DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
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DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

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2001/SMA-4 (DT)
2000/SV-12

June 15, 2001

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
State Office Tower, Room 702
235 South Beretania Street
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

CHAPTER 343, HAWAII REVISED STATUTES
FINAL ENVIRONMENTAL ASSESSMENT (EA)

Recorded Owner	:	State of Hawaii/City and County of Honolulu
Applicant	:	TyCom Networks (US) Inc.
Agent	:	R.M. Towill Corporation (Chester Koga)
Location	:	Kahe Point Beach Park, Waianae Wastewater Treatment Plant Outfall, and along a portion of Farrington Highway
Tax Map Keys	:	9-2-3: por. 15 and 8-6-1: por. 7
Request	:	Special Management Area Use Permit and Shoreline Setback Variance
Proposal	:	Install fiber optic cables, new manholes and ductlines
Determination	:	A Finding of No Significant Impact is Issued

Attached and incorporated by reference is the Final EA prepared by the applicant for the project. Based on the significance criteria outlined in Title 11, Chapter 200, Hawaii Administrative Rules, we have determined that preparation of an Environmental Impact Statement is not required.

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final EA. If you have any questions, please

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Ms. Genevieve Salmonson, Director
Page 2
June 15, 2001

We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final EA. If you have any questions, please contact Dana Teramoto of our staff at 523-4648.

Very truly yours,

Barbara A Moore
For RANDALL K. FUJIKI, AIA
Director of Planning
and Permitting

RKF:nt

attachs.

cc: R. M. Towill Corporation
(Chester Koga)

posse doc no. 100901

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2001-07-08-OA-FEA-

FILE COPY

FINAL

ENVIRONMENTAL ASSESSMENT

FOR THE

TGN HAWAII CABLE SYSTEM

KAHE POINT BEACH PARK, OAHU, HAWAII
WAIANAE WASTEWATER TREATMENT PLANT OUTFALL
OAHU, HAWAII

Prepared for:
TyCom Networks (US) Inc.
Patriots Plaza, Building A
60 Columbia Road
Morristown, NJ 07960

June 13, 2001

Prepared By:
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941
1-18902-0E

FINAL

ENVIRONMENTAL ASSESSMENT

FOR THE

TGN HAWAII CABLE SYSTEM

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WAIANAE WASTEWATER TREATMENT PLANT OUTFALL
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Figure No. | Description

PROJECT SUMMARY

Project:	TGN Hawaii Fiber Optic Cable System
Applicant:	TyCom Networks (US) Inc. Patriots Plaza, Building A 60 Columbia Road Morristown, NJ 07960 Contact: Mr. Ben Delisle 973-656-8610
Accepting Authority:	City and County of Honolulu Department Planning and Permitting
Tax Map Key (area)	Kahe Park: 9-2-3:15 (4.47 acres) Waianae WWTP Outfall Site: 8-6-01: por. 7 (17.75 a)
Location:	Kahe Point Beach Park, Waianae, Oahu Waianae WWTP Outfall, Waianae, Oahu Farrington Highway, Waianae, Oahu
Owner:	Department of Budget and Fiscal Services City & County of Honolulu 650 South King Street Honolulu, Hawaii 96813 523-4796
Agent:	R. M. Towill Corporation 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817 Contact: Chester Koga, AICP Tel: 842-1133 Fax. 842-1937
Existing Land Uses:	Recreational Area, Beach Park
State Land Use District:	Urban, Agriculture and Conservation
General Plan Land Use Designation:	Preservation
County Zoning Designation:	P-2 (General Preservation)

EXECUTIVE SUMMARY

TyCom Networks (US) Inc. (TyCom), the world's leading network supplier of undersea telecommunications systems, has recently announced its intent to design, install, and maintain the **TyCom™ Global Network** (TGN). Upon completion, this system will be the largest and most advanced global undersea telecommunications fiber optic network in the world. As part of the development of the TGN, TyCom Networks (US) Inc. now proposes to land submarine cables in Oahu, Hawaii, linking the State with the continental United States, Guam, Hong Kong and Japan. Designed to provide voice, data and video traffic infrastructure, this system will connect Hawaii with more than 30 major world industrial and municipal telecommunication hubs. Realizing the goals set by the Hawaii State Plan to develop Hawaii's telecommunication infrastructure and positioning it as a leader in information services in the Pacific, this project will provide additional telecommunication capacity, accommodate exponential increases in global telecommunication traffic, improve system integrity; and, provide additional path diversity.

The proposed landing locations of the cable system are at Kahe Point Beach Park and at the Waianae Wastewater Treatment Plant's (WWTP) Outfall site adjacent to Lualualei Beach Park. A terrestrial conduit and fiber optic cable installation along Farrington Highway from Kahe Point Beach Park to the Waianae WWTP Outfall site, connecting to the cable station at Maili is also proposed.

In preparing this Environmental Assessment (EA) and before finalizing any plans, this project was presented and discussed at Neighborhood Board meetings. In addition to the 50+ copies of the Draft EA were distributed for review and comment, input from several key and concerned members of the community was solicited. Elected officials were likewise contacted and consulted. Many comments were received, incorporated into the final EA, and were influential in the final selection of the two landing locations.

With this valuable input from the community, detailed planning, and careful construction, impacts to the environment, archeological resources, and the community have been minimized. Impacts to the environment have been limited by employing the use of Horizontal Directional

Drilling (HDD) technology where feasible, reducing the disturbance to the land and community. An archeological monitoring program has been established to ensure that no historical artifacts are lost or destroyed. Community members have provided valuable input to help formulate plans that will minimize disturbance to the community during construction activities.

Installation of the system will have impacts to the community during the construction period. Traffic flow may be impeded during some periods of the construction. Every effort has been made to reduce this burden on the community. To mitigate this, HDD, dual work shifts, night work, limited open trenches, and coordination with other construction projects have all been employed.

Once installed, the cable system will be virtually invisible to the community. Manhole covers will be the only visible structure. All sites will be restored to pre-construction condition or better.

By installing TGN in Hawaii, TyCom Networks (US) Inc. brings tremendous opportunity to Hawaii. By increasing bandwidth capacities, TyCom Networks (US) Inc. sets the stage for Hawaii's leadership position in the telecommunication industry in the Pacific.

SECTION 1
INTRODUCTION

1.1 INTRODUCTION

TyCom Networks (US) Inc. is a vertically integrated designer, builder, installer, and maintainer of transoceanic fiber optic communication systems. With cable, repeater, and transmission equipment manufacturing at facilities located in New Hampshire and New Jersey, its internationally distinguished TyCom Laboratories, located in Eatontown, New Jersey, provides leading edge fiber optic technology. In addition TyCom Networks (US) Inc. owns and operates 13 world-class cable ships for the installation and maintenance of undersea communication network systems. Having successfully completed 85 undersea networks, consisting of more than 300,000 kilometers of cable and connecting over 100 countries, TyCom Networks (US) Inc. is the world's leading network supplier of undersea telecommunications systems.

TyCom Networks (US) Inc. has recently announced its development of the **TyCom™ Global Network** (TGN). Upon completion, the system will be the largest and most advanced global undersea telecommunications fiber optic network in the world. Also, the deployment of TGN will make TyCom Networks (US) Inc. the industry's first and only fully integrated fiber-optic network owner and supplier.

The **TyCom™ Global Network** (TGN) will be implemented in phases, segmented by geographical regions. Phase 1 of TGN will offer a minimum upgradeable bandwidth capacity from 980 gigabits per second up to 7.68 terabits per second (depending on region), will span over 70,000 km, and connect more than 30 major cities and locations worldwide. The transatlantic portion of Phase 1 will be operational by mid-2001, and the remainder of Phase 1 by mid-to end-2002. Subsequent phases will be implemented based on global and regional demand. Ultimately, TGN will span approximately 250,000 undersea kilometers, and link terrestrial networks on all six inhabited continents. Phase 1 of TGN will offer capacity up to 7.68 terabits over a fully integrated system that will connect New York, London, Tel Aviv, St. Petersburg, Hong Kong, Tokyo, Guam, Hawaii, Seattle, Los Angeles and 15 major European cities. TyCom Networks (US) Inc. will utilize its own state-of-the-art technology to design and manufacture all the cable, optical amplifiers and terminal equipment needed for Phase 1. TyCom Networks (US) Inc. will also design, build and equip the requisite network operating centers, telehouses and cable stations which route the bandwidth traffic flowing over TGN.

TyCom Networks (US) Inc. now proposes, as part of the development of the TGN, to develop a submarine and terrestrial fiber optic cable system, and link Hawaii with the continental United States, Guam, Hong Kong and Japan. This system, designed to provide voice, data and video traffic infrastructure, will connect Hawaii with more than 30 major world industrial and municipal telecommunication hubs. When completed this project will provide additional telecommunication capacity to accommodate exponential increases in global telecommunication traffic, improve system integrity, and provide additional path diversity.

Today's submarine communication cables are constructed of steel wires, polyethylene, copper, and optical fibers. They employ fiber optic technology to transmit signals of light which are converted into voice and data signals. The TGN Hawaii submarine fiber optic cable will contain 16 fiber optic strands and be approximately 1.5 inches in diameter. The terrestrial cable is constructed of rubber insulation, inner steel structure, and optical fibers. The terrestrial cable will also have 16 fibers and be approximately 5/8 inches in diameter.

Fiber optic technology is utilized because:

- Fiber optic cables provide superior capacity. Each cable to be installed has a combined capacity of 10,000,000 voice calls where each fiber has the capacity of 10 gigabits; and
- The smaller diameter fiber cable ensures there will be minimal disturbance to the marine environment necessary to install the cable. There is less land needing to be graded, cleared and stockpiled in order to site a 1.5-inch diameter cable.

1.2 PROJECT LOCATION

This proposed project will be developed in three locations as follows: 1) cable landing at Kahe Point Beach Park, 2) a cable landing at the Waianae Wastewater Treatment Plant's (WWTP) outfall site adjacent to Lualualei Beach Park, and 3) a fiber optic conduit installation along

Farrington Highway from Kahe Point Beach Park to the Waianae WWTP Outfall site and along Kulaaupuni Street in Maili. See **Figure 1. Location Map.**

1.2.1 Kahe Point Beach Park

The first cable landing is at Kahe Point Beach Park, located along the southwest coast of Oahu, to the north of Barbers Point (see **Figure 2**). The shoreline in this area is rocky, consisting primarily of low limestone sea cliffs approximately 15 to 20 feet high. The proposed landing site is within a developed beach park. Existing features of Kahe Point Beach Park include two comfort stations, a pavilion, camping and picnic area with barbecues, fourteen marked camping sites with parking, and access via Farrington Highway. When completed the only visible structure will be a manhole cover. This landing site is adjacent to an existing Verizon Hawaii cable that was installed in 1992.

Figure 3 illustrates the proposed alignment of the TyCom terrestrial cable from the landing site to the TyCom terminal building in Maili. A new reinforced concrete manhole approximately 6 feet wide by 12 feet long by 6 feet deep will be constructed at Kahe Point Beach Park approximately 300 feet makai of Farrington Highway and approximately 5 feet south north of the existing Verizon Hawaii manhole.

1.2.2 Waianae WWTP Outfall

The second landing is located near the Waianae WWTP Outfall, also located along the southwest coast of Oahu in Waianae, locally known as "sewers" (See **Figure 4**). The landing site is on the ocean side of the Waianae WWTP and Farrington Highway. A beach manhole approximately 6 feet wide by 12 feet long by 6 feet deep will be installed in the Lualualei Beach Park, approximately 70 feet makai of Farrington Highway. When completed the only visible structure will be a manhole cover. The terrestrial route from the beach park to the Maili cable station on Kulaaupuni Street is shown in **Figure 3.**

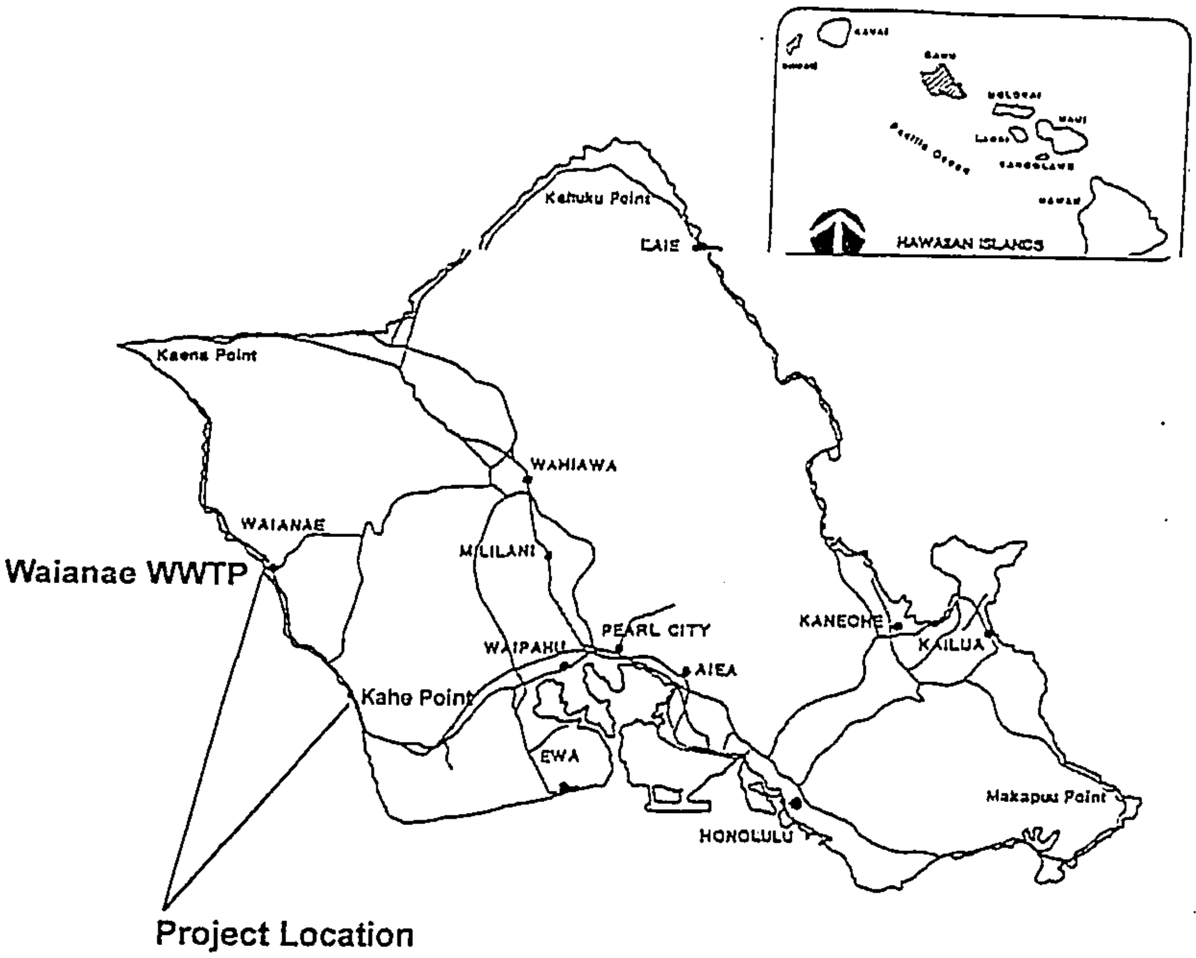


Figure 1
LOCATION MAP

TGN - Hawaii

0 6 12 MILES

R. M. TOWILL CORPORATION

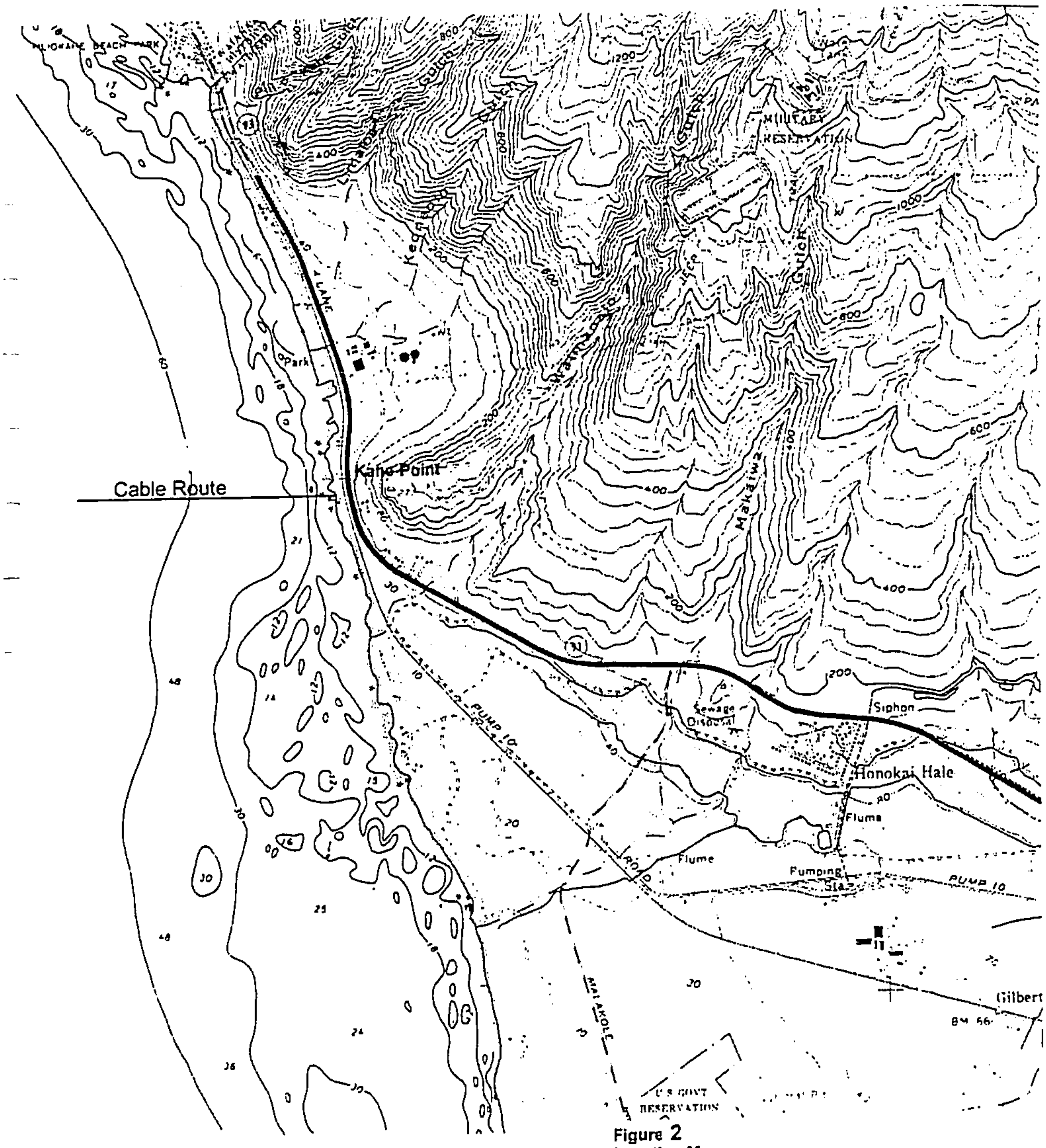
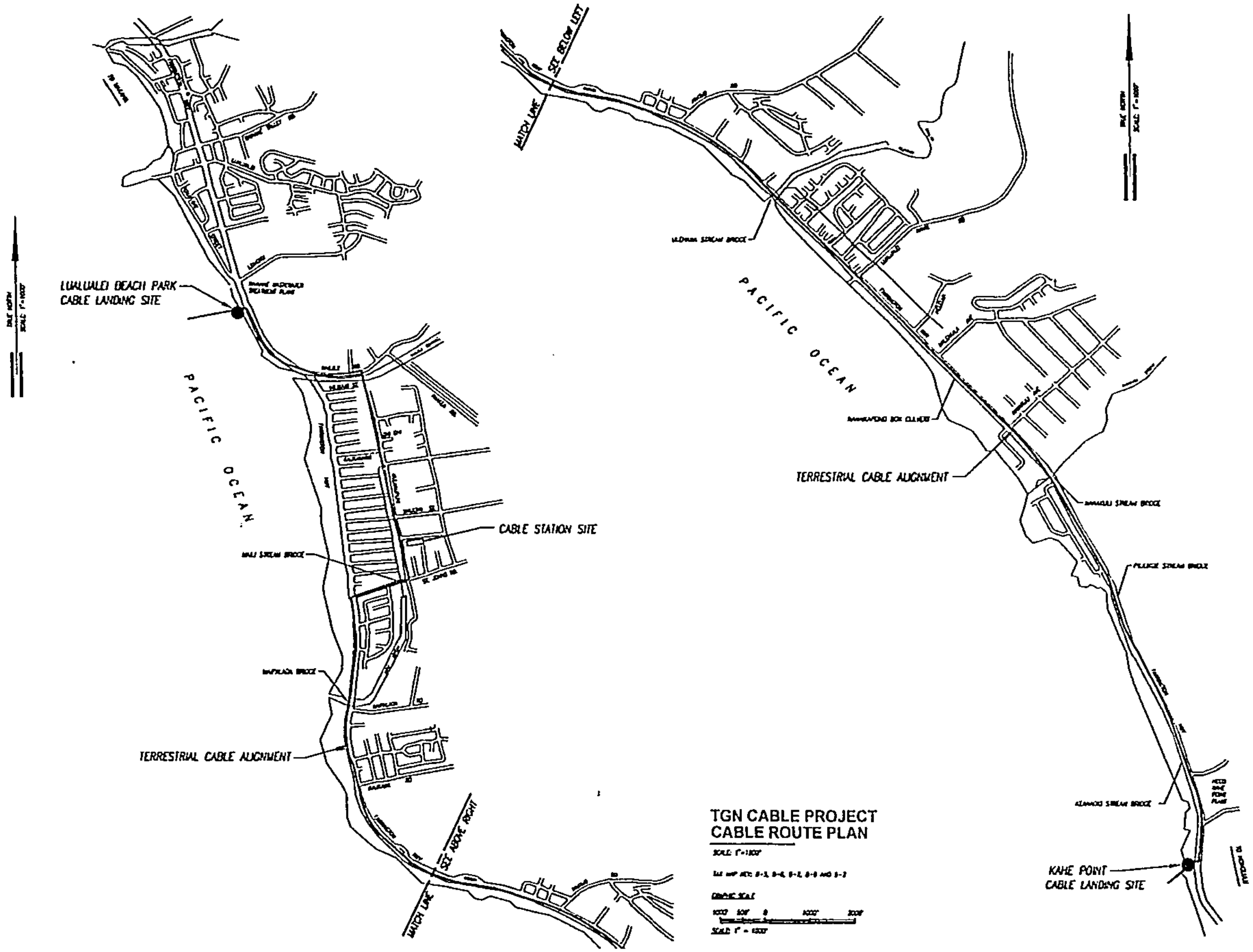


Figure 2
Location Map
Kahe Point Beach Park

TGN - Hawaii

R.M. Towill Corporation


LUALUALEI BEACH PARK
CABLE LANDING SITE
PACIFIC OCEAN
CABLE STATION SITE
TERRESTRIAL CABLE ALIGNMENT
MATCH LINE
SEE ABOVE RIGHT
SEE BELOW LEFT
PACIFIC OCEAN
TERRESTRIAL CABLE ALIGNMENT
KAHE POINT
CABLE LANDING SITE
TGN CABLE PROJECT
CABLE ROUTE PLAN

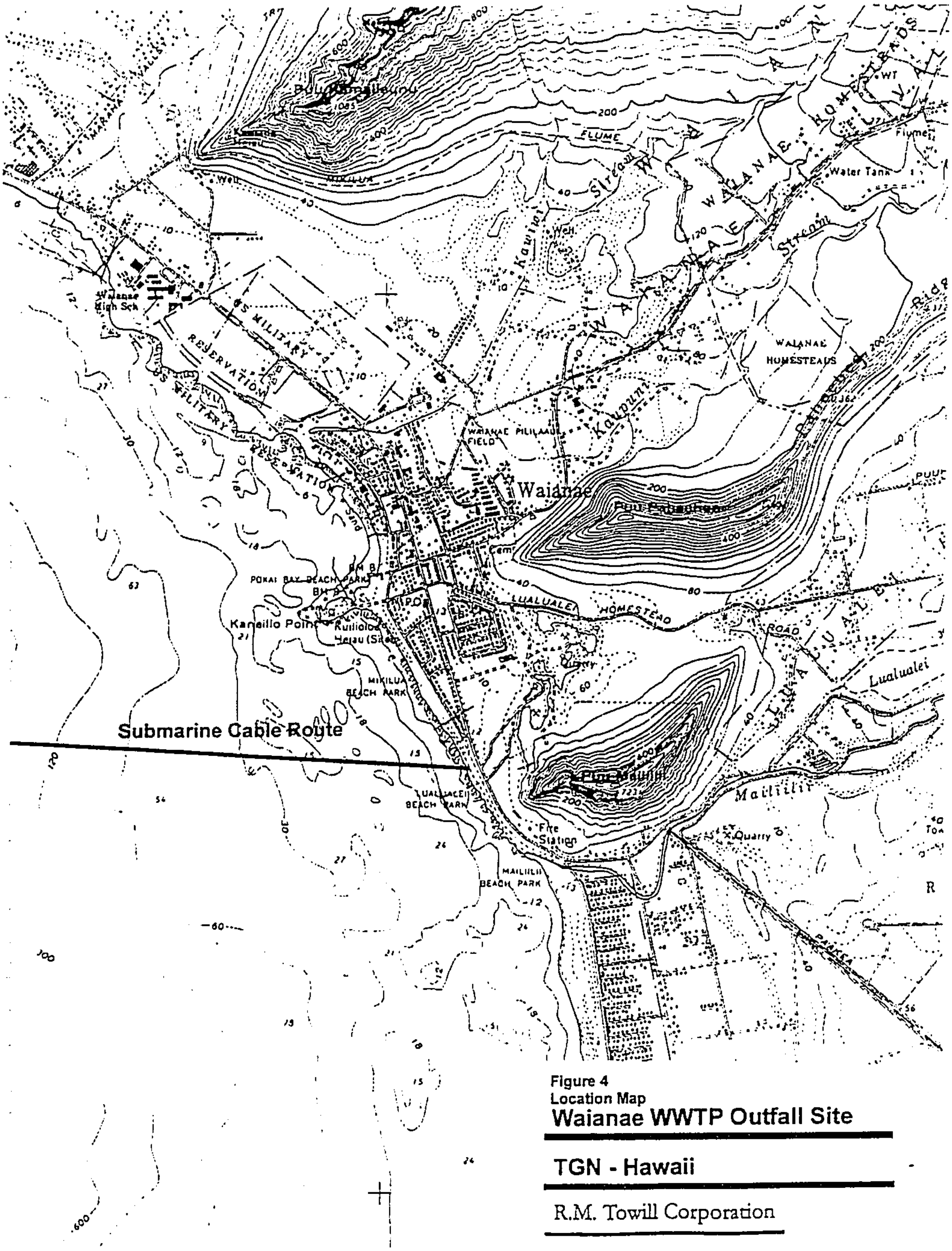


Figure 4
Location Map
Waianae WWTP Outfall Site

TGN - Hawaii

R.M. Towill Corporation

1.2.3 Farrington Highway

TyCom Networks (US) Inc. will install five 4-inch and one six inch PVC conduits, on the Makai side, within the Farrington Highway right-of-way between Kahe Point Beach Park and St. Johns Road in Maili. From St. Johns Road to the cable station, five 4-inch conduits will be placed. From the cable station to the Waianae WWTP Outfall site, five 4-inch conduits will be installed. Visible structures of the completed project will consist of only manhole covers. See **Figure 3.**

SECTION 2
PROJECT DESCRIPTION

2.1 OVERVIEW

Construction of the project will be accomplished in two phases. The first phase involves all land-side construction activities; and the second phase includes all work necessary to prepare the landing sites and actual landing of the transpacific submarine fiber optic cables.

The land-side construction activities include: the installation of new manholes at the Kahe Point Beach Park and the Waianae WWTP outfall site and the installation of the PVC conduits and intermediate manholes and handholes along Farrington Highway between the beach manholes and the cable station at Maili. The terrestrial route (from Kahe Point) begins from the beach manhole and crosses the park to Farrington Highway and on through Nanakuli to St. Johns Road in Maili, to Kulaaupuni Street to Mailiili Road, Farrington Highway to the beach manhole at the outfall site.

The second phase involves landing the submarine fiber optic cable by pulling the cable through directionally drilled or trenched conduits from a cable laying ship nearby and connecting it to the new manholes at Kahe Point and at the Waianae WWTP Outfall site.

The following provides a description of each of construction phase:

2.2 LAND-SIDE ACTIVITY (Phase 1)

2.2.1 Beach Manholes

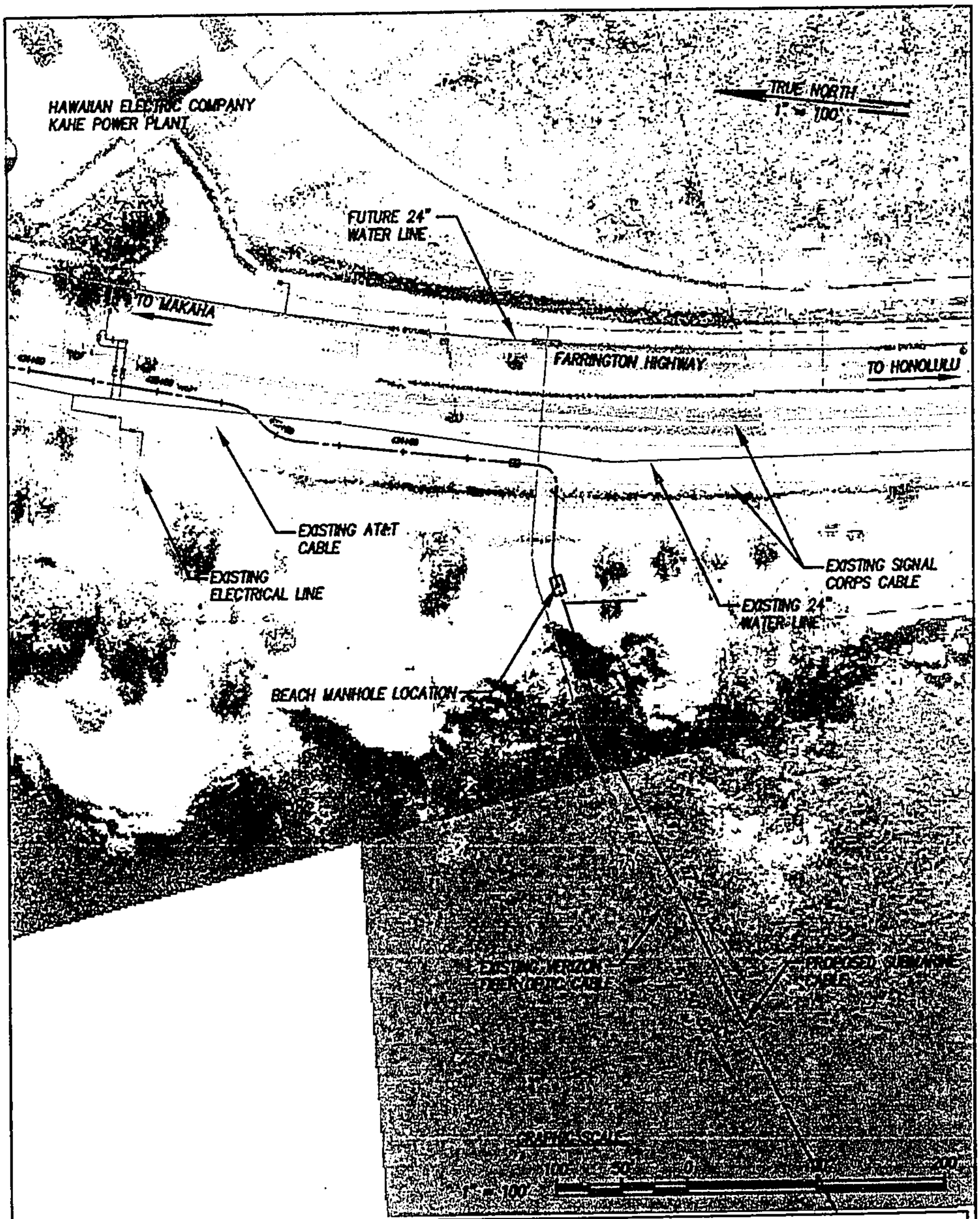
New reinforced concrete manholes approximately 6-feet wide by 12-feet long by 6-feet deep will be installed at Kahe Point Beach Park and Waianae WWTP outfall site.

A. Kahe Point Beach Park

The new manhole will be the terminus of the land-side activities and is constructed to accept the submarine cable. See **Figures 5 & 6.** The manhole will be prefabricated and trucked to the site. Once installed, the only visible part of the manhole will be the cover that is approximately 36 inches in diameter and constructed of cast steel. The manholes will be placed outside of the shoreline setback area at Kahe Point Beach Park. Seaward of the manhole, two five-inch diameter steel or HDPE conduits will be installed via trench method to the waters edge approximately one foot below the average mean low tide. The conduits will parallel the Verizon Hawaii cable system. From this opening, the submarine cable will be placed on the ocean bottom. In the near shore area up to a water depth of 40 feet, the cables will be encased in split pipe armor protectors to ensure that the cable is not damaged. The addition weight provided by the armor protectors further ensures that the cables will be kept in place. The cable will be laid on the ocean bottom between the rocks found in this location.

Landside of the manhole, five 4-inch and one 6-inch diameter PVC conduits will be installed in a trench from the new manhole to a manhole located on the makai shoulder of Farrington Highway. The conduits will be encased in concrete and buried under approximately 4 feet of earth cover. The trench will cross the railroad right-of-way to the shoulder of Farrington Highway. Once the conduits are in place, the tracks and ties will be restored to their original condition. The plans for the crossing were submitted to the Hawaiian Railway Society for review and approval. Because the railway at Kahe Point Beach Park is on the State Register of Historic Places, the Historic Preservation Division of the Department of Land and Natural Resources has been consulted. A monitoring plan will be established whereby when the work at the park occurs, a trained archaeologist will be present during the trenching activity. Further, the Hawaiian Railway Society will be advised of the work and will provide final acceptance of the restoration work.

Traffic control procedures such as rerouting the traffic onto the shoulder of the highway with the aid of necessary safety measures (i.e. temporary traffic control devices (cones or signals, flag men, etc.) to direct traffic will be implemented during work activities at the Park. Two-way traffic on Farrington Highway and access into the Park will be maintained at all times. Approximately 2 weeks will be required to complete the



TYCOM GLOBAL NETWORK HAWAII OUTSIDE PLANT CONSTRUCTION

R. M. TOWILL CORPORATION	*KAHE POINT AERIAL PLAN*	*FIGURE 6*

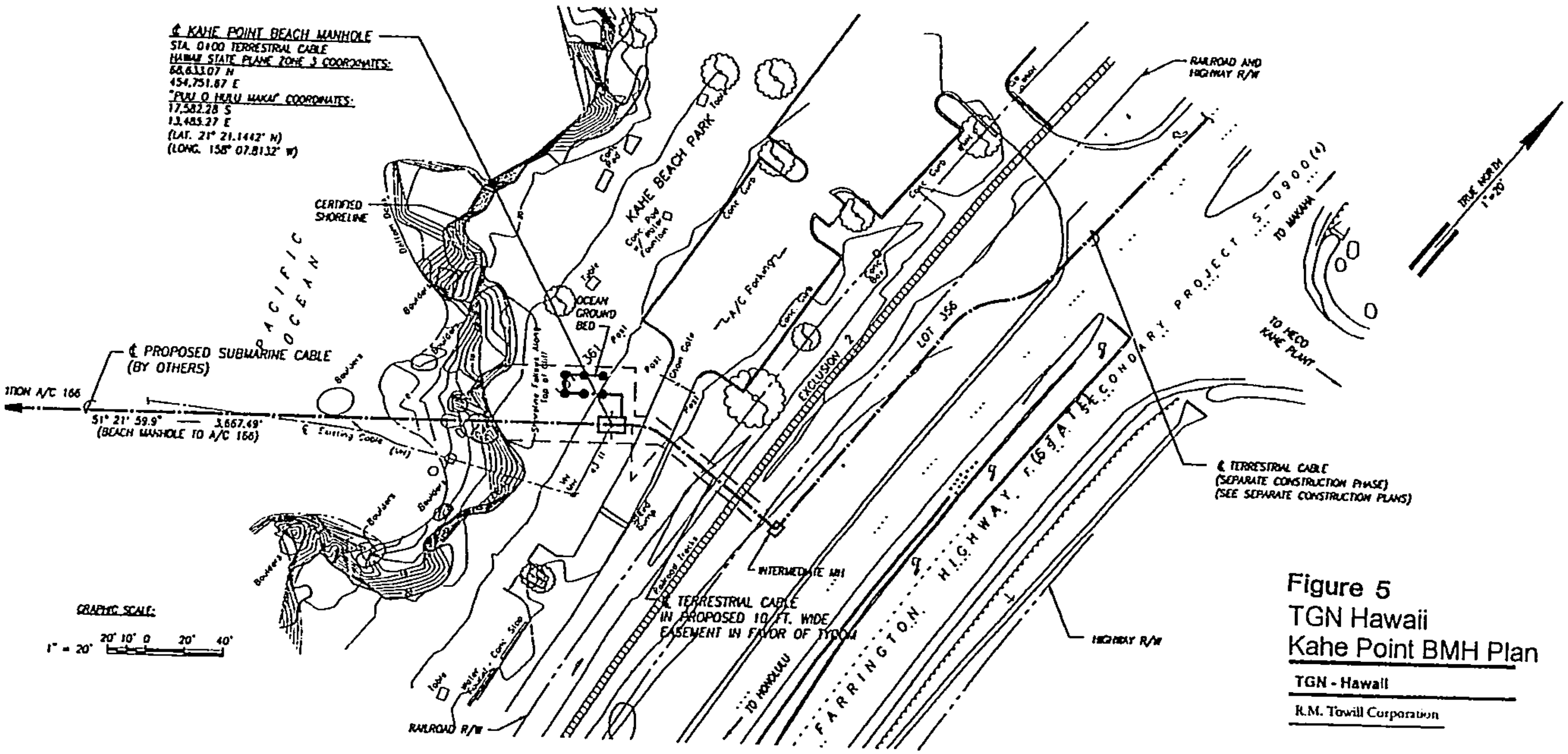


Figure 5
TGN Hawaii
Kahe Point BMH Plan

TGN - Hawaii

R.M. Towill Corporation

installation of the conduits in the Park and installation of the beach manholes. Once all trenching work has been completed, the Park will be restored to its original condition. In order to re-establish any damaged landscaping, a 30 day maintenance program will be instituted to allow for the irrigation of the grassed areas. Any damaged pavement will also be restored. The site will be considered acceptable once a letter of acceptance of the restoration work is obtained from the Department of Parks and Recreation.

B. Waianae WWTP Outfall Site

The new beach manhole will be located within the shoulder of Farrington Highway adjacent to the outfall of the Waianae WWTP on the north side. (**See Figures 7 & 8**). The installation of the beach manhole at the Waianae WWTP outfall site will be similar to the installation at Kahe Point Beach Park. Seaward of the manhole, two four-inch diameter steel conduits will be horizontal directional drilled (HDD) into the ocean paralleling the ocean outfall. The drill pipes will exit in approximately 50-60 feet of water depth and approximately 2,000 feet from the manhole. They will be drilled at a bearing of approximately 230 degrees from the manhole. The exit point is within a sand channel that exists at that location. This exit point was selected because there were no reef or other features that currently support reef fauna. Further, at the depth of 50-60 feet, the normal effects of currents are negligible.

Landside of the manhole, five 4-inch diameter PVC conduits will be installed in a trench from the new manhole on the makai shoulder of Farrington Highway. The PVC conduits will be encased in concrete and buried under approximately 3 feet of earth cover. The conduits will continue to be installed along Farrington Highway until its intersects with Mailiili Road. Traffic control procedures such as rerouting traffic with the aid of necessary safety measures such as temporary traffic control devices (cones) and/or use of flag men to direct traffic will be implemented during work activity. Two-way traffic on Farrington Highway will be available at all times.

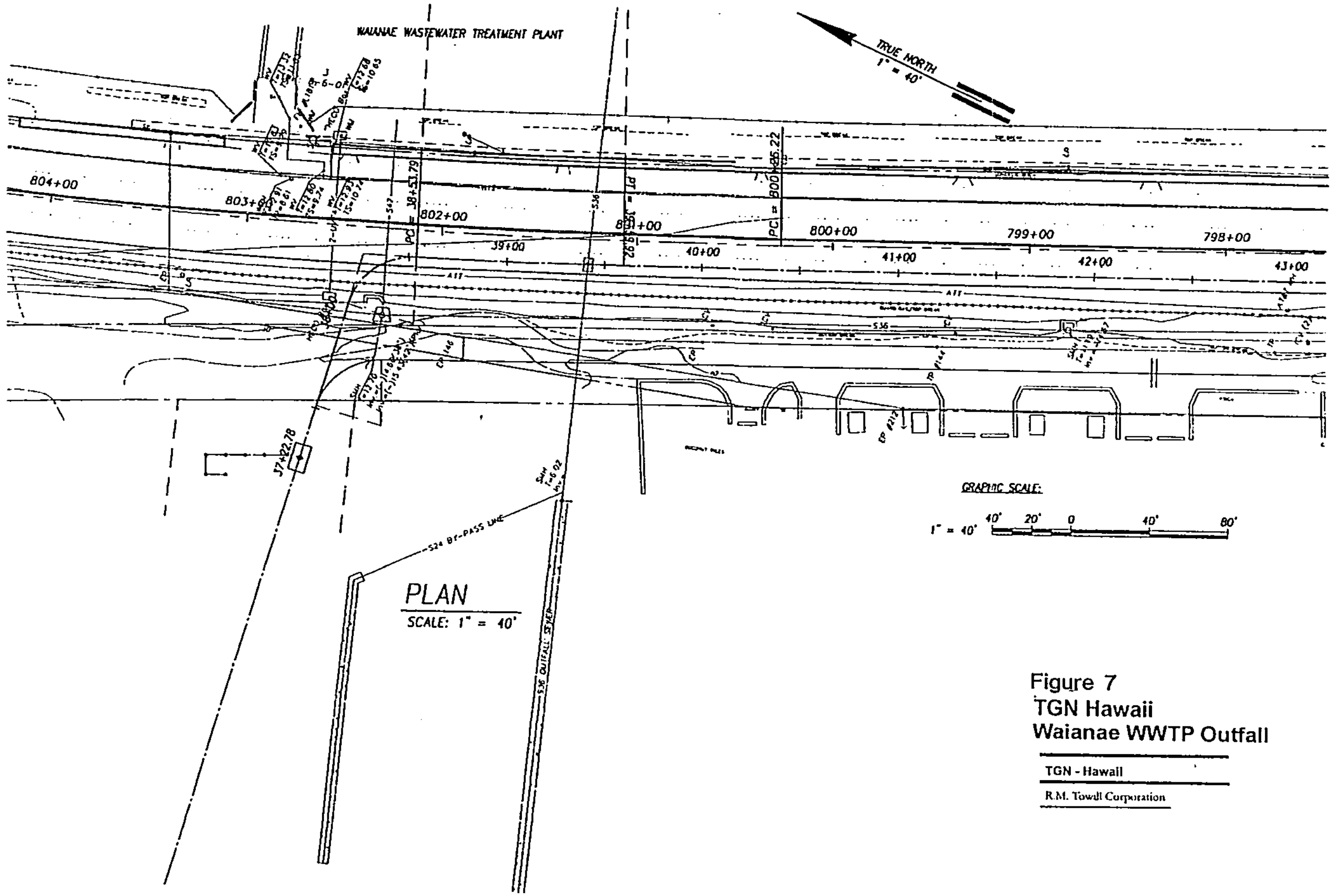


Figure 7
TGN Hawaii
Waianae WWTP Outfall

TGN - Hawaii

R.M. Towill Corporation

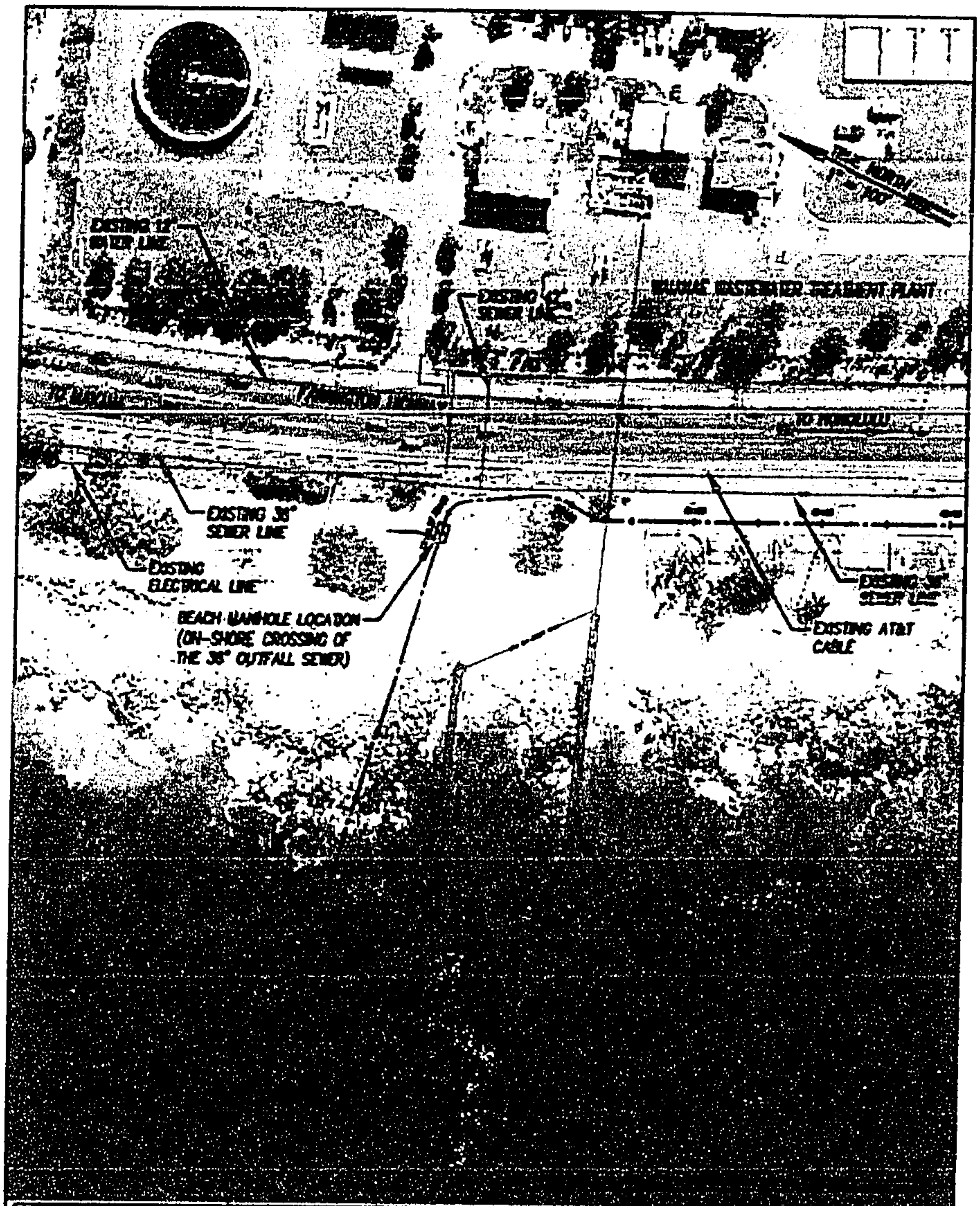
Once all trenching and drilling work has been completed the site will be restored to its original condition. Because the site currently lacks any vegetation, the Department of Parks and Recreation (DPR) will be consulted to re-establish landscaping at this site, if desired by the DPR.

2.2.2 Terrestrial Conduit

Five 4-inch and one 6-inch PVC conduits will be installed with in the Farrington Highway right-of-way between Kahe Point Beach Park and St. Johns Road, and 5 4-inch conduits from St. Johns Road to the Waianae WWTP Outfall site. The proposed route is shown in **Figure 3.** A typical section showing the conduits under the pavement is shown in **Figure 9.** The conduits will be concrete encased and placed approximately 3 feet below the road grade and along the makai shoulder of the Highway. Where it is not possible to locate the conduits in the shoulder, the conduits will be installed along the outer-most travel lane. To minimize some highway impacts, all stream crossings will be accomplished via the use of horizontal directional drilling (HDD). This work entails the construction of a manhole on each side of the stream and drilling under the stream at a depth sufficiently deep to avoid the channel linings or culvert structures. The use of HDD technology at the stream crossing has the additional benefit of not disturbing the streambed as would trenching and digging in and around the stream. Further, for each segment that is horizontally drilled, approximately 500 to 1,500 feet of road shoulder or travel way will not be impacted. During construction, two way travel will be maintained at all times along the highway.

During construction the following actions will be taken to minimize traffic impacts:

1. No construction work will take place during peak commuting hours and work during the day will be limited between 9 a.m. and 3 p.m.
2. Multiple construction crews will be employed to lessen the overall construction period.
3. Night work will be implemented on a limited basis, between 7 p.m. and 11 p.m. on Farrington Highway where residential units are across the street from the work area. No night work will take place where residential dwelling units are adjacent



TYCOM GLOBAL NETWORK HAWAII OUTSIDE PLANT CONSTRUCTION

R. M. TOWILL CORPORATION

LUALUALEI CABLE LANDING SITE

Figure 8

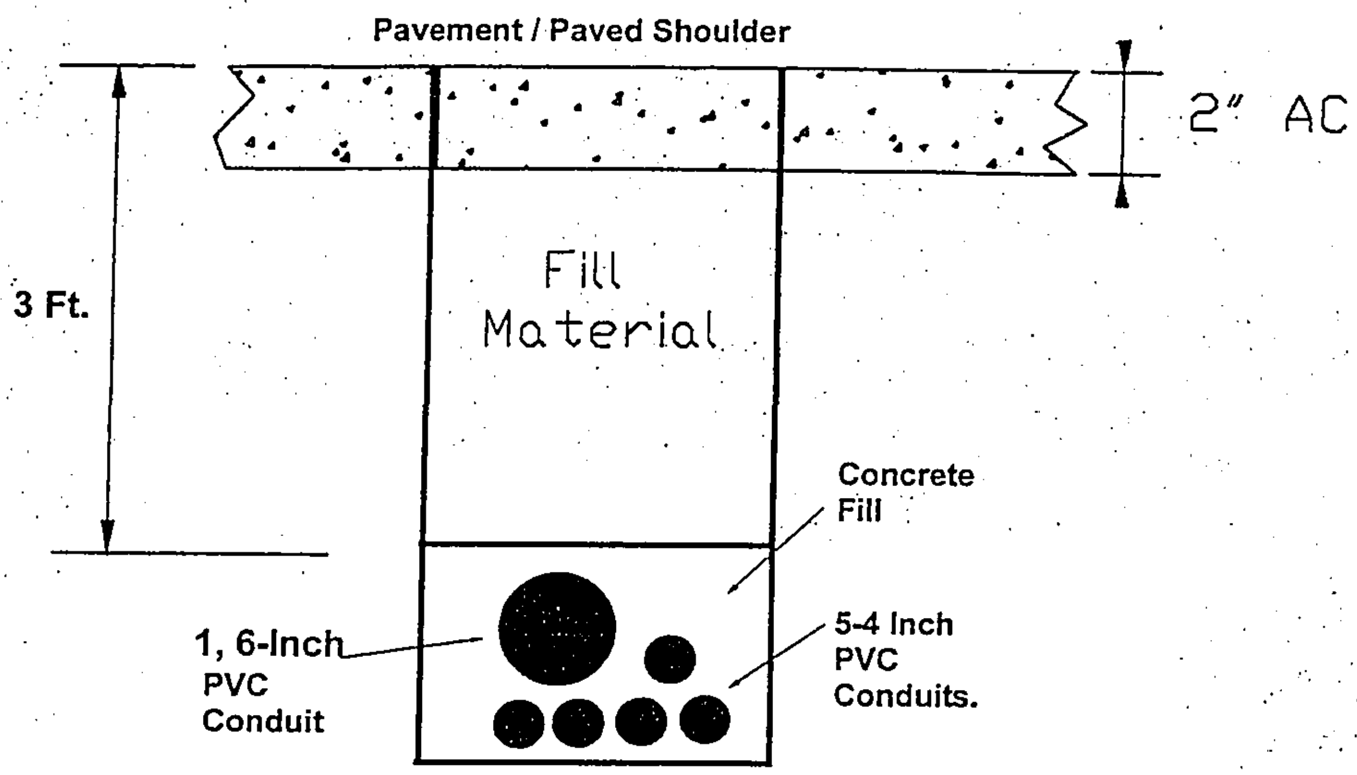
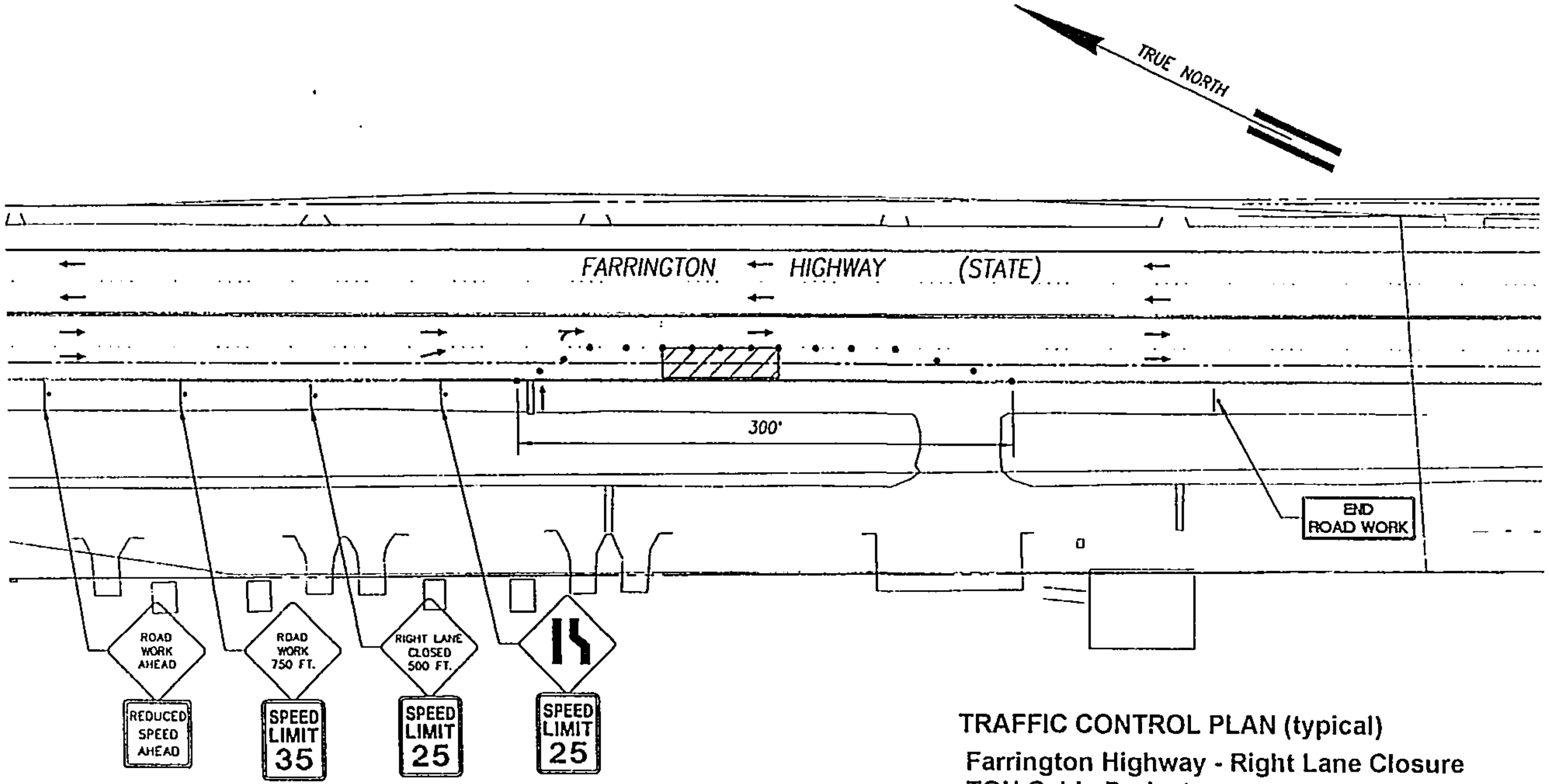


Figure 9
Typical Conduit Section
Along Farrington Highway

TGN - Hawaii

R.M. Towill Corporation



TRAFFIC CONTROL PLAN (typical)

Farrington Highway - Right Lane Closure
TGN Cable Project

to the work area. However, no night work will occur on Fridays and Saturdays.

4. Night work will be implemented between 7 p.m. and 4 a.m. for areas where there are no residential dwellings.
5. Coordination with the Board of Water Supply (BWS), Department of Transportation, and Sandwich Isle Communications will continue to insure that work on both projects are planned to minimize construction time.
6. Coordination with other projects on the highway is ongoing to further insure that construction times are minimized, and where mutually beneficial, work done in concert.

An archaeological monitoring program will be instituted in all areas that are underlain with sand. A trained archaeologist will be hired to monitor all trenching activities to observe if any significant features are uncovered. In the event that a feature is uncovered, work in that area will be halted until the significance can be determined in consultation with the Historic Preservation Division.

Finally, where the shoulder or travel lane has been disturbed by trenching, that segment of the shoulder or roadway (the entire lane) will be re-paved to its original or better condition. To ensure that there is a smooth transition, the road surface will be planed to the same level as the existing highway grade.

2.3 NEARSHORE ACTIVITY (Phase 2)

The second phase of work involves landing the submarine fiber optic cable and establishing a connection to the new manholes at Kahe Point Beach Park and the Waianae WWTP Outfall site.

A cable laying ship serves as the primary means of laying the submarine fiber optic cable. The following procedures describe the activities involved during the cable landing operations.

The ship's captain will approach the landing site and align the vessel along the proposed route to the beach manhole. Once the ship reaches a safe and workable operating depth, it will fix its position relative to the proposed cable route and the exit point of the bore pipe using its dynamic positioning system involving side-thrusters, the main engine and differential global positioning computers.

On the beach a team will have previously setup a winch at the head of the conduit or bore pipe. It is with this winch that the cable will eventually be brought ashore. When the shore team and the ship are in position the ship will begin paying out floating line to a small boat meant to bring the line to the seaward end of the bore pipe. Here the line will be attached to a preinstalled cable in the bore pipe. The cable is now attached to the line and thus ready to be hauled ashore.

The ship will pay out cable while its personnel attach suspension floats at regular intervals to keep the cable from sinking to the ocean bottom. As the cable is lowered to the water, it will float, allowing it to be pulled toward shore using the winch.

When the cable reaches the bore pipe, divers will remove the floats allowing the cable to sink and enter the pipe at the proper angle. Once in the bore pipe the cable will be pulled into the manhole on the beach. At this point the cable will be temporarily anchored while divers readjust the suspension floats in the water to obtain a proper nearshore to shoreline alignment.

Once the cable is aligned, the divers will cut the remaining floats away, allowing the rest of the cable to sink to the ocean bottom, and the cable will be permanently installed in the manhole. The submarine portion of the cable is then spliced to the terrestrial cable which terminates at the cable station.

The entire landing operation will take between 12 and 24 hours. Following the shore end installation, all reasonable efforts will be taken to restore the beach to its original pre-construction condition.

Ocean Ground Bed installation:

Prior to the cable landing, the ocean ground bed (OGB) will be installed. The OGB is the earth return for the powered sea cable. In simple terms, it is a ground. This will involve the installation of 6 anodes (cast iron rods measuring 4 inches in diameter by 6 feet long) into the ground nearby the manhole. The anodes are generally placed five feet below grade by means of an auger to effectively reduce trenching. Lastly, all six anodes are connected by a 6 AWG wire that in turn connects to the cables running back to the terminal building at Maili.

2.4 SAFETY CONSIDERATIONS

During the construction phase on the beach (approximately 2 weeks at Kahe Point Beach Park and 4 weeks at the Waianae WWTP outfall site), the portion of the beach which contains the open trench or drilling equipment will be barricaded from public entry. During the construction period, a security guard will posted at the job site at night and weekends to ensure public safety and integrity of the job site during non-working hours.

During the cable laying process (approximately 2 days each at each site depending on the weather conditions), the nearshore waters adjacent to the bore exit points 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.

2.5 SCHEDULE AND ESTIMATED COST

The first phase (land-side activities) of the project is scheduled tentatively to start in July 2001 and continue through December 2001. The second phase (installation of the submarine cable and cable landing operations) is scheduled tentatively for September and December 2001. Construction cost is estimated to be $15,000,000.

SECTION 3
ALTERNATIVE SITE SELECTION

3.1 ROUTE SELECTION CRITERIA

Selecting a submarine cable route is a careful and deliberate process which involves the identification of areas that warrant study, based on a set of minimum evaluation criteria. A wide range of issues are considered, including the physical, geographical, biological, archeological, and cultural aspects of the sites being considered. Difficult to qualify and quantify, not all aspects of a potential landing site are weighted the same as those of other sites being considered. Cultural and archeological resources and issues, may, for example, weigh more heavily than the physical characteristics of a potential landing site. In addition to the shoreline/ nearshore conditions (slope, bottom substrate, beach area), biological and natural resources (flora and fauna, endangered species, essential habitat, coral reefs, etc.), and cultural and archeological resources (public use, burial sites, historical artifacts, etc), site selection criteria includes rapid erosion, giant landslides, drowned coral reefs, seismic activity, dumping areas, ship and airplane wrecks, other cables, and the location of terrestrial facilities (cable stations). Below is a brief discussion of criteria considered in determining landing sites and submarine routes:

<u>Shoreline/Nearshore Conditions</u>

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 sub-optimal in providing protection during storms and other high wave conditions.

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

Cultural and Archeological Resources Considerations

Public areas beaches and parks are often heavily used for sunbathing, surfing, swimming, etc. Conflicts with area users of major public areas are considered in the site 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.

Biological and Natural Resources Considerations

Proximity to rare or endangered species or their habitats is a criteria for site selection. Sites that reduce impacts to shoreline and ocean water quality, disturbance of benthic habitats, and erosion are preferred.

Location of Terrestrial Facilities

TyCom Networks (US) Inc. is currently constructing a cable station in Maili on Kulaaupuni Street. The cable station was required to be located between two cable landing sites which were at least five miles apart. Five miles was determined to be the minimum distance required to ensure that a catastrophic event at one location would not also befall the other landing location. The cable station site selected is in Maili on Kulaaupuni Street adjacent to the Maili Elementary School.

Rapid Erosion

The greatest danger to the 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).

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).

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).

Dumping Areas

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

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

Ship and Airplane Wrecks

A complete, high resolution side-scan survey of the proposed cable route will be carried out to determine that the route is free of man-made hazards such as ship wrecks and lost airplanes.

Other Cables

There are several other cables in Hawaiian water, particularly along the Waianae coast. At Kahe Point, the Hawaii Interisland Cable System (HICS) operated by Verizon Hawaii was installed. There are currently no cables installed at the Waianae WWTP site. The next closest cable installation is located at Makaha Beach Park.

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.

3.2 ALTERNATIVE LANDING SITES

In September 2000 a study was conducted by R.M. Towill Corporation, using the criteria outlined above, to select two landing sites for the TyCom Networks (US) Inc. fiber optic cable system. The advantages and disadvantages of each site were evaluated, providing a basis for comparing the different sites. These are summarized in **Table 1.** The entire area considered for cable landings was the leeward side of Oahu, from the Barbers Point Naval Air Station to Makaha Beach Park, a distance of approximately 14 miles. Existing facilities which limit the selection of cable route areas include cooling water intakes and discharges for the Kahe Generating Station, a U.S. Navy underwater test range, an ocean outfall for domestic sewage, a large fish haven and a small boat harbor. As such, a total of seven possible landing sites were identified and evaluated. They include: Kahe Point Beach Park, Waianae Wastewater Treatment Plant Outfall, the coastline south of Kahe Point, Ulehawa Park, Pokai Bay, Camp Malakole, Nanakuli Beach Park, and Makaha Beach Park.

A. Kahe Point Beach Park

The Kahe Point Beach Park site is one of the preferred landing sites. The site exhibits positive characteristics including nominal landside conditions and workable nearshore waters. Another positive site feature of Kahe Point Beach Park is the low likelihood for discovery of archaeological/historic sites based on discussions with DLNR, Historic Preservation Division. In addition, impacts to the railroad right-of-way can be minimized and the site restored to its original condition.

The coastline is used for recreational purposes such as fishing, SCUBA and skin-diving. The near shore area (shoreline to 40 feet water depth) is a combination of hard limestone and rock bottom interspersed with sand pockets. At about 40 feet water depth the bottom transitions to more sand deposits and less hard bottom. At approximately 50-60 water depth the bottom transitions to mostly sand. This sand area curves seaward in the Nanakuli direction.

The ocean bottom at the Kahe Point Beach Park is an acceptable but not an ideal cable installation site because of the rocky in-shore area. The installation of the submarine cable in the in-shore area will need to be laid between rocks in order for the cable to lay on the bottom. In addition, the cable will be double-armored (wound with stainless steel wires) and covered with cast iron cable protectors to prevent abrasion of the cable against the rocks and to add additional weight to prevent movement of the cable by wave action. This installation will be similar to the Verizon Hawaii cable installed at Kahe Point Beach Park.

B. Waianae WWTP Outfall

The Waianae WWTP Outfall site is the other selected landing site. The primary advantage of this site is the proximity to the sewer outfall. The site has already been disturbed during the installation of the 36-inch sewer outfall both on land and in the ocean. Because the sewer outfall is laid on the ocean bottom, the area where the pipeline is laid has been graded to create a flat surface to lay the pipeline. At the shoreline the sewer outfall was trenched in at a depth of more than 10 feet in order for it be below water level at the shoreline. The installation of the proposed TGN™ beach manhole will be on the ocean-side of an existing 36-inch sewer main that leads to the treatment plant. The shoreline is a combination of weathered coral and basaltic rocks and is sparsely vegetated. Because the limestone shelf is exposed, no evidence of cultural remains has been observed.

The coastline is used for recreational purposes such as fishing, skin-diving, and some surfing. The near shore area (shoreline to 30 feet water depth) is a combination of hard limestone bottom interspersed with sand pockets. At about 60 feet water depth the bottom transitions to more sand deposits and less hard bottom. At approximately 100-120 feet of water depth the bottom transitions to mostly sand. This sand area curves seaward in the Maili direction.

The ocean bottom at the Waianae WWTP outfall site is not an ideal trenching installation site to lay the cable on the ocean bottom because of the hard bottom condition. This same hard limestone bottom, however, provides a workable medium for horizontal directional drilling. In order to avoid the near shore coral environment, HDD technology will be utilized.

C. Makaha Beach Park

Makaha Beach Park is an alternative landing site, should Waianae WWTP outfall site be removed from consideration. Makaha Beach Park is the location of most transpacific submarine cable installation in Hawaii. The first transpacific cable to be installed in Hawaii was landed at Makaha in 1963. The first fiber optic cable was also installed by AT&T at Makaha in 1987. The Makaha Beach site has been considered an excellent site for the installation of cables because of the extensive sand deposits in the near shore as well as in deeper water. The sand movement at Makaha Beach is also extreme where as much as 200 feet of beach can erode and accrete during a year. This sand movement also covers the cables in the ocean and therefore can go undetected by the normal beach user or swimmer. The one disadvantage of cable landings at Makaha Beach is the requirement to have the cable installed within a sand channel that extends from the northern side of the beach and extend out to sea. The ocean bottom within this channel transitions gradually from the shoreline to deep sea in a short distance making it an ideal cable landing site.

D. Coastline South of Kahe Point

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

E. Camp Malakole

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

F. Nanakuli Beach Park

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

G. Ulehawa Beach

"A sand channel off the beach park corresponds to the mouth of Ulehawa Stream.

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

G. Pokai Bay Beach Park.

The bay was a former harbor that was abandoned when the Waianae Harbor was constructed. The southern half of the shore area is now a public park administered by the City and County of Honolulu, while the northern half is a military recreation area. The bay and shoreline area are bounded to the south by Kaneilio Point, a rock headland extending about 800 feet seaward from the shore, and to the north by Kaupuni Stream and Waianae Harbor. Both the military and public recreation areas are heavily used.

The shoreline is a sandy beach. The old harbor breakwater, currently failing in places, marks the southern end of the beach. Progressing to the north along the beach from the breakwater, there is small recreational pier, and a groin about 200 feet long in the center of the beach that separates the public and military areas. The nearshore region consists of a sand channel 600 to 1000 feet in width cutting through the fringing reef and extending from the shoreline to about the 60-foot water depth. Beyond the 60-foot depth the sand expands into a larger sand deposit that trends north-south. For most of the region inside the breakwater, the bottom consists of flat, hard reef rock, scattered coral heads up to 2 feet high, and an area of thin sand (less than 1 foot thick) overlying reef rock. However, along a line from the tip of the breakwater into the groin, there is a band of relatively thick sand. Probed sand thicknesses were 9 feet off the tip of the breakwater, 6 feet at the 9-foot water depth, and 2.8 feet at the 7-foot water depth about 100 feet south of the tip of the groin. Elsewhere inside the breakwater, the sand probes indicated hard coral bottom, or a very thin covering of sand (less than 1 foot) overlying hard coral. North of the groin, in the military recreation area, the sand extends into the beach; no probes were conducted in this area.

Outside the breakwater, sand thickness towards the middle of the sand deposit ranged from 4 to 9 feet. Close to the northern edge of the deposit, the sand is thinner; the probes recorded 2 to 3 feet of sand. About 1200 feet east of the breakwater, the sand deposit is narrows to about 600 feet wide and bends to the south. The reef margin at this location is pronounced, and rises 4 to 8 feet above the adjacent sand bottom. In other locations, the transition to reef bottom is gradual. Scattered coral outcrops mix with sand, before the bottom becomes entirely coral reef.

Physical characteristics of this site make it an ideal landing site, however local concerns of public use and the possible presence of historic and archeological artifacts have removed this site from consideration.

3.3 ALTERNATIVE HIGHWAY ROUTES

Alternative terrestrial routes were explored in addition to alternative construction methods. In general, there were limited opportunities for construction work on streets other than Farrington Highway. The only area within the project area that presented a parallel street to Farrington Highway was in Maili on Kulaaupuni Street. Therefore, in order to minimize traffic impacts on Farrington Highway, the section of Kulaaupuni between Mailiili Channel and St. Johns Road will be utilized.

3.4 ALTERNATIVE CONSTRUCTION-INSTALLATION METHODOLOGIES

Alternative construction-installation methods were examined in order to minimize construction duration and construction impacts. The alternatives studied include:

Increase the Number of Construction Crews.

Increasing the number of construction crews from one to two or more has the advantage of reducing the overall construction duration. On the negative side, having more crews means more of the roadways are dug up at the same time. The latter can be mitigated by ensuring that the work is being done at different locations, and at distances far enough apart to reduce traffic impacts.

Performing Work At Night Only.

Working at night only will generally slow down construction and increase the duration of the overall construction. Further, unless the construction crews are allowed to work for longer hours, there is no direct benefit.

Performing Work at Night and Days.

This action has the similar advantage as increasing the number of working crews. The additional time spent at night will shorten the duration of construction time thereby reducing overall community impacts. This is the preferred method of construction.

Utilizing Horizontal Directional Drilling (HDD).

The utilization of HDD technology has the advantage of reducing some traffic impacts by minimizing lane closures and open trenches. Another advantage of HDD technology is that the work in some instances can be done in a shorter period of time than trenching, especially where a number of utilities must be crossed. The drilling work can be done under most installed utilities. The utilization of HDD technology is limited in areas where the soil condition is mostly basaltic rock or soil and rock combination. Generally with this type of soil condition, the drilling operations will take longer than trenching because the operator will be required to change the drill bits each time he encounters different soil types. The disadvantage of the use of HDD technology is that once the drilling operations start it is usually not practical to demobilize the equipment. Therefore, where drilling takes place in a travel lane, traffic will need to be routed around the drilling equipment, even during peak travel time, unless the drilling operation can be shortened. To the extent possible, the drilling work will be done from the shoulders of the highway.

3.5 NO ACTION

The no action alternative will contribute to the State of Hawaii losing the opportunity to increase its current bandwidth capacity to conduct activities that depend on telecommunication services. Losses resulting from this alternative would include:

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

* Lost tax revenues for City and State governments from the cable vendor, and increased public and private telecommunication usage; and

* Lost attainment of the City and County of Honolulu General Plan's objective of expansion of existing infrastructure systems.

3.6 RECOMMENDED ACTION

The recommended action is to proceed with the establishment of a submarine fiber optic cable system with a landing at Kahe Point Beach Park and the Waianae WWTP outfall site. From the landing sites, the cable would be located underground within the Farrington Highway right-of-way except for the portion in Maili where the cable will be routed along Kulaaupuni Street. In order to mitigate construction and traffic impacts, the alternative construction methodology identified will be utilized to minimize construction duration. Should Waianae WWTP outfall site be removed from consideration, Pokai Bay or Makaha Beach Park may be considered as alternative landing sites.

Table 1

Summary of Evaluation of Alternative Landing Sites in Oahu, Hawaii

Site Name	Kahe Point Beach Park	Waianae WWTP Outfall	Coastline south of Kahe Point	Pokai Bay	Malakole Camp	Makaha Beach Park	Ulehawa Park	Nanakuli Beach Park
Selection Status	Preferred	Preferred	Dropped from consideration	Alternate	Alternate	Alternate (first)	Alternate	Alternate
Beach Manhole Status	Proposed	Proposed	Not existing	Not existing	Not existing	Not existing	Not existing	Not existing
Advantages	Site of other cable landings	Cable can be placed parallel to a sewer outfall	None	Sand channel minimizes environmental impacts	None	Site of other cable landings	Sand channel minimizes environmental impacts	None
Disadvantages	Long distance from cable station	Manhole location not ideal	Long distance from cable station	Possible archeological resources	Site within the Navy training area	Site of other cable landings	Site is too close to other landing sites and a fish haven located near by	Navy training area
Marine Route Issues	Rock and coral inshore with sand beyond	Mixed limestone and rock inshore with sand beyond 2000 feet	Rocky limestone in shore with sand deposits beyond 1500 feet	Sand channel from near shore to 100 feet water depth	Rock hard bottom with sand areas	Sand channel from shoreline line to more than 100 feet water depth	None – ocean bottom sandy	None
Land Route Distance To Cable Station at Maili	4.5 miles	2.5 miles	4.5+ miles	3.5 miles	4 miles	5 miles	3 miles	4 miles
Land Route Issues To Cable Station at Maili	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets	Traffic congestion on Farrington Hwy and local streets
Construction Duration to Cable Station	Long	Short	Medium	Short	Medium	Long	Short	Medium

SECTION 4
DESCRIPTION OF THE AFFECTED ENVIRONMENT, IMPACTS, AND MITIGATION

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate

The project sites and surrounding areas are located on the south-western side of Oahu which is generally warm and dry. The mean annual temperature is between 72 and 79 degrees Fahrenheit and the annual rainfall is about 20 inches, most of it occurring during winter months. The prevailing winds are tradewinds blowing from a northeasterly direction. Winds from a southeasterly direction (Kona winds) may be expected 5-8 percent of the time (Atlas of Hawaii, 1998).

Impacts/ Mitigation

The proposed project will not impact local climate of the project area and vicinity.

4.1.2 Topography, Geology, Soils

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

A. Kahe Point Beach Park

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

A study of the ocean bottom conducted in 1991 by Sea Engineering along the proposed cable alignment at the landing site indicates the following characteristics:

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

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

B. Waianae WWTP Outfall

The soil regime that comprise the outfall site includes mostly limestone and some beach sand (BS), and rocks. The area where the new beach manhole will be placed is nearly level and is mostly weathered coral with a mixture of basaltic rocks.

The outfall location is bounded by Farrington Highway on the mauka (east side), Lualualei Beach Park to the south (Nanakuli side), and Pokai Bay Street to the north (Kaena side). The outfall is 36 inches in diameter and extends to 120 feet water depth. The site is known for some reef fishing, skin diving and some surfing. Most of the beach activity is centered at the Lualualei Park where there is parking and picnicking facilities. Because there is no sand beach in this area, limited use of the area was observed. In the near shore area within 120 feet water depth the bottom consists of mostly sand and coral rubble with scatted small limestone mounds. At the 100 feet water depth the sand-rubble bottom transitions to a hard limestone bottom.

C. Farrington Highway

The Farrington Highway right-of-way is 100 feet wide with 2 travel lanes in each direction. The paved shoulders vary in width from 4 feet to 8 feet. For most of the Highway in the project area, there are no sidewalks on the makai side of the Highway. The highway maintains a nearly constant grade between Waianae and Nanakuli. From Nanakuli to Kahe Point the grade rises from near sea level to an elevation of approximately 40 feet above sea level. The construction work will be limited to the makai (ocean side) shoulder of the highway. Where the shoulder is occupied with other utilities, the conduit line will be placed in the outer most travel lane. Based on soil bore samples taken along the highway the underlain material varies between a combination of coral, clay-loam soils, sand and loam soils, and sand layers. The depth of the material varies based on location and proximity to the shoreline.

Impacts/ Mitigation

The cable will be installed underground with approximately 4 feet of ground cover and no long term surface impacts are anticipated since the project involves temporary excavation and restoration to existing conditions. The excavated portions will be returned to its present status by reusing soil excavated for fill or by using fill approved by the State Department of Transportation. Archaeological monitoring will be instituted for areas where the subsurface material is sand. A trained professional archaeologist will be retained to monitor the excavation work. The archaeologist will be empowered to halt work in the event that cultural deposits are uncovered. Work will not resume in the area until the significance can be determined in consultation with the State Historic Preservation Division.

4.1.3 Hydrology

There are no perennial streams in the subject area. However, there are a number of intermittent streams that are tidally influenced along the terrestrial route. The conduits will be installed under the streams by utilizing horizontal directional drilling technology. Generally, manholes will be placed on each side of the streams and the drilling equipment temporarily staged on one side during the drilling operations.

For the stream crossings, the drill will go under the bottom of the stream, lined channel, or culvert at sufficient depth that it will not impact the integrity of the stream or drainage structures. The depth under the streams will usually be minus 15 feet. Groundwater for the area is brackish and is not a source for domestic use (Atlas of Hawaii, 1998).

Impacts/ Mitigation

No adverse impacts are anticipated on surface water or groundwater since the project will not alter existing drainage patterns or have any long term water requirements. The use of directional drilling will also minimize or eliminate the potential for impacts to water quality in the stream or adjacent ocean.

4.1.4 Terrestrial Flora/Fauna

The area's flora is classified as lowland dry shrub and typically contain species such as kiawe, koa haole, bristly foxtail, uhaloa, naupaka, milo, and fingergrass. Home sites, roadways, military installations, and open spaces are the most common uses for this type of plant environment. No rare or endangered species of plants were observed by the planning and design team during field visits to the landing sites in December 2000 and January 2001.

With respect to animal wildlife for the area, no rare or endangered animals are known to inhabit the site. Urban birds were observed at the parks and include the barred dove, the spotted dive, English sparrow, common mynah, and an unidentified finch. The kolea (Golden Plover) is anticipated that the parks but were not observed by the planning and design team. Other animals such as feral cats, mongoose, rats and dogs are also anticipated but none were observed. The area has a dry climate and sparse vegetation does not provide good habitats for rare animals.

Impacts/ Mitigation

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

4.1.5 Marine Flora and Fauna

A. Kahe Point Beach Park.

Sea Engineering carried out a qualitative reconnaissance of the Kahe Point Beach Park cable route in May 2001 (See Appendix A). This work supplements work done earlier where quantitative sampling of this site was done in December 1991 (see Appendix). To obtain an overall perspective on the extent of the major communities occurring in the study area divers were slowly towed behind a skiff over most of the study site from shore seaward to at least the 80 foot contour. During the course of the field work notes were taken on the number, size and location of any green sea turtles and other threatened or endangered species seen within or near to the study area.

Benthic communities in the vicinity of the project site are situated on hard shore substratum. "Coral coverage may locally (over areas up to $10m^2$) exceed 75 percent; mean coverage is about 15 percent"(Sea Engineering, January 1992).

Diversity and abundance of fish in the area is high due to the plentitude of coral and the warm water outfall from the Hawaiian Electric Power Plant. Invertebrate species richness and abundance is similarly high. The intertidal bench supports normal tidal zone marine life, including starfish, crabs, small fishes, algae, and sea urchins.

"The biological survey did not find any rare or unusual species or communities. There were no sightings of green sea turtles in the area. "To the south of the beach park (i.e., offshore of Paradise Cove and West Beach) are known concentrations of green sea turtles. Some shelter (caves, ledges and undercuts) at sizes and scales appropriate for green sea turtle resting areas were seen in the region adjacent to shore and macroalgal species were encountered both subtidally and intertidally which are known forage for green turtles. No information was discovered to suggest that nesting of sea turtles in the vicinity of Kahe Point Beach Park has occurred in historical times. Another protected species, the humpback whale, also was not seen offshore of the study area" (Sea Engineering, January 1992).

As noted by Herman (1979), humpback whales tend to be found in regions remote from human activities and the proposed Kahe Point cable alignment is in relatively close proximity to the Barbers Point Harbor which is becoming an important commercial port for Oahu.

B. Waianae WWTP Outfall

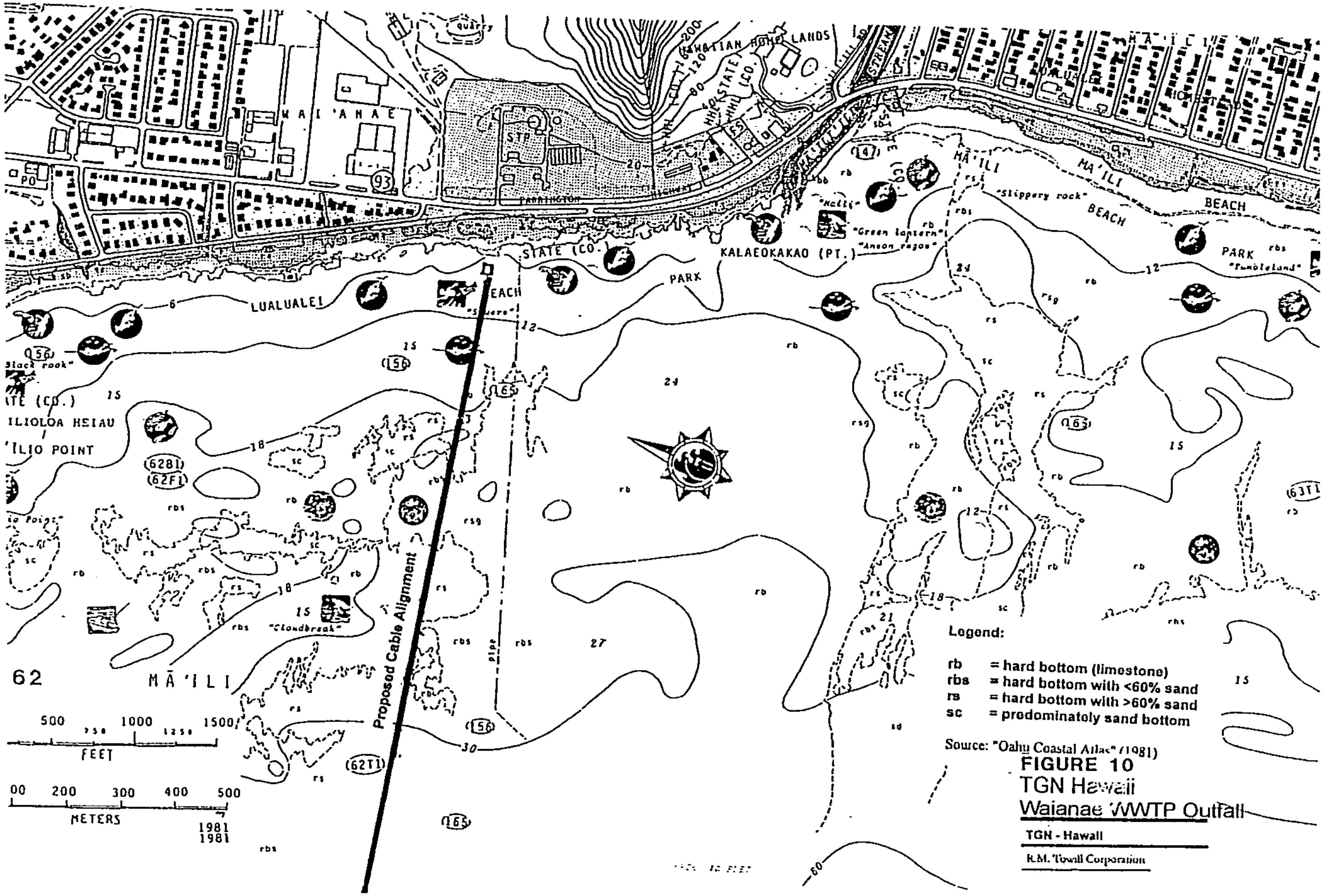
The Waianae WWTP outfall shoreline is characterized as an area with a combination of hard rock bottom, areas where there are combination of rock and sand bottoms and sandy areas. Sea Engineering carried out a qualitative reconnaissance of the Waianae WWTP outfall cable route in May 2001 as shown in **Figure 10.** Their findings of the near shore areas (within 1,500 feet of the shoreline) indicate a mixed community of reef fish with areas of mixed coral growth. The area is utilized for shore fishing and skin diving. Green sea turtles were anticipated in the area but none were sighted during the field study.

Impacts/ Mitigation

The potential for impact to the shallow marine communities will probably be greatest with the construction phase of this proposed project at both landing sites if trenching at the beach is employed. As noted earlier, however, the near shore area will not be impacted because of the use of HDD technology. At the Waianae WWTP outfall site the exit bore will be between 2,000 and 2,500 feet from the shore line. At Kahe Point Beach

Park the conduits will be trenched in next to the Verizon Hawaii conduits to the water's edge. From the water's edge, the submarine cable will be placed to avoid coral for approximately 1,500 feet where the bottom changes to sand. If the site is bored, the exit bores will be approximately between 1,500 feet to 2,000 feet from the shoreline to the sand deposit previously described.

During their field investigations Sea Engineering noted "from the sea the proposed cable alignment enters the shallows through a substrate of sand, where most of the organisms are mobile. Since these forms are mobile, deployment of the cable across such a substratum



Legend:

rb = hard bottom (limestone)
rbs = hard bottom with <60% sand
rs = hard bottom with >60% sand
sc = predominately sand bottom

Source: "Oahu Coastal Atlas" (1981)

FIGURE 10
TGN Hawaii
Waianae WWTP Outfall

TGN - Hawaii
R.M. Towill Corporation

presents little chance of negative impact to resident species because they would probably just move out of the way as the cable was deployed. Additionally since the substratum shifts, it is probable that the deployed cable will sink into the substrate." (Sea Engineering, January 1992).

A previous Environmental Assessment of a similar project in the same area found that "in the shallower areas along the route, there are areas where the cable will cross hard substratum and there is a greater possibility of impact to benthic and fish communities. Impacts associated with these construction activities primarily include removal of benthic communities in the cable path, and the generation of turbidity which may impact surrounding communities. The small scale of the proposed activities that would be necessary to protect the cable in shallow water would produce little sediment, and over a relatively short period of time." (Sea Engineering, January 1992). As such, any turbidity created by the construction should be a minor impact.

We expect that there would be no direct impacts to the threatened green sea turtle or to endangered humpback whales. As far as the impact to humpback whales are concerned, construction activities will be conducted within the period between April through October where there would be no impacts because the whales are seasonal and are only in island waters from November through March (information provided by NOAA website, April 2001). Even assuming that the cable deployment occurs when the whales are present in Hawaiian waters, it is anticipated that the impacts would be minimal. The cable laying ship should not be on site more than one or two days.

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

Sea turtles are permanent residents in inshore Hawaiian habitats. Although the potential exists for problems during the construction phase at Kahe Point where some trenching work at the shoreline is anticipated, the generation of fine particulate material from dredging appears not to hinder the green turtle in Hawaiian waters; at West Beach, Oahu, green turtles moved from an offshore diurnal resting site about 3,300 feet offshore to a point about 600 feet from the construction site within days of the commencement of dredging and the generation of turbid water. The turtles appeared to establish new resting areas in the turbid water directly offshore of the construction site (Brock 1991a). The reason(s) for this shift in resting areas is unknown but may be related to the turtles seeking water of poor clarity to possibly lower predation by sharks (a major predator on green sea turtles).

4.1.6 Scenic and Visual Resources

A. Kahe Point Beach Park.

Kahe Point Beach Park has the Hawaiian Electric Power Plant to the north end and the rest of the area is generally void of man-made structures. Except for power poles along Farrington Highway, the beach park has amenities such as two comfort stations, a pavilion, camping and picnic equipment, and fourteen marked camping sites with parking. Views of the ocean are unimpeded and allow a panoramic view of the Waianae coastline. From the park, view of the Waianae range is also unobstructed.

B. Waianae WWTP Outfall.

The outfall site is located on the ocean side of Farrington Highway across the Waianae Wastewater Treatment Plant. The site is unimproved and there is sparse vegetation. Visual resources from the site include views of the ocean and the Waianae Range. However, because of the limited shoulder area due to the guardrail next to the shoulder, parking of vehicles are limited. Access by pedestrian and bicyclists along the shoulder is allowed.

Impacts/ Mitigation

No long term adverse scenic impacts are anticipated on the visual resources since the proposed cable, conduits and manholes will be located below surface. From the parks the cable will be routed via conduits under Farrington Highway to connect to the TyCom Networks (US) Inc. cable station in Maili.

For four weeks at the Waianae WWTP outfall and two weeks at Kahe point, there will be temporary impacts on the coastal views from construction activities on the beach and along the highway corridor. During the construction period, the work areas of the project site will have construction equipment and a mound of rubble from the excavated trench and manhole. The construction areas will be returned to its existing condition at the conclusion of the cable installation. Excess material not utilized for fill will be removed from the site.

Therefore, after the cable is installed no long-term impact is anticipated.

4.1.7 Historic/Archaeological Resources

A. Kahe Point Beach Park.

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

No subsurface testing was undertaken in association with this assessment. This was due to a number of facts which include: (1) The sea cave and crevices in the park can easily be avoided; (2) The O.R. & L. right-of-way is listed as a national registered site (50-80-9714) and a mitigation plan to get by it must be approved by the Historic Preservation Division of the Department of Land and Natural Resources (DLNR); (3) Sub-surface testing along the approximately 7-mile long conduit line within Farrington Highway was deemed not necessary based on the observed degree of land alteration associated with the highway's construction, it would appear that no archaeological resources of significance remain within the actual right-of-way itself (Cultural Surveys Hawaii, Feb. 1992).

The proposed manhole and conduits to be installed at Kahe Beach Park will be placed next to the existing Verizon Hawaii cable. The sea caves identified will be avoided because the on-shore conduits will parallel the Verizon Hawaii conduits. The OR&L tracks will be crossed by going under the tracks. The conduit installation will entail trenching under the tracks to a depth of approximately 4 feet. Once the trench is opened the 4 four-inch PVC conduits will be placed and concrete encased. Once the concrete has hardened, the trench will be filled and compacted. If any ties are removed, they will be replaced and the site restored to its original condition. The work on the tracks will be coordinated with the Hawaiian Railway Society in order that planned activities of the Society are not disrupted.

B. Waianae WWTP Outfall

The shoreline at the outfall site is a combination of hard weathered coral interspersed with basaltic rocks. The area is nearly devoid of any vegetation except for scattered clumps of naupaka. Based on observations at the site there appear no visible evidence of cultural deposit because the site does not have a sand or soil layer due to erosion by wind and water. The location of the proposed beach manhole is also devoid of any vegetation and the ground is of the same hard weathered coral. The manhole, as described earlier, will be approximately 6 feet wide by 12 feet long by 6 feet deep and will be installed underground.

Because the area has been severely altered through erosional effects of the ocean and wind where there is no sand or soil remain on the hard limestone surface, there are no surface evidence of the original shoreline.

C. Act 50 (SLH, 2000) Consultation.

During the course of the project planning phase a number of individuals were contacted to provide information on cultural practices of the area. The principal source of information was Mr. William Aila and Mr. Landis Ornellas, both Waianae residents. Other persons interviewed included Cynthia Rezentes (Waianae Neighborhood Board), Danny Rodrigues (Waianae Neighborhood Board), Councilman John DeSoto and others gathered for informal talks. Information gathered were via phone conversations and in meetings. The following are highlights of the concerns expressed and information provided:

- The area adjacent to the proposed beach manhole at Pokai Bay was used by the railroad
- There are burials in the sand areas at Pokai Bay
- "Kona" crabbing is an important activity at Pokai
- Canoe activity at Pokai Bay is a large activity
- Young children are taken to Pokai to be taught how to swim
- The Waianae Small Boat Harbor is one of the busiest in the State
- The area outside of the breakwater is a congregation point for spinner dolphins
- The ocean area at Kahe Point is used by recreational divers and commercial divers
- Burials have been discovered in the Maili Beach area
- Burials have been discovered in the Ulehawa Beach area

Impacts/ Mitigation

The primary action taken since the publication of the Draft EA was the movement from the landing site at Pokai Bay to the Waianae WWTP outfall site. As a result of this move the Waianae Neighborhood Board voted to support the project as described in this EA. At Kahe

Point the two areas of concern raised by the Historic Preservation Division are the rail line and the sea cave and fissures. The cable will be routed to the south of the sea cave and therefore no impact is foreseen for the cave and fissures. However, during the installation of the beach manhole and trenching to the highway, an archaeologist will be on call to observe the work in the event cultural deposits are discovered. DLNR was consulted during the design phase of the project to minimize impacts on the rail line. Further, the Hawaiian Railway Society was consulted during design and construction under the rail line.

Prior to construction an archaeological monitoring plan will be prepared and submitted for review by the Historic Preservation Division (Meeting with HPD staff March 27, 2001). The components of the monitoring plan will include the following:

* Identification of an archaeologist who will be retained for the duration of the construction activities;
* Identification of areas where known archaeological and cultural features are known;
* Identification of areas where cultural features may be encountered; and
* Development of standard procedures in the event cultural or historic features are discovered.
* Training of construction workers on observation techniques for historic or cultural features.

During construction, if historic artifacts are found at either landing sites or along the highway, all work in the immediate vicinity will be stopped and the Historic Preservation Division will be consulted before further work is continued.

4.1.8 <u>Beach Erosion and Sand Transport</u>

A. <u>Kahe Point Beach Park</u>.

"The shoreline in this area is rocky, consisting primarily of low limestone sea cliffs approximately 15 to 20 feet high and is not subject to the typical processes of coastal erosion and accretion. The shoreline therefore has been stable in recent history. The cliff appears to be erodible, and there are large pieces of fallen limestone at the base of the cliffs. Also at the foot of the cliffs, at the waterline, there is a narrow limestone bench that terminates in a drop into 3 to 5 feet of water. The nearshore bottom off Kahe Point Beach Park is irregular with areas of hard rock bottom, alternating with patches of sand. Further offshore, a sandy bottom predominates" (Sea Engineering, January 1992).

B. Waianae WWTP Outfall.

The coastline at the Waianae WWTP outfall site is a combination of hard weathered coral interspersed with basaltic rocks. There are no sand deposits on either side of the WWTP outfall therefore no beach erosion, other than by wave action is anticipated.

Impacts

The proposed project is not expected to impact beach processes. Upon completion of construction activities, the construction crew will make every reasonable effort to return the ground to existing pre-construction contours through use of existing excavated materials for backfill. Further, a short-term maintenance program agreed upon with the Department of Parks and Recreation will be instituted to ensure restoration of damaged landscaping.

4.1.9 Noise From Construction Activity

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

Impacts/ Mitigation

Noise generated from machinery will be mitigated by requiring contractors to adhere to State and County noise regulations. This includes ensuring that machinery are properly muffled. Some work at night may be required. Night activities may include cable splicing, cable pulling, operation of machinery, etc. When night work is planned near residential units, the use of jack-hammers and pavement saw-cutting equipment will be banned.

Boats (tugs and a small craft) that are used during the cable landing 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 which will be during day light hours.

Residents residing close to construction areas will be consulted prior to construction starting to advise them of the work schedule.

4.1.10 Air Quality

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

Impacts/ Mitigation

During the excavation process, loose sand and dirt may be cast into the air by wind. The release of sand into the air can be prevented by requiring the contractor to periodically wet down the work area. The areas that are used for the placement of the construction equipment will also be exposed during the construction period. The area will be similarly wetted to control fugitive dust. The work site will be returned to its original state after the cable laying process is completed. Operation of construction vehicles is expected to temporarily contribute carbon monoxide pollutants in the project vicinity.

4.1.11 Water Quality

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

Impacts/ Mitigation

It is anticipated that the nearshore waters may be clouded during the drilling operations where the bore hole exits or "daylights." The daylighting action will be closely monitored to ensure that the release of drilling lubricant (bentonite) is minimized. Bentonite (clay) is supplied in a dry form and mixed into a slurry to lubricate and cool the drill head. Bentonite is non-toxic to humans and most animals. If released, bentonite may impact the coral reefs by smothering them. The selection of exiting in sand channels will minimize the impact to marine fauna. The following actions will be put in place during the drilling activity to minimize the release of the drilling lubricant into the ocean.

Divers will be stationed at the planned bore exit points to notify the drill operator that the drill head has daylighted. The dive team will be equipped with an a submersible pump to contain the released lubricant into a boat on the surface, if necessary. As an alternative, the drilling contractor will be requested to use seawater as a cooling agent in the last two meters of drilling to eliminate the risk of the release of bentonite in the ocean.

On land, the drilling lubricant will be stored on a truck-mounted tank thereby eliminating the possibility of the release of the lubricant on the streets, streams, or ocean.

4.2 SOCIO-ECONOMIC ENVIRONMENT

Although the population within the Waianae area numbers 37,966, the population of Honolulu County as of 1998 was 870,761, and is projected to increase 2010 (The State of Hawaii Data Book, 1998). This projected population increase over the 1990 level requires that the County's communication system be upgraded and expanded to meet future communication needs.

Impacts/ Mitigation

No adverse impact on existing resident and worker populations of Waianae are expected. The proposed action will provide employment to local resident construction workers during the construction period. Approximately 120 person months of employment will be available based on four construction crews working five months. The wages that result from this employment will circulate into the local economy in the form of income taxes and business taxes to the government, and to other business in the form of purchases made by the construction workers.

4.3 PUBLIC FACILITIES

4.3.1 Transportation Facilities

The project area is served by Farrington Highway. Trenching through the access roads and Farrington Highway will involve excavation of the pavement and subsurface, placement of the conduits within the exposed trench, and restoring the roadway and Farrington Highway to their original condition after installation of the cables.

The excavation of the trench along Kahe Point Beach Park Access Road and Farrington Highway will impact traffic. Traffic may be detoured around the construction equipment. Traffic control procedures such as rerouting the traffic onto the shoulder of the highway with the aid of necessary safety measures such as temporary traffic control devices (cones) and/or use of flag men to direct traffic will be implemented during work activity. Two-way traffic on Farrington Highway will be maintained at all times. Approximately 16 weeks will be required to complete the installation of the fiber optic conduit system.

The Kahe Park Access Road may be partially closed to vehicular traffic during construction.
The City and County of Honolulu, Department of Transportation Services, operates TheBus on a supply

and demand basis, subject to availability of resources. Existing public transit service to the vicinity is provided by the City between Honolulu and Makaha passing on Farrington Highway fronting the project area.

Impacts/ Mitigation

The proposed project is expected to have no long term impact on the existing traffic or bus services, after completion of construction activities. Construction will take approximately 16 weeks. Construction along Farrington Highway will be impacted during the installation of the conduits. It is anticipated that approximately 300 to 400 feet of highway will be excavated at one time. Traffic along the affected portions of the highway will be reduced to one lane in the Honolulu-bound lanes. Further, no construction will occur during the morning and afternoon peak travel periods. Where the excavated portions of the highway cannot be restored in a timely manner, those portions of the highway will be covered with steel plates to ensure safety of motorists. Additional mitigation measures proposed are:

a. No construction work will take place during peak commuting hours and work during the day will be limited between 9 a.m. and 3 p.m.
b. Multiple construction crews will be employed to lessen the overall construction period.
c. Night work will be implemented on Farrington Highway in concert with the Board of Water Supply where residential units are across the street from the work area. No night work will take place where residential dwelling units are adjacent to the work area. However, no night work will occur on Fridays and Saturdays.
d. Night work will be implemented between 7 p.m. and 4 a.m. for areas where there are no residential dwellings.
e. Coordination with the Board of Water Supply (BWS) and Sandwich Isle Communications will continue to insure that work on both projects are planned to minimize construction time.
f. Coordination with other projects on the highway is ongoing to further insure that construction times are minimized, and where mutually beneficial, work done in concert.

4.3.2 Recreation Facilities

Although the cable landing sites are located within existing recreational sites, the installation and maintenance of the cable will not restrict recreational use of the park other than in the immediate area of construction and only during installation or repair. Access to Kahe Beach Park by the public will be allowed at all times.

Impacts/ Mitigation

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

Waianae WWTP Outfall. Construction at the Waianae WWTP outfall site will take four weeks to complete the HDD work.

SECTION 5
RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS AND POLICIES

5.1 THE HAWAII STATE PLAN

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

Section 226-10.5: Economy - Information Industry
The proposed project serves to assist in the State's objective of positioning Hawaii as the leader in information services in the Pacific. The proposed project will continue development and expansion of Hawaii's telecommunications infrastructure and will help to accommodate future growth in the information industry.

Section 226-14 Facility Systems - In General
The proposed project supports the State's goals for achieving telecommunications systems necessary for Statewide social, economic, and physical objectives.

Section 226-18: Facility System - Energy/Telecommunications
The proposed project will help to ensure adequate and dependable telecommunication services for Hawaii by promoting efficient management of existing and proposed facilities, and by promoting installation of new telecommunications cables.

5.2 STATE FUNCTIONAL PLANS

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

Education Implementing Action A(4)(c):

The proposed project will help to ensure adequate telecommunication services necessary for Hawaii's schools.

Education Implementing Action B(3)(d):

The proposed project serves to promote and expand the appropriate use of telecommunications to deliver distance education as well as enhance the learning process and communication competencies of students.

Education Implementing Action(3)(e):

The proposed project enables school library media centers to effectively manage and provide access to information and knowledge through telecommunications.

5.3 STATE LAND USE LAW

The State of Hawaii classifies the lands of the State into four land use districts: Urban, Rural, Agricultural, and Conservation. The uses and activities allowed in each district is defined in Chapter 205, Hawaii Revised Statutes (HRS).

The "Urban" classification is defined as "areas characterized by city-like concentration of people, structures, streets and other related uses." Uses within the "Urban" districts shall "include activities or uses as provided by ordinances of regulations of the county within which the urban district is situated." (Chapter 205, HRS)

The purpose of the "Agricultural" district is to maintain a strong agricultural economic base and to prevent unnecessary conflicts among incompatible uses." (Chapter 205, HRS)

"Conservation" district shall "include areas necessary for protection watersheds and water sources, preserving scenic and historic areas, providing park lands, wilderness, and beach reserves, conserving endemic plants, fish, and wildlife, preventing floods and soil erosion, forestry, open space areas whose existing openness, natural condition, or present state of use, if retained, would enhance the present or potential value of abutting or surrounding communities, or would maintain or enhance the conservation of natural or scenic resources, areas of value for recreational purposes, other related activities, and other permitting uses not detrimental to a multiple uses conservation concept." (Chapter 205, HRS).

The State of Hawaii Land Use District classifications designate Kahe Point Beach Park as "Urban and Agricultural", and the surrounding areas as "Urban" and "Agricultural" (see **Figure 11**). The State land use about the Waianae WWTP outfall is "Urban" and "Conservation." The proposed project does not require any amendments in the current State Land Use classification. The proposes cable installation is a permitted use in each of the three district being effected.

5.4 COUNTY ZONING

Zoning for the Kahe Point Beach Park area is general preservation (P-2). The areas surrounding Kahe Point Beach Park are zoned intensive industrial (I-2), restricted agriculture (AG-1), general agriculture (AG-2), and country (see **Figure 12 - Kahe Point**).

The zoning at the Waianae WWTP outfall is general preservation (P-2). The areas surrounding the park are zoned residential (R-5), and industrial (I-2). (see **Figure 13 - Waianae WWTP Outfall**). The proposed project does not require any zoning adjustments.

5.5 CITY AND COUNTY OF HONOLULU GENERAL PLAN

The General Plan of the City and County of Honolulu provides a statement of long range social, economic, environmental, and design objectives for the Island of Oahu and a statement of policies necessary to meet these objectives. A specific objective of the General Plan relating to the proposed project is the maintenance and expansion of existing utilities systems. The proposed project is generally in conformance with the goals and objectives of the City and County General Plan.

5.6 CHAPTER 205A (HRS) AND SPECIAL MANAGEMENT AREA

Chapter 205A, HRS, defines the Coastal Zone Management Program for the State of Hawaii. The stated objectives of the program include:

"A. Provide coastal recreational opportunities accessible to the public.

B. Protect, preserve, and where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that area significant in of natural or scenic resources, areas of value for recreational purposes, other related activities, and other permitting uses not detrimental to a multiple uses conservation concept." (Chapter 205, HRS).

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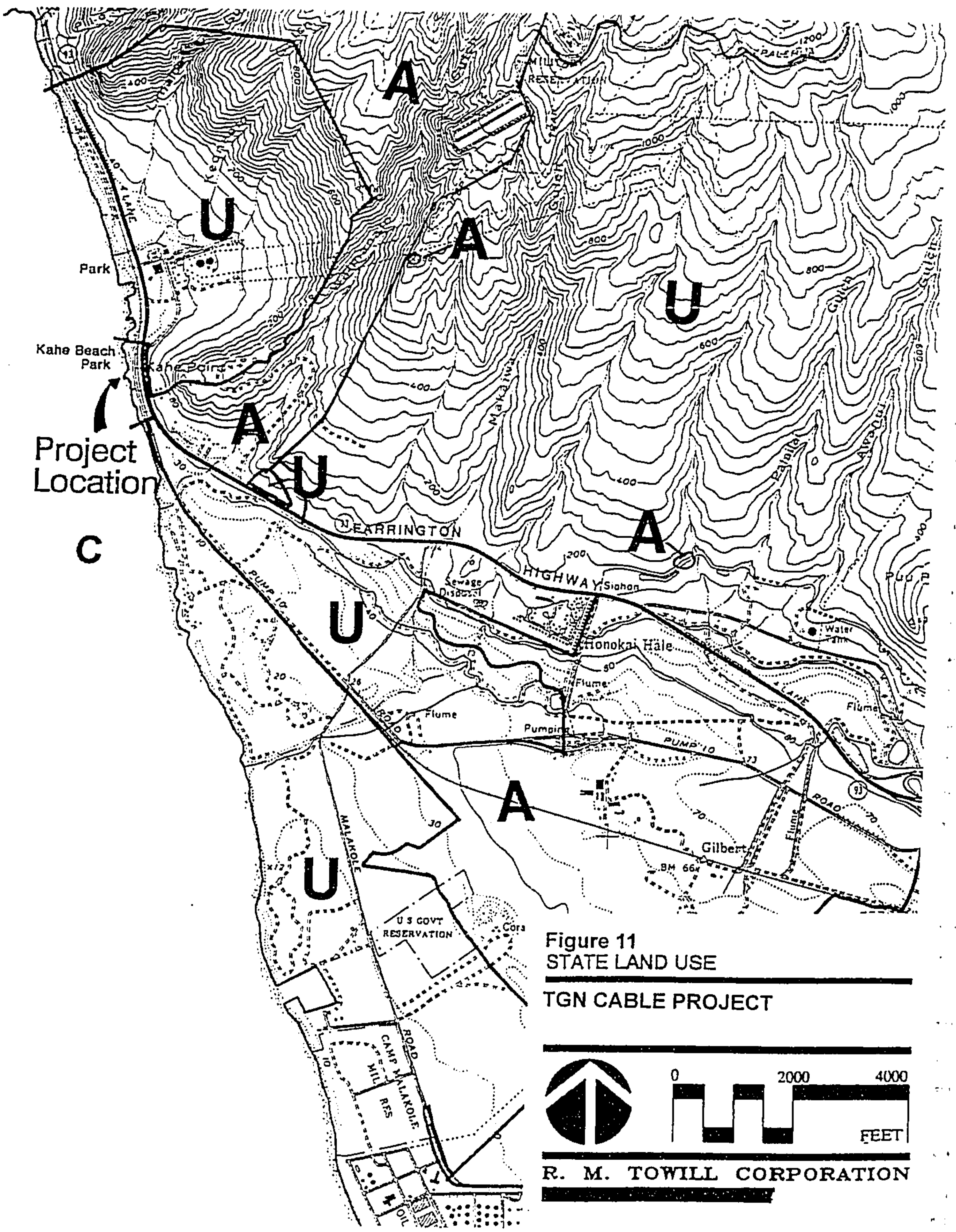


Figure 11
STATE LAND USE

TGN CABLE PROJECT

R. M. TOWILL CORPORATION

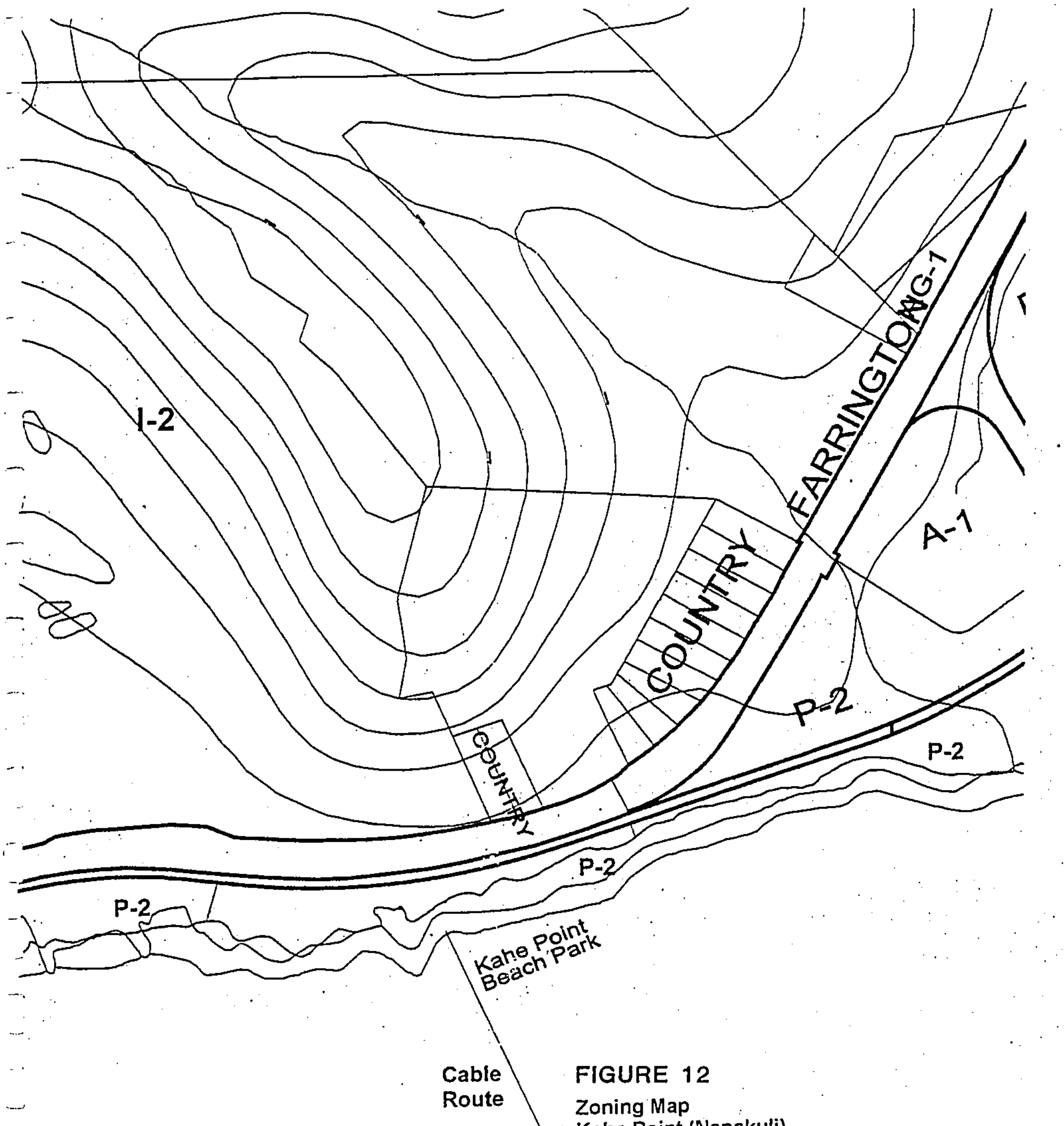


FIGURE 12
Zoning Map
Kahe Point (Nanakuli)

TGN - Hawaii

R.M. Towill Corporation

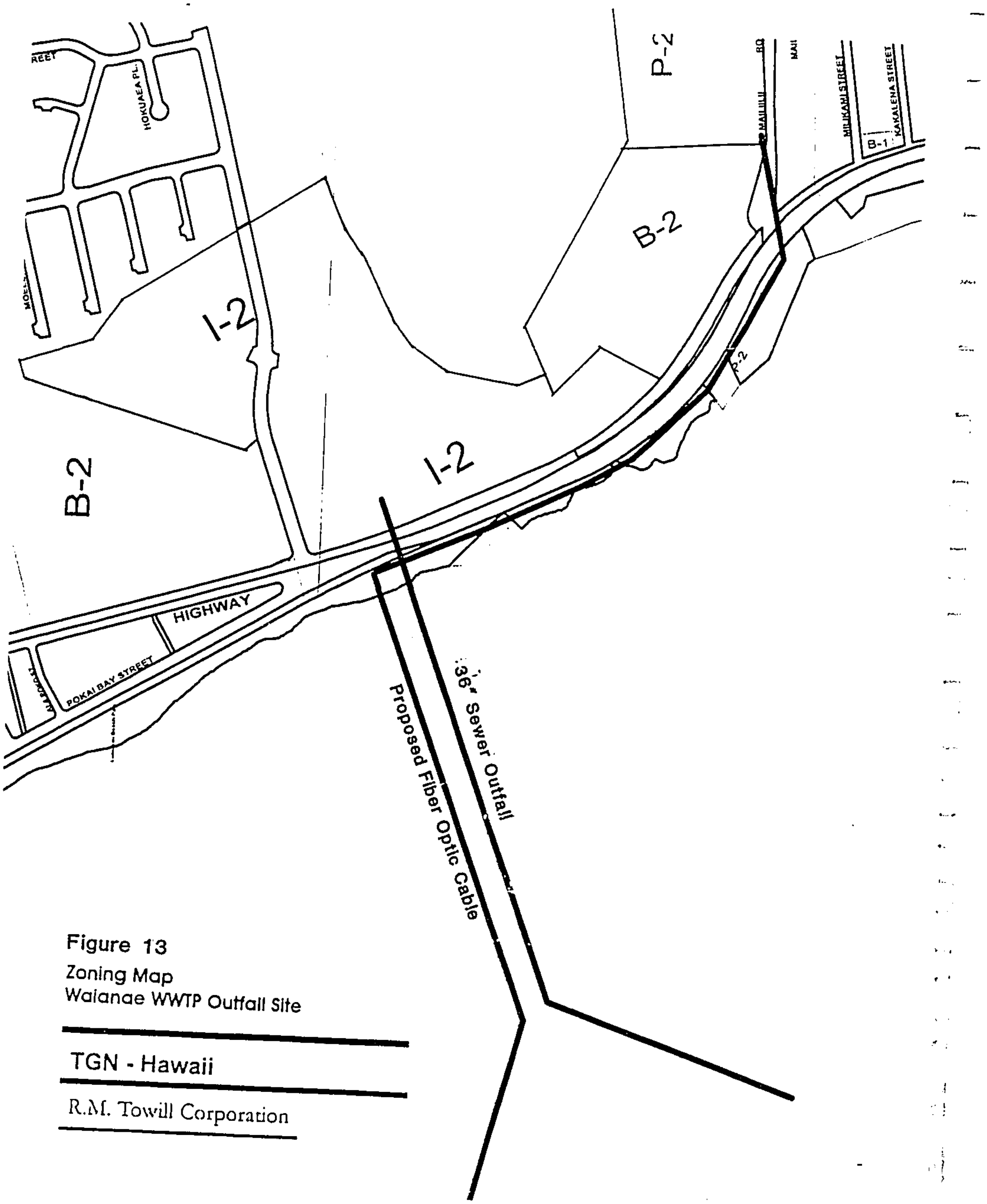


Figure 13
Zoning Map
Waianae WWTP Outfall Site

TGN - Hawaii

R.M. Towill Corporation

Hawaiian and American history and culture.

C. Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and opens space resources.

D. Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

E. Provide public or private facilities and improvements important to the State's economy in suitable locations.

F. Reduce hazards to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.

G. Improve the development review process, communications, and public participation in the management of coastal resources, and hazards." (Chapter 205A, HRS)

Chapter 205A further provides for each County to define boundaries for "Special Management Areas" as areas of land inland from the shoreline as delineated on maps on file with the Counties.

The City and County of Honolulu has designated the shoreline and certain inland areas of Oahu as being within the Special Management Area (SMA). SMA areas are felt to have a sensitive environment and should be protected in accordance with the State's coastal zone management policies. The project area is within the SMA Boundary as defined by the City and County of Honolulu (see **Figure 14 - Kahe Point, Figure 15 - Waianae WWTP Outfall**). A SMA permit will be necessary for development of the proposed project. Review of the project under SMA criteria will be conducted during the processing of the SMA permit with the Department of Planning and Permitting (DPP), City and County of Honolulu.

5.7 SHORELINE SETBACKS

Chapter 205, Section 13, provides for the establishment of "setbacks of not less than twenty feet and not more than forty feet inland from the upper reaches of the wash of the waves other than storm and tidal waves." The City and County of Honolulu has established rules for activities or uses within the shoreline setback area. Chapter 23, Revised Ordinances of Honolulu states that "It is a primary policy of the city to protect and preserve the natural shoreline, especially sandy beaches; to protect and preserve public pedestrian access laterally along the shoreline and to the sea; and to protect and

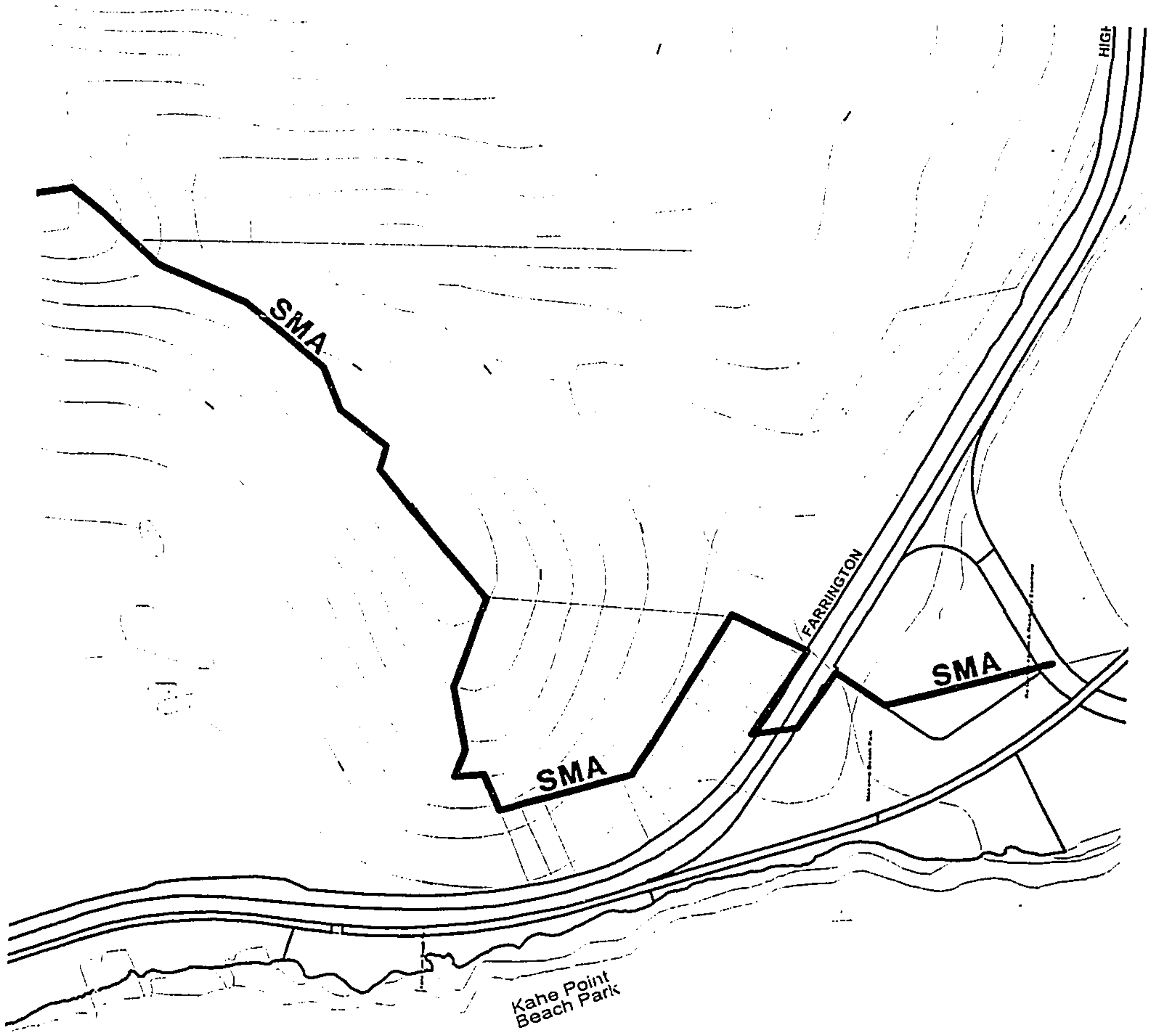


Figure 14
SMA Boundary
Kahe Point Beach Park

TGN HAWAII CABLE SYSTEM

R.M. Towill Corporation

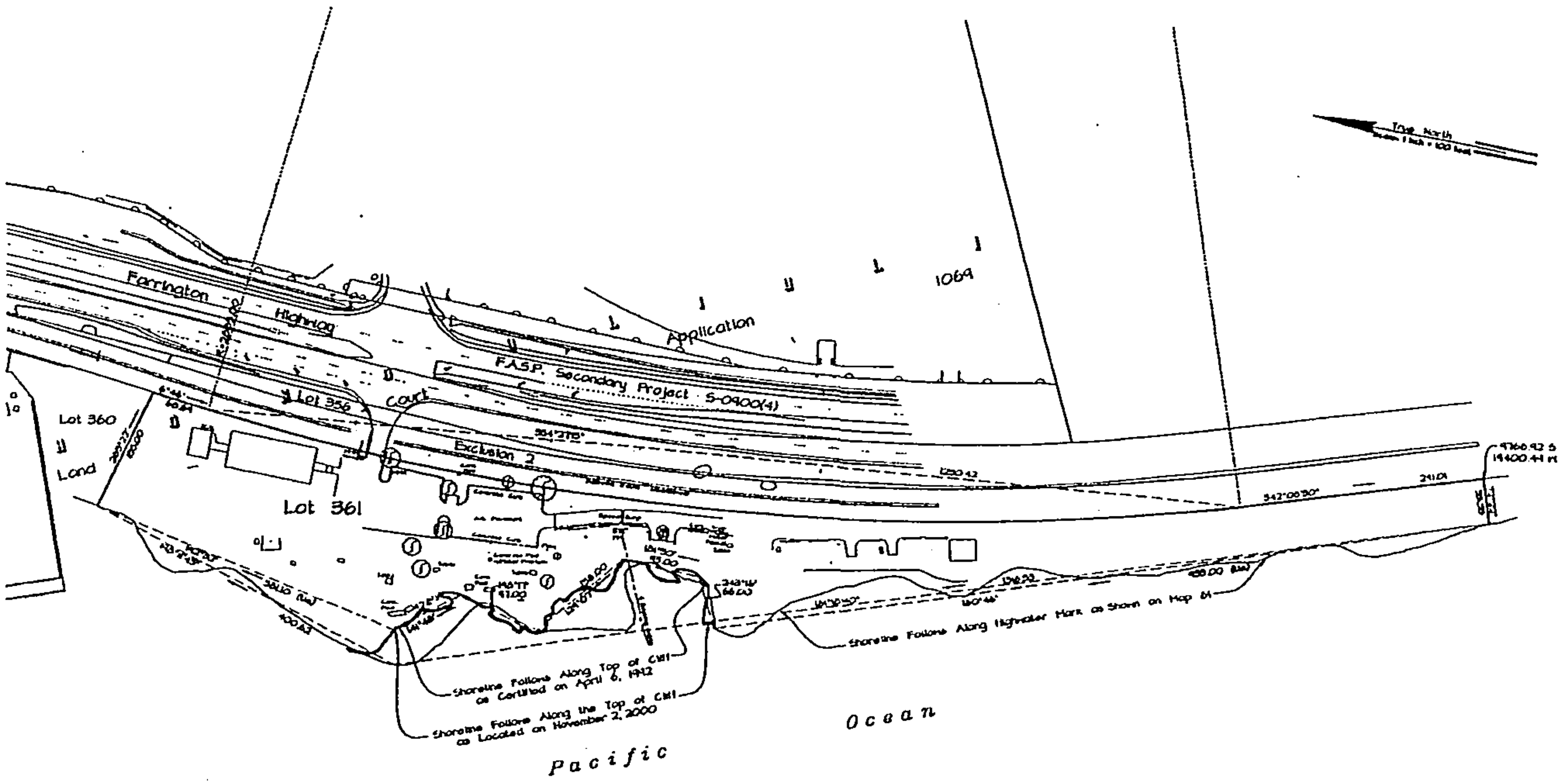
Figure 15
SMA Boundary
Waianae WWTP Site

TGN HAWAII CABLE SYSTEM

R.M. Towill Corporation

preserve open space along the shoreline. It is the secondary policy of the city to reduce hazards to property from coastal hazards."

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 16 - Kahe Point and Figure 17 - Waianae WWTP Outfall** show 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. The conduits for the submarine telecommunications cables will be installed within the 40-feet shoreline setback area and therefore a permit will be sought from the City and County of Honolulu.



The shoreline as located and certified and delineated in red is hereby confirmed as being the actual shoreline as of DEC 8 2001

Chairman, Board of Land and Natural Resources

Notes:

Azimuths and coordinates are referred to Government Survey Triangulation Station "Kapuai Nee" △.

Property lines compiled from record data.

Shoreline certification is for permitting purposes.

RUSSELL FIGUEIROA LICENSED PROFESSIONAL LAND SURVEYOR No. 4729 HAWAII, U.S.A.

This work was prepared by me or under my direct supervision

Russell Figueiroa
Licensed Professional Land Surveyor
Certificate Number 4729

Owner: City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Property Address:
92-801 Farrington Highway
Makakilo, Hawaii 96792

Shoreline Survey
of a Portion of Lot 361
of Land Court Application 1069 (Map 61)
At Honouliuli, Ewa, Oahu, Hawaii
Tax Map Key: 9-2-03: 15

Figure 16

Ref. No. 1-18862-0-5
o. 7206
Kahe-SL.Dwg

R. M. TOWILL CORPORATION

420 Waiakamilo Road, Su
Honolulu, Hawaii 96817
November 2,

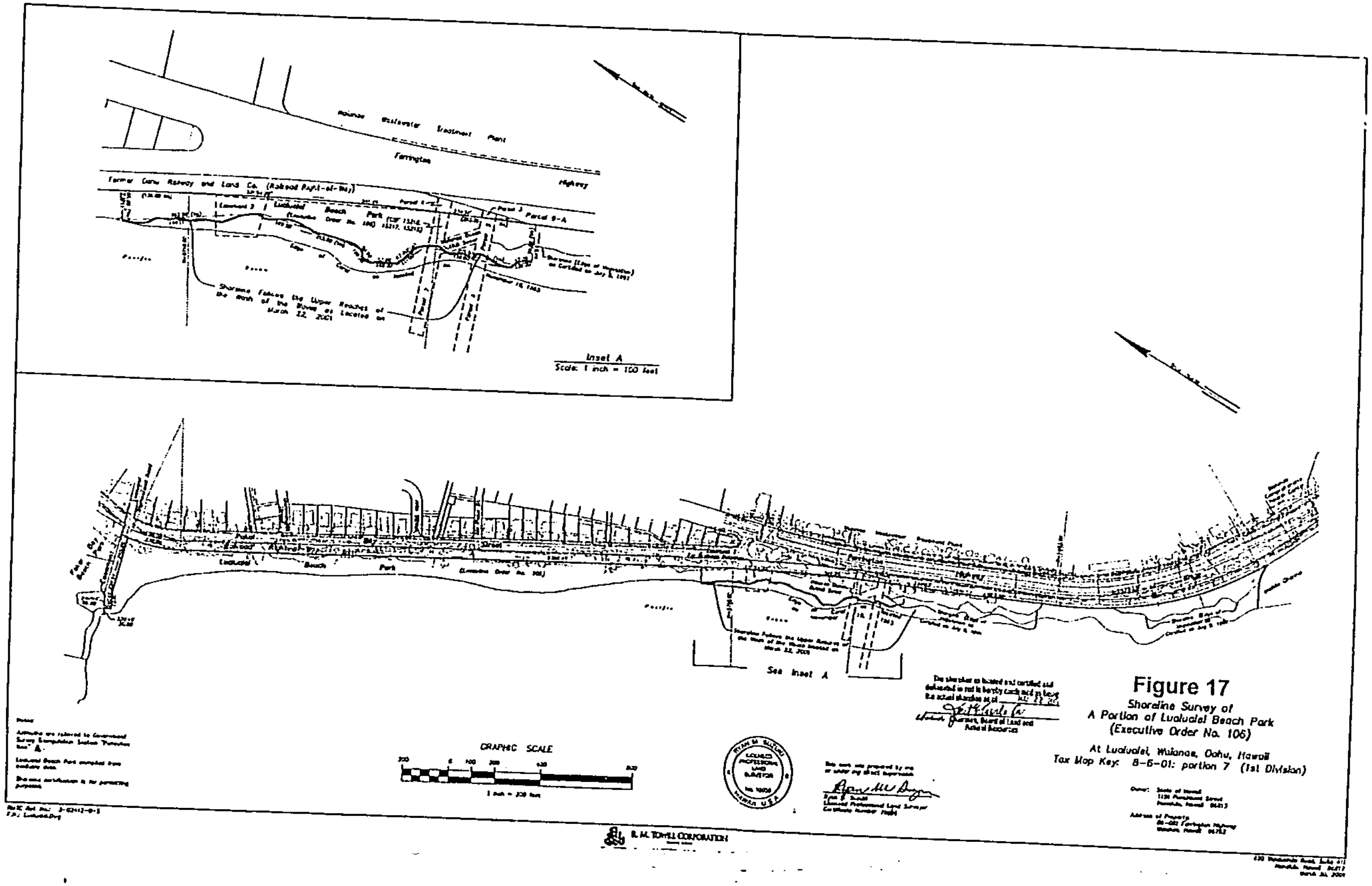


Figure 17

Shoreline Survey of
A Portion of Lualualei Beach Park
(Executive Order No. 106)

At Lualualei, Waianae, Oahu, Hawaii
Tax Map Key: 8-6-01: portion 7 (1st Division)

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

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

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

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

SECTION 7

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 State of Hawaii and the City and County of Honolulu.

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

SECTION 8

NECESSARY PERMITS AND APPROVALS

8.1 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 402, National Pollution Discharge Elimination System

Department of Transportation

- State Highway Rights-Of-Way

8.2 CITY AND COUNTY OF HONOLULU

Department of Planning and Permitting

- Shoreline Management Area Permit
- Shoreline Setback Variance

8.3 FEDERAL

U.S. Army Corps of Engineers

- Corps of Engineers Section 404/Section 10

SECTION 9

CONSULTED AGENCIES AND PARTICIPANTS IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

9.1 FEDERAL AGENCIES

U.S. Army Corps of Engineers

9.2 STATE AGENCIES

Department of Land and Natural Resources

- Office of the Chairperson
- Land Division
- Historic Preservation Division

Department of Transportation

Department of Health

Environmental Center

9.3 CITY AND COUNTY OF HONOLULU

Department of Planning and Permitting

Department of Design and Construction

Department of Park and Recreation

Department of Budget and Fiscal Services

Waianae Neighborhood Board

9.4 INDIVIDUALS

Mr. William Aila

Mr. Landis Ornellas

SECTION 10

SUMMARY OF IMPACTS AND EIS DETERMINATION

10.1 SUMMARY OF IMPACTS

10.1.1 Physical Impacts

No long term negative physical impacts are anticipated with the implementation of the proposed action. Short-term, construction related impact such as noise and dust are anticipated, but should be adequately mitigated through the use of sound construction practices.

Beneficial impacts of the project are those related to the provision of increased capacity, reliability and speed of telecommunication facilities to the islands. The installation of the beach manholes and conduits will provide construction employment for a five month duration.

10.1.2 Impacts on Public Services

No long term negative impacts are anticipated to public services.

10.1.3 Socio-Economic Impacts

No long term negative impacts are anticipated to the socio-economic environmental as a result of the implementation of the proposed action. Short-term benefits of this project is the creation of employment in the construction industry.

10.2 NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT (EIS)

Because no long term adverse impacts are anticipated resulting from the proposed fiber optic cables it has been determined by the Department of Planning and Permitting, City and County of Honolulu, that a Findings of No Significant Impact is anticipated.

10.3 SIGNIFICANCE CRITERIA

According to the Department of Health Rules (Chap. 11-200-12), an applicant or agency must determine whether an action may have a significant impact on the environment, including all phases of the project, its expected consequences, both primary and secondary, its cumulative impact with other projects, and its short and long-term effects. In making the determination, the Rules establish a Significance Criteria to be used as a basis for identifying whether significant environmental impacts will occur. According to the Rules, an action shall be determined to have a significant impact on the environment if it meets any on of the following criteria:

(1) *Involves an irrevocable commitment to loss or destruction of any natural or cultural resources;*
The proposed action will not entail the loss or destruction of any natural or cultural resource. Prior to construction an archaeological monitoring plan will be developed and reviewed with the Historic Preservation Division. The components of the monitoring plan will include the following:

a. Identification of an archaeologist who will be retained for the duration of the construction activities;
b. Identification of areas where known archaeological and cultural features are known;
c. Identification of areas were cultural features may be encountered; and
d. Development of standard procedures in the event cultural or historic features are discovered.
e. During construction, if historic artifact are found at either landing sites or along the highway, the Historic Preservation Division will be contacted before further work is continued.

(2) *Curtails the range of beneficial uses of the environment;*
The proposed fiber optic cable project is being built within a previously developed complex of communication cables and therefore will limit certain types of development; however, existing recreation activities will be impacted in the short-term.

(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 action does not conflict with the State's long-term environmental polices or goals and guidelines.

(4) *Substantially affects the economic or social welfare of the community or state;*
The proposed action could have a substantial affect on the economic welfare of the community and state by providing greater communications access and providing band width capacity for new technologies.

(5) *Substantially affects public health;*
The proposed action when completed will not have a substantially affect on public health because the fiber optic system does not have any harmful emissions. During construction, there will be the release of vehicle exhausts, however, the duration will be limited. Fugitive dust may all be released but can be mitigated through good house-keeping actions and by watering to keep dust to a minimum.

(6) *Involves substantially secondary impacts, such as population changes or effect on public facilities;*
The proposed action will not have any secondary impacts such as population changes. However, there will be short-term impacts to the road facilities and traffic movement. This latter impact will be short-term and only during the construction period.

(7) *Involves a substantial degradation of environmental quality;*
The proposed action will not have a substantial degradation of environmental quality. The proposed site is within an urban environment and in an area previously developed.

(8) *Is individually limited but cumulatively has considerable effect on the environment, or involves a commitment for larger actions;*
The proposed project is part of a large telecommunications network that will interconnect Japan, with Hawaii and the continental U.S. This system will provide additional connectivity and capacity to the existing systems currently serving Hawaii.

(9) *Substantially affects a rare, threatened or endangered species or its habitat;*
The proposed project will not impact any rare, threatened or endangered species or its habitat as the work areas have been previously disturbed.

(10) *Detrimentally affects air or water quality or ambient noise levels*

The proposed project will not detrimentally impact air or water quality. Any air quality impacts will be short-term and limited to the construction period.

(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, freshwater, or coastal waters;*

The proposed project will not be developed in an environmentally sensitive area.

(12) *Substantially affects scenic vistas and view planes identified in county or state plans or studies;*

The proposed project will not have long term impact to any scenic vistas or view planes because all of the facilities to be installed will be underground. Short-term impacts will be limited to the construction period.

(13) *Requires substantial energy consumption.*

The proposed development of the TGN Hawaii system will require the consumption of energy, both during its construction and for its operations. The project, however, cannot be considered a substantial energy user.

SECTION 11

COMMENTS RECEIVED DURING THE PUBLIC REVIEW PERIOD

The notice of availability for review of the Draft EA (DEA) was published in "The Environmental Notice" on February 8, 2001. The public comment period ended on March 10, 2001. A revised Draft Environmental Assessment was published on May 8, 2001 to address concerns raised during the first EA. The public comment period ended on June 7, 2001. Comments were received, and responses provided follows for both DEA public review periods.

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

REPLY TO ATTENTION OF

March 8, 2001

Regulatory Branch

Mr. Chester Koga
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Dear Mr. Koga:

This responds to your request for comments on the Draft Environmental Assessment (DEA) for the TGN Hawaii Cable System, which will include construction of submarine fiber optic cable landings at Kahe Point Beach Park and Pokai Bay Beach Park, Oahu. Nearshore work will include trenching and backfilling to install conduits connecting to onshore manholes. Landside work will include installation of a connecting cable which will involve stream crossings along Farrington Highway, which will be achieved by bridge attachment, trenching, or directional drilling.

Based on the information provided in the DEA, I have determined that your proposed activity will involve work in waters of the U.S. and that a Department of the Army (DA) permit will therefore be required.

A DA permit application and instructions for its preparation, including information about submission of drawings and illustrations, is enclosed for your use. An optional questionnaire and applications for Water Quality Certification and Coastal Zone Management Consistency Determination are also enclosed for your use.

Should you have any questions regarding this determination, please contact Mr. Peter Galloway of my staff at 438-8416 (fax 438-4060). File number 200100135 has been assigned to this project.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Enclosures

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

March 28, 2001

File No. 200100135

Mr. George P. Young, P.E.
Chief, Regulatory Branch
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, Hawaii 96858-5440

Dear Mr. Young:

Draft Environmental Assessment (EA)
TGN Hawaii Cable system

Thank you for your comments of March 8, 2001. Your guidance is appreciated and we will be processing a Department of the Army permit at the appropriate time.

When we file our permit application we will forward plans for the installation for your review.

Should you have any additional comments please contact the undersigned.

Very truly yours,

Chester Koga

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-tgn

BENJAMIN J. CAYETANO
GOVERNOR

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

MAR 13 2001

LETTER NO. (P)1178.1

MAR 9 2001

Mr. Chester Koga, AICP
R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Dear Mr. Koga:

Subject: TGN Hawaii Cable System
Draft Environmental Assessment

Thank you for the opportunity to review the Draft Environmental Assessment for the subject project.

The project does not impact any Department of Accounting and General Services projects or existing facilities. Therefore, we have no comments to offer.

Should you have any question, please have your staff call Mr. Allen Yamanoha of the Planning Branch at 586-0488.

Sincerely,

GORDON MATSUOKA
Public Works Administrator

AY:mo

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420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

March 28, 2001

Reference: (P) 1178.1

Mr. Gordon Matsuoka
Public Works Administrator
Department of Accounting and General Services
State of Hawaii
P.O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Matsuoka:

Draft Environmental Assessment (EA)
TGN Hawaii Cable System

Thank you for your comments of March 9, 2001. We appreciate your taking time to review this important project.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-tgn

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

Re Chester Koga

February 16, 2001

Randall Fujiki, Acting Director
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attn: Dana Teramoto

Dear Mr. Fujiki:

Subject: Draft Environmental Assessment (EA) for TGN Hawaii Cable System, Pokai Bay and Kahe Point Beach Park

We have the following comments to offer:

Cultural impacts assessment: Act 50 was passed by the Legislature in April of 2000. This mandates an assessment of impacts to local cultural practices by the proposed project. In the final EA include such an assessment. For assistance in the preparation refer to our *Guidelines for Assessing Cultural Impacts*. Contact our office for a paper copy or go to our homepage at http://www.state.hi.us/health/oeqc/index.html. You will also find the text of Act 50 linked to this section of our homepage.

Archeologic and historic resources: Native Hawaiian burials in sandy coastal areas are quite common. It is possible that skeletal remains will be uncovered during any subsurface activity for this project. A determination and concurrence is required by the State Historic Preservation Division of DLNR. In the final EA include documentation to this effect from this division.

Figures:
1. In the final EA include a figure which shows the exact location for the manhole installation at Kahe Point Beach Park.

2. Include a clearer, close-up SMA map for Kahe Point (Figure 9) which shows the work site in relation to Farrington Highway and the mauka SMA boundary.
3. Figures 11 and 12 (certified shoreline maps) for both locations are missing from the draft EA. These must be included in the final EA.

Contacts: In the final EA enclose copies of all correspondence with those consulted during both the pre-consultation phase and during the comment period for this project.

Significance criteria: For criteria numbers 1, 5, 6, and 9 through 12 the draft EA includes a reiteration of these criteria in the negative rather than the required discussion and analysis. Please correct this in the final EA.

Marine flora and fauna: Section 3.1.5 lacks discussion on this but repeats text given in section 3.1.2.B (Geology and soils). In the final EA include a complete discussion of marine flora and fauna, impacts and related mitigation measures.

Alternative site: Section 5.2.2, *Alternative Landing Sites*, notes that Makaha Beach will be the alternate site if Kahe Point is dropped from consideration. If this occurs, a full disclosure of conditions, impacts and related mitigation measures at Makaha would be required before the project can proceed.

Cable surfacing: Coastal Zone Management staff has noted that a fiberoptic cable buried at Makaha Beach once surfaced. What mitigation measures do you plan to prevent this? Who will be responsible if this occurs?

If you have any questions call Nancy Heinrich at 586-4185.

Sincerely,

Genevieve Salmonson

GENEVIEVE SALMONSON
Director

c: Chester Koga, RM Towill
Gerald Lynch, TyCom Networks

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@lava.net.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

March 28, 2001

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

**Draft Environmental Assessment (EA
TGN Hawaii Cable System
Pokai Bay and Kahe Point Beach Park**

Thank you for your letter of February 16, 2001. We would like to offer the following responses to your concerns:

Cultural Impact Assessment. In accordance with Act 50, we have conducted consultation with regard to cultural practices at both locations and the finding will be reported in the Final EA.

Archaeological and Historic Resources. We have been in consultation with the Division of Historic Preservation and we have shared our construction plans with the Division staff. Areas of concern have been identified and appropriate mitigation measures are being put in place to ensure that archaeological and historic resources are protected. The principal action to be taken is the presence of a trained archaeologist during trenching work.

Figures. We will include additional graphics to show the exact location of work at Kahe Beach Park in the Final EA. Another map showing the limits of the SMA boundary will also be include for Kahe Point. Further, the Certified Shoreline Maps will be bound into the Final EA.

Contact. We will enclose copies of all correspondence received during the public review period.

Significance Criteria. We will revise the section addressing the significance criteria in the Final EA.

Marine Flora and Fauna. Additional studies have been conducted since the publication of the Draft EA and the findings will be included in the Final EA.

Alternative Sites. Additional discussion will be included in the Final EA addressing alternative sites and the potential impacts to these sites if they area chosen instead of the primary sites.

Cable Surfacing. The fiber optic cable recently installed at Makaha Beach was exposed during a storm period that eroded sand from the beach. The contractor who installed the cable, Global Marine, acknowledged that the cable was buried at a depth much shallower than was specified in the construction plans. At Makaha Beach, corrective action was taken by the cable owner, AT&T by lowering the cable to the prescribed depth. Since that action was taken no further incidents have taken place. It is anticipated that should this event occur where the TGN cables are installed, Tycom will be responsible for taking corrective action.

Should you have additional comments, please contact the undersigned.

Very truly yours,

Chester Koga

Chester Koga, AICP
Project Manager

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cc. Randall Fujiki, Department of Planning and Permitting
Gerard Lynch, Tycom Networks Inc.

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DEPT OF PLANNING AND PERMITTING
CITY & COUNTY OF HONOLULU

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION
PO BOX 621
HONOLULU, HAWAII 96809

Randall K. Fujiki, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King St.
Honolulu, Hawaii 96813

Dear Mr. Fujiki,

Subject: Draft Environmental Assessment by TyCom Networks (US) Inc. for a Portion of the TyCom Global Network (TGN) Undersea Telecommunications Fiber Optic Network System, Offshore and Onshore of Land Parcels at Pokai Bay, Oahu TMK, 1st 8-5-01:62 and Kahe Point, Oahu, TMK 1st 9-2-03:15

Thank you for your request for comment dated January 24, 2001 on the subject environmental assessment. According to the environmental assessment, we understand that TyCom Networks (US) Inc. would like to install fiber optic cables at submerged and fast lands at Pokai Bay and Kahe Point, Oahu. One or more cables would be installed at each landing location at "beach manholes". No cable conduits or bores are proposed to be installed at submerged lands. One or more fiber optic cables would be lain in one or more of four 4 inch conduits between the two sites for eight miles along the shoulder or inside lane of Farrington Highway. A cable station site would be located someplace at Maili.

According to the environmental assessment, we understand that a cable landing site selection study, not submitted with the EA, was conducted. The study considered shoreline and nearshore conditions, public use considerations, environmental and natural resource considerations and location of terrestrial facilities considerations. The study selected Kahe Point, Pokai Bay and Makaha Beach as possible landing locations.

We have comments related to three topic areas.

Submarine Cable Landing Sites On the Waianae Coast:

Pokai Bay Beach Park is owned by the State of Hawaii and managed, landward of any shoreline accretion, by the City and County of Honolulu, Department of Parks and Recreation. The proposed cable route appears to cross a ten foot wide easement for a wastewater line. No submarine cables are presently installed at Pokai Bay. What is the capacity of the area for future submarine cable installation? Would installers other than TyCom be able to install submarine cable at Pokai Bay in the future? Would future installers be able to utilize the proposed beach

manhole? If so, how close could future submarine cables be to the proposed submarine cable at Pokai Bay? In total, how many submarine cables would be installed at Pokai Bay and Kahe pursuant to the subject EA now and in the future? What is the purpose of each presently planned submarine cable?

Previous environmental assessments including: GTE Hawaiian Tel Interisland Fiber Optic Cable System, 1993, Submarine Fiber Optic Cable Landings at Makaha Beach and Keawaula, Oahu, 1996 and Submarine Fiber Optic Cable Landing at Kahe Beach, Oahu 1999, indicate that Pokai Bay: 1) Is an anchorage area; 2) Is too near the Waianae Small Boat Harbor for submarine cable installation; 3) Has potential for discovery of archaeological remains; 4) Is a heavily used recreational area; 5) Anchored split pipe would be necessary to protect the cable in the transition from the nearshore (approximately 1,300 feet from shore) to deeper ocean waters. How do you respond to these previously stated concerns?

Keawaula (Yokohama) Beach, Makaha Beach, Nanakuli Beach and the Kahe Point area are present submarine cable landing corridors. We understand that Yokohama Beach was not considered as a landing location. Makaha Beach was removed from consideration due to its distance from the proposed cable station site somewhere near Maili. Nanakuli Beach was dropped from consideration because of existing US Navy use. What is the cost of the proposed work at Farrington Highway from Pokai Bay and Kahe to Maili?

In the general area of Kahe Point, our records indicate that four submarine cables presently exist in two submarine cable easements. One submarine cable is presently located at Kahe Beach Park. Is the cable still in use? Could the proposed Kahe cables be installed within the existing non-exclusive easement or immediately adjacent to it? Could you include the location of the proposed Kahe submarine cables on a map along with the presently existing submarine cable? Three submarine cables are presently located in a non-exclusive easement at three of four 4 inch directionally drilled bore holes at Kahe near Nanakuli Beach Park. Is it possible to locate the proposed Kahe submarine cables in the presently empty conduit? Is it possible to drill new bores within or next to the existing easement for the proposed new Kahe submarine cable?

Present submarine cables on the Waianae Coast are located in non-exclusive easements and, therefore, new submarine cables may be located there or within similar areas. What is the excess capacity for submarine cable landing at the Yokohama and Makaha Beach locations? Our records indicate that, in the past, two submarine cables at Yokohama Beach have been removed and new submarine cables installed in their place at existing cable easements. What submarine cables on the Waianae Coast are presently in disuse? Is it possible to locate both or either of the proposed submarine cables in an existing submarine cable easement, thus removing the need for a Conservation District Use Permit and avoiding impacts of new submarine cable landings and new landing corridors?

Pursuant to relevant telecommunications laws, is it possible to enjoy an exclusive easement for the proposed submarine cables? If so, why not install greater excess submarine cable capacity than is currently proposed and capture rents in the future from other cable installers to compensate for construction costs incurred? If not, pursuant to relevant legislation, is it possible to, at present, capture rent from others' use of easements and conduits at submerged lands and along the Farrington Highway route?

Submarine Cable Conduits:

The environmental assessment does not examine the installation of larger conduits, instead of four 4 inch conduits, at the Kahe and Pokai Bay Beaches and along the highway. Is it possible to install one or more larger conduits and ultimately place more cable within new conduits? How many cables can be placed in a 4 inch conduit?

At Kahe Point, why are submarine cable conduits not proposed for nearshore submerged land areas? Wouldn't installation of such conduits avoid environmental impacts from subsequent conduit lifetime submarine cable installation and removal?

Is there existing excess conduit capacity in which fiber optic cable may be lain under Farrington Highway? What is the cost of installing conduits from Yokohama Beach and Makaha Beach to Maili. Is there existing excess conduit capacity at the highway in which fiber optic cable may be lain from these sites? How does the proposed highway conduit laying operation fit in with plans for expansion of conduit use along the highway? If greater conduit capacity is presently needed, does it make sense to install the larger conduit capacity now, all at once?

Lifetime Submarine Cable Maintenance:

Under what circumstances and how would the proposed cables be removed? If the proposed submarine cables fell into disuse, would TyCom remove the cables at their own expense?

Thank you for the opportunity to comment on the subject environmental assessment. Should there be any questions, please contact Eric Hill of our planning staff at (808) 587-0380.

Aloha,

Dean Y. Uchida, Administrator

c. OEQC
TyCom Networks (US) Inc., Patriots Plaza, Building A, 60 Columbia Turnpike, Morristown, NJ 07960
R.M. Towill Corporation, 420 Waiakamilo Road, Suite 411, Honolulu, Hawaii 96817

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R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Surveying
Construction Management

April 4, 2001

Mr. Dean Uchida, Administrator
Land Division
Department of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Uchida:

Draft Environmental Assessment (EA)
TGN Hawaii Cable System

Thank you for you comments relating the TGN Cable System project. We would like to point out that Tycom has elected not to land the cables at Pokai Bay because of community concerns. We will move the landing site to a location west of the Waianae Wastewater Treatment Plant (WWTP) at their outfall site. We would like to offer the following responses to your comments.

Submarine Cable Landing Sites On the Waianae Coast

We acknowledge the State's landownership of the lands where the sewer outfall is located. The Waianae WWTP site will have additional capacity in the beach manholes to install two additional submarine cables at the proposed landing site because only one cable will be installed at this time. Because of community concerns, we have proposed that the cables be installed using horizontal directional drilling (HDD) technology. The drilling will take place on shore and exit in approximately 60 feet of water depth.

At the proposed Kahe Point landing site, there will also be additional space within the beach manhole to accommodate two additional submarine cables. However, like Pokai Bay, only two conduits will be directed towards the ocean. Further, to further minimize impacts to the shoreline area, we are planning to also employ HDD technology to install the two submarine cables. The bores will start on-shore and exit in approximately 60 feet of water depth.

Purpose of the Planned Cables. The TGN Hawaii Cable System, a state-of-the-art telecommunications system, will provide the next generation of connectivity between Hawaii, Asia and the mainland for voice, data and video traffic. The planned capacity of the system is 7.68 terabytes per second of bandwidth. The system is planned to provide connectivity to Hawaii businesses via telecom carriers to other parts of the world through a world-wide information network.

Why Pokai Bay. The choice for utilizing Pokai Bay was based on being able to overcome the limitations cited earlier. During previous installations, HDD technology was limited and did not have a proven track record. Since the early 1990's, HDD technology has advanced to point where it has become much more economical, however, still costing more than trenching. Further, HDD technology allow for boring much greater lengths than previous equipment. Recent installations at Kahe Beach and on Kauai have proven that HDD can be used for bores in excess of one-half mile taking the cable out to depths previously thought impossible. Also by using HDD technology, the system can be installed at a depth that will be below archaeological and cultural features.

Cost of Cable Installation Along Farrington Highway. The estimated cost of installation of the cable system in Hawaii is $15 million. This work will be done by local contractors and tradesmen and will provide important employment.

Kahe Point Easements and Cable Installation. The single cable installed at Kahe Point Beach Park is under the ownership of Verizon Hawaii and is used as part of their interisland communications system. The three other cables at Kahe Park are under the ownership of Southern Cross Network. There are four conduits at Kahe Point Beach Park, and only one is occupied. Verizon Hawaii has indicated that because the TGN cable is powered (DC power is supplied to the undersea repeater in the system) they have a policy that the beach manhole cannot be shared with their non-powered system. The one additional conduit installed by Southern Cross has been reserved by them in the event that repair or maintenance work is required on their system.

The TGN submarine cable will be installed paralleling the Verizon Hawaii cable in the ocean for approximately 1 mile then it will turn to the southeast around Makapuu Point and then head towards the mainland. The Verizon Hawaii cables turn to the northwest and heads to Kauai. The installation at Kahe Point Beach Park will be via the use of HDD technology to a depth of approximately 60 feet of water depth approximately 1500 feet offshore.

Capacity at Makaha Beach. There are presently 6 vacant conduits at Makaha Beach and are owned by AT&T.

Capacity Keawaula. There are presently 4 vacant conduits at Keawaula that are under the control of AT&T.

Cable In Disuse. This information is not available to us.

Use of Existing Easements. Except for approximately 1 mile at Kahe Point Beach Park, new submarine easements will be required because the owners of the cables wish to have as much separation from other cables in the event that repair or maintenance activity takes place. The usual method of cable repair is to drag the ocean bottom to retrieve the cable for repair. If two or more cables are in close proximity to one another, there is a high probability that the adjoining cable will also be hooked and therefore increasing the risk of damage to the other cable.

Installation of Cables with Greater Capacity. As noted earlier, the present system being installed is considered the state-of-the-art and represents the best technology with the highest capacity present technology will allow. Generally speaking, the cables that have been previously installed as well as the current installation depend on other telecommunications subscribers to use up the capacity of the cable. Therefore, what you have proposed is already taking place. The installation of excess conduit on land is always considered and the TGN system is not an exception. There will be spare conduits installed on land for others to rent.

Submarine Cable Conduits

The 4-inch submarine conduit was selected to accommodate a single double-armored cable that is approximately 2 inches in diameter. General industry standard practice is to use only one transmission cable in a conduit because if another cable is pulled through the same conduit binding may occur due to the limited bend radius of the double-armored cable. Further, only a limited amount of pressure can be exerted during pulling on the cable before damage to the fiber occurs. The optimal solution is to provide additional conduits into the ocean. On land, however, the cable are without the armor protection, and therefore more than one cable, usually up to three cables, can be pulled in a four-inch conduit.

Kahe Point Beach Park. We have re-examined the installation at Kahe Point Beach Park and have decided to install conduits into the ocean through the use of HDD technology cited earlier to avoid near shore impacts.

Installation of Additional Conduits in Farrington Highway. As noted earlier, additional conduits will be installed in Farrington Highway for others to rent. Current plans provide for up to 6 conduits in Farrington Highway. Two will be used by Tycom with 4 as spare.

Lifetime Submarine Cable Maintenance

The removal of cables that are retired require that they are not crossed by another cable system. The method of removal, if required, will entail the use of the same methodology used to install them in the first instance. Generally the cable can be lifted an then dragged ashore, or place aboard a barge or cable laying ship. The cost of removal will be borne by the cable owner.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester Koga

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-lgn

cc. Gerard Lynch, Tycom Networks, Inc.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

AQUATIC RESOURCES
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COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

February 23, 2001

Mr. Randall K. Fujiki, Acting Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

LOG NO: 26970 ✓
DOC NO: 0102SC05

Dear Mr. Fujiki:

SUBJECT: (File Nos. 2001/SMA-4 & 2000/SV-12) Chapter 6E-42 Historic Preservation Review of a Draft Environmental Assessment (DEA) Prepared for a Special Management Area Use Permit (SMP) and Shoreline Setback Variance (SSV) for the Proposed Installation of Fiber Optic Cables, New Manholes, and Ductlines at Pokai Bay Beach Park, Farrington Highway, and Kahe Point Beach Park
Wai`anae Kai and Honouliuli, Wai`anae and `Ewa, O`ahu
TMKs: 8-5-001: 062 & 9-2-003: 015

Thank you for the opportunity to review the DEA prepared as part of SMP and SSV applications made for the proposed installation of fiber optic cables, new manholes, and ductlines at Pokai Bay Beach Park, Kahe Point Beach Park, and along Farrington Highway between the two parks. According to the DEA and submitted construction plans, at Kahe Point Beach Park, the applicant proposes to construct a new manhole (6 feet wide by 12 feet long by 6.5 feet deep). From the *makai* (seaward) side of the manhole, four four-inch diameter PVC conduits will be installed at a depth of about six feet below existing ground surface; the conduits will terminate below the waterline at the shoreline. From the *mauka* (inland) side of the manhole, four four-inch diameter PVC ducts will be installed in a trench from the new manhole to a manhole on the *makai* shoulder of Farrington Highway. It is not clear from the plans or DEA if the manhole on the shoulder of the highway is a new manhole or an existing one. The *mauka* ductlines will cut through the right-of-way (ROW) for the OR & L railroad berm and track. The OR & L railroad berm and track form State Site 50-80-12-9714, a significant historic site that has been placed on the National Register of Historic Places. Similarly, according to the DEA and submitted construction plans, the cable installation plans for Pokai Bay Beach Park include a new manhole of similar dimensions to be located within the existing parking lot. *Makai* of the new manhole,

four four-inch diameter PVC conduits will be installed within the sand beach at an average depth of 6-8 feet below existing surface. *Mauka* of the new manhole, four four-inch diameter PVC conduits will be installed from the new manhole to a man hole on the *makai* shoulder of Pokai Beach Road. It is not clear from the plans or DEA if the manhole is on the *makai* shoulder of Pokai Beach Road. Finally, the terrestrial ductline consists of four four-inch diameter PVC conduits to be installed within the Farrington Highway right-of-way between Kahe Point Beach Park. The installation will be along the *makai* shoulder of the Highway or, in areas lacking sufficient shoulder room, along the *makai* side of the outer-most traffic lane. Our review is based on historic maps, aerial photographs, reports, and records maintained at the State Historic Preservation Division; no field inspection was made of the proposed project areas. In addition, R.M. Towill, the planning consultant, has provided construction plans for the proposed cable installations. We provide the following comments.

First of all, it appears that the proposed cable installation is an undertaking involving a federal agency, as defined in 36 CFR Part 800. A federal permit through the US Army Corps of Engineers is needed. Therefore, the responsible federal agency will need to ensure that the project is in compliance with Section 106 of the National Historic Preservation Act (NHPA). Compliance actions include appropriate identification of the area(s) of potential effect and historic sites, and consultation with consulting parties and the public on these matters. Consulting parties include but are not limited to the State Historic Preservation Office and Native Hawaiian organizations likely to have concerns with or knowledge of historic properties in the area. Interested parties may include members of the public or groups such as the Hawaiian Historic Railway Society. With regard to the identification of historic sites, we have provided some general information below but it will be incumbent upon the federal agency involved, or its designated representatives, to provide more specific information to all consulting parties.

The data and conclusions presented in Section 3.1.7 concerning the historic and archaeological resources at Pokai Bay and Kahe Point are incomplete and incorrect. In particular, we are puzzled by the citation of an archaeological assessment prepared some years ago for a fiber optic cable landing site at Wailua, Kaua`i (*Archaeological Assessment of the Proposed Fiber Optic Cable Landing for Wailua, Kauai*. 1992. Cultural Surveys Hawaii). The referenced report, on file at our office, does not contain any information on Pokai Bay or Kahe Point, O`ahu. We wonder if you intended to cite another report on file at our office which provides a brief archaeological assessment of Kahe Point Beach Park: *Archaeological Assessment of the*

Proposed Fiber Optic Cable landing for West O'ahu Kahe Point, Honouliuli, O'ahu (1992. Shideler et al.).

According to our records, a number of significant historic sites have been recorded at and around Pokai Bay Beach Park. Three significant historic sites are known to be within or immediately adjacent to the park: Kaneilio Heiau (State Site No. 50-80-07-153), the OR & L Railroad Berm (Site -12-9714), and a traditional Hawaiian cultural layer with associated burials (Site -07-3998). The largest study to date was carried out at the US Army's Wai'anae Army Recreation Center (WARC) just north of the project area (*Archaeological Excavations at the Wai'anae Army Recreation center Poka'I Bay, Wai'anae, O'ahu, Hawai'i.* 1985. Hammatt et al.). State Site -07-3998 included numerous subsurface archaeological features such as fire pits, hearths, house sites, living floors, and 10 Native Hawaiian burials. There is also an earlier report on archaeological monitoring on the WARC property in which five human burials and a cultural layer (later determined to be Site -3998) were identified (*Report of Archaeological Consulting Service During Repair of Sewer Lines and Replacement of Water Main lines at Walanae Army Recreation Center, O'ahu, Hawaii.* 1984. Riford). In 1997, SHPD personnel recovered two human burials eroding from the shoreline sand deposits just south of Kaneilio Point. Finally, a recent survey of a proposed park expansion at Pokai Bay Beach Park found some evidence for the continuation of Site -3998, the subsurface cultural layer, within Sub-Area 3 of the park expansion (*Subsurface Archaeological Survey for the Proposed Poka'I Bay Beach Park, Poka'I Bay, Wai'anae, O'ahu, Hawai'i.* 1999. Borthwick et al.). Sub-Area 3 of the 1999 study includes a portion of the subject project site. The monitoring report recommends that, for Sub-Area 3, "Monitoring would be appropriate for all major sub-surface excavations within sand deposits such as water lines, sewer lines, and footing trenches associated with park construction" (p.38).

Two significant historic sites are known to be present at Kahe Point Beach Park: a *koa* or fishing shrine (Site -12-1433) and a portion of the OR & L Railroad berm (-12-9714). The previously referenced assessment report (Shideler et al. 1992) identified a third area of sensitivity – a sea cave and fissures with possible human-made modifications – within the park. The assessment report recommended an archaeological inventory survey with subsurface testing in the event that the cable route traversed the cave and fissures. Additionally, on-site monitoring was recommended for any direct impact to the OR & L berm. Finally, a single human burial (Site No. -12-4061) was found eroding from sand deposits about 300 feet north of Kahe Point Beach Park. The assessment did not include subsurface testing. Soils data indicate that Beach

Sand deposits extend along the *makai* side of the beach park; beach sands can contain buried cultural layers and human burials.

A recent assessment of the Farrington Highway corridor along this portion of the Wai'anae Coast indicated that segments of the highway corridor are underlain by Jaucas or Beach Sands deposits (*Archaeological Monitoring Plan for Board of Water Supply Work Along Farrington Highway Makaha [TMK: 8-4-01 – 09, 11, 13-18], Wai'anae [TMK: 85-02, 14-18, 23], Lualualei [TMK: 8-7-06 – 08, 17, 26, 31, 33, 34], Nanakuli [TMK: 8-9-01, 02, 05-07], and Honouliuli Ahupua'a [TMK: 9-2-03]. Districts of Wai'anae and 'Ewa, Island of O'ahu.* 2000. Bushnell et al.). These areas would thus have the potential to contain buried archaeological layers with associated burials, and have been recommended for on-site archaeological monitoring during Board of Water Supply construction activities.

In view of the foregoing, it appears likely that the proposed cable landing sites will have an "adverse effect" on the significant historic sites known to be present in the Pokai Bay and Kahe Point Beach Park areas. Although the DEA states that, for example, that the "sea cave and crevices in the [Kahe Point Beach] park can easily be avoided," we cannot tell from the 1992 assessment, the DEA, or the submitted construction plans if the submarine cable landing site <u>will</u> avoid any impact to the cave. Similarly, the proposed cable landing and shoreline facilities at Poka'i Bay Beach Park appear to be largely within the Sub-Area 3 which was identified as having a high potential for subsurface deposits. Thus, the cable landing site at Poka'i Bay Beach Park will likely have an "adverse effect" on significant historic sites at Poka'i Bay. With regard to the OR & L Railroad berm, the bisecting cable lines, at two points along the berm, will undoubtedly have an "adverse effect" on this significant historic site. Finally, it seems likely that excavations within some portions of the Farrington Highway corridor will also encounter buried cultural deposits and/or human burials, thus having an "adverse effect" on these significant historic sites.

Clearly, the available documentation on historic sites (in the DEA and archaeological assessment of Kahe Point Beach Park) and the proposed mitigation methods are inadequate. We would recommend deferral of action on the subject permits until the applicant has worked with the US Army Corps of Engineers to complete the Section 106 requirements of the National Historic Preservation Act. Once the Section 106 documentation is available, our office as well as interested members of the public will have a better idea of what effects the proposed cable installations will have on significant historic sites and how those effects, if "adverse," may be mitigated.

Should you have any questions please feel free to contact Sara Collins at 692-8026.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

SC:jk

c: Mr. A. Van Horn Diamond, Chair, O`ahu Island Burial Council
✓Mr. Greg Hiyakumoto, Project Manager, R.M. Towill Corporation, 420 Waiakamilo Road, Suite 411, Honolulu, HI 96817-4941
Mr. Kala`au Wahilani, Burial Sites Program
Mr. Farley Watanabe, Regulatory Branch, Department of the Army, US Army Engineer District, Honolulu, Ft. Shafter, Hawaii 96858-5440

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

February 23, 2001

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

MEMORANDUM

LOG NO: 26971 ✓
DOC NO: 0102SC06

TO: Dean Uchida, Administrator
Land Division

FROM: DON HIBBARD, Administrator
Historic Preservation Division

SUBJECT: (Ref. No. 2001/SMA4.COM) Chapter 6E-42 Historic Preservation Review of a Draft Environmental Assessment (DEA) Prepared for a Special Management Area Use Permit (SMP) and Shoreline Setback Variance (SSV) for the Proposed Installation of Fiber Optic Cables, New Manholes, and Ductlines at Pokai Bay Beach Park, Farrington Highway, and Kahe Point Beach Park
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TMKs: 8-5-001: 062 & 9-2-003: 015

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Poka`i Bay Beach Park will likely have an "adverse effect" on significant historic sites at Poka`i Bay. With regard to the OR & L Railroad berm, the bisecting cable lines, at two points along the berm, will undoubtedly have an "adverse effect" on this significant historic site. Finally, it seems likely that excavations within some portions of the Farrington Highway corridor will also encounter buried cultural deposits and/or human burials, thus having an "adverse effect" on these significant historic sites.

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Should you have any questions please feel free to contact Sara Collins at 692-8026.

SC:jk

c: Mr. A. Van Horn Diamond, Chair, O`ahu Island Burial Council
Mr. Greg Hiyakumoto, Project Manager, R.M. Towill Corporation, 420 Waiakamilo Road, Suite 411, Honolulu, HI 96817-4941
Mr. Kala`au Wahilani, Burial Sites Program
Mr. Farley Watanabe, Regulatory Branch, Department of the Army, US Army Engineer District, Honolulu, Ft. Shafter, Hawaii 96858-5440

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817 4941
Telephone 808 842 1133
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eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

March 28, 2001

Log No. 26970 and 26971

Mr. Don Hibbard, Administrator
Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Mr. Hibbard:

Draft Environmental Assessment, TGN Hawaii Cable System
TMK: 8-5-001: 062 and 9-2-003: 015

Thank you for your comments of February 23, 2001. We would like to offer the following in response to your concerns:

1. Beach Manholes. At both proposed landing sites new manholes will be installed the accommodate the new cables. The location of the manholes were chosen because the sites were previously disturbed (graded or top soil added above a coral base, or paved).

2. Road Side Manholes. The proposed manholes or handholes along the highway are mainly located along the paved shoulders of the highways. Where the manhole or handhole cannot be placed in the shoulder, the manhole or handhole is placed in the outermost travel lane.

3. Crossing of the Railroad Right-of-Way. At Kahe Point where the cable will cross the railroad right-of-way, we have designed the crossing to minimize impact to the tracks and to ensure that the berm and track based is restored to existing conditions. We have coordinated our work with the Hawaiian Railway Society to maintain a high level of design standards.

4. Federal Permitting Requirements. The proposed work has been discussed with the U.S. Army Corps of Engineers to determine permitting requirements. The requirements of Section 106 will be complied with as required. Consultation with community groups, individuals, and agencies are still in progress and the findings will be reported in the revised EA. Further, the findings of an assessment of historic properties will be forwarded to the Historic Preservation Division for review.

5. References Cited - Kahe Point. The correct reference for the Kahe Point Beach Park should be "Archaeological Assessment of Proposed Fiber Optic Cable Landing for West Oahu, Kahe Point, Honouliuli" by Cultural Surveys Hawaii (1992). The proposed cable landing at Kahe Point will parallel the cable installed in 1992 by Verizon Hawaii (formerly GTE Hawaiian Tel) and therefore no impact to historic resources are anticipated.

6. Archaeological Resource. Pokai Bay. References utilized for Pokai Bay included: "Subsurface Archaeological Survey for the Proposed Pokai Bay Beach Park" Cultural Surveys Hawaii (1999); "Archaeological Excavations at the Waianae Army Recreation Center Pokai Bay" Cultural Surveys Hawaii (1985) and "Archaeological Research for the Kuilioloa Heiau Restoration Project, Pokai Bay" Bishop Museum (1979).

7. Monitoring During Construction. As part of the construction process, a professional archaeologist will be employed to monitor construction activities that involve trenching. Should historic or cultural features by uncovered, work will be suspended until investigations can be made to ascertain their properties. Further, the Historic Preservation Division will be notified of the findings and concurrence will be sought for final disposition once significance has been determined.

In conclusion, Tycom, the project sponsor, is committed to the having this project proceed with no impacts to historic and cultural features. Measures described above will also insure that construction activities proceed in this manner.

Should there be other concerns please contact the undersigned.

Very truly yours,

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-tgn

cc: A. Van Horn Diamond, Chair, Oahu Island Burial Council
Mr. Kala'au Wahilani, Burial sites Program
Mr. Farley Watanabe, Regulatory Branch, Department of the Army

BENJAMIN J. CAYETANO
GOVERNOR

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

FEB 2 3 2001

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

02048PJS.01

February 20, 2001

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

Dear Mr. Koga:

Subject: **TGN Hawaii Fiber Optic Cable System**
Kahe Point Beach Park, Pokai Beach Park, and Farrington Highway
Waianae, Oahu, Hawaii
TMK: (1) 9-2-3:15 and (1) 8-5-01:62

The Department of Health (Department), Clean Water Branch has reviewed the February 14, 2001 transmittal of the Draft Environmental Assessment for the subject project and has the following comments:

1. The Army Corps of Engineers should be contacted to identify whether a Federal permit (including a Department of Army permit) is required for the construction project. If it is determined that a Federal permit is required for the subject project, then a Section 401 Water Quality Certification would also be required from our office.

2. If the construction project involves any of the following discharges into Class A or Class 2 State waters, a National Pollutant Discharge Elimination System (NPDES) general permit coverage is required for each activity:

   a. 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. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale.

   Note: After March 10, 2003, NPDES general permit coverage will be required for discharges of storm water associated with construction activities, including clearing, grading, and excavation that result in the disturbance of one (1) acre or more.

   b. Construction dewatering effluent.

Notices of Intent (NOI) for NPDES general permit coverages should be submitted at least 30 days before the discharge is to occur. NOI forms can be downloaded from *http://www.state.hi.us/doh/eh/cwb/forms/index.html.*

If you have any questions, please contact Ms. Joanna L. Seto, Engineering Section of the Clean Water Branch, at 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

JLS:cr

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF HEALTH
PO BOX 3378
HONOLULU, HAWAII 96801-3378

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

03016CEC.01

RECD MAR 1 4 2001

March 7, 2001

Mr. Greg H. Hiyakumoto, P.E.
Project Manager
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4942

Dear Mr. Hiyakumoto:

Subject: **Tykom Global Network Hawaii Cable Construction, Pokai Bay to Kahe Point, Waianae and Ewa, Island of Oahu**

Thank you for the opportunity to review and comment on the preliminary "Cable Landing Sites" construction plan and prefinal "Terrestrial Cable Rout" construction plan for the subject project.

The following are our comments:

1. The project involves construction activity below the ordinary high tide line. Please contact the Honolulu Engineer District (HED) of the U.S. Army Corps of Engineers (HED) regarding the Department of the Army (DA) permit requirements. A Section 401 Water Quality Certification (WQC) may also be required if a DA license or permit is required and the construction activity will result in any discharges. Definition of the term "discharge" may be found in Section 502 of the Clean Water Act and Section 11-54-09.1 of the Hawaii Administrative Rules (HAR).

2. The construction of this eight (8) miles long cable may involve land disturbance of five (5) acres or more. A National Pollutant Discharge Elimination System (NPDES) permit authorizing storm water discharges associated with construction activity is required.

3. Based on construction methods identified in the plans, it appears that construction related dewatering effluent discharges are unavoidable and an NPDES permit authorizing such discharges is also required. You should also address concerns on slurry handling associated with the horizontal directional drilling.

Rules regulating the NPDES permitting program (HAR, Chapter 11-55) and Section 401 WQC program (HAR, Chapter 11-54), as well as the Notice of Intent forms for NPDES general permits and application form for a Section 401 WQC, can be located at the Department's web site at: http://www.state.hi.us/health/eh/cwb/forms/index.html.

Should you have any questions regarding this matter, please contact Mr. Edward Chen, Engineering Section of the Clean Water Branch, at (808) 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

EC:cr

c: Regulatory Branch, HED/COE

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Planning
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Surveying
Construction Management

April 4, 2001

Reference: 033016CEC.01

Mr. Dennis R. Lau, P.E., Chief
Clean Water Branch
Department of Health
State of Hawaii
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Lau:

Draft Environmental Assessment ((EA)
TGN Hawaii Cable System

Thank you for your comments of March 7, 2001. We offer the following in responses to your comments:

1. *Department of the Army Permit*

   A permit from the Department of the Army will be sought.

2. *Stormwater Discharge*

   In accordance with construction guidance provided by the Department Transportation, the amount of ground disturbance will be limited to no more than 300-400 feet at a time and therefore will be less than the 5 acres of open trenches. Further, Best Management Practices (BMP's) will be instituted to ensure good housekeeping along the work areas to ensure that runoff impacts are mitigated.

3. *Dewatering Discharges and Slurry Handling*

   No discharges into waters of the State are anticipated. If dewatering is required, the effluent will be contained in the trenches open during construction. The slurry required as a lubricant for the horizontal directional drilling process will be contained away from water bodies and streams. The following two methods will be utilized for this project:

1) Truck mounted tanks to contain the drilling slurry. 2) Lined holding tank on the ground to contain the slurry.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester Koga

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-tgn

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Krauss Annex 19 · 2500 Dole Street · Honolulu, Hawaii 96822
Telephone: (808) 956-7361 · Facsimile: (808) 956-3980

March 10,2001

Tycom Networks (US) Inc.
C/0 Mr. Gerald Lynch
Patriots Plaza, Building A
60 Columbia Turnpike
Morristown, NJ 07960

Dear Mr. Lynch:

Draft Environmental Assessment
TGN Cable System
Waianae and Ewa, Oahu

Tycom Networks Inc. proposes to construct a submarine and terrestrial fiber optic cable system along the Waianae Ewa coast. The cables would be along the ocean floor, stretching outward, from Kahe Point Beach Park and Pokai Bay Beach Park with an underground optic ductline along Farrington Highway, which will connect the two beach sites. The proposed action will link Hawaii with the continental United States, Guam, Hong Kong and Japan. This action is part of a larger plan called The Tycom Global Network (TGN). Once completed TGN will connect 30 major cities worldwide with a bandwidth capacity 7.68 terabits per second.
The proposed construction activities will take place in two phases. The first phase would be to prepare the terrestrial environment for cable placement, by constructing ductlines along Farrington Highway and constructing manholes at each of the beach sites to feed the lines into. The second phase of the project is to lay the submarine lines and connect them through the manhole and ductlines.

This review was conducted with the assistance of Cengiz Ertekin, Ocean and Resources Engineering; and Renee Thompson, Environmental Center.

General Comments

We find the level of information presented in this draft environmental assessment to be inadequate. Information on the marine flora and fauna, for example, is 10 years old. Traffic, a big problem along Farrington Highway, is treated as a minor irritant. We expand on these comments below, but it was the feeling of the reviewers that the proposers have not examined the area thoroughly enough to reach the finding that no significant impact exists.

We are also curious as to why two beach parks are chosen as the on-shore sites for the underwater cable. Is there no private land that TyCom Network can purchase? It would seem to us that a private firm would want to have control over access to the cable, which could better be accomplished, if they own the site.

Maps and Figures

We have not been able to find the certified shoreline maps, they seem to be missing from the report (figures 11 and 12), pages 39 and 40.

The DEA report does not show a figure on shoreline cross sectional cut. Such a figure is necessary to understand the proposed cable landing route both in and out of ocean. The figure should also show the bathymetric water depth at the cut, thereby making the identification of resident marine life in the area (currently unknown).

Land-Side Activity

If trenching is used for the concrete conduits from the manhole on land to the shoreline, below the waterline, there will be irreversible damage to the limestone cliff and the rock beach area. The use of trenching for conduits seaside of the manhole is not recommended. The only possible method to protect the area from both short and long term damage is by directional drilling.

It is not stated how deep below the water line the conduits will exit the land. This must be specified so that an assessment of the impacts of such an exit on the environment can be make. The depth at which the cable enters the water should be studied carefully and in a scientific manner. This has not been done. It is recommended that directional drilling be used with a metal casing rather than trenching. The casing should enter the water at a depth determined from carefully conducted engineering and environmental study.

What is the estimated size of the barricaded area in the construction zone? How will it affect the public usage of the parks? There are no statements on the effect of Beach Park and partial road closures on the residents. This could be assessed through dialogue with area residents, perhaps through the neighborhood boards.

Referring to page 11 section 2.2.2 Terrestrial Ductline, at what locations is it not possible to locate the ducts in the shoulder along the Farrington Highway? These locations should be made known to determine the effect of lane closures on the local traffic.

Mr Lynch
March 10, 2001
Page 3

If some work at night is required, what noise levels are anticipated and how will this noise affect the residents in the area? What repairs are anticipated and how frequent are they expected to happen? How will such repairs affect the recreational use of the parks?

Nearshore Activity

The use of equipment such as backhoe or excavator to remove sand, coral, etc. in the ocean is expected to damage the environment especially the coral life. This issue is not adequately addressed in this DEA. The DEA report must clearly specify the extent of coral life in the areas and what damage might occur during the construction.

Since the depth of the trenching is not stated, on page 14, one cannot determine the potential movement of the cable. Therefore anchoring of the cable by bolts to prevent abrasion from movement during a tsunami may not work.

The cable landing locations both at Kahe Point and Pokai Bay should be identified. The EA report lists variable beach conditions at two sites and therefore cable landing locations on water edge must be identified, and the environmental assessment should be made for these specific locations, with a reasonable amount of spatial variation specified.

Marine Flora and Fauna

Such a project, potentially altering the ocean environment, must be backed by recent surveys to determine the current physical environment. The most important survey that needs to be conducted should be on the determination of the environment impact of the existing cable system. How will the project affect the environment, especially below water line?

The major impact generated by this project will be to the benthic flora and fauna in the nearshore area. Yet, the EA relies on studies that were done nearly a decade ago. According to section 3.1.5 page 20, Sea Engineering conducted reconnaissance of the sit area in 1991. The wildlife in the area could have changed substantially during that time. The second paragraph of this section talks of coral coverage in the area. The coral coverage in the area may be different today than ten years ago.

Mr. Lynch
March 10, 2001
Page 4

The Impacts sub-section of the section on Marine Flora and Fauna 3.1.5 makes no mention of the impacts to the coral itself. Increased sediment in the water has the potential to cover the coral and kill algae communities which live there. There are several species non-mobile marine organisms that could be impacted, including sea urchins and cucumbers. There should be additional reconnaissance of this area by a qualified marine biologist to determine if the benthic community has changed in the past decade. There should be a better description of the substrate that may be covered of disturbed so that a better evaluation of the impacts can take place. It is impossible to determine the extent of the impacts from the information provided in the draft EA.

The office of Environmental Quality Control has developed Guideline for Biological Surveys, Ecosystem Impact Analysis available at: http://www.state.hi.us/health/oeqc/index.html. We suggest that these be used in preparing the Final Environmental Assessment.

Mitigation

The document alludes to mitigation measures in section 2.3 Nearshore Activity. Paragraph 3 page 14 states that "silt screens or filters will be utilized" to reduce the potential for turbidity. The DEA should expand on this and create an entire mitigation section to explain how the applicant will go about moving non-mobile organisms and how they will reduce the chance of sedimentation on nearby coral communities. A detailed plan should be developed to minimize impact to the terrestrial and marine environment.

Impacts

There is not adequate evidence presented to lead to the conclusion that "thee will be no affect on the recreational activities, marine life or wildlife" without studying the impact of existing cable landing system and without adequate study or assessing the proposed project's impact. The DEA report states that there will be irretrievable loss of certain environmental resources. What are they?

Conclusion

We recommend that this DEA be revised after carefully conducting scientific and engineering studies as well as communicating with the neighborhood boards to minimize the adverse effects of the project on the community.

A more up-to-date marine survey should be conducted for this project before this EA can be deemed adequate. In addition a more thorough discussion on traffic is necessary. However, there is a larger issue that is not addressed in this EA. We believe that for the long term that state and county should develop a cable corridor or designate some locations where cables can be placed. It would be preferable to have several sites surveyed rather than looking at sites piecemeal. This way we can avoid having excavations for cable construction all along our shorelines.

Thank you for the opportunity to review this Draft Environmental Assessment.

Sincerely,

Peter Rappa
Environmental Review Coordinator

cc: OEQC
Cengiz Ertekin
Renee Thompson
James Moncur, WRRC
Dana Teramoto, Planning and Permitting
Chester Koga, R M. Towill Corporation

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Planning
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Environmental Services
Photogrammetry
Surveying
Construction Management

April 4, 2001

Mr. Peter Rappa
Environmental Review Coordinator
Environmental Center
Krause Annex 19
2500 Dole Street
Honolulu, Hawaii 06822

Dear Mr. Rappa:

Draft Environmental Assessment (EA)
TGN Hawaii Cable System

Thank you for your comments of March 10, 2001. Since the publication of the Draft EA we have met with the community and Tycom has elected not to land a cable at Pokai Bay because of the community's concerns. We will move to a location south of Pokai Bay at the Waianae Wastewater Treatment Plant outfall. We offer the following responses to your comments:

General Comments

As stated in the Draft EA, Tycom Networks Inc. proposed the development of a state-of-the-art telecommunications system that will provide the next generation of connectivity between Hawaii, Asia and the mainland. Once completed, the TGN system will provide connectivity at bandwidth capacity of 7.68 terabits per second. The work proposed for the installation of the cable system has taken into account the impacts to the community and ocean environment. There are certain impacts that cannot be entirely mitigated, such as traffic. However, measures are being taken to minimize the impacts, and are described below.

Regarding site selection of the landing point. The selection of the landing sites have been determined by a number of factors that include ocean considerations and land considerations. The initial criteria that the cable owners included was to have the landing points at least five miles apart to insure the integrity of the system by providing diversity. The cable landings, as currently planned, are approximately 7 miles apart. Another criteria in site selection included an evaluation of near-shore areas where the cable cannot be landed. From the remaining sites (areas) the final selection was made for the landing points. As a final point, the parks selected was based on knowledge of development plans for each park.

Maps and Figures

We apologize for the omission of the maps showing the certified shoreline. Copies of the maps will be enclosed in the Final EA.

Land-Side Activity

After further consideration of the installation methodology to be utilized, it has been determined by the owner that horizontal directional drilling (HDD) technology will be used to installed the cables at the new landing site at the Waianae WWTP outfall. Further, we have decided to abandon further pursuit of installing cables at Pokai Bay in favor of a location parallel to the ocean outfall at the Waianae Wastewater Treatment Plant. The drilling will take place on shore and exit in approximately 60 feet of water depth. The exit location is approximately 1500 feet from the shoreline within a sand channel. This location was selected because of the potential for minimal impact to the marine flora and fauna.

At the proposed Kahe Point landing site the submarine cable will be installed via standard trenching methods. A trench will be dug adjacent to the existing telecommunication cable from a new manhole to the shoreline. The trench will terminate approximately two feet below the water line. From this point the cable will be laid parallel to the existing cable on the ocean bottom. To protect the cable in the water, the cable will be double armored (wound with stainless steel wire) and protected within a cast iron sleeve for a distance of 1,000 feet out to sea. From this location, which is a large sand deposit and channel, the cables will be laid out to sea without any additional protection.

The construction zone to be utilized is approximately 100 feet wide by 200 feet wide. Access to the usable park areas will be kept open at all times.

Construction within Farrington Highway will be limited to work where allowed by the State Department of Transportation (DOT). In accordance with DOT policy, no construction will take place during peak travel periods. Further, to limit the construction duration we are proposing to work at nights. Night work, however, will only occur in non-residential areas, and where noise levels can be kept below those set by the "Community Noise Code."

Nearshore Activity

As cited earlier, no trenching work will be done at the shoreline or nearshore areas of the cable landing because HDD technology will be utilized. Additional figures will be included in the Final EA to depict work area at the parks.

Marine Flora and Fauna

The findings of recent studies of the nearshore environmental will be included in the Final EA.

Mitigation

Because HDD technology will be utilized at the new landing site we do not anticipate impacts to the nearshore environment. As noted earlier, the bore exits will be in sand deposits in channels that lead to deep ocean. The primary concern of HDD work is the potential for release of the drilling lubricant (bentonite). Standard procedure for this type of action is to station divers at the exit point with "air-lifts" or pumps to take the lubricant to a surface vessel for disposal.

At Kahe Point, minimal impacts are anticipated because the cable will be lowered in place thereby avoiding rock and limestone out-croppings in the water.

Impacts

We will include additional information in the Final EA to address impacts of the project and irretrievable loss of resources such as labor, certain construction material, and fuels, etc.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester Koga

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-tgn

cc. Mr. Randall Fujiki, Department of Planning and Permitting

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET • HONOLULU, HAWAII 96813
JEREMY HARRIS
MAYOR
RANDALL K. FUJIKI, AIA
DIRECTOR
LORETTA K.C. CHEE
DEPUTY DIRECTOR

RECEIVED MAR 0 8 2001 RMTC

2001/SMA-4(DT)
2000/SV-12

March 7, 2001

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

Dear Mr. Koga:

Draft Environmental Assessment (EA)
TGN Hawaii Cable System
Tax Map Keys: 9-2-3: por 15 and 8-5-1: por. 62

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

1. Page 19 of the Draft EA states that there are no rare or endangered animals at the site. The EA should specify what type(s) of animals and/or wildlife inhabit Pokai Bay Beach Park and Kahe Point Beach Park.

2. The EA should mention the specific area of each beach that will be affected when the cables are installed. Also, the square footage of each affected area (in comparison to the total square footage of each park) should be provided.

3. The EA should mention how many cubic yards of grading and/or filling will be done at the project sites. The depth of the cable below the ground surface should be included in the EA.

4. Figure 8 shows the cable line at Pokai Bay Beach Park. The proposed cable line and landing site should also be shown on Figure 7 for Kahe Point Beach Park.

5. The EA mentions that there is coral and an abundance of marine life surrounding Kahe Point Beach Park. The weight of the cable should be indicated, as well as an evaluation on whether the laying of cables may damage the coral in the area. The method in laying the cable in this area and in the Pokai Bay Beach Park area should be mentioned.

The above comments should be implemented into the Final EA. If you have any questions regarding this letter, please call Dana Teramoto of our staff at 523-4648.

Sincerely yours,

for RANDALL K. FUJIKI, AIA
Director of Planning and Permitting

RKF:nt

posse document no. 77345

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March 28, 2001

Mr. Randall K. Fujiki, AIA, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Fujiki:

Draft Environmental Assessment (EA) / 2001/SMA-4 (DT), 2001/SV-12
TGN Hawaii Cable System
Tax Map Keys: 8-5-001: 062 and 9-2-003: 015

Thank you for your comments of March 7, 2001. Due to concerns of the community, the applicant is no longer considering Pokai Bay as a landing site. We offer the following in response to your comments on the Draft EA:

1. Types of Animals at the Beach Parks
During site visits to the cable landing sites very few animals were observed. The birds observed with common urban birds such as the barred dove. It is anticipated that the Golden Plover would also be found at the site but none were observed. Domesticated dogs were observed as well as feral cats. The mongoose and rats would also be anticipated but none were observed during site visits.

2. Areas Impacted by the Proposed Action
The areas to be impacted during installation will be limited to an area within 20 feet on either side of the conduits and manholes. During the installation period, approximately 10 days at each landing site, the immediate work area will be barricaded to ensure public safety. Access across the park will be maintained at all time. Based on the size of the parks, approximately 150 square feet of a total area of 194,713 square feet at Kahe Park will be impacted. At Pokai Park, approximately 200 square feet of the total 536,600 square feet of the park parcel will be impacted. Following installation, the impacted will be restored to pre-construction conditions.

3. Quantity of Grading (cubic yards) or Fill Required
Total excavation will be limited to the installation of the two beach manholes (approx. 6' x 12' x 6') and the ocean ground bed. The amount of grading or excavation work will be approximately 31 cubic yards at each landing site.

4. Location of Cable Line
Detailed site maps of the cable lines at the two beach park will be included in the Final EA. At Kahe Beach Park the cable line will parallel the existing Verizon Hawaii cable. At Pokai Bay the beach manhole will be located within a paved parking area at the park. The location of the manholes have been coordinated with the Department of Parks and Recreation and the Department of Design and Construction.

The new site is 2,000 feet south of the Pokai Bay landing site and is located on the west side of Farrington Highway across from the Waianae Wastewater Treatment Plant (WWTP) adjacent to the WWTP's ocean outfall. A map showing the location of the proposed installation is shown in the attached figure.

5. Cable Detail and Method of Installation
After review of the installation method proposed for each cable landing site, it has been determined that the use of horizontal directional drilling (HDD) will be the method of choice for the new sites. This method of installation is being chosen to minimize impact to nearshore environments. At the Waianae WWTP outfall site the HDD bore will extend a total length of approximately 2500 feet. The exit will be in approximately 60 feet of water depth and be within a sand channel and therefore no impacts to coral are anticipated. At Kahe Point Beach Park, HDD technology will also be employed to minimize impacts to nearshore reef and rock environment. The bore will be made from shore and extend approximately 1500 feet to an area with sand as the predominant bottom characteristic.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester Koga, AICP
Project Manager

CTK:L:\plan\18902-tgn

Attachment

WAIANAE COAST NEIGHBORHOOD BOARD NO. 24
c/o NEIGHBORHOOD COMMISSION • CITY HALL, ROOM 400 • HONOLULU, HAWAII 96813

March 10, 2001

MAR 1 3 2001

Chester Koga, AICP
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawai'i 96817

Dear Mr. Koga:

SUBJECT: Draft Environmental Assessment for the TGN Hawaii Cable System

On March 6, 2001, the Wai'anae Coast Neighborhood Board No. 24 heard a presentation regarding the above referenced subject. After hearing the presentation and giving due consideration to the comments received from board members and the public constituency the board represents, as voluntary-elected members, the board passed the following motion: Based on the presentation this evening, and the difference between the Draft Environmental Assessment (EA), the board requests that the public comment March 10th deadline be extended for 45 days. Also, that the board send a letter to not support the project as written in the Draft EA. In addition, the board requests the Draft EA be updated to reflect the actual project as presented by the consultant, R.M. Towill."

The board is hereby, officially requesting an extension on the comment deadline for this project and we are also requesting the Draft EA be updated to reflect the actual project, as it is to be proposed to be implemented.

The current Draft EA was subject to many concerns including:

- The traffic impact to the community was inadequately addressed, especially in light of the fact that the community is faced with a Board of Water Supply project to install new water mains along the same route and the potential of another fiber optic project within the same routing being initiated within the same timeframe.
- There was nothing to address anchoring restrictions where the cable would "daylight" in a sand area approximately ½ mile off-shore. (This would be applicable with the process of sub-surface drilling under the bay to reach the connection point off-shore. This perspective is part of the presentation received at the March 6th presentation and not part of the original Draft EA.)
- The Draft EA does not mention drilling as an option for the Poka'i Bay cable landing but this was presented as the method under consideration at the board meeting. The Draft EA should be updated to reflect the methodology alternatives proposed.
- The Poka'i Bay area is the only fish sanctuary along the coastline as a designated Fisheries Management Area. The cable landing, as proposed in the Draft EA is inconsistent with the intent of classifying an area as a sanctuary.
- There is no statement within the Draft EA stating if there are any health impacts from fiber optic cables being within close proximity to the public (the area is *widely used by children since it is one of the safest areas along the coast for* youngsters). What, if any, are the health impacts?
- What are the social impacts and benefits to the community to have a fiber optic cable cut through the community with the proposed disruption it will cause?
- The off-shore area from Poka'i Bay is a spinner dolphin resting area. What measures will be taken to mitigate any interference with their normal patterns of resting, etc?
- The location of the cable landing off-shore of Poka'i Bay is near one of the busiest harbors on the island. What plans have been made to guarantee that the cable laying operations will not impact the normal operations coming out of the small boat harbor towards Poka'i Bay?
- It appears that the area in which the cable (if drilling is used) will 'daylight' is within the area that older fishermen use to gather "kona" crabs, a crab that is almost non-existent outside of Hawaiian waters. What effects will the cable laying or daylighting have on the population of this crab? Was it even considered?
- There is still a question as to whether or not the cable landing, whether the cut and cover or drilling method, will encounter burials within the beach area. The area was previously occupied with residents where it was customary to bury their relatives within their yards. It cannot be assumed that there is no potential for encounters.

Given all of these concerns, we would encourage you to revisit the total project to make sure that the concerns presented above are considered and addressed within you Environmental Assessment.

Upon an update to your Environmental Assessment, the Wai'anae Coast Neighborhood Board No. 24 would be pleased to schedule you for an updated presentation on the project.

If you have any questions, please do not hesitate to contact me at: 696-0131.

Sincerely,

Cynthia K. L. Rezentes, Chair

cc: Neighborhood Commission Office
Councilmember John DeSoto
Senator Colleen Hanabusa
Representative Emily Auwae
Representative Mike Kahikina

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April 4, 2001

Ms. Cynthia K.L. Rezentes, Chair
Waianae Neighborhood Board No. 24
c/o Neighborhood Commission
City Hall, Room 400
Honolulu, Hawaii 96813

Dear Ms. Rezentes

Draft Environment Assessment (EA)
TGN Hawaii Cable System

On behalf of Tycom Networks Inc. we would like to thank to Waianae Neighborhood Board for the opportunity to present information about the TGN Hawaii Cable System, a state-of-the-art telecommunications system that will provide the next generation of connectivity between Hawaii, Asia and the mainland. We also appreciate the Board taking time to provide us with thoughtful and helpful comments.

We would like to take this opportunity to respond to the comments the Board has offered:

1. *Content of the Draft EA.* The Draft EA is being used as a planning document and the information presented to the Board included changes that we had embodied in our planning as a result of comments received from community members prior to our attendance at the Board meeting. We trust that the updated information was taken in the spirit that it was intended and that was to present a project that had minimal impacts to the community.

2. *Traffic Impacts.* We fully appreciate the Board's and community's concern about impacts to free movement of traffic along Farrington Highway and have taken steps to minimize disruption to traffic. The following actions will be taken to minimize traffic impacts:

   a. Coordination with the Board of Water Supply (BWS) water line work. We have been in discussion with the BWS, Department of Transportation, and Sandwich Isle Communications to coordinate work schedules and minimize traffic disruption during construction. We understand the BWS will perform night work so as to avoid day time lane closures. We will also be applying for night work to avoid daytime closure of traffic lanes. Weekend work will be avoided.

   b. To further minimize traffic disruptions, we are planning to directional drill to the extent practical in order to eliminate much roadway trenching.

   c. We have also requested that the contractor include extra crews on the project to ensure that work takes place in the shortest time possible.

   d. Limiting the Hours of Work. As directed by the State Department of Transportation, we will ensure that no work is done during peak commuting periods. We will also avoid working on Wednesday afternoons due to early school closing.

3. *Pokai Bay Concerns.* Due to the concerns of the community, the project is no longer considering Pokai Bay as a landing site. Nonetheless, responses to concerns raised are listed below:

   a. Daylighting of Directional Drilling. As we stated in our presentation, the directional drilling work at Pokai Bay is being proposed in response to community concerns raised outside of the Board meeting. This method of installation allows the selected contractor to work in a manner that will have the least amount of impacts to beach and ocean users. Further, the depth at which we will be drilling will be below known cultural features.

   b. Pokai Bay Fish Sanctuary. Because we had proposed directional drilling at Pokai Bay, the Fishery Management Area outside of the breakwater will not be impacted. Generally, the exit point will be in about 40 feet of water and will consist of two steel drill pipes 4 inches in diameter about 20 feet apart. The pipes will not protrude out of the sand causing any hazards. Further, based on a marine biological study conducted of the area it was noted that most fish leave the area in the presence of humans.

   c. Health Impacts of the Cables. We are not aware of any health impacts resulting from the cable. The method of data transmission is light in the infrared frequency. Further, the cable does not produce an electromagnetic field (EMF) as does electrical cables along our streets.

   d. Social Impacts and Benefits to the Community. Benefits to the State include the opportunity to utilize the additional state-of-the-art telecommunication capacity being provided by the project, which could lead to greater business in Hawaii.

e. Impacts to Spinner Dolphins. We do not anticipate any long term impacts to the dolphin population at Pokai Bay because of the short duration of work in the water at Pokai Bay. Generally, the cable installation will not take more than two days, one day each for each cable.

f. Impacts to Waianae Small Boat Harbor. We will not impact the operations of the small boat harbor because most of the work will be done south of the channel entrance. Anchoring of boats in the vicinity of the boat harbor will not be affected.

g. Impacts to "Kona" Crabs. We do not anticipate any impact to the crab population in the area. At other locations where cable have been laid, we have not observed any deleterious effect. During the cable installation, most fish and other motile fauna leave, but return after the work is completed.

h. Impacts to Burials. Based on geotechnical work that we have conducted at the Pokai Bay area, we believe that our drilling work will be below the level of any known burials. This information is based on survey work conducted by Cultural Surveys Hawaii for the Department of Parks and Recreation.

We have taken into account the Board's and community concerns and have decided to relocate our landing site at Pokai Bay to an alternative site that parallels the sewer outfall at the Waianae Wastewater Treatment Plant to ensure that the cultural integrity of the Bay is maintained. We have studied the site, both on land, and in the water to ensure that there will not be any impacts to cultural or biological features.

Should you have additional comments, please contact us and we will be happy to discuss them with the Board.

Very truly yours,

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-lgn

cc: Neighborhood Commission
Councilman John DeSoto
Senator Colleen Hanabusa
Representative Emily Auwae
Representative Mike Kahikina

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

'01 FEB 5 PM 1 32
DEPT OF PLANNING and PERMITTING CITY & COUNTY OF HONOLULU

February 2, 2001

Mr. Randall K. Fujiki
Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawai'i 96813

Dear Mr. Fujiki:

Subject: DRAFT ENVIRONMENT ASSESSMENT REVIEW
Special Management Area Use Permit (2001/SMA-4)
Shoreline Setback Variance (2000/SV-12)
Applicant: TyCom Networks (US) Inc.
TMK Nos.: 9-2-3: portion of 015 (Kahe Park)
8-5-1: portion of 062 (Pokai Park)

We have reviewed the Draft Environmental Assessment ("DEA") for the subject permit applications to install fiber optic cables, new manholes and ductlines at Pokai Bay Beach Park, Kahe Point Beach Park, and a portion of Farrington Highway.

Upon review of the DEA for the subject applications, we have the following comments:

1. The Kahe Point Beach Park project site appears to be within the State Land Use Agricultural and Conservation Districts and not in the Urban District, as depicted on Figure 6 of the DEA.

The Pokai Bay Beach Park project site appears to be within the State Land Use Urban and Conservation District and not in the Urban District, as depicted on Figure 4 of the DEA.

We would like to point out that the project areas seaward of the certified shoreline would be within the Conservation District. We note that Figures 11 and 12 depicting the certified shoreline maps for these project areas were not included in the DEA. The Final

Environmental Assessment ("FEA") should include the correct State Land Use District designation of the project areas.

2. In regard to Section 3.1.5, Marine Flora and Fauna, we recommend that the FEA include environmental studies conducted such as the "Marine Environmental Analysis of Selected Landing Sites, Sea Engineering, Inc., and Environmental Assessment Co., Jan. 1992."

3. In regard to Section 3.1.7, Historic/Archaeological Resources, we recommend that the FEA include assessments of historic/archaeological resources for the project areas and verification of the assessment from the DLNR.

4. The FEA should include a discussion of Chapter 205A, Hawaii Revised Statutes, in light of the proposed special management area and shoreline variance permit applications.

5. In regard to Section 9, Consulted Agencies and Participants in the Preparation of the Draft Environmental Assessment, we recommend that the Coastal Zone Management Program, Office of Planning, be included in the review of the DEA.

We have no further comments to offer at this time. We appreciate the opportunity to review and comment on the DEA for the subject applications.

If you have questions regarding this matter, please contact me or Russell Kumabe of our office at 587-3822.

Sincerely,

Bert Saruwatari

BERT SARUWATARI
Acting Executive Officer

BS:RK:aa

c: Office of Planning

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817-4941
Telephone 808 842 1133
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eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Photogrammetry
Surveying
Construction Management

March 28, 2001

Mr. Bert Saruwatari, Acting Executive Officer
Land Use Commission
Department of Business and Economic
Development and Tourism
State of Hawaii
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Saruwatari:

Draft Environmental Assessment (EA)
TGN Hawaii Cable System

Thank you for you comment of February 2, 2001. We would like to offer the following responses to your comments.

1. *Land Use District.* We will adjust the land use boundaries according to your comments in the Final EA.

2. *Marine Flora and Fauna Studies.* We will include the complete text of the study conducted in the Final EA.

3. *Archaeological Studies.* We will include additional information regarding archaeological studies conducted in the Final EA.

4. *Chapter 205A Discussion.* We will include further discussion of Chapter 205A in the Final EA.

5. *Consulted Parties.* While the Office of Planning was not initially consulted for this project, they have been given an opportunity to comment on the Draft EA and to date have not responded.

Should you have additional comments, please contact the undersigned.

Very truly yours,

Chester Koga, AICP
Project Manager

CTK:k:\plan\18902-tgn

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
PHONE: (808) 523-4564 • FAX: (808) 523-4567

JEREMY HARRIS
MAYOR

RAE M. LOUI, P.E.
DIRECTOR
GEORGE T. TAMASHIRO, P.E.
DEPUTY DIRECTOR
ERIC G. CRISPIN, AIA
ASSISTANT DIRECTOR

May 1, 2001

MEDE

MEMORANDUM

TO: RANDALL K. FUJIKI, AIA, DIRECTOR
DEPARTMENT OF PLANNING AND PERMITTING

FROM: RAE M. LOUI, P.E., DIRECTOR
DEPARTMENT OF DESIGN AND CONSTRUCTION

SUBJECT: CHAPTER 343, ENVIRONMENTAL ASSESSMENT
SPECIAL MANAGEMENT AREA USE PERMIT (SMP)
SHORELINE SETBACK VARIANCE (SV)

This is in response to your letter dated April 18, 2001, regarding the above subject matter.

We have no comments regarding any environmental impact that this project may have on our facilities.

Please call Gerald Hamada at local 5002 if you have any questions.

Attachment

BENJAMIN J. CAYETANO
GOVERNOR

'01 APR 5 PM 3 06
DEPT OF PLANNING AND PERMITTING
CITY & COUNTY OF HONOLULU

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

BRIAN K. MINAAI
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JADINE Y. URASAKI

IN REPLY REFER TO:
HWY-PS
2.2277

APR 4 2001

Mr. Randall K. Fujiki
Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Fujiki:

Subject: Environmental Assessment
Special Management Area Use Permit (SMP)
Shoreline Setback Variance (SV)
TyCom Networks (US) Inc.
Pokai Bay Beach park, Kahe Point Beach Park, Farrington Highway
Install Fiber Optic Cables, New Manholes and Ductlines

Thank you for your transmittal requesting our review and comments regarding the proposed project.

We require the applicant to submit and coordinate with our Highways Division, construction plans for all work to be done with the Farrington Highway right-of-way. Any proposed facilities must be placed as far away as possible from the highway's paved areas.

Very truly yours,

BRIAN K. MINAAI
Director of Transportation

2001/ED-97010

BENJAMIN J. CAYETANO
GOVERNOR

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

'01 MAY 16 PM 2 13
DEPT OF PLANNING AND PERMITTING
CITY & COUNTY OF HONOLULU

BRIAN K. MINAAI
DIRECTOR

DEPUTY DIRECTORS
GLENN M. OKIMOTO
JADINE Y. URASAKI

IN REPLY REFER TO:
STP 8.9835

May 7, 2001

Mr. Randall K. Fujiki
Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Fujiki:

Subject: TGN Hawaii Cable System
Environmental Assessment (EA)
Special Management Area Use Permit (SMP)
Shoreline Setback Variance (SV)
TMK: 9-2-3: por. 15 and 8-5-1: por. 62

Thank you for your transmittal requesting our review of subject project.

All plans for work within the State highway right-of-way must be submitted to our Highways division for review and approval.

We appreciate the opportunity to provide comments.

Very truly yours,

BRIAN K. MINAAI
Director of Transportation

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hawaii.rr.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Construction Management

June 12, 2001

Mr. Brian K. Minaai, Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Minaai:

Revised Draft Environmental Assessment (EA)
TGN Hawaii Cable System
Waianae WWTP Outfall and Kahe Point Beach Park

Thank you for your letter dated April 4, 2001 and May 7, 2001. We have submitted construction plans to your Department for review and approval. Scheduling of construction is also being coordinated with your Department.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester T. Koga

Chester T. Koga, AICP
Project Manager

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cc: Tycom Networks

2001/EO-97014

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

DEPT OF PLANNING AND PERMITTING
CITY & COUNTY OF HONOLULU

May 9, 2001

LCG1443
LD-NAV

Ref.: 2000/SMA4.RCM

Honorable Randall K. Fujiki, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Fujiki:

SUBJECT: I.D.: 2001/SMA-4 Special Management (SMA) Area Use Permit Final Environmental Assessment for the TGN Hawaii Cable System - Install Fiber Optic Cables at Pokai Bay Beach Park, Kahe Point Beach Park and along Farrington Highway - R. M. Towill Corp - Island of Oahu, Hawaii

Thank you for the opportunity to review and comment on the subject matter.

A copy of the subject SMA application was transmitted to our appropriate divisions for their review and comment.

The Department has no comment to offer.

Should you have any questions, please feel free to contact Nicholas Vaccaro of the Land Division Support Services Branch at 808-587-0438.

Very truly yours,

DEAN Y. UCHIDA
Administrator

C: Oahu District Land Office
Planning and Technical Services

R. M. TOWILL CORPORATION

420 Waiakamilo Road
Suite 411
Honolulu Hawaii 96817 4941
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eMail rmtowill@hawaii.rr.com

Planning
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Construction Management

June 12, 2001

Mr. Harry M. Yada, Acting Administrator
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Yada:

Revised Draft Environmental Assessment (EA)
TGN Hawaii Cable System
Waianae WWTP Outfall and Kahe Point Beach Park

Thank you for your letter dated May 9, 2001. We will be coordinating the processing of a Conservation District Use permit application and a request for a Grant of Easement with your Department.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester T. Koga, AICP
Project Manager

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cc: Tycom Networks

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

'01 MAY 15 PM 12 11
CITY & COUNTY OF HONOLULU

May 14, 2001

Mr. Randall K. Fujiki
Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Fujiki:

Subject: FINAL ENVIRONMENT ASSESSMENT REVIEW
Special Management Area Use Permit (2001/SMA-4)
Shoreline Setback Variance (2000/SV-12)
Applicant: TyCom Networks (US) Inc.
TMK Nos.: 9-2-3: portion of 015 (Kahe Point Beach Park)
8-5-1: portion of 062 (Pokai Bay Beach Park)

We have reviewed the *Final Environmental Assessment* ("FEA") for the subject permit applications to install fiber optic cables, new manholes and ductlines at Waianae Wastewater Treatment Plant ("WWTP") Outfall (formerly sited at the Pokai Bay Beach Park), Kahe Point Beach Park, and a portion of Farrington Highway.

Upon review of the subject FEA, we have the following comments:

1. We note the following inconsistencies in the description of the State Land Use Districts for the shoreline project areas that are involved with the landing of the submarine fiber optic cables.
   - In regard to Figure 11, the State Land Use District boundaries are not shown accurately. Staff had informed Chester Koga, RM Towill Corporation, of this inaccuracy. The map in this figure should be corrected.
   - As we have pointed out in our letter dated February 2, 2001, the Kahe Point Beach Park project site appears to be within the State Land Use Agricultural and Conservation Districts and not in the Urban and Agricultural District, as described in Section 5.3, State Land Use Law, and depicted on Figure 11 of the FEA. Also, the State Land Use District should be identified as "Agricultural" and not "Agriculture" as described in the FEA.
   - We verify that the Waianae WWTP Outfall project site at Lualualei appears to be within the State Land Use Urban and Conservation District.

Mr. Randall K. Fujiki
May 14, 2001
Page 2

2. In regard to Section 4.1.5, Marine Flora and Fauna, the FEA did not include the referenced study, Marine Environmental Analysis of Selected Landing Sites, Sea Engineering, Inc., and Environmental Assessment Co., January 1992. The Applicant's response, dated March 28, 2001, to our aforementioned letter, stated that full text of the study would be included in the FEA. The FEA did not include this text. We recommend that the Applicant verify that corrections and inclusions in response to comments from reviewing agencies are addressed in the FEA as represented by the Applicant.

3. In regard to Section 4.1.7, Historic/Archaeological Resources, we recommend that the Applicant clarify if it had addressed the concerns raised by the Historic Preservation Division, Department of Land and Natural Resources ("SHPD"). In its letter dated February 23, 2001, the SHPD commented that the available documentation on historic sites and proposed mitigative measures provided in the DEA were inadequate. In its response to SHPD, dated March 28, 2001, the applicant stated that pursuant to Section 106 requirements, consultation with community groups, individuals, and agencies were still in progress with any findings to be included in the revised environmental assessment. It does not appear that the FEA included these findings nor addressed SHPD's concerns of inadequate information and mitigative measures.

4. In regard to Section 5.3, State Land Use Law, the description of the State Land Use District classifications should be corrected in light of No. 1. We reiterate that the FEA should include discussion of Chapter 205A, Hawaii Revised Statutes, in light of the proposed special management area and shoreline variance permit applications. We had made this comment in our aforementioned letter and Applicant responded that it would be included in the FEA.

5. We recommend that the Department, as the accepting authority of the FEA, verify with the Applicant that any corrections, inclusions, and edits, as represented in its response to reviewing agencies are included or addressed in the FEA or its revision thereof, prior to its acceptance.

We have no further comments to offer at this time. We appreciate the opportunity to review and comment on the subject FEA.

Please feel free to contact Russell Kumabe of my staff at (808) 587-3822, should you require clarification or any further assistance.

Sincerely,

Anthony J. H. Ching
ANTHONY J. H. CHING
Executive Officer

c: Office of Planning

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowil@hawaii.rr.com

R. M. TOWILL CORPORATION

Planning
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Surveying
Construction Management

June 12, 2001

Mr. Anthony J.H. Ching, Executive Officer
Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Ching:

Revised Draft Environmental Assessment (DEA)
TGN Hawaii Cable System
Waianae WWTP Outfall and Kahe Point Beach Park

Thank you for your letter dated May 14, 2001. We offer the following responses to your comments.

1. Land Use District Boundaries. Thank you for the information on the land use district boundaries. The map exhibit for the Kahe area will be revised based on information provided by your staff.

2. Marine Flora and Fauna. We will include the 1992 study reference in the DEA.

3. Archaeological Consultation. Consultation with the community is still on-going and several actions have been taken including meetings with individuals and community groups. Generally, the move away from Pokai Bay eliminated many of the concerns raised. At a meeting after the publication of the revised DEA, the Waianae Neighborhood Board found that mitigation proposed was satisfactory and voted to support the project. Continuing discussions are centered about coordination with other planned projects in the area to further minimize traffic impacts. Further, an archaeological monitoring plan is being prepared for submission to the Historic Preservation Division prior to the start of construction.

4. State Land Use Law. Additional discussion will be included in the Final EA to discuss the land use district and the provisions of Chapter 205A, HRS.

Should you have additional comments please contact the undersigned.

Very truly yours,

Chester T. Koga

Chester T. Koga, AICP
Project Manager

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cc: Tycom Networks

BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

June 7, 2001

Randall Fujiki, Acting Director
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Attn: Dana Teramoto

Dear Mr. Fujiki:

Subject: Revised Draft Environmental Assessment (EA) for TGN Hawaii Cable System, Waianae WWTP Outfall and Kahe Point Beach Park

We have the following comments to offer:

Two-sided pages. In order to reduce bulk and save on paper, please consider printing on both sides of the pages in the final document

Figures: Figure 14, the SMA map for Kahe Point, is illegible. In the final EA enclose a clear map which shows the work site in relation to Farrington Highway and the mauka SMA boundary.

Determination. A determination stating that an environmental impact statement will not be required is listed in section 10.2 of the draft EA. The EIS law prohibits a determination of significant impact or lack of significant impact before the end of the 30-day public comment period and prior to receipt, response and analysis of all written comments. For a draft EA the proper determination is *anticipated FONSI* (Finding of No Significant Impact)

Archeological monitoring plan. In its 2/23/01 letter the Historic Preservation Division of DLNR expressed serious concerns about impacts to archeological resources, including human remains, in the project's areas of activity. In the final EA include documentation showing concurrence with your monitoring plan from this division

Randall Fujiki
June 7, 2001
Page 2

Cables: What is the expected lifetime of the cables? At some point in the future will the cables have to be replaced?

If you have any questions call Nancy Heinrich at 586-4185.

Sincerely,

GENEVIEVE SALMONSON
Director

c: Chester Koga, RM Towill
Gerald Lynch, TyCom Networks

[illegible]
Suite [illegible]
Honolulu, Hawaii [illegible]
Telephone 808 842 1133
Fax 808 842 1937
eMail [illegible]

R. M. TOWILL CORPORATION

Planning
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Surveying
Construction Management

June 12, 2001

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Salmonson:

Revised Draft Environmental Assessment (EA)
TGN Hawaii Cable System
Waianae WWTP Outfall and Kahe Point Beach Park

Thank you for your letter dated June 7, 2001. We offer the following responses to your comments.

1. Two-sided pages. The Final EA will be printed on two sides of a page to reduce bulk and save paper.

2. Figures 14. Figure 14 will be revised with line work rather then shading to improve legibility.

3. Determination. We will correct the statement listed in the determination section.

4. Archaeological monitoring plan. We have been in consultation with the Historic Preservation Division of the Department of Land and Natural Resources. Based on our meetings a "Monitoring Plan" will be prepared based on the final construction plans. This plan will be prepared and submitted to Historic Preservation Division for approval prior to construction which is schedule for August 2001.

5. Cables Expected Lifetime. The expected service life of the cables are 20-25 years (on average). Generally, once a cable system reaches its service life the system is replaced with current technology.

If there are additional comments please contact the undersigned.

Very truly yours,

Chester T. Koga

Chester T. Koga, AICP
Project Manager

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cc: Tycom Networks

REFERENCES

1. Atlas of Hawaii, Third Edition, Department of Geography, University of Hawaii, 1998.

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

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

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

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

6. Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, United States Department of Agriculture, Soil Conservation Service, In Cooperation with the University of Hawaii Agricultural Experiment Station, August 1972.

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

8. Final Environmental Assessment, Hawaii Interisland Cable System, 1992.

9. Hawaii State Plan, Chapter 226

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

11. Prodigious Submarine Landslides on the Hawaiian Ridge, J.G. Moore, 1989.

12. Sites of Oahu, Elspeth P. Sterling and Catherine C. Summers, Bishop Museum Press, 1978.

13. Submarine Route Study, SSI, 2000.

14. Site Characterization Proposed Fiber Optic Cable Landing Sites, Kahe Point and Lualualei, Leeward Oahu, May 2001, Sea Engineering and Environmental Assessment Co.

APPENDIX

SITE CHARACTERIZATION
PROPOSED FIBER OPTIC
CABLE LANDING SITES
KAHE POINT AND LUALUALEI,
LEEWARD OAHU

Prepared For:

R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawai'i 96817-4941

Prepared By:

Sea Engineering,Inc.
Waimānalo, Hawaii
and
Richard Brock, Ph.D.
Environmental Assessment Co.
Honolulu, Hawai'i

May 2001

1.0 EXECUTIVE SUMMARY

This study examined the nearshore (shoreline to 120 foot depth) physical and biological characteristics along two proposed routes for fiber optic cable landings on the leeward Oahu coast. One site is at Kahe Point, just south of the Kahe Generating Station and the other is offshore of Lualualei, just north of the Waianae Ocean Outfall.

There are reasonably well-developed marine communities in the near shore area of the proposed Kahe Point alignment. A subtidal limestone bench extends approximately 300 feet from shore to a depth of about 15 feet. Seaward of this limestone bench and corals is a large expanse of sand; at approximately 2,900 feet from shore a biotope of rubble and scattered corals begins and continues uninterrupted to at least the 120 foot depth. Besides these biological features, there are a number of ocean users who could be impacted by the deployment of a second fiber optic cable at Kahe Point. At first glance, the presence of the well-developed coral communities on the shallow limestone bench would seem to be a reason to use directional drilling for the cable deployment. However, the first fiber optic cable deployed in 1992 at Kahe Point utilized an articulated armor pipe through this area. Inspection of this pipe suggests that other than the visual impact, there does not appear to be any quantifiable negative impact to the marine communities through which it passes. Indeed, the armor pipe serves as an appropriate substratum for the recruitment of corals. Either method would be appropriate for deploying the proposed cable along the Kahe Point alignment.

The bottom along the proposed Lualualei alignment is predominantly limestone from the shoreline to the 120 foot depth. In some areas, this limestone is irregular with significant vertical relief; in other areas the limestone is relatively flat and featureless with sandy depressions across it. The bottom seaward of the 120 foot depth consists of sand. In the more topographically-complex areas, the coral and fish communities more developed than in the featureless areas. The heterogeneity of the substratum, the presence of biologically-diverse areas, and the irregular inshore bottom lead to the conclusion that directional drilling is the preferred alternative for the proposed deployment on this alignment. A breakout point 3,600 feet seaward of the manhole location would avoid many of the important inshore biological features as well as affording protection to the cable from the elements (i.e. surf) in shallow water. This would still result in the cable being routed across another 3,600 feet of hard limestone bottom before reaching the offshore sand deposit.

2.0 INTRODUCTION

Because it is the commercial and population center of Hawaii, the majority of the fiber optic cables in the state have landed on Oahu. Most of these cables come ashore on the leeward coast because of appropriate submarine and shoreline topography, ease of landing and appropriate landside infrastructure. From a near shore marine biological perspective, the ideal cable landing site utilizes a sand substratum through the nearshore area. This allows the cable to bury into the sand thus reducing exposure of the cable and risk of later damage as well as reducing the potential for environmental impacts associated with cable deployment and subsequent operation. Previous work along the leeward coast of Oahu has identified extensive offshore deposits with sand channels that either reach the shoreline or come quite close to shore at a number of locations. To the extent possible, utilizing these natural features as appropriate routes for cable deployment reduces possible impacts from these activities on near shore marine communities.

In this study, two proposed nearshore cable routes were investigated; one at Lualualei and the other approximately 6 miles to the southeast at Kahe Point. The objectives of this study were to (1) characterize the physical and biological characteristics of the seafloor from shore to a depth of 120 feet along both of these routes, (2) assess the status of marine resources along these proposed alignments and (3) determine the impacts that may occur with cable deployment on these alignments.

3.0 STUDY METHODS

This study focused on a pre-selected alignment at each of the two routes. The investigation methods were different for the two routes.

Some information about substratum characteristics and benthic community development at the Kahe Point site was available from previous environmental work conducted for the GTE/ Hawaiian Tel fiber optic cable installation at Kahe Point in 1992. This background information serves as a point of departure for the present study.

Since the general benthic characteristics and zonation at the site were known, this study concentrated on the areas of biological diversity, i.e., the hard bottom areas. Many benthic (i.e., bottom-dwelling) coral reef species require the presence of hard substratum and many motile species utilize the shelter created by the presence of hard bottom and associated sessile species living on it. Thus the presence of hard substratum signals the possibility of greater impact to coral reef species with cable deployment activities than would occur on sand bottom areas. Organisms found on sand substratum have evolved to survive in an ever-shifting bottom. The deployment of a cable through a sandy bottom usually has little or no resulting impact to the communities resident to the area; these species are all, to a degree, motile and are able to avoid any impact by moving.

The biological studies at Kahe Point were therefore centered upon areas where the proposed alignment crossed hard substratum or coralline rubble. The locations of these sampling stations were chosen as being representative of major biological zones or biotopes. Each of these locations was located using a hand-held global positioning system (GPS). Immediately following site selection, a visual census of fishes was undertaken to estimate their abundance. These censuses were conducted over a 4 x 25 m 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 25 m 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 the distinctive features of individual communities. To alleviate this problem, a short transect (25 m in length) has proven adequate in sampling many Hawaiian benthic communities Brock and Norris 1989).

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels or puhis (family Muraenidae) and nocturnal species, e.g., squirrelfishes or ala'ihis (family Holocentridae), aweoweos or bigeyes (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus or rockfishes, family Scorpaenidae; the 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 the 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 2 cm in some dimension (without disturbing the substratum) were censused in the 4 x 25 m 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), arthropods, molluscs and polychaetes. 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 50 cm). 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 25 m).

If macrothalloid algae were encountered in the 1 x 1 m 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 areas. With green turtles, efforts were made to record the size (straight line carapace length) of the individuals seen as well as the presence of tags, tumors or any deformities.

The Lualualei site had not been previously investigated, so to obtain an overall perspective of the route, divers were first towed behind a vessel from the 120 foot depth to about the 10 foot depth, a distance of approximately 7,000 feet. An underwater sled, which carried two divers (ocean engineer and marine biologist), was towed 400 feet behind the surface vessel. The surface vessel navigated the route centerline using differential GPS with the vessel position and the centerline displayed on a laptop computer. The depth of the tow sled is diver controlled, so the sled could be "flown" five to ten feet off the bottom along the route centerline. A perspective of conditions and zonation along the entire route was therefore obtained and specific features were noted. Areas inshore of the 10 foot depth were initially examined by snorkeling. Areas representative of general conditions and those of special interest were later revisited for more detailed evaluation by diving.

4.0 RESULTS AND DISCUSSION

4.1 Kahe Point Alignment

<u>Physical Characteristics</u>
The general bathymetry and proposed cable alignment for Kahe Point are shown in Figure 1. The shoreline is comprised of limestone cliffs rising about 20 feet above the sea. This limestone continues seaward and creates a subtidal shelf that is from 150 to 350 feet wide. This shelf is bisected by alternating ridges and channels, along with scattered boulders and coral. This is the zone or biotope of emergent limestone and corals. Vertical relief ranges from 2 to 6 feet; the water depth at the seaward end of this hard bottom area is about 15 feet . The inshore half of this subtidal limestone bench has fewer corals and less vertical relief than the outer half. The inshore area appears to be scoured by the movement of rubble and sand due to occasional wave impact. In the vicinity of the proposed cable alignment, the limestone grades into sand about 150 feet

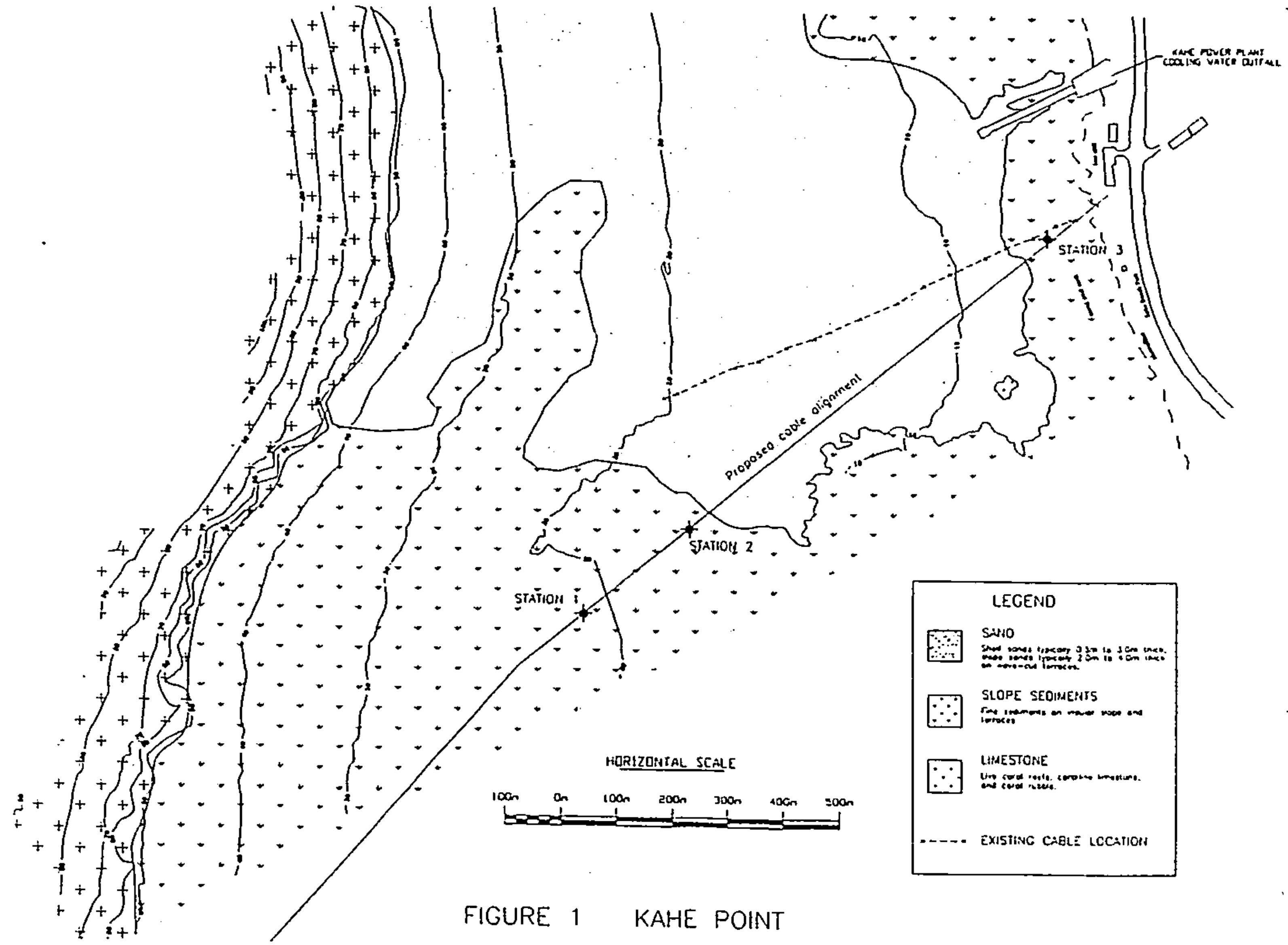

FIGURE 1 KAHE POINT

offshore where small emergent limestone knolls appear. Corals are present on some of these knolls and these features continue seaward for about 100 feet; seaward from this point is a large expanse of sand. As shown on Figure 1, this sand deposit is a prominent bottom feature. Along the proposed alignment, the sand gives way to a biotope of rubble and scattered corals at a depth of 45 feet approximately 2,900 feet offshore.

The biotope of rubble and scattered corals is a continuous feature from that point to beyond the 120 foot depth, which was the outer depth limit of this study. As the name implies, the substratum in the biotope of rubble and scattered corals is comprised of coralline rubble with scattered corals. Corals occur in relatively low abundance across this area with local mean coverage ranging from 5 to 10%. The most common coral species are the lobate coral (*Porites lobata*), plate coral (*Montipora verrucosa*) and to a lesser extent, the cauliflower coral (*Pocillopora meandrina*), brown plate coral (*Montipora patula*), finger coral (*Porites compressa*) as well as a number of other species. The substratum is relatively flat and gently slopes off in a seaward direction. Most vertical relief is created by the upward growth of the scattered groups of coral colonies. The size of individual coral colonies varies with depth; the species with the largest colonies encountered is the hemispherically-growing lobate coral (*Porites lobata*). In the deeper portions of the proposed alignment, *Porites lobata* colonies tend to be small (less than 1 foot in diameter) but along the shallower inshore boundary of this distinctive zone, the size of *Porites lobata* colonies is greater, with the largest seen being about 5 feet in diameter.

Three stations, shown on Figure 1, were established to quantitatively sample the marine communities along the proposed cable alignment. Two of these (Stations 1 and 2) were placed in the biotope of rubble and scattered corals. The third quantitative station was established near the shoreline in the biotope of emergent limestone and corals. The biotope of sand was not quantitatively sampled in this study.

Biotope of Sand

In the near shore environment, about 2,200 feet of the proposed cable alignment crosses the biotope of sand. Because of sand's 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 crustceans such as the Kona crab (*Rania rania*). Without considerable time spent searching in the sand, many species in this habitat will not be seen. The faunal assemblages in the biotope of sand are best developed at greater depths; where this habitat occurs in shallow water, many of the characteristic species become less abundant.

Species commonly seen in deeper sand habitats include a number of molluscs: the helmet shell (*Cassis cornuta*), augers (*Terebra crenulata, T. maculata* and *T. inconstans*), the leopard cone (*Conus leopardus*) and the flea cone (*Conus pulicarius*). Echinoderm species frequently seen include the sea hare (*Brissus* sp.), starfish (*Mithrodia bradleyi*) and brown sea cucumber (*Bohadschia vitiensis*) as well as the commercially important kona crab (*Rania rania*). Fishes encountered in this biotope include the mackeral scad or opelu (*Decapterus macarellus*), grey snapper or uku (*Aprion virescens*), sand wrasse or nabeta (*Xyrichthys pavo*), white goatfish or weke (*Mulloidichthys flavolineatus*), sting ray or hihimanu (*Dasyatis hawaiiensis*) and a host of small gobies and goby-like species. Undoubtedly with more searching, many more species would be encountered in this biotope. As noted above, most of these species become less evident in the shallower portions of the biotope.

<u>Biotope of Rubble and Scattered Corals</u>

As noted above, the characteristic features of this biotope are a substratum comprised primarily of coralline rubble with occasional living coral colonies. This biotope was examined along the proposed cable alignment from a depth of about 120 feet to the inshore boundary of the biotope about 2,900 feet from shore. Coral colonies tend to be small through most of this biotope except near the inshore boundary where some individual colonies are of a larger size. Throughout the biotope many coral colonies occur clustered in small groups with intervening rubble areas. In general, vertical relief is not great but where the colony size is larger there is greater relief. Two quantitative stations were established to sample this biotope; Station 1 was established on the proposed alignment in 70 feet of water where the individual coral colonies tend to be smaller. Station 2 was placed on the proposed cable alignment in about 45 feet of water where many of the coral colonies are larger.

The substratum at Station 1 is primarily coralline rubble and corals occurring in small irregularly shaped mounds having a general orientation perpendicular to shore and spaced from 15 to 100 feet apart. These mounds rise from 1 to 3 feet above the surrounding substratum (Photo 1). Despite the presence of these corals, the majority of the substratum is low-relief coralline rubble in the vicinity of the transect site (Photo 2). The results of the quantitative survey carried out at Station 1 are given in Table 1. The quadrat survey noted the coralline alga (*Porolithon onkodes*) having a mean coverage of 0.3%, two sponge species (*Spirastrella coccinea* and *Chondrosia chucalla*) with a mean coverage of 0.1% and four coral species (*Porites lobata, Porites compressa, Montipora verrucosa* and *Montipora patula*) with an estimated mean coverage of 10.3%. The invertebrate census noted seven species: the boring bivalve (*Lithophaga* sp.), cone shell (*Conus lividus*) christmas tree worm (*Spirobranchus gigantea*), black sea urchin (*Tripneustes gratilla*), wana (*Echinothrix diadema*), banded urchin (*Echinothrix calamaris*) and the black sea cucumber (*Holothuria atra*).

The results of the census of fish at station 1 are given in Appendix A. The census noted 27 species and 198 individual fishes. The most common species were the small damselfishes (*Chromis hanui. Chromis agilis*), whitespot damselfish or alo'ilo'i (*Dascyllus albisella*), the brick soldierfish or menpachi (*Myripristes amaenus*), orangebar surgeonfish or na'ena'e (*Acanthurus olivaceus*) and goldring surgeonfish or kole (*Ctenochaetus strigosus*). The standing crop of fishes at this station was estimated to be 248 g/m^2 and the species making the greatest contribution to this standing crop are the menpachi (*Myripristes amaenus* - 8% of the total), the sleek unicornfish or kala holo (*Naso hexacanthus* - 9%) and the na'ena'e (*Acanthurus olivaceus*) making up 64% of the biomass at this station.

At Station 2 the substratum also consists of coral rubble with irregularly shaped and spaced coral mounds scattered over it (Photo 3). These coral mounds vary in size from 3 x 3 feet up to 10 x 25 feet, and are spaced from 2 to 50 feet apart. These clusters of living corals are dominated by the lobate coral (*Porites lobata*). The largest colonies in the immediate area have estimated diameters up to 5 feet and an approximate age of up to 75 years.

Table 2 presents the results of the quantitative survey carried out at Station 2. The quadrat survey noted the coralline alga (*Porolithon onkodes*) with a mean coverage of 0.7%, the two ubiquitous sponges (*Spirastrella coccina* and *Chondrosia chucalla*) having a mean coverage of 0.6% and five coral species (*Porites lobata, Pocillopora meandrina, Montipora verrucosa, Montipora patula* and *Montipora verrilli*) with an estimated coverage of 4.6%. The invertebrate census noted eight species including the rock oyster (*Spondylus tenebrosus*), boring bivalve (*Lithophaga* sp.) and the tiger cowry (*Cypraea tigris*) as well as the green urchin (*Echinometra mathaei*), banded urchin (*Echinothrix calamaris*), wana (*Echinothrix diadema*), boring urchin (*Echinostrephus aciculatum*) and the coral-feeding starfish (*Acanthaster plancii*). The fish census (Appendix A) noted 25 species and 129 individual fishes at station 2. The most common species were the arc-eye hawkfish or piliko'a (*Paracirrhites arcatus*) and the brown surgeonfish or ma'i'i'i (*Acanthurus nigrofuscus*). The biomass of fishes at Station 2 was estimated to be 91 g/m^2. Species contributing heavily to this standing crop include a single blue-spotted grouper or roi (*Cephalopholis argus*) contributing 12%, the na'ena'e (*Acanthurus olivaceus*) adding 27% and kala holo (*Naso hexacanthus*) making up 22% of the biomass at this station.

The Biotope of Emergent Limestone and Corals

The biotope of emergent limestone and corals occurs as a near-continuous feature along the shoreline of Kahe Beach Park. In the vicinity of the proposed cable alignment, this biotope is about 350 feet wide, extending from the shore and terminating in the biotope of sand on the seaward side. Along the seaward side of this hard-bottom biotope, the limestone forms "spurs" or ridges that project seaward with sand in the intervening areas. These ridges rise abruptly 3 to 6 feet above the surrounding sand (Photos 4 and 5). The articulated pipe protection placed on the GTE/Hawaiian Tel cable during the 1992 deployment can be seen in the center of Photo 4. Seaward of this, scattered outcrops of limestone protrude above the sand; corals occur on these elevated areas. These isolated patches are from 2 x 6 feet up to 6 x 15 feet in size, have a general orientation perpendicular to shore, and are spaced from15 to 75 feet apart.

Station 3 was established about 75 to 100 feet offshore in water depths of 9 to 12 feet. The substratum is limestone with small channels cut into it having an orientation perpendicular to shore. These channels are from 2 to 8 feet wide, 1 to 2 feet deep, and are up to 60 feet long. Water-worn boulders are scattered in some of the channel bottoms. Corals are spread across the bottom in this area. The quantitative transect sampling this site was established parallel to shore.

The results of the quantitative survey carried out at Station 3 are given in Table 3. The quadrat survey noted two algal species, limu kohu (*Asparagopsis taxiformis*) and *Amansia glomerata* collectively having a mean coverage of 0.2%. Seven coral species were also noted in the quadrat survey having a mean coverage of 21.9%; species in the quadrats include *Porites lobata, Porites evermanni, Pocillopora meandrina, Montipora verrucosa, Montipora patula, Montipora verrilli* and *Leptastrea purpurea*. This transect was established in the area with the greatest local

CORRECTION

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

At Station 2 the substratum also consists of coral rubble with irregularly shaped and spaced coral mounds scattered over it (Photo 3). These coral mounds vary in size from 3 x 3 feet up to 10 x 25 feet, and are spaced from 2 to 50 feet apart. These clusters of living corals are dominated by the lobate coral (*Porites lobata*). The largest colonies in the immediate area have estimated diameters up to 5 feet and an approximate age of up to 75 years.

Table 2 presents the results of the quantitative survey carried out at Station 2. The quadrat survey noted the coralline alga (*Porolithon onkodes*) with a mean coverage of 0.7%, the two ubiquitous sponges (*Spirastrella coccina* and *Chondrosia chucalla*) having a mean coverage of 0.6% and five coral species (*Porites lobata, Pocillopora meandrina, Montipora verrucosa, Montipora patula* and *Montipora verrilli*) with an estimated coverage of 4.6%. The invertebrate census noted eight species including the rock oyster (*Spondylus tenebrosus*), boring bivalve (*Lithophaga* sp.) and the tiger cowry (*Cypraea tigris*) as well as the green urchin (*Echinometra mathaei*), banded urchin (*Echinothrix calamaris*), wana (*Echinothrix diadema*), boring urchin (*Echinostrephus aciculatum*) and the coral-feeding starfish (*Acanthaster plancii*). The fish census (Appendix A) noted 25 species and 129 individual fishes at station 2. The most common species were the arc-eye hawkfish or piliko'a (*Paracirrhites arcatus*) and the brown surgeonfish or ma'i'i'i (*Acanthurus nigrofuscus*). The biomass of fishes at Station 2 was estimated to be 91 g/m^2. Species contributing heavily to this standing crop include a single blue-spotted grouper or roi (*Cephalopholis argus*) contributing 12%, the na'ena'e (*Acanthurus olivaceus*) adding 27% and kala holo (*Naso hexacanthus*) making up 22% of the biomass at this station.

<u>The Biotope of Emergent Limestone and Corals</u>
The biotope of emergent limestone and corals occurs as a near-continuous feature along the shoreline of Kahe Beach Park. In the vicinity of the proposed cable alignment, this biotope is about 350 feet wide, extending from the shore and terminating in the biotope of sand on the seaward side. Along the seaward side of this hard-bottom biotope, the limestone forms "spurs" or ridges that project seaward with sand in the intervening areas. These ridges rise abruptly 3 to 6 feet above the surrounding sand (Photos 4 and 5). The articulated pipe protection placed on the GTE/Hawaiian Tel cable during the 1992 deployment can be seen in the center of Photo 4. Seaward of this, scattered outcrops of limestone protrude above the sand; corals occur on these elevated areas. These isolated patches are from 2 x 6 feet up to 6 x 15 feet in size, have a general orientation perpendicular to shore, and are spaced from15 to 75 feet apart.

Station 3 was established about 75 to 100 feet offshore in water depths of 9 to 12 feet. The substratum is limestone with small channels cut into it having an orientation perpendicular to shore. These channels are from 2 to 8 feet wide, 1 to 2 feet deep, and are up to 60 feet long. Water-worn boulders are scattered in some of the channel bottoms. Corals are spread across the bottom in this area. The quantitative transect sampling this site was established parallel to shore.

The results of the quantitative survey carried out at Station 3 are given in Table 3. The quadrat survey noted two algal species, limu kohu (*Asparagopsis taxiformis*) and *Amansia glomerata* collectively having a mean coverage of 0.2%. Seven coral species were also noted in the quadrat survey having a mean coverage of 21.9%; species in the quadrats include *Porites lobata, Porites evermanni, Pocillopora meandrina, Montipora verrucosa, Montipora patula, Montipora verrilli* and *Leptastrea purpurea*. This transect was established in the area with the greatest local coverage in the vicinity of the proposed cable alignment. Invertebrates seen in the transect area include the rock oyster (*Spondylus tenebrosus*), christmas tree worm (*Spirobranchus gigantea*), boring sea urchin (*Echinostrephus aciculatum*), black sea urchin (*Tripneustes gratilla*), green urchin (*Echinometra mathaei*), slate-pencil urchin (*Heterocentrotus mammillatus*) and the cushion starfish (*Culcita novaeguinaea*).

The results of the fish census carried out at Station 3 are given in Appendix A. In total there were 506 individual fishes censused among 30 species. The most common species were the alo'ilo'i (*Dascyllus albisella*), the sargeant major or mamo (*Abudefduf abdominalis*), the saddleback wrasse or hinalea lauwili (*Thalassoma duperrey*), ma'i'i'i (*Acanthurus nigrofuscus*), the bluelined surgeonfish or maiko (*Acanthurus nigroris*) and the na'ena'e (*Acanthurus olivaceus*). The standing crop of fishes at Station 3 was estimated to be 306 g/m 2 . Species contributing greatly to this standing crop include the hinalea lauwili (*Thalassoma duperrey*) and black tirggerfish or humuhumu 'ele'ele (*Melichthys niger*) both contributing 9%, the ma'i'i'i (*Acanthurus nigrofuscus*) adding 12% and the na'ena'e (*Acanthurus olivacues*) comprising 28% of the standing crop at this station.

One small green sea turtle was encountered in the biotope of emergent limestone and corals. This turtle was seen first about 50 feet southeast of Station 3. This turtle appeared to have no fear of divers and approached to within 3 feet. This turtle had no tags or evidence of fibropapilloma tumors. The turtle was estimated to have a straight-line carapace length of 1 foot.

During the fieldwork, notes were taken on the activities of other users in the vicinity of the proposed alignment. On 9 April 2001 four shoreline fishermen were seen fishing within 300 feet of the proposed Kahe landing site and one spearfisherman was seen in the shallows next to shore. Also present were three commercial dive tour boats bringing clients to the area for snorkeling, SNUBA and SCUBA diving. Approximately 25 individuals appeared to be in the tour groups. On 20 April there was one fisherman seen on the shoreline and two tour boats with probably less than 15 clients. On 23 April we noted four fishermen using the shoreline area over a 1.5 hour period, one shoreline swimmer and two tour boats were present. One boat anchored about 150 m offshore and off-loaded about 12 clients to two smaller rubber boats which moved to the northwest following a school of spinner porpoises (*Stenella longirostris* - about 20 porpoises were in this school) passing through the area and moving northwest. In the 23 April survey, the commercial dive tours had two tourists on SCUBA and 4 on SNUBA. In summary, the shallow waters fronting Kahe Point Beach Park are regularly used by both the general public and commercial dive tours. The commercial recreational tour activities in the area have increased significantly in the last few years.

It should be noted that many of the fish seen around Station 3 were quite bold and approached the biologist while in the water. This suggests that some feeding of the fishes probably occurs in this area by the dive tour operators, which could account for the relatively high standing crop of fishes encountered at this station.

<u>Implications for Cable Deployment at Kahe Point</u>
From a biological perspective, there are reasonably well-developed marine communities in the near shore area of the proposed Kahe Point alignment. The subtidal limestone bench extending

300 feet out from shore could be viewed as an impediment to the deployment of the fiber optic cable, especially with the well-developed coral community present. The large expanse of sand seaward of the limestone bench offers an ideal cable route. Cable placement should have minimal impact on the offshore biotope of rubble and scattered corals, which begins seaward of the sand deposit. Besides these biological features, there are a number of ocean users who could be impacted by the deployment of a second fiber optic cable at Kahe Point.

In general, nearshore cable deployment in the Hawaiian islands utilizes one of two methods; direct lay across the bottom to the shoreline, with articulated pipe placed to protect the cable in hard bottom areas, or, directional drilling from the shoreline beneath the bottom to a specified offshore point. At first glance, the presence of well-developed coral communities on the shallow subtidal area adjacent to shore at Kahe Point would seem to argue for the use of directional drilling in the deployment through this portion of the alignment. However, the first fiber optic cable deployed in 1992 at Kahe Point utilized an articulated armor pipe to protect the cable (Photo 4). Photos 5 and 6 show two more views of the cable as it crossed the nearshore bench. through this area. Other than the visual impact of the armor pipe deployed across the limestone, there does not appear to be any quantifiable negative impact to the marine communities through which it passes. Indeed, the armor pipe serves as an appropriate substratum for the recruitment of corals (Photo 6).

A search was made through the biotope of rubble and scattered corals about 3,500 feet offshore for the cable deployed in 1992, in an effort to ascertain impacts that may be occurring or have occurred due to its deployment through this habitat. We were not successful in finding the cable suggesting that it may have become buried into the substratum over the years.

It appears that there are no ongoing impacts associated with the direct lay of the GTE/Hawaiian Tel cable, and that either method would be appropriate for the proposed cable. Impacts on the offshore biotope of rubble and scattered corals (Stations 1 and 2) could be minimized even more by shifting the cable route slightly toward the existing cable. The existing route enters this biotope at a water depth of 80 feet; the proposed route enters this biotope at a depth of 50 feet.

4.2 Lualualei Alignment

The Lualualei alignment was examined from a depth of 120 feet to about 10 feet, which occurs within 300 feet of the proposed manhole location. Figure 2 shows a plan view of the proposed route; Figure 3 shows a cross section profile based on a detailed bathymetric survey along the alignment. Figure 3 also shows the locations of the individual sites selected for additional investigation. The horizontal scale in Figure 3 is the distance from the proposed manhole. The results of the qualitative inspection as well as the individual dives are presented below.

<u>Zonation of the Lualualei Alignment</u>
The initial tow identified several types of bottom zonation along the route. These are described briefly below. Follow up dives were made in each zone, except for the offshore sand deposit, and additional details are given in the description pertaining to each dive site.

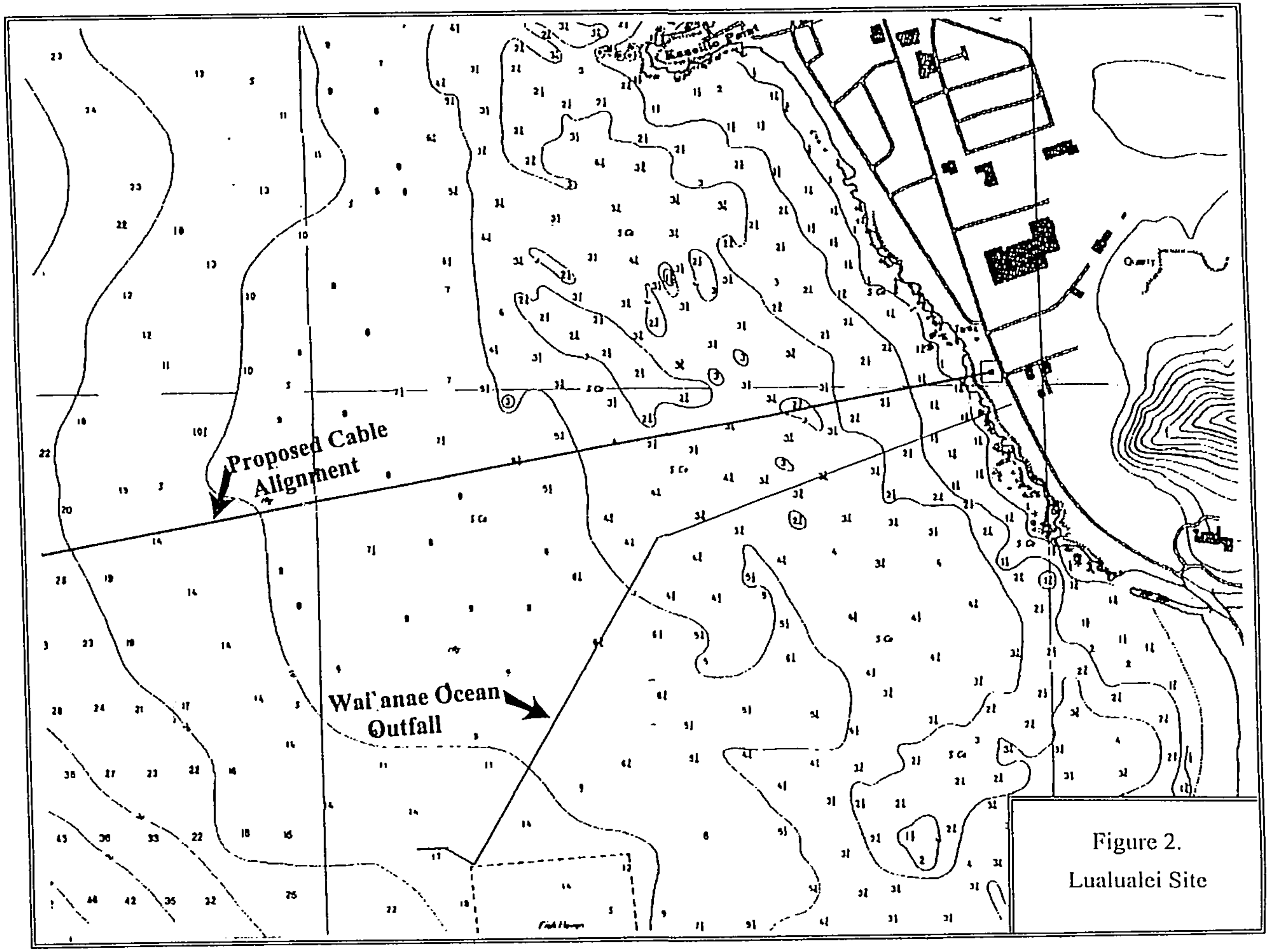

Figure 2.
Lualualei Site

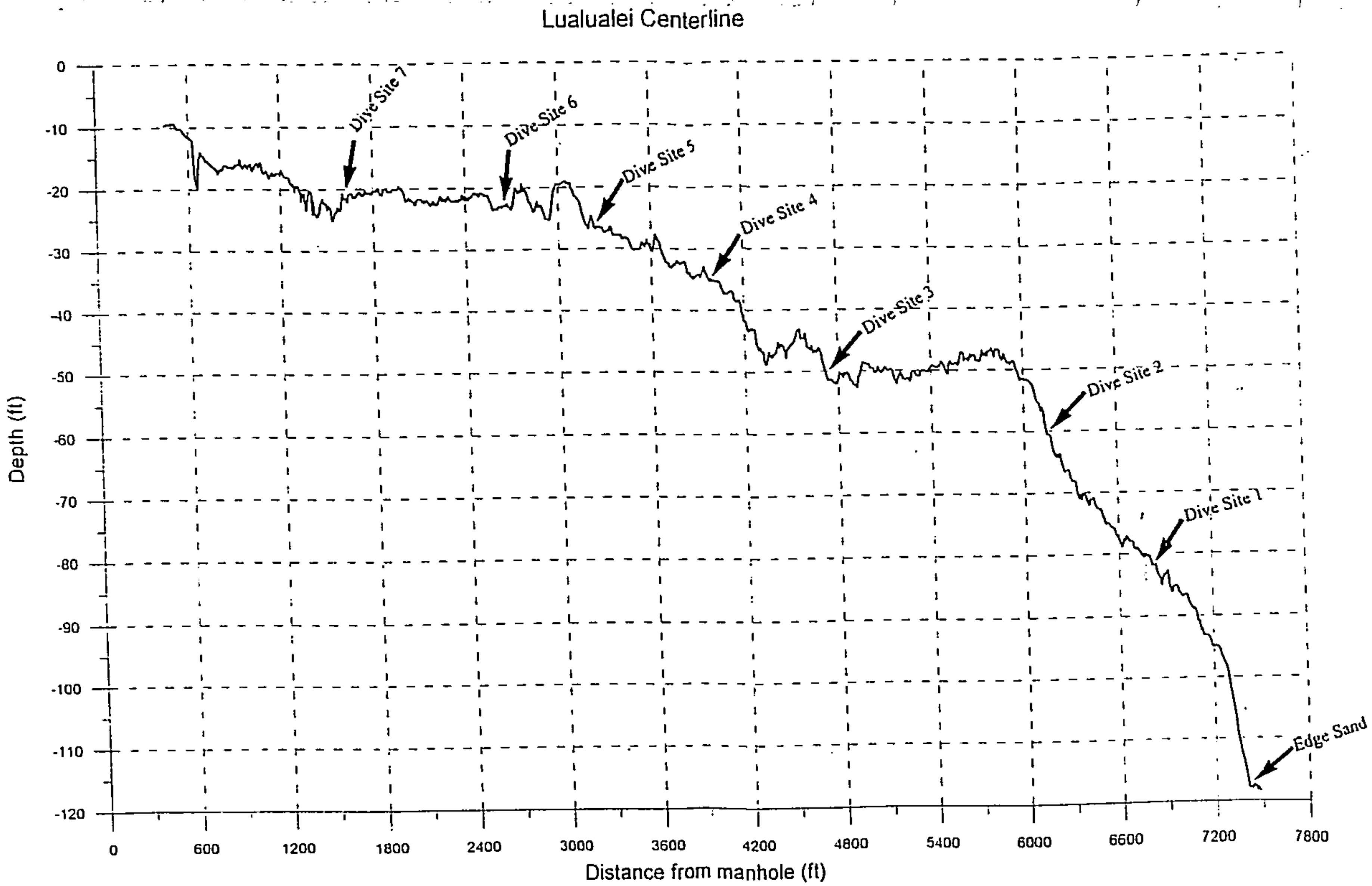

Figure 3. Lualualei Cross-Section

The bottom seaward of the 120 foot depth is sand. This is part of a large offshore deposit. Branches of this deposit extend shoreward at Pokai Bay, and inshore of the fish haven, which is located just south of the outfall. .

A transition to relatively barren limestone occurs at the 120 foot depth. This seaward edge of the reef rises quickly to the 50 foot depth, with a bottom slope of approximately 1 on 20. There are occasional depressions or potholes present on the deeper part of the slope. These potholes range in diameter from 6 to 15 feet, are up to 5 feet deep, and are spaced from 100 to 150 feet apart. A small amount of coral is present primarily around the edges of these potholes, otherwise the substratum is relatively featureless. These potholes continue as occasional features to a depth of about 90 feet where coral colonies become more evident and are scattered across the substratum (Photo 7). The irregularity of the bottom increases slightly near the top of the slope. Photo 8 shows a two foot high ledge at the 60 foot depth. This flat limestone continues inshore to about the 50 foot water depth. Inshore of the 50 foot depth, the limestone has greater vertical relief and coral growth is better developed (Photo 9). These higher relief substratum characteristics continue shoreward to a depth of 45 feet, about 4,200 feet from shore. Over the next 600 feet toward shore, the limestone substratum becomes more undulating with fewer potholes. The channels are not as pronounced resulting in less topographical relief and fewer corals present (Photo 10). The low points or depressions are filled with sand and few fishes are seen.

The bottom becomes more irregular with increasing coral coverage approximately 3,600 feet from shore, and this continues for a distance of 900 feet to a point 2700 feet offshore (Photo 11). These features continue shoreward along the proposed cable alignment to a depth of 22 feet, about 2700 feet from the shoreline. From this point shoreward the substratum is relatively flat and has little vertical relief present (Photo12). However, commencing about 1,800 feet offshore and continuing to within about 700 feet of the shore is an area where there are scattered coral colonies, many of which are relatively large (Photo13). Most of the larger corals are lobate corals (*Porites lobata*) and have diameters up to 5 feet and thus have maximum ages close to 70 years. Water depth through the area where these corals are located ranges from 10 to 20 feet.

Physical and Biological Features Along the Proposed Alignment

Following the preliminary tow along the proposed alignment, a series of dives were made at specific sites to obtain additional information physical and biological characteristics at each of the sites. The locations of the dive sites are shown in Figure 3 and the observations are presented below.

Site 1: (depth 83 feet)
The substratum at this site is limestone with little vertical relief present. Coral colonies tend to be relatively small and scattered across the substratum (Photo 8). The dominant species is the cauliflower coral (*Pocillopora meandrina*). Other species seen include small colonies of *Porites lobata, Montipora verrucosa, Leptstrea purpurea, Cyphastrea ocellina* and *Monitpora patula*. Mean coral coverage is estimated to be 3%. One staghorn coral colony (*Pocillopora eydouxi*) was encountered in the immediate area. Other macroinvertebrates seen include the grey sponge (*Plakortis simplex*), miter (*Mitra papalis*), cone shell (*Conus miles*), banded sea urchin (*Echinothrix calamaris*), boring

urchin (*Echinostrephus aciculatum)* and octopus or he'e (*Octopus cyanea*). Very little shelter or cover for fishes is present in the immediate vicinity of the proposed alignment at this depth. Fishes seen include the damselfish or alo'ilo'i (*Dascyllus albisella*), whitemouth moray or puhi'oni'o (*Gymnothorax meleagris*), arc-eye hawkfish or piliko'a (*Paracirrhites acratus*) and the bridled triggerfish or humuhumu mimi (*Sufflmen fraenatus*).

Site 2: (depth 60 feet)
The limestone becomes more undulating with vertical relief not exceeding two feet; corals are more evident in this area, yet occupy less than 2% of the substratum (Photo 14). The cauliflower coral (*Pocillopora meandrina*) is the dominant species but also present are small colonies of other species (i.e., *Porites lobata, Montipora verrucosa, Monitpora patula, Montipora verrilli, Pocillopora eydouxi, Pavona varians* and *Leptastrea purpurea*). Several fish species were seen in this area including the toby (*Canthigaster jactator*), arc-eye hawkfish or piliko'a (*Paracirrhites arcatus*), bridled triggerfish or humuhumu mimi (*Sufflamen fraenatus*), lei triggerfish or humuhumu lei (*Sufflamen bursa*), guilded triggerfish (*Xanthichthys auromarginatus*), alo'ilo'i (*Dascyllus albisella*), na'ena'e (*Acanthurus olivaceus*), redbar hawkfish or piliko'a (*Cirrhitops fasciatus*) and a school of mackeral scad or opelu (*Decapterus macarellus*) passed through the area during the survey. Macroinvertebrates seen at this location include the pearl oyster (*Pinctado margarifera*) and one marbled cone shell (*Conus marmoratus*). Interestingly, a relatively large area (estimated to be in excess of 2,000 square feet) was occupied by the alien algal species *Avrainvillea amadelpha* (Photo15).

Site 3: (depth 48 feet)
The substratum at this site is more irregular with potholes as well as small channels cut into the limestone substratum. The channels are from 6 to 30 feet wide and up to 3 feet deep. They are 10 to 30 feet long and spaced from 10 to 60 feet apart. Their general orientation is perpendicular to shore. Coral species present include *Porites lobata, Montipora verrucosa* and *Montipora patula*. Coral coverage is estimated to be between 5 to 8% and coral rubble is found at the bottom of the channels. Common fishes of the area include humuhumu lei (*Sufflamen bursa*), manybar goatfish or moano (*Parupeneus multifasciatus*), guilded triggerfish (*Xanthichthys auromarginatus*), humuhumu mimi (*Sufflamen fraenatus*), hinalea lauwili (*Thalassoma duperrey*), pinktail triggerfish or humuhumu hi'ukole (*Melichthys vidua*) and the piliko'a (*Paracirrhites arcatus*). Macroinviertebrates seen include the boring urchin (*Echinostrephus aciculatum*), green urchin (*Echinometra mathaei*) and the black sea cucumber (*Holothuria atra*). About 75 feet east of the proposed cable alignment is an area with greater vertical relief and cover; over one 400 square foot area corals (*Porites lobata, Pocillopora meandrina, Pavona duerdeni, Montipora verrucosa*) had a estimated coverage of 40%. In this area were seen damselfish (*Chromis vanderbilti, Chormis hanui*), multiband butterflyfishes or kikakapu (*Chaetodon multicinctus*) as well as the species noted above. This area of greater complexity just east of the proposed cable alignment points out the diversity of topographic variations found over relatively small spatial scales along Oahu's leeward coast.

Site 4: (depth 32 feet)
As with other sites, the substratum at this location is limestone; however shallow sand-filled depressions ranging from 3 to 15 feet in diameter are present. The other feature of the area is a number of small sand-filled channels that have an orientation perpendicular to shore and are up to 5 feet wide, 2 feet deep, up to 60 feet long, and spaced from 15 to 50 feet apart. In one shallow depression old ordnance was seen (Photo 16). The dominant species of the area include algae or limu; most common are limu lipoa (*Dictyopteris australis*), limu palahalaha (*Ulva fasciata*) and *Spatoglossum solierii*. Coral present tend to be on the more elevated portions of the limestone; the dominant species is the cauliflower coral (*Pocillopora meandrina*) and mean coverage by live corals in this area is less than 1%. Macroinvertebrates seen include the black sea cucumber (*Holothuria atra*), banded urchin (*Echinothrix diadema*), green urchin (*Echinometra mathaei*) and the black urchin (*Tripneustes gratilla*). Few fishes were seen in this area which is probably related to the lack of shelter present; species encountered include humuhumu hi'ukole (*Melichthys vidua*), hinalea lauwili (*Thalassoma duperrey*, humuhumu lei (*Sufflamen bursa*) and the banded wrasse or 'omaka (*Stethojulis balteata*).

Site 5: (depth 27 feet)
The limestone in this area forms low mounds that rise up to 6 feet above the general bottom. The mound areas have typical dimensions of 100 x 150 feet, and are separated by flat limestone and sand. The mounds are from 75 to 150 feet apart. The mounds are high relief, with ledges and undercuts with sand filled bottoms. Vertical relief ranges up to 8 feet. A number of corals are found in these topographically complex areas (*Pocillopora meandrina, Porites lobata, Montipora verrucosa, Montipora patula, Montipora verrilli, Leptastrea purpurea* and *Pavona varians*) with a mean coverage of 25%. Because of the presence of shelter there are a greater number of fishes seen including humuhumu mimi (*Sufflamen fraenatus*), humuhumu lei (*Sufflamen bursa*), humuhumu hi'ukole (*Melichthys vidua*), na'ena'e (*Acanthurus olivaceus*), ma'i'i'i (*Acanthurus nigrofuscus*), hinalea lauwili (*Thalassoma duperrey*), piliko'a (*Paracirrhites arcatus*), moano (*Parupeneus multifasciatus*), damselfishes (*Chromis vanderbilti* and *Stegastes fasciolatus*), kikakapu (*Chaetodon multicinctus*), fourspot butterflyfish or lau hau (*Chaetodon quadrimaculatus*), milletseed butterflyfish or lau wiliwili (*Chaetodon miliaris*) and the longnose butterflyfish or lau wiliwilinukunuku'oi'oi (*Forcipiger flavissimus*).

Site 6: (depth 23 feet)
The limestone at this location is generally flat but there are widely separated gently sloping "domes" of limestone rising no more than 5 feet above the general bottom (Photo 17). In the depressions between these rises or domes is sand and the area is relatively devoid of most corals and fish. Common coral species seen include *Porites lobata, Montipora verrucosa, Montipora patula* and *Pocillopora meandrina*. Mean coral coverage in the area is 3%. Macroinvertebrates seen include the green urchin (*Echinometra mathaei*), banded urchin (*Echinothrix calamaris*), and the boring urchin (*Echinostrephus aciculatum*).

Site 7: (depth 22 feet)
As noted above, the relatively flat limestone continues uninterrupted towards shore. About 1700 feet offshore is a zone of relatively large lobate coral colonies (*Porites lobata*). These hemispherical colonies have an average diameter of about 3 feet suggesting an age of about 50 years and are spaced from 6 to 50 feet apart. Overall coral coverage is about 5% through the area. Associated with these corals are cauliflower coral (*Pocillopora meandrina*) and plate corals (*Montipora verrucosa* and *M. patula*). Other invertebrates seen in this area include the pearl oyster (*Pinctado margarifera*), slipper lobster or ula'papa (*Paribaccus antarcticus*), cone shells (*Conus ebreus* and *Conus lividus*), cushion starfish (*Culcita noveaguinaea*), wana (*Echinothrix diadema*) and boring urchin (*Echinostrephus aciculatum*). Fishes seen around these large coral colonies include damselfishes (*Chromis vanderbilti, Plectroglyphidodon johnstonianus, Chromis hanui, Stegastes fasciolatus*), hinalea lauwili (*Thalassoma duperrey*), toby (*Canthigaster jactator*), ma'i'i'i (*Acanthurus nigrofuscus*), piliko'a (*Paracirrhites arcatus, Cirrhitops fasciatus*), hilu piliko'a (*Paracirrhites forsteri*) and the moano (*Parupeneus multifasciatus*).

Implications of Cable Deployment on the Lualualei Alignment

The proposed Lualualei alignment can be characterized as an area dominated by limestone from the shoreline to the 120 foot depth. In some areas, this limestone is highly irregular, having topographical complexity while in other areas the limestone is relatively flat and featureless with sandy depressions across it. Seaward of the limestone is a large sand deposit. In the more topographically-complex areas, the coral and fish communities are better developed.

The heterogeneity of the substratum, the biologically-diverse areas (such as the zone of large *Porites lobata* colonies approximately 1700 feet offshore on the alignment), and the inshore areas of high vertical relief area lead to the conclusion that directional drilling would be the preferred alternative for this installation. A breakout point 3,600 feet from the manhole would avoid many of the important inshore biological features as well most of the areas of high vertical relief. However, a 1,600 foot wide zone of irregular bottom characterized by dive site 3 would still have to be crossed. Photos 18 and 19 show the variety of conditions that the cable would have to cross in the vicinity of dive site 3, located 4,500 feet seaward of the manhole.

5.0 REFERENCES

Brock, R.E. 1982. A critique on the visual census method for assessing coral reef fish populations. Bull. Mar. Sci. *32*:269-276.

Brock, R.E. and J.H. Brock. 1977. A method of quantitatively assessing the infaunal community residing in coral rock. Limnol. Oceanogr. *22*:948-951.

Brock, R.E. and J.E. Norris. 1989. An analysis of the efficacy of four artificial reef designs in tropical waters. Bull. Mar. Sci. *44*:934-941.

Brock, V.E. 1954. A preliminary report on a method of estimating reef fish populations. J. Wildlife Mgmt. *18*:297-308.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bu.. Fish. Res. Bd. Canada, Bull. No. 191. 382p.

Sea Engineering, Inc. 2000. Leeward Oahu preliminary nearshore cable site investigation Ulehawa Beach to Pokai Bay. Prepared for: R.M. Towill Corporation, Honolulu, Hawaii. November 2000. 9p.+figs.

6.0 PHOTO LOG

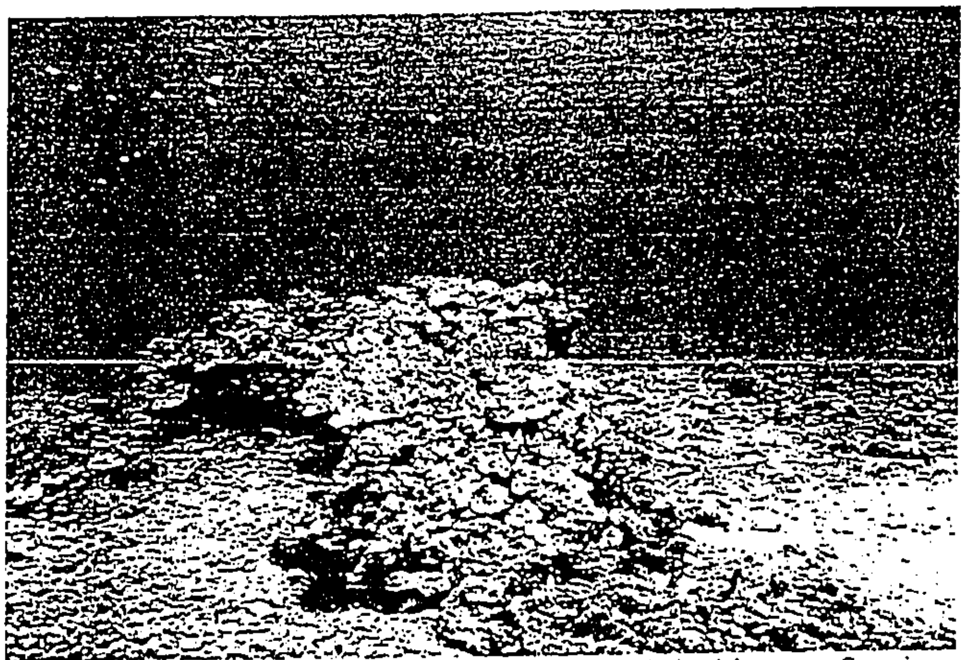

Photo 1. Kahe Point, Station 1. One of the coral mounds in this area. Species present in the "mound" are *Porites lobata* and *Porites compressa*. Damselfishes in the water column include alo' ilo'i (*Dascyllus albisella*) and the brown damsel (*Chromis hanui*).

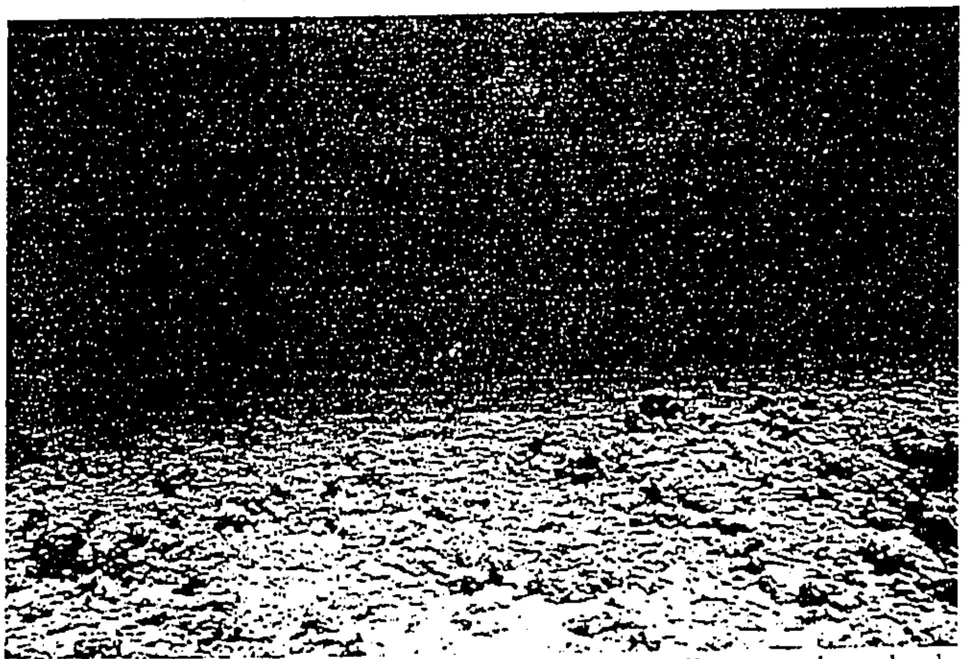

Photo 2. Kahe Point, Station 1. Coralline rubble with small scattered coral colonies that comprise this deeper biotope.

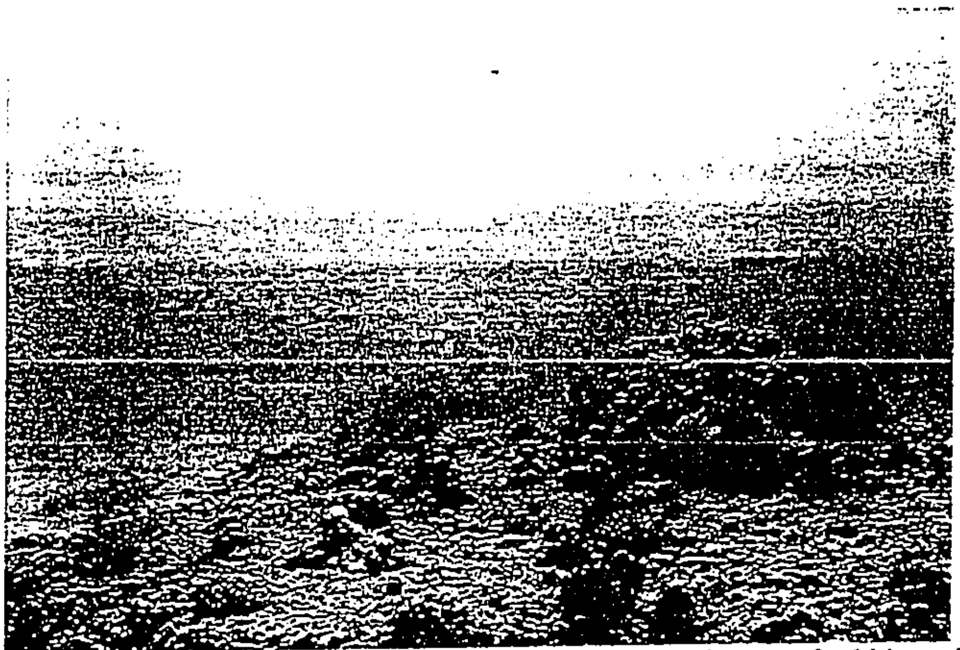

Photo 3. Kahe Point, Station 2. The interface between the biotope of rubble and scattered corals and the biotope of sand (left side of photo) at Station 2. The large coral colony is *Porites lobata* with an estimated age of about 60-70 years.

Photo 4. Kahe Point, vicinity of Station 3. Seaward edge of limestone shelf 150 feet seaward of the shoreline showing a sand channel and part of a limestone ridge projecting seaward (left side of photo).

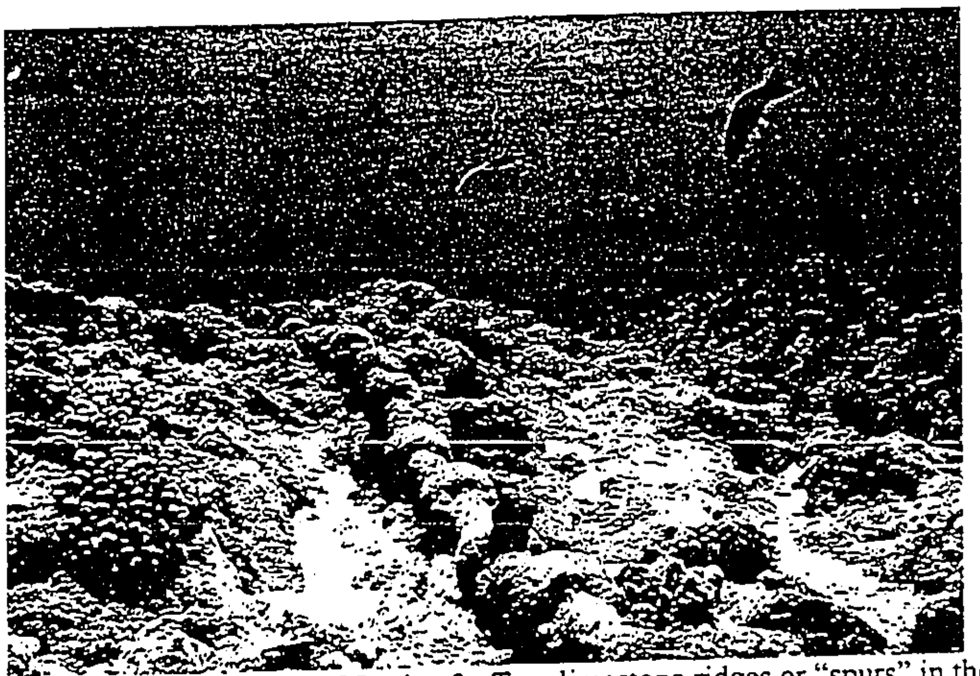

Photo 5. Kahe Point, vicinity of Station 3. Two limestone ridges or "spurs" in the biotope of emergent limestone and corals at a depth of 15 feet. Also shown is the weighted and armored fiber optic cable deployed in 1992. Note the presence of corals (*Pocillopora meandrina*) growing on the cable.

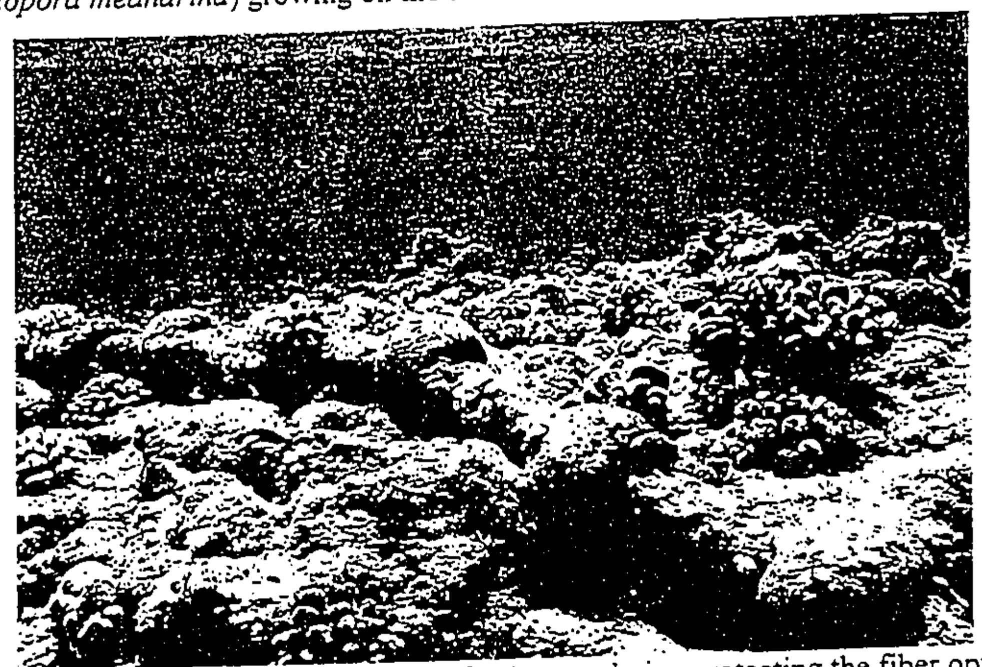

Photo 6. Kahe Point, vicinity of Station 3. Armored pipe protecting the fiber optic cable deployed in 1992. Note the presence of coral (*Pocillopora meandrina*) and a variety of microalgal species on the armor pipe suggesting that other than the visual impact of the deployed pipe, there are no negative impacts on the surrounding marine communities.

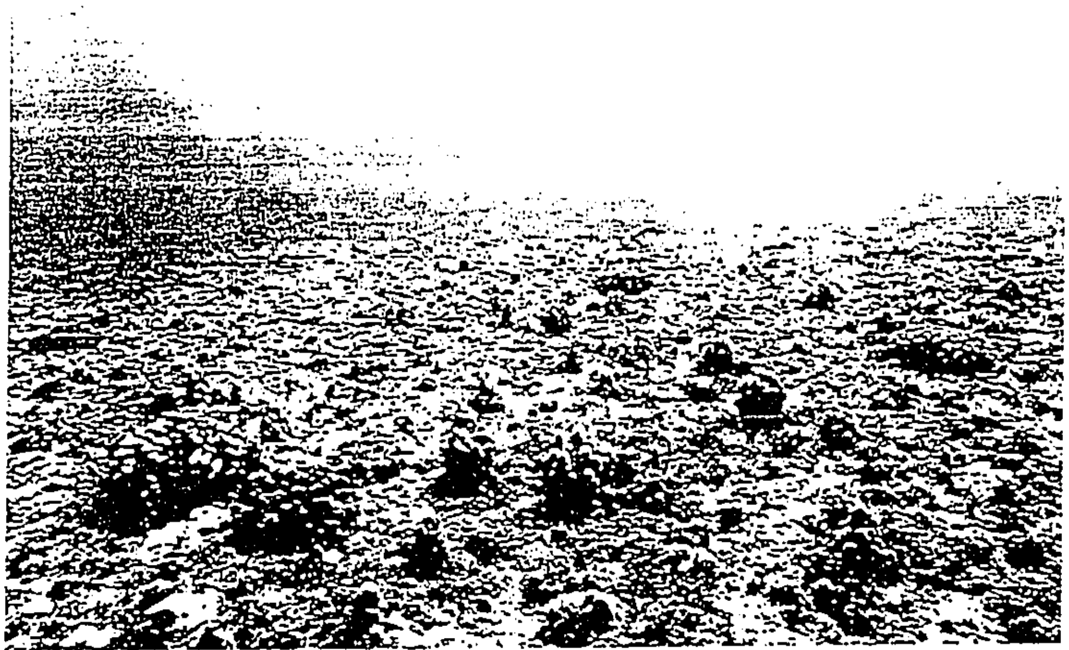

Photo 7. Lualualei, dive site 1. The substratum is flat limestone with small corals scattered across it. In the foreground are the lobate coral (*Porites lobata*) with colonies being no higher than 4inches, and the cauliflower coral (*Pocillopora meandrina*) which have diameters not exceeding 1 foot.

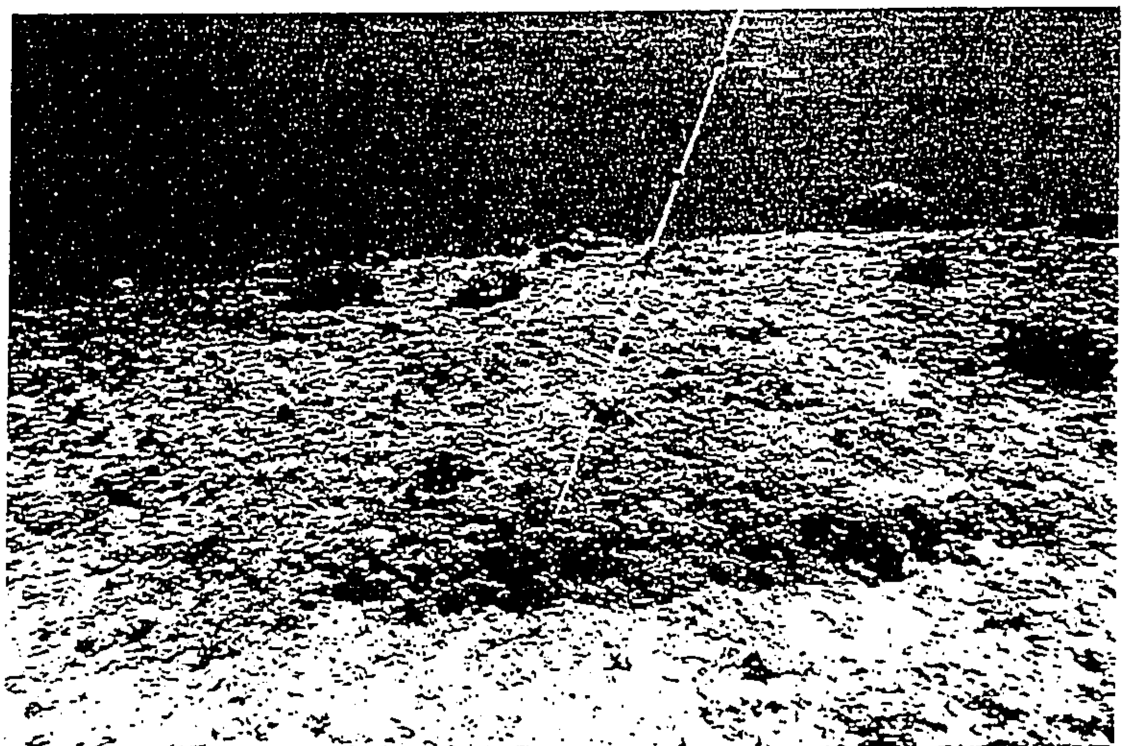

Photo 8. Lualualei, dive site 2. Two foot ledge near the top of the seaward margin of the reef.

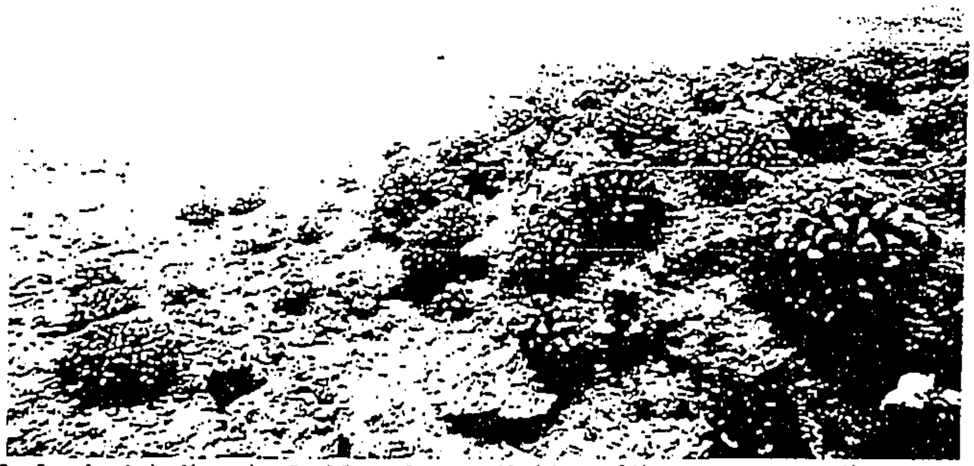

Photo 9. Lualaulei, dive site 3. Note the small ridge of limestone extending seaward and the cauliflower coral (*Pocillopora meandrina*) on it; locally over small areas such as in the photograph coral coverage may approach 25%.

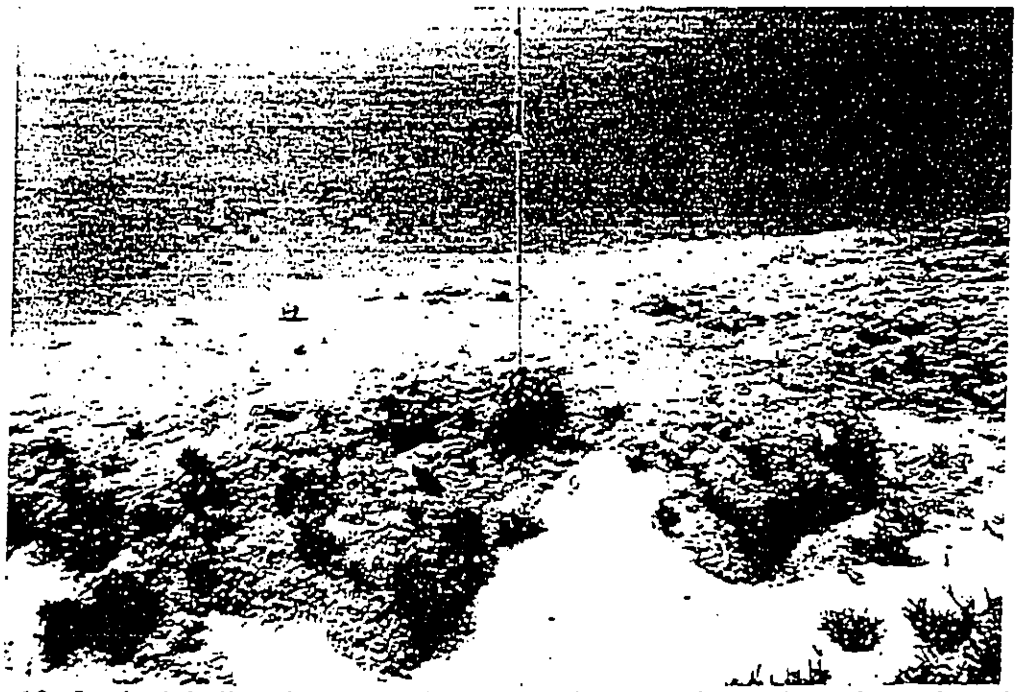

Photo 10. Lualaulei, dive site 4. In this area the limestone is less irregular and sand fills the depressions. Seaweed or limu in the photo is *Spatoglossum solierii.*

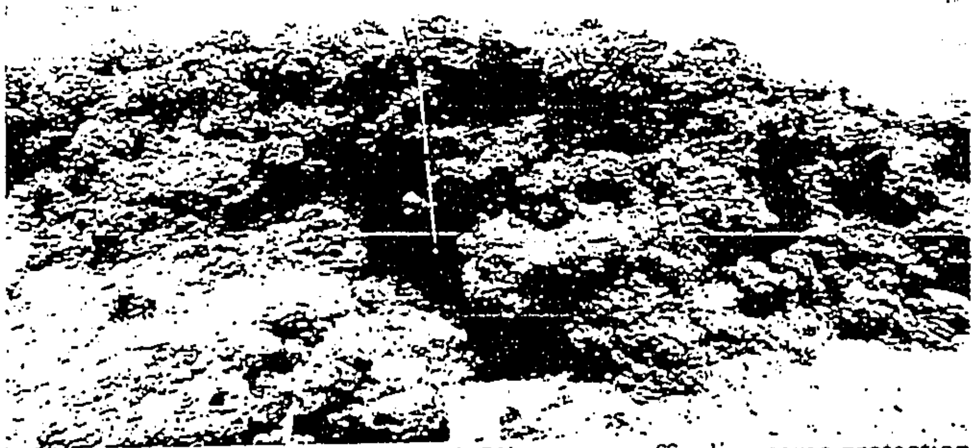

Photo 11. Lualaulei, dive site 5. High relief limestone, affording some protection to corals from abrasion due to occasional surf.

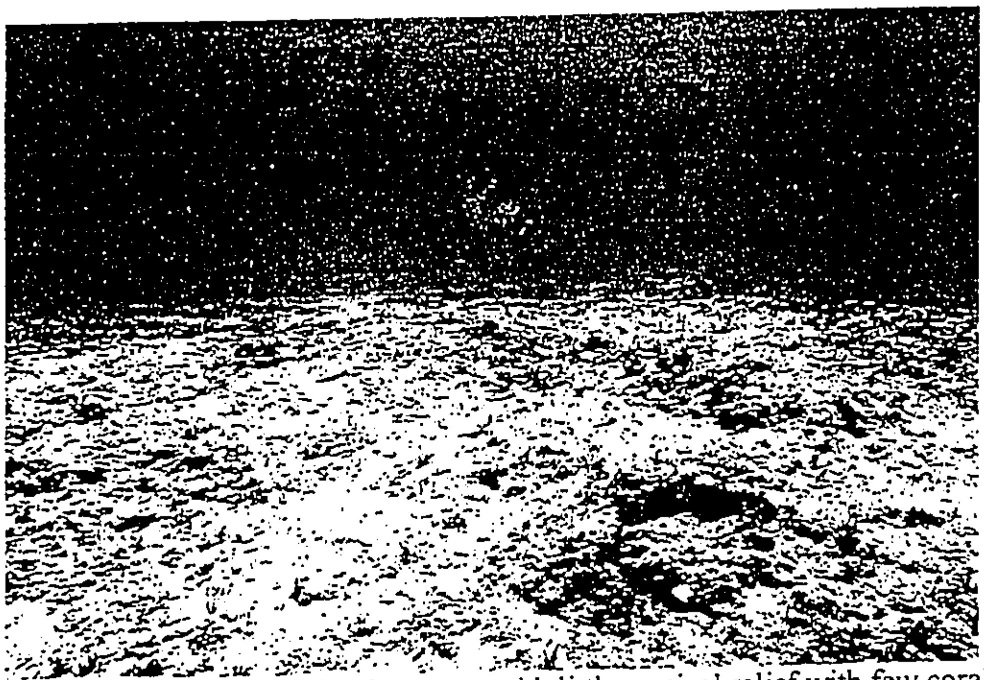

Photo 12. Lualaulei. dive site 6. Limestone with little vertical relief with few corals present. The lack of cover results in few fishes present in this habitat.

Photo 13. Lualaulei, dive site 7. The limestone substratum is similar to that at site 6, but corals are more apparent. The dominant species is the lobate coral (*Pocillopora meandrina*). Colonies attain a maximum diameter of about 6 feet. Other than these scattered colonies, the substratum is relatively flat in this area.

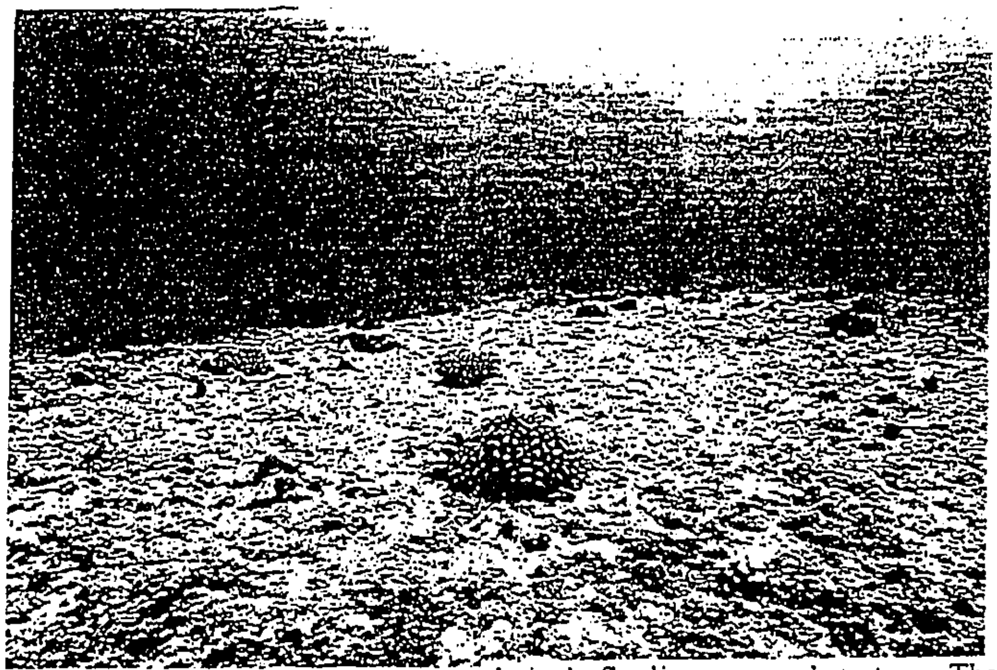

Photo 14. Lualaulei, dive site 2. Note the relatively flat limestone substratum. The dominant coral species in the area is the cauliflower coral, *Pocillopora meandrina.* Coral coverage does not exceed 2% in this area.

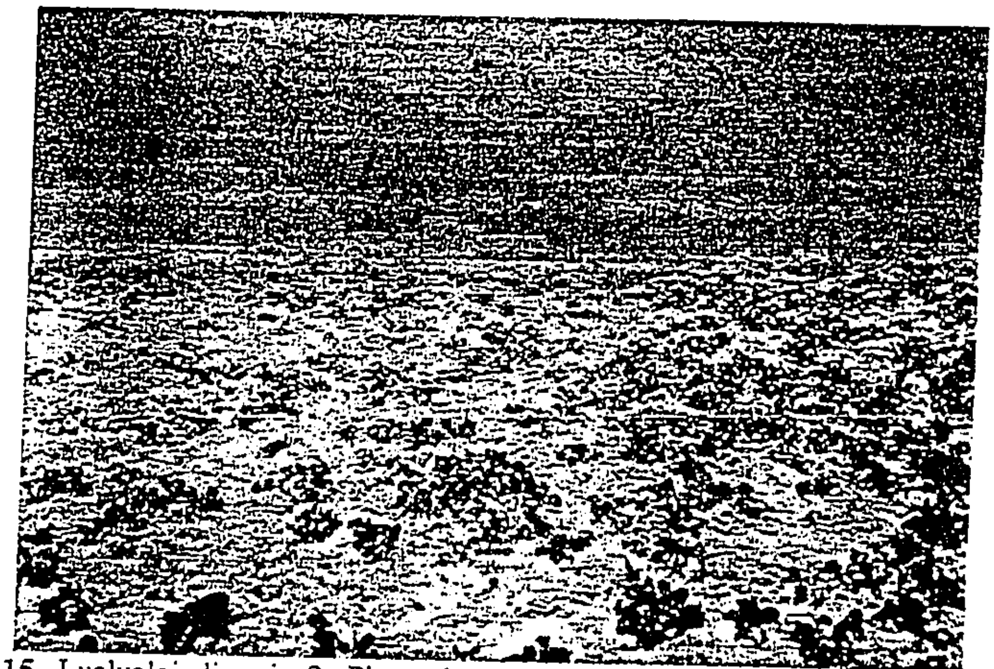

Photo 15. Lualualei, dive site 2. Photo shows a field of the alien algae, *Avrainvillea amadelpha* located slightly seaward and east of the proposed cable alignment. This alga is rapidly becoming a dominant species in many low energy habitats around O`ahu.

Photo 16. Lualualei, dive site 4. Photograph of old ordnance (50 caliber ammunition) in a sand-filled depression. Algae or seaweeds in the photograph are limu palahalaha (*Ulva fasciata*) and *Spatoglossum solierii*.

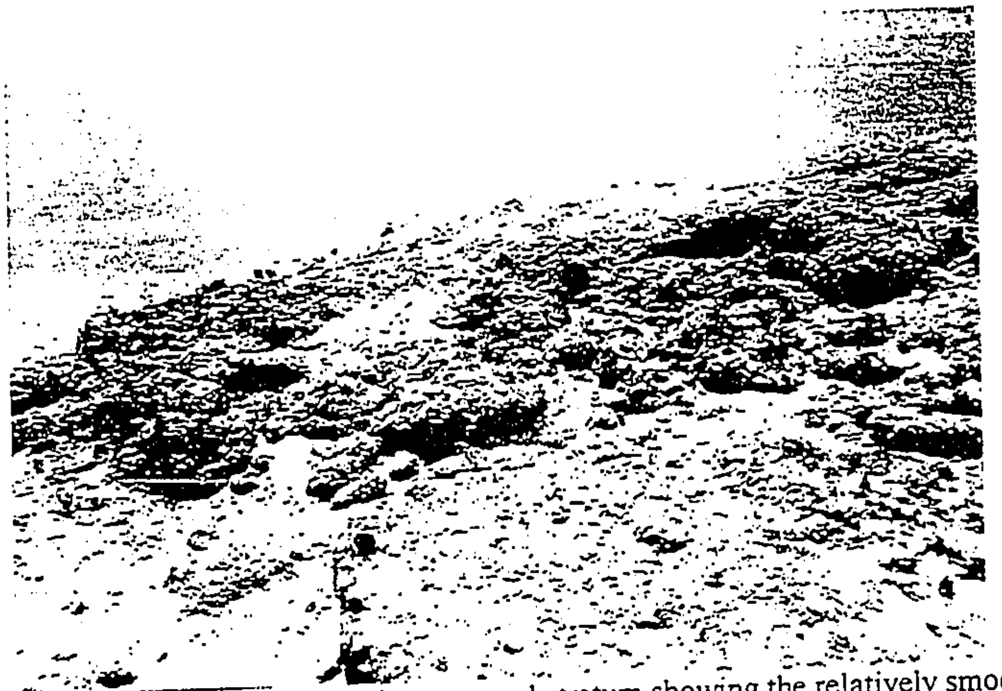

Photo 17. Lualualei, dive site 6. Limestone substratum showing the relatively smooth rise of the bottom features creating ridges or domes, with sand through much area in between. Mean coral coverage is about 3%.

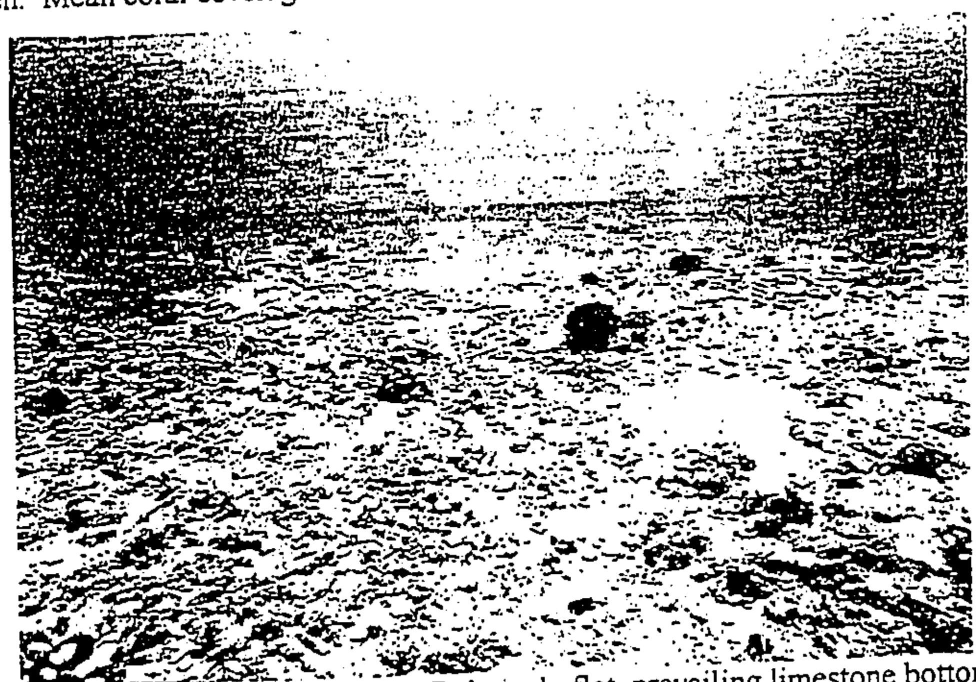

Photo 18. Lualualei, dive site 3. Relatively flat, prevailing limestone bottom.

Photo 19. Lualualei, dive site 3. One of many ledges in the area from 4,200 to 5,700 feet offshore. Vertical relief is 3 feet at this ledge.

TABLE 1. Summary of the benthic survey conducted at station 1 approximately 1.1 km offshore Kahe Point in the biotope of rubble and scattered corals on 23 April 2001. Results of the 6 m^2 quadrat sampling of ~~the~~ benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth is 21 m; mean coral coverage is 10.3% (quadrat method).

A. Quadrat Survey

	Quadrat Location					
Species	0m	5m	10m	15m	20m	25m
Algae						
Porolithon onkodes			1.7			
Sponges						
Spirastrella coccinea	0.2					
Chondrosia chucalla				0.4		
Corals						
Porites lobata	3.2	2.5	36.0	0.1	9.5	2.7
Porites compressa			0.4			
Montipora verrucosa	0.1	1.0		0.7	2.1	1.4
Montipora patula					1.3	0.5
Sand	1.0			6.0	1.5	2.0
Rubble	63.5	67.5		79.8	44.7	50.4
Hard Substratum	32.0	29.0	61.9	13.0	41.0	43.0

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Amansia glomerata	2
Corals	
Porites lobata	6
Sand	2
Rubble	70
Hard Substratum	20

TABLE 1. Continued.

C. Invertebrate Census (4 x 25 m)

Species	Number
Phylum Mollusca	
Lithophaga sp.	6
Conus lividus	1
Phylum Annelida	
Spirobranchus gigantea	5
Phylum Echinodermata	
Tripneustes gratilla	1
Echinothrix diadema	7
Echinothrix calamaris	1
Holothuria atra	1

D. Fish Census (4 x 25 m)

27 Species
198 Individuals
Estimated Biomass = 248 g/m^2

TABLE 2. Summary of the benthic survey conducted at station 2 approximately 880 m offshore of Kahe Point in the biotope of rubble and scattered corals on 23 April 2001. Results of the 6 m^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 ranges from 12.8 to 13.7 m; mean coral coverage is 4.6% (quadrat method).

A. Quadrat Survey

Species	Quadrat Location					
	0m	5m	10m	15m	20m	25m
Algae						
Porolithon onkodes					4.0	
Sponges						
Spirastrella coccinea		1.0			0.4	1.1
Chondrosia chucalla		0.5			0.1	0.4
Corals						
Porites lobata		9.0	0.1	1.5	5.0	2.0
Pocillopora meandrina			0.1	0.1	2.0	
Montipora verrucosa	0.1	1.0	1.2	1.0	0.8	1.2
Montipora patula			0.3	0.6	0.5	1.0
Montipora verrilli						0.3
Sand	3.0	4.0		3.0		
Rubble	96.9	65.5	9.0	31.0	58.2	27.0
Hard Substratum		19.0	89.3	62.8	29.0	67.0

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Amansia glomerata	2
Corals	
Porites lobata	6
Montipora patula	4
Pocillopora meandrina	2
Sand	4
Rubble	48
Hard Substratum	34

TABLE 2. Continued.

C. Invertebrate Census (4 x 25 m)

Species	Number
Phylum Mollusca	
Spondylus tenebrosus	1
Lithophaga sp.	4
Cypraea tigris	1
Phylum Echinodermata	
Echinometra mathaei	21
Echinothrix calamaris	2
Echinothrix diadema	3
Echinostrephus aciculatum	18
Acanthaster plancii	1

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

25 Species
129 Individuals
Estimated Biomass = 91 g/m^2

TABLE 3. Summary of the benthic survey conducted at station 3 approximately 25 m offshore of Kahe Point Beach Park in the biotope of limestone and corals on 23 April 2001. Results of the 6 m^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 ranges from 2.8 to 3.5 m; mean coral coverage is 21.9% (quadrat method).

A. Quadrat Survey

	Quadrat Location					
Species	0m	5m	10m	15m	20m	25m
Algae						
Asparagopsis taxiformis				0.2		
Amansia glomerata		1.0				
Corals						
Porites lobata	7.0	14.0	9.5	3.0	2.5	4.0
Porites evermanni		3.0				
Pocillopora meandrina	3.5	2.0	8.0		1.2	10.0
Montipora verrucosa	7.0	3.0	3.0	8.0	7.0	
Montipora patula	6.7	5.2	5.0	2.0		9.0
Montipora verrilli			0.5			1.5
Leptastrea purpurea			3.5	1.3	1.1	
Sand			4.0	6.0	12.0	1.5
Hard Substratum	75.8	71.8	66.5	79.5	76.2	74.0

B. 50-Point Analysis

Species	Percent of the Total
Corals	
Porites lobata	6
Porites evermanni	2
Montipora patula	6
Pocillopora meandrina	4
Sand	14
Hard Substratum	68

TABLE 3. Continued.

C. Invertebrate Census (4 x 25 m)

Species	Number
Phylum Mollusca	
Spondylus tenebrosus	1
Phylum Annelida	
Spirobranchus gigantea	17
Phylum Echinodermata	
Echinostrephus aciculatum	9
Tripneustes gratilla	2
Echinometra mathaei	298
Heterocentrotus mammillatus	4
Culcita novaeguinaea	1

D. Fish Census (4 x 25 m)

30 Species
506 Individuals
Estimated Biomass = 306 g/m^2

APPENDIX A. Results of the 4 x 25 m^2 fish censuses carried out on three transects along the Kahe Point alignment on 23 April 2001. The estimated standing crop is given at the foot of the table for each station.

Family and Species	Transect Number 1	2	3
MURAENIDAE			
Gymnothorax flavimarginatus		1	
HOLOCENTRIDAE			
Adioryx xantherythrus	1		
Myripristes amaenus	15		
AULOSTOMIDAE			
Aulostomus chinensis			1
SERRANIDAE			
Cephalopholis argus		1	
APOGONIDAE			
Apogon kallopterus	4		
MULLIDAE			
Parupeneus pleurostigma		1	
Parupeneus multifasciatus	1	9	1
CHAETODONTIDAE			
Forcipiger flavissimus	2	4	
Chaetodon fremblii	1		
Chaetodon kleini	1	2	
Chaetodon auriga			2
Chaetodon quadrimaculatus		2	
Chaetodon multicinctus	2		1
Chaetodon miliaris	1		1
POMACANTHIDAE			
Centropyge potteri	3		
POMACENTRIDAE			
Dascyllus albisella	33		22
Plectroglyphiphodon johnstonianus		1	
Abudefduf abdominalis			37
Chromis vanderbilti			9
Chromis hanui	18	2	
Chromis agilis	24		
Stegastes fasciolatus			2
CIRRHITIDAE			
Paracirrhites arcatus	3	13	
Paracirrhites forsteri		1	
Cirrhitops fasciatus		1	
LABRIDAE			
Labroides phthirophagus		1	
Bodianus bilunulatus	2		1

APPENDIX 1. Continued.

Family and Species	Transect Number 1	2	3
LABRIDAE (Cont.)			
Pseudocheilius octotaenia		3	
Thalassoma duperrey		12	45
Gomphosus varius			1
Coris venusta			1
Stethojulis balteata			6
Pseudojuloides cerasinus	9	1	
SCARIDAE			
Scarus psittacus	1		23
ACANTHURIDAE			
Acanthurus nigrofuscus	4	45	166
Acanthurus nigroris	2		93
Acanthurus olivaceus	24	5	43
Ctenochaetus strigosus	34	9	
Zebrasoma flavescens	1	3	
Naso lituratus	1	4	3
Naso hexacanthus	6		2
Naso unicornis			11
ZANCLIDAE			
Zanclus cornutus			2
BALISTIDAE			
Rhinecanthus rectangulus			1
Melichthys vidua	1	1	1
Melichthys niger		1	17
Sufflamen bursa	1	1	
MONACANTHIDAE			
Cantherhines dumerili			1
Cantherhines sandwichiensis			1
Pervagor melanocephalus			2
Alutera scripta			2
TETRAODONTIDAE			
Canthigaster jactator	3	5	8
Number of Species	27	25	30
Number of Individuals	198	129	506
Biomass (g/m^2)	248	91	306

GTE Hawaiian Tel
Interisland Fiber Optic Cable System

MARINE ENVIRONMENTAL ANALYSIS OF SELECTED LANDING SITES

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91-85

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I. INTRODUCTION

GENERAL

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

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

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

ROUTE SELECTION PROCESS

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

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

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

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

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

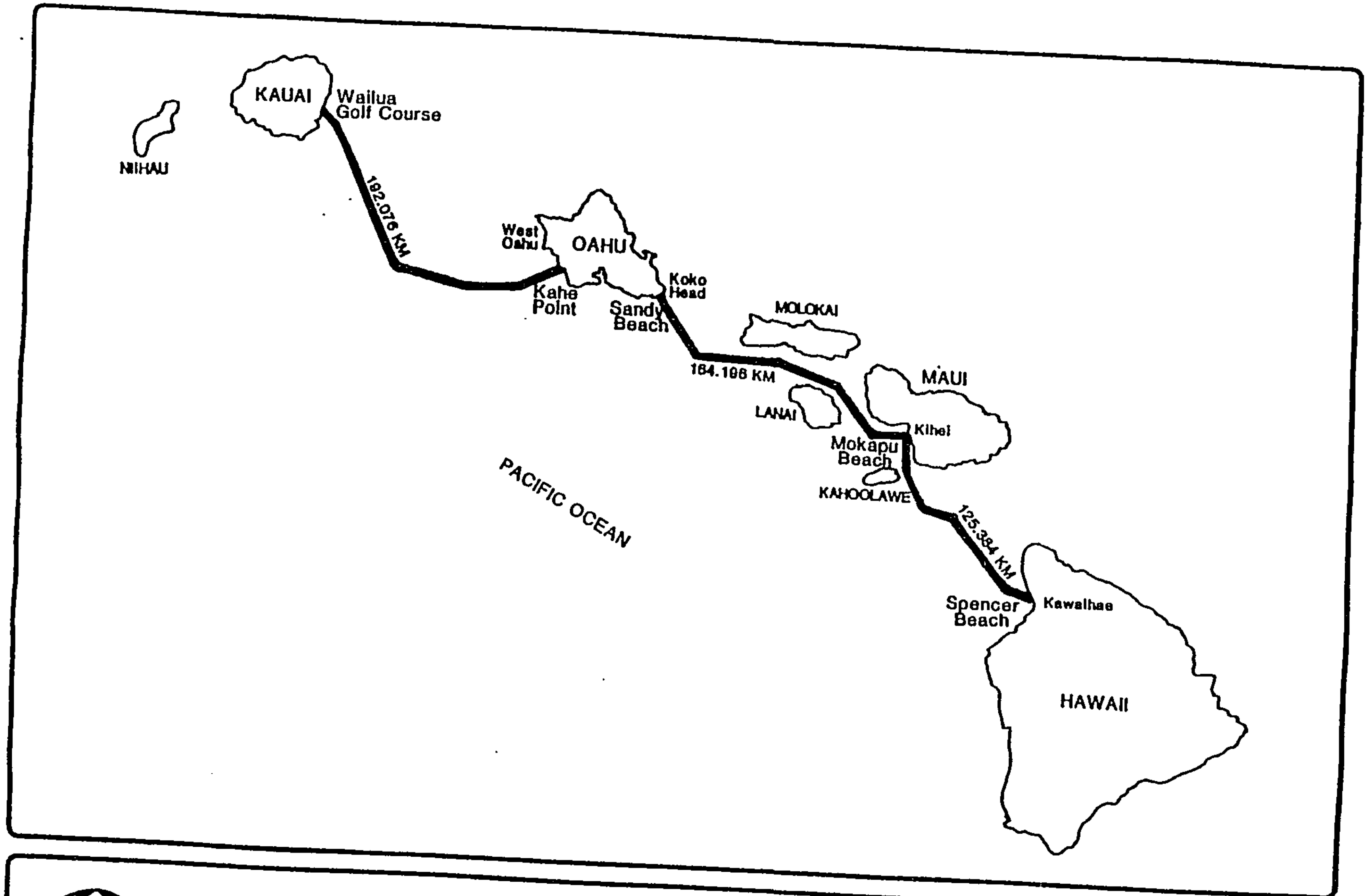

FIGURE I-1. SUMMARY OF RECOMMENDED GTE HAWAIIAN TEL FIBER OPTIC LANDING SITES – STATE OF HAWAII characteristics and uses. A one day field reconnaissance was then conducted in each sector to select three potential landing sites in each sector. If no suitable sites were found within the sector limits,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

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

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

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

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

MARINE SELECTION CRITERIA FOR NEARSHORE
CABLE ROUTE EVALUATION

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

Specific selection criteria included the following:

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

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

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

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

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

II. GENERAL OCEANOGRAPHIC CHARACTERISTICS

WINDS

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

PREVAILING WAVE CLIMATE

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

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

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

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

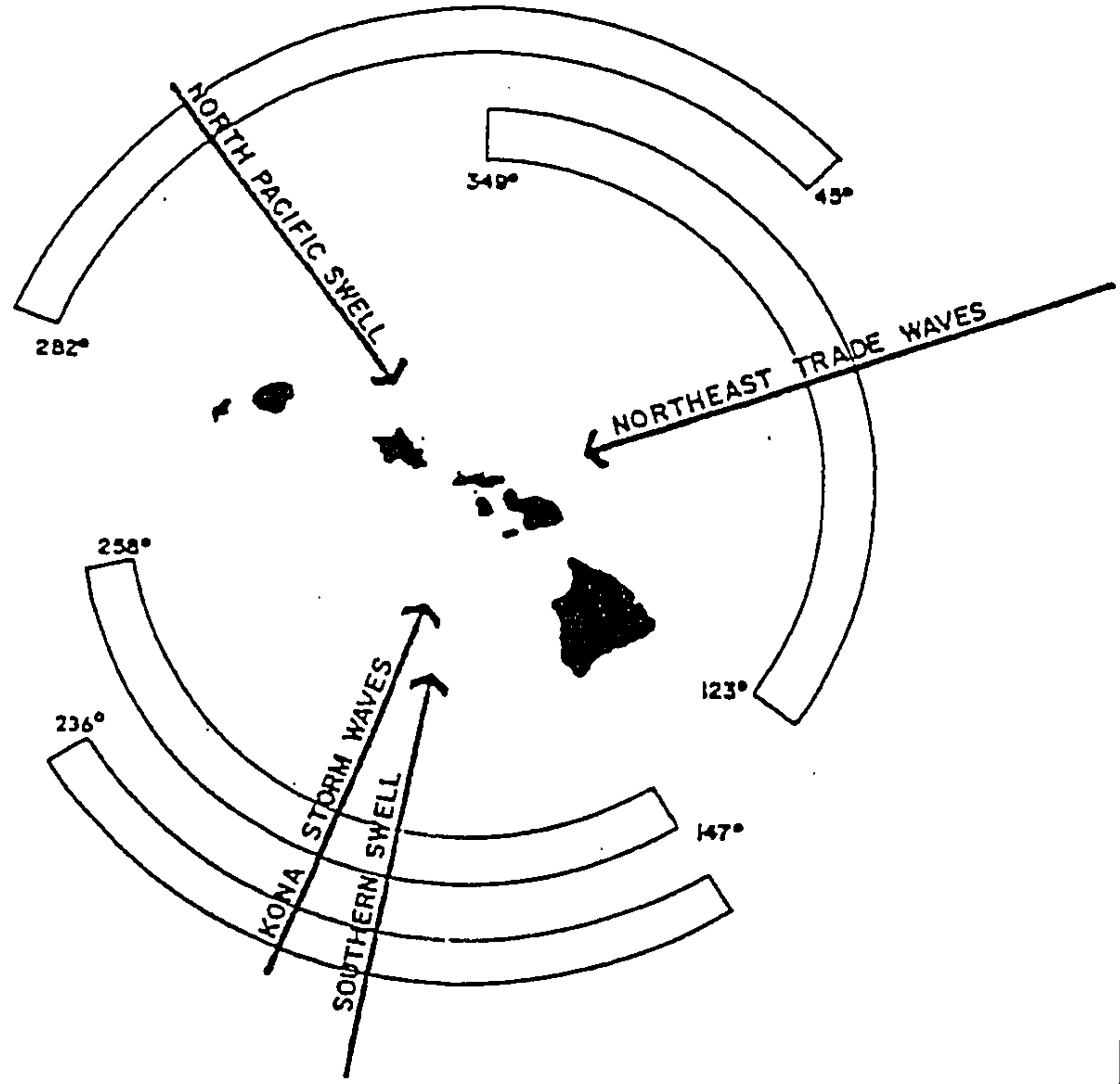

FIGURE II-1.
GENERALIZED WAVE TYPES
(Adapted From The Atlas of Hawaii)

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

Hurricane Storm Waves

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

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

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

TIDES

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

COASTAL CURRENTS

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

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

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

TSUNAMIS

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

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

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

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

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

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

III. METHODOLOGY FOR MARINE BIOLOGICAL SURVEYS

GENERAL

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

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

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

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

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

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

IV. KAHE POINT BEACH PARK, OAHU

ALTERNATIVES CONSIDERED

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

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

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

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

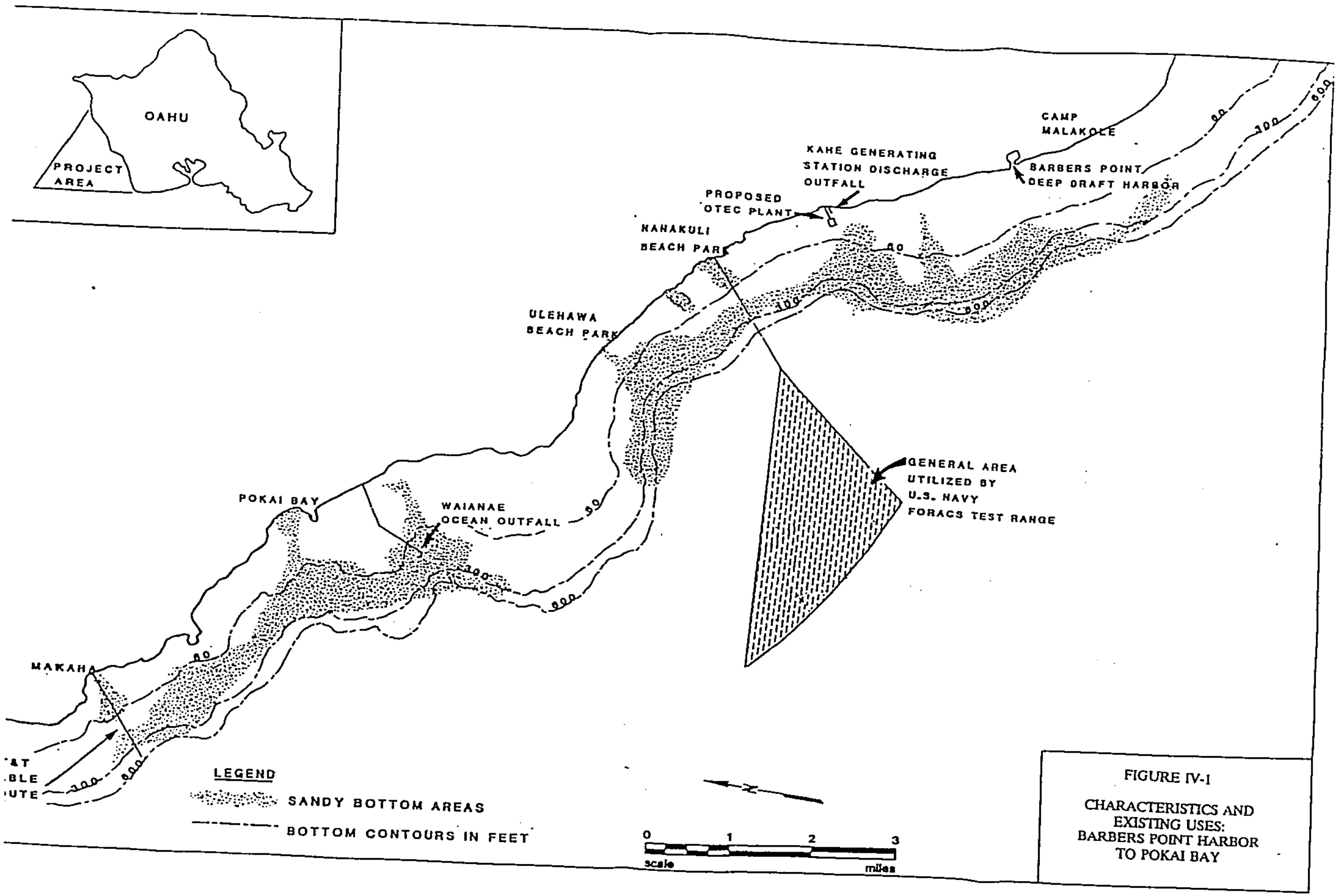

FIGURE IV-1

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

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

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

DESCRIPTION OF THE SELECTED ROUTE

General Description

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

Shoreline History

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

Existing Usage

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

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

Physical Characteristics of the Selected Route

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

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

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

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

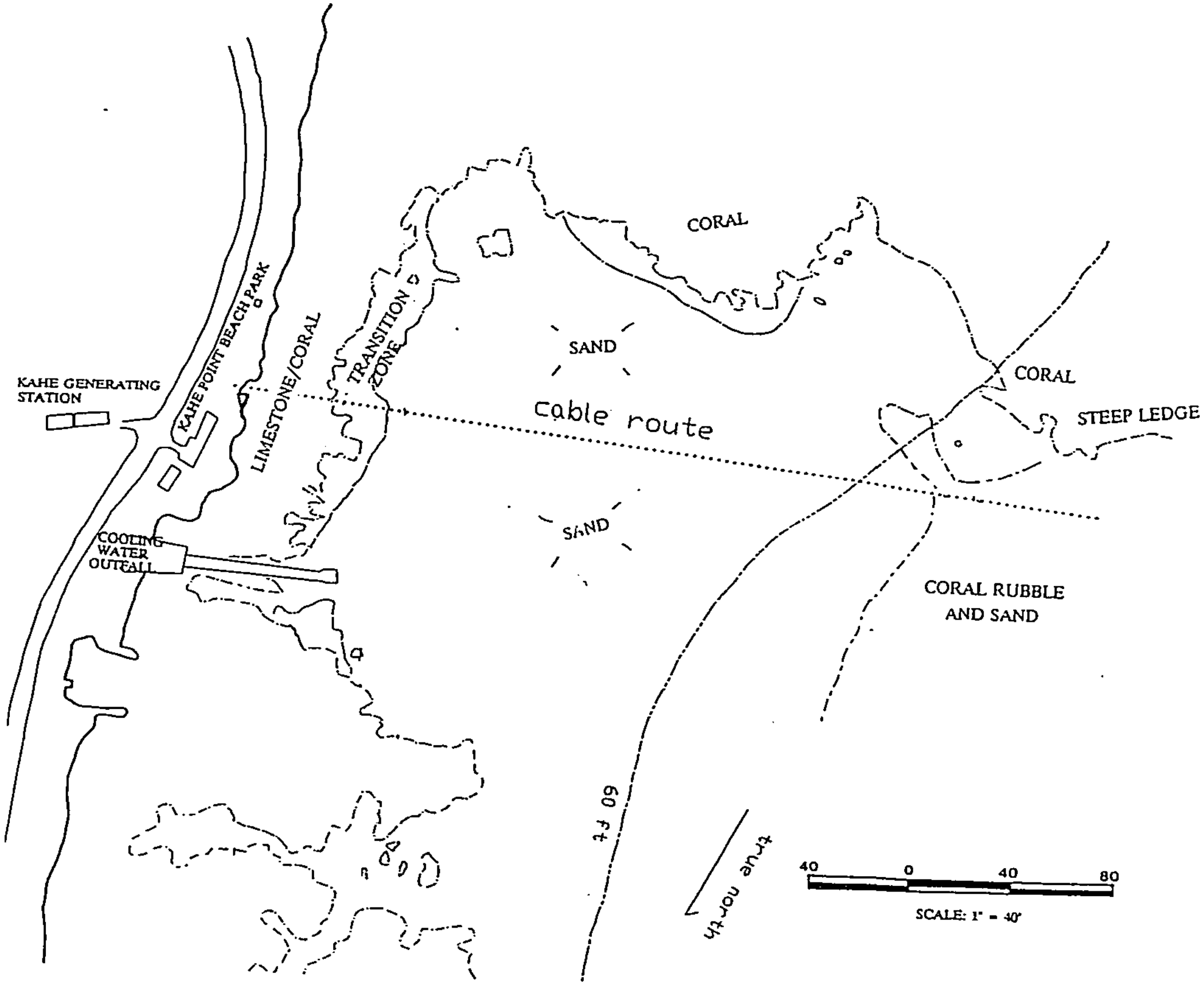

FIGURE IV-2
BOTTOM CHARACTERISTICS ALONG
SELECTED CABLE ROUTE

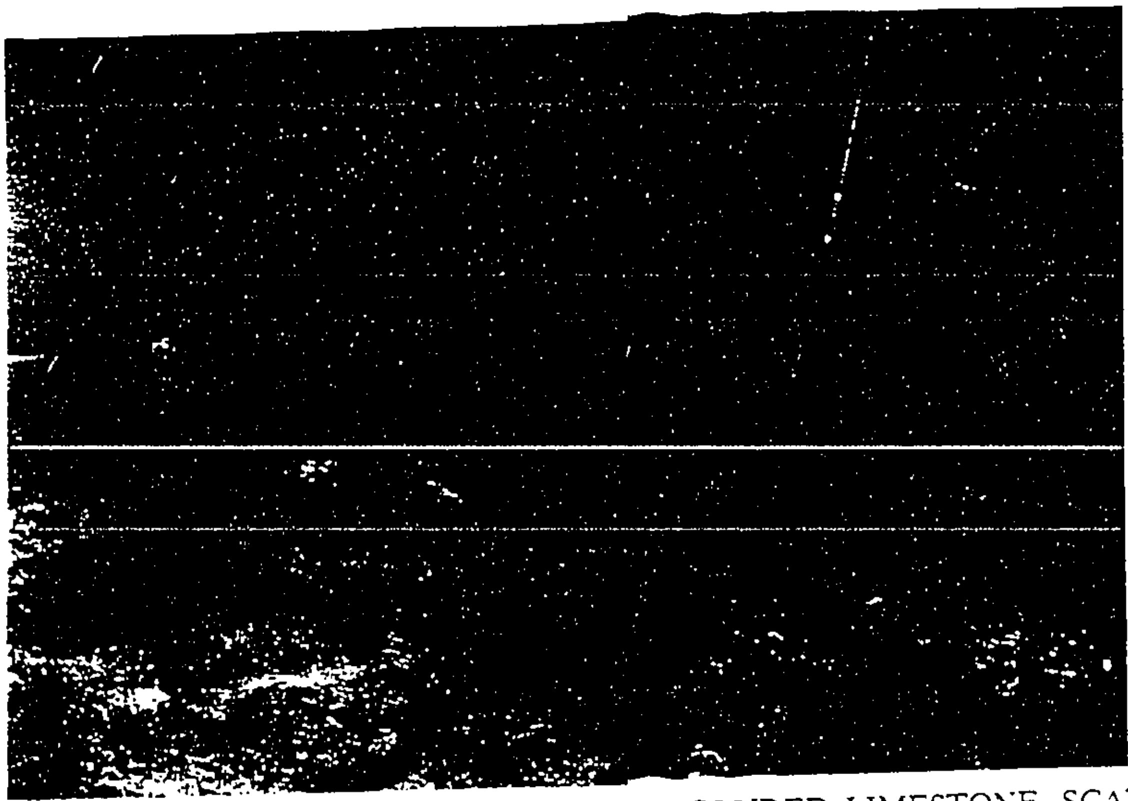

PHOTO 5. NEARSHORE CONDITIONS: SCOURED LIMESTONE, SCATTERED BOULDERS AND CORAL FORMATIONS. WATER DEPTH IS APPROX. 10-FEET.

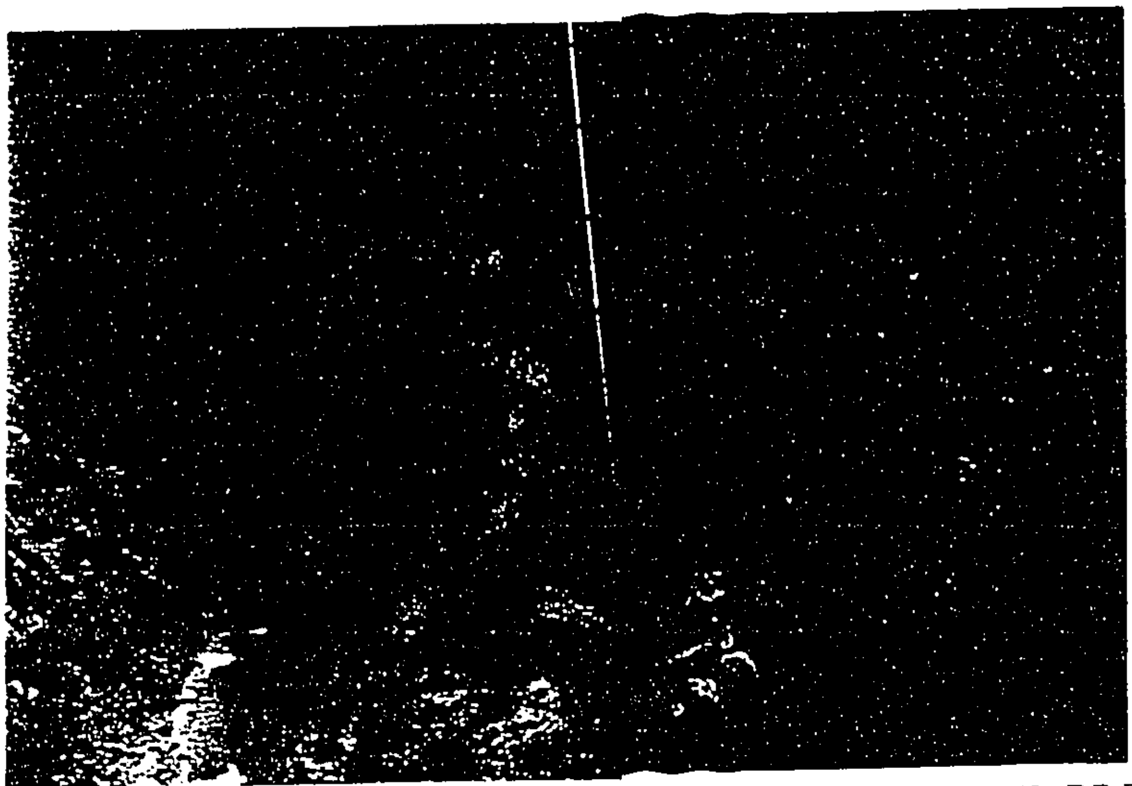

PHOTO 6. TYPICAL CONDITIONS IN SEAWARD HALF OF THE HARD BOTTOM ZONE; RIDGE AND CHANNEL FORMATION. WATER DEPTH IS APPROX. 15-FEET.

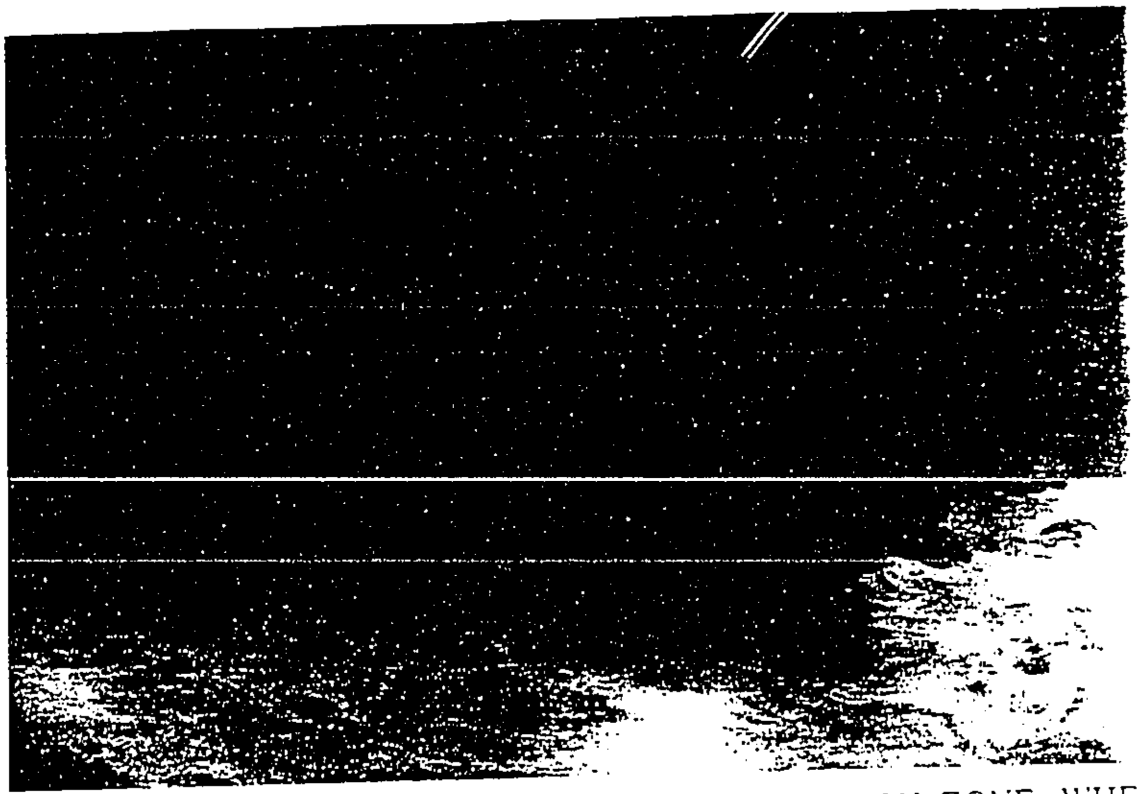

PHOTO 7. TYPICAL VIEW OF INSHORE TRANSITION ZONE, WHERE THE LIMESTONE AND CORAL BOTTOM GIVES WAY TO SAND DEPOSIT. DEPTH IS APPROX. 20-FEET.

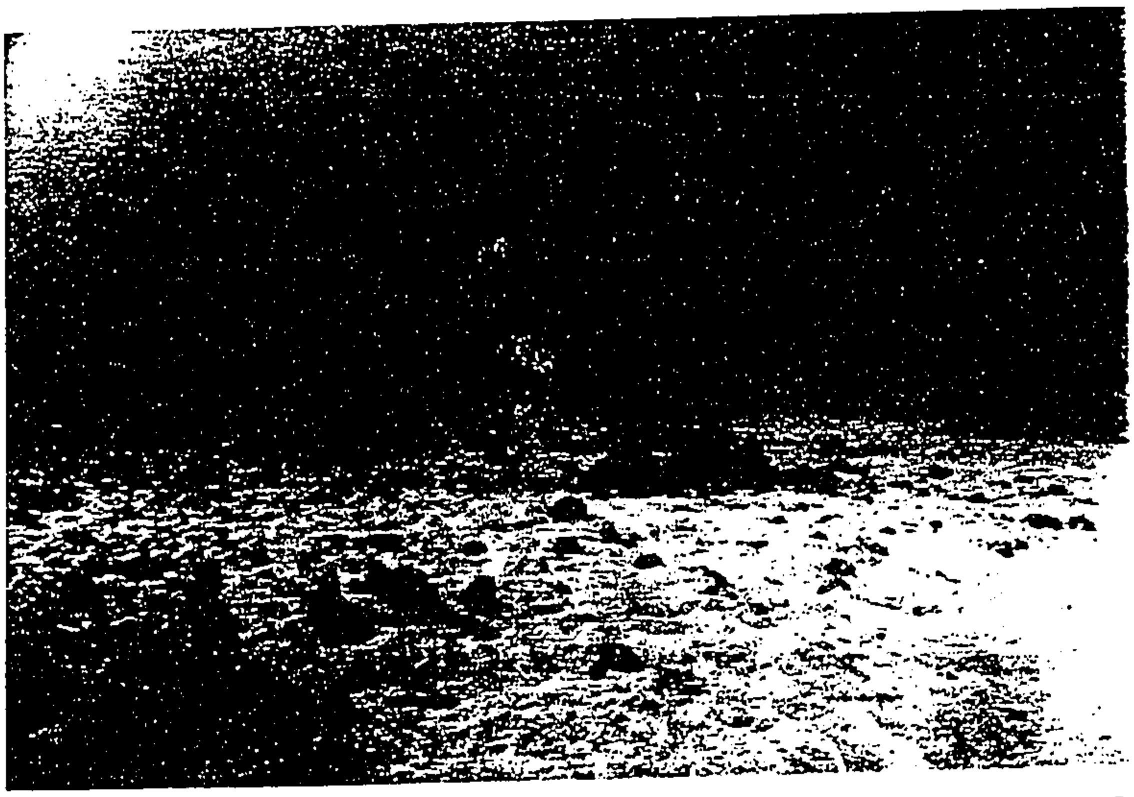

PHOTO 8. TYPICAL BOTTOM CONDITIONS IN THE OFFSHORE ZONE OF CORAL RUBBLE. WATER DEPTH IS APPROX. 80-FEET.

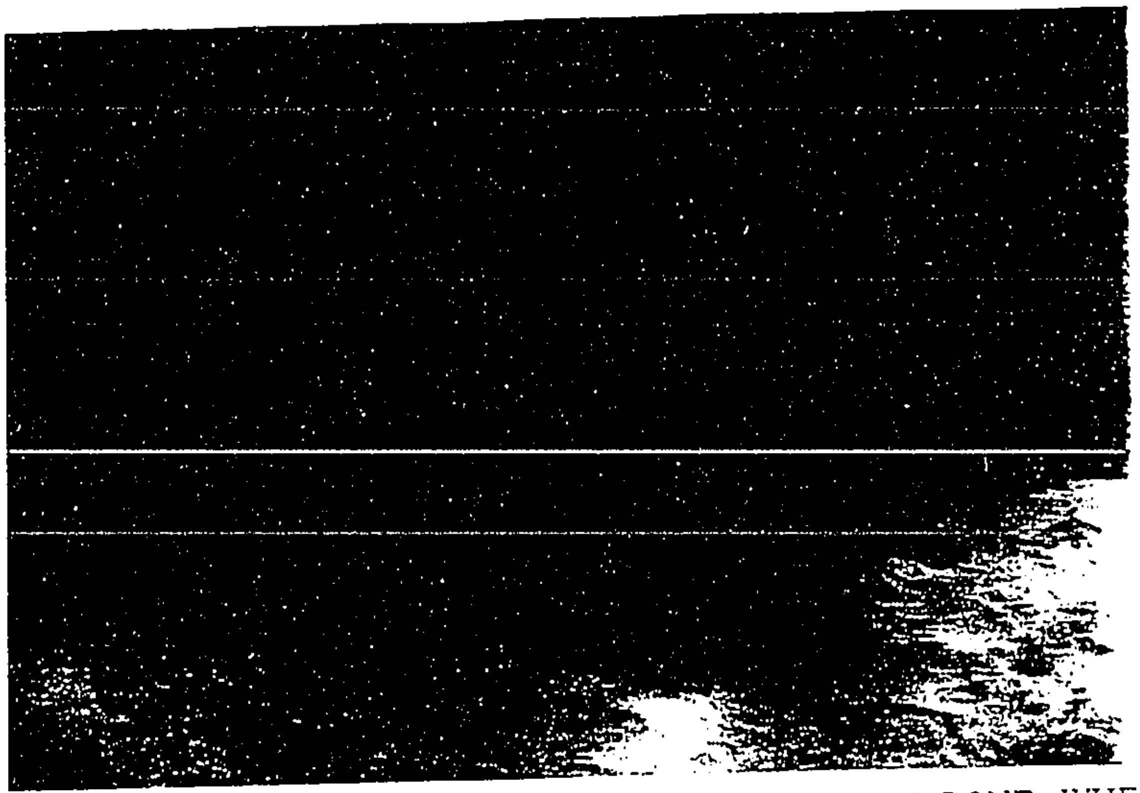

PHOTO 7. TYPICAL VIEW OF INSHORE TRANSITION ZONE, WHERE THE LIMESTONE AND CORAL BOTTOM GIVES WAY TO SAND DEPOSIT. DEPTH IS APPROX. 20-FEET.

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

OCEANOGRAPHIC CONDITIONS

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

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

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

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

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

DESCRIPTION OF THE PROPOSED PROJECT

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

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

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

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

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

MARINE BIOLOGICAL SETTING

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

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

The Biotope of Sand

The biotope of sand lies principally seaward of the project site but extends to within 500 feet of the shoreline in the vicinity of the proposed alignment (Figure IV-3). As the name implies, the substratum in the biotope of sand is dominated by sand. Because of its shifting nature, the benthic species found in sand habitats are generally adapted for life on an unstable and frequently abrading environment. Many species that are found in this habitat

LEGEND

A	BIOTOPE OF SAND
B	BIOTOPE OF SAND AND RUBBLE
C	BIOTOPE OF HARD SUBSTRATUM AND CORALS
D	BIOTOPE OF BOULDERS AND HARD SUBSTRATUM
1,2	LOCATION OF QUANTATIVE SAMPLING STATIONS

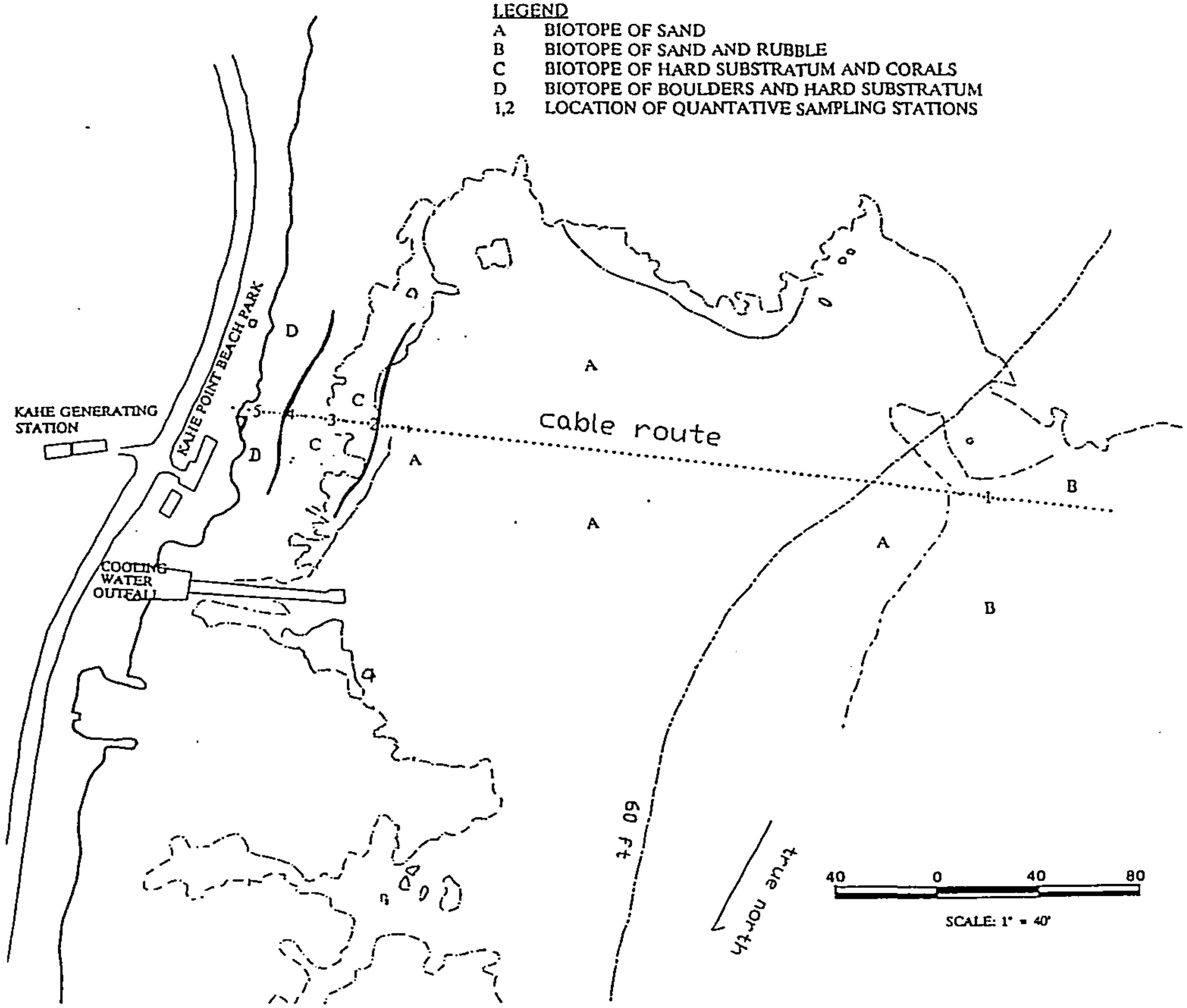

FIGURE IV-3
BIOTOPES ALONG SELECTED
CABLE ALIGNMENT

will bury into the sand to avoid predators and the abrasion that occurs with storm waves. Thus many species in the sand biotope are cryptic and difficult to see; among those are many of the molluscs and crustaceans such as the Kona crab (Ranina serrata). Hence, without considerable time spent searching in the sand many species in the sand habitat will not be seen. The biotope of sand is best developed at greater depths; where it enters the shallow water, many of the characteristic species become less abundant. Benthic communities on sand substrates usually have their greatest development at depths below which wave impact occurs (below 100 feet). Because of constraints with bottom time at these depths, only a qualitative survey was done. Species commonly seen in the deeper regions of the biotope of sand include a number of molluscs: the helmet shell (Cassis cornuta), augers (Terebra crenulata, T. maculata and T. inconstans), the leopard cone (Conus leopardus) and flea cone (Conus pulicarius) as well as the sea hare (Brissus sp.), starfish (Mithrodia bradleyi), brown sea cucumber (Bohadschia vitiensis), the Kona crab (Rania serrata), opelu or mackerel scad (Decapterus macarellus), nabeta (Hemipteronotus umbrilatus), the goby-like fish (Parapercis schauslandi), uku or snapper (Aprion virescens), hihimanu or sting ray (Dasyatis hawaiiensis) and the weke or white goatfish (Mulloides flavolineatus). Undoubtedly, with greater searching, many more fish species would be encountered in this biotope. Most of these species become less evident in the shallower portions of this biotope.

The Biotope of Rubble and Sand

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

TABLE IV-1.

Summary of the benthic survey conducted in the biotope of rubble and sand approximately 3,400 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Pact C. A short summary of the fish census is given in Part D. Water depth is 72 to 75 feet; mean coral coverage is 0.05 percent (quadrant method).

A. **Quadrant Survey**

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

B. **50-Point Analysis**

Species	Percent of the Total
Sand	92
Rubble	8

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

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

(TABLE CONTINUED ON NEXT PAGE)

D. Fish Census (4 x 25m)

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

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

The Biotope of Emergent Hard Substratum and Corals

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

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

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

TABLE IV-2.

Summary of the benthic survey conducted in the ecotone between the biotope of emergent hard bottom and corals and the more seaward biotope of sand approximately 400 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant sampling of the benthic community (expressed in per- cent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 18 to 23 feet; mean coral coverage is 9.3 percent (quadrant method).

A. Quadrant Survey

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

B. 50-Point Analysis

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

(TABLE CONTINUED ON NEXT PAGE)

TABLE IV-2.
Continued.

C. Invertebrate Census (4 x 25m)

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

D. Fish Census (4 x 25m)

28 Species
181 Individuals
Estimated Biomass = 35 g/m²

urchin or Echinometra mathaei and the cushion starfish or Culcita novaeguineae. Twenty-eight fish species (181 individuals) were censured at Station 2. The results of this census are presented in Appendix A. Common fishes at Station 2 include the damselfish (Chromis vanderbilti), saddleback wrasse or hinalea lauwili (Thalassoma duperrey) and the brown surgeonfish or ma'i'i'i (Acanthurus nigrofuscus). The standing crop of fishes at this station was estimated to be 35 g/m²; species contributing heavily to this biomass include the many bar goatfish or moano (Parupeneus multifasciatus), saddleback wrasse or hinalea lauwili (Thalassoma duperrey), brown surgeon- fish or ma'i'i'i (Acanthurus nigrofuscus), parrotfish or uhu (Scarus sordidus), pinktail triggerfish or humuhumu hi'ukole (Melichthys vidua) and the lei triggerfish or humuhumu lei (Sufflamen bursa). In the vicinity of Station 2 were seen the mackerel scad or opelu (Decapterus macarellus), moorish idol or kihikihi (Zanclus cornutus), ringtail wrasse or po'ou (Chelinus rhodochrous), long spine sea urchin or wana (Echinothrix diadema) and the coral (Pavona varians).

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

TABLE IV-3.

Summary of the benthic survey conducted in the biotope of emergent hard bottom and corals approximately 290 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the 6m^2 quadrant sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 10 to 18 feet; mean coral coverage is 30.2 percent (quadrant method).

A. Quadrant Survey

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

B. 50-Point Analysis

Species	Percent of the Total
Soft Corals	
Palythoa tuberculosa	2

(TABLE CONTINUED ON NEXT PAGE)

TABLE 3.
Continued.

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

C. Invertebrate Census (4 x 25m)

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

D. Fish Census (4 x 25m)

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

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

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

TABLE IV-4.

Summary of the benthic survey conducted in the biotope of emergent hard bottom and corals commencing approximately 186 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the $6m^2$ quadrant sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 8 to 10 feet; mean coral coverage is 8.9 percent (quadrant method).

A. Quadrant Survey

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

B. 50-Point Analysis

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

(TABLE CONTINUED ON NEXT PAGE)

TABLE IV-4.
Continued.

C. Invertebrate Census (4 x 25m)

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

D. Fish Census (4 x 25m)

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

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

The Biotope of Boulders and Hard Bottom

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

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

TABLE IV-5.

Summary of the benthic survey conducted in the biotope of hard bottom and boulders commencing approximately 50 feet offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Results of the 6m^2 quadrant sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth ranges from 4 to 6 feet; mean coral coverage is 0.05 percent (quadrant method).

A. Quadrant Survey

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

B. 50-Point Analysis

Species	Percent of the Total
Hard Substratum	100

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mosllusca	
Drupa morum	1
Conus lividus	1

(TABLE CONTINUED ON NEXT PAGE)

TABLE IV-5.
Continued.

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

D. Fish Census (4 x 25m)

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

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

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

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

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

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Impacts with Construction

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

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

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

We expect that there would be no direct impacts to the threatened green sea turtle or to endangered humpback whales (Megaptera novaeangliae). As far as the impact to humpback whales is concerned, if construction activities are restricted to the period between April through October, the impacts are minimal because the whales are seasonal and are only in island waters from November through March. Even assuming that the cable deployment occurs when whales are present in Hawaiian waters, impacts should be non-existent or minimal. The cable ship will not be on site more than one or two days. After departure of the cable ship, all work will be within 500 feet of shore. There will be no blasting during the construction of the cable protection.

TABLE IV-6.

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

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

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

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

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

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

Fishery Considerations

Access to the shoreline at Kahe Point Beach Park is possible but there is a 12 to 20 foot high limestone "cliff" and/or boulders that one must cross before entering the water in the immediate vicinity of the proposed cable landing site. Despite this impediment, many people climb down on to the limestone bench and either fish or enter the sea. This section of coastline has probably been used since prehistoric times. The beach park is heavily used by people interested in beachgoing, SCUBA shore diving, surfing (on the northern end of the beach park (when the swell is present) as well as fishing. Fishermen catch fish both from shore as well as offshore from small boats. In all probability, some commercial fishing occurs offshore of the proposed cable alignment. We are unaware of any individuals that specifically and exclusively use Kahe Point Beach Park area for subsistence fisheries. Probably most of the fishing activity in and around Kahe Point Beach Park is by recreational fishermen. With most Hawaiian recreational fisheries, species targeted include papio and ulua (family Carangidae), o'io or bonefish (Abula vulpes), moi (Polydactylus sexfilis), goatfishes (family Mullidae), snappers (family Lutjanidae), surgeonfishes (family Acanthuridae), parrotfishes (family Scaridae), and a host of smaller species such as the aholehole (Kuhlia sandvicensis), aweoweo (Priacanthus cruentatus) and menpachi (Myripristes amaenus). Fishing methods used include nets, spears, traps as well as hook and line.

This survey noted a general paucity of fishes of commercial or recreational interest in the inshore waters at sizes appropriate for exploitation. Many of the individual fish encountered were small suggesting that the Kahe Point area may receive considerable fishing pressure. The encounter of a school of mackerel scad or opelu (Decapterus macarellus) at Station 1 is a "chance encounter" because opelu are a coastal pelagic species that wander over large areas and encountering such a school in a $100m^2$ transect site is not a common event. This chance encounter increased the estimated standing crop at Station 1 from 4 g/m^2 to 771 g/m^2.

The standing crop of fishes on coral reefs is usually in the range of 2 to $200g/m^2$ (Brock 1954, Goldman and Talbot 1975, Brock et al. 1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, or to chance encounters such as happened at Station 1, the variation in standing crop appears to be related to the variation in local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in a lower estimated standing crop of fish (2 to $20g/m^2$). Goldman and Talbot (1975) note that the upper limit to fish biomass on coral reefs is about $200g/m^2$. The present study found estimated standing crops in ranges frequently seen at other Hawaiian reef localities (i.e., from 40 to 80 g/m^2).

Water Quality Considerations

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

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

High water motion will keep fine particulate and sedimentary material suspended in the water column, reducing the settlement on benthic organisms in shallow water habitats thus assisting in the advection of this material out of these areas (less than 300 feet in depth) where corals are found.

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

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

These data suggest that if needed as a means for protecting the proposed fiber optic cable in shallow water, the short term disturbance (probably less than two weeks) created by small-scale trenching (probably removing less than $10m^2$ of coral) will be a minor impact.

APPENDIX D.

Results of the quantitative visual censuses conduct- ed at five locations offshore of Kahe Point Beach Park, Oahu on 6 December 1991. Each entry in the body of the table represents the total number of individuals of each species seen; totals are presented at the foot of the table along with an estimate of the standing crop (g/m^2) of fishes present at each location.

FAMILY AND SPECIES	STATION NUMBER 1	2	3	4	5
MURAENIDAE					
Gymnothorax meleagris	1	1			
SYNODONTIDAE					
Saurida gracilis		1			
AULOSTOMIDAE					
Aulostomus chinensis			1		
FISTULARIIDAE					
Fistularia commersoni					1
CARANGIDAE					
Decapterus macarellus		400			
Scomberoides laysan					1
MULLIDAE					
Mulloides flavolineatus				7	1
Parupeneus pleurostigma				2	1
P. multifasciatus		6	14	30	34
P. cyclostomus			1		1
CHAETODONTIDAE					
Forcipiger flavissimus		1			
Chaetodon fremblii			1		
C. unimaculatus				2	
C. lunula					1
C. ornatissimus					1
C. multicinctus		2	7	2	

APPENDIX D.
Continued.

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

APPENDIX D - Continued

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

REFERENCES

AECOS, Inc. 1989. *Biological and Water Quality Studies in the Marine Environment for a Proposed Hotel Development at Kamaole, Maui.* Prepared for Engineering Concepts, Inc., Honolulu, Hawaii.

AECOS, Inc. 1981. *Oahu Coastal Zone Atlas.* Prepared for the US Army Corps of Engineers, Pacific Ocean Division, Fort Shafter, Hawaii.

AECOS, Inc. 1979. *Hawaii Coral Reef Inventory, Island of Oahu* Prepared for the US Army Corps of Engineers, Pacific Ocean Division, Fort Shafter, Hawaii.

Bak, R.P.M. 1978. *Lethal and Sublethal Effects of Dredging and Corals.* Mar. Pollut. Bull. 9:14-16.

Balazs, G.H. 1980. *Synopsis of Biological Data on the Green Turtle in the Hawaiian Islands.* NOAA Tech. Memorandum, NMFS. NOAA-TM-NMFS-SWFC-7. 141p.

Balazs, G.H., R.G. Forsyth and A.K.H. Kam. 1987. *Preliminary Assessment of Habitat Utilization by Hawaiian Green Turtles in their Resident Foraging Pastures.* NOAA Tech. Memorandum, NMFS. NOAA-TM-NMFS-SWFC-71. 107p.

Bathen, K.H. 1978. *Circulation Atlas for Oahu, Hawaii.* University of Hawaii SeaGrant Misc. Rept. UNHI-SEAGRANT-MR-78-05. 94p.

Bauer, G.B. 1986. *The Behavior of Humpback Whales in Hawaii and Modifications of Behavior Induced by Human Interventions.* Ph.D. Dissertation, University of Hawaii, Honolulu, 314p.

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.

Brock, R.E. 1982. *A Critique on the Visual Census Method for Assessing Coral Reef Fish Populations.* Bull. Mar. Sci. 32:269-276.

Brock, R.E. 1990a. *Summary of Observations on the Green Turtle Population in the Area Fronting the West Beach Project Site, Report.* Prepared for West Beach Estates, Honolulu. EAC Rept. No. 90-06. 18p.

Brock, R.E. 1990b. *Biological Reconnaissance of the Marine Resources in the Waters Fronting West Beach, Oahu, Final Report.* Prepared for OI Consultants, Waimanalo, Hawaii. EAC Rept. No. 90-10. 231p.

Brock, R.E. and J.H. Brock. 1977. *A Method of Quantitatively Assessing the Infaunal Community Residing in Coral Rock.* Limnol. Oceanogr. 22:948-951.

Brock, R.E. and J.E. Norris. 1989. *An Analysis of the Efficacy of Four Artificial Reef Designs in Tropical Waters.* Bull. Mar. Sci. 44:934-941.

Brock, R.E. 1954. *A Preliminary Report on a Method of Estimating Reef Fish Populations.* J. Wildlife Mgmt. 18:297-308.

Brock, R.E. and T.C. Chamberlain. 1968. *A Geological and Ecological Reconnaissance Off Western Oahu, Hawaii, Principally by Means of Research Submarine "Asherah".* Pac. Sci. 22:373-394.

Brock, R.E. 1991. *Stability and Persistence of Fish Communities in Honokohau Harb or, Kona, Hawaii*: A report spanning 21 years of observations. Prepared for OI Consultants, Inc., Makapuu Point, Waimanalo, Hawaii. EAC Report No. 91-04. 37p.

Brock, R.E., C. Lewis and R.C. Wass. 1979. *Stability and Structure of a Fish Community on a Coral Patch Reef in Hawaii.* Mar. Biol. 54: 281-292.

Brodie, P.F. 1981. *Marine Mammals in the Ecosystem of the Canadian East Coast.* Proc. Offshore Environment in the 80's. St. John's Newfoundland. 10p.

Clark, J.R.K., 1977. *The Beaches of Oahu.* The University of Hawaii Press.

Cortes, J. and M. Risk. 1985. *A Reef Under Siltation Stress.* Cahuita, Costa Rica. Bull. Mar. Sci. 36:339-356.

Dollar, S.J. and R.W. Grigg. 1981. *Impact of Kaolin Clay Spill on a Coral Reef in Hawaii.* Mar. Biol. 65:269-276.

Ekern, P.C. 1976. *Turbidity and Sediment Rating Curves for Streams on Oahu, Hawaii.* pp.242-254. In: Soil erosion: prediction and control. Soil Conservation Soc. Amer., Ankeny, Iowa.

Environmental Consultants, Inc. 1977. *A Reconnaissance Survey of Nearshore Marine Environments at Kihei, Maui.* Prepared for U.S. Army Corps of Engineer Division, Pacific Ocean. ECI-140.

Fitzharding, R.C. and J.H. Bailey-Brock. 1989. *Colonization of Artificial Reef Materials by Corals and Other Sessile Organisms.* Bull. Mar. Sci. 44:567-579.

Glockner-Ferrari, D.A. and J.J. Ferrario. 1987. *Report on the Behavior of Cow-Calf Pairs Off West Mau, Hawaii.* Abstract for the Sixth Biennial Conference on the Biology of Marine Mammals. Miami, Florida. December 1987.

Glockner-Ferrari, D.A. and M.J. Ferrari. 1985. *Individual identification, Behavior, Reproduction and Distribution of Humpback Whales, Megaptera Navaeangliae, in Hawaii.* Marine Mammal Commission, Report Number MMC-83/06.

Glynn, P.W. and R.H. Stewart. 1973. *Distribution of Coral Reefs in the Pearl Islands (Gulf of Panama) in Relation to Thermal Conditions.* Limnol. Oceanogr. 18:367-379.

Goldman, B. and F.H. Talbot. 1975. *Aspects of the Ecology of Coral Reef Fishes.* Pages 135-154. In: Jones, O.A. and R. Endean (eds.). *Biology and Geology of Coral Reefs.* Vol. 3, Biology 2. Academic Press, London.

Grigg, R.W. 1985. *Hamakua Coast Sugar Mill Ocean Discharges.* Univ. Hawaii Sea Grant Tech. Rept. 85-02.

Hall, J.D. 1982. Prince William-Sound, Alaska - *Humpback Whales Population and Vessel Traffic Study,* Seattle, NMFS, Final report. 14p.

Haraguchi, Paul, 1979. *Weather in Hawaiian Waters.* Pacific Weather Inc., Honolulu, Hawaii.

Herman, L.M. 1979. *Humpback Whales in Hawaiian Waters: A study in Historical Ecology.* Pacific Sci. 33:1-15.

Hodgson, G. 1989. *The effects of Sedimentation on Indo-Pacific Reef Corals.* Ph.D. dissertation, Univ. Hawaii, Honolulu. 338p.

Hopley, D. and R.V. Woesik. 1988. *Turbidity Levels in Nelly Bay, Magnetic Island, North Queensland With Reference to the Magnetic Quay proposal.* Appendix 3. Public Environmental Report: Magnetic Quay Nelly Bay-Magnetic Island. McIntyre & Associates, Townsville, Q., Australia. (Cited in Hodgson 1989).

Hubbard, D.K. 1987. *A General Review of Sedimentation as it Relates to Environmental Stress in the Virgin Islands Biosphere Reserve and the Eastern Caribbean in General.* Biosphere Reserve Rpt. No. 20., U.S. National Park Service.

Hubbard, D.K. and D. Scaturo. 1985. *Growth Rates of Seven Species of Scleractinian Corals* Bull. Mar. Sci. 36:325- 338.

Jurasz, C. and V. Jurasz. 1980. *Whale-vessel Interactions in Glacier Bay National Monument, Alaska.* p66. In; Sand Diego Workshop on the Interaction Between Man-Made Noise and Vibration and Arctic Marine Wildlife. 25-29 February 1980, a report and recommendations, Acoustical Society of America.

Kay, E.A. 1979. *Hawaiian Marine Shells, Reef and Shore Fauna of Hawaii.* Section 4: Mollusca. B.P. Bishop Museum Spec. Publ. 64. xviii+653p.

Kuhlman, D.H.H. 1985. *The Protection Role of Coastal Forests on Coral Reefs.* Pp.503-508. In: C. Gabrie, M.V. Harmelin (eds.). Proc. 5th Int. Coral Reef Congr., Tahiti, 1985 (6).

Laevastu, Taivo, Avery, Don E., and Cox, Doak C., 1964. *Coastal Currents and Sewage Disposal in the Hawaiian Islands.* Hawaii Institute of Geophysics.

Loya, Y. 1976. *Effects of Water Turbidity and Sedimentation on the Community Structure of Puerto Rican corals.* Bull. Mar. Sci. 26:450-466.

M & E Pacific, Inc., 1978. *Manual for Determining Tsunami Runup Profiles on Coastal Areas of Hawaii.* Prepared for Army Corps of Engineers, Pacific Ocean Division.

M & E Pacific, Inc., 1979. *Environmental Impact Statement for the Kihei Boat Launching Ramp Facility at Keawakapu, Maui, Hawaii (TMK: 3-9-04).* Prepared for Water Transportation Facilities Division, Department of Transportation, State of Hawaii.

Maragos, J.E. 1972. *A Study of the Ecology of Hawaiian Reef Corals.* Ph.D. dissertation. Univ. Hawaii, Honolulu.

Mayo, C.A. 1982. *Observations of Cetaceaus: Cape Cod Bay and Southern Stellwagen Bank, Massachusetts*, 1975-1979. U.S. Dept. Commerce., NTIS PB82-186263, 68p.

Moberlyand Chamberlain, 1964. *Hawaiian Beach Systems.* Hawaii Institute of Geophysics, State of Hawaii. Prepared for State of Hawaii, Department of Transportation, Harbors Division.

Muzik, K. 1985. *Dying Coral Reefs of the Ryukyu Archipelago (Japan).* Pp. 483-489. In: C. Gabrie, M.V. Harmelin (eds.). Proc. 5th Int. Coral Reef Congr., Tahiti, 1985 (6).

National Oceanic and Atmospheric Admin. 1977. *United States Coast Pilot 7, Pacific Coast.* Thirteenth Edition

Norris, K.S. and R.R. Reeves (eds.). 1978. *Report on a Workshop on Problems Related to Humpback Whales (Megaptera novaeangliae) in Hawaii.* U.S. Dept. Commerce, NTIS PB-280 794. 90p.

ORCA, Ltd./D.P. Cheney. 1984. *Hawaii Coral Reef Inventory.* Prepared for the U.S. Army Corps of Engineers, Pacific Division, Fort Shafter, Hawaii. Contract No: DACW84-80-C-0003.

R. M. Towill Corporation, 1991. *Detailed Site Evaluation, Site Selection and Permit Scoping.* Prepared for GTE Hawaiian Tel.

R. M. Towill Corporation, 1991. *GTE Hawaiian Tel Interisland Fiber Optic Cable System, Phase 1. Site Selection and Route Study.* Prepared for GTE Hawaiian Tel.

Randall, R.H. and C. Birkeland. 1978. *Guam's Reefs and Beaches. Part II. Sedimentation Studies at Fouha Bay and Ylig Bay.* Tech. Rept. 47, Univ. Guam Mar. Lab.

Ricker, W.E. 1975. *Computation and Interpretation of Biological Statistics of Fish Populations.* Bull. Fish. Res. Bd. Canada, Bull. No. 191. 382p.

Roy, K.J. and S.V. Smith. 1971. *Sedimentation and Coral Reef Development in Turbid Water: Fanning Lagoon.* Pac. Sci. 25:234-248.

Sea Engineering, Inc. 1989. *Nearshore Wave and Current Measurements for the Mauna Lani Resort, South Kohala, Island of Hawaii.*

Sunn, Low, Tom & Hara, 1973. *Investigation of the Effects of Hawaii Kai Treatment Plant Effluent on Water Quality and Ecosystems Off Sandy Beach.* Prepared for Kaiser-Aetna, Honolulu, Hawaii.

Tinney, R.T., Jr. 1988. *Review of Information Bearing Upon the Conservation and Protection of Humpback Whales in Hawaii.* Preparation for Marine Mammal Commission, Washington, D.C. 56p.

U.S. Army Engineer District, Honolulu. 1975. *Draft Environmental Statement, Harbor Maintenance Dredging in the State of Hawaii.*

Wyrtki, Klaus, Graefe, Volker, and Patzert, William, 1969. *Current Observations in the Hawaiian Archipelago.* Prepared for Office of Naval Research.