EXECUTIVE CHAMBERS

HONOLULU

GEORGE R. ARIYOSHI
GOVERNOR

December 7, 1983

Mr. Roy R. Takemoto, Chairman
Environmental Quality Commission
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Mr. Takemoto:

Based on the recommendation of the Office of Environmental Quality Control, I am pleased to accept the environmental impact statement for the commercial fishing vessel berthing area at Honolulu Harbor's Pier 16 as a satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes.

This environmental impact statement will be a useful tool in deciding whether this project should be allowed to proceed. My acceptance of the statement is an affirmation of its adequacy under applicable laws and does not constitute an endorsement of the proposal.

When the decision is made regarding this action, I expect the proposing agency to carefully weigh the societal benefits against the environmental impact which will likely occur. This impact is adequately described in the statement, and, together with the comments made by reviewers, provides a useful analysis of alternatives to the proposed action.

With warm personal regards, I remain,

Yours very truly,

George R. Ariyoshi

cc: Honorable Wayne Yamasaki

Revised Environmental Impact Statement for Commercial Fishing Vessel Berthing Area Pier 16, Honolulu Harbor, Oahu

Job No. H.C.-1422

Harbors Division
Dept. of Transportation
State of Hawaii

September 1983

R.M. TOWILL CORPORATION

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ENVIRONMENTAL IMPACT STATEMENT

FOR

COMMERCIAL FISHING VESSEL BERTHING AREA

PIER 16, HONOLULU HARBOR, OAHU

JOB NO. H.C. - 1422

PROPOSING AGENCY:

Department of Transportation
State of Hawaii

ACCEPTING AUTHORITY:

Governor, State of Hawaii

This Environmental Impact Statement is Submitted Pursuant to Chapter 343, Hawaii Revised Statutes

9/28/83
DATE

David K. Higa
Chief, Harbors Division

Reviewed for Content and Accepted by the State Department of Transportation

R Higashionna 9/29/83
DATE

R. Higashionna, Ph.D
Director of Transportation

Prepared By:

R. M. Towill Corporation
677 Ala Moana Blvd., Suite 1016
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SEPTEMBER 1983

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SUMMARY

1.1 PROJECT DESCRIPTION

The proposed project is located in Honolulu Harbor on the Island of Oahu. The objective is to construct a pier for the use of Oahu's commercial fishing vessels and to alleviate the present berthing shortage faced by Hawaii's fishing industry.

The construction of Pier 16 constitutes Phase II of the Department of Transportation, Harbors Division's (DOT-Harbors Division) project to increase berthing space for Oahu's fishing fleet. Phase I consisted of the construction of Pier 17 and a back-up area at Pier 18, a roadway connecting Piers 17 and 18 and the installation of water, electrical outlets, security lighting, telephone service and a sewage pump-out station. Phase II will involve dredging the project's existing harbor floor to a depth of -18 feet, the construction of Pier 16 and a roadway connection to Pier 17. The construction design is similar to that of Pier 17.

1.2 DESCRIPTION OF THE ENVIRONMENT

The project is located in a Conservation Zone. A Conservation District Use Application (CDUA) will be required for the work to be carried out. Honolulu Harbor, although designated as a Class A water, is already so impacted such that it is understood that it will never meet present water quality standards. Two streams which contribute much to the harbor's present condition are the Nuuanu and Kapalama Streams. Both streams are sources of various pollutants.

Air quality is good considering the nature of activities centered in the harbor. This is attributable to prevailing trade winds which tend to blow pollutants out to sea. Problems arise during "Kona" conditions when the wind pattern changes.

The terrestrial flora and fauna are sparse and are representative of the industrial environment of the project area. Marine biota, although more varied, is poorly developed because of the existing conditions of the harbor.

1.3 RELATIONSHIP TO EXISTING LAND USE PLANS AND POLICIES

The project is in conformance with the Hawaii State Plan and the City and County of Honolulu's General Plan. It will promote an atmosphere for the expansion of Hawaii's fishing industry and focus on the natural resources available.

The construction of Pier 16 has been stated as objectives of other plans and studies. Among these are the Hawaii Fisheries Development Plan, the Kewalo Basin Task Force and the DOT's Conceptual Planning Study for Honolulu Harbor.

1.4 PROBABLE IMPACTS

The major adverse impact will be upon the marine environment. Not only will water quality suffer, but marine biota will be adversely affected by the dredging operations. This is applicable not only to the harbor environment but also to the dredge disposal site. However, these impacts are expected to be temporary in nature. Recolonization is expected to follow previous post-dredging patterns thus establishing a benthic community similar to the existing one. During construction, noise levels will increase with the use of construction vehicles, and air quality in the immediate area is expected to be adversely impacted. Dispersion aided by the prevailing trade winds will limit the impact. Drivers using Nimitz Highway in the project area will suffer inconveniences due to movement of construction vehicles and materials.

Economic benefits will be realized by the construction industry, Hawaii's fishing industry and the people of the State. These benefits will result from both the construction and operation of the proposed project.

Special areas of concern are the impact of dredging on the nehu bait fish resource located within the harbor and the impact of dredge disposal at the South Oahu site on the humpback whale. However, according to the Environmental Protection Agency's "Final EIS for Hawaii Dredged Material Disposal Sites Designation," the South Oahu site is not frequently visited by the whales.

1.5 ADVERSE IMPACTS THAT CANNOT BE AVOIDED AND MITIGATION MEASURES

Construction and operation of the pier will have adverse impacts that cannot be avoided. These will affect air and water quality and marine biota. Various departmental regulations governing these areas will be complied with such that the full effect of these impacts may be mitigated. Dredging methods to minimize impact on marine habitat will also be considered.

Construction impacts will be temporary in nature lasting for the duration of the pier's construction. Operation impacts are expected to be longer lasting and may be considered permanent as long as the pier is in use.

1.6 ALTERNATIVES

A number of alternatives are considered but economic considerations and competing uses make them infeasible for the present.

1.7 UNRESOLVED ISSUES

At this time there are no unresolved issues regarding potential environmental impacts.

SECTION 2

DESCRIPTION OF THE PROPOSED ACTION

2.1 PROJECT OVERVIEW

2.1.1 Honolulu Harbor

Honolulu Harbor is the largest civil harbor in the State of Hawaii and is the only deep water port on Oahu. It is located in Mamala Bay on Oahu's southern coast and lies 5 miles northwest of Diamond Head (Figure 2-1). Approximately 2 miles in length, the harbor varies in width from 600 feet to 2,900 feet. Honolulu Harbor has been greatly altered and expanded from its original contour by the successive development and dredging of berthing areas into the natural shoreline and by the construction of various harbor related structures along the entire shoreline of the harbor. Originally the harbor was a channel in the reef resulting from the freshwater discharge from Nuuanu Stream. Honolulu Harbor has now grown to include:

- Fort Armstrong Channel: An entrance channel 500 feet wide, 4,000 feet long and 45 feet wide located on the east side of the harbor.

- Honolulu Harbor: The main harbor basin, which is 1,520 feet wide, 3,300 feet long and 40 feet deep.

- Kapalama Basin: A west harbor basin 1,000 feet wide, 3,400 feet long and 35 feet deep.

- Kapalama Channel: A connecting channel between the two basins. It is 1,000 feet narrowing to 600 feet wide, 3,400 feet long and 40 feet deep.

- A Slip: Located on the east side of Pier 39 in Kapalama Basin 100 feet long and 35 feet deep.

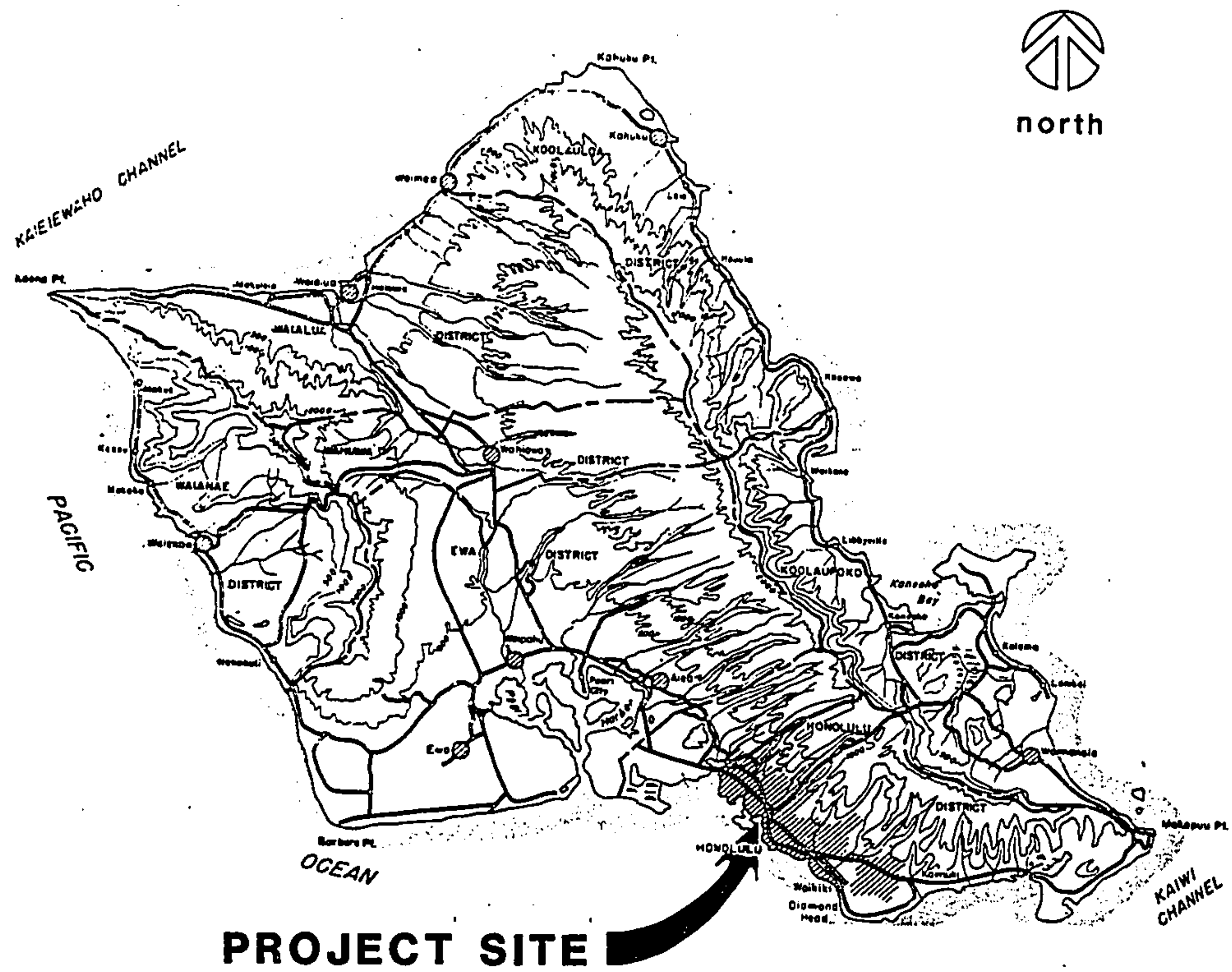


FIGURE 2-1

LOCATION MAP

- Kalihi Channel: A second entrance channel on the west end of the harbor extending 10,300 feet seaward from Kapalama Basin. It is 450 to 960 feet wide and 35 feet deep. It has an emergency turning basin in Keehi Lagoon.

In front of the harbor is Sand Island which was created by coral fill resulting from the construction dredging of Honolulu Harbor. A double-leaf bascule drawbridge across Kalihi Channel connects Sand Island with the City of Honolulu. Sand Island and the adjoining reefs shelter the harbor from the open sea making it a haven for ships.

2.1.2 Pier 16

The proposed pier is located along the Iwilei curve near the Salvation Army store (Figure 2-2). East of the harbor is the downtown district of the City of Honolulu which is the center of social, economic and political activities for the State. To the west is the harbor's industrial area where a variety of cargo traffic and other activities take place.

The construction of Pier 16 by the DOT-Harbors Division will supplement the berthing capabilities of the Kewalo Basin Annex in Honolulu Harbor. This annex includes Piers 15, 17 and 18. Pier 16 will enable Honolulu Harbor to better serve the local commercial fishing fleet and alleviate the present berthing shortage for its vessels.

The project is part of the DOT's plans as stated in its report "Conceptual Planning Study, Piers 2 Through 18, Honolulu Harbor." This study is directed to the better utilization of the State's waterfront property and the integration of the harbor with the downtown district. It also provides for present and future uses and related activities that will encourage more public use and activity. It includes the preparation of comprehensive short-range and long-range action plans, together with alternatives to guide the development of the waterfront between Piers 2 and 18.

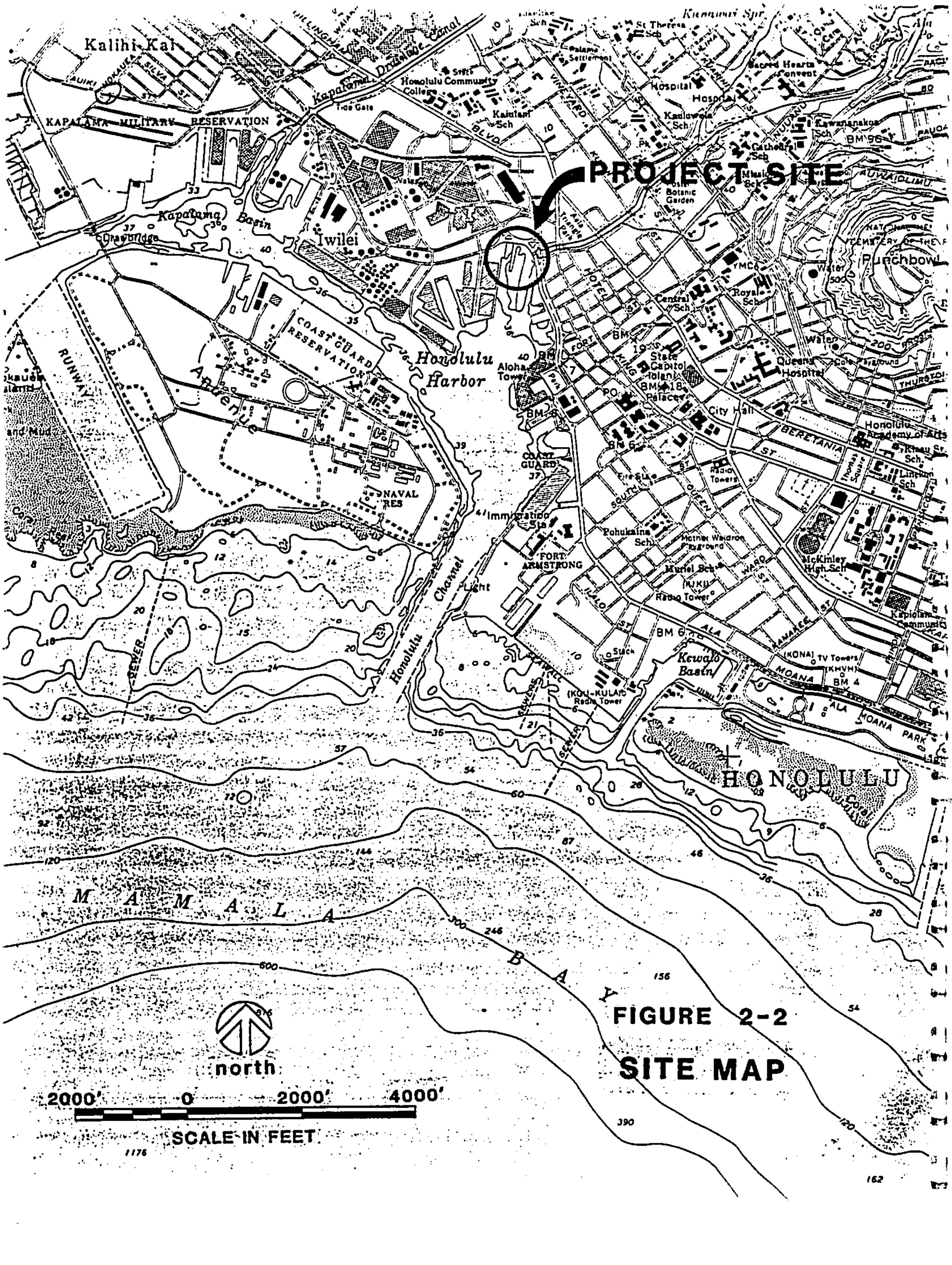


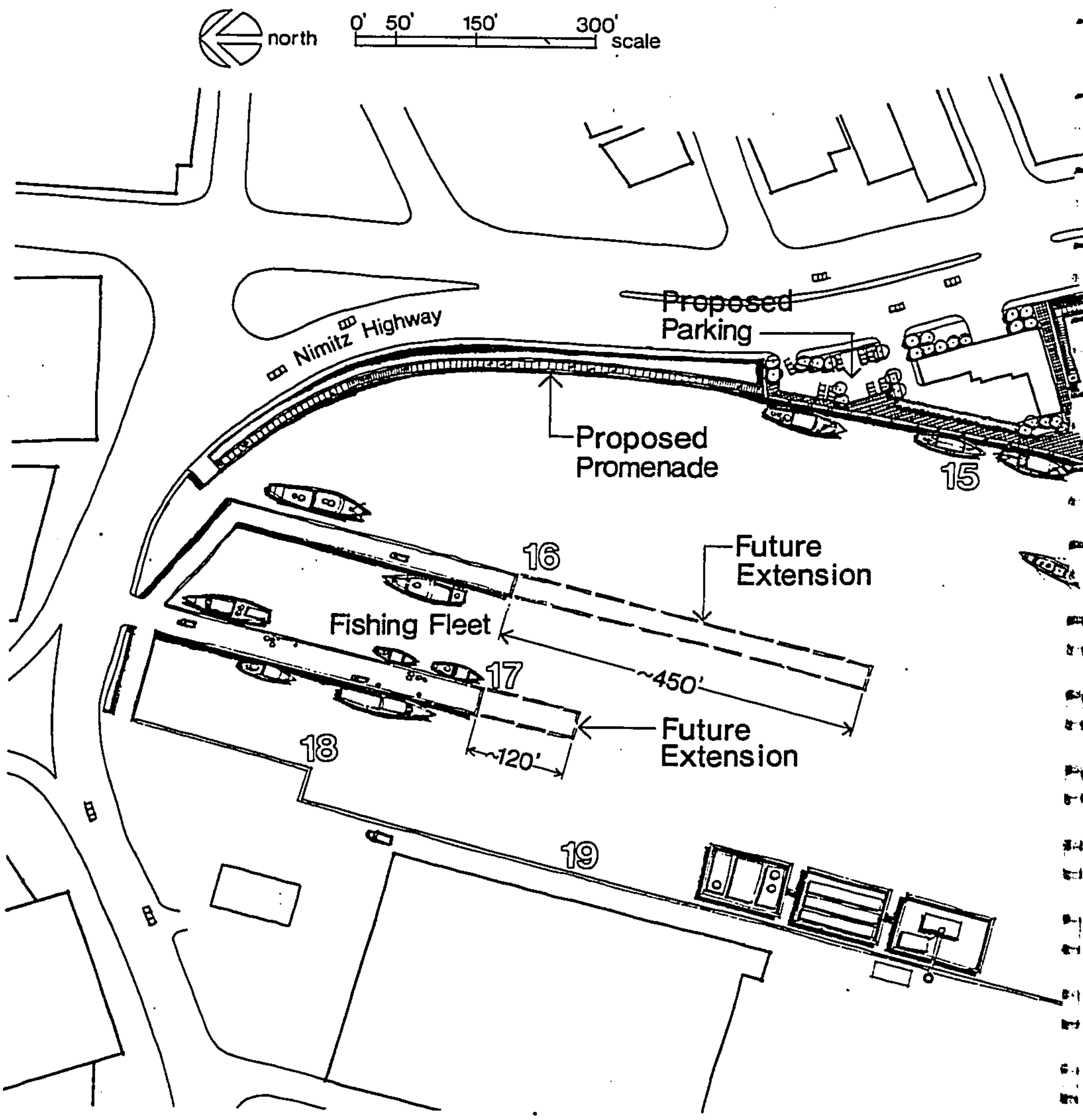
FIGURE 2-2

SITE MAP

Recommendations for the project area include the conversion of a building presently used as storage area by fishermen into an open waterfront market. Another alternative is its removal and use of the dock as waterfront open space.

Continued use of Piers 17 and 18 as an extension of Kewalo Basin by the commercial fishing fleet is supported by the study. At present both piers are used to capacity. Pier 18 also provides parking and services to Piers 17 and 19.

In accordance with the conceptual study, the DOT-Harbors Division is undertaking the construction of Pier 16 for the use of the commercial fishing fleet. Figure 2-3 shows the layout of the proposed pier in relation to existing facilities as visualized by the DOT's conceptual planning study. Although alternate plans were formulated for the remainder of the harbor, there were no alternate sites suggested for another commercial fishing pier. Separation of the commercial piers would entail duplicating facilities to accommodate the vessels. Future plans for Honolulu Harbor has designated Pier 37 for berthing commercial fishing vessels. However, these vessels will primarily be transients.



Reference: State of Hawaii
Department of Transportation
"Conceptual Planning Study
Piers 2 to 18, Honolulu Harbor"
September 1978

FIGURE 2-3

PROPOSED LAYOUT FOR PIER 16

2.2 PURPOSE AND NEED

The purpose for the construction of Pier 16 is to provide the local fishing fleet with additional berthing space for the fleet's vessels. The need for this pier is illustrated by the waiting list for commercial berths and in a profile of Hawaii's commercial fishing fleet.

Although the State as a whole has experienced economic growth, the local fishing industry has not kept pace. Ironically, an increase in the market for seafood has been met by foreign fleets utilizing Hawaii's offshore resources. In 1978, Governor George R. Ariyoshi and the State Legislature passed nine resolutions addressing fisheries issues. This was done in response to the industry's efforts to realize its potential as a viable component of Hawaii's economy.

Previous decades have seen the fishing industry as a static entity. In 1975, 9.5 million pounds of fish were landed for commercial use. Compared to 1900 when 6 million pounds were landed, this is not an appreciable increase. Immediately after World War II, the peak years of the fishing industry were realized with over 3,500 fishermen commercially operating full time. However, a few years later, a steady decline occurred until 1965 when the population of fishermen reached its lowest point. Recent years show an increase in the number of registered commercial fishing licenses and vessels, but these are inclusive of an increase in parttime and licensed recreational fisherman.

Although the fishing industry has experienced a decline in work force, the total catch has been maintained. In 1900, 6 million pounds of fish realized a market value of $1.1 million in today's currency. In 1940, 19.4 million pounds brought in $1.5 million. The 1978 catch of 13.4 million pounds of fish realized $12.2 million.

Today the fishing industry's future is viewed optimistically. In 1977, the local fishing fleet numbered 14 vessels, a drop from the 1948 fleet of 32. In 1979, 12 new vessels joined the fleet and 8 to 10 more were expected by mid-1980. In the past 2 years, almost $2 million have been invested in fish handling and processing facilities. The State has joined with the industry in pioneering a new albacore fishery north of Midway Island. The first year realized a catch of 4 million pounds. The State has also initiated a program for installing fish aggregating devices and is starting commercial feasibility surveys in the Leeward Islands. Nationally, a National Fisheries Policy which identifies fisheries development as a top priority has the White House endorsement.

The composition of Hawaii's fishing fleet has undergone a dramatic change. This change reflects the trend away from full-time commercial fishing. While the number of larger fishing vessels decreased in the 1950's and 60's, the number of smaller trailerable commercial boats increased substantially. In 1958, there were 200 of these trailer type fishing vessels. By 1978 they numbered 800. In the 1970's, the fishing fleet for the first time experienced a change for the better. A net increase in large vessels was effected. Between the years 1969 to 1975 the fleet lost 3 older vessels but gained 10 new ones ranging from 60 feet to 90 feet.

Kewalo Basin is home port for these vessels and with the construction of Pier 17 in 1977 it has accommodated the modest growth of the fleet. During the period after 1977, all available commercial fishing berths were filled to capacity. Funds were appropriated in 1974 for the design of Pier 16 but lapsed in 1979 without use. Today there is a waiting list for 88 commercial berths of which 35 are commercial fishing craft, while 41 are charter boats, 11 are cruise ships and 1 is classified as other (research).

By the middle of 1979, eight more fishing vessels of 65 feet or more joined the local fleet. The lack of dock space became critical when 4 trolling vessels arrived in September of 1979. This was after the first year of commercial albacore fishing at Midway Island. While the owners of these vessels wanted permanent berths in Honolulu, they were unable to secure them. November 1979 saw the construction or design of eight new vessels for the local fleet. These ranged in size from 65 feet to 180 feet. It was also anticipated that five more albacore trollers would choose to reside in Hawaii following the 1980 Midway fishery season. All owners have indicated a need to dock in Honolulu because of the major fisheries' marketing and support facilities centered here.

The present situation is one of all commercial dock space used to capacity with no berthing available for the 17 vessels that were scheduled to join the fleet in mid-1980. Of the 35 commercial fishing craft applicants on the waiting list, it is uncertain how many of these will purchase new vessels regardless of the lack of space. However, each new vessel will accent the lack of berthing space. Projected fleet growth indicates an additional 65 resident and 50 transient vessels joining the fleet by 1990. By the year 2000, total additions to the fleet are expected to be 105 resident and 80 transient vessels (Table 2-1). Most vessels can be nested two to four abreast, thereby decreasing the amount of absolute dock space needed. However, nesting will depend on dock location and type of vessel. Resident ships will be berthed two abreast while the transient albacore vessels will nest four deep.

The shortage of adequate dock space is a major constraint inhibiting the growth of the fishing industry. Another constraint is the high cost of wharf development. Indeed it is the single largest use of public funds in the development of the fishing industry. Planning for dock construction is a time-consuming process which may take up to 5 years for the design, acquisition of funds and approval of various permits. The issue of limited harbor space is a prime example of the competition for limited resources. Growth cannot only be limited to the fishing industry. Other special interest groups such as recreational, tour and charter boats also require the attention of the DOT.

The "Hawaii Fisheries Development Plan" published by the Department of Land and Natural Resources (DLNR) in 1979 has developed a scenario for the development of Oahu's Harbors. This scenario (Appendix A) includes the construction of Pier 16 as interim dock space. Its recommendation for

TABLE 2-1

PROJECTED FLEET GROWTH

Year	Resident Albacore	Multi-Purpose	Long-Line	Aku	Transient Albacore
1979	5 (65')	5 (75-125')	1 (65')	1 (75')	15 (65')
1980	5 (65')	3 (60-180')	-	-	15 (65')
1981	-	2 (65-80')	1 (80')	1 (85')	5 (65')
1982	5 (65')	2 (80')	-	2 (85')	5 (65')
1983	-	2 (80')	2 (80')	2 (85')	-
1984	5 (65')	2 (90')	-	2 (85')	5 (65')
1985	-	2 (80')	2 (80')	2 (85')	-
1986	-	-	-	2 (85')	-
1987	-	2 (80')	1 (80')	1 (85')	5 (65')
1988	-	-	-	1 (85')	-
1989	-	2 (80')	1 (80')	1 (85')	-
1990	-	-	-	-	-
Subtotal 1979-90	20 (65')	22 (80')	8 (80')	15 (85')	50 (65')
1995		10 (80')	5 (80')	5 (85')	15 (65')
2000		10 (80')	5 (80')	5 (85')	15 (65')
TOTAL	20	42	18	25	80

Source: Hawaii Fisheries Development Plan, Dept. of Land and Natural Resources, 1979.

long-range goals is the dedication of one or more major facilities which would accommodate the fleets growth for at least the next 20 years.

With the shortage of berthing space in mind the DOT is proceeding with its plans for Pier 16's construction. When completed, the pier will accommodate a minimum of 20 fishing vessels.

2.3 DESCRIPTION OF THE PROPOSED PROJECT

2.3.1 Site Selection

Pier 16 is part of a 2-phase project by the DOT to increase berthing facilities for Hawaii's commercial fishing fleet. The site was chosen because the space was available and for its proximity to fishing facilities at Kewalo Basin.

All harbor facilities on Oahu with the exception of Kewalo Basin and portions of Honolulu Harbor are oriented toward cargo traffic or recreational craft use of shoreline facilities. Kewalo Basin is the center of commercial fishing activity in Honolulu and of fish processing in Hawaii. The Hawaiian Tuna Packers Cannery, an ice plant, marine railway, the fish auction and several processing plants are all located at Kewalo Basin. The cannery processes 16,000 tons of fish a year thus playing an important role in the seafood industry.

At present, all available commercial dock space is utilized to capacity. Kewalo Basin berths approximately 150 "commercial" fishing vessels but this number includes many charter and cruise ships. Local ships are not the only users of berthing facilities. Transient vessels from the mainland's albacore fleet utilizes harbor space for approximately 2 weeks at a time. These vessels stopover in Honolulu before proceeding to their fishing grounds up north. The 1981 fishing season had at one time 3 rows of 5 transient vessels each berthed in Kewalo Basin. The local fleet uses the space for the remainder of the year. Space is not the only problem faced by the fishing fleet, size is also a constraint. The local fleet has 13 large (65 feet plus) vessels which include three crafts over 75 feet and two crafts over 100 feet all berthed at Kewalo. The berthing facilities at Kewalo Basin are not designed to handle boats of these sizes.

Piers 15, 17 and 18 in Honolulu Harbor are also used to capacity. Twenty-one vessels may be docked here. The area adjacent to Pier 17 was formerly occupied by a pier (16) which was demolished in the 1950's. This space is currently unutilized and available for development.

2.3.2 Project Description

2.3.2.1 General

Pier 16 will be located in Honolulu Harbor parallel to Pier 17. It will be constructed approximately 140 feet east of Pier 17 and will be 377 feet long and 20 feet wide. The new pier will be connected to Pier 17 by a 150-foot long by 24-foot wide ramp. Construction will consist of prestressed double tees with concrete topping supported by concrete piles spaced at 12 feet on centers. To accommodate the draft of the fishing vessels, the area surrounding the pier will be dredged to a depth of -18 feet. Facilities will include water, electricity and telephone services. The pier is designed to accommodate 20 vessels. The conceptual study put out by the DOT recommends that Pier 18 continue to be used as a parking and access area for Piers 16 through 18 and also as a net drying and support area for the fishing fleet.

It is estimated that the construction of Pier 16 will cost the State approximately $2.0 million. Construction is scheduled to begin around mid-1983 and will take about 12 months to complete.

2.3.2.2 Dredging

The present depth of the harbor floor in the project area ranges from -1.0 along the highway wall near Pier 17 to about -36.0 between Piers 17 and 18. Depths within the project limits vary from -3.4 at the highway end to -14.2.

To accommodate the draft of the fishing vessels it is proposed that the site be dredged to a depth of -18 feet which will take approximately 3 months to complete and will involve 65,000 cubic yards of material to be removed. This information is based on a topographic and hydrographic survey done in August 1981.

A. Dredging Methods

There are a variety of methods that are available for dredging. They are classified as mechanically operated and hydraulically operated dredgers. Mechanical dredges consist of the grapple dredge, the dipper dredge and the bucket ladder dredge. The grapple dredge is a derrick mounted on a barge and equipped with a "clamshell" bucket. Best use of this dredge is in soft underwater deposits. The dipper dredge is a counterpart of the land-based mechanical excavating shovel. It is best suited for hard compact material or rock because of its great leverage and "crowding" action. The bucket-ladder dredge is basically an endless chain of buckets that each digs its own load and carries it to the surface. Since it is a continuous operation, it is more efficient than either the grapple or dipper dredges.

All three dredges mentioned above are characterized by an inability to transport the dredged materials for long distances, lack of self-propulsion and relatively low production. The chief advantage to these machines is their ability to operate in restricted locations such as docks and jetties.

Hydraulic dredges include the dustpan dredge, hydraulic pipeline cutterhead dredge and the self-propelled hopper dredge. The dustpan dredge is named because its suction head resembles a large vacuum cleaner or dustpan. It is a hydraulic plain suction self-propelled dredge and works best for use with high volume, soft material dredging. This is because of its lack of a cutterhead. It operates by agitating and mixing the dredge material with high velocity water jets and sucks the mixture to the surface. Disposal is done through a floating pipeline through which the material is pumped to a disposal site. Dustpan dredging is principally used in the dredging of river channels. The hydraulic pipeline cutterhead dredge can efficiently dredge and pump all types of alluvial materials and impacted deposits such as clay and hardpan. The larger dredges of this type are used to dredge rock-like formations such as coral and the softer types of basalt and limestone without blasting. This capability is accomplished by the presence of a rotating cutter attached to the intake end of the suction pipe.

Recent years have brought to surface environmental concerns with regard to the use of the cutterhead method of dredging. This has gone so far as to cause rejection of permits or work stoppage. Its original design was developed to loosen densely packed deposits and eventually cut through soft rock. It has also been applied to dredging silt, clay or fine sand. In these cases the rotation of the cutter produces a sediment cloud and increases the possible environmental impact. Use of a hooded shield can reduce this impact.

The hopper dredge is a sea-going vessel which utilizes dragheads. Material excavated is pumped through the dragarm to hoppers aboard the ship. Excess water is passed overboard through overflow troughs. Once the hoppers are filled, the vessel proceeds to the dredge disposal site, empties the hopper through bottom doors and returns to the excavation site to repeat the cycle. This type of dredge is used for maintenance work and improvements in exposed harbors and waterways where traffic and operating conditions rule out the use of stationary dredges.

The most preferred method of dredging would be a hydraulic pipeline cutterhead dredge. This method, utilizing a hooded shield would have the least impact especially in regard to sediment dispersion. However, the use of this type of dredge entails the use of a pipeline for removal of the dredged material to another site. This would either be another site within the harbor or to a dewatering pond located on land. There are no sites available within operating distance for storage while water is evaporated from the dredged material. Additionally, the odor from dead organisms and detritus would, after a few days, become objectionable causing a degradation to the existing surroundings which include the downtown district.

The other two methods of hydraulic dredging are both infeasible in that one is basically designed for river channels and both operate by continuously moving over the area that requires dredging.

Of the three mechanical dredging methods, the grapple dredge appears the most feasible. It can operate in a restricted space and further is designed for dredging the soft underwater deposits that are anticipated. Both the dipper and the bucket-ladder dredges are not available for use in Hawaii.

2.3.2.3 Scope of Planned Development Activity

The construction time for Pier 16 is expected to take approximately one year to complete. This will involve approximately 3 months for dredging and 9 months for the construction of the pier itself.

2.3.2.4 Project Cost Estimates

The following is an estimated breakdown of costs of the construction:

Structural Construction	$ 830,000
Dredging (65,000 cy @ $9)	585,000
Electrical and Telephone	200,000
Miscellaneous	60,000
Subtotal	$1,675,000
Contingency (10%)	167,500
TOTAL	$1,842,500* SAY $2 million

*reflects 1981 construction costs

2.3.3 Pier Description

Pier 16, when completed, will be 377 feet long and 20 feet wide. It will be supported by 16-1/2-inch octagonal prestressed concrete piles placed at 12 feet on centers. A batter pile will be placed at every fourth pile.

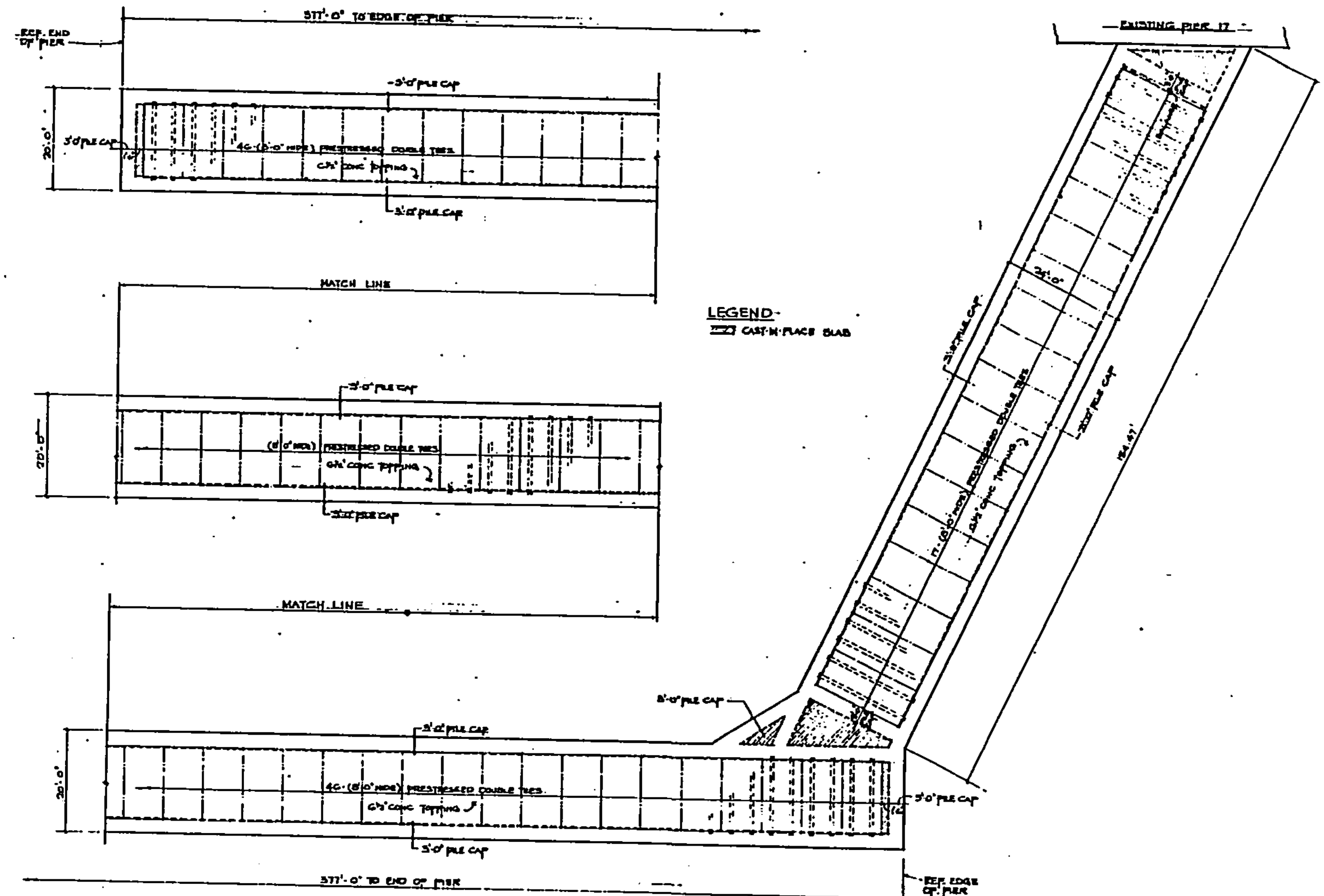
The top of the pier will be constructed with a 6-1/2-inch concrete topping placed on 16-1/2-inch prestressed double tees placed 8 feet on centers. Bull rails will be placed along the edges of the pier top and tire fenders along the sides of the pier (Figures 2-4 and 2-5).

2.3.4 Road Description

The roadway will be constructed in the same manner as the pier. It will be approximately 154 feet long and 24 feet wide. Connections to the existing and proposed piers will be of cast-in-place concrete slabs (Figure 2-4).

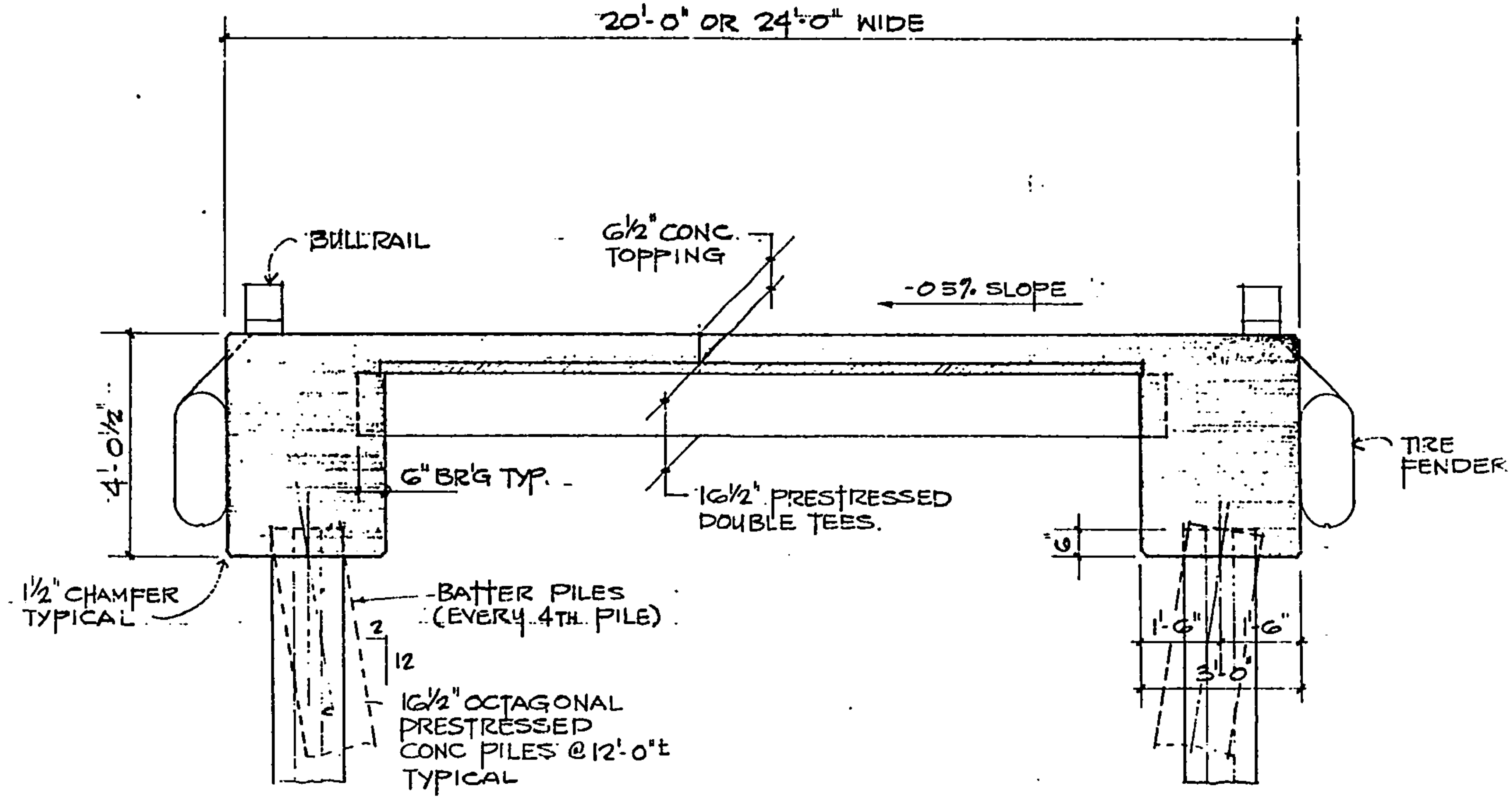
2.3.5 Utilities Description

Water and electricity will be made available to the fishing vessels. A telephone exists at the highway end of Pier 17. A sewage pump-out station is also available.



Reference: Preliminary DOT-Harbors Division plans for "Commercial Fishing Vessel Berthing Area - Pier 16" prepared by Nishimoto, Oki and Santo, Inc.

FIGURE 2-4
PIER 16
DECK FRAMING PLAN



Reference: Preliminary DOT-Harbors Division plans for "Commercial Fishing Vessel Berthing Area - Pier 16" prepared by Nishimoto, Oki and Santo, Inc.

FIGURE 2-5

TYPICAL CROSS SECTION

SECTION 3
DESCRIPTION OF THE ENVIRONMENTAL SETTING

In order to evaluate the impact of the project on the environment, a research of available studies and reports was conducted. Although recent data for the area is limited, the available data gives a general idea of the existing conditions. Additional research was conducted to determine the potential impact of dredged materials on marine flora and fauna and a foundation investigation of the harbor floor at the proposed site was performed.

3.1 GENERAL SITE DESCRIPTION

The proposed pier is located on the harbor side of the Iwilei curve near the Salvation Army Store. This area is dominated by light industry and therefore, little exists in the way of terrestrial flora and fauna. Due to heavy siltation discharged by Nuuanu and Kapalama Streams, the benthic zone in Honolulu Harbor is poorly developed.

In accordance with Chapter 37A, Department of Health, Public Health Regulations, Water Quality Standards the harbor waters are designated as Class A. There is little danger from natural hazards such as tsunamis and floods due to the protection of the harbor interior by Sand Island and flood control projects.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Geology

The Hawaiian Archipelago lies mid-Pacific in the Tropic of Cancer stretching 1,500 miles from point to point. This chain of islands includes Kure Island at the northwestern end to the Island of Hawaii in the southeast. Hawaii is geologically the youngest and largest island and is still in its growing stage. The archipelago is composed of the exposed summits of an undersea mountain range that have been built up through volcanic activity. Elevations vary from a few feet above sea level among the older northwestern islands to 13,800 feet in the southeastern isles. The eight major islands lie in the southerly portion. Among these, Oahu is the third largest.

The Island of Oahu was formed by the merging of two great basaltic shield volcanoes. Today, the volcanoes are known as the Waianae and Koolau Ranges and are connected by the Schofield Plateau. The Waianae Range is the older of the two deeply eroded volcanoes and forms the western half of the island. Stretching some 22 miles, the Waianaes form a bow-shaped mountain range averaging 3,000 feet in elevation. The highest peak is Mt. Kaala which rises 4,025 feet and is the highest point of the island.

The younger Koolau Range extends in a nearly straight northwest to southeast line for 37 miles. The peaks of this range average approximately 2,500 feet in elevation. The highest point is Puu Konahuanui which overlooks both the Nuuanu and Manoa Valleys in Honolulu. The elevation of this peak is 3,105 feet above sea level.

Honolulu Harbor is located on a narrow coastal plain situated on Oahu's south central coast. Geologically known as the Honolulu Plain, this area is composed of an elevated coral reef covered with alluvium washed down from the Koolau Range. This reef is a relict of a period when the sea level was 25 feet higher than the sea level today. The changes in sea level has resulted in the interbedding of coral and alluvial deposits on the coastline. These deposits overlay the original Koolau series basalt.

Between the basalt base and sedimentary layers is the caprock, a zone of low permeability extending approximately 800-900 feet below sea level along the coastline. This caprock prevents the seaward movement of potable water into the basaltic aquifer.

Elevation of the plain ranges from 0 to 10 feet above sea level. Prior to the development of the harbor area to its present condition, the area was composed of submerged coral reefs, mudflats and small islands of varying shapes and elevations.

The submergence and emergence of the island has influenced the physical and hydrologic character of Mamala Bay.

3.2.2 Climate

Hawaii's mild and equable climate results from waters originating in the Bering Sea. These cool waters cause the ocean around the islands to be 10°F lower than that of other regions in the same latitude and also act to decrease large temperature swings. The islands lie in the northern fringe of the Tropic of Cancer placing them within the belt of northeasterly trade winds which persist for the major part of the year. These "trades" are occasionally interrupted by southerly or "Kona" winds.

Hawaii's seasons are essentially summer and winter. Summer months are from May to October when the weather is warm and dry (70-88°F) and the "trades" are most persistent. Winter months are from November to April. The temperature is cool, 65-83°F, and "Kona" conditions frequent the islands.

The average temperature on Oahu's lowlands is 75°F. With each 1,000-foot increase in elevation, a decrease of 4°F in temperature is effected. The warmest month of the year is August when the temperature averages 78°F. The coldest is January when the average temperature is about 75°F. The Waianae District holds a record high of 96°F; however, the temperature rarely exceeds 90°F. The coldest recorded temperatures hover around 50°F.

On Oahu, the trade winds are prevalent for 90 percent of the time between May to October. From November to April the "trades" drop in frequency to about 50 percent. Although the "winter" season brings intense rains that may cause localized flash flooding, severe weather is uncommon. Thunderstorms are infrequent and usually mild. Few tropical cyclones have struck the island since 1950.

The climate, relative to the Honolulu Harbor area, is typical of the leeward coastal lowlands of Oahu. This climate is characterized by abundant sunshine, persistent northeasterly trades, equable temperatures and moderate humidity. Trade winds are predominant for 65 percent of the year and velocities range from 8 to 18 mph. Rainfall in this area is low, averaging only 20-25 inches per year, but monthly variations are considerable.

The harbor is fairly well sheltered from northerly winds but is exposed to westerly, northwesterly and southwesterly winds. These winds are especially strong during winter storms. Sand Island acts as a bulwark against westerly and southerly winds so the main harbor basins are protected. However, both the Kalihi and Fort Armstrong entrance channels are exposed.

3.2.3 Air Quality

Honolulu Harbor is located within the Greater Honolulu Air Basin. This basin extends from the coastline toward the inland divide across the Schofield Saddle and from the Waianae Range to Diamond Head.

For the greater part of the year, Hawaii's trade winds carry pollutants from the land out towards sea. This is responsible for the generally good air quality that the islands experience. Localized problems may occur during periods of "Kona" weather or in areas of intense industry or vehicular traffic.

The existing ambient air quality at the Pier 16 project site is generally good because of the predominating "trades" which blow pollutants out to sea. Air pollution problems may occur during times of "Kona" winds which reverses wind direction. The problems are usually localized and occur most often during the winter months. Other pollution conditions which give rise for concern are areas of intense industrial development or along heavily utilized vehicle corridors.

The industrial nature, in the vicinity of the proposed pier, causes air pollution to be of a greater concern. Primary pollutant concerns are carbon monoxide and particulate matter. State air quality stations in the vicinity of the project are located in the Department of Health Building, Kalihi-Kai and Sand Island. As seen on Table 3-1, the mean ambient air quality at all three stations were well within Hawaii Air Quality Standards as presented by Chapter 42 of the Public Health Regulations. The only month that exceeded standards was August when one hundred four micrograms per cubic meter (ug/m^3) was registered. This was 4 ug/m^3 over established standards and represents an extreme condition. Levels returned to normal the following month.

3.2.4 Water Quality

The waters of Honolulu Harbor have been designated by the Department of Health (DOH) as Class A waters under Section 6, Chapter 37A of the DOH Public Regulations. Class A waters are to be protected for "recreational purposes and aesthetic enjoyment."

"Any other use shall be permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. Such waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class. No new industrial or sewage discharges will be permitted within embayments." The basic water quality criteria in Chapter 37A which is applicable to all waters further states, "All waters shall be free of substances attributable to domestic, industrial, or other controllable

TABLE 3-1

SUMMARY OF RANGE AND MEAN OF 24-HOUR CONCENTRATIONS OF SPECIFIED CONTAMINANTS FOR 1981
(Micrograms Per Cubic Meter)

Month	Contaminant	HONOLULU-DOH Range	HONOLULU-DOH Mean	KALIHI-KAI Range	KALIHI-KAI Mean	SAND ISLAND Range	SAND ISLAND Mean
JANUARY	Particulates	24-46	39	48-66	58	--	--
	Sulfur Dioxide	<5-29	12	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	20-61	40
	Nitrogen Dioxide*	--	--	--	--	--	--
FEBRUARY	Particulates8	32-69	41	45-93	71	--	--
	Sulfur Dioxide	10-23	16	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	10-61	27
	Nitrogen Dioxide*	--	--	--	--	6-68	38
MARCH	Particulates	31-44	36	36-66	52	--	--
	Sulfur Dioxide	<5-32	19	<5- 8	5	--	--
	Oxidants*	--	--	--	--	27-65	42
	Nitrogen Dioxide*	--	--	--	--	6-77	24
APRIL	Particulates	30-41	37	38-76	59	--	--
	Sulfur Dioxide	8-44	27	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	31-59	49
	Nitrogen Dioxide*	--	--	--	--	--	--
MAY	Particulates	32-38	36	35-56	49	--	--
	Sulfur Dioxide	15-22	19	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	10-86	48
	Nitrogen Dioxide*	--	--	--	--	--	--
JUNE	Particulates	--	--	40-52	47	--	--
	Sulfur Dioxide	--	--	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	10-63	34
	Nitrogen Dioxide*	--	--	--	--	--	--
JULY	Particulates	--	--	46-60	52	--	--
	Sulfur Dioxide	--	--	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	22-63	34
	Nitrogen Dioxide*	--	--	--	--	--	--

TABLE 3-1 - Continued

Month	Contaminant	HONOLULU-DOH Range	HONOLULU-DOH Mean	KALIHI-KAI Range	KALIHI-KAI Mean	SAND ISLAND Range	SAND ISLAND Mean
AUGUST	Particulates	--	--	45-54	49	--	--
	Sulfur Dioxide	--	--	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	10-104	33
	Nitrogen Dioxide*	--	--	--	--	--	--
SEPTEMBER	Particulates	--	--	34-52	43	--	--
	Sulfur Dioxide	--	--	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	10-55	24
	Nitrogen Dioxide*	--	--	--	--	--	--
OCTOBER	Particulates	23-34	29	32-48	37	--	--
	Sulfur Dioxide	10-34	19	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	22-88	36
	Nitrogen Dioxide*	--	--	--	--	--	--
NOVEMBER	Particulates	35-75	54	38-84	56	--	--
	Sulfur Dioxide	15-32	22	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	22-76	37
	Nitrogen Dioxide*	--	--	--	--	--	--
DECEMBER	Particulates	29-54	38	34-92	62	--	--
	Sulfur Dioxide	5-22	16	<5-<5	<5	--	--
	Oxidants*	--	--	--	--	10-47	32
	Nitrogen Dioxide*	--	--	--	--	--	--

*Maximum hourly average concentration in micrograms per cubic meter.

Hawaii Air Quality Standards

Particulates - 100 ug/m³
Surfur Dioxide - 80 ug/m³
Oxidants - 100 ug/m³
Nitrogen Dioxide - 150 ug/m³

Source: Department of Health
State of Hawaii

sources of pollutants and subject to verification by monitoring as may be prescribed by the Director of Health." The specific water quality criteria related to embayments is shown on Table 3-2.

Because the harbor receives runoff from Kapalama Channel, Nuuanu Stream, various drainage pipes and other pollution sources, the quality of the harbor water is poor when compared to the standards set for Class A. The pollutants received by the harbor are also accountable for the poor water clarity and visibility.

Section 303(e) of Public Law 92-500 of the Federal Water Pollution Control Act Amendments of 1972 states that the coastal waters of Hawaii are divided into water quality segments and effluent limitation segments. Honolulu Harbor is situated in the Keehi portion of the Mamala Bay Water Quality Segment. This portion encompasses the area from Fort Armstrong to Ahua Point. This designation indicates that the water quality within this segment does not meet existing water quality standards and is not expected to even after effluent limitation requirements are applied.

Before Kalihi Channel was dredged in the 1950's, stagnation within the harbor was a problem. The opening of this channel restored the original circulation pattern of the harbor waters. Reestablishment of this circulation now results in a good clean-out, alleviating the stagnation problem of previous decades. Even so, the water quality of the harbor falls below that set for its designated classes.

The influx of fresh water from the two streams also creates a two-layered water system with the less dense fresh water floating on the denser sea water. This causes the surface layer of the harbor waters to become more turbid than the bottom layers thus adding to the poor water quality of the harbor.

TABLE 3-2

SPECIFIC CRITERIA FOR EMBAYMENTS

(Note that criteria for embayments differ based on fresh water inflow.)

Parameter	Geometric Mean Not to Exceed the Given Value	Not to Exceed the Given Value More than 10% of the Time	Not to Exceed the Given Value
Total Kjeldahl Nitrogen (ug N/l)	200.00* 150.00**	350.00* 250.00**	500.00* 350.00**
Ammonia Nitrogen (ug NH_4-N/l)	6.00* 3.50**	13.00* 8.50**	20.00* 15.00**
Nitrate & Nitrite Nitrogen (ug (NO_3 +NO_2)-N/l)	8.00* 5.00**	20.00* 14.00**	35.00* 25.00**
Orthophosphate Phosphorus (ug PO_4-P/l)	10.00* 7.00**	25.00* 12.00**	40.00* 17.00**
Total Phosphorus (ug P/l)	25.00* 20.00**	50.00* 40.00**	75.00** 60.00**
Light Extinction Coefficient (k units)	0.40* 0.15**	0.80* 0.35**	1.20* 0.60**
Chlorophyll <u>a</u> (ug/l)	1.50* 0.50**	4.50* 1.50**	8.50* 3.0**
Turbidity (Nephelometric Turbidity Units)	1.50* 0.40**	3.0* 1.00**	5.0* 1.50**
Non-Filtrable Residue (ug/l)	25,000.00* 15,000.00**	40,000.00* 25,000.00**	50,000.00* 35,000.00**

*"Wet" criteria apply when the average fresh water inflow from the land equals or exceeds 1 percent of the embayment volume per day.

**"Dry" criteria apply when the average fresh water inflow from the land is less than 1 percent of the embayment volume per day.

Applicable to both "wet" and "dry" conditions:

pH Units shall not deviate more than 0.5 units from a value of 8.1.

Dissolved Oxygen - Note less than 75 percent saturation.

Temperature - Shall not vary more than 1°C from ambient conditions.

Salinity (ppm) - Shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

Water quality data is not available for the immediate project area. However, available data from nearby areas and previous studies indicate that coliform levels were in excess of standards set for Class A and Class B waters (Table 3-3). The waters of the Kalihi Channel and Kapalama Stream mouth do not meet the coliform criteria set for Class A waters. Kalihi Channel, Kapalama Drainage Canal and the vicinity of the Nuuanu Stream mouth were in excess of coliform standards set for Class B waters. Coliform levels for the main harbor entrance however was low and within Class B criteria.

Earlier studies also show that salinity in the harbor averaged approximately 34 parts per thousand. Dissolved oxygen levels were near saturation throughout the harbor. Nutrient levels were generally low within the harbor but high at the mouths of Nuuanu Stream and the Kapalama Drainage Canal.

Data from Pier 11 obtained during DOH sampling studies from January 1973 to October 1975 show a high concentration of coliform in the area. Table 3-3 shows coliform levels far in excess of Class B standards. Assuming the same levels apply to the Pier 16 project area, the water quality falls short of DOH standards. The possibility exists that levels may be even higher than Pier 11 since Nuuanu Stream contributes flow to the Pier 16 area.

3.2.5 Pollution Sources

Used as a port-of-call since the late 1700's, Honolulu Harbor has since been the recipient of a number of pollution sources. From the harbors earliest beginnings, sailing ships used the harbor as a dumping ground for refuse and bilge waters. Today, pollution is contributed by input from storm drains, effluent and hot sea water from the HECO electric power plant. Intensive use of the harbor adds oil and other wastes directly to the waters. Oil slicks are also not an uncommon occurrence. Sewage and galley wastes from ships in the harbor also contribute to harbor pollution.

TABLE 3-3

WATER QUALITY DATA FOR PIER 11 IN HONOLULU HARBOR
(Mean Data From the Period January 1973 to December 1975)

Determination	Units	Level
Total Coliform	/100 ml	3941.32
Fecal Coliform	/100 ml	1671.13
pH	SU	8.03410
Total Phosphorus	mg/l P	0.029314
Total Nitrogen	mg/l	0.234666
Total Kjeldahl	mg/l	0.213437
$NO_2 + NO_3$	mg/l	0.013333
Dissolved Oxygen	mg/l	6.27142
Temperature	Centigrade	26.2571
Turbidity	Hach FTO	1.88000

SOURCE: Department of Health

Other than harbor related sources, both Kapalama Canal and Nuuanu Stream with its tributary Pauoa Stream, add their share of harbor pollution. These two streams are sources of organic matter, pollutants and nutrients, industrial waste and urban runoff picked up during their courses through residential and business districts of Honolulu. During periods of high rainfall, trash and debris also enter the harbor.

The most noticeable pollutants in the harbor are oil, debris and silt. Sedimentation is a primary concern with major sources being the tributary streams which feed into the harbor. The sediments from these streams accumulate both on the harbor floor and near the stream mouths, contributing significantly to silting and shoaling. The influx of sediments and other pollution sources have resulted in the generally poor quality of the harbors waters.

In 1972, gradation analysis of bottom sediments indicated a high percentage of land-derived silty clays and a small percentage of sand. Because of a lack of studies, data is not readily available on the amount of sediment that can be attributed to stream discharge. However, approximately 200,000 cubic yards of bottom sediment are removed every five years during periodic maintenance dredging.

3.2.6 Hydrology

The geologic sequence of submergence and emergence of Oahu's coastline has influenced the physical and hydrologic character of Mamala Bay. The changes in sea level resulted in the interbedding of coral and sediment deposits on the leeward coast. These layers are laid over the original Koolau series basalt. Between the sedimentary layers and basalt is an interface of low permeability known as the caprock. This caprock extends approximately 800 to 900 feet below sea level along the coast and decreases in thickness inland. It functions to prevent the seaward movement of potable water in the basaltic aquifer.

Honolulu Harbor's location on the south coast of Oahu makes it highly susceptible to wave attacks from the southerly direction. The effect of the southerly waves on the harbor interior is mitigated by Sand Island. However, both entrance channels are still exposed to these waves and experience rough waters. The southeast side of the main harbor basin is subject to light to moderate surge when southwesterly or storm waves enter the Fort Armstrong channel.

Two freshwater streams discharge into Honolulu Harbor. Kapalama Stream flows into Kapalama Basin; Nuuanu Stream flows into the main harbor basin. Nuuanu Stream originates in the Koolau Forest Reserve in Nuuanu Valley and flows through residential and business districts before finally discharging into the harbor. At the lowest gaging station on Nuuanu Stream (631-foot elevation), the flow was recorded at 5 million gallons per day (mgd). Water reservoirs along the course help to stabilize the flow. Flood flows, lowland springs and seepage all add to the mean discharge via the channelized Nuuanu estuary. The discharge is quite small.

Kapalama Stream is not a perennial stream and like Nuuanu Stream has a low mean flow. The section entering into the harbor is part of a flood control project and is known as the Kapalama Drainage Canal. In addition to flood waters, the Kapalama Canal transports effluent and cooling water from the Honolulu Gas Company and urban runoff from adjacent industrial and residential areas.

The circulation of harbor waters has not been studied in any great detail. However, the limited available data indicate that the double entry configuration results in a fairly good exchange of waters. This may also contribute to the absence of serious circulation problems within the harbor. Thermal studies performed by HECO estimate the harbor's flushing time is approximately 6 hours. Fresh water from Kapalama Canal, Nuuanu Stream, ditches and storm drains create an outflowing layer above the harbor's sea water. These surface currents are dependent on wind conditions and topography of the shoreline. Movement of tidal currents is generally in a clockwise direction during flood tides and counter-clockwise during ebb tides. These tidal currents are the predominant currents and play a major role in the flushing characteristics of the harbor.

The mean sea level recorded for Honolulu Harbor is 0.8 feet. Tidal range is from 1.3 feet below mean lower low water (MLLW) to 3.5 feet above MLLW. The mean tidal range between MLLW and mean higher high water (MHHW) is 1.9 feet. The maximum extreme tidal range is 4.8 feet.

3.2.7 Flood Control

Honolulu Harbor is designated as a Zone C area according to the National Flood Insurance Program. This zoning indicates it is an area of minimal flooding. Although two streams, the Nuuanu Stream and Kapalama Drainage Canal, empty into the harbor, there is little danger as a result of flood control projects.

3.2.8 Tsunami

According to Civil Defense Tsunami Inundation Maps, Honolulu Harbor's interior, especially around Fort Armstrong, is within the inundation zone (Figure 3-1). This includes the area inland up to the Ala Moana Boulevard and about 1,500 feet of Sand Island's seaward southeast coast. It should be noted that the predicted maximum rise within the harbor is 4 feet and water currents could be strong.

Historically, Honolulu Harbor has not been subject to severe damage from tsunami wave actions. Danger from tsunamis is mitigated by the presence of Sand Island and the formation of coral reefs outside the harbor. Both of these formations lessen the impact of any tsunamis which may hit the

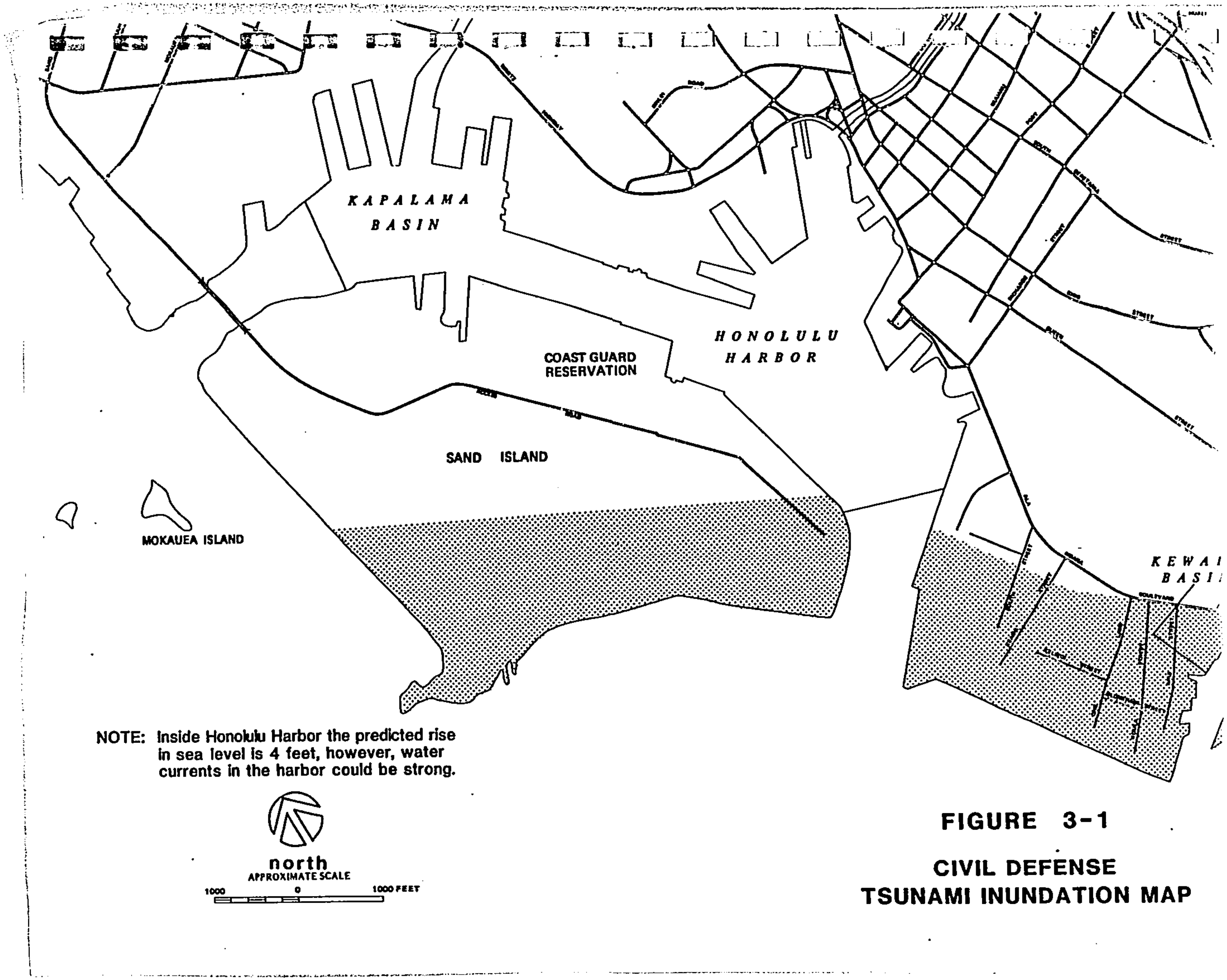


FIGURE 3-1

CIVIL DEFENSE
TSUNAMI INUNDATION MAP

harbor. Most tsunamis that have affected Honolulu Harbor have been relatively small. The 1960 tsunami had the greatest recorded range at 10 feet. There is however the possibility that a more severe tsunami can occur. Emergency procedures have been developed for the evacuation of all ships from the harbor prior to the estimated time of arrival of a tsunami wave.

3.2.9 Sediment Analysis

Samples of sediment from the harbor analyzed by the University of Hawaii's Department of Agronomy indicate a high concentration of montmorillonite (a high shrink-swell clay) and traces of halloysitic kaolin (a shrink-swell clay), crisbolite (S_1O_3 - biological origin), gibbsite ($Al(OH)_3$), carbonates calcite, argonite and calcium carbonate silicate hydrate (present in marine organisms). These are minerals commonly found in Hawaiian soils indicative of weathered basalt and marine organisms which have died and settled to the bottom.

A foundation investigation performed in September 1981 by Ernest K. Hirata & Associates, Inc., for the project gave the following results: "...exploratory boring encountered a loose layer of dark gray silty sand with gravels, approximately 8 feet thick. Underlying the silty sand is a dark gray organic clayey silt with mixtures of sand, gravel, and shell fragments. The clayey silt stratum is in a soft to firm condition and grades to a medium stiff condition at an approximate elevation of -54.

At an elevation of approximately -113, a stratum of sandy silt with boulders and cobbles was encountered. The stratum is in a medium dense to dense condition. Hard, slightly fractured basalt with weathered seams was encountered at elevation -128.5 down to the maximum depth drilled."

Studies performed by the Navy in Pearl Harbor may give a indication of the character of heavy metals which may exist in a marine environment. Data collected seemed to suggest that cadmium, lead, mercury and zinc from natural or manmade sources are trapped in harbor sediments. Manganese and iron, together with sediments, pass through the harbor into the ocean. The retention of the first group of materials are caused by clays which flocculate in a saline environment and remove heavy metals and other materials from the water and trap them in the sediments.

The lack of a thriving benthic community may be attributed to a high concentration of heavy metals. A relationship seems to exist between total heavy metal concentration and biological quality. High concentrations of metal produce an unfavorable condition which were found to be associated with a low number of species and organisms. Conversely, a high quantity of species and organisms is found in an environment with a favorable lower metal concentration.

A bioassay (Appendix B) for the project was performed by Dr. James P. Szyper of the Oceanic Institute to analyze the sediments that are to be disposed of at the South Oahu disposal site. Test results showed that there was "no evidence of significant toxicity to planktonic animals (Artemia), fishes (mullet), or bottom-dwellers (shrimp) due to exposure to dissolved substances and fine suspended matter from the sediments to be dredged."

As part of the bioassay, bioaccumulation tests were performed on the tissues of clams (Tapes japonica (philippinarum)) for eleven substances to assess the potential for accumulation of eleven toxicants in benthic animals at the disposal site. The report summarized that "Ten of the substances (cadmium, chromium, copper, lead, mercury, DDT, dieldrin, mirex, polychlorinated biphenyls, and petroleum hydrocarbons) failed to accumulate to a statistically significant degree in the tissues of the clams during ten day's exposure to test sediments following inundation. DDE, a persistent degradation product of DDT (which was not itself detected in any tissues), showed statistically significant accumulation in clam tissue. Because studies of the disposal site show that little disposed sediment actually reaches the bottom, the real-world potential for DDE accumulation remains open to question, based solely on these tests and present knowledge of the site."

According to the Federal Register "The available data for DDE indicates that acute toxicity to saltwater aquatic life occurs at concentrations as low as 14 ug/l and would occur at lower concentrations among species that are more sensitive than those tested. No data are available concerning the chronic toxicity of DDE to sensitive saltwater aquatic life."

The bioaccumulation test results on the clam, Tapes, japonica for DDE ranged from 49 ppm (49,000 ug/l) to 89 ppm (89,000 ug/l). These results prompted further testing on the sediment at the project site.

In July and September of 1983, the DOT - Harbors Division received the test results of Pier 16 sediment samples from AECOS (Appendix C). Two separate test runs were performed on core samples and the results confirmed that "there were no detectable amounts of DDE in any of the samples."

3.3 BIOLOGICAL ENVIRONMENT

3.3.1 Terrestrial Flora and Fauna

Vegetation in the harbor area has been influenced by the generally low rainfall and high degree of development and human activity. Flora is primarily composed of introduced species that are usually part of landscaping and grassing projects connected with the development of building and facilities. Other vegetation includes hardy grasses and weeds growing in the cracks and crevices of the pavement.

Since the project area is primarily composed of commercial and industrial structures, it is not an optimal habitat for fauna. The few birds that may be seen are those common to urban areas. These include the common mynah (Acridotheres tristis), house sparrow (passer domesticus), pigeon, barred dove (Geopelia striata) and spotted dove (Streptopelia chinensis). An occasional Brazilian cardinal (Paroaria coronata) may be present. A major attraction for birds in the area is the Carnation Milling Company which is a storage area for grain and bird feed.

A few indigenous or migratory birds may occasionally be seen flying in the immediate project area. An occasional brown booby (Sula lencogaster plotus) may be seen floating on harbors waters. However, this would probably only occur if the bird was ill or injured.

Larger mammals are restricted to stray cats, dogs and rats attracted by the milling and fishing activities.

3.3.2 Marine Flora and Fauna

Honolulu Harbors' benthic community is poorly developed due to pollution. It has been highly influenced by past sedimentation and indeed is still affected by this condition. Epifaunal organisms are well developed along the rock fringes within a few feet of the harbor shoreline and there is abundant fouling by barnacles (Balanus amphitrite) and encrusting bryozoans (Bulgula neritina) on pilings and bulkheads. Other fauna include crabs, hydroids, sponges and fanworms. Living coral can be found on the harbor walls but nowhere else. A coral reef exists on the harbor side of Sand Island but this has been severely polluted. A silt-algae covered rubble bottom gives indication that the coral community has been killed off by past dredging and sedimentation.

Infauna communities between the rocky harbor shore and the deeper dredged harbor floor are also sparse. These include a few microinvertebrates, crabs though not in any great concentration, and a spotty distribution of hydroids and sponges. Also found are shrimp and worm holes.

Species of phytoplankton found are typical of those found near shores and in semi-enclosed marine embayments (Table 3-4). Planktons perform an important part in the ecosystem as it sustains recreational and commercial fishing activities.

The harbor is also a habitat for a variety of reef fishes (Table 3-5). They are scattered throughout the harbor but are most abundant in the vicinity of the Hawaiian Electric Company's (HECO) thermal outfall. Honolulu Harbor is also used as a nursery for several species of carangids (jacks), mugilids (mullets), sphyraenids (barracudas), mullids (goat fishes) and sphyrnalewini (hammerhead sharks).

Honolulu Harbor is also an important resource as a baiting area for the skipjack industry. The nehu fishery is located off the harbor side of Sand Island and is second only to the Pearl Harbor and Kaneohe Bay nehu fisheries according to the National Marine Fisheries Service (NMFS). The nehu <u>(Stolephorus purpureus)</u> is the preferred species of bait and constitutes 93 percent of the bait used by the skipjack industry. The season for nehu fishing is concentrated during the months of May through September. Unlike the two major fisheries, nehu fishing in Honolulu Harbor is accomplished at night using lights and nets.

TABLE 3-4

COMMON HAWAIIAN PHYTOPLANKTON[2] AND ESTUARINE ZOOPLANKTON[3]

Scientific Name	Common Name
PHYTOPLANKTON	
PHYLUM PHAEOPHYTA	
CLASS BACILLARIACEA: DIATOMS	
Chaetoceros compressum	Diatom
Nitzschia longissima	Diatom
N. seriata	Diatom
Skeletonema costatum	Diatom
ZOOPLANKTON	
PHYLUM ARTHROPODA	
CLASS CRUSTACEA: CRUSTACEANS	
Lucifer chacei	Shrimp
PHYLUM CHAETOGNATHA	
Sagitta inflata	Arrowworm
PHYLUM CHORDATA	
CLASS OSTEICHTHYS: BONY FISHES	
Stolephorus purpureus	Nehu larvae

[1]Source: Tetra Tech, Inc.; Final Report, Study Areas II and VI-C Water Quality Analysis and Environmental Assessments Oahu, Hawaii; prepared for National Commission on Water Quality; Pasadena, California; February 1976.

[2]Reference: McCain and Coles, 1973; Data from Honolulu Harbor.

[3]Reference: Conoco-Dillingham Oil Company, 1972; Data are from Mamala Bay.

TABLE 3-5

CHECKLIST OF FISHES FROM HONOLULU HARBOR

Scientific Name	Local Name	Common Name
Abudefduf abdominalis	Maomao	Sargeant major
Abudefduf sordidus	Kupipi	
Acanthurus dussumieri		Surgeon fish
Acanthurus mata	Pualu	Surgeon fish
Acanthurus nigrofuscus	Mai i	Brown surgeon fish
Acanthurus nigrosis		Surgeon fish
Acanthurus xanthopterus	Pualua	Surgeon fish
Albula vulpes	Olo	Bonefish
Arothron hispidus		
Adioryz xantherythrus		
Aulostemus chinenis	Nunu	Stickfish
Canthigaster jactator	Oopu hue	Puffer
Caranx ignobilis	Pauuu	White jack
Caranx melampygus	Omilu	Blue jack
Caranx sexfaciatus	Papio	White jack
Chaetodon auriga	Kikakapu	Treadfin butterflyfish
Chaetodon lunula	Kikakapu	Raccoon butterflyfish
Chaetodon millaris	Kikakapu	Lemon butterflyfish
Chaetodon unimaculatus	Kikakapu	
Chanos chanos	Awa	Milkfish
Chromis ovalis		Damselfish
Conger marjuratus		
Ctenochaetus strigosus	Kole	Surgeon fish
Dascyllus albisella		White spotted angelfish
Diodon holocanthus		
Diodon hystrix		Porcupine
Elops hawaiinenis	Awaawa	Lady fish
Flammeo sammara		
Gymnothorax undulatus	Puhi	Moray eel
Hemiramphus depauperatus	Iihehe	Halfbeak
Hepatus sandvicensis	Manini	Convict tang
Kuhlia sandvicensis	Aholehole	Mountain bass
Lutjanus fulvus	Toau	Blacktailed snapper
Microcanthus strigatus		
Mugil cephalus	Ama ama	Mullet
Mulloidichthys auriflamma	Weke ula	
Mulloidichthys samoensis	Weke ula ula	Sand goatfish
Myripristis borbonicus	Pauu	
Myripristis murdjan	Uu	
Naso unicornus	Kala	Unicornfish
Ostracion meleagris	Moa	Boxfish
Parupeneus multifasciatus	Moano	Goatfish
Parupeneus porphyreus	Kumu	Goatfish

TABLE 3-5 - (Continued)

Scientific Name	Local Name	Common Name
Peravagor spilosoma	Oiliuwi	Fantailed filefish
Pomacentrus jenkinsi		Damselfish
Scomberoides sanctipetri	Lai	Leatherback
Sphyraena snodgrassi	Kaku	Barracuda
Sphyrna lewini		Hammerhead shark
Stethojulis balteatus	Hinalea	Wrasse
Stolephorous purpureus	Nehu	Hawaiian anchovy
Tilapia spp		Tilapia
Upeneus arge		
Zanclus canescens	Kihi Kihi	Moorish idol
Zebrasoma flavescens	Laipala	

Sources: HECO, 1976; and Tetra Tech, 1976

3.4 HUMAN ENVIRONMENT

3.4.1 Economy

Oahu is the third largest island in the State of Hawaii having a land area of 604 square miles. It is the center of social, cultural, economic, governmental and military activities of the State. It is the only island where farming or ranching is not a major economic activity. Top sources of income are the visitor industry and federal expenditures which both exceeded the production of sugarcane and pineapple.

The year 1980 saw a noticeable decline in Hawaii's economic activity. Tourism, the State's largest export industry, went through the first decline in yearly visitors since 1949. This represented a 1.0 percent drop over the 1979 figures (Table 3-6). This, however, was offset by upswings in defense expenditures, the sugar and pineapple industries and construction field.

The decline in tourism was a reflection of the nation's overall economy. High inflation rates between 1979 and 1980 led to a 26 percent rise in consumer prices. Correspondingly, personal income rose only 24 percent for the same period. Escalation in fuel prices and housing costs probably led to a change in spending priorities relegating vacations as second to necessities. High fuel prices also contributed to an increase in the cost of air travel. These factors all have had a part in the decline of visitors to the State.

Despite drops in the tourist industry, the State of Hawaii's economy has remained stable due to other export-oriented industries. Defense spending contributed to the stability of the economy by injecting some $1.3 billion in wages, salaries and defense projects. This represents an increase of 7.7 percent in 1980.

The sugar industry in 1980 was exceptionally profitable realizing $385,000,000 compared to $217,600,000 in 1979. This was the result of an

Table 3-6 .-- VISITOR ARRIVALS AND AVERAGE VISITOR CENSUS: 1964 TO 1980

Year	Visitors staying overnight or longer			Average number present 1/		
	Total	West-bound 2/	Other	Total	West-bound 2/	Other
1964	563,925	460,290	103,635	16,037	14,901	1,136
1965	686,928	567,218	119,710	17,369	16,057	1,312
1966	835,456	686,886	148,570	20,918	19,271	1,647
1967	1,124,818	893,103	231,715	27,630	24,898	2,732
1968	1,314,571	1,015,844	298,727	32,335	28,784	3,551
1969	1,527,012	1,181,029	345,983	37,198	33,088	4,110
1970	1,746,970	1,326,135	420,835	36,943	32,028	4,915
1971	1,818,944	1,430,325	388,619	40,889	36,504	4,385
1972	2,244,377	1,782,737	461,640	50,143	45,098	5,045
1973	2,630,952	2,067,861	563,091	59,578	53,407	6,171
1974	2,786,489	2,184,620	601,869	63,535	56,939	6,596
1975	2,829,105	2,207,417	621,688	66,308	59,495	6,813
1976	3,220,151	2,551,601	668,550	75,532	68,225	7,307
1977	3,433,667	2,763,312	670,355	83,030	75,684	7,346
1978	3,670,309	3,030,999	639,310	92,034	85,028	7,006
1979	3,960,531	3,139,455	821,076	98,676	89,678	8,998
1980	3,934,504	3,046,132	888,372	96,497	86,788	9,709

1/ Data for 1964-1979 have been revised from the corresponding figures in the 1980 edition, table 128.

2/ Arriving from the Mainland United States or Canada.

Source: Hawaii Visitors Bureau, Annual Research Report (annual) and records.

increase in the average price of raw sugar. From 1979, a 99 percent increase in price was realized in 1980 resulting in a raw sugar price of $604 per ton.

The pineapple industry also showed a growth in sales. This was for both fresh and canned fruits. The 1980 sales were estimated at $215 million, an approximate increase of 13 percent over 1979. Employment rates for both industries, however, remained the same.

High interest rates in 1980 caused the decline of newly authorized housing units to 16 percent below that of 1979. However, the total permit value rose 19 percent over 1979. This was probably caused by a shift towards the construction of high value housing and the increase of construction costs. In spite of high interest rates, private commercial and industrial construction authorizations rose about 67 percent in 1980. Decreases in planned residential and government construction did not affect the actual volume of work which remained high. This was probably due to an upswing of authorizations in 1979 (30 percent over 1978) which assured a significant amount of construction work in 1980.

Hawaii's fishing industry suffered a drop in the pounds of fish caught and sold in 1980 according to the "Hawaii Data Book, 1981." This drop occurred despite the fact that both the number of commercial fishermen and vessels increased. These numbers, however, do not reflect the true position of the industry since there were unreported aku (skipjack tuna) boat and flagline boat catches. The Data Book reports the commercial fish catch for 1980 as 9.6 million pounds with a value of $9.7 million. This represents a drop of 1.7 million pounds of fish and a decrease in revenue of $3.1 million. One-third of the year's catch was accounted for by skipjack tuna. Other important species caught were ahi, ahipalala, akule, opelu and opakapaka. There were 2,497 commercial fishermen operating 1,377 fishing vessels which served 35 fish wholesaling and processing operations. These figures, however, include all commercial licensed fishermen operating parttime and full time.

3.4.2 Population

As of 1980, the resident population for the State of Hawaii was reported as 965,000. This figure includes the 61,000 members of the military population and 64,000 military dependents. This represents an increase of 25.3 percent over the 1970 census count of 769,913. Neighbor islands reversed their population decline and exceeded Oahu in growth rates (Table 3-7). The State's median age is 28.4 years indicating a young population. Racially, the State is diversified such that everyone is a member of a minority group. There is no single major ethnic group in the State. Table 3-8 shows a breakdown of the State's population by age, sex and race. Population projections based on current growth rates indicate that by 1990 the resident population will be 1,091,500 and 1,225,900 by the year 2000.

The population of the City and County of Honolulu (the Island of Oahu) was estimated at 762,565 by the 1980 census. This figure includes military personnel and their dependents. Table 3-7 shows a 20.9 percent increase over the 1970 census population of 630,528. The City of Honolulu alone had a resident population of 365,000, almost 50 percent of the island's total. Paralleling the State's racial diversity, Oahu also has no ethnic majority. Based on 1979 data, the ethnic composition is as follows:

Caucasion	27.2 percent
Japanese	24.6 percent
Hawaiian/Part Hawaiian	17.6 percent
Filipino	9.8 percent
Chinese	5.3 percent
Mixed Other Than Part Hawaiian	9.4 percent
Other	6.1 percent

3.4.3 Historic/Cultural Setting

Originally known as Kou Harbor, Honolulu Harbor has long been of commercial importance to the islands. Little more than a decade after Captain Cook's discovery of these islands, another British explorer found Honolulu Harbor. Captain William Brown envisioned a commercial port where what was then a

TABLE 3-7- RESIDENT POPULATION, TOTAL AND CIVILIAN, OF COUNTIES AND ISLANDS: 1970 AND 1980

[Excludes visitors present and includes residents temporarily absent.]

County and island	Total resident population 1/			Civilian resident population 2/	
	April 1, 1970	April 1, 1980 3/	Percent change	April 1, 1970	April 1, 1980 3/
State total	769,913	964,691	25.3	714,771	903,672
City and County of Honolulu	630,528	762,565	20.9	575,719	701,899
Oahu	630,497	762,534	20.9	575,719	701,893
Outlying islands 4/	31	31	0	-	6
Other counties	139,385	202,126	45.0	139,052	201,773
Hawaii	63,468	92,053	45.0	63,328	91,891
Kauai	29,761	39,082	31.3	29,627	38,918
Kauai	29,524	38,856	31.6	29,390	38,692
Kaula and Lehua	-	-	...	-	-
Niihau	237	226	-4.6	237	226
Maui and Kalawao	46,156	70,991	53.8	46,097	70,964
Kahoolawe	-	-	...	-	-
Lanai	2,204	2,119	-3.9	2,204	2,119
Maui	38,691	62,823	62.4	38,632	62,796
Molokai	5,261	6,049	15.0	5,261	6,049
Kalawao	172	144	-16.3	172	144
Rest of Molokai	5,089	5,905	16.0	5,089	5,905

1/ Including military personnel and their dependents.
2/ Excluding military personnel but including their dependents.
3/ Revised.
4/ The Northwestern Hawaiian Islands, from Nihoa to Kure Atoll but excluding Midway.

Source: U.S. Bureau of the Census, 1980 Census of Population and Housing, PHC80-V-13 (March 1981) and correction note sent August 20, 1981; Hawaii State Department of Planning and Economic Development, Military Personnel and Dependents in Hawaii, April 1980 (Statistical Report 139, May 15, 1980), and records.

Table 3-8 - AGE, SEX, AND RACE OF THE POPULATION: 1980

Age	Sex: Total	Sex: Male	Sex: Female	Race 1/	Number
All ages	964,691	494,683	470,008	All races ...	964,691
Under 5 years	77,848	40,004	37,844	White	318,770
5 to 9 years	73,057	37,555	35,502	Black	17,364
10 to 14 years	74,870	38,459	36,411	American Indian ..	2,655
15 to 19 years	86,446	45,673	40,773	Eskimo	68
20 to 24 years	105,682	59,070	46,612	Aleut	45
25 to 29 years	95,287	48,864	46,423	Japanese	239,748
30 to 34 years	84,314	42,990	41,324	Chinese	56,285
35 to 44 years	111,416	56,449	54,967	Filipino	133,940
45 to 54 years	94,444	44,887	49,557	Korean	17,962
55 to 59 years	47,383	23,502	23,881	Asian Indian	604
60 to 64 years	37,794	18,871	18,923	Vietnamese	3,463
65 to 74 years	49,375	26,375	23,000	Hawaiian	115,500
75 to 84 years	21,214	9,973	11,241	Guamanian	1,677
85 years and over ..	5,561	2,011	3,550	Samoan	14,073
				Other	42,537
Under 18 years	275,583	141,516	134,067		
18 to 64 years	612,958	314,808	298,150		
65 years and over ..	76,150	38,359	37,791		

1/ By self-identification or race of mother. Data are not comparable to Health Surveillance Program tabulations in table 14; the latter, unlike the 1980 census figures shown here, exclude persons in military barracks or institutions and report Part Hawaiians and other persons of mixed race separately.

Source: U.S. Bureau of the Census, Census of Population and Housing, 1980: Summary Tape File 1A, Hawaii (1981).

hot, humid lowland with mud flats and coral reefs. It had no attractive beaches to sport in and was not popular with the Hawaiians. Nonetheless, Captain Brown could see a harbor with commercial promise. It was the only place in the islands that had a navigable channel through the reef with protective anchorage within and deep water close to shore. More than 100 ships could safely anchor there. Originally, christened "Fair Haven" by Captain Brown it was for years simply called "Brown's Harbor."

Half a century later, Honolulu Harbor was known throughout the Pacific and it was a rarity for a month to pass without a ship dropping anchor. This was paralleled with the growth of a village of several hundred native huts along the muddy beach front. This was the beginning of the City of Honolulu.

By the middle of the 19th century, whaling as well as commerce vessels vied for berthing space. As a natural consequence of the intensive shipping activity, Honolulu grew as a town. During the latter half of the 1800's, the waterfront of the harbor was a busy mixture of wharf buildings and grass shacks. Photographs of the period show an increasing number of sailing ships anchored and great piles of coal, lumber and other goods on the docks and wharfs. At around the turn of the century, the number of sailing ships had increased such that as many as 20 ships would be anchored in the harbor at any one time. By 1896, three major steamship companies had stops and offices in Honolulu. The year 1913 saw more than 1900 vessels utilizing berthing facilities in the harbor. By the 1930's steamships had taken over where sailing ships once held dominance and as many as six large passenger liners would be docked awaiting their passengers.

Today, commerce in the harbor is primarily transpacific shipping. Inter-island cargo flow constitutes a small portion of harbor shipping. The area surrounding the harbor is predominately light industry and includes an electrical generating plant, pineapple canneries, a gas company, oil storage yards, warehouses, a passenger and inter-island cargo terminal and numerous small businesses.

Prior to the development of the area as a commercial harbor, the area where Sand Island now exists was a reef platform of mud and stones which was exposed at low tide. Inland of the reef was a series of fishponds. During low tide, the Hawaiians would gather small fish, crabs, shellfish, etc., from the ponds for food. In the area around Honolulu Harbor there are a number of buildings with historic, ethnic or architectural significance. Some are listed in or have been nominated to the National Register of historic Places. These are:

- Chinatown Historic District (Bounded by Beretania Street, Nuuanu Stream, Nuuanu Avenue, and Honolulu Harbor).
- Falls of Clyde Sailing Ship (Pier 5, Honolulu Harbor).
- Merchant Street Historic District, Honolulu.
- Kamehameha V Post Office Building (Corner Merchant and Bethel Streets).
- U. S. Post office, Customhouse, and Courthouse (335 Merchant Street).
- U. S. Immigration Office (595 Ala Moana Boulevard).
- Aloha Tower, Nominated (Between Piers 8 and 11).

The area surrounding the Pier 16 project site is geared towards fishing and industrial activities. There are no archaeological or historical sites in the immediate vicinity that will be endangered by the construction of the pier.

3.4.4 Recreation

Honolulu Harbor is not only an area dedicated to industrial and commercial uses. It is also host to a number of recreational activities including fishing. Recreational fishing is popular along the waterfront and the HECO discharge outlet at Pier 7.

Passive activities, such as viewing harbor and shoreline activities, are other recreational activities offered by the harbor.

The location of the project offers excellent opportunities for recreational fishing and harbor viewing. It presents an uninterrupted vista of the harbor along Nimitz Highway. Users of this thoroughfare (visitors, residents, etc.) can see a large portion of the harbor and also a portion of Sand Island. Recreational fishermen frequently fish along this stretch of the waterfront between Piers 15 through 17.

3.4.5 Land Use

The project site (land area) is designated "urban" by the State Land Use Commission. The land is State owned. The harbor waters, however, are zoned as "conservation" and subzoned as "resource" (Figure 3-2).

The City and County of Honolulu's Comprehensive Zoning Code designates Piers 2 to 15 as B-2, Community Business District. Piers 17 and 18, however, are designated I-1, Light Industrial District (Figure 3-3).

3.4.6 Infrastructure

Honolulu Harbor is primarily served by Nimitz Highway and Ala Moana Boulevard, (State Highway 92). It is a 6 to 8-lane highway which parallels the harbor and acts as a buffer between the City and harbor activities. It was once a major east-west artery and is still a primary route for tourists traveling between the airport and Waikiki. However, H-1 now carries much of the private and commercial traffic.

As of July 14-15, 1980, a total of 64,342 vehicles were recorded at the Department of Transportation's Station SL-30. This station counts traffic on Nimitz Highway at the Nuuanu Stream Bridge. East bound traffic accounted for 28,524 vehicles while the west bound lanes handled 35,818. Traffic during the morning peak hours (7-8 a.m.) was 2,537 for east bound lanes and 2,359 for west bound lanes. During the afternoon peak hours from

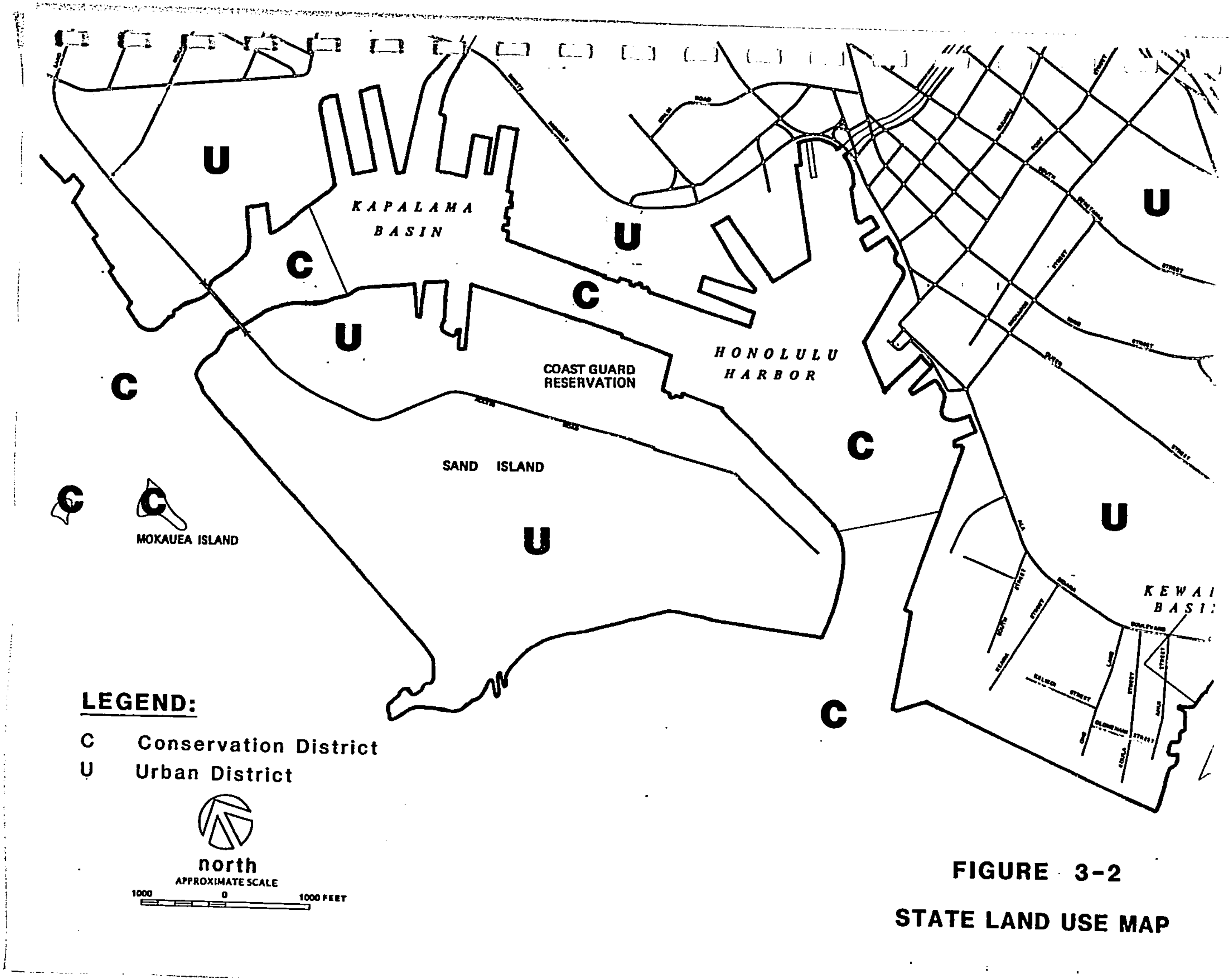


FIGURE 3-2

STATE LAND USE MAP

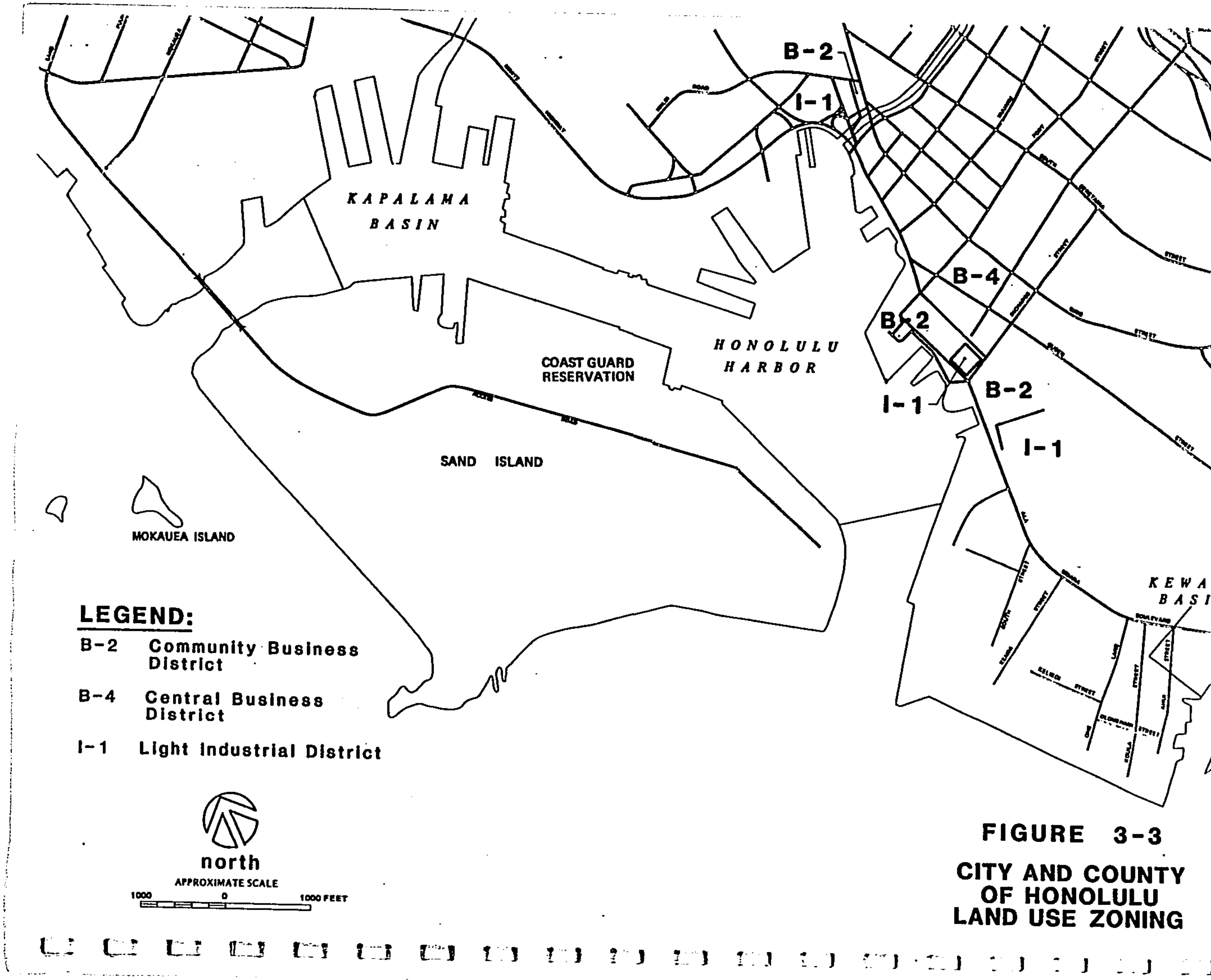


FIGURE 3-3

CITY AND COUNTY OF HONOLULU LAND USE ZONING

4 p.m. to 5 p.m. 2,606 vehicles were accommodated on the east bound lanes and 3,225 on the west bound lanes. Although passenger cars were by far the greatest users, buses and commercial vehicles consisting of single unit trucks, semi-trailers and combinations contributed significantly to the traffic load. The harbor is well served by available power, water, telephone and health and safety facilities.

3.5 NOISE

The existing noise level in the Honolulu Harbor area is the accumulation of a number of contributing factors. Natural ambient noise is produced by wind and wave actions. Man-made noises contributed are from overhead aircraft in approach/departure patterns, industrial activities at the various docks and piers and vehicle traffic using Nimitz Highway and Sand Island roads.

SECTION 4

THE RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS FOR THE AFFECTED AREA

4.1 INTRODUCTION

The relationship of the project to various State and City and County of Honolulu plans and policies will be discussed in this section. Its relationships to other studies will also be examined.

4.2 POLICY PLANS

Both the State of Hawaii and the City and County of Honolulu have formulated general plans to guide the physical, social and economic development of Oahu. These contain general objectives and policies that encourage the development of Oahu's various resources (energy, water, economics, etc.). Although these policies are general, they provide the framework which allows for the construction of the projected pier.

4.2.1 Hawaii State Plan

The Hawaii State Plan serves as a guide for the long-range development of the State by identifying the goals, objectives, policies and priorities for the State. It also provides a basis for determining priorities and allocating limited resources such as public funds, services, manpower, land, energy and water. It also seeks to assure the coordination of State and County plans, policies, programs, projects, and regulatory activities.

Although the goals, objectives and policies are broadly stated in the State Plan, the proposed project is consistent with many of the objectives and policies. These are discussed with regard to the project's conformance or nonconformance to them.

4.2.1.1 Economic Objectives and Policies

With respect to the project, the State planning in general is directed toward a growing and diversified economic base that is not overly dependent on a few industries. To achieve this goal the State policy is to "promote Hawaii as an attractive market for investment activities that benefit Hawaii's people," and "expand existing markets and penetrate new markets for Hawaii's products and services."

The construction of Pier 16 will contribute to this objective. It will allow for a greater number of commercial fishing vessels to join the local fishing fleet thereby expanding a promising and growing industry and contributing to the economic welfare of the islands. Additional transient vessels may berth in Honolulu and add to the economic stability of services which these vessels require. A larger fleet will also allow for the expansion of the fishing industry by realizing larger fish catches. This will not only enhance the fishing industry but also cut Hawaii's dependence on outside sources for sea foods.

The above is also applicable to objectives and policies specified for potential growth activities that will serve to increase and diversify Hawaii's economic base. The State's policy on this matter is the encouragement of investment and employment in economic activities that have the potential for growth. The fishing industry after decades of quiescence faces an optimistic economic future.

4.2.1.2 Objectives and Policies for the Physical Environment - Land Based, Shoreline and Marine Resources

The objectives to which this project relates to are the prudent use of Hawaii's shoreline resources and the effective protection of Hawaii's unique and fragile environmental resources. Policies which seek and achieve these objectives are:

- "Exercise an overall conservation ethic in the use of Hawaii's natural resources.

- Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

- Take into account the physical attributes of areas when planning and designing activities and facilities.

- Pursue compatible relationships among activities, facilities, and natural resources, especially within shoreline areas."

The pier location is in a conservation designated district. It is a policy of the State Conservation Land Plan to "establish and manage Hawaii's freshwater and marine fishing areas and encourage the expansion of Hawaii's fishing industry." The construction of Pier 16 will assist in the realization of this policy. The fact that all of Honolulu Harbor waters are designated conservation does not eliminate the fact that it is already a highly impacted area resulting from the intense industrialization of its surrounding areas. The proposed project is not expected to create a long term and/or significant depreciation of its present condition.

4.2.1.3 Objectives and Policies for the Physical Environment - Land, Air and Water Quality

An objective of the State Plan which is related to the project is the maintenance and pursuit of improved quality in Hawaii's land, air and water resources. To achieve this, the State's policies include the promotion of effective measures to achieve the desired quality in Hawaii's surface, ground, and coastal waters. It also encourages actions to maintain or improve aural and air quality levels to enhance the health and well being of Hawaii's people. It also stresses the recognition of the importance and value of the land, air, and water resources to Hawaii's people and their culture.

As mentioned before, the waters of Honolulu Harbor are already significantly impacted by decades of use and misuse. The project will have an added immediate and long-range impact on the existing environment. This will result from both the construction phase and the actual use of the pier. It will be important to enforce current rules and regulations that serve to maintain, if not better, the quality of the environment.

4.2.2 The General Plan of the City and County of Honolulu

The General Plan is designed to guide the physical development, government operations and social and economic programs for the Island of Oahu. Discussed below will be those objectives related to the construction of Pier 16.

4.2.2.1 Economic Activity

The objective related to the project under this section of the General Plan is the full utilization of the economic resources of the sea. To be able to contribute to this objective, the local fishing fleet must expand its capabilities not only to compete with foreign fishing fleets but also to harvest promising fishing grounds at some distance from their home port. A limitation which holds the development of commercial fishing back is the lack of suitable berthing facilities.

4.2.2.2 Natural Environment

In accordance with State policies, the objective of the City and County is to protect and preserve the natural environment of Oahu. The project's impact on the environment can be mitigated by the application of existing rules and regulations to prevent the further degradation of the harbor.

4.2.3 Conceptual Planning Study, Piers 2 through 18, Honolulu Harbor

This study put out by the DOT in 1978 is concerned with the comprehensive short-range and long-range action plans, together with alternatives, to guide the development of the waterfront area between Piers 2 and 18. It has also considered the recommendations of other previous studies. The planning goals and objectives of this report are:

- "To encourage more public enjoyment, use of, and contact with the waterfront by introducing attractive and compatible uses and creating a park-like atmosphere along the water's edge.

- To provide for present and future maritime uses and related activities that will encourage more public use and activity.

- To integrate the harbor with the downtown area.

- To minimize the adverse effects of Nimitz Highway and Ala Moana Boulevard.

- To preserve the Aloha Tower as the symbolic, historic landmark and major focal point of the waterfront area.

- To preserve and enhance the mauka-makai vistas."

Plans for the various piers include the construction of Pier 16 for use by the commercial fishing fleet.

4.2.4 Kewalo Basin Task Force

This report, which was approved by Governor George R. Ariyoshi on January 26, 1981, is the result of four subcommittees which addressed the concerns of the berthing situation in Kewalo Basin with regard to commercial fishing, cruise boats, charter boats and basin tenants. Recommendations of the Task Force include designating Kewalo Basin as the central commercial fishing complex with designated areas in Honolulu Harbor as its annex; restricting the existing cruise and charter activities in Kewalo Basin to the Ala Moana Boulevard face; continuing studies of the industries' needs by DPED, DLNR and DOT; periodically reconvening the Kewalo Basin Task Force; requesting the Legislature for the necessary funding to implement the preferred plans; and establishing of the Oahu Commercial Harbors Advisory Committee.

This plan will provide for the necessary short term and long term needs of the commercial fishing industry as well as the cruise and charter boat activities. The construction of Pier 16 is recommended for immediate action.

4.2.5 Hawaii Fisheries Development Plan

In 1978, the State Legislature passed nine resolutions addressing fisheries issues. Among these was the resolution calling for a fisheries development master plan. In 1979, the "Hawaii Fisheries Development Plan" was presented to the legislature. Its goal is the increase of the productivity of Hawaii's fishing industry in terms of landings, value and employment. A major constraint, however, is the lack of dock space for commercial fishing vessels. A scenario for harbors development was conceived to deal with immediate, interim and long-range problems. Pier 16 is part of the interim dock space strategy.

4.3 LAND USE PLANS

Land use plans are much more specific than policy plans, primarily because they contain maps relating to the particular area of concern. Land use plans and controls which affect the development of the project are the State Land Use District Regulations, and the County Comprehensive Zoning Code.

4.3.1 State Land Use District

Under the provisions of Chapter 205-2, Hawaii Revised Statutes (commonly known as the "green belt law") all lands in the State of Hawaii are classified into one of four major land use districts by the State Land Use Commission: (a) urban, (b) rural, (c) agricultural, and (d) conservation.

The land around Honolulu Harbor is designated urban land. The project area itself, however, is in a conservation zone. This designation applies to all of Oahu's offshore waters. Conservation zones are further classified into four subzones: the Protective "P" subzone, the Resource "R" subzone, the Limited "L" subzone and the General "G" subzone. Pier 16 falls into the Resource "R" subzone. The objective of this subzone is to develop, with proper management, areas to insure sustained use of the natural resources in those areas. The use of lands in this subzone entails Conservation District Use Application (CDUA).

4.3.2 Comprehensive Zoning Code

The Comprehensive Zoning Code controls development on Oahu and regulates the internal zoning of the State designated urban, rural and agricultural districts. Under this code there are seven zoning districts which are further subclassified to define the permitted uses and densities. The project, Piers 17 and 18, is zoned as I-1 or Light Industrial District.

4.3.3 Public Facilities Map

This map indicates that road improvements to Nimitz Highway are "planned for Future - 7 years beyond."

4.3.4 Primary Urban Center Development Plan

According to this development plan, Piers 15 and 16 are designated as Public Facilities. The project site is part of Honolulu Harbor and has no designation.

4.4 OTHER PROGRAMS AND CONTROLS

4.4.1 State Environmental Policy

The State recognizes the need for information on the environmental consequences of a proposed action in making decisions. Therefore, an Environmental Impact Statement (EIS) is required for any project that significantly impacts the environment; is not specifically exempted; uses either State or County funds or lands; is in a Conservation District; a shoreline setback area; or certain parts of Waikiki; or a listed historic site; or requires a County General Plan amendment. The construction of the proposed pier will subject the existing environment to significant impacts especially during the dredging phase. Therefore, this EIS is submitted to comply with the State's environmental policy and to insure that environmental concerns are given appropriate consideration along with economic and technical considerations.

4.4.2 Coastal Zone Management Program

The Hawaii Coastal Zone Management (CZM) Program seeks to provide and protect recreational, historic, scenic, and open space resources. The program also seeks to protect valuable coastal ecosystems, locate economically important facilities in suitable areas, reduce hazards, and improve management of new development within the coastal zone management area. To implement this program, all State and County agencies are to insure that coastal development is located, designed, and constructed to minimize social, visual, and environmental impacts in the coastal zone management area. This includes the Special Management Area and the waters from the shoreline to the seaward limit of the State's jurisdiction.

CZM policies relevant to the project involve recreational resources, coastal ecosystems, economic uses and scenic and open space resources. The objective of each category's policy is stated below:

Recreational Resources:	Provide coastal recreational opportunities accessible to the public.

Coastal Ecosystems:	Protect valuable coastal ecosystems from disruption and minimize adverse impacts in all coastal ecosystems.
Economic Uses:	Provide public or private facilities and improvements important to the State's economy in suitable locations.
Scenic and Open Space Resources:	Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.

The project is not within the jurisdiction of the Special Management Area (SMA).

4.4.3 Land Tenure

The majority of leases in the project area are on a short-term month to month basis. Pier 15 is under a long-term lease to the year 1991 with the City and County Fire Station. Chevron has an agreement for a pipeline easement on Pier 18.

SECTION 5
PROBABLE IMPACTS OF THE PROPOSED ACTION

This section will deal with the probable impacts of the project based on the information discussed in Section 3. The impacts of the proposed action on the environment may be classified as primary or direct impacts and secondary or indirect impacts. Primary impacts, associated with construction, are generally of a short term nature, including dust, noise and traffic disruption. Secondary or indirect impacts may be conditions resulting from the improvement of a public facility such as a harbor improvement. Examples of this type of impact are uncontrolled traffic congestion, urban sprawl, induced land use changes and pollution of various types. These impacts are generally long term in nature.

The primary and secondary impacts are further subdivided into beneficial and adverse impacts. Beneficial impacts are those which will enhance the quality of the physical or human environment or enable a more effective use of natural and/or economic resources. Adverse impacts, on the other hand, are those which decrease the quality of the environment.

5.1 IMPACTS OF CONSTRUCTION

The greatest adverse impact created by the project will be the result of construction dredging and dredge disposal. This will affect the physical and biological environments of the construction and the dredge disposal sites. The parameters that will be most affected are water quality and marine biota. The extent of dredging impact will depend on the nature and amount of material to be dredged, the dredging method used and the controls exercised during the dredging operation to minimize the adverse impacts.

5.1.1 Impacts on Air Quality

The primary or direct adverse impact on air quality will be the generation of some dust and additional hydrocarbon emissions by construction vehicles. This not only includes the actual vehicles used for construction purposes but those used for transportation by the construction workers. This is an unavoidable impact. However, it is expected to be insignificant due to the industrial nature of the project area. Additionally, these fumes and dust will generally be dispersed out to sea by the prevailing trade winds. Should "Kona" conditions prevail, the ambient air quality would depreciate below the normal condition.

5.1.2 Impacts on Water Quality

Dredging will have the following possible impacts on the marine environment. Discoloration of the water will result from the suspension of silts, organic detritus and nutrients. This is expected to be temporary and may create artificial feeding opportunities for fish which may be attracted to bottom dwelling organisms and organic detritus stirred up by the dredging. Dredging will also remove or destroy the ethnic organisms present in the material to be dredged.

The dredging of the harbor floor for the construction of the pier will disturb bottom sediments causing resuspension and redistribution. The coarser grained material, because of their weight, will settle close to the dredge. However, the finer material will be carried by water currents to other areas. Sediments fine enough to remain in suspension for a long period of time may be transported out of the harbor. However, if the previous sediment settling pattern associated with the 1972 maintenance dredging may be assumed for the project, sediment settlement outside the harbor may not occur. During maintenance dredging the turbidity increased 30 times above normal levels. Overall turbidity for the harbor increased tenfold and light penetration based on Secchi disc readings was 70 percent less than the predredging condition. Measurements at the entrance showed turbidity values close to deep ocean water indicating that the bulk of the suspended material was deposited on the harbor floor or in Keehi Lagoon, not in the offshore waters. This would spare the benthic community of the harbor's offshore waters and its environment would not be affected by the project.

As the dredging operation for Pier 16 is of a much smaller scale than the 1972 maintenance dredging the impacts associated with dredging are expected to be much less.

Localized discoloration of harbor waters caused by the suspension of silts, organic detritus and nutrients will also occur. A distinct plume will be visible during dredging operations and for a short period following its cessation. Dispersion and dissipation of these sediments will be difficult to detect in the harbor because of its muddy appearance caused by the stream discharge.

Dredging may also cause the resuspension of pollutants absorbed to the sediments thereby increasing their toxicity.

The lack of a suitable land area or nearshore disposal site requires the removal of dredged material at a deep ocean site. Alternative dredging methods are hydraulic cutterhead dredge or a barge-mounted clamshell dredge. Use of the hydraulic cutterhead dredge would require a pipeline system to a temporary land disposal site and eventual barge disposal at sea or direct discharge to a barge to be transported to the offshore disposal site. Although this operation is more efficient and produces less turbidity than the clamshell dredge, the availability of a temporary land disposal site near the harbor with adequate space for settling ponds and stockpiling is a significant problem. Direct discharge into a barge also presents serious operational problems because of the large amounts of water drawn up with the dredged material. Water constitutes about 60 to 80 percent of the material sucked up by the hydraulic cutterhead dredge. This would entail a three to four-fold increase in barge loadings and transfers. The economic aspect of this operation may limit this use.

Clamshell operations are less efficient in working with finer materials than the hydraulic suction-type dredges. However, turbidity problems may be mitigated by the use of construction controls such as the use of movable silt barriers around the dredging plant.

5.1.3 Impacts on Biota

5.1.3.1 Impacts on Terrestrial Biota

A. Flora

It is not expected that the project construction will adversely affect any flora in the project area.

B. Fauna

Construction activity is not expected to cause a significant impact on the existing terrestrial fauna found in the project area. Avifauna may avoid the project area during construction but can be expected to return after completion of the project. The harbor is a highly industrialized area and has been subjected to construction stresses before with no known lasting adverse effects on the avifauna. The above situation also applies to any terra fauna that inhabit the area. Any animals existing in this area have already adapted their existence to the industrial nature of their environment. Although construction activities may disrupt their habitat temporarily, it is not expected to be of a long lasting nature.

5.1.3.2 Impacts on Marine Biota

Dredging will not only cause disturbances to the physical nature of the marine environment but will also affect the marine biota directly and indirectly. This is not only true of the project area but also of the deep ocean dredge disposal site. The direct adverse impact of dredging will be the removal or destruction of benthic organisms that are present in the dredge material. These include tube worms, bryozoans, and other silt and sand dwelling organisms. There would probably be a temporary reduction in the fish population as mobile fish communities move out of harms way during dredging activity.

There is no significant impact expected to adversely affect the marine biota of the harbor. The benthic community of the harbor is, as previously mentioned, poorly developed and has been highly influenced by long-term natural sedimentation. Previous dredging activities have also impacted the community. It is anticipated that similar bottom conditions will develop after the completion of the project and will also be periodically disturbed by maintenance dredging. The present benthic community is the result of recolonization by organisms following previous dredging cycles. A similar community is expected to recolonize the area after completion of the pier.

Active and free-swimming organisms would be the least affected since they would be able to avoid the dredging operation. They would probably be quickest to recolonize.

An area for special concern is the nehu fishery. It has been observed in past dredging operations that schools of nehu have been attracted to the sediment plumes. However, the effect of silt and clay particles on the free floating larvae and eggs of the nehu is as yet undetermined. Nehu catch statistics do not indicate any long-term population declines related to past dredging activities.

Other impacts resulting from dredging may indirectly affect the marine biota. Resuspension of pollutants absorbed in sediments may increase their toxicity. The dredge plume may create a barrier to the movement of fish and other marine life. Added to the destruction of the habitat, creation of additional turbidity and a possible change of flow patterns may all affect marine organisms and remove them from the food chain.

The Final Environmental Impact Statement (EIS) for Hawaii Dredged Material Disposal Sites Designation put out by the U. S. Environmental Protection Agency (EPA) discusses the environmental setting of alternative deep ocean dredge disposal sites. The South Oahu Disposal site is included. The unavoidable and adverse environmental impacts that will affect the dredge disposal site are those associated with the immediate disposal operation and the long term effect of the disposal material itself. The immediate impacts will be a greater concentration of suspended material in the water, a short term dissolved oxygen decrease and ammonia increase, possible attraction or avoidance of the area by fish, and biota trapping. The first three impacts are mitigated by the natural conditions of the site. Natural and rapid dilution of the dredge plume will occur and although some biota may be trapped as the dredged material falls to the ocean floor, other organisms will be able to dig out and escape. Long term effects are biota smothering and the accumulation of material on the ocean floor. However, the deep ocean communities are small. The few organisms which cannot escape represent a small portion of the inhabitants.

The impact of deep ocean disposal of dredged material on marine biota is not expected to be significant. Dredged materials will not jeopardize the life support systems of the marine biota because of the dilution which occurs (approximately 1:1,000,000). Flora and fauna, although sensitive to outside influences, have low populations in the deep ocean. Thus, the deep oceans do not produce significant quantities of food for man and do not support as much biota as the inshore shallow water environments. Dredge spoil disposal will destroy some of the benthic communities during removal and by burial. Organisms which survive and those that are attracted by the dredge plume will provide the basis for recolonization. Free-swimming organisms will be the least affected since they will be able to avoid the dredging operations and will also be quickest to recolonize the impacted areas.

The disposal of dredged materials at this site is not expected to lower the water quality of the region. Using the most conservative ocean currents at this site (10 cm/sec), surface waters are replaced every seven hours. The occurrence of a surface plume for 1.5 to 5 hours after disposal will not reduce the water quality here.

Although some benthic fauna are destroyed during periodic disposal, the biota have been shown to repopulate the area shortly after disposal.

Although the major impacts of dredging are adverse, there are some beneficial aspects. Dredging can reoxygenate sediments which would prevent anaerobic conditions which can cause objectionable odors; it would increase the overall water column oxygen content by mixing; resuspends nutrients in the water and make them available to suspension feeders; and it could remove dissolved and particulate absorbed pollutants from the water column and tie them up in bottom sediments.

5.1.4 Socio-Economic and Cultural Impacts

5.1.4.1 Impacts on Historical/Archaeological Sites

No historical or archaeological sites of interest or value will be affected by the construction of the pier.

5.1.4.2 Economic/Labor Impacts

The construction of the pier would provide economic benefits for local construction firms and the people of the City and County of Honolulu working on the project. Local suppliers of construction materials and some retail businesses may also benefit from the project.

5.1.4.3 Transportation/Traffic Impacts

The increased traffic from construction vehicles will be a source of inconvenience to Nimitz Highway users, business operators and fishermen using the facilities at Piers 17 and 18. Transportation of materials, equipment, work force and other construction related traffic will necessitate the use of Nimitz Highway since it is the only means of access to the project site. Congestion will probably result from construction activities.

The dredging and construction of the pier will probably interfere with normal water-borne activity to some extent. Users of the fishing complex will be affected most since the project is in the immediate vicinity.

5.1.4.4 Scenic and Recreational Impacts

Motorists and sightseers using Nimitz Highway have an uninterrupted view of Honolulu Harbor when passing by the project area. This view also includes a portion of Sand Island. During the dredging and construction phases of Pier 16, virtually all construction equipment and activities will be visible from the highway. This is considered an unavoidable and adverse impact which will detract from the scenic view. However, this impact is considered temporary and will cease when the pier is complete.

Recreational fishing in the vicinity of Pier 16 is a favorite past time along the waterfront paralleling Nimitz Highway. Fishing will temporarily be curtailed by the dredging and construction activities. This impact is considered unavoidable.

5.1.5 Noise

Noise generated by construction activities will temporarily impact workers and businesses in the project vicinity and the project workers themselves. This will add to the general noise levels produced by the industrial activity in the area and by aircraft flying overhead.

5.2 IMPACTS OF OPERATION

5.2.1 Impacts on Air Quality

Although an increase in the amount of hydrocarbon emissions is expected, because of the increased number of fishing vessels and vehicles utilizing the area, it is not thought to be a significant impact. Under normal conditions, these emissions would be blown out to sea by Hawaii's persistent trades.

5.2.2 Impacts on Water Quality

Secondary impacts may result from the presence of oil pollution. Sources include bilge or ballast waters or accidental spills from the increased number of vessels.

5.2.3 Impacts on Biota

5.2.3.1 Impacts on Terrestrial Biota

The completion of the project is not expected to have any impacts on the environment. Once construction vehicles have moved out of the area, it is expected that previous conditions will prevail.

5.2.3.2 Impacts on Marine Biota

The aquatic flora and fauna of the project area may be affected by the operation and use of the new pier. Oil pollution from discharged bilge or ballast waters or accidental spills could have a severe and/or long lasting effect on harbor habitats. Biologically, oil pollution is destructive to aquatic life. Free oil and emulsions may coat and destroy algae and plankton. A heavy coating on the surface of the water or on plants may interfere with reaeration or the photosynthetic process. Water soluble factions may have a toxic effect on marine flora and fauna. Oil with settling characteristics may coat the harbor floor, destroy benthic organisms and interfere with spawning areas.

Another impact will be biofouling. Any object upon immersion into water immediately acquires an organic coating. This coating in turn is colonized by micro-organisms which include bacteria, protozoans and single-celled algae. Bacteria usually attach themselves within one hour of immersion of an object and begins the subsequent process of attachment by macro fouling organisms. There are a number of factors influencing the pattern of species arrival and rate of growth. These factors include surface roughness, water currents and circulation, pollution, gregarious settling, color and shading, light transmission, salinity, temperature, competition for space, and depth and distance from shore. Principal macrofouling organisms include various species of algae, sponges, hydroids, serpulid polychaetes, barnacles, tube dwelling amphipods, mollusks and tunicates. In Hawaii corals can also constitute as fouling organisms. The above are sessile fouling organisms which may play host to a secondary fouling community which use the attached forms for food and shelter. These include small crabs, amphipods, isopods pycnogonids, free-living polychaetes and mollusks. Fishes such as blennies and gobies may also be associated with fouling communities.

5.2.4 Socio-Economic and Cultural Impacts

5.2.4.1 Impacts on Historical/Archaeological Sites

There will be no impacts on historical and/or archaeological sites.

5.2.4.2 Economic/Labor Impacts

The greatest benefit from the operation of the new pier will be on the local fishing industry. The construction of this pier will allow for the expansion of the local fishing fleet thereby allowing a greater landing of fish. This in turn will economically benefit Hawaii in five areas. The most direct and measurable impact will be the direct income to harvestor and processors effected from larger catches. A higher employment rate will result from increased crews required to man the larger fleet. An increase in State tax revenues would also be realized through the 1/2 percent excise tax, personal income taxes and sales taxes on new vessels purchased and a net social benefit taking into account public expenditures. The existing fleet would benefit as the new pier will allow it to operate more efficiently.

Indirectly, other benefits may be realized. There will be a greater stability in fresh fish supply with the possibility of lower consumer prices and an increased technical support for all of Hawaii's fishing operators which includes the charter industry, recreational fishers and part-time or subsistence fishers. It will allow for the diversification of Hawaii's industrial structure. Neighbor islands may also indirectly benefit from the growth of the fishing fleet on Oahu.

5.2.4.3 Transportation/Traffic Impacts

The additional traffic generated by the increased number of fishermen using the facility is not expected to contribute a signficant impact on traffic in that area. Their hours of operation do not coincide with "normal" working hours. Therefore, their peak traffic is not synchronous with the "normal" flow.

Parking for users of Pier 16 will be accommodated by the parking area adjacent to Pier 18. No parking will be allowed on Pier 16 itself, except for very short term parking for loading and unloading activities. Vehicular traffic on the pier will be prohibited except to serve this purpose.

5.2.4.4 Coastal Zone Management (CZM)

The impacts of the project on CZM policies, as stated in Section 4.4.2, Coastal Zone Management Project, are discussed below. The project will have an impact on the recreational fishing resources of the harbor. Although it has been noted that nehu are attracted to the dredge plume which appears during dredging operations, it is uncertain if this can apply to recreational fish species. The dredge plume may be an attraction or cause fishes to disperse from the area. After construction of the pier is complete, the loss of a recreational fishing spot may be realized. A small landing adjacent to Pier 17 is occasionally used by recreational fishermen. A variety of small fishes, aholehole, squirrel fish, opapalu, etc., may be caught from this point. During construction of the pier it would become inaccessible.

The major impact of the construction of Pier 16 will be upon the ecosystem of the harbor. Dredging would be the most significant cause of disruption destroying the benthic habitat and some of its inhabitants as well. The water quality will certainly be degraded due to agitation of sediments on the harbor floor. Use of the new facilities may also result in the presence of oil pollution from bilge and ballast waters or accidental spills from the increased number of boats.

The economy of the State would benefit from Pier 16's construction. This would allow the fishing fleet to acquire more fishing vessels. Direct economic benefits would result. These include direct income to the harvesters and processors as a result of increased landings, increased employment, tax revenues, overall social benefit and increased efficiency for the existing fishing operations.

The location of the new pier is situated in one of the few spots where a large vista of the harbor may be viewed. The pier itself may not detract from this scenic resource but the fishing vessels when in port may create a distraction from the view. It may also add to the picturesque quality of the scene.

5.2.4.5 Scenic and Recreational Impacts

After cessation of dredging and construction activities, Pier 16 will be a visible entity from Nimitz Highway. The completion of the pier will result in the loss of some waterfront open space. This visual impact of moored fishing vessels may be considered adverse depending upon the observer's viewpoint. The moored fishing vessels may be viewed as pictureque by some while others may see them as distractions.

Recreational fishing may be resumed after the pier is finished. Completion of the project will not adversely impact recreational use of the harbor in the project's vicinity. Public access to commercial piers has always been restricted and this restriction will also be applied to Pier

16. The sidewalk fronting the harbor in the vicinity of the project will still be accessible to the public. No restrictions are foreseen to impair the present harbor viewing and recreational use of that section of the waterfront.

5.2.5 <u>Noise Impacts</u>

The noise level is not expected to be significantly increased by the increased number of fishing vessels planned to use the new pier facility. Noise levels produced would be insignificant when compared to the existing levels produced by overhead aircraft and various other industrial related noises.

SECTION 6
MITIGATION AND MONITORING

6.1 MITIGATION

6.1.1 Construction and Operation

6.1.1.1. Air Quality

Emissions from construction vehicles and equipment are unavoidable. However, the amount is not expected to be significant and is not expected to result in any permanent adverse environmental impacts. Regular maintenance of vehicles and equipment will be made to prevent undue exhaust discharges. Excessive dust resulting from construction activities will be reduced by sprinkling as required to reduce dust levels. Current Department of Health air quality regulations will be observed by the Contractor.

6.1.1.2 Water Quality

Regardless of the method of dredging used, turbidity will be a significant problem. This may be mitigated by implementing construction controls such as the use of movable silt barriers around the dredge area. These barriers are filter-like screens which are suspended in the water around the dredge. They act to contain the sediments stirred up by dredging operations and prevent them from dispersing to other parts of the harbor. Thus, they limit turbidity and confine the resettlement of sediments to within the immediate area of the dredge.

The discharge of oily waters or an accidental spill will greatly affect the quality of the harbor waters. Mitigation measures would be the strict enforcement of existing regulations regarding overboard discharge by ships using the new pier and its surrounding facilities.

6.1.1.3 Biota

Terrestrial biota is not expected to be affected by the project. Aquatic biota will be the most significantly impacted component of the environment. The dredging operation will have the greatest effect on marine life. To minimize the impact of this operation, the following measures should be seriously considered:

A. Construction practices and special mitigative measures should be used, especially during dredging, to prevent persistent turbidity and excessive sediment transport into other areas of the harbor. This would include the use of sediment screens.

B. Construction materials, petroleum products, human wastes, debris and other chemical substances should not be allowed to fall, flow or otherwise enter the water.

C. Construction materials treated with creosote or other preservative substances should not be permitted to come in contact with the water until completely dry.

6.1.2 Socio-Economic and Cultural Values

A disruption in the fishing activities in the project area because of construction will be realized. This includes the displacement of some of the fishing vessels presently using Pier 17. This impact may be mitigated by temporarily mooring these vessels elsewhere for the duration of the project, thereby allowing them to continue their fishing operations without disruption. However, this in turn may inconvenience other crafts. Since the entire construction period would extend over a time frame of approximately 1 year, it would not be feasible to limit construction during the albacore off season.

The Contractor will be required to keep Nimitz Highway open to traffic at all times and to use proper construction signs, barricades, and flagmen to control traffic and any other devices necessary to insure minimum inconvenience and maximum safety to the highway users.

After completion of construction, the pier will be highly visible. Landscaping may mitigate the visual effect of the pier. However, landscaping of the pier itself is incompatible with its use as commercial berthing. The alternative would be to landscape that stretch of Nimitz Highway providing the most open vista of the harbor. This alternative has been dealt with by the Highways Division in its report entitled "Honolulu Gateway Beautification Project" dated March 1980. Highway beautification is the responsibility of the Highways Division.

The Harbors Division has also published a study entitled "Conceptual Planning Study, Piers 2 to 18, Honolulu, Harbor," which includes integration of Honolulu Harbor with the downtown area, minimizing the adverse impacts of Nimitz Highway and Ala Moana Boulevard and to preserve and enhance the mauka-makai vistas. However, landscaping of Piers 16 to 18 is not included since it is not compatible with the designated uses of the piers. Therefore, landscaping has not been planned and will not be included in the proposed pier project.

6.1.3 Noise

Equipment used during construction will generate a higher noise level than is generally experienced. Project operations must conform to the State DOH's Public Health Regulation, Chapters 44A and 44B. A noise permit will be required from the Noise and Radiation Branch of the DOH. The Contractor must comply with the conditions issued with the permit. Mufflers for noise control will be required for all construction equipment.

SECTION 7
ALTERNATIVES TO THE PROPOSED ACTION

There are alternative actions that may be taken instead of the proposed project. These include "no action" and alternatives to the project. These are discussed below.

7.1 NO ACTION

The "no action" alternative will leave a under-utilized section of Honolulu Harbor as is. This would keep commercial berthing space at its present capacity. The demand for mooring space is expected to increase, thus creating further stress on the already limited facilities available. This, in turn, would limit the growth of Hawaii's fishing industry which is just now emerging from a long period of dormancy. Without the proposed pier, the State would lose the opportunity to develop a viable and integral part of its economy and it would continue Hawaii's dependence on the importing of a large percentage of seafood consumed. The "no action" alternative would therefore constitute a detriment to the growth of the fishing industry here in Hawaii.

7.2 DISCUSSION OF ALTERNATIVES

A number of alternative options have been considered for the use of the commercial fishing fleet. However, these all have overriding restrictions which make them infeasible.

7.2.1 Honolulu Harbor

There are a few areas that may be utilized by the fishing fleet to accommodate their vessels. Pier 35 which is used by Castle and Cooke for pineapple operations during the summer months, has been altered to accommodate up to 20 fishing vessels. However, vessels assigned to this pier must vacate it during the months of May through August for use by Castle and Cooke.

Pier 39, although slated for inter-island barge use, could provide temporary mooring until such time its intended use comes into play. However, this is just a temporary scheme and any fishing vessels assigned to this pier would eventually have to find another more permanent berth elsewhere.

SECTION 8

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

The proposed project will provide a much needed berthing facility for Hawaii's fishing fleet. The objective to provide relief for a critical shortage of necessary berthing space in an economically and environmentally acceptable manner will be accomplished.

The initial short term adverse impacts from the construction of the pier and those long term impacts resulting from its use are to be balanced against the growth and economic development of a small but viable part of Hawaii's economy. It will contribute to the maintenance and enhancement of long term productivity in the fishing industry.

SECTION 9
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The project will require several irreversible and irretrievable commitments of resources. These are the materials and capital to be invested in the new facility and the manpower and energy to be used to operate and maintain the facilities.

The implementation of the proposed action will utilize resources and materials considered essential to complete the project. Financial, manpower, and material resources will be irreversible and irretrievable commitments for planning, engineering, construction, operation and maintenance of the proposed project. Energy will also be irreversibly committed, not only for the construction of the pier but also for its operation. The commitment of harbor space is irretrievable as long as the harbor is in use and may be considered essentially irreversible.

Another long-term commitment will be the revenues collected by the State for the use of the property and facilities at Pier 16. These will be based on the expenses of the operation and maintenance and the cost to the State for the improvements. They would be reasonable and fixed with due regard to the primary purposes of providing a commercial boating facility and promoting the fishing industry. Mooring fees and utilities will comprise all the State's revenues.

Still another irreversible, but not necessarily irretrievable commitment of resource is the loss of habitats for marine organisms due to dredging, dredging disposal, and construction. It should be noted that Honolulu Harbor is periodically dredged for maintenance purposes and the selected disposal site is used for the disposal of harbor maintenance dredge spoils.

SECTION 10

AN INDICATION OF WHAT OTHER INTERESTS AND CONSIDERATIONS OF GOVERNMENTAL POLICIES ARE THOUGHT TO OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION

Compliance with environmental regulations helps to offset the adverse effects of the proposed action. The project complies with the policies set by the Hawaii Statute on Environmental Quality (Chapter 342, Hawaii Revised Statutes).

The Coastal Zone Management Program has developed objectives and policies for all action affecting the State's coastal zone. The proposed project complies with these objectives and policies in that it will provide a public facility and an improvement important to the State's economy with a minimal environmental impact upon the coastal environment.

The State Environmental Policy Act, Chapter 344, Hawaii Revised Statutes, has developed policies and guidelines in an effort to enhance the quality of life and conserve the natural resources. It also encourages the economic development of Hawaii while at the same time encouraging all industries including fishing to protect the environment. Compliance with these policies and guidelines by erecting Pier 16 while minimizing any adverse impacts upon the coastal environment is the intent of the proposed project.

SECTION 11
SUMMARY OF UNRESOLVED ISSUES

At this time there are no unresolved issues regarding potential environmental impacts.

SECTION 12
LIST OF NECESSARY APPROVALS

The construction of Pier 16 will require various government approvals. A list of approvals is as follows.

12.1 STATE OF HAWAII

A. Department of Land and Natural Resources; Conservation District Use Application.

B. Department of Health, responsible for checking on air quality, water pollution and noise control which may be caused by this project.

12.2 FEDERAL

A. U. S. Army Engineer District, Honolulu, Application for a Department of the Army Permit.

SECTION 13
ORGANIZATIONS AND PERSONS CONSULTED

Department of Health - Air and Water Quality Data

Department of Land and Natural Resources

- Historic Sites Office
- Aquatic Resources Division
- Forestry and Wildlife

Department of Land Utilization

Department of Planning and Economic Development

- Coastal Zone Management Program

Department of Transportation

Environmental Center, University of Hawaii

Naval Undersea Research Center

Oceanic Institute

BIBLIOGRAPHY

1. City and County of Honolulu, Department of Public Works, Division of Sewers, "Final Environmental Impact Statement for the New Ala Moana Sewage Force Main" prepared by Wilson, Okamoto & Associates, Inc., November 1975.

2. Environmental Consultants, Inc., "Environmental Assessment and Management Planning of Mooring Systems in Hawaii," prepared for U. S. Army Engineer Division, Pacific Ocean, November 20, 1978.

3. Federal Register, Rules and Regulation, Vol. 45, No. 138, July 1980.

4. Grace, Jean McKean, "Marine Atlas of Hawaii, Bays and Harbors," Sea Grant Miscellaneous Report UNIHI-SEAGRANT-MR-74-01, January 1974.

5. Hawaii Audubon Society, "Hawaii's Birds," Edited by Robert J. Shallenberger, 1981.

6. Long, Edward R., "Marine Fouling Studies Off Oahu, Hawaii," The Veliger, Vol. 17, No. 1.

7. Loomis, Harold G., "Tsunami Wave Runup Heights in Hawaii," HIG-76-5, May 1976.

8. State of Hawaii, Department of Transportation, "Sand Island Development of Container Handling Facilities Environmental Impact Statement," prepared by Wilson Okamoto & Associates, February 1978.

9. State of Hawaii, Department of Transportation, "State Transportation Plan", A State Functional Plan in accordance with Chapter 226, Hawaii Revised Statutes," October 1981.

10. State of Hawaii, Department of Transportation, Harbors Division Memorandum, "Negative Declaration Commercial Fishing Vessel Moorings, Piers 15 to 18, Honolulu Harbor, Job H.C. 1144," January 7, 1975.

11. Thorson, Gunnar, "Bottom Communities (Sublittoral or Shallow Shelf)," Treastise on Marine Ecology and Paleoecology, the Geological Society of America, Memoir 67, Reprint 1963.

12. U. S. Army Engineer District, Department of the Army, "Honolulu Harbor, Final Environmental Statement," July 1976.

13. U. S. Army Engineer District, Department of the Army, "Final Environmental Statement Harbor Maintenance Dredging in the State of Hawaii," September 1975.

14. U. S. Army Engineer District, Department of the Army, "Sand Island Shore Protection Detailed Project Report and Environmental Statement," September 1978.

15. U. S. Environmental Protection Agency, "Environmental Impact Statement (EIS) for Hawaii Dredged Material Disposal Sites Designation," September 1980.

APPENDIX A

HAWAII FISHERIES DEVELOPMENT PLAN

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HAWAII FISHERIES DEVELOPMENT PLAN

HARBORS DEVELOPMENT SCENARIO

For the sake of clarity, the harbors development problem has been separated into three time frames: immediate, interim (2-5 years), and long-range (5-20 years).

IMMEDIATE DOCK SPACE

By mid-1980, approximately 15 to 20 new resident vessels will require dock space. Alterations are currently being made to Pier 35, at a cost of $8,000 to accommodate up to 20 vessels. Pier 35, however, is used by Castle and Cooke for pineapple operations during the summer months and does not offer a permanent site for fishing vessels. Thus, situation appears workable for five of the vessels which participated in the 1979 Midway albacore fishery, and up to 20 transient vessels in future years. The remaining 10 to 15 resident vessels will require year-round accommodations.

The east face of Pier 39, currently used as a "catch-all" dock, could be made available to the fishing fleet in mid-1980. A small amount of funds, probably less than $25,000, would be required to provide power and water for the vessels. Pier 39, though eventually slated for inter-barge use, could provide temporary mooring for 20 vessels until 1982.

The availability of Pier 35 for seven months of the year for transient albacore vessels and the use of Pier 39 will partially relieve the immediate problem of dock shortage.

INTERIM DOCK SPACE

DOT has requested design funds in their FY 1981 budget to complete plans for Pier 16 in Honolulu Harbor. Following construction in 1983, the new dock will accommodate approximately 20 vessels.

However, fleet growth in late 1981, early 1982, may necessitate further interim facilities. Piers 13 and 14, currently used by Pacific Marine for repair activities, will be vacated in late 1981, early 1982, when Pacific Marine moves to Piers 27 and 28. Although dedicated for eventual tourist-related use, Piers 13 and 14 could be temporarily used for resident fishing vessels until Pier 16 is completed.

LONG RANGE DOCK SPACE

Even with the interim measures proposed above, it is anticipated that the fleet will expand beyond the available space in Honolulu Harbor and Kewalo Basin. By 1990, the fleet will have increased by 65 resident and 50 transient vessels. The proposed interim measures will have provided for most of these vessels, but in space dedicated for other uses. By the year 2000 an additional 40 resident and 30 transient vessels will have joined the fleet. Rather than face the Legislature year after year with piecemeal solutions, it would seem prudent to dedicate one or more major facilities which will accommodate growth in the fleet for at least the next 20 years. Several sites do exist for a large commercial fishing vessel complex, and these options are examined below.

NEIGHBOR ISLAND PORTS

Considerable expansion of commercial facilities is feasible at Nawiliwili, Kauai and Kawaihae, Hawaii. Both harbors are currently under-utilized and could accommodate most of the expected fleet growth. Actual docks, however, are non-existent and would have to be constructed at a cost comparable to, or slightly higher than, similar construction on Oahu. The major drawbacks are lack of marketing, processing, marine repair, and logistic support services. Each additional handling of fish and equipment will increase costs to the industry. Further, neighbor island port planning must take into consideration the growth of other potential industries.

BARBERS POINT DEEP DRAFT HARBOR

Assuming that Barbers Point Harbor becomes a reality in the 1980's, adequate space could be available to accommodate growth of the local fleet. Although not nearly as remote as the neighbor island ports, Barbers Point still suffers from absence of support services. Unless marketing, processing, and repair services are established at Barbers Point, each trip to Honolulu will accrue additional cost to the industry. It should be noted that preliminary plans for the Barbers Point Deep Draft Harbor have not included fishing facilities. Further, it is possible that the land required for a fisheries complex may have to be transferred from the Federal Government.

It is anticipated that the existing fishing industry will offer some resistance to development of major facilities at either Barbers Point or the neighbor islands. The majority of fishermen and market personnel reside in Honolulu, and the existing industry will want to accrue benefits from fleet expansion without relocating.

KEEHI LAGOON

Several areas within Keehi Lagoon offer possibilities for a commercial fisheries complex. Substantial undeveloped shoreline exists along the west shore, adjacent to Lagoon Drive. The Airports Division of DOT, however, foresees complete utilization of this area for either airport-related north-east shore of Keehi Lagoon. This area, to the north of the present Amfac Marina, has been proposed as either a recreational marina or a possible coal barge landing. Further, the City and County of Honolulu has viewed the interior as a potential rapid transit baseyard. There is no question that the site would be suitable for a commercial fisheries base, but again the issue of competing uses must be addressed. This applies not only to the shoreline, but also to the waterways where substantial recreational boat traffic is envisioned.

HONOLULU HARBOR

Although not adequate to take care of all future needs, some unutilized shoreline does exist between Snug Harbor and the Bascule Bridge. Acquisition of additional interior acreage within the adjacent military reservation would provide space for support facilities.

KEWALO BASIN

As indicated earlier, Kewalo Basin is now filled to current capacity with a combination of commercial fishing, charter, and tour boats. In addition, most of the existing commercial fisheries infrastructure is located around Kewalo. Although originally developed for commercial fisheries use, the basin has increasingly become a focal point for tourist-related activities. With continuing increases in the commercial, charter, and tour fleets, the competitive forces have become even more critical. There is the possibility of greatly increasing the capacity of Kewalo Basin by rearranging docks and nesting vessels, but would this be to the benefit of the commercial fishing fleet or the tourist-related fleets? This question revolves around the long-range plans for the whole Kakaako area, and is especially critical to the commercial fishing industry. Relocation of the existing tour boats would free some land (now used for bus parking) and greatly reduce congestion. There is considerable question, however, whether the tour boats can find a new home. In terms of new support services, some acreage could be available on the west and south sides of the basin, but again this depends on long-range plans for the area. To complicate matters, relocation of Wakiki Aquarium to the Kewalo peninsula is being considered in some quarters.

APPENDIX B

BIOLOGICAL ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS OF DREDGED MATERIAL DISPOSAL FROM THE PROJECTED PIER 16 AREA

Biological Assessment of Potential Environmental Impacts of Dredged Material Disposal from the Projected Pier 16 Area.

A Report Submitted to the R. M. Towill Corporation

by the Oceanic Institute, Waimanalo, Hawaii.

April, 1982

Dr. James P. Szyper
Project Manager

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I. Executive Summary

The work described herein was undertaken to satisfy certain legally-mandated requirements for the issuance of a permit to dispose Honolulu Harbor dredge-spoil materials at the designated South Oahu disposal site. Samples of sediment from the proposed dredging site were tested for toxicity to representative marine animals, and for the potential accumulation of toxic materials from the sediments in the tissues of living animals at the disposal site.

There is no evidence of significant toxicity to planktonic animals (*Artemia*), fishes, (mullet), or bottom-dwellers (shrimp) due to exposure to dissolved substances and fine suspended matter from the sediments to be dredged.

There is no evidence that inundation with slurries of the test sediments caused significant mortality either to the clam *Tapes japonica*, a burrowing filter-feeder, or to juveniles of the shrimp *Penaeus vannamei*, an epibenthic deposit-feeder. The burrowing, deposit-feeding shrimp *Penaeus japonicus* showed significant mortality, which is attributable at least in part to immediate effects of inundation. Because these effects will not take place in an actual disposal situation, the experimental mortality is not a clear indication of adverse impact.

Eleven potentially toxic substances were tested for their potential to accumulate in the tissue of bottom-dwelling animals at the disposal site. Ten of the substances (cadmium, chromium, copper, lead, mercury, DDT, dieldrin, mirex, polychlorinated biphenyls, and petroleum hydrocarbons) failed to accumulate to a statistically significant degree in the tissues of the clams during ten day's exposure to test sediments following inundation. DDE, a persistent degradation product of DDT (which was not itself detected in any tissues), showed statistically significant accumulation in clam tissue. Because studies of the disposal site show that little disposed sediment actually reaches the bottom, the real-world potential for DDE accumulation remains open to question, based solely on these tests and present knowledge of the site.

The tests were conducted according to published guidelines developed by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers. A specific plan for the tests reported here, which included the list of test animals to be used, and some deviations from standard procedures necessitated by local conditions, was submitted to these agencies before tests were begun. This plan was approved, with some comments by the agencies which were incorporated into the actual procedures.

Three species of test animals were exposed to each of three preparations of sampled sediments: the "solid phase", the "suspended-particulate" phase, and the "liquid" phase. This experimental design was repeated with sediment samples from each of three sampling locations within the proposed dredging area. Suspended-particulate phase (SP) material was prepared by mixing sediments with seawater, allowing denser sediment particles to settle, and drawing off the remaining mixture of water and fine suspended particles. Liquid phase (LIQ) material was prepared like SP material, but was, in addition, filtered to remove particles larger than 0.45 μm. Tests on SP and LIQ materials were run concurrently.

Juvenile mullet (Mugil cephalus) exhibited no significant mortality in either SP or LIQ experiments. Of the 630 fish exposed to various dilutions of the test materials from the three sampling locations, only 6 failed to survive to the end of the 96-hour tests, and 3 of these 6 were in pure-seawater control aquaria.

Juvenile shrimp (Penaeus japonicus and Penaeus vannamei) similarly showed no significant mortality in SP and LIQ tests. Of 620 animals used, only 4 died during 96 hour's observation.

The brine shrimp (Artemia salina) showed no significant mortality in tests performed with sediments from two of the three sampling stations. With sediments from the third station, 96-hour mortality in 100% concentrations of SP and LIQ materials was statistically significant, but cannot be clearly attibuted to toxicity alone. The mortalities involved took place during the last day of the four-day experiments, and may well be related to the difficulty of providing the animals with sufficient food without altering concentrations of test medium. Overall, 524 out of 630 animals (83%) survived to 96 hours.

Solid-phase tests involved establishing bottom-dwelling animals in and upon sediments resembling those at the disposal site (the material was obtained from seaward portions of Kaneohe Bay). Test sediments from the dredge area were then slurried with seawater and poured into the aquaria containing seawater, animals, and the "reference" sediment, in an effort to simulate the effects of arrival of solid disposed material on the sea floor at the dump site. Sample sediments from all three stations were tested simultaneously. Mortality after ten days was assessed, and the results were subjected to analysis-of-variance (ANOVA) as directed. This statistical technique tests whether sediment from any of the sampling stations produced significant mortality in excess of mortality related to a similar inundation with slurries of the reference sediment.

Two of the three animal species tested showed no significant mortality due to inundation with test sediments. The clam *Tapes japonica*, a burrowing filter-feeder, showed 94% survival overall (377 of 400 individuals) through the ten-day experiment. Juveniles of the commercial shrimp *Penaeus vannamei* an epibenthic deposit feeder, similarly, exhibited 90% survival (358 of 400 individuals).

Juveniles of the shrimp *Penaeus japonicus*, a burrowing deposit-feeder, underwent statistically significant mortality in sediments from all three stations, the effect being least severe in the coarsest-grained sediments, which will constitute the bulk of actual dredged material. An additional experiment showed that at least part of the mortality was associated with the early minutes of the inundation treatment. Half the animals inundated in this additional experiment died during the first hour, whereas all animals placed into aquaria 30 minutes after inundation survived an additional 2 hours. In all inundation tests, including solid-phase bioassays, some animals that had burrowed in the reference sediment and were then inundated made vigorous attempts to escape, but were retained by aquarium covers. Some animals in such treatments were unable to leave their burrowed-in positions, and were found dead in the sediments. The experimental mortality of *Penaeus japonicus* is thus questionable as evidence of chemical toxicity, since physical effects and B.O.D. during inundation may be important. It is also questionable whether these results indicate potentially adverse environmental impact in nature, because fine sediments reach the bottom only slowly, if at all, and animals are free to escape.

Overall, the testing program, conducted as required and approved in advance, provided little clear indication of potential adverse impact from the proposed disposal. The characteristics of the disposal site will assist in diluting and dispersing the fine components of the solid-phase, thus minimizing native animal exposure to any physical or chemical dangers the sediments might pose.

II. Introduction

The testing program described here was performed to facilitate evaluation of the potential environmental impacts of disposal of dredged material from Honolulu Harbor at the South Oahu disposal site. The State of Hawaii proposes to remove approximately 100,000 cubic yards of sediment in connection with development of the Pier 16 berthing area, deepening the site to approximately 18 feet.

Disposal of the dredged sediment requires a permit from the U.S. Army Corps of Engineers, which can be issued only when certain legally mandated requirements have been met. The purpose of the sediment testing program was to satisfy the regulations necessary for the issuance of such a permit.

Section 103 of Public Law 95-532 (The Marine Protection, Research, and Sanctuaries Act of 1972) directed the formulation of regulations for ocean dumping of dredged material. The resulting regulations were published in The Federal Register, volume 42, number 7, 11th January 1977, under the title "Ocean Dumping - Final Revision of Regulations and Criteria". The Environmental Protection Agency (EPA) and the Corps of Engineers (CE) have jointly developed an implementation manual for the provisions of Section 103 entitled "Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters" (EPA/CE, 1978). This manual contains a flow-chart of tests to be considered in determining acceptability of dredged materials for disposal. As anticipated by the manual, and as indicated by review of the Department of Health survey report (1978) for the proposed dredge site, the dredged material is regarded as unlikely to contain unacceptable levels of the materials specified as prohibited for ocean dumping. Furthermore, the dredged material could reasonably be presumed to fail to meet several of the stated criteria for presumed environmental acceptability (appendix A of the implementation manual). The bioassay and bio-accumulation trials were therefore performed as required. The testing program described here was performed with close attention to the guidelines of the implementation manual.

Other workers involved in evaluations of the impact of dredged material disposal in Hawaii have found it necessary to operate with modifications of the procedures described in the manual (Brock and Kimmerer, 1980; AECOS, 1980). Their modifications were necessitated by the nature of the South Oahu disposal site, and by the availability of "appropriate sensitive marine organisms" in Hawaii, both of which are rather different from the usual conditions on the coasts of the continental United States. The implementation manual, in stating that it is "...not intended to establish standards or rigid criteria...", recognizes that "it is inevitable that situations will arise that are not specifically addressed..., as well as occasions when a choice of the appropriate course of action must be made." Thus, modifications in the guidelines have been allowed in cases when it has been possible to "justify and defend the technical validity of such variations."

The work reported here was also done with some modification in recommended procedures. A description of the modifications, in the context of the overall experimental design, was prepared (Szyper, 1981) and submitted to CE and EPA for advance review and approval. Notification of approval was received at the Oceanic Institute on October 5th, 1981. Both agencies made comments and suggestions, which were incorporated where appropriate in the experimental program.

III. Environmental Setting

A. Disposal Site

The South Oahu disposal site has a bottom depth of approximately 400 m, yet is relatively nearshore by comparison with the location of similar depths off the continental coasts of the U.S. The proximity of an acceptable deep-water disposal site, for dredge materials approved by permit, is of great advantage in minimizing potential environmental impact. Studies done before and after disposal of Honolulu Harbor dredge spoils at the South Oahu site found minimal measurable effects, including little evidence of benthic deposition (Goeggel and Guinther, 1978; EPA, 1980).

The Final Environmental Impact Statement (EIS) for the disposal sites in Hawaii (EPA, 1980), includes information on the physical and chemical characteristics of the waters at the South Oahu site. In general, these conditions are similar to nearby waters of the open sea, with little evidence of coastal influence at most times. Vigorous currents provide great dilution of any disposed materials; living things of all types are rather scarce both in the water column and on the bottom. Little human food is taken from the area, and thus both environmental and human impacts due to spoil disposal are regarded as minimal.

B. Dredge Site

The site of proposed dredging lies just to the west of the entrance of Nuuanu Stream into Honolulu Harbor (figure 1). The locations marked A, B, and C in the figure are the sites from which sediment samples were taken for this study.

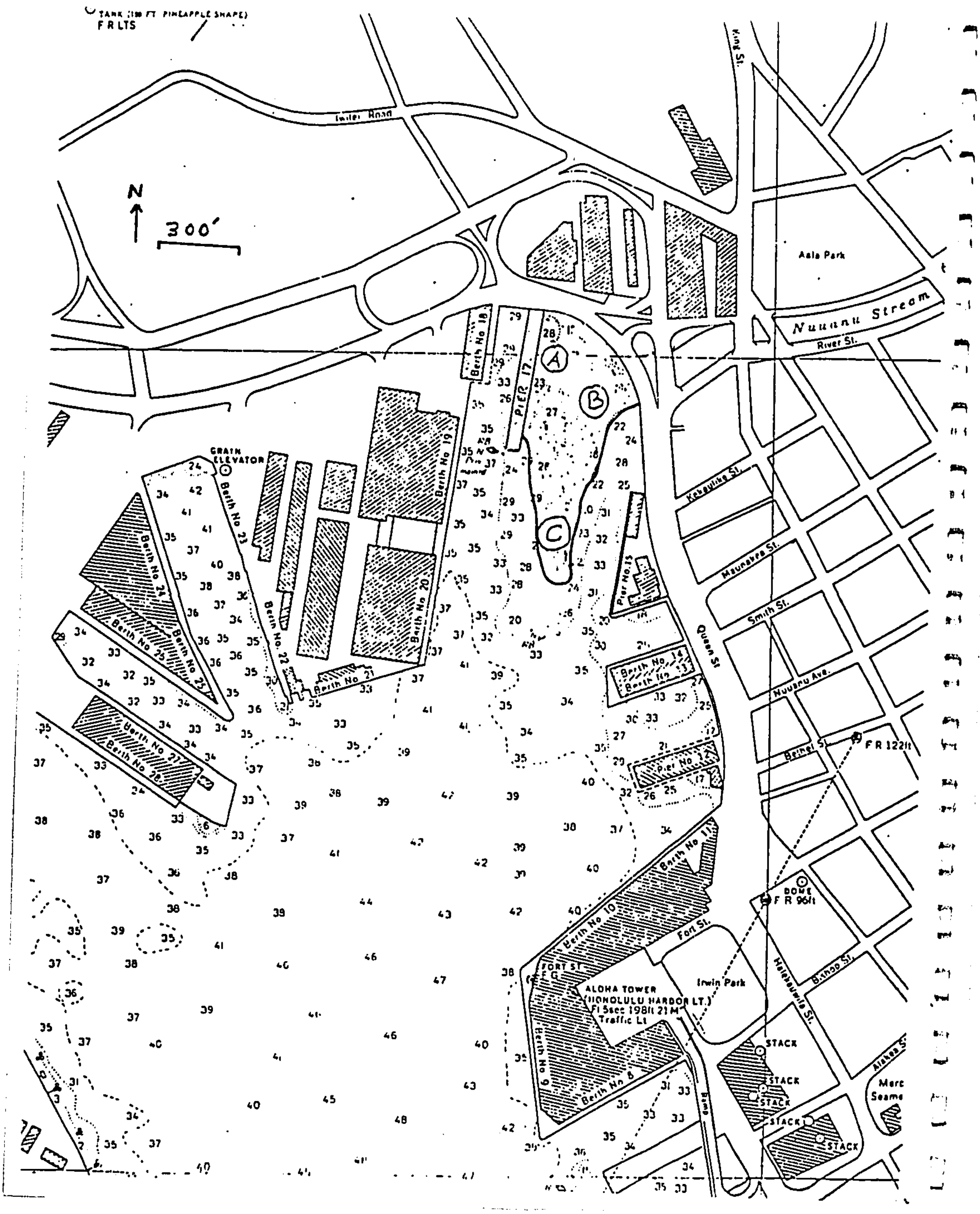
Nuuanu Stream and its tributaries drain some of Honolulu's oldest residential areas, passing through the downtown commercial district on their way to the Harbor. Berths in the immediate vicinity of the proposed dredge area are in service for general cargo, bulk storage and some marine repair (Grace, 1974).

Previous studies addressing the potential impact of Honolulu Harbor dredge spoil on deep disposal sites indicate that such impacts as have been investigated are minimal (Tetra Tech, 1977; EPA, 1980), although there have as yet been no bioassay and bioaccumulation studies on Honolulu Harbor dredge spoil. The State of Hawaii Department of Health (1978) found that at least some parts of the Harbor area exhibited elevated levels of copper, zinc, chromium, nickel, and lead, compared with estuaries near non urban areas. Notable mercury concentration was not noted. Honolulu Harbor sediments were not identified as significant accumulators of pesticide residues, although there were some high levels in a stream entering the far end of the Harbor, away from the proposed dredge site.

The sediments to be tested may be expected to be finer-grained and more basaltic (due to stream input) than the predominantly carbonate sand deposits characteristic of the dump site, although the Harbor samples studied earlier (Tetra Tech, 1977) were coarser.

Figure 1

The proposed dredging area (shaded) and the three sediment sampling sites (Stations A, B, and C) in the projected Pier 16 berthing area, Honolulu Harbor.


TANK (150 FT PINEAPPLE SHAPE)
F R LTS
Iwilei Road
N
300'
King St.
Aala Park
Nuuanu Stream
River St.
Berth No 18
PIER 17
A
B
C
Berth No 19
Berth No 20
Berth No 21
Berth No 22
Berth No 23
GRAIN ELEVATOR
Berth No 24
Berth No 25
Berth No 26
Berth No 27
Berth No 28
Pier No 15
Berth No 14
Berth No 13
Pier No 12
Kekaulike St.
Maunakea St.
Smith St.
Nuuanu Ave.
Bethel St.
F R 122ft
Queen St
Berth No 11
Berth No 10
DOME
F R 96ft
Fort St.
Irwin Park
Bishop St.
Halekauwila St.
FORT ST
ALOHA TOWER
(HONOLULU HARBOR LT.)
Fl 5sec 198ft 21M
Traffic Lt
Berth No 9
Berth No 8
STACK
STACK
STACK
STACK
STACK
Alakea St

IV. Materials and Methods

A. Seawater

The Oceanic Institute's seawater system provides high clarity water similar to disposal-site surface water in all parameters pertinent to bioassay and bioaccumulation studies (Table 1). Use of this water as the control and diluent seawater in all experiments was approved in advance.

The collection, transport, and holding of water from the offshore disposal site, in the quantities required, was infeasible in this location. The depth of the water column at the site, furthermore, guarantees that "disposal-site water" is not homogeneous throughout its depth in pertinent properties, such as dissolved oxygen concentration. Thus, Oceanic Institute seawater is as realistic a model of disposal site conditions as is surface water from the site. Delicate and sensitive marine organisms have been reared in the Institute's seawater for many years. The organisms include plankton and fish native to the disposal site and its vicinity.

B. Test Sediments

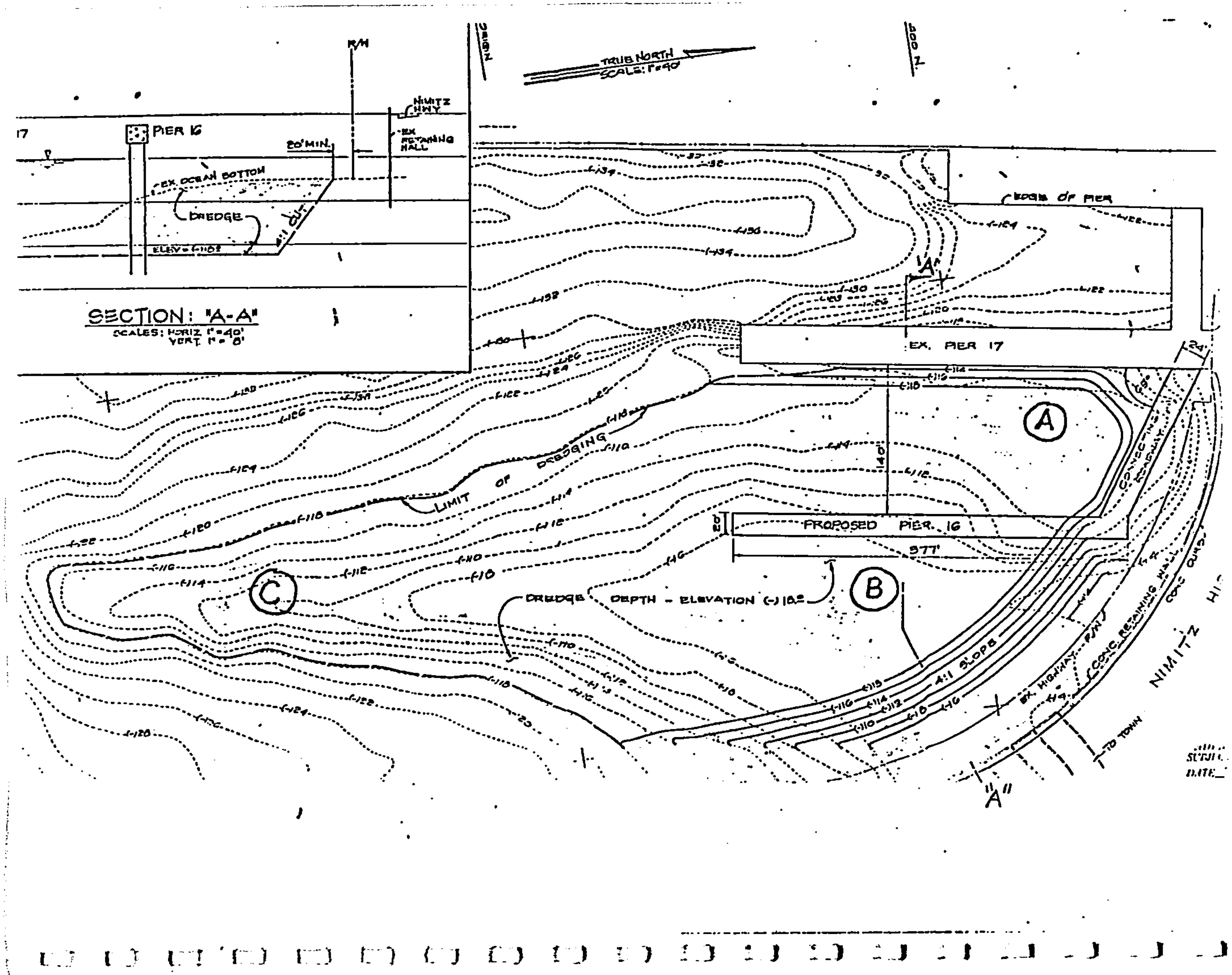
Test sediments were taken from three locations within the proposed dredging area, labelled A, B, and C in figure 1. The stations were chosen after examination of a detailed bottom-contour map of the area (Figure 2) and a skin-diving in situ reconnaissance. Station B represents a shallow (< 6 feet re: MLLW) region directly in front of the stream entrance, built up by stream deposition. Figure 2 indicates that Station B sediments will constitute most of the bulk of dredged material. Stations A and C were selected to represent parts of the dredge area as far as possible from the stream influence, in the two available directions. Samples were taken with a Peterson dredge, a grab-type sampler whose action resembles the clamshell-type dredging apparatus to be used for the proposed work.

Samples of the sediments from each station were sieved through a set of wire-mesh geological screens to determine grain-size distribution. The percentage of total dry weight in each of five size classes was determined for each station, as well as the organic matter content (by ashing at 500°C) for each size class.

Table 1. Comparison of physical and chemical properties of seawater from the Oceanic Institute's seawater supply system with surface water at the South Oahu disposal site.

Property	Units	Levels: Oceanic Institute	Levels: Disposal Site
Temperature	°C	22 - 27	22 - 27
Salinity	°/∞	∿ 32	34 - 35
Dissolved Oxygen	ppm	6.5 - 7.5 (saturated)	6.5 - 7.5 (saturated)
Plant Nutrient ions	ppm		
NH_4^+		< 0.01	< 0.01
NO_3^-		0.5 - 1.2	∿ 0.01
PO_4^{-3}		0.19	< 0.01
Suspended Solids	ppm	< 1	< 1

Figure 2. Bottom contours, sampling stations, and preliminary dredge plan for the projected Pier 16 berthing area.


SECTION: "A-A"
SCALES: HORIZ 1"=40'
VERT. 1"=8'
PIER 16
EX. OCEAN BOTTOM
DREDGE
20'MIN.
R/W
NIMITZ HWY
EX RETAINING WALL
TRUE NORTH
SCALE: 1"=40'
EDGE OF PIER
EX. PIER 17
PROPOSED PIER 16
577'
LIMIT OF DREDGING
DREDGE DEPTH - ELEVATION (-) 18.0
4:1 SLOPE
CONNECTING ROADWAY
EX. HIGHWAY R/W
CONC. RETAINING WALL
CONC. CURB
NIMITZ
TO TOWN
A
B
C
"A"

C. Liquid and Suspended-particulate Phase Bioassays

1. Procedures

Dredged sediment from each of three sampling sites in the area of proposed dredging was tested in bioassays using three organisms. Glassware was prepared using procedures standard for laboratory technique at the Institute: a soak and wash in detergent, followed by copious tapwater rinse, a rinse in deionized water, a rinse in 10% HCl, and finally three rinses with deionized water. Given that chemical analyses of exotic or trace constituents were not to be performed on the waters, this procedure is more than adequate to insure clean animal-culture technique. The liquid phase (LIQ) was prepared by mixing test sediment and control water in a 1:4 ratio as described in the implementation manual (Page B5), and agitating mechanically at 10 minute intervals during 30 minutes of vigorous aeration. After one hour's settling, the liquid was filtered through membrane filters of 0.45 μm pore size. The suspended-particulate phase (SP) was prepared like the liquid phase, with the exclusion of the filtration step.

The liquid and suspended-particulate phases were used in 10, 50, and 100% concentrations, with three replicate aquaria representing each concentration of each of the two phases or test media. Triplicate controls (100% seawater with no sediment components) were prepared as directed. Ten animals of each of the three test species were placed in each aquarium. Containers were incubated under continuous light, and the waters monitored daily for temperature, salinity, dissolved oxygen and pH. Mortality was assessed at 4, 8, 24, 48, 72 and 96 hours incubation time.

2. Test Animals

The disposal site is too depauperate in native plankton, nekton, and benthos (Tetra Tech, 1977; Brock and Kimmerer, 1980; AECOS, 1980) to make feasible the collection of sufficient numbers of organisms there. In addition, animals of the open sea, particularly zooplankton, are notoriously difficult to maintain artificially. Reasonable alternatives were essential. All organisms used had been approved in advance.

The LIQ and SP bioassays were performed with the same three species. As suggested in the manual, a zooplankter, a benthic crustacean, and a fish were used.

The brine shrimp Artemia salina served as the zooplankter for both the LIQ and SP bioassays. Artemia has been the approved zooplanktonic species for both of the previous Section 103 permit bioassay programs in Hawaii (AECOS, 1980; Brock and Kimmerer, 1980). The latter found Artemia to be one of the more sensitive organisms in their study; many bioassay applications of Artemia have been documented (Grosh, 1967; Michael et al., 1956; Brown and Ahsanullah, 1971).

The benthic crustaceans for LIQ and SP tests were deposit-feeding shrimps of the genus Penaeus. These animals were approved in advance as alternatives to the glass-shrimp Palaemon, which could not be captured in sufficient numbers for the tests at this time. Several species of Penaeus are routinely cultured at the Oceanic Institute, and sufficient test animals were available from these programs. Cultured stocks, being genetically more uniform than populations found in nature, are advantageous for bioassays in improving the reproducibility of replicated treatments, thus increasing sensitivity. Penaeus vannamei was used for LIQ and SP tests on sediments from two of the three sampling stations (B and C); Penaeus japonicus was used for the other (A).

Finally, juveniles of the grey mullet Mugil cephalus served as the fish representative. The planktivorous juvenile mullet were available from the Institute programs investigating the captive propagation and baitfish applications of the species. Mugil cephalus occurs naturally in Hawaiian waters; Miller et al., (1979) found mullet larvae widely distributed, including significant abundances in the waters off Honolulu. In addition, it has been demonstrated (EPA, 1975), that juvenile Mugil cephalus are feasible and sensitive bioassay organisms for several pesticides.

D. Solid Phase Bioassays

1. Procedures

These tests were conducted according to the procedural guidelines in the manual. Twenty individuals of each of three species of test organisms were established (over 48 h) in and upon reference sediments in each aquarium, then inundated with slurries of the prescribed aliquots of reference (for the five control aquaria) or test sediments (in the five test aquaria representing each of the three sediment samples). Static system procedures were used (75% water exchange at 1, 48, 96 h...etc;

gentle aeration) and the bioassay continued for the ten days with daily observations of temperature, salinity, dissolved oxygen, obvious mortality, and other pertinent phenomena. Reference and test sediments were screened at 1.0 mm as prescribed, to remove indigenous fauna before use.

Collection of sufficient quantities of reference sediment from the depth of the dump site was not feasible. A suitable alternative, approved for this program and for previous local Section 103 programs, is sediment from a location in Kaneohe Bay which has a similar grain size distribution and chemical composition (Figure 3) to dump site sediments (Brock and Kimmerer, 1980).

2. Test Animals

Benthic animals of three feeding habits were used in the solid-phase bioassays; a burrowing filter-feeder, an epibenthic deposit-feeder, and a burrowing deposit-feeder.

The clam *Tapes japonica* (= *philippinarum*), an infaunal bivalve filter-feeder, was obtained from a local commercial culture operation. Individuals of ≤ 2 cm shell width were used. This species was approved in advance as an alternative to field-collected *Ctena*, which were scarce at the time of this work.

Juveniles of the epibenthic, deposit-feeding shrimp *Penaeus vannamei* was again used as the approved alternative to wild *Palaemon* (see LIQ and SP test description, section IV.C.2).

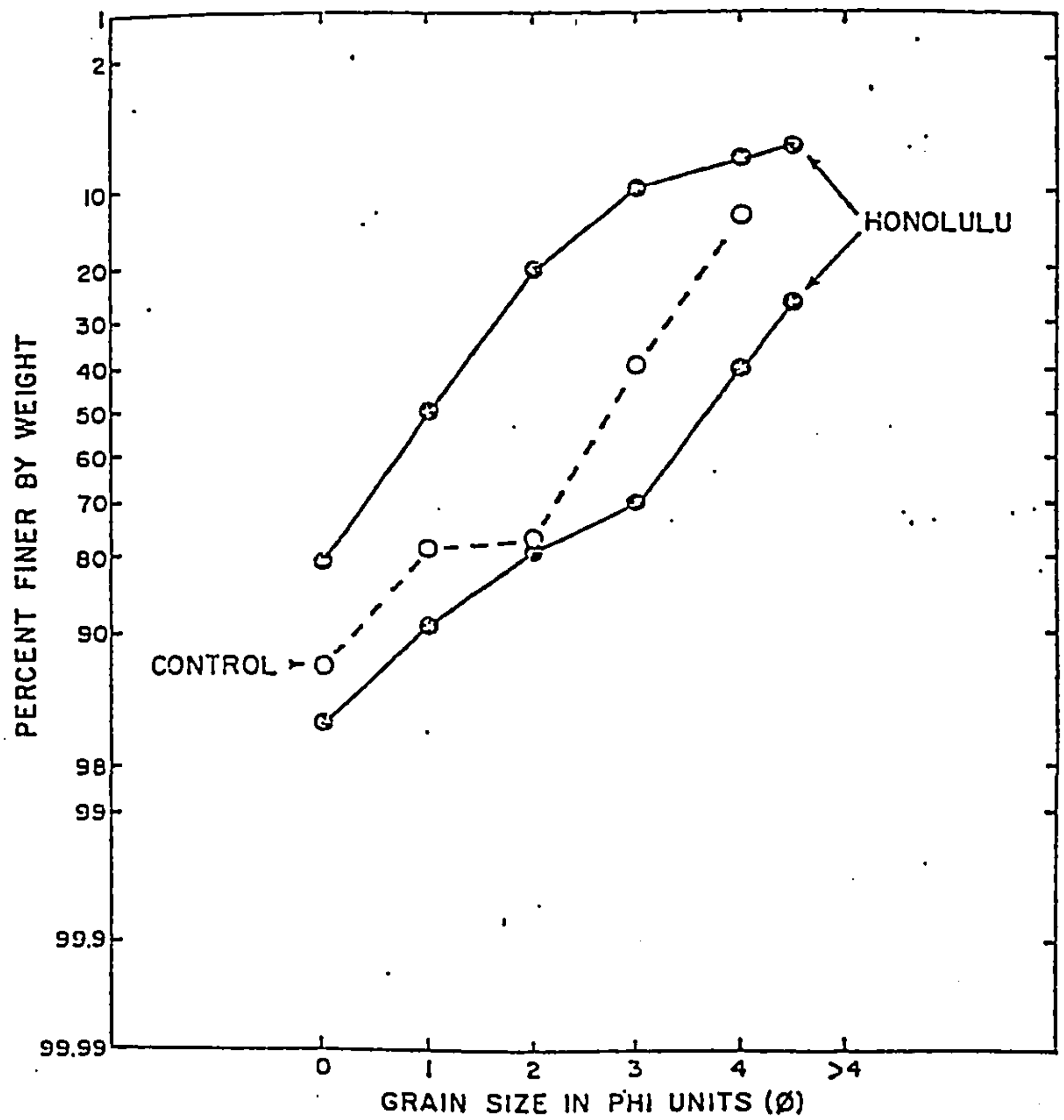
The burrowing shrimp *Penaeus japonicus* (juvenile) was the approved burrower used in the tests.

The clam *Tapes*, and *Penaeus japonicus*, were established in the reference sediment and were allowed to remain there at the time of inundation with sediments. The juvenile *P. vannamei*, being quite small (∿ 2 cm) at the time of the tests, and of epibenthic habit, were withheld from the aquaria during test-sediment addition, and placed into the experiments immediately thereafter.

E. Bioaccumulation Tests

The clam *Tapes* was used for bioaccumulation studies, because as recognized in the manual, molluscs are particularly sensitive for this purpose. Following the ten-day solid-phase bioassay, clams were held in clear water for 24 h, after which there was no evidence of further defecation. They were then shucked and frozen in plastic bags pending analysis.

Figure 3. Plot of the grainsize distribution of sediments at the Honolulu disposal site (solid lines, data from Goeggel and Guinther, 1978) and the control (reference) sediment from the outer portion of Kaneohe Bay (dashed line; from Brock and Kimmerer, 1980).


PERCENT FINER BY WEIGHT
GRAIN SIZE IN PHI UNITS (Ø)
HONOLULU
CONTROL
1
2
10
20
30
40
50
60
70
80
90
98
99
99.9
99.99
0
1
2
3
4
>4

Analyses were performed by E. A. L. Corp. of Richmond, California, for the metals cadmium, chromium, copper, lead and mercury; the organohalide pesticides and residues DDT, DDE, Dieldrin, and Mirex; PCB's; and petroleum hydrocarbons, by the methods indicated in Appendix A.

F. Statistical Analysis

Statistical tests were performed as directed in the implementation manual, and are described where appropriate in the next ("Results") Section.

V. Results and Discussion

A. Liquid- and Suspended-Particulate Phase Bioassays

There was no clear evidence of significant toxic effect of either liquid- or suspended-particulate phase medium on any of the three animal species tested. Survival rates to the end of the 96-hour tests, for all treatments combined, were as follows: *Mugil cephalus*, 99.0% (624 of 630 animals); *Penaeus* spp., 99.4% (616 of 620); and *Artemia salina*, 83.2% (524 of 630). Complete data for all LIQ and SP tests are presented in appendix B; 96-hour survival in 100% test media are summarized in Table 2.

The implementation manual specifies that any treatment resulting in survival equal to or greater than that in the appropriate control treatment need not be analyzed further. This was the case in 100% test medium from all stations, in both LIQ and SP tests, with *Penaeus*. This was also true in five of the six cases (3 stations x 2 phases) for *Mugil cephalus*, and in 3 of the six cases for *Artemia*.

It is further specified that experiments must show at least 90% survival in controls (80% for planktonic animals) in order to be valid as tests of mortality in experimental treatments. Experiments that meet this criterion, but show some experimental mortality in excess of that in the controls, are to be analyzed by t-tests. The single mullet experiment showing experimental mortality in 100% test medium (SP, station B, see table 2), was so analyzed, as directed in the manual. Cochran's test showed that variances of experimental and control treatments were homogeneous;

Analyses were performed by E. A. L. Corp. of Richmond, California, for the metals cadmium, chromium, copper, lead and mercury; the organo-halide pesticides and residues DDT, DDE, Dieldrin, and Mirex; PCB's; and petroleum hydrocarbons, by the methods indicated in Appendix A.

F. Statistical Analysis

Statistical tests were performed as directed in the implementation manual, and are described where appropriate in the next ("Results") Section.

V. Results and Discussion

A. Liquid- and Suspended-Particulate Phase Bioassays

There was no clear evidence of significant toxic effect of either liquid- or suspended-particulate phase medium on any of the three animal species tested. Survival rates to the end of the 96-hour tests, for all treatments combined, were as follows: *Mugil cephalus*, 99.0% (624 of 630 animals); *Penaeus* spp., 99.4% (616 of 620); and *Artemia salina*, 83.2% (524 of 630). Complete data for all LIQ and SP tests are presented in appendix B; 96-hour survival in 100% test media are summarized in Table 2.

The implementation manual specifies that any treatment resulting in survival equal to or greater than that in the appropriate control treatment need not be analyzed further. This was the case in 100% test medium from all stations, in both LIQ and SP tests, with *Penaeus*. This was also true in five of the six cases (3 stations x 2 phases) for *Mugil cephalus*, and in 3 of the six cases for *Artemia*.

It is further specified that experiments must show at least 90% survival in controls (80% for planktonic animals) in order to be valid as tests of mortality in experimental treatments. Experiments that meet this criterion, but show some experimental mortality in excess of that in the controls, are to be analyzed by t-tests. The single mullet experiment showing experimental mortality in 100% test medium (SP, station B, see table 2), was so analyzed, as directed in the manual. Cochran's test showed that variances of experimental and control treatments were homogeneous;

Table 2. Survival of test animals to 96 hours in liquid- and suspended particulate-phase bioassays.

Species	Phase	Station	Percent Survival (out of 30 animals)	
			Control	100% Test Medium
Mullet (*Mugil cephalus*)	Liquid	A	100	100
		B	97	100
		C	93	100
	Suspended	A	100	100
		B	97	93
		C	100	100
Commercial Shrimp (*Penaeus* spp.)	Liquid	A	100	100
		B	100	100
		C	100	100
	Suspended	A	100	100
		B	100	100
		C	100	100
Brine Shrimp (*Artemia salina*)	Liquid	A	97	80
		B	90	93
		C	70	73
	Suspended	A	97	80
		B	90	97
		C	70	67

thus the t-test would be valid and appropriate. The mortality difference between experimental and control treatment was not significant ($t = 1.73$, $p > 0.05$). There was therefore no significant mortality effect on either Penaeus or on Mugil cephalus, from either SP or LIQ medium, from any sampling station.

Overall, Artemia showed a 96-hour survival rate of 86% (154 of 180 animals) in control treatments, and, as mentioned, 83% of all treatments combined. These rates are attibutable to some care taken with aeration (a few minutes bubbling twice per day in the 50 mℓ water volumes in 125 mℓ flasks) and to attempts to keep the animals fed (a few drops of dense algal culture, once per day). However, no water exchange was done, and volumes of food suspensions were kept to a minimum, in order to preserve test medium concentrations. Since it is highly likely that food levels are critical for Artemia survival over periods as long as four days (Brock and Kimmerer, 1980; many personal communications and observations), some experimental and control mortality may be due to starvation.

There were two of the six Artemia experiments (station C, SP and LIQ) in which control survival was 70% (table 2). In one of these cases (station C, LIQ), experimental survival in 100% test medium was greater than that in the control; in the other case, the t-test showed no significant difference between control and experimental mortality ($t = 0.37$, $p > 0.05$).

There were two cases of Artemia experiments (station A, LIQ and SP) in which experimental mortality in 100% test medium was statistically significant ($t = 6.13$, $p < 0.05$ for both cases). These effects did not appear in 50% test medium, in which mortality was not significant.

When significant mortality occurs, the manual directs analysis of mortality data in combination with predictions of mixing and dilution at the dump site. An essential part of this analysis is the calculation of the concentration of test medium that would be lethal to 50% of test animals in a given period of time (LC50). Since no treatment, at any dilution, produced as much as 50% mortality, this analysis cannot be performed further. There is no evidence that any possible exposure of Artemia to SP or LIQ media would produce 50% mortality.

There is no clear evidence of Artemia mortality that can be attributed solely to toxicity of LIQ or SP materials. Although two of six experiments produced statistically significant mortalities, some of the effect may be attributable to the difficulty of preventing starvation without altering medium concentrations.

Taken as a whole, LIQ and SP experiments indicate little if any toxicity to plankton, nekton, or benthic life at the dump site due to soluble or finely-suspended material from dredged sediments.

B. Solid-Phase Bioassays.

Two of the three species used in solid-phase bioassays showed no significant mortality ($p > 0.05$) in sediments from any station, as compared with controls. The clam Tapes japonica exhibited, overall, 94% survival (377 of 400 individuals). Young juveniles of the epibenthic shrimp Penaeus vannamei showed 90% survival to the end of the ten-day experiments (358 of 400 animals). Juvenile Penaeus japonicus, a burrowing shrimp, suffered statistically significant mortality in all test sediments, with an overall survival rate of 39% (155 of 400). Complete survival data for all solid phase tests, along with results of the prescribed analysis-of-variance (ANOVA), is given in tables 3, 4, and 5.

The ANOVA Procedures were performed as prescribed in the manual, and with reference to Sokal and Rohlf (1981). For a given species, variances were tested for homogeneity by Cochran's test, as directed. These tests showed that variances were homogeneous for the data sets pertaining to each species, and so the ANOVA were done without transforming the data.

Because the control treatments, (inundation with reference sediment) showed 88-100% survival (97% overall), the experiments are valid for further analysis. There is no evidence of harmful effects of inundation with test sediments from any station on Tapes or on Penaeus vannamei. The ANOVA procedure tests whether the mean survival in any treatment (control and 3 test sediments) is significantly different from the overall mean survival. The designation "$p > 0.05$" in tables 3 and 4 thus means that control and test sediments did not differ in their effects on these species.

The designation "$p < 0.01$" in table 5 means that treatment means differed significantly among themselves, implying that significant experimental mortality took place in test populations of Penaeus japonicus. In

Table 3. Survival of juveniles of the epibenthic shrimp *Penaeus vannamei* to the end of the ten-day solid-phase bioassay. All replicates began with 20 live animals, or a total of 100 animals per treatment.

Sediment Source	Control	Animals Surviving Station A	Station B	Station C
Replicate # 1	20	20	19	20
# 2	19	20	20	10
# 3	18	18	11	17
# 4	19	16	16	19
# 5	20	18	20	18
Total	96	92	86	84

ANOVA Data

Source of Variance	Sum of Squares	d.f.	Mean Square	*F*	*P*
Treatments	18.20	3	6.067	0.716	> 0.05 (not significant)
Error	135.60	16	8.475		
Total	153.80	19			

Table 4. Survival of the clam *Tapes japonica* to the end of the ten-day solid-phase bioassay. All replicates began with 20 live animals.

Sediment Source	Control	Animals Surviving: Station A	Animals Surviving: Station B	Animals Surviving: Station C
Replicate # 1	20	20	20	20
# 2	20	20	12	13
# 3	20	20	20	20
# 4	20	19	20	20
# 5	20	19	17	17
Total	100	98	89	90

ANOVA Data

Source of Variance	Sum of Squares	d.f.	Mean Square	*F*	*P*
Treatments	18.55	3	6.183	1.124	> 0.05 (not significant)
Error	88.00	16			
Total	106.55	19			

Table 5. Survival of juveniles of the burrowing shrimp *Penaeus japonicus* to the end of the ten-day solid-phase biossay. All replicates began with 20 live animals.

Sediment Source	Control	Animals Surviving Station A	Station B	Station C
Replicate # 1	20	2	14	2
# 2	19	1	11	3
# 3	18	0	10	2
# 4	17	1	14	1
# 5	14	3	1	2
Total	88	7	50	10

ANOVA Data

Source of Variance	Sum of Squares	d.f.	Mean Square	F	P
Treatments	877.35	3	292.45	32.86	< 0.001 (significant)
Error	142.40	16	8.90		
Total	1019.75	19			

cases of significant mortality as indicated by ANOVA, the manual prescribes the performance of further tests to identify which treatments were and were not responsible for the significant statistical outcome. It is apparent by inspection, and confirmed by individual t-test pairings, that all three test sediments produced significant mortality in excess of that in the controls. The test sediment in which survival was greatest (45%) came from station B.

As mentioned earlier (Materials and Methods), Penaeus vannamei was withheld from solid-phase test aquaria until immediately after the sediment-slurry inundations were applied. This was done because these young juveniles of about 2 cm appeared to be rather delicate, and the manual recommends this strategy in such cases. Penaeus japonicus, however, was left in the aquaria, burrowed into the reference sediment, at the time of inundation, as were the clams. This was done because the P. japonicus were larger (about 5 cm) and less delicate, and because an informative test on a burrowing organism seemed to require it.

Upon inundation, some Penaeus japonicus individuals made vigorous attempts to escape, jumping out of the water and hitting the plastic aquarium covers about 10 cm above the surface. After several hours, aquarium waters had cleared sufficiently for many dead P. japonicus to be observed (about half of all eventual mortalities). These were removed. Upon termination of experiments, some dead P. japonicus were recovered from within the sediments. Some fragmented bodies were observed, and so it was assumed that some dead individuals had been eaten, also. P. vannamei, placed into aquaria after the inundation, showed some signs of distress, but no obvious mortality.

The observations of immediate mortality of Penaeus japonicus suggested an additional experiment aimed at determining whether the results observed were repeatable, directly related to the inundation treatment, and peculiar to P. japonicus. Ten of the shrimp were established in a reference sediment overnight, and inundated with a slurry of station C sediment the next day. After 1 hour, 5 of 10 animals were recovered alive. Another aquarium, containing reference sediment but no animals, received a similar inundation, after which ten shrimp were added. All were recovered alive two hours later. Too few P. japonicus of the proper size were available at this time to permit the use of replicate aquaria for this test. A similar paired test was performed (with duplicate aquaria for each treatment) with P. vannamei, which does not burrow. All were recovered alive after 2 h.

These additional experiments support the hypothesis that at least part of the observed mortality of Penaeus japonicus in solid-phase bioassays was due to immediate effects of the inundation. Mechanical effects, such as clogging of gill tissue, and possibly high initial B.O.D. in the sediments, may be suspected but were not investigated.

Because mortality was substantially more severe in sediments from stations A and C than in sediments from station B, the sediments were examined for properties that might help to explain the mortality differences. The size distributions of all test sediments in terms of dry weight are presented in figure 4. It is immediately obvious that station B sediments are of coarser character than sediments from the other two stations. The difference was also readily discernible visually, and by handling the sediments. The same size and dry-weight information is presented in the traditional manner, using the ϕ (phi) scale, in figure 5. This is presented to facilitate comparisons with sediment-size information from other studies. All test sediments used in this study, for example, appear to contain greater percentages of coarse components than the Pearl Harbor sediments tested by Brock and Kimmerer (1980). The organic-matter content of test sediments in various size classes is presented in figure 6. Again, station B sediments are quite different from the others, being less organic in nearly all size-classes and more than 90% mineral overall.

Several major points about station B sediments may be made:

1. Station B sediments are of coarser grain size than sediments from the other stations, and have less organic matter content;
2. In cases where a bioassay treatment has been associated with significant mortality to an animal species in these tests, Station B sediments either 1) failed to produce the mortality that other sediments did (as for Artemia LIQ and SP tests), or 2) produced less severe mortality than sediments from stations A and C (as for Penaeus japonicus in solid-phase tests).
3. Station B sediments will constitute most of the bulk of actual dredged material from the proposed project (figure 2). This means that the coarsest and least potentially harmful of the three sediment samples represents most of the material to be disposed.

Figure 4. Size-distribution of bioassay test sediments among various grain-size classes, in terms of dry weight.

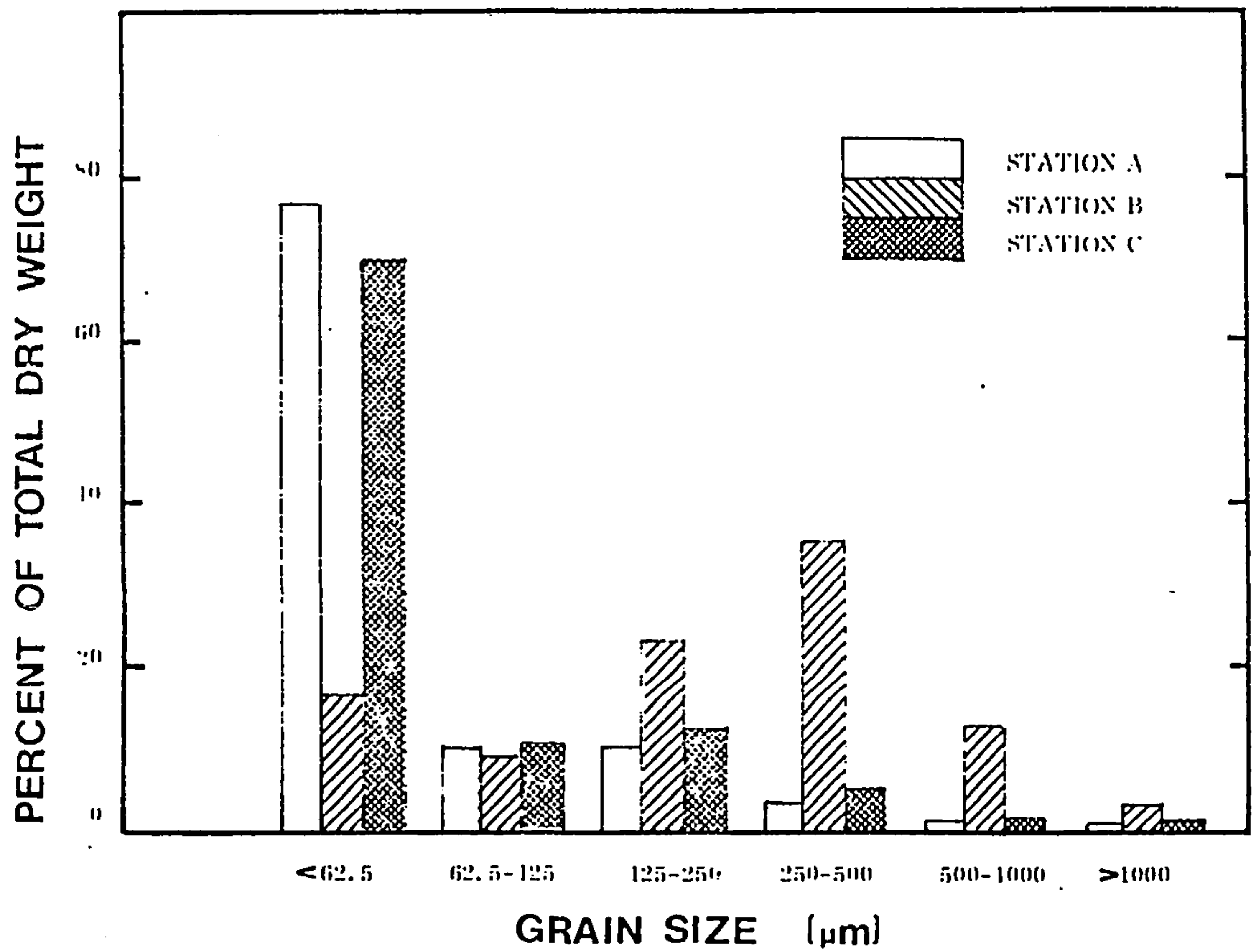
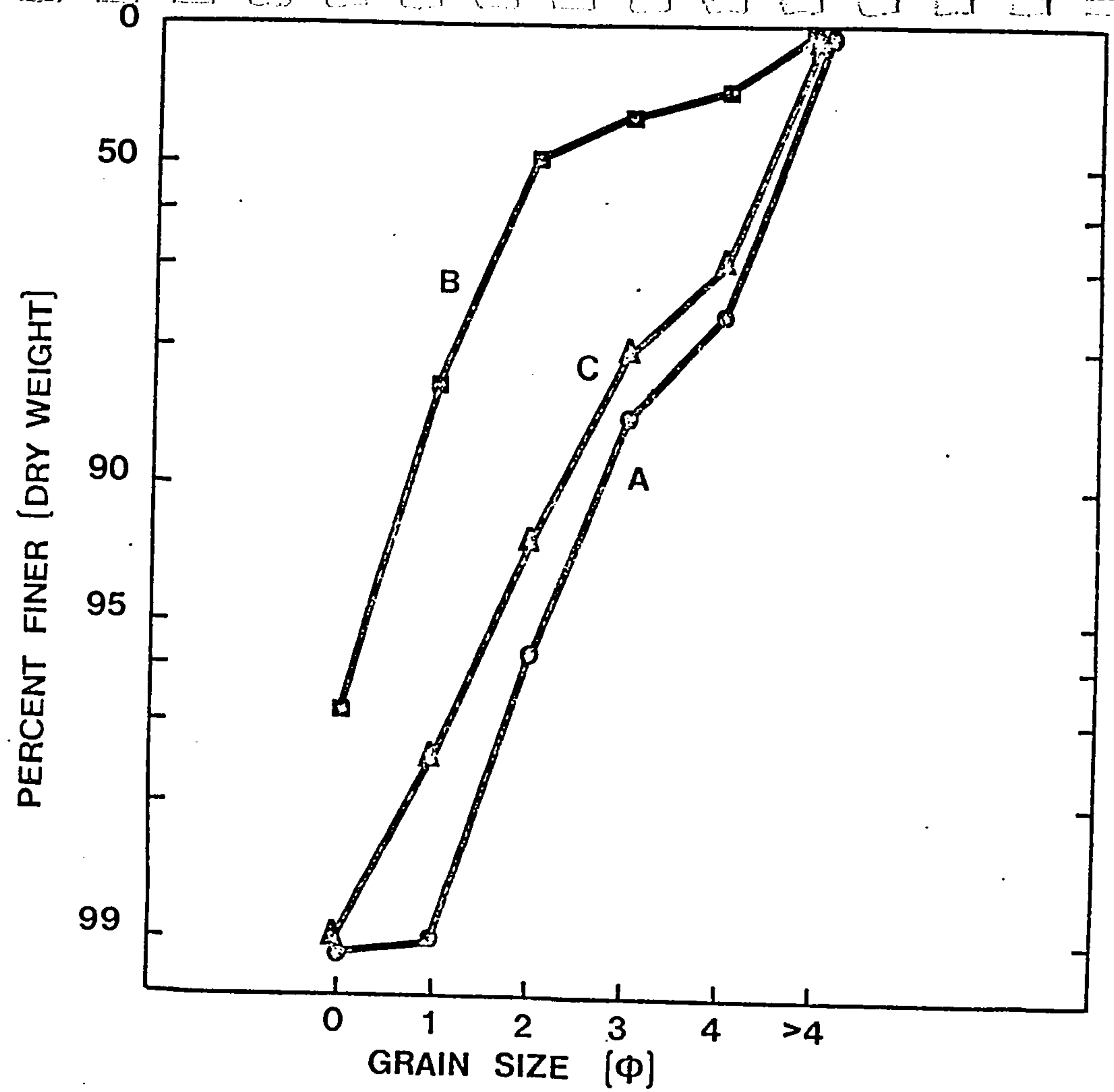
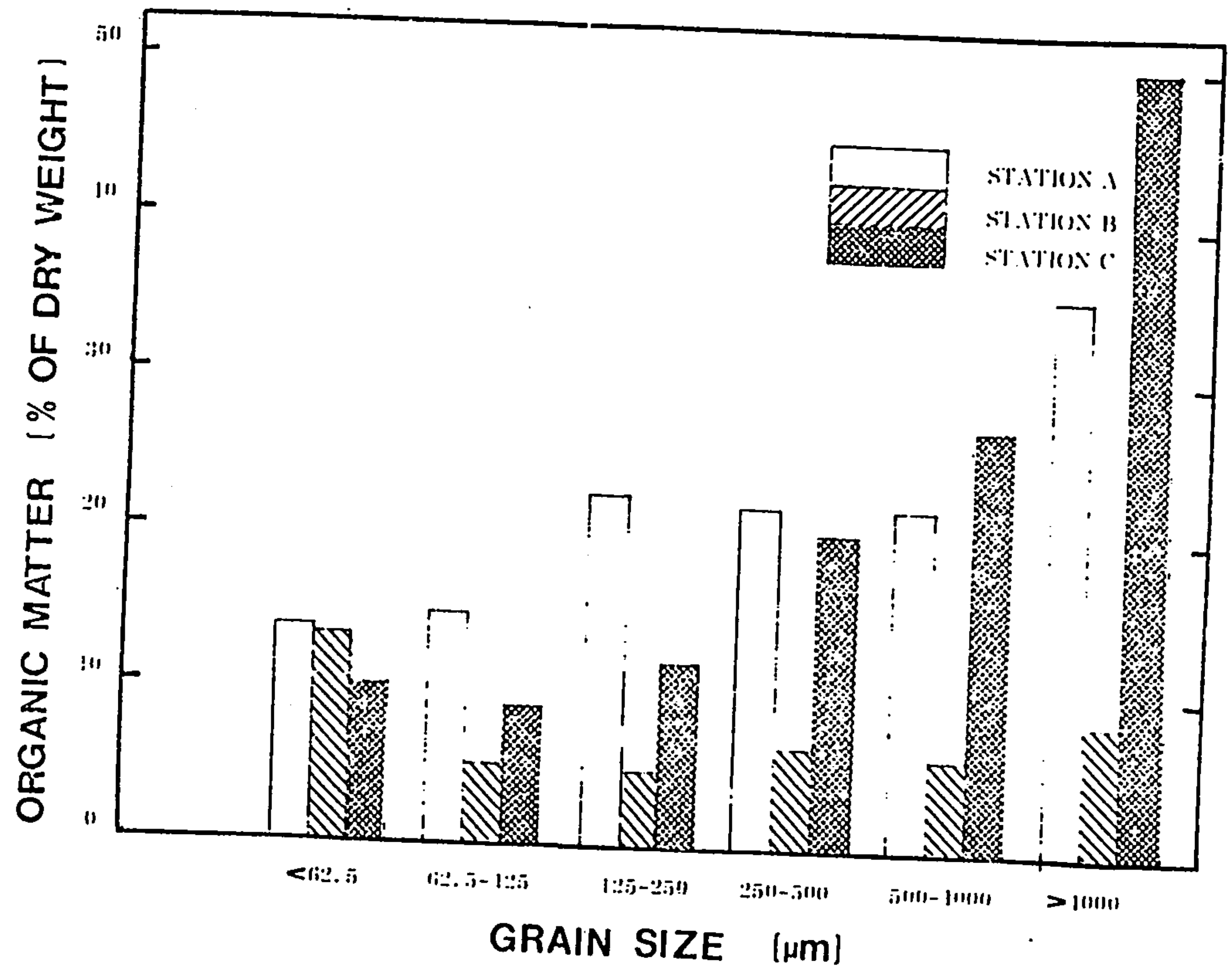

PERCENT OF TOTAL DRY WEIGHT
80
60
40
20
0
STATION A
STATION B
STATION C
<62.5
62.5-125
125-250
250-500
500-1000
>1000
GRAIN SIZE (μm)

Figure 5. Grain-size analysis of bioassay test sediments used in this study. Zero ϕ indicates 1.0 mm, and each higher ϕ number represents one-half the grain size of the previous ϕ number (e.g., 1 ϕ = 0.5 mm).



PERCENT FINER (DRY WEIGHT)
0
50
90
95
99
GRAIN SIZE (Φ)
0
1
2
3
4
>4
A
B
C

Figure 6. Organic content of bioassay test sediments in various grain-size classes.



ORGANIC MATTER [% OF DRY WEIGHT]
50
40
30
20
10
0
STATION A
STATION B
STATION C
<62.5
62.5-125
125-250
250-500
500-1000
>1000
GRAIN SIZE [µm]

Although sediments produced significant mortality in one of the three species tested, the effects can be attributed at least in part to immediate physical effects of experimental inundation. A closely-related congeneric species (Penaeus vannamei), experienced very little mortality during prolonged exposure to the same materials.

Given the results of these tests and their implications, and given that studies done for the disposal site EIS (EPA, 1980) found little evidence that disposed material will be deposited at the site (Goeggel and Guinther, 1978), it is reasonable to conclude that these solid-phase tests have failed to provide clear evidence of harmful impact of sediment disposal.

C. Bioaccumulation Tests.

The tissue of the clams involved in the Solid-Phase Bioassays was analyzed for eleven substances in an effort to assess the potential for accumulation of toxicants in benthic animals at the disposal site. The clam tissue from each of three aquaria from each of the four treatments (control and three sediment samples) were analyzed for all substances except petroleum hydrocarbons, yielding a total of 12 such samples. Analysis of petroleum hydrocarbons required more tissue than had been anticipated; clam tissue from the remaining two aquaria in each treatment was combined to yield one sample representing each treatment, i.e. four samples.

Concentrations of substances in the tissue are reported here as ppm (mg/kg) or ppb (μg/kg) on a dry-weight basis. Comparisons with data from other sources that are expressed on a wet-weight basis may be made by dividing the concentrations given in this report by 5, the average factor relating wet weight to dry weight for these tissue samples.

Of the eleven substances analyzed, five were undetectable in all 12 samples. This group included mercury, p, p-DDT, dieldrin, mirex and PCB's. The minimum detection limits for these analyses are given in Appendix C, part II of this report.

For an additional three substances (cadmium, chromium, and copper), mean concentrations in the tissues of clams exposed to the control sediment equalled or slightly exceeded the concentrations in the tissue of clams exposed to the test sediments. The data from these analyses is given in Appendix C, part I. In general, these concentrations are similar to mean levels found in wild clams of the same species by the State of Hawaii

Department of Health (1978) in a statewide survey of estuarine environments. This survey, furthermore, found no detectable levels of DDT, dieldrin, or PCB's in 27 tissue samples from fishes, crabs and clams. It must be noted, however, that the State survey involved no such animals from the Honolulu Harbor site sampled in this study. The State survey did analyze some sediment from the site.

There is no evidence from the tests reported here of bioaccumulation potential for these eight substances, and they are not discussed further.

In the case of analyses for lead (see also appendix C, part I), concentrations in tissues from all 3 control aquaria were undetectable (< 0.20 ppm), as were the levels in several other samples (3 of the remaining 9). As directed in the implementation manual, analyses of the data proceeded after substitution of the detection-limit value in the position of all samples with non-detectable levels. ANOVA could not be performed, because Cochran's test showed the treatment variances to be significantly inhomogeneous, even after the "$\ell n\ (x + 1)$" transformation. The approximate test of equality of means recommended in the manual was then performed, with reference to Sokal and Rohlf (1981). The test failed to indicate any difference among the four treatment means at the 0.05 probability level. Although inspection of the data on lead concentration might nonetheless lead to concern with the levels associated with exposure to station B sediments, it should be noted that the concentrations involved are in all cases below the lowest level of lead found in any of the 772 clam tissue samples analyzed by the State Department of Health (1978) from other Hawaiian embayments.

Interpretation of the data on concentrations of petroleum hydrocarbons (appendix C, part II) is severely restricted by the availability of only one analysis pertinent to each treatment. No rigorous tests of significant differences can be made without replicated samples. Several informative data may be noted:

1) tissue exposed to control sediments did contain hydrocarbons at the minimum detection limit;
2) the tissue exposed to station B sediments, which will constitute most of the actual material to be dredged had less than the detectable limit; and

3) the highest analytical result, of unknown significance, applies to a sediment samples (station A) which was very near a possible hydrocarbon source (Pier 17), and which represents a minor component of actual material to be dredged.

The concentrations of o, p'-DDE in tissues exposed to test sediments (appendix C, part I) were significant for all sampling stations, compared with controls. DDE is a persistent metabolic product of DDT degradation; the use of DDT has been banned since 1972 (State of Hawaii Department of Health, 1978). The occurrence of DDE in these tissue samples was surprising in view of the failure of the State survey to find any DDT product in any tissue samples, and no o, p'-DDE, in any of 91 sediment samples, including two samples near the site of the present study. An examination of older and recent harbor charts does show a fairly rapid shoaling of the area, which is attributable to deposition by Nuuanu Stream. The higher tissue concentrations associated with station B and C sediments, compared with station A, (see Figure 1), support but cannot confirm a speculation of recent stream input of pesticide-bearing debris. In terms of a real dredging and disposal situation, these results do not in themselves indicate significant environmental or human danger. The final EIS for the disposal site (EPA, 1980) indicates that 1) little disposed material reaches the bottom at the site, and 2) abundance of animals, including any in the human food chain, is low in the area. Furthermore, the liquid- and suspended-particulate-phase tests conducted with the sediments under discussion reveal no demonstrable danger to life in the water column above the disposal-site bottom.

VI. Conclusions

In overview, the tests conducted during this study failed to provide clear indications of adverse environmental impacts from the proposed disposal of dredged materials. In general, tests proceeded smoothly and animals survived in high percentage. In the cases where animal mortality was observed, some extenuating circumstance (such as possible inadequacy of *Artemia* food ration, and mechanical effects of sediment inundation on *Penaeus japonicus*) cast strong doubt on a hypothesis of sediment toxicity.

The one case (out of eleven potential toxicants analyzed) of potential bioaccumulation (DDE) must be considered in view of the known characteristics of the disposal site, which combine to greatly dilute disposed material, and disperse it widely before deposition.

VII. References

Brock, R. E., and W. J. Kimmerer, 1980. A bioassay evaluation of proposed discharge of Pearl Harbor dredged material (West Loch) at the Honolulu Disposal site. Hawaii Inst. Mar. Bio. 54 p.

Brown, B. and M. Ahsanullah, 1971. Effects of heavy metals on mortality and growth. Mar. Poll. Bull. 2:182-187.

E.P.A., 1975. Effects of Mirex and Methoxychlor on striped mullet, _Mugil cephalus_ L. National Environmental Research Center, Office of Research and Development, U.S. Environmental Protection Agency, Corvalis, Oregon, 97330.

E.P.A., 1978. Bioassay procedures for the ocean disposal permit program. EPA-600/9-78-010, Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Gulf Breeze, Florida.

E.P.A., 1980. Final environmental impact statement (FIS) for Hawaii dredged material disposal sites designation. EPA Oil and Special Materials Control Division, Marine Protection Branch, Wash. D.C.

Goeggel, G. B. and E. Guinther, 1978. Phase III. Environmental surveys of deep ocean dredged spoil disposal sites in Hawaii. Prepared for U.S. Army Engineers, Pacific Division, 141 p. + app.

Grace, J. M. (ed.), 1974. Marine Atlas of Hawaii. Bays and Harbors. Sea Grant Miscellaneous Report, UNIHI-SEAGRANT-MR-74-01. University of Hawaii, 241 p.

Grosh, D. S., 1967. Poisoning with DDT: effect on reproductive performance of _Artemia_. Science 155:592-593.

Michael, A. S., C. G. Thompson, and M. Abramovitz, 1956. _Artemia salina_ as a test organism for bioassay. Science 123(3194):464.

Miller, J. M., W. Watson, and J. M. Leis, 1979. An atlas of common near-shore marine fish larvae of the Hawaiian Islands. Seagrant Miscellaneous Report UNIHI-SEAGRANT-MR-80-02. University of Hawaii Sea Grant College Program, 179 p.

Neighbor Island Consultants and Hawaii Planning, Design, and Research, 1977. Environmental Surveys of Deep Ocean Dredged Spoil Disposal Sites in Hawaii. Final Rept. Prep. for U.S. Army Corps of Engineers, Honolulu. 2 Volumes, 131 p. + app.

Sokal, R. R., and F. J. Rohlf, 1981. Biometry (2nd ed.,), W. H. Freeman and Co., San Francisco, 859 p.

State of Hawaii, Department of Health, 1978. Distribution of heavy metals, chlorinated pesticides, and PCB's in Hawaiian estuarine environment. Intensive Survey Report, Pollution Investigation and Enforcement Branch, 32 p.

Szyper, J. P., 1981. Test Procedures for dredged materials from the projected Pier 16 Berthing Area. The Oceanic Institute, 17 p. Prepared for the R. M. Towill Corp.

Tetra Tech, 1977. Ocean disposal of harbor dredged materials in Hawaii, Final Report. Prepared for U.S. Army Corps of Engineers, Hawaii, 153 p.

Appendix A. Methods of chemical analysis of tissue samples from bioaccumulation studies, with literature references.

Heavy Metals: (References 1, 2 and 3)

Preparation to be done using Class 100 Clean Room facilities. Samples to be analyzed for chromium, copper, cadmium, and lead will be freeze dried and digested using a HNO_3/H_2O_2 mixture. Analysis will be done by either flame or graphite furnace atomic absorption as required by analyte concentrations. Samples to be analyzed for mercury will be digested using a $KMnO_4/H_2SO_4$ mixture, and analyzed by the cold-vapor atomic absorption technique.

Accuracy of metals test results will be assured by analyzing NBS Oyster Tissue, SRM 1566, simultaneously with the samples.

Organohalides: (References 1, 4)

Samples to be analyzed for DDT, DDE, dieldrin, mirex, and PCB's will be extracted in hexane, concentrated, transferred to a Florisil column, and the concentrated column eluant analyzed by electron capture gas-liquid chromatography. If significant amounts of pesticides and PCB's are detected, mutual interference will necessitate an additional silicic acid column cleanup step. However, this extra cleanup is not expected to be required, and is included only as an option.

Petroleum Hydrocarbons: (References 1, 5 and 6)

Samples to be analyzed for petroleum hydrocarbons will be refluxed in a methanol/KOH to saponify any biogenic hydrocarbons present. The digested mixture will then be filtered and extracted into carbon tetrachloride. The concentrated extract will be analyzed by infrared spectrometry.

Analytical References:

1. Pequegnat, W. E., Pequegnat, L. H., James, B. M. 1981. Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites, TerEco Corporation final report for Office of Chief of Engineers, U.S. Army, Washington, D.C. pp 191-194.
2. Stephenson, M. D., Martin, M., Lange, S. E., Flegal, A. R., Martin, J. H., 1979. Trace Metal Concentrations in the California Mussel, Water Quality Monitoring Report No.79-22, Volume II, State Water Resources Control Board, California Mussel Water 1977-78.
3. U.S. Environmental Protection Agency, 1979. Methods for Chemical Analysis of Water and Wastes, EMSL, Cincinnati, Ohio: EPA-600/4-79-020, March, 1979.
4. U.S. Environmental Protection Agency, 1980. Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples, HERL, Research Triangle Park, N.C., EPA-600/8-80-038, Section 5, A.
5. Goldberg, Edward D., 1976. Strategies for Marine Pollution Monitoring, John Wiley and Sons, New York, pp 12-18.
6. American Public Health Association 1981. Standard Methods for the Examination of Water and Wastewater, 15th Ed., AWWA, WPCF, APHA, Washington, D.C. Method 503E.

Appendix B. Numbers of animals surviving to standard observation times in liquid- and suspended-particulate phase bioassays. *Penaeus japonicus* was used for station A experiments, *Penaeus vannamei* for station B and C experiments.

LIQUID PHASE BIOASSAY

Station	Test Species / Elapsed Time (Hrs.)	Replicates	*Artemia salina* 0	4	8	24	48	72	96	*Mugil cephalus* 0	4	8	24	48	72	96	*Penaeus* spp. 0	4	8	24	48	72	96
STATION A SEDIMENT	Culture Water Control	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	29	29	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	100% Test Medium	1	10	10	10	9	9	8	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	9	7	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	9	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	28	27	24	24	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	50% Test Medium	1	10	10	10	10	10	9	8	10	10	10	10	10	10	10	10	9	9	9	9	9	9
		2	10	10	10	9	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	29	29	28	27	30	30	30	30	30	30	30	30	29	29	29	29	29	29
	10% Test Medium	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	29	29	28	30	30	30	30	30	30	30	30	30	30	30	30	30	30
STATION B SEDIMENT	Culture Water Control	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	8	8	8	8	8	8
		2	10	10	10	10	10	9	8	10	10	10	10	10	10	10	8	8	8	8	8	8	8
		3	10	10	10	9	9	9	9	10	10	10	10	10	10	9	8	8	8	8	8	8	8
		Total	30	30	30	29	29	28	27	30	30	30	30	30	30	29	24	24	24	24	24	24	24
	100% Test Medium	1	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	30	28	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	50% Test Medium	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	9
		3	10	10	10	10	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	29	28	28	30	30	30	30	30	30	30	30	30	30	30	30	30	29
	10% Test Medium	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	8	8	8	8	8	8
		3	10	10	10	10	10	10	10	10	10	10	10	10	9	9	8	8	8	8	8	8	8
		Total	30	30	30	30	30	30	30	30	30	30	30	30	29	29	26	26	26	26	26	26	26
STATION C SEDIMENT	Culture Water Control	1	10	10	10	10	10	9	5	10	10	10	8	8	8	8	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	28	21	30	30	30	28	28	28	28	30	30	30	30	30	30	30
	100% Test Medium	1	10	10	10	10	9	9	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	9	9	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	28	28	22	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	50% Test Medium	1	10	10	10	10	10	9	3	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	9	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	27	19	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	10% Test Medium	1	10	10	10	10	9	8	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	9	9	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	28	27	24	30	30	30	30	30	30	30	30	30	30	30	30	30	30

SUSPENDED-PARTICULATE PHASE BIOASSAY

Station	Test Species / Elapsed Time (Hrs.)	Replicates	*Artemia salina* 0	4	8	24	48	72	96	*Mugil cephalus* 0	4	8	24	48	72	96	*Penaeus* spp. 0	4	8	24	48	72	96
STATION A SEDIMENT	Culture Water Control	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	29	29	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	100% Test Medium	1	10	10	10	9	9	9	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	29	29	29	24	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	50% Test Medium	1	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	29	28	28	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	10% Test Medium	1	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	8	8	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	28	28	23	30	30	30	30	30	30	30	30	30	30	30	30	30	30
STATION B SEDIMENT	Culture Water Control	1	10	10	10	10	10	10	10	10	10	10	10	10	10	10	8	8	8	8	8	8	8
		2	10	10	10	10	10	9	8	10	10	10	10	10	10	10	8	8	8	8	8	8	8
		3	10	10	10	9	9	9	9	10	10	10	10	10	10	9	8	8	8	8	8	8	8
		Total	30	30	30	29	29	28	27	30	30	30	30	30	30	29	24	24	24	24	24	24	24
	100% Test Medium	1	10	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	9	10	10	10	10	10	9	9	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	29	29	30	30	30	30	30	29	29	30	30	30	30	30	30	30
	50% Test Medium	1	10	10	10	10	10	10	9	10	10	10	10	10	9	9	10	10	10	10	10	10	10
		2	10	10	10	10	9	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	29	28	27	30	30	30	30	30	29	29	30	30	30	30	30	30	30
	10% Test Medium	1	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	9
		Total	30	30	30	30	30	29	28	30	30	30	30	30	30	30	30	30	30	30	30	30	29
STATION C SEDIMENT	Culture Water Control	1	10	10	10	10	10	9	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	10	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	28	21	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	100% Test Medium	1	10	10	10	10	10	9	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	9	9	5	3	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	29	29	23	20	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	50% Test Medium	1	10	10	10	10	10	9	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	9	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	6	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		Total	30	30	30	30	30	24	19	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	10% Test Medium	1	10	10	10	10	8	6	4	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		2	10	10	10	10	10	6	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		3	10	10	10	10	10	10	8	10	10	10	10	10	10	10	10	10	9	9	9	9	9
		Total	30	30	30	30	28	22	17	30	30	30	30	30	30	30	30	30	29	29	29	29	29

Appendix C. Results of chemical analyses of soft tissues of the clam *Tapes japonica*, following solid-phase bioassays.

Part I. Test constituents with detectable concentrations in some or all samples. Concentrations are reported on a dry-weight basis. Results of analysis of variance are included where appropriate.

Test Constituent	Replicate Aquarium	Sediment Source: Control	Station A	Station B	Station C
Cadmium, ppm	1	0.24	0.30	0.37	0.28
	2	0.38	0.24	0.24	0.24
	3	0.40	0.28	0.38	0.38
	Mean	0.34	0.27	0.33	0.30
	Standard deviation	0.09	0.03	0.08	0.07
	ANOVA not performed:	control means higher than treatment means.			
Chromium, ppm	1	1.8	1.8	3.8	2.2
	2	2.9	1.2	2.2	1.4
	3	4.1	3.8	2.4	2.9
	Mean	2.9	2.3	2.8	2.2
	Standard deviation	1.2	1.4	0.9	0.8
	ANOVA not performed:	control means higher than treatment means.			
Copper, ppm	1	11.0	8.6	13.0	11.0
	2	10.0	8.4	7.6	7.9
	3	12.0	11.0	8.0	9.8
	Mean	11.0	9.3	9.5	9.6
	Standard deviation	1.0	1.4	3.0	1.6
	ANOVA not performed:	control means higher than treatment means.			

Appedix C (contd.)

Test Constituent	Replicate Aquarium	Control	Sediment Source Station A	Station B	Station C
Lead, ppm					
(nd means < 0.20 ppm)	1	nd*	nd*	1.4	0.20
	2	nd*	nd*	0.55	nd*
	3	nd*	0.28	0.36	0.29
	Mean	0.20*	0.23*	0.77	0.23*
	Standard deviation	0	0.05	0.55	0.05

ANOVA not performed: variances inhomogeneous, even after transformation.

* Detection limit is used for samples whose concentrations are under this limit.

Test Constituent	Replicate Aquarium	Control	Station A	Station B	Station C
o,p-DDE ppb					
(nd means < 0.6 ppb)	1	nd*	57	88	88
	2	nd*	24	79	110
	3	nd*	67	66	68
	Mean	3*	49	78	89

ANOVA Data

Source of Variance	Sum of Squares		d.f.	Mean Square		F	p
Treatments	13	148.7	3	4	382.9	16.4	< 0.01
Error	2	140.0	8		267.5		
Total	15	288.7	11				

* Detection limit is used for samples whose concentrations are under this limit.

Part II. Test constituents with undetectable concentrations in all samples, and the minimum detectable levels for each substance.

Constituent	Minimum Detectable Concentration (dry weight basis)
Mercury	0.7 ppm
P, p-DDT	30 ppb
Dieldrin	1 ppb
Mirex	10 ppb
PCB's	50 ppb

Part III. Concentrations of petroleum hydrocarbons in combined samples of clam tissue from each of the four treatments (sediment sources). Samples from replicate aquaria were combined because large amounts of tissue were required for the analyses. Concentrations are given in ppm; the detection limit is 0.1 ppm.

Sediment Source	Control	Station A	Station B	Station C
	0.1	0.9	nd	0.2

APPENDIX C

SEDIMENT ANALYSIS

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone: (808) 254-5884

July 26, 1983

Mr. Gordon Matsuoka
Harbors Division
State Department of Transportation
79 South Nimitz Highway
Honolulu, Hawaii 96813

Dear Mr. Matsuoka,

Enclosed are the results of our analysis for DDE of eight sediment samples from Honolulu Harbor - Pier 16. No detedcable amounts of DDE were found in any of the samples. The lowest detectable amount given in the data report varied with the amount of sediment analysed and extract volume for each sample. The lowest detectable amount for all samples was below 1 ppb (ug/kg). An invoice for this work is enclosed.

Sincerely,

David A. Ziemann, Ph.D.
Vice President

Enclosures

AECOS

970 N. Kalaheo Ave., A300
Kailua, HI 96734

JOB NO. 1083-DOT
DATE 7/26/83
PAGE 1 OF 1

LABORATORY ANALYSIS REPORT

TO: STATE HARBORS DIVISION ATTN: MR. GORDON MATSUOKA
ADDRESS: 79 S NIMITZ HWY PHONE:
SAMPLES OF: HONOLULU HARBOR - PIER 16

SAMPLED BY: E.K. HIRATA & ASSOC. SAMPLING DATE: 6/9/83 TIME:
RECEIPT DATE: 6/9/83 TIME:

DATE SAMPLE ANALYZED						
TIME SAMPLE ANALYZED						
SAMPLE TYPE		CORE				
SAMPLE DESCRIPTION	UNITS	DDE ppb				
H @ 1'		<0.33				
F @ 1'		<0.53				
D @ 2'		<0.35				
D @ 5'		<0.50				
A @ 1'		<0.53				
E @ 2'		<0.37				
E @ 4'		<0.35				
E @ 6'		<0.45				

LABORATORY REMARKS Samples analyzed according to "Methods for Chemical Analysis of Water and Wastes", U.S. Environmental Protection Agency, March, 1976

David Ziemann

AECOS
970 N. Kalaheo Avenue, Suite A300 • Kailua, Hawaii 96734
Telephone: (808) 254-5884

September 6, 1983

Mr Gordon Matsuoka
Harbors Division
State Department of Transportation
79 South Nimitz Highway
Honolulu, Hawaii 96813

Dear Mr Matsuoka:

Please find enclosed the results of DDE analyses on 9 samples from sediment cores collected in Honolulu Harbor. DDE was not detected in any of the samples. As a check on the method I ran a recovery experiment on a subsample from sediment C - 6'. The spiked sample when analyzed had 2.26 ug DDE. Since the subsample was originally spiked with 2.50 ug DDE this results in a 91% recovery. An invoice is enclosed with the results. Please call me if you have any questions regarding these data.

Sincerely,

David Crear

David Crear

DC/dc
Enclosures

AECOS
970 N. Kalaheo Ave., A300
Kailua, HI 96734

LABORATORY ANALYSIS REPORT

JOB NO. 1083-DOT-2
DATE 6 September 1983
PAGE 1 OF 1

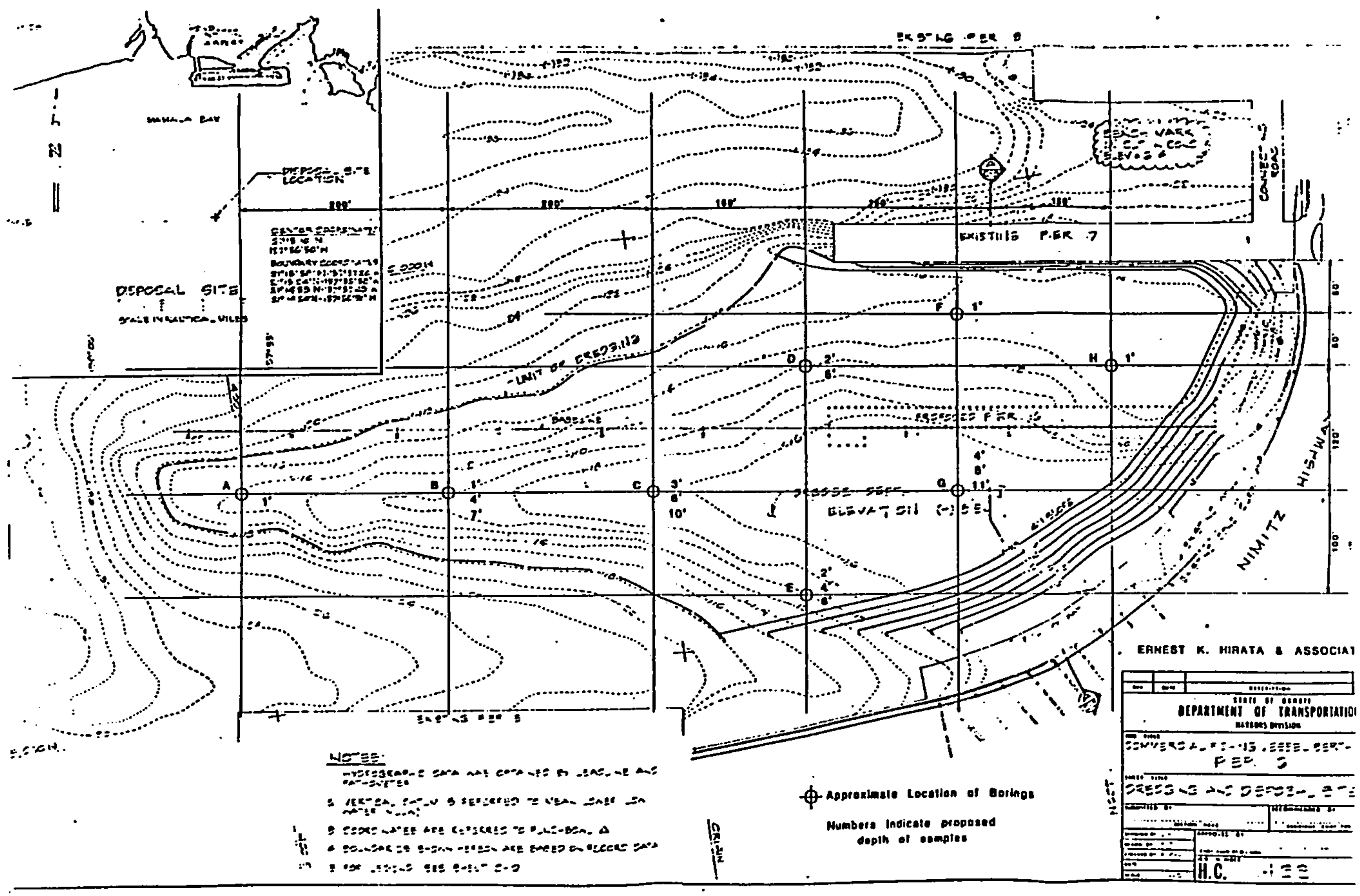
TO: State Harbors Division
ADDRESS: 79 S. Nimitz Highway
ATTN: Mr Gordon Matsuoka
SAMPLES OF: Sediment Cores
PHONE: 548-2505

SAMPLED BY:
RECEIPT DATE:
SAMPLING DATE:
TIME:
TIME:

ANALYSIS DATE	6 Sept'83					
MEASUREMENT	DDE					
UNITS:	ug/kg					
SAMPLE(S)	Sediment Cores					
C - 6'	< 28					
B - 4'	< 26					
B - 7'	< 25					
G - 11'	< 26					
B - 1'	< 26					
G - 8'	< 26					
C - 10'	< 26					
C - 3'	< 32					
G - 4'	< 27					

LABORATORY REMARKS: The samples were extracted with hexane saturated acetonitrile, back-extracted into hexane, and then injected on a Tracor 550 Gas Chromatograph equipped with a Hall electrolytic conductivity detector. Recovery experiments produced a 91% recovery.

David Crear



EXISTING PIER 7
UNIT OF DREDGING
DISPOSAL SITE
SCALE IN NAUTICAL MILES
DISPOSAL SITE LOCATION
NIMITZ HIGHWAY
A
B
C
D
E
F
G
H
NOTES:
Approximate Location of Borings
Numbers indicate proposed depth of samples
ERNEST K. HIRATA & ASSOCIAT
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATIO
HARBORS DIVISION
H.C.

APPENDIX D

COMMENTS AND RESPONSES TO THE EIS

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

CHARLES G. CLARK
DIRECTOR OF HEALTH

JOHN F. CHALMERS, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

MELVIN K. KOIZUMI
DEPUTY DIRECTOR OF HEALTH

ADELINA MADRID SHAW, M.A., J.D.
DEPUTY DIRECTOR OF HEALTH

August 27, 1982

In reply, please refer to:
File: EPHSD-SS

MEMORANDUM

To: Jacqueline Parnell, Director
Office of Environmental Quality Control

From: Deputy Director for Environmental Health

Subject: Environmental Impact Statement (EIS) for
Commercial Fishing Vessel Berthing Area

Thank you for allowing us to review and comment on the subject EIS. On the basis that the project will comply with all applicable Public Health Regulations, please be informed that we do not have any objections to this project.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

MELVIN K. KOIZUMI

BC:jh

cc: Department of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMACK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO:
HAR-ED 1607

October 26, 1982

Mr. Melvin K. Koizumi
Deputy Director
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Koizumi:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated August 27, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

APZV-EHV 1 SEP 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

The Environmental Impact Statement (EIS) for the Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu, has been reviewed and we have no comments to offer.

Thank you for the opportunity to comment on the EIS.

Sincerely,

Original signed by

RONALD A. BORRELLO
LTC(P), EN
Director of Engineering and Housing

CF:
Mr. Ryokichi Higashionna, Director
State Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES H. CAMARA
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1495

Mr. Ronald A. Borrello
Director of Engineering and Housing
Directorate of Engineering and Housing
U. S. Army Support Command Hawaii
Fort Shafter, Hawaii 96858

Attention: Environmental Management Office

Dear Mr. Borrello:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 1, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING

FRANKLIN Y. K. SUNN
DIRECTOR
RICHARD K. PAGLINAWAN
DEPUTY DIRECTOR
ALFRED K. SUGA
DEPUTY DIRECTOR

September 2, 1982

MEMORANDUM

TO: Jacqueline Parnell, Director
Office of Environmental Quality Control

FROM: Franklin Y.K. Sunn, Director
Department of Social Services and Housing

SUBJECT: Commercial Fishing Vessel Berthing Area EIS

We have reviewed the subject draft environmental impact statement and have no comments to offer relative to the proposed action.

Thank you for the opportunity to comment on this matter.

Director

cc Ryokichi Higashionna, Director
Department of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1612

The Honorable Franklin Y. K. Sunn
Director
Department of Social Services
and Housing
State of Hawaii
Liliuokalani Building
1390 Miller Street
Honolulu, Hawaii 96813

Dear Mr. Sunn:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 2, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

for
Ryokichi Higashionna
Director of Transportation

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 15TH AIR BASE WING (PACAF)
HICKAM AIR FORCE BASE, HAWAII 96853

REPLY TO ATTN OF: DEEV (Mr Yamada, 449-1831) 8 SEP 1982

SUBJECT: Environmental Impact Statement for the Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu

TO: Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

1. This office has reviewed the subject EIS and has no comment relative to the proposed project.

2. We greatly appreciate your cooperative efforts in keeping the Air Force apprised of your project and thank you for the opportunity to review the document.

3. We are returning the copy of the EIS.

WILLIAM T. MORIOKA
Chief, Engrg & Envmtl Plng Div
Directorate of Civil Engineering

1 Atch
EIS

Cy to: Mr Ryokichi Higashionna, Director
State Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

G. R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES H. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO:

October 26, 1982

HAR-ED 1606

Mr. William T. Morioka, Chief
Engineering & Environmental
Planning Division
Headquarters, 15th Air Base Wing
Department of the Air Force
Hickam Air Force Base, Hawaii 96853

Dear Mr. Morioka:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 3, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

HEADQUARTERS
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860

IN REPLY REFER TO:
002B:WKL:jal
Ser 2063

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell,

Environmental Impact Statement
Commercial Fishing Vessel Berthing Area

The EIS for the commercial fishing vessel berthing area has been reviewed and the Navy has no comments to offer. As this command has no further use for the EIS, the EIS is being returned.

Thank you for the opportunity to review the EIS.

Sincerely,

Q. L. BRUHN
Lieutenant, CEC, U. S. Navy
Deputy Facilities Engineer
By direction of the Commander

Enclosure

Copy to:
✓State DOT

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

IN REPLY REFER TO
HAR-ED 1613

October 26, 1982

Q. L. Bruhn, Lieutenant
CEC, U. S. Navy
Deputy Facilities Engineer
HQ, Naval Base Pearl Harbor
P. O. Box 110
Pearl Harbor, Hawaii 96860

Dear Lt. Bruhn:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816

A. U. ISHIMOTO
MAJOR GENERAL
ADJUTANT GENERAL

DANIEL K. C. AU
COLONEL
DEPUTY ADJUTANT GENERAL

HIENG

7 SEP 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Commercial Fishing Vessel Berthing Area

Thank you for providing us the opportunity to review the proposed project, "Commercial Fishing Vessel Berthing Area" Environmental Impact Statement.

We have completed our review and have no comments to offer at this time.

Yours truly,

JERRY M. MATSUDA
Captain, HANG
Contr & Engr Officer

cc: Mr. Ryokichi Higashionna (DOT)
Environmental Quality Commission w/EIS

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO:

October 26, 1982

HAR-ED 1603

Mr. Jerry M. Matsuda
Office of the Adjutant General
Department of Defense
State of Hawaii
3949 Diamond Head Road
Honolulu, Hawaii 96816

Dear Mr. Matsuda:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 7, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

PB 82-812

September 7, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: Commercial Fishing Vessel Berthing Area
Environmental Impact Statement

Thank you for the opportunity to review the subject EIS. We have no comments.

Very truly yours,

ROY H. TANJI
Director and Building Superintendent

TH:vk
cc: R. Higashionna, Dept. of Transp.
J. Harada

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO
HAR-ED 1497

October 26, 1982

Mr. Roy H. Tanji
Director and Building
Superintendent
Building Department
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Tanji:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 7, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307

SEP 09 1982

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Re: EIS for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu

Dear Jackie:

We have reviewed the referenced material and find that due to its nature, the proposed project will have no significant deleterious impact on fish and wildlife resources. We encourage adoption of the mitigation measures listed in Section 6 of the EIS during project implementation.

Please do not hesitate to call on us if we may be of further assistance. We appreciate this opportunity to comment.

Sincerely yours,

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: NMFS - WPPO
HDF&W
HDAR
EPA San Francisco
Director, DOT

Save Energy and You Serve America!

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1604

Mr. Ernest Kosaka
Project Leader
Office of Environmental Services
Fish and Wildlife Service
U. S. Department of Interior
300 Ala Moana Boulevard
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Environmental Impact Statement for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 9, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

United States Department of Agriculture

Soil Conservation Service

P. O. Box 50004
Honolulu, Hawaii
96850

September 9, 1982

Mrs. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila St., Room 301
Honolulu, HI 96813

Dear Mrs. Parnell:

Subject: EIS for Commercial Fishing Vessel Berthing Area
Pier 16, Honolulu Harbor, Oahu - Job No. H.C. - 1422

We have reviewed the subject environmental impact statement and have no comments to make.

Thank you for the opportunity to review this document.

Sincerely,

FRANCIS C. H. LUM
State Conservationist

cc:
Ryokichi Higashionna
Director, Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

The Soil Conservation Service is an agency of the Department of Agriculture

---

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

HAR-ED 1602

October 26, 1982

Mr. Francis C. H. Lum
State Conservationist
Soil Conservation Service
U. S. Department of Agriculture
P. O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Lum:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 9, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

EMIKO I. KUDO
DIRECTOR

SAM L. CARL
DEPUTY DIRECTOR

OSCAR K. ASAHINA
EXECUTIVE ASSISTANT

September 9, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

SUBJECT: REVIEW OF EIS FOR COMMERCIAL FISHING VESSEL BERTHING AREA - PIER 16, HONOLULU HARBOR, OAHU

The Pier 16 project fronts on Nimitz Highway which is the route that our visitors pass going to Waikiki from the Airport. We feel that it is highly desirable that the Pier 16 project be landscaped in conformance with a plan for beautification of this Airport to Waikiki route.

The waterfront area has a tremendous potential of becoming a people-oriented environment offering a relief to the heavily urbanized environment of the adjacent downtown area.

Thank you for the opportunity to review and comment on the EIS for the Pier 16 project.

Very truly yours,

/s/ Emiko I. Kudo

(Mrs.) EMIKO I. KUDO, Director

EIK:vc

cc: State Department of Transportation

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

RYOKICHI HIGASHIONNA, PhD
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, PhD

IN REPLY REFER TO
HAR-ED 1492

October 26, 1982

Mrs. Emiko I. Kudo, Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mrs. Kudo:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H.C. 1422

Thank you for reviewing the subject EIS on our proposed Pier 16 project. Your letter dated September 9, 1982 to Ms. Jacqueline Parnell, Director of the Office of Environmental Quality Control, has been referred to us for direct reply. We offer the following response to your comments.

Landscaping along Nimitz Highway and Ala Moana Boulevard is the responsibility of the Department of Transportation Highways Division. The subject of beautifying the "Gateway corridor" has been addressed in the Highways Division's report entitled "Honolulu Gateway Beautification Project," dated March 1980.

The Harbors Division has also published a study entitled "Conceptual Planning Study, Piers 2 to 18, Honolulu, Harbor," which includes integration of Honolulu Harbor with the downtown area, minimizing the adverse impacts of Nimitz Highway and Ala Moana Boulevard and to preserve and enhance the mauka-makai vistas. However, landscaping of Piers 16 to 18 is not included since it is not compatible with the designated uses of the piers. Therefore, landscaping has not been planned and will not be included in the proposed pier project.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

Jacqueline Parnell
DIRECTOR

TELEPHONE NO.
548-6915

September 10, 1982

Dr. Ryokichi Higashionna, Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii

Dear Dr. Higashionna:

Subject: Environmental Impact Statements for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu

We have reviewed your environmental impact statement and have no comments.

Sincerely,

Jacqueline Parnell
Director

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, PhD
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, PhD

IN REPLY REFER TO

October 26, 1982

HAR-ED 1605

Ms. Jacqueline Parnell, Director
Office of Environmental
Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Environmental Impact Statement for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 10, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

September 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: Environmental Impact Statement for Commercial Fishing Vessel Berthing Area at Pier 16, Honolulu Harbor

We have no objections to the proposed project. The project is not anticipated to have adverse impacts on potable groundwater resources or our water system facilities in the area.

The availability of water for the project will be determined when the construction drawings or building permit application are submitted for our review and approval. A water development charge for source, reservoir, and transmission main will be assessed for this project.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Dr. Ryokichi Higashionna

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

RYOKICHI HIGASHIONNA, PhD
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, PhD

IN REPLY REFER TO

October 26, 1982

HAR-ED 1493

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

Environmental Impact Statement for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu
Job H.C. 1422

Thank you for reviewing the subject Environmental Impact Statement on our proposed Pier 16 project. Your letter dated September 13, 1982 to Ms. Jacqueline Parnell, Director of the Office of Environmental Quality Control, has been referred to us for direct reply.

Water service to Pier 16 will be provided by connection to the existing water system serving Piers 17 and 18. Connection will be made to a tee located at the eastern end of the roadway which connects Piers 17 to 18. Therefore, no new meter is anticipated with this proposed project.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

United States Department of the Interior
GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

September 21, 1982

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

The U.S. Geological Survey, Water Resources Division, staff has reviewed the EIS for the Commercial Fishing Vessel Berthing Area, located on Pier 16 at the Honolulu Harbor, Oahu, Hawaii, and at this time has no comments to offer.

Sincerely,

Benjamin L. Jones
District Chief

Enclosure

cc: Ryokichi Higashionna, DOT, Honolulu, Hawaii

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1500

Mr. Benjamin L. Jones
Water Resources Division
Department of the Interior
U. S. Geological Survey
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Jones:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 21, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

September 20, 1982

MEMORANDUM

To: Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control

Subject: Environmental Impact Statement
Commercial Fishing Vessel Berthing Area

The Department of Agriculture has reviewed the subject statement and does not have any comments to offer.

Thank you for the opportunity to comment.

Jack K. Suwa

JACK K. SUWA
Chairman, Board of Agriculture

cc: Mr. Ryokichi Higashionna

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1611

The Honorable Jack K. Suwa
Chairman
Board of Agriculture
State of Hawaii
1428 South King Street
Honolulu, Hawaii 96813

Dear Mr. Suwa:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 20, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna

Ryokichi Higashionna
Director of Transportation

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

MICHAEL M. McELROY
DIRECTOR

September 22, 1982

LU8/82-4886(JDN)

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Environmental Impact Statement for Commercial Fishing Vessel Berthing Area--Pier 16, Honolulu Harbor, Oahu Job No. H.C. - 1422; Tax Map Key 1-5-40: 01

We have reviewed the subject Environmental Impact Statement (EIS) per your request and have no comments to offer. For your information, the Department of Land Utilization confirmed for the State Department of Transportation that the project site is not located within the Special Management Area and that a Special Management Area Use Permit is not required (copy of letter attached).

Thank you for the opportunity to review this EIS. Should you have any questions, please contact John Nakagawa of our staff at 523-4077.

Very truly yours,

MICHAEL M. McELROY
Director of Land Utilization

MMM:sl
attach.

cc: State D.O.T.

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1499

Mr. Michael M. McElroy
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. McElroy:

Environmental Impact Statement for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu Job H. C. 1422

Thank you for your letter dated September 22, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

September 22, 1982

Ref. No. 6601

Ms. Jacqueline Parnell
Director
Office of Environmental Quality
Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell;

Subject: EIS - Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu

Thank you for the opportunity to review the above document. We have no substantive comments to offer at this time. However, please be informed that the Hawaii Coastal Zone Management Program staff has recently conducted a Federal consistency review of the project. The review findings have been communicated directly to the proposing agency.

Sincerely,

Hideto Kono

cc: Hon. Ryokichi Higashionna

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1610

The Honorable Hideto Kono, Director
Department of Planning and
Economic Development
State of Hawaii
Kamamalu Building
250 South King Street
Honolulu, Hawaii 96813

Dear Mr. Kono:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 22, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO
HAR-ED 1608

October 26, 1982

Dr. Doak C. Cox, Director
Environmental Center at Hanoa
University of Hawaii
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Dr. Cox:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for reviewing our document addressing the environmental impacts of our proposed Pier 16 project. Your letter dated September 22, 1982 to Ms. Jacqueline Parnell, Director of the Office of Environmental Quality Control was referred to us for a direct reply. We offer the following responses to your comments.

a. Agencies directly related to the fishing industry. Although the agencies mentioned in your letter were not directly consulted in the preparation of the EIS, their input is reflected in the document. Much of the information relative to Hawaii's fishing industry is derived from previously published material such as the Kewalo Basin Task Force Report and the Hawaii Fisheries Development Plan. These reference materials were prepared in consultation with the various agencies referred to in your letter.

b. Bait-Fish Holding. Currently there are five commercial fishing vessels which hold live bait at Piers 15 and 17. All five utilize akule for live bait.

Kewalo Basin, which has conditions similar to Honolulu Harbor where Pier 16 will be located, presently accommodates boats with bait-fish holding capability. Both sites presumably have similar

water qualities because of drainage outlets that enter the berthing area at both facilities. Since the water at Kewalo Basin is being utilized at present for bait-fish holding tanks with no detrimental effects, therefore, it is presumed that the waters at the new Pier 16 site can be used for bait-fish holding purposes.

c. Phasing. "The construction of Pier 16 constitutes Phase II of the Department of Transportation, Harbors Division (DOT-Harbors Division) project to increase berthing space for Oahu's fishing fleet," (page 1-1). Future extensions to Piers 16 and 17 will be contingent upon State-wide harbor priorities and availability of funds.

Dredging with this project will encompass the area designated for future extension.

Relocation of the fishing vessels which uses the piers during construction will be dealt with as the need arises. As mentioned in Section 6.1.2, vessels will be moored at other locations during periods of construction.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

September 22, 1982

RE:0360 (REV)

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Draft Environmental Impact Statement
Commercial Fishing Vessel Berthing Area
Pier 16, Honolulu Harbor, Oahu

The general adequacy of this statement and minimal environmental impacts that can be expected to occur as a result of the activity proposed led us to conclude that a broad University review of this document was not necessary. There are a few points which the staff of the Center would like to call to your attention in the hope that they will be considered in the design of the dock facilities and that some of the physical-biological impacts which are unavoidable in dredging activities may thereby be minimized. Overall the document is a conscientious and thorough effort in addressing environmental concerns related to the proposed project.

Our primary concern with the Draft EIS revolves around the agencies consulted in the information gathering process. We find no indication that agencies directly related to the fishery industry have been consulted. Agencies such as the United Fishing Agency, the National Marine Fisheries, the Western Pacific Fisheries Management Council, the Hawaii Fisheries Coordinating Committee, and the Hawaii Tuna Boat Owner Co-op should be consulted for their input. The latter two organizations would be able to provide "grass-roots" input on the adequacy of the design to meet the needs of the commercial fishermen.

Because of the seemingly lack of consultation with local fishing agencies, we wish to draw attention to some secondary impacts that need to be addressed in the revised EIS.

First, is the project site suitable for bait-fish holding? What effect does the drainage from Nuuanu Stream have on this area? We are concerned that Nuuanu Stream may carry sufficient pollutants to render bait-fish holding impossible in this area.

Second, it is stated in the DEIS that to date "there is a waiting list for 88 commercial berths of which 35 are commercial fishing craft, while 41 are of charter boats, 11 cruise ships and 1 is classified as other (research)" (p. 2-5). It is further stated

that when completed, the pier will accommodate a minimum of 20 fishing vessels" (p. 2-7). Does the term "completed" refer to both phase 1 and phase 2 or only to phase 2? If this refers to only phase 1, what is the minimum number of boats that can be accommodated by phase 2?

Furthermore, it is stated that relocation of the existing fishing fleet during construction of phase 1 will create problems. After the construction of phase 1, will not the problem of relocation be multiplied, making it even more difficult to relocate the expanded fishing fleet for the construction of phase 2? Will not this same problem be repeated during the extention of pier 17? It would seem that construction of phases 1 and 2 simultaneously would greatly reduce this problem and better serve the fishing industry.

Our final concern lies with the dredging of the project area. Will the currently proposed area to be dredged include the areas designated for future extensions? If not, would it not be better to include these areas in the dredging process so as to alleviate the negative impacts of exposing the area to additional dredging in the future? Granted, Honolulu Harbor does need to be periodically dredged, but we see no justification for exposing this area to repeated and unnecessary dredging and greatly increased detrimental impacts on marine biota such as the nehu. Also, it would be helpful to include a detailed breakdown of the dredging costs so that alternatives may be explored.

Overall, we feel that it would be both environmentally and economically sounder to construct phases 1 and 2 simultaneously. In addition, we urge that the local fishing industry be consulted for their input on the adequacy of the project to see if it suits their needs. In this manner, the local fishing industry will be the focus of the benefits, not the construction industry.

We appreciate the opportunity to comment on this draft EIS.

Yours truly,

Doak C. Cox
Director

cc: Jacquelin Miller
Richard Erwin
Ryokichi Higashionna ✓

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO
HAR-ED 1494

October 26, 1982

Mr. Ralph Kawamoto, Planner
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Kawamoto:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H.C. 1422

Thank you for your review of the subject Environmental Impact Statement for the proposed Pier 16 project. Your letter dated September 23, 1982 to Ms. Jacqueline Parnell, Director of the Office of Environmental Quality Control, has been forwarded to us for direct reply. Our response to your comments is as follows:

1. Scenic Views

We concur with your comment on the adverse impact on the harbor's vista while construction is underway. This condition is considered temporary and unavoidable.

After completion of construction, the pier will be highly visible, as noted. Landscaping may mitigate the visual effect of the pier. However, landscaping of the pier itself is incompatible with its use as commercial berthing. The alternative would be to landscape that stretch of Nimitz Highway providing the most open vista of the harbor. This alternative has been dealt with by the Highways Division in its report entitled "Honolulu Gateway Beautification Project" dated March 1980. Highway beautification is the responsibility of the Highways Division.

2. Recreational Use

Completion of the project will not adversely impact recreational use of the harbor in the project's vicinity. Public access to

commercial piers has always been restricted and this restriction will also be applied to Pier 16. The sidewalk fronting the harbor in the vicinity of the project will still be accessible to the public. No restrictions are foreseen to impair the present harbor viewing and recreational use of that section of the waterfront.

3. Traffic Impact

Mitigative measures during construction will involve the movement of construction equipment and materials during hours that will not interfere with peak morning and afternoon traffic.

The additional traffic generated by the increased number of fishermen using the facility is not expected to contribute a significant impact on traffic in that area. Their hours of operation do not coincide with "normal" working hours. Therefore, their peak traffic is not synchronous with the "normal" flow.

These points you have brought to our attention are appreciated and will be included in the revised EIS.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

WILLARD T. CHOW
CHIEF PLANNING OFFICER

RALPH PORTMORE
DEPUTY CHIEF PLANNING OFFICER

DGP8/82-2990

September 23, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality
Control
State of Hawaii
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Commercial Fishing Vessel Berthing Area
Pier 16, Honolulu Harbor, Oahu

We have reviewed the subject EIS and offer the following comments:

Scenic Views

Motorists as well as the sightseer presently enjoy an uninterrupted vista of the harbor between piers 15 and 18 from Nimitz Highway. This setting also includes a portion of offshore Sand Island. While construction is underway, this scenic view is likely to be disturbed by dredging operations and presence of heavy equipment and vehicles in the area.

When pier improvements are completed, a highly visible 377-foot long and 20-foot wide boat berthing facility will be in place, resulting in some loss of waterfront open space. In order to reduce the full effect of adverse visual impacts, mitigative measures to protect and maintain some scenic view as seen from heavily traveled Nimitz Highway may be necessary. Negative impacts may be considered permanent as long as the pier is in use.

Recreational Use

Recreational shoreline fishing is popular along the waterfront. Passive activities such as viewing harbor and shoreline activities are other recreational pursuits presently offered. Although during the construction period restricting use of nearby pier facilities is reasonable, policies regarding future use by the public for recreational purposes may need to be discussed.

Traffic Impact

The presence of project related heavy equipment and vehicles on Nimitz Highway will be very likely during construction. Upon project completion, vehicular traffic generated by users of the facility may also be a source of inconvenience to Nimitz Highway motorists. Because parking and access to piers 16, 17, and 18 will be located at a curving section of Nimitz Highway, traffic disruptions and hazardous conditions are likely to develop. Additional discussion may be necessary in the EIS regarding consideration of eastbound/westbound traffic projections on Nimitz Highway. The description of the highway section affecting in/out vehicular movements from pier 18, accident data near pier 18, and mitigative proposals to reduce traffic disruptions are also needed.

Sincerely,

Ralph Kawamoto

RALPH KAWAMOTO
Planner

APPROVED:

W.T. Chow

WILLARD T. CHOW

cc: √DOT

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Fourteenth Coast Guard District
Prince Kalanianaole Federal Bldg.
300 Ala Moana Blvd
Honolulu, Hawaii 96850

DEC 1982

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

The Fourteenth Coast Guard District has reviewed the Environmental Assessment for the Commercial Fishing Vessel Berthing Area and has no objection or constructive comments to offer at the present time.

Sincerely,

J. E. SCHWARTZ
Commander, U. S. Coast Guard
District Planning Officer
By direction of
Commander, Fourteenth Coast Guard District

Copy to: Ryokichi Higashionna

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

RYOKICHI HIGASHIONNA, PhD
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, PhD

IN REPLY REFER TO

October 26, 1982

HAR-ED 1601

Commander J. E. Schwartz
Fourteenth Coast Guard District
300 Ala Moana Blvd., PKFB
Honolulu, Hawaii 96850

Dear Commander Swartz:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 13, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

PODED-PV

16 September 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

Thank you for the opportunity to review the Environmental Impact Statement for the Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu. A permit application is presently under review by the U.S. Army Corps of Engineers and our comments will be addressed to it.

Sincerely,

KISUK CHEUNG
Chief, Engineering Division

Copy Furnished:
Mr. Ryokichi Higashionna, Director
State Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO:
HAR-ED 1496

October 26, 1982

Mr. Kisuk Cheung, Chief
U. S. Army Engineering Division
Pacific Ocean, Building 230
Fort Shafter, Hawaii 96853

Dear Mr. Cheung:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 16, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

ROY A. PARKER
DIRECTOR

TE8/82-3275

September 14, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: Environmental Impact Statement for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu

We have reviewed the Environmental Impact Statement and have no comments.

Very truly yours,

ROY A. PARKER
Director

cc: State Department
of Transportation

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO

October 26, 1982

HAR-ED 1498

Mr. Roy A. Parker
Department of Transportation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Parker:

Environmental Impact Statement for
Commercial Fishing Vessel Berthing
Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for your letter dated September 14, 1982 regarding the Pier 16 project.

We appreciate the time you spent in reviewing our document.

Very truly yours,

Ryokichi Higashionna
Director of Transportation

(P)1829.2

SEP 13 1982

Ms. Jacqueline Parnell
Director
Office of Environmental
Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: EIS for the Commercial Fishing Vessel Berthing Area

We have reviewed the subject document and are concerned about the parking provisions and traffic access and routing in the vessel berthing area. These items were not fully covered in the EIS.

We request that the proposing party address these concerns.

If you have any questions or comments in regards to our concerns, please have your staff contact Mr. Merton Ishida of the Public Works Division at 548-3923.

Very truly yours,

/s/ Hideo Murakami

HIDEO MURAKAMI
State Comptroller

HI:jm

cc: Dr. Ryokichi Higashionna

GEORGE R. ARIYOSHI
GOVERNOR

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

RYOKICHI HIGASHIONNA, Ph.D.
DIRECTOR

DEPUTY DIRECTORS
WAYNE J. YAMASAKI
JAMES R. CARRAS
JAMES B. McCORMICK
JONATHAN K. SHIMADA, Ph.D.

IN REPLY REFER TO
HAR-ED 1609

October 26, 1982

The Honorable Hideo Murakami
State Comptroller
Department of Accounting and
General Services
Kalanimoku Building
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Murakami:

Environmental Impact Statement for Commercial Fishing Vessel Berthing Area, Pier 16, Honolulu Harbor, Oahu
Job H. C. 1422

Thank you for reviewing the subject Environmental Impact Statement for the proposed Pier 16 project. Your letter to Ms. Jacqueline Parnell, Director of the Office of Environmental Quality Control, dated September 13, 1982, has been referred to us for a direct reply. We offer these responses to your comments.

Parking for users of Pier 16 will be accommodated by the parking area adjacent to Pier 18. No parking will be allowed on Pier 16 itself, except for very short term parking for loading and unloading activities. Vehicular traffic on the pier will be prohibited except to serve this purpose.

Very truly yours,

Ryokichi Higashionna
Director of Transportation