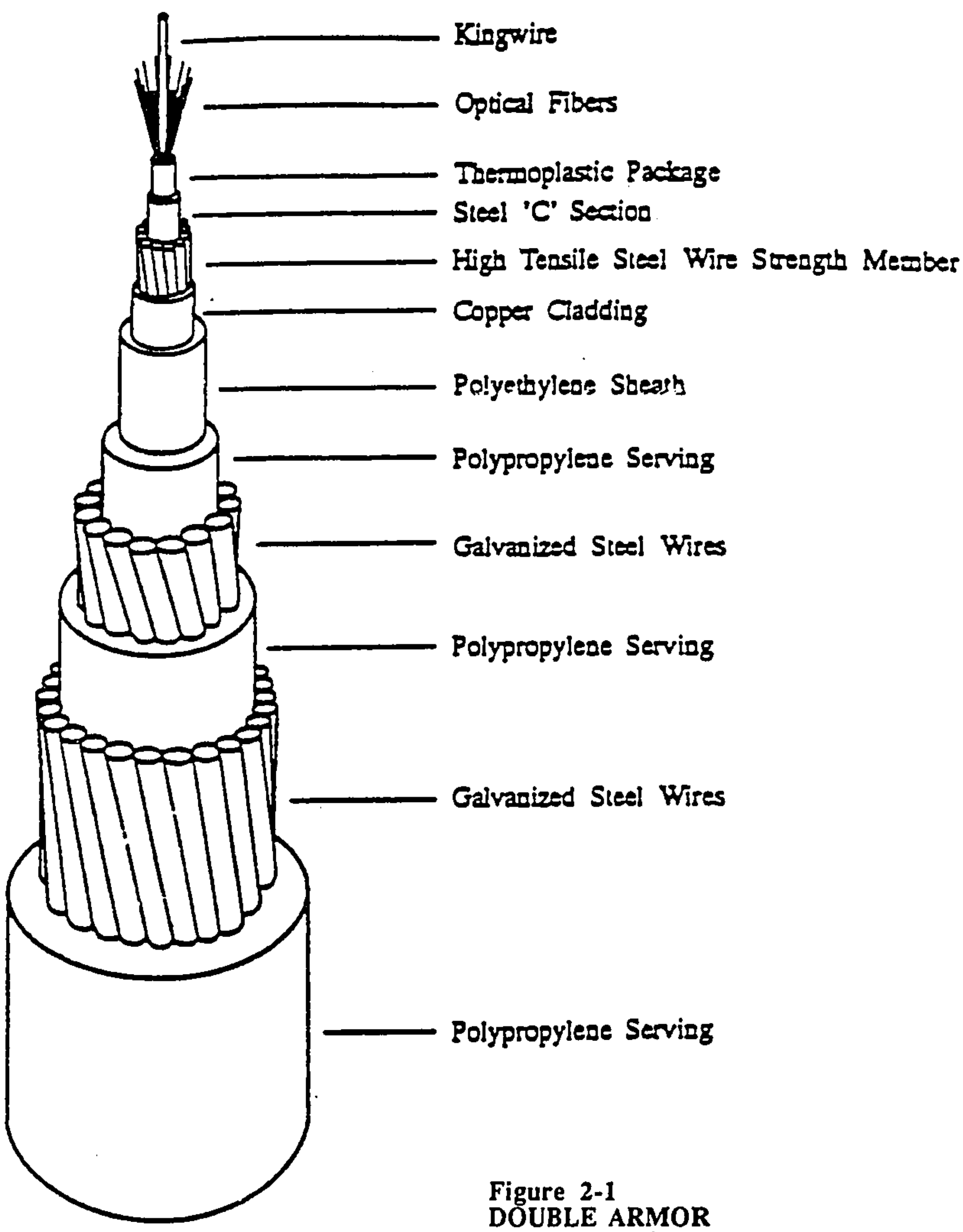


Figure 2-1
DOUBLE ARMOR
FIBER OPTIC CABLE

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

R. M. TOWILL CORPORATION

- The smaller diameter fiber cable ensures there will be minimal disturbance to the surrounding land in order to site the cable. There is less land needing to be graded, cleared and stockpiled in order to site a 17 to 51 mm 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 nearshore users including commercial harbor operators, recreational boaters, fishers, 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.

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

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

### 2.2.8 Length of Routes Less Than 200 Kilometers

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

## 2.3 LANDING SITES SELECTION

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

The following is a brief discussion of criteria for determining a landing site on Molokai:

### 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 were considered for the Molokai landing of the fiber optic cable where underwater geology would be most suitable: Kaunakakai area, Kolo Harbor located approximately 10 miles west of Kaunakakai, and a small serpentine channel located approximately 3.5 miles west of Kaunakakai. Kaunakakai area was selected as the preferred landing site due to the proximity to the population center of Molokai. Two general cable alignments were investigated (Sea Engineering, 1996). Alternative 1 approximately follows the eastern edge of the harbor entrance channel, eventually making landfill at the Pier Island. Alternative 2 is located approximately 600 feet to the east, and would cross the shallow fringing reef flat making landfill in the vicinity of the Pau Hana Inn. Alternative 2 is preferred cable alignment because it provides better cable protection from ship and tug operation in the entrance channel.

Should the Kaunakakai area be removed from consideration, it is recommended that the small serpentine channel located approximately 3.5 miles west of Kaunakakai be utilized. The channel provides access to the shore through the reef, and is readily visible from the air.

## SECTION 3

## CONSTRUCTION ACTIVITIES

### 3.1 GENERAL

Construction of the project will include all work necessary to prepare the landing sites, landing the cable, and installing the cable to a new handhole at a proposed terminal building.

Proposed construction will take place in two phases. The first phase involves landside construction activities including trenching of the beach and nearshore area, and placement of temporary landing targets. This phase will be described in 3.2 LAND-SIDE ACTIVITY.

The second phase will involve the actual landing of the cable into a new handhole and beach restoration. Phase two will be described in 3.3 NEARSHORE ACTIVITIES.

3.4 CABLE LANDING PROCESS provides a detailed description of the cable landing, and 3.5 SAFETY CONSIDERATIONS identifies precautions that will be exercised to ensure safety of the public.

### 3.2 LAND-SIDE ACTIVITY

The first phase involves land-side construction which includes installation of new handhole, terminal building, and approximately 4000 feet of subsurface cable along public rights-of-way to Molokai General Hospital (**Figure 3-1**).

The new 24' x 10' terminal building will be constructed at the northeast corner of the parcel adjacent to the intersection of Beach Place and Mohala Street, approximately 200 feet mauka of the certified shoreline. The terminal building includes a new 4' x 6' deep reinforced concrete handhole (smaller version of a manhole). The new underground ducts will be encased in a concrete jacket and buried under 3-4 feet of earth cover (**Figure 3-2**). Only one duct will be utilized while the others remain vacant and retained should their future use be necessary. From

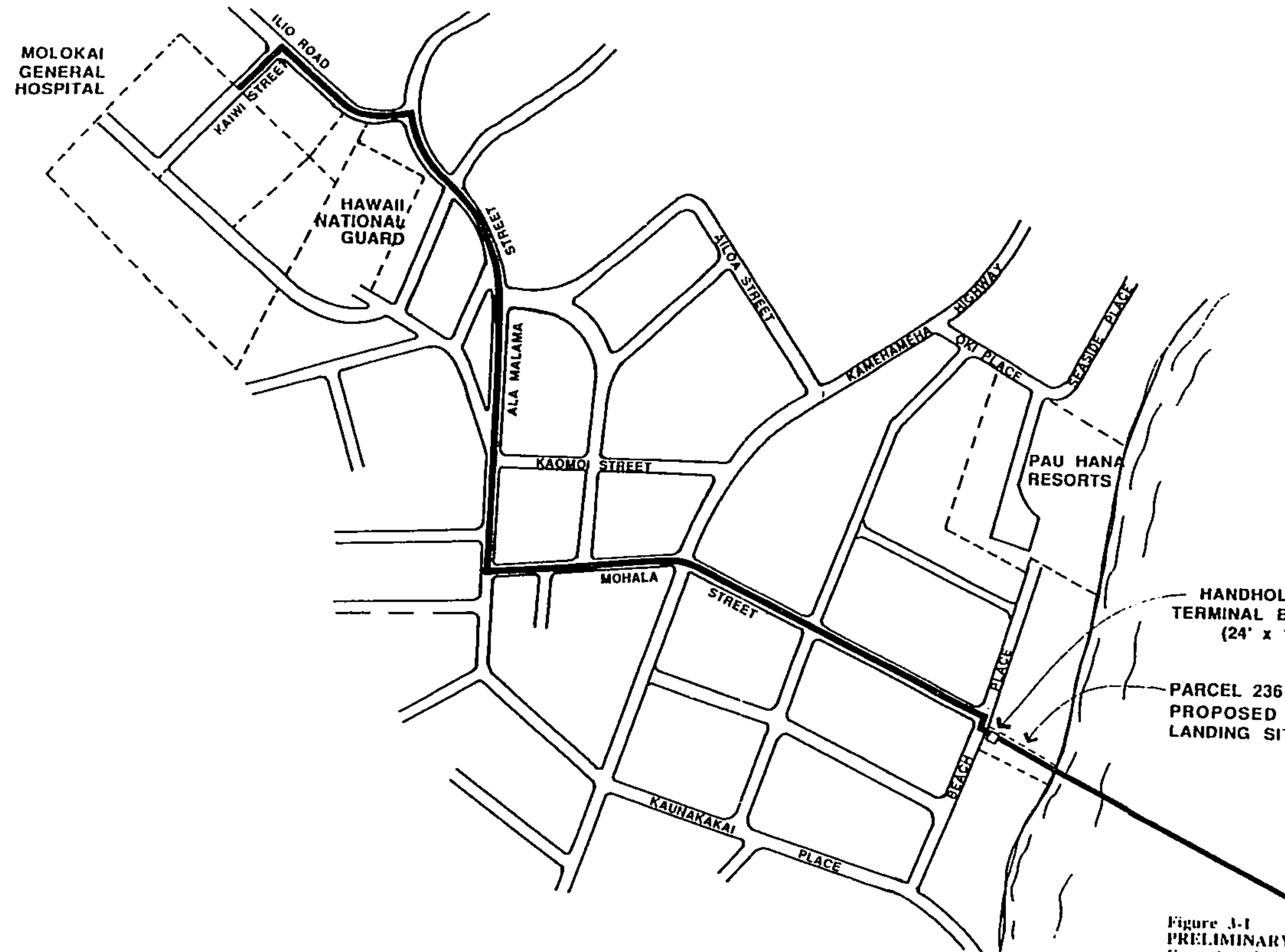


Figure 3-1
PRELIMINARY SITE PLAN
Kaunakakai, Molokai

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

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April 1996

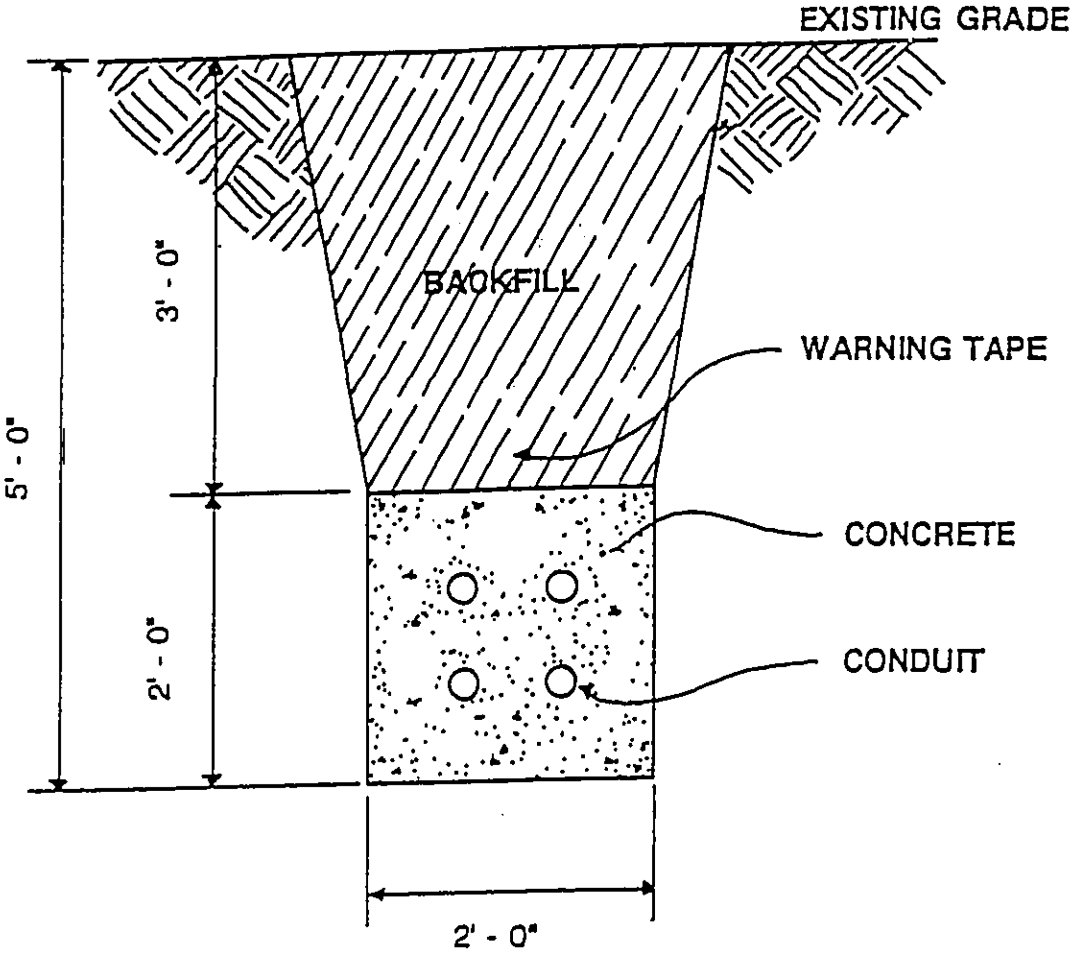


**Figure 3-2**
**Handhole Profile**
**Kaunakakai, Molokai**

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

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April 1996

the handhole the cable will be routed subsurface through one of four, 4 inch diameter PVC ductlines along Mohala Street, Ala Malama Street and Kaiwi Street to Molokai General Hospital.

Traffic will be affected during work operations and may be detoured around construction equipment. Traffic control procedures such as rerouting the traffic onto the shoulder of the road with the aid of temporary traffic control devices (cones) and/or flagmen to direct traffic will be implemented.

## 3.3 NEARSHORE ACTIVITY

The greatest danger to a cable system is the submarine (underwater) portion of the route, and this necessitates more construction effort than the land-side activity. 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, it is suggested that trenching or cable armoring be used to protect the cable and for public safety.

The second phase involves landing the cable, establishing a connection to the handhole (to be constructed) at the shoreline area makai of Beach Place, and placement of range targets to guide the cable laying ship.

An approximately 200-foot long trapezoidal shaped trench will be excavated between the new handhole and the mean low water mark and four 4-inch steel conduits encased in concrete installed within the trench (see **Figure 3-2**). The trench will have a 2-foot base and will be approximately 5-foot deep, with 1 to 1 side slopes. Approximately 260 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 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 also be removed using a backhoe or other similar mechanical means.

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.

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 the existing roadway system.

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 handhole. When the cable is secured in the handhole, it will be temporarily anchored while the divers readjust the suspension floats in the water to obtain a proper nearshore to shoreline alignment.

Studies were conducted by Sea Engineering, March 1996, and AT & T, June 1996, to assess the ocean bottom along the proposed cable alignment for the Molokai landing site.

The proposed cable will be laid approximately 700 feet to the east of Kaunakakai Harbor, and would cross the shallow fringing reef/mudflat. The ocean bottom survey was conducted on the proposed cable route, starting at the 100-foot depth where the inshore slope begins to shoal up to the fringing reef. The sand to hard bottom transition occurs at a depth of between 90 to 100 feet. The zone between 90 and 40 feet represents the coral coverage and the typical vertical relief of 2 feet. The zone between 40 to 30 feet indicated increasingly irregularity of the bottom conditions and the typical vertical relief of 3 feet. At the 30-foot depth point, there is a distinct shift in the bottom zonation. The bottom becomes flat and scoured, with scattered pieces of coral rubble. This zone extends to the 20 foot depth, and is apparently where the maximum wave induced forces occur. The spur and groove formation typical of the seaward faces of fringing reefs begins at the 20-foot depth. Vertical relief is up to 4 feet and the surf zone is comprised mostly of mud flat. Typical bottom conditions in 5 feet of water indicate increased sediment deposit.

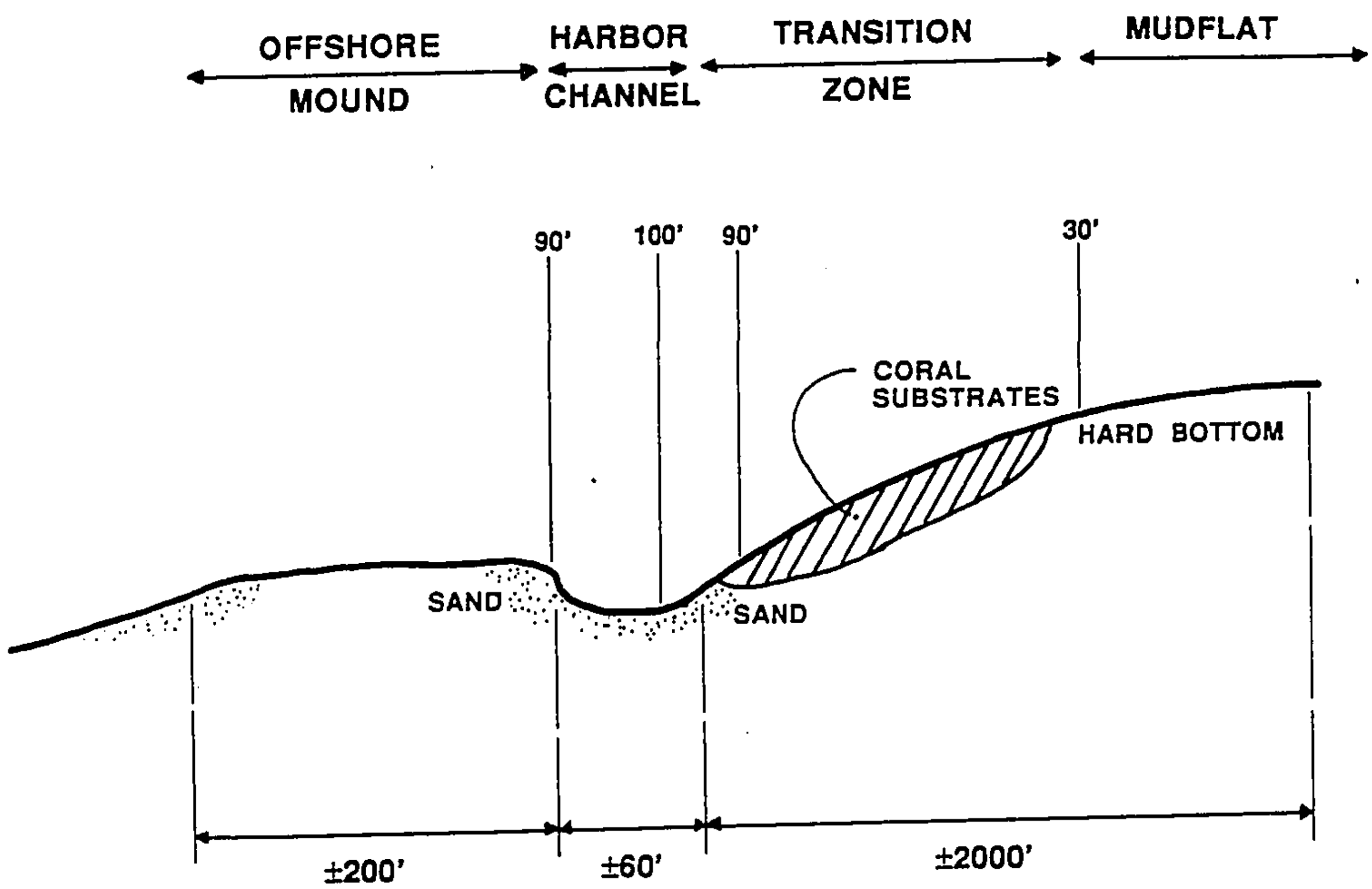


**Figure 3-3a**
**OFFSHORE MOUND**
**OCEAN FLOOR PROFILE**
**Kaunakakai, Molokai**

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

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Not to Scale

After investigation of the site it was determined that no further protection of the cable would be required along the cable alignment. The construction of the cable will be provide sufficient protection from southwest wave forces which approach from the area of open ocean between South Molokai and Lanai. At the beach, the cable will be buried to a depth of approximately five (5) feet. This alignment through the mudflat will result in minimal environmental impacts since the fiber optic cable can be adjusted within the alignment so that little to no coral will have to be displaced to site the cable (The installation of fiber optic cable at Spencer Beach Park, Kawaihae, Hawaii, was similarly routed to avoid coral heads).

During investigation of the offshore alignment (e.g., approximately 90-foot depth), an offshore mound was discovered to the west of Kaunakakai Channel entrance (March, 1996). This mound was determined to be in the general vicinity of proposed cable alignment (Figure 3-3a). A subsequent survey of the specific alignment taken in June 1996, revealed that while some portions of the area do have these offshore mounds, the specific alignment of the fiber optic cable could be laid within a relatively flat and featureless area (Figure 3-3b).

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

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

## 3.4 CABLE LANDING PROCESS

Cable landing process includes the use of the land-side targets (aligned markers) to assist in the alignment of the cable as it is being installed. The cable laying ship may be assisted by two tugboats to maintain proper alignment of the cable ship. This assistance is essential to ensure that the cable is placed within the existing cable easement. Once the cable laying ship is properly aligned, the cable will be towed from the ship by one of the tugs to a transfer location nearshore.

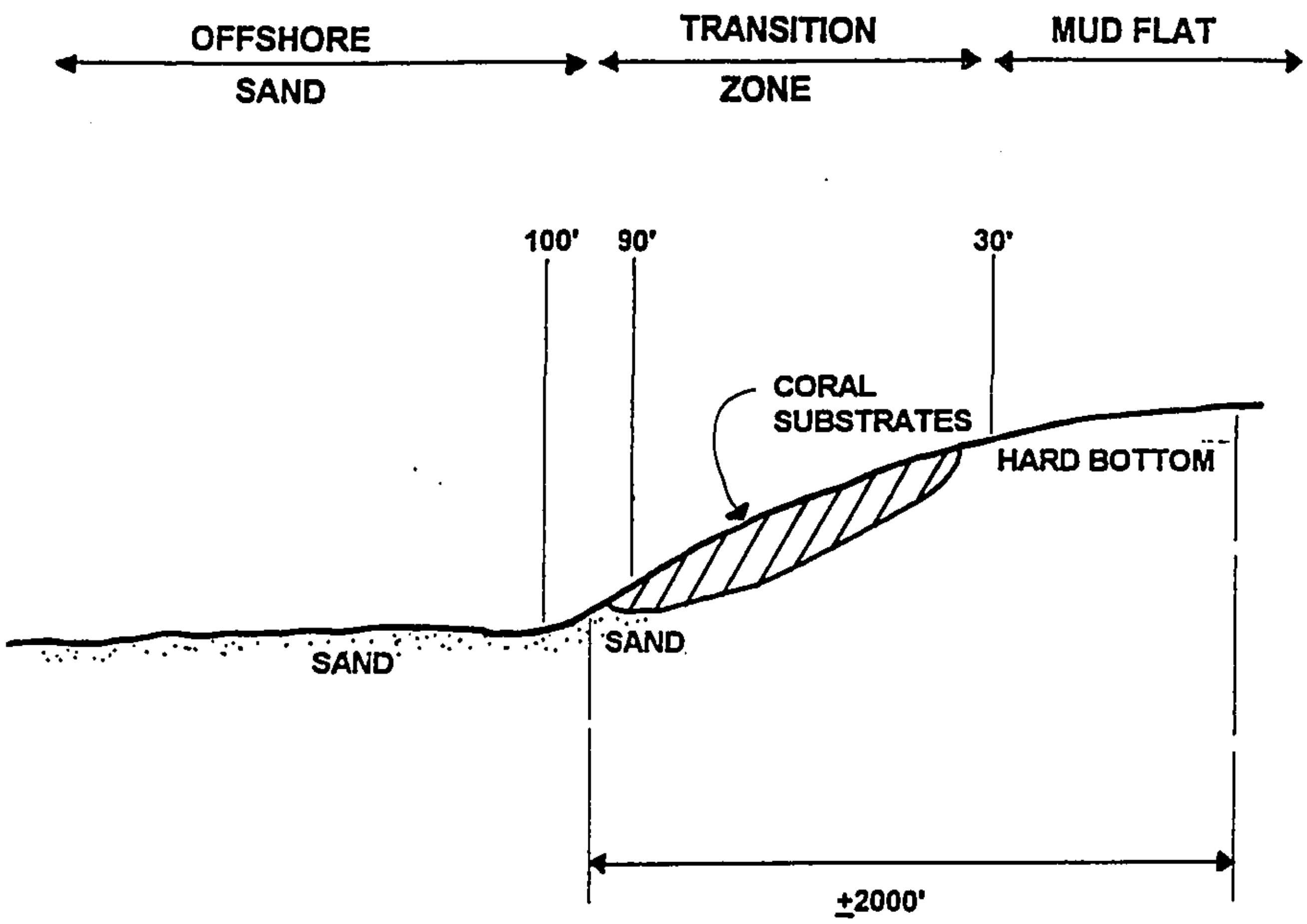


**Figure 3-3b**
**OCEAN FLOOR PROFILE**
**ALONG CABLE ALIGNMENT**
**Kaunakakai, Molokai**

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At this location, the leading end of the cable will be attached to a rope connected to land based pulling equipment (i.e., winch) and pulled ashore. Divers will assist in the nearshore landing process. Once the cable is placed within the new steel conduit, the leading end of the cable will be secured within the handhole and spliced together with cable emanating from Molokai General Hospital.

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

### 3.5 SAFETY AND ENVIRONMENTAL CONSIDERATIONS

During the construction phase on the beach (approximately 7-10 calendar days in November/December 1996), portions of the harbor shoreline area and breakwater 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 10-12 hours depending on the weather conditions), the nearshore waters will be closed to ocean activities to ensure public safety of the ocean users. The area that will be closed will be approximately 100 to 150 feet wide and 2,000 to 5,000 feet long. The actual area may be more or less depending on the tides. This period when the waters will be closed is not expected to be more than two days, weather permitting. This short-time "closure" of nearshore water areas will be achieved by publishing a notice to advise mariners to avoid the area.

All work shall be performed in conformance with 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 Fall 1996. The second phase (installation of the interisland cable and cable landing operation) is scheduled tentatively for Fall 1996. Construction costs for the first phase is estimated at +$250,000.

## 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 Molokai which is very dry and sunny, typical of the Hawaiian Islands. Essentially, the climate is characterized as a two-season year (winter and summer) dominated by northeasterly winds. The annual rainfall is about 14 inches. The recorded temperatures at Molokai Airport, which is closest to Kaunakakai, range from 70.2°F in the coolest month and 77.6°F in the warmest month. Winds are predominantly northeasterly tradewinds. Some of these winds are diverted around the eastern tip of the Island by the island's mountain range and result in easterly prevailing winds along the southern coast.

#### 4.1.2 Topography, Geology, Soils

The landing site is generally level and well-vegetated. Geologically, Molokai was created from the lava flows of three separate shield volcanoes. The East Molokai Volcano rises to an elevation of 4,970 feet and is cut with deep valleys and is typical of the rugged topography of moist areas of the State. The West Molokai Volcano rises to an elevation of only 1,381 feet and is much drier. This volcano consists of mostly rolling hills and plateaus. The north shore of this part of the island is characterized by sea cliffs which drop steeply into the ocean. Along the south shore are plains with offshore fringing coral reefs. Inland of the fringing reef is nearly a continuous apron of alluvium which represents terrestrial sediment due to accelerated erosion of the southern mountain slopes. The revetted mole and pier were constructed over this reef formation.

A third volcano, located on the north shore of Molokai, created the Kalaupapa Peninsula. The steep cliffs of the east Molokai volcano separates this peninsula from the rest of Molokai isolating the communities of Kalawao and Kalaupapa which have served as colonies for victims of Hansen's Disease since 1865.

A major drainage feature, Kaunakakai Gulch, is located approximately 2,000 feet to the west of the project site. During storm conditions, runoff from the Kaunakakai Stream deposits silt into the western portion of the harbor. This silt contributes to the shoreside mudflats typically found along Molokai's south shore.

According to the *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, the landing site is part of a larger soil unit known as Jaucas sand (Jac) which occurs as narrow strips on the coastalplain, adjacent to the ocean. Jaucas sand is extremely drained and develop in wind- and water- deposited sand from coral and seashells.

Extensive erosion occurs in the Kamiloa Drainage Basin which contributes to the heavy siltation of the marine water on the fringing reef. This erosion and subsequent deposits have negatively affected the water quality of nearshore ocean waters on the project area.

Impacts

With respect to the segment of the cable to be installed subsurface, no long term surface impacts are anticipated since the project involves temporary excavation and filling with the same material. The excavated portions will be returned, as much as practicable, to its original preconstruction condition.

### 4.1.3 Hydrology

There are no perennial streams in the subject area. The major intermittent drainage feature for the area is Kaunakakai Gulch which originates in the West Molokai Mountains. Kaunakakai Stream flows past Kaunakakai Town on the west and according to records of the U. S. Department of the Interior Geological Survey, averages about 1.9 cubic feet per second. During storm conditions, sedimentation from storm flows are deposited in the harbor basin and channel and the surrounding fringing reef.

Groundwater for the area is brackish 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 and Fauna

According to the *Final Environmental Assessment, Negative Declaration for the Kaunakakai Town Drainage Improvements, Kaunakakai, Molokai, March 1995*, the coastal plain of the area is characterized as low, marshy land covered with grass and brush. Kiawe trees and brush cover the areas above the coastal plain which thickens to a tropical growth in the uppermost, wet regions. Along the shore, the vegetation consists mainly of kiawe, haole koa, finger grass and pili grass. About a mile to the west is the Kamehameha Coconut Grove and a very dense growth of mangrove.

Molokai's major terrestrial animal life consists mainly of introduced feral mammals including deer, goat, mongoose, and wild pig. There are about nine species of birds, five of which are listed as endangered by the U. S. Department of Interior, Fish and Wildlife Service and the State of Hawaii and include the Hawaiian Coot (*Fulica alai*), Hawaiian common moorhen (*Gallinula chloropus*), Hawaiian stilt (*Himantopus mexicanus*), the Molokai creeper (*Paroreomyza flammea*), and the Molokai thrush (*Myadestes lanaiensis*). The endangered coot, moorhen, and stilt, are waterbirds with habitats in the south shore fishponds, the nearest being more than a mile to the east. The creeper and the thrush are endemic to the island and make their habitats at the 2,000-foot elevation, about 5 miles northwest of the project area.

Impacts

The landing site does not contain any rare plants or animals. If any rare or endangered fauna are found to frequent the landing site, work in the immediate area will cease and the appropriate government agencies will be contacted for further mitigative measures.

### 4.1.5 Marine Flora and Fauna

According to the *Water Quality and Marine Biological Studies; Impact Analysis Included in the Final Environmental Assessment for the Kaunakakai Drainage Improvements, June 1992*, a biological survey was conducted to inventory the area's offshore marine animal and flora communities. Various locations on the reef, corresponding to proposed drainage discharge points, were surveyed (**Figure 4-1**). Findings were similar to those of a previous benthic study prepared for the U. S. Army Corps of Engineers in 1978. Three coral colonies were recognized, e.g. nearshore, mid-reef, and offshore; along with a diverse invertebrate community.

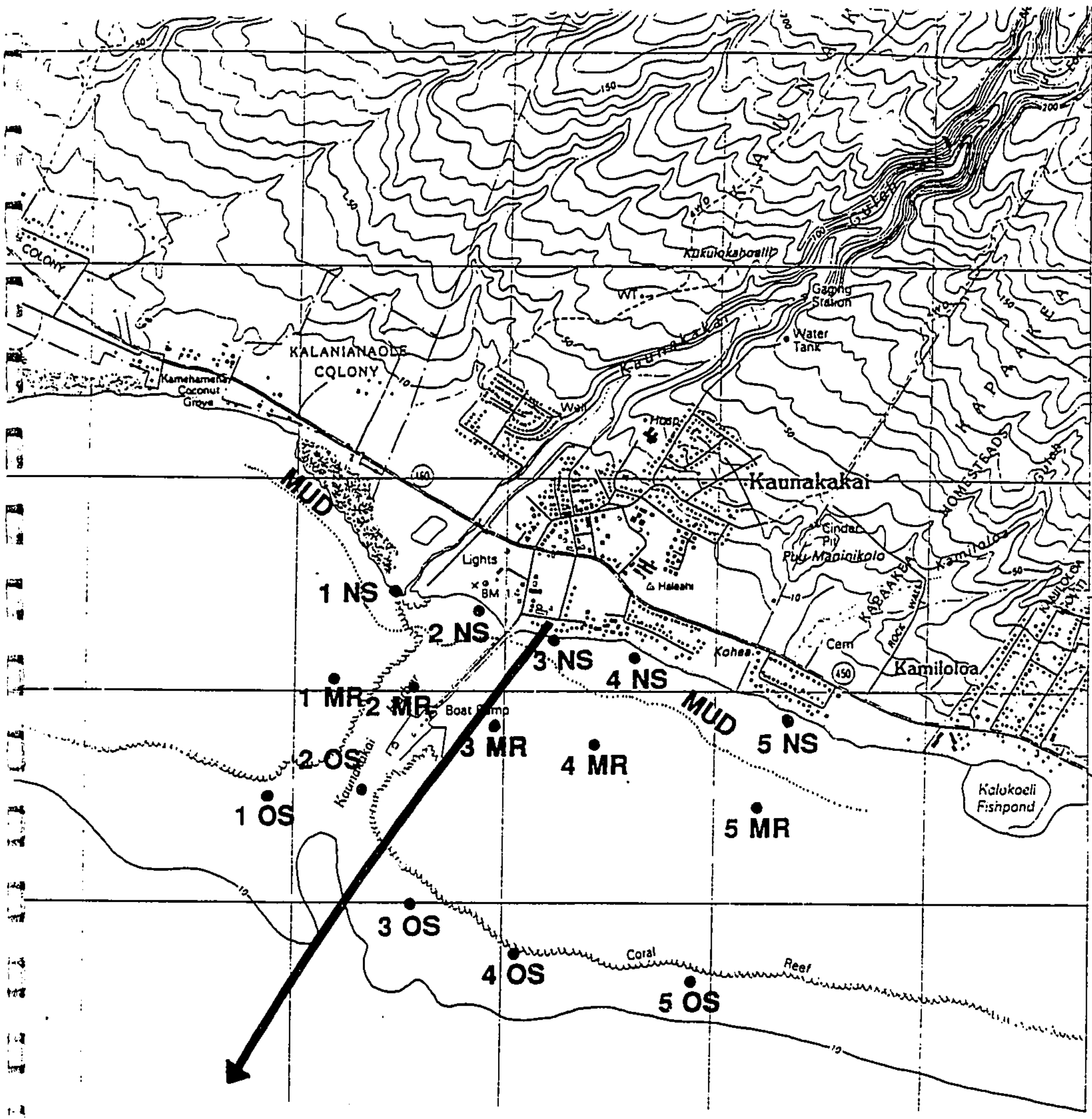
**Nearshore (NS) and Mid-Reef (MR) Zones**

The near shore areas, NS 1 through NS 5, were nearly devoid of invertebrates other than the blue clawed swimming crab, *Thalamita crenata*. At NS 1, other species observed include the alpheid shrimp and some tubes of vermitid molluscs.

The mid-reef section, MR 1, revealed two species of coral: *Porites lobata* and *Pocillopora damicornis*. A yellow nudibranch, a bristle worm (*Phrecardia striata*) and some sea urchins (*Echinometra mathaaei*) were also observed in the coral rubble. MR 2, which is directly shore ward of the harbor basin, had no sightings of benthic organisms other than burrow openings. The remainder of the mid-section survey stations on the east side of the mole consisted of exposed muddy sand and a complex association of *Halophila ovalis* with a variety of microalgae. The microalgae include *Acanthophora spcifera, Hypnea sp., Padina japonica, Spyridia filamentosa, Dictyota sp., Lyngbya sp., Neomeris annulata, Halimeda discoidea,* and *Turbanaria ornata.*

**Offshore Zone**

The offshore zone directly seaward of the pier island, OS 1, showed a typical coral community of leeward Hawaiian reef. As stations progressed eastward, reef coral showed a decrease in abundance.




Source: Kaunakakai Drainage Master Plan, Water Quality & Marine Biological Studies; Impact Analysis, by Dr. David A. Ziemann, OI Consultants, Inc. Makapuu Point, Waimanalo, Hawaii, June 1992.

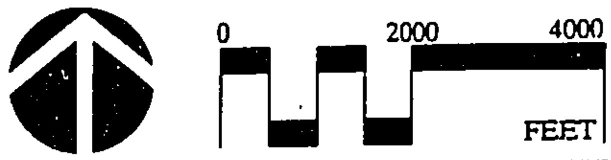



**Figure 4-1**
**MARINE BIOLOGICAL SURVEY SITES**
**Kaunakakai, Molokai**

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At OS 1, on the west side of the harbor channel entrance, the coral community was dominated by *Porites lobata* (37%), followed by *Montipora verrucosa* (6%), and *Montipora patula* (5%), with a few small *Pocillapora meandrina* colonies totaling approximately 2% of coverage. At station OS 3, a moderate amount of coral coverage was dominated by *Montipora patula* (10%), *Pocillapora meandrina* (6%), *Montipora verrcosa* (4%), *Porites lobata* (2%), and traces of *Porites compressa, Pavona varians, Pavona duerdeni,* and the zoanthid *Palythoa tuberculosa.*

Farther east, the coral abundance decreased dramatically to about 7% of coverage at OS 4 and down to only 1.5% at OS 5. Apparently, the increasing sand cover in these areas restricts the amount of coral growth through scouring of reef surfaces.

With respect to fish assemblages, the June 1992 survey found low fish populations in the nearshore and mid-reef sites. However, the off-shore sites showed a great diversity, especially OS 1 and OS 3. These included the hawkfish *(Paracirrchites arcatus)*, goatfish *(Parupeneus multifasciatus)*, damselfish *(Plectoglyphidodon johnstoniatus)*, wrasses *(Thalassoma duperrey and Coris gaimard)*, surgeonfish *(Acanthurus nigrofuscus)*, triggerfish (*Rhinecanthus rectangulus*), and toby *(Canthigaster jactator)*. Green sea turtles were observed during the survey of the area fronting Kaunakakai.

The biological survey of the area fronting Kaunakakai did not find any rare or unusual species or communities. Another protected species, the humpback whale (*Megatera novaeangliae*) was not seen offshore of the study area during the period of the previous field survey.

Impacts

The cable laying will have little or no impact on the reef fronting the project. The reef at the nearshore area is covered with a thick layer of fine sediment. The near shore area is devoid of surface fauna and farther off-shore, the mud/silt bottom is covered with dense seagrass-macroalgal biotype. The wide sediment coverage suggests that the area has been influenced by major storm flows and the resulting sedimentation for many years. Once deployed over the rocky bottom, no impacts are anticipated.

Another concern may be with disturbance to threatened or endangered species. 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. Finally, no known adverse impacts on whales were reported during the laying of the Hawaii Interisland cable system (HICS).

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 cable laying 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 have been occurring 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.

**<u>Water Quality Considerations</u>**: A water quality analysis was conducted as part of the *Water Quality and Marine Biological Studies; Impact Analysis Included in the Final Environmental Assessment for Kaunakakai Drainage Improvements, June 1992*. The project site was found to be subject to groundwater and surface water discharges. 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 re-suspending 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 (approximately 2 days) created by small-scale anchoring 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

Kaunakakai Wharf, located approximately 500 feet west of the site, is an impressive public vista. These views will improve by developing a proposed shoreline park at the Kamehameha

Home. Presently, there are large structures (i.e. oil reservoir and warehouse) on the pier island. The parcels makai of Beach Place are heavily vegetated with a few houses.

Impacts

The project is not anticipated to have significant impacts on the views toward the ocean and/or Kaunakakai Wharf. The only surface structure planned on the site is a 24' x 10' terminal building. The cable will be located entirely below surface. The visual impacts of the building can be minimized by limiting its height and painting it an appropriate color. For two days there will be a temporary impact on the coastal views from cable laying activities. During this period, a portion of the harbor's shoreside facilities will be temporarily closed for safety considerations. This portion of the project site will have construction equipment and a mound of sand and rocks from the excavated trench. Following the installation of the optic cable, the beach will be returned to its existing condition prior to excavation. Therefore, visual impacts of this project will be minimal.

4.1.7 Historical and Archaeological Resources

According to the State Historic Preservation Division (SHPD), there are two known significant historic sites, approximately 600 feet east of the landing site. Both sites are located on a property (TMK: 5-3-01:2 &3) southeast of Kaunakakai Place. One is Site 50-60-03-630, which consists of a historic and prehistoric subsurface deposit. The other site is the Malama House Site (Site 50-60-03-1030), a rectangular platform which is believed to be the foundation of Kamehameha V's residence. However, the proposed cable alignment is located away from these sites, and will be routed within existing public rights-of-way.

Impacts

No short or long term impacts are expected from the installation of a fiber optic cable within the proposed alignment. 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

The marine substrate of the landing primarily consists of silt and sand. The inshore bottom consists of a gently sloping mudflat, sand channel, and offshore mound. The fiber optic cable, which is 2 inches in diameter, does not have sufficient volume to significantly affect sand transport. Above mean low water level, the cable will be buried subsurface. Beyond the handhole, the cable will traverse along side the existing paved road to Molokai General Hospital.

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 excavated beach sand to existing preconstruction contours through use of the excavated material for backfill.

4.1.9 Nearshore Conditions

The proposed cable landing site is on a vacant residential lot. On land, the cable will be installed in an underground cable duct which connects to a new handhole at the proposed terminal station. The proposed cable duct route was established at this location because of the following factors:

1. A landing site east of the harbor entrance minimizes potential for cable damage due to either ship anchoring in the entrance channel, or damage due to the bridles and tow cables of the tugs and barges as they shorten up their tow prior to entering the harbor. According to discussion with Sea Engineering the tug and barge bridles and tow cables are made of very heavy steel links and connecting hardware, and will typically reach depths of up to 230 feet as the barge pulling tugs enter the harbor channel. The dragging action of the tow lines scour the bottom and in large part accounts for the severely abraded harbor channel.

The specific cable alignment cuts across relatively featureless sandy substrate. This location is anticipated to avoid the heavier shipping traffic associated with the harbor.

2. The landing is near to the built-up (urbanized) areas of the island.

4.1.10 Noise From Construction Activity

During the construction phase of the project, noise will be generated. Cable laying and excavation equipment and machinery will be used, which will be sources of noise.

Impacts

Noise generated from machinery can be mitigated to some degree by requiring contractors to adhere to State and County noise regulations. This includes ensuring that machinery are properly muffled. Boats (tugs and 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. It is expected that the level of noise will not be greater than existing levels of noise during active use of the harbor.

4.1.11 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 low intensity of residential and commercial development indicates an overall low degree of urban pollutants. The major factor affecting air quality in the area will be from the operation of construction equipment for excavation and cable laying. No long term adverse impacts from these operations are anticipated.

Impacts

During the excavation process, wind may cast loose sand into the air. The release of sand into the air can be prevented by requiring the contractor to periodically wet down the 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 similarly be 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 increase carbon monoxide pollutants in the project vicinity. No long term adverse impacts are anticipated from this action.

#### 4.1.12 Water Quality

The State Department of Health has designated waters on the south shores of Molokai as Class "A". A water quality analysis was conducted in June 1992 by OI Consultants, Inc. The nearshore waters were found to be affected by groundwater and surface water discharges, typical of islands in the State. Water quality was found to be affected by three processes: 1) nearshore groundwater discharges, which introduce dissolved nutrients, 2) waves and currents which suspend or re-suspend sediments which are transported along the shore; and, 3) biological processes which may reduce nutrient levels. Water temperature and salinity are normal for ocean water with evidence of fresh water inflow along the shore.

Impacts

It is anticipated that the nearshore waters may be clouded during the trench excavation and backfilling operations. Silt screens to lessen turbidity effects will be erected where practicable to minimize this impact.

### 4.2 SOCIO-ECONOMIC ENVIRONMENT

#### 4.2.1 Population

The estimated resident population of Molokai for 1994 is 6,681 and is projected to increase to 9,019 by 2010 (The State of Hawaii Data Book, 1994 and "Social Economic Forecast Study for Maui"). There are presently no interisland fiber optic cables serving the islands of Molokai or Lanai, and it is not possible to predict the specific potential for employment. However, it is anticipated that the competitive pricing of new fiber optic telecommunications service will provide for both direct and indirect employment.

Direct employment will result from the need for skilled and semi-skilled personnel necessary to supervise, operate, repair, and maintain equipment providing service between Molokai and the neighbor islands.

Indirect employment will result from new business opportunities with related job multiplier effects. This will involve employment for firms which could provide telecommunications associated services (e.g., software development, communications services, etc.), as well as employment through support services (e.g., industrial, retail, restaurant, legal, accounting, leisure, and other services).

Impacts

There are no negative adverse impacts anticipated as a result of the proposed project. Overall, it is expected that the project will provide an improvement in benefits associated with fiber optic telecommunications service. This includes availability of computer modem connections, real time telemedicine for emergency and critical care patients, videoconferencing for education, government and business needs, and research applications.

### 4.2.2 Surrounding Land Use

All lots makai of Beach Place are owned by Molokai Ranch, Ltd. The entire wharf and surrounding submerged lands are owned by the State of Hawaii. Land use mauka of the causeway includes light industrial, recreational, and single-family residential uses. Industrial uses include storage tanks, buildings, cattle pens, and open storage areas. Recreational uses include canoe storage areas, a canoe launching area, and Kaunakakai Park.

Impacts

Short term impacts in the form of subsurface cable installation activities are anticipated on the pier for 2 days. Following the installation of the fiber optic cable, any disturbed ground areas will be restored. No long term impacts are expected from the proposed project. The cable route will be routed within ducts along the mole and pier island concrete piles. Accordingly, there will be no significant adverse impacts to surrounding uses.

## 4.3 PUBLIC FACILITIES AND SERVICES

### 4.3.1 Transportation Facilities

The project site is served by Beach Place, a paved residential access road. The landing site is located near the intersection between Beach Place and Mohala Street. Mohala Street, a secondary residential access, connects to Kamehameha V Highway.

Kaunakakai Place, a County-owned, two-lane road also connects Beach Place to Kamehameha V Highway and Kaunakakai. The road on the causeway is wide enough to allow two-way traffic since parking on the causeway is prohibited. The western side of Kaunanakai Harbor is a commercial boat harbor. In the evenings, Kaunakakai Harbor has barge traffic on mondays, wednesdays and thursdays.

#### Impacts

The proposed project is expected to have no major impact on existing traffic. Cable installation will take two days during which equipment will be placed within the vacant residential lot. With the use controls, sufficient space will be available so that adequate thoroughfare can be maintained.

No adverse impacts are anticipated on barge traffic. Construction activities will be restricted to periods when barge traffic is not occurring.

### 4.3.2 Recreational Facilities

Major recreational facility adjacent to the project site is Kaunakakai Wharf. Kaunakakai Wharf is a recreational amenity for fishing and boating. Other recreational amenities in the vicinity of the project site is Kaunakakai Park where canoe paddling is popular in the calm reef waters and fishing on the surrounding wide reef.

Impacts

There will be no long term impacts to recreational activities associated with the cable laying process. However, installation activities may temporarily impact water recreational uses on the eastern side of the pier island. This impact will be short term, lasting only until cable installation and backfilling is completed.

The proposed action is not expected to impact boat activities. Construction work will be scheduled for time periods when boat traffic is light. If needed, construction activities will be halted to allow boats access to the harbor.

## SECTION 5

## RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS AND POLICIES

### 5.1 THE HAWAII STATE PLAN

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

Section 226-10.5: Economy - Information Industry
The proposed project serves to assist in the State's objective of positioning Hawaii as the leader in 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.

### 5.2 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.

## 5.3 STATE LAND USE LAW

The State of Hawaii Land Use District classifications designate the landing site (parcel 236) as "Urban", and the surrounding waters as "Conservation" **(Figure 5-1)**. The urbanized nature of the project area does not appear to suggest that there are any significant constraints due to natural conditions. Appropriate measures will be implemented to guard against permanently injuring marine ecosystems and non-point source pollution due to soil erosion.

## 5.4 COUNTY OF MAUI GENERAL PLAN

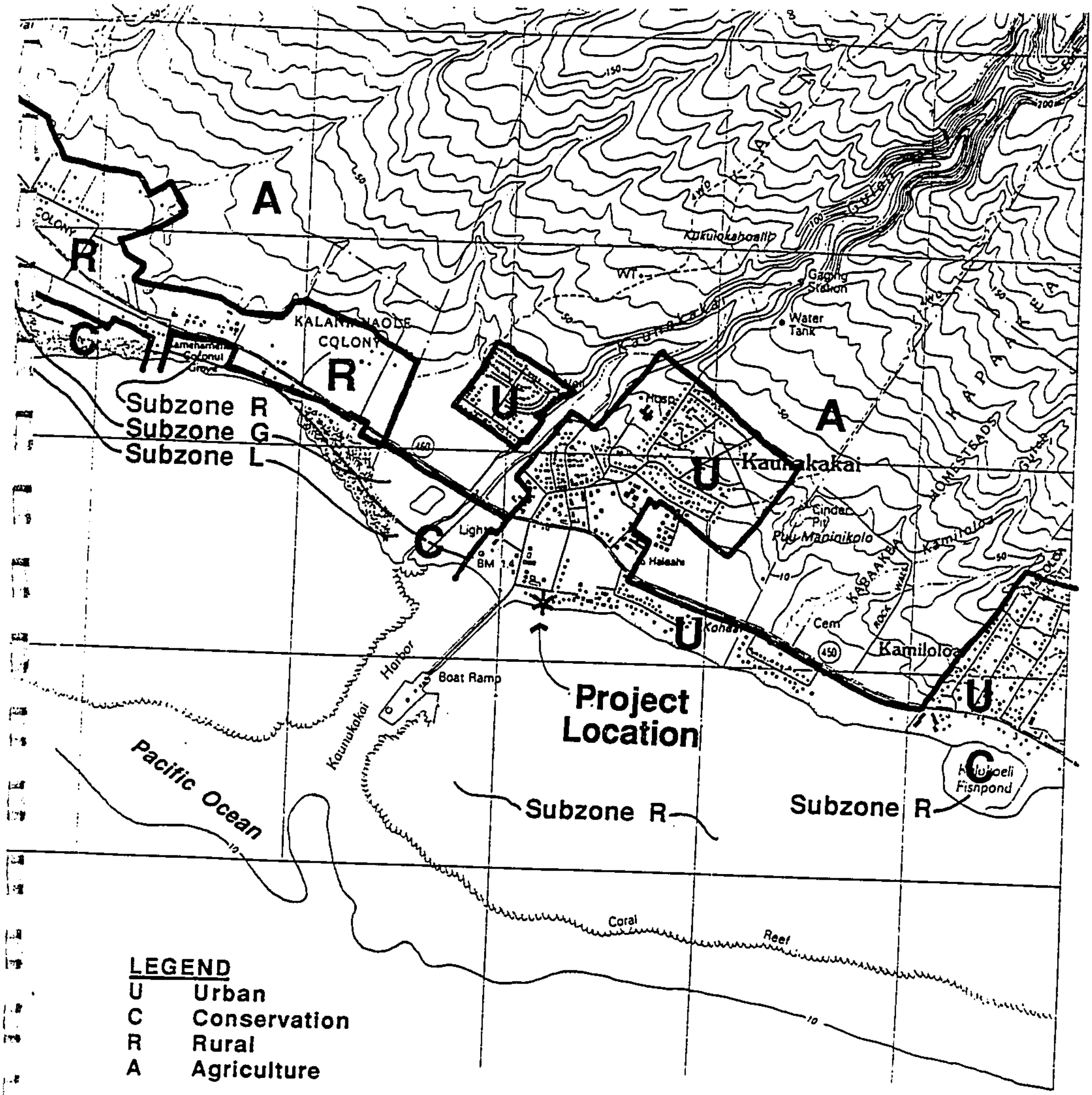
The General Plan of the County of Maui provides a statement of long range social, economic, environmental, and design objectives, and a statement of policies necessary to meet these objectives. A specific objective of the General Plan relating to the proposed project is to provide public utilities which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

## 5.5 MOLOKAI COMMUNITY PLAN

The County of Maui has established nine community plan regions to guide each region's growth and development, in accordance with the County's General Plan. The community plan contains objectives and policies with relatively detailed statements to implement such objectives and policies.

The Molokai Community Plan designates the western side of the project site as community park and the eastern-side as hotel/resort and single-family residential **(Figure 5-2)**. The proposed line is then routed through land zoned public/quasi-public, light industrial, and business/commercial. The fiber optic cable and central office is consistent with these objectives.

The Community Plan does not specifically address the need for additional telecommunications, except indirectly in a recommendation concerning population. The recommendation of the




**LEGEND**

U Urban
C Conservation
R Rural
A Agriculture

**Conservation District Subzones**

R Resource
L Limited
G General

0 2000 4000 FEET

Figure 5-1
STATE LAND USE
Kaunakakai, Molokai

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

R. M. TOWILL CORPORATION

JANUARY 96

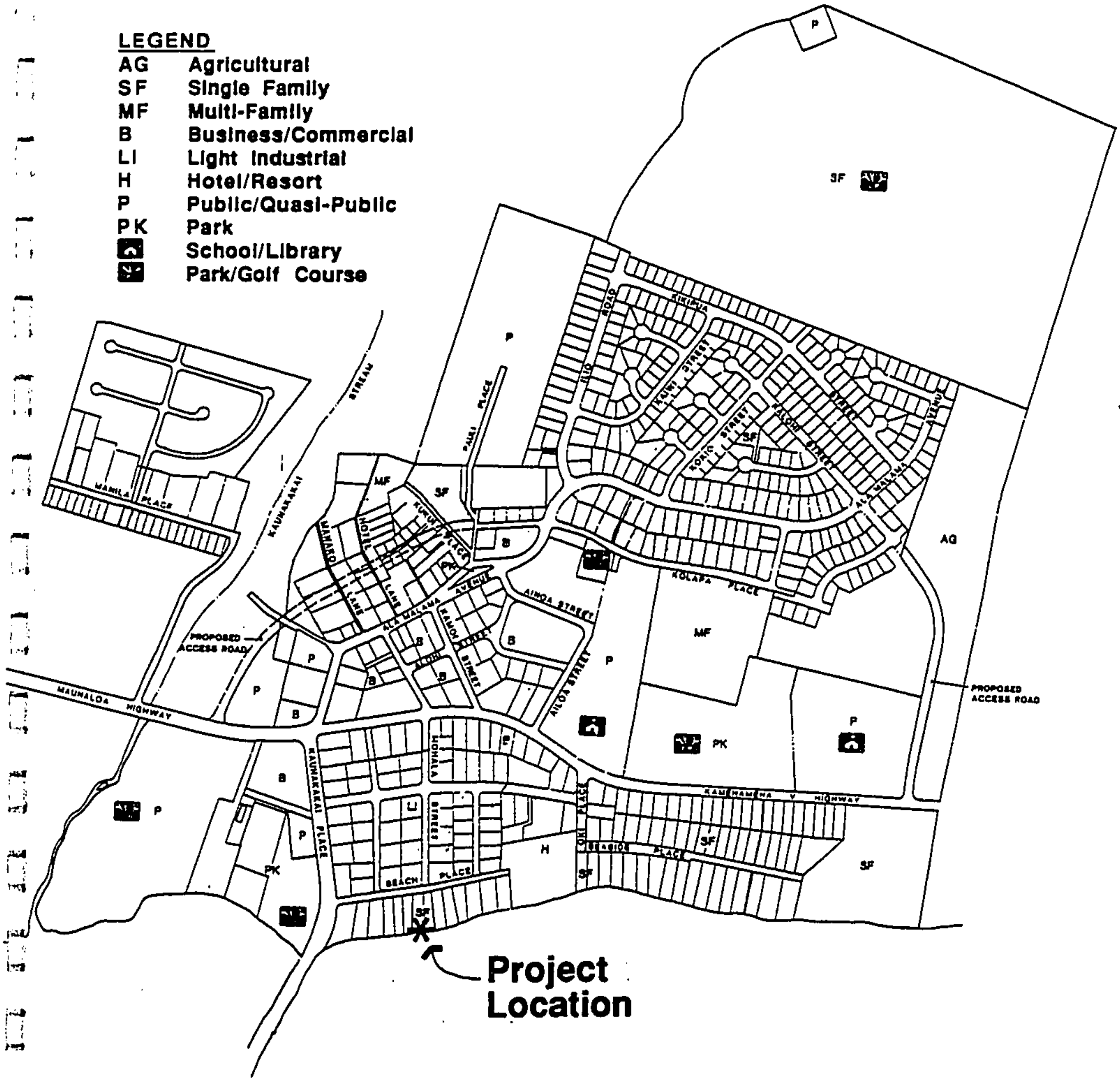



Figure 5-2
MOLOKAI COMMUNITY PLAN
of the COUNTY OF MAUI
Kaunakakai, Molokai

Not to Scale

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

R. M. TOWILL CORPORATION

JANUARY 96

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".

## 5.6 COUNTY ZONING

The landing site is currently designated as "Urban", and the surrounding waters as "Conservation".

## 5.7 COASTAL ZONE MANAGEMENT, SMA RULES AND REGULATIONS

The County of Maui has designated the shoreline of the Island of Molokai as being within the Special Management Area (SMA) and will require an SMA Permit and a Shoreline Setback Variance from the Molokai Planning Commission. 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 (**Figure 5-3**), therefore, a County SMA permit will be submitted to the County of Maui for review and approval.

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. An application for a Shoreline Setback Variance will also be submitted to the County of Maui.

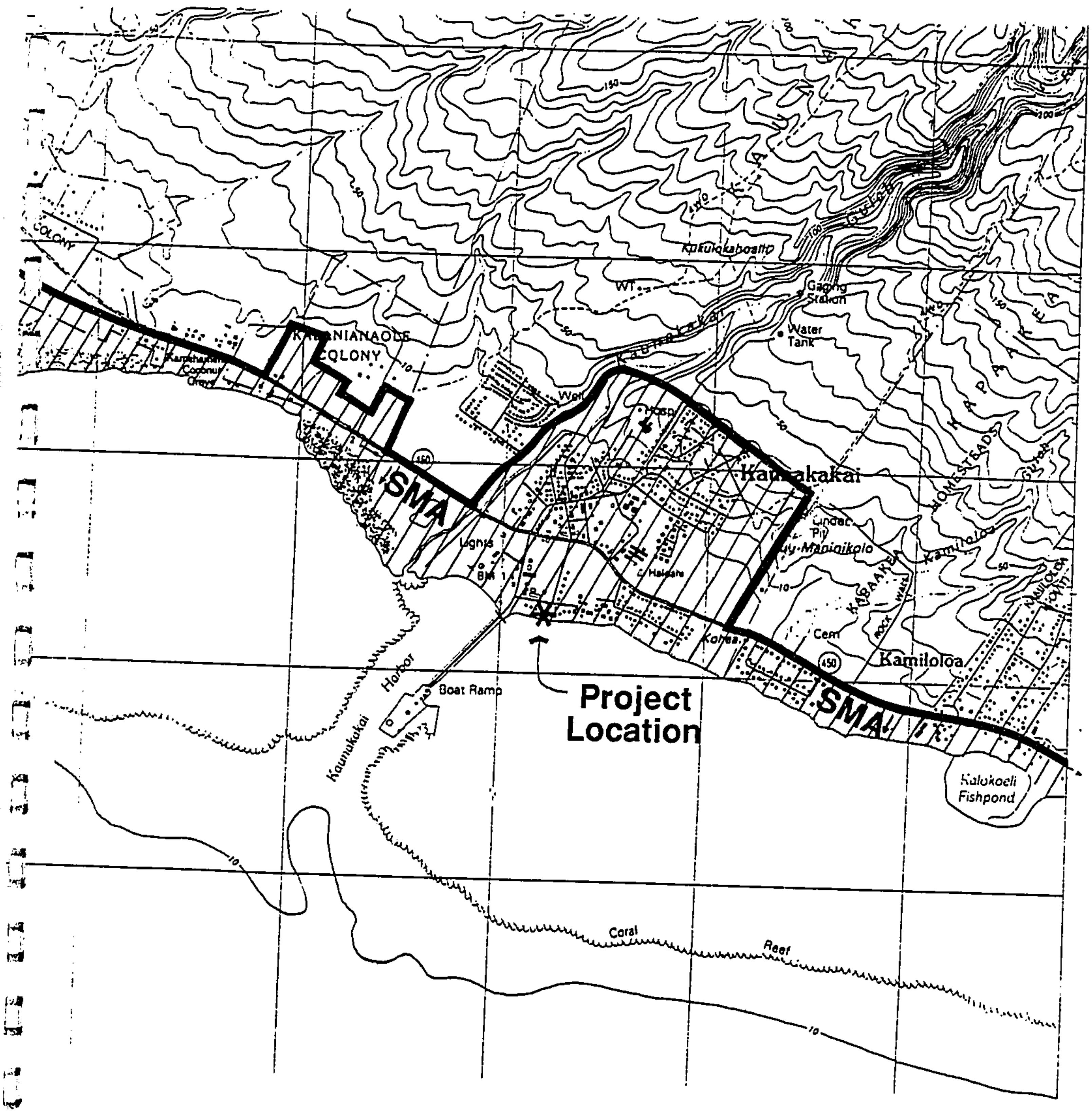



Figure 5-3
SPECIAL MANAGEMENT AREA (SMA) BOUNDARY
Kaunakakai, Molokai

0 2000 4000 FEET

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

R. M. TOWILL CORPORATION

JANUARY 96

## SECTION 6
## ALTERNATIVES TO THE PROPOSED ACTION

### 6.1 NO ACTION

The no action alternative would eliminate the opportunity to provide for alternative means of telecommunications. A fiber optic cable would be prudent as a backup to the existing copper wire telecommunications system. Presently, there are no fiber optic cable systems serving the islands of Molokai and Lanai.

Other losses resulting from no action would include:

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

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

### 6.2 ALTERNATIVE SITE

The proposed landing site was selected after the study of alternative landings for the Molokai landing (1996). The proposed landing site is located in proximity to Kaunakakai Town, the Island's population center where telecommunication demand would be highest in the Island. Two alternative sites, a small serpentine channel located approximately 3.5 miles west of Kaunakakai and Kolo Harbor located approximately 10 miles west of Kaunakakai, were eliminated from consideration during the initial study because it would serve no practical purpose to locate father away from the center of population.

Two general cable alignments were investigated (Sea Engineering, 1996). Alternative 1 approximately follows the eastern edge of the harbor entrance channel, eventually making landfall at the Pier Island **(Figure 6-1)**. Alternative 2 is located approximately 600 feet to the east, and would cross the shallow fringing reef/mudflat.

A primary consideration at Kaunakakai is the protection of the cable from possible damage due to periodic maintenance dredging as well as from barge and tug operations where the towing cable descends into the water as it shortened prior to entry into the harbor. Alternative 2 is therefore the preferred cable alignment because it provides better cable protection from ship and tug operations in the harbor entrance channel.

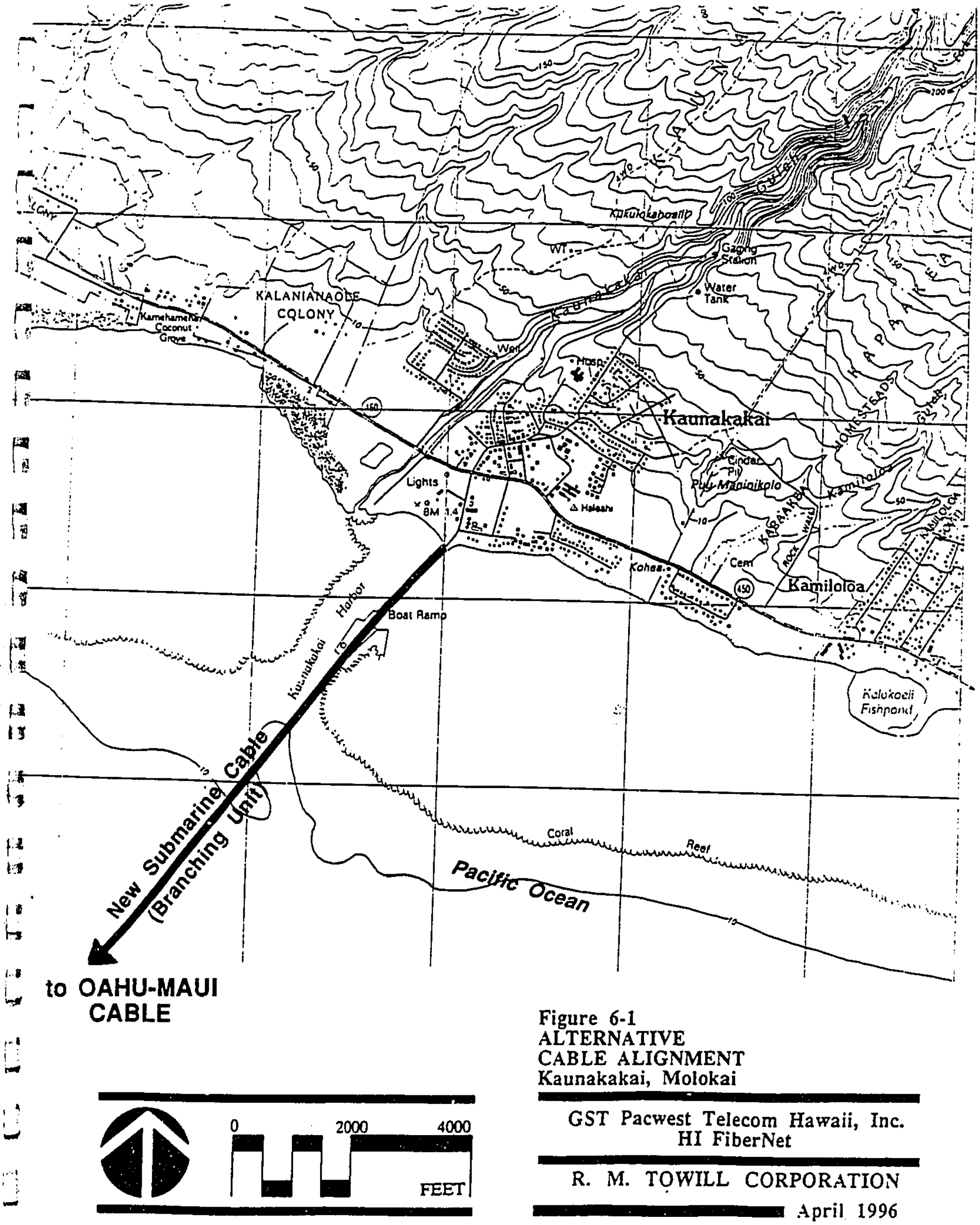



Figure 6-1
ALTERNATIVE
CABLE ALIGNMENT
Kaunakakai, Molokai

GST Pacwest Telecom Hawaii, Inc.
HI FiberNet

R. M. TOWILL CORPORATION
April 1996

The following is a discussion of Alternative 1, which was considered but not selected.

Kaunakakai Harbor (TMK: 5-3-10:11) is a State-owned commercial barge harbor and recreational boating facility located along the southern coast of the Island of Molokai. The harbor is the only State-owned facility where both large and small boats operate in the same general area. The harbor consists of a dredged natural channel with 700-yard long mole terminating in a pier island. This alternative route approximately follows the eastern edge of the harbor entrance channel, eventually making landfall at the Pier Island. The offshore mound is also present along the entrance channel centerline, with the crest of the mound at a water depth of 40 feet. The cable would be routed to the Pier Island revetment at the sand/coral transition. Cable protection against wave action would probably not be required on this route, but harbor operations would pose a definite threat to the cable.

## 6.3 ALTERNATIVE TECHNOLOGY

The following describes the alternatives to fiber optic cable technology:

### 6.3.1 Microwave Radio Systems

The use of additional or modification to the existing interisland microwave radio systems is a feasible alternative providing connectivity to Maui or Oahu. However, in comparison with microwave radio systems, fiber optic technology is the only means of providing the bandwidth necessary for interisland digital circuits without distortion and problems with signal strength and reliability.

### 6.3.2 Satellites

Satellites are not a feasible alternative based on extreme disadvantages associated with the use of satellites which 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 bandwidth necessary for interisland digital circuits without transmission delays and major visual and aesthetic problems.

## 6.4 RECOMMENDED ACTION

The recommended action is to proceed with the establishment of a new submarine fiber optic cable system with a landing at the proposed sandy beach area (parcel 236). From there, the cable would be located subsurface along existing public rights-of-way.

# SECTION 7

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

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

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

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

## SECTION 8

## IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES BY THE PROPOSED ACTION

Development of the proposed project will involve the irretrievable loss of certain environmental and fiscal resources. However, the costs associated with the use of these resources should be evaluated in light of recurring benefits to the residents of the region, the State of Hawaii and the County of 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 9

## NECESSARY PERMITS AND APPROVALS

### 9.1 STATE

Department of Land and Natural Resources

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

Office of State Planning

- Coastal Zone Management Consistency Review

Department of Health

- Section 401, Water Quality Certification

Department of Transportation

- Permit to Work in Ocean Waters

### 9.2 COUNTY OF MAUI

Molokai Planning Commission

- Special Management Area Permit
- Shoreline Setback Variance

### 9.3 FEDERAL

U. S. Army Corps of Engineers

- Department of Army Permit, Section 404/Section 10

### 9.4 PRIVATE

Access Easement

# SECTION 10

## CONSULTED AGENCIES AND PARTICIPANTS IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

### 10.1 FEDERAL AGENCIES

U.S. Army Corps of Engineers

U.S. Coast Guard

### 10.2 STATE AGENCIES

Department of Land and Natural Resources

Office of the Chairperson

Department of Transportation

Department of Health

### 10.3 COUNTY OF MAUI

Department of Planning

### 10.4 PRIVATE

Molokai Ranch, Ltd.

## SECTION 11
## COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT

This section contains the comments and responses to comments which were prepared during the Draft Environmental Assessment phase of review.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIIKE
DIRECTOR OF HEALTH

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

'96 AUG -8 P2:27

In reply, please refer to:

August 1, 1996 96-111/epo

Mr. David W. Blane
Planning Director
County of Maui
Planning Department
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Draft Environmental Assessment and Special Management Area Permit (96/SSV-0005 and 96/SMI-0011) Submarine Fiber Optic Cable Landings at Kaunakakai, Molokai, and Manele Bay, Lanai TMK: 5-3-01: 16

Thank you for allowing us to review and comment on the subject permit application. We have the following comments to offer:

1. If the project involves the following activities with discharges into state waters, an NPDES general permit is required for each activity:

   a. Discharge of storm water runoff associated with construction activities, including clearing, grading, and excavation that result in the disturbance of equal to or greater than five (5) acres of total land area;

   b. Construction dewatering effluent;

   c. Non-contact cooling water;

   d. Hydrotesting water; and

   e. Treated contaminated groundwater from underground storage tank remedial activity.

2. If there is any type of process wastewater discharge from the activity into State waters, the applicant is required to apply for an individual NPDES permit.

3. The applicant has submitted to the Department of Health a 401 Water Quality Certification (WQC) application for the landing of a submarine fiber optic cable at the Wailua Golf Course of Kauai, Makaha Beach, Keawaula, and Sandy Beach Park of Oahu, Mokapu Beach of Maui, Manele Bay of Lanai, Kaunakakai of Molokai and Spencer Beach Park of Hawaii. The Department is processing the application as expeditiously as possible.

Should you have any further questions regarding this matter, please contact Ms. Hong Chen, Engineering Section of the Clean Water Branch, at 586-4309.

Sincerely,

Bruce S. Anderson

BRUCE S. ANDERSON, Ph.D.
Deputy Director for
Environmental Health

c: CWB

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Bruce S. Anderson, Ph.D.
Deputy Director for Environmental Health
State Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Anderson:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

We have reviewed your comment letter dated August 1, 1996, and have prepared the following reply.

We acknowledge receipt of our Section 401 Water Quality Certification Waiver (WQC 333), from your Department, which was granted on August 28, 1996. At this time we do not anticipate any further need for discharges which would trigger the filing of a National Pollutant Discharge Elimination System (NPDES) permit.

Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

BENJAMIN J. CAYETANO
GOVERNOR

'96 AUG -2 P1:21

RECEIVED

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING
AND GENERAL SERVICES
SURVEY DIVISION
P. O. BOX 119
HONOLULU, HAWAII 96810

SAM CALLEJO
COMPTROLLER

RESPONSE REFER TO:

FILE NO. ____________

August 1, 1996

MEMORANDUM

TO: Mr. David W. Blane, Planning Director
Maui County Planning Department

ATTN.: Mr. Don A. Schneider, Staff Planner

FROM: Randall M. Hashimoto, State Land Surveyor

SUBJECT: I.D.: 96/SSV-0005 & 96/SM1-0011
TMK: 5-3-01:16
Project Name: Hawaiian Island Fiber Network
Applicant: GST Telecom Hawaii, Inc.

The subject proposal has been reviewed and confirmed that no Government Survey Triangulation Stations and Benchmarks are affected. Survey has no objections to the proposed project.

Randall M. Hashimoto
RANDALL M. HASHIMOTO
State Land Surveyor

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Randall M. Hashimoto
State Land Surveyor
Survey Division
Department of Accounting and General Services
P. O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Hashmoto:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your letter dated August 1, 1996. We appreciate your review of this important project.

Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

Ukc?

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIIKE
DIRECTOR OF HEALTH

'96 AUG 14 P12:23

STATE OF HAWAII
DEPARTMENT OF HEALTH
MAUI DISTRICT HEALTH OFFICE
54 HIGH STREET
WAILUKU, MAUI, HAWAII 96793

LAWRENCE HART, M.D., M.P.H.
DISTRICT HEALTH OFFICER

August 12, 1996

Mr. David W. Blane
Planning Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: **HAWAIIAN ISLAND FIBER NETWORK**
**TMK: (2) 5-3-01:16**
**I.D.: 96/SSV-0005 & 96/SMI-0011**

Thank you for the opportunity to review and comment on the application. We have the following comments to offer:

Any construction discharge into state waters will require a National Pollutant Discharge Elimination System (NPDES) permit.

If you have any questions, please feel free to call me at 984-8230.

Sincerely,

HERBERT S. MATSUBAYASHI
Chief Sanitarian

HM:km

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Herbert S. Matsubayashi
Chief Sanitarian
Maui District Health Office
State Department of Health
54 High Street
Wailuku, Hawaii 96793

Dear Mr. Matsubayashi:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your letter dated August 12, 1996. We appreciate your review of this important project. At this time we do not anticipate need for discharges which would trigger the filing of a National Pollutant Discharge Elimination System (NPDES) permit.

Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

3919

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

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

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

'96 AUG 22 P12:08

August 13, 1996

Mr. David W. Blane, Director
Planning Department, County of Maui
250 S. High Street
Wailuku, Maui, Hawaii 96793

LOG NO: 17827 ✓
DOC NO: 9608SC04

Dear Mr. Blane:

SUBJECT: **(I.D. 96/SSV-0005 & 96/SM1-0011) Chapter 6E-42 Historic Preservation Review of Shoreline Setback Variance and Special Management Area Use Permits for the Submarine Fiber Optic Cable Landing, Kaunakakai, Moloka'i**
**TMK: 5-3-01: 16**

Thank you for the opportunity to comment on the Shoreline Setback Variance (SSV) and Special Management Area (SMA) Use permits requested for the proposed installation of a submarine fiber optic cable landing site. The applicant proposes to lay a fiber optic cable on the sea floor east of Kaunakakai Harbor channel; the cable landing site is at the end of Mohala Street, on a vacant residential lot where a small terminal building will also be constructed. From its landing site, the cable will be routed subsurface along existing public streets, within the rights-of-way, to its terminus near Molokai General Hospital. Our review is based on historic reports, maps, and aerial photographs maintained at the State Historic Preservation Division. In addition, Sara Collins and Elaine Jourdane of our office made a brief field inspection of the cable landing site area on July 19, 1996.

We note that on page 4-9, in Section 4.1.7, it is stated that "two known significant historic sites" are "approximately 600 feet east of the landing site." According to our records, the two historic sites described (50-60-03-630, a subsurface cultural deposit, and -1030, the Kamehameha V house platform) are in fact about 200 - 300 meters west of the cable landing site, the other side of Kaunakakai Pier. We have no record of historic sites on the subject parcel although no archaeological inventory survey has been conducted there. Historic aerial photographs taken in 1972 show the subject parcel to have been cleared at that time with structures upon it. In view of these prior modifications we believe that is unlikely that significant historic sites are still present in the area. Therefore, we believe that the SSV and SMA permits, if approved, will have "no effect" on significant historic sites. This correspondence constitutes our concurrence letter under Chapter 6E-42, Hawaii Revised Statutes.

We would make the following precautionary recommendation:

> Should historic remains such as artifacts, burials, concentrations of shell or charcoal be encountered during construction activities, work shall cease immediately in the immediate vicinity of the find, and the find shall be protected from further damage. The applicant shall immediately contact the State Historic Preservation Division (587-0013), which will assess the significance of the find and recommend an appropriate mitigation measure, if necessary.

Should you have any questions, please feel free to call Sara Collins at 587-0013.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Hibbard:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your letter dated August 13, 1996. We appreciate your review of this project and your finding of "no effect" on significant historic sites.

Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

Maui Electric Company, Ltd. • 210 West Kamehameha Avenue • PO Box 398 • Kahului, Maui, HI 96732-0398 • (808) 871-8461

'96 JUL 15 P12:30

DEPT OF PLANNING
COUNTY OF MAUI
RECEIVED

July 10, 1996

Mr. David W. Blane
Planning Director
Maui Planning Department
250 S. High Street
Wailuku, HI 96793

Dear Mr. Blane:

Subject: Hawaiian Island Fiber Network
TMK 5-3-01:16
I.D. No.: 96/SSV-0005 & 96/SM1-0011

Thank you for allowing us to comment on the subject project.

In reviewing the information transmitted and our records, we have no objection to the subject project. If electrical service is required from MECO for the new terminal building, we encourage the developer's electrical consultant to meet with us as soon as practical to verify the project's electrical requirements so that service can be provided on a timely basis

If you have any questions or concerns, please call Dan Takahata at 871-2385.

Sincerely,

Edward L. Reinhardt

Edward L. Reinhardt
Manager, Engineering

ER:llk

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Edward Reinhardt
Engineering Manager
Maui Electric Company, Ltd.
210 West Kamehameha Avenue
P.O. Box 398
Kahului, Hawaii 96732-0398

Dear Mr. Reinhardt:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your comments dated July 10, 1996. We appreciate your review of this important project. Per your request, any electrical requirements will be coordinated with Mr. Dan Takahata at (808) 871-2385. Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

\\\ -\

MOLOKAI - LANAI SOIL AND WATER CONSERVATION DISTRICT

P.O. Box 396
Hoolehua, HI 96729
Phone (808) 567-6869
FAX (808) 567-9062

6 August 1996

County of Maui
Planning Department
250 S. High Street
Wailuku, Hi 96793
ATTN: Don A. Schneider

'96 AUG -8 P2:25

RE: Submarine Fiber Optic Cable Landing at Kaunakakai, Island of Molokai - TMK: 5-3-01: 16

Dear Mr. Schneider:

We are in receipt of your request for review of the above-mentioned project.

It was noted that although the plans adequately address the installation of cable, length of routes, construction of terminal building, etc. there is no mention of proposed temporary Best Management Practices to be installed during construction in order to protect the shoreline and surrounding areas.

Thank-you for the opportunity to review this project. Should you have any questions or concerns regarding this matter, please do not hesitate to contact me at the number listed above.

Sincerely,

Malia C. Pierce

Malia Pierce
MLSWCD Resource Coordinator

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

Solid Waste Division

BRIAN HASHIRO, P.E.
Highways Division

July 19, 1996

Mr. Robert Volker
General Manager
GST Packwest Telecom Hawaii, Inc.
91-238 Kalaeloa Boulevard, Suite 100
Kapolei, Hawaii 96707

SUBJECT: HAWAIIAN ISLAND FIBER NETWORK
SMA AND SHORELINE SETBACK VARIANCES
TMK: 5-3-01:16

Dear Mr. Volker:

Attached for your information are maps showing our proposed Kaunakakai Drainage Master Plan. System "A" is scheduled for construction in August 1996, and System "B" is under design and is scheduled for construction in 1997. Your project may impact our System "B" and System "C", therefore, we request to review your construction plans to coordinate these projects to mitigate any possible impacts.

If you have any questions or need more information, please call Joe Krueger of our Engineering Division at 243-7745.

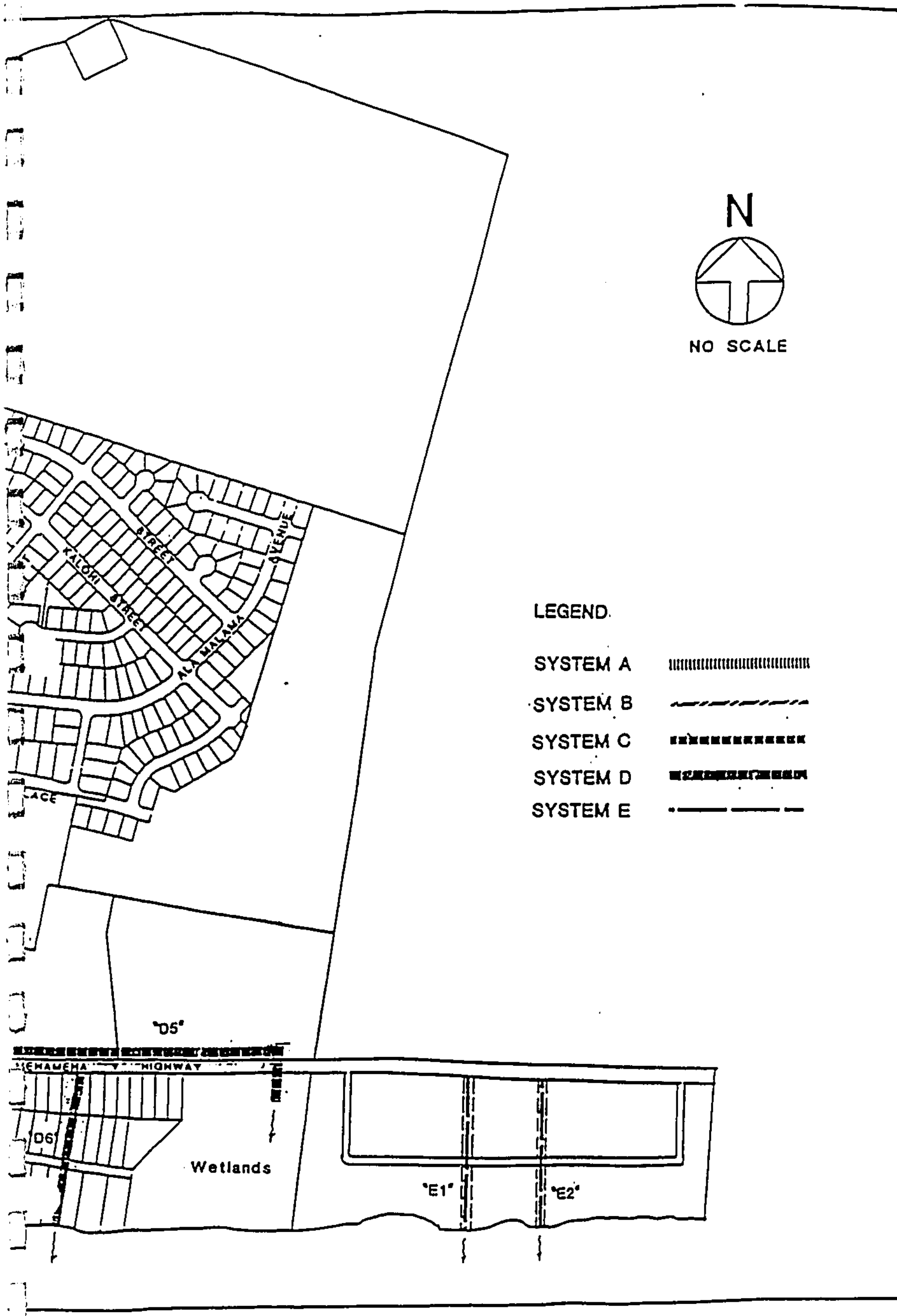
Very truly yours,

CHARLES JENCKS
Director of Public Works
and Waste Management

LL/JK:c(ED96-765)
Hwrdsle.RV

Enclosures

xc: Judith Henry, OSP (FAX: 587-2824)
R. M. Towill Corp (FAX: 842-1937)
County of Maui, Planning Department




WILSON OKAMOTO & ASSOCIATES, INC.

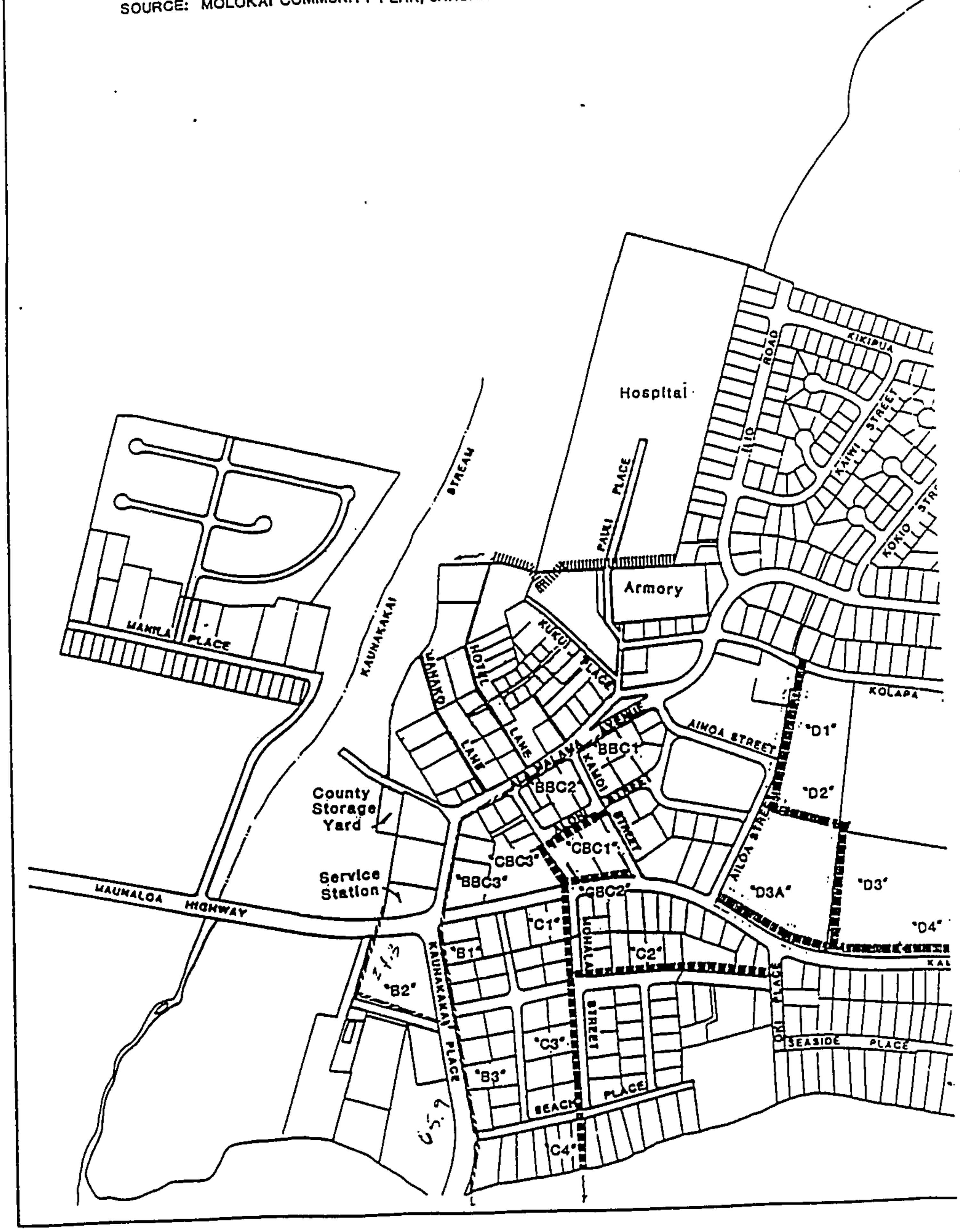
FIGURE 11

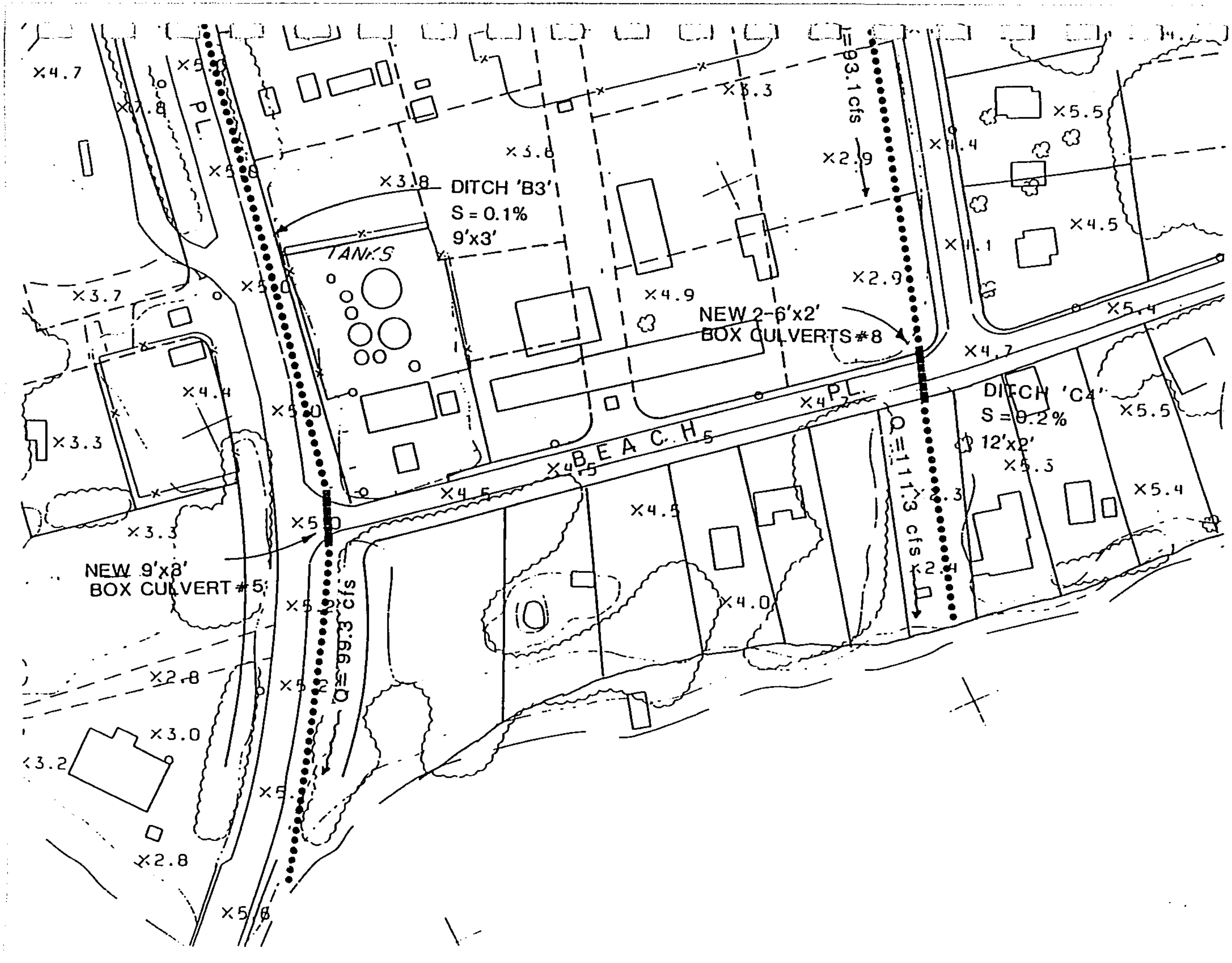
PROPOSED DRAINAGE SYSTEM

KAUNAKAKAI

DRAINAGE MASTER PLAN

SOURCE: MOLOKAI COMMUNITY PLAN, JANUARY 1984.





DITCH 'B3'
S = 0.1%
9'x3'
TANKS
Q = 93.1 cfs
NEW 2-6'x2'
BOX CULVERTS #8
DITCH 'C4'
S = 0.2%
12'x2'
Q = 111.3 cfs
BEACH PL.
PL.
NEW 9'x8'
BOX CULVERT #5
Q = 99.3 cfs

4437

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

Solid Waste Division

COUNTY OF MAUI
**DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT**
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

August 5, 1996

MEMO TO: DAVID W. BLANE, DIRECTOR OF PLANNING

FROM: CHARLES JENCKS, DIRECTOR OF PUBLIC WORKS AND WASTE MANAGEMENT

SUBJECT: Special Management Area Permit and Shoreline Setback Variance Application
HAWAIIAN ISLAND FIBER NETWORK
TMK: (2) 5-3-001:016
96/SSV-0005 & 96/SM1-0011

We reviewed the subject application and have the following comment.

1. A Solid Waste Management Plan shall be submitted for review and approval which addresses the disposal of construction debris.

AS:da/mt
xc: Engineering Division
Solid Waste Division
Wastewater Reclamation Division

G:\LUCA\CZM\HAWNISLI.SMA

'96 AUG -7 P3:51

RECEIVED

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Charles Jencks, Director
Department of Public Works and Waste Management
200 South High Street
Wailuku, Hawaii 96793

Dear Mr. Jencks:

SUBJECT: Special Management Area Permit and Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your letters dated July 19 and August 5, 1996. We appreciate your review of this important project. Per your instructions:

- Construction Plans shall be coordinated with Mr. Joe Kruger (808-243-7745) of your Department; and,
- A Solid Waste Management Plan shall be submitted to address the disposal of construction debris. This plan shall be submitted prior to start of construction.

Should you have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

LINDA CROCKETT LINGLE
MAYOR

'96 JUL 24 P12:13

# POLICE DEPARTMENT

COUNTY OF MAUI

55 MAHALANI STREET
WAILUKU, HAWAII 96793
AREA CODE (808) 244-6400
FAX NO. (808) 244-6411

HOWARD H. TAGOMORI
CHIEF OF POLICE

LANNY TIHADA
DEPUTY CHIEF OF POLICE

OUR REFERENCE

YOUR REFERENCE

RECEIVED

July 17, 1996

MEMORANDUM

TO : DIRECTOR, PLANNING DEPARTMENT

FROM : HOWARD H. TAGOMORI, CHIEF OF POLICE

SUBJECT : I.D. No.: 96/SSV-0005 & 96/SM1-0011
TMK: 5-3-01: 16
Project Name: Hawaiian Island Fiber Network
Applicant Name: GST TELECOM HAWAII, INC.

___ No recommendation or special condition is necessary or desired.

✓ Refer to attachment(s).

Assistant Chief Charles Hall
for: HOWARD H. TAGOMORI
Chief of Police

| | | |
|---|---|---|
| TO | : | HOWARD TAGOMORI<br>CHIEF OF POLICE<br>COUNTY OF MAUI |
| VIA | : | THOMAS PHILLIPS<br>DEPUTY CHIEF OF POLICE<br>COUNTY OF MAUI |
| VIA | : | CHARLES HALL<br>ASSISTANT CHIEF OF POLICE<br>UNIFORM SERVICES DIVISION |
| FROM | : | CAPTAIN GEORGE KAHO'OHANOHANO<br>DISTRICT COMMANDER---MOLOKA'I<br>UNIFORM SERVICES DIVISION |
| SUBJECT | : | SUBMARINE FIBER OPTIC CABLE LANDING<br>AT KAUNAKAKAI, ISLAND OF MOLOKA'I |

In reviewing this request, it was found that as long at this is the portion of the project that concerns only the landing on Moloka'i and not the continuation to the hospital, it would not impact the police services area.

From the information provided this would bring the cable to the island of Moloka'i and place it on a vacant lot on Beach Place and that the lot is owned by the Moloka'i Ranch. As long as all of the work is kept on the property and the storage of any equipment, machinery, and material is kept on the property there should be no need for any police intervention.

If it is where they would be operating on the roadway or the shoulder of Beach place then they will have to have the proper permits.

As of this typing there is no need for police recommendation or work at this time. This report is being submitted as requested.

Captain George Kaho'ohanohano
District Commander---Moloka'i
07/15/96 1430 hrs.

R. M. TOWILL CORPORATION

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

October 4, 1996

Chief Howard H. Tagomori, Chief of Police
Police Department
County of Maui
55 Mahalani Street
Wailuku, Hawaii 96793

Dear Chief Tagomori:

SUBJECT: Special Management Area Permit and Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your letter dated July 17, 1996. We appreciate the review of this important project by Captain George Kaho'ohanohano, District Commander, Molokai.

As noted all necessary construction permits will be obtained prior to scheduled work. Should you have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

4172

DEPARTMENT OF
**PARKS AND RECREATION**
COUNTY OF MAUI

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

LINDA CROCKETT LINGLE
Mayor
HENRY OLIVA
Director
ALLEN SHISHIDO
Deputy Director

(808) 243-7230
FAX (808) 243-7934

'96 JUL 17 P3:23

July 16, 1996

RECEIVED

Mr. David W. Blane, Director
County of Maui
Department of Planning
250 South High Street
Wailuku, Hawaii 96793

Attention: Don A. Schneider, Planner

Dear Mr. Blane:

SUBJECT: Hawaiian Island Fiber Network

We have reviewed the SMA and Shoreline Setback Variance applications and have no objections to the above-referenced project.

If you require additional information, please contact Patrick Matsui, Chief of Parks Planning and Development, at 243-7387.

Sincerely,

HENRY OLIVA
Director

PTM:ik

c: Patrick Matsui

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Henry Oliva, Director
Department of Parks and Recreation
County of Maui
1580-C Kaahumanu Avenue
Wailuku, Hawaii 96793

Dear Mr. Oliva:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

Thank you for your letter dated July 16, 1996. We appreciate your review of this important project.

Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

7199

BENJAMIN J. CAYETANO
GOVERNOR

'96 JUL 18 P2:45

OE
C. RECEIV

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

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

IN REPLY REFER TO:
STP 8.7439

July 16, 1996

Mr. David W. Blane
Director
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Hawaiian Island Fiber Network
GST Telecom Hawaii, Inc.
Shoreline Setback Variance (96/SSV-0005)
Special Management Area Permit (96-SM1-0011)
TMK: 5-3-01: 16

Thank you for your transmittal of July 13, 1996.

The subject project is not anticipated to have an adverse impact on our State transportation facilities.

We appreciate the opportunity to provide comments.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Director of Transportation

R. M. TOWILL CORPORATION

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

October 4, 1996

Mr. Kazu Hayashida
Director of Transportation
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Hayashida:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable <u>Landing at Kaunakakai, Molokai, GST Telecom Hawaii, Inc.</u>

Thank you for your letter dated July 16, 1996. We appreciate your review of this important project and your finding of no anticipated adverse impact on State transportation facilities.

Should you or your staff have any further comments please contact us at (808) 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

BT/bt
cc Mr. Jack Lewis, GST International, Inc.
CK RMTC

BENJAMIN J. CAYETANO
GOVERNOR

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

REC'D OCT 2 1996

October 1, 1996

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

Dear Mr. Blane:

Subject: Draft Environmental Assessment for the Submarine Fiber Optic Cable Landing at Manele Bay, Lanai and Kaunakakai, Molokai

Thank you for the opportunity to review the subject document. We have the following comments.

1. According to the draft environmental assessment, Manele Bay has been designated as a Marine Life Conservation District. Please describe the significance of a Marine Life Conservation District. Please show what rules govern activities within the district? How does this project conform with or differ from allowable activities established by the rules?

2. Activities proposed during the cable laying process include trenching and anchoring. Please describe in detail the trenching and anchoring techniques that will be employed. What type of equipment will be used? What is the size of the anchor? How many anchors will be placed over coral? Is blasting going to be conducted?

3. Trench excavation and backfilling operations will generate fine particulate materials that could impact coral. Please estimate the quantity of sediment that would be created and the amount of coral that the trenching activities would impact.

4. Please provide reasons for supporting the determination based on an analysis of the significance criteria in section 11-200-12 of the Hawaii Environmental Impact Statement Rules.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185. Mahalo.

Sincerely,

Gary Gill
Director

c: R.M. Towill
GST

R. M. TOWILL CORPORATION

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

October 3, 1996

Mr. Gary Gill, Director
Office of Environmental Quality Control
220 South King Street, Fourth Floor
Honolulu, Hawaii 96813

ATTN: Mr. Jeyan Thirugnanam

Dear Mr. Gill:

SUBJECT: Draft Environmental Assessment for Submarine Fiber Optic Cable Landings at Manele Bay, Lanai, and Kaunakakai, Molokai, GST Telecom Hawaii, Inc.

We have received your comments dated October 1, 1996, and have prepared the following response.

1. *Manele Bay, Lanai, Marine Life Conservation District (MLCD)*

The authorization for establishment of MLCDs are by Hawaii Revised Statutes (HRS), Chapter 190. Rules governing the establishment of the MLCD at Manele Bay and Hulopoe Bay, Lanai, are by Hawaii Administrative Rules (HAR), Chapter 13-30.

At this time the State Attorney General has been asked to review and determine whether the proposed activity is consistent with regulations governing uses within the MLCD. It is our understanding that this interpretation will be provided shortly and would form the basis for the Department of Land and Natural Resources (DLNR's) position regarding the proposed fiber optic cable landing at this location.

2. *Activities proposed during the cable laying process*

Manele Bay, Lanai

Please find attached the construction method statement which describes the proposed fiber optic cable installation at Manele Bay. As noted in the method statement no live coral destruction or other disturbance to existing environmental resources within the MLCD would take place in accordance with HRS, Chapter 190, and HAR, Chapter 13-30. Therefore, no blasting within the submerged lands of the MLCD will be permitted.

Kaunakakai, Molokai

Trenching to install the fiber optic cable within the nearshore portion of the landing site will be limited to approximately ±30 feet seaward of the shoreline. Trenching is proposed to be accomplished using a backhoe, shovels, or other means. It is expected that the excavated material will be largely comprised of sand and mud. This material already surrounds the site and would be allowed to re-enter the open trench upon completion of installation. Potential for water quality impacts associated with this work will be regulated through the Section 401 Water Quality Certification which was granted by the State Department of Health on August 28, 1996.

Portions of the fiber optic cable will be anchored within the rock bottom of the mud flat at various locations along the alignment. This anchorage will be by use of pneumatically or mechanically driven bolts, ±1/2" in diameter by ±10" long, secured into the bolt holes by non-toxic marine epoxy. Once the fiber optic cable is secured it is not expected to remain visible due to the depth of the alluvium over the mud flat.

As with the proposed installation at Manele Bay, Lanai, no blasting is proposed.

3. *Generation of particulate material from trench excavation and backfilling*

Trench excavation is not permitted within the submerged MLCD lands at Manele Bay, Lanai. Trenching in offshore waters at Kaunakakai, Molokai, will be limited to an area ±30 feet seaward of the certified shoreline. The quantity of sediment generated is expected to be approximately ±15 cubic yards. This is the only trenching that is proposed along the 1,000 meter long cable run which crosses the Molokai mud flat.

The Section 401 WQC, described above, identifies specific methods and measures that will be practiced to mitigate the potential for water quality impacts due to proposed work at both sites. These practices will include use of silt screens as well as BMPs (Best Management Practices) to govern work site activities.

4. *HAR, §11-200-12, Hawaii Environmental Impact Statement Rules*

An evaluation of significance criteria per §11-200-12 was undertaken in the course of preparing the subject Environmental Assessments. Please refer to the attached summary and these documents for further detail.

Thank you for this opportunity to comment. Should you have any further questions please contact us at 842-1133.

Sincerely,

Brian Takeda

Brian Takeda
Senior Planner

Attachments
BT/bt
cc Mr. Jack Lewis, GST International, Inc.
Mr. Everett Kaneshige, Alston Hunt Floyd and Ing
CK RMTC

GST INTERNATIONAL

91-228 KALAELOA BLVD., SUITE 200
KAPOLEI, HI 96707
808-682-5123   808-682-7630 FAX

# METHOD STATEMENT FOR FIBER OPTIC CABLE INSTALLATION ON THE MANELE BAY, LANAI SAND CHANNEL BOTTOM OF THE ENTRANCE TO THE SMALL BOAT HARBOR

## Landing Shore End:

Above High Water Construction:

The make ready work on the landing will be completed prior to the cable ship's arrival. The site work will include installation of a concrete reinforced manhole and ductline excavation to a point near the certified shoreline. "No excavation will take place seaward of the certified shoreline, which marks the upper limit of the Marine Life Conservation District." A range line marker set will be erected to assist in the accurate placement of the cable.

## Nearshore Harbor Lay:

The cable ship will approach Manele Bay from the south southeast and hold position in ten (10) fathoms just north of the R "2" FIR 4s buoy. The ship will maintain position using a combination of Differential Global Positioning System control links to the central navigation system computer and visual point orientation of the in place navigational aids.

The combination of bow thrusters, stern thrusters, and main propulsion engines will hold the ship at the proper angle to maintain location and alignment with a safety factor of the multiple fathometer stations. Radar scans of the shoreline will confirm the alignment accuracy. The ship will not drop anchor or engage main engines with high propeller settings while in shallow waters to avoid any possibility of impacting the bottom conditions and obscuring the visibility for the divers monitoring the activity.

When both the ship and the shore crew are on station and ready, the ship will lower a floating rope to a small workboat (32 feet in length or less) and will then pull this rope to shore, where the end will be attached to a shore mounted inhaul winch. The other end of the reope will be attached to the end of the fiber optic cable.

The ship will deploy approximately one kilometer of double armored eight (8) fiber cable from the ship, attaching floats along the cable to support the entire deployed length. The floating cable will not contact the bottom during the pull. During the pull, three to four small boats (24 feet or less in length) will standby to assist as required and to prevent other vessels from crossing the cable. The cable will then be floated to shore.

The cable will be routed to the east of the channel marker RN2 and away from the area of the Harbor entrance that requires periodic maintenance dredging by the Small Boat Harbors Department. The actual easement and special positioning will be charted and filed with the Harbors Small Boating Division as-built drawings and submitted to the appropriate agencies for chart updates and notices to mariners.

Once the cable end is at the shoreline, it will be inserted into the shore conduit and secured inside the manhole on shore. At this point, the small boats will pull the cable into its final alignment, and after a final check by divers to ensure that the cable is in the sand channel, the floats will be removed, allowing the cable to sink to the bottom along the selected alignment. During this process, divers will ensure that there is sufficient slack at the point 10 to 15 meters off-shore where the cable crosses the 1 to 1.5 meter high ledge and drops into the channel bottom. This ledge is an old dredge cut, and the slack will allow the cable to conform to the bottom rather than spanning across the bottom immediately seaward of the cut.

There will be no attempt to bury the cable under the water. The surf zone will settle the protected cable to a safe level under the constantly shifting sands and cobbles in the harbor entrance.

After the manhole splicing is complete and the cable continuity is checked, the cable ship will move slowly off-shore, deploying cable as she moves. The ship will maintain a constant tension on the cable as the cable is deployed into deeper waters and the cable will have a slight percentage of slack to compensate for settlement and final adjustments by the ocean currents. Typical ship time on station is from four (4) to eight (8) hours.

The shoreward 100 to 150 meters of cable will be protected by split pipe type armor starting at the shore-end above the high water line,. This will place the end of the split pipe approximately in line with the end of the harbor breakwater. The split pipe will protect the cable from wave action and from potential anchor drag damage. The split sections are approximately 0.6 meters long and 0 15 meters in diameter. Each joint is articulated, allowing the split pipe to follow the bottom configuration. Placement of the pipe is non-intrusive, and does not require any excavation. Nearshore, the split pipe can be placed by workmen wading out from shore. Seaward of the ledge, the split pipe will be placed by divers working out of a small boat . Under optimum conditions, all split pipe can be placed on the same day as the pull. However, under adverse conditions, this operation could take up to two (2) days after the pull to complete.

No nearshore marine activities have been scheduled at night. Advance notices will be distributed to the boating community at Manele Bay. No degradation of the quality of marine life in or around Manele Bay is anticipated.

**Summary Evaluation of Proposed Fiber Optic Cable Landings at Manele Bay, Lanai, and Kaunakakai, Molokai, According to Significance Criteria of HAR §11-200-12**

October 3, 1996

An exhaustive evaluation of the following significance criteria per §11-200-12 was undertaken in the course of preparing the subject Draft and Final Environmental Assessments (Final EA to be published shortly). Please also refer to these documents for further detail.

1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource.

The proposed project will not require the irrevocable loss or destruction of Hawaii's natural or cultural resources. Concerns relating to this item are addressed in the subject Environmental Assessment.

2. Curtails the range of beneficial uses of the environment.

The proposed project will not affect the range of beneficial uses of the environment. The work proposed involves the installation of utility infrastructure which will be a short-term event at the shoreline lasting approximately 1-day. Once installed the cable will remain unobtrusive and buried within a utility easement. Future uses of the environment, therefore, will not be curtailed.

3. Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The proposed project is consistent with the State's long-term environmental polices and goals for protection and conservation of Hawaii's resources. Please refer to Sections 2, 3, 4, 5, and 7 of the Environmental Assessments.

4. Substantially affects the economic or social welfare of the community or State.

The proposed project is consistent with the State's goals for facility systems (§226-14 and 18) and the economy (§226-10.5).

The applicant, GST Telecom Hawaii, Inc., is a public utility company registered in the State of Hawaii. The proposed action will enable a second interisland telecommunications provider to promote both improved and expanded services as well as competitive pricing.

5. Substantially affects public health.

No impacts on public health are expected. The cable itself is constructed of inert materials including optical quality glass fiber strands, steel, plastic, and polypropylene. No transmission of electricity will be required through the cable. The primary medium utilized will be electronically pulsed light signals.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities.

No adverse secondary impacts are expected. The only effect will be to enable a public utility licensed telecommunications company to operate a second interisland fiber optic cable system. Operation of this system will result in an enhanced and competitively priced telecommunications service.

7. Involves a substantial degradation of environmental quality.

Per the Draft and Final Environmental Assessments, no substantial degradation of environmental quality is expected.

8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.

The proposed project is a major commitment involving capital costs in excess of +$20 million. No other commitments which would result in environmental degradation are expected.

9. Substantially affects a rare, threatened, or endangered species, or its habitat.

The proposed project has been extensively reviewed by various Federal and State environmental agencies including Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, State Office of Coastal Zone Management, and the State Department of Health. No rare, listed threatened or endangered species will be affected by the proposed activity.

10. Detrimentally affects air or water quality or ambient noise levels.

Based on environmental review of the proposed activity, no detrimental impacts on air, noise, or water quality are expected.

11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The proposed project has been sited based on thorough review of criteria necessary for the installation of a fiber optic cable. The proposed action is not expected to affect or be affected by damage from the above.

12. Substantially affects scenic vistas and view planes identified in county or state plans or studies.

The fiber optic cable when installed will be buried. No scenic vistas or view planes will be affected by the proposed activity. All work will be limited in scope and short-term in duration.

13. Requires substantial energy consumption.

The proposed project does not require substantial or significant consumption of energy.

## REFERENCES

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Bauer, G.B. and L.M. Herman. 1986. *Effects of Vessel Traffic on the Behavior of Humpback Whales in Hawaii.* Prepared for NMFS, Honolulu Laboratory, Hawaii. 140+pp.

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

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# APPENDIX

# INVESTIGATION OF POTENTIAL FIBER OPTIC CABLE LANDING SITES

## KAUNAKAKAI, MOLOKAI AND MANELE BAY, LANAI

Prepared By:

Sea Engineering, Inc.
Waimanalo, Hawaii

March 1996

# AN ANALYSIS OF POTENTIAL LANDING SITES
# FOR FIBER OPTIC CABLES
# KAUNAKAKAI HARBOR, MOLOKA'I AND
# MANELE HARBOR, LANA'I

Prepared For:

Sea Engineering, Inc.
Makai Research Pier
Makapuu Point
Waimanalo, Hawaii

By:

Richard Brock, Ph.D.
Environmental Assessment Co.
1820 Kihi Street
Honolulu, Hawaii 96822

March 1996

EAC Report No. 96-01

# FIBER OPTIC CABLE LANDING SITES: KAUNAKAKAI AND MANELE HARBORS

R.E. Brock
March 1996

## INTRODUCTION:

As part of the expanding telecommunications network, Sea Engineering, Inc. was contacted to examine possible shallow-water routes for the landings of two fiber optic cables, one at Kaunakakai Harbor, Moloka'i and the second at Manele Harbor, Lana'i. A number of parameters are considered in the selection of the most appropriate route for a cable landing through the nearshore environment. Among these are the proximity of shoreside infrastructure, access to the shoreline and with the shallow underwater segment, the physical structure of the seafloor, degree of exposure to occasional storm generated surf and the impacts that could occur to marine communities in the proposed path of the cable. This report focuses on the development of marine communities in the vicinity of the two proposed cable landing routes and discusses possible impacts that could occur if the project is to proceed as well as mitigative measures that may be considered.

## MATERIALS AND METHODS:

In general marine communities in the vicinity of each proposed cable route from shore to a minimum depth of 25m were assessed.

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 here may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a <u>Pocillopora meandrina</u> coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, we designed a sampling program that attempted to delineate all major extant 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 examined the bottom features in each study area from shore seaward to at least the 25m isobath (the outer limits for this study). This exercise allowed the qualitative delineation of major biotopes or zones 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.

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 condiucted over a 4 x 25m corridor and all fishes within this area to the water's 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., cross 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 lenght) 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 flatfishes or paki'is, family Bothidae) might still be missed.

Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count and to estimate sizes. Additionally, bias related to the experience of the diver conducting counts should be considered in making any comparisons between surveys. In the present study, one individual (Brock) 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.

**RESULTS AND DISCUSSION:**

1. Kaunakakai Harbor Corridor

Two general cable alignments were proposed for the Kaunakakai Harbor area. The first of these approximately follows the eastern edge of the harbor entrance channel emerging at the pier island and the second lies about 300m to the east crossing the emergent coral reef east of the small vessel section of the harbor coming ashore at Kaunakakai town.

The biological fieldwork for Kaunakakai Harbor was carried out on 8 March 1996. The qualitative survey extended from the "Red No. 2" bouy situated on the eastern side of the harbor just seaward of the pier island to approximately the 24m isobath more than 900m from the seaward side of the pier island. In the harbor, most of the survey effort concentrated along the eastern side which is consistent with one of the proposed cable alignments. Along the proposed second alignment 300m to the east, qualitative surveys were carried out from the seaward side of the emergent reef crest to a point more than 680m seaward.

The harbor entrance channel faces directly southwest and is cut into a shallow extensive reef flat that fronts Kaunakakai. The crest of this reef flat lies close to the zero tide mark so that on low tide some of it appears above the water's surface. The pier island lies at the seaward end of a 500m long mole that services the area and the reef crest is situated about 300m seaward of the pier island. The entrance channel creates a break in the reef crest that is more than 200m in width. Depth of the channel inside of the reef crest is close to 10m in the areas surveyed by this study. The floor of the entrance channel is sand with some coralline rubble. Seaward of the reef crest water depth rapidly increases, dropping from about 10m to more than 24m creating a deep "moat" that generally parallels the reef. The seaward side of this "moat" is bounded by a large elongate mound of coralline rubble which varies in width from about 50 to more than 200m. This mound has an orientation that roughly parallels the reef crest and it continues to the east at least as far as the second proposed cable alignment more than 300m to the southeast. Seaward of the rubble mound, sand substratum is again encountered at a 24m depth which gentle slopes seaward to greater depths outside of the range of this study.

In this harbor entrance environment three zones or biotopes were recognized; these are the biotope of sand, the rubble/coral mound biotope and the biotope of high coral cover found primarily along the sides and protected shallows of the harbor. The biotope of sand as well as the rubble/coral biotope continue uninterrupted to the area of the second proposed cable alignment about 300 m to the southwest. Also present in this latter area are the biotope of sand and rubble as well as the biotope of spurs and grooves. The approximate boundaries of these biotopes is given in Figure 1.

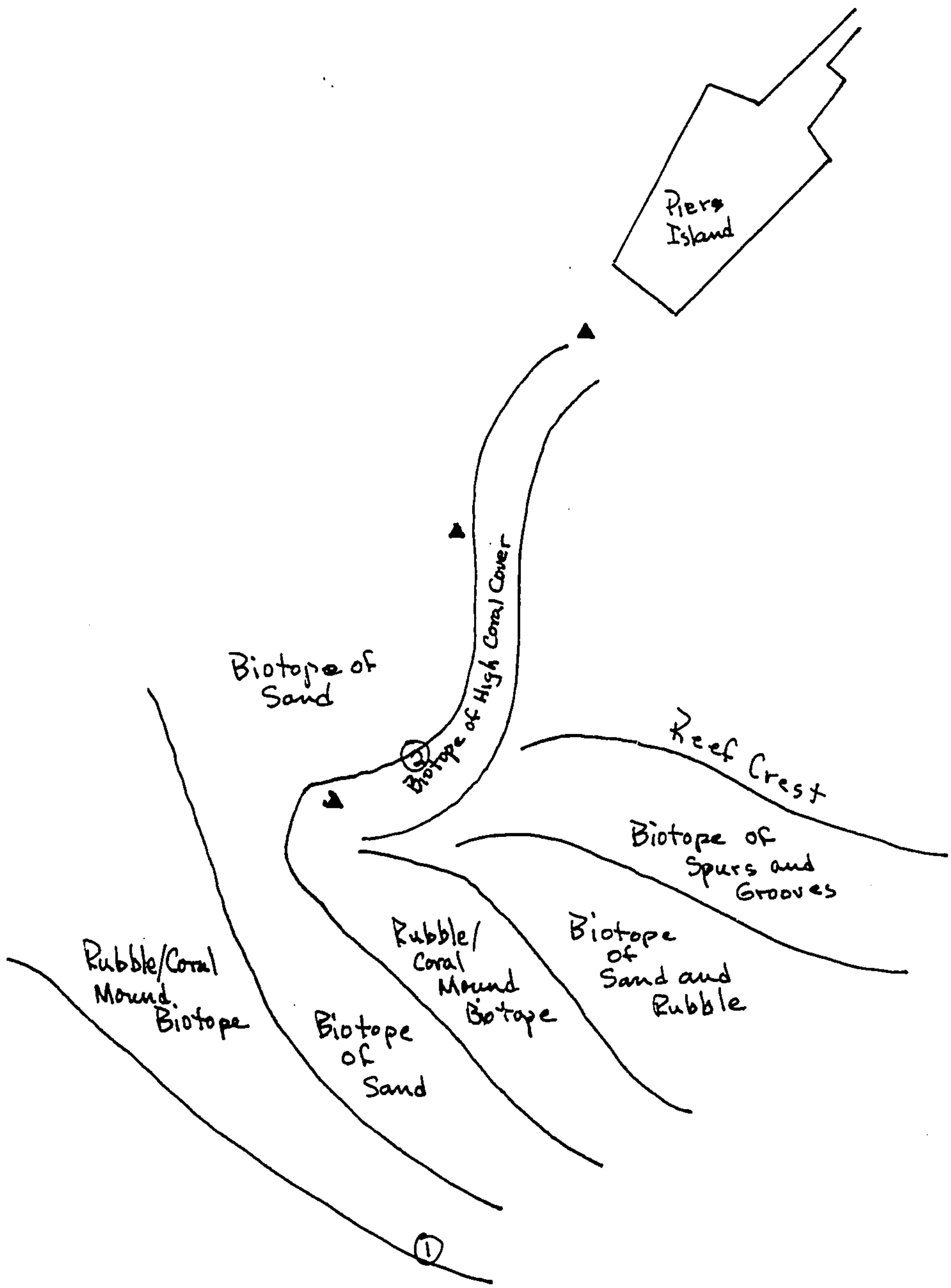
It should be noted that the boundaries of each zone or biotope are not sharp but rather grade from one to another; these are ecotones or zones of transition. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave and current action, and the major structural elements present in the 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 were named for distinctive features of each as shown in Figure 1.

### The Biotope of Sand

The biotope of sand lies principally seaward of the project site as well as in the harbor entrance channel. At the outer depth limits of this study, the biotope of sand is bisected by a large elongate mound of coral rubble as noted above (the rubble/coral mound biotope). 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 ranina). 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 constraints with bottom time at the depth of which the best biological development in the biotope of sand is

FIGURE 1. Map of Kaunakakai Harbor, Moloka'i and environs showing some of the harbor bouys and biotopes (lettered) defined in the area. Also shown are the locations of the two quantitative stations (numbered) established to sample representative areas within biotopes. The biotopes are lettered where A = the biotope of sand, B = the rubble/coral mound biotope, C = the biotope of high coral coverage, D = the biotope of sand and rubble and E = the biotope of spurs and grooves. Scale: 1cm = 49m.


Piers Island
Biotope of Sand
Biotope of High Coral Cover
Reef Crest
Biotope of Spurs and Grooves
Biotope of Sand and Rubble
Rubble/Coral Mound Biotope
Rubble/Coral Mound Biotope
Biotope of Sand
2
1

found, we did not quantitatively sample this biotope but rather carried out a qualitative reconnaissance of the habitat in waters from 10 to 25m 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), leatherback or la'i (Scombroides laysan), nabeta (Hemipteronotus umbrilatus), omilu (Caranx melampygus) the goby-like fish (Parapercis schauslandi), uku or snapper (Aprion virescens), the nightmare weke (Upeneus arge) and the weke or white goatfish (Mulloides flavolineatus). With greater effort many more fish and invertebrate species species would be encountered in this biotope.

## The Rubble/Coral Mound Biotope

As mentioned above a large elongate mound of coral rubble lies seaward of the harbor entrance channel. This mound appears to have an orientation that approximately parallels the reef crest and is situated from 390 to 420m seaward of it. This mound is situated on a sand/rubble substratum that is about 24-26m in depth and rises more than 8m. The width of the mound varies from about 50 to more than 200m and it parallels the reef spanning the area at least from the harbor entrance away to the southeast for more than 400m. We did not attempt to determine the overall dimensions of this mound. It appears to be an extensive feature. The rubble/coral mound biotope also occurs on the seaward side of of the main reef platform to the southeast of the harbor entrance channel. In this area it is more than 100m in width and, again, approximately parallels the shallow reef crest (see Figure 2-A). Two hypotheses may be put forward to explain the presence of this biotope. The first is that it is very similar in appearance to the rubble/coral mound biotope found seaward of the Kewalo Landfill in Honolulu. In this latter location, these rubble mounds have been attributed to the dumping of dredge tailings from harbor maintenance operations years ago. The second hypothesis is that the rubble/coral mounds offshore of Kaunakakai Harbor are the result of occasional storm surf impinging on this reef and breaking up corals. Contributing to the breakup of coral in the vicinity of the harbor mouth could be the fact that barge-tug operations will take up their tows (shorten the tow cable) just outside of the harbor and in doing so, the cable may drag across the substratum destroying coral colonies in its path. None of these hypotheses is mutually exclusive and the rubble mounds may be the result of all three factors.

Marine communities are not well-developed on the top of this mound. Coral communities are reasonably developed along the seaward edge of the mound and to a lesser extent, on the shoreward edge. In these areas, coral cover may locally exceed 80 percent over scales of 5 to 25 $m^2$ where the corals have "cemented" the rubble forming a near-continuous hard substratum. Between these areas of higher coral cover, coralline rubble and sand dominate the substratum affording little vertical relief and shelter for fishes. Thus overall mean cover along these facies is closer to 5 percent. Benthic communities are much less developed across the top of the rubble mound and cover has an overall average of less than 2 percent although there are areas where it may locally exceed 20 percent. In the area directly fronting the harbor entrance channel, corals are virtually absent from the top of this mound. Where encountered, dominant coral species on the top of the mound are Pocillopora meandrina and Porites lobata.

Because of the relatively high diversity of fishes and invertebrates, a quantitative station was established along the seaward facing slope of the coral rubble mound in the vicinity of the second proposed cable alignment. This station is approximately 580m seaward of the reef crest on proposed cable alignment no. 2 in 21m of water (see Figure 2-A). The substratum at this station is comprised of coralline rubble with areas of consolidation due to coral growth. The transect was carried out at the top of this rubble mound, along the seaward side; some topographical relief is present due to small coral colonies (to 0.5m in height) and larger blocks of dead coral (up to 0.5 by 1m in dimensions). These topographical features are spaced from 8 to 30m apart, thus most of the substratum affords little cover for fishes. The transect covered one small area of principally encrusting coral growth.

The results of the quantitative survey of station 1 are given in Table 1. The quadrat survey noted eight coral species having a mean coverage of 29.4 percent. Dominant coral species include Porites compressa, Montipora patula and Montipora verrucosa. The macroinvertebrate census noted seven species including the boring bivalve Lithophaga sp., a pair of banded shrimps (Stenopus hispidus), the polychaete (Lomia medusa), the banded urchin (Echinothrix calamaris), black urchin (Tripneustes gratilla), starfish (Linckia multiflora) and sea cucumber (Holothuria atra). The results of the fish census at station 1 are given in Appendix A (transect 2). In total, 29 species of fishes (441 individuals) were encountered at this station. The most abundant species included the red squirrelfish or ala'ihi (Adioryx xantherythrus), the milletseed butterfly fish or lau wiliwili (Chaetodon miliaris) and the blacklip butterfly fish or kikakapu (Chaetodon kleinii). The biomas of fish was estimated to be 152 g/$m^2$ and the species that contributed most heavily to this were the black triggerfish or humuhumu 'ele'ele (Melichthys niger - 23% of the

TABLE 1. Summary of the benthic survey conducted in the rubble-/coral mound biotope approximately 900m seaward of the pier island at Kaunakakai Harbor, Moloka'i on 8 March 1996. 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 21m; mean coral coverage is 29.4 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Sponges | | | | | | |
| *Spirastella coccinea* | | | | 0.5 | | |
| Corals | | | | | | |
| *Porites lobata* | 4 | | 6 | | 0.1 | |
| *P. compressa* | 19 | 1 | | | | |
| *Pocillopora meandrina* | | | 0.5 | 2.8 | 0.5 | 1.8 |
| *Montipora verrucosa* | 21 | 64 | 2 | 0.5 | | |
| *M. flabellata* | 3 | | | 0.5 | | |
| *M. patula* | 12 | 26 | 2 | | | |
| *M. verrilli* | | | 0.5 | | | |
| *Pavona varians* | 9 | | | | | |
| Sand | | | 6 | 7 | 29 | 48.2 |
| Rubble | 18 | 9 | 73 | 82.7 | 64.4 | 38 |
| Hard Substratum | 14 | | 10 | 6 | 6 | 12 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Porites lobata* | 2 |
| *P. compressa* | 2 |
| *Pocillopora meandrina* | 2 |
| *Montipora verrucosa* | 12 |
| *M. patula* | 8 |
| Sand | 14 |
| Rubble | 52 |
| Hard Substratum | 8 |

(TABLE CONTINUED ON NEXT PAGE)

# I. INTRODUCTION

This report describes the findings of field investigations of proposed nearshore cable routes and landings at Kaunakakai, Molokai and Manele Harbor, Lanai. The work was completed by a two man team, an ocean engineer from Sea Engineering, and Dr. Richard Brock, a marine biologist. Sea Engineering's work concentrated on the physical aspects of the ocean bottom that would affect the cable placement and the requirement for cable protection. Dr. Brock's work was oriented toward a description of the benthic communities and the potential impacts of cable placement. Dr. Brock's report is included as an appendix to this one; cetain portions of his report have also been utilized in the main body of this report.

The vicinity of the proposed fiber optic cable shore landing at Kaunakakai Harbor, Molokai was investigated on March 8, 1996. Positioning was by means of a hand held GPS, upgraded to receive the U.S. Coast Guard differential beacon, giving an overall positioning accuracy of $\pm$10 meters or better.

The proposed Manele Bay cable landing site was investigated on March 13, 1996, using the same personnel and methods as for the Kaunakakai Harbor site.

# II. KAUANAKAKAI, MOLOKAI

## Bottom Description

Figure 1, taken from NOAA Chart #19353 shows details of the harbor entrance channel and immediate vicinity. Bathymetry on this chart does not extend beyond the area shown, and the next larger scale chart shows insufficient detail for this area. Figure 1 is therefore a combination of the detailed NOAA chart and our annotated positioning notes. The starting and ending points of all dives were determined with the DGPS, and the locations are shown on Figure 1.

Two general cable alignments were investigated. Alternative 1 approximately follows the eastern edge of the harbor entrance channel, eventually making landfall at the Pier Island. Alternative 2 is located approximately 300 meters to the east, and would cross the shallow fringing reef flat making landfall in the vicinity of the Pau Hana Inn.

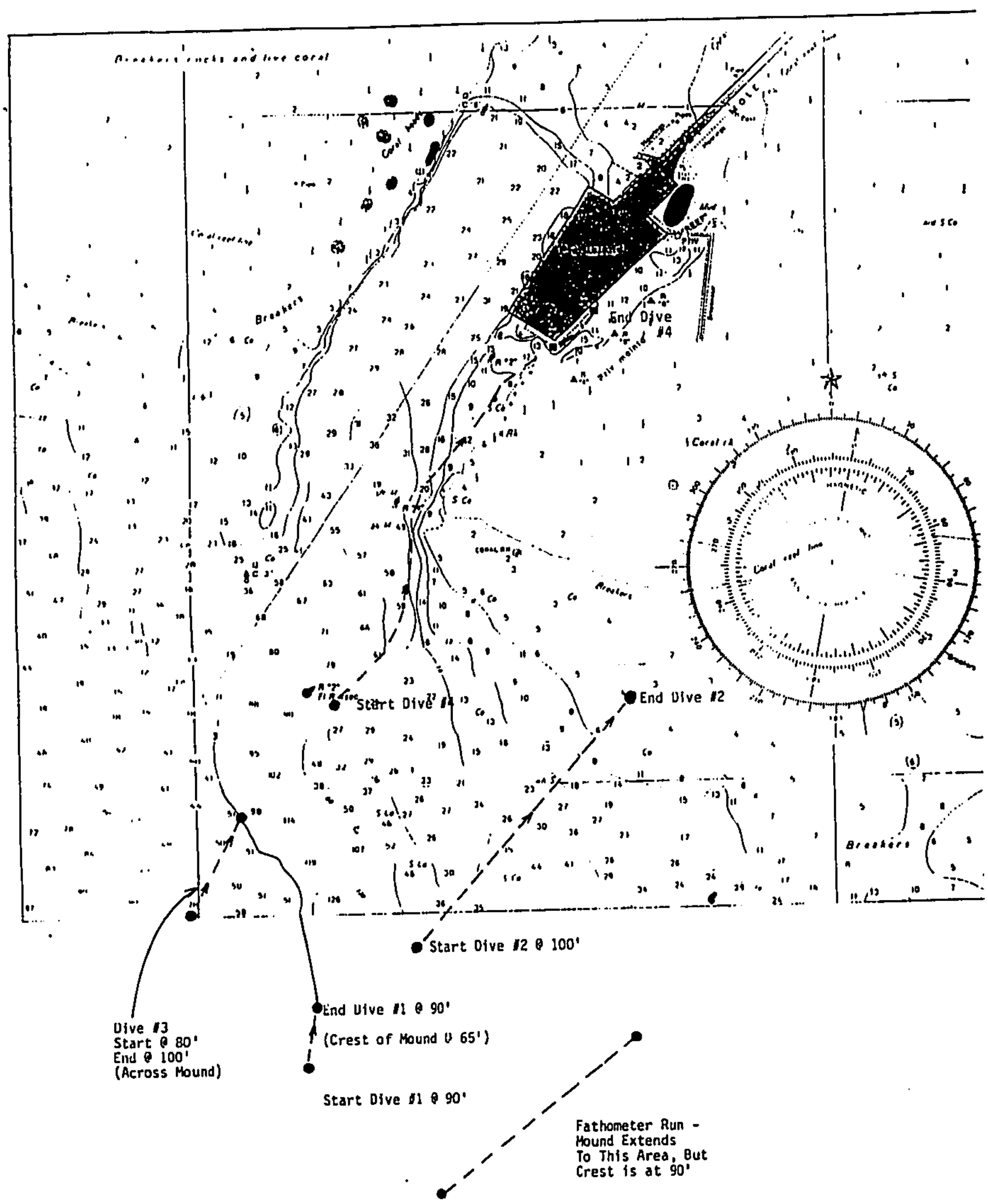



Figure 1. Kaunakakai Harbor (Scale 1:5,000: Water Depths in Feet)

One of the significant features affecting both route alternatives is an offshore mound, which is actually an extension of the shallow bottom to the west of the entrance channel. The deep entrance channel makes a 45 degree bend to the east just seaward of the R"2" buoy. The shallower adjacent bottom contours west of the channel parallel this bend, and further offshore are aligned almost parallel to the coastline. This bottom feature therefore appears as a mound or obstruction to potential cable approaches which would be perpendicular to the coastline. The bottom both offshore and inshore of the mound is deeper and consists of flat featureless sand. The mound consists of hard substrate, with coral and coral rubble coverage. The mound is an extensive feature, extending across the entrance channel and well to the east beyond alternative 2. The shallow bathymetry of the mound is apparent on Figure 1.

Dive #1 was made on the mound east of the entrance channel, along the proposed alternative 2 approach. The dive started at the transition from sand to hard bottom on the seaward side of the mound, at a depth of 90 feet. Typical vertical relief of the seaward slope and the crest of the mound is 2 feet. Photo 1 was taken at the crest of the mound at a depth of 60 feet. The inshore face of the mound is slightly steeper than the offshore face, and is typified by small ledges, such as that shown in Photo 2. Vertical relief is on the order of 3 feet. The transition back to sand bottom on the inshore side occurs at the 90 foot depth.

The second dive was made on approximately the same approach alignment, starting at the 100 foot depth where the inshore slope begins to shoal up to the fringing reef. The sand to hard bottom transition occurs at a depth of between 90 and 100 feet. Photo 3, taken at a depth of 40 feet, shows the coral coverage and the typical 2 foot vertical relief representative of the zone between 90 and 40 feet. Photo 4, taken at 35 feet, shows the increasing irregularity of the bottom and the typical vertical relief of 3 feet. Photo 5 was taken at a slope break at a depth of 32 feet. Inshore of this point, the bottom slope flattens out, and the vertical relief decreases. Although there is less coral coverage, there are still scattered coral formations in this area with vertical relief of 3 feet (see Photo 6 for example). At the 30 foot depth, there is a distinct shift in bottom zonation. The bottom becomes flat and scoured, with scattered pieces of coral rubble, as shown in Photo 7. This zone extends in to the 20 foot depth, and is apparently where the maximum wave induced forces occur. The spur and groove formation typical of the seaward faces of fringing reefs begins at the 20 foot depth. Vertical relief is up to 4 feet, and Photo 8 shows a typical view. Photo 9 shows typical bottom conditions in 5 feet of water, inside the surf zone.

The third dive was made on the outer mound on proposed route alternative 1. The transition from sand to hard bottom occurs at the 90 foot depth. Photo 10 shows the outer slope of the mound at 70 feet, and is typical of the entire outer slope of the mound, which crests at a water depth of 48 feet. Vertical relief is typically only 1 foot. The inshore slope of the mound consists of rubble and limestone, with vertical relief up to 2 feet.

The fourth dive was made along the east side of the channel, and extended from just seaward of the R"2" buoy to the Pier Island. The channel bottom through this area is flat sand, bordered by steep coral covered walls rising to a shallow reef shelf on the east side of the channel. The depth of the transition from the sand channel bottom to the coral covered walls is 40 to 45 feet between R"2" and R"4". Photo 11 shows the channel wall in the vicinity of R"2". Photo 12 shows a typical view of the shelf midway between R"2" R"4". The depth of the shelf is about 15 feet. The topography of the shelf is very irregular, with vertical relief up to 6 feet. Photo 13, taken at a depth of 45 feet in the vicinity of R"4", shows the remnant of a tow bridle or anchor line wrapped around a small irregularity on the channel bottom. Photos 14 and 15 show two typical views of the steep channel walls in the vicinity of R"4". At R"4", the depth of the channel bottom decreases to approximately 30 feet, and that of the reef shelf to approximately 5 feet. A large anchor is wedged into the channel wall just inboard of R"4".

From R"4", the dive followed the east wall of the channel toward the small craft channel. This channel is approximately 12 feet deep, with a steep ledge up to the 2 foot deep shelf to the east. Photo 16 shows the very irregular reef shelf in this area.

Photo 17 shows the revetment on the east side of the Pier Island. The revetment is built on a limestone shelf, which can be seen paralleling the revetment in the photo. The shelf is approximately 10 feet wide, then gives way to a steep drop to the channel bottom. At the southeast corner of the Pier Island the ledge is not present, and the revetment rocks extend down to the channel bottom.

## Conclusions

Either of the selected route alternatives will have to cross the outer mound. Reconaissance runs to determine the limits of the mound were made using the dive vessel's fishing fathometer. The mound is present, as shown by the bathymetry on Figure 1, along the entrance channel centerline, with the crest of the mound at a water depth of 40 feet. East of route alternative 2 (see Figure 1) the mound is still present, but it is narrower, with a deeper crest (90 feet). A cable landing even further to the east would probably avoid the mound.

Cable protection in the relatively shallow water on the crest of the mound may be required for either alternative. Along alternative 2, the inshore bottom is irregular, and may require an additional long span of cable protection (see dive #2, Figure 1). The Kaunakakai area is protected by the island of Lanai from waves aproaching from the south and southeast, but is exposed to wave approach from the southwest. Both Kona storm and hurricane waves approach from this direction, and the design wave height at this site could be significant.

The proposed route for alternative 1, which involves anchoring the cable on the shallow reef shelf, does not appear to be practical because of the steep channel walls and extensive encrusting coral coverage. Additionally, the shallow shelf fronting the exposed reef flat has heavy coral growth and is very irregular. Working on the shallow reef crest may be difficult.

The best alternative might be to route the cable along the east side of the entrance channel, carefully placing it right at the sand/coral transition. The route would run from R"2" to R"4", and then up the east side of the small boat channel. The cable could be routed over to the Pier Island revetment at any desired point. Cable protection against wave action would probably not be required on this route, but harbor operations would pose a definite threat to the cable.

A major concern requiring further clarification is the high possibility of cable damage due to either emergency ship anchoring in the entrance channel, or more likely, damage due to the bridles and tow cables of the tugs and barges as they shorten up their tow prior to entering the harbor. Damage from this source is not limited only to the harbor channel. For example, several oceanographic instrumentation arrays have been lost in the vicinity of the Sand Island Ocean Outfall diffuser, which is located 8,000 feet west of the Honolulu Harbor entrance channel. Abrasion marks caused by tow wires dragging across the exposed diffuser pipe bells in 235 feet of water have been observed. The practicality of the route described above is totally dependent upon being able to determine, with a high degree of certainty, that ship and tug operations will not impact the cable.

Should the Kaunakakai area not be suitable for a shore landing, there are two other possibilities, both located to the west, as shown in Figure 2. There is a small serpentine channel located approximately 3.5 miles west of Kaunakakai. The channel provides access to the shore through the reef, and is readily visible from the air. The only available bathymetric details of the channel are shown in the figure. Another channel through the reef is located at Kolo Harbor, approximately 10 miles west of Kaunakakai. Figure 3 shows

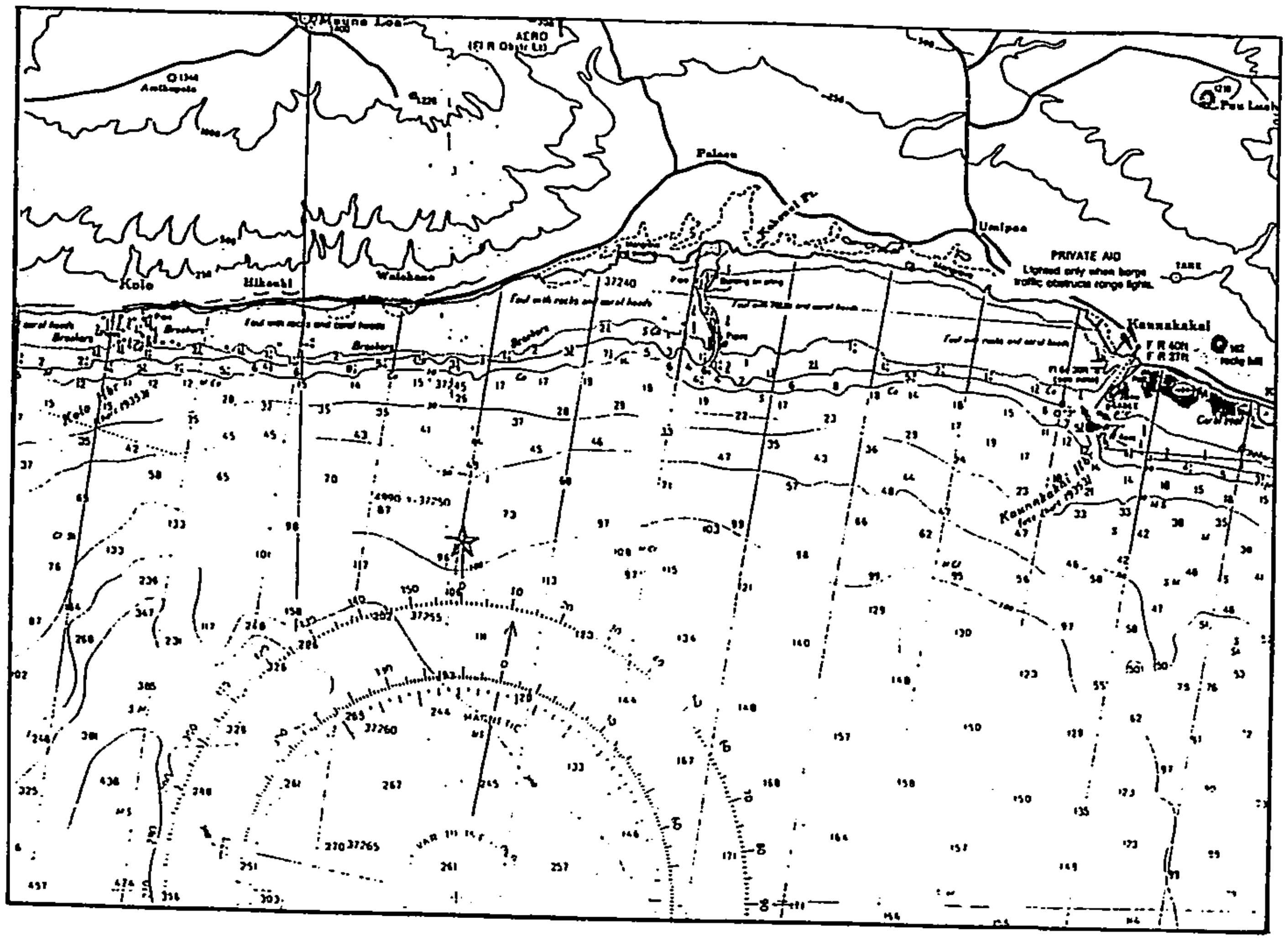



Figure 2. South Coast Moloka'i SOUNDING IN FATHOMS - Scale 1:80,000

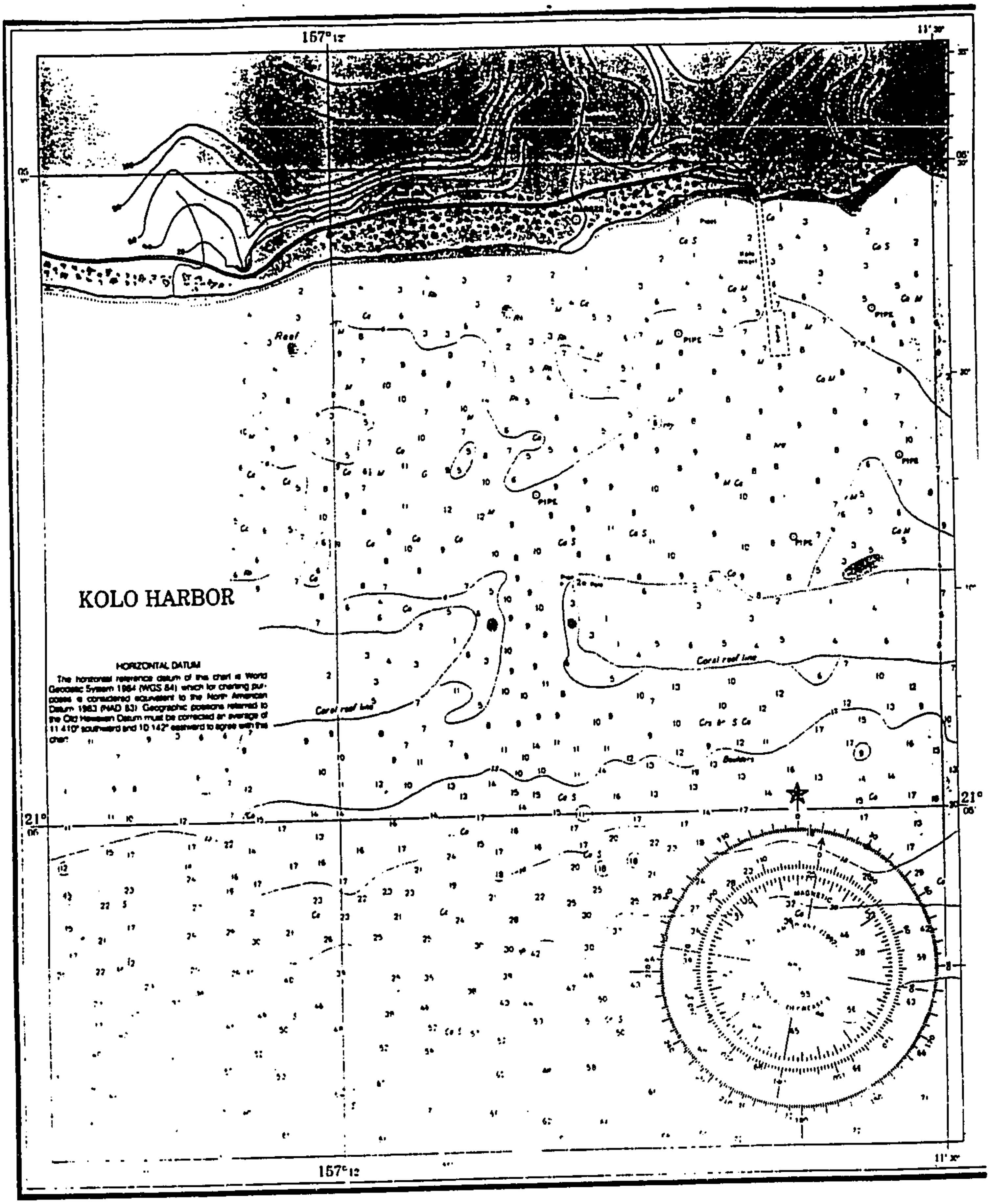



Figure 3. Kolo Harbor. Depths in Feet

the detailed bathymetry of the harbor.

## III. MANELE HARBOR, LANAI

General Description

Preliminary fathometer runs in the center of the bay showed a relatively flat bottom, indicative of a sand channel, and this was confirmed by a dive to 90 feet in the center of the bay. The sand coverage is extensive and the deposit appears to be relatively thick. Fathometer runs out to the 120 foot depth were made, and the sand appears to continue to at least that depth. No steep ledges were noted. The sand bottom offers optimum conditions for cable routing.

The boundaries of the sand channel were mapped using the hand held DGPS, and were superimposed on a nautical chart of the bay (Figure 4). The diving investigations were concentrated on the western side of the bay in the vicinity of the proposed cable landing.

Brock delineated three major biological zones, or biotopes, and these are described thoroughly in the appendix. They were the biotope of sand, the biotope of high Porites (finger coral) cover, and the biotope of high coral diversity. These biotopes are also superimposed on Figure 4.

The biotope of high Porites cover lies off the remnants of an old loading ramp. The transitition from sand to coral bottom occurs at approximately the 65 foot depth. Photo 18, taken at a depth of 25 feet shows typical bottom conditions. The coral cover is extensive, and the bottom is undulating with vertical relief on the order of 3 feet. The bottom becomes more irregular in shallow water near the shoreline, with vertical relief increasing to 5 feet. At the shoreline, a near vertical ledge rises from the 14 foot depth to the waterline, as shown in Photo 19. The ledge continues above the waterline, as shown in Photo 20, which also shows the remnants of the ramp.

The nearshore band of coral coverage is continuous along the western side of the bay, but the zonation changes in the northwest corner near the breakwater. Brock defined this zone as a biotope of high coral diversity. The bottom becomes very irregular, with numerous interspersed pockets of sand. The sand areas have no particular orientation, and since they

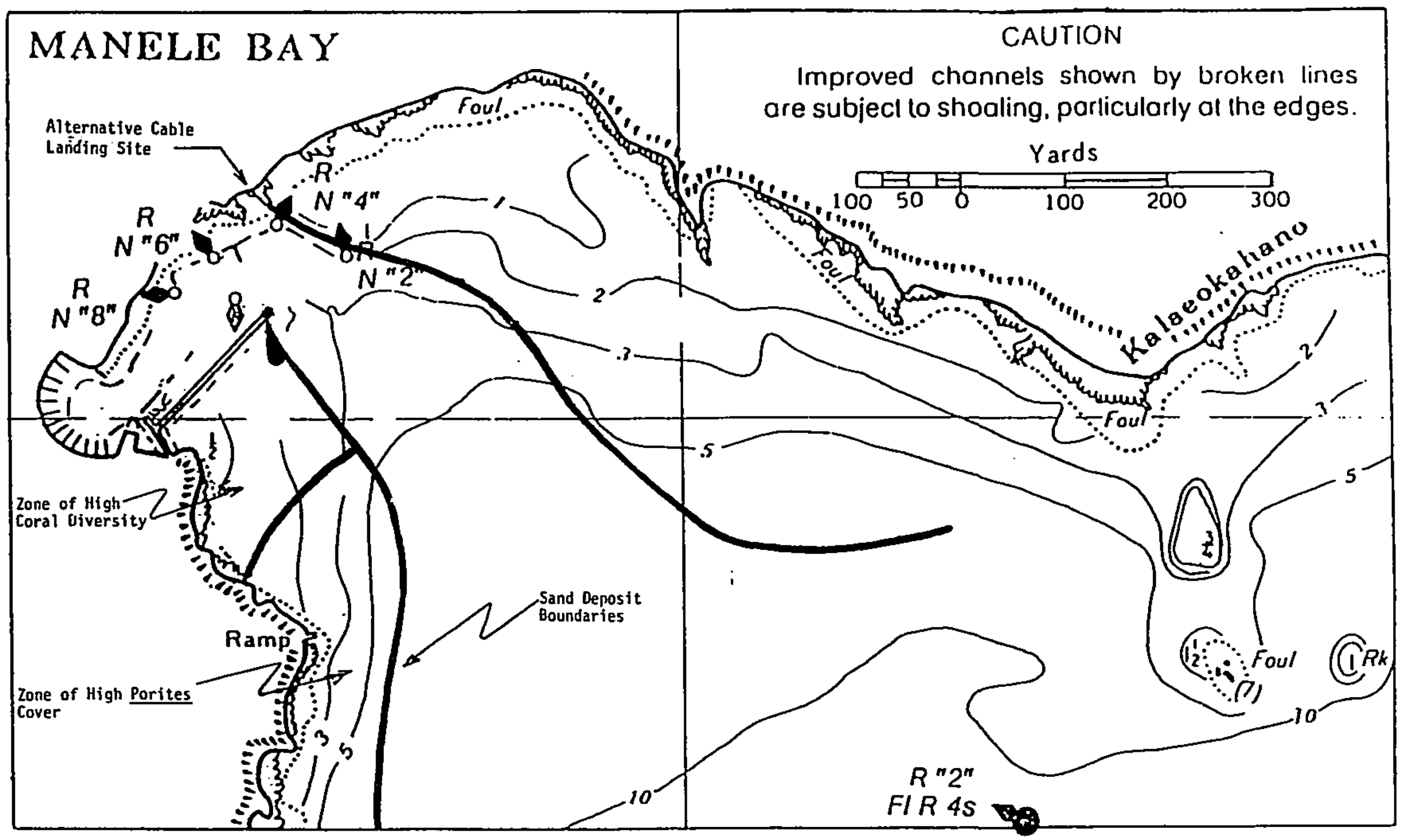



Figure 4. Manele Bay

all abruptly dead end, do not provide a possible cable route through this area. The sand pockets are typically 5 to 10 feet below the ridges of surrounding hard bottom, and the diverse coral growth occurs on the tops and sides of these ridges. This inner zone ia apparently a popular snorkeling area. One tour boat has a temporary mooring in one of the sand pockets, and was present with a tour group during the morning of our reconnaissance. Individual snorkelers were also observed entering the water from the proposed cable landing area near the culvert. Photo 21, taken at a depth of 30 feet, shows the transition from sand to the diverse coral bottom. The height of the ledge is approximately 7 feet. The next four photos, 21-25, show typical views of the zone of high coral diversity, and illustrate the irregular bottom topography.

The bottom just offshore of, and parallel to, the breakwater was investigated to see if it offered a possible cable route. Along the outer half of the breakwater, the diverse coral zone extends up to the breakwater rocks. Inshore, there is a narrow band of basalt rocks, and the bottom topography is more regular.

The east side of the entrance channel was also investigated for a possible cable route. The sand bottom extends slightly east of the small boat channel, and a cable could be routed to avoid the channel and still cross little or no hard bottom. Photos 26 and 27 show views from the water of this approach. There is a shallow basalt shelf within the small shoreline embayment that is approximately 100 feet wide. A three foot ledge (Photo 28) marks the transition from the offshore sand bottom to the shelf.

## Conclusions

The proposed cable landing on the northwest side of Manele Bay does not appear to be feasible. The cable would cross a highly diverse and heavily used coral area. The 10 foot vertical relief would result in the cable being suspended across the deeper sand pockets, with subsequent visual impact. Excavation of the coral ridges would almost certainly not be allowed in this area. Aesthetic and environmental issues would be exacerbated since the entire bay lies within a Marine Life Conservation District. From an engineering perspective, properly protecting the suspended cable would be difficult.

Considering marine issues only, the best cable landing site is just northeast of the small boat harbor. A landing at this site would take advantage of the extensive offshore sand deposit, and only the inshore 100 feet or so would cross hard bottom. This recommended shore landing point is shown on Figure 4. The cable could be routed on the north side of the channel, outboard of buoys RN "2" and RN "4", and would therefore be out of the entrance channel and potential impacts from future dredging operations.

Another landing site that would avoid crossing the irregular coral bottom would be on the tip of the existing breakwater. However, this site has several disadvantages. The cable would have to be pulled up to the crest of the breakwater, and then run shoreward along the crest. This might present a physically difficult landing. Also, any shifting of the breakwater rocks during storms could put the cable at risk.

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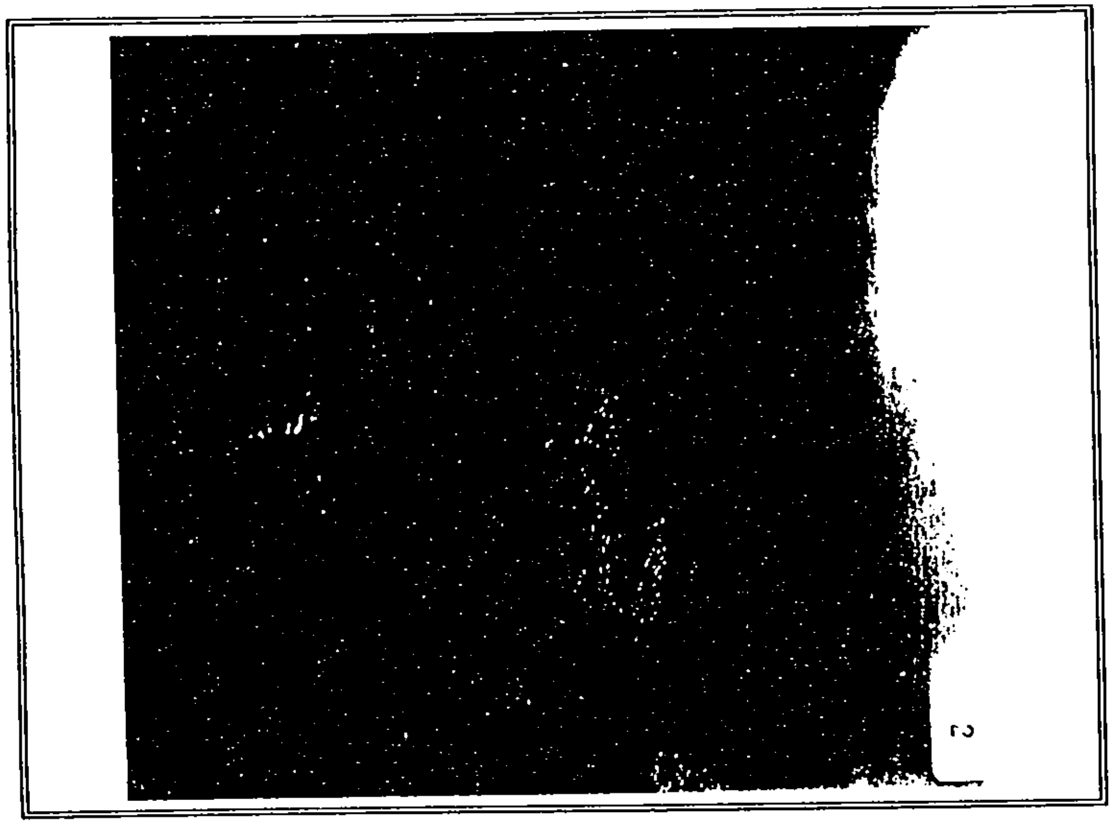


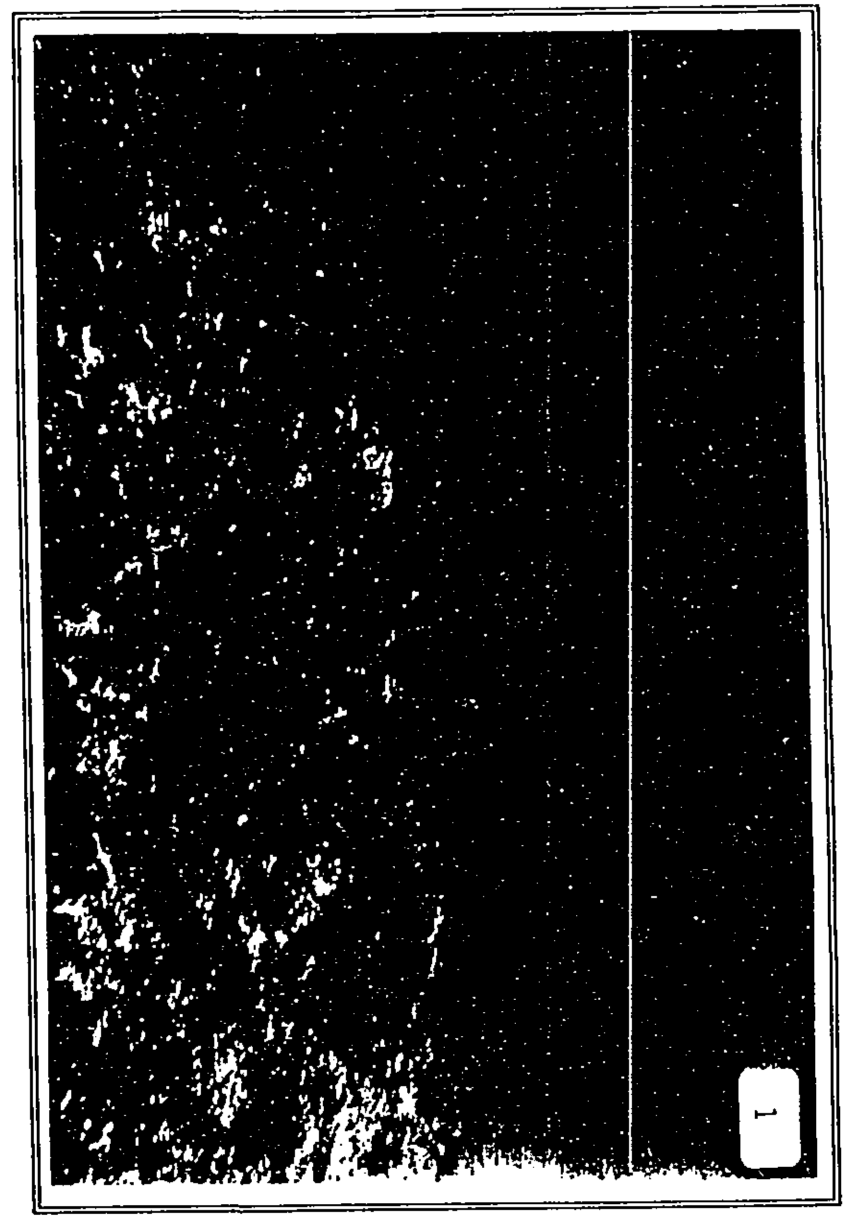


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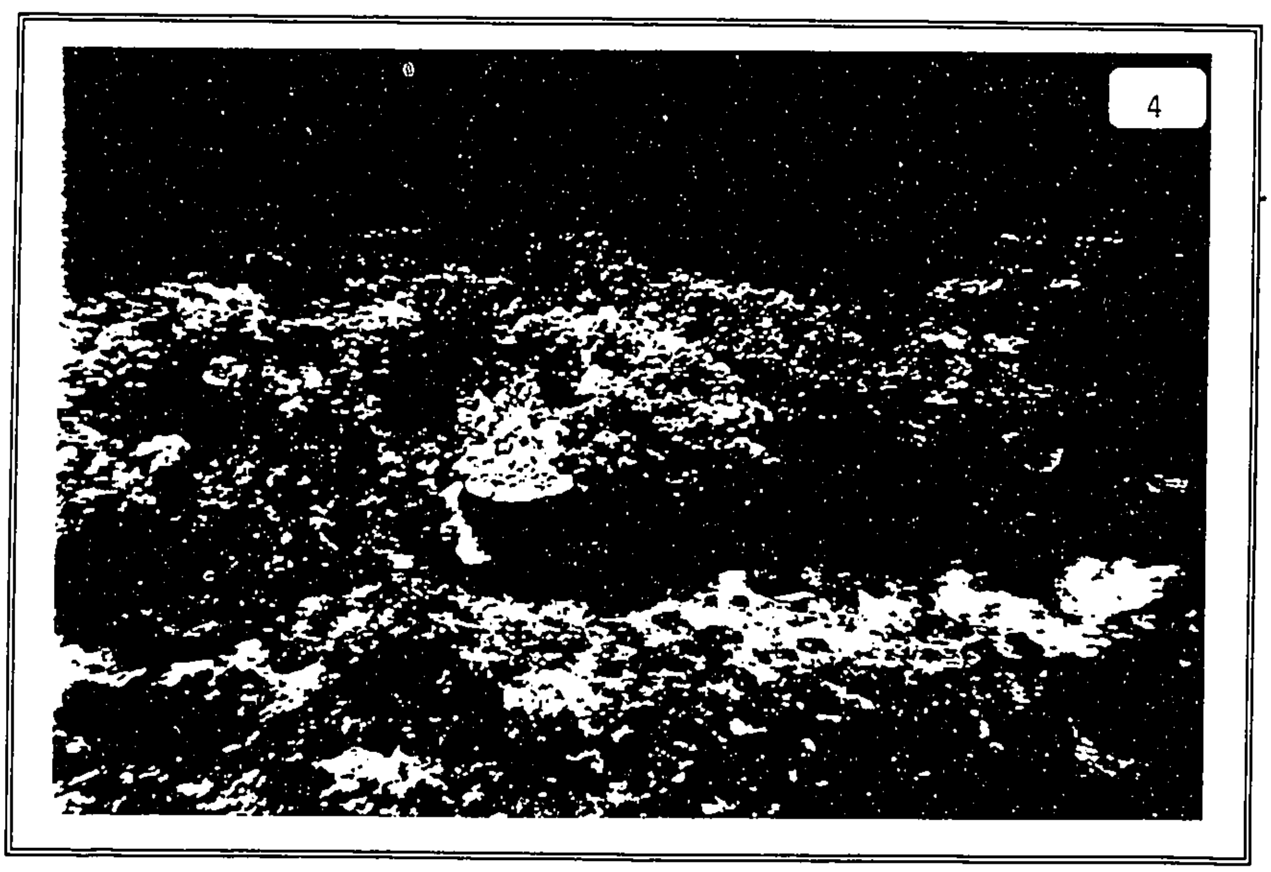
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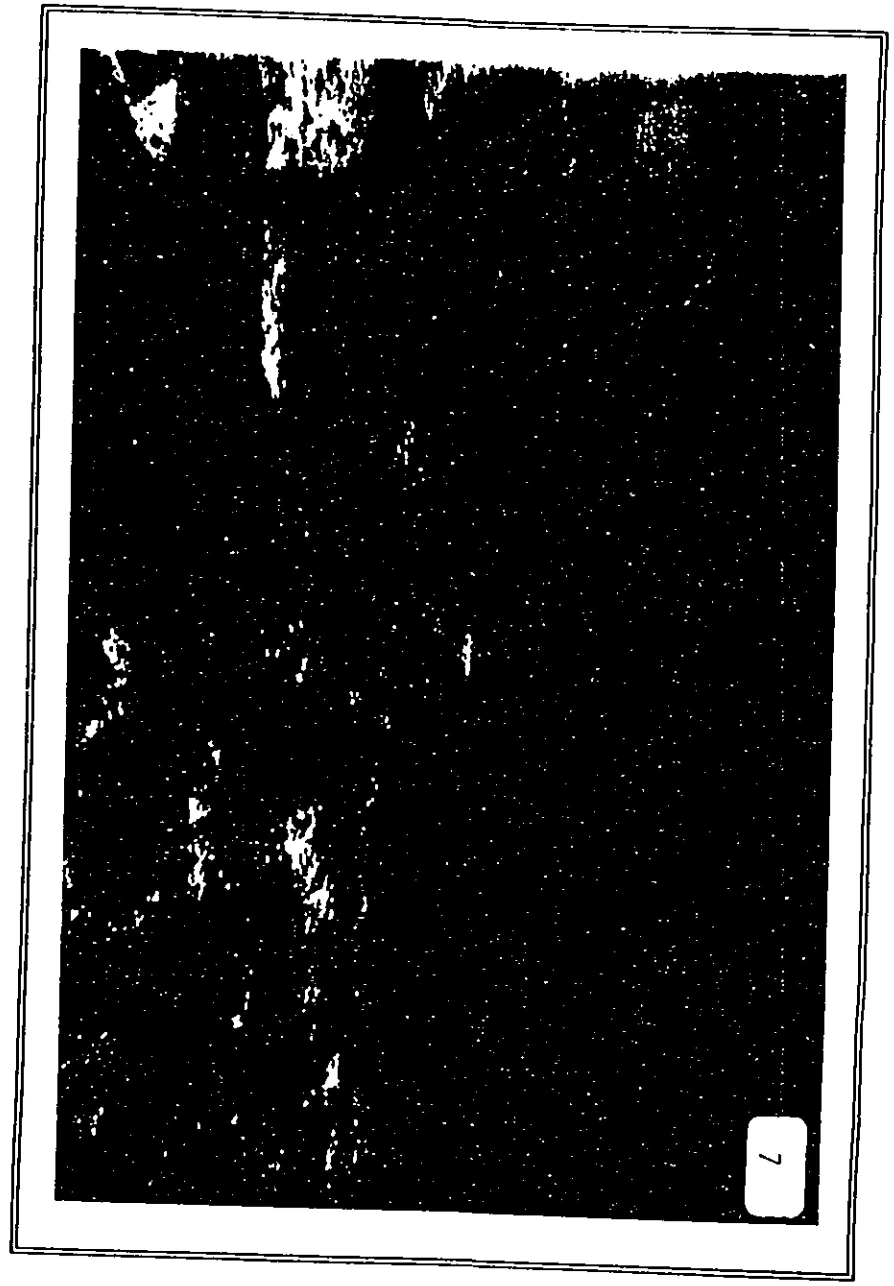
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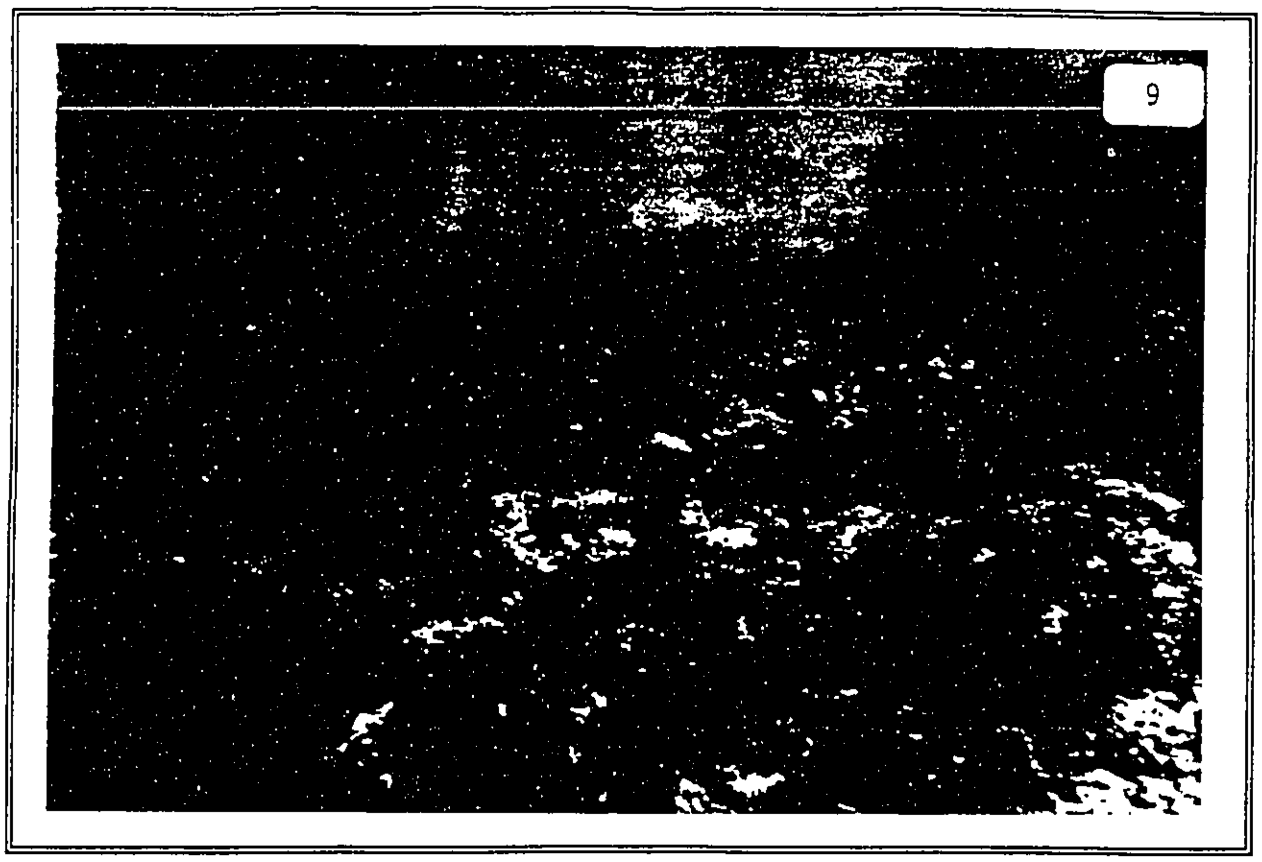
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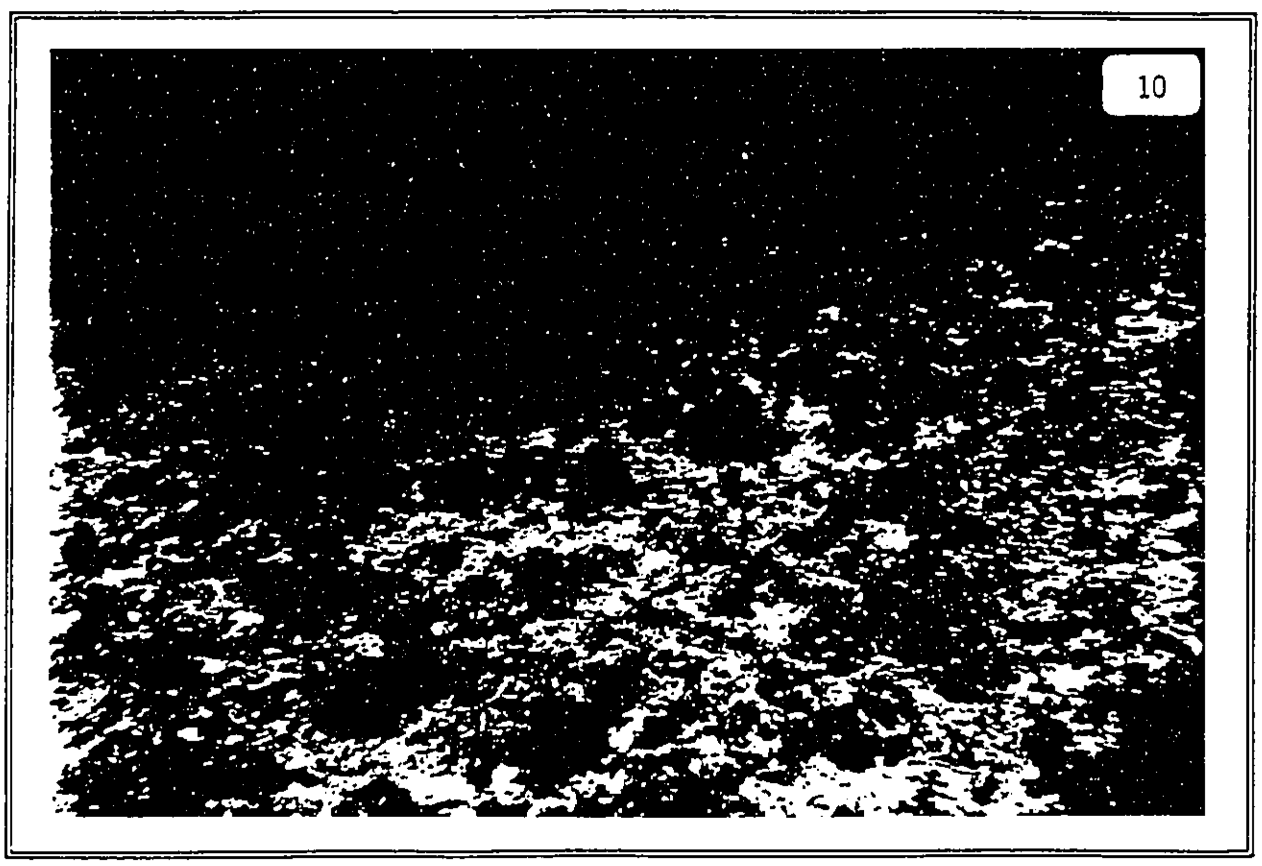
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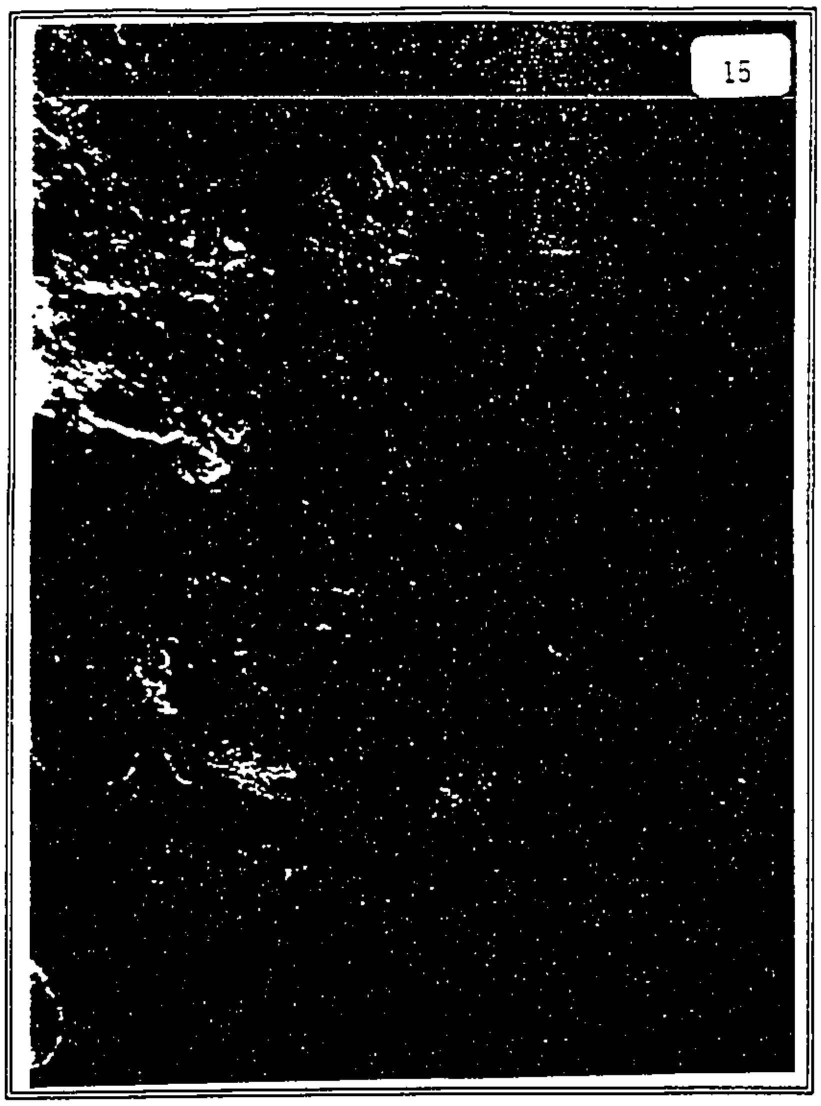
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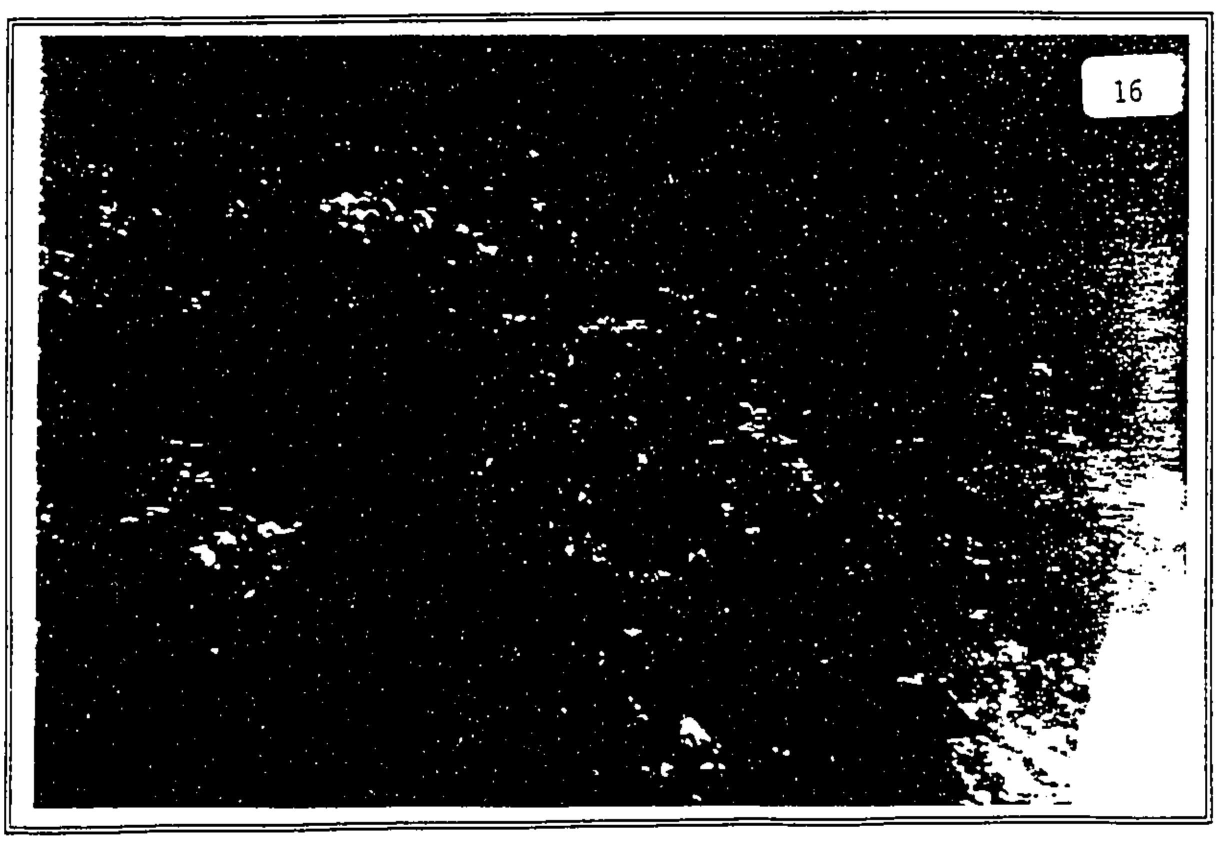
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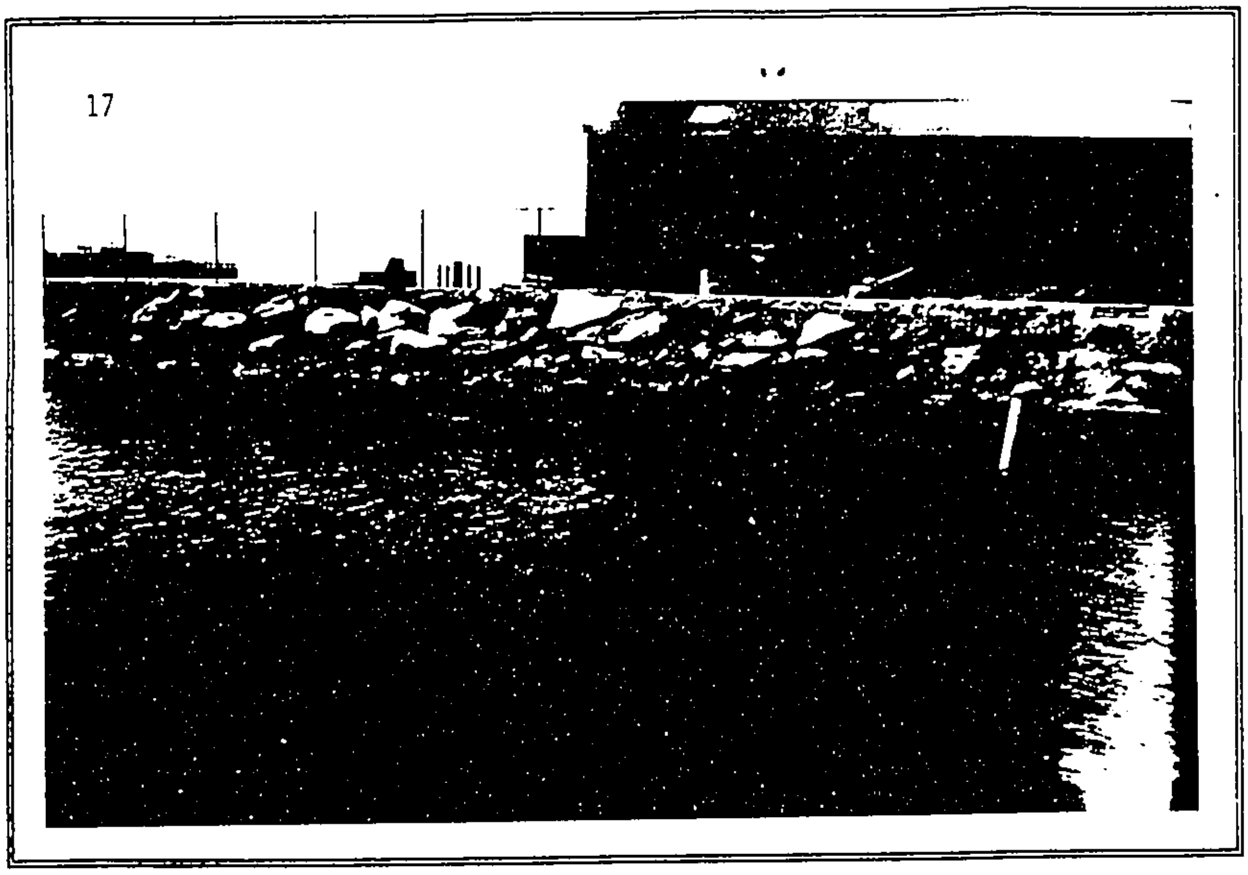
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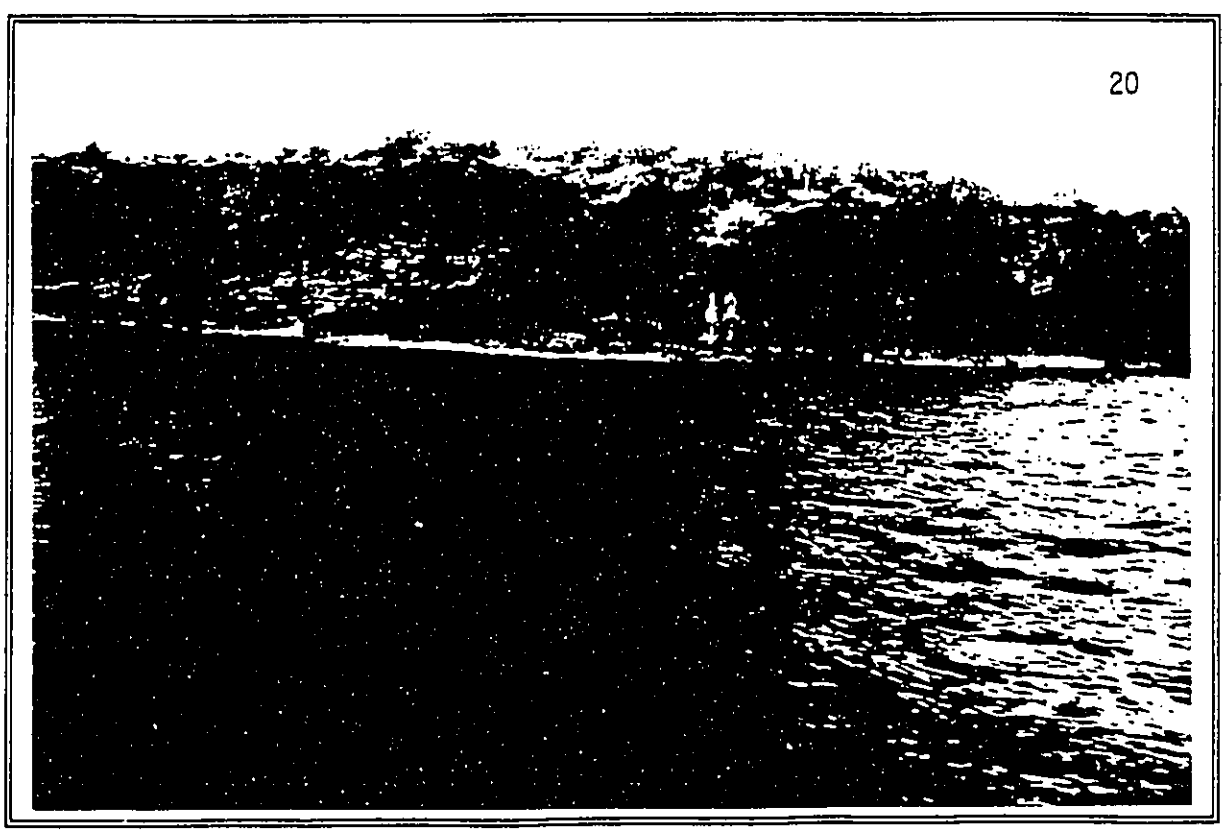

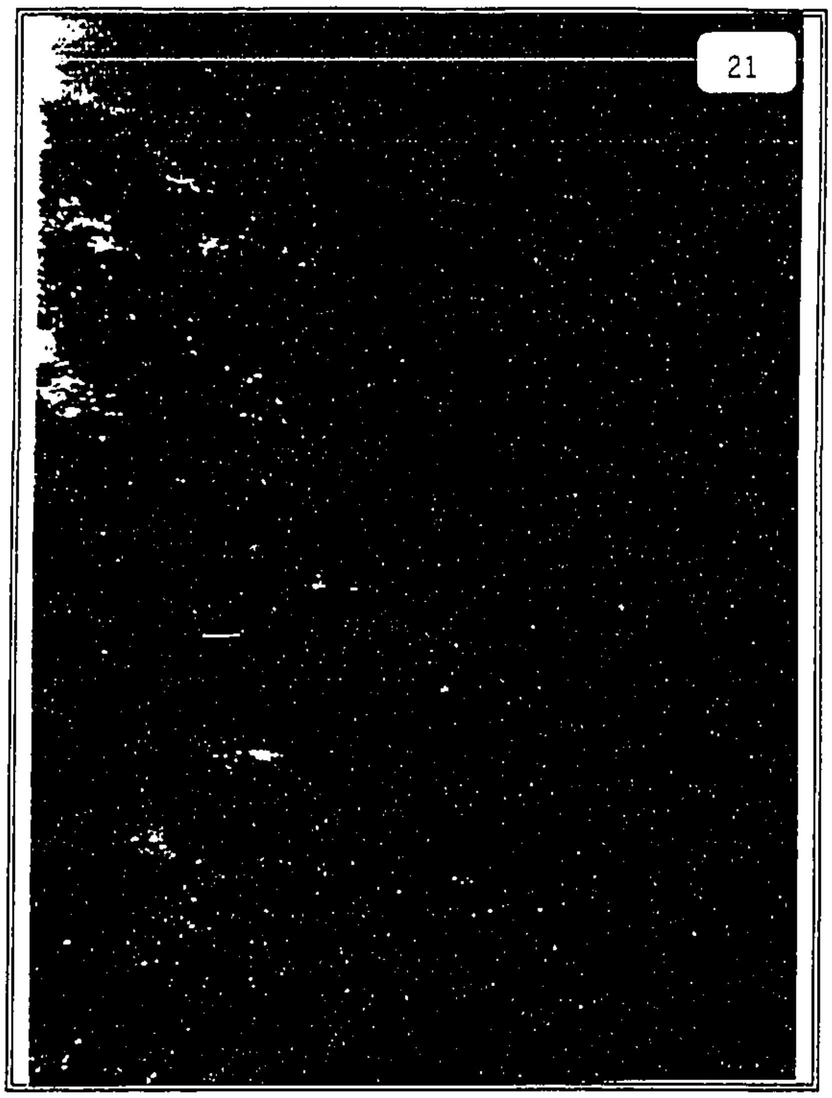
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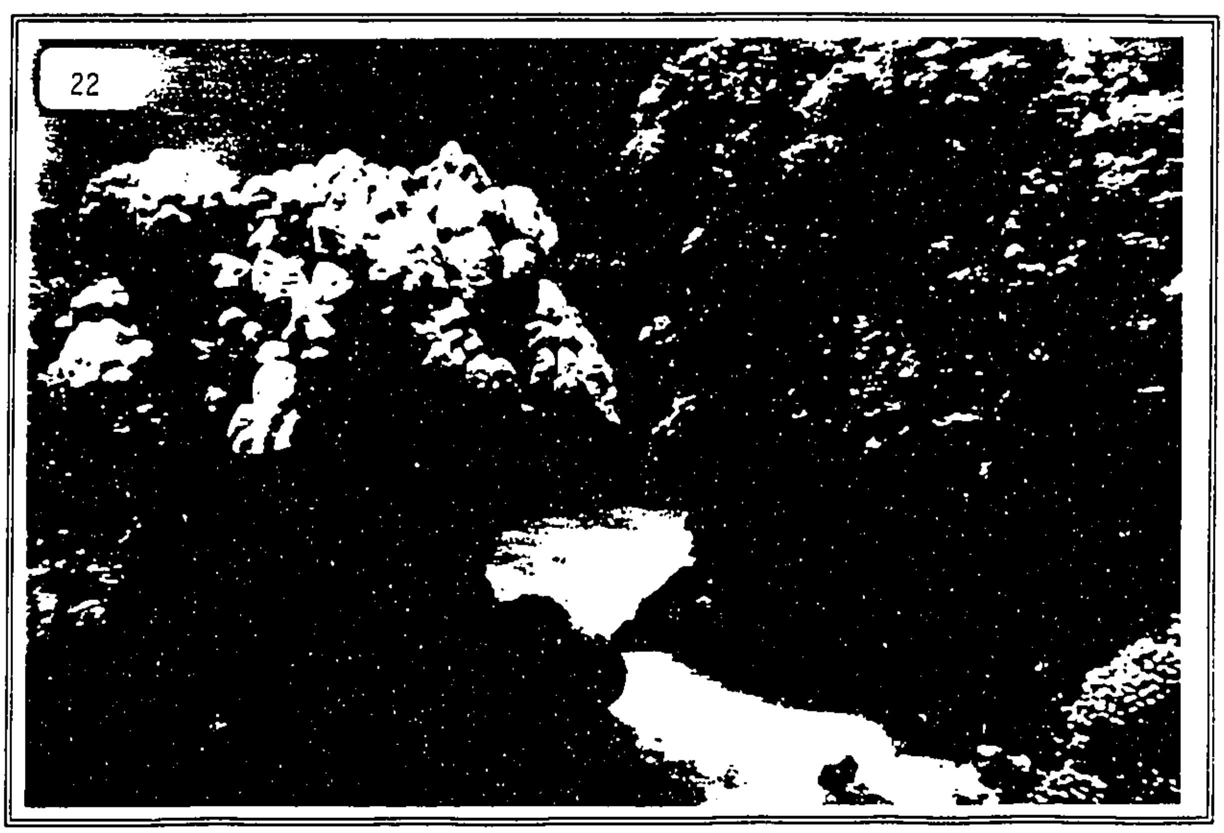
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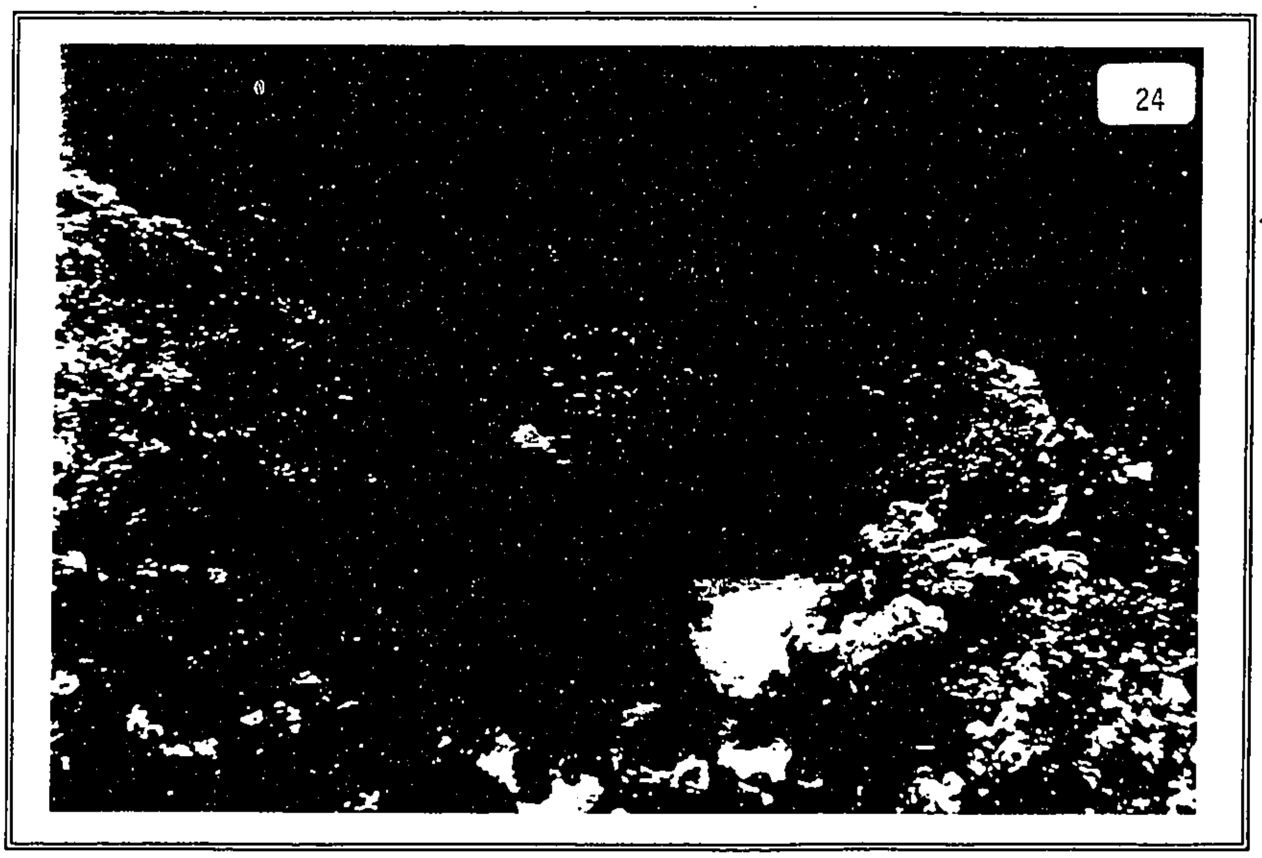
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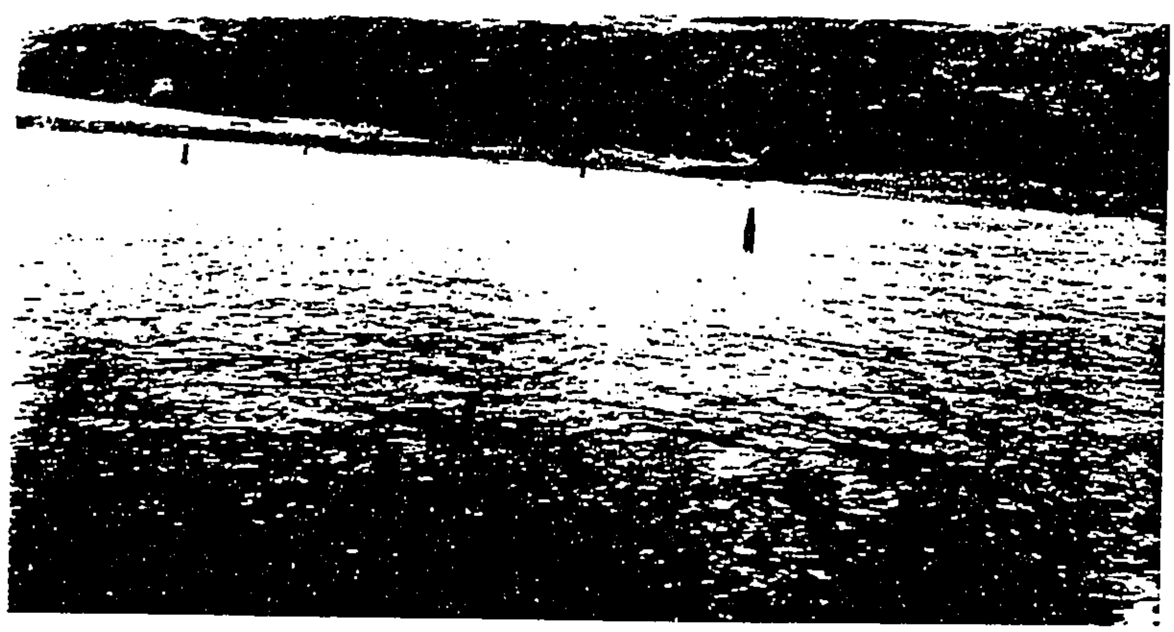

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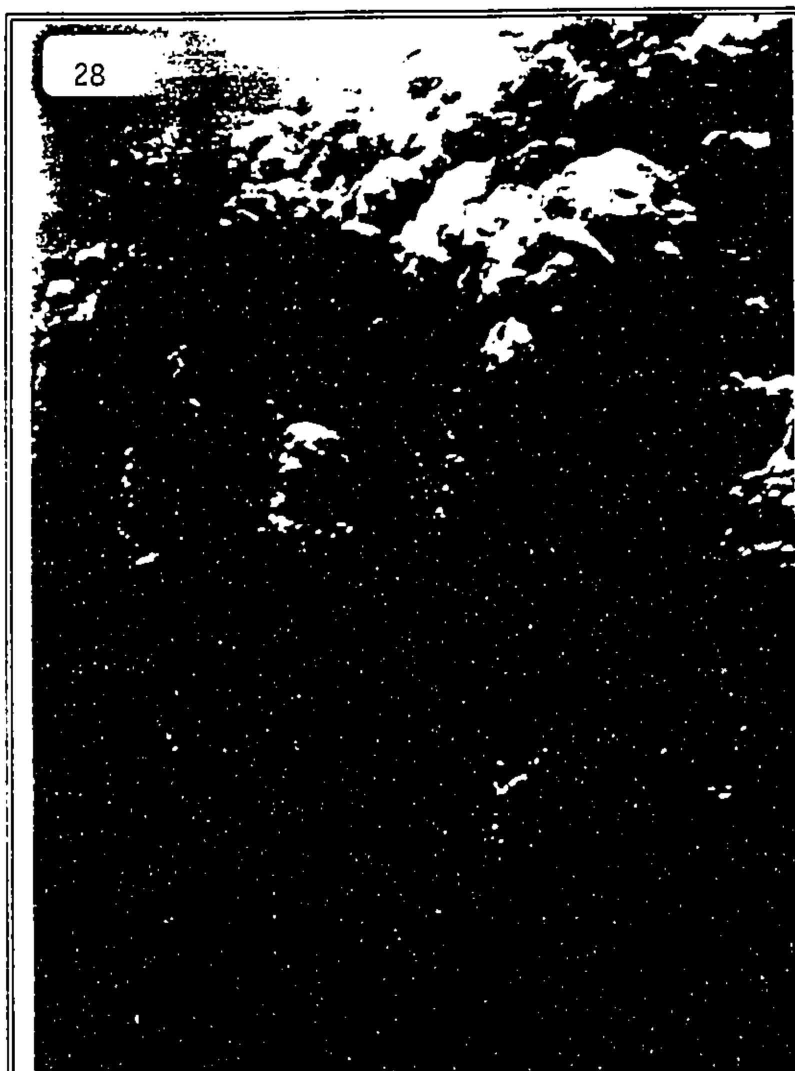


TABLE 1. Continued.

C. Invertebrate Census (4 x 25m)

| Species | Number |
| --- | --- |
| Phylum Mollusca | |
| *Lithophaga* sp. | 1 |
| Phylum Arthorpoda | |
| *Stenopus hispidus* | 2 |
| Phylum Annelida | |
| *Lomia medusa* | 1 |
| Phylum Echinodermata | |
| *Echinothrix calamaris* | 1 |
| *Tripneustes gratilla* | 3 |
| *Linckia multiflora* | 1 |
| *Holothuria atra* | 2 |

D. Fish Census (4 x 25m)

29 Species
441 Individuals
Estimated Biomass = 152 $g/m^2$

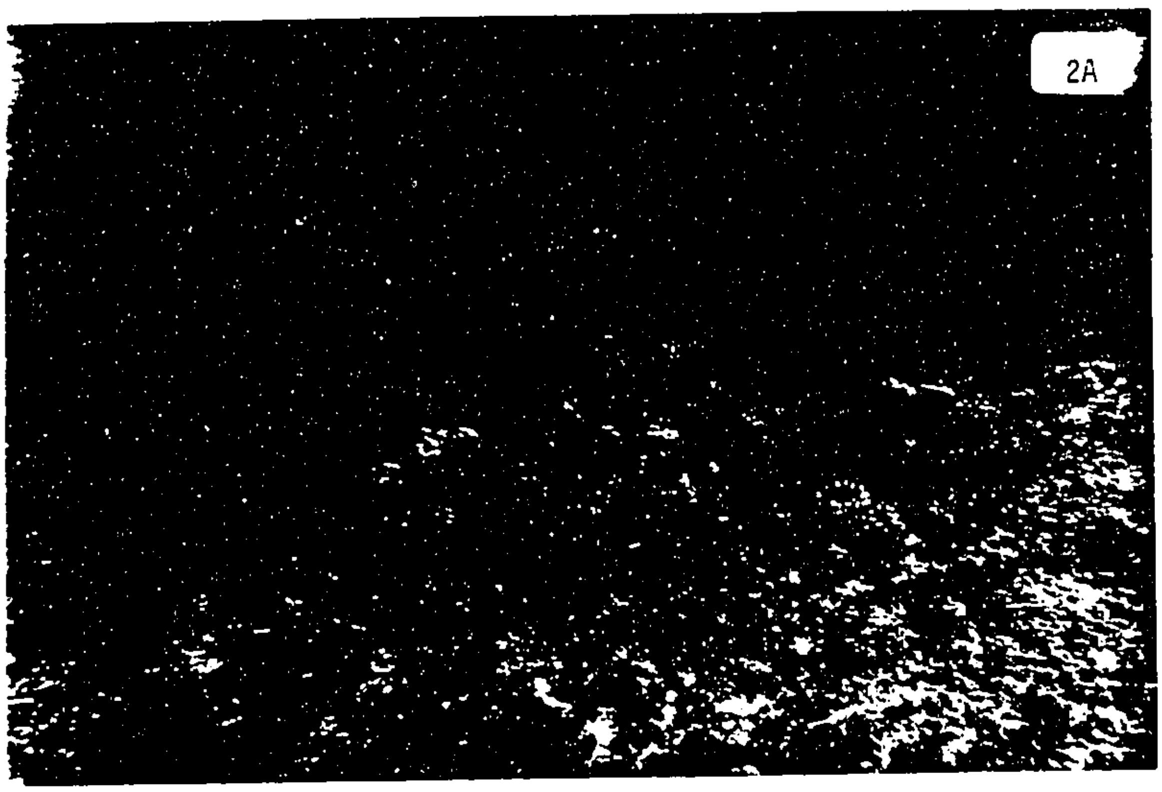
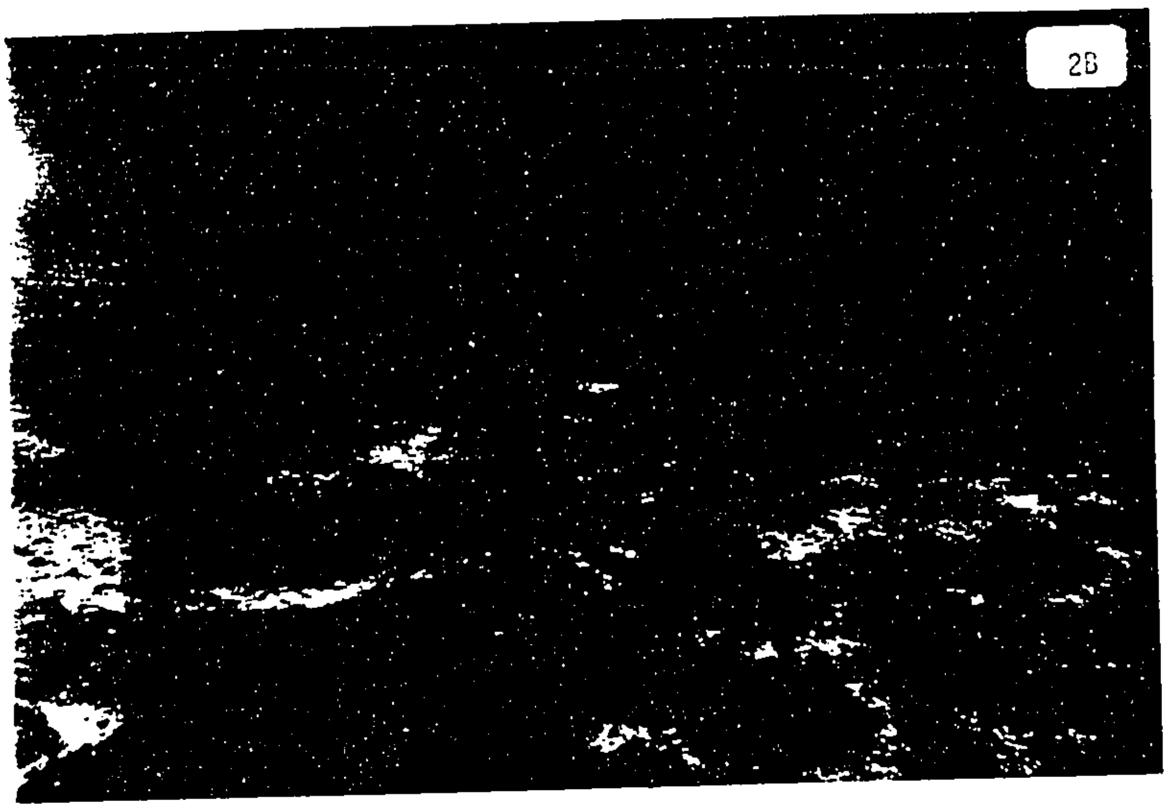



FIGURE 2. Photographs the some of the important biotopes along the proposed cable alignment 300m south of Kaunakakai Harbor. A - the rubble/coral mound biotope along the seaward edge, 20m, B - biotope of sand and rubble, depth 10m, C - biotope of spurs and grooves seaward of the reef crest, depth 5m.


2B


2C

total), the orangebar surgeonfish or na'ena'e (Acanthurus olivaceus - 18% of the total) and the ala'ihi (Adioryx xantherythrus - 19% of the total). In the vicinity of this station were seen the redlip parrotfish or palukaluka (Scarus rubroviolaceus), the goldring surgeonfish or kole (Ctenochaetus strigosus), the eye-stripe surgeonfish or palani (Acanthurus dussumieri), the la'i (Scombroides laysan), yellowmargin moray or puhi paka (Gymnothorax flavimarginatus), spiny lobster or 'ula (Panulirus marginatus), the octopus or he'e (Octopus cyanea) and corals (Montipora verrilli, Porites (Synarea) convexa, Pocillopora eydouxi and Povana duerdeni).

### The Biotope of Sand And Rubble

This biotope lies between the rubble/coral mound biotope and the biotope of spurs and grooves seaward of the reef crest southeast of the harbor (see Figure 1) and is a transition between these two major biotopes. The biotope of sand and rubble is situated at water depths from 6 to 10m and forms a band that approximately parallels the shore. The mix of sand and rubble is a substratum that does not allow for much benthic community development to occur. As a result, there are very few corals present (>>0.1%) and little or no cover for fishes and there are few visually apparent species to be seen (see Figure 2-B). Among the species encountered in this biotope were a few small nabeta (Hemipteronotus umbrilatus), the sea cucumber (Holothuria atra), mantis shrimp (Gonodactylus maculatus), and the sidespot goatfish or malu (Parupeneus pleurostigma). No quantitative studies were performed in this biotope.

This biotope is probably present as a result of the considerable amount of loose coralline material in the waters seaward of the Kaunakakai reef flat and the usual wave action that impinges in this area.

### Biotope of Spurs and Grooves

The biotope of spurs and grooves is a characteristic feature of the seaward edge of emergent coral reefs. This formation is nature's response to wave action and it serves to effectively dissipate wave energy. This biotope fronts the Kaunakakai reef southeast of the harbor (see Figure 1). The substratum of the biotope of spurs and grooves is limestone that forms ridges or fingers that extend seaward for distances between 5 to 30m and these ridges rise from 0.5 to 1.8m (see Figure 2-C). Distances between ridges are from 1-2m up to 20m; the intervening channel floors are comprised primarily of limestone with some coral. Coral development is greatest on the ridges where cover may exceed 50 percent; overall through the biotope of spurs and grooves the mean coral cover is estimated to be about 35 percent. The dominant coral species in this biotope are Porites lobata and Pocillopora meandrina.

A qualitative reconnaissance was made through this biotope rather than carrying out a quantitative survey because of the difficulity in keeping a transect line in place due to wave activity. Coral species encountered in the qualitative reconnaissance Porites lobata, Pocillopora meandrina as the most abundant, with Montipora verrucosa, M. verrilli, M. flabellata, Pavona varians, P. duerdeni, Leptastrea purpurea being less abundant. Other species of corals seen include Pocillopora molokaiensis, Cyphastrea ocellina and Leptastrea bottae. The biotope of spurs and grooves affords considerable cover for fishes. Where this cover is well developed more species will be seen and where the wave surge is greater will be a characteristic assemblage of surgeonfishes and wrasses. Fishes commonly seen in the biotope of spurs and grooves that are of commercial and recreational importance include the eye-stripe surgeonfish or palani (Acanthurus dussumieri), the yellowfin surgeonfish or pualo (A. mata and A. xanthopterus), the whitespotted surgeonfish or 'api (A. guttatus), the brown surgeonfish or ma'i'i'i (A. nigrofuscus), the bluelined surgeonfish or maiko (A. nigroris), the orangebar surgeonfish or na'ena'e (A. olivaceus), the whitebar surgeonfish or maiko'iko (A. leucopareius), the convict tang or manini (A. triostegus), the achilles tang or paku'iku'i (A. achilles), the orangespine unicornfish or umaumalei (Naso lituratus), the bluespine unicornfish or kala (N. unicornis), the goldring surgeonfish or kole (Ctenochaetus strigosus), the chub or nenue (Kyphosus biggibus), the undulate moray eel or puhi laumilo (Gymnothorax undulatus), the brick soldierfish or menpachi (Myripristes amaena), the scorpionfish or nohu (Scorpaenopsis diabolus), the cardinal fish or 'upapalu (Apogon kallopterus), the blackside hawkfish or hilu piliko'a (Paracirrhites forsteri), the sidespot goatfish or malu (Parupeneus pleurostigma), the whitesaddle goatfish or kumu (P. porphyreus), the manybar goatfish or moano (P. multifasciatus), the blue goatfish or moano kea (P. cyclostomus), the yellowstripe goatfish or weke (Mulloides flavolineatus), the yellowfin goatfish or weke'ula (M. vanicolensis), butterfly fishes or kikakapu (various species of Chaetodon), the sargeant major or mamo (Abudefduf abdominalis), the ringtail wrasse or po'ou (Cheilinus unifasciatus), the tableboss or a'awa (Bodianus bilunulatus), the cigar wrasse or kupoupou (Cheilo inermis), the yellowstripe wrasse or hilu (Coris flavovittata), the stareye parrotfish or ponuhunuhu (Calotomus carolinus), the bulletnose parrotfish or uhu (Scarus sordidus), the spectacled parrotfish or uhu'ahu'ula and uhu uliuli (S. perspicillatus), the redlip parrotfish or palukaluka (S. rubroviolaceus), and the black triggerfish or humuhumu'ele'ele (Melichthys niger). Other species not seen as often include the mullet or ama'ama or 'anae (Mugil cephalus), the milkfish or awa'awa (Chanos chanos), small jacks or papio (various species of Caranx), the blue trevelly or omilu (Caranx melampygus), the bonefish or 'oio (Albula vulpes), the barracuda or kaku (Sphyraena barracuda), the bigeye or aweoawo (Priacanthus cruentatus) and others. Commercially important invertebrates include the slipper lobster or 'ula papa (Paribaccus antarcticus), the spiny lobster or 'ula (Panulirus penicillatus and P. marginatus), the octopus or he'e (Octopus cyanea), and brown cowry (Cypraea mauritiana). Besides these species of commercial and recreational interest, there are many other fish and invertebrate species found in this biotope.

Inshore of the biotope of spur and grooves is the reef crest which is comprised primarily of coralline algae which accreates calcium carbonate much like a coral creating a near solid pavement. Also present in the reef crest area are other macrothalloid algal species or limu. This zone was not examined in any detail in this study.

Biotope of High Coral Cover

This biotope is best developed in areas that are somewhat protected from the prevailing seas. In the study area, the biotope of high coral cover occurs along the eastern edge of the harbor entrance channel at depths from about 1 to 10m and is restricted to the area roughly between the outermost and innermost bouys (see Figure 1). The high coral coverage in this biotope is probably the result of dredging the harbor entrance channel creating an area of hard substratum that is protected from most surf action. Thus the biotope follows the sloping channel wall as well as the shallow water inshore of the wall. The substratum of this biotope is comprised primarily of living corals (see Figures 3-A and B).

Because of the high coral coverage present in this biotope as well as the numerous green sea turtles, a quantitative station was established approximately 20m east of the outermost bouy marking the eastern edge of the entrance channel and proceeding in a direction approximately parallel to the harbor entrance channel. The transect was carried out at a depth ranging from 3 to 4 m. The results of the quantitative survey carried out at station 2 are presented in Table 2. The quadrat survey noted 8 species of corals having a mean coverage of 85.2 percent. The dominant coral species is Montipora verrucosa. The high coverage affords considerable cover for macroinvertebrates, thus the count in this area found only four species: the horn shell (Cerithium sinense), the rock oyster (Spondylus tenebrosus), the banded

TABLE 2. Summary of the benthic survey conducted in the biotope of high coral cover approximately 20m shoreward of Red Bouy No. 4 along the eastern side of Kaunakakai Harbor on 8 March 1996. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Pact C. A short summary of the fish census is given in Part D. Water depth is 3-4m; mean coral coverage is 85.2 percent (quadrat method).

A. Quadrat Survey

| Species | Quadrat Number 0m | 5m | 10m | 15m | 20m | 25m |
|---|---|---|---|---|---|---|
| Corals | | | | | | |
| *Porites lobata* | | 9 | 1 | | | |
| *P. evermanni* | | 1.5 | | | 4 | |
| *P. compressa* | | 3 | | 12 | 1 | 17 |
| *Pocillopora meandrina* | 1 | | 2 | 2 | 2 | 2 |
| *Montipora verrucosa* | 61 | 42 | 74.5 | 83 | 81 | 61 |
| *M. patula* | | 12 | 7 | 3 | 9 | 2 |
| *M. flabellata* | | | | | | 14 |
| *Pavona varians* | | | | | | 4 |
| Sand | 4 | | 3 | | | |
| Rubble | 27 | 11.5 | 2 | | | |
| Hard Substratum | 7 | 21 | 9 | | 3 | |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Porites lobata* | 2 |
| *P. compressa* | 8 |
| *Montipora verrucosa* | 64 |
| *Pavona duerdeni* | 2 |
| Sand | 2 |
| Rubble | 6 |
| Hard Substratum | 16 |

(TABLE 2 CONTINUED ON NEXT PAGE)

TABLE 2. Continued.

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| *Cerithium sinense* | 1 |
| *Spondylus tenebrosus* | 1 |
| Phylum Echinodermata | |
| *Echinothrix calamaris* | 1 |
| *Holothuria verrucosa* | 1 |

D. Fish Census (4 x 25m)

20 Species
109 Individuals
Estimated Biomass = $36 g/m^2$


FIGURE 3. Photographs from the eastern side of Kaunakakai Harbor. A - biotope of high coral cover showing the dominance of plate-like Montipora verrucosa, depth 10m, B - another view of the biotope of high coral cover showing the diversity of coverage by live coral, depth 3m, C - green sea turtle with tumors (fibropapolomas) on the eye (towards the camera) and trailing edge of the front flipper. Shell length estimated at 60cm.


3b


3C

urchin (Echinothrix calamaris) and the brown sea cucumber (Holothuria verrucosa). The results of the fish census are given in Appendix A (transect 1). Twenty fish species (109 individuals) were censused at this station. The most abundant species were the damselfish (Chromis vanderbilti), the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), and the saddleback wrasse or hinalea lauwili (Thalassoma duperrey). The standing crop of fishes at this station was estimated to be 36 $g/m^2$ and the species contributing most heavily to this were six small blue trevelly or omilu (Caranx melampygus - 38% of the total), and a single bulletnose parrotfish or uhu (Scarus sordidus) that comprised 21 percent of the total weight at this station.

We carried out a qualitative survey of the entrance channel wall from the seaward bouy to the pier island. During this roughly linear swim, we encountered eight individual green sea turtles (Chelonia mydas). We estimated the straight line carapace lengths of each as follows: one individual at 50cm, one individual at 60cm, four individuals at 75cm, one female at 80cm and a second female at 120cm. The latter two were mature individuals and the remainder were juveniles. Two of the eight turtles had tumors (fibropapolomas); both of these individuals were estimated to have a straight line carapace length of 60cm and 75cm (see Figure 3-C). None of the turtles appeared to carry any tags or other deformities.

Hawaiian green sea turtles are a threatened species. The eight individuals seen underwater were all resting which is their usual mode during most of the day. We estimate that the population using this biotope on 8 March was probably close to 16 individuals. Typically green sea turtles select resting areas during the day on or under coral colonies. These resting habitats range in depth from about 5m to over 30m. In the present case all of the resting habitat being utilized by green sea turtles in the biotope of high coral cover is in water less than 10m of depth. Under the cover of darkness these turtles will leave their resting areas to forage in usually shallow water close to shore. As adults green sea turtles are herbivorous feeding on seaweed or limu (Balazs,1980, Balazs et al. 1987). We did not identify any particular area that had an abundance of limu in the vicinity of this resting area. The foraging area is probably just shoreward of the reef crest fronting much of Kaunakakai. Algal development is usually high in this habitat.

During the course of this survey several humpback whales were seen offshore of the Kaunakakai Harbor study area. The humpback whale (Megaptera novaeangliae) is a protected species under the Endangered Species Act. This whale will frequent Hawaiian waters during the winter months from about December through April as part of their annual migration. In general, their distribution in Hawaii appears to be limited to the 180m (100 fathom) isobath and in shallower waters Nitta and Naughton 1989).

In summary, the nearshore biological survey of the eastern side of Kaunakakai Harbor entrance channel to and including the area 300m to the east noted exceptional coral growth both in the biotope of spurs and grooves just seaward of the fringing reef as well as in the biotope of high coral cover along the eastern edge of the harbor entrance channel. The fish communities are relatively well developed in the biotope of spurs and grooves and there appears to be a major green sea turtle resting habitat in the biotope of high coral cover. Biological communities in the biotope of sand as well as in the rubble/coral mound biotope do not have a similar degree of development in the area examined by this study.

2. Manele Harbor, Lana'i Corridor

Manele Harbor was developed in the early 1960's to service small vessels on the island of Lana'i. The harbor is situated at the head of Manele Bay in the northwestern corner and is comprised of a basalt rock mole serving as a wave protected barrier (approximately 140m long) with the area between the mole and shore being dredged to accept vessels. Manele Bay faces to the southeast; the substratum through the middle part of the bay is sand that forms a pie-shaped wedge pointing towards shore. The entrance channel to the harbor utilizes this deeper sand (about 7m) which extends shoreward to the eastern edge of the mole. As a result, very little dredging for the entrance channel was necessary during the construction of the harbor.

Our survey of Manele Bay was undertaken on 13 March 1996. Our charge with this landing site was to generally describe the biological zonation present in the bay and make recommendations as to possible cable landing routes with the least impact to the extant marine communities.

As noted above, biotopes in Manele Bay were delimited by swimming and qualitatively examining the general area. Our focus in this study was primarily in the western portion of the bay extending from the harbor mole seaward to approximately the 25m isobath. In general where hard substratum is encountered in Manele Bay corals are well developed if protected from occasional storm generated surge. Where exposure to storm generated surf is greater such as along some of the outer portions of the bay around the emergent rocks on the eastern side, corals are kept at a earlier point in successional development and cover is less.

The qualitative examination of the western part of Manele Bay noted three major zones or biotopes. These are the biotope of sand, the biotope of high *Porites* cover and the biotope of high coral diversity. Across much of the central part of Manele Bay is the biotope of sand. This biotope slopes seaward from the point of our deepest dives (25m). The biotope of sand occurs across most of the mouth of the bay and continues shoreward as a pie-shaped wedge as noted above. The western side of the bay is quite protected from storm surf and hard substratum is dominated by a mix of two *Porites* species forming the biotope of high *Porites* cover. Inshore of this and adjacent to the mole is the biotope of high coral diversity.

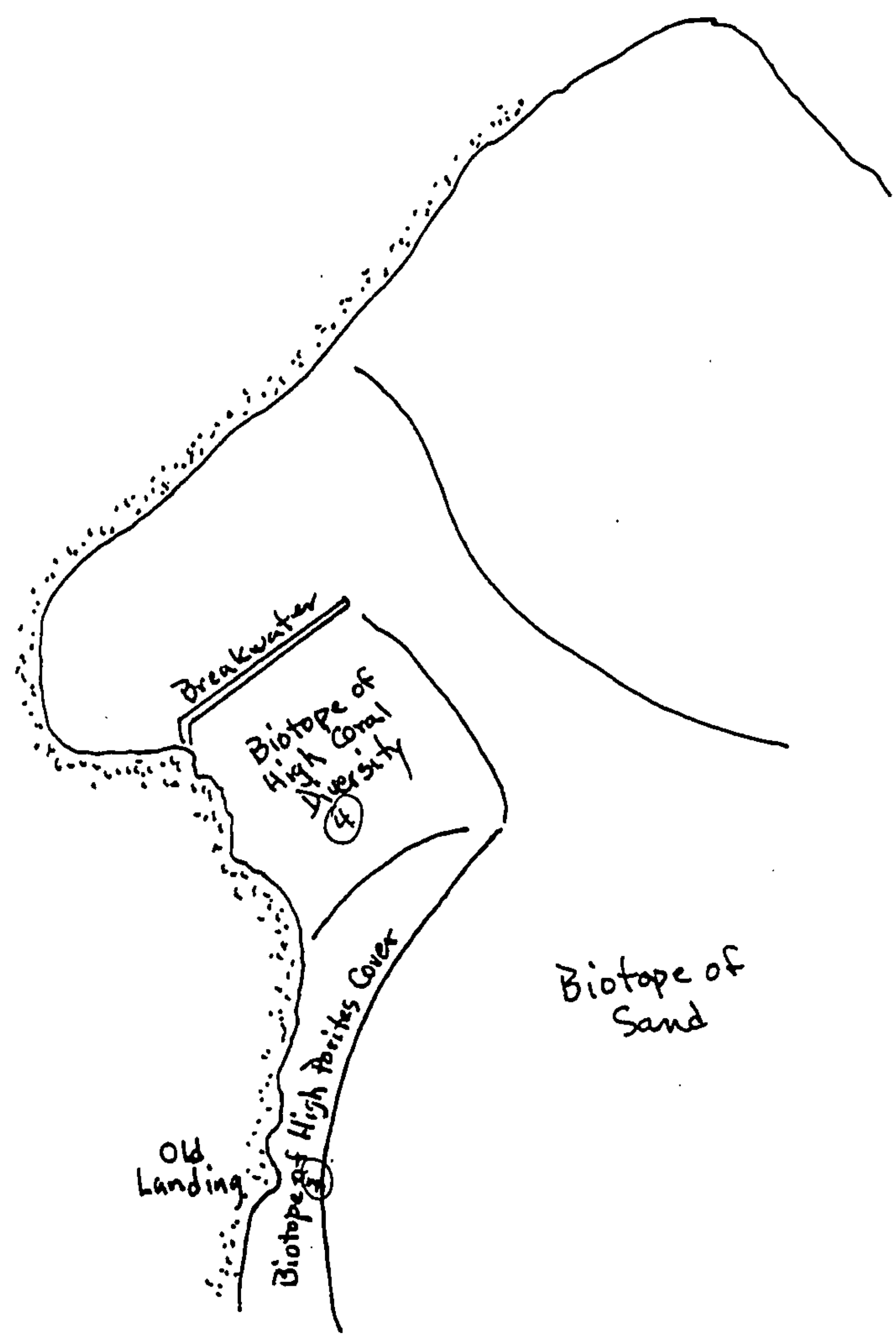
It should be noted that the boundaries of each zone or biotope are not sharp but rather grade from one to another; these are ecotones or zones of transition. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave and current action, and the major structural elements present in the 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 were named for distinctive features of each as shown in Figure 4.

Biotope of Sand

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 ranina*). 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 constraints with bottom time at the depth of which the best biological development in the biotope of sand is found, we did not quantitatively sample this biotope but rather carried out a qualitative reconnaissance of the habitat in waters from 4 to 25m in depth. Species noted in this overview of the biotope include a number of molluscs: the augers (*Terebra crenulata*, *T. maculata* and *T. inconstans*), the leopard cone (*Conus leopardus*) and flea cone (*Conus pulicarius*) as well as the sea

FIGURE 4. Map of Manele Bay, Lana'i showing the approximate boundaries of the three biotopes or zones defined in this study (lettered) of the western part of the bay. Also shown are the locations of the two quantitative stations (nmbered) established to sample representative areas within biotopes. The biotopes are lettered where A = the biotope of sand, B = the biotope of high <u>Porites</u> cover, and C = the biotope of high coral diversity. Scale: 1cm = m.


Breakwater
Biotope of
High Coral
Diversity
4
Biotope of
Sand
Old
Landing
Biotope of High Porites Cover
3

hare (*Brissus* sp.), starfish (*Mithrodia bradleyi*), brown sea cucumber (*Bohadschia vitiensis*), flying fish or malolo (*Parexocoetus brachypterus*), halfbeak or ihe'ihe (*Euleptorhamphus viridis*), opelu or mackeral scad (*Decapterus macarellus*), leatherback or la'i (*Scombroides laysan*), nabeta (*Hemipteronotus umbrilatus*), yellow jack or pa'opa'o (*Gnathanodon speciosus*) the goby-like fish (*Parapercis schauslandi*), uku or snapper (*Aprion virescens*), the nightmare weke (*Upeneus arge*) and the goby or o'opu (*Gnatholepis anjerensis*). With greater effort many more fish and invertebrate species species would be encountered in this biotope.

### The Biotope of High *Porites* Cover

As noted above, sand dominates the middle section of Manele Bay. Approaching the western edge this sand gives way to a bank of coral; seaward of the old landing on the western side of the bay this coral is met with at a depth of about 20m. Inshore of this the depth of the sand-coral interface decreases to a minimum of about 12m. The coral bank varies in width from about 25 to about 75m (see Figure 4). In the inner bay the biotope of high *Porites* cover merges with the biotope of high coral diversity which is situated in shallower water.

The biotope of high *Porites* cover is comprised primarily of *Porites lobata* and *P. compressa*. Cover in this biotope is locally high, approaching 100 percent over areas of 20 to 100$m^2$ (see Figure 5-A). Water depth in this biotope ranges from about 7 to 20m.

A quantitative station (station 3) was established in the biotope of high *Porites* cover east of the old landing. The results of this survey are given in Table 3. The quadrat survey noted two algal species (*Desmia hornemannii* and *Porolithon onkodes*) having a mean coverage of 6.4 percent, six coral species (*Porites lobata*, *P. compressa*, *Montipora verrucosa*, *M. patula*, *Pocillopora meandrina* and *Pavona varians*) having a mean coverage of 66.8 percent. The macroinvertebrate census noted the drupe shell (*Drupa morum*), the black sea urchin (*Tripneustes gratilla*), the slate pencil urchin (*Heterocentrotus mammillatus*) and the black sea cucumber (*Holothuria atra*). The results of the fish census are given in Appendix A. Twenty-one species (344 individuals) were censused in this transect. The most abundant fishes were the damselfishes (*Chromis verator* and *C. agilis*), the bulletnose parrotfish or uhu (*Scarus sordidus*), the brown surgeonfish or ma'i'i'i (*Acanthurus nigrofuscus*), the goldring surgeonfish or kole (*Ctenochaetus strigosus*) and the yellow tang or lau'ipala (*Zebrasoma flavescens*). The biomass of fishes at this station was estimated to be 73 $g/m^2$. The species that contribut-

TABLE 3. Summary of the benthic survey conducted in the the biotope of high Porites cover approximately 45m offshore ofthe old landing situated on the west side of Manele Bay, Lana'i on 13 March 1996. 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 7-11m; mean coral coverage is 66.8 percent (quadrat method).

A. Quadrat Survey

| Species | Quadrat Number 0m | 5m | 10m | 15m | 20m | 25m |
|---|---|---|---|---|---|---|
| Algae | | | | | | |
| *Desmia hornemannii* | 2 | 4 | 3 | 2 | 2.5 | 4 |
| *Porolithon onkodes* | | | | 12 | 7 | 2 |
| Corals | | | | | | |
| *Porites lobata* | 17 | 9 | 2 | | | |
| *Porites compressa* | 74 | 62 | 85 | 21 | 14 | 86 |
| *Montipora verrucosa* | 1 | 3 | | | | |
| *Montipora patula* | 3 | 6 | 1 | | 4.5 | 0.5 |
| *Pocillopora meandrina* | 1 | | | 1 | 2 | 0.5 |
| *Pavona varians* | | | | 4 | 3.5 | |
| Sand | 2 | 6 | | | | |
| Hard Substratum | | 10 | 9 | 60 | 66.5 | 7 |

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Porites lobata* | 6 |
| *Porites compressa* | 60 |
| *Montipora verrucosa* | 2 |
| Sand | 2 |
| Hard Substratum | 30 |

TABLE 3 CONTINUED ON NEXT PAGE

TABLE 3. Continued.

C. Invertebrate Census (4 x 25m)

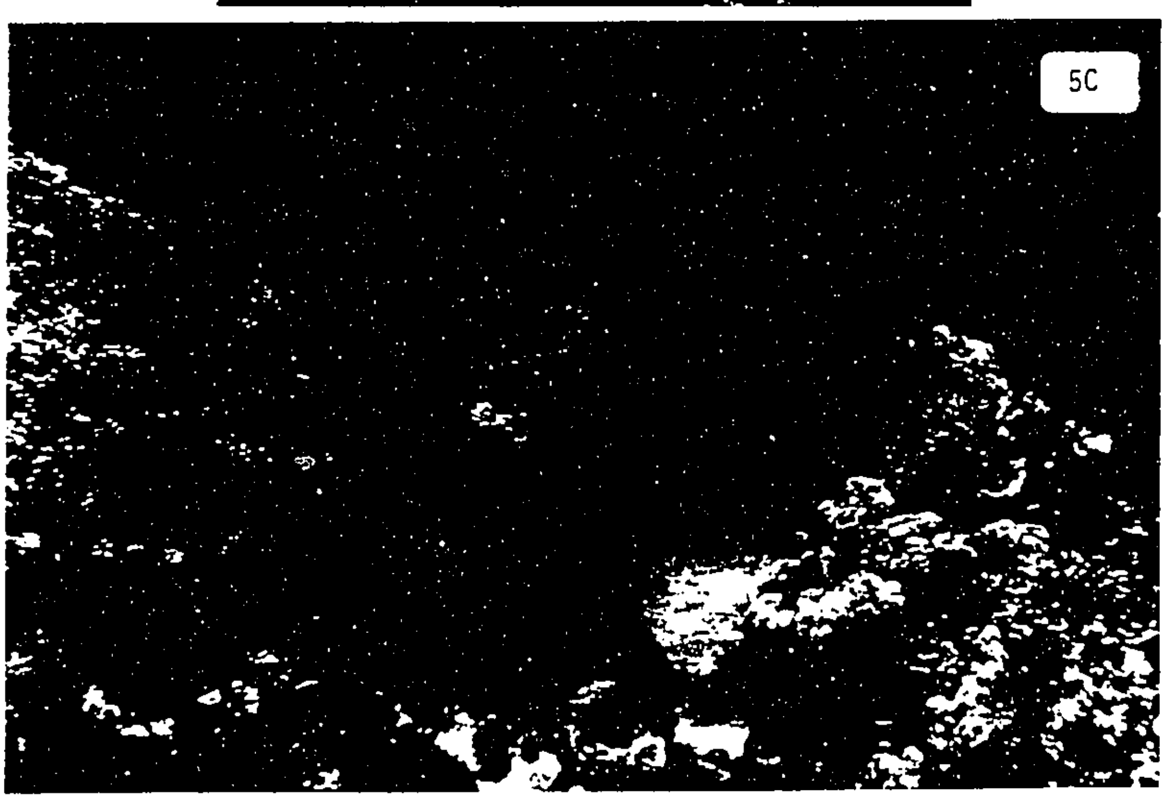
| Species | Number |
|---|---|
| Phylum Mollusca | |
| *Drupa morum* | 1 |
| Phylum Echinodermata | |
| *Tripneustes gratilla* | 15 |
| *Heterocentrotus mammillatus* | 3 |
| *Holothuria atra* | 2 |

D. Fish Census (4 x 25m)

21 Species
344 Individuals
Estimated Biomass = $73 g/m^2$


FIGURE 5. Photographs from the biotopes in the western side of Manele Bay, 13 March 1996. A - biotope of high Porites cover, depth 10m in the area fronting the old boat landing, B - biotope of high coral diversity, depth 5m showing a mix of Porites lobata and Pocillopora meandrina, C - biotope of high coral diversity depth 6m showing the highly irregular topography that typifies this biotope.


5B


5C

ed most heavily to this standing crop include the uhu (<u>Scarus sordidus</u> - 57% of the total) and the kole (<u>Ctenochaetus strigosus</u>) that comprised 11 percent of the total.

In the vicinity of this station were seen the brick soldierfish or menpachi (<u>Myripristes amaenus</u>), the blue goatfish or moano kea (<u>Parupeneus cyclostomus</u>), the trumpetfish or nunu (<u>Aulostomus chinensis</u>), the orangespine surgeonfish or umaumalei (<u>Naso lituratus</u>), the whitebar surgeonfish or maiko'iko (<u>Acanthurus leucoparieus</u>), the convict tang or manini (<u>A. triostegus</u>), the christmas wrasse or awela (<u>Thalassoma trilobatum</u>), the yellowtail wrasse or hinalea aki'lolo (<u>Coris gaimard</u>), the chub or nenue (<u>Kyphosus bigibbus</u>) and the emperor or mu (<u>Monotaxis grandoculis</u>). Also seen were the corals <u>Fungia scutaria</u> and <u>Montipora verrilli</u> as well as a small octopus or he'e (<u>Octopus cyanea</u>). Also seen was a small green sea turtle or honu (<u>Chelonia mydas</u>) that had an estimated straight line carapace length of 55cm. There was no evidence of any deformities, tumors or tags on this individual which was resting on the coral substrate adjacent to the transect.

### The Biotope of High Coral Diversity

The biotope of high coral diversity is situated in the western corner of Manele Bay seaward of the harbor breakwater extending from shore to more than 100m offshore where the biotope of sand or the biotope of high <u>Porites</u> cover is encountered. The biotope of high coral diversity has a very rugose substratum with numerous large holes or small channels spread through it. The scale of these holes or channels is from 1.5 to 10m across and they are from 2 to 35m in length with no particular orientation. The hole or channels are spaced from 2 to about 35m apart and their depths range from 2 to 5m. Between these features are knolls with high coral coverage. The highly irregular topography affords considerable cover for fishes and invertebrates (see Figures 5-B and C).

The coral and fish communities are well-developed in this biotope. As a result, dive tours bring their visitors to this part of the bay for snorkeling. Often present in this part of Manele Bay is the well-known pod of spinner porpoises (<u>Stenella longirostris</u>) that rest during daylight hours along the sheltered coves and bays of this coastline (personal observations). About 1400 hours on 13 March we noted about 30 porpoises passing through the outer portion of Manele Bay apparently heading west.

We established a quantitative station just inshore of a temporary mooring used by the snorkel tour boats to sample the fish and benthic communities of the area. The water depth at this station ranged from 2 to 5m and the station was situated about in the middle of the biotope. The substratum was very irregular with holes and small channels on scales as described above. The results of the benthic survey are presented in Table 4. The quadrat survey noted two macroalgal species (Halimeda opuntia and Porolithon onkodes) with a mean coverage of 1.9 percent, three soft coral species (Anthelia edmondsoni, Palythoa tuberculosa and Zoanthus pacificus) having a mean coverage of 0.1 percent and ten coral species (Porites lobata, P. compressa, P. evermanni, P. (Synarea) convexa, Montipora patula, M. verrucosa, Pocillopora meandrina, Pavona duerdeni, and Leptastrea purpurea) with a mean coverage of 28.0 percent. Many of the hemispherical coral colonies (such as Porites lobata and P. evermanni) have diameters exceeding 2m suggesting that they have ages close to 100 years. The invertebrate census did not find many species, probably due to their cryptic nature and the large amount of cover available. Species seen include the drupe shell (Drupa morum), the spiny lobster or 'ula (Panulirus penicillatus), the slate pencil urchin (Heterocentrotus mammillatus) and the black sea cucumber (Holothuria atra).

The results of the fish census carried out at station 4 are given in Appendix A. In total, 32 species (449 individuals) were censused having an estimated biomass of 504 g/m$^2$. The most abundant species in the transect area were the yellowstripe goatfish or weke (Mulloidichthys flavolineatus), the damselfish (Chromis vanderbilti), the convict tang or manini (Acanthurus triostegus), the brown surgeonfish or ma'i'i'i (A. nigrofuscus), the bulletnose parrotfish or uhu (Scarus sordidus), the goldring surgeonfish or kole (Ctenochaetus strigosus) and the yellow tang or lau'ipala (Zebrasoma flavescens). The species contributing the most to the estimated standing crop of fishes at this station were the weke (Mulloidichthys flavolineatus - 53% of the total), the uhu (Scarus sordidus - 13% of the total), the chub or nenue (Kyphosus biggibus - 6%) and the orangespine surgeonfish or umaumalei (Naso lituratus) making up 6 percent of the total weight at this station.

A qualitative swim was made along the seaward side of the mole or breakwater that serves to protect Manele Harbor. Along the outer two-thirds of this breakwater coral coverage was close to 80 percent over the boulders and there were numerous commercially and recreationally important fishes present. Among these were the yellowfin goatfish or weke'ula (Mulloides vanicolensis), the whitespoted surgeonfish or 'api (Acanthurus guttatus), the whitebar surgeonfish or maiko'iko (A. leucoparieus), uhu (Scarus sordidus), uhu 'uliuli and uhu ahu'ula (S. perspicillatus), nenue (Kyphosus biggibus), aholehole (Kuhlia sandvicensis) as well as others. The highly prized limpet or 'opihi is also present but at very low densities (approximately 1/30m$^2$ on the basalt rock

TABLE 4. Summary of the benthic survey conducted in the the biotope of high coral diversity approximately 80m offshore of the mole forming the breakwater for the Manele Harbor on the west side of Manele Bay, Lana'i on 13 March 1996. 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 2-5m; mean coral coverage is 28.0 percent (quadrat method).

A. Quadrat Survey

| | Quadrat Number | | | | | |
|---|---|---|---|---|---|---|
| Species | 0m | 5m | 10m | 15m | 20m | 25m |
| Algae | | | | | | |
| *Halimeda opuntia* | | 0.5 | | | | |
| *Porolithon onkodes* | 7 | | | 4 | | |
| Soft Corals | | | | | | |
| *Anthelia edmondsoni* | | | 0.1 | | | |
| *Palythoa tuberculosa* | | | | | | 0.5 |
| *Zoanthus pacificus* | | | | | | 0.2 |
| Corals | | | | | | |
| *Porites lobata* | 2 | 25 | 12 | | 9 | |
| *Porites compressa* | 1 | 2 | 3 | 8 | | |
| *Porites evermanni* | | 3 | | | 3 | |
| *Porites (Synarea) convexa* | | 2 | | | | |
| *Montipora patula* | 2 | 4 | 15 | | 11 | |
| *Montipora verrucosa* | | | 3.5 | | | |
| *Pocillopora meandrina* | 12 | 8 | 2 | 2.5 | 3 | 3.5 |
| *Pavona varians* | 6 | 2 | 0.5 | 4.5 | | |
| *Pavona duerdeni* | | | 1 | 3 | | 14 |
| *Leptastrea purpurea* | | | | | 1.3 | |
| Hard Substratum | 70 | 53.5 | 62.9 | 78 | 72.7 | 81.8 |

TABLE 4 CONTINUED ON NEXT PAGE

TABLE 4. Continued.

B. 50-Point Analysis

| Species | Percent of the Total |
|---|---|
| Corals | |
| *Porites lobata* | 8 |
| *Porites compressa* | 2 |
| *Porites evermanni* | 4 |
| *Montipora verrucosa* | 4 |
| *Montipora patula* | 4 |
| *Montipora flabellata* | 2 |
| *Pocillopora meandrina* | 4 |
| *Pavona varians* | 4 |
| Hard Substratum | 68 |

C. Invertebrate Census (4 x 25m)

| Species | Number |
|---|---|
| Phylum Mollusca | |
| *Drupa morum* | 2 |
| Phylum Arthropoda | |
| *Panulirus penicillatus* | 1 |
| Phylum Echinodermata | |
| *Heterocentrotus mammillatus* | 1 |
| *Holothuria atra* | 1 |

D. Fish Census (4 x 25m)

32 Species
449 Individuals
Estimated Biomass = 504 $g/m^2$

substrate).

An objective of this study was to determine possible cable alignments through the nearshore environment with least possible impact to marine communities. As noted above, passage through a sand biotope presents a route with low possible impact insofar as nearshore marine species are concerned. Thus an effort was made to delineate possible routes through sand habitats. One such route lies just east of the Manele Harbor entrance channel where a fiber optic cable could be run from sea to shore across sand and only cross about 10m of hard substratum right along the shoreline.

This sand area was created during the dredging of the outer basin of the harbor. Material was removed to the east of the bouy marked edge of the harbor. The substratum in the dredged area is sand which slopes seaward. Inshore of this is a narrow basaltic shelf that extends from the intertidal to a depth of about 1m. This shelf is what is left of the old substratum following the development of the harbor. The top of this shelf was qualitatively surveyed as a possible landing site for the cable. The shelf runs from the intertidal to a depth of about 1m approximately 10m offshore where a break in the shelf occurs and the depth increases to about 9m. The substratum seaward of this shelf break for the first 3m is comprised of basalt rock (up to 40cm in diameter and sand; seaward of this it is entirely sand.

Benthic communities are reasonably developed on the top of this shallow shelf. Several coral species are commonly seen including Porites lobata, Pocillopora meandrina, Monitpora verrucosa and Montipora patula. The dominant coral species is P. lobata and the average cover in this area is about 30-35 percent (at a distance of 5m from the shore). Closer to shore (where depth decreases) the coral cover decreases. A number of common reef fish species were seen in this area including the saddleback wrasse or hinalea lauwili (Thalassoma duperrey), the yellowtail wrasse or hinalea 'akilolo (Coris gaimard), the peral wrasse or 'opule (Anampses cuvier), the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus), the whitebar surgeonfish or maiko'iko (A. leucoparieus), the convict tang or manini (A. triostegus), the bulletnose parrotfish or uhu (Scarus sordidus), the palenose parrotfish or uhu (S. psittacus), the orangespine surgeonfish or umaumalei (Naso lituratus), the blackspot sargeant or kupipi (Abudefduf sordidus), the ornate butterfly fish or kikakapu (Chaetodon ornatissimus), the four-spot butterfly fish or lau hau (C. quadrimaculatus) and the doublebar goatfish or munu (Parupeneus bifasciatus). Among the exposed macroinvertebrates seen were the durpe shell (Drupa morum), the cone shell (Conus lividus), the green sea urchin (Echinometra mathaei) and the boring black urchin (E. oblongata).

About a mile seaward of Manele Bay several humpback whales were seen on the 13 March survey.

## POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### Possible Cable Landing Routes

As noted above, the cable route with the least biological impact is one where the cable does not require trenching through or crossing hard substratum. Coral reef communities show much greater development on hard substratum relative to sand substratum. Sand and/or soft bottom areas do not provide the stable substratum necessary for the successful survival of many coral reef benthic species. Placing a cable across a sand bottom will usually result in the cable being covered by the natural movement of sand thus burying it which affords a degree of protection. Little impact will occur to benthic species living on shifting sand bottoms with cable deployment. Thus from a biological standpoint, the cable route with the least impact in shallow marine communities is one crossing sand. Knowing this, the preferred strategy to decrease biological impact is to select the route with the greatest amount of sand. This is the strategy used in this study.

With the objective of keeping as much of the cable alignment in a sand biotope, we considered a number of alternative routes for each location. In the case of the Manele Harbor cable landing we recognized four possible alternatives: (1) landing the cable at the old landing site on the west side of the bay, (2) at the base or landward side of the breakwater or mole for the harbor, (3) at the seaward end of the mole and (4) outside but parallel to the eastern side of the harbor entrance channel. At Kaunakakai Harbor we recognized two possible cable landings: (1) crossing the shallow reef approximately 300m to the east of and parallel to the harbor entrance channel, (2) along the eastern edge of the harbor entrance channel. The potential impacts of placing a cable through these routes are discussed below.

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

As the cable is brought into the shallows there are areas where it would cross hard substratum and present a greater opportunity for impact to benthic and fish communities. The construction techniques selected to protect the cable will play a large role in the range of impacts possibly encountered; at one end of the spectrum would be the development of a channel using blasting and dredging techniques in which the cable is laid and covered with stone and tremie concrete and at the other would be the "no action" alternative. The construction of a trench could entail the use of dynamite and dredging. Impacts to marine communities with these activities will include those associated with shock waves (from dynamite), removal of benthic communities in the trench path, and the generation of turbidity which may impact surrounding communities.

With any construction is the concern are over possible impacts to corals because of their sessile nature and usual slow growth characteristics. One potential impact to corals would be the removal of the entire benthic community in the alignment path by trenching. Because of this, it is recommended that the cable be encased in pipe to protect it rather than allow trenching to be done. It is recognized that some minor amount of trenching may be necessary at the point where the cable comes ashore (at the air/water interface).

Besides trenching and backfilling, other deployment methods for cables in shallow water range from just laying the cable directly on the substratum without any specific attachment, to placing it inside of a protective pipe that is bolted to the substratum. In the case of leaving the cable loose and exposed over hard substratum, lateral movement may serve to abrade corals and other attached biota as well as the outer layer(s) of the cable. It is assumed that movement in the cable due to wave action is undesirable. The use of a protective pipe in which the cable is run could serve as a means of protecting the cable through the shallow subtidal region if the protective pipe is bolted to the substratum. This strategy has been used at the Natural Energy Laboratory of Hawaii facility at Keahole Point, Hawaii to secure pipes coming ashore through a subtidal region that is frequently subjected to extreme high energy conditions. Bolting a pipe to the substratum significantly reduces the impact to benthic communities over the alternative of trenching and backfilling. This alternative may provide low impact to marine communities but it will have an obvious visual impact to any underwater observer. If the trenching and backfilling strategy is used, the tremie concrete cap will probably be colonized by corals, algae and other benthic forms. Studies on substrate selection in Hawaiian coral larvae have shown concrete to be second only to limestone/coral as an appropriate substratum for settlement (Fitzhardinge and Bailey-Brock 1989).

If the cable is to be protected by use of steel pipe that is deployed over the hard substratum in water less than 25m of depth, how much coral would potentially be covered or overshadowed by the deployed pipe? Table 5 presents a synopsis of the amount of coral that is estimated to be actually covered by the protective pipe assuming that (1) a protective pipe is used through these shallow environments and (2) the outside diameter of this pipe is 15cm. In the four Manele Bay sites, no more than $4.2m^2$ of living coural would be covered and at Kaunakakai, the estimated maximum is $12.7m^2$ of living coral covered by the pipe (Table 5).

The amount of direct impact to corals appears relatively small but there are other factors that should be considered in proposing the most appropriate alignment. Among these considerations are the possibility of disturbance to the deployed cable by routine harbor maintenance activities (i.e., cable breakage), the visual impact of the deployed cable in some coral reef habitats used for "fish watching", and the impacts of cable deployment/construction on shallow marine communities.

Any underwater construction activity will generate fine particulate material that serves to lower light levels and in the extreme, bury benthic communities. In all likelihood, the deployment of fiber optic cables at Kaunakakai Harbor and Manele Harbor will be protected by a metallic pipe sheath. This pipe sheath will be laid over the substratum and in the case of sand, will probably "sink into" or be partially covered by the shifting sand. On hard substratum, the pipe casement may similarly be

TABLE 5. Table estimating the amount of living coral on hard substratum (expressed in square meters) along several possible alignments at Kaunakakai Harbor, Moloka'i and Manele Harbor, Lana'i that would be overlain assuming that the cable is sheathed in a protective pipe with a diameter of 15cm. Calculations are derived from field estimates of the linear distance traversed in each biotope as well as coral coverage and the amount of hard substratum present in each of the different biotopes crossed.

| Island and Location | Mean Percent Coral Cover | Distance Traversed on Hard Substrate | Estimated Area of Coral Covered ($m^2$) |
|---|---|---|---|
| **Manele Bay Lana'i** | | | |
| 1. From Sand Channel to Old Boat Landing (west side of bay) | 66.8% | 40m | $4.0m^2$ |
| 2. From Sand Channel to Base of Mole | 28% | 100m | $4.2m^2$ |
| 3. Up Sand Channel to End of Mole | 80% | 5m | $0.6m^2$ |
| 4. Along Eastern Side of Entrance Channel Directly to Shore | 20% | 10m | $0.3m^2$ |
| **Kaunakakai Harbor, Moloka'i** | | | |
| 1. Across Emergent Reef 300m East of Harbor Directly to Shore | 29.4%<br>35% | 172m<br>98m | Total=$12.7m^2$ |
| 2. Along Eastern Side of Harbor Entrance to Pier Island | 29.4% | 157m | $6.9m^2$ |

laid over the substratum and may or may not be bolted down to the bottom. Bolting may create a small amount of sedimentation through the drilling of bolt holes.

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.

In the case of bolting a pipe casement to the seafloor, very little sediment would be generated. 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

Manele Bay is part of a state designated Marine Life Conservation District or MLCD. Two bays, Manele and Hulopoe, comprise the MLCD. An imaginary line drawn from Pu'u Pehe Rock at the western tip of the bay to Kalaeokahano Point on the east form the seaward boundary of the Manele Bay portion of the MLCD. Manele Bay forms "Subzone B" of the MLCD where fishing by any legal method is authorized except with spear, net or trap. Fishermen are usually present around the Manele Small Boat breakwater or along the shoreline side of the harbor; the most common gear seen is hook and line and many of the commonly sought inshore species are caught there including goatfishes, wrasses, jacks, squirrelfishes, surgeonfishes. Seasonal runs of juvenile bigeye scad or hahalalu (Selar crumenophthalmus) often bring many people to the harbor where they line the harbor's edges to catch these fish. There are not many points around Lana'i where the shoreline is in easy access via vehicle. Manele Harbor is one such site and thus may account for the number of fishermen seen around the harbor.

Fishermen are also seen on the Kaunakakai Harbor pier island. Casual conversations with fishermen suggest that some fishing is undertaken in the waters offshore and east and west of the harbor entrance although no fishing activity was noted in these waters during our short period of field work (8 March 1996). Species taken just seaward of the reef flat again include squirrelfishes, jacks, goatfishes, surgeonfishes, parrotfishes as well as the occasional pelagic species such as the kawakawa (Euthynnus affinis) and fishing methods probably include spearing, netting, trapping as well as hook and line methods.

Deployment of a cable through the inshore waters at eight of these sites is an event that would probably be restricted to a period of one to four days during which time men and vessels would be in the area to pull the cable ashore. It is only during this period of time that local fishing activities may be somewhat curtailed, otherwise the deployed cable should have no negative impact to fishermen using the area or to the resource.

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 and blasting) will generate fine particulate material that could impact corals. Additionally, the use of explosives such as dynamite may temporarily increase the levels of nitrates in the water column. 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.

It is expected that the small scale of the "in water" work associated with the deployment of the proposed cable would produce little, if any, sediment. This statement is supported by the fact that if the selected cable route runs through sand, little opportunity for the generation of sediment will occur. Other than a possible minimal transitory increase in local turbidity due to deployment of the cable, the deployment and subsequent operation of the cable should not result in any change to the water chemistry of the nearshore waters.

These data suggest that the deployment of the proposed fiber optic cable through the nearshore environment should have a transitory impact, if any, only during the actual deployment process.

Route Recommendations

Manele Bay, Lana'i

Coral communities are well-developed on the west side of Manele Bay (Figure 5-A) and this is probably related to the relatively high degree of protection of the area from most storm surf. The inshore western corner of this coral reef is utilized by dive tour operations, in part, due to the diversity of corals and fish present. A surface mounted fiber optic cable crossing through this area would not be aesthetically pleasing or the most appropriate route from the standpoint of coral community (Figure 5-B and C). As such the proposed landing the cable at the old ship landing on the west side of the bay as well as the proposed landing at the base of the harbor breakwater would not be recommended.

If the cable were to be routed alongside of the harbor entrance channel it could be landed either at the seaward end of the harbor breakwater or on the shoreline just east of the harbor. Both of these proposed routes will potentially expose the cable to damage during periodic harbor maintenance dredging operations. The potential for damage would probably be greater if the cable is landed on the seaward end of the breakwater relative to the shoreline landing just east of the harbor. However, both of these proposed landing sites allows the cable to be situated in sand to within 10m of where it would exit the ocean thus reducing the potential for impact to coral communities. Everything else being equal, the routing of the cable as far east in the large sand area as is possible and bringing it ashore just east of the harbor may be the route with the least potential for biological impact in Manele Bay.

Kaunakakai Harbor, Moloka'i

Two possible routes have been mentioned for the Kaunakakai Harbor cable landing; one of these is coming ashore by crossing the shallow reef about 300m east of the Kaunakakai Harbor pier and the second route approximately follows the eastern edge of the entrance channel and exiting the water perhaps on the pier island.

A primary consideration at Kaunakakai is the protection of the cable from possible damage due to periodic maintenance dredging as well as from barge and tug operations where they drop the towing cable to shorten it up prior to entry into the harbor.

During this operation the steel towing cable may fall to the seafloor and drag across the bottom. If the fiber optic cable is in the path of the dragging cable, it could be damaged. A fiber optic cable coming ashore using either route could be potentially exposed to dragging towing cables. The proposed fiber optic cable alignment following the eastern edge of Kaunakakai Harbor entrance channel would also be exposed to possible damage from maintenance dredging operations.

From a biological standpoint, the deployment of the cable on the sand substratum along the eastern side of the Kaunakakai Harbor entrance channel would be best. This proposed route would avoid crossing any significant amount of coral and would lie primarily in sand. The proposed route approximately 300m to the east would cross areas of greater coral development and because of the exposed nature of the site to storm surf, the cable would probably have to be secured to the substratum.

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APPENDIX A. Results of the quantitative visual censuses conducted at two locations offshore of Kaunakakai Harbor, Moloka'i on 8 March 1996 (T-1 and T-2) and two locations offshore of Manele Harbor, Lana'i on 13 March 1996 (T-3 and T-4). Each entry in the body of the table represents the total number of individuals of each species seen; totals are presented at the foot of the table along with an estimate of the standing crop ($g/m^2$) of fishes present at each location.

| FAMILY AND SPECIES | STATION NUMBER 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| HOLOCENTRIDAE | | | | |
| Adioryx xantherythrus | 135 | | | |
| AULOSTOMIDAE | | | | |
| Aulostomus chinensis | | | | 1 |
| APOGONIDAE | | | | |
| Apogon kallopterus | 9 | | | |
| SERRANIDAE | | | | |
| Pseudanthias thompsoni | 14 | | | |
| CARANGIDAE | | | | |
| Caranx melampygus | | 6 | | |
| LUTJANIDAE | | | | |
| Alphareus furcatus | | | | 1 |
| MULLIDAE | | | | |
| Parupeneus multifasciatus | 19 | 5 | 2 | 1 |
| Mulloidichthys flavolineatus | | | | 43 |
| KYPHOSIDAE | | | | |
| Kyphosus bigibbus | | | | 8 |
| CHAETODONTIDAE | | | | |
| Forcipiger flavissimus | | | | 1 |
| F. longirostris | | | | 1 |
| Chaetodon auriga | | 1 | | |
| C. kleini | 43 | | | |
| C. ornatissimus | | | 4 | 2 |
| C. multicinctus | | | 10 | 2 |
| C. unimaculatus | 4 | 2 | | 1 |
| C. quadrimaculatus | | 1 | | 1 |
| C. miliaris | 31 | | | |

APPENDIX A. Continued.

| FAMILY AND SPECIES | STATION NUMBER 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| POMACANTHIDAE | | | | |
| _Centropyge potteri_ | 4 | | 8 | |
| POMACENTRIDAE | | | | |
| _Dascyllus albisella_ | 28 | | | |
| _Plectroglyphidodon johnstonianus_ | 1 | | 2 | 1 |
| _Chromis vanderbilti_ | | 32 | 14 | 37 |
| _C. hanui_ | 12 | | 9 | |
| _C. agilis_ | | 1 | 53 | |
| _C. verator_ | | | 26 | |
| _Stegastes fasciolatus_ | | | | 8 |
| _Abudefduf abdominalis_ | | | | 15 |
| CIRRHITIDAE | | | | |
| _Paracirrhites arcatus_ | 7 | 1 | | 3 |
| _P. forsteri_ | | 1 | | |
| LABRIDAE | | | | |
| _Labroides phthirophagus_ | | 1 | 1 | |
| _Bodianus bilunulatus_ | 1 | | | |
| _Pseudocheilinus octotaenia_ | 3 | | 2 | |
| _P. tetrataenia_ | 2 | | | |
| _Thalassoma duperrey_ | 4 | 13 | 11 | 23 |
| _T. ballieui_ | | 1 | | |
| _Gomphosus varius_ | | 8 | 1 | 4 |
| _Pseudojuloides cerasinus_ | 4 | | | |
| SCARIDAE | | | | |
| _Scarus perspicillatus_ | 13 | | | |
| _S. sordidus_ | 5 | 1 | 39 | 35 |
| _S. psittacus_ | 1 | | | |
| BLENNIIDAE | | | | |
| _Exallis brevis_ | | | | 1 |
| ACANTHURIDAE | | | | |
| _Acanthurus triostegus_ | | | | 53 |
| _A. achilles_ | | | 2 | 5 |
| _A. leucoparieus_ | | 1 | | |
| _A. nigrofuscus_ | 15 | 23 | 22 | 42 |
| _A. nigroris_ | 12 | 3 | 18 | 13 |
| _A. olivaceus_ | 7 | | | |

APPENDIX A. Continued.

| FAMILY AND SPECIES | STATION NUMBER 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| ACANTHURIDAE (Cont.) | | | | |
| *A. dussumieri* | | 3 | | 1 |
| *A. mata* | | 1 | | |
| *Ctenochaetus strigosus* | 19 | 4 | 78 | 90 |
| *Naso hexacanthus* | 20 | | | |
| *N. lituratus* | | | | 7 |
| *Zebrasoma flavescens* | | | 38 | 42 |
| ZANCLIDAE | | | | |
| *Zanclus cornutus* | 1 | | | 1 |
| BALISTIDAE | | | | |
| *Melichthys niger* | 21 | | | |
| *M. vidua* | | | | 1 |
| *Sufflamen bursa* | 5 | | 1 | |
| TETRAODONTIDAE | | | | |
| *Arothron meleagris* | | | | 1 |
| CANTHIGASTERIDAE | | | | |
| *Canthigaster jactator* | 1 | | 3 | 4 |
| Total Number of Species | 29 | 20 | 21 | 32 |
| Total Number of Individuals | 441 | 109 | 344 | 449 |
| Estimated Standing Crop ($g/m^2$) | 152 | 36 | 73 | 504 |