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FEB 23 1993

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

FILE NO.: OA-9/29/92-2598
DOC. NO.: 2049

JAN 28 1993

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QUALITY ...

MEMORANDUM

TO: The Honorable Brian J. J. Choy, Director
Office of Environmental Quality Control

FROM: fr William W. Paty, Chairperson
Board of Land and Natural Resources

SUBJECT: Document for Publication in the OEQC Bulletin - Final Environmental Assessment for Conservation District Use Application OA-9/29/92-2598 for repair and replacement of Kaimala Marina Dock Facilities at Kuapa Pond, Oahu; TMK: 3-9-08: 01

The above mentioned Chapter 343 document was reviewed and a negative declaration was declared based upon the final environmental assessment provided with the CDUA.

Please feel free to call me or Roy Schaefer of our Office of Conservation and Environmental Affairs, at 587-0377, if you have any questions.

1993-02-23-OA-FEA-Kaimala Marina Dock Repair : Replacement FEB 23 CDUA #OA-2598

FINAL

ENVIRONMENTAL ASSESSMENT FOR DOCK REPAIR AND RESTORATION KAIMALA MARINA, HAWAII KAI

Prepared for:

Association of Owners at Kaimala Marina
444 Lunalilo Home Road
Hawaii Kai, Honolulu, Hawaii

Prepared by:

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

June 1992

92-16

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I. INTRODUCTION

The Kaimala Marina Association of Owners (Kaimala) is planning the repair and replacement of its dock facilities in Kuapa Pond, Hawaii Kai. The general location of the project is shown in Figures 1 and 2. The existing boat docks at the marina consist of a 3-foot wide concrete walkway seaward of the CRM seawall, with 2.5-foot-wide and 28-foot-long finger piers extending into the marina at a 45 degree angle from the walkway (Figure 3). There are a total of 22 finger piers, spaced 19 feet apart. The docks are twenty years old and badly deteriorated. Extensive concrete spalling has occurred, and reinforcing steel is exposed and badly corroded on the finger piers and the walkway. All of the pier decks need to be replaced.

The Kaimala Marina Association has therefore decided to replace the docks with a floating catwalk and finger piers. The layout of the docks has been modified slightly from the existing layout to better meet the present needs of the Kaimala Marina home owners and to more efficiently utilize the shoreline space. The efficiency of the new layout would increase the number boat slips from the existing 22 to 36. In addition, the Hawaii Kai Marina Association, who is responsible for the overall management of the Hawaii Kai Marina, has recently amended the dock easement at this location to permit the docks fronting Kaimala Marina to extend a maximum of 30 feet from the shore, as opposed to 25 feet which was the limit when the original docks were constructed.

The repair and replacement of the docks will occur in two steps:

1) demolition of the deteriorated docks and piles, with disposal at an approved on-land location; and
2) installation of floating catwalk and piers.

This environmental assessment (EA) describes the proposed project, the existing environment, the anticipated impacts, and the proposed mitigation measures.

II. PROJECT DESCRIPTION AND ALTERNATIVES CONSIDERED

General Project Area Description

Kaimala Marina has an approximately 600-foot-long, slightly curved, shoreline fronting the Hawaii Kai Marina general navigation waterway. The shore is protected by a CRM seawall, with a crest elevation at +3 feet mean sea level (msl). Ground floor units have concrete lanais which extend to within 10 feet or less of the seawall, and landscaping between the lanais and the seawall. There is effectively no lateral access along the shore, except for that provided by the dock walkway. There are three approximately equal sized condominium unit building structures, with common element walkways to the shore at each end of the

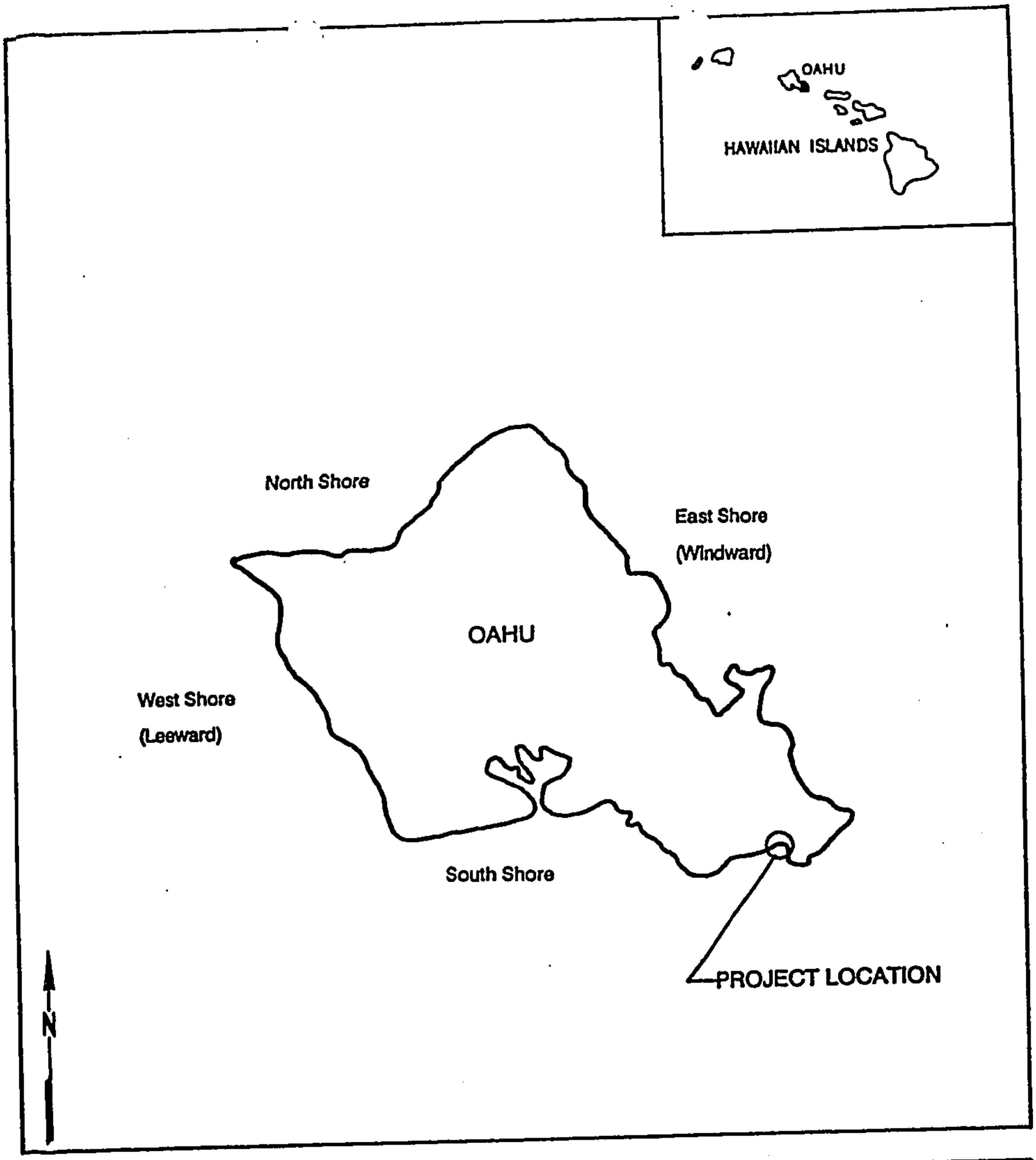

FIGURE 1.
PROJECT LOCATION MAP

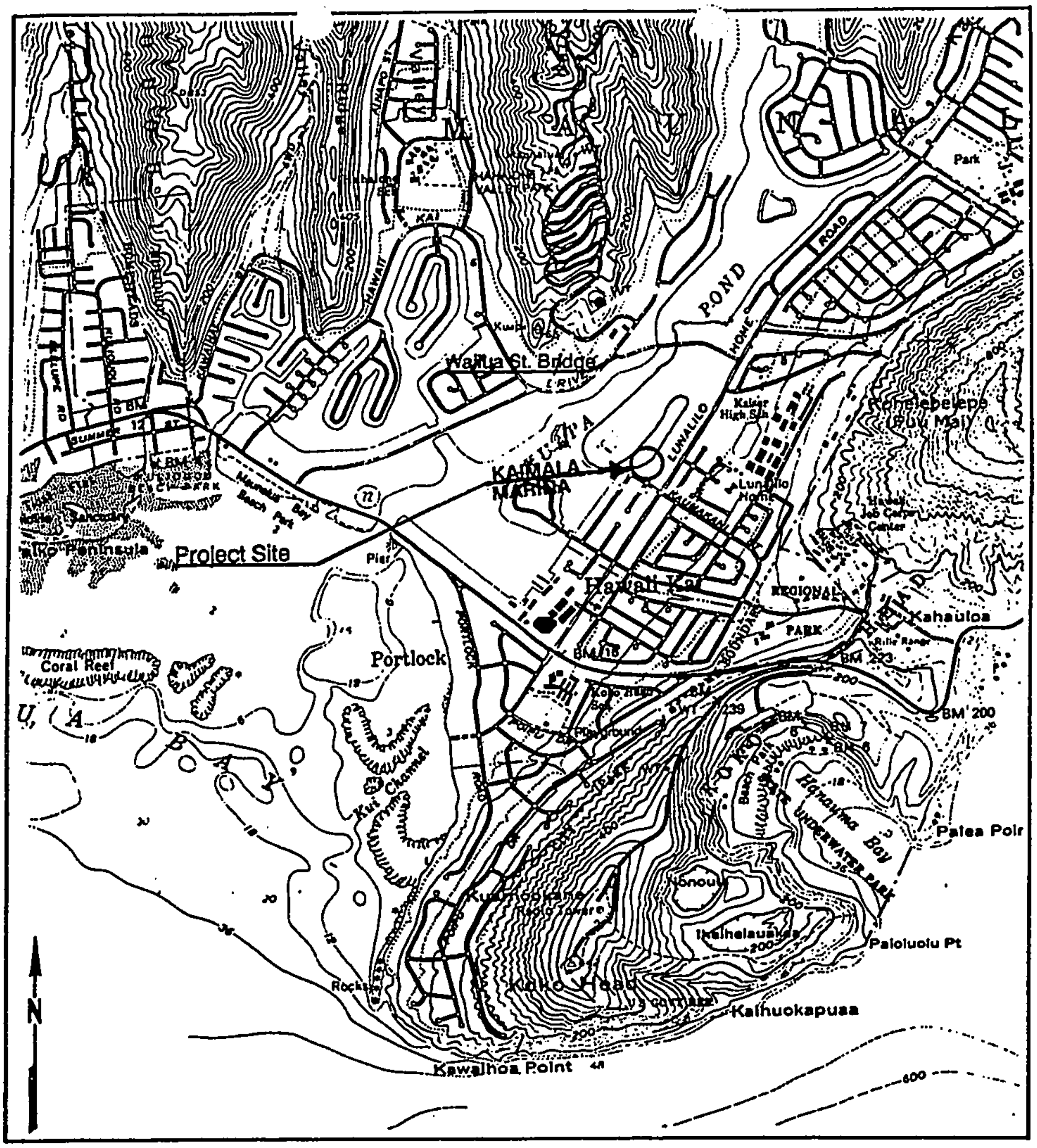

FIGURE 2.
VICINITY MAP

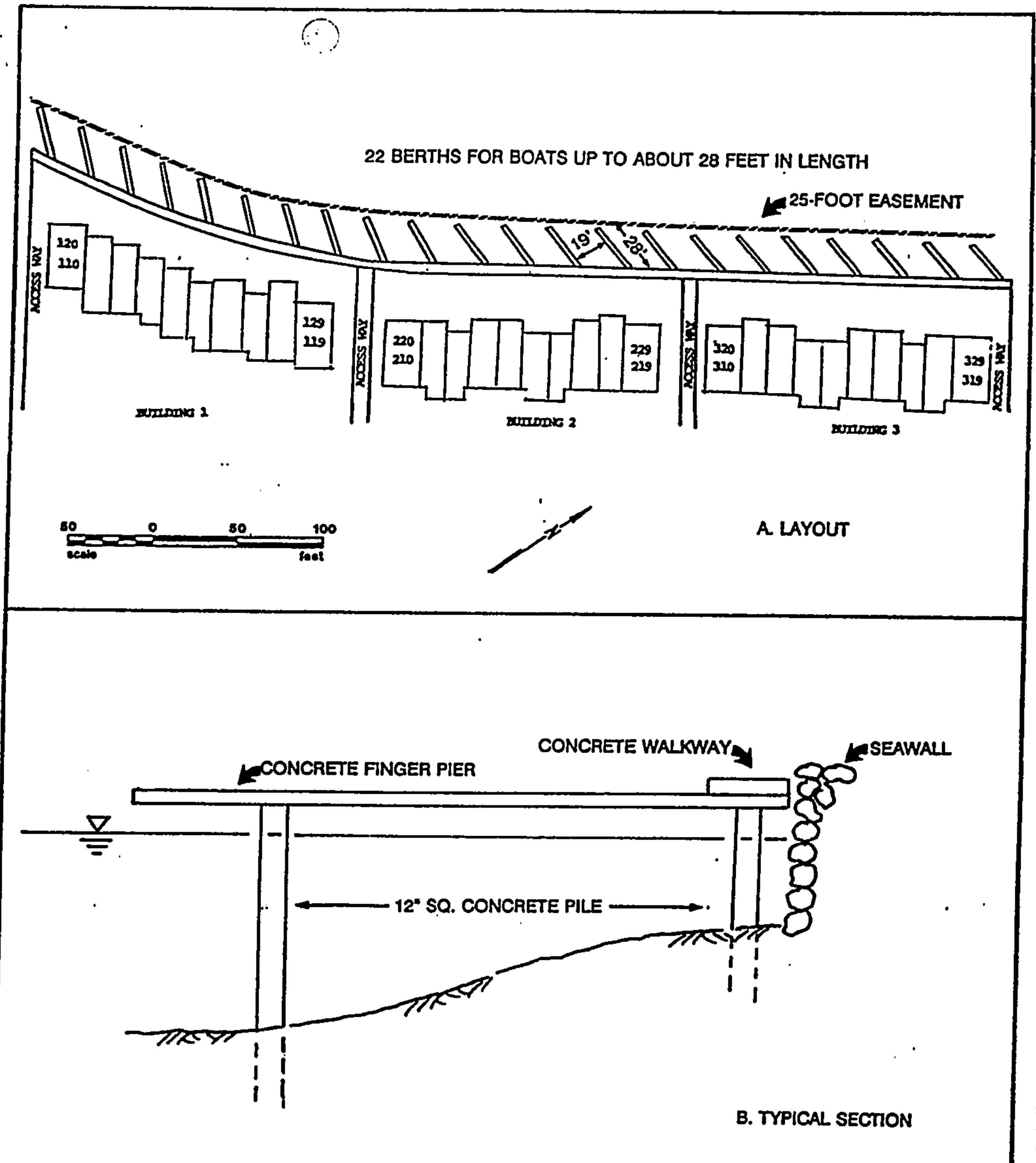

FIGURE 3.

KAIMALA MARINA
EXISTING DOCK LAYOUT AND CROSS-SECTION

property and between the buildings (i.e. four walkways at 200-foot intervals). Although the buildings are set back about 13 feet from the ends of the property, and spaced about 28 feet between buildings, the layout and landscaping precludes land access to the shore by heavy equipment or even small trucks.

When originally constructed, Kaimala Marina was required to construct the docks inside of a 25-foot-wide easement measured perpendicularly from the seawall. In 1991, as part of the dock repair project, the Hawaii Kai Marina Association was petitioned for an extension of the easement to 30 feet. The 30-foot easement was granted by letter dated April 15, 1991.

Boat Sizes and Desired Dock Features

In Hawaii Kai Marina typically about 75% of the registered boats are under 20 feet in length. The statistics for boats at Kaimala Marina are skewed toward slightly longer boats, as shown below:

	Boat Length		
Year	≤20 feet	20-25 feet	≥25 feet
1990	2	5	5
1989	2	6	8
1988	1	8	9
1987	3	7	12
Percent	12%	38%	50%

The Kaimala Marina Board of Directors has indicated a desire to accommodate boats up to about 30 feet in length.

In addition to boat docks, desire has also been expressed for a pier or float large enough to provide for a kayak and canoe storage rack.

Wind, Wave and Water Level Design Conditions

The project site is well sheltered from wave action, and is subject only to waves generated in the short fetch in the immediate area. The dock system should be designed to withstand the forces associated with waves having a height of 1 foot and a length of 15 feet. The site has the potential for the occurrence of strong, gusty winds, and the dock system should be designed for a wind pressure of 15 psf applied to the projected area of all moored vessels and exposed portions of the dock system. This is proportional to an approximate 70 mph wind.

The tides at the site are semi-diurnal, i.e. two high and two low tides every 24 hours, with a typical tide range of 1-foot above and below mean sea level (msl). High spring tides during new and full moons can reach +1.8 feet above msl occasionally during the year. During storms, such as when wind and waves from Hurricane Iwa struck Oahu's south shore, storm water levels in Hawaii Kai have been reported to be at about the elevation of the seawall crest, or +3 feet above mean sea level.

Foundation Conditions

The firm of Geolabs-Hawaii was contracted by Kaimala (July 1991) to investigate subsurface foundation conditions pertinent to the design of pile supports for dock renovations. Two borings were drilled to a depth of 47 feet adjacent to the existing docks, in the vicinity of buildings 1 and 3.

Based on the borings, the mudline is located at a depth of approximately -7 feet msl. Very soft clayey silt with high moisture content extended about four (4) feet below the mudline. Well cemented volcanic tuff was then encountered immediately below the silt. Based on the borings and other experience in the general area, Geolabs states that the underlying volcanic tuff is likely competent and well cemented along the dock area.

If new floating docks are to be anchored by piles, Geolabs recommends the use of 12-inch square, precast and prestressed concrete piles. In order to withstand the anticipated lateral loads exerted by floating docks, a lateral pile capacity of 2 kips per pile is necessary, with a bending moment on the order of 34 foot-kips. Piles driven to a minimum depth of 16 feet below the mudline would be required to provide the necessary lateral support. The volcanic tuff material four feet below the mudline may not be penetrable to the required embedment depth without predrilling to create a socket for pile installation.

Pile driving of standard concrete piles requires the use of heavy equipment. The lack of land access to the shoreline precludes using land-based equipment. It would be possible to use floating (barge mounted) equipment, however the mobilization cost (estimated to be about $50,000) is very high, particularly in light of the relatively few piles required. Thus, alternatives to standard concrete piles should be considered in the development of a repair plan.

Dock Repair Alternatives

There are two basic types of docks used for small boat marinas - fixed docks such as are presently used at Kaimala Marina, and floating docks such as are used at the condominium adjacent to Kaimala (Esplanade) and at the Koko Kai Marina. The selection of fixed or floating docks typically depends on variables such as the tide range, use, appearance, subsoil foundation conditions, construction considerations and cost. The tide range at Kaimala is such that either fixed or floating docks are appropriate. In the past, fixed docks were the more usual choice where the tide range was less than about four feet. In more recent years, improvements in technology and design have improved the durability and lowered the cost of floating docks to the point where they are now in common usage throughout the country. New materials technology and the growth of an industry that specializes in the manufacture of floating dock systems has resulted in the development of high strength, low maintenance and cost effective floating dock systems. A major advantage of the new floating dock systems is their strength, which allows for flexibility of the layout and mooring system.

The Kaimala Marina Association has chosen floating docks because they permit more convenient access between the dock and the floating boat, mooring lines and fenders are easier to arrange, and less berth clearance is required, allowing more boats to be accommodated in a given area.

There is a wide variety of choice in manufactured floating dock systems. Construction materials include wood, metal, concrete and plastic. The selection of dock type depends on several factors - intended use, the project environment, durability and maintenance, and cost. The economy class of dock systems, typified by wooden frames and decks with plastic or polyethylene floats, have relatively low strength and marginal stability, are lightweight for ease of handling, and reflect the economy in a low cost. These are used where the design conditions are relatively benign, high use and good serviceability are not major factors, and cost is a major concern. The strength and durability of the economy systems are not considered the best choice for Hawaii's tropical marine environment, with its salt water, tide changes, strong sunlight, and biofouling by marine organisms.

Modular concrete dock systems have become increasingly popular as their technology has improved, and there are now a number of experienced and reputable manufacturers of quality concrete dock systems on the West Coast. The advantages of concrete include 1) its mass which makes the docks very stable, 2) relatively low maintenance (if properly designed and fabricated, 3) durability, and 4) strength which allows for flexibility in design of the mooring system. Concrete dock systems have been used in almost all of the more recent marina projects in Hawaii which utilized floating docks.

<u>Floating Dock Design</u>

<u>Layout</u> - The use of floating docks permits considerable flexibility in the layout of the docks. This will permit a much more efficient use of the available space than is presently the case with the existing fixed docks. A combination of perpendicular and angled finger piers as shown on Figure 4 would provide slips for 28 boats up to about 24 feet in length and 8 boats 30 feet in length, as well as including a 25-foot-wide canoe/kayak rack float. This is an efficient layout for the project site.

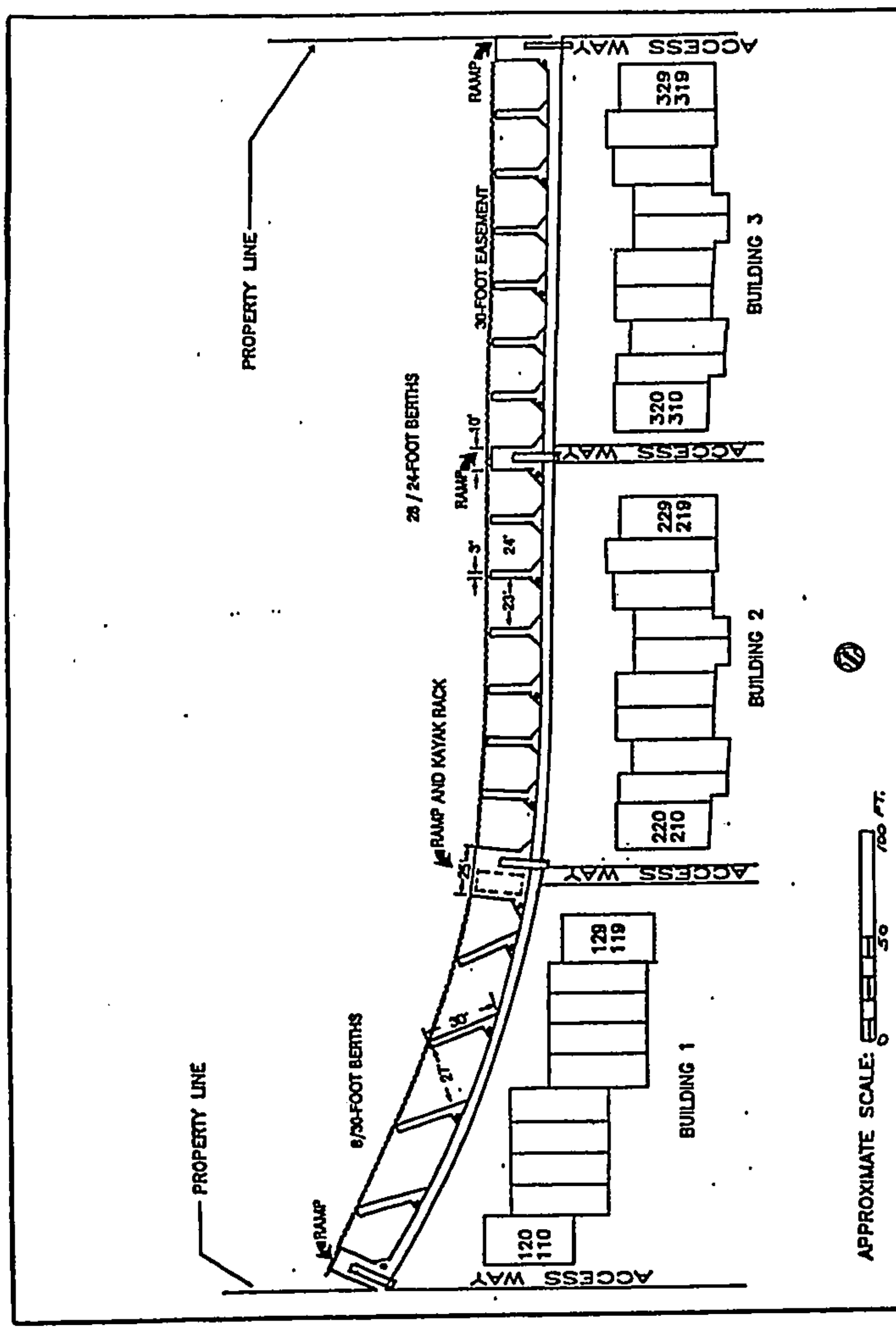

FIGURE 4. KAIMALA MARINA NEW FLOATING DOCK LAYOUT

Access - Floating dock systems must be accessed by hinged ramps because of their constantly changing elevation due to the rise and fall of the tide. Access ramps will be provided at the location of the four common element access ways. The floats at the access ramp locations would be wide enough to accommodate the ramp as well as serve as finger piers, and one float would be large enough to also include the kayak rack. The access ramps would require construction of cast-in-place concrete anchor blocks in the ground on shore immediately behind the seawall.

Mooring System - The mooring system is an integral part of the dock design, and must be adequate for both the environmental design forces at the site (wind, waves and currents) as well as the docking and berthing loads imparted by the boats. Mooring systems are typically pile supported or chains with bottom anchors. Mooring arms cantilevered from anchors imbedded onshore are sometimes used for individual docks or small dock systems. Unfortunately, all of these mooring systems pose problems for Kaimala.

Mooring arms cantilevered from shore are being used for the new docks being constructed at "Kalele Kai", adjacent to the Hawaii Kai Shopping Center. Given the close proximity of the Kaimala buildings to the marina seawall, and the fact that the ground floor units "backyards" essentially abut the seawall, there is no space to construct the anchor blocks necessary to construct a mooring arm system cantilevered from shore without infringing significantly on the space and aesthetics of the ground floor residents. In addition, there is no access for construction equipment along the shore.

The floating concrete docks at Kaneohe Yacht Club utilize chains attached to concrete anchor blocks on the seafloor for their mooring. This system avoids the expense of driving piles, however it requires sufficient water depth and area around the docks so that the chains and anchor blocks do not interfere with boat traffic and berthing. This system results in much greater lateral movement of the whole dock system as wind, waves and currents change, so sufficient water area must be available for the docks to move around in and the access ramp must be able to accommodate considerable shifting of dock position. At Kaimala, the docks must remain in a relatively confined area within the property shoreline and easement, and water depths are relatively shallow, thus chains and anchors will not work well for this project.

Individual piles driven into the subsoil are the most commonly used form of floating dock mooring. The pile may be steel, timber or concrete, with concrete being the typically preferred pile for tropical marine application due to its resistance to corrosion and marine organisms. Pile design and the required number of piles is a structural design problem involving the physical design parameters at the site (wind, waves, currents), the subsoil characteristics and pile support capacity, and the docking and berthing forces exerted by the user boats. The connection between the dock system and the piles is typically accomplished by using hoop or roller pile guides which transfer horizontal loads from the dock system to the piles while permitting the docks to rise and fall with changing water levels without adding vertical forces or local bending stresses. Concrete piles would provide a good anchor system for floating docks at Kaimala, however the lack of access along the shore for construction equipment would necessitate the use of a floating barge mounted pile driver. This is commonly done for driving piles in the water, however the mobilization costs for the necessary equipment are high (in the order of $50,000), particularly in light of the need for only about a dozen piles to moor floating docks at Kaimala. The design parameters for the Kaimala project, including its relatively sheltered location, the relatively lightweight boats anticipated to use the dock, and the small number of docks and physical size of the project, will permit the use of a steel spud pile in lieu of the standard driven concrete pile. The advantage of the spud pile system is its relative ease of construction without using large, high mobilization cost equipment, and thus its lower cost. The major disadvantage is the fact that being a steel pipe it will require more maintenance and will have a shorter life in sea water than a concrete pile, and they may be noisier than rubber rollers on rigid concrete piles. The spud piles achieve their resistance to lateral loads in one direction by having a number of them in a row along the seawall (in effect similar to table legs), and in the other direction by the fact that they are attached to long finger piers with considerable buoyancy which do not permit the piles to tip toward the marina channel. A typical spud pile design is shown on Figure 5.

Dock Components

The floating dock units will consist of monolithic deck/floatation assemblies made up of precast modular polystyrene floats covered with structural concrete. The modules are joined together by timber walers to form the desired dock configuration.

Floating Dock Repair Plan Summary

- A dock layout as shown on Figure 4, providing a total of 36 berths for vessels up to about 30 feet in length, and a canoe/kayak rack float.
- Concrete encased polystyrene foam walkway, finger pier and canoe/kayak floats constructed in accordance with the performance criteria for this project (similar to those manufactured by Bellingham Marine Industries and Shoreside Construction).
- Four access gangways located opposite the existing common element access walkways beside buildings.
- Dock mooring using spud piles as shown on Figure 5.

The estimated construction cost of the proposed dock repair, including demolition and disposal of the existing concrete fixed docks and installation of the new floating dock system is $300,000.

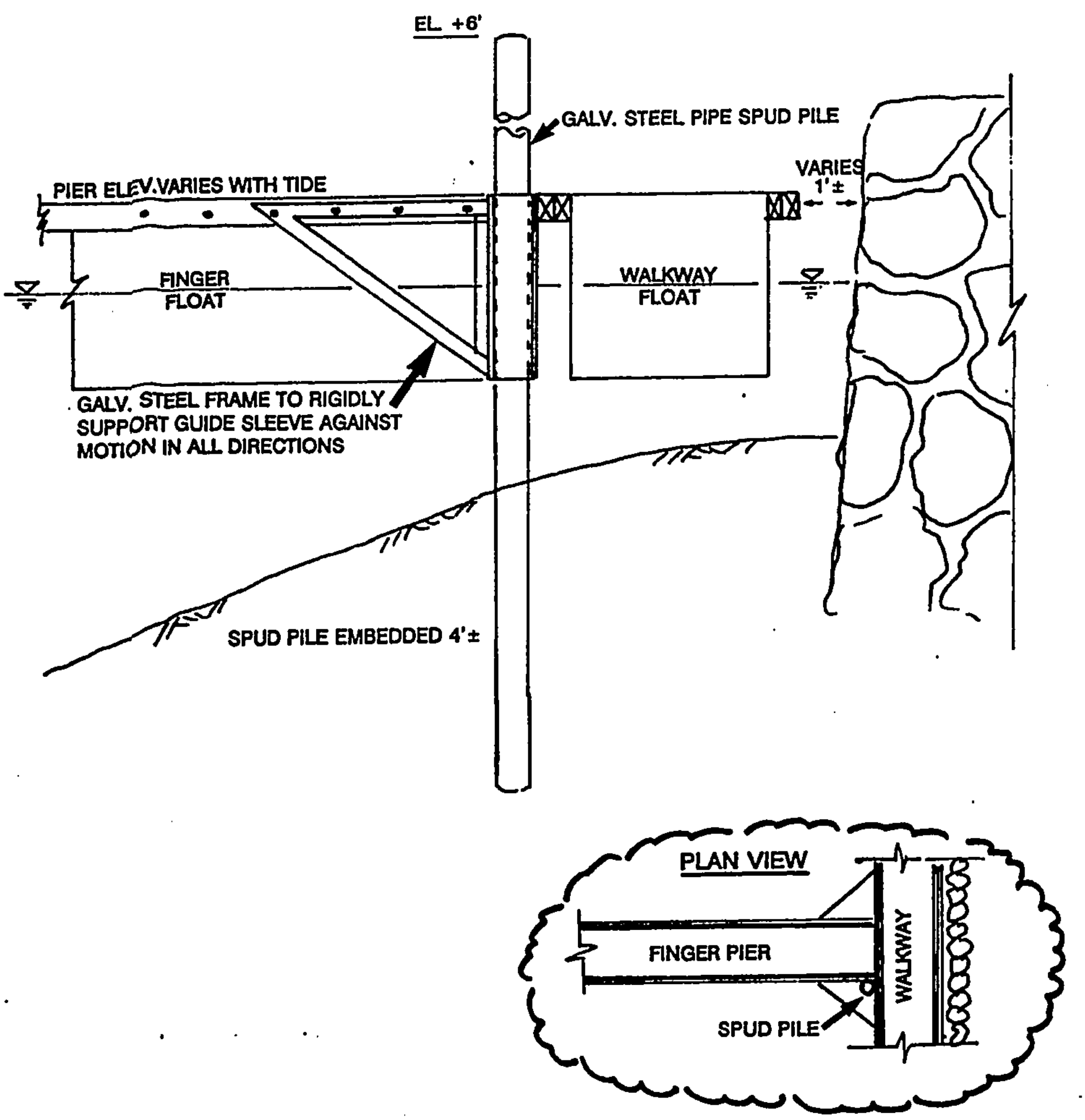

FIGURE 5	KAIMALA MARINA TYPICAL SPUD PILE DETAIL

III. EXISTING PHYSICAL ENVIRONMENT

General Description

Kuapa Pond was initially a brackish water fishpond surrounded by marshland, which was developed in the 1960's into a recreational marina and associated residential area. The area of the pond was reduced from 523 acres to 258 acres by filling, and the average water depth of the remaining water areas was increased from 2 feet to 5 to 8 feet. The Hawaii Kai Marina overall has about 12 miles of shoreline, most of it consisting of vertical cemented rock walls. The marina is connected to Maunalua Bay through two dredged channels.

Kaimala Marina is located along 600 feet of shoreline along the eastern shore of the pond, adjacent to Lunalilo Home Road (Figure 2). The shoreline in the project area consists of a vertical basalt rock and concrete masonry (CRM) seawall with a crest elevation at + 3 feet mean sea level. Ground floor units have concrete lanais that extend to within 10 feet or less of the seawall, and have landscaping between the lanais and the seawall. Along the shorelines on either side of Kaimala marina are located floating docks, belonging to single family homes as well as the Esplanade Apartments.

Across the waterway from Kaimala Marina is the site of The Peninsula project proposed by Nansay Hawaii. The proposed Peninsula is located on a man-made peninsula which extends into the marina south of Wailua Street (Figure 2). Most of the property is unvegetated fill that has been graded to a more or less uniform elevation of seven feet above mean sea level, although part of the land towards the north end rises an additional ten feet. A vertical, basalt rock and concrete masonry (CRM) wall surrounds the entire peninsula. This wall extends from several feet below sea level to an elevation of about +3 feet above sea level. The fill land rises another 4 feet immediately behind the wall. Part of this peninsula was used as a settling pond during the last dredging of the marina in the early 1980's.

The waterway fronting Kaimala Marina is a closed inlet, extending only a few hundred feet to the north of the marina. At the north end of the inlet opposite the Esplanade condominiums, there is a break in the wall where a drainage channel enters the marina. This drainage carries storm run-off from nearby streets, is unlined, and dry most of the time.

Terrestrial Environment

The terrestrial environment at the project site consists of landscaped lanais which will not be affected by the emplacement of floating docks.

Marine Environment

Bathymetry and Bottom Conditions - Prevailing water depths in Hawaii Kai Marina range from 5 to 8 feet. In the project area, depths three feet out from the wall are generally 4 to 5 feet, while depths 15 feet out are generally greater than 7 feet. At both ends of the marina, water depths become shallower close to the wall. Sedimentation is a chronic problem in some areas of the marina, particularly in the vicinity of storm drains or culverts. Most of the sedimentation occurs during heavy rainfall; at other times there is little fresh water flow into the marina. Extensive maintenance dredging was completed in the early 1980's, and will probably be required again in the near future.

Marine Biota - A previous study (U.S. Army Corps of Engineers, 1975) reported fouling organisms encrusting the marina walls, piers, and pilings as the most notable features of the Hawaii Kai Marina fauna. Within the inner-most areas, polychaetes (Hydroides sp. and Mercierella enigmata), bryozoans (Bugula neritina), and barnacles (Balanus sp.) were listed as the more conspicuous components. With respect to fishes, the Corps of Engineers report noted that mullet and barracuda were common, and nehu (Stolephorus purpureus) and a "variety of reef fishes" are present.

A site survey was conducted for The Peninsula project across the waterway. The findings of this survey apply also to Kaimala Marina. Water clarity is generally poor, with visibility under three feet. The CRM wall surrounding the site provides a suitable substratum for a variety of fouling organisms such as barnacles (Balanus sp.), oysters (probably mostly Ostrea hanelyana), sponges, tube worms (Pomatoleios kraussii), and tunicates. The barnacles from a distinct zone high on the wall above the other species, extending from about mean sea level to high tide level. The giant fanworm (Sabellastarte sanctijosephi) was prominant along the east side of the peninsula. Tube worms were especially abundant towards the north along the west side. Individuals of a common shore crab (Metopograpsus thukuhar), are common. This species is characteristic of quiet, somewhat brackish waters. Jellyfish are also abundant in the area. The nearshore bottom (seawall and boulders at the north end) supports a limited variety of algae.

Very few fishes are visible, no doubt in part because of the low clarity of the water, although the sea wall might be expected to attract juvenile and "reef" fishes. At the small inlet formed by the mouth of the drainage channel a goby (possibly Oxyurichthys lonchotus), young aholehole (Kuhlia sandvicensis), and a topminnow (Poecilidae) were common. Only a single sailfin surgeon (Zebrasoma veliferum) and two kupipi (Abudefduf sordidus) were seen elsewhere along the wall.

Oceanographic Conditions - The project site is well inside Hawaii Kai Marina and is sheltered from the direct influence of ocean waves. The waves at the site are basically wind generated within the fetch provided by the marina.

The prevailing tradewinds will affect the day to day vessel operations, primarily approaching and leaving the dock, and the floating pier layout was designed to make these operations as easy as possible.

The still water level in the marina will rise during severe storm conditions. The total water level rise is the sum of several factors: the astronomical tide stage, the water level set-up due to waves breaking on the outer fringing reef in Maunalua Bay, and the storm wind surge. The total calculated stillwater rise in the marina is approximately 3 feet above mean sea level for a severe storm.

Water Quality - Silt from dredging operations, adjacent land development, and a poorly vegetated ridge and upper valley area has long been considered the major water quality problem in Hawaii Kai Marina (Cox and Gordon, 1970). Although several streams enter the area, they flow only intermittently, and most of the sediment is washed into the marina during periods of heavy rainfall. There is active tidal exchange between the marina and inner Maunalua Bay, and water over the shallow reef flat is frequently turbid. According to the Hawaii Coral Reef Inventory (AECOS, 1979) the waters of Maunalua Bay were turbid even before the dredging of the marina and the disturbance of the surrounding land.

IV. POTENTIAL IMPACTS AND MITIGATION MEASURES

Impacts During Demolition and Construction

The demolition of the existing fixed docks and construction of the floating dock facility should have no significant direct effect upon the marine environment. Minor turbidity will be generated during the demolition and removal of the existing docks, however the turbidity will be temporary and localized, and should have no permanent effect upon the existing benthic fauna.

The floating dock components will be assembled on land and then floated into place. This aspect of the construction should have no impacts upon the marine environment.

Noise levels will be temporarily increased during construction.

Operational Impacts

The floating docks will reduce the light reaching the seawall, and may reduce the growth of algae. However, the new structures will provide additional surfaces upon which will grow the same community of attached flora and fauna that now occupies the shoreline.

The primary water quality concerns, however, in any area of concentrated power boat operation are the inputs of fuels, oils, and exhaust gases to the water. The new floating docks at Kaimala Marina, however, will only increase the number of boat slips from 22 to 36. These additional boats will have a negligible impact on water quality.

Furthermore, while the waters of Hawaii Kai marina tend toward being estuarine in character, the natural value of this estuary was lost many years ago with the infilling of nearly half of the former Kuapa Pond and the urbanization of the valley. The waterway is now an inland marina. Construction and use impacts of the proposed boat slips on the motile components of the marina's biota (i.e., certain fishes typical of this aquatic environment) are therefore not likely to be significant. These waters are not regarded as important to the life-cycles of any fishes of commercial or ecological value.

The floating docks will have a beneficial visual impact compared to the existing fixed docks. The existing docks are badly deteriorated, and in places, hazardous. The replacement of these docks with new floating docks will represent a significant improvement to the project area. Aesthetic consideration were an important factor in deciding upon the type and configuration of the dock system. Floating docks are more aesthetically pleasing than fixed docks, especially at times when the vessels are not moored.

V. DETERMINATION

No Significant Negative Environmental Impacts:

The proposed floating dock project constitutes no significant negative environmental impact. The project is in keeping with the current usage of the Hawaii Kai Marina and will enhance the recreational potential of the marina.

VI. REASONS SUPPORTING DETERMINATION

1) The intended use of the area is in compliance with the permitted uses in a conservation district subzone "G".

2) Benthic surveys conducted for other projects in Hawaii Kai, particularly for the Peninsula Project across the waterway, have indicated that the construction impacts will be minimal. The entire Hawaii Kai Marina area was subjected to extensive dredging and filling during the initial construction of the Hawaii Kai residential community, and little remains of the original environment.

3) The operational impacts will be negligible. Kaimala Marina contributes only a very small portion of boat operations in Hawaii Kai.

VII. LIST OF PERMITS AND APPROVALS

Conservation District Use Permit (State of Hawaii, Department of Land and Natural Resources) - Conservation District Use Application (CDUA) approval for the existing dock facility was obtained in 1970. In June 1991 a request was made to DLNR for a determination as to whether the proposed dock rehabilitation, consisting of demolition of the existing deteriorated docks and piles and construction of new floating docks, can be accomplished as repairs to an existing approved structure without the need to apply for new CDUA approval. By letter dated July 11, 1991, the DLNR replied that no new CDUA would be required to accomplish the proposed dock rehabilitation. DLNR requires, however, that copies of the construction plans and this environmental assessment (EA) be provided for review prior to actual start of repairs.

Section 10 Permit for Work in Navigable Waters of the U.S (Department of the Army, U.S. Army Corps of Engineers) - In July 1991, the U.S. Army Corps of Engineers (USACOE) was asked for a determination as to whether the proposed dock rehabilitation can be accomplished under the authority of the Nationwide permit for repair, rehabilitation, or replacement of a currently serviceable structure. The USACOE responded that the proposed work would exceed the scope of the Nationwide permit, but that, assuming that there is no fill material placed in the water, the project could be evaluated under the Letter of Permission procedures. This will require permit application accompanied by construction plans and this EA.

In addition to State and Federal permits, the Project must be approved by the Hawaii Kai Marina Association, Bedford Properties, Inc. and the Bishop Estate. Building permits must also be obtained from the City and County of Honolulu.

VIII. ORGANIZATIONS, AGENCIES AND PERSONS CONSULTED DURING THE PREPARATION OF THIS ASSESSMENT

1. State of Hawaii, Department of Land and Natural Resources
2. Mr. Art Challacombe, City and County of Honolulu, Department of Land Utilization
3. United States Army, Corps of Engineers
4. Hawaii Kai Marina Association
5. Mr. Skip Tracy, Hawaii Kai Marina Manager
6. Mr. Eric Guinther, AECOS, Inc.
7. Geiger Engineers in Seattle Washington- (Dock designers)

IX. REFERENCES

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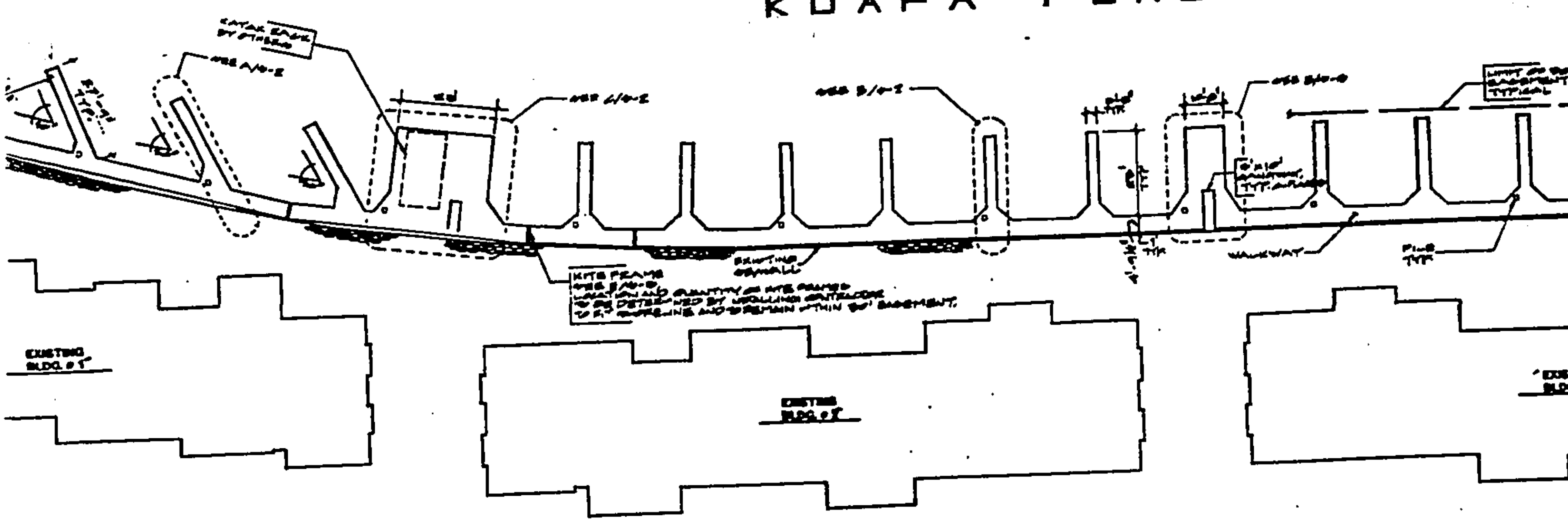
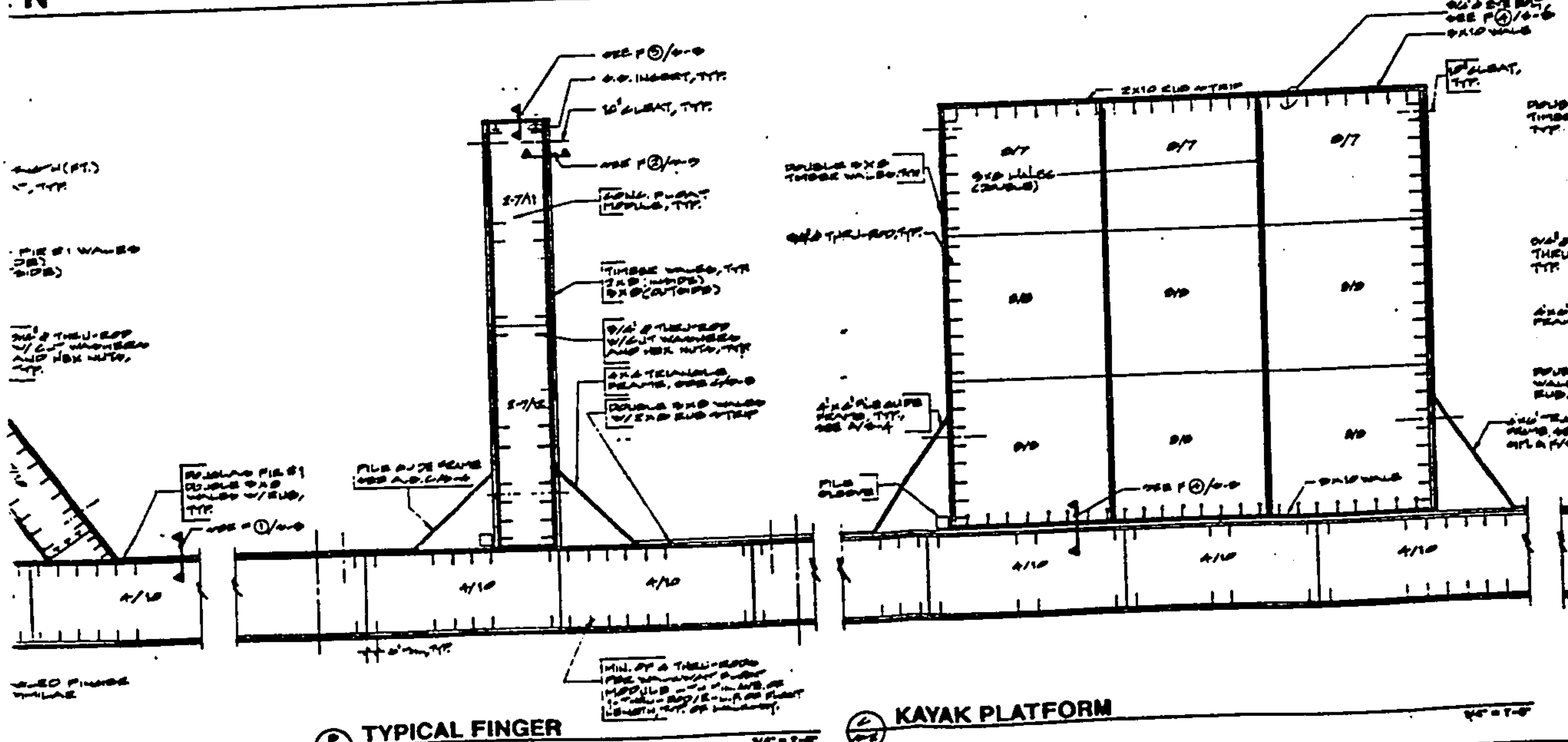
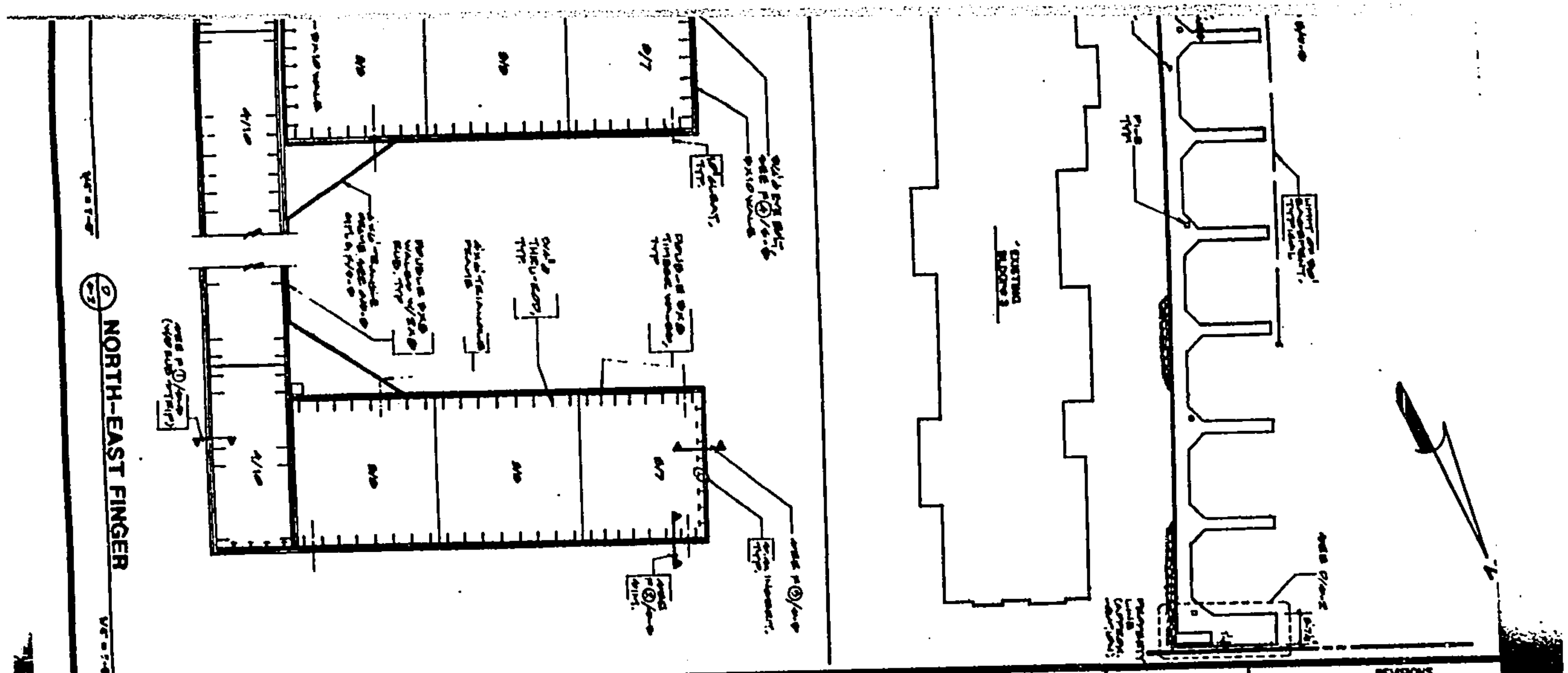




TYPICAL FINGER

KAYAK PLATFORM



REVISIONS		
No.	Date	Description
1	31 July 92	Issued for Bid

THIS WORK PREPARED BY ME OR UNDER MY SUPERVISION

SIGNED

DATE 31 July 92

Kaimala Marina

Honolulu Hawaii

SITE PLAN

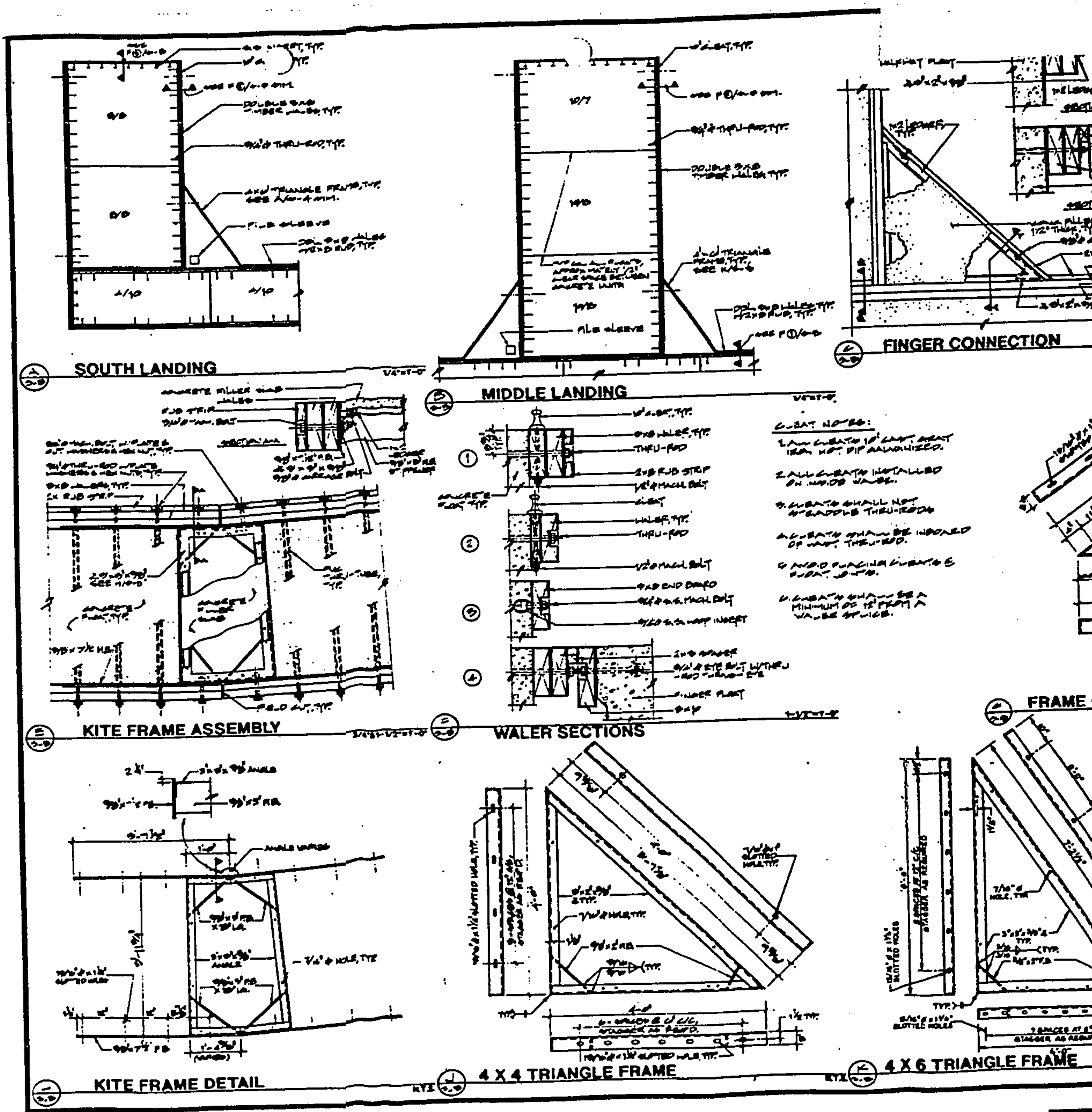
GEIGER ENGINEERS

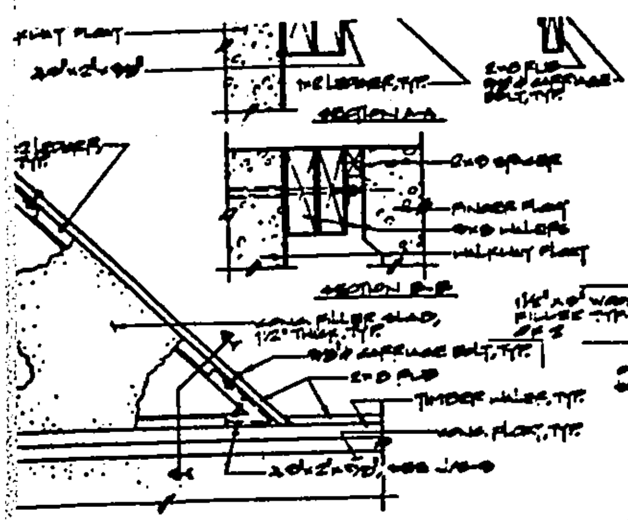
New York/Bellingham

PROJECT # 91828-101

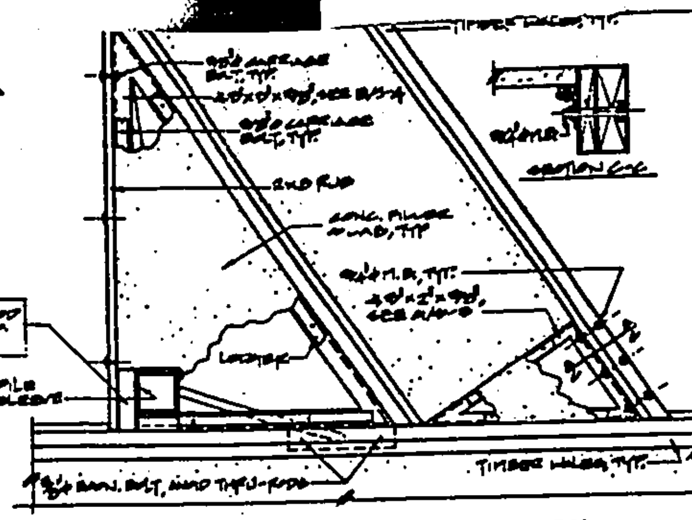
DRAWN

SHEET S-2 OF SHEETS

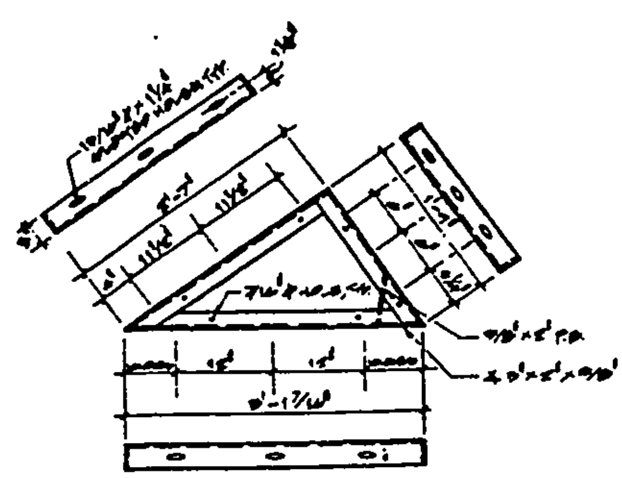

SOUTH LANDING
MIDDLE LANDING
FINGER CONNECTION
KITE FRAME ASSEMBLY
WALER SECTIONS
FRAME
KITE FRAME DETAIL
4 X 4 TRIANGLE FRAME
4 X 6 TRIANGLE FRAME
CLEAT NOTES:
1. ALL CLEATS 10' LIGHT WEIGHT IRON, HOT DIP GALVANIZED.



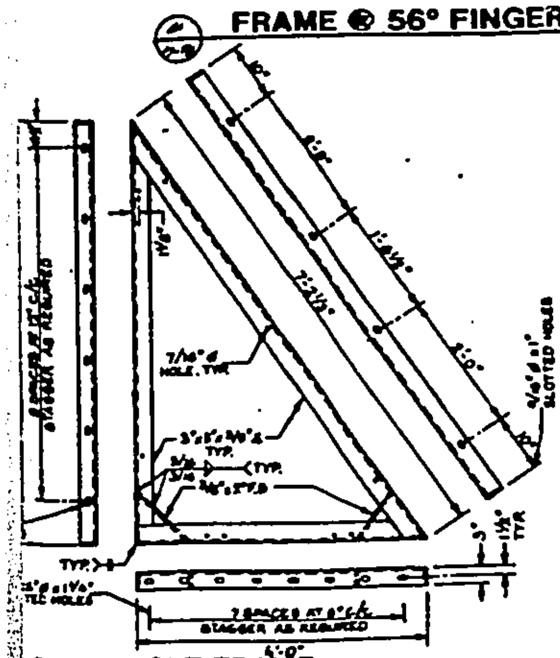
NGER CONNECTION



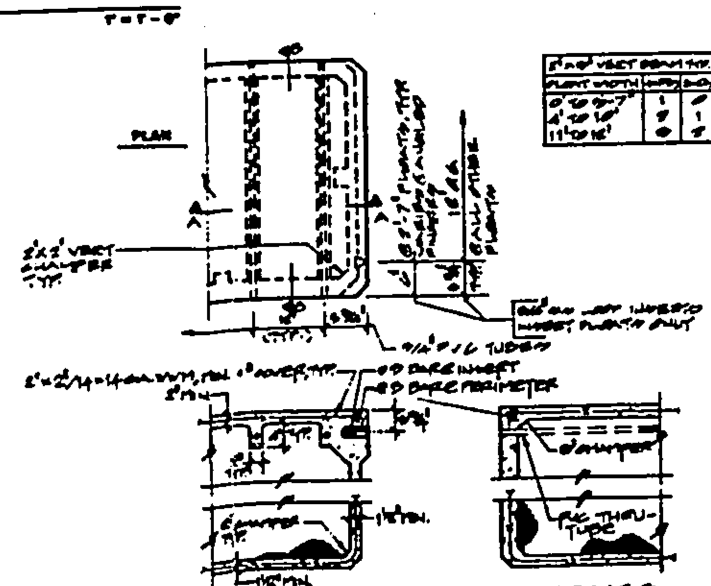
56° ANGLED FINGER CONNECTION



FRAME @ 56° FINGERS



6 TRIANGLE FRAME



CONCRETE FLOAT DETAIL

REVISIONS

No.	Date	Description

THIS WORK PREPARED BY ME OR UNDER MY SUPERVISION

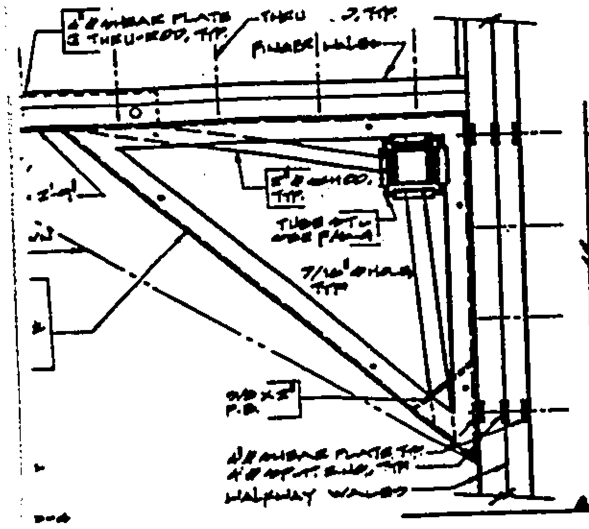
Kaimala Marina

Hawaii

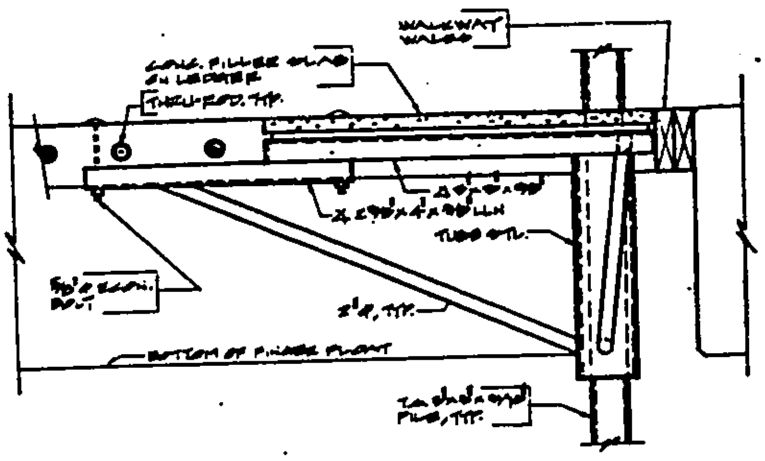
SECTIONS & DETAILS

GEIGER ENGINEERS

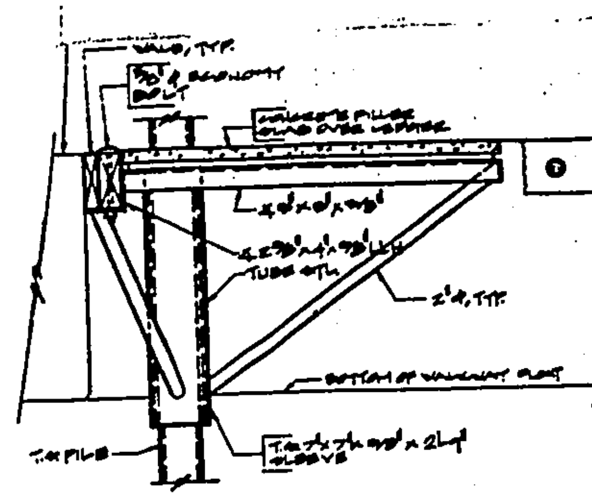
SHEET S-3 OF SHEETS



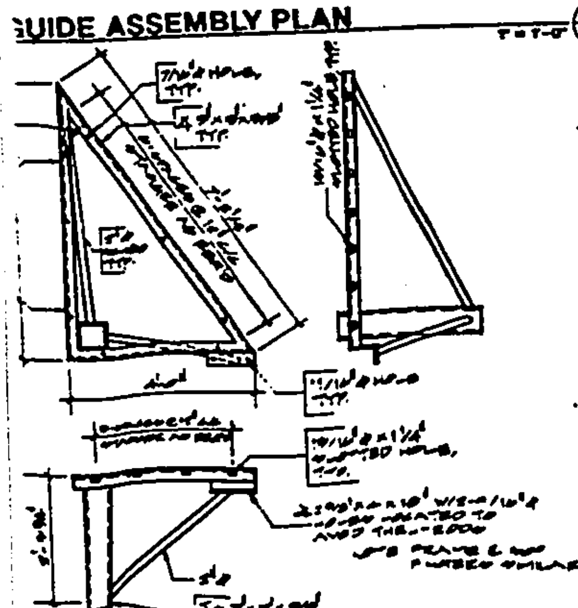
UIDE ASSEMBLY PLAN



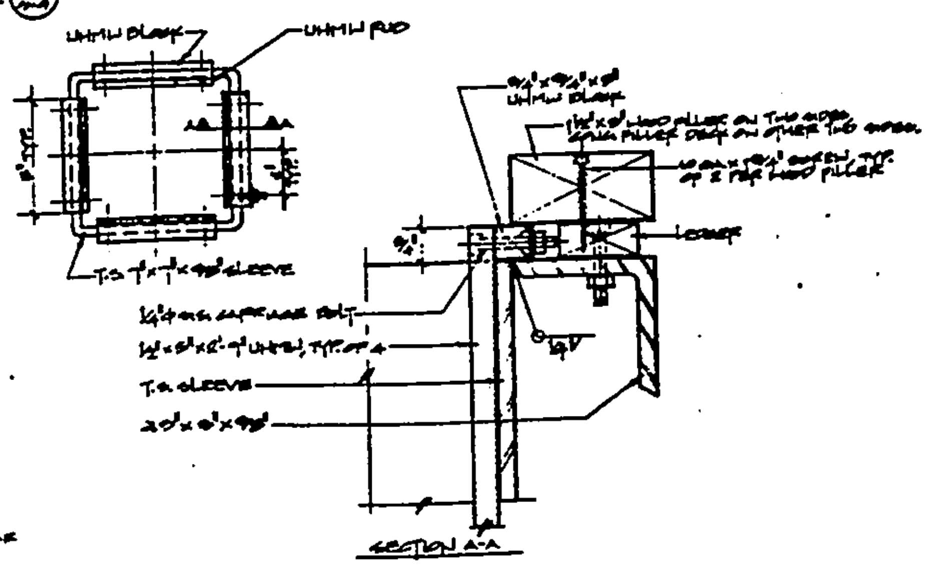
ELEVATION



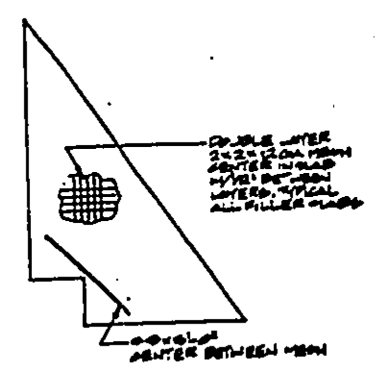
ELEVATION



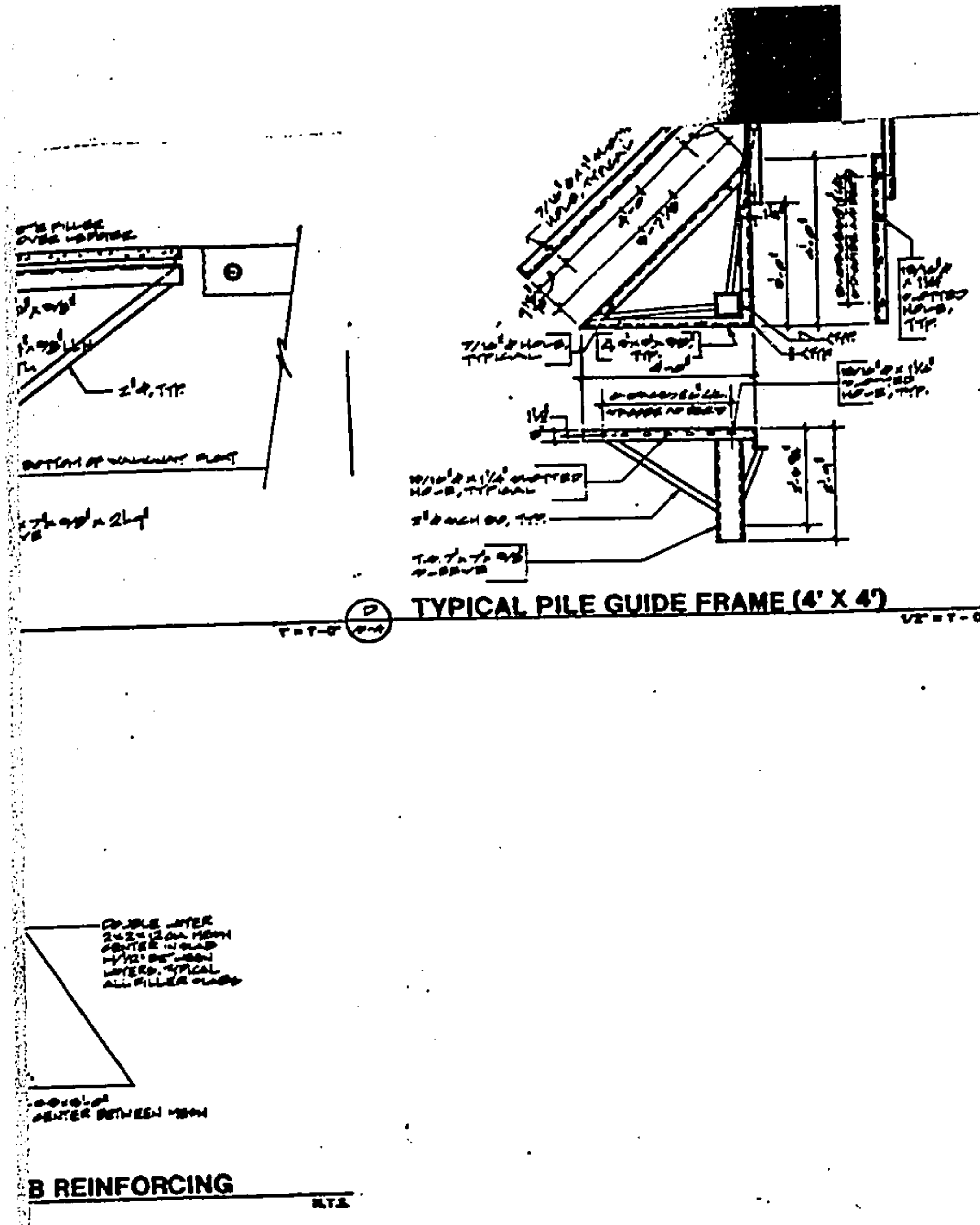
GUIDE FRAME @ 56° FINGERS



UHMW RUB @ SLEEVE



FILLER SLAB REINFORCING



TYPICAL PILE GUIDE FRAME (4' X 4')

1/2" = 1'-0"

B REINFORCING

N.T.S.

REVISIONS

No.	Date	Description
1	31 July 92	Issued For Bid

THIS WORK PREPARED BY ME OR UNDER MY SUPERVISION.

DATE

Kaimala Marina

Honolulu Hawaii

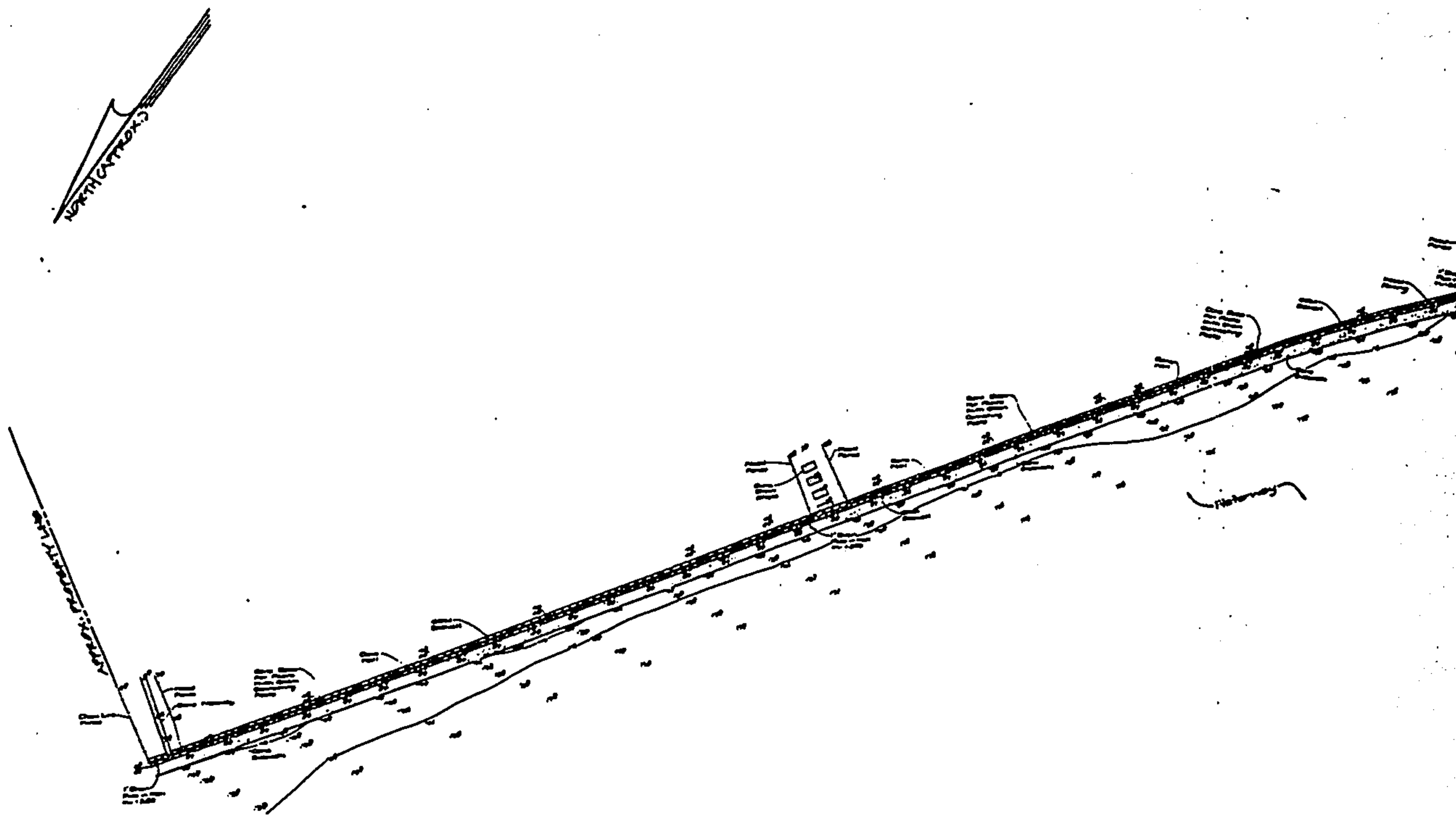
SECTIONS & DETAILS

GEIGER ENGINEERS

PROJECT

DRAWN

SHEET S-4 OF SHEETS



TOPOGRAPHIC SURVEY

SEAWALL AT KAIMALA MARINA

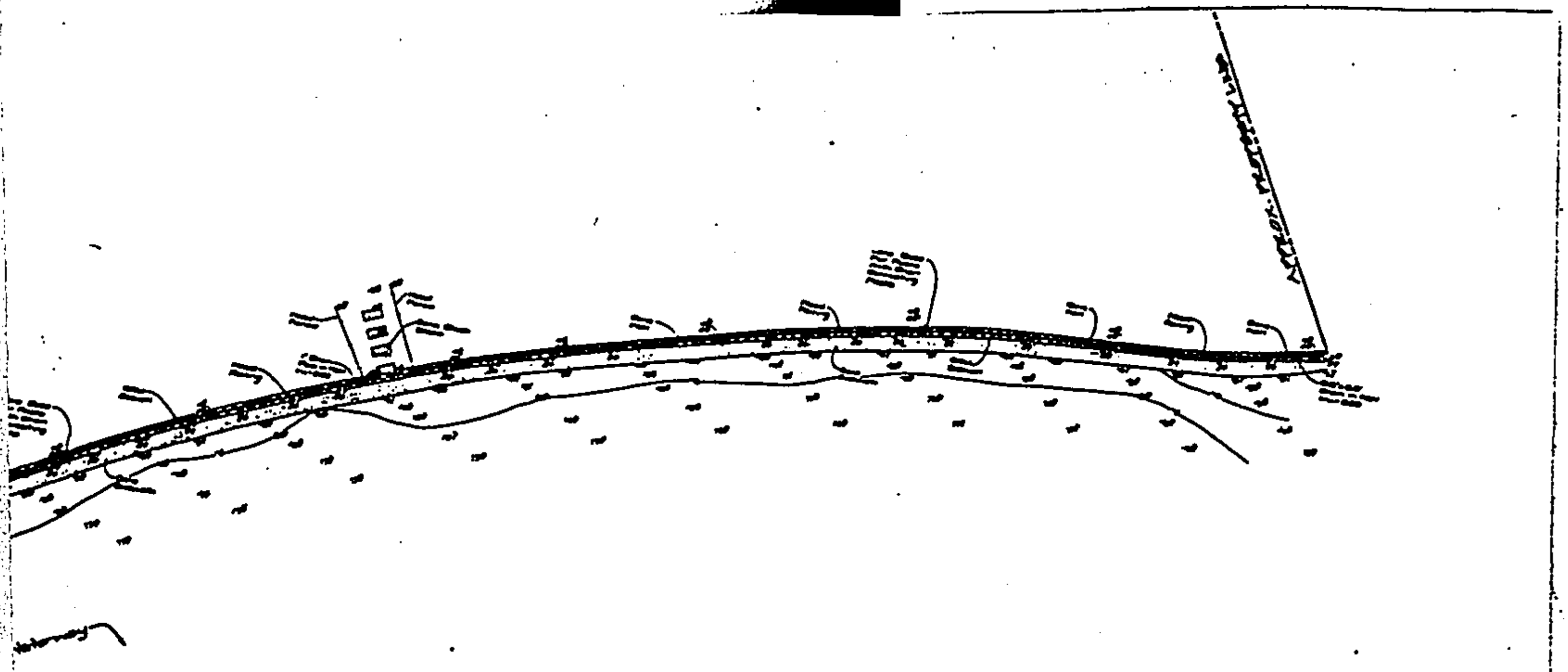
At: Maunalua, Honolulu, Oahu, Hawaii

Tax Map Key: 3-9-08: 8 por. & 11 por.

0 20 40 60

Scale: 1in = 20 ft.

Direction and Position
are assumed
Vertical Datum: Mean Sea Level



SURVEY

LA MARINA

Oahu, Hawaii

ROBERT K.Y. LEE
LICENSED PROFESSIONAL LAND SURVEYOR
HAWAII, U.S.A.

This work was prepared by me or under my supervision

Licensed Professional Surveyor

K A I M A L A M

H O N O L U L U , H A W

STUCTURAL NOTES

[illegible]

ASSOCIATION OF OWNERS, KAIMALA MARINA	OWNER
SEA ENGINEERING INC.	PROJECT ENGINEER
GEIGER ENGINEERS	MARINE STRUCTURAL

DRAWING INDEX

MARINA

, HAWAII

ABBREVIATIONS

[illegible]

...all be a suitable grade. Do not sold ... Building Society ANSI/ASE 86.4, Latest

...ASTM A325 and shall be galvanized.

...d support of reinforcing bars in forms, ...ndard Practice.

...ia. unless noted otherwise on plans.

...be as follows, except as noted in plans

...rds: Coastal Range Douglas Fir-Larch #1

...be treated with chromated copper arsenate ...tention in accordance with AWPA Standard ...ch BLF shall be accepted as evidence of

...ll be accomplished prior to pressure ...s required after pressure treatment, all ...y coats of copper naphthenate solution to

...e bit 1/16 inch larger in diameter than

...inal 3/4" diameter round rod conforming ...rm to ASTM A307 unless noted otherwise. ...er all bolt heads and nuts which would ...Threads, bolts, nuts and washers shall ...ith ASTM A153-82.

...anded polystyrene weighing between 0.95 ...nded polystyrene shall conform to Federal ...damed of repried material shall not

...- 12" into the ruff layer covering of ...e.

...material shall be the responsibility of

...ve shown with a maximum variation from

vertical of 1/12.

A representative of the Engineer shall be present during initial pile installations.

Top of pile elevations for pile caps shall be +6.0 feet mean tide level. Piles may be driven to grade. If cutting of piles is required, cut off piles with a smooth level cut using pneumatic tools, sawing or other suitable methods approved by the Engineer. Provide corrosion protection for exposed steel resulting from cutting piles.

INSPECTIONS AND CERTIFICATES

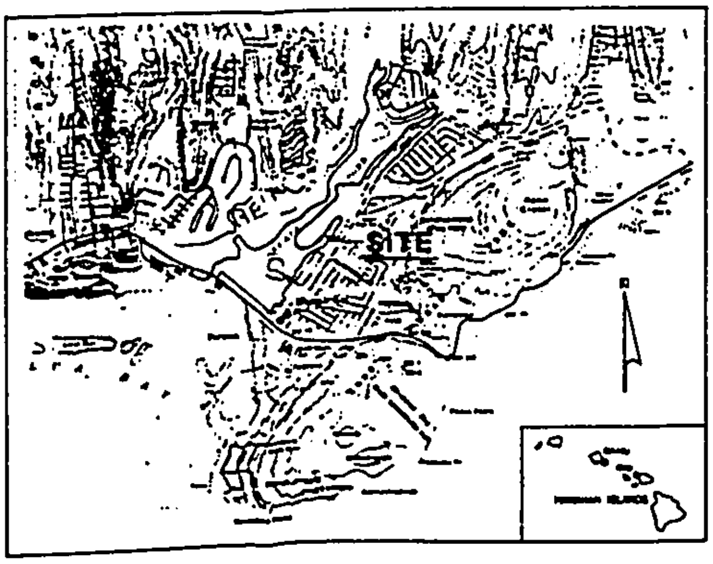
The following special inspections will be performed by the owner's testing agency:

Concrete: Slump, air content, cylinders per UBC 306 (1).
Reinforcing: Placement of all reinforcing per plans: cover, number, and laps.

Certificates: Manufacturer's certificates for steel piling and rolled shapes.

NG INDEX

VICINITY MAP



REVISIONS		
No.	Date	Description
-	31 July 92	Issued for Bid

THIS WORK ... BY ME OR ...

SIGN... 31

DATE

Kaimala Marina

Honolulu Hawaii

TITLE SHEET / STRUCTURAL NOTES

GEIGER ENGINEERS

PROJECT # 91828-01

DRAWN SMH

SHEET S-1 OF SHEETS