

1991-12-23-0A FEA

Conservation District Use Application and
Environmental Assessment for the

HAWAII-5 & PACRIM-EAST CABLE LANDING PROJECT

Keawaula, Oahu, Hawaii

AUGUST 1991

PREPARED FOR:

American Telephone and Telegraph Company
340 Mt. Kemble Avenue
Morristown, New Jersey 07960

RMTC

R. M. Towill Corporation

420 Waiakamilo Rd., Suite 411
Honolulu, Hawaii 96817-4941
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PREFACE

This document is being submitted for the purpose of acquiring a Conservation District Use Permit for the Hawaii-5 and PACRIM-EAST Cable Landing Project. There are three parts to this document: (1) the Department of Land and Natural Resources Master Application Form, (2) the Supplement to the Conservation District Use Application and (3) the project Environmental Assessment. The Environmental Assessment is being processed concurrently for a Negative Declaration through the City and County of Honolulu Department of Land Utilization.

APPLICATION FORM

February 2, 1991

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

DEPARTMENT MASTER APPLICATION FORM

FOR DLNR USE ONLY

Reviewed by _____
Date _____
Accepted by _____
Date _____
Docket/File No. _____
180-Day Exp. _____
EIS Required _____
PH Required _____
Board Approved _____
Disapproved _____
Well No. _____

(Print or Type)

I. LANDOWNER/WATER SOURCE OWNER
(If State land, to be filled
in by Government Agency in
control of property)

Name State of Hawaii
Address Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Telephone No. _____

SIGNATURE _____

Date _____

II. APPLICANT (Water Use, omit if applicant
is landowner)

Name American Telephone and Telegraph C

Address 340 Mt. Kemble Avenue
Morristown, New Jersey 07960

Telephone No. _____

Interest in Property Cable System Owner

(Indicate interest in property; submit
written evidence of this interest)

*SIGNATURE G. R. Serpan, Vice President
International Services Operations

Date 6-3-91

*If for a Corporation, Partnership,
Agency or Organization, must be signed
by an authorized officer.

III. TYPE OF PERMIT(S) APPLYING FOR

- () A. State Lands
- (x) B. Conservation District Use
- () C. Withdraw Water From A Ground Water Control Area
- () D. Supply Water From A Ground Water Control Area
- () E. Well Drilling/Modification

IV. WELL OR LAND PARCEL LOCATION REQUESTED

District Conservation

Island Oahu

County Honolulu

Tax Map Key 8-1-01:07,08,18,23

Area of Parcel Approx. 18,200 sq. ft.
(Indicate in acres or
sq. ft.)

Term (if lease) _____

DOCUMENT CAPTURED AS RECEIVED

V. Environmental Requirements (SEE ATTACHED ENVIRONMENTAL ASSESSMENT)

Pursuant to Chapter 343, Hawaii Revised Statutes, and in accordance with Title 11; Chapter 200, Environmental Impact Statement Rules for applicant actions, an Environmental assessment of the proposed use must be attached. The Environmental assessment shall include, but not be limited to the following:

- (1) Identification of applicant or proposing agency;
- (2) Identification of approving agency, if applicable;
- (3) Identification of agencies consulted in making assessment;
- (4) General description of the action's technical, economic, social, and environmental characteristics;
- (5) Summary description of the affected environment, including suitable and adequate location and site maps;
- (6) Identification and summary of major impacts and alternatives considered, if any;
- (7) Proposed mitigation measures, if any;
- (8) Determination;
- (9) Findings and reasons supporting determination; and
- (10) Agencies to be consulted in the preparation of the EIS, if applicable.

VI. Summary of Proposed Use (what is proposed)

American Telephone and Telegraph Company (AT&T) is proposing to land and install two new transpacific submarine communications fiberoptic cables at Keawaula, Oahu. The project has been designated the "Hawaii-5(HAW-5) and PACRIM-EAST Cable Landing Project." The proposed action includes the installation of a conduit system within an existing cable easement, construction of a new ocean ground bed, placement of two cables and the shore end landings for the HAW-5 and PACRIM-EAST projects.

INFORMATION REQUIRED FOR ALL USES (See attached CDUA Supplement and Environmental Assessment)

I. Description of Parcel

- A. Existing structures/Use. (Attach description or map).
- B. Existing utilities. (If available, indicate size and location on map. Include electricity, water, telephone, drainage, and sewerage).
- C. Existing access. (Provide map showing roadways, trails, if any. Give street name. Indicate width, type of paving and ownership).
- D. Vegetation. (Describe or provide map showing location and types of vegetation. Indicate if rare native plants are present).
- E. Topography; if ocean area, give depths. (Submit contour maps for ocean areas and areas where slopes are 40% or more. Contour maps will also be required for uses involving tall structures, gravity flow and other special cases).
- F. If shoreline area, describe shoreline. (Indicate if shoreline is sandy, muddy, rocky, etc. Indicate cliffs, reefs, or other features such as access to shoreline).
- G. Existing covenants, easements, restrictions. (If State lands, indicate present encumbrances.)
- H. Historic sites affected. (If applicable, attach map and descriptions).

II. Description: Describe the activity proposed, its purpose and all operations to be conducted. (Use additional sheets as necessary).

III. Commencement Date: November 1991

Completion Date: October 1992

IV. TYPE OF USE REQUESTED (Mark where appropriate) (Please refer to Title 13, Chapter 2)

1. Permitted Use (exception occasional use);
DLNR Title 13, Chapter 2, Section _____; Subzone _____.
2. Accessory Use (accessory to a permitted use):
DLNR Title 13, Chapter 2, Section _____; Subzone _____.
3. Occasional Use: Subzone _____.
4. Temporary Variance: Subzone _____.
5. Conditional Use: Subzone R and G.

Area of Proposed Use Approx. 12,000 sq. ft. (Existing Cable Easement)
Approx. 6,200 sq. ft. (New Ground Bed Easement)
(Indicate in acres or sq. ft.)

Name & Distance of Nearest Town or Landmark
Kaena Point, approximately four miles

Boundary Interpretation (If the area is within 40 feet of the boundary of the Conservation District, include map showing interpretation of the boundary by the State Land Use Commission).

Conservation District Subzone Resource and General
County General Plan Designation Preservation

V. FILING FEE

1. Enclose \$50.00. All fees shall be in the form of cash, certified or cashier's check, and payable to the State of Hawaii.
2. If use is commercial, as defined, submit additional public hearing fee of \$50.00.

INFORMATION REQUIRED FOR CONDITIONAL USE ONLY

- I. Plans: (All plans should include north arrow and graphic scale).
 - A. Area Plan: Area plan should include but not be limited to relationship of proposed uses to existing and future uses in abutting parcels; identification of major existing facilities; names and addresses of adjacent property owners.
 - B. Site Plan: Site plan (maps) should include, but not be limited to, dimensions and shape of lot; metes and bounds, including easements and their use; existing features, including vegetation, water area, roads, and utilities.
 - C. Construction Plan: Construction plans should include, but not be limited to, existing and proposed changes in contours; all buildings and structures with indicated use and critical dimensions (including floor plans); open space and recreation areas; landscaping, including buffers; roadways, including widths; offstreet parking area; existing and proposed drainage; proposed utilities and other improvements; revegetation plans; drainage plans including erosion sedimentation controls; and grading, trenching, filling, dredging or soil disposal.
 - D. Maintenance Plans: For all uses involving power transmission, fuel lines, drainage systems, unmanned communication facilities and roadways not maintained by a public agency, plans for maintenance shall be included.
 - E. Management Plans: For any appropriate use of animal, plant, or mineral resources, management plans are required.
 - F. Historic or Archaeological Site Plan: Where there exists historic or archaeological sites on the State or Federal Register, a plan must be submitted including a survey of the site(s); significant features; protection, salvage, or restoration plans.
- II. Subzone Objective: Demonstrate that the intended use is consistent with the objective of the subject Conservation District Subzone (as stated in Title 13, Chapter 2).

**SUPPLEMENT TO CONSERVATION
DISTRICT USE APPLICATION**

SUPPLEMENT TO
CONSERVATION DISTRICT USE APPLICATION
FOR THE
HAWAII-5 AND PACRIM-EAST CABLE LANDING PROJECT
KEAWAULA, OAHU, HAWAII

PREPARED FOR:

American Telephone and Telegraph Company
340 Mt. Kemble Avenue
Morristown, New Jersey 07960

PREPARED BY:

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

AUGUST 1991

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SECTION 1
INTRODUCTION

This document has been prepared to supplement information required by the Conservation District Use Application (CDUA). It describes the landing of the planned transpacific communications cables that will be installed between the U.S. mainland and Hawaii, and between Hawaii and Takapuna, New Zealand. The project has been designated by the project proponents as the "Hawaii-5 (HAW-5) and PACRIM EAST Cable Landing Project." The CDUA amends CDUA-OA-1417 approved by Board action on June 25, 1982. An Environmental Assessment has been prepared and is part of this CDUA application. The Environmental Assessment details the proposed cable landing and installation and assesses the potential environmental impacts associated with the installation of the fiber optic cables at Keawaula, Oahu.

SECTION 2
DESCRIPTION OF PARCEL

2.1 EXISTING USE AND FACILITIES

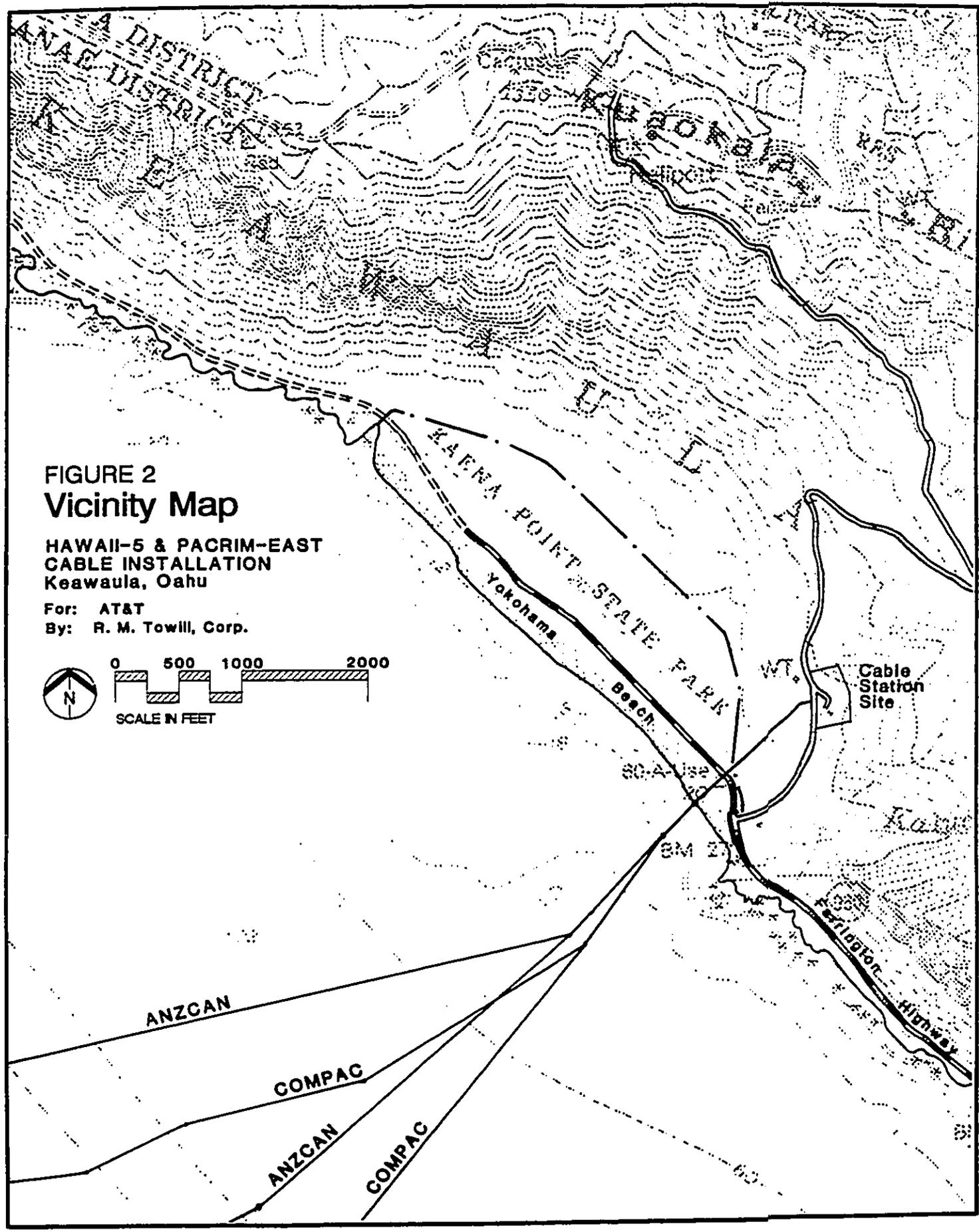
The site for the HAW-5/PACRIM-EAST cable landing is at Keawaula, Oahu, Hawaii. Keawaula is located along the Waianae coast of the Island of Oahu (see Figure 1). The proposed cables will be laid across lands that are owned by the State of Hawaii (Tax Map key: 8-1-01: 07, 08, 18, 23) and leased to AT&T (State Lease #S-3809). The cables will be laid within an existing 10-foot wide cable easement which extends from the ocean across Farrington Highway to an existing cable station located approximately 1,200 feet east of Farrington Highway. The cable easement is granted in favor of AT&T. A portion of the cable easement crosses through Kaena Point State Park. The beach area of the park in which the cable easement crosses is used for swimming, sunbathing, surfing, skin diving and picnicking.

The project area already serves as a cable landing site for four undersea cables landed by Teleglobe Canada (see Figure 2). The first two undersea cables were landed at Keawaula in 1963. These cables serve as part of the COMPAC cable system. In 1983, two additional cables were landed within the same easement. These additional cables serve as part of the ANZCAN cable system. Both the COMPAC and ANZCAN cable systems link Hawaii with Canada and Fiji, Australia and New Zealand.

The existing cable station, built in 1983, is a three-level structure (basement, mezzanine, and ground floor) with most of the floor area located underground. The communications equipment, power equipment and test areas are located underground, and the office, storage and garage areas are located on the ground floor. The gross floor area of the building is approximately 7,082 square feet.

2.2 ACCESS

Access to the project site is provided by Farrington Highway (State Route No. 930). The roadway right-of-way fronting the project site is 50 feet.



2.3 VEGETATION

Plant material along the cable route consists primarily of koa haole trees and assorted grasses.

2.4 SHORELINE DESCRIPTION AND NEARSHORE PROFILE

The beach area where the new cables will be installed in the existing cable easement slopes to the water's edge at a slope of approximately 5+ percent. There are no structures on the beach. Portions of the area between the edge of the road and the beach are grassed, however, there are no trees. The width of the beach (shoreline to roadway) varies depending on the season with the average width being approximately 100 feet.

The general bottom profile of the nearshore zone is shown in Figure 3. Within 100 feet of the shoreline, the bottom depth is -5 feet, within 500 feet it is -15 feet. The nearshore bottom is predominantly sand. Existing submarine cables are laid directly on the ocean bottom except for that portion of the cable near the shoreline. This portion is covered with sand.

2.5 EXISTING EASEMENTS

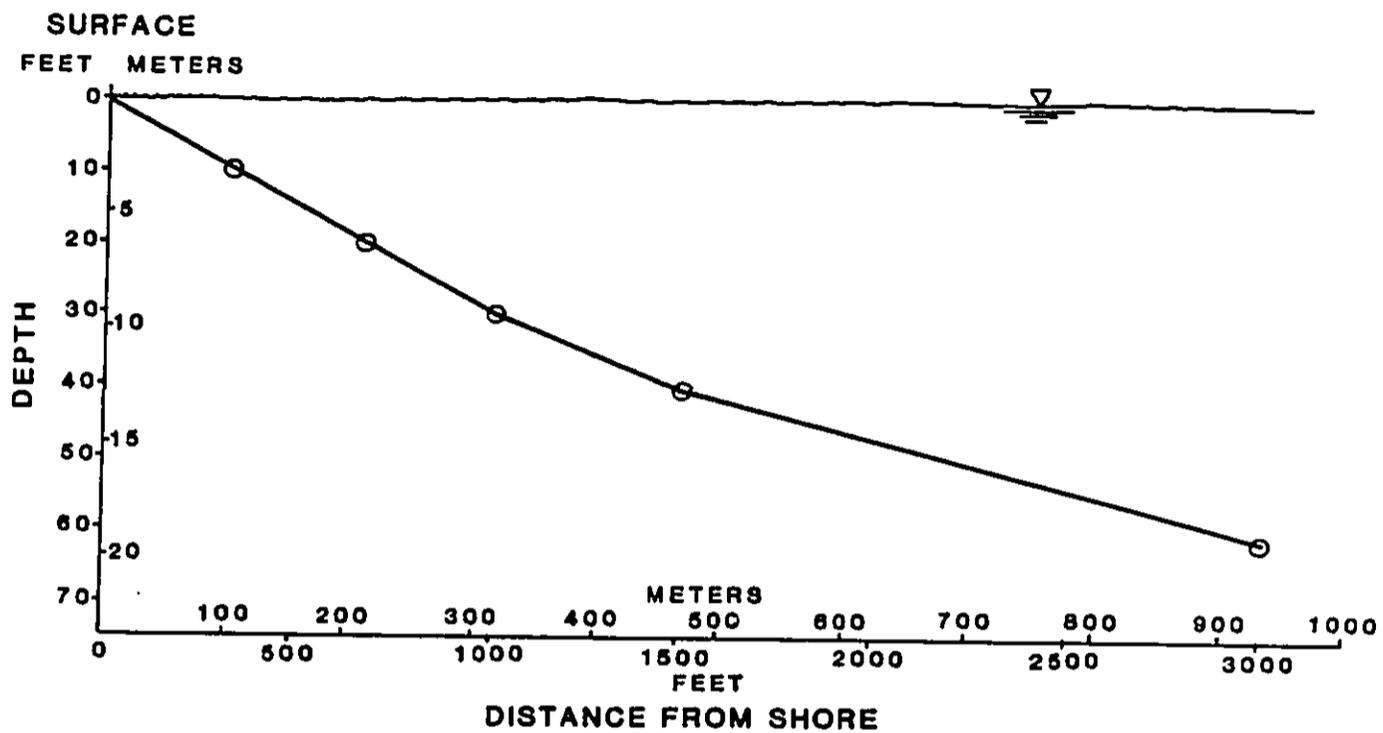
Existing easements crossing the project site are depicted on the Cable Alignment Site Map (Figure 4). They include:

- a. 25' wide easement for Hawaiian Electric transmission line.
- b. 10' wide underground communication line easement reserved for the State of Hawaii.
- c. 60' wide roadway easement for access to Kaena Point Missile Tracking Station.

2.6 HISTORIC SITES AFFECTED

There are no known sites of historical or cultural significance on the project site. However, there are some archaeological features in the vicinity of the site, i.e., a heiau. These features will not be affected by the proposed action as work will be confined within the existing cable easement through areas where the archaeological features are located.

FIGURE 3
General Bottom Profile



GENERAL BENTHIC AND BIOLOGICAL DESCRIPTION

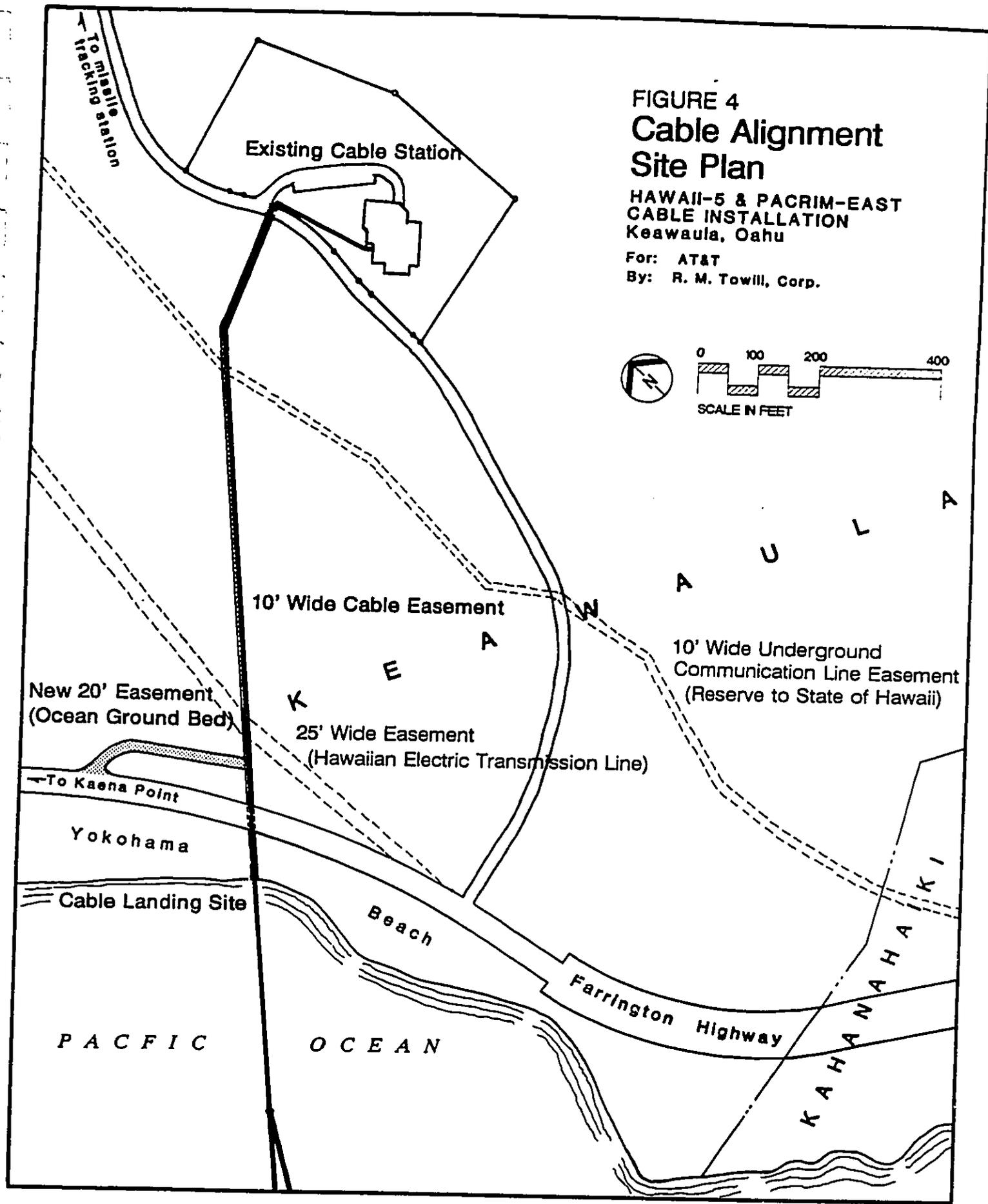
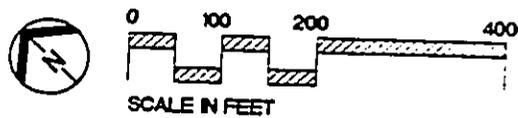
DEPTH (ft)	Benthic and Biological Characteristics
10	No live coral coverage, however, scattered consolidated coral protrudes up to 3 feet above the sand substratum. Cable is buried in sand until depth of 10 to 12 feet where a small cut through solid limestone allows the cable to continue seaward with only a short segment visible above the surrounding sand.
20	Sand substratum with cables buried, estimated depth of up to 18 inches.
30	From 15-foot depth to 60-foot depth, cables are alternately buried in sand and exposed where it passes over areas of consolidated coral that protrude above the sand. Live coral coverage less than 1 percent.
40-45	Depth range where highest live coral coverage of 10 percent (maximum visually estimated) was observed.
60	Hard, consolidated coral substratum characterized by very low relief (1 to 2 feet) and live coral coverage (1 to 2 percent).

SOURCE: Environmental Impact Assessment for the Teleglobe, Canada ANZCAN Cable Landing at Keawaula, Oahu, December 1980.

**FIGURE 4
Cable Alignment
Site Plan**

**HAWAII-5 & PACRIM-EAST
CABLE INSTALLATION
Keawaula, Oahu**

For: AT&T
By: R. M. Towill, Corp.



SECTION 3
DESCRIPTION OF THE PROPOSED ACTIVITY

3.1 PURPOSE

The purpose of the project is to improve the telecommunications service quality currently available in the Pacific Ocean region. The installation and landing of the HAW-5 and PACRIM-EAST cables will increase available circuits between Hawaii and the mainland USA as well as between Hawaii and the Pacific region. Specifically, the new cables will:

- a. Improve diversity in path media;
- b. Increase restoration capability; and
- c. Provide additional communications circuits for the forecasted growth in the Pacific Ocean region.

3.2 PROPOSED IMPROVEMENTS

The proposed improvements will entail the installation of six 4-inch PVC conduits, two manholes (6'x12'x17' and 5'x12'x7') and the landing and installation of two new transpacific submarine communications fiber optic cables within the existing 10-foot cable easement. Also included as part of the project is the installation of a new ocean ground bed adjacent to the existing cable easement.

3.3 CONSTRUCTION PLAN

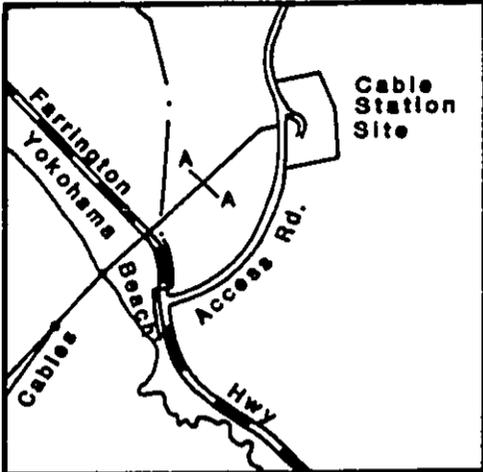
The proposed alignments of the HAW-5/PACRIM-EAST cables are shown in Figure 4. As described in paragraph 2.1 of this supplement, the new cables will be placed within existing cable easements. Project construction work will be accomplished in two phases. The first phase will involve the land-end activity of installing cable conduits from the existing cable station to the beach. It will take place approximately in November and December 1991. The second phase of work will be in conjunction with the cable landing and will entail the trenching of the beach and nearshore area; placement of temporary landing targets; and the cable landing process. This phase will occur in September and October of 1992.

3.3.1 Land-End Activity

The land-end construction activities will initially involve excavation of material within the existing 10-foot wide cable easement from the existing cable station to the eastern edge of the Farrington Highway right-of-way (approximately 1,000 feet). After the material is removed, six 4-inch PVC conduits will be placed in the trench and encased in concrete (see Figure 5). Along with the installation of the conduits, a 5'x12'x7' manhole will be constructed at the cable station site. Upon completion of installation of conduits, two cables will be pulled through the conduits. The cables will be connected from a new 6'x12'x17' manhole located 50 feet mauka of Farrington Highway to a new ocean ground bed (see Figure 5). The ocean ground bed will consist of six anodes located approximately 150 feet northwest of the manhole and 50 feet from the Farrington Highway right-of-way. Each of the anodes will be prepackaged in carbon backfill approximately eight inches in diameter and buried beneath the ground surface about 10 feet apart. Although the ground bed will only occupy an area approximately one foot wide by 50 feet long, a new easement, approximately 20'x 310', will need to be established to allow access from Farrington Highway for future maintenance. The cable connecting the ground bed to the manhole will be buried approximately four feet deep within the new easement. Once installation is completed, all surfaces will be returned to their original grade and replanted.

The excavation of material from the new manhole to the ocean will require crossing the Farrington Highway right-of-way and the beach area. When crossing Farrington Highway, traffic will be routed along the eastern shoulder of the highway with the aide of necessary safety measures such as temporary traffic control devices (cones) and/or flagmen to direct traffic. Four 6-inch steel pipes will also be placed into these sections of the easement to encase the new cables. Within the beach area, the conduits will extend approximately 50 feet west of the roadway right-of-way. From that point seaward, the cables will be buried beneath the surface without the conduit casing. Following installation of the conduits, the road will be restored to its original condition.

The second phase of work will entail the excavation of sand to expose the trench which contains the existing cables. This work will be done just prior to the landing of the cables

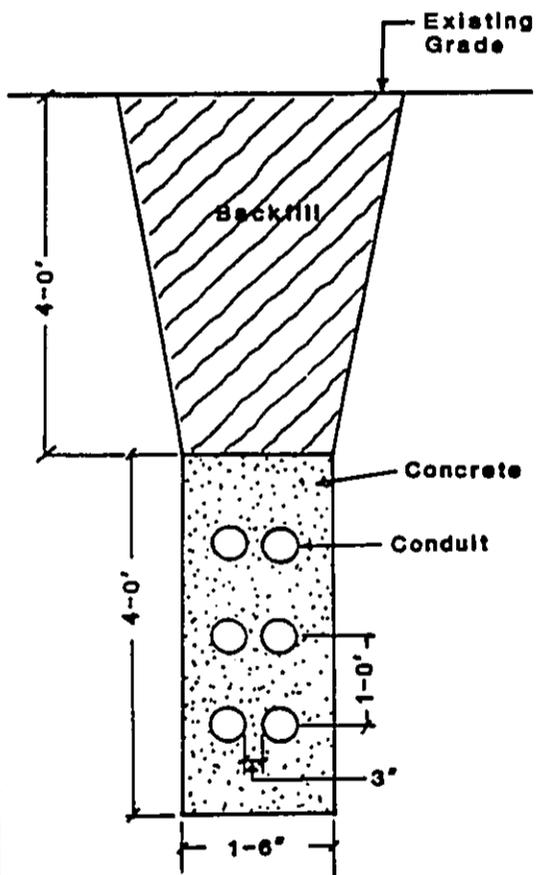


**FIGURE 5
Trench Sections**

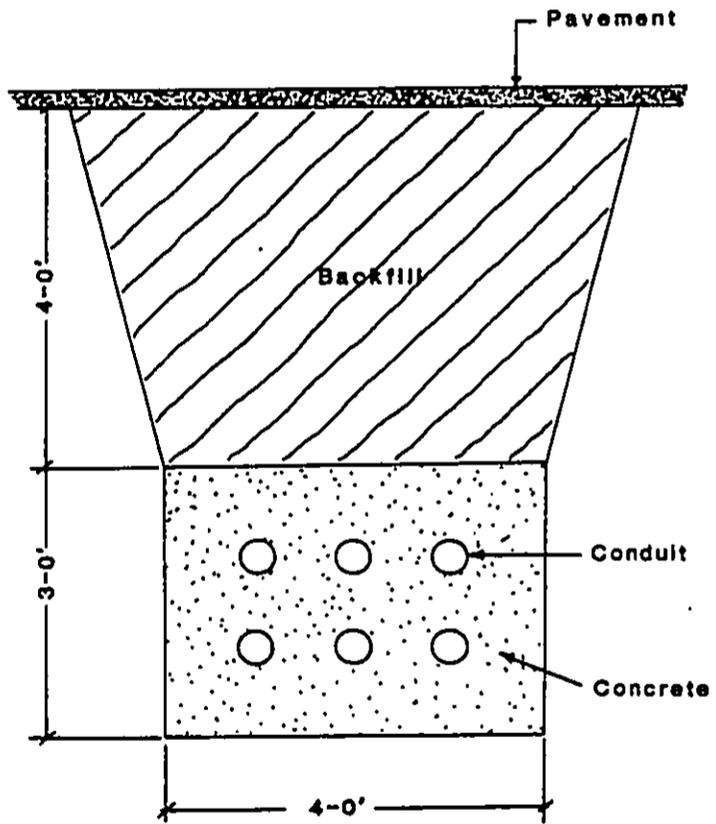
**HAWAII-5 & PACRIM-EAST
CABLE INSTALLATION
Keawaula, Oahu**

For: AT&T
By: R. M. Towill, Corp.

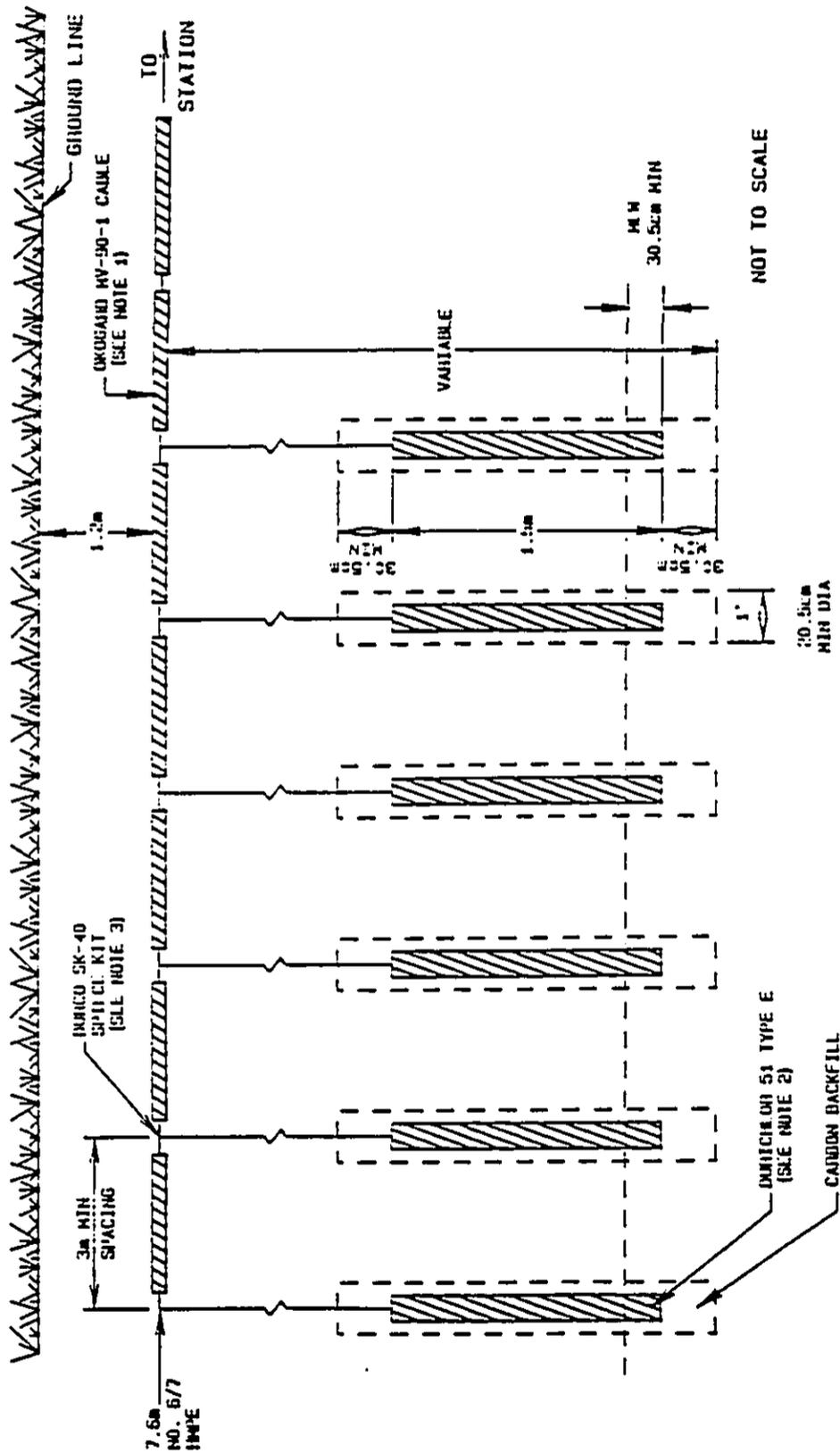
Section AA



Section at Highway



SCALE: 1/2" = 1'-0"



NOTES: 1 - CABLE DESCRIPTION: OKUGARD HV-90-1 DRY SHIELDED POWER CABLE WITH 1/60/7X BARE COPPER, .135" I.P.H., .030" SHEATH CONDUCTING TPE, .005" BARE COPPER TAPE SHIELD, .030" O.K. LINE HIGH DENSITY PUR YU THYLIN. JACKET. OBTAIN FROM: OKURITE COMPANY, HANSELY, N.H. U.S.A.

2 - ANODE DESCRIPTION: DUNCO 51 TYPE E EQUIPPED WITH 7.6m OF NO. 6/7 INWE PREPACKAGED IN CARBON BACKFILL. OBTAIN FROM: THE DUNCO COMPANY, INC., DAYTON, OHIO.

3 - SPLICE KIT: DUNCO SK-40 SPLICE KIT WILL BE USED AT ALL CABLE TO ANODE CONNECTIONS.

FIGURE 6
OCEAN GROUND BED SECTION
HAWAII-5 & PACRIM-EAST
CABLE INSTALLATION
 Keawoula, Oahu
 For: AT&T
 By: R. M. Towill Corp.

in October of 1992. The existing cables are currently buried in the sand at a depth of 3 to 7 feet. The upper layer of sand will be removed by machinery (either clamshell or backhoe). Layers of sand that are closer to the existing cables will be removed manually. Dewatering of the exposed trench may also be required. The excavated sand will be stored on the beach adjacent to the work site for later placement back into the excavated trench. Approximately 185 (10'x 100'x 5') cubic yards of sand will be excavated and will be placed adjacent to the cable easement on the beach.

Two range targets (alignment markers) will be placed on land just prior to the landing of the cables to aid in the cable laying process. The first range target will be placed on the western (mauka) edge of the Farrington Highway right-of-way over the existing cable easement with the second target located approximately 150 feet east of the front range target. 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 Farrington Highway.

3.3.2 Nearshore Activity

From the mean high water mark, the cables will be placed in a trench for a distance of approximately 30 feet seaward. The work in this nearshore area requires the removal of the sand which covers the existing cables. For this process, machinery will be used to remove the upper layers of sand. A hydro-jet will be used to remove the remaining sand. If necessary, sandbags will be placed in the water to prevent the sand from reentering the open trench. In the water, screens will be placed to reduce turbidity impacts. The sand that is removed will be stored onshore for later backfilling.

After the cable landing, approximately 985 meters of each cable will be encased in an armor protection from the end of the steel pipe seaward. This will provide protection for the cables in the nearshore area.

3.3.3 Cable Landing Process

The cable landing process includes the use of the landside range targets (alignment

markers) to assist in the alignment of the cables as they are being installed. The cable laying ship will be assisted by two tugboats to maintain proper alignment of the cable ship. This assistance is essential to ensure that the cables are placed within the cable easements. Once the cable laying ship is properly aligned, the cables will be towed one at a time from the ship by one of the tugs to a transfer location nearshore. At this location, the leading ends of the cables will be attached to a wire rope connected to land based pulling equipment (i.e., winch) and pulled ashore. Once the cables are placed within the trench, the leading ends of the cables will be secured within the manhole and spliced together with cables emanating from the cable station. AT&T personnel will perform all splicing and cable terminating operations.

After the cables have been landed, the cable laying ship will lay out to sea to connect the deep water portion of the cables with the shore-end portion of the cables. This connection will occur beyond the three-mile territorial limit.

Once the cables have been secured, the open trench will be backfilled and the beach restored to its original condition.

3.3.4 Safety Considerations

During the construction phase on the beach (approximately 30-45 calendar days, September-October 1992), the portion of the beach which contains the open trench will be barricaded from public entry. A security guard will be on duty at night and weekends to ensure public safety and integrity of the job site.

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

personnel will advise beach users to avoid the project site both on land and in the water via small powered water crafts.

3.4 MAINTENANCE PLAN

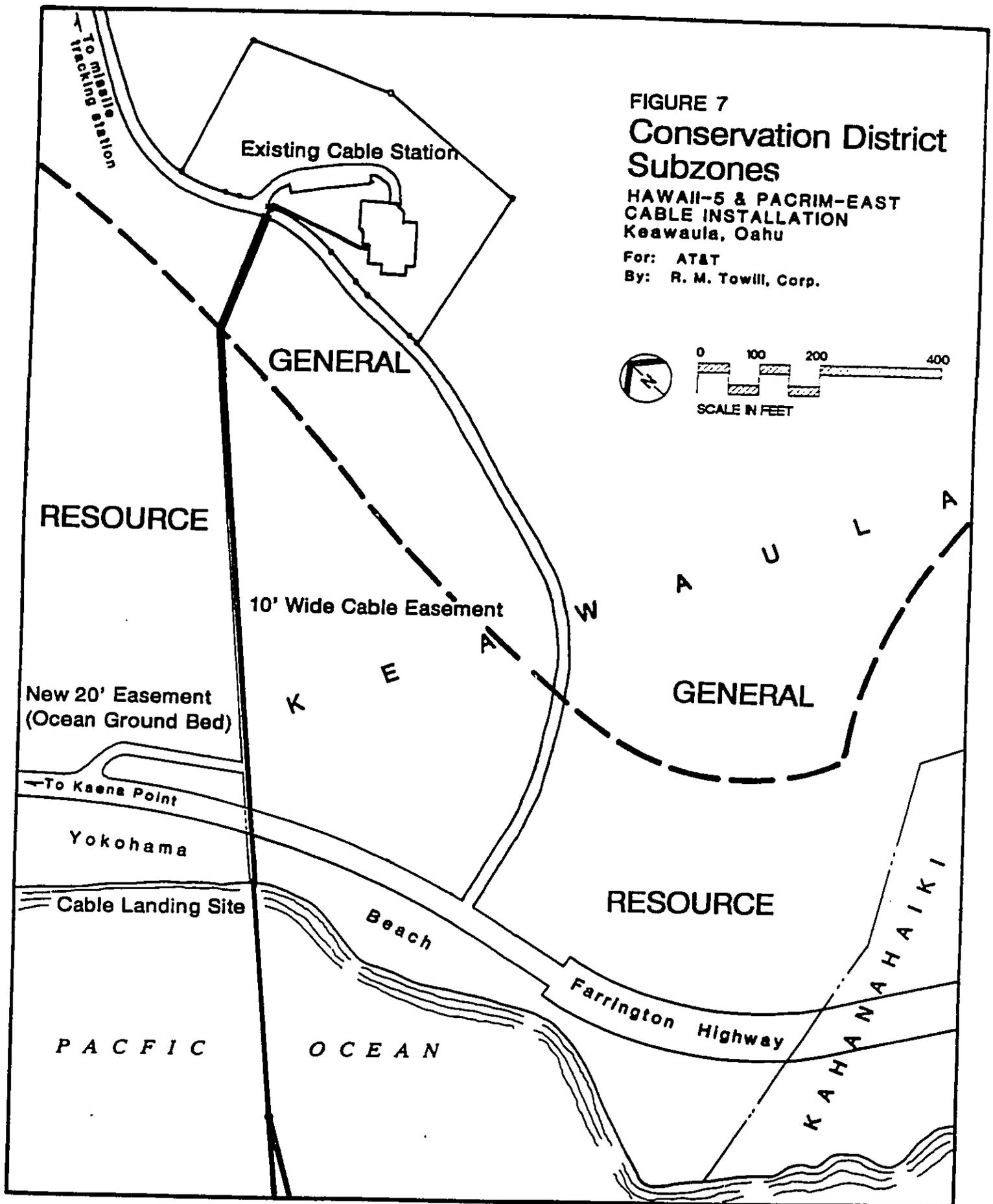
The shore-end of the proposed cables, once installed, will require no maintenance unless a fault is discovered in the system. Work on the cables will be required if the cables are damaged during severe storms or if a ship should accidentally damage the cables with its anchor.

SECTION 4
SUBZONE OBJECTIVES

The proposed new communications cables will be installed in areas within two Conservation District Subzones: Resource (R) and General (G). Figure 7 reflects the Conservation District Subzones in which the project lies. The respective objectives of these subzones are to:

- a. Develop, with proper management, areas to ensure sustained use of the natural resources of those areas.
- b. Designate open space where specific conservation uses may not be defined, but where urban use would be premature.

Although the proposed action is not specifically identified as a permitted use in either subzone, it will be consistent with the subzone objectives as the present use of the project area will remain the same.



ENVIRONMENTAL ASSESSMENT

ENVIRONMENTAL ASSESSMENT for the

HAWAII-5 & PACRIM-EAST CABLE LANDING PROJECT

Keawaula, Oahu, Hawaii

AUGUST 1991

PREPARED FOR:

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ENVIRONMENTAL ASSESSMENT

FOR THE
HAWAII-5 AND PACRIM-EAST CABLE LANDING
KEAWAULA, OAHU, HAWAII

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AUGUST 1991

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PROJECT SUMMARY

Project: Hawaii-5 and PACRIM-EAST Cable Landing

Applicant: American Telephone and Telegraph Company
340 Mt. Kemble Avenue
Morristown, New Jersey 07960

Accepting Authority: City and County of Honolulu
Dept. of Land Utilization

Tax Map Key: 8-1-01: 07, 08, 18, 23

Location: Keawaula, Oahu, Hawaii

Lot Area: Approximately 12,000 sq. ft (existing cable easement)
and 2,000 sq. ft. (new easement for ground bed)

Owner: State of Hawaii
Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809
(808) 548-6550

Agent: R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817
(808) 842-1133

Existing Land Uses Beach Park, Telecommunications Facilities

State Land Use District: Conservation

Development Plan Land
Use Designation: Preservation

County Zoning Designation: P-1 (Preservation-Restricted)

SECTION 1
INTRODUCTION

1.1 PURPOSE

The purpose of this Environmental Assessment is to describe the installation and landing of two transpacific submarine communications cables by American Telephone and Telegraph Company (AT&T) on behalf of the cable owners. The cables are planned to connect the U.S. mainland with Hawaii and Hawaii with Takapuna, New Zealand. The project has been designated by the project proponents as the "Hawaii-5 (HAW-5) and PACRIM-EAST Cable Landing Project." The Environmental Assessment will assess the potential environmental impacts associated with the landing of the cables at Keawaula, their operation, and the maintenance of these fiberoptic cables.

The focus of this Environmental Assessment is the portions of the cable project having to do with the landing of the "HAW-5/PACRIM-EAST" cables at Keawaula. The construction activities are discussed in Section 2.

1.2 PROJECT LOCATION

The site for the HAW-5/PACRIM-EAST cable landing is at Keawaula, Oahu, Hawaii. Keawaula is located along the Waianae coast of the Island of Oahu (see Figure 1). The proposed cables will be laid across lands that are owned by the State of Hawaii (Tax Map key: 8-1-01: 07, 08, 18, 23) and leased to AT&T (State Lease No. S-3809). The cables will be laid within an existing 10-foot wide cable easement which extends from the ocean across Farrington Highway to an existing cable station located approximately 1,200 feet east of Farrington Highway. The cable easement is granted in favor of AT&T.

1.3 DESCRIPTION OF EXISTING FACILITIES

The Keawaula project area already serves as a cable landing site for four undersea cables landed by Teleglobe Canada (see Figure 2). The first two undersea cables were landed at Keawaula in 1963. These cables serve as part of the COMPAC cable system. In 1983, two additional cables were landed within the same easement. These additional cables serve as part of the ANZCAN cable system. Both the COMPAC and ANZCAN cable systems link

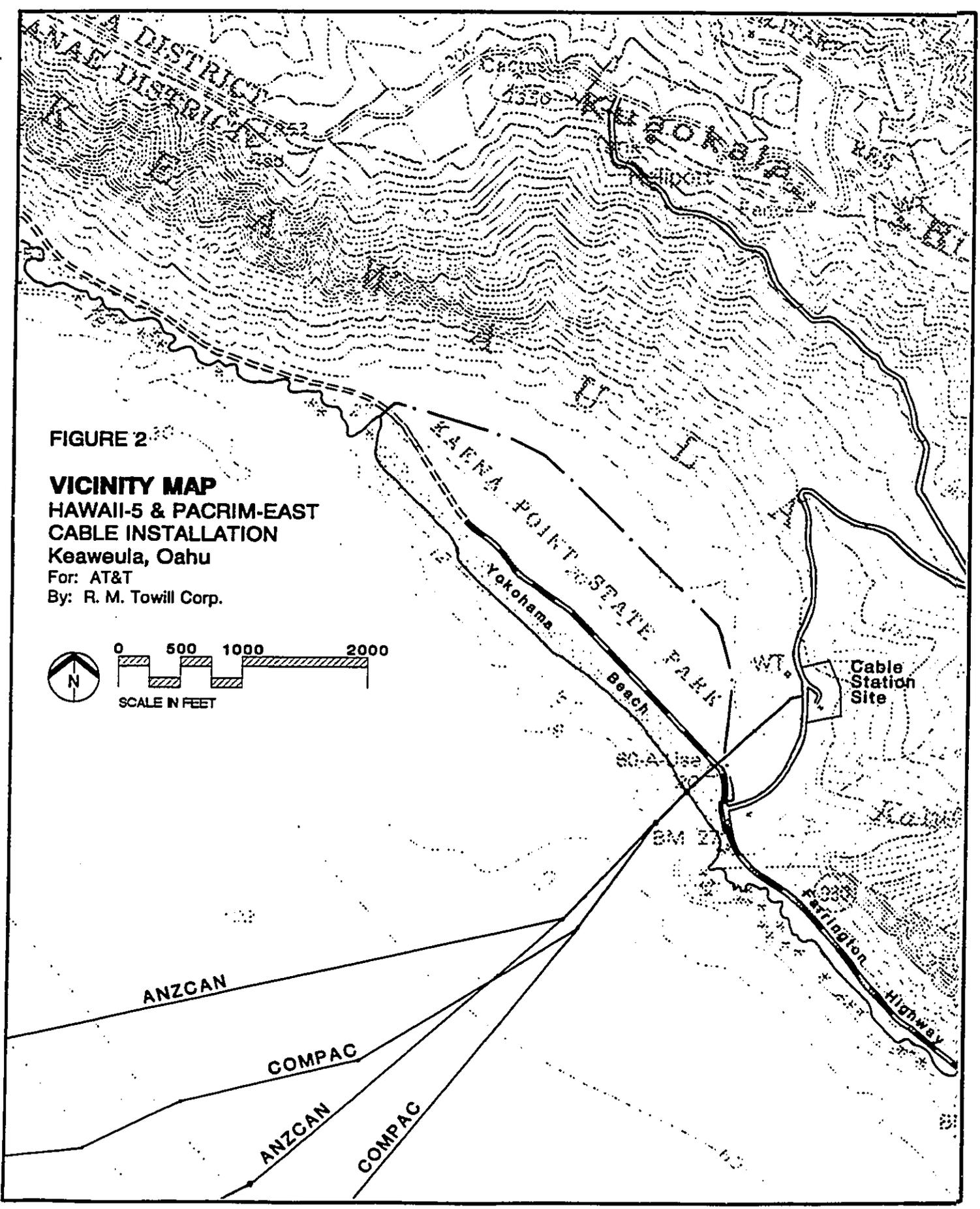
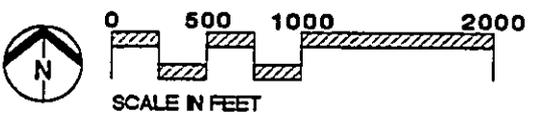


FIGURE 2

VICINITY MAP
HAWAII-5 & PACRIM-EAST
CABLE INSTALLATION
Keaweula, Oahu
For: AT&T
By: R. M. Towill Corp.



Hawaii with Canada and Fiji, Australia and New Zealand.

The existing cable station, built in 1983, is a three-level structure (basement, mezzanine, and ground floor) with most of the floor area located underground. The communications equipment, power equipment and test areas are located underground, and the office, storage and garage areas are located on the ground floor. The gross floor area of the building is approximately 7,082 square feet.

1.4 OBJECTIVES OF THE PROPOSED ACTION

This project will improve the telecommunications service quality currently available in the Pacific ocean region. In order to improve service quality the cable will:

- a. Improve diversity in path media;
- b. Increase restoration capability; and
- c. Provide for additional communications circuits for the forecasted growth in the Pacific Ocean Region (POR).

The proposed improvements will consist of landing new cables at Keawaula and extending these cables underground within existing easements about 1,200 feet to the existing cable station.

SECTION 2
GENERAL DESCRIPTION OF PROJECT CHARACTERISTICS

2.1 PROJECT OVERVIEW

The installation and landing of the Hawaii-5 and PACRIM cables are being proposed in order to increase the available circuits between Hawaii and the mainland and between Hawaii, Asia and the Pacific. It is anticipated that both cables will be fully subscribed by 2005. The owners of the cables are as follows:

Hawaii-5

- American Telephone and Telegraph Company
- Fedex International Transmission Corporation
- FTC Communications, Inc.
- GET Hawaiian Telephone Company Incorporated
- Long Distance/USA
- MCI International, Inc.
- TRT/FTC Communications, Inc.
- US Sprint Communications Company Limited Partnership
- World Communications, Inc.

Pacrim-East

- American Telephone and Telegraph Company
- FTC Communications, Inc.
- GET Hawaiian Telephone Company Incorporated
- Overseas Telecommunications, Inc.
- TRT Telecommunications Corporation
- US Sprint Communications Company Limited Partnership
- World Communications, Inc.

This section describes the fiberoptic cables that will be laid and the proposed construction activity both on land and in the nearshore waters off Keawaula, Oahu, Hawaii.

2.2 TECHNICAL CHARACTERISTICS

2.2.1 Fiberoptic Cable

The AT&T fiberoptic submarine cable "SL" design incorporates three working lightguide

pairs (two working pairs and one spare pair) with associated regenerators and supervisory circuits. The "SL" deep sea cable structure consists of:

- A unit fiber structure of six lightguides in a helical path embodied in an extruded elastomer surrounding a king wire with a nylon overjacket.
- A DC power conductor/strength member of a double layer of strength wires over the unit fiber structure, overlaid with a continuous welded swaged copper tube.
- Polyethylene insulation over the copper tube.

2.2.2 Proposed Cable Alignment

The proposed alignments of the HAW-5/PACRIM-EAST cables are shown in Figure 3. The proposed cables will be placed within existing cable easements as described in Section 1.2.

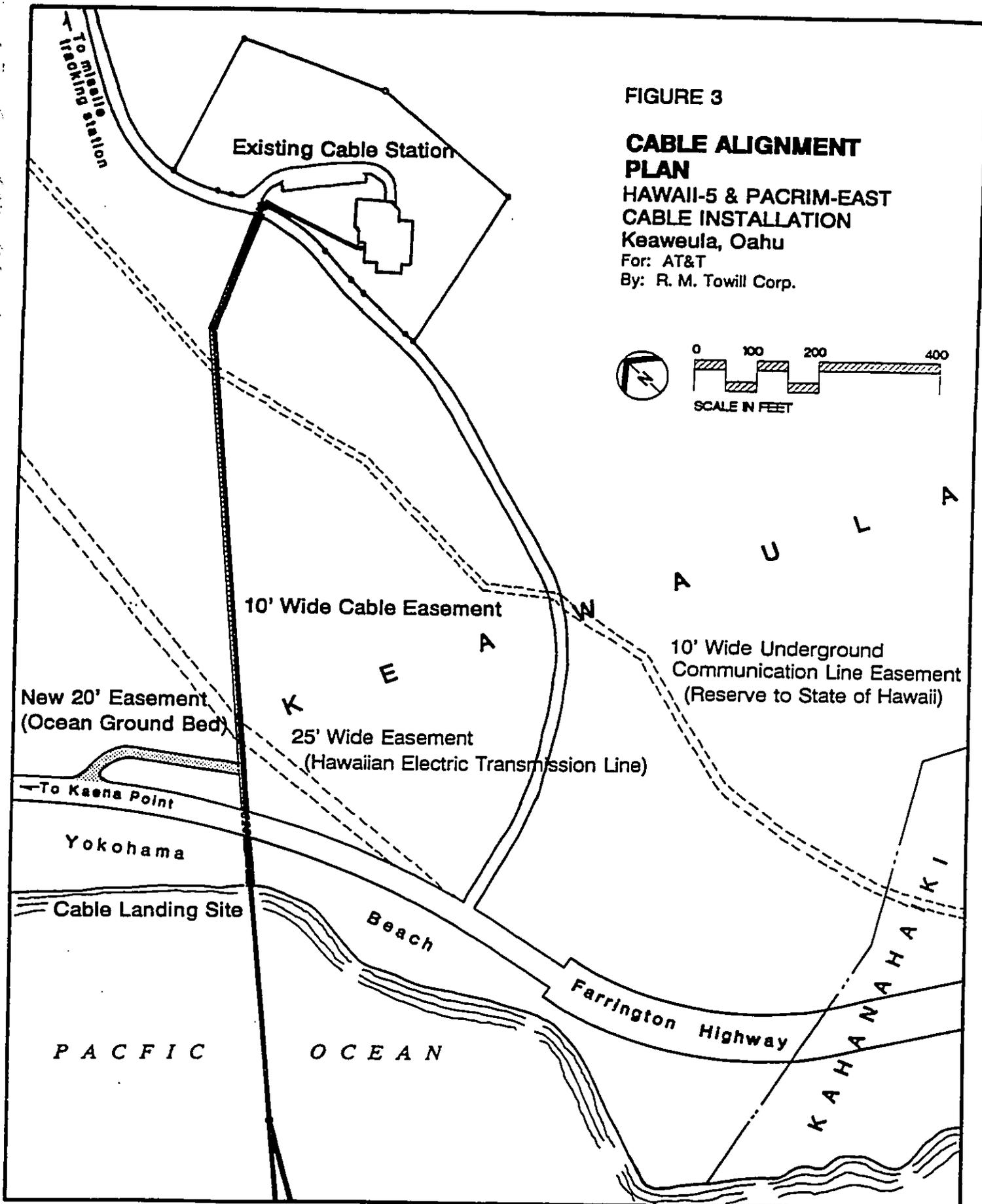
2.3 CONSTRUCTION ACTIVITIES

2.3.1 Schedule and Estimated Cost

Project construction work will be accomplished in two phases. The first phase will involve the land-end activity of installing cable conduits from the existing cable station to the beach. It will take place approximately in November and December 1991. The second phase of work will be in conjunction with the cable landing and will entail the trenching of the beach and nearshore area; placement of temporary landing targets; and the cable landing process. This phase will occur in September and October of 1992. Construction costs, excluding costs for the cables and grounding anodes, is estimated at \$300,000.00.

2.3.2 Land-End Activity

The land-end construction activities will initially involve excavation of material within the existing 10-foot wide cable easement from the existing cable station to the eastern edge of the Farrington Highway right-of-way (approximately 1,000 feet). After the material is removed, six 4-inch PVC conduits will be placed in the trench and encased in concrete (see Figure 4). Along with the installation of the conduits, a 5'x12'x7' manhole will be constructed at the cable station site. Upon completion of installation of conduits, two cables



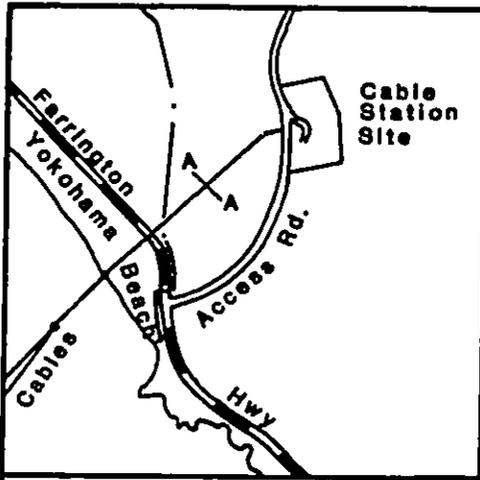
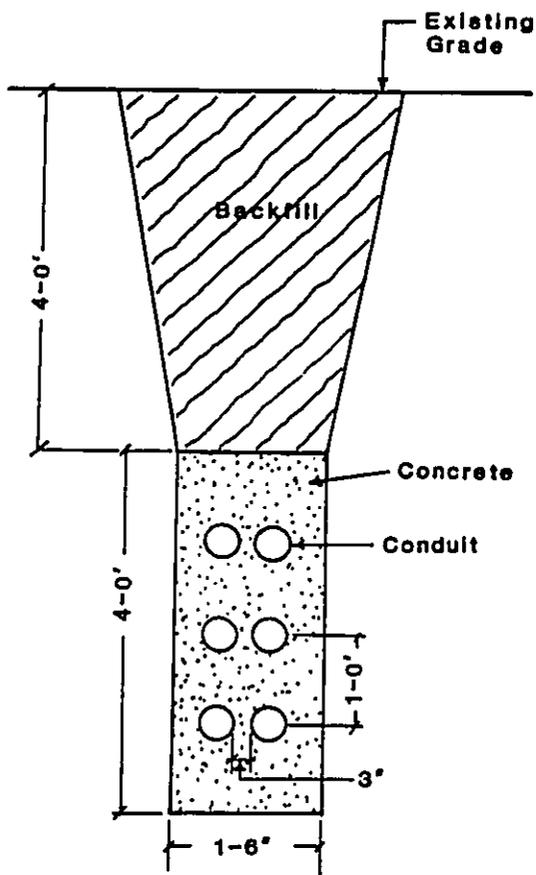


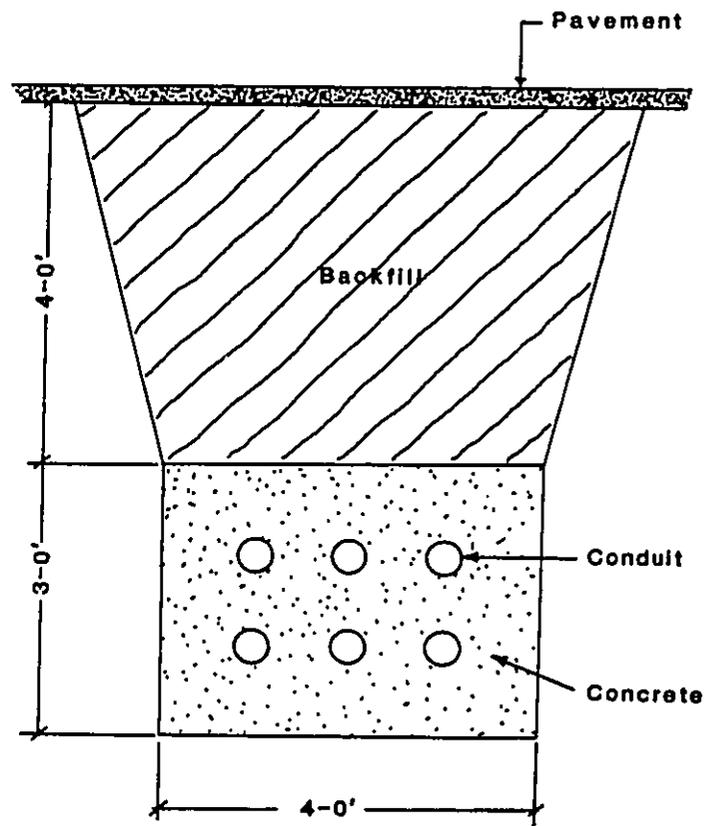
FIGURE 4

TRENCH SECTIONS
HAWAII-5 & PACRIM-EAST
CABLE INSTALLATION
 Keaweula, Oahu
 For: AT&T
 By: R. M. Towill Corp.

Section AA



Section at Highway

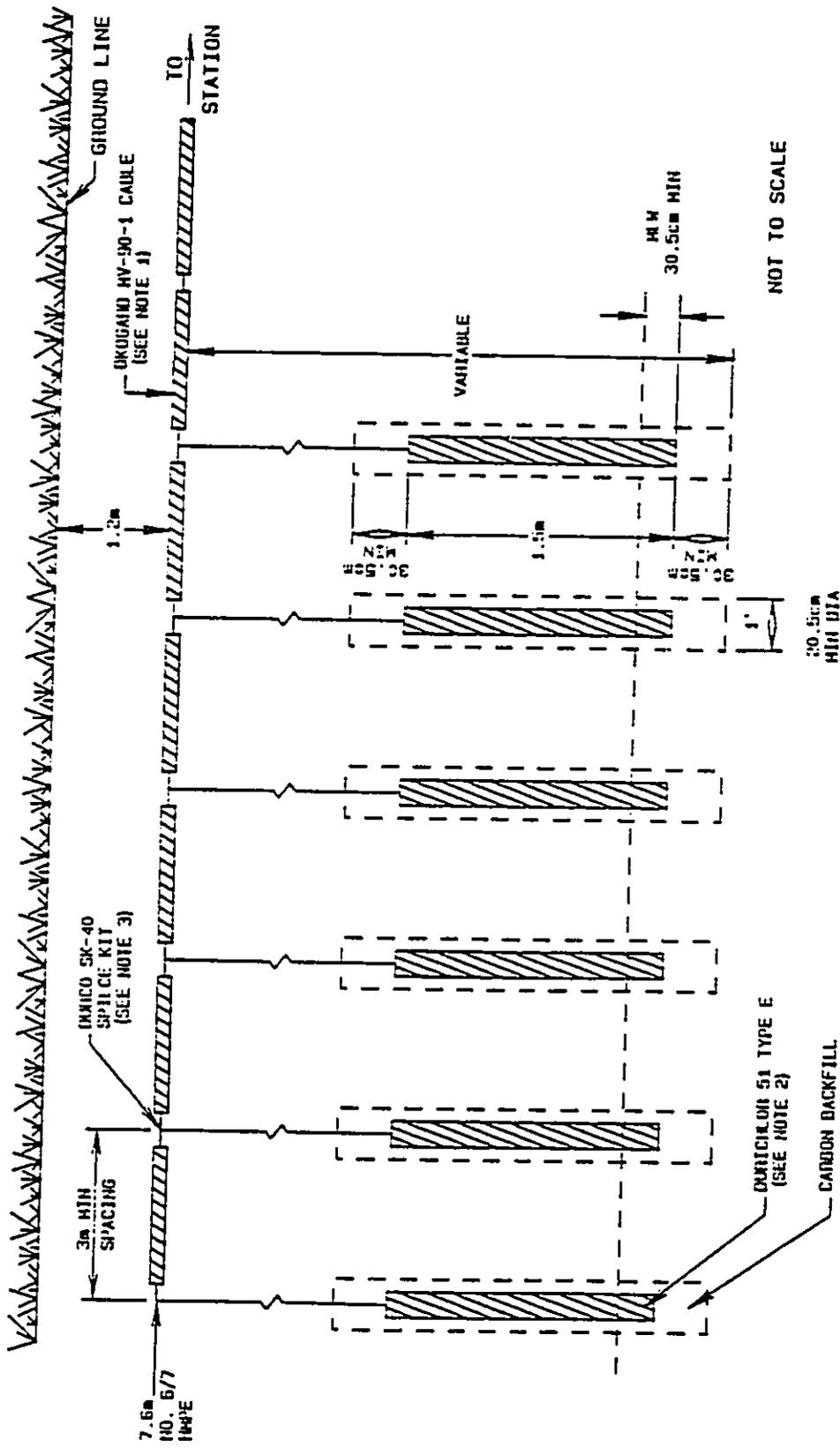


SCALE: 1/2" = 1'-0"

will be pulled through the conduits. A new manhole (6'x12'x17") about 50 feet mauka of Farrington Highway will be constructed within the cable easement. From this manhole, the cables will be connected to a new ocean ground bed (see Figure 5). The ocean ground bed will consist of six anodes located approximately 150 feet northwest of the manhole and 50 feet from the Farrington Highway right-of-way. Each of the anodes will be prepackaged in carbon backfill approximately eight inches in diameter and buried beneath the ground surface about 10 feet apart. Although the ground bed will only occupy an area approximately one foot wide by 50 feet long, a new easement, approximately 20'x30', will need to be established to allow access from Farrington Highway for future maintenance. The cable connecting the ground bed to the manhole will be buried approximately four feet deep within the new easement. Once installation is completed, all surfaces will be returned to their original grade and replanted.

The excavation of material from the new manhole to the ocean will require crossing the Farrington Highway right-of-way and the beach area. When crossing Farrington Highway, traffic will be routed along the eastern shoulder of the highway with the aide of necessary safety measures such as temporary traffic control devices (cones) and/or flagmen to direct traffic. Four 6-inch steel pipes will also be placed into these sections of the easement to encase the new cables. Within the beach area, the conduits will extend approximately 50 feet west of the roadway right-of-way. From that point seaward, the cables will be buried beneath the surface without the conduit casing. Following installation of the conduits, the road will be restored to its original condition.

The second phase of work will entail the excavation of sand to expose the trench which contains the existing cables. This work will be done just prior to the landing of the cables in October of 1992. The existing cables are currently buried in the sand at a depth of 3 to 7 feet. The upper layer of sand will be removed by machinery (either clamshell or backhoe). Layers of sand that are closer to the existing cables will be removed manually. Dewatering of the exposed trench may also be required. The excavated sand will be stored on the beach adjacent to the work site for later placement back into the excavated trench. Approximately 185 (10'x 100'x 5') cubic yards of sand will be excavated and will be placed adjacent to the



- NOTES: 1 - CABLE DESCRIPTION: UKUGARD HV-90-1 0KV SHIELDED POWER CABLE WITH 1/32" DIA. COPPER, .115" EPA, .030" SEMICONDUCTING THL, .005" BARE COPPER TAPE SHIELD, .080" UKOLITE HIGH DENSITY POLYETHYLENE JACKET. OBTAIN FROM: UKOLITE COMPANY, BARCEL, NEW JERSEY
- 2 - ANODE DESCRIPTION: DUNICO 51 TYPE E EQUIPPED WITH 7.6m OF NO. 6/7 INP/E PREPACKAGED IN CARBON BACKFILL. OBTAIN FROM: THE DUNICO COMPANY, INC., DAYTON, OHIO.
- 3 - SPLICE KIT: DUNICO SK-40 SPLICE KIT WILL BE USED AT ALL CABLE TO ANODE CONNECTIONS.

FIGURE 5
OCEAN GROUND BED SECTION
HAWAII-5 & PACRIM-EAST
CABLE INSTALLATION
 Keaweula, Oahu
 For: AT&T
 By: R. M. Towill Corp.

AT&T - INTERNATIONAL CABLE ENGINEERING AND CONSTRUCTION

cable easement on the beach.

Two range targets (alignment markers) will be placed on land just prior to the landing of the cables to aid in the cable laying process. The first range target will be placed on the western (makai) edge of the Farrington Highway right-of-way over the existing cable easement with the second target located approximately 164 feet east of the front range target. 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 Farrington Highway.

2.3.3 Nearshore Activity

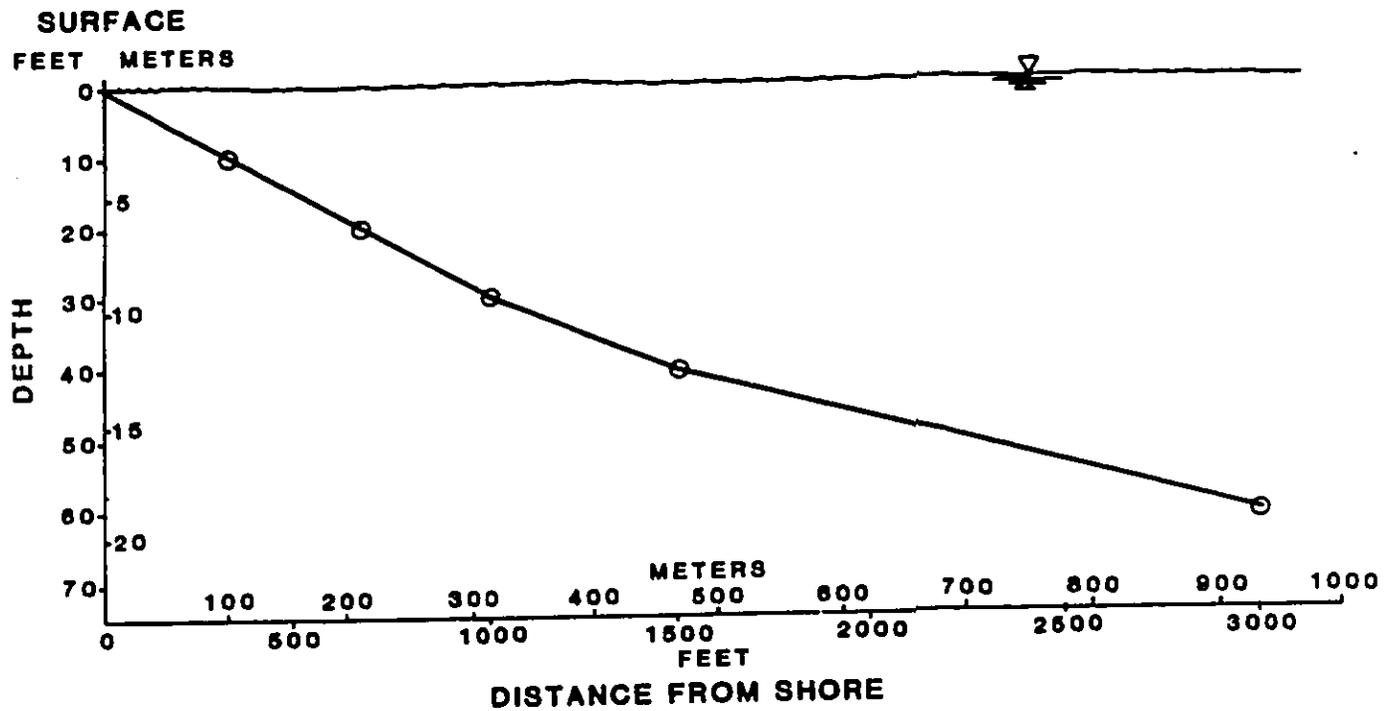
From the mean high water mark, the cables will be placed in a trench for a distance of approximately 30 feet seaward. Figure 6 shows a section through the area on the beach and in the water. The work in this nearshore area requires the removal of the sand which covers the existing cables. For this process, machinery will be used to remove the upper layers of sand. A hydro-jet will be used to remove the remaining sand. If necessary, sandbags will be placed in the water to prevent the sand from reentering the open trench. In the water, screens will be placed to reduce turbidity impacts. The sand that is removed will be stored onshore for later backfilling.

After the cable landing, approximately 985 feet of each cable will be encased in an armor protection from the end of the steel pipe seaward. This encasement will provide the cables protection in the nearshore area.

2.3.4 Cable Landing Process

The cable landing process includes the use of the landside range targets (alignment markers) to assist in the alignment of the cables as they are being installed. The cable laying ship will be assisted by two tugboats to maintain proper alignment of the cable ship. This assistance is essential to ensure that the cables are placed within the cable easements. Once the cable laying ship is properly aligned, the cables will be towed one at a time from the ship by one of the tugs to a transfer location nearshore. At this location, the leading ends of the cables

**FIGURE 6
GENERAL BOTTOM PROFILE**



GENERAL BENTHIC AND BIOLOGICAL DESCRIPTION

DEPTH (ft)	Benthic and Biological Characteristics
10	No live coral coverage, however, scattered consolidated coral protrudes up to 3 feet above the sand substratum. Cable is buried in sand until depth of 10 to 12 feet where a small cut through solid limestone allows the cable to continue seaward with only a short segment visible above the surrounding sand.
20	Sand substratum with cables buried, estimated depth of up to 18 inches.
30	From 15-foot depth to 60-foot depth, cables are alternately buried in sand and exposed where it passes over areas of consolidated coral that protrude above the sand. Live coral coverage less than 1 percent.
40-45	Depth range where highest live coral coverage of 10 percent (maximum visually estimated) was observed.
60	Hard, consolidated coral substratum characterized by very low relief (1 to 2 feet) and live coral coverage (1 to 2 percent).

SOURCE: Environmental Impact Assessment for the Teleglobe, Canada ANZCAN Cable Landing at Keawaula, Oahu, December 1980.

will be attached to a wire rope connected to land based pulling equipment (i.e., winch) and pulled ashore. Once the cables are placed within the trench, the leading ends of the cables will be secured within the manhole and spliced together with cables emanating from the cable station. AT&T personnel will perform all splicing and cable terminating operations.

After the cables have been landed, the cable laying ship will lay out to sea to connect the deep water portion of the cables with the shore-end portion of the cables. This connection will occur beyond the three-mile territorial limit.

Once the cables have been secured, the open trench will be backfilled and the beach restored to its original condition.

2.3.5 Safety Considerations

During the construction phase on the beach (approximately 30-45 calendar days, September-October 1992), the portion of the beach which contains the open trench will be barricaded from public entry. During the construction period, a security guard will be on duty at night and weekends to ensure public safety and integrity of the job site.

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

SECTION 3
DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 PHYSICAL CHARACTERISTICS

3.1.1 General Site Characteristics

The general physical characteristics of the project area can be summarized as follows:

- a. Average temperature of 75°.
- b. Average annual rainfall of approximately 20 inches.
- c. Northeasterly tradewinds from the ocean with average speeds of 18.4 to 23 miles per hour.
- d. Tidal currents flowing northwest to southeast during flood tide; currents with a reversed movement during ebb tides.
- e. Plant materials primarily include assorted grass and koa haole trees.
- f. Located within the tsunami inundation zone.
- g. Land consisting mainly of stony and rocky land types with well drained soils of reddish silty clay loam and very dark grayish-grown clay.
- h. No known archaeological sites exist in the cable easements. Although there are some features in the vicinity of the project site, they will not be affected by the proposed action as work will be confined within the easements through areas where the archaeological features are located.

3.1.2 Beach Zone

The project location is within a portion of the Kaena Point State Park. The beach slopes to the water's edge at a slope of approximately 5 percent. There are no structures on the beach. The beach zone (between the ocean and road) is devoid of trees. Portions of the area between the edge of the road and the beach is grassed. The width of the beach (shoreline to roadway) varies depending on the season with the average width being approximately 100 feet.

3.1.3 Nearshore Waters

The bottom profile of the nearshore zone is shown in Figure 6. Within 100 feet of the

shoreline, the bottom depth is -5 feet, within 500 feet it is -15 feet. The nearshore bottom is predominantly sand. The existing submarine cables are laid directly on the ocean bottom except for that portion of the cable near the shoreline. This portion is covered with sand.

3.1.4 Coastal Views

Views of Yokohama Beach and the Waianae Coast are available from the portion of Farrington Highway that crosses the project area.

3.2 SOCIO-ECONOMIC CHARACTERISTICS

3.2.1 Existing Land Use (Vicinity)

The predominant use that will be affected by the proposed project is the Kaena Point State Park. Also, located nearby on the ridge on the east side of Farrington Highway is an Air Force installation.

3.2.2 State Land Use

The State land use classification of the project site is classified as "Conservation." No land use change is required for the cable landings. Construction activity in the water will require a Conservation District Use Permit. Further, coordination with the State Department of Transportation, Harbors Division, and the Coast Guard is required to advise mariners of the proposed cable landing.

3.2.3 City and County Land use

A. Development Plan

The project site is designated "Park." No land use change is required for the proposed cable landings.

B. Zoning

The zoning for the project is "Preservation - Restricted" (P-1). No zoning change is required for the proposed cable landings.

3.2.4 Special Management Area

The project area is within the Special Management Area Boundary as defined by the City

and County of Honolulu (see Figure 7). A Special Management Area Permit will be required for the proposed construction activity pursuant to ordinance 84-4 (as amended).

The proposed project, portions of which are within the shoreline setback area, is also subject to the provisions of the Shoreline Setback Rules and Regulations of the City and County of Honolulu. Figure 8 shows the certified shoreline and shoreline setback line in the area where the project crosses the shoreline setback area. A Shoreline Setback Variance Permit will be required.

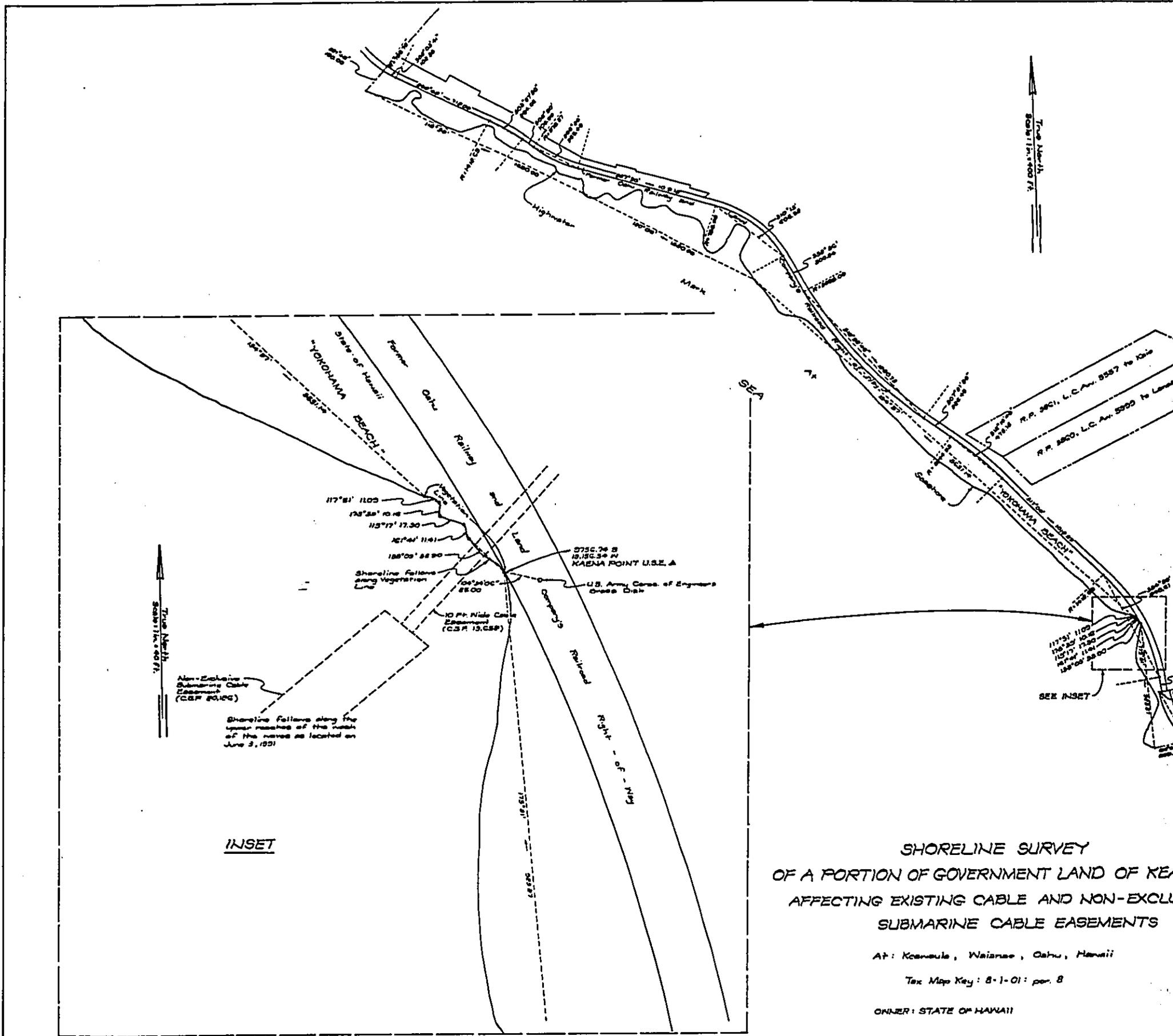
3.3 PUBLIC FACILITIES AND SERVICES

3.3.1 Transportation Facilities

The project site is served by Farrington Highway (State Route No. 930). The right-of-way width fronting the project site is 50 feet. Construction within the roadway right-of-way will involve excavation of the pavement and subsurface within the 10-foot easement, placement of the conduits within the exposed trench, routing traffic along the eastern shoulder, and restoring the roadway to its original condition after installation of the cables.

3.3.2 Recreational Facilities

The principal recreational facility in the vicinity of the project site is the Kaena Point State Park. The beach park (Yokohama Beach) is used for swimming, sunbathing, surfing, skindiving and picnicking. The proposed action will only marginally disrupt recreational activity in November and December of 1991 and September and October of 1992 during the cable laying processing on a small portion of the park while the excavation activity takes place. During the cable landing phase of the project (September/October 1992), activity in the water near the landing area will need to be suspended for approximately two days for the safety of the beach and ocean users.



SHORELINE SURVEY
 OF A PORTION OF GOVERNMENT LAND OF KEOLU
 AFFECTING EXISTING CABLE AND NON-EXCLUSIVE
 SUBMARINE CABLE EASEMENTS

At: Keolu, Waianae, Oahu, Hawaii

Tax Map Key: 8-1-01: per. 8

OWNER: STATE OF HAWAII

CERTIFICATION PENDING APPEAL DE

R. M. TOWILL CORPORATION
 Engineers-Surveyors

SECTION 4
PROBABLE IMPACTS OF THE PROPOSED ACTION
AND MITIGATING MEASURES

4.1 SHORT-TERM IMPACTS

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

4.1.1 Noise From Construction Activity

During the construction phase of the project excavation work and cable laying equipment and machinery will be used which will be sources of noise. Noise generated from machinery can be mitigated to some degree by requiring contractors to adhere to State and County noise regulations. This includes ensuring that machinery are properly muffled. Some work at night may be required. Night activities include cable splicing, cable pulling, operation of machinery, etc.

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

4.1.2 Dust Control

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

4.1.3 Traffic Impacts

During the construction phase of the proposed project when the cables are laid across the roadway right-of-way, traffic along Farrington Highway will be disrupted. Because this segment of roadway experiences very little traffic, the temporary disruption is not expected to have significant adverse impacts on motorists. A traffic control plan will be developed and filed with the State Department of Transportation.

4.1.4 Aesthetics

During the construction period, the beach portion of the project site will have construction equipment and a mound of sand from the excavated trench. This visual impact will be limited to the construction period. After the cables are installed, the beach will be returned to its original state, therefore, no long-term impact is anticipated.

4.1.5 Restricted Access

During the excavation period, a portion of the beach will be closed to the public. Access will be restricted by a barricade around the work site. To further ensure that unauthorized personnel do not enter the work site, a security guard will be on duty during non-working hours. This closure of a portion of the beach will be only for the duration of the cable laying process. No long-term impacts are anticipated.

During the cable landing, a portion of the nearshore waters will be closed to public access (estimated to be two days). Two methods will be used to keep unauthorized water craft out of the operation area. The first method is to advise mariners through the published "Advice to Mariners." The second method will be to have personnel in small crafts on-site to advise mariners of the work in progress and to advise them to avoid the area.

4.1.6 Siltation of Nearshore Waters

It is anticipated that the nearshore waters will be clouded during the trench excavation and backfilling operations. A screen to lessen turbidity effects will be erected to minimize this impact. Water collected during the dewatering process will be discharged on the beach adjacent to the work area.

4.2 LONG-TERM IMPACTS

There are no long-term adverse impacts that can be associated with this proposed action. The project site will be restored to its original state after the completion of the cable laying.

The long-term positive benefit of this proposed action is the increase in telecommunications capacity which has international benefit.

SECTION 5
ALTERNATIVES TO THE PROPOSED ACTION

5.1 NO ACTION

The no action alternative is undesirable because "no action" will mean that the objectives of the project, to increase service quality and increase telecommunications capacity, cannot be met. While there are alternative means of increasing telecommunications capacity (i.e., satellites) cables, particularly fiberoptic cables, have been proven to be a desirable choice for those who require a high degree of security and digital communications capabilities.

5.2 ALTERNATIVE SITES

Alternative sites, while theoretically available, were not considered because of the added cost and time involved in the selection of an appropriate site and construction of a new cable station. Further, any new site selected would require the laying of land lines to the new cable station which would be an additional burden placed on the cable proponents.

5.3 PROPOSED ACTION

The proposed action has the advantage of using existing facilities (cable station and cable easement) that would cause a minimum of adverse short-term and long-term environmental impacts.

SECTION 6
RELATIONSHIP BETWEEN LONG SHORT-TERM USES OF
MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT
OF LONG-TERM PRODUCTIVITY

The proposed action will not present any significant change in the use of the project area. The project site will be restored to its original condition once the cable laying process is completed. Short-term losses and long-term gains will result from the proposed action.

The primary short-term loss that is anticipated is related to the temporary closing of a portion of the beach to use by the public during the construction period. The beach closing is seen as an essential element to ensure the safety and welfare of beach users. The area beyond the immediate work site will continue to be available to beach users. During the cable laying process, the waters within the cable alignment will also be closed to swimmers, surfers, divers, and mariners. This closing is also seen as an essential element of the overall project to ensure the safety of users.

The long-term gain will be in the provision of additional capacity of telecommunications services. The project will maintain and enhance economic productivity by increasing telecommunications capacity between the U.S. mainland, Hawaii, and countries in the Pacific and Asia.

SECTION 7

**IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF
RESOURCES BY THE PROPOSED ACTION**

The proposed cable installation will require an irretrievable and irreversible commitment of a number of resources for its completion. These resources include capital, materials, manpower and energy. Financial, material and manpower resources will be irretrievably committed to the planning, design and installation of the cable. Energy is another valuable resource which will be required for the completion of the proposed cable installation.

There will be no change to the present use of the beach and water (ocean) resources.

SECTION 8
REQUIRED PERMITS AND APPROVALS

8.1 FEDERAL

Section 10, Rivers and Harbors Act
Army Corps of Engineers

Section 404, Clean Water Act
Army Corps of Engineers

8.2 STATE

Conservation District Use Permit
Department of Land and Natural Resources

Coastal Zone Management Federal Consistency Review
Department of Planning and Economic Development

Section 401, Clean Water Act
401 Water Quality Certification
Department of Health

Title 11, Administrative Rules, Chapter 43
Department of Health

8.3 CITY AND COUNTY OF HONOLULU

Shoreline Setback Variance
Department of Land Utilization

Special Management Area Use Permit
Department of Land Utilization

Building Permit
Building Department

SECTION 9

FINDINGS AND REASONS SUPPORTING DETERMINATION

The installation and landing of the transpacific submarine communications cables by AT&T is proposed at Keawaula, Oahu, Hawaii (Tax Map Keys: 8-1-01: 07, 08, 18, 23). The proposed cables will increase telecommunications capabilities between the US mainland, Hawaii and abroad. These new cable will be laid within an existing 10-foot wide cable easement which extends from the ocean to an existing cable station located approximately 1,200 feet east of Farrington Highway. The easement already contains four submarine cables previously installed in 1963 and 1983 and a fiberoptic terrestrial cable installed by Hawaiian Telephone.

The proposed cable installation and landing will not cause any significant adverse impacts within the immediate area or vicinity of the project site. Temporary impacts (during construction and installation period) will include: a slight increase in traffic due to the movement of construction vehicles, closure of a portion of the beach and nearshore waters, redirection of vehicles during construction within the roadway right-of-way, and increase noise and dust. When the installation and landing is completed, the project site will be restored to its original state.

The proposed action will not result in loss or destruction of natural or cultural resources, will not adversely effect the social or economic welfare of the community, County or State, and will not conflict with future plans and policies of the County of State.

SECTION 10
AGENCIES, ORGANIZATION AND INDIVIDUALS CONSULTED

10.1 FEDERAL AGENCIES

U.S. Army Corps of Engineers

10.2 STATE AGENCIES

Department of Land and Natural Resources

Department of Transportation

Department of Business, Economic Development and Tourism

Department of Health

Office of State Planning

10.3 CITY AND COUNTY OF HONOLULU

Department of Public Works

Department of Parks and Recreation

Department of Land Utilization

Neighborhood Board No. 29 (Waianae)

10.4 ORGANIZATIONS AND INDIVIDUALS

Hawaiian Telephone Company

REFERENCES

1. Federal Communications Commission, "PACRIM-EAST Cable Landing License Application", February 7, 1990.
2. Federal Communications Commission, "HAW-5 Cable Landing License Application", March 30, 1990.
3. University of Hawaii, Department of Geography, Atlas of Hawaii, University Press, 2nd Edition, 1983.
4. State of Hawaii, Department of Planning and Economic Development, State Data Book, 1989.