KAHANA BAY

NAVIGATION IMPROVEMENTS

OAHU, HAWAII

DRAFT Detailed Project Report
and
Environmental Impact Statement

US Army Corps
of Engineers
Honolulu District

SEPTEMBER 1985

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

REPLY TO
ATTENTION OF

KAHANA BAY

NAVIGATION IMPROVEMENT

OAHU, HAWAII

DRAFT

DETAILED PROJECT REPORT

AND

ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 1985

KAHANA BAY NAVIGATION IMPROVEMENT
OAHU, HAWAII

MAIN REPORT

KAHANA BAY

NAVIGATION IMPROVEMENT
OAHU, HAWAII

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LIST OF ABBREVIATIONS AND SYMBOLS

Symbol	Definition
ac-ft	acre feet
BERH	Board of Engineers for Rivers and Harbors
C&C	City and County of Honolulu
CFR	Code of Federal Regulations
CT	Census Tract
CVM	Contingent Value Method
d_s	Depth of water at structure toe
DA	Department of the Army
DPR	Detailed Project Report
EIS	Environmental Impact Statement
EM	Engineer Manual
EO	Executive Order
EQ	Environmental Quality
ER	Engineer Regulations
FIA	Federal Insurance Administration
FIRM	Federal Insurance Rate Map
FR	Federal Register
FWS	US Fish and Wildlife Service
fpc	finite population correction
ft	foot or feet
H	Shallow water wave height
H_o	Deep water wave height
HRS	Hawaii Revised Statutes
i	Interest rate
IDC	Interest During Construction
m	slope
MLLW	Mean Low Low Water
MM	Modified Mercalli
mph	miles per hour
MSL	Mean Sea Level
MOA	Memorandum of Agreement
NA	Not Available or Not Applicable
NED	National Economic Development
NEPA	National Environmental Protection Agency
OCE	Office of the Chief of Engineers
OSE	Other Social Effects
PAL	Planning Aid Letter
PL	Public Law
P&G	Priciples and Guidelines
RED	Regional Economic Development
S_a	Astronomical Tide Level
S_p	Atmospheric Pressure Drop
S_s	Storm Surge
S_w	Wave Setup
sq mi	square miles
SSMO	Summary of Synoptic Meterological Observation
SWL	Still Water Level
TM	Technical Manual
t	Wave Period
UDV	Unit Day Value
USGS	U.S. Geological Survey
WTP	Willingness to Pay

I. INTRODUCTION

A. PURPOSE AND STUDY AUTHORITY

The purpose of this study was to determine the need for and feasibility of providing light-draft navigation improvements at Kahana Bay, on the Island of Oahu, Hawaii.

This study was accomplished under the authority provided by Section 107 of the River and Harbor Act of 1960 (Public Law 84-645), as amended. Pertinent paragraphs of the authority are included in Appendix A.

The Kahana Bay Study was initiated following a letter from the State of Hawaii, Department of Transportation, Harbors Division, dated 8 September 1982 requesting a study for a possible light-draft navigational improvements and a harbor of refuge at Kahana Bay, Oahu, Hawaii.

B. SCOPE OF THE STUDY

This study identified and evaluated the problems and needs associated with providing light-draft navigation improvements to serve the needs of local recreational boaters in the Kahana area and the impacts upon the overall environmental, economic, social, cultural, and recreational resources of the area. The development of alternative design layouts and the costs and benefits associated with implementing these measures were evaluated.

Studies conducted include site investigations, archaeological-cultural studies, social studies, hydrographic and topographic surveys, geologic, foundation and material investigations, fish and wildlife studies, oceanographic and meteorological studies, engineering designs, economic evaluations and environmental assessments.

The objective of this study is to provide the result of a planning process based on increasingly specific stages of investigation. At the conclusion of each stage, the range of possible alternatives was assessed and evaluated. Elimination of infeasible or undesirable measures narrowed the field of potential alternatives until an acceptable alternative or plan was developed.

The Detailed Project Report (DPR) constitutes the authorizing document for construction for the U.S. Army Corps of Engineers small projects or continuing authorities program. Construction plans and specifications can be initiated after subsequent acceptance of the DPR by the Chief of Engineers, the Secretary of the Army and receipt of local cooperation agreements from the State of Hawaii.

C. STUDY AREA

1. State of Hawaii

The Hawaiian Islands are centrally located in the Pacific Ocean, extending approximately 1,700 miles northwest to southwest from about 155° to 179° W longitude and 19° to 28° N latitude. The eight major islands, seven of which are inhabited, form a 400-mile arc at the southeastern end of the archipelago (Figure 1).

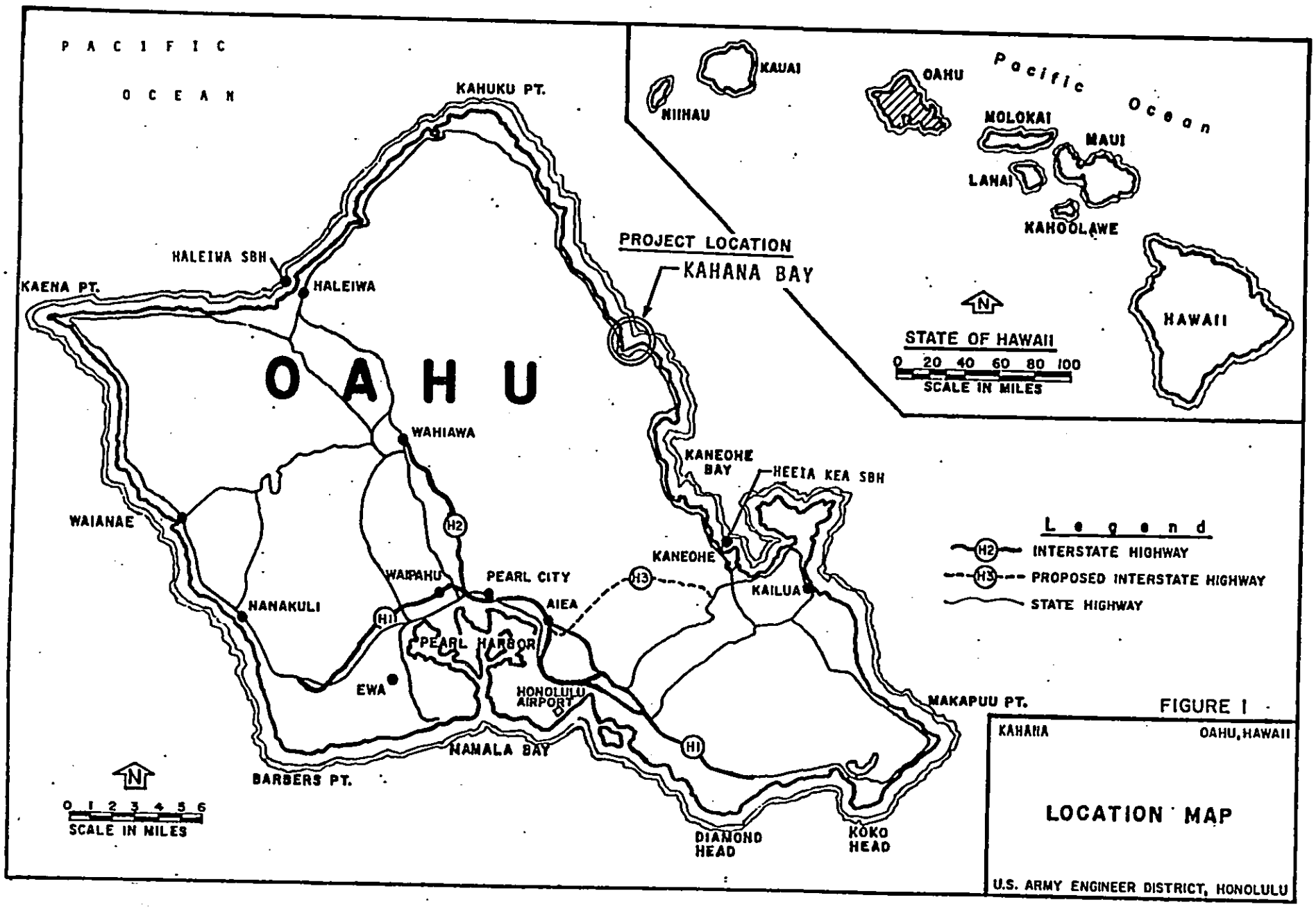

FIGURE 1

KAHANA OAHU, HAWAII

LOCATION MAP

U.S. ARMY ENGINEER DISTRICT, HONOLULU

Land area of the State totals 6,425 square miles. The island of Hawaii, the "Big Island," accounts for 4,037 square miles. The remainder is divided among the islands of Maui (728), Oahu (593), Kauai (549), Molokai (261), Lanai (139), Niihau (70), Kahoolawe (45), and the northwest leeward islands, all of which are small islets, rock atolls, or exposed reefs (total of 3 square miles).

2. Oahu

Oahu is the third largest island in the State in terms of land area and includes a total coastline of approximately 137 statute miles. It serves as the center of business, government, social, cultural, economic and military activities for the State of Hawaii. Honolulu, the State capitol, is located on the island of Oahu, approximately 2,400 miles southwest of the U.S. Mainland.

3. Kahana Bay

The study area is located at Kahana Bay on the northeast coast of Oahu, between Kahuku and Kaneohe at about 21° 33' N latitude and 157°51 W longitude (Figure 2). The mouth of the bay is about one mile wide, and the beach is about 3/4 of a mile long and 40 feet wide. The project site is located on the north end of the bay at Kapa'ele'ele Point. A sand-bottomed channel leads out of the bay, maintained by freshwater flow from Kahana Stream and the current within the bay. An 18-foot wide concrete boat launching ramp was constructed in 1962 and is administered by the State Harbors Division. Boating facilities at this location include a groin, loading dock, freshwater faucets, restrooms, picnic and camping areas, parking at the ramp for six cars with trailers, and a parking area for 15 cars.

D. STUDY PARTICIPANTS AND COORDINATION

The U.S. Army Corps of Engineers, Honolulu District, is responsible for conducting and coordinating the overall study and preparing the study report. Studies and investigations were performed with the assistance of the State of Hawaii, Department of Transportation, Harbors Division, which initially requested the study, and serves as the local sponsor.

Governmental agencies (Federal, State and Local), community groups, and private interests were contacted during the study to help identify study concerns, to obtain pertinent study information, and to develop and evaluate alternative plans. A list of those contacted and the Public Involvement Program are presented in Appendix B.

E. REPORT PREPARATION

This document consists of a main report and a series of appendices. The main report is a self-contained document which describes the planning process and includes the Environmental Impact Statement. The appendices contain technical and detailed information and background data to support the information contained in the main report.

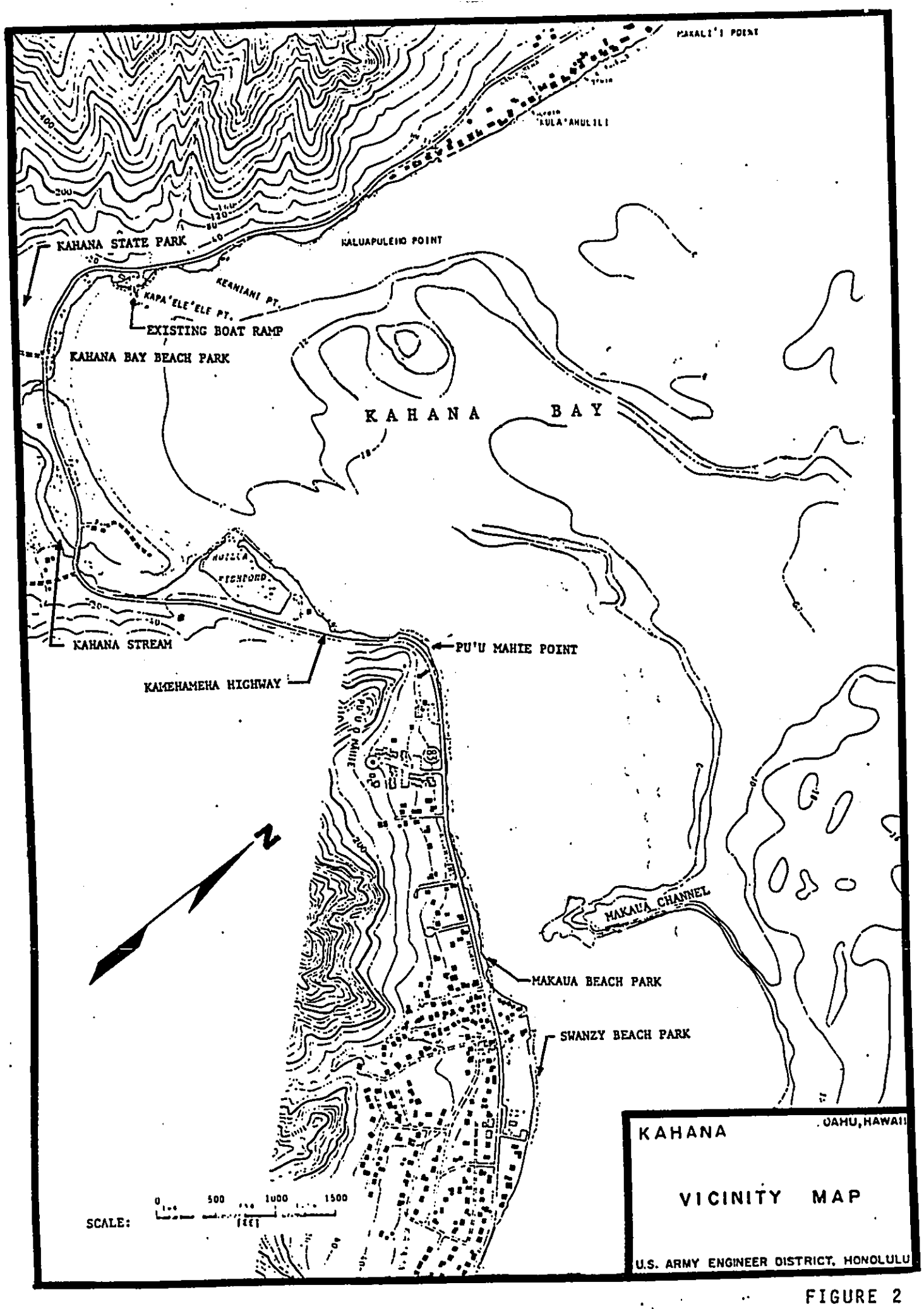
MAKALE'I POINT
KULA'AHULILI
KAHANA STATE PARK
KALUAPULEHU POINT
KEANIANI PT.
KAPA'ELE'ELE PT.
EXISTING BOAT RAMP
KAHANA BAY BEACH PARK
KAHANA BAY
HUELO
KAHANA STREAM
KAMEHAMEHA HIGHWAY
PU'U MAHIE POINT
MAHIE
MAKAUA CHANNEL
MAKAUA BEACH PARK
SWANZY BEACH PARK
N
0 500 1000 1500
SCALE:
FEET
KAHANA
OAHU, HAWAII
VICINITY MAP
U.S. ARMY ENGINEER DISTRICT, HONOLULU

FIGURE 2

APPENDIX A, Plan Formulation Criteria and Compliance Reports, contains specific information regarding the study authority, legislative requirements, planning criteria and constraints, and local cooperation requirements that contribute to the plan formulation process of the study. Also included in this appendix are the evaluation reports required by the Executive Order 11988 on Flood Plain Management, Section 404 of the Clean Water Act, and the Coastal Zone Management Act.

APPENDIX B, Public Involvement, describes the public involvement program contains pertinent correspondence and public comments received during the study and evaluation period.

APPENDIX C, Geology, Foundations and Materials, contains the analyses and data relevant to the geologic, soils and foundation design assumptions.

APPENDIX D, Engineering and Cost Estimates, contains the engineering analyses and data relevant to the design of the proposed shore protection improvements. This appendix also provides cost estimates for each alternative.

APPENDIX E, Economic Analysis, contains the economic background, data, and analyses for determining the benefits associated with each alternative plan.

Appendix F, Social Well-Being Analysis, contains background information and impact evaluation of social and recreational activities within the study area.

APPENDIX G, Natural Resources, contains the Fish and Wildlife Service Coordination Act Report consultation with the National Marine Fisheries Service.

F. PRIOR STUDIES

A reconnaissance report was completed in November 1983 by the U.S. Army Corps of Engineers, Honolulu District. The report recommended that detailed studies be undertaken to determine the feasibility of providing navigation improvements for Kahana Bay.

II. PROBLEM IDENTIFICATION

A. PURPOSE

The purpose of this section is to describe the study area and the problems to be addressed in the study. This includes describing the base conditions, identifying public concerns, establishing planning criteria and analyzing the problems. Public concerns which relate to water and related land resource problems are identified and then refined, based on national and local policies.

National planning policies are prescribed by the Water Resources Council's Principles and Guidelines, the National Environmental Policy Act of 1969 (PL 91-190), Section 122 of the River and Harbor and Flood Control Act of 1970 (PL 91-911), the Water Resources Development Act of 1974 (PL 93-251), the Clean Water Act of 1977 (PL 95-217), and the Corps of Engineers' policy guidelines (ERs).

To help determine the resource management[1/] problems, the base conditions of the study area is initially defined. The base condition is the existing economic, social, and environmental characteristics of the area.

Future conditions are then projected and analyzed to determine to the "most probable future"[2/] which would prevail over the area without any changes to existing resource management plans. This analysis describes the "without condition" criterion. Planning objectives[3/] are then formulated based on the problems and needs of the area related to the "without condition" criterion.

B. PROFILE OF EXISTING BASE CONDITIONS

The cultural, physical, environmental, and economic characteristics are briefly described to provide the reader with the general background of the study area. The appendices contain more detailed description relevant to the planning and design of general navigation improvements.

1/ "Resource management" involves the development, conservation, enhancement preservation and maintenance of water and related land resources to achieve the goals of society expressed nationally and locally.

2/ "Most probable future" is the projection of basic demographic, economic, social, and environmental parameters, which is used as the basis for defining the "without condition" and the planning objectives for a particular study.

3/ "Planning objectives" are the national, state, and local water and related land resource management needs (opportunities and problems) specific to a given study area that can be addressed to enhance National Economic Development or Environmental Quality.

1. History and Culture

The State park is the focal point of many cultural activities at Kahana, and many sites of archaeological and historical significance have been recorded in the area. Probably the most important site of cultural significance in the bay is Huilua Fishpond located immediately to the east of the mouth of Kahana Stream on the opposite side of the bay from the existing boat ramp. Huilua Fishpond is listed on the National Register of Historic Places and is considered of paramount national historic significance by its concurrent designation as a National Historic Landmark. Another important coastal site near the boat ramp includes Kapa'ele'ele, which is on a bluff above Kamehameha Highway overlooking the "Kapa'ele'ele Boat Ramp." Kapa'ele'ele, which translates as "black tapa," takes its name from the site of a former fishing shrine (ko'a) in this case specifically for the akule (big-eyed scad) which used to visit the waters of Kahana Bay in large schools. There are no known sites of archaeological or historical significance near the ramp facility, which was constructed in 1962. Surface and subsurface cultural remains, if any, were probably destroyed during ramp construction, although subsurface archaeological monitoring might be advisable if construction involves cutting into previously undisturbed areas.

Kahana Bay was a registered konohiki fishing right.

Konohiki rights for Kahana were condemned in 1970 and acquired by the State of Hawaii. Konohiki fishing rights constitute part of the land system of old Hawaii. The word konohiki originally was the designation for the person who managed the chief's land. Eventually, it referred to the things that were the private property of the chief himself. As a result, "konohiki fisheries" mean the chief's or privately owned fisheries. Traditional fishing methods are practiced today in Kahana Bay. The method consists of chasing schools of fish to the bay by canoe and netting them. The acquisition of the konohiki rights allowed public access to the bay where in the past such access was private.

2. Physical Setting

a. Physical Features. The Hawaiian Islands are centrally located in the Pacific Ocean, with its eight major islands forming a 400-mile arc at the southeastern end of the archipelago.

The study site is located on the northeast coast of Oahu (the third largest island in the chain), between Kahuku and Kaneohe. The mouth of Kahana Bay is about a mile wide and the beach is about 40 feet wide and 3/4 of a mile long. A sand bottomed channel leads out of the bay, maintained by freshwater flow from Kahana Stream and current within the bay.

b. Climate. Kahana's climate is characterized by a two-season year, mild and fairly uniform temperatures. Along the coast, average monthly minimum temperatures range from the mid-60's in winter to the mid-70's during July and August. Average monthly maximums there rise

from mid-70's in winter to the mid-80's in summer. Near the coast, humidity never drops below 50 percent. The average for the late morning hours is 70 percent during all seasons. Average annual rainfall within the Kahana Valley ranges from 75 inches along the coast to over 300 inches near the crest of the Ko'olaus.

c. Winds. No wind gauges exist in the immediate vicinity of Kahana Bay. Records are kept at the Kaneohe Marine Corps Air Station. The records suggest that the tradewinds dominate during the summer. Winds are from the north-northeast through east over 90 percent of the time at velocities that deviate relatively little from the 11.7 knot average. During the winter, the trade winds are both weaker and less consistent than in the summer. Storms, especially from the southwest, are much more frequent, and maximum wind velocity often exceeds 30 knots.

d. Waves. Waves at Kahana Bay originate from various areas in the Pacific. Offshore waves approaching the bay from the north to north-northeast and east-northeast break on the fringing reef, reform, and travel to the beaches. Waves approaching from the northeast enter the channels without breaking on the reefs to the north and south. The waves diverge as they proceed shoreward in the channel and break on the beach or seaward of the beach depending on the wave height and period. The most damaging waves are those generated by storms in the North Pacific.

(1) Northeast trade waves, which are generated by the prevailing trade winds, are present throughout the year and are most intense from April to November, having heights ranging from 4 to 12 feet.

(2) North Pacific swells are generated by storms in the Aleutian area and by mid-latitude lows, having heights of 8 to 14 feet, approaching from the northwest, north, or northeast. Some of the largest waves reaching the Hawaiian Islands are of this type.

e. Tides. There is no tide gauge at Kahana Bay. However, a tidal bench mark at Waikane, about 7 miles southeast of Kualoa, which was established in May 1933 was considered applicable to the study area. The bench mark has since been destroyed. Tidal data taken from this location based on 7 months of records are as follows:

Level	Gauge Height in Feet
Highest Tide (estimated)	3.5
Mean Higher High Water	2.20
Mean High Water	1.80
Mean Low Water	0.40
Mean Lower Low Water	0.00
Lowest Tide (estimated)	-1.0

f. Tsunami. During the past 36 years, 36 tsunamis have been recorded in Hawaii. Twenty-seven have affected the island of Oahu and four caused severe damages throughout the State (1946, 1952, 1957, 1960). Tsunami wave heights recorded near or in Kahana Bay 1/ are as follows:

1946	1.2 - 5.1 m
1952	1.8 - 2.4 m
1957	2.4 - 3.9 m
1960	2.1 - 2.4 m
1964	1.1 m

The 1946 tsunami and earlier ones had a significant impact on the early human community of Kahana. Damage to shore front residences, the historic Huilua Fishpond, other property, as well as loss of life have occured here. The 1946 tsunami killed four members of one family and caused subsequent relocation of residents within the valley, and in some cases dislocation away from Kahana altogether. McAllister, in his Archaeology of Oahu (1933) reports that the February 3, 1923 wave broke through the walls of Huilua Fishpond causing considerable damage. Marion Kelly of the Bishop Museum, in her report on Kahana's history (1979, unpublished) includes a list of known tsunamis, and indicates damage occured at Huilua during the 1923, 1946, 1957, and 1960 occurrences. Heavy storm waves have further damaged sea walls of the pond.

g. Geology. The submerged portion of Kahana Bay is a submarine canyon extending from Kahana Stream. It was formed by the downcutting erosion of the stream during a lower stand of sea level (effects of Pleistocene flaciation). Steep valley walls line the east and west sides of the bay from the ridge tops to the water's edge. Landward a gentle, seaward-sloping floodplain has developed in the stream's valley. The shallow offshore conditions in Kahana Bay are also the result of a portion of the stream's floodplain being submerged as the sea level rose. The land surrounding Kahana Bay generally constists of alluvial and colluvial deposits of weathered lava basalts and pyroclastic materials. These deposits are a chaotic mixture of lateritic clays, silts and detrital rock fragments in various sizes and stages of decompostion. The shoreline on the east and west sides of the bay is lined with round to semi-round basalt gravels, cobbles and boulders. The south shoreline is covered with fine coral sand which grades into the alluvial-colluvial deposits of the backshore area. The offshore areas at the proposed site are covered with a veneer of coral sand. This sand is coarse and thin (up to 1-foot thick) near the shoreline and grades into fine sand of unknown thickness farther offshore. Further information on geology and soils in the study area can be found in Appendix C of this report.

1/ U.S. Dept of Commerce, Coast and Geodetic Survey, Catalog of Tsunamis in The Hawaiian Islands, May 1969.

3. Environmental Setting

a. Flora and Fauna. Terrestrial vegetation along the shoreline consists of common indigenous and Polynesian-introduced species including Kamani trees, tree heliotrope, naupaka, beach morning glory, coconut palms, hau tree, and other grasses and ornamental shrubs and trees. At the boat ramp, the large Kamani trees form a dramatic canopy providing much shade, and serve to diminish the visual significance of the man-made ramp facility in an otherwise natural shoreline reach. The fresh, estuarine, and marine waters of Kahana support
a rich and diverse aquatic biota including Samoan crab, aholehole, many reef fishes, octopus, reef corals and edible seaweeds (limu). The most important ecological resources in proximity to the boat ramp facility are the crabbing grounds (in Kahana estuary and Huilua Fishpond) to the east and the unique coral patch reef about one-half mile outside the bay to the northeast.

Large growths of the limu are attached to the shallow rocky reef and basalt boulder flats to the north of the ramp. The sediment deposits, shifting sand, high water turbidity, and high suspended sediment load in the vicinity of the ramp facility inhibit the colonization of the area by important marine species. Corals are absent and fishes are few in number and species.

Wildlife for Kahana include black-crowned night heron, cattle egret, *Hawaiian Coot and the Hawaiian Gallinule, Kentucky cardinal, California* linnet, mynah, white-eye, house sparrow, ricebird, mourning or lace-necked dove, Mexican, and barred-wing dove. The Hawaiian Coot and Hawaiian Gallinule are listed as Federal endangered birds which intermittently occur at the mouth of Kahana Stream.

The endangered humpback whale is found migrating off the windward shores during the months of December and May. While the site has not been identified as a calving or mating area, it is more likely a migration corridor for the whales. The threatened green sea turtle is commonly seen in Kahana Bay.

b. Marine Resources. Kahana is best known for large schools of akule. Other fish found in the area are ulua, papio, aholehole, 'o'io, goatfish, mullet, and octopus. Large growths of limu are attached to the shallow rocky reef and basalt boulder flats to the north of the existing ramp facility. Macrofauna of Kahana estuary includes the native prawn, native fishes. Near the boat ramp, coral species are absent and fish are few in numbers.

4. Economic Setting

a. Economic Base. Hawaii is a properous state with a growing population and economy. Between 1950 and 1981, the total resident population increased over 97 percent from 498,000 to 981,000. During the same period, the Gross State Product increased from $900 million to over $12.9 billion. The three largest contributors to the State's economy are tourism, defense expenditures, and agriculture, the bulk of the last

activity being in the production of sugar and pineapple. The most rapid growth during the last several years has been in the tourist industry, which in 1970 became the state's leading export industry. Tourist expenditures were approximately $600 million in 1970 and increased to $3.0 billion in 1980, an increase of about 500 percent. This is compared to an increase of slightly over 200 percent for defense spending during this same period. Growth of the tourist industry, together with the State economy in general, is expected to continue.1/

b. Population. The State of Hawaii's resident polulation has grown from 154,000 in year 1900, to 633,000 in 1960, 770,000 in 1970, 965,000 in 1980, and 1,039,000 in 1984. This population is relatively young and racially diversified. Migration has been a major factor in rapid growth. Between 1970 and 1980, there was a net in-migration (excluding military personnel) of 101,000 accounting for 54 percent of the total civilian population growth. The resident population of the island of Oahu in 1980 was 763,000, with an estimated 365,000 living in the Honolulu District.2/ This reflects a population density of 1,290 persons per square mile for the island, and 4,510 persons per square mile for the Honolulu District.

Population projections prepared by the State Department of Planning and Economic Development point to continued growth and are summarized in Table 1.

1/ State of Hawaii Department of Planning and Economic Development; Data Book 1983; Honolulu, Hawaii; December 1983.

2/ Ibid.

TABLE 1. — POPULATION PROJECTIONS: 1975 to 2000

Year	De Facto population 1/ (000) State Total	De Facto population 1/ (000) Oahu	Resident population 2/ (000) State Total	Resident population 2/ (000) Oahu	Resident population 2/ (000) Age: Under 15 Years	Resident population 2/ (000) Age: 65 years and over
1975	943.5	752.7	886.2	718.6	213.8	54.6
1980	1,055.8	823.7	968.9	764.8	226.0	76.2
1985	1,166.4	883.4	1.057.8	815.2	231.3	93.7
1990	1,277.5	941.1	1,138.4	859.3	246.4	111.7
1995	1,373.0	985.2	1,211.5	896.9	261.2	127.4
2000	1,477.2	1,018.2	1,267.8	925.7	273.2	142.0

1/ Including visitor present but excluding residents temporarily absent. The estimates of visitor present and residents absent are annual averages.

2/ Including armed forces stationed or homeported in Hawaii and their dependents living in Hawaii but excluding visitors present.

c. Land Use. Table 2 shows the breakdown of land use for the State of Hawaii and the City and County of Honolulu (Oahu). Both categories show unused open space and agriculture as the largest categories. Recreation space on Oahu comprised only 1.7 percent of the total, whereas the State had 6.9 percent of its land use in recreation.

TABLE 2. LAND USE 1/
(Acres)

Land Use	State of Hawaii Acres	State of Hawaii Percent	Oahu Acres	Oahu Percent
All Uses 2/	4,045,343	100.00	373,006	100.00
Residential	66,527	1.6	27,702	7.4
Manufacturing	3,836	0.09	1,503	0.40
Mfg. Services	11,023	0.27	2,805	0.75
Commercial	2,390	0.06	1,563	0.42
Services	122,854	3.0	52,669	14.1
Social & Cultural	7,821	0.19	4,135	1.1
Recreation	280,481	6.9	6,322	1.7
(Improved Recreation)	(5,185)	(0.13)	(2,748)	(0.74)
Agriculture	1,346,704	33.3	75,096	20.1
Transportation	6,120	0.15	1,763	0.47
Unused Open Space	2,197,587	54.3	199,448	53.5

1/ Totals may not add due to roundings.
2/ Excludes public streets an highways.

Source: The State of Hawaii Data Book, 1982, Hawaii State Department of Planning and Economic Development.

5. Recreational Resources

Kahana Bay is an important regional recreation area and is the site of Kahana Beach Park and Kahana Valley State Cultural Park, the latter encompassing the entire Kahana Valley watershed. Although the watershed portions of the park are undeveloped, hiking canoeing, hunting, swimming, fishing, and nature studying are practiced along the stream and surrounding watersheds. Along the beach and in offshore water, activities include picnicking, swimming, body surfing, sailing, canoeing, and other water-related contact activities. The existing boat ramp facility enhances boating and related recreational opportunities in the bay adjacent waters.

C. PROBLEMS AND NEEDS

Facilities at Kahana Bay are limited to a single lane public launch ramp, and is the only public facility serving this part of the island. The nearest boat harbor facility to Kahana is located at Heeia in Kaneohe Bay, which is approximately 10 miles to the southeast. Another launching facility is located at Haleiwa on the northwest coast approximately 27 miles away. Heeia-Kea is the only capable ramp facility on this side of Oahu, where overcrowding is a common concern. Approximately 25,000[1/] launches/retrievals occur per year at Heeia-kea while Kahana Bay only records approximately 400 launches/retrievals per year due to poor capability. The facility is utilized by recreational boaters and part-time fishermen who supplement their income and food sources.

The State Department of Transportation, Harbors Division indicates that many boaters have requested either improving the Kahana Bay facility to allow greater usage or providing an additional facility. Boaters have also complained that the existing boat ramp is inadequately protected against wave surge and that there is a great need for range lights for night users. During certain sea and climatic conditions, launchings and retrievals of trailered boats become very hazardous. Harbors Division also feels that a refuge for transient boaters and fishermen would be beneficial as it would represent the only adequate site in the northeastern Oahu area. Light-draft boats along the northeast coast presently do not have a safe all-weather launch ramp facility and a possible place of refuge during storms, high seas or mechanical difficulties. The northeast coast of Oahu is exposed to both northeast trade waves and North Pacific swells. Further information on storm waves is provided in Appendix D.

The determination of demand for small boating facilities at Kahana Bay is derived from results of a contingent valuation survey conducted on Oahu in the spring of 1985. The survey consisted of a mail survey sent to a sample of 623 boat owners and 480 non-boat owners on Oahu. The methodology and results are shown in detail in Appendix E, Economic Analysis.

The proposed Kahana small boat facility will provide a safe and efficient base of operations for local subsistence fishing and recreational boats. The project will provide the needed navigation facilities for the Kahana area, as well as for the northeast of Oahu.

1/ 1972 data from Statewide Boat Launching Facilities Study Master Plan with a project 1990 value of 58,000.

D. WITHOUT-PROJECT PROFILE

If no Federal action is taken to provide navigation improvements, possible improvements at Kahana Bay will likely be considered by the Harbors Division. Their request for this study reflects the concern that the lack of safe and adequate harbor facilities will continue to constrain full use of the ocean's resources in the study area for subsistence fishing and other boating-related recreation. Federal assistance would facilitate implementation of the needed improvements. See Figure 3 and Photos 1 through 5.

The resident population of the northeast portion of Oahu will continue to expand. Continued population growth will also place greater demands on the sea as a subsistence food source. Increased boating and fishing activity will also have an impact on the environmental resources of Heeia-Kea and Haleiwa areas.

E. PLANNING OBJECTIVES

The planning objectives for light-draft navigation improvements in the area of Kahana, Oahu, are based on an analysis of the boating problems and needs as well as consideration of the environmental and human resources of the area. The following planning objectives were adopted to guide the formulation and evaluation of alternative plans:

a. Improve small-scale commercial and subsistence fishing opportunities in the Kahana area, Oahu, for the 1990-2040 period of analysis.

b. Improve the socioeconomic and water-oriented recreational opportunities in the study area.

c. To protect and enhance the marine and terrestrial environment, cultural and archaeological resources of the study area.

In addition to the specific objectives cited above, water resources planning by the Corps of Engineers is also guided by a set of national objectives. The Water Resources Council Principles and Guidelines (P&G) for Water and Related Land Resources define the national objectives of national economic development (NED). The NED objective is achieved by increasing the value of the nation's output of goods and services and improving national economic efficiency. The Federal objective is to contribute to NED consistent with protecting the nation's environment pursuant to national environment statutes, applicable executive orders, and other Federal planning requirements.

The P&G also state that various alternative plans are to be formulated in a systematic manner to insure that all reasonable alternatives are evaluated. A plan that reasonably maximizes the NED benefits, consistent with Federal objective, is to be formulated. Other plans which reduce net NED benefits in order to further address other Federal, State, local, and international

FIGURE 3. An aerial view of Kahana Bay. The existing launch ramp facility is located just right of center in this photo near the lower end of the beach (Kahana Bay, Oahu).

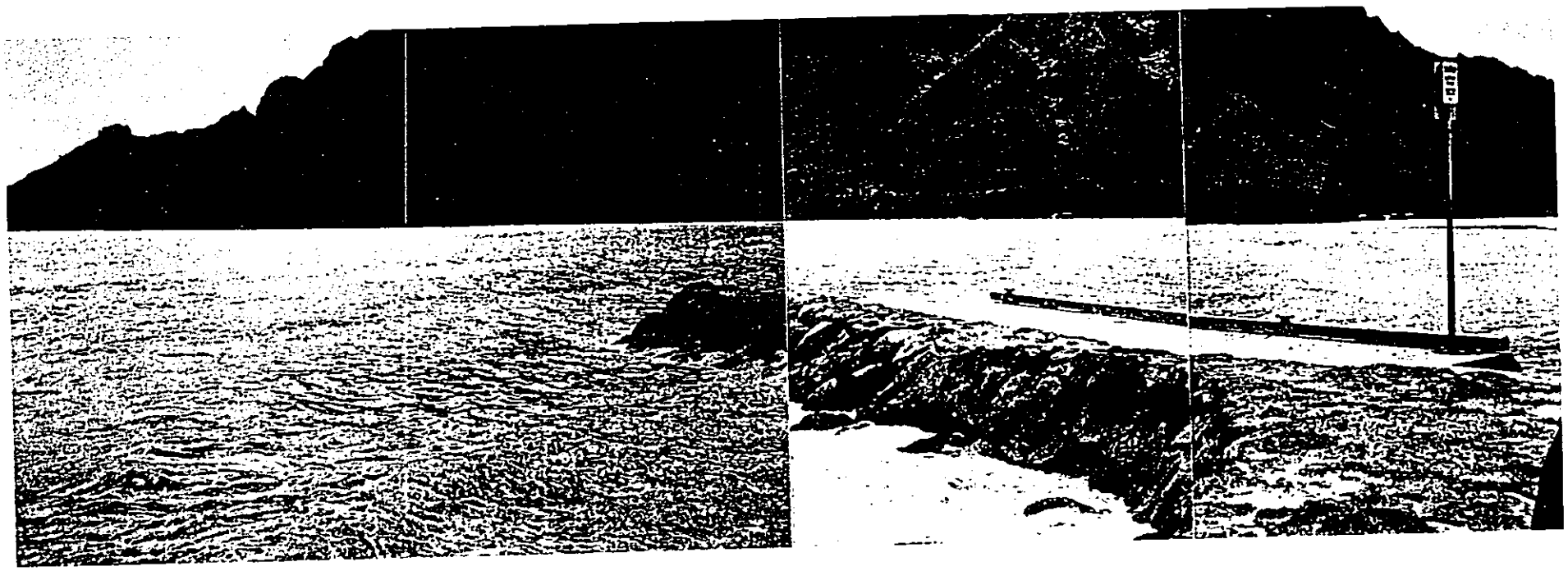

PHOTO 1. The existing groin and loading dock protrudes some 60+ feet into Kahana Bay from the parking area seawall (Kahana Bay, Oahu).

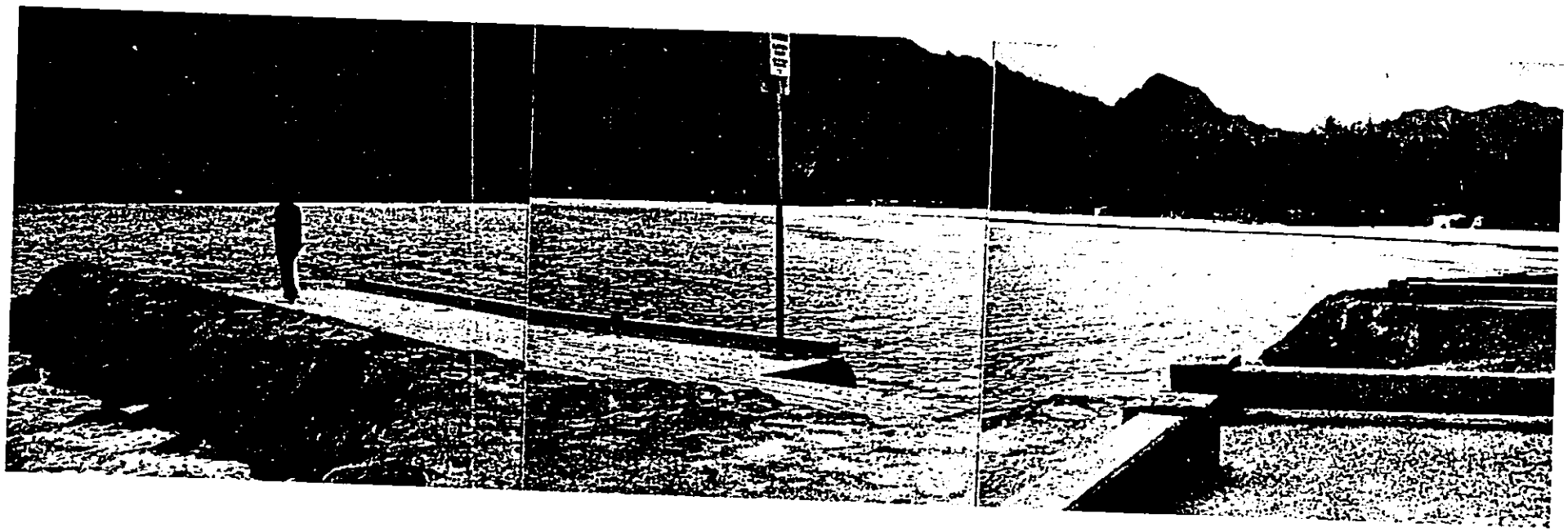

PHOTO 2. Looking south from the existing launch facility, the expanse of scenic Kahana Bay beach can be seen in the background (Kahana Bay, Oahu).

PHOTO 4 (above). The existing rock groin does not provide adequate protection from wave surges to boaters utilizing the launch ramp. Here, a moderately-sized wave can be seen overtopping the groin (Kahana Bay, Oahu).

PHOTO 3 (left). Sand and other debris are strewn onto the parking area by waves overtopping the seawall (Kahana Bay, Oahu).

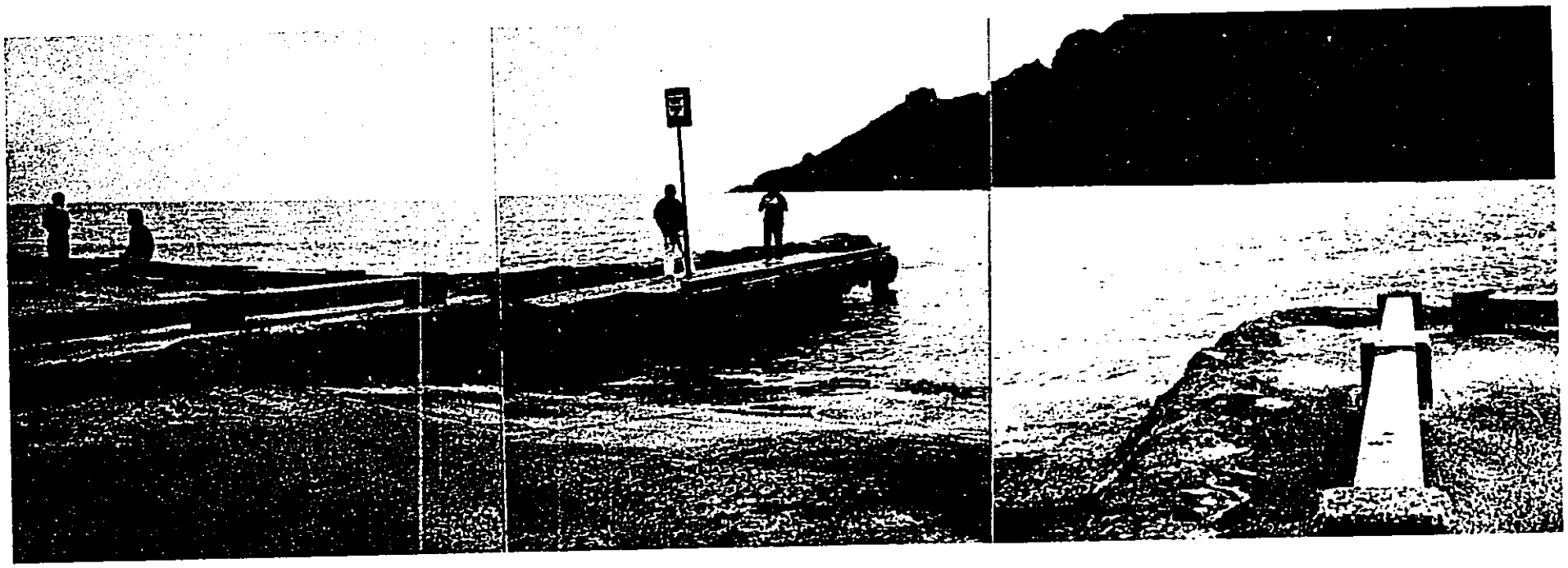

PHOTO 5. Incident waves currently bend around the end of the groin to create problems to boaters launching and retrieving their small craft (Kahana Bay, Oahu).

concerns not fully addressed by the NED plan may be formulated. A plan recommending Federal action is to be the alternative plan with the greatest economic benefit, unless the Secretary of a department or head of an independent agency grants an exception to this rule.

Four accounts are established to facilitate evaluation and display of effects of alternative plans. The national economic development account is required. Other information that is required by law or that will have a material bearing on the decisionmaking process should be included in the other accounts, or in some other appropriate format used to organize information on effects.

a. The national economic development (NED) account displays changes in the economic value of the national output of goods and services.

b. The environmental quality (EQ) account displays nonmonetary effects on significant natural and cultural resources.

c. The regional economic development (RED) account registers changes in the distribution of regional economic activity that results from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.

d. The other social effects (OSE) account registers plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts.

III. FORMULATION AND ASSESSMENT OF PRELIMINARY PLANS

A. FORMULATION AND EVALUATION CONCEPTS

This section of the report details the development and evaluation of alternative measures to resolve the problems and needs of the study area and to meet the planning objectives defined in the previous section. Possible measures do not necessarily have to be within the Corps of Engineers' authority or capabilities. If favorable or superior measures are available outside the Corps of Engineers authorities, the final recommendations will also indicate these alternatives. The initial step in the formulation process is the identification of broad measures (structural and non-structural) available to resolve the problems. If the structural measures are found to be the best solution to meet the planning objectives, the second step is to identify and evaluate potential sites where structural solutions can be constructed with minimal adverse impacts. After the selection of a suitable project site or sites, specific design layouts can be formulated and evaluated. Those plans that meet the planning objectives and local desires can then be identified.

Nonstructural alternatives or measures are those actions that can meet the planning objectives without constructing new facilities. Typical measures include improving the efficiency of existing facilities or converting facilities presently used for other purposes. The lack of any harbors or protected mooring areas in northeast Oahu makes it difficult to apply nonstructural measures. The nearest public small boat facility is about 10 miles away at Heeia in Kaneohe Bay. To improve navigation conditions, a protective basin is considered necessary for the boaters.

The following criteria were used in selecting harbor sites and in formulating the various alternative structural measures.

1. Technical Criteria

a. The plan of improvement for improved/safer harbor facility should provide for a design vessel up to 25 feet in length, beams up to seven feet and drafts up to three feet.

b. The entrance channel should provide for the same design vessel, serve one-way traffic and be navigable during all weather and sea conditions except during severe storms.

c. The turning basin should be adequate for maneuvering of the design vessel.

d. Protective structures should be designed to withstand a severe combination of oceanographic and meterological conditions which are characteristic of the study area.

2. Economic Criteria

a. Improvement plans recommended for implementation should have net positive NED benefits and as far as possible, should be maximized.

b. The benefits and costs should be expressed in comparable quantitative economic terms to the fullest extent possible. Annual costs should be based on a 50-year amortization period and an 8-3/8 percent interest rate, and should include the annual maintenance cost.

3. Environmental Criteria

a. Identify, assess, and evaluate all forms of fish and wildlife which may be affected.

b. Offshore harbor structures should be as open and segmented as technically feasible to minimize long term disturbances or changes in the physical environment.

c. Avoid severe adverse social, health, and safety impacts.

d. Improved harbor siting and design should minimize potential conflicts between boating and beach use, recreational swimming and diving, picnicking and cultural resources.

e. Evaluate the potential environmental and social effects on an equal basis with the technical and economic considerations.

B. SCREENING OF POTENTIAL SITES

1. Site Identification. This section of the report is directed towards the development and evaluation of alternative sites for a light-draft harbor and launch ramp facilities. The initial step is to identify potential sites. The number of potential sites can then be reduced by eliminating areas that would not meet preliminary technical, economic and environmental criteria.

Potential sites were limited to the northeast coast of Oahu to conform with the expressed desire for improvements in the Kahana vicinity.

Three sites were initially considered as possible areas for light-draft navigation improvements (see Figure 4). The major considerations in a

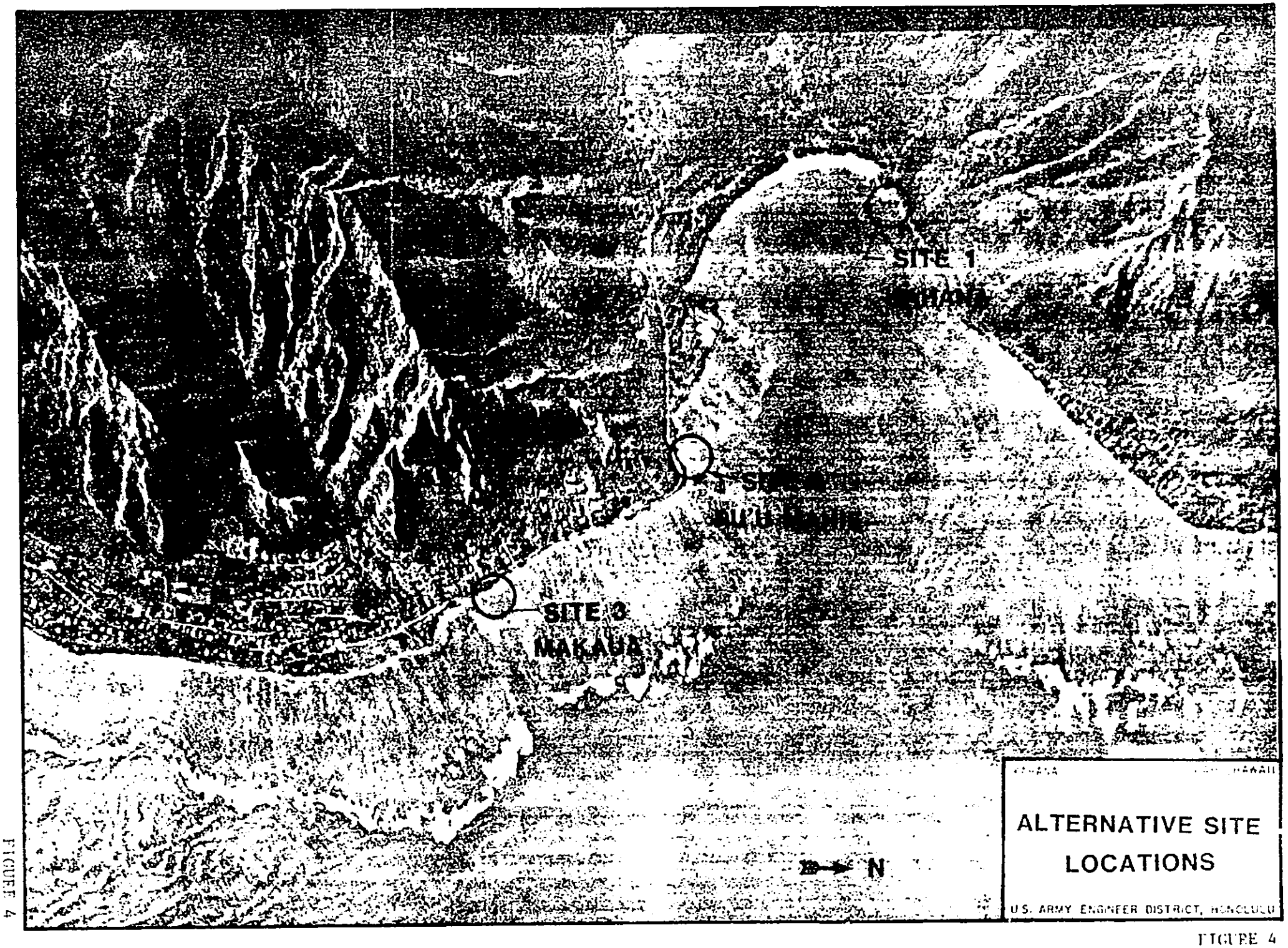

FIGURE 4

FIGURE 4

site selection were: (1) preliminary project cost, (2) sea conditions, (3) endangered species, (4) archaeological sites, (5) existing and proposed land use zoning, (6) accessability, and (7) public acceptance. The possible alternatives sites for navigation improvements include:

1) Kahana Bay
2) Pu'u Mahie Point
3) Makaua Beach Park

2. Site 1 - Kahana Bay: This site has an existing 18-foot wide (one-lane) concrete boat launching ramp constructed in 1962. Boating facilities include a groin, loading dock, freshwater faucets, restrooms, picnic and camping areas, and parking. This site is partially protected from storm wave conditions due to its natural configuration. The offshore areas at this site are covered with a veneer of coral sand. Blasting will not be required.

Because the facilities are located just seaward of Kamehameha Highway, with only a narrow stretch of land between the shore and highway, additional parking area is limited.

3. Site 2 - Pu'u Mahie Point: This site is located just outside of Kahana Bay on the east point near Crouching Lion restaurant. Presently, there is no navigation facility or parking in this area. There is coral reef rock immediately offshore extending out approximately 700 feet towards the middle of Kahana Bay. Located about 500 feet southwest of this site is Huilua Fishpond, which is a registered National Historical Landmark. Dredging coral may require blasting. No parking area is available.

4. Site 3 - Makaua Beach: This site is located 2,500 feet southeast of Pu'u Mahie Point. Presently, there is no navigation facility or parking in this area. There is coral reef rock immediately offshore, extending out about 400 feet towards open ocean. Dredging coral may require blasting. No parking area is available.

5. Site Selection. Table 3 provides an overview and comparison of the preliminary project first costs and other factors considered in the site selection process.

Table 3. Site Comparison

Criteria Considered	Site 1 (Kahana)	Site 2 (Pu'u Mahie)	Site 3 (Makaua)
Preliminary Project Cost	$0.7 million	$1.1 million	$0.9 million
Protection from Storm Waves	Good	Fair	Fair
Access During Storm Conditions	Good	Fair	Fair
	Good	Good	Good
Impact on Fish and Wildlife Resources	Minor	Major	Minor
Presence of Archaeological and/or Historical Sites	No	Yes	Probable
Land Use Change	No	Yes	Yes
Public Acceptance	Most Acceptable	Least Acceptable	Moderately Acceptable

Site 1 has the lowest preliminary project first cost of the three sites. Site 1, being in the bay, has good protection from storm waves, whereas Sites 2 and 3 have more direct exposure to storm waves. Site 1 could be used under more sea conditions than Sites 2 and 3. Presently, Sites 2 and 3 have no existing facilities such as shoreside utilities, restrooms, parking, or other recreation areas, whereas Site 1 already has these existing facilities. Sites 2 and 3 could require blasting due to the coral immediately offshore of these sites. Site 1 would not require blasting because of the sandy characteristics of the bay. Therefore, improvements at Site 1 will have less impact on the environment and the fish and wildlife resources because it is a disturbed area, and improvements at Sites 2 and 3 would affect these resrouces more significantly. All three sites have the same convenient road access, as they are all directly off of Kamehameha Highway. Site 1 has the most favorable public acceptance and Site 2 being the least favorable. Site 1 will not have an impact on any historical/archaeological sites, Site 3 will probably impact potentially valuable cultural resources. Site 2 is very close to and may impact on the Huilua Fishpond.

Based on the preliminary overall comparison of economic, environmental and technical considerations, Site 1 (Kahana Bay) was selected for further studies.

C. FORMULATION OF ALTERNATIVE PLANS

Based on the identified problems and needs, the planning objectives and the formulation and evaluation concepts discussed in prior sections of this report, four (4) alternative designs were developed for the Kahana Bay Site. The plans consist of the same alignment of the breakwater to protect the launch ramp from storm surge most efficiently, but the level of protection or level of useability of the small craft facility varies in each plan. (See Appendix D for more information on level of useability.) These four alternative plans are described in the section below.

1. Alternative 1 (Figure 5)

This alternative consists of a 220-foot long breakwater just seaward (north) of the existing groin and launch ramp. The crest elevation is 11.0 ft above mean lower low water (MLLW). A 90-foot by 90-foot turning basin is provided for the design vessel dredged to a depth of 6 feet (MLLW). A 50-foot wide entrance channel will be dredged to a depth of 8 feet MLLW with side slopes of 1V:3H. This plan allows for a no overtopping condition (100% useability). The typical section is shown on Plate D-6.

2. Alternative 2 (Figure 6)

Alternative 2 is similar to Alternative 1 with a 90-foot by 90-foot turning basin dredged to a depth of -6 feet (MLLW). It also has an entrance channel 50-feet wide dredged to a depth of -8 feet MLLW with side slopes of 1V:3H. The breakwater is located on the seaward side of the existing groin. This breakwater is 220-feet long with a crest elevation of 8.0 feet above MLLW. This plan allows for overtopping of 3-feet (94.6% useability). The typical section is shown on Plate D-8.

3. Alternative 3 (Figure 7)

Alternative 3 is similar to both Alternatives 1 and 2. The turning basin is 90-feet by 90-feet dredged to a depth of -6-feet (MLLW). The entrance channel is 50-feet wide dredged to a depth of -8 feet (MLLW) with side slopes of 1V:3H. The breakwater is located just seaward (north) of the existing groin. This breakwater is 220-feet long with its crest elevation at 6.5 feet above MLLW. This plan allows for overtopping of 4.5 feet (71% useability). The typical section is shown on Plate D-10.

4. Alternative 4 (Figure 8)

This alternative is similar to the rest of the alternatives. The turning basin is 90-feet by 90-feet dredged to a depth of -6 feet (MLLW). The entrance channel is 50-feet wide and dredged to a depth of -8 feet MLLW with side slopes of 1V:3H. The breakwater is located seaward of the existing groin. This breakwater, 220-feet long, has a crest elevation of 5.0 feet and allows for 6-feet overtopping (32.2% useability). The typical section is shown on Plate D-12.

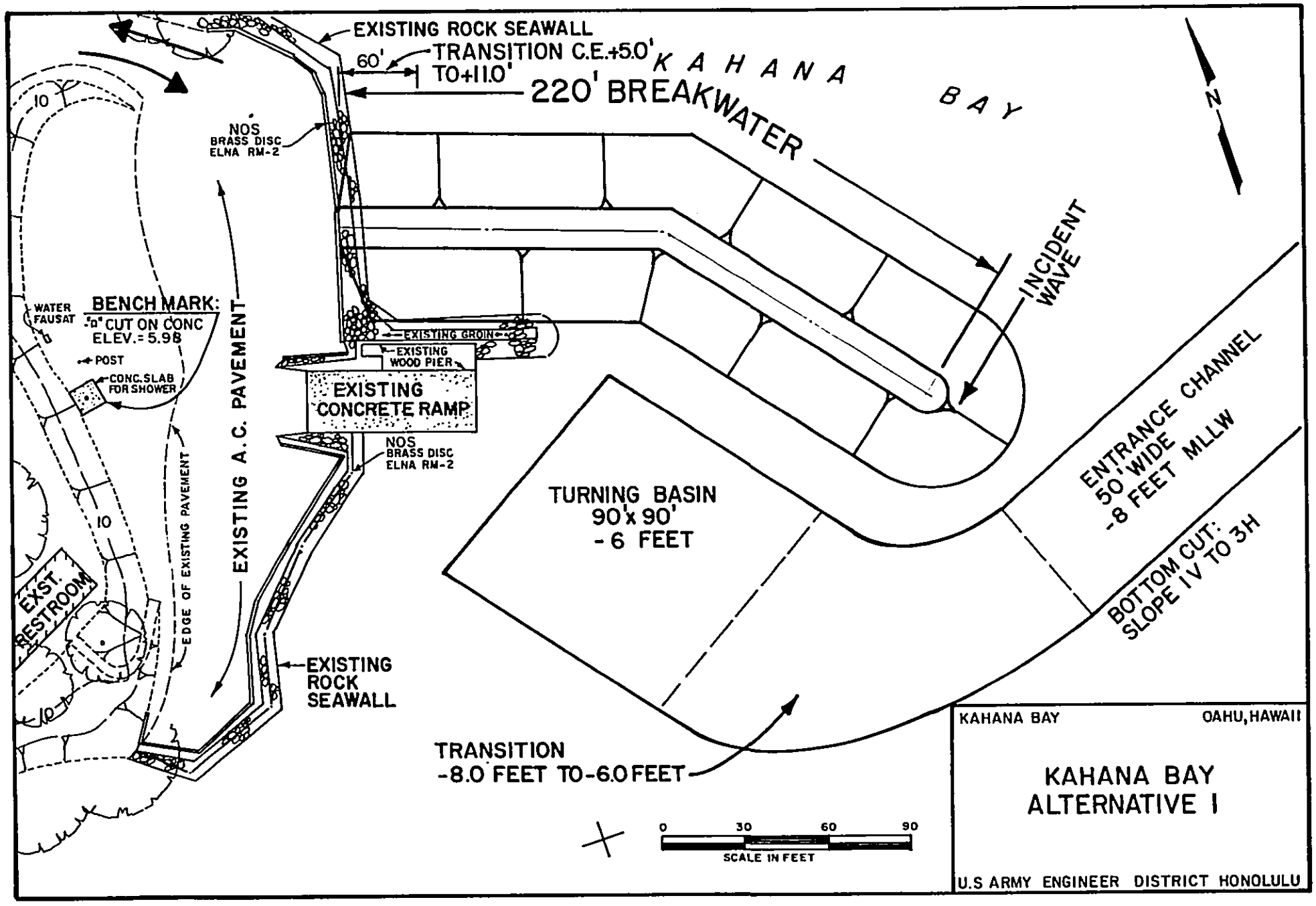

FIGURE 5

FIGURE 5

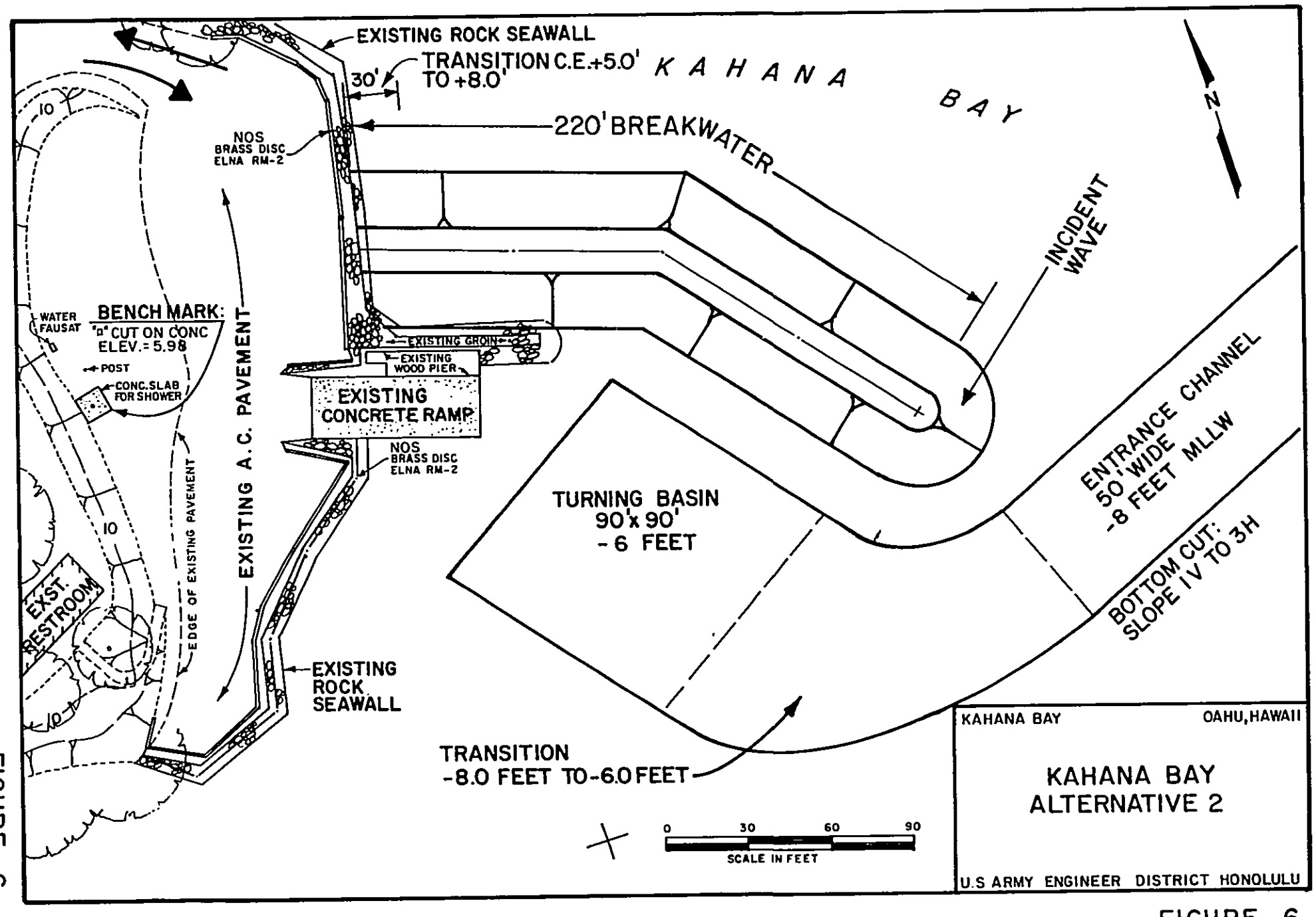

FIGURE 6

FIGURE 6

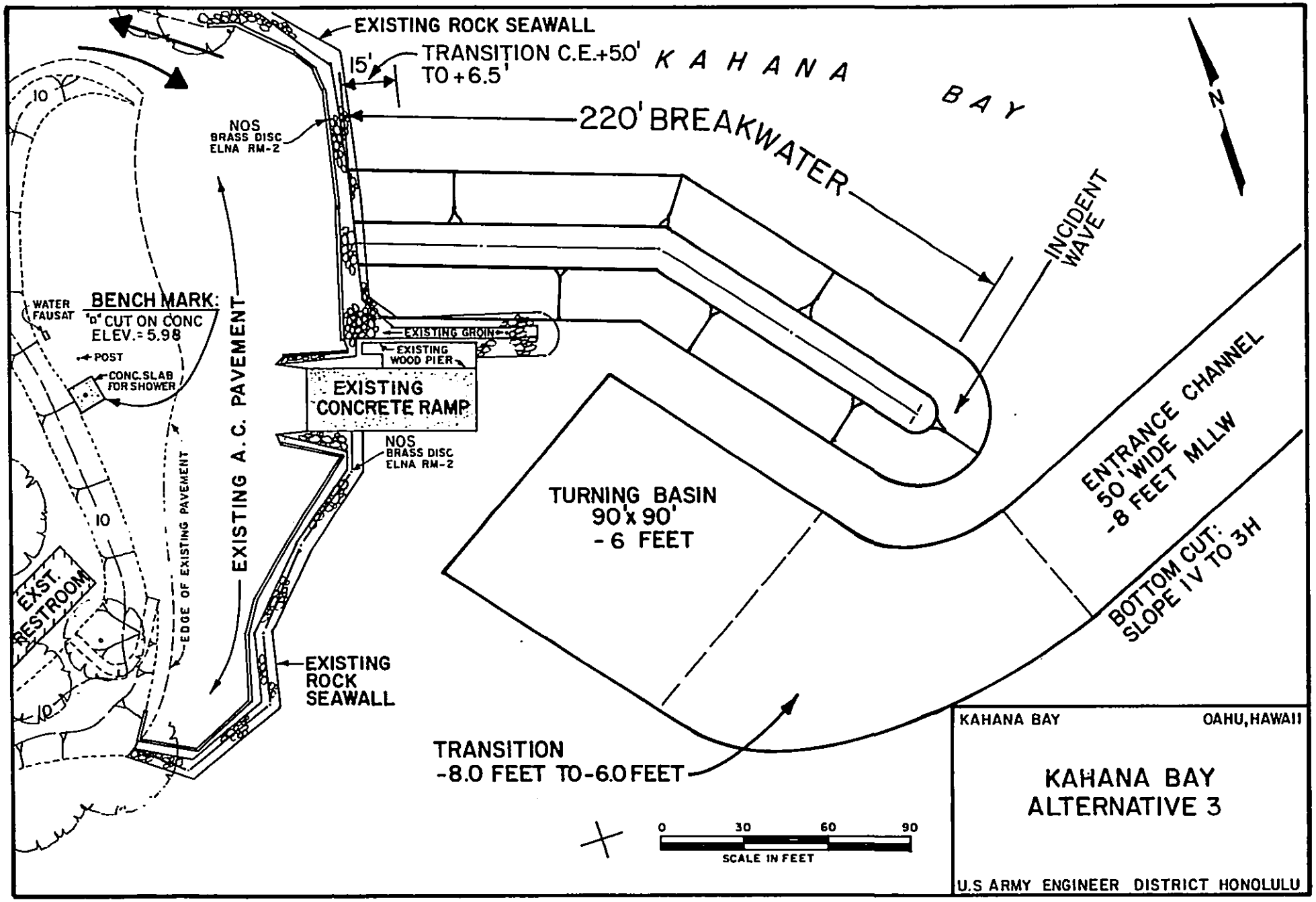

FIGURE 7

FIGURE 7

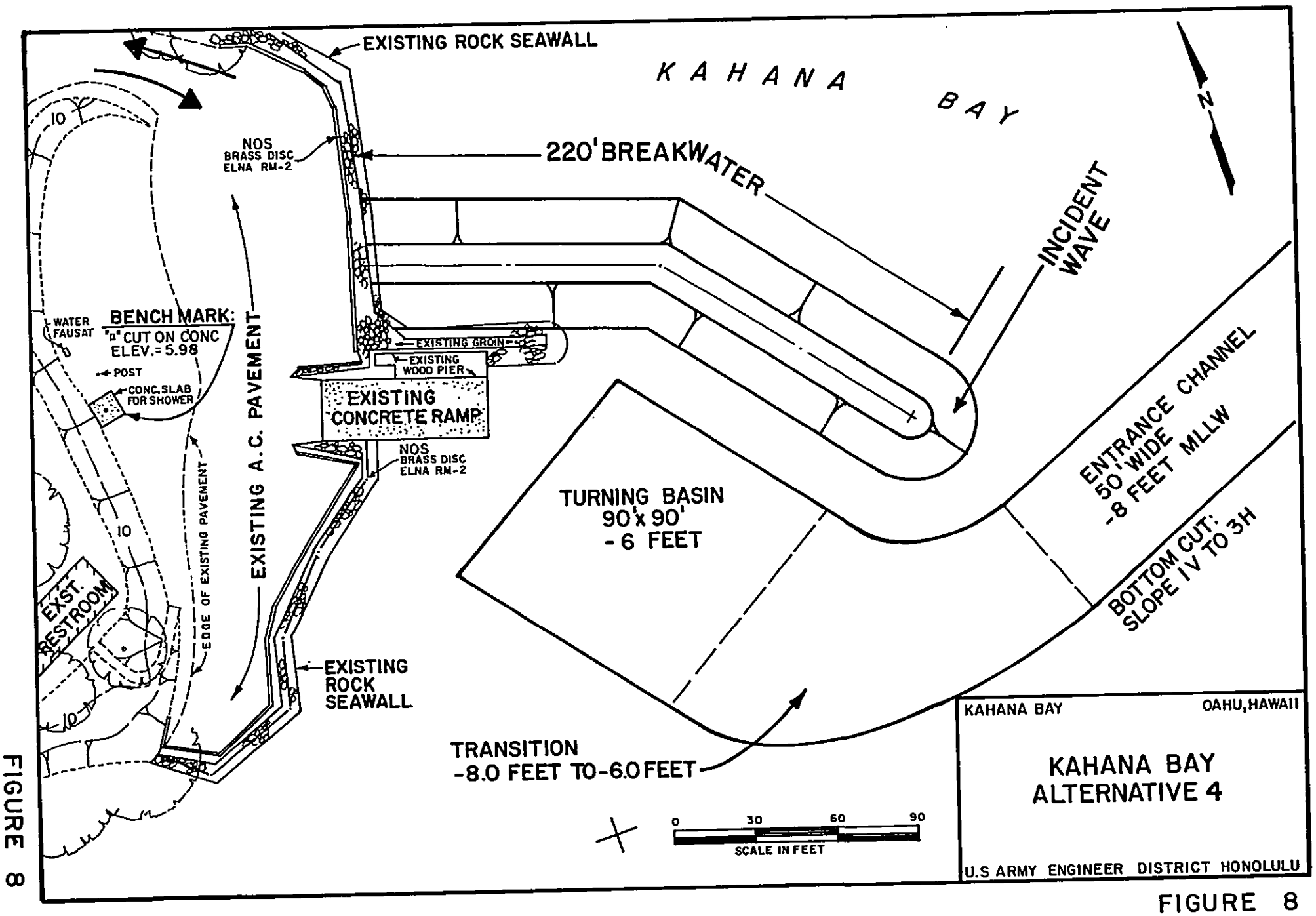

FIGURE 8

FIGURE 8

The level of useability is discussed further in Appendix D, Engineering Design and Cost Estimates.

5. Other Design Considerations

a. Typical Sections. Typical cross sections for the alternatives are shown in Appendix D.

b. Aids to Navigation. The U.S. Coast Guard will provide the necessary aids to navigation for the selected plan of improvement. These aids are a Federal Cost but are not included in the Corps of Engineers monetary limitation under the authorizing legislation.

c. Construction Materials. Appendix C on Geology, Foundations and Materials provide information on stove sources on Oahu.

D. ESTIMATED BENEFITS AND COSTS

This section assesses the economic feasibility on the alternative plans.

1. Benefits.

Benefits accruing from each plan were derived from improvements in recreational boating and subsistence fishing. Economic evaluations were conducted in accordance with procedures defined by the Corps of Engineers. Benefits are estimated at October 1985 price levels. Detailed analysis of the benefits can be found in Appendix E. The average annual benefits for each alternative are summarized below in Table 4.

Table 4. SUMMARY OF BENEFITS FOR ALTERNATIVES (Average Annual)

Category	Alt 1	Alt 2	Alt 3	Alt 4
Launch Use Value	$ 22,500	$ 21,300	$ 16,000	$ 7,300
Existence Value[1/]				
Boat Owners	56,500	53,400	40,100	18,200
Non-Boat Owners	437,500	413,900	310,600	140,900
Passenger Benefits[2/]	51,400	48,500	35,800	14,900
Total Annual Benefits	$567,900	$537,100	$402,500	$181,300

1/ Theoretically, the existence value may or may not remain constant. Responses to the existence value WTP value question on the CVM questionnaire are based on a generic description of project features (i.e., breakwater to protect boats from storms) and not on various levels of protection. We assumed that the existence value is proportional to the level of useability in this analysis.

2/ Changes in passenger benefits corresponding to the changes in levels of useability were calculated by taking the difference between the with project value multiplied by the percent useability and the without project value.

2. Costs.

Estimated project first costs were developed from October 1985 price levels. Using an interest rate of 8-3/8 percent and an amortization period of 50 years, the project first costs are converted to average annual costs. These are summarized in Table 5. Detailed cost estimates are presented in Appendix D.

Table 5. SUMMARY OF COSTS

Category	Alt 1	Alt 2	Alt 3	Alt 4
Total Project First Cost	$1,109,800	$ 973,500	$907,200	$837,000
Interest During Construction (IDC)	30,300	26,600	24,800	22,900
Total Project Investment	$1,140,100	$1,000,100	$932,000	$859,900
Interest and Amortization	97,200	85,300	79,500	73,300
O&M	7,500	7,200	6,900	6,600
Total Annual Cost	$ 104,700	$ 92,500	$ 86,400	$ 79,900

3. Benefit to Cost Comparison

The benefit to cost ratio (B/C) is the proportion of the average annual benefits to average annual costs. Table 6 summarizes the benefits and costs associated with each alternative.

Table 6. BENEFIT TO COST COMPARISON (In $1,000)

Item	Alt 1	Alt 2	Alt 3	Alt 4
Average Annual Cost	$104,700	$ 92,500	$ 86,400	$ 79,900
Average Annual Benefit	567,900	537,100	402,500	181,300
Benefit-to-Cost Ratio (B/C)	5.4	5.8	4.7	2.3
Net Benefits	463,200	444,600	316,100	101,400

4. Cost Apportionment

The apportionment of costs between Federal and non-Federal interests corresponds to Section 107 of the River and Harbor Act of 1960, as amended, which limits Federal participation in this type of project to a monetary maximum of $2 million. This Federal limit excludes the cost of the aids to navigation, but does include the costs of preauthorization studies. There are also guidelines on the cost-sharing of light-draft navigation facilities which apportion costs based on the allocation of benefits between general and local interests. Benefits for recreation craft are split 50% to general interests and 50% to local interests, whereas 100% of the benefits from subsistence fishing, charter fishing craft and from dredged material use accrue to general interests. The relative proportion of benefits allocated to general and local interests determines the apportionment of costs to Federal and non-Federal interests, respectively. The cost sharing percentages determined by this method (General 69.5% and local 30.5%) apply to the Federal portion of the project (i.e., cost of breakwater and other protective structures, dredging of entrance channel, turning basin, engineering and design, supervision and adminstration and contingency costs). The costs of the shoreside facilities and utilities are local costs. Further information on this allocation of benefits to general and local interests is provided in Appendix E.

Application of the cost sharing percentages to the project first cost of $1,109,800, $720,000 would be borne by the Corps, $5,000 by the U.S. Coast Guard and the remaining $384,800 by the State of Hawaii.

General legislation authorizing implementation of water resoruces projects, the most recent being the Water Resources Development Act of 1976, contain local cooperation requirements established by enactment of various laws. The Administration is currently reviewing cost sharing and financing

across the entire spectrum of water resources development functions and has submitted proposed legislation for water projects to Congress. The basic principle governing the development of specific cost sharing policies is that, whenever possible, the cost of services produced by water projects should be paid by their direct beneficiaries. While specific cost sharing policies applicable to the project have not yet been established, non-Federal interests can expect that, under the Administration's financing and cost sharing principles, the level of their financial participation may be greater than in the past.

E. ASSESSMENT OF ALTERNATIVES

In addition to the economic factors analyzed for each alternative, trade off analyses must also include the environmental, social and aesthetic effects associated with each alternative.

Table 7, the System of Accounts Table, facilitates the evaluation and comparison of these critical criteria for each alternative under consideration as well as the without project condition.

F. DESIGNATION OF THE NED AND TENTATIVELY RECOMMENDED PLAN

The NED plan is that plan which maximizes the net National Economic Development benefits. Alternative 1 (no overtopping) has the maximum net NED benefits and is therefore designated as the NED plan as well as the tentative recommended plan. The estimated annual net benefits are $463,200 and the benefit-cost ratio is 5.4. This plan also does not have significant adverse or unmitigative environmental effects. See Figure 9.

IV. SCHEDULED WORK

The final selection of the most suitable and desirable plan will involve further analysis of the alternatives and public input. This will be accomplished following the public meeting scheduled in early fiscal year 1986, and review comments on this draft document. Additional sections to complete this Detailed Project Report are the Selected Plan, Plan Implementation and Public Views, and Conclusions and Recommendations.

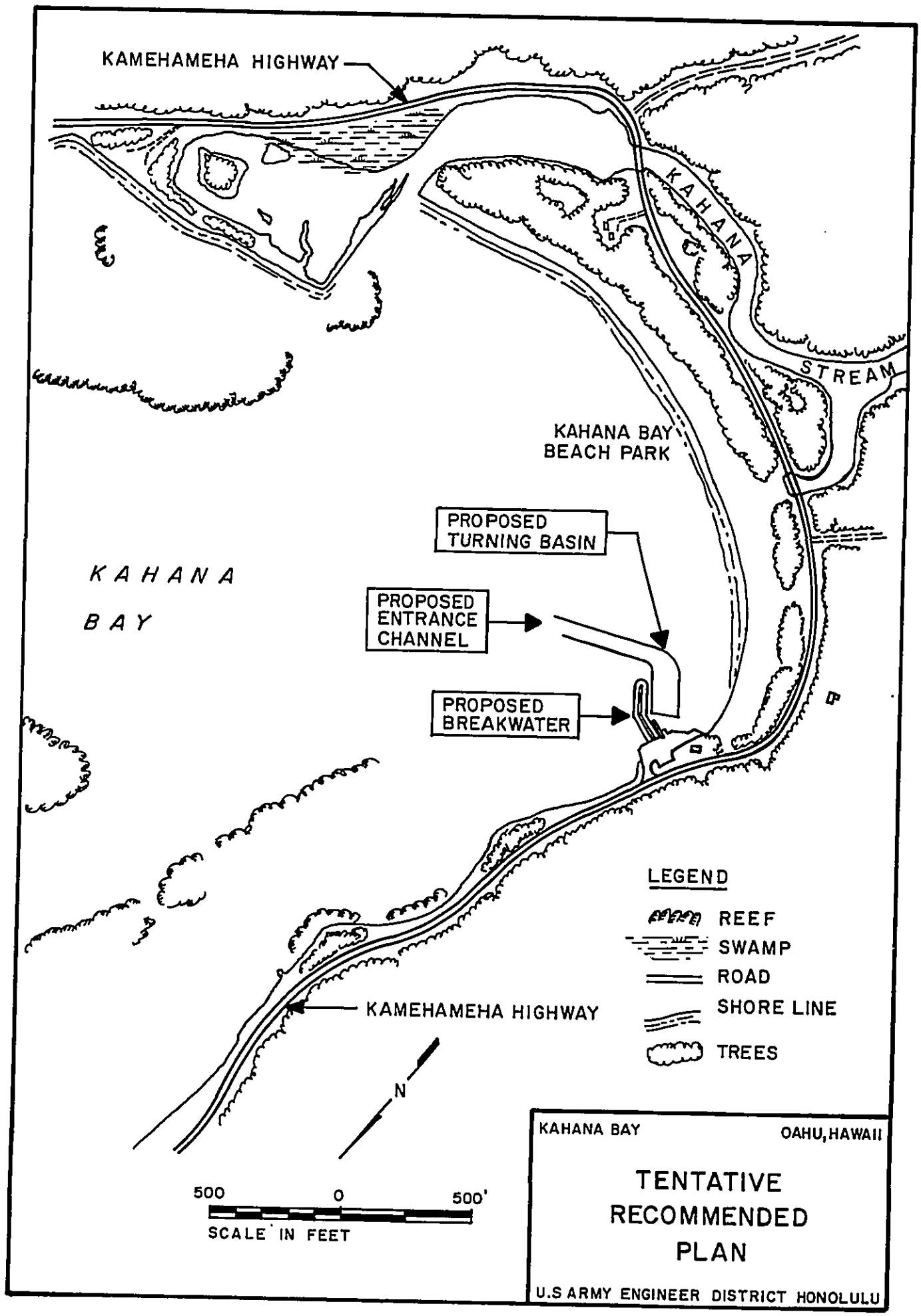
KAMEHAMEHA HIGHWAY
KAHANA STREAM
KAHANA BAY BEACH PARK
PROPOSED TURNING BASIN
KAHANA BAY
PROPOSED ENTRANCE CHANNEL
PROPOSED BREAKWATER
KAMEHAMEHA HIGHWAY
LEGEND
REEF
SWAMP
ROAD
SHORE LINE
TREES
N
500 0 500'
SCALE IN FEET
KAHANA BAY
OAHU, HAWAII
TENTATIVE RECOMMENDED PLAN
U.S ARMY ENGINEER DISTRICT HONOLULU

FIGURE 9

TABLE 7. SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
A. PLAN DESCRIPTION	Existing facilities consist of a one-lane launch ramp, 50-foot groin with loading dock, shoreside facilities and parking area.	Construction of a 220-foot long breakwater with no overtopping, an entrance channel and turning basin.	Construction of a 220-foot long breakwater with 1.5 feet overtopping, an entrance channel and turning basin.	Construction of a 220-foot long breakwater with 3 feet overtopping, an entrance channel and a turning basin.	Construction of a 220-foot long breakwater with a 4.5 feet overtopping, an entrance channel and a turning basin.
B. IMPACT ASSESSMENT					
1. Economic					
a. Public Facilities & Services	Continued use of an unsafe boating facility and continued unmet demand for a safe boating facility.	Improvement would provide for safe navigation (launch, retrievals, and storm surge protection).	Same as Plan 1 but to a lesser extent.	Same as Plan 2 but to a lesser extent.	Same as Plan 3 but to a lesser extent.
b. Consituent Facilities & Services	None	Consituent of 9,700 tons of quarried rock, time, manpower, and energy resources.	Consituent of 7,200 tons of quarried rock, time, manpower, and energy resources.	Consituent of 4,100 tons of quarried rock, time, manpower, and energy resources.	Consituent of 4,900 tons of quarried rock, time, manpower, and energy resources.
c. Recreation	No change. However the full potential of this area as a major focal point of recreational activities would probably not be realized without a boating facility.	Would increase opportunities for boating, fishing, and other water-based recreation activities.	Same as Plan 1.	Same as Plan 1.	Same as Plan 1.

TABLE 7. SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
2. Environmental					
a. Marine Environment	No change	Approximately 1.99 acres of marine habitat would be affected.	Approximately 1.93 acres of marine habitat would be affected.	Approximately 1.91 acres of marine habitat would be affected.	Approximately 1.88 acres of marine habitat would be affected.
b. Terrestial Environment	No change	No impact	Same as Plan 1	Same as Plan 1	Same as Plan 1
c. Fish and Wildlife	No effect	Rock breakwater may create ideal habitat for variety of fish and invertebrates.	Same as Plan 1	Same as Plan 1	Same as Plan 1
d. Endangered Species					
---Humpback Whale (endangered)	No critical habitat, seasonal migration offshore.	No impact	No impact	No impact	No impact
---Green Turtle (threatened)	No critical habitat, but seen in Kahana Bay.	No impact	No impact	No impact	No impact
e. Air Quality	No change	Temporary impact during construction.	Same as Plan 1	Same as Plan 1	Same as Plan 1
f. Water Quality	No change	Temporary impact during construction.	Same as Plan 1	Same as Plan 1	Same as Plan 1

TABLE 7. SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
3. Social					
a. Noise	No change	Temporary impact during construction.	Same as Plan 1	Same as Plan 1	Same as Plan 1
b. Population	No impact	No impact	Same as Plan 1	Same as Plan 1	Same as Plan 1
c. Aesthetic Values	No change	Moderate visual intrusion	Same as Plan 1	Same as Plan 1	Same as Plan 1
d. Historical, Cultural, and Archaeological Resources	The nearest archaeological sites are a fishing shrine, a low rock shrine seen only at low tide, and Huilua fishpond which is a registered historic site located on the southern portion of Kahana Bay.	No impact on the Huilua Fishpond, nor fishing or rock shrine.	Same as Plan 1	Same as Plan 1	Same as Plan 1
e. Health, Safety, and Well-being of Community	No change	Would enhance health, safety, and community well-being by providing safe navigation.	Same as Plan 1	Same as Plan 1	Same as Plan 1
f. Community Growth and Cohesion	No change	Would provide increased focus for regional and community interaction by improved recreational activities.	Same as Plan 1	Same as Plan 1	Same as Plan 1

TABLE 7. SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
C. PLAN EVALUATION					
1. Contributions to Planning Objectives					
a. Improve Subsistence & Small-scale Commercial Fishing Opportunities and Realated Recreational Boating Activities	No change	Would provide a safe launch facility, contribute to the development of boating-related business activities. Increase efficiency for existing fishing and related recreational boating operations.	Same as Plan 1	Same as Plan 1	Same as Plan 1
b. Improve the Socio-Economic and Water-related Recreational Opportunities in the Study Area.	No change	Would provide employment opportunities, provide diversity to Hawaii's tax revenue base from commercial boating and boating related business activities, and improve water-related recreational opportunities.	Same as Plan 1	Same as Plan 1	Same as Plan 1
2. Response to Formulation Criteria					
a. Technical					
---Safe Navigation Conditions	N/A	Yes	Yes	Yes	Yes
---Adequate Turning Basin	N/A	Yes	Yes	Yes	Yes
---Structures Designed for Severe Storm	N/A	Yes	Yes	No	No
---Accomodate Design Vessel	N/A	Yes	Yes	Yes	Yes

TABLE 7. SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
b. Economic					
---Economically Sound	N/A	Yes	Yes	Yes	Yes
---Benefit to Cost > 1	N/A	Yes	Yes	Yes	Yes
---Maximize Net Benefits	N/A	Yes	No	No	No
c. Environmental					
---Minimize Long-Term Effects	No change	Yes	Yes	Yes	Yes
---Confine Work Area	N/A	Yes	Yes	Yes	Yes
3. Relationship to National Accounts					
a. National Economic Development					
---Average Annual Benefits	N/A	$567,900	$537,100	$402,500	$181,300
---Average Annual Costs	N/A	$104,700	$92,500	$86,400	$79,900
---Net Annual Benefits	N/A	$463,200	$444,600	$316,100	$101,400
---Benefit to Cost Ratio	N/A	5.4	5.8	4.7	2.3

TABLE 7. SUMMARY COMPARISON OF ALTERNATIVE PLANS AND SYSTEM OF ACCOUNTS

DESCRIPTION	BASE CONDITION & WITHOUT PROJECT	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
4. Response to Associated Evaluation Criteria					
a. Acceptability	N/A	Medium	Medium	Medium	Medium
b. Completeness	N/A	Complete, with periodic maintenance.	Same as Plan 1	Same as Plan 1	Same as Plan 1
c. Effectiveness	N/A	Effective	Effective	Effective	Effective
d. Efficiency	N/A	Efficient	Efficient	Efficient	Efficient
e. Reversibility	N/A	Irreversible commitment of monetary and environmental resources.	Same as Plan 1	Same as Plan 1	Same as Plan 1
f. Stability	N/A	Stable	Stable	Stable	Stable
D. IMPLEMENTATION RESPONSIBILITIES					
1. Corps of Engineers	N/A	Provide estimated project first cost share of $720,000, design and construction of the breakwater, entrance channel and turning basin.	Provide estimated project first cost share of $625,200, design and construction of the breakwater, entrance channel and turning basin.	Provide estimated project first cost share of $579,100, design and construction of the breakwater, entrance channel and turning basin.	Provide estimated project first cost share of $530,300, design and construction of the breakwater, entrance channel and turning basin.
2. State of Hawaii	N/A	Provide estimated local first cost share of $384,800, provide local assurances, cooperation, and develop shoreside facilities.	Provide estimated local first cost share of $343,300, provide local assurances, cooperation, and develop shoreside facilities.	Provide estimated local first cost share of $323,100, provide local assurances, cooperation, and develop shoreside facilities.	Provide estimated local first cost share of $301,700, provide local assurances, cooperation, and develop shoreside facilities.
3. US Coast Guard	N/A	Provide navigation aids and maintenance.	Provide navigation aids and maintenance.	Provide navigation aids and maintenance.	Provide navigation aids and maintenance.

V LIST OF REFERENCES

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KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

ENVIRONMENTAL IMPACT STATEMENT

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR
KAHANA BAY, OAHU, HAWAII

September 1985

The responsible Federal lead agency is the U.S. Army Corps of Engineers, Honolulu District, Hawaii. The responsible Federal cooperating agency is the U. S. Fish and Wildlife Service. The responsible local cooperating agency is the State of Hawaii, Department of Transportation.

Information, displays and figures referred to in the Main Report and Appendices are incorporated as a part of this Environmental Impact Statement.

Abstract: The project proposes to provide light-draft navigation improvements and a harbor of refuge for Kahana Bay, Oahu, Hawaii. Kahana Bay is located on the northeast coast of Oahu between Punaluu and Kaneohe Bay.

Three sites, one alternate design and the no action alternative were considered. The sites include the existing boat ramp site at Kahana Bay, Puu Mahie Point and Makaua Beach Park. Two design improvement alternatives are at the existing Kahana Bay boat ramp. The project consists mainly of an entrance channel, breakwater and turning basin. The major anticipated environmental impacts are water quality, marine life and social/cultural lifestyles. The environmentally preferred alternative is using the existing boat ramp area because of the reduce adverse environmental impacts.

If you have any comments on this Draft EIS, please send them to the District Engineer. If you would like further information on this environmental impact statement please contact:

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I. SUMMARY

A. **Major Conclusions and Findings.** Four plans were evaluated for Kahana Bay. These plans include a breakwater, an entrance channel, a turning basin and dredging. They are as follows:

TABLE 1. Plan Features

Plan 1

This plan is located at Kahana Bay boat ramp and includes a 195-foot long breakwater, a mooring area, a square turning basin 100 feet by 100 feet and an entrance channel 50 feet wide and 1000 feet in length. The turning basin and the entrance channel will be dredged to -6 feet MLLW and -8 feet MLLW respectively. Approximately 8,000 cubic yards of sand material will be dredged.

Plan 1A and Alternatives 1,2,3, and 4

Plan 1A is also located at the existing Kahana boat ramp. The project consists of a 220-foot long breakwater, 90 feet by 90 feet square turning basin and an entrance channel about 50 feet wide and 1000 feet in length. The turning basin and the entrance channel will be dredged to -6 feet MLLW and -8 feet MLLW respectively. Crest elevations will be +11.0 feet MLLW for Alternative 1, +8.0 feet MLLW for Alternative 2, +6.5 feet for Alternative 3 and +5.0 feet MLLW for Alternative 4. Approximately 8,600 cubic yards of sand material will be dredged.

Plan 2

This plan is located at Puu Mahie Point. The plan consists of a square turning basin 100 feet by 100 feet, a rectangular fill area 100 feet by 210 feet and an entrance channel 50 feet wide and 800 feet in length. The depth of the turning basin and the entrance channel will be dredged to -6 MLLW and -8 MLLW respectively. Approximately 320 feet of revetted mole and a 180-foot revetment will surround the fill area. Approximately 9,300 cubic yards of coral/sand material will be dredged.

Plan 3

Located at Makaua Beach, the plan consists of a rectangular fill area 100 feet by 210 feet, a rectangular turning basin 100 feet by 100 feet, an entrance channel about 50 feet wide -8 feet MLLW and 400 feet in length, a 120-foot long breakwater, a 320-foot long revetted mole and a 180-foot long revetment. The turning basin will be dredged to -6 feet MLLW. Approximately 5,200 cubic yards of coral/sand material will dredged.

No wetlands are involved but the sites are in a flood plain and tsunami inundation area. The effects of the discharge of dredged and fill material were evaluated under Section 404 (b) (1) of the

Clean Water Act. Plan 1A is the environmentally preferrable alternative.

B. Areas of Controversy. During the public workshop at Kaaawa Elementary School and subsequent letters, concern has been generated over the project's effect on the konohiki fishing rights and traditional fishing methods. The Corps of Engineers has evaluated the konohiki issue and has found that the konokihi fishing rights were purchased by the State of Hawaii in the late 1960's. Traditional fishing methods can still be practiced in the Bay and will not be significantly affected by the proposed project.

C. Unresolved Issues. Although the navigational improvements are strongly supported by the boating and fishing community, other persons may not be in favor of the proposed improvements. Some of the public feel that the Corps should delay its planning process until the Kahana Advisory Committee drafts a plan.

D. Relationship to Environmental Requirements. These relationships are located on Table 2.

TABLE 2. RELATIONSHIP OF THE PLANS TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

Federal Statutes	Plan 1	Plan 1A	Plan 2	Plan 3
Archaeological and Historic Prservation Act	Full	Full	Full	Full
Clean Air Act	Full	Full	Full	Full
Clean Water Act	Full	Full	Full	Full
Coastal Zone Management Act	Full	Full	Full	Full
Endangered Species Act	Full	Full	Full	Full
Estuaries Protection Act	N/A	N/A	N/A	N/A
Federal Water Project Recreation Act	Full	Full	Full	Full
Fish and Wildlife Coordination Act	Full	Full	Full	Full
Land and Water Conservation Act	N/A	N/A	N/A	N/A
Marine Protection, Research and Sanctuaries Act	N/A	N/A	N/A	N/A

National Historic Preservation Act	Full	Full	Full	Full
National Environmental Policy Act	Full	Full	Full	Full
Rivers and Harbors Act	Full	Full	Full	Full
Watershed Protection and Flood Prevention Act	N/A	N/A	N/A	N/A
Wild and Scenic Rivers Act	N/A	N/A	N/A	N/A
<u>Executive Orders, Memoranda</u>				
Flood Plain Management	N/A	N/A	N/A	N/A
Protection of Wetlands	N/A	N/A	N/A	N/A
Environmental Effects Abroad of Major Federal Actions	N/A	N/A	N/A	N/A
Analysis of Impacts on Prime and Unique Farmlands	N/A	N/A	N/A	N/A
<u>State and Local Policies</u>				
State EIS law, Chapter 343, HRS	Full	Full	Full	Full
State Coastal Zone Management Program	Full	Full	Full	Full
County Special Management Area Permit	Full	Full	Full	Full
State Conservation District Use Application	Full	Full	Full	Full
County General Plan	Full	Full	Full	Full
State Land Use Law	Full	Full	Full	Full

<u>Required Federal Entitlements</u> (Permits)

None required

NOTES:

a. Full (Full Compliance). Having met all requirements of the statute, Executive Order or other environmental requirements

for the current stages of planning (either pre- or post-authorization).

b. Partial (Partial Compliance). Not having met some of the requirements that normally are met in the current stage of planning. Partial compliance entries should be explained in appropriate places in the report and/or EIS and referenced in the table.

c. Non-Compliance. Violation of a requirement of the Statute, Executive Order or other environmental requirement. Non-compliance entries should be explained in appropriate places in the report and/or EIS and referenced in the table.

d. N/A (Not applicable). No requirements for the statute, Executive Order or other environmental requirement for the current stage of planning.

II. NEED FOR AND OBJECTIVES OF THE ACTION

A. Study Authority. The project is under the authority of Section 107 of the River and Harbor Act of 1960, as amended.

B. Historical Review of the Problem to be Solved. The coastal reach between Haleiwa and Kaneohe Bay lacks adequate light-draft craft refuge. The boat ramp at Kahana Bay is the only public launching facility between Haleiwa and Kaneohe Bay. The nearest launching site to the south is Kaneohe Bay which is about 10 miles away and to the north is Haleiwa which is about 27 miles away. The State Department of Transportation, Harbors Division requested the Corps investigate the possibility of improving Kahana Bay to reduce an existing wave exposure problem at the ramp and to accommodate light-draft crafts in distress during storm conditions when travelling between Kaneohe and Haleiwa. Kahana Bay appeared to be the most suitable site for a harbor of refuge because of its natural sand-bottomed channel and the semi-protective configuration of the bay.

C. Public Concerns. The public has expressed the need for navigation improvements and a harbor of refuge between Haleiwa and Kaneohe Bay. During the public workshop on July 23, 1983, the public felt that Kahana Bay was the best alternative site because of the existing boat ramp.

D. Planning Objectives. The following objectives for the light-draft navigation improvements and a harbor of refuge were derived from the consideration of public concerns and management needs expressed during public and agency coordination of the project. These objectives are:

1. Improving the navigation for Kahana Bay.
2. Minimizing environmental modifications to terrestrial and marine environments.
3. Minimizing the social/cultural impacts.

4. Providing a harbor of refuge between Haleiwa and Kaneohe Bay.

III. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

A. Plans Eliminated from Further Study. Not applicable.

B. Without Project Alternative. Presently, no harbor of refuge is located between Haleiwa and Kaneohe. During storm and emergency conditions, light-draft crafts will continue to be exposed to danger in the windward area.

C. Plans Considered in Detail.

1. **Plan 1.** Plan 1 is located at Kahana Bay at the existing boat ramp. The plan consists of a 195-foot long breakwater, a mooring area, a square turning basin measuring 100 feet on a side and 6 feet deep and an entrance channel 50 feet wide, 1000 feet long and 8 feet deep.

2. **Plan 1A and Alternatives 1,2,3, and 4.** Located at the Kahana Bay boat ramp, the project would consist of a 220-foot long breakwater, a square turning basin measuring 90 feet on a side and 6 feet deep and an entrance channel 8 feet deep, 50 feet wide and 1000 feet in length. Alternatives 1,2,3, and 4 are the same with the exception of crest elevations which are +11.0 feet MLLW, +8.0 feet MLLW, +6.5 feet MLLW and +5.0 feet MLLW respectively.

3. **Plan 2.** Plan 2 is located at Puu Mahie Point which is on the south side of the Kahana Bay. The project would consist of a rectangular fill area 100 feet by 210 feet, a square turning basin measuring 100 feet on a side and 6 feet deep and an 8-foot deep entrance channel which is 50 feet wide and 800 feet in length. The fill area will be surrounded by 320 feet of revetted mole and a 180-foot long revetment.

4. **Plan 3.** Plan 3 is located a Makaua Beach. It consists of a rectangular fill area 100 feet by 210 feet, a 120-foot long breakwater, a square turning basin measuring 100 feet on a side and 6 feet deep and an 8 feet deep entrance channel which is 50 feet wide and 400 feet long.

D. Comparative Impacts of Alternatives. The comparative impacts are shown on Table 3.

TABLE 3. COMPARATIVE IMPACTS OF ALTERNATIVES

Resource	Base Condition	Plan 1	Plan 1A	Plan 2	Plan 3	Without Project Condition
Recreation						
Beach parks	Kahana Bay Beach Park	Adjacent to beach park.	Adjacent to beach park.	No effect	No effect	No effect
	Makaua Beach Park	No effect	No effect	No effect	Eliminates beach area.	No effect
Fishing	Shoreline area	Adds new breakwater to shoreline.	Adds new breakwater to shoreline.	Adds new breakwater to shoreline.	Adds new breakwater to shoreline.	No effect
Surfing	Kahana Bay Beach Park	No effect	No effect	No effect	No effect	No effect
	Mahie Pt. (Teardrops)	No effect	No effect	No effect	No effect	No effect
	Makaua Beach	No effect	No effect	No effect	No effect	No effect
Boating	Kahana Bay Boat Ramp	Temporary inconvenience during construction.	Temporary inconvenience during construction.	No effect	No effect	No effect
Natural Hazards						
Volcanic	Low risk	No effect	No effect	No effect	No effect	No effect
Tsunami	High risk	Increase potential damage.	Increase potential damage.	Increase potential damage.	Increase potential damage.	No effect
Endangered Species						
Humpback whale (endangered)	No critical habitat, seasonal migration offshore	No impact	No impact	No impact	No impact	No impact
Green Turtle (threatened)	No critical habitat, but seen in Kahana Bay and Makaua	No impact	No impact	No impact	No impact	No impact
Terrestrial Area	None	None created	None created	Revetted fill	Revetted fill	None
Marine Resources						
Fishery Resources	Recreational value high. Akule spawning	No effect	No effect	No effect	No effect	No effect

	grounds.					
Estuary	Kahana Bay	No effect	No effect	No effect	No effect	No effect
	Huilua Fishpond	No effect	No effect	No effect	No effect	
Water Quality	Pollutants/contamination	Increase in petrochemicals & other boating related contaminants.	Increase in petrochemicals & otherboating related contaminants.	Increase in petrochemicals & other boating related contaminants.	Increase in petrochemicals & other boating related contaminants.	Same as existing condition
	During heavy rains, State stds. exceeded	Temporary increase in turbidity.	Temporary increase in turbidity.	No impact	No impact	No impact
	High turbidity, high sedimentation	Temporary increase in turbidity during dredging.	Temporary increase in turbidity during dredging.	Temporary increase in turbidity during dredging.	No effect	No effect
Social	Active interaction among residents, rural lifestyle	Minor impact	Minor impact	Minor Impact	No impact	No impact

IV. AFFECTED ENVIRONMENT

A. Physical Setting.

1. General. Kahana Bay is located on the windward side of Oahu. The bay is about one mile wide with the beach covering about 3/4 mile of the shoreline and extends from Puu Mahie Point on the east and to Kaluapuleho on the west. The beach area is a City and County of Honolulu park. Behind the beach park, the State of Hawaii Department of Land and Natural Resources (DLNR) has developed the Kahana Valley State Cultural Park, an innovative park concept where approximately 150 persons many of whom grew up there reside in the park. The "living park" concept is "to nuture and foster native Hawaiian culture and spread knowledge of its values and ways.....in such a living park, the individuals living there shall participate in the purposes of the park by helping in the education of the public and by incorporating in the structure of their daily lives as such values and ways" (Senate Resolution 264-77). The concept requires that everyone living in the valley take part in operating and maintaining the park as a requirement of residency. Any use of the valley by government agencies must be in consonance with the "living park" concept. Because much of the skills and knowledge from the old Hawaiian culture are not practiced today, the living park plan has been instigated to foster these diminishing Hawaiian ways. As a result, an important goal of the park is to nurture the old lifestyle and to promote the teachings of the Hawaiian culture and values. Most of the residents live in the lower coastal (makai) portion of the valley. Although the homes are generally old and in poor condition, park plans include new houses for the residents. A majority of the families raise chickens, ducks and geese. Some residents are engaged in commercial agriculture activities such as grazing of cattle and horses and growing papayas, bananas and ti leaves. The park encompasses approximately 5,260 acres and extends to the back of the watershed. Public access to the upland (mauka) portion of the park is controlled. Phase I of the park has been implemented and consists of a main access road, parking, a comfort station, an orientation building and the Hawaiiana Demonstration Area. Although portions of the park are undeveloped, hiking, canoeing, hunting, swimming, fishing and nature studying are practiced along the stream and surrounding watersheds.

Kahana, located at the southern end of windward Oahu's Koolauloa District, is formed by two valleys. One valley is formed by Kawa Stream and the other by Kahana Stream. Both streams are joined about 1 1/2 miles from the sea. The sand beach lies between two former fishponds, one natural and one man-made. At the western end of the beach, the muliwai (lagoon) of Wailua was a natural fishpond formed by a small mountain stream entering the bay. The fishpond has been incorporated into Kahana Bay. On the eastern end of the beach lies Huilua Fishpond.

On the northeast side of the bay, the State of Hawaii Department of Transportation Harbors Division constructed an 18-foot wide boat launching ramp in 1962 at Kapa'ele'ele Point (meaning black

tapa). The facility includes a groin, loading dock, freshwater faucets, restrooms, picnic and camping areas, parking at the ramp for six cars with trailers and a parking area for 15 cars.

Makaua Beach (meaning the eye of the rain) is across the street from Makaua Village, a small residential development. Offshore, an entrance channel was excavated through the reef to provide safe navigation for small crafts.

2. **Study Area.** Kahana Valley is located on the windward side of Oahu and is approximately a forty-five minute drive from Honolulu. The project site is located on the northeast side of Kahana Bay at the Department of Transportation boat launching ramp. The boat launching ramp is located within the boundaries of the Kahana Valley Cultural Park.

Puu Mahie Point is located on the opposite side of the boat ramp at Kahana Bay, which is approximately 0.7 mile away. Makaua is approximately 1.5 miles away from Kahana.

3. **Climate.** Kahana Bay experiences a two-season year that typifies the climate of the windward sides of the islands in the State of Hawaii. Mild temperatures and humid conditions exist all year round. Coastal monthly averaging temperatures range from mid-60's to mid-70's in the winter and from mid-70's to mid-80's in the summer months. Near the coastal areas, the humidity never drops below 50 percent. Tradewinds moving from the north-northeast to the east dominate the wind patterns over 90 percent of the time. During the winter months, tradewinds are less consistent. Storms especially from the southwest direction are more frequent and exceeds 30 knots in wind velocity fairly often. The average annual rainfall is approximately 60 inches along the coast as compared to about 300 inches per year at the crest of the Koolau Range.

Puu Mahie and Makaua experience similar climatic conditions.

4. **Topography.** Kahana Valley ranges from a flat flood plain with a 0 to 10 percent slope at the mouth of the valley to steep rugged terrain with a slope of 30 percent or more that form the valley sides. Kahana Valley encompasses over 5,260 acres shaped as a large, deep amphitheater headed valley. Elevations range from sea level to over 2,700 feet along the crest of the Koolau Range.

Puu Mahie Point (meaning pleasant hill) has very little flat coastal land and is primarily a rocky cliff. Makaua Beach Park has a narrow sandy and rocky beach that is bordered by Kamehameha Highway. The area is a gradual slope. From the shoreline to about 200-feet offshore, the substrate is mainly sand with protruding basalt cobble. Coral rubble and sand are the substrates beyond 200 feet. A few isolated live coral heads occur on top of the boulders.

5. Geology. Kahana Bay is the canyon-like submarine extension of Kahana Stream. It was formed by the downcutting erosion of the stream during a lower stand of sea level during the of Pleistocene glaciations. Steep valley walls line the east and west sides of the bay from the ridge tops to the water's edge. A gentle, seaward-sloping flood plain has developed in the stream's valley which is the land area south of the bay. The offshore bathymetric configuration of Kahana Bay is also the result of a portion of the stream's flood plain being submerged as the sea level rose. The land surrounding Kahana Bay consists generally of alluvial and colluvial deposits of weathered lava basalts and pyroclastic materials. These deposits are a chaotic mixture of lateritic clays, silts and detrital rock fragments in various sizes and stages of decomposition. The shoreline of the east and west sides of the bay is lined with round to semi-round basalt gravels, cobbles and boulders. The south shoreline is covered with fine coral sand which grades into the proposed site are covered with a veneer of coral sand. This coral is coarse and up to 1-foot thick near the shoreline and grades into fine sand of unknown thickness farther offshore. Along the sides and offshore of the bay, coral reefs were built up since the last glacial recession.

Makaua Beach consists of coral sand covered with basaltic rocks.

6. **Natural Hazards.**

a. **Volcanic Hazards.** There are no active volcanoes on the island of Oahu. As a result, the volcanic hazards are minimized.

b. **Tsunami and Flood Plain Hazards.** During the past 36 years, twenty-seven tsunamis has affected the island of Oahu. The 1946 tidal wave and earlier ones had a significant impact on the early human community of Kahana. Loss of life and damages to shorefront residences and the historic Huilua Fishpond have occured. Consequently, many residents relocated within the valley and in some cases relocated away from Kahana. According to McAllister (1933), it was reported that the February 3, 1923 wave broke through the walls of Huilua Fishpond and caused considerable damage. In an unpublished report by Marion Kelly (1979), a list of known tidal waves indicate that Huilua Fishpond has been damaged by tidal in 1923 as well as 1946, 1957 and 1960. Heavy storm waves have further damaged the sea walls of the pond as well. As a result, all the plans will be subject to tsunami inundation.

7. **Water Quality.** According to the Chapter 54 of Title 11 Water Quality Standards, Department of Health, State of Hawaii, Kahana Bay is one of the few coastal embayments designated as Class AA. Class AA is the most restrictive standard for marine waters. The objective of this classification is that:

...these waters remain in their natural pristine

> state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions. To the extent practicable, the wilderness character of such areas shall be protected. No zones of mixing shall be permitted in this class within a defined reef area, in waters of a depth less than ten fathoms or in waters up to a distance of 1,000 feet offshore if there is no defined reef area and if the depth is greater than ten fathoms. The uses to be protected in this class of waters oceanographic research, the support and propagation of shellfish and other marine life, conservation of coral reefs and wilderness areas, compatible recreation, and aesthetic enjoyment. The classification of any water area as Class AA shall not preclude other uses of such water compatible with these objectives and in conformance with criteria applicable to them. (Section 11-54-03 (c)(1))

The marine bottom at Kahana Bay is designated Class I. The objective of Class I is to keep the marine bottom ecosystems in their natural pristine state with an absolute minimum of pollution from any human-induced source. Uses of this class consist of passive human uses without intervention or alteration, allowing the perpetuation and preservation of the marine bottom in a must natural state. (Section 11-54-03 (d)(1))

Appendix A summaries water quality data from the State Department of Health. It is also interesting to note that during heavy rains, the water quality standards frequently are not met for Kahana.

Makaua Beach has been classified as Class A which protects the water quality 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 recreation in and on these waters. No water quality data is available for Makaua; however, the adjacent beach, Swanzy Beach Park is known for the filamentors blue green benthic alga, Lyngbya majuscula which may cause swimmer's itch. The marine bottom at Makaua has been designated Class I in which all uses are to be compatible with the protection and propagation of fish, shellfish, wildlife and recreation.

8. Air Quality. The Kahana Bay area and Makaua Beach are within areas of relatively pristine air quality.

9. Noise Quality. All the plans are located in a rural setting where noise is not considered to be a problem.

10. Physical Oceanographic Conditions. Waves at Kahana Bay originate from various areas in the Pacific. Offshore waves approaching from the north to north-northeast and east-northeast break on the fringing reef, reform and travel to the beach. Waves from the northeast enter the channels without breaking on the

reefs to the north and south. The waves diverge as they proceed shoreward in the channel and break on the beach or seaward of the beach depending on the height of the wave and period. The most damaging waves are storm generated in the North Pacific.

Although Kahana Bay does not have a tide gauge, a tidal bench mark at Waikane is considered applicable to the Kahana and Makaua areas. Tidal data from the site which is based on 7 months indicates:

Level	Gauge Height (Ft.)
Highest Tide (estimated)	3.5
Mean Higher High Water	2.20
Mean High Water	1.80
Mean Low Water	0.40
Mean Lower Low Water	0.00
Lowest Tide (estimated)	-1.00

B. Significant Resources.

1. Human Resources and Activities.

a. Community. Although no specific census data for Kahana Valley is given, the population is small and estimated to be about 150 persons. In a broader contrasting view, Kahana and Makaua are part of the Koolauloa District where the population has increased 34.9 percent for the years 1970-1980.

Kahana Valley is owned entirely by the State of Hawaii and supports a small rural community. The lifestyle can best be described as being a rural and/or agrarian community. A loose 'ohana (family) structure exists and includes about 70 percent of the residents. Although it performs only a few traditional functions, many individuals possess skills in lauhala weaving, net making, taro raising canoe building and quilt making. Residents and other people still practice traditional fishing methods in Kahana Bay.

b. Land Use. Although Kahana Valley is designated Conservation District by the State Land Use Commission, the boat ramp area has been designated urban. Puu Mahie and Makaua Beach is also designated urban by the State Land Use Commission. As a result, no farm lands, unique or prime agricultural lands will be affected by the proposed project.

c. Recreation. Kahana Bay is an important regional recreation area and is the site of Kahana Bay Beach Park and Kahana Valley State Cultural Park, the latter encompassing the entire Kahana Valley watershed. Although the watershed portions of the park are undeveloped, hiking, canoeing, hunting, swimming, fishing and nature studying are practiced along the stream and

surrounding watersheds. Beach and water activities include picnicking, fishing, swimming, surfing, body surfing, sailing, canoeing and other water-contact activities. Public access to the watershed portions of the park requires advanced permission by the park authorities.

Recreational activities at Puu Mahie Point is similar to those at Kahana Bay. In addition, shell collecting and surfing are other activities.

Makaua Beach area activities include boating, throw netting, spearing, trapping and pole fishing. During the spring and fall, netting for mullet is important. The narrow rubble beach is exposed during low tide which discourages swimming. Due to the physical features of the area, very strong rip currents occur making swimming hazardous.

d. **Cultural Resources.** The Kahana Valley Cultural Park is the focal point of many cultural activities and contains numerous archaeological sites. These sites include auwai, cleanups, dry terraces, enclosures, graves, kuleana, midden deposits, mounds, platforms, walls, wells, wet terraces, habitation structures and the Huilua Fishpond. The sites are concentrated in the lower valley areas in the proximity of Kahana Bay and along the upper reaches of Kahana Stream. The Revised Environmental Impact Statement for the Kahana Valley State Park dated October 1978 and prepared by the State Department of Land and Natural Resources contains a more detailed discussion of the sites. Huilua Fishpond, a loko kuapa or an enclosed seashore fishpond is the most significant archaeological site in Kahana. As a registered National Historic Landmark and a registered historic site on the State and Federal Register of Historic Places, it is eligible for federal grants for preservation and reconstruction. Another important coastal site near the existing boat ramp is the remnants of a low rock shrine, Kauninio Ko'a, offshore at Kaluapuleho Point which can be seen only at low tide. On the side of the hill behind Kapa'ele'ele Point is Kapa'ele'ele Ko'a, a fishing shrine for the akule fish.

Kahana Bay was a registered konohiki fishing right. Konohiki fishing rights constitute part of the land system of old Hawaii. The word konohiki originally was the designation for the person who managed the chief's land. Eventually, it was referred to the things that were the private property of the chief himself. As a result, "konohiki fisheries" mean the chief's or privately owned fisheries. The main features of konohiki fisheries are:

(1). Specific geographic areas of the private konohiki fisheries which normally extend from the beach or shoreline (at the low water mark) to the outer edge (wave break) of the reefs. Where reefs are absent, then the area extended one mile seaward from the beach at the low water mark.

(2). Within these areas, fishing is restricted to the konohiki and hooainas (tenants of the lands) where the fisheries originally belonged to ahupuaas.

(3). Regulation of the fishing within the fisheries by the konohikis were done by:

(a). Placing a tabu or reserving one specific type of fish for their exclusive use; or

(b). Prohibiting fishing during certain months of the year, and during the fishing season, so that each tenant pays one-third of all the fish caught within the fishery.

Konohiki rights for Kahana were acquired by the State of Hawaii in the late 1960's when they initiated condemnation proceedings.

Traditional fishing methods are practiced today in Kahana Bay. The method consists of chasing schools of fish to the Bay by boat and netting them.

Above Puu Mahie Point, the natural formation of boulders resemble a crouching lion which is believed to represent Kauhi, the watchdog of heaven. Under the Crouching Lion, the site known as Kukuiula is a possible heiau; however, no literature confirms this. Bulldozing and grazing cows may have contributed to the deterioration of the site.

No known cultural sites exist within the Makaua Beach area.

e. Historic and Scenic Values. The U. S. Department of Interior, National Park Service's Nationwide Rivers Inventory, has included Kahana Stream for its important historic and scenic values. Kahana Stream is, however, outside the project limits.

2. Natural Resources.

a. Marine Resources. Kahana Bay is best known for large schools of akule (Selar crumenophthalmus). Other fish found in the area are ulua and papio (Caranx spp.), aholehole (Kuhlia sandvicensis), oio (Albula vulpes), goatfish (Mulloidichthys spp. and Parupeneus spp.) and mullet (Mugil cephalus). The boulder revetment and groin provides habitat for manini (Acanthurus triostegus), kupipi (Abudefduf sordidus), maomao (A. abdominalis), aholehole (Kuhlia sandvicensis), milletseed butterfly fish (Chaetodon miliaris) and wrasses (family Labridae).

Makaua Beach is depauperate in fish and corals which is probably due to the low relief topography, poor water quality and shifting substrate. Fish species found in inshore waters include tropical half-beak (Hemiramphus depauperatus), red and black banded goatfish (Parupeneus multifasciatus), milletseed butterfly fish (Chaetodon miliaris), cresent-masked butterfly fish (C. lunula),

saddle wrasse (Thalassoma duperrey), Moorish idol fish (Zanclus cornutus), manini (Acanthurus triostegus) and Black-headed file fish (Pervagor spilosoma). Corals found offshore include Montipora verrucosa, Pocillopora meandrina and Porites compressa. The reef flat is a popular fishing site for octopus. The Federally listed threatened green sea turtle (Chelonia mydas) has been observed offshore of the Makaua Channel. A more detailed marine species list is included in Appendix G which is the Fish and Wildlife Service Coordination Report.

Puu Mahie Point has the most species of fish and corals due to the more protected orientation of the site. The shallow reef flat has an abundance of shell life and is known for cowrie and cone shells. He'e (octopus) and sea urchins (Diadema paucispinum) are found offshore. The fringing reef off the point is estimated to be about 10 percent in coral cover, including Montipora verrucosa, Pocillopora damicornis, P. meandrina and Porites compressa. Fish species include Echidna nebulosa, Mulloides vanicolensis, Chaetodon lunula, C. miliaris, Thalassoma duperrey, Coris sp. Zanclus cornutus, Naso brevirostris, Acanthurus nigrofuscus, A. triostegus, Ctenochaetus strigosus, Dactyloptena orientalis, Pervagor spilosoma, Ostracion meleagris and Lactoria fornasini. The dominant seaweed is Sargassum sp. with other species such as Dictyota bartayresii, Padina australis, Acanthophora spicifera and Halimeda discoidea.

b. Flora and Fauna. Terrestrial vegetation along the beach and shoreline of for Kahana Bay consists of common indigenous and Polynesian introduced species including kamani tree (Terminalia catappa), tree heliotrope (Messerschmidia argentea), naupaka (Scaevola taccada), beach morning glory (Ipomoea brasiliensis), coconut palm (Cocos nucifera), hau tree (Hibiscus tiliaceus) and other grasses and ornamental shrubs and trees. A varierty of other trees, shrubs and grasses are found in the landward or upland portions of the watershed.

Birds for Kahana Bay include the black-crowned night heron (Nycticorax nycticorax hoactli), cattle egret (Bulbulcus ibis), Kentucky cardinal (Cardnalis cardinalis), California linnet (Carpodacus mexicanus), mynah (Acridotheres tristis), white-eye (Zosterops japonicus), house sparrow (Passer domesticus) and rice birds (Lonchura punctulata). Endangered species, Hawaiian Coot (Fulica americana alai) and the Hawaiian Gallinule (Gallinulla chloropus sandvicensis), are recorded annually in Huilua Pond. It is likely that native birds such as the Apapane (Himatione sanguinea), Amakihi (Loxops virens) and the Iiwi (Vestiaria coccinea) may exist in the upper valley. It is also possible that the Oahu honeycreeper (Loxops maculatus), an endangered species may be found in the ohia forest of the upper watershed area.

The wandering tattler (Heteroscelus incanus) has been observed foraging on the cobble beach. Other migratory shorebirds like the Pacific golden plover (Pluvialis dominica fulva) and the ruddy turnstone (Arenaria interpres) may use the beach as resting and feeding habitats.

Relatively few land mammals exist in Kahana. Feral pigs, mongoose, rats and mice are exotic fauna that inhabit Kahana.

c. Endangered Species. The Hawaiian Coot and Hawaiian Gallinule are listed as endangered birds on the State and Federal endangered species list. The threatened green sea turtle (Chelonia mydas) is commonly observed in Kahana. Although the numbers and age/sex classes are not known, subadults and adults have also been observed feeding and resting in the Makawa Channel which is located offshore Makaua Beach.

The endangered humpback whale (Megaptera novaeangliae) is found during the winter migration months of December through May off the windward shore of Oahu between the edge of the outer reef margins and the 100 fathoms isobath. While this area has not been identified as a calving or mating site, calves do occur on this coast as evidenced by the calf stranding at Punaluu on February 22, 1981. This area seem more likely to serve as a migration corridor for the whales.

d. Aesthetics. The Kahana area is a rural setting with lush green vegetation which reflects the "rural Hawaiian lifestyle." The combination of steep cliffs, green vegetation, white sand beaches, Kahana Stream, wave action, the bay configuration and coastal waters render Kahana Bay as one of the most beautiful and scenic coastal areas on the windward side of Oahu.

Makaua Beach Park with the cobble beach and vegetation is a typical shoreline vista for the windward side of Oahu.

e. Areas of Particular Concern. No areas of particular concerns have been identified.

f. Social and Socioeconomic Resources. About 80 percent of the economic activity in Hawaii occurs on the island of Oahu. The largest sources of income to the State in 1981 were generated by visitor expenditures followed by defense expenditures, sugar production and pineapple production. The 1982 per capita income was $11,652. While no specific census for Kahana Valley exists, it is estimated that about 150 persons reside in Kahana. Of that figure the majority of the residents are Hawaiian or part-Hawaiian with other ethnic groups of Filipino, Samoan, Chinese, Caucasian and Japanese.

Kahana today can be best described as "rural Hawaiian." A loose 'ohana structure exists that encompasses approximately two-thirds of the residents. Some of these resident retain many of the Hawaiian cultural values such as a deep feeling for the land, love of the valley's mountains, streams, plants, and ocean; a spirit of community; and a desire to preserve the quiet lifestyle. The Hui O Kanani O Kahana is the community association that speaks for most of the valley's long term resident.

Kahana was not a prominent site for an ali'i. Instead, the maka'ainana (common people) tilled the fields, caught the fish and lived off the land. Although relatively primitive tools were used, the people developed an extremely sophisticated set of horticultural techniques that included hybridization, irrigation systems, mulching, green manuring and many more. The decline of the native population in Kahana gradually led to the abandonment of many fields. Rice cultivation and sugar cane fields became the major crops until it floundered. After World War II, only sporadic and unsuccessful efforts to utilize the lands have been initiated (H. Mogi Planning & Research, 1974).

In the early seventies, the State Department of Land and Natural Resources adopted policies for the Kahana Valley State Park which were based on the assumption that the valley contained a unified, viable typically Hawaiian community that actively wanted to play a central role in the creation of the park; however, a 1972 Liliuokalani Trust Childrens' Center report indicated that the assumption had been overly optimistic. The people of Kahana no longer have any economic ties with the land or each other. The decline of the valley's local economy have forced the residents to find jobs elsewhere or become dependent on the welfare system. In addition, the external pressure of urban development has greatly influenced the valley community. Thus, the spirit of the community that once prevailed has eroded over the years. The concept of the living park hopes to integrate a group of people and their present life-style into a public park program. It requires that everyone living in the valley take part in maintaining and operating the park.

d. Estuaries. Kahana Stream and Huilua Fish Pond are a part of a large estuary in the Kahana Bay area. The estuary supports important recreational and traditional fisheries.

e. Groundwater. Groundwater in Kahana Valley is stored underground by a basal freshwater lens truncated by dikes that floats on top of denser salt water and dikes which are high level water stored in porous and permeable rock between volcanic structures of low porosity and permeability. The basal freshwater forms under the valley floor while the high level dike water is found several miles inland from the coast.

V. ENVIRONMENTAL CONSEQUENCES

A. Land Use. Plans 1 and 1A will not change the existing land use. At present, the area is an existing boat ramp with the related appurtenances. Plans 2 and 3 are undeveloped areas and will require shoreside facilities.

B. Recreation. Plans 1, 1A, 2 and 3 will increase recreational boating activities by providing better access to the ocean waters. In addition, a larger breakwater as in Plans 1 and 1A and a new breakwater in Plans 2 and 3 will provide an increase in the number of fishing sites and opportunities. During

construction activities, temporary impacts to fishing and boating activities may occur; however it is not anticipated to be a significant adverse impact.

C. **Natural Hazards.**

1. **Volcanic Hazards.** None of the plans will increase volcanic hazard risks.

2. **Tsunami and Riverine Flood Hazards.** None of the plans will effect riverine flooding of Kahana Stream nor tsunami run-up elevations. With increased boats in the Kahana Bay and Makaua Beach, potential damages from tsunami could increase.

D. **Water Quality.**

1. Existing water quality data for Kahana Bay indicates that the Bay does not meet all of the standards set in the water quality regulations as shown in the water quality data in Appendix A. Coordination with the State Department of Health has been initiated to minimize the impact on the water quality and to comply with the Hawaii 208 Plan.

2. Plans 1, 1A and 2 which are within Kahana Bay and Plan 3 all involve dredging that results in a temporary increase in water turbidity. The impact of dredging is a cumulative impact which adds to the stress already created by the influx of sediment from Kahana Stream. Kahana Stream water is characterized by a suspended load of fine, round basalt fragments, clay materials and organic material. After heavy rains, water in the bay is discolored by suspended sediment for several days. To mitigate the adverse impacts on the water quality, a turbidity control standard will be established for open water construction aspects. Plan 1 and Plan 1A will involve approximately 8,000 and 8,600 cubic yards of dredged material respectively. Plan 2 and Plan 3 will involve approximately 9,300 cubic yards and 5,200 cubic yards respectively.

The location of Plans 1 and 1A at the existing boat ramp reduces the impact on water quality since the existing area has been previously disturbed. Thermal changes resulting from the proposed action are not anticipated.

3. The improvements will increase boat usage which will contribute to impacts associated with boating such as petroleum spillage, litter, hydrocarbon emission, noise, dust and turbidity. The amount of petroleum products released into the Bay is expected to be insignificant since boat users are mainly small craft which have a small fuel capacity. In case of on oil spill, the US Coast Guard will be notified. A Spill Preventiion Control Plan and Countermeasure Plan will be considered in the design phase.

4. Freshwater springs flow out of the reef margins at Kahana. The springs along the shoreline show chloride content up to 100 ppm. The dredging and possibly blasting activities could

increase the amount of groundwater flowing into the Bay. The increased amount would be insignificant when compared with the overall groundwater capacity of Kahana Valley.

E. **Blasting.** To facilitate dredging, blasting may be required in Plan 2 and 3, namely at Puu Mahie Point and Makaua Beach area. If blasting becomes necessary, the Contractor will submit a blasting plan which must be approved by the Corps of Engineers Contracting Officer. The blasting plan shall contain the details of the blasting operation. The impacts of blasting are discussed below:

1. **Marine Environment.** Anticipated environmental impacts of blasting include but are not limited to: fish and invertebrate kills, dislodging or shattering coral, increased predation on injured fish by predatory species such as sharks, increased wave heights, underwater shock, damage to the ocean floor and increased turbidity and suspended sediments. Factors adversely causing injury and/or damages from underwater shock include the proximity to the source of the blast, size and character of the explosive, degree of submersion of receiver such as fish, influence of boundary reflections, duration of pressure pulse and location of the charge with respect to medium interfaces such as water and water-air. The direction of movement of blast energy through the water and substrate can affect the degree of damage or injury.

Air-filled organs such as swim bladders of fish are vulnerable to injury from underwater shock waves. The damage of the air-filled cavities is a function of impulse and peak pressure.

Water waves generated from explosions can cause damage to shoreline facilities based on how far the blast is located from the shore. Maximum height caused by a single charge or multiple charges can be predicted.

Fish will be killed, injured, temporarily injured or unaffected by the blasts, depending upon the species, the proximity to the blast, depth of the water column, magnitude of charge and other factors. Dead fish will either float to the surface or sink to the bottom where they will be eaten by other fish or decay. Certain groups of fish may be more sensitive to blasting such as flying fish, half beaks, damselfish, butterflyfish, triggerfish and surgeonfish. Because the Kahana offshore area and reef are highly productive and are the spawning grounds for akule, any blasting could severely impact the species. Plan 2 may require possible blasting and thus will have a significant adverse effect on the environment. In any case, Plans 2 and 3 may require blasting to be restricted during the months of June through November. No blasting will be done during the akule spawning season.

2. **Water Quality.** The hardness of the coral at Puu Mahie Point and Makaua Beach may require blasting. Because the waters off Puu Mahie Point is very clear, any type of dredging,

blasting or excavation will be highly noticeable and will have a significant impact to the existing water quality. Blasting activity generates conspicuous turbidity and suspended sediments, increased deposition of sediments downstream of the blast area and destruction or damage to marine life. The immediate vicinity of the blast area will have the most severe effects of turbidity and suspended sediments. The size of the plume and quantities of suspended sediments are dependent upon the size of the charge and the method of blasting. Explosive by-products such as nitrogen gas, water, nitrogen dioxide and aluminium oxide are not expected to significantly degrade the water quality.

3. **Blasting Noise.** The detonation of the blasting agent will generate noise. The sound level will depend upon the amount and type of explosive, the water depth over the charges and the distance of the observer from the blast. The Contractor will be required to comply with all applicable State and local noise control regulations.

4. **Ground Vibration.** Seismic motion or ground vibration is generated from all detonations. The perception of explosives depends on such factors as geology of the site, the weight of explosives per delay and the distance of the structures and observers. Blasting activities will comply to the Corps' safety and health plan. For example, the plan requires that a blast with a scaled distance less than 50, a 3-component seismograph will be required to monitor vibration levels. Scaled distance is a function of the distance from the nearest structure to the blast site and the maximum weight of explosives per day. If vibration levels are below 2 inches per second, no damages to structures are anticipated. In the blast is below 0.2 inches per second, negative reactions from nearby residents will be minimized.

5. **Dust and Flyrock.** Dust is not anticipated since the blasts will be underwater. However, some flyrock may be generated for blasts in shallow water. Most particulate matter will be contained by the water column if the charges are small.

6. **Smoke and Odors.** Smoke and odor from the blasting activities are not expected.

7. **Recreation.** Blasting activities will attract predators such as sharks due to the killing of fish from the blast. Since Kahana Bay is a popular water recreation area, the possible increased presence of sharks may discourage water recreation until the blasting is completed.

There are several methods that can be used to reduce the impacts of blasting. The size of the explosive can be limited, the number of delays per shot can be specified and the method of drilling and shooting can be practiced to reduce the environmental effects of blasting.

8. **Safety.** The Contractor will be required to conduct his blasting operations in accordance with the blasting plan approved by the Corps Contracting Officer, Engineer Manual 385-1-1, Safety and Health Requirements and the State Occupational Safety and Health Standards.

F. **Sediment Quality.** The combination of wind, discharge rates and bathymetric configuration directs the turbid stream outflow along the eastern reef edge. The clay silt and very fine sand introduced from Kahana Stream settle to the bottom seaward of the surf break. Organic carbon is a significant sediment of the swamp mud and generally comprises of less than 4 percent of the channel sands. Calcerous reef sediment is transported into the channel from the western reef and the eastern reef near Huilua Pond. Water entering Kahana Bay from the northwest reef is assumed to be the driving force behind the observed southeasterly sediment transport according to Sedimentology of Kahana Bay, Oahu, Hawaii by William T. Coulburn (1971). All the plans will not improve the sediment quality. Plans 1 and 1A will require dredging. Dredging will result in temporary resuspension of existing sediments which may reduce the already low diversity of corals found in the area. Plans 2 and 3 will generate fine sediments from excavation and filling.

Kahana Stream and Kawa Stream, its principal tributary, are the main water courses in Kahan Valley. The stream channels character range from very steep, narrow and rocky in the valley to wide, nearly level and heavily vegetated on the flood plain of the lower valley. Average discharge at the gaging station is 353 cfs and over 30 mgd for the entire watershed. The project is not anticipated to have an effect on the drainage patterns or sediment deposition of Kahana Stream.

G. **Estuaries.** Huilua Fishpond is on the eastern end of Kahana Bay. The proposed plans will not modify the fishpond and the Kahana Bay estuary.

H. **Air Quality.** None of the proposed plans when completed has the potential for affecting air quality. The dredged material may be a source of dust if used for fill until the area is covered with stones.

I. **Noise Quality.** The proposed plans will not result in long-term increase in noise. The operation of equipment in the construction of breakwaters and dredging and filling will be temporary noise sources. The only area that will be affected by noise will be Makaua if Plan 3 is implemented.

Blasting will generate temporary noise and ground vibration.

J. **Historic and Archaeological Resources.** The nearest archaeological sites are Kauninio Ko'a, a low rock shrine seen only in low tide, Kapa'ele'ele Ko'a, a fishing shrine on a hill above Kapa'ele'ele Point and Huilua Fishpond which is a registered historic site on the State and Federal Register of Historic

Places. Plans 1 and 1A are not anticipated to have an adverse impact on the site. During certain times of the day, however, it has been reported that an image namely the face and hair of a Hawaiian woman can be seen in the water at the boat launch ramp area. The proposed plans will affect the area; however, it is uncertain whether the plans will affect the image.

Some indirect adverse impact may occur to portions of Huilua Fishpond if Plan 2 is implemented. In situ prehistoric (pre-A.D. 1800) cultural deposits are naturally eroding at a slow rate from the north and northwest margins of the fishpond. Construction of Plan 2 may accelerate this rate of erosion. The archaeological resource above Puu Mahie Point is located quite a distance from the proposed plan, and therefore, no adverse impact to the site is anticipated.

The Plan 3 alternative may also adversely impact potentially valuable in situ cultural resources. The sandy shoreline between Kamehameha Highway and the ocean at Makaua Beach may contain subsurface cultural deposits. Similarly situated locations along this section of Windward O'ahu, i.e. Malaekahana, Kahuku, Kualoa, Mokapu, etc., contain valuable such deposits. Archaeological test excavations shall be performed at this location prior to construction of alternate Plan 3.

K. Natural Resources.

1. Marine Resources. Kahana Bay is an important and popular fishing area. Moreover, Kahana Bay is also the spawning grounds for the akule. The proposed plans would have only a temporary direct impact on the marine resources. The bottom supports mainly transient bottom feeding fishes which would be displaced during construction of the facility. Hard substrate communities that inhabit the man-made existing structures would increase after the construction of a longer breakwater. As a result, this would compensate for the loss of habitat when the existing groin is removed. The dredging of the basin area would increase vertical relief along the edges which may under certain conditions, provide habitat for reef fish.

Puu Mahie and Makaua Beach sites would be significantly altered by the proposed plans. The breakwater and revetment would increase the amount of hard substrate available for intertidal benthic organism. The dredging of the turning basin and entrance channel would increase the amount of vertical relief and its edges may provide increased habitat for reef fishes. The extensive dredging would destroy existing hard bottom communities and loss of inshore habitat would result from the fill areas. The fills would reduce total habitat and smother sessile and low-moving benthic animals and algae. The most significant impact to marine resources would result from blasting impacts. Since Kahana Bay is a popular recreational area, the attraction of predators would impact the recreational area. To minimize impacts of blasting on the marine life, blasting activities will not be permitted during December-May and during the akule spawning season.

Improvement to the Kahana Bay boat launching ramp area may encourage greater exploitation of the local fishery resources, particularly the akule fishery.

Limitations on the size of charges and other techniques such as drilling and shooting may also be required to reduce the impact of blasting.

L. Endangered Species.

1. Endangered Humpback Whale. The humpback whale migrating in the months of December through May off the windward shore of Oahu is found between the edge of the outer reef margins and the 100 fathom isobath. This area has not been identified as a calving or mating site and is more likely a migration corridor for the whales. Kahana Plans 1 and 1A will not affect the migratory route of the whales. Plans 2 and 3 which may require blasting will not impact the whales because blasting activities will not be permitted during the months of December through May. Thus no adverse impact is anticipated.

2. Threatened Green Turtle. The green sea turtle is commonly found in Kahana Bay. The Corps has determined that the project is not likely to affect the green sea turtles. A letter dated 11 March 1985 from the National Marine Fisheries Service indicates that the proposed project is not likely to affect the green sea turtles or the humpback whales is included in Appendix B.

M. Ciguatera. A hypothesis associating dredging activities and the presence of the ciguatera toxin has been proposed; however, study results have not concluded that dredging is the cause of ciguatera toxin. The carrier of the toxin has been identified as Gambierdiscus toxicus which is a benthic algae epiphyte on other macroscopic benthic algae that are otherwise non-toxic. The Corps has established a program to monitor the levels of ciguatera toxin in the algae at Barbers Point Deep Draft Harbor encompassing the entire period of dredging. The monitoring program enables the Corps to provide an early forecast of potential ciguatera poisoned fish outbreaks that may be caused by the dredging activities. The method entails collection of macroscopic algae at specified sampling stations, laboratory preparation and identification of the toxic algae. Based upon population densities, the researchers will predict whether the potentially toxic levels of algae exist. Over the past two years of dredging, the results thus far indicate that the population densities of the toxin have remained very low. Therefore, ciguatera poisoned fish outbreaks are not likely at Barbers Point. During construction activities at Kahana, the Corps will sponsor similar monitoring of the potential for ciguatera toxin, since the area is known for its fishery resources.

N. Social and Socioeconomic Resources. The improvements will not significantly alter Kahana Bay's population or influence the existing economic trends. People, farms and businesses will not

be displaced by the proposed plans. Construction activities may temporary affect the use of the existing boat ramp.

The breakwater for Plans 1, 1A and 2 will be a significant visual intrusion into the presence of the rural setting of Kahana Bay. The impact cannot be mitigated entirely; however, State-sponsored shoreside development should landscape the area to reduce the visual impact.

The revetted mole and breakwater for Plan 3 at Makaua will have a significant visual impact for the residents of Makaua Village. The aesthetic loss cannot be mitigated entirely, even with landscaping and other measures; however, the amenity of having a boating facility in front of them may have a positive commercial benefit offsetting the negative impact.

V. ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

A. Turbidity and Sedimentation. Turbidity and sedimentation are unavoidable impacts that results from offshore dredging activities and blasting activities. The amount of turbidity, sedimentation and fish kill are dependent on the size of the blasts and the number of the blasts.

B. Marine Life. The dredging activities may attract a number of fish due to the exposure of food resources. Blasting activities, however, may destroy these fish. Predators such as sharks will be attracted to the area by the presence of dead or injured fish and will probably inhabit the area or nearby during the blasting and shortly thereafter. Recreational activities such as swimming, diving, snorkeling and other water type activites would be limited during these times. Indirectly, a completed project will encourage increased levels of fishing activity that could affect marine life.

C. Recreation. Recreational activities will be limited during construction. The boat launch ramp will be temporarily closed and shoreside fishing will be limited. The interruption to these activities is temporary in nature and is not expected to have a significant effect.

VI. MEANS TO MITIGATE ADVERSE ENVIRONMENTAL EFFECTS

A. Blasting. Blasting will be prohibited from 1 December to 31 May. Blasting will also be prohibited in Kahana Bay during the akule spawning season. A blasting plan will be submitted to the Corps by the Contractor for approval that may include additional controls to reduce the impact of blasting.

B. Water Quality. A water quality monitoring program will be established and a turbidity standard will be specified during construction actvities to mitigate the impact.

C. **Ciguatera.** A ciguatera monitoring program will be established to warn the public of potential outbreaks of fish toxicity, if any, that occur during and after construction.

IV. PUBLIC INVOLVEMENT

A. **Public Involvement Program.** The public involvement has consisted of meetings and workshops with the public at large with members of the Federal, State and County agencies. A public meeting held on July 27, 1983 raised issues such as sea conditions which makes launching and retrieving the boat difficult at Kahana, the affect of the proposed action on the akule spawning grounds and the traditional fishing methods, the konohiki fishing rights and the need for navigational improvements.

B. **Required Coordination.** The following paragraphs list the status of coordination with various agencies:

1. **Coastal Zone Management Act.** A Federal Consistency Determination has been prepared by the Corps and is included in Appendix C.

2. **Endangered Species Act.** Coordination with the National Marine Fisheries Service has been initiated to determine whether Section 7 consultation is required.

3. **Marine Protection, Research and Sancutaries Act.** Ocean disposal of dredged material is not planned. As result, this act is not applicable to the proposed action.

4. **Clean Water Act.** A Section 404(b)(1) evaluation has been completed and is included in Appendix D. The State of Hawaii Department of Health has provided comments on the water quality impact for Kahana Bay and is included in Appendix E.

5. **Fish and Wildlife Coordination Act.** A draft Fish and Wildlife Coordination Act report has been prepared and is included in Appendix F. The final report will be included in the final EIS.

6. **National Environmental Policy Act.** A notice of intent to prepare an EIS was published in the January 17, 1985 Federal Register.

7. **National Historic Preservation Act.** Coordination with the State Historic Preservation Officer, the Keeper of the National Register and the Advisory Council for Historic Preservation will be done during the review of the draft EIS.

8. **Archaeological and Historic Preservation Act of 1974.** Coordination with the State Historic Preservation Officer, the Keeper of the National Register and the Advisory Council for Historic Preservation will be done during the review of the EIS.

9. **State and County Approvals.** The State of Hawaii, Department of Transportation, is responsible for obtaining all necessary local permits and approvals and satisfying the requirements of the State EIS regulations. The construction impacts and compatibility of the action to local coastal zone management policies are discussed in the CZM Federal Consistency Determination.

C. **Distribution List for the Draft EIS.** The distribution list is included in project report.

VIII. LIST OF PREPARERS

The following persons are primarily responsible for preparing this draft environmental impact statement:

Dr. James E. Maragos, NEPA Coordinator. BS, Zoology; PhD, Oceanograhpy; 2 years postdoctoral research; 8 years environmental consultant; 10 years EIS studies with the Corps of Engineers.

Helene Y. Takemoto, EIS Preparer. AB, Chemistry; *MS Public Health* (Environmental Health Management); 3 years research; 9 years EIS studies, 3 years EIS studies with the Corps of Engineers.

Charles F. Streck, Jr., Archaeology/Historic Sites Assessment preparer. BA, MA, PhD candidate (ABD) Anthropology (Archaeology); 13 years research, consultanting and government work; 1 year with the Corps of Engineers.

Andrew Yuen, Fish and Wildlife Assessment preparer. BS, MS, Zoology; 2 years research; 1 year EIS studies with the US Fish and Wildlife Service.

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APPENDIX A

STORET RETRIEVAL DATE 85/02/27
000178 OAHU WINDWARD KAHANA
21 33 37.0 157 52 40.0 2
KAHANA PARK
15003 HAWAII
OAHU
WINDWARD
21HI 'TYPA/AMBNT/OCEAN
0001 FEET DEPTH CLASS 00 CSN-RSP 0222538-0806027

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT LOG	00076 TURB TRBIDMTR HACH FTU LOG	00300 DO MG/L LOG	00400 PH SU LOG	00480 SALINITY PPTH LOG	00530 RESIDUE TOT NFLT MG/L LOG	00600 TOTAL N MG/L LOG	00610 NH3+NH4- N TOTAL MG/L LOG	00625 TOT KJEL N MG/L LOG	00630 NO2&NO3 N-TOTAL MG/L LOG
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81/01/01												
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99/99/99												

STORET RETRIEVAL DATE 85/02/27

GROSS ANALYSIS

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT LOG	00076 TURB TRBIDMTR HACH FTU LOG	00300 DO MG/L LOG	00400 PH SU LOG	00480 SALINITY PPTH LOG	00530 RESIDUE TOT NFLT MG/L LOG	00600 TOTAL N MG/L LOG	00610 NH3+NH4- N TOTAL MG/L LOG	00625 TOT KJEL N MG/L LOG	00630 NO2&NO3 N-TOTAL MG/L LOG
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99/99/99												

STORET RETRIEVAL DATE 85/02/27
P305B/STA

STORET RETRIEVAL DATE 85/02/27
000179 OAHU WINDWARD KAHANA
21 33 37.0 157 52 40.0 2
KAHANA PARK
15003 HAWAII
OAHU
WINDWARD
21HI /TYPA/AMBNT/OCEAN
0001 FEET DEPTH CLASS 00 CSN-RSP 0222538-0806027

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P LOG	00680 T ORG C C MG/L LOG	31505 TOT COLI MPN CONF /100ML LOG	31615 FEC COLI MPNECMED /100ML LOG	31616 FEC COLI MFM-FCBR /100ML LOG	31678 FECSTREP MPN TUBECODE LOG	32209 CHLRPHYL A UG/L LOG	70300 RESIDUE DISS-180 C MG/L LOG	70507 PHOS-T ORTHO MG/L P LOG
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00/00/00											
STATION	NUMBER		47	15	52	52	52		34		48
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99/99/99											

STORET RETRIEVAL DATE 85/02/27

GROSS ANALYSIS

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P LOG	00680 T ORG C C MG/L LOG	31505 TOT COLI MPN CONF /100ML LOG	31615 FEC COLI MPNECMED /100ML LOG	31616 FEC COLI MFM-FCBR /100ML LOG	31678 FECSTREP MPN TUBECODE LOG	32209 CHLRPHYL A UG/L LOG	70300 RESIDUE DISS-180 C MG/L LOG	70507 PHOS-T ORTHO MG/L P LOG
00/00/00	NUMBER		47	15	52	52	52		34		48
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99/99/99											

STORET RETRIEVAL DATE 85/02/27
P305B/STA

APPENDIX B

CATEGORY OF APPLICATION (check one only)

[x] I. Federal Activity

[ ] II. Permit or License

[ ] III. OCS Plan/Permit

[ ] IV. Grants & Assistance

TYPE OF STATEMENT (check one only)

[x] Consistency

[ ] General Consistency (Category I only)

[ ] Negative Determination (Category I only)

[ ] Non-Consistency (Category I only)

APPROVING FEDERAL AGENCY (Categories II, III, & IV only)

Agency _____

Contact Person _____

Telephone No. during business hours:

A/C ( ) _____

A/C ( ) _____

FEDERAL AUTHORITY FOR ACTIVITY

Title of Law River and Harbor Act of 1960, as amended

Section 107

OTHER STATE AND COUNTY APPROVALS REQUIRED

Agency	Type of Approval	Date of Applic.	Status
DLNR	CDUA	Unknown	

CZM 9/79

FEDERAL CONSISTENCY
SUPPLEMENTAL INFORMATION FORM

Date: 11 March 1985

Project/Activity Title or Description: Kahana Bay, Oahu

Location: Island Oahu District First

Tax Map Key No.

Other applicable area(s), if appropriate

Est. Start Date: Unknown Est. Duration:

APPLICANT

Name & Title Colonel Michael M. Jenks

Agency/Organization Honolulu Engineer District

Address Building 230

Fort Shafter, Hawaii Zip 96858-5440

Telephone No. during business hours:

A/C (808) 438-1091

A/C (808) 438-1069

AGENT

Name & Title Kisuk Cheung, Chief, Engineering Division

Agency/Organization Honolulu Engineer District

Address Building 230

Fort Shafter, Hawaii Zip 96858-5440

Telephone No. during business hours:

A/C (808) 438-9523

A/C (808) 438-1634

HAWAII CZM PROGRAM
ASSESSMENT FORMAT

RECREATIONAL RESOURCES

Objective: Provide coastal recreational opportunities accessible to the public.

Policies

1) Improve coordination and funding of coastal recreation planning and management.

2) Provide adequate. accessible, and diverse recreational opportunities in the coastal zone management area by:

   a) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

   b) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites and sandy beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

   c) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value.

   d) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

   e) Encouraging expanded public recreational use of County, State, and Federally owned or controlled shoreline lands and waters having recreational value;

   f) Adopting water quality standards and regulating point and non-point sources of pollution to protect and where feasible, restore the recreational value of coastal waters;

   g) Developing new shoreline recreational opportunities, where appropriate, such as artificial reefs for surfing and fishing; and

   h) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of section 46-6.

Discussion:

1. The project document and subsequent authorization have resulted in the coordinated planning and funding for the navigation improvements.

2. Development of a protected basin, safe entrance channel and navigational aids will provide for adequate access to ocean recreational resources.

SCENIC AND OPEN SPACE RESOURCES

Objective: Protect, preserve and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies

1) Identify valued scenic resources in the coastal zone management area;

2) Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

3) Preserve, maintain and, where desirable, improve and restore shoreline open space and scenic resources; and

4) Encourage those developments which are not coastal dependent to locate in inland areas.

Discussion:

1. No scenic resources will be affected by navigation improvements.

2. The project (preferred alternative) will be at the Kahana Bay existing boat ramp and is compatible with the existing visual environment. Minimal alterations to the natural land forms along the shoreline will occur during project construction.

3. The project will have only minimal effects on shoreline open space and will not affect any scenic reources.

4. The proposed navigation improvement is coastal dependent.

HISTORIC RESOURCES

Objective: Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies

1) Identify and analyze significant archaeological resources;

2) Maximize information retention through preservation of remains and artifacts or salvage operations; and

3) Support State goals for protection, restoration, interpretation, and display of historic resources.

Discussion:

1. Huilua Fishpond is a National Historic Landmark and a registered site on the State and Federal Registers of Historic Places. Kauninio Ko'a offshore Kaluapuleho Point and Kapa'ele'ele Ko'a, a fishing shrine above the boating launching ramp have been identified historic sites. These sites are outside the project area; however the Corps will coordinate with the State Preservation and to determine whether these sites will be affected by the project.

2. Construction specifications will detail methods of maximizing preservation of the existing site and any remains or artifacts identified during project planning or discovered during construction activities.

3. State goals regarding historic resources will be supported through active coordination during the planning and construction phases of the project with the State Historic Preservation Officer.

ECONOMIC USES

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

Policies

1) Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy.

2) Insure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

3) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

   a) Utilization of presently designated locations is not feasible;

   b) Adverse environmental effects are minimized; and

   c) Important to the State's economy.

Discussion:

1. The project will contribute to commercial and recreational fishing by providing a sheltered harbor and will result in an increase in the number of boat launchings. These opportunities will aid the State's economy.

2. Only a small portion of the shoreline area will be affected by the navigational improvements. The project will be constructed within the existing Kahana boat launching ramp which is already dedicated to navigation needs.

3. The project is confined to an area already committed to boating activities.

COASTAL ECOSYSTEMS

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

Policies

1) Improve the technical basis for natural resource management;

2) Preserve valuable coastal ecosystems of significant biological or economic importance;

3) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

4) Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate State water quality standards.

Discussion:

1. Geotechnical investigations conducted during project planning will expand the technical knowledge of the offshore area in the existing boat launch ramp area and will aid in the management of that resource.

2. The project construction may temporarily disturb the nearby ecosystems; however, those ecosystems will enhanced after project completion due to the additional marine habitat created by the project.

3. Coastal waters will be temporarily degraded during dredging activities, but this degradation will be minimized by the enforcement of specified standards during construction.

4. Construction specifications and compliance with State and local laws will promote planning and management practices which reflect the tolerances of marine ecosystems and prohibit uses which violate State water quality standards. A water quality cerfification has been requested from the State Department of Health.

COASTAL HAZARDS

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.

Policies

1) Develop and communicate adequate information on storm wave, tsunami, flood, erosion, and subsidence hazard;

2) Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard;

3) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

4) Prevent coastal flooding from inland projects.

Discussion:

1. The project report develops and communicates detailed information on storm waves and the risk of coastal flooding due to tsunami and subsidence hazards.

2. The navigation improvement project may encourage related development; however, such development is subject to coastal zone controls and requirements. The improved boating facility will offer storm wave protection for areas within the basin.

3. Not applicable to the project.

4. Not applicable to the project.

MANAGING DEVELOPMENT

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies

1) Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development;

2) Facilitate timely processing of application for development permits and resolve conflicting permit requirements; and

3) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Discussion:

1. The project development process utilizes and implements existing Federal, State and County laws and ordinances as well as existing Federal and US Army Corps of Engineers regulations.

2. The implementation of project planning facilitates timely processing of permit applications to the maximum extent practicable.

3. The project report thoroughly discusses all aspects of short- and long-term impacts relative to the project. Significant impacts will be discussed at a public meeting held prior to a decision on the project and commencement of actual project construction.

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

PLAN FORMULATION CRITERIA AND COMPLIANCE REPORTS

APPENDIX A

APPENDIX A

PLAN FORMULATION CRITERIA AND
COMPLIANCE REPORTS APPENDIX

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	B. Planning Criteria & Constraints Institutional Policy Design/Benefit Criteria Regulatory/Environmental Requirements	A-2
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	B. Evaluation of the Effect of the Discharge of Dredged Material into Waters of the U.S., Using U.S. Environmental Protection Agency (EPA) Section 404(b) Guidelines	A-6

I. PLAN FORMULATION CRITERIA

A. LEGISLATIVE AUTHORITY.

Section 107 of the River and Harbor Act of 1960, as amended by Section 310 of the River and Harbor Act of 1965, Section 112 of the River and Harbor Act of 1970, and Section 133(a) of the Water Resources Development Act, approved 22 October 1976, states:

(a) The Secretary of the Army is authorized to allot from any appropriations hereafter made for rivers and harbors not to exceed $25,000,000 for any one fiscal year for the construction of small river and harbor improvement projects not specifically authorized by Congress which will result in substantial benefits to navigation and which can be operated consistently with appropriate and economic use of the waters of the nation for other purposes, when in the opinion of the Chief of Engineers such work is advisable, if benefits are in excess of the costs.

(b) Not more than $2,000,000 shall be allotted for the construction of a project under this section at any single locality and the amount allotted shall be sufficient to complete the Federal participation in the project under this section.

(c) Local interests shall provide without cost to the United States all necessary lands, easements, and rights-of-way for all projects to be constructed under the authority of this section. In addition, local interests may be required to hold and save the United States free from damages that may result from the construction and maintenance of the project, and may be required to provide such additional local cooperation as the Chief of Engineers deems appropriate. A state, county, municipality or other responsible local entity shall give assurance satisfactory to the Chief of Engineers that such conditions of cooperation as are required will be accomplished.

(d) Non-Federal interests may be required to share in the cost of the project to the extent that the Chief of Engineers deems that such cost should not be borne by the Federal Government in view of the recreational or otherwise special or local nature of the project benefits.

(e) Each project for which money is allotted under this section shall be complete in itself and not commit the United States to any additional improvement to insure its successful operation other than routine maintenance, and except as may result from the normal procedure applying to projects authorized after submission of survey reports and projects constructed under the authority of this section shall be considered as authorized projects.

B. PLANNING CRITERIA AND CONSTRAINTS

1. Institutional Policies. Several institutional policies of the Federal Government affect the design and decisions for local and Federal participation. Executive policies are issued through the Office of Management and Budget (OMB), the Water Resources Council (WRC) and the Council of Environmental Quality (CEQ). Legislative policies are expressed by various legislative enactments of Congress which has developed a body of laws establishing national concerns regarding the nation's natural resources.

The draft Principles and Guidelines (P&G) provide the basic framework for Federal agencies in formulation and evaluating alternative plans for water and related land resources implementation studies.

The Corps of Engineers regulations (ER) are specific guidelines to implement the Principles and Guidelines as well as other legislative laws and executive orders within the Corps' civil works programs.

2. Design/Benefit Criteria. In developing justification for Federal participation, technical and economic evaluation policies, standards, principles, and procedures are established in determining a benefit to cost comparison. All projects must have a benefit to cost comparison. The Principles and Guidelines further state that a plan must be formulated which reasonably maximizes net NED benefits, consistent with the Federal objective. That is, this plan must have combined benefits that optimally outweigh combined cost.

3. Regulatory/Environmental Requirements. A number of statutory and regulatory requirements of the Federal government must be complied with during the planning process. These requirements largely relate to the assessment and evaluation of possible impacts on the environmental resources of the project area. The major requirements include:

Clean Air Act, as amended (42 USC 7401 et seq.) As it applies to Corps Studies and construction projects, this act requires that all Federal projects must conform to EPA-approved or promulgated state implementation plans.

National Environmental Policy Act of 1969 (Public Law 91-190). The National Environmental Policy Act (NEPA) requires an environmental statement in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment.

Clean Water Act of 1977 (Public Law 95-217). (Formerly the Federal Water Pollution Control Act Amendment of 1972.) The requirements for Corps projects is to evaluate discharge effects of dredged or fill materials into waters of the United States and to comply.

Coastal Zone Management Act of 1972 (Public Law 92-583). This act requires that Corps project comply with the objectives of Federal law as well as be consistent with the Coastal Management Program for the State of Hawaii.

Endangered Species Act of 1973 (Public Law 92-583). The implementing agency shall coordinate with the appropriate Federal wildlife agency to determine the presence of listed endangered or threatened species or their critical habitat which may be present in the area of proposed action. The results of the assessment shall be contained in the EIS.

Fish and Wildlife Coordination Act of 1958 (Public Law 85-624). This act requires any Federal agency proposing a water-resource project to consult with the Department of Interior, US Fish and Wildlife Service (USFWS) and the head of the state of territorial agency exercising control over fish and wildlife resources, concerning the impacts of such action. The USFWS shall commend, in a 2(b) report, methods to mitigate impacts of the proposed action and to conserve fish and wildlife resources.

Marine Protection, Research, and Sanctuaries Act of 1972 (Public Law 92-532). This act requires the evaluation of the need for transportation of dredged material for the purpose of dumping in ocean waters. In the case of this project, there is no specific need to provide an ocean dump site for excess construction materials.

National Historic Preservation Act of 1966 (Public Law 89-635). This act requires that Federal agencies, when it proposes a construction project, to take into account the effect of the undertaking on any property included in, or eligible for inclusion in the National Register and shall afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to such undertaking. Coordination is also required with the SHPO.

Executive Order on Flood Plain Management (EO 11988). This order requires that agencies avoid occupancy and modification of the base floodplain unless it is the only practicable alternative. For potential action in the floodplain, an evaluation of effects on floodplain values, a description of other practicable alternative actions outside the floodplain, and adequate dissemination of the action to the public must be undertaken.

Executive Order on Protection of Wetland (EO 11990). This order requires the agency to analyze potential impacts of a project to existing wetlands and associated values and to give the public opportunity to comment.

Wild and Scenic Rivers Act of 1968 (Public Law 90-542). This act requires agencies to identify potential impacts to designated wild and scenic rivers and to coordinate action and obtain concurrence with the US Department of the Interior. There are no such designated rivers on Sand Island.

Federal Water Project Recreation Act (Public Law 89-72, as amended). This act requires that full consideration be given to project opportunities for outdoor recreation and fish and wildlife enhancement; that planning based on coordination for use with existing and planned Federal and local public recreation developments and that the views of governmental agencies concerned with recreation and wildlife be included in the report.

Watershed Protection and Flood Prevention Act, as amended (16 USC 1001 et seq.). This statute which authorized the Soil Conservation Service to construct dams and other works in upstream watersheds, imposes no requirements on Corps projects.

Archaeological and Historic Preservation Act of 1974 (Public Law 93-291), as amended. This act, also known as the Reservoir Salvage Act, provides for the preservation of historical and archaeological data which might be otherwise destroyed by flooding or other alteration of the terrain and authorizes up to one percent of the total amount authorized for appropriation for the project to be spent on recovery, protection and preservation of data. This act will be utilized only for sites eligible for or listed on the National Register of Historic Places. Applicability of this act to the project is assessed in Appendix G and the EIS.

Estuary Protection Act (Public Law 90-454). The act requires that Federal agencies, in planning for use or development of water and land resources, give consideration to estuaries and their natural resources and that if estuaries may be affected, the Secretary of the Interior shall be given an opportunity to evaluate the effects of the project on the estuary. There are no estuaries in the study area.

Land and Water Conservation Fund Act of 1965 (16 USC 4601-4 et seq.). As it applies to Corps studies and project, this act requires that Corps recreation planning be coordinated with the State plan developed pursuant to the Act. The non-Federal cost for the porject may not be paid out of LWCFA funds.

Rivers and Harbors Appropriation Act of 1899, as amended (33 USC 401 et seq.). This statute, which established Corps' regulatory responsibilities and generally prohibited a wide range of actions which might obstruct navigable waters of the United States, does not impose any requirements on projects that are affirmatively authorized by Congress.

II. COMPLIANCE REPORTS

A. PRESIDENTIAL EXECUTIVE ORDER 11988 ON FLOOD PLAIN MANAGEMENT EVALUATION REPORT

The purpose of this supplemental report is to present the results of additional studies in accordance with 33 CFR 239 which implements Executive Order (EO) 11988, Floodplain Management, dated 24 May 1977. The objective of EO 11988 is to avoid to the maximum extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The Order requires Federal agencies to:

a. Avoid development in the base floodplain unless it is the only practicable alternative;

b. Reduce the hazard and risk of flood loss;

c. Minimize the impact of floods on human safety, health, and welfare; and

d. Restore and preserve the natural and beneficial floodplain values.

The proposed action at Kahana Bay is not located within the base floodplain of the Kahana Stream. However, the project area is susceptible to inundation by tsunami. The nature of harbors makes these prone to coastal flooding. The only practical non-floodplain alternative would be tne without project condition.

Boating and fishery related activities are water dependent by their nature, necessitating the location in coastal areas which are subject to flood hazards. Improvements of this study site would offer benefits which would outweigh the anticipated environmental losses and added potential flood damage resulting from this action.

B. EVALUATION OF THE EFFECTS OF THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO THE WATERS OF THE U.S. USING THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) SECTION 404(b) GUIDELINES.

The evaluation and finding of compliance with these guidelines are found below.

FINDING OF COMPLIANCE
SECTION 404(b)(1) EVALUATION
FOR
KAHANA BAY, OAHU
1 April 1985

1. Four alternatives were considered. Plan 1 consists of a breakwater, entrance channel, turning basin and mooring area in Kahana Bay. Plan 1A, the preferred alternative with the least environmental impacts, consists of a breakwater, entrance channel and turning basin also at Kahana Bay. Plans 2 and 3 consist of entrance channels, breakwaters, revetted fills and turning basins at Puu Mahie Point and Makaua Beach, respectively. The environmental impacts associated with Plans 2 and 3 are more significant.

2. The planned disposal site would not violate any applicable water quality standards of the State of Hawaii. The disposal operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

3. Use of the selected disposal sites will not harm any endangered species or their critical habitat.

4. The proposed disposal of the fill material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity, productivity and stability, or recreational, aesthetic, and economic values will not occur.

5. Appropriate measures to minimize the potential adverse impact of the discharge on aquatic systems include: requiring the contractor to comply to the water quality standards established by the State Department of Health and assuring no debris, petroleum products or other deleterious materials be allowed to fall, flow, leach or otherwise enter the water.

6. On the basis of the above evaluation, disposal of fill material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

MICHAEL M. JENKS
Colonel, Corps of Engineers
District Engineer

EVALUATION OF THE EFFECTS OF
THE DISCHARGE OF DREDGED OR FILL MATERIAL INTO
WATERS OF THE UNITED STATES
USING THE SECTION 404(b)(1) EVALUATION
KAHANA BAY, OAHU, HAWAII
1 April 1985

I. Project Description.

a. Location. Kahana Bay is located on the windward side of Oahu and is approximately a forty-five minute drive from Honolulu. The project site is located on the northeast side of Kahana Bay at the State Department of Transportation boat launching ramp.

b. General Description. The proposed action consists of a 220-foot breakwater, a turning basin 90 feet by 90 feet and an entrance channel about 50 feet wide, 1000 feet in length and -6 to -8 feet MLLW. The action is located at the existing boat ramp.

c. Authority and Purpose. The authority for the project is under Section 107 of the River and Harbor Act of 1960, as amended.

d. General Description of Dredged or Fill Material.

(1) The quantity of material proposed for discharge is about 2,500 cubic yards for the breakwater.

(2) The material will be basalt stones quarried from one of the Oahu quarry sites.

e. Description of the Proposed Discharge Site(s).

(1) The location of the discharge site is shown on Figure 1.

(2) The area required by the breakwater is approximately less than 0.1 acre.

(3) The type of site is an embayment.

(4) No corals or hard-bottom habitats were observed. The affected area is predominately a fine-grained sand which are mainly calcareous with a small percentage of terrigenous and detrital materials.

(5) The disposal will occur during the 12-month construction period and has a project life of 50 years.

f. Description of Disposal Method. Mechanical construction equipment will be used for placing the stone used in the breakwater.

II. Factual Determinations.

a. Physical Substrate Determinations.

(1) The substrate elevation is about -2.0 at the base of the breakwater and is basically flat.

(2) The fill consists of material larger than silt size, i.e., spalls to 8,500-pound stones.

(3) No fill material movement is expected to occur.

(4) The physical effects on the benthos will consist of covering and destroying benthic species. Motile and benthic species will probably colonize the intertices and surfaces of the completed breakwater.

(5) Action to be taken to minimize the impacts include: minimizing discharges by avoiding construction on unstable slopes and subsequent slumping into the water; grading properly to mitigate erosion runoff; and assuring that no debris, petroleum products or other deleterious materials will be allowed to fall, flow, leach or otherwise enter the water. The construction contractor will be required to comply with the water quality regulations established by the State of Hawaii, Department of Health.

b. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water. A temporary, minor and localized reduction in light transmission will be caused by turbidity generated during placement of the breakwater.

(2) Current Patterns and Circulation. No changes in water circulation will occur as the result of discharge of fill materials.

(3) Normal Water Level Fluctuations. The fill material will have negligible effects on the water level fluctuations.

(4) Salinity Gradients. Salinity gradients will not be affected by the discharge of fill materials.

(5) Action That Will Be Taken to Minimize Impacts. Care will be taken to minimize turbidity by avoiding unstable slopes during construction; grading properly to mitigate erosion from runoff; and assuring that no debris, petroleum products or other deleterious materials be allowed to fall, flow, leach or otherwise enter the water. The construction contractor will be required to comply with State water quality regulations.

c. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site. Construction activities will generate temporary and minor turbidity at the project site.

(2) Effect on Chemical and Physical Properties of the Water Column. Not applicable.

(3) Effects on Biota. No significant fishery resources and commercial harvestable shellfish beds, marine sanctuaries, national wildlife refuges or wetlands will be affected by the proposed project.

(4) Actions Taken to Minimize Impacts. The construction contractor will be required to comply with the State water quality regulations during construction.

d. Contaminant Determinations. Contaminants are not expected since the material will be basalt stones.

e. Aquatic Ecosystem and Organism Determinations. The project will bury or destroy benthic organisms. Later, other motile and benthic organisms will probably colonize the breakwater. Effects on special aquatic sites and endangered and/or threatened species are not anticipated.

f. Proposed Disposal Sites Determinations. No zone of mixing will be required. The contractor will comply with applicable water quality regulations. The project will not have an impact on municipal water supply intakes, shellfish, fisheries, wetlands, national seashores, wilderness areas, research sites, recreational areas and preserves.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The cumulative impacts of the breakwater will be minimal.

h. Determination of Secondary Effects on Aquatic Ecosystem. The secondary impact on the aquatic ecosystem is deemed to be minimal.

III. Findings of Compliance or Non-Compliance With Restrictions on Discharge.

a. Adaption of the Section 404(b)(1) Guidelines to This Evaluation. The project complies with the Section 404(b)(1) guidelines.

b. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem. Three alternatives, in addition to the proposed project, were considered. Plan 1 is located at the same location as the proposed plan and includes a mooring area. Plan 2, located at Puu Mahie Point, consists of a turning basin, revetted fill and an entrance channel. Plan 3, located at Makaua Beach, also consists of a turning basin, revetted fill and an entrance channel. Plan 1A, the proposed project, was evaluated as having the least impact to the aquatic ecosystem because it occurs within an existing boat ramp and requires less disturbances to the environment.

c. Compliance With Applicable State Water Quality Standards. The contractor will be required to comply with the water quality standards established by the State of Hawaii, Department of Health.

d. Compliance With Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act. Not applicable to the project.

e. Compliance With the Endangered Species Act of 1973. The Corps has made the determination that the project will not affect endangered or threatened species.

f. Compliance With Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research and Sanctuaries Act of 1972. Not applicable.

g. Evaluation of Extent of Degradation of the Waters of the United States. The project will not have an effect on human health and welfare; life stage of aquatic life and life other stages dependent on aquatic ecosystems; aquatic ecosystem diversity, productivity and stability; and recreational, aesthetic and economic values.

h. Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impact of the Discharge on the Aquatic Ecosystem. Care will be taken to mitigate erosion from runoff. Extreme care will be taken to assure that no debris, petroleum products or other deleterious materials be allowed to fall, flow, leach or otherwise enter the water. All construction activities within and adjacent to the water will be conducted so as to minimize turbidity and control erosion. The contractor will also be required to comply with the water quality standards promulgated by the State Department of Health.

i. On the basis of the guidelines, the proposed disposal site for the discharge of fill material is specified as complying with the requirements of these guidelines.

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

PUBLIC INVOLVEMENT

APPENDIX B

APPENDIX B
PUBLIC INVOLVEMENT PROGRAM APPENDIX

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APPENDIX B

I. PUBLIC INVOLVEMENT PROGRAM

OBJECTIVES

To insure that the desires and needs of the public were identified and considered, a public involvement program was developed. The public, as broadly interpreted by the U.S. Army Corps of Engineers, is any affected or interested non-Corps of Engineers entity; other federal and territorial government entities and officials; public and private organizations, and individuals. The public participation program is directed to maintaining information flow, achieving a mutual understanding and acceptance of the problems and opportunities, and attainment of interest level for proper decision making.

The objectives of the public participation program are:

a. To inform citizens of the current Corps of Engineers planning process and direction.

b. To surface key planning issues and concerns so that they are given full consideration.

c. To help formulate and review potential plans of improvement.

d. To offer technical, historical, and localized information pertinent to the study.

e. To provide a communicative forum between the Corps, local agencies, advocacy groups, and interested citizens on the subject plan and problems.

TECHNIQUES

The types of public participation forums in this study will be small informal meetings, workshops, and formal public meetings:

a. Informal Meetings. These meetings are of less than 10 persons with specific invited agency personnel, group representatives, or citizens. These meetings are undertaken at various intervals throughout the study to help the planners obtain information and address certain issues.

b. Workshops. These meetings are informal exchange sessions open to the general public and usually numbering from 10 to 50 persons. The purpose is to promote the full airing of various views in recognition of current Corps' planning efforts. Public information notices and fact sheets are issued to all interested parties prior to the meeting.

c. Public Meeting. A formal public meeting will be held at key points in the study effort. The purpose is to notify all interested parties of the planning effort to date and to obtain specific views on various items of the

agenda. The meeting, presided by the District Engineer, will include a presentation of formal statements by others, and tentative conclusions. A public notice of this meeting is issued to the media and the general public invited. All information and statements are documented as part of the planning record.

d. Guidance and general policies for conducting public involvement program were obtained from ER 1105-2-800 (Public Involvement and General Policy) and ER 1105-2-502 (Planning Public Meetings).

ACTIVITIES CONDUCTED

Studies for possible navigation improvements at Kahana Bay were requested by the State Department of Transportation - Harbors Division by letter dated September 8, 1982. A reconnaissance report (initial appraisal) was completed in February 1983. The report established Federal interest and recommended that an Expanded Reconnaissance Report be prepared. This report, completed in November 1983, evaluated alternative sites for the project, and selected a tentatively recommended plan and site of possible improvement. This Expanded Reconnaissance Report also confirmed the Federal interest in possible improvements and recommended that a Detailed Project Study at Kahana Bay be undertaken. A public workshop was held on July 28, 1983 and is summarized in Section II.

FUTURE COORDINATION

The Draft Environmental Impact Statement will be filed with the U.S. Environmental Protection Agency and a Notice of Availability will be published in the Federal Register in accordance with current Environmental Quality Policy and Procedure Guidelines (44 FR 127). A 45-day comment period from the date of publication in the Federal Register will be made available to those who wish to review and comment on the Draft Environmental Statement. No administrative action will be taken on the report for at least 90 days.

After this draft report is circulated to Federal and local governmental agencies and interested citizens, a public meeting will be held to obtain the public's views on the alternative plans. Public views and concerns expressed at that meeting and written comments received during the review period will be one of the major factors in selecting the final plan. All public comments will be documented in the final report. A Final Detailed Project Report and Final Environmental Statement will be prepared at the end of the review period detailing the selected plan.

II. PUBLIC WORKSHOP

A public workshop was conducted at the Kaaawa Elementary School on July 28, 1983 at 7:30 PM. Public notices were sent to the local residents as well as to Federal and local government agencies. Also, a news release was submitted to various newspapers for publications.

ATTENDANCE AT THE PUBLIC WORKSHOP

28 JULY 1983

Federal Agencies
- Mr. James K. Ligh, Corps of Engineers
- Mr. B. David Swenson, Corps of Engineers
- Mr. Pat Tom, Corps of Engineers
- Ms. Lise Ditzel, Corps of Engineers
- Mrs. Helene Takemoto, Corps of Engineers

State Agencies
- Mr. John McDonald, Department of Transportation
- Mr. Ian Birney, Department of Transportation
- Mr. Charles Toguchi, State Representative
- Mr. Robert Nakata, 43rd District Representative

Individuals
- Mr. Howard C. Geiger, Kaaawa Community Association
- Mr. Jim Muckridge, President, Kaaawa Community Association
- Mr. Hassell Gabriel
- Mr. George Keoho
- Mrs. Lora Geiger
- Mr. Glen Yamashita
- Mr. Sam Giese
- Mrs. Ann S. Giese
- Mr. Roy Yamashita
- Ms. Barbara Kahana
- Mr. Kimo Mills
- Mr. Vernon Soga
- Ms. Gwen Kim
- Ms. Elizabeth Kahala

SUMMARY

A brief presentation was given which covered the following: purpose of the workshop; preliminary objectives of study; probable benefits; possible improvements; environmental concerns; and study process. Many views were expressed by the public: there were those who fully supported any improvements, those who would like to see some improvement, but perhaps located away from existing facilities; and those who opposed any improvement at all.

There appeared to be a concensus on the need for navigation improvements to the existing launch ramp at Kahana. However, a concern regarding the impacts on the Konohiki rights and on the akule spawning areas in Kahana Bay must be addressed, as raised by a person in the audience.

III. PERTINENT CORRESPONDENCE

Any letters and comments received during the comment/review period of this Draft Detailed Project Report will be included in the Final Detailed Project Report and will be grouped by Federal, State, County, private interest groups and individuals.

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HARBORS DIVISION
79 SO. NIMITZ HWY. • 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:

September 8, 1982

HAR-EP 890

LTC Kenneth E. Sprague
District Engineer
U. S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858

Dear Colonel Sprague:

Reconnaissance Study Request for Oahu

As discussed informally with Mr. Henry Nakashima of your office, we have several projects on Oahu which will require major improvements in the future. More specifically, these projects are described below:

1. Waianae Boat Harbor

Since the completion of the catwalks and boat ramps in this harbor, boaters have complained of significant surging in the ramp and adjacent berthing areas. Recent attempt to alleviate the condition at the launching ramps by constructing a small wave absorber was met with minimal success. An analysis is needed to determine the extent and feasibility of resolving the surge problem.

2. Heeia-Kea Boat Harbor Expansion

As authorized, the Heeia-Kea Boat Harbor was to be expanded in a northwesterly direction and accommodate approximately 1,600 boats. Recent discussions with boaters and others have placed heavy emphasis on a 300-berth capacity concept as depicted in the Corps' Kaneohe Bay Urban Waters Resources Study. The Corps' Kane-Kai Boat Harbor study should be continued in conjunction with the Heeia-Kea expansion study because of its proximity and impact on the existing berthing demand in this area.

3. Keehi Lagoon Boat Harbor

This totally State developed facility is located in a naturally protected area in Keehi Lagoon. There is a great potential for expansion in this ideal setting. New protective structures, albeit minor, will be required if such an expansion is to be realized. The Corps' expertise in engineering and planning of this type of expansion project is well documented, making it an excellent candidate for Corps' participation in the early planning and design phases.

4. Kahana Bay Boat Launching Ramp

Although this facility is protected by a small groin, the boaters utilizing the launching ramp still experience heavy surge conditions. It appears incoming waves refract around the tip of the groin, causing surge condition that makes it hazardous and difficult to launch or retrieve a boat. A study should be conducted to determine the extent of protection needed to make the ramp safe, facilitate launchings and retrievals, and provide for a turning basin and refuge area for distressed boaters in the area. Complaints have also been received that the existing channel is too shallow to safely accommodate the larger trailered boats with a draft of over 3 feet. Channel dredging requirements should also be determined.

The above projects are major State boating projects which will require expert analysis and evaluation to determine their feasibility. We are respectfully requesting, therefore, that the Corps undertake the necessary reconnaissance studies for the 5 projects. We understand all costs associated with such studies if conducted will be borne solely by the Corps. Of course, we will be available to assist the Corps in other capacities to assure the success of this endeavor.

Your favorable response to our request would be appreciated. Please contact us if you have any questions.

Very truly yours,

DAVID K. HIGA
Chief

PODED-PJ 28 September 1982

Mr. David K. Higa
Chief, Harbors Division
State of Hawaii
Department of Transportation
79 South Nimitz Highway
Honolulu, HI 96813

Dear Mr. Higa:

We appreciate your interest and support for Corps navigation studies in the State of Hawaii. Our response to your 8 September 1982 request for reconnaissance studies for the island of Oahu is detailed below.

Waianae Boat Harbor - We have discussed the surge problem previously with Harbors Division personnel, and have recommended that the difficulties associated with launching and retrieval could be alleviated with a new ramp located at the root of the existing breakwater. We can evaluate other possible measures that may address the surge problem under the ongoing Coasts of the Hawaiian Islands Study.

Heeia-Kea Boat Harbor - Expansion of the Heeia-Kea Boat Harbor will be reviewed under the Coasts of the Hawaiian Islands Study, as will the problems and needs at other potential sites in the Kaneohe Bay area, including the Kane-Kai boat harbor site. The Coasts of the Hawaiian Islands Study is scheduled for completion in fiscal year 1984. We believe that a 200- to 300-berth capacity harbor is reasonable for the projected needs in the Kaneohe Bay area. Detailed sizing will be accomplished during the latter stages of the study.

Keehi Lagoon Boat Harbor - A preliminary feasibility study for expansion of small craft facilities at Keehi Lagoon could be accomplished either as a reconnaissance study under Section 107 of the River and Harbor Act of 1960 (Public Law 84-645), as amended, or as part of the Coasts of the Hawaiian Islands Study. There are advantages to each approach, and we would like to discuss this matter further with your staff to determine the best course of action.

Kahana Bay Boat Harbor - A Section 107 reconnaissance study for a small boat harbor at Kahana Bay will be initiated in October 1982, with study

completion scheduled for early 1983.

We will continue to coordinate with your staff as these studies proceed.

Sincerely,

ALFRED J. THIEDE
Colonel, Corps of Engineers
District Engineer

May 25, 1983

Mr. David K. Higa, Chief
Harbors Division
Department of Transportation
State of Hawaii
79 S. Nimitz Highway
Honolulu, HI 96813

Dear Mr. Higa:

We wish to update the status of your September 8, 1982 letter request for possible navigation improvements at the Kahana Bay Launching Ramp on Oahu. A reconnaissance has been completed (copy enclosed) and funds have been received to continue the investigation into the expanded reconnaissance phase. Detailed feasibility studies will follow if warranted. We will be conducting hydrographic surveys this summer and have coordinated with Mr. Fred Shinsato of your staff for rights-of-entry permits.

We will keep you apprised on the study progress and look forward to working with you and your staff on this study.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Enclosure

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96812

March 11, 1985 F/SWR1:ETN

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Corps of Engineers
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

We concur with the Corps of Engineers assessment that the proposed improvements at Kahana Bay (Plan 1A) are not likely to affect humpback whales or green turtles. However, we are requesting that this office be kept informed of the progress of this project for monitoring purposes.

Sincerely yours,

Doyle E. Gates
Administrator

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
Western Pacific Program Office
P. O. Box 3830
Honolulu, Hawaii 96812

October 17, 1983 F/SWR1:ETN

Mr. Kisuk Cheung
Chief, Engineering Division
Pacific Ocean Division
U.S. Army Corps of Engineers
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

This responds to your letter of September 30, 1983 requesting information on any candidate or listed threatened or endangered species that may be present in the proposed project site at Kahana Bay, Oahu.

The endangered humpback whale (Megaptera novaeangliae) is found during the winter migration months of December through May off the windward shore of Oahu between the edge of the outer reef margins and the 100 fathom isobath. This area has not been identified as a calving or mating site and is more likely a migration corridor for humpback whales. However, calves do occur on this coast as evidenced by the calf stranding at Punaluu on February 22, 1981.

The threatened green turtle (Chelonia mydas) is commonly seen in Kahana Bay. Although the numbers and age/sex classes of the turtles are not known, subadults and adults have been observed feeding and resting in the Makawa Channel, one of the alternate sites for the project. Because of the lack of data on green turtle abundance and distribution we recommend that the Corps supplement the U.S. Fish and Wildlife Service "Two-B Report" with a baseline survey in the Kahana Bay area. If the Corps should require any assistance in designing or conducting the study please contact Mr. Gene Nitta at 955-8831.

Sincerely yours,

John J. Naughton
Acting Administrator

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

Leslie S. Matsubara
DIRECTOR OF HEALTH

In reply, please refer to:
EPHSO-SS

January 16, 1985

Mr. Kisuk Cheung
Chief, Engineering Division
U.S. Army Engineer District, Honolulu
Department of the Army
Ft. Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

Subject: Kahana Bay Project

Our staff has reviewed this request and provides the following comments:

1. The major factor influencing water quality at Kahana Bay is primarily non-point sources of pollution. This occurs quite extensively and over a long duration during the winter season. Therefore, timing and duration of the project is important so as not to compound any project generated impacts.

2. The specific criteria for embayments as stated in the Water Quality Standard Rules [SII-54-06(a)(3)] should be addressed in the construction phase, in addition to the basic criteria stated under SII-54-04. Adequate turbidity control measures should be implemented based on the criteria. Also, specific attention should be given to limiting recreational activities and fishing in the area during construction.

Sincerely,

MELVIN K. KOIZUMI
Deputy Director for
Environmental Health

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

GEOLOGY, FOUNDATIONS AND MATERIALS

APPENDIX C

APPENDIX C

GEOLOGY, FOUNDATIONS AND MATERIALS

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A. Regional Geology.

The island of Oahu was formed from the coalescence of lava flows from two volcanic ranges -- the Waianae and Koolau. Although the Waianae volcanic range appears to be older (the first to become extinct), both volcanoes were concurrently active from the late Tertiary Period of geologic time to the early Pleistocene Epoch (2 million to less than 1 million years before present). When volcanic activity ceased, streams carved deep, amphitheater-headed canyons into the surfaces of the volcanoes' shield-shaped domes. At the same time (and over the past 600,000 years), changes in the ocean level accompanying glaciation and deglaciation of the earth during the Pleistocene Epoch were partially responsible for shifting Oahu's coastline. These ocean level changes drowned stream valleys and created wave-cut terraces and coral reef deposits at various elevations between 1,800 feet below and 1,200 feet above the present day sea level. Volcanism (the Honolulu Series) was renewed on the Koolau range between 900,000 and 100,000 years before present which created such features as Diamond Head, Salt Lake, Aliamanu, Punchbowl and the Koko craters.

B. Site Geology.

Kahana Bay is located on the windward (northeast) coast of the island of Oahu. The bay is 0.5 miles wide and is recessed 0.5 miles into the shoreline. Kahana Stream empties into the bay on the southeast side and a small unnamed stream empties into the bay on the southwest side. The shoreline between the two streams make up the beach portion of the Kahana Bay State Park. The subject project is located on the west side of the bay, less than 1,000 feet from the unnamed stream and about 3,000 feet from the mouth of Kahana Stream.

Kahana Bay is the submarine valley (submerged extension) of Kahana Stream. It was formed by the downcutting erosion of the stream during a lower stand of sea level (effects of Pleistocene glaciation). Steep valley walls line the east and west sides of the bay from the ridge tops to the water's edge. Landward a gentle, seaward-sloping floodplain has developed in the stream's valley. The shallow offshore conditions in Kahana Bay are also the result of a portion of the stream's floodplain being submerged as the sea level rose. Although hard basalt rock outcrops along the valley ridges, the land immediately surrounding Kahana Bay generally consists of alluvial and colluvial deposits of weathered lava basalts and pyroclastic materials. These deposits are a chaotic mixture of lateritic clays, silts and detrital rock fragments in various sizes and stages of decomposition. The shoreline on the east and west sides of the bay are covered with hard, round to semi-round basalt gravels, cobbles and boulders. This deposit formed from the erosion of the weak constituents (clays, silts and decomposed basalts) of the colluvial-alluvial deposit. The south shoreline is covered with fine coral sand which grades into the alluvial-colluvial deposits of the backshore area. The offshore areas at the proposed site are covered with a veneer of coral sand. This sand is coarse and thin (up to 1 foot thick) near the shoreline and grades into fine sand of unknown thickness (3+ feet) farther offshore. Facilities at the proposed site consist of a paved revetted fill used for parking, a boat launch ramp with a small (30 feet by 10 feet) wooden dock, a 50-foot long breakwater protecting the ramp and dock and a public comfort station.

C. Subsurface Explorations.

No subsurface explorations have been made at the proposed site for the Kahana Bay Navigation Improvements project. Tentatively scheduled are geotechnical investigations including subsurface drilling and sampling (standard penetration testing, "undisturbed" thin-walled tube sampling, etc.), materials testing of samples, substratum analysis and foundation design recommendations. In addition, a survey of potential rock sources for breakwater construction shall be conducted.

D. Foundation Conditions.

The proposed breakwater is to be constructed from the north end of the existing revetment which protects the paved fill parking lot. At the toe of the existing revetment are gravels, cobbles and boulders grading into and being covered by the coral sand veneer. It is not known whether these gravels, cobbles and boulders at the toe are the naturally deposited (alluvial-colluvial) materials or fill which grades into the natural deposits. Whichever the case, these materials appear to have adequately stabilized the toe of the revetment of the existing parking lot. The alluvial-colluvial deposit is thick, being in excess of 50 feet at the project location. The sand veneer covering the initial 150 feet of the proposed breakwater foundation is thin (1 foot or less) and should be removed prior to placement of new revetment and toe protection. No additional toe protection shall be required (within the initial 150 feet of breakwater) where the revetment is founded on the underlying alluvial-colluvial deposit. The remaining 210 feet of breakwater will require toe protection because the thickened (in excess of 3 feet) offshore surface deposit of loose sand is highly susceptible to wave and current erosion. The subsurface conditions for the proposed breakwater foundation appear similar in all directions beyond and normal to the axis of the breakwater. The underlying alluvial-colluvial deposit within and surrounding the area of the proposed breakwater is a stable formation which is generally resistant to currents and wave action. The stability of the formation will not be affected by construction of the subject project.

E. Preliminary Design/Construction Considerations.

The following design/construction considerations are preliminary in nature and are to be used for initial project concept formulation. These considerations are subject to change depending upon the outcome of subsurface investigations.

1. Dredging. Dredging can be accomplished by any conventional method currently used to dredge sediments. No drilling and blasting is anticipated. Continued maintenance dredging will be required periodically throughout the life of the project because of considerable littoral movement of sand from offshore reefs to the shoreline areas in Kahana Bay by waves and currents.

2. Cut-Slopes. Pending future verification by detailed stability analysis cut-slopes in the alluvial-colluvial material (underlying the proposed site) will be stable with a 1 vertical on 1 horizontal slope configuration provided the slope height does not exceed 25 feet. Slopes with a 1 vertical on 2 horizontal for the overlying sand veneer would be stable for the access

channel during and following construction, provided the slopes are revetted for protection against wave and current action. If no revetment protection is provided, wave action could eventually flatten the slope to 1V on 5H or flatter. The impact of the flattening of cut slopes by natural forces should be considered in locating the breakwater.

3. Breakwaters. Breakwater slopes are currently being analyzed. Recommendations on breakwater slopes will be forthcoming in the final report. For preliminary design, breakwater slopes of 1 vertical on 2 horizontal should be used. Toe protection will be required in areas where the breakwaters are founded on sand (nearly all of the proposed breakwater).

4. Seismic Design. Although Oahu's seismic regime may appear subdued, intensities from major earthquakes on or near a neighboring island can have catastrophic effects on any and all of the Hawaiian Islands. Two such significant earthquakes occurred on the East Molokai Fracture Zone in 1871 and 1938. These events registered about Richter Magnitude 7.5 and were felt in Honolulu with a Modified Mercalli (MM) Intensity VIII. The original Modified Mercalli Intensity Scale (abridged) states for MM VIII:

> "Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse; and great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls, heavy furniture overturned. Sand and mud ejected in small amounts. Changes in water wells. Persons driving motorcars disturbed."

These events have been considered the "worst of credible events" and have been used in the development of seismic probability zones as well as in seismic designs for modern structures. The Uniform Building Code lists Oahu in seismic probability zone 1. For design consideration, Army Technical Manual TM 5-809-10 places Oahu into seismic probability zone 2 and describes damages as "moderate."

5. Construction Materials. Materials excavated from the access channel and breakwater locations may be used for general land-fills, but are not suitable for breakwater construction. Protection by revetment of all exposures facing water will be required if the excavated materials are used as fills for offshore land reclamation. Stone of the existing revetment, if removed, is reusable. However, additional stone will have to be obtained to furnish the additional height and length of the revetment. The most commonly used source of revetment and armor rock on Oahu is Kapaa Quarry located approximately 25 miles from the project site in the Kaneohe-Kailua area. Hard and dense lava basalt is available in sizes and quantities required for this project. In addition, bedding material and graded aggregates for filter zones are also available from the Kapaa Quarry.

6. Dredge Disposal. Suitable dredge disposal sites (if they can be made available) are located in the backshore areas within close proximity of the proposed site. These sites will be less expensive than offshore dredge disposal sites because of the high cost of revetting and preventing environmental damage.

7. Site Access. Although access to the site is excellent from Kamehameha Highway, very limited working and storage space exists between the project site and highway. Because of this, it may be necessary to close the existing facilities (i.e., ramp, parking lot, etc.) or create working and storage sites in very limited backshore areas on the side of tne highway opposite the proposed site. The later alternative may create traffic problems along the highway.

8. Borings. Because of the characteristic of Kahana Bay, no borings were deemed warranted at this time. However, in order to design for the toe of the breakwater, the determination of hard bottom depth was necessary. In order to accomplish this, jet probings were performed under contract to Sea Engineering. The results are as follows:

Station Number	Depth (feet)
1	boulders
2	2.5
3	2.5
4	2.0
5	2.0
6	2.0
7	1.5
8	4.0
9	2.0-6.0
10	2.0
11	1.5
12	3.0
13	3.0
14	3.0
15	3.0
16	rock
17	rock
18	4.0
19	5.0
20	3.0
21	2.0
22	2.0
23	3.0
24	3.5
25	4.0
26	3.0
26A	4.0
27	2.5
27A	3.0
28	3.0
29	1.0
29A	1.0-1.5
30	0-5.0

Locations of these borings by station number are shown on Plate C-1.

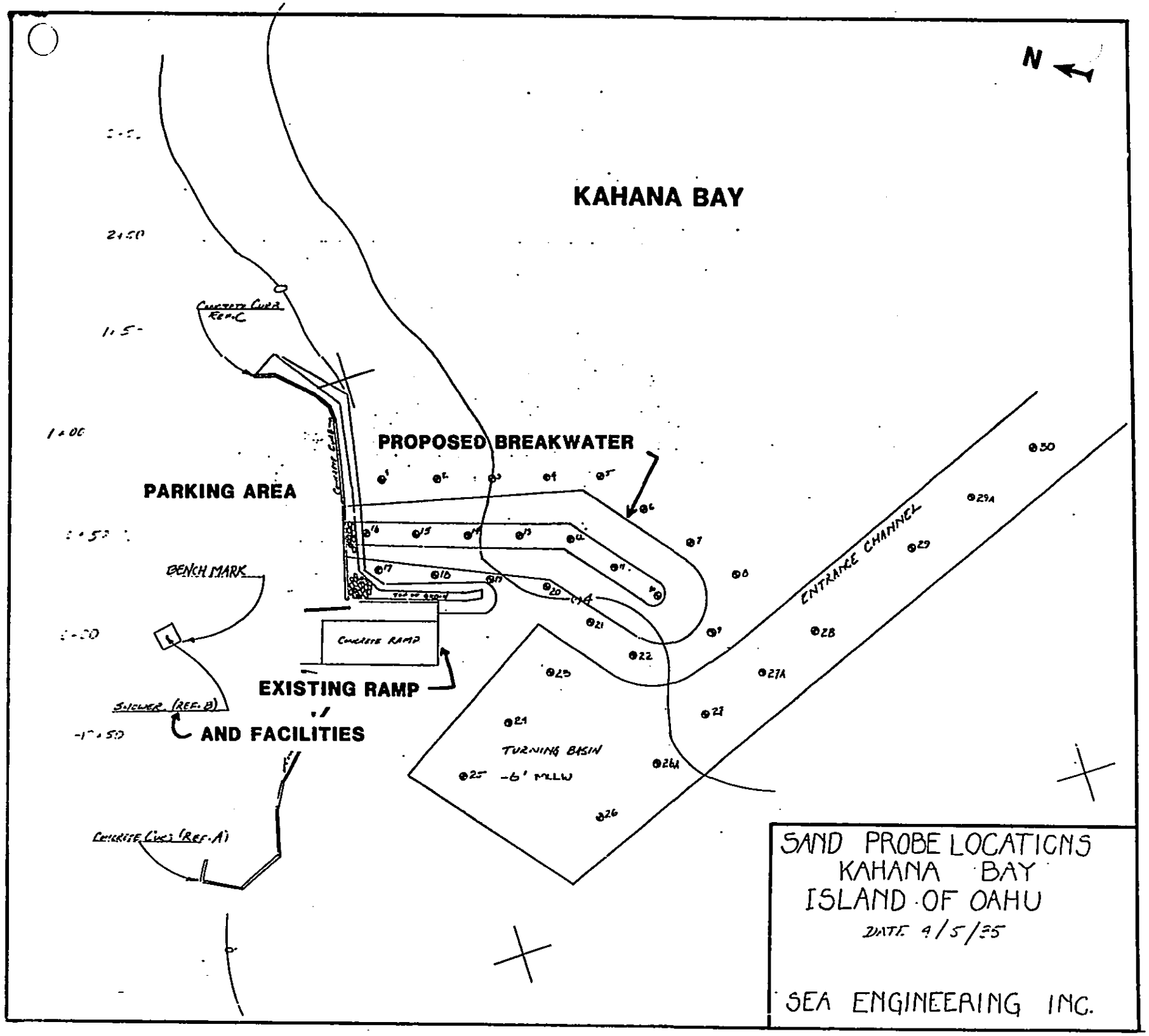
N
KAHANA BAY
PROPOSED BREAKWATER
PARKING AREA
BENCH MARK
CONCRETE RAMP
EXISTING RAMP
AND FACILITIES
SEWER (REF. B)
CONCRETE CURB (REF. A)
CONCRETE CURB REF. C
ENTRANCE CHANNEL
TURNING BASIN
-6' MLLW
SAND PROBE LOCATIONS
KAHANA BAY
ISLAND OF OAHU
DATE 9/5/75
SEA ENGINEERING INC.

PLATE C-1

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

ENGINEERING AND COST ESTIMATES

APPENDIX D

APPENDIX D
KAHANA BAY NAVIGATION IMPROVEMENTS

ENGINEERING DESIGN AND COST ESTIMATES APPENDIX

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	D. TSUNAMI	D-2
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APPENDIX D

1. GENERAL

The analysis for possible small craft facilities at Kahana Bay is presented herein. The site was initially selected based on public accessibility, oceanographic conditions, historical use factors (for small craft) and land availability.

There are no long term wave records other than presented in the SSMO[1/] which generally provide visual observations of deep ocean wave characteristics. A wave side buoy was installed in 1981 on the east coast of Oahu which generally provides trade wind generated wave data which is presented in Paragraph E, Waves. Design guidelines presented in the Shore Protection Manual were used except as noted. Field site analysis, aerial photographs and available bathymetric and topographic information were used for analytical purposes.

2. BASIS FOR DESIGN

A. SITE LOCATION

Kahana Bay is located on the northeast coast of Oahu, between Kahuku and Kaneohe at about 21°33' north latitude and 157°51' west longitude. See Figure 1 in the Main Report.

B. TIDES

There is no tide gauge at Kahana Bay. However, a tidal bench mark at Waikane, about 7 miles southeast of Kahana Bay, which was established in May 1933 was considered applicable to the study area. The bench mark was removed in 1963. Tidal data taken from this location based on 7 months of records are as follows:

TABLE D-1. TIDAL DATA

Level	Gauge Height in Feet[2/]
Highest Tide (estimated)	3.50
Mean Higher High Water	2.20
Mean High Water	1.80
Mean Low Water	0.40
Mean Lower Low Water	0.00
Lowest Tide (estimated)	-1.00

C. WINDS AND STORMS

The prevailing winds in the Hawaiian Islands are the northeasterly trade winds, which occur approximately 90-95 percent of the time during the summer

1/ SSMO - Summary of Synoptic Meteorological Observation.
2/ All elevations in the report are referenced to mean lower low water (MLLW) Datum.

months of May through October, and 55-65 percent of the time from November through April, with speeds of 10-20 miles per hour (mph). Storm conditions generally result from a breakdown of the trade wind circulation through the islands, and are relatively infrequent.

Three classes of disturbances produce major storms in Hawaii: cold fronts, low-pressure passages, and true tropical storms or hurricanes. Cold fronts, which occur during the winter, cause spotty rainfall and gusty winds. The low-pressure passage brings heavy rain, sometimes with strong winds. The low-pressure storm type known as the "Kona" storm usually occurs during the winter months, and is associated with strong and persistent southerly winds and intense rainfall on the south and western side of the island. Hurricanes classified as storms with wind speeds greater than 64 mph, are infrequent, but, in historic times, nine have passed within 200 miles of the island of Oahu. The latest occurred in November 1982 when Hurricane Iwa passed over the island of Kauai. All were of tropical storm intensity at their closest point of approach to Hawaii except Hurricane Nina (December 1957), Dot (August 1959), and Iwa (November 1982) which remained at hurricane strength until they had passed through the island chain.

D. TSUNAMI

During the past 36 years, 36 tsunamis have been recorded in Hawaii. Twenty-seven have affected the island of Oahu and four caused severe damages throughout the State (1946, 1952, 1957, 1960). Tsunami wave heights recorded near or in Kahana Bay[3/] are as follows:

1946	1.2 - 5.1 meters
1952	1.8 - 2.4 meters
1957	2.4 - 3.9 meters
1960	2.1 - 2.4 meters
1964	1.1 meters

E. WAVES

Waves at Kahana Bay originate from various areas in the Pacific. Offshore waves approaching the bay from the north to north-northeast and east-northeast break on the fringing reef, reform, and travel to the beaches. Waves approaching from the northeast enter the channels without breaking on the reefs to the north and south. The waves diverge as they proceed shoreward in the channel and break on the beach or seaward of the beach depending on the wave height and period. The most damaging waves are those generated by storms in the North Pacific.

a. Northeast trade waves, which are generated by the prevailing trade winds, are present throughout the year and are most intense from April to November, having heights ranging from 4 to 12 feet.

b. North Pacific swells are generated by storms in the Aleutian area and by mid-latitude lows, having heights of 8 to 14 feet, approaching from the northwest, north, or northeast. Some of the largest waves reaching the Hawaiian Islands are of this type.

3/ US Dept of Commerce, Coast and Geodetic Survey, Catalog of Tsunamis in the Hawaiian Islands, May 1969.

Wave data recorded off Makapuu Point on Oahu will be applied in this instance because no wave gaging instrument exist in the Kahana Bay area. Makapuu Point is located 23 miles southeast of Kahana Bay. The data were analyzed and tabulated by the Ocean Engineering Research Group at the Scripps Institution of Oceanography. Table D-2 shows the wave climatology for Makapuu Point as a distribution of wave height in percent versus wave period. Data were collected from January 1982 to December 1984. The highest wave recorded was 19 feet with a period of 11 seconds which occurred in 1984. Wave height to percentage of occurrence is shown on Plate D-1.

Table D-2. WAVE CLIMATOLOGY FOR MAKAPUU POINT

Distribution of wave height in percent as a function of wave period
Observation Period: January 1981 to December 1984
Number of Observations: 4,310

Wave Period (SEC)	Wave Heights 0-3	3-6	6-9	9-12	12-16	16+	TOTAL
0-6.9	0.9%	17.5%	4.0%	0%	0%	0%	22.4%
7.0-9.9	0.9	25.3	28.5	4.5	0.8	0	60.0
10.0-12.9	0.1	3.6	3.7	0.7	0.5	0	8.6
13.0-16.9	0	3.8	3.4	1.1	0.1	0	8.3
17.0-19.9	0	0.3	0.3	0	0	0	0.6
20.0+	0	0	0	0	0	0	0.0
TOTAL	1.9%	50.5%	39.9%	6.3%	1.4%	0.0%	100.0%

NOTE: Record obtained with a waverider accelerometer buoy located off Makapuu Point

F. WAVE REFRACTION AND DIFFRACTION ANALYSIS

a. Refraction. Refraction analysis was done for the site to assist in the layout of the plan. Channel alignment was selected based on the generalized wave refraction pattern as shown on Plate D-2.

The refraction analysis indicates that large north to northeast swell waves, especially those approaching from due northeast with 10 second periods, are the critical waves affecting the bay.

b. Diffraction. Wave diffraction analysis was evaluated as shown on Plate D-3. The angle of approach at the entrance channel mouth was assumed to be perpendicular to the breakwater structure and a 10-second wave period was used.

G. WAVE TRANSMISSION

The transmitted wave height shoreward of the breakwater is determined to be minor. Wave steepness and the crest width minimized the wave transmission through the structure. Based on TP 76-8[4/], the transmission coefficient for the trapezoidal - layered breakwater results in a transmission coefficient of

4/ Army Coastal Research Center, Technical Paper No. 76-8, July 1976.

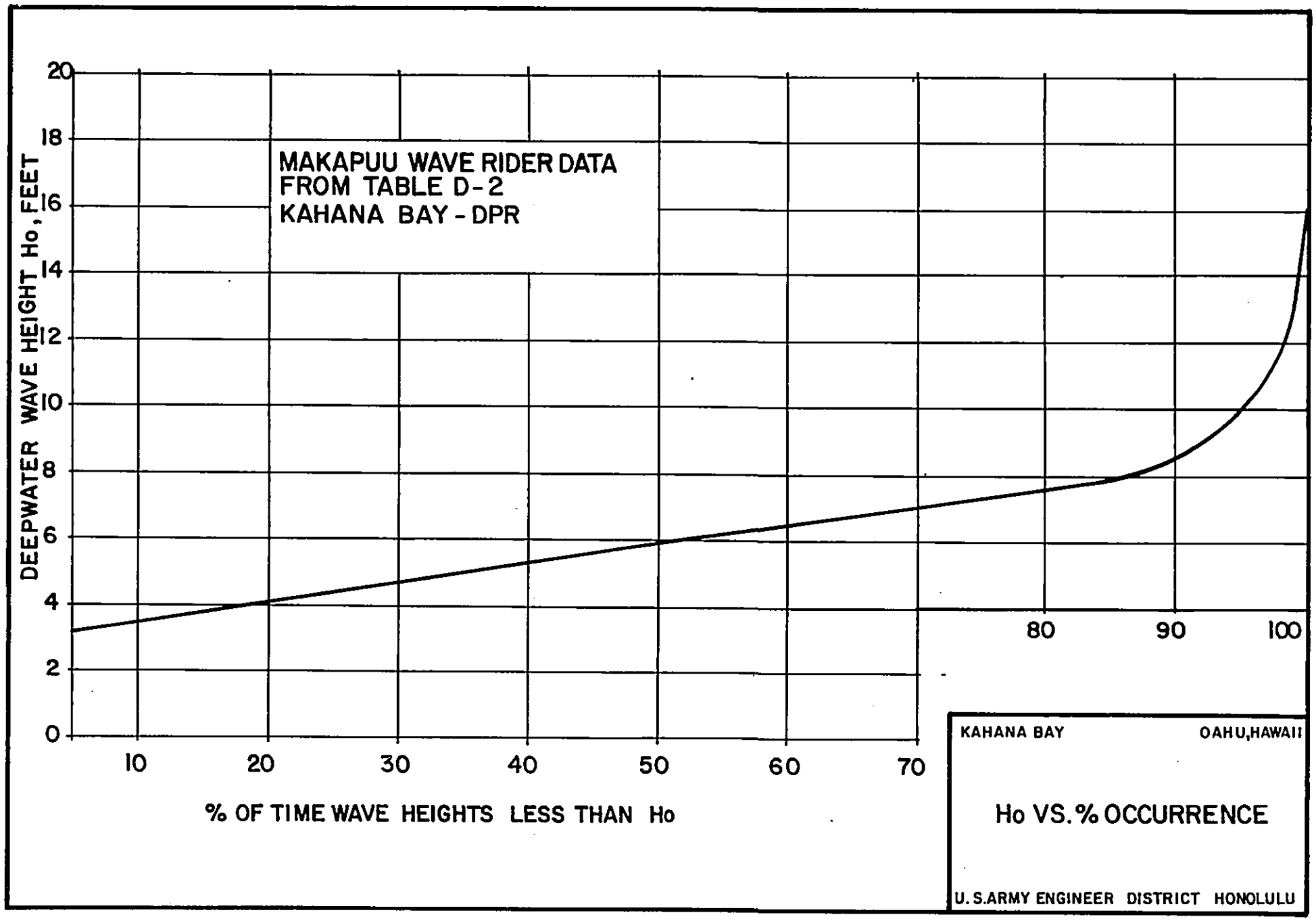


PLATE D-1

PLATE D-1

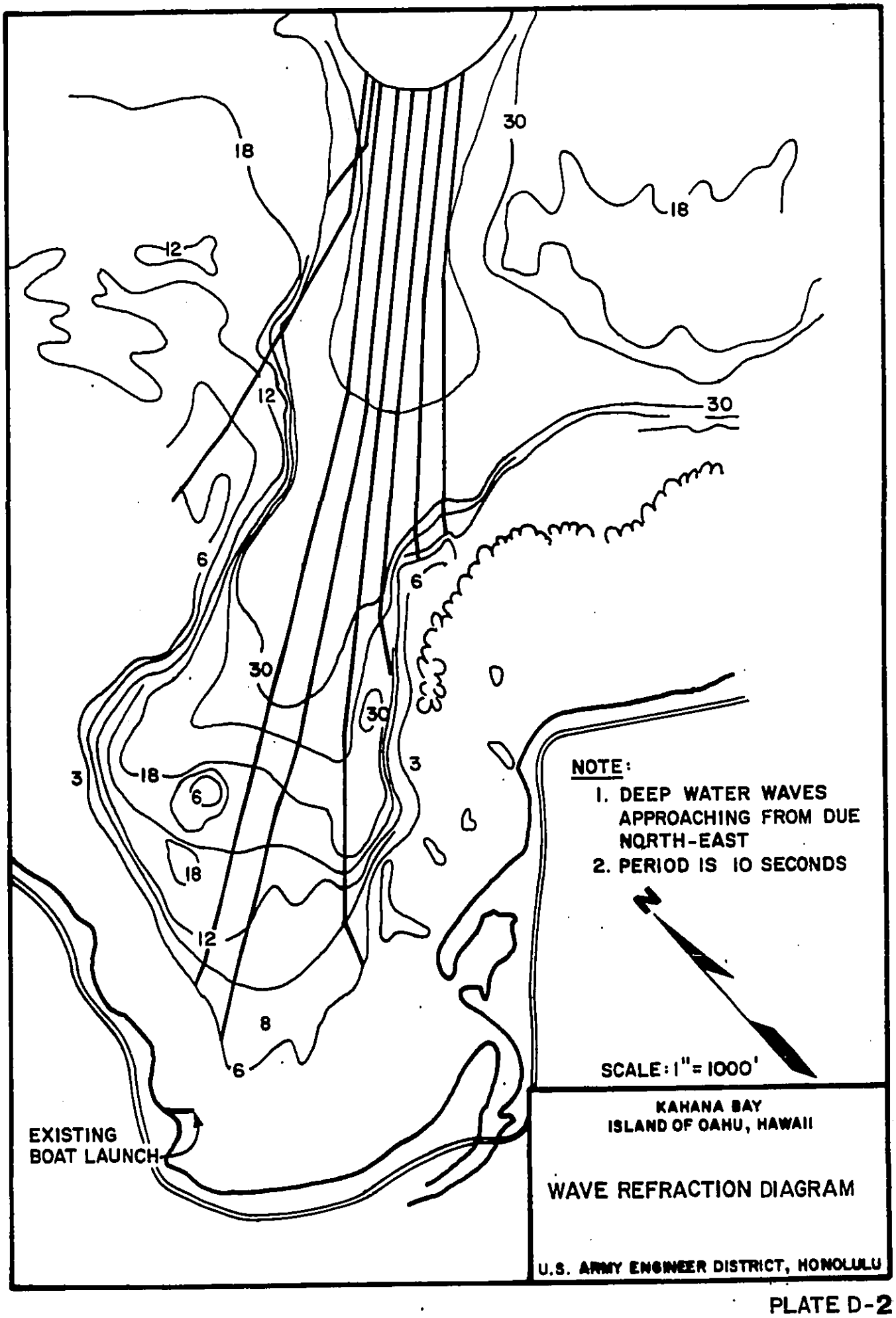

18
12
12
6
30
18
30
6
6
30
30
3
3
18
6
18
12
8
6
EXISTING
BOAT LAUNCH
NOTE:
1. DEEP WATER WAVES APPROACHING FROM DUE NORTH-EAST
2. PERIOD IS 10 SECONDS
N
SCALE: 1" = 1000'
KAHANA BAY
ISLAND OF OAHU, HAWAII
WAVE REFRACTION DIAGRAM
U.S. ARMY ENGINEER DISTRICT, HONOLULU

PLATE D-2

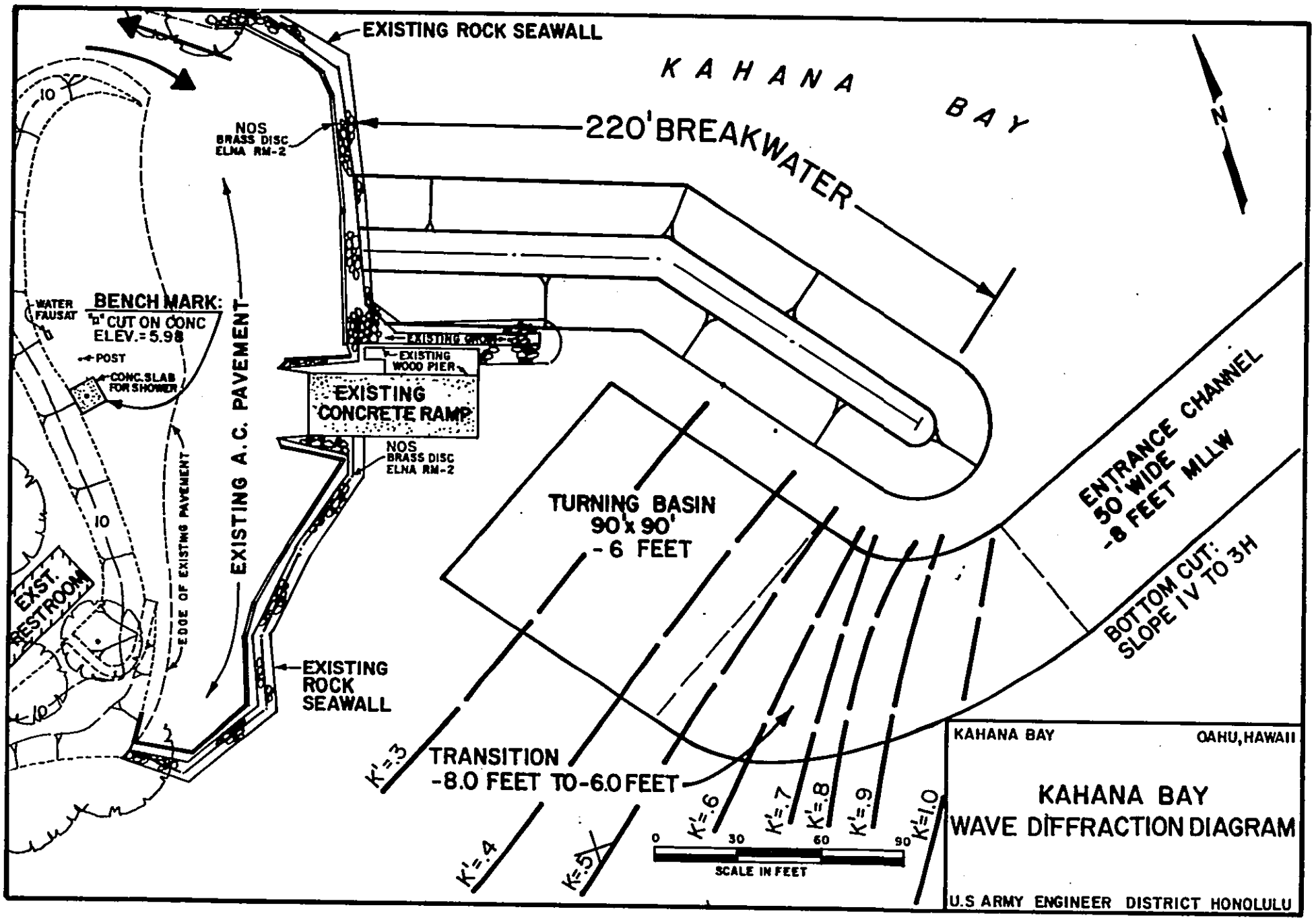


PLATE D-3

PLATE D-3

about 0.2. Based on selection criteria on the breakwater for harbor useability presented hereinafter, the transmitted wave height is less than 1 foot during periods that the ramp would be used. The wave overtopping condition is discussed in paragraph, Level of Useability.

H. DESIGN STILLWATER LEVEL

The design stillwater level (SWL) is defined as the level of water above the elevation datum plane, when no waves are present. The SWL at Kahana Bay is determined to be 4.1 feet. Components of the SWL are astronomical tide level (Sa), atmospheric pressure drop (Sp), storm surge (Ss), and wave setup (Sw). Stillwater level components are calculated as follows:

a. Astronomical Tide (Sa).

The maximum astronomical tide is estimated to be equivalent to the mean higher high water level of 2.2 feet.

b. Atmospheric Pressure Drop (Sp).

The following storm parameters of hurricane FICO, 1978, were used in determining Sp. The water level rise due to the flux in atmospheric pressure is calculated by:

$$SP = 1.14\ (Pn-Po)\ (1-e^{-R/r})$$ EQ. 3-85, SPM[5/]

Pn = Normal sea level atmospheric pressure = 29.92 in. Hg
Po = Central pressure of storm = 28.20 In. Hg
R = Radius of maximum winds = 25 Nautical Miles
r = Radial distance from the storm center to the computation point = 100 Nautical Miles.

The resulting water level rise is calculated to be 0.4 feet.

c. Storm Surge (Ss).

The water level rise due to storm surge is calculated by:

Storm Surge = Ss, which is the incremental rise in water level due to wind stress perpendicular to the bottom contour.

$$Ss = \frac{540K\ Ur^2\ X}{\bar{d}}$$ TR-4, 1-64[6/]

K = 3.0×10^{-6}
U_r = 90 Knots
X = Incremental distance over which U_r acts in Nautical Miles = 10 N.M.

$\bar{d}$ = Average water depth over X in feet = 2,700 feet

5/ Army Coastal Research Center, Shore Protection Manual, 3d Edition,1977.
6/ Army Coastal Research Center, Technical Report No. 4, 3d Edition, 1966.

Storm Surge in the study area is 0.5 feet.

d. Wave Setup (Sw).

The water level rise due to wave setup is calculated by:

$$S_w = 0.15\ (d_b) - \frac{g^{1/2}(Ho')^2\ T}{64 \quad (d_b)^{3/2}}$$

d_b = Depth of water at breaking wave = 8 ft.
g = Gravitational acceleration = 32.2 Ft/Sec.^{2}
Ho' = Deepwater wave height equivalent to shallow water wave if unaffected by refraction and friction = 4.2 ft.
T = Wave period = 10 sec.
Sw = 1.0 ft.

e. Design Stillwater level:

SWL = 2.2 + 0.4 + 0.5 + 1.0 = 4.1 feet

I. DESIGN WATER DEPTH

The design water depth (ds) at the proposed structure is based on the following equation:

ds = d + SWL

Where: ds = Design Water Depth
d = Depth at toe of structure = 4.5 feet
SWL = Design Stillwater Level = 4.1 feet
ds = 8.6 feet

Hard coral bottom is determined to exist at (-)6 feet MLLW. Because the depth of scour also exist at (-)6 feet MLLW, it is recommended that the soft material be removed and the toe of the structure be placed on hard bottom at the elevation of (-)6 feet. The depth at toe of structure of (-)4.5 feet will be used to determine the design wave height due to the consistency of this depth in the surrounding area.

J. DESIGN WAVE HEIGHT

Due to the bathymetry at the nearshore sites, the breakwater design is based on depth-controlled breaking wave criteria which determines the maximum wave height to which the structure might be subjected. The design wave height is based on depth at the structure toe (ds), wave period (t), and the slope (m) seaward of structure.

The design wave hieght, Hb, for the breakwater was computed on depth at the structure toe of 4.5 feet, ds of 8.6 feet, 10-second wave period and slope of M = 0.0025. From SPM, Figure 7-4:

$$\frac{Hb}{ds} = 0.80$$

Hb = Design Wave Height = 8.6 feet x 0.80
= 6.9 feet

K. BREAKWATER DESIGN

The armor stone and the secondary stone sizes for the breakwater head and trunk sections were computed as shown in Table D-3 with a 50% size increase in stone size for conditions with overtopping of the structure.

$$W = \frac{Wr\ Hb^3}{Kd\ (Sr-1)^3\ \cot\theta}$$

Where W = Armor Stone Weight
Wr = Unit Weight of Armor Stone
Hb = Design Wave Height
Kd = Stability Coefficient
Sr = Specific gravity of armor units related to seawater
Cotθ = Cotangent of angle of structure side slope

Rough angular quarry stone is used for all structures. The stone size for the secondary layer is given by the formula:

$$W_2 = W/10 \text{ to } W/15$$

Where W_2 = Secondary Layer Stone Size

Table D-3. STONE SIZE FOR ARMOR LAYER AND SECONDARY LAYER

STONE SIZE		NO OVERTOPPING	OVERTOPPING
Overtop Coef	=	NA	1.5
Wr	=	156 lb/ft^3	156 lb/ft^3
Hb (Head)	=	6.9 ft	6.9 ft
(Trunk)	=	6.9 ft	6.9 ft
Kd (Head)	=	1.9	1.9
(Trunk)	=	2.0	2.0
Sr	=	2.44	2.44
Cot θ	=	1.5	1.5
W (Head)	=	6000 lbs	9000 lbs
(Trunk)	=	5700 lbs	8600 lbs
Range (Head)	=	2-4 Ton Stone	3-5 Ton Stone
(Trunk)	=	2-4 Ton Stone	3-5 Ton Stone
W2	=	300-800 lbs	400-1000 lbs

L. LAYER THICKNESS

The following equation was used to calculate the layer thickness:

$$t = nk\ (W/Wr)^{1/3}$$

Where t = Layer Thickness
n = Number of Layers

K = Layer coefficient (k = 1.0 for Quarry Stone)
W = Weight of Stone Unit
Wr = Unit Weight of Stone Unit (Wr = 156 lbs/ft^3 stone)

Layer thicknesses are tabulated in Table D-4.

Table D-4. LAYER THICKNESS FOR ARMOR STONE

	NO OVERTOPPING	OVERTOPPING
N =	2	2
K =	1.0	1.0
W =	6000 lbs	8000 lbs
Wr =	156 lb/ft^3	156 lb/ft^3
t =	6.8 ft	7.4 ft

M. CREST WIDTH

A crest width of 15 feet was used for the breakwater to allow adequate access for construction and maintenance equipment.

N. CREST ELEVATION

According to CETA 80-7, the equation for estimating runup on rough slope breakwaters is given by Ahrens and McCartney, "Wave Period Effect on the Stability of Riprap," ASCE, 1975. This equation is as follows:

$$\frac{R}{H} = \frac{aZ}{1+bZ}$$

Where R = Wave runup
H = Incident design wave height = 6.9 ft
a = Empirical Coefficient (a = 0.692 for rough stone)
b = Empirical Coefficient (b = 0.504 for rough stone)

Z = Surf parameter
= tan $\theta/(H/L_0)1/2$
Where θ = Angle of seaward face of breakwater = $(\tan^{-1})(1/1.5)$
H = Incident wave height = 6.9 ft
L_o = Deepwater wavelength = $5.12(T)^2$
T = Wave period = 10 seconds

$$\frac{R}{H} = 1.02$$

Crest Elevation (CE) = $\frac{R}{(H)}$ (H) + SWL
= (1.02)(6.9) + 4.1
= 11.0 ft for Non-Overtopping Condition

O. LEVEL OF USEABILITY

To better determine the National Economic Development (NED) plan, an array of alternatives were created based on the level of useability of the small craft facility. The procedure used to determine the level of useability is as follows:

Crest elevations are assumed as in Table D-5. To allow for overtopping conditions the mean high water level of +1.8 ft is used in place of SWL in the crest elevation equation.

$$CE = R + SWL$$
$$CE = R + MHW$$

Knowing R, solve simultaneously for the shallow water wave height (H) by rearranging Ahren's equation for calculation wave runup.

$$\frac{R}{H} = \frac{aZ}{1+bz}$$

$$\frac{R}{H} = z\left(a-b\frac{R}{H}\right)$$

Knowing the shallow water wave height (H), solve for the corresponding deep water wave height (Ho) using the refraction equation.

Deepwater Wave Height:

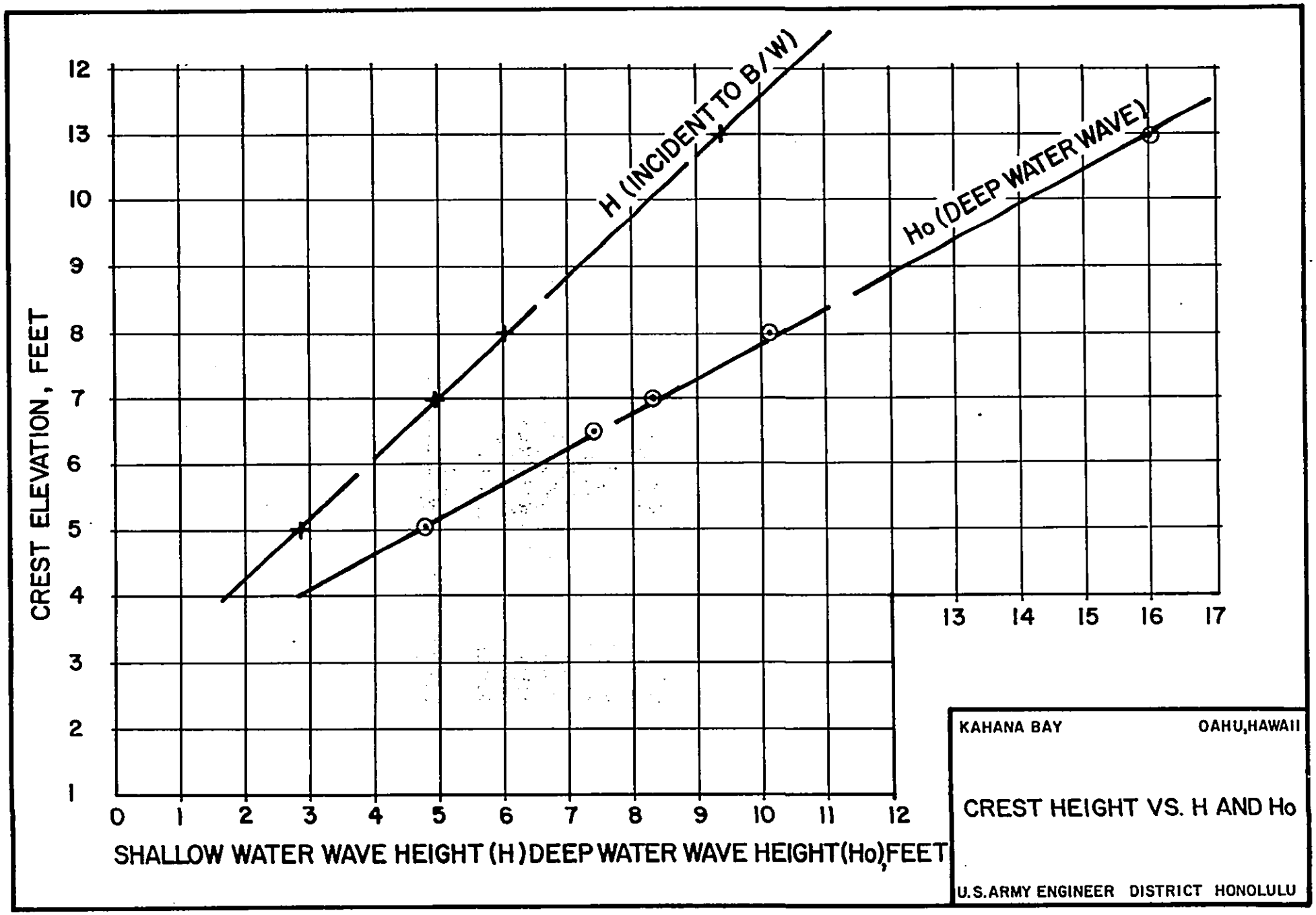
$$\frac{\text{Shallow Water Wave Height}}{\frac{\text{Distance Between Orthogonals in Deep Water (Od)}}{\text{Distance Between Orthogonals in Shallow Water (Os)}}}$$

The analysis for crest height vs. Ho (deepwater wave height) is shown on Plate D-4.

The level of useability is expressed as a percentage of time related to the wave climate shown on Plate D-1. Since, under normal boating use situations for the Kahana area, the harbor improvements would be used primarily when sea conditions are less than 6-7 feet, a selection of 7 feet deepwater wave (Ho) is assumed as the controlling conditions under which boating would take place at the Kahana facility. Using this criteria and referencing Plate D-1, the facility would be useable approximately 70 percent of the time.

Table D-5. LEVEL OF USEABILITY

	Alternative 1 (No Overtop)	Alternative 2 (3-Ft Overtop)	Alternative2 (4.5-Ft Overtop)	Alternative 4 (6-Ft Overtop)
CE	11.0 ft	8.0 ft	6.5 ft	5.0 ft
MHW	1.8 ft	1.8 ft	1.8 ft	1.8 ft
R	9.2 ft	6.2 ft	4.7 ft	3.2 ft
H	9.4 ft	6.0 ft	4.4 ft	2.85 ft
O_d	140 ft	140 ft	140 ft	140 ft
O_s	400 ft	400 ft	400 ft	400 ft
H_o	16.0 ft	10.1 ft	7.4 ft	4.8 ft
% USEABILITY	100.0%	94.6%	71.0%	32.2%



KAHANA BAY OAHU, HAWAII

CREST HEIGHT VS. H AND Ho

U.S. ARMY ENGINEER DISTRICT HONOLULU

PLATE D-4

PLATE D-4

P. ENTRANCE CHANNEL DESIGN

The entrance channel and turning basin are designed to accommodate vessels up to a length of 25 feet, a beam of 7 feet and a draft of 3 feet. This criteria represents the dimensions of a typical vessel anticipated to use these sites. The entrance channel width and depth were computed as follows:

Minimum width (based on two-way traffic).

Width = 2A + 2B + C

Where A = Maneuvering Land (2x Beam)
B = Bank Clearance Lane (1.0 x Beam)
C = Ship Clearance Lane (1.0 x Beam)

Width = 2 (2x7) + 2 (1.0x7) + (1.0x7)
= 50 ft Bottom width

The equation used to determine the minimum channel width is taken from Criteria for Depths of Dredged Navigational Channels (Marine Board Commission on Engineering and Technical Systems National Research Council, 1983). Because this reference is designed for deep draft vessels, the equation has been modified to reflect the superior maneuverability of small craft vessels.

Minimum depth is based on an acceptable wave height of 6.9 feet within the entrance channel at Kahana Bay.

Depth = Draft + Wave Allowance + Bottom Clearance + Squat
= 3.0 + 2.3 + 2.0 + 0.5
= 7.8 feet; use 8.0 feet

Q. TURNING BASIN DESIGN

The minimum dimensions for the turning basin were computed as follows:

Length and Width = 3 x Design Vessel length + Bank Clearance
= 3 x 25 + (2 x Beam Width)
= 89 Feet; Use 90 Feet

Minimum depth is based on an incident wave of 6.9 feet diffracting around the breakwater.

Depth = Draft + Wave Allowance + Bottom Clearance
= 3 + 1 + 2
= 6.0 Feet

The alternative designs, as described in the main report may be found as Plates D-5 through D-12.

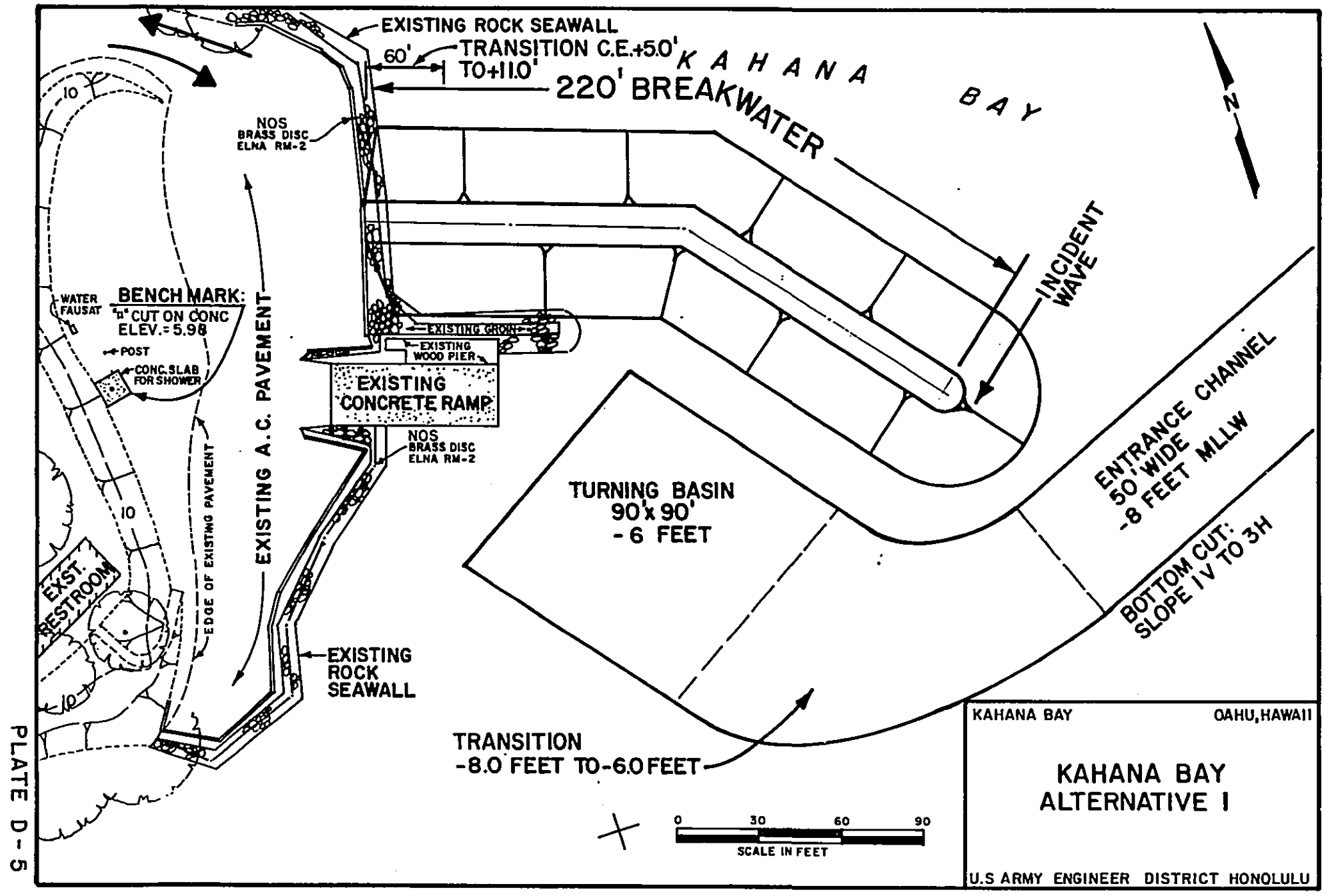
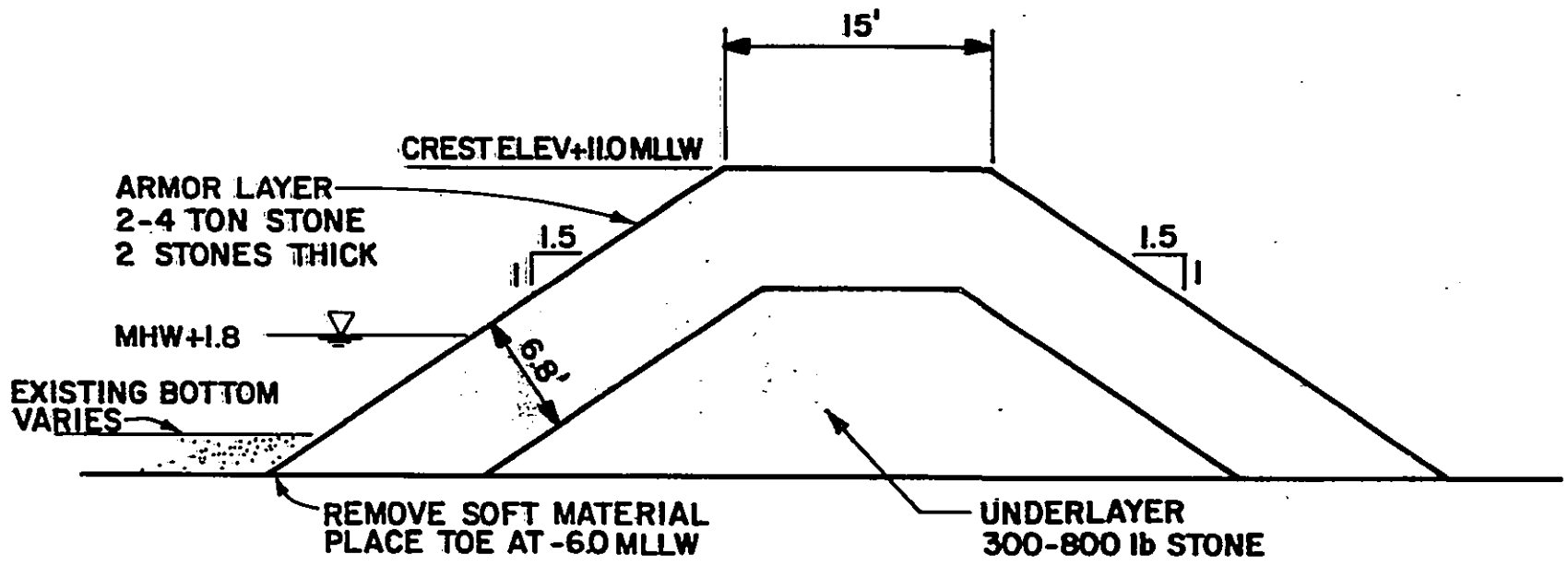


PLATE D-5

PLATE D-5



TYPICAL BREAKWATER SECTION

SCALE: 1" = 10'-0"

KAHANA BAY OAHU, HAWAII

KAHANA BAY
TYPICAL SECTION
ALTERNATIVE I

U.S. ARMY ENGINEER DISTRICT HONOLULU

PLATE D-6

PLATE D-6

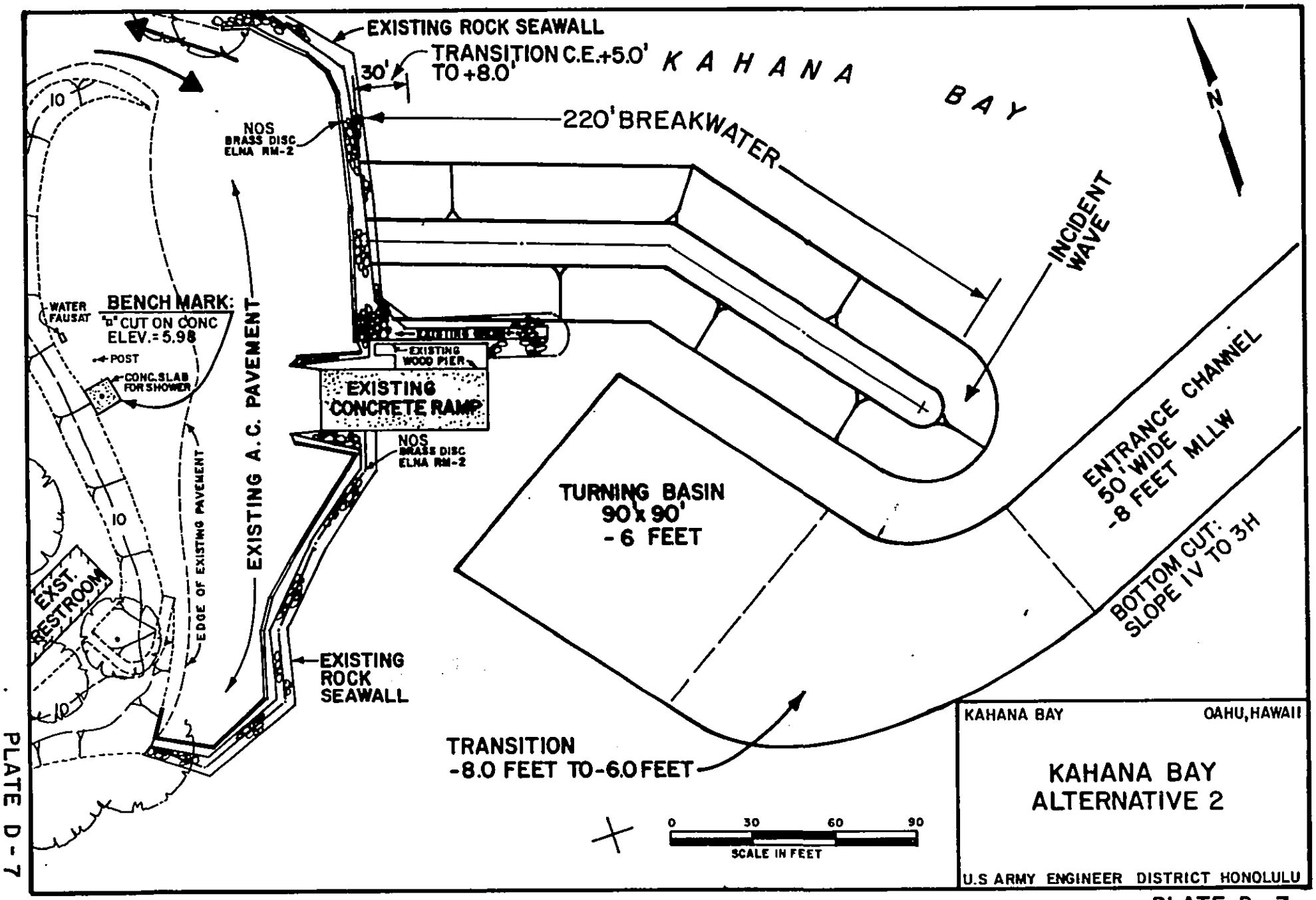
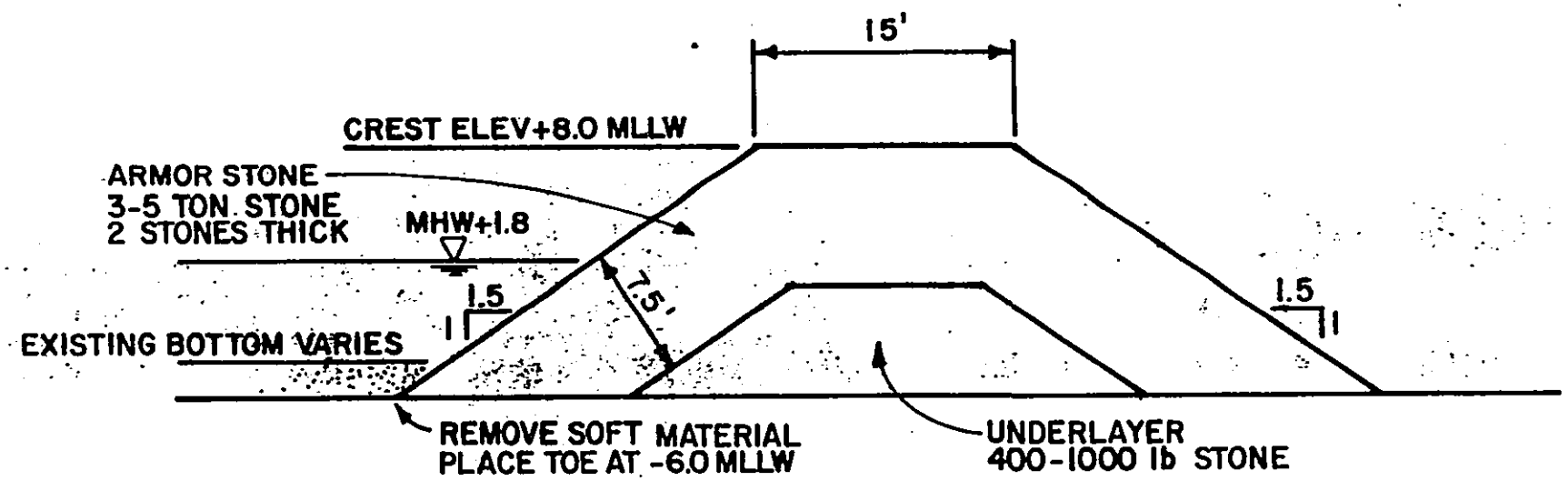

EXISTING ROCK SEAWALL
TRANSITION C.E.+5.0' TO +8.0'
30'
K A H A N A
B A Y
220' BREAKWATER
INCIDENT WAVE
N
NOS BRASS DISC ELNA RM-2
WATER FAUSAT
BENCH MARK: "B" CUT ON CONC ELEV.= 5.98
POST
CONC. SLAB FOR SHOWER
EXISTING WOOD PIER
EXISTING CONCRETE RAMP
NOS BRASS DISC ELNA RM-2
EXISTING A.C. PAVEMENT
EDGE OF EXISTING PAVEMENT
EXST. RESTROOM
EXISTING ROCK SEAWALL
TURNING BASIN 90' x 90' - 6 FEET
ENTRANCE CHANNEL 50' WIDE -8 FEET MLLW
BOTTOM CUT: SLOPE IV TO 3H
TRANSITION -8.0 FEET TO -6.0 FEET
10
0 30 60 90
SCALE IN FEET
KAHANA BAY
OAHU, HAWAII
KAHANA BAY ALTERNATIVE 2
U.S ARMY ENGINEER DISTRICT HONOLULU
PLATE D-7

PLATE D-7



TYPICAL BREAKWATER SECTION

SCALE: 1"= 10' - 0"

KAHANA BAY OAHU, HAWAII

KAHANA BAY
TYPICAL SECTION
ALTERNATIVE 2

U.S.ARMY ENGINEER DISTRICT HONOLULU

PLATE D-8

PLATE D-8

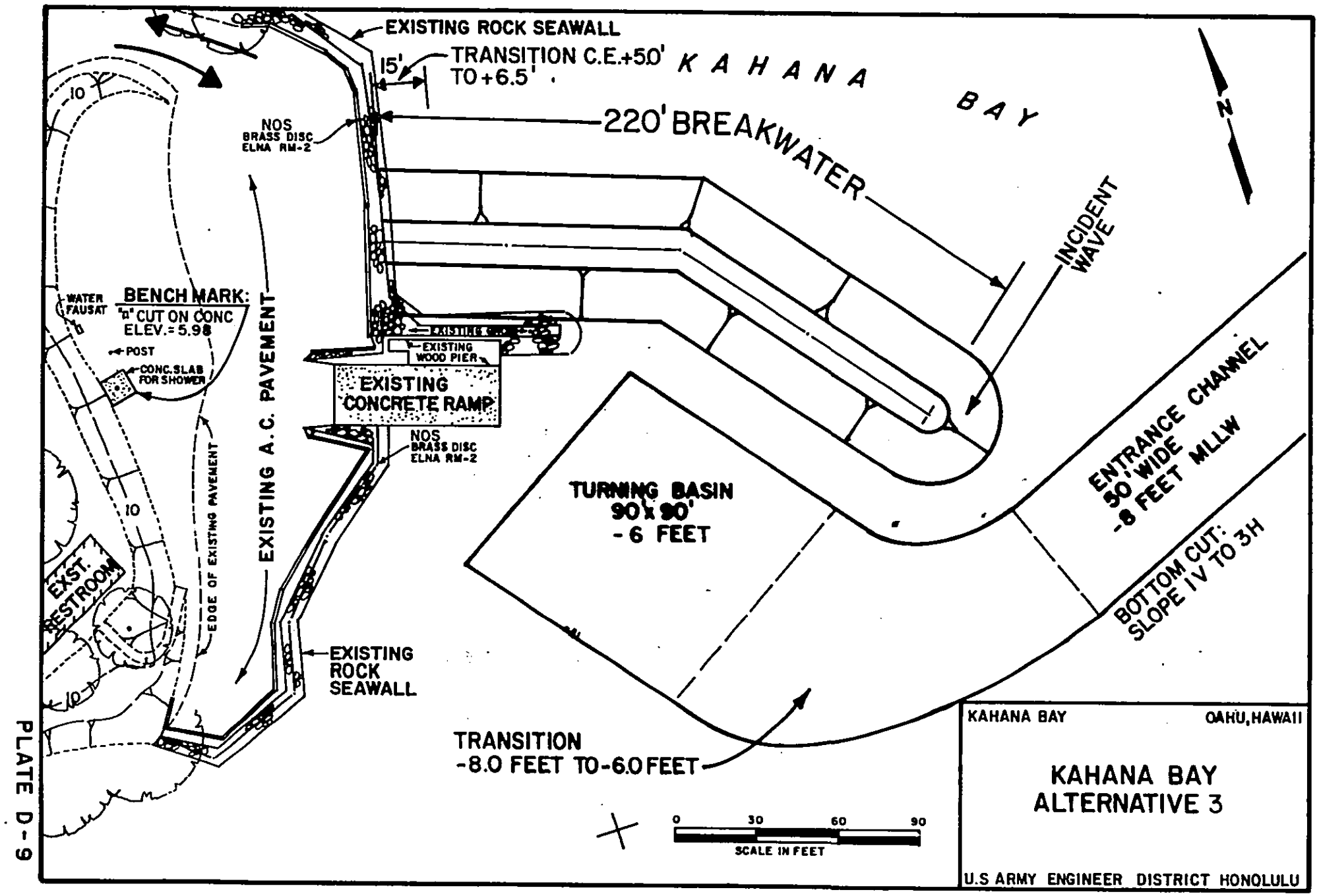
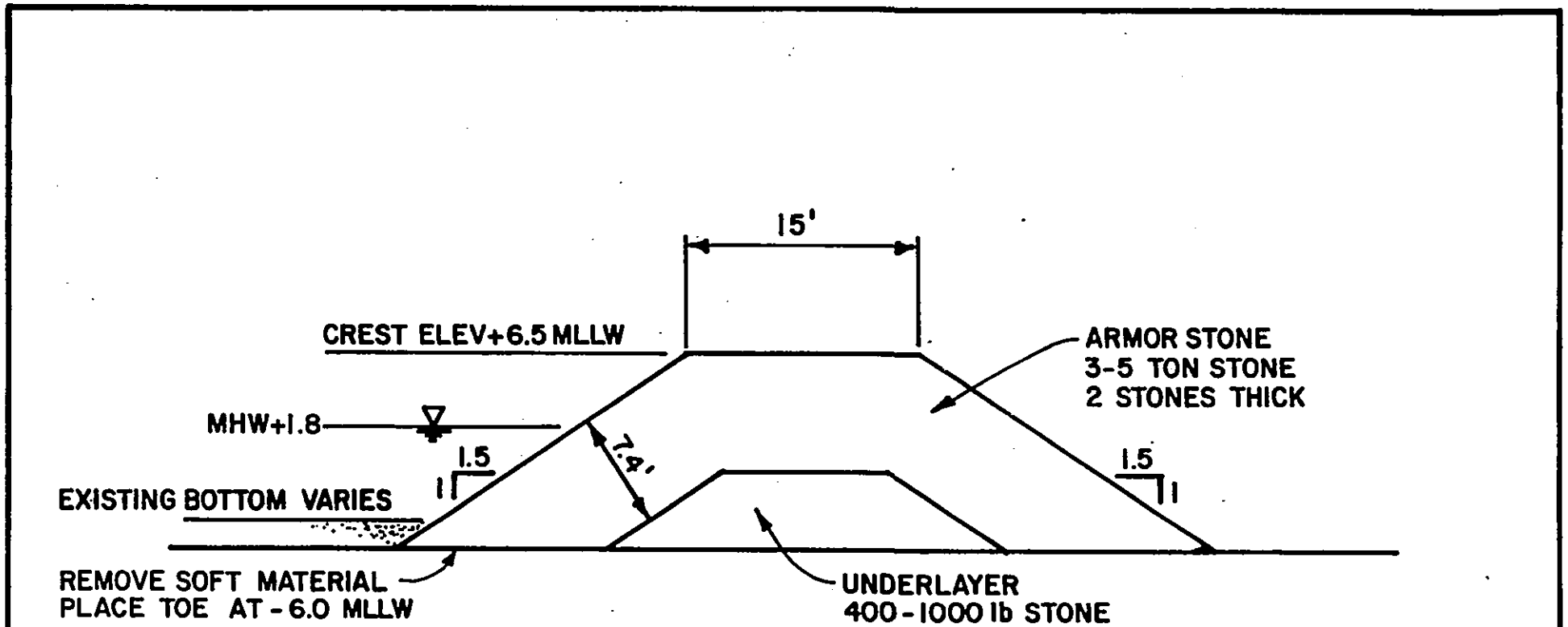

EXISTING ROCK SEAWALL
15'
TRANSITION C.E.+5.0' TO +6.5'
K A H A N A B A Y
220' BREAKWATER
INCIDENT WAVE
N
NOS BRASS DISC ELNA RM-2
BENCH MARK: "B" CUT ON CONC ELEV.= 5.98
WATER FAUSAT
POST
CONC. SLAB FOR SHOWER
EXISTING WOOD PIER
EXISTING CONCRETE RAMP
NOS BRASS DISC ELNA RM-2
EXISTING A.C. PAVEMENT
EDGE OF EXISTING PAVEMENT
EXST. RESTROOM
EXISTING ROCK SEAWALL
TURNING BASIN 90' x 90' - 6 FEET
ENTRANCE CHANNEL 50' WIDE -8 FEET MLLW
BOTTOM CUT: SLOPE 1V TO 3H
TRANSITION -8.0 FEET TO -6.0 FEET
0 30 60 90
SCALE IN FEET
PLATE D-9
KAHANA BAY OAHU, HAWAII
KAHANA BAY ALTERNATIVE 3
U.S ARMY ENGINEER DISTRICT HONOLULU

PLATE D - 9



TYPICAL BREAKWATER SECTION

SCALE: 1'= 10'- 0"

KAHANA BAY OAHU, HAWAII

KAHANA BAY
TYPICAL SECTION
ALTERNATIVE 3

U.S.ARMY ENGINEER DISTRICT HONOLULU

PLATE D-10

PLATE D-10

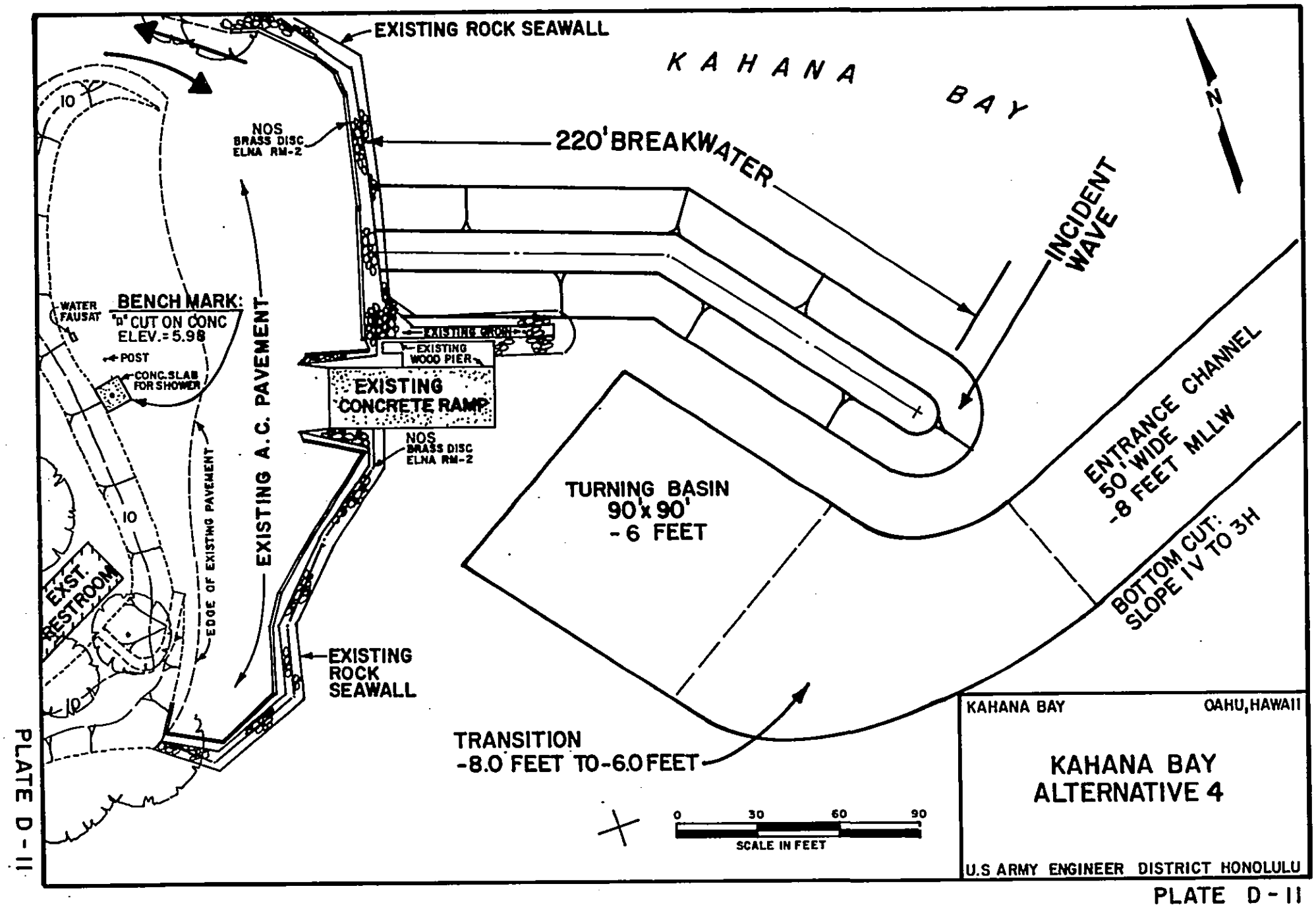
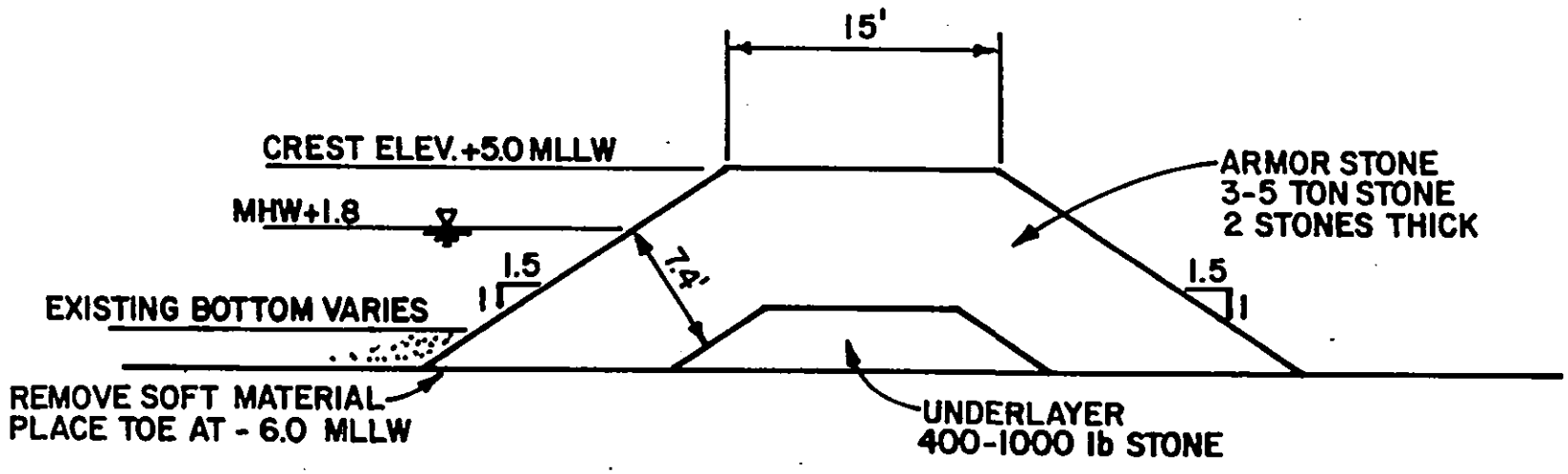

EXISTING ROCK SEAWALL
KAHANA BAY
220' BREAKWATER
INCIDENT WAVE
N
NOS BRASS DISC ELNA RM-2
BENCH MARK: "D" CUT ON CONC ELEV.= 5.98
WATER FAUSAT
POST
CONC. SLAB FOR SHOWER
EXISTING WOOD PIER
EXISTING CONCRETE RAMP
NOS BRASS DISC ELNA RM-2
EXISTING A.C. PAVEMENT
EDGE OF EXISTING PAVEMENT
EXST. RESTROOM
EXISTING ROCK SEAWALL
TURNING BASIN 90'x 90' -6 FEET
ENTRANCE CHANNEL 50' WIDE -8 FEET MLLW
BOTTOM CUT: SLOPE 1V TO 3H
TRANSITION -8.0 FEET TO -6.0 FEET
0 30 60 90
SCALE IN FEET
KAHANA BAY
OAHU, HAWAII
KAHANA BAY ALTERNATIVE 4
U.S ARMY ENGINEER DISTRICT HONOLULU
PLATE D-II

PLATE D - II



TYPICAL BREAKWATER SECTION

SCALE: 1'= 10'- 0"

KAHANA BAY OAHU,HAWAII

KAHANA BAY
TYPICAL SECTION
ALTERNATIVE 4

U.S.ARMY ENGINEER DISTRICT HONOLULU

PLATE D-12

PLATE D-12

3. BASIS FOR ESTIMATE

a. Estimated Quantities were based on existing topographic and hydrographic maps and surveys and typical plans and sections.

b. Materials to be dredged and excavated are coral reef rock and unconsolidated sands. Blasting will not be required.

c. The disposal site will be designated within five (5) miles from the existing Kahana Bay Launch Ramp.

d. Armor stones and underlayer stones will be obtained from Ameron's Kapaa Quarry.

e. The estimated construction period is eight (8) months.

f. October 1985 price levels.

g. A 25% contingency cost allowance.

h. A 1-foot overdepth allowance for dredging of the entrance channel and turning basin.

4. PROJECT FIRST COST

A. KAHANA BAY - ALTERNATIVE 1

Item	Quantity	Unit Cost ($)	Subtotal Cost ($)	Total Cost ($)
Federal				
Mob & Demob	LS	-	$ 30,000	
Dredge & Disposal	8,600 CY	30	258,000	
Breakwater				
Exc. & Disposal	1,300 CY	11	14,300	
Armor - 2 to 4 Ton	5,800 T	46	266,800	
Core - 300 to 800#	3,900 T	37	144,300	
Contingency (25%)			713,400 178,400	
TOTAL DIRECT FEDERAL CONSTRUCTION COST				$ 891,800
Plans & Specifications			$ 30,000	
Engineering during Construction (6. %)			54,000	
Supervision & Administration			60,000	
TOTAL ENGINEERING & DESIGN COST 1/				144,000
TOTAL COE FIRST COST				$1,035,800
Non-Federal				
Shoreside Facilities			$ 55,000	
Contingency (25%)			14,000	
TOTAL NON-FEDERAL FIRST COST				$ 69,000
U.S. COAST GUARD AIDS TO NAVIGATION				5,000
TOTAL PROJECT FIRST COST				$1,109,800

1/ Excludes pre-authorization study costs.

B. KAHANA BAY - ALTERNATIVE 2

Item	Quantity	Unit Cost ($)	Subtotal Cost ($)	Total Cost ($)
Federal				
Mob & Demob	LS	-	$ 30,000	
Dredge & Disposal	8,600 CY	30	258,000	
Breakwater				
Exc. & Disposal	1,300 CY	11	14,300	
Armor - 3 to 5 Ton	5,200 T	46	239,200	
Core - 400 to 1000#	2,000 T	37	74,000	
			615,500	
Contingency (25%)			154,000	
TOTAL DIRECT FEDERAL CONSTRUCTION COST				$769,500
Plans & Specifications			$ 30,000	
Engineering during Construction			46,000	
Supervision & Administration			54,000	
TOTAL ENGINEERING & DESIGN COST[1/]				130,000
TOTAL COE FIRST COST				$899,500
Non-Federal				
Shoreside Facilities			$ 55,000	
Contingency (25%)			14,000	
TOTAL NON-FEDERAL FIRST COST				$ 69,000
U.S. COAST GUARD AIDS TO NAVIGATION				5,000
TOTAL PROJECT FIRST COST				$973,500

1/ Excludes pre-authorization study costs.

C. KAHANA BAY - ALTERNATIVE 3

Item	Quantity	Unit Cost ($)	Subtotal Cost ($)	Total Cost ($)
Federal				
Mob & Demob	LS	-	$ 30,000	
Dredge & Disposal	8,600 CY	30	258,000	
Breakwater				
Exc. & Disposal	1,100 CY	11	12,100	
Armor - 3 to 5 Ton	4,600 T	46	211,600	
Core - 400 to 1000#	1,500 T	37	55,500	
			567,200	
Contingency (25%)			142,000	
TOTAL DIRECT FEDERAL CONSTRUCTION COST				$709,200
Plans & Specifications			$ 30,000	
Engineering during Construction			43,000	
Supervision & Administration			51,000	
TOTAL ENGINEERING & DESIGN COST[1/]				124,000
TOTAL COE FIRST COST				$833,200
Non-Federal				
Shoreside Facilities		$ 55,000		
Contingency (25%)		14,000		
TOTAL NON-FEDERAL FIRST COST				$ 69,000
U.S. COAST GUARD AIDS TO NAVIGATION				5,000
TOTAL PROJECT FIRST COST				$907,200

1/ Excludes pre-authorization study costs.

D. KAHANA BAY - ALTERNATIVE 4

Item	Quantity	Unit Cost ($)	Subtotal Cost ($)	Total Cost ($)
Federal				
Mob & Demob	LS	-	$ 30,000	
Dredge & Disposal	8,600 CY	30	258,000	
Breakwater				
Exc. & Disposal	1,100 CY	11	12,100	
Armor - 3 to 5 Ton	4,000 T	46	184,000	
Core - 400 to 1000#	900 T	37	33,300	
			517,400	
Contingency (25%)			129,000	
TOTAL DIRECT FEDERAL CONSTRUCTION COST				$646,400
Plans & Specifications			$ 30,000	
Engineering during Construction			39,000	
Supervision & Administration			48,000	
TOTAL ENGINEERING & DESIGN COST[1/]				117,000
TOTAL COE FIRST COST				$763,000
Non-Federal				
Shoreside Facilities			$ 55,000	
Contingency (25%)			14,000	
TOTAL NON-FEDERAL FIRST COST				$ 69,000
U.S. COAST GUARD AIDS TO NAVIGATION				5,000
TOTAL PROJECT FIRST COST				$837,000

1/ Excludes pre-authorization study costs.

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

ECONOMIC ANALYSIS

APPENDIX E

APPENDIX E

ECONOMIC ANALYSIS

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APPENDIX E

ECONOMIC ANALYSIS

GENERAL

Small craft navigational improvements at Kahana Bay Launching Facility will contribute to national economic development (NED) by improving the quality of the experience and by increasing the usage of the existing site. The NED benefits arising from use of the improved launching facility are measured in terms of willingness to pay (WTP) for each increment of supply which is provided by the project. The WTP includes use fees actually paid (though none exist currently nor are proposed at Kahana Bay) plus any unpaid value (consumer surplus) enjoyed by consumers. If competitive markets existed for the goods and services produced by water resources investments such as proposed at the Kahana Bay Launching Facility, individuals would reveal their willingness to pay through the market demand curve. The market demand curve for improvements at Kahana Bay could then be used to measure the welfare gain to the nation (i.e., benefits). Conceptually, a small craft launching facility has a demand curve analagous to that of a marketed good even though the "goods and services" are provided without charging a price. This demand curve, which reflects users' willingness to pay for improvements at Kahana Bay, is estimated using contingent valuation techniques. Additionally, an estimated demand curve and hence benefits have also been derived for non-users, whose willingness to pay for project improvements is based on the idea that they may want to use it at some time in the future (option value) or because they benefit from simply knowing that the site exists (existence value).

The contingent value method (CVM) is a self-estimate approach used to estimate the value of non-market goods (e.g., recreational experience). The CVM allows the simulation of a market for non-market goods by creating a hypothetical market and asking a portion of the population of interest, how much they would be willing to pay so that the goods and services would be provided. The method is based on collective sampled responses to a questionnaire or a personal interview. The CVM assumes that individuals know the value to themselves and that the goods and services that would be created can be described in the hypothetical market so that respondents react to the survey in the same way as they would to a real market for those goods and services. The CVM for the Kahana Bay analysis is based on a mail survey questionnaire (see Exhibits E1 and E2).

EVALUATION BASIS

Traditionally, water resource alternative plans for improvements are evaluated using a with-project versus without-project basis. Benefits associated with a particular plan are typically measured as the difference in the value which would be expected if no plan was implemented and the value which is estimated assuming the particular plan is put in place. A unique advantage in using contingent valuation techniques for measuring the economic

value associated with proposed water resources alternatives is that the benefits associated with the changes produced with a particular alternative can be elicited directly. In other words, after the conditions of the without-project and the conditions of the with-project have been fully described, survey respondents can be asked their willingness to pay for the proposed changes in project conditions.

This eliminates the need to determine the without-project value and with-project value separately.

Use value benefits for boat owners and existence or option value benefits for boat owners and non-boaters alike are calculated using CVM. Use value benefits for passengers of launched craft could not be measured using CVM (because of the absence of a mailing list identifying this unique population of users); therefore, the unit day value (UDV) method is used to measure the benefits associated with use value for passengers. For this category of benefit, a with-project versus without-project approach is used.

Estimated project NED costs (Appendix D) include first construction cost, contingency, associated costs, cost of lands and annual operation and maintenanace cost. Both costs and benefits estimated in fixed October 1985 prices are expressed in an average annual equivalent basis using the current FY85 water resources discount rate of 8-3/8 percent. The project base year, which is the year the project is expected to be operational, is 1990. The economic life of the project is estimated to be 50 years.

EVALUATION METHODOLOGY USING CVM

The expected increase in non-commercial boating activities at Kahana Bay, as a result of harbor facility improvements, was evaluated using the CVM. Non-commercial boating activities include recreational boating and subsistence fishing. The CVM consists of designing and using a simulated market to identify the value of non-commercial harbor uses just as actual markets would if they existed. Estimates of changes in NED value (benefits) can be ascertained by sampling the population of interest and asking individuals about their willingness to pay (WTP) for changes in the quantity of their use of facilities at a particular site. Their answers can then be used to simulate a demand curve from which claimable benefits can be estimated.

SURVEY ADMINISTRATION

A survey was conducted on Oahu during the spring of 1985. The survey consisted of mail questionnaires to three populations of interest: (1) boat owners who reside in the immediate vicinity of the project area (namely, Kaneohe and Kaaawa); (2) boat owners residing on Oahu outside of Kaneohe and Kaaawa and (3) non-boat owners on Oahu (excluding the Waianae and Ewa Districts).

The total population of boaters was stratified into two populations of interest, as differences in the variation of WTP and in response rates were believed to exist between boaters who reside near the Kahana project site and

boaters from other areas on Oahu. Boat owners residing near the project site (Stratum 1) were defined as those State-registered boat owners from the Kaneohe and Kaaawa areas having zip codes of 96744 and 96730. This population of interest comprised a total of 1,721 boat owners, leaving the number of Oahu boat owners residing outside of the project site vicinity (Stratum 2) of 9,560. Names and mailing addresses of Oahu boat owners were obtained from current boat registration rosters (1983) from the State of Hawaii Harbors Division.

City and County of Honolulu voter registration lists served as a proxy for the non-boat owning population of interest. Those voters who resided in the Ewa and Waianae Districts were excluded from the population, as it was believed that the distance form the Kahana site might inhibit their concern for improvements to boating facilities in the northeastern area of Oahu. This population of interest comprised a total of 233,365 non-boaters who voted in the 1984 State General Election.

An initial determination of minimum sample size (see Table E-1) was estimated using the following equation:

$$n_o = t^2 * v^2/r^2$$

Where: n_o = minimum required sample size.

r = target tolerated limits of error between sampled average WTP and actual average WTP of the population.

t = tolerated risk of estimate.

v = coefficient of variation of WTP estimates (ratio of standard deviation to the mean of the distribution).

The following assumptions were made:

a. To accept an error in the sample mean of ± 20 percent of the true population mean WTP (i.e., $r = 0.20$).

b. To accept a 1 in 20 chance that the assumption in (a) is wrong (i.e., $t = 1.96$).

c. That the $v = 1$.

Thus: $n_o = 1.96^2 * (1)^2/(.20)^2$

$= 96$

The finite population correction (fpc) factor is employed for samples greater than 5 percent of the population.

TABLE E-1. MINIMUM REQUIRED SAMPLE SIZE

For t = 1.96 (tolerated risk = .05)

r	V = 0.5	V = 1	V = 1.5	V = 2
.01	9,604	38,416	86,436	153,664
.05	384	1,537	3,457	6,147
.10	96	384	864	1,537
.15	43	171	384	863
.20	24	96	216	384
.25	15	61	138	246
.30	11	43	96	171
.35	8	31	71	125
.40	6	24	54	96

Since 96 is a significant fraction of the boat owning population of Kaneohe and Kaaawa, the following equation was used for the Stratum 1 boater population:

$$fpc = N/(N + n_o - 1)$$

This yields the following minimum required size for the Stratum 1 boater sample:

$$n = 96 * [1,721/(1,721 + 96 - 1)]$$

$$= 91$$

Investigation of previous contingent valuation mail survey experience (Molokai Boating Survey, January 1985) revealed a surprisingly high response rate of 73 percent (169/232). Ninety-nine of the 169 completed surveys had valid $0 value of greater WTP bids. Therefore, 43 percent of the Molokai boaters provided valid responses. Because there is a greater number of existing alternative sites on Oahu than on Molokai, it was assumed that the response to the Oahu survey on Kahana Launching Facility improvements would not be as high as Molokai. Therefore, response rates of 30 percent for the two boat owning populations and 20 percent for non-boat owning populations were assumed for determining the number of mail questionnaires sent out.

Based on these response rate assumptions, it was necessary to increase the Stratum 1 boater sample size to 91/.30 or 303. The fpc factor was not applied to the Stratum 2 boater and non-boater samples. With an assumed response rate of 30 percent for the Stratum 2 boater and 20 percent for non-boaters, the total number of mail questionnaires sent out for each respective population was 320 (96/.30) and 480 (96/.20).

SURVEY DESIGN

Two different surveys were designed: one for boat owners and the other for non-boat owners. Survey recipients were allowed 3 weeks from the mailing date to answer the questionnaire. Otherwise, a second mailing consisting of a follow-up letter and a duplicate survey were sent to non-respondents, allowing an additional 3-week response period. A free report on State small craft facilities was offered as an inducement to survey respondents, in an effort to increase the response rate. Non-boat owners who received boating surveys were instructed to return the questionnaire uncompleted, as well as boat owners who received non-boating questionnaires.

A pretesting of the Kahana CV was not conducted as the experience gained from CV surveys for Merizo and Molokai was used in design considerations for the Kahana questionnaire. Examination of the effectiveness of these previous CV surveys resulted in changes to the protest bid question, payment vehicle and questionnaire format. The payment vehicle chosen was a monthly user fee for launching to help pay for the improvements to the existing launching facility. Respondents could choose a value from a matrix of prices or write-in an amount.

DETAILED METHODOLOGY

Simulated demand schedules were derived for three populations of interest: Stratum 1 boat owners (currently registered boat owners) who reside in close proximity to the project site (Kaneohe and Kaaawa); Stratum 2 boat owners (all other registered boat owners on Oahu); and non-boat owners, which is comprised of currently registered non-boat owning Oahu voters (excluding Ewa and Walanae Districts).

Population sizes for Stratum 1 boat owners, Stratum 2 boaters and non-boaters are 1,721, 9,560, and 233,365, respectively. The derivation of simulated demand schedules are based on factoring up valid sample responses to WTP questions from the contingent valuation (CV) survey questionnaire. The two boat owning samples provided WTP data for launch ramp use value and existence value and the non-boat owning sample provided WTP data for existence value.

The CV questionnaire described the existing boat launching facility at Kahana Bay and also the proposed changes which the proposed project would provide. The description of existing conditions and proposed changes as presented in the survey questionnaire is as follows:

> The Corps of Engineers and the State of Hawaii are trying to determine the value of improved boating facilities on Oahu. One project under consideration is the improvement of the boat launching ramp at Kahana Bay. It is important for us to know how boaters on Oahu value the proposed improvements to this boat ramp.
> The existing boat launching facility at Kahana Bay is limited to:
>
> - o Single-lane launch ramp
> - o Loading dock
> - o Parking for 6 trailer-cars and an additional 15 cars
> - o Restrooms
> - o Nearby access to picnic and camping areas
> - o Stub breakwater to partly affect wave surge
> - o Access to freshwater
>
> Plans are being made to provide safer boat launching at Kahana Bay. The proposed change includes:
>
> - o Navigational aids (lights or buoys)
> - o An entrance channel and an additional breakwater to provide safe water access for entering and leaving Kahana Bay
> - o A turning basin to provide a safe area for boats to maneuver after launching and before retrieval
> - o An additional parking area
>
> 6. Would you ever want to launch your boat at an improved boat ramp at Kahana Bay as we've described, if no other boating facilities are built or improved on Oahu?
>
> (1) ___ YES (2) ___ NO

The above descriptions are the basis for determining launch use value and existence value to the populations of interest.

LAUNCH USE VALUE

Boat owners were asked their WTP in the form of a monthly user fee to help pay the costs of providing the proposed changes. The question as stated is as follows:

7. If it were necessary to charge a monthly user fee, what is the highest fee you would pay per month to help pay for the construction and maintenance costs of the boat ramp improvements at Kahana Bay? Please circle the value from the list below.

(CIRCLE ONE)

$500	$400	$300	$250	$200
$175	$150	$125	$100	$90
$80	$70	$60	$50	$40
$30	$20	$10	$5	$0

If the amount you would pay per month is not shown on the list above, please write in the amount here. $_____.

A project bid question followed the WTP question to determine the validity of the respondents answer. The protest bid question used for all WTP questions is as follows:

8. Please mark the answer which best describes your reason for answering the above question the way you did.

(1) ___ That is what it is worth to me.

(2) ___ It's worth more to me, but it's all I can afford to pay.

(3) ___ Not enough information is provided.

(4) ___ I did not want to place a dollar value.

(5) ___ I object to the way the question is worded.

(6) ___ Other (Please Specify) _____.

Valid WTP responses used for analysis are those which answered either (1) or (2) on the protest bid question. All others are classified as missing values. Valid WTP per month bids are converted to WTP per year for each respondent based on their response to the question asking how many months per year they would launch at the improved boat ramp at Kahana Bay if a monthly user fee equal to their bid in the WTP question were charged.

The total number of annual launches for each respondent is calculated based on results of the question asking how many days per month they would typically use the improved Kahana Bay boat ramp. The total number of people using the improved facility annually (boat owner and passengers) is determined by the results of the question asking, on the average, how many persons go with the respondent on a boating trip. Each respondent's average number of pasengers, including himself, is multiplied by the number of annual launches produced by that respondent to calculate the total number of annual people-launches. This calculation is used to measure passenger benefits using the unit day value (UDV) method which is detailed in a subsequent section. At various selected annual WTP bids, the sum of the number of respondents willing to pay the stated amount or more is calculated as well as the sum of the corresponding number of annual launches, and annual people-launches. Tables E-2 and E-3 present the expected cumulative annual launch use at the Improved Kahana Bay Launching Facility for Strata 1 and 2 based on each respective sample factored up to represent each respective user population. In the sample for Stratum 1 on Table E-2, there were 63 boat owners who indicated their desire to launch their boats at an improved boat ramp at Kahana Bay, as described, and would be willing to pay $0 per year or greater. At a $0 price, these 63 boat owners would produce 996 launches per year and, including themselves and passengers, there would be 3,990 persons using the facility. At $60.00 per year, 12 of the 63 boat owners would launch at the improved facility for a combined total of 426 annual launches and provide 1,626 people-launches.

Stratum 1 and Stratum 2 samples were factored up to their respective populations by multiplying the ratio of the population size to the total number of valid survey responses by the total number in the sample who would launch at the improved facility with a WTP/year bid equal to or greater than a specific annual price. Estimated population launch use numbers for the strata at an annual price of $0 are calculated as follows:

STRATUM 1

Number Boat Owners	=	1,721/115 X 63 = 943
Number Launches	=	1,721/115 x 996 = 14,904
Number People-Launches	=	1,721/115 x 3,990 = 59,710

STRATUM 2

Number Boat Owners	=	9,560/118 x 68 = 5,509
Number Launches	=	9,560/118 x 1,308 = 111,783
Number People-Launches	=	9,560/118 x 4,942 = 400,422

Stratum 2 was modified by removing an outlier from the sample. As shown on Table E-3, one respondent expressed an annual WTP of $600; 2.4 times higher than the next highest sample annual WTP. This one response factors up to 81 boat owners willing to use the improved Kahana Bay launching facility for $600 per year and generates over 24,000 annual launches. Therefore, this outlier was removed from the sample for subsequent data analysis.

The launch use demand schedules for Stratum 1 and Stratum 2 populations were combined into one demand schedule and is presented in Table E-4. Ninety-five percent confidence intervals around the mean proportions were calculated and used to determine the range of launching demand schedules. Table E-5 provides the estimated combined strata launches along with 95 percent confidence intervals around the mean proportions.

The 95 percent confidence interval around the cumulative mean proportion is calculated using the equations $P \pm 1.96\ [P(1-P)/n]^{0.5}$ where P = cumulative mean proportion, n = sample size (combined strata 1 and 2 sample size is 130). From Table E-4 we observe that, on average, 900 boat owners would launch their boat at the improved Kahana Bay launching facility and be willing to pay at least $100 annually. Table E-5 shows that these 900 boats would produce over 41,000 launches annually. We can be 95 percent certain that there would be no fewer than 518 boat owners and no greater than 1,282 who would want to launch their boats at the improved launching facility and would pay $100 or more annually.

The total value of the use opportunities to boat owners which would be created by the improved Kahana Bay launching facility is calculated by measuring the area under the simulated demand schedule. The area under the curve is calculated by trapezoidal estimation. Table E-6 presents total WTP (area under the curve) for various quantities of use opportunities provided by the improved launching facility for the mean and 95% confidence limits. Table E-6 provides alternative methods of calculating the annual benefits associated with the use constraint for various facility design sizes (number of launch lanes). The maximum annual benefits (shown in the next to last column) are calculated as the total area under the simulated population demand curve up to the quantity supplied. The maximum annual benefit for the mean value for a size constraint of 1 launch lane (8,000 annual launches) is calculated as follows: from table E-5 we can calculate that there are 227 boat owners in the population with an annual WTP of $160.75 or greater which would produce 8,000 launches. The area under the demand curve of all those willing to pay $160.75 per year or greater is $60,096. The annual average benefit (shown in the last column) is calculated as the number of annual launches associated with the number of launch lane constraint multiplied by the average WTP per launch. Average WTP is calculated as the total area under the simulated demand curve excluding $0 WTP bids. The $0 WTP bids were removed from the average calculations based on the assumption that the expected queuing at the new facility (because of the projected excess demand) has a reater than $0 cost. Therefore, $0 WTP bidders would not want to use the facility. These annual average benefits are used for project evaluation. It is estimated that one launch lane can support 8,000 launchings annually. It is evident by Table E-6 that demand for the improved launching facility at Kahana Bay far exceeds current plans under consideration for providing the necessary launch lanes to satiate that demand.

TABLE E-2 STRATUM 1 - CUMULATIVE ANNUAL LAUNCH USE BY PRICE AT IMPROVED KAHANA BAY

	SAMPLE			POPULATION		
WTP/ Year	Number of Boat Owners	Number of Launches	Number of People-Launches	Number of Boat Owners	Number of Launches	Number of People-Launches
0	63	996	3,990	943	14,904	59,710
5	45	814	3,263	673	12,184	48,827
6	44	812	3,257	658	12,154	48,738
10	43	800	3,221	644	11,975	48,199
15	38	784	3,175	569	11,735	47,510
20	33	754	3,016	494	11,286	45,131
25	25	656	2,608	374	9,815	39,031
30	24	631	2,508	359	9,441	37,535
40	19	559	2,262	284	8,364	33,853
41	13	466	1,826	195	6,973	27,324
59	13	466	1,826	195	6,973	27,324
60	12	426	1,626	180	6,374	24,331
90	8	378	1,413	120	5,656	21,143
100	6	318	1,281	90	4,758	19,168
120	4	253	931	60	3,785	13,930
121	3	157	451	45	2,349	6,747
200	3	157	451	45	2,349	6,747
201	2	125	291	30	1,870	4,352
240	2	125	291	30	1,870	4,352
241	1	41	123	15	613	1,838
409	1	41	123	15	613	1,838
410	0	0	0	0	0	0

TABLE E-3. STRATUM 2 - CUMULATIVE ANNUAL LAUNCH USE BY PRICE AT IMPROVED KAHANA BAY

	SAMPLE			POPULATION		
WTP/ Year	Number of Boat Owners	Number of Launches	Number of People-Launches	Number of Boat Owners	Number of Launches	Number of People-Launches
0	68	1,380	4,942	5,509	111,783	400,422
4	53	1,256	4,462	4,294	101,756	361,476
5	52	1,240	4,414	4,213	100,460	357,587
6	49	1,223	4,333	3,970	99,082	351,025
10	47	1,215	4,307	3,808	98,434	348,919
12	39	1,171	4,173	3,160	94,870	338,062
15	38	1,147	4,077	3,079	92,925	330,285
20	31	1,081	3,852	2,512	87,578	312,356
25	29	1,073	3,824	2,349	86,930	309,787
30	27	1,048	3,769	2,187	84,904	305,331
40	23	1,006	3,571	1,863	81,502	289,290
60	21	986	3,487	1,701	79,881	282,485
68	18	893	3,094	1,458	72,347	250,645
80	16	870	2,958	1,296	70,508	239,614
90	15	857	2,931	1,215	69,432	237,461
92	12	764	2,592	972	61,897	209,996
100	11	752	2,556	891	60,925	207,079
101	10	744	2,516	810	60,277	203,839
120	10	744	2,516	810	60,277	203,839
121	4	394	1,266	324	31,921	102,567
160	4	394	1,266	324	31,921	102,567
161	3	362	1,106	243	29,328	89,605

TABLE E-3. STRATUM 2 - CUMULATIVE ANNUAL LAUNCH USE BY PRICE AT IMPROVED KAHANA BAY (CONT)

	SAMPLE			POPULATION		
WTP/ Year	Number of Boat Owners	Number of Launches	Number of People-Launches	Number of Boat Owners	Number of Launches	Number of People-Launches
210	3	362	1,106	243	29,328	89,605
211	2	320	980	162	25,925	79,397
250	2	320	980	162	25,925	79,397
251	2	320	980	162	25,925	79,397
600	1	300	900	81	24,305	72,915
601	0	0	0	0	0	0

TABLE E-4 . ANNUAL LAUNCH USE DEMAND SCHEDULE AT IMPROVED KAHANA BAY LAUNCHING FACILITY COMBINED STRATA 1 AND 2

WTP/ Year	Number of Boats	95% Confidence Interval 1/ Proportion Lower	Mean	Upper	95% Confidence Interval Population Lower	Mean	Upper
410	0	0.000	0.000	0.000	0.0	0.0	0.0
409	15	-0.006	0.002	0.011	(38.1)	15.0	68.1
241	96	-0.006	0.015	0.036	(37.4)	96.0	229.4
240	111	-0.005	0.017	0.040	(32.3)	111.0	254.3
201	192	0.001	0.030	0.060	4.8	192.0	379.2
200	207	0.002	0.032	0.063	12.8	207.0	401.2
161	207	0.002	0.032	0.063	12.8	207.0	401.2
160	288	0.009	0.045	0.081	60.5	288.0	515.5
121	288	0.009	0.045	0.081	60.5	288.0	515.5
120	789	0.067	0.124	0.180	428.2	789.0	1,149.8
100	900	0.081	0.141	0.201	518.5	900.0	1,281.5
90	1,254	0.128	0.197	0.265	818.5	1,254.0	1,689.5
60	1,800	0.205	0.283	0.360	1,306.9	1,800.0	2,293.1
40	2,066	0.244	0.324	0.405	1,553.3	2,066.0	2,578.7
30	2,465	0.303	0.387	0.471	1,931.6	2,465.0	2,998.4
25	2,642	0.330	0.415	0.499	2,102.4	2,642.0	3,181.6
20	2,925	0.373	0.459	0.545	2,379.2	2,925.0	3,470.8
15	3,567	0.475	0.560	0.645	3,023.3	3,567.0	4,110.7
10	4,371	0.606	0.686	0.766	3,862.7	4,371.0	4,879.3
6	4,547	0.636	0.714	0.791	4,051.9	4,547.0	5,042.1
5	4,805	0.680	0.754	0.828	4,333.5	4,805.0	5,276.5
0	6,371	1.000	1.000	1.000	6,371.0	6,371.0	6,371.0

1/ Based on combined sample size of 130
Stratum 1 Sample Size = 63
Stratum 2 Sample Size = 67
(With one outlier in Stratum 2 removed from sample)

TABLE E-5 . ANNUAL LAUNCHES BY ANNUAL WTP AT IMPROVED KAHANA BAY LAUNCHING FACILITY COMBINED STRATA 1 AND 2

WTP/ Year	Number of Boats	Launches	95% Confidence Interval 1/ Proportion Lower	Mean	Upper	95% Confidence Interval Population Lower	Mean	Upper
410	0	0	0.000	0.000	0.000	0.0	0.0	0.0
409	15	613	-0.007	0.006	0.019	(744.8)	613.0	1,970.8
241	96	2,233	-0.003	0.022	0.047	(337.7)	2,233.0	4,803.7
240	111	3,490	0.003	0.034	0.065	296.4	3,490.0	6,683.6
201	192	6,893	0.024	0.067	0.110	2,482.7	6,893.0	11,303.3
200	207	7,372	0.028	0.072	0.116	2,822.5	7,372.0	11,921.5
161	207	7,372	0.028	0.072	0.116	2,822.5	7,372.0	11,921.5
160	288	9,965	0.046	0.097	0.148	4,748.3	9,965.0	15,181.7
121	288	9,965	0.046	0.097	0.148	4,748.3	9,965.0	15,181.7
120	789	39,757	0.305	0.388	0.472	31,179.4	39,757.0	48,334.6
100	900	41,378	0.320	0.404	0.489	32,741.3	41,378.0	50,014.7
90	1,254	50,783	0.410	0.496	0.582	41,983.4	50,783.0	59,582.6
60	1,800	61,950	0.521	0.605	0.689	53,346.6	61,950.0	70,553.4
40	2,066	65,561	0.558	0.640	0.723	57,114.9	65,561.0	74,007.1
30	2,465	70,040	0.604	0.684	0.764	61,858.3	70,040.0	78,221.7
25	2,642	72,440	0.629	0.708	0.786	64,434.0	72,440.0	80,446.0
20	2,925	74,559	0.652	0.728	0.805	66,729.5	74,559.0	82,388.5
15	3,567	80,355	0.714	0.785	0.855	73,122.8	80,355.0	87,587.2
10	4,371	86,104	0.778	0.841	0.904	79,668.3	86,104.0	92,539.7
6	4,547	86,931	0.788	0.849	0.911	80,630.9	86,931.0	93,231.1
5	4,805	88,339	0.804	0.863	0.922	82,284.3	88,339.0	94,393.7
0	6,371	102,382	1.000	1.000	1.000	102,382.0	102,382.0	102,382.0

1/ Based on combined sample size of 130

Table E-6 Total Launch-Use Value
At Improved Kahana Bay Launching Facility
Mean Value and 95% Confidence Intervals

Est. No. of Launch Lanes	Annual Launches	(Mean) No. of Boat Owners	Equilibrium Price (WTP/Yr)	Area Under Curve (Annual Benefits) Maximum 1/	Average 2/
-	102,382	6,371	$ 0	$283,631	$248,524
3	24,000	524	121	98,444	67,519
2	16,000	390	121	82,215	45,013
1	8,000	227	161	60,096	22,506

95% Confidence Intervals

Est. No. of Launch Lanes	Annual Launches	(Lower) No. of Boat Owners	Equilibrium Price (WTP/Yr)	Area Under Curve (Annual Benefits) Maximum 1/	Average 2/
-	102,382	6,371	$ 0	$196,097	$160,954
3	24,000	328	120	42,623	43,728
2	16,000	217	121	29,220	29,152
1	8,000	106	121	15,784	14,576

Est. No. of Launch Lanes	Annual Launches	(Upper) No. of Boat Owners	Equilibrium Price (WTP/Yr)	Area Under Curve (Annual Benefits) Maximum 1/	Average 2/
-	102,382	6,371	$ 0	$378,190	$343,109
3	24,000	684	121	156,986	93,216
2	16,000	531	121	138,495	62,144
1	8,000	290	229	94,644	31,072

1/ Calculated as the area under the simulated population demand curve up to the annual launches constraint.

2/ Calculated as the number of launches multiplied by the average WTP per launch. Average WTP is calculated by using the total area under simulated population demand curve excluding $0 WTP bids and dividing by the total number of launches.

EXISTENCE VALUE.

Boat owners and non-boat owners were asked their WTP in the form of a one time contribution for the improved boating facility at Kahana Bay simply to have it exist. The question used in the CV survey is as follows:

> 4. If the improvements to the Kahana Bay boat ramp site were made, it may be a good thing for the community as well as for boaters who plan to use the ramp. Please circle the value in the list below which is the highest dollar amount that you would contribute <u>one time</u> to a non-profit group to help pay the construction and maintenance costs of the boat ramp improvements to ensure that they would be made even if you never plan to use the boat ramp.

This is to help us determine the value of the facility.

THIS IS <u>NOT</u> A REQUEST FOR CONTRIBUTIONS.

$5000	$4000	$3000	$2500	$2000
$1500	$1000	$750	$500	$400
$300	$200	$150	$125	$100
$75	$50	$40	$30	$25
$20	$15	$10	$5	$0

If the amount that you would give is not shown on the list above, please write in the amount here. $_____.

Valid WTP responses to the existence bid question are ranked from high to low. The sample distribution of respondents willing to pay a stated amount or greater is then cumulated. The sample cumulative mean proportion is calculated as well as 95% confidence intervals around the cumulative mean proportion. Sample mean proportions are used to factor up to the estimated mean population and lower and upper 95% confidence intervals. WTP for the population is calculated by multiplying cumulative proportion values by the number in the total population of interest (boat owners: stratum 1 = 1721, boat owners stratum 2 = 9560, and non-boat owners = 233,365. Tables E-7 through E-9 present the estimated demand schedule of existence values with 95% confidence units for stratum 1 boat owners, stratum 2 boat owners and non-boat owners.

Stratum 1 boat owners and non-boat owners samples each had two respondents who indicated an existence value WTP of $5,000 the highest amount of the selection of bid choices on the survey questionnaire. The next highest bid selected by survey respondents was $1,500 for stratum 1 boat owners and $500 for non-boat owners. The $5,000 outlier bids were removed from each sample on the assumption that the bids reflected a strategic bias on the part of the survey respondents.

The area under these demand schedules are calculated using trapezoidal estimation. Because WTP responses are expressed as a one-time contribution, the total existence value for each population of interest is converted to an annual equivalent by multiplying each respective area under the curve by the capital recovery factor at 8 3/8 percent. Table E-10 presents areas under each population's demand schedule (with outliers removed) and the annual equivalent benefit for the mean population value as well as the 95% confidence intervals around the mean population.

Table E-7 STRATUM 1 BOATER EXISTENCE VALUE DEMAND SCHEDULE FOR PROPOSED IMPROVEMENTS AT KAHANA BAY LAUNCHING FACILITY[1/]

WTP RANGES	WTP DISTRIB	SAMP. CUM. DISTRIB	95% CONFIDENCE INTERVAL PROPORTION LOWER	MEAN	UPPER	95% CONFIDENCE INTERVAL POPULATION LOWER	MEAN	UPPER
1501	0	0	0.000	0.000	0.000	0	0	0
1500	1	1	-0.009	0.009	0.027	(15)[2]	16	46
1000	1	2	-0.007	0.018	0.043	(12)[2]	31	74
500	1	3	-0.003	0.027	0.057	(5)[2]	47	98
200	1	4	0.001	0.036	0.071	2	62	122
100	11	15	0.072	0.135	0.199	123	233	342
50	7	22	0.124	0.198	0.272	213	341	469
40	1	23	0.132	0.207	0.283	227	357	486
30	3	26	0.155	0.234	0.313	268	403	539
25	12	38	0.254	0.342	0.431	437	589	741
20	6	44	0.305	0.396	0.487	526	682	839
15	1	45	0.314	0.405	0.497	541	698	855
10	6	51	0.367	0.459	0.552	631	791	950
5	12	63	0.475	0.568	0.660	818	977	1,135
1	1	64	0.485	0.577	0.668	834	992	1,150
0	47	111	1.000	1.000	1.000	1,721	1,721	1,721

1/ Sample size n=111 and population size N=1,721. 2 $5,000 bids removed from sample as outliers
2/ Zero value is used for data analysis.

Table E-8 STRATUM 2 BOATER EXISTENCE VALUE DEMAND SCHEDULE FOR PROPOSED IMPROVEMENTS AT KAHANA BAY LAUNCHING FACILITY[1]

WTP RANGES	WTP DISTRIB	SAMP. CUM. DISTRIB	95% CONFIDENCE INTERVAL PROPORTION LOWER	MEAN	UPPER	95% CONFIDENCE INTERVAL POPULATION LOWER	MEAN	UPPER
1001	0	0	0.000	0.000	0.000	0	0	0
1000	1	1	-0.009	0.009	0.028	(86)[2]	90	266
500	2	3	-0.003	0.028	0.060	(31)[2]	271	572
200	1	4	0.001	0.038	0.074	14	361	708
100	12	16	0.083	0.151	0.219	791	1,443	2,095
75	1	17	0.091	0.160	0.230	865	1,533	2,201
50	11	28	0.180	0.264	0.348	1,723	2,535	3,328
25	7	35	0.241	0.330	0.420	2,301	3,157	4,012
20	6	41	0.294	0.387	0.480	2,811	3,698	4,584
15	1	42	0.303	0.396	0.489	2,898	3,788	4,678
10	9	51	0.386	0.481	0.576	3,690	4,600	5,509
5	14	65	0.520	0.613	0.706	4,976	5,862	6,749
0	41	106	1.000	1.000	1.000	9,560	9,560	9,560

1/ Sample size n=106 and population size N=9,560.
2/ Zero value is used for data analysis.

TABLE E-9 NON-BOATER EXISTENCE VALUE DEMAND SCHEDULE FOR PROPOSED IMPROVEMENTS AT KAHANA BAY LAUNCHING FACILITY[1/]

WTP RANGES	WTP DISTRIB	SAMP. CUM. DISTRIB	95% CONFIDENCE INTERVAL PROPORTION LOWER	MEAN	UPPER	95% CONFIDENCE INTERVAL POPULATION LOWER	MEAN	UPPER
501	0	0	0.000	0.000	0.000	0	0	0
500	3	3	-0.002	0.014	0.030	(405)	3,271	6,947
400	0	3	-0.002	0.014	0.030	(405)	3,271	6,947
300	1	4	0.001	0.019	0.038	127	4,362	8,597
200	0	4	0.001	0.019	0.038	127	4,362	8,597
150	0	4	0.001	0.019	0.037	127	4,362	8,597
125	0	4	0.001	0.019	0.037	127	4,362	8,597
100	7	11	0.022	0.051	0.081	5,091	11,995	18,900
75	1	12	0.025	0.056	0.087	5,892	13,086	20,279
50	10	22	0.062	0.103	0.143	14,495	23,991	33,487
40	0	22	0.062	0.103	0.143	14,495	23,991	33,487
30	1	23	0.066	0.107	0.149	15,397	25,081	34,765
25	13	36	0.118	0.168	0.218	27,562	39,258	50,954
20	20	56	0.203	0.262	0.321	47,324	61,067	74,811
15	0	56	0.203	0.262	0.321	47,324	61,067	74,811
10	20	76	0.291	0.355	0.419	67,914	82,877	97,840
5	27	103	0.414	0.481	0.548	96,698	112,321	127,943
1	1	104	0.419	0.486	0.553	97,784	113,411	129,038
0	110	214	1.000	1.000	1.000	233,365	233,365	233,365

1/ Sample size n = 214 and population size N = 233,365. 2 $5,000 bids removed from sample as outliers.

2/ Zero value is used for data analysis.

Table E-10 Existence Value Benefits for Proposed Improvements at Kahana Bay

Mean Population	Boat Owners Stratum 1 $	Boat Owners Stratum 2 $	Non-Boat Owners $	Total $
Total Value	106,198[1]	555,607	5,130,213[2]	5,792,018
Annual Benefits	9,057[1]	47,382	437,505[2]	493,944
Lower 95% Confidence				
Total Value	37,682	247,252	2,565,838	2,850,782
Annual Benefit	3,214	21,086	218,815	243,115
Upper 95% Confidence				
Total Value	186,360	897,940	7,755,467	8,839,767
Annual Benefit	15,893	76,576	661,386	753,855

1/ Without outliers removed from sample, total value is $283,280 and annual benefits are $24,158.

2/ Without outliers removed from sample, total value is $21,558,172 and annual benefit is $1,910,021.

PASSENGER BENEFITS

The Oahu contingent valuation survey is used to determine the NED value of the improvements to the launching ramp facilities at Kahana to current and potential owners of watercraft. Additional benefits are also realized by the passengers who accompany boat operators on outings. It is difficult at best to survey this unique sub-population of users. Therefore, benefits associated with this group are estimated using the unit day valuation (UDV) method.

The without project condition at Kahana Bay consists of an inadequately protected, single-lane launch ramp. The existing stub breakwater provides minimal mitigation of wave surge. Absence of navigational aids constrains the recreational opportunities of boat operators and their passengers who must limit their boating activities to daylight hours. Parking currently accommodates only six cars with trailers.

The planned improvements to the Kahana boat ramp will enhance the quality of the recreational experience of accompanying passengers by providing safer conditions for launch/retrieval operations.

Benefits for the recreational value of passengers are based on ER 1105-2-40 dated 9 July 1983 and Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies dated 10 March 1983. The following judgement factors (Table VIII-3-2, Guidelines for Assigning Points for General Recreation) were utilized:

a. Recreation Experience. The point values are 2 without and 8 with the proposed project. Although demand for boating activities is high in this area of Oahu, the existing launching facility is unsafe and gaining access to the ocean is difficult. Current conditions at Kahana limit the recreational experience of both boat owners and accompanying passengers during daylight hours. With the proposed improvements, the users will be able to gain safer access to the water even at night.

b. Availability of Opportunity. With the excess demand for launching/retrieval areas in Northeast Oahu, adequate facilities to conduct boating activities at Kahana Bay will increase the availability of recreational opportunities. Nearest launch ramp is at Heeia Kea about 20 minutes driving time away. The points for this factor are 3 for the without and the with condition.

c. Carrying Capacity. The points for this factor are 1 without and 8 with the project. The existing facilities at Kahana are underutilized due to unsafe launching conditions at the boat ramp and the insufficient parking facilities. According to the Statewide Boat Launching Facilities Master Plan, November 1972, the northeastern area has the highest boat owner density per capita.

The proposed improvements to the existing site would increase the launching/retrieval capability of Kahana into a "fully capable" single-lane ramp facility of approximately 8,000 launchings/retrievals per year.

d. Accessibility. The roads to Kahana provide fair access from either side of the island. Existing on-site access is fair with the project. The roads to the site and on-site access roads will not be improved. Thus, both the without and the with project value for this item is 7.

e. Environmental Quality. The existing facility and environs are picturesque and of high aesthetic quality. The proposed improvement will neither add nor detract from the existing environmental quality condition. Therefore, the with and without point values for this element are both 14.

Point value assignments for the without project and with project conditions are summarized in Table E-11.

TABLE E-11
POINT VALUES FOR GENERAL RECREATION

Criteria	Without Condition	With Condition
Recreation Experience	2	8
Availability of Opportunity	3	3
Carrying Capacity	1	8
Accessibility	7	7
Environmental Quality	14	14
Total Points	27	40

The conversion of points to dollar values equals unit day values of $2.48 and $2.90 for the without and the with project conditions, respectively. The dollar value conversions are based on the current range of approved unit day values for FY 84 as set forth in EC 1105-2-128 dated 24 February 1984. The unsafe launching conditions at Kahana have limited the existing usage to the boat ramp.

Based on information from the 1980 State Boating Survey, the number of launchings at Kahana is estimated at 436 annual launches. The average number of passengers per craft is 2.3 persons according to the Oahu CV survey.

Passenger values for the without project conditions is calculated as follows: 436 (2.3)($2.48) = $2,487. For the with project conditions, the value for existing launches will increase. The single lane of launch ramp will be fully operational at 8,000 annual boat launchings. Using results from the CV study, 8,000 launches correspond with 18,576 accompanying passengers. This yields the following value: 18,576($2.90) = $53,870

Passenger benefits are calculated as the difference between the values of the with and the without project conditions and is equal to $51,383.

SUMMARY OF BENEFITS

NED benefits which are attributed to any proposed plan of improvement at Kahana Bay launch facility have been summarized in Table E-12. Benefits are based on 1 launch lane (8,000 annual launches) and use mean population proportion estimates.

TABLE E-12. SUMMARY OF BENEFITS - KAHANA BAY LAUNCHING FACILITY IMPROVEMENTS.

Category	Annual benefits
Launch Use Value	$ 22,500
Existence Value	
Stratrum 1 Boaters	$ 9,100
Stratrum 2 Boaters	$ 47,400
Non-Boaters	$437,500
Passenger Benefits	$ 51,400
Total Benefits	$567,900

LEVEL OF USEABILITY

The benefits derived thus far are for the condition at the facility of no overtopping (100% useability), as discussed in Appendix D, Engineering Design and Cost Estimates. Benefits vary depending on the level of useability of the designed improvement. Table E-13 shows the decrease in these benefits as a function of the percent useability based upon engineering evaluation. The 3 foot, 4.5 foot and 6 feet overtopping schemes would be useable 94.6%, 71.0% and 32.2% of the time. The benefits are reduced proportionately.

Table E-13. SUMMARY OF BENEFITS WITH USEABILITY CONSTRAINT (Average Annual)

Category	Alt 1 (No Overtopping	Alt 2 (3-feet Overtopping	Alt 3 (4.5-feet overtopping	Alt 4 (6-feet overtopping
Launch Use Value	$ 22,500	$ 21,300	$ 16,000	$ 7,300
Existence VAlue[1/]				
Boat Owners	56,500	53,400	40,100	18,200
Non-Boat Owners	437,500	413,900	310,600	140,900
Passenger Benefits[2/]	51,400	48,500	35,800	14,900
Total Annual Benefits	$567,900	$537,100	$402,500	$181,300

1/ Theoretically, the existence value may or may not remain constant. Responses to the existence WTP value question on the CVM questionnaire are based on a generic description of project features (i.e., breakwater to protect boats from storms) and not on various levels of protection. We assumed that the existence value is proportional to the level of useability in this analysis.

2/ Changes in passenger benefits corresponding to the changes in levels of useability were calculated by taking the difference between the with project value multiplied by the percent useability and the without project value.

BENEFIT AND COST COMPARISON

The following Table E-14 summarizes the average annual costs and benefits for the four alternatives

Table E-14. SUMMARY OF BENEFITS AND COSTS (in $1,000)

	Alt 1	Alt 2	Alt 3	Alt 4
Average Annual Cost	$104,700	$ 92,500	$ 86,400	$ 79,900
Average Annual Benefits	567,900	537,100	402,500	181,300
Benefit-to-Cost Ratio	5.4	5.8	4.7	2.3
Net Benefits	463,200	444,600	316,100	101,400

BENEFIT ALLOCATION

Table E-15 summarizes the allocation of benefits for alternative 1. Sixty one percent of the indicated use of the proposed improved launch ramp will be by recreational boaters per the CV survey. The launch use value, passenger use value and existence value benefits are split to 61% recreation and 39% non-recreation. The split between general and local is 69.5% to 30.5% for alternative 1 (see Table E-15). This split is also the same for alternatives 2, 3 and 4 because the same proportion of recreation to non-recreation use is applied to each benefit category for each alternative.

Table E-15. ALLOCATION OF BENEFITS FOR ALTERNATIVE 1

Benefit Category	Average Annual Benefit Total	General	Local
Launch Use Value[1/]	$ 22,500	$ 15,600	$ 6,900
Existence Value Boat Owners	56,500	39,200	17,300
Existence Value Non-Boat Owners	437,500	304,100	133,400
Passenger Benefits[1/]	51,400	35,600	15,800
Total Average Annual Benefits	$567,900	$394,500	$173,400
Percent Distribution	100%	69.5%	30.5%

1/ Sixtyone percent of launch use value ($13,700) is to recreation craft (split 50/50) and thirtynine percent ($8,800) to non-recreation craft (all general). Passenger Benefits and existence values are split using the same proportion.

CONTINGENT VALUATION SURVEY COMMENTS

Boat owners and non-boat owners were asked if they had any comments regarding either the need for additional recreational facilities or about the questionnaire. These comments are provided below in three groups: Stratum 1 boat owners (Kaaawa and Kaneohe residences), Stratum 2 boat owners (rest of island residences) and non-boat owners. Non-boaters were also asked, "How do you feel about the proposed project at Kahana Bay?" Out of 278 returned questionnaires, 117 favor the project, 131 do not care one way or the other, 16 are against the project and 14 did not answer the question.

KAHANA BOATER COMMENTS STRATUM 1 (KANEOHE AND KAAAWA)

1. Improve Heela Kea Instead!

2. I am an old senior citizen so I won't be able to go to Kahana Bay boat ramp.

3. Kaneohe Bay is great and in its infancy of use. It needs another pier facility facing KMCA boating facility. More people would use it than one, 2/3rds of the way to Laie.

4. Think that it is a waste of time to do this at Kahana. The facilities are adequate for the usage. We would like to see some improvements at Kailua ramp i.e., breakwall in front of ramp and more parking.

5. There is a tremendous need for additional boating facilities. For the one state totally surrounded by ocean, the facilities are minimal! When the Fed. Gov't. and the State won't (or can't) provide... Ridiculous regulations prevent private groups who are willing, from providing. As an example, my Yacht Club (KYC) would like to dredge the silted up inner harbor. No provision for a windward side of Oahu dumping ground has been made, making dredging exceedingly costly. Why can't a windward site dumping ground be established?

6. My answers are influenced by the fact that I sail exclusively in Kailua Bay and off Lanikai. It would be rare for me to go out to Kahana Bay although I have sailed there. I would be very much interested in seeing improvements to the launching ramp and paving for the parking area at Kailua Beach Park adjacent to the ramp. After paving, stalls should be marked to accommodate cars w/trailers to prevent haphazard parking. The ramp should have a dock extension for boarding your motorboat like there is at Heela in Kaneohe Bay.

7. As roads, etc., are maintained with tax dollars, so should improvements and additions to launch areas and other related areas. Public access should be provided to Enchanted Lake via a paid for by user permit fee.

8. I am sure the improved facilities would be welcome and used by many. I happen to have facilities available to me which are closer to home and therefore much more convenient.

9. I don't think this kind of facility should be put in at Kahana Bay. It would have too much impact on the bay. As the facilities at Heela Kea are increased and upgraded they will take care of increased boating for the area. Work on Kahana Bay would be a misuse of taxpayer's money.

10. If anything, I would like to see the facility here in Kaneohe called Heela Kea be improved to include more parking and extend the launching ramps to enable more boaters to launch at one time.

11. In actuality, Kahana is a bit far for me to trailer my boat. I prefer to continue to use Heela pier.

12. Need more facilities. Need more supervision of illegal live-aboard boats anchored in south end Kaneohe Bay. Raw sewage is being released into the bay.

13. Try to keep the upset to the natural setting to a minimum. As a member of the Kaneohe Yacht Club, I personally have no need for the new ramp, but I would like to see it for the many others who don't enjoy the same privileges.

14. Any plans in the future to develop a boat launch ramp at Waimanalo or Makai pier, Makapuu.

15. My husband is deceased. I enjoy going to the reef and do inshore things like little bamboo pole reef fishing, crabbing, octopus catching, and limu (seaweed) picking for food (home consumption) in Kaneohe Bay.

16. Due to the volume of users, I think Heela Kea ramp should have priority for improvement, especially the small ramp. The pier should be extended and another ramp be built adjacent to the existing ramp.

17. Water facilities should be available for all, whether they belong to clubs or not. Good safe facilities are needed.

18. Launching at Kahana is convenient because I live nearby.

19. I mostly use the Lanikai Boat ramp, I'm a member of the Hawaii Hobie Cat Association. Our club races in the waters off Kailua, Kaneohe and Waimanalo Bay at Lanikai. The parking could be enlarged by filling in the drainage ditch with a large pipe to the ocean under the dirt, that way more parking could be used. That drainage ditch takes up a lot of usable space. I feel Kahana Bay boat ramp is mainly used for access to the open ocean. The bay is actually too small to encourage more launching of boats. For sailing it has poor directional trade winds.

20. Recreational boating needs a boost from someone - Kahana Bay ramp or marina, may be a good project.

21. Heela Kea boat facilities should be expanded.

22. I presently launch my boat from Kaneohe Beach Park - this park has great possibilities for a launch ramp and parking. At least some gravel to fill large holes. I am hopeful in this matter.

23. There is an extreme shortage of slips and moorings in Kaneohe Bay. Boats that cannot be trailered (most sailboats over 25') would go there if more room was available.

24. I feel it would alot boaters in the designated area and be very worth while project.

25. More boat slips are badly needed on Oahu and outer islands such as Maui.

26. Improve Heela Kea pier- needs more slips and more launch ramps.

27. Yes, for an island state I feel our boating facilities and state government's interest in boating to be woefully inadequate, both from a pleasure and commercial point of view. Compared to other states, berthing facilities have been reduced or remain "as is" as storms take out available slip space.

28. In general, for a state surrounded by water, Hawaii has just about the poorest boating facilities of all 50 states. Molokai, Kauai, and Hawaii are completely substandard at all boating facilities. Oahu and Maui are just marginal. Maui lacks the number of wet moorage slips that is necessary in this state. Maui needs at least 200 additional slips and the associated facilities. Pump out, fuel and supplies are lacking at all small boat harbor facilities.

29. Yes. I use a private ramp in Alii Shores, but from what I see is that an additional ramp and loading docks are needed at Heela Kea small boat harbor. It is the only public ramp for recreational and fishing use.

30. Kahana dangerous due to wave surge - tradewind, Waianae - also dangerous due to wave surge during south wind conditions.

31. I have converted over to small sail craft as an answer to fuel and upkeep costs. I do most of my diving and fishing from these craft. I don't care to see your proposed facilities promoting the launching of large power craft along this area of the island.

32. Because I pay to belong to the Kaneohe Yacht Club, and also use Heela Kea launching pier on occasion I rarely have a need to use Kahana Bay piers. Except once a year for the Papio tournament.

33. I was born and raised in the Kahana Valley. I feel our privacy has been invaded. The boaters have no respect for the fishermen or swimmers. They fish and crab by night in the bay and river. The weather is rough most of the time, instead of improving and enlarging, they should put more ramps on the windward side i.e., Kaneohe, Kahana, and Wailua.

34. Channel markers into ramps near Hawaii Kai needs improvements. Boat ramp at new harbor at Barbers Point would be well utilized. Improved underwater charts with currents are needed and how currents change during the year.

35. Yes, first of all, who has the final jurisdiction over such a facility? The state or the county? We, the citizens, usually pay one way or another, whether money is appropriated by Gov't or not! Mahalo! A minor majority!

36. Moanalua Bay-Hawaii Kai area looks like a great location for a large marine development the State could surely use.

37. Additional boat ramps should be provided at various locations where feasible, such as Kahuku, Hauula, Waimanalo, Waimea Bay, etc. Boat ramp at Kailua Beach Park should also be improved.

38. Why not improve Heeia Kea launch and parking facilities?

39. I think questionnaires are good if discussions (meetings with interested people) follow. If I'm going to pay for something, I like to express my feeling and ideas. I was disappointed with the additional ramp at Heeia pier. I don't think the engineer who planned it was too akamai.

40. Questionnaire is useful and a good idea. I would like to see the Corps or State clear silt from shoreline. Navigable waterways that have become unusable due to silt carried to them through state and county storm drains. As silt traps they protect Kaneohe Bay, but not if they are full. If cleaned out they would provide additional rec. facilities at low cost.

41. I and many of my fellow boaters would like to see the small ramp (one nearest the state park) at Heeia Kea boat harbor improved! Also, additional trailer parking facility is sorely needed. A possible solution would be to fill in the tidal flat between said ramp and the park.

42. Live on Kaneohe Bay with pier in back yard, no need for other facilities.

43. The Heeia Kea small boat harbor is in terrible condition. There are piles of beer bottles in the water next to the slips, the restrooms are filthy, there are no equipment lockers, no fresh water hose bibs at individual slips, and no way to board your boat unless you build your own steps at your expense. The harbor manager at Heeia Kea is very efficient and the natural beauty of the spot is unsurpassed, but the physical facilities need a lot of work.

44. I feel improving the facilities at Kahana is a great idea. The primary reason I don't use it now is vandalism to my truck and trailer while left at the parking area. Other problems are the condition of the ramp, lack of adequate parking, and the dangers caused by the surge and waves. Improving Kahana may take some of the pressure off Heeia Kea.

45. Heeia Kea needs more parking and another launch next to the single small launch for in and out launch at the same time. Very, very difficult to launch in the p.m.

46. I believe additional recreational facilities are required. Your questionnaire directed to boat owners who will have use for this boat ramp is direct and appropriate.

47. I have never launched my boat at Kahana Bay and do not plan to use the boat ramp or the facilities at Kahana Bay at any time.

48. A fine questionnaire and I'm glad somebody is working on these issues. One concern is the complete overwhelming of the U.S. Coast Guard. Another is the multiple use (power, sail, sailboard, swim) of inshore areas. I witnessed a collision of jetski and catamaran. Eventually, some areas must be designated sail and paddle only.

49. Boat ramp/harbor needed in Kahuku/Laie area.

50. I think Hawaii needs quite an improvement in harbor facilities. It seems like this is the last thing the state wants to do. They built a new one at Pokai Bay which is real nice, but all the other harbors need improvements. Why build a new one when the others can be upgraded, Hawaii Kai, Kaneohe, Ala Wai, Keehi Lagoon. I use all these ramps and think they all need improvements such as parking, wash racks, restrooms, and most of all more piers for the boats that are in the water (maybe a whole new harbor). Thank you for reading this.

51. Kahana Bay is a seldom-used boating area. Improvements to the pier at Kaneohe Bay (parking, etc.) or other more often used piers would seem to be of greater value.

52. I think additional boating facilities are urgently needed on this island and strongly support this plan.

53. Although not a fisherman, I know windward local fishermen are plentiful. I have launched small boats at Kahana and know that it needs improvement. As a resident of Hawaii for years, I am a water person. I cannot belive how little water oriented this state government is and has been. This state needs more safer boat harbors, piers, slips, etc. I hope my delay in returning this questionnaire is not detrimental to the survey. It was unavoidable. What about the proposed ext. of Heela Kea pier facilities.

54. Install more than 1 launch ramp. Currently, there occurs frequent incidents of vandalism and theft to unattended cars and trucks. Security is a consideration. I would favor a users monthly fee to tie in with regulated use of the launching ramp, to avoid congestion at this limited facility.

55. Yes, this concern Heela Kea boat ramp and parking stalls for boat trailer. On Sunday and holidays the area is all fill up. I think that this questionnaire is great.

56. Heela boat harbor is the most used harbor on the windward side and is so inadequate its pathetic.

57. I feel you should ask people in the area of Kahana Bay these questions and get an accurate survey. People from Kaneohe, Kahaluu will launch at Heela Kea pier, its closer.

58. I'm not sure there is a need for any changes at Kahana, I would like to see more improvements at Kaneohe.

59. Heela Kea pier and the Kailua boat ramp are both now getting sorely inadequate. The Kailua ramp can be dangerous even on good weather days. Heela Kea pier no longer is able to contain the shear number of boats let alone cars and trailer traffic. Parking on weekends is almost nonexistent. At least enlarge that area.

60. There is an urgent need for more mooring facilities. Costs should be borne by the state or counties.

61. Kahana Bay is badly in need of improvements to make it safer and more pleasurable for sailing. As I indicated I would contribute to a non-profit group of the type you describe, but I (and my sailing friends) are violently opposed to a "fee" for using the bay. Government provides recreational facilities for the public use or they don't cut-n-dry! What fee is now charged to the beach people who have effectively taken over Kahana Bay? No fee! Not from me anyway-better to increase annual boat registration fees.

62. I have never used a ramp and therefore I am not too interested in the Kahana Project.

63. Item #20 - This is confidential information. Income has nothing to do with this questionnaire.

64. I am sure everyone in Hawaii is interested in the need for additional recreational facilities.

65. Since the last rain storm boat ramp is not usable when tide is low because of sand accumulation. Thank you.

66. I prefer to have the Heela Kea facilities improved and provide for disable fishermen who's only recreation is going fishing and pleasure boating. Provide ample spaces for the disabled. The questionnaire on Kahana Bay is good, but too far for the disabled to travel. Thank you for giving me the opportunity to comment.

67. Thanks for being concerned about recreational boating.

68. Why do we have to pay for improvements at Kahana? Where are funds coming from for other boat harbors or ramps? Heela Kea pier still needs more improvements. A lot has been done no doubt about that, but small ramp area still needs improvements. Bathrooms are filthy, around the State.

69. I feel Kaneohe Bay could support a public harbor or another yacht club, while maintaining the environment. Boat ramps and facilities used by commercial fishermen and other commercial enterprises should be supported financially by these commercial people, not by Sunday sailors and recreational boaters.

70. I would be interested in overnight anchoring in Kahana Bay. I would like to see the 1938 channel along shore of Kaneohe Bay from H-3 to near Kaneohe Bay Yacht Club dredged of silt to its reportedly 6' depth for recreational purposes sand to act as a linear silt basin to protect the bay from further siltation.

71. The only place I use my boat is in Kaneohe Bay and the ocean.

72. Heela facilities need expansion and improvements.

73. I can understand desirability to improve Kahana Bay facility, however, for so few stalls (and, therefore, users at a time) the expense is not worth the effort of revision. I'd prefer to see more extensive revision of other areas with greater expandibility . Also, there are other more desirable launching locations which could use revision.

74. We badly need more sites on the outer island, where can you go for a 3 day weekend on Molokai, Maui, or Lanai. Black Manila is full almost all of the time. Questionnaire is good, but #7 and #12 are hard to answer without most cost information.

75. Enlarge Heela Kea Pier parking facilities or build a ramp in Kahaluu.

76. Current out-of-state due to military assignment. Questionnaire did not appropriately deal with this category of response.

77. How's about cleaning up existing facilities instead of building up facilities that aren't that bad. Ex: Better sewage disposal facilities as in deeper disp. areas, stronger ducts, more efficient procedures. Ex: Sand Island area. Ex: Property own by military not kept up.

78. This questionnaire is fine, but it does not cover my area of the bay. Since my catamaran is 10' wide I cannot move it over the road without a permit and escort. The one territory/state ramp in my neighborhood (Lilipuna Rd.) was given over to private land owners several years ago.

79. I am in favor of any boating facilities improvements.

80. I think it would be a waste of money improving Kahana Bay. Heela Kea Pier is more centralized and more people use it. Therefore, improvements should be made there.

81. N.E. corner, near the Kaneohe Bay Marine Corps access road, of Kaneohe Bay, would make a good area for a marina, with boat storing facilities both wet and dry storage. A fishing dock with other facilities would be a valuable and needed addition. No dredging should be necessary except to build berths, etc. I appreciate your asking these questions and am glad to cooperate with you.

KAHANA BOATER COMMENTS STRATUM 2

1. Hope you can improve the Hawaii-Kai ramp. Thanks.

2. Unfortunately, I should not have been picked to answer your survey. Presumably, thru boat registration data which should have revealed type of boat owned as not pertinent to the purpose of your survey. Am building my own sail boat and am member of two yacht clubs. The State has a crying need for more large boat facilities. An Island State is negligent in not taking advantage of its location to expand revenue tourist, Pacific leadership potential by expanding the yachting scene. I realize my suggestion is not within the realm of your responsibility.

3. I would like to see more improvements to Keeakea in Kaneohe this facility needs more boat slips - and more launch ramps and more parking spaces.

4. What you really need are many more small boat harbors. There aren't enough safe places a small boat can pull into to get out of the rough Hawaiian waters. Also, you need more docks, slips. The waiting list at the Ala Wai is about 5-6 years. What about expanding Heela Kea? What about another harbor with slips out by Hawaii Kai (oceanside, so a sailboat won't have to go under a low bridge)? What about that plan to build a harbor out at Queens Beach? (By Makapuu?) and other places?

5. I would like to see the Hawaii Kai boat ramp facilities improved (paving, fresh water, etc.) As for Kahana Bay, a breakwater would be sufficient enough. We don't need the overcrowding of Kahana Bay - Think of all the traffic.

6. My concerns are limited to supporting our area at this time. We do support recreational needs in general, but concentrate resources closer to home.

7. It's too bad the city doesn't like sailing for there should be additional yacht harbor all over the Island like Hawaii Kai, Haleiwa, Keehi Lagoon, Mahaka.

8. Not enough slips available for larger boats. I had to wait on a list for 9 years to get a slip. Other people I know want to have a boat but there is no slip spaces available.

9. A boating facility like the new Waianae boat harbor would be very good for the windward area.

10. Hawaii needs more slip space for out of town sailing, i.e., Lahina, all Oahu, Pearl Harbor facilities need a great amount of work.

11. For such a potential boaters paradise, Hawaii is horrible. Way too few boat ramps and other facilities.

12. I sail a Hobie Cat. Hobies are best launched in areas where they can be pulled up on the beach. This allows them to put up the sails after launching rather than before launching. There are few places on Oahu where a ramp is close to a beach or where a car could be brought close enough to the water to launch. Should Kahana Bay's facilities be made easy enough and the water calmer, I would be willing to place more support behind the project.

13. I think we just need to upkeep all the ramps we have now. So we don't have to build new ones.

14. Yes, I would like to see the boat launch in Waimanolo rebuilt and improved. That is one launch I would really like to use.

15. I would like to request adequate lighting for night launching at facilities such as Hawaii Kai, Ala Wai and Sand Island. Wording for questions should be shorter and more concise and choices in lesser quantity.

16. Because of the roads leading to Kahana boat ramp and the average size of boats, which is 20'-29', not too many people would use the facility in my opinion. Money would be more wisely spent by improving other facilities like Hawaii Kai with channel alignment lights and parking facility and washdown area. Because it is most heavily used throughout the year.

17. I believe facilities for boats are adequate on windward side but should be kept in better condition (size and shape of existing ones "OK"). Favor additional ramp in Waimanalo and some areas next Kaneohe.

18. The Island of Oahu is in dire need of more recreational boating facilities. I suggest a more comprehensive survey to all registered boat owners so they can identify their needs.

19. There will always be a serious need for improvement of the recreational facilities available. The questionnaire is a good idea if some action is taken as a result. I am personally not interested in Kahana Bay, but recognize the need for some help to those who would use the facility.

20. I believe the state needs at least another 500 docks for boaters. It is impossible for many people to purchase a boat that has to be left in the water as pier space is not readily available.

21. How about improving the boat ramp in and near Honolulu. Some need to be paved. Also wash place and more boat ramp. How about better security. Several time my trailer was damaged overnight.

22. There should be another ramp between Heiiewa and Kahana.

23. There should be some kind of user fee, not only at Kahana, but at all public ramps.

24. Most of this questionnaire is not applicable since I don't own a trailerable boat.

25. I use Haleiwa Harbor - we need more power outlets. I know you tried floating docks in this harbor and they didn't work. They will if your pilings were longer. We have too much surge during high surf and I think this is your only solution.

26. As a recreational small boat owner who is not a member of any exclusive clubs, I find difficulty launching between Haleiwa and Heela. The Waianae boat ramp is, in my opinion, an excellent facility. I plan to have a larger boat (20-25 ft) within the next 2 years and would make more use of Kahana only if improvements were constructed. Somewhere along the north shore of Oahu a larger boat ramp facility will be needed in the next 5 years.

27. I believe a boat ramp at Kahana is a well established idea already and use of it would benefit only the residents of the area. It's too long a haul for large boats, roads winding and narrow. Those who choose to launch there are fishermen primarily wet, trap, divers, etc. and the out of the way factor contributes to moderately good fishing there. The money would be better spent at Kailua or Heela Kea.

28. I would like to see the Corps would hold a meeting to discuss plans for new ramps and facilities. Some of the public would like to input some ideas into the design of these ramps.

29. I would like to see a boat ramp in Waimanalo. I know we have more boaters in Waimanalo than the Kahana area. More people would use Waimanalo, than Kahana Bay.

30. Too much access has screwed up the fishing. The only way we can bring the fish back is to control the near-shore commercial fishermen. That includes the barter and cash tenders. Also, tax the *@#! out of any one who brings in undersized fish, etc.

31. I am more of a fresh water type fisherman - would like a 2nd boat ramp on Kemoo farm side of Lake Wilson - usually by summer - existing ramp water level too low to launch boat at upper ramp area - by new bridge - do need ramp at Kemoo farm area - have dam area - water level always same.

32. I would like to have better ramps and facilities in paved parking, wash areas (for boats) at the Hawaii Kai boat ramp. At least comparable to the Waianae boat harbor. At the latter, improvement to control the surge would be greatly appreciated.

33. I own a trailered catamaran. I see a need for much more parking for car and trailers and access to beach launch my boat is the ability to drive the trailer down to the water's edge to launch.

34. Kahana Bay does not apply to me because we live and boat on Leeward Oahu. Your questionnaire does not ask that pertinent point. If we lived windward my answers would surely be different.

35. Insofar as personal usage, I have found Kahana to be adequate. My personal feeling is that Kahana is a valuable ramp mostly when weekend traffic at Heela is heavy.

36. Why aren't the present facilities brought up to par as originally planned? I.E., North Shore Oahu (Haleiwa) poor and inconvenient facilities poor harbor control, insufficient navigational aids, etc.

37. Because of myself living on the leeward side, we hardly do any go fishing on that side, only if the fishing and weather conditions permits.

38. I believe in a plan to repair Kahana Bay's facilities not to expand; dredging just the ramp area; repairing the pier; installing a night area light and please some maintenance within the years after the repair.

39. I feel that where I live to Kahana Bay is too far to go boating from Kapahula.

40. Larger ramps (more), more parking, clean restrooms, something like Waianae boat harbor for the windward area.

41. Need wash area at Hawaii Kai ramp. Lights also. Too much surge at Pokai Bay ramp.

42. Fix and improve existing ramps at Hawaii Kai and Keehi Lagoon at Hawaii Kai at least put water faucets to wash trailers and boats and repair parking facility also put some lights and pave the area. Also add more launching ramps and make it wider. Thank you.

43. Agreed, more facilities are needed. Improvements can be made to existing facilities and I believe that these existing facilities would be adequate for the foreseeable future.

44. Owning an inflatable-I'm not very interested in launch ramps.

45. Kahana Bay is an attractive anchorage for a large sailboat, but requires a good channel for safe entrance, and a marked turning basin. These improvements are encouraged, and improvement of the existing ramp seems a logical part of the process so that all boaters could enjoy the bay. I support the intent of this survey; however, I am unable to presently provide financial support.

46. Sir, I know people will appreciate this kind of survey. I for myself is very happy too. How about making a single ramp for small boat to go down in the water at the end (left side) of the Kahalula river. Since the river has been widen I think people will be happy to have a fishing pier at the mouth side of the river.

47. Need for more conservation measures to protect existing sea life. Need to create more responsible boater courtesy, pollution, wake damage. More facilities for boat washdown at ramps.

48. We need more state harbors. 5 years on a mooring list is a long time in a state surrounded by water.

49. Kahana Beach Park ramp is dangerous. Why not build a surf deflecting wall from Lanakai Point, parallel with Kailua Beach. Launching a vessel into surf is dangerous. Then construct a decent ramp.

50. The ramp at Kahana Bay sure is a lot nicer than what we have in Kailua. How about some work on Kailua's boat ramp.

51. We need additional launch and navigational facilities on windward side. Kailua and Kahana ramps are junk and unsafe. Don't fully understand why you are soliciting for this. Seems Government should spend money wisely on these facilities and save on rescue operations. Community project would be good idea for Corps of Eng.

52. I wish I knew of the situation at Kahana. If there are many who use site then improvements may be OK. I like Kahana because only small boats and canoes are all I ever see there. I don't think seeing sailboats or large fishing vessels anchored all over would be good. It's nice for snorkeling and swimming and canoeing. I think it would be environmentally wrong to put too much pollutants in Kahana. Thank you.

53. There is always a need for additional recreational facilities.

54. I would only launch my small Boston Whaler at Kahana for occasional race committee use, so have little interest in this facility. Would prefer improvements in facilities in other areas: Waianae harbor - surge control; Keehi marina - paving and dry storage with a ton lift to launch small boats; new harbor off Koko Marina; dredging and more slips in Keehi Lagoon.

55. I think the ramp should be fixed using our tax money. Kailua boat ramp could use repairs also I would be more willing to help with that.

56. Need more room to park trucks and trailers. Extend the breakwater so boats wouldn't hit ramp.

57. Oahu needs more space, piers, docks, ramps, etc. for boating.

58. Fix the facilities at Kailua Beach Park.

59. This state needs more harbors. It needs them on the Honolulu side. It needs water and land facilities for working on boats. The present harbors need amenities.

60. Kailua boat ramp is not only dangerous but also needs a breakwater and better parking.

61. Who is going to pay for this improvement of this boat launching ramp at Kahana Bay and also the maintenance of this area. If any of this money is coming from the Small Boat Harbors Fund, I believe I am paying for this via mooring fees at Heela Kea Small Boat Harbor. Assess an annual fee on trailer boats and requiring a sticker or plate on trailer showing the fee was paid. If you have no concern over the funding of this area, please refer this to the person who is concerned.

62. I have not used boat launching ramps with my present 12' boat which is car-topable. However, being a "beginning boater" I am willing to contribute whatever I can afford (in time and money) to do my share to benefit everyone. I would not object to reasonable increases in boat registration fees to support/maintain a better facilities.

63. The Kailua boat is very hazardous. How come Kailua Beach ramp hasn't been improved? I think a lot of Island boaters need a better ramp because it's hazardous. Why don't you take a similar survey on Kailua Beach ramp. I would gladly contribute to this cause. As far as the Kahana Bay ramp; people can use the Kaneohe Bay, Heela pier ramp.

64. Why not improve the boat launching facilities at the very well used ramps-Maunalua, Keehi, Heela-Kea.

65. Improve the facilities at Hawaii Kai - additional ramps, paved parking, restroom, night lights, boat wash area. Great questionnaire. Should be done annually to identify needs and problems.

66. It is proper that user input be sought and considered when planning public facilities.

67. I love to go bottom fishing with a hand line. Nowadays, there are many divers and people or fishermen who lay traps all over and these practices literally "wipe out" the fishes. Therefore, it is difficult to catch half a dozen or so fishes.

68. I would like to see improvement on the Kailua beach ramp and a small ramp put in the Waimanalo area.

69. I do my launching at Waimae Harbor. I have no intention in using the Kahana ramp or facility. If I may add by saying I am against the fee charge of any future launching charges of any harbor. With the high cost of boat maintenance, fuel, oil and the necessity of owning a boat sometimes is not worth it, my owning a boat.

70. Fix our harbor at Waianae like lights for the boats on B & C pads.

71. Many more slips and harbors needed throughout Islands. Would be a great cruising area.

72. Ramp improvement for Kailua Bay is badly needed. Surge in Waianae boat harbor needs to be reduced. Bad job out their guys.

73. Keehi Lagoon is full of houseboats. People need to live on-moorings drag in high winds - almost impossible to row back to shore against wind-absolutely no shower facilities open to boaters-state seems like it hates us. All our dingys get stolen-some of the boats have been sabotaged and sunk something must be done. USA citizen.

74. A boat ramp at Kahana Bay doesn't really involve or interest as far as use is concerned. The people with sailing vessels (non-trailerable) on HNL side of Island. However, I'm very much in favor of any new boating facility on Hawaii. How bout some more slips?

75. More and better quality launching ramps are needed. The number of existing sites are limited and are inadequate in terms of ramps, parking, and washdown facilities. Use is heavy at existing site and long waits to launch or load a trailer are commonplace.

76. Not for my type boating. Poorly organized questionnaire. Much does not apply to me.

77. Re - Part III: 14, 15, 16, 17, 18, 19, 20, 21, these items should not be part of this survey-not related to Kahana Bay launching ramp.

78. I am surprised that we don't have a facility somewhat like "Marina Del Ray" or a "Port of Call" in Hawaii. I would think that Hawaii Kai could offer such a development and it would be a great excursion from Ala Wai Harbor. I am sure other boaters feel as I do, we have the perfect investment for it here in Hawaii. I think more surveys like this are needed and more enthusiasm from our legislators.

79. Leeward Oahu is just as rough or rougher than Kahana (at sea) but both are equal as far as launching facilities - Keehi safer because of calmer waters; but both are lacking in providing maximum launching and recovery facilities in terms of time. More ramps are needed and wash ramps.

80. I would like to use Kahana ramp more often, but size and conditions are rough and facilities prohibitive at present time.

81. The State of Hawaii is in need of additional small boat harbors. A check of waiting lists at existing harbors is evidence of this problem. The start of planned harbor at Maunalua Bay (Hawaii Kai) would be a step in the right direction.

82. We definitely need more recreational facilities. I would like to see the Hawaii Kai boat ramp improved. It is nice to know that the military is involved in this type of project. Good luck and thank you.

83. Some improvements at Heela-Kea boat harbor.

84. Kahana Bay facility for boaters use needs improvements immediately. Parking, boat holding area, wave barrier and light dredging will help, also lighted marker (buoy). To enjoy recreational fishing, restocking of fish (small fish) should be a high priority project.

85. All ramps in Hawaii should be upgraded with the exception of Waianae. I've never launched at Kahana but I'm familiar with it. A disgrace. The worst is Sand Island. I've never seen a worse ramp situation and I've fished in many mainland lakes and foreign locations. We're surrounded by water, with prime fishing grounds, but have one of the lowest per capita boat ownership in the nation. I'm glad you're making this survey. It's about time somebody pays attention to the recreational fishing. Exceptions to the above statements; Waianae - excellent; fishing agrigates - good (more study needed).

86. I think we need more dry storage for small boats in the Honolulu area.

87. Yes. Would like to see boat launching facilities at Barbers Point/Ewa area.

KAHANA NON-BOATER COMMENTS

1. All boat operators should pay a $2.00 fee for use of the boat ramp.

2. I think this questionnaire should be sent to boat owners. We should have more fishing piers or places where we can go fishing with poles some place like pier 2.

3. I do not own a boat or plan to own one, therefore, this means nothing to me. I'm sure it would be important to some people.

4. I would like to see the Kahana improvements.

5. The State of Hawaii needs to do much more for small boats; Mala Wharf Maui, make a small boat harbor. Make Kewalo non-commercial - move commercial to Honolulu Harbor. Allow more regional piers, anchorages slips etc. - relax rules. We are an island state, but rate about last in small boat facilities - help!

6. There are already ample small craft navigation facilities on Oahu for boat users. Kahana needs to be left alone so that those with non-boat interests have a shoreline to enjoy without navigational clutter. The present scenic and ecological state must be preserved.

7. Stop H-3 and save Hoomaluhia Park.

8. Yes, I do. Why would you send this to me as our family is in no way involved in boating but if you needed input, I would never answer this type of questionnaire without doing some research to able to give you a hopefully intelligent answer.

9. How about better maintenance of what we already have. Why have more when we can't even take care of what we already have. If we can do that, then we should go for more.

10. I would like to see a center provided for dancers. There are many dance groups-ballroom, square, round, etc. on Oahu and no large facility they can use for dances. This is a good recreational exercise past-time for people and they have been unable to get anyone interested in getting a facility the groups can use.

11. The present facilities are very over crowded and things won't be getting any better until the situation is improved.

12. Recreational facilities-yes. Boating facilities-no.

13. When my original questionnaire was not returned, would have preferred that you send it to someone else.

14. "Another study"-stop wasting my tax dollars. Close Hawaii State, Pacific Ocean Division, Corps of Engineers-relocate to USA. Make all "users" pay a higher fee to use recreational facilities. Leave well alone, Kam. Hwy. to Kahana Bay boat ramp-too narrow; unsafe for large boat trailers; ties up too much traffic; congestion; too much people pollution. Stop wasting our precious water at all boat ramps.

15. Regarding questionnaire. I am a unlikely person to answer this type of questionnaire because I do not own a boat and have no interest in boating or marine facilities.

16. Should be cleaner and safer for the public use. Often times we are afraid to send younger children because it is so unsafe and unsanitary.

17. I would like to know just how insufficient the present facilities are; if there have been any accidents because of poor facilities and also how many complaints the state or city and county gets on an average about poor recreational facilities.

18. I'm sure this questionnaire is just a formality, because the government has certain standards to be met. Actually, the decision has probably already been made concerning the boat ramp. Also, what about safety enforcement? The boats in Haleiwa Harbor come speeding in with no regard to regulations, there is absolutely no enforcement.

19. Though we personally do not care about "boating" we do have many friends and a neighbor who do own boats and enjoy boating. We would like to have them enjoy such facilities to their hearts content.

20. I feel that any expenditure that would assist and improve recreational facilities for the people of this state is worthwhile.

21. I have absolutely no interest in this project. I live nowhere near the project location. I think this survey is ridiculous.

22. Yes, there is a great need for additional recreational facilities, but money of public funds has other priorities. I'm sorry I don't feel too enthused about boating and ramps. It's not my interest.

23. We need one for Kaneohe Bay.

24. Think you should conduct your survey among boat people and people who reside in the area involved. Not people like me.

25. More information should be given. I'm not real familiar with the project.

26. I have no knowledge of boating and required facilities whatsoever, and therefore cannot determine the value of such proposed changes. Perhaps, if possible, the questionnaire could have included boat owners, and boat enthusiasts, because randomly selecting from non-boat owners would tend to bias your sample population to the negative side or not interested side.

27. Before any facilities are added a better plan must be made to safeguard them against those who go out of their way to destroy things.

28. Would like to know how immediate community feels about proposed Kahana Bay project. What of current use of facilities at Kahana Bay? Great or minimal? Are boat launchings there unsafe?

29. I feel very negative in whatever the Army Corps of Engineers is undertaking or proposing because of recent articles in reliable publications. But aside from that, how dare you ask me those ridiculous questions. Let me insult you back by asking you, "What the *@#! do you care how much I earn or what my educational background is?" Do you really care about Hawaii's people or is this just another project for you?

30. In regards to question 12, I don't see what my income has to do with this questionnaire and don't see that it is anyone's business.

31. This is one of the most "boating" states and therefore, we should have exceptional facilities for boaters.

32. I enjoy eating seafood and I hope that your proposal is accepted and approved. Then, maybe the quantity of seafood brought on the Island will increase. Then seafood prices may decrease which means I can afford buying and continue enjoy eating all the seafood I want.

33. Yes, we do need a safe launching ramp for those interested and own a boat.

34. What is not indicated on this form-questionnaire is the effect of proposed additional facility to the general beach area and its use by non-boaters. Boat owners would naturally approve; however, the bay itself is special, and with the development of the living Hawaiian ag. park mauka of the bay, it seems to me that any increase in use for boaters should be limited. There must be other beach areas nearby that do not affect the area-traffic congestion, impingement on use of bay by simple beach goers, distracting from living park area.

35. I only wish I could do more, but wheel chair keeps me limited, unfortunately. Brain says, yes, but body too slow.

36. Not enough information has been included here, for the survey to be a true one. How many people use the described facilities now continually. Whose idea is it to build the new facilities etc., not able to complete survey for above reasons.

37. My son(wife), and family love to water ski, and I enjoy watching them. Also, my son-in-law plans to go into the fishing business and there's five of them.

38. Perhaps Kahaluu could use a launch ramp, maybe in the basin area mauka of Kam Highway bridge at Kahaluu Stream.

39. This is not an additional recreational facility. Only extra parking and breakwater, which will reduce available facilities.

40. I believe this questionnaire should be sent to boat owners only, as non-boat owners would have no interest in subject matter.

41. More city parks.

42. I believe Oahu needs more public golf courses. Would like to see military golf courses having some open periods for use by civilians without sponsorship by military personnel.

43. Progress, improvement, beneficial to the public.

44. Present facilities suffice, but require better maintenance.

45. Additional recreational facilities not only service the people of Hawaii, but also enhance the image of Hawaii. Being the paradise of the Pacific where people of the entire world can come to enjoy the beauty and the lifestyle of Hawaii.

46. Boat ramp and adjoining area that should be addressed is the boat ramp at Hawaii Kai. The parking and other facilities are either bad, or non-existing. Any improvmeents would better service more of the community, not only of Hawaii Kai, but all the way into Kaimuki.

47. We spent 25 years cruising Puget Sound and Canadian Gulf Island. We believe boating is a most pleasurable family activity. However, we doubt there are enough bays, inlets, etc., for this activity in these island with small boats.

48. Water ski areas are very limited. Need more protected areas for such activities. Also, need more sailboat mooring buoys or dock slips (public) throughout state for overnighters.

49. I believe that recreational facilities such as parks, beaches and boating areas are essential to the community. They provide a service which is not available through any other means. The aesthestics of ones life provide for the balancing peace of mind that enhances ones existence in the community and increases ones contributions.

50. With shoreline fishing very limited deep sea fishing is the only alternative. The price of market fish speaks for itself.

51. The more recreational facilities available is a plus for the people of this island.

52. Recreational facilities for a select group should be supported in large part by user charges/assessments.

53. Reasons for negative answer for improved launching wharf at specified area: Strong backwash of shore waves; whirlpool and undertow dangers are ever present; enormous white wave water to hide coral or water depth; only stronger boats with good motors can boat there safely; inexperience navigator will cause troubles; and hardly the vacation or resort type of sea conditions.

54. There was no mention of estimated cost of this project in relation to the possible number of users. I am in favor of more recreational facilities as long as each project dollar serves the greatest number of people.

55. I was surprised to receive such a survey since I don't own a boat. However, since it is a random survey it would only be fair to ask everyone and also the fact that I may decide to own a boat in the future.

56. Questionnaire well conducted/organized.

57. As a basic principle I support the construction of additional recreational facilities such as boat ramps. From a personal standpoint, I no longer expect to use such facilities.

58. If this is confidential, why do you need the number on the reverse of this page?

59. I personally do not feel this survey to get opinions from non-boat owners is very valuable, particularly since Kahana Bay is so far from where most of us would go for recreational use. I feel these surveys are a waste of more money than the project itself would be.

60. Kahana Bay seems ideally suited for boating recreation, I have reservations on how such a facility is going to affect the traffic on Kam Highway. Will there be adequate room for parking, accommodating of boats still in tow when turning on or off the highway? I hope the beach will still be open to swimming and camping. These are my observations from seeing the congestion of "land" traffic at Kahana and also at Heela Pier. The water's fine, it's the "land".

61. With the ever-increasing numbers of boat owners, I think the proposed changes are without doubt a good thing for the community and boaters. My comment towards this questionnaire is why is there a need to know of my personal income?

62. Sounds like a good idea for improvements. Since I don't use the boating facilities, though, I wouldn't want to finance it, boat owners and community should pay for some of costs.

63. Clean beaches and parks.

64. This launch ramp at Kahana Bay will be in the best interests of the people of the US and Hawaii in the following manner: Promotion of fishing, boatsmanship, seamanship, and interest in sealife.

65. I am in favor of improving boat launch facilities that have some usage.

66. Build more places for people to live on boats.

67. I think mailing a questionnaire to the community to make a survey is a great idea.

68. I am not a boater, would like to participate in future, however.

69. With population growth, good idea to plan and improve more recreation facilities.

70. Hawaii, as the only state surrounded entirely by ocean; needs to have good harbor and ocean facilities. It is my opinion that in the future Hawaii will have to and shall turn more and more to the ocean for it's trade and resources needed to pay it's monetary bills. Income that is needed to support this state of Hawaii, will come from the ocean and its resources in the distant future, not from tourism.

71. Listen to Ronald Reagan. If it costs money-don't do it.

72. This type of questionnaire is a waste of taxpayer's money.

73. As the population here increases, the demand for recreational facilities will increase. The question is, what percent of our population is interested in boating activities and is the money being spent for these people proportionate to their number? If so, fine, but if not, it seems to me that money can be spent more effectively on activities enjoyed by a larger number of people.

74. Am not qualified to answer needs of additional recreation facilities because I don't know a thing about adequate facilities and volume of people using facilities. Kahana Bay appears to be in a bad location because of the roads in the area. Trailers on small highway on weekends may pose more of a problem.

75. New and improve boat launch sounds good, but it's hard to answer this one (Kahana Bay)) because it's so far from where I live.

76. I own a 14' alcort sunfish sailboat w/trailer which may be launched by hand at any convenient spot, I don't need a ramp.

77. Small boater's use ramp that make a living out of fishing let them pay for the improvements not us.

78. Hawaiians who want to go fish would benefit from this. If the taxpayers have to put up the bucks-think twice. This is probably going add to deficit.

79. Although I probably wouldn't use new proposed boating facilities, I am in favor of improving our recreational facilities as long as they are reasonable and affordable.

80. My concern is for parking facilities at Kahana Bay six aren't enough.

81. The proposed Kahana Bay improvements would be appreciated by many windward boat users. We do hope that if the entrance channel and turning basin involve dredging now and in the future to maintain depth, that an environmentalist objectively assess the impact of such activity to marine life in the area of the boat ramp.

82. Kahana Bay is a pretty spot-shallow, nice for kids to wade. The boat ramp facilities that are there now are not used to capacity. A breakwater would surely change the bay. The windward side has enough boat ramps to take care of the needs. Quite a few boats are anchored in the shore.

83. Presently not interested in subject, however, could become of interest in the future.

84. I think it's great you do a questionnaire. I hope it works and you get good results. I would love to see all the facilities maintained and improved for safety as this one is.

85. Although boating is not one of my leisure interests, I support for that segment of the population that likes boating, monies should be spent to allow them to pursue their interest in a comfortable safe environment.

86. Hauula Beach Parks needs to be renovated, more important to more people than a boat ramp.

87. Heeia Kea ramp is the only ramp available. Lanikai and Kahana Bay ramps are limited or useless. Therefore, we on the windward side have to put up with the crowded and limited conditions at Heeia. This is the only reason I am in favor of improving the Kahana ramp even if I wouldn't use it.

88. The questionnaire did not appear objective. Questions seemed to favor the improvement of Kahana Bay boat ramp Ex. #2.

89. The ocean around us is our greatest asset. We need better facilities to handle our increasing boating needs.

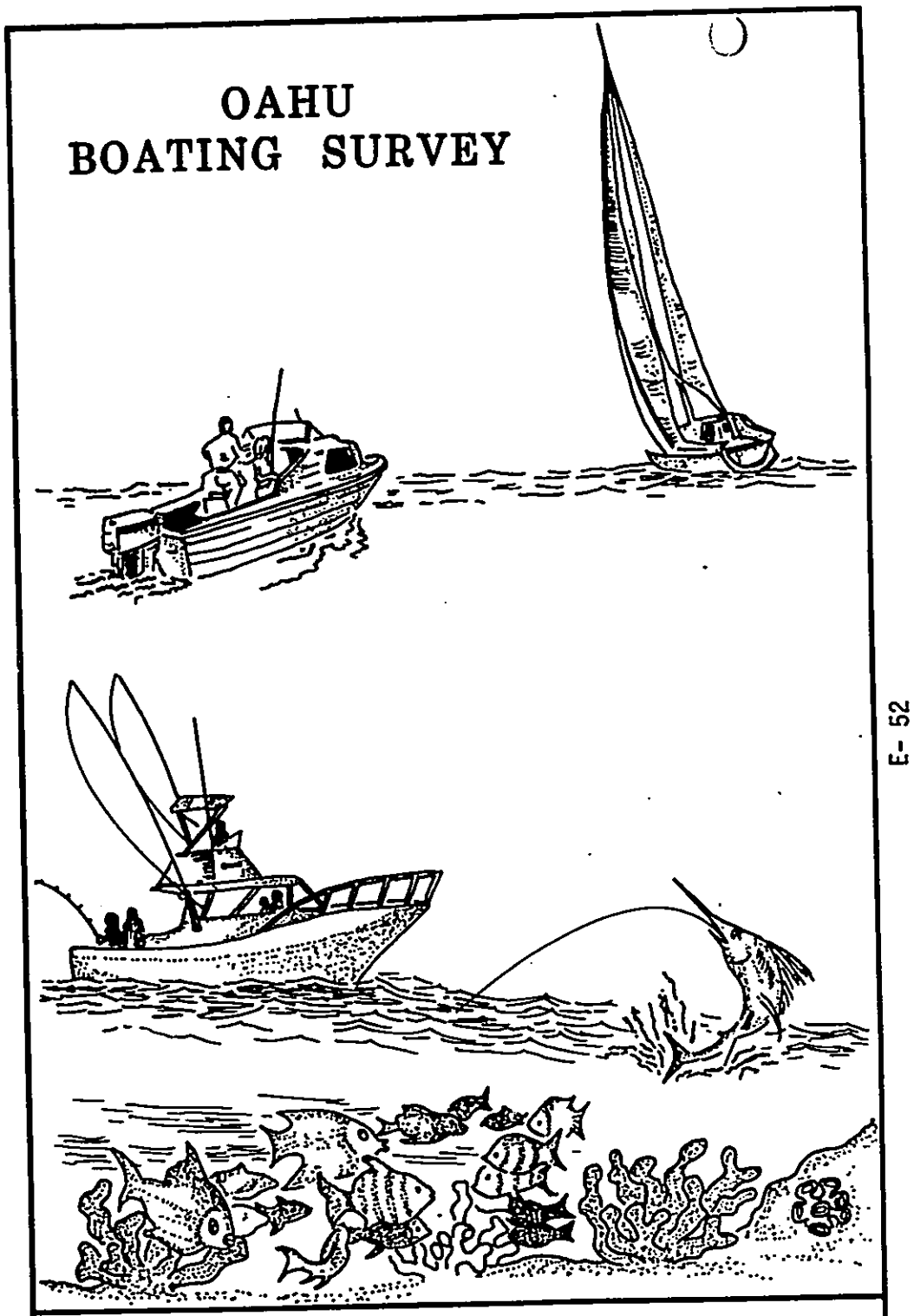
90. I have little to do with boating other than occasional day-sailing. My major water sport is swimming and body surfing.

91. I would be much more interested if I had some idea where Kahana Bay was.

92. One question why do private organization have to build or expand this harbor-with all the state is spending foolishly let them foot the bill.

EXHIBIT E-1. KAHANA BAY CONTINGENT VALUATION SURVEY FOR BOAT OWNERS

OAHU
BOATING SURVEY



APRIL 1985

E- 52

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

May 13, 1985

Dear Oahu Boater:

We are trying to measure the benefits of providing safer boating conditions at the Kahana Bay boat launching ramp in Windward Oahu.

We need your help in determining the value of the proposed changes. Please take the time to fill out the attached survey and return it to us in the postage-paid envelope.

Because we are only surveying a small random sample of Oahu boaters, your response is very important as it will represent the opinion of the boaters of Oahu.

This survey is entirely voluntary. Individual responses will be kept completely confidential.

In appreciation of your help, we would like to send you a complimentary copy of our latest publication describing the boating facilities in this State. Please write your address in the space provided at the end of this survey if you would like a copy.

Thank you for your cooperation.

Sincerely,

for Michael H. Jenks
Colonel, Corps of Engineers
District Engineer

OMB #0702-0016
APPROVAL EXPIRES: 10/31/86

PLEASE READ EACH QUESTION CAREFULLY. CHOOSE ONLY THE MOST APPROPRIATE ANSWER WHERE CATEGORIES ARE SUPPLIED, UNLESS OTHERWISE SPECIFIED. THEN MARK THE BOX TO THE LEFT OF THE ANSWER WITH AN "X".

For classification purposes, please record the Zip Code of your residence 96_____

PART I: BOAT OWNING STATUS

1. a. Do you presently own a boat?

(1) ☐ YES (2) ☐ NO

b. Do you plan to own a boat in the future?

(1) ☐ YES (2) ☐ NO

IF YOU DO NOT PRESENTLY OWN A BOAT AND DO NOT PLAN TO OWN ONE IN THE FUTURE, PLEASE DO NOT COMPLETE THIS SURVEY. RETURN IT UNCOMPLETED IN THE SELF-ADDRESSED, POSTAGE-PAID ENVELOPE. THIS WILL ENSURE THAT WE WILL NOT SEND FOLLOW-UP NOTICES ASKING ABOUT YOUR RESPONSE.

2. Mark the category which best describes the type of boat that you now own or plan to own in the future. (If you presently own more than one boat, answer for the boat that you use most.)

a. Boat Type.

(1) ☐ Outboard
(2) ☐ Cabin Cruiser
(3) ☐ Inboard
(4) ☐ Inboard/outdrive
(5) ☐ Sailboat
(6) ☐ Auxiliary sailboat
(0) ☐ Other

b. What is the length of your boat (overall)?

_____Ft.

c. What is the beam (maximum width) of your boat?

_____Ft.

d. What is the draft (depth of boat in water) of your boat?

_____Ft.

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e. How do you presently store your boat?

(1) ☐ On a trailer

(2) ☐ On a rack

(3) ☐ In the water alongside a dock or pier

(4) ☐ In the water at a mooring buoy

(0) ☐ Other (Specify) _____

3. During the past 12 months, did you use your boat in any of the following activities?

a. Mark each activity in which you participated.

(1) ☐ Fishing for food for family and friends

(2) ☐ Recreational fishing

(3) ☐ Other recreational boating

(4) ☐ Commercial fishing

(5) ☐ Other commercial use (such as charter fishing, diving tours, etc.)

(6) ☐ Did not go boating in last 12 months

(0) ☐ Other (Specify) _____

b. Circle from the list above the one activity you did most often.

4. How many days during the past 12 months did you use your boat? (Check only one)

(1) ☐	0	(7) ☐	81 - 100
(2) ☐	1 - 10	(8) ☐	101 - 150
(3) ☐	11 - 20	(9) ☐	151 - 200
(4) ☐	21 - 40	(10) ☐	201 - 250
(5) ☐	41 - 60	(11) ☐	251 - 300
(6) ☐	61 - 80	(12) ☐	More than 300

5. On the average, how many persons go with you on a boating trip?

_____ persons

PART II: PROPOSED PROJECT AT KAHANA BAY

The Corps of Engineers and the State of Hawaii are trying to determine the value of improved boating facilities on Oahu. One project under consideration is the improvement of the boat launching ramp at Kahana Bay. It is important for us to know how boaters on Oahu value the proposed improvements to this boat ramp.

The existing boat launching facility at Kahana Bay is limited to:

- Single-lane launch ramp
- Loading dock
- Parking for 6 trailer-cars and an additional 15 cars
- Restrooms
- Nearby access to picnic and camping areas
- Stub breakwater to partly affect wave surge
- Access to fresh water

Plans are being made to provide safer boat launching at Kahana Bay. The proposed changes include:

- Navigational aids (lights or buoys)
- An entrance channel and an additional breakwater to provide safe water access for entering and leaving Kahana Bay.
- A turning basin to provide a safe area for boats to manuever after launching and before retrieval
- An additional parking area

6. Would you ever want to launch your boat at an improved boat ramp at Kahana Bay as we've described, if no other boating facilities are built or improved on Oahu?

(1) ☐ YES (2) ☐ NO

7. If it were necessary to charge a monthly user fee, what is the highest fee you would pay per month to help pay for the construction and maintenance costs of the boat ramp improvements at Kahana Bay? Please circle the value from the list below.

(CIRCLE ONE)

$500	$400	$300	$250	$200
$175	$150	$125	$100	$ 90
$ 80	$ 70	$ 60	$ 50	$ 40
$ 30	$ 20	$ 10	$ 5	$ 0

If the amount you would pay per month is not shown on the list above, please write in the amount here. $_____

8. Please mark the answer which best describes your reason for answering the above question the way you did.

(1) ☐ That is what it is worth to me.

(2) ☐ It's worth more to me, but it's all I can afford to pay.

(3) ☐ Not enough information is provided.

(4) ☐ I did not want to place a dollar value.

(5) ☐ I object to the way the question is worded.

(0) ☐ Other (Please specify)_____.

9. At the monthly user fee you circled above, how many months in a year would you launch your boat from the improved boat ramp at Kahana Bay?

_____ months per year

10. Circle the months that you would typically use the improved boat ramp at Kahana Bay.

(1) January	(4) April	(7) July	(10) October
(2) February	(5) May	(8) August	(11) November
(3) March	(6) June	(9) September	(12) December

11. During the months you circled on the previous page, how many days per month would you typically use the improved Kahana Bay boat ramp?

_____ days per month

12. If the improvements to the Kahana Bay boat ramp site were made, it may be a good thing for the community as well as for boaters who plan to use the ramp. Please circle the value in the list below which is the highest dollar amount that you would contribute <u>one time</u> to a non-profit group to help pay the cost of construction and maintenance of the boat ramp improvements to ensure that they would be made even if you never plan to use the boat ramp.

This is to help us determine the value of the facility
THIS IS <u>NOT</u> A REQUEST FOR CONTRIBUTIONS
(CIRCLE ONE)

$5000	$4000	$3000	$2500	$2000
$1500	$1000	$ 750	$ 500	$ 400
$ 300	$ 200	$ 150	$ 125	$ 100
$ 75	$ 50	$ 40	$ 30	$ 25
$ 20	$ 15	$ 10	$ 5	$ 0

If the amount that you would give is not shown on the list above, please write in the amount here. $_____

13. Please mark the answer which best describes your reason for answering the above question the way you did.

(1) ☐ That is what it is worth to me.

(2) ☐ It's worth more to me, but it's all I can afford to contribute.

(3) ☐ Not enough information is provided.

(4) ☐ I did not want to place a dollar amount.

(5) ☐ I object to the wording of the question.

(0) ☐ Other (Please specify) _____

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PART III: BACKGROUND INFORMATION

The following information will help our research staff analyze the results of the study properly.

14. Which of the following best describes your present status?

(1) ☐ EMPLOYED FULL-TIME
(2) ☐ EMPLOYED PART-TIME
(3) ☐ RETIRED
(4) ☐ NOT EMPLOYED
(0) ☐ OTHER (SPECIFY) _____

15. What was the last grade of regular school that you completed?

(1) ☐ NO SCHOOLING
(2) ☐ GRADE SCHOOL (1-8)
(3) ☐ SOME HIGH SCHOOL (9-11)
(4) ☐ HIGH SCHOOL GRADUATE (12)
(5) ☐ SOME COLLEGE (13-15)
(6) ☐ COLLEGE GRADUATE (16)
(7) ☐ POST GRADUATE (17+)
(8) ☐ OTHER SCHOOL AFTER HIGH SCHOOL (SUCH AS SECRETARIAL, ART, OR TRADE SCHOOL)

16. Are you male or female?

(1) ☐ MALE (2) ☐ FEMALE

17. Are you married?

(1) ☐ YES (2) ☐ NO

18. Including yourself, how many persons live in your household?

_____ PERSONS

19. What is your age? Mark the category that contains your age.

(1) ☐ 15-19
(2) ☐ 20-24
(3) ☐ 25-29
(4) ☐ 30-34
(5) ☐ 35-39
(6) ☐ 40-44
(7) ☐ 45-49
(8) ☐ 50-54
(9) ☐ 55-59
(10) ☐ 60-64
(11) ☐ 65-74
(12) ☐ 75 AND OVER

20. Here is a list of income categories. Mark the category that best describes the combined annual income before taxes that you and all other members of your household received during 1984.

(1) ☐ UNDER $5,000
(2) ☐ $5,000 - $7,499
(3) ☐ $7,500 - $9,999
(4) ☐ $10,000 - $14,999
(5) ☐ $15,000 - $19,999
(6) ☐ $20,000 - $24,999
(7) ☐ $25,000 - $34,999
(8) ☐ $35,000 - $49,999
(9) ☐ $50,000 - $99,999
(10) ☐ $100,000 OR MORE

21. How many years have you lived in Hawaii?

_____ YEARS

22. Would you like us to send you a copy of the publication, "State of Hawaii Small Craft Navigation Facilities?" (If yes, record your mailing address below.)

(1) ☐ YES (2) ☐ NO

23. We are interested in your thoughts about the need for additional recreational facilities and your comments about this questionnaire. Do you have any comments?

_____

_____

_____

_____

_____

_____

_____

_____

_____

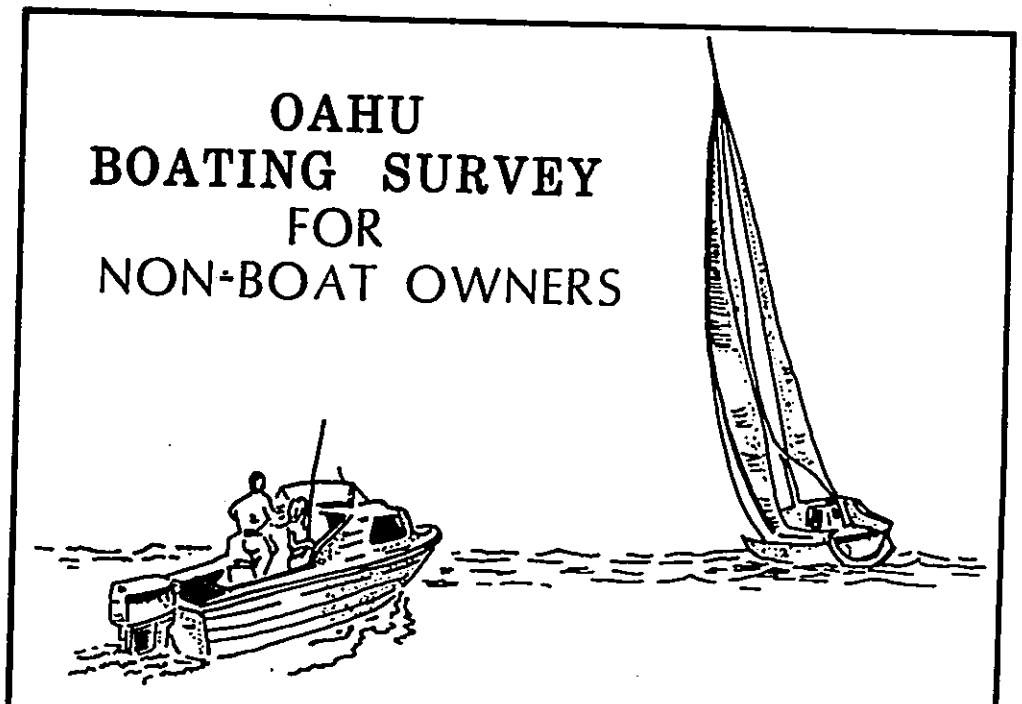
_____

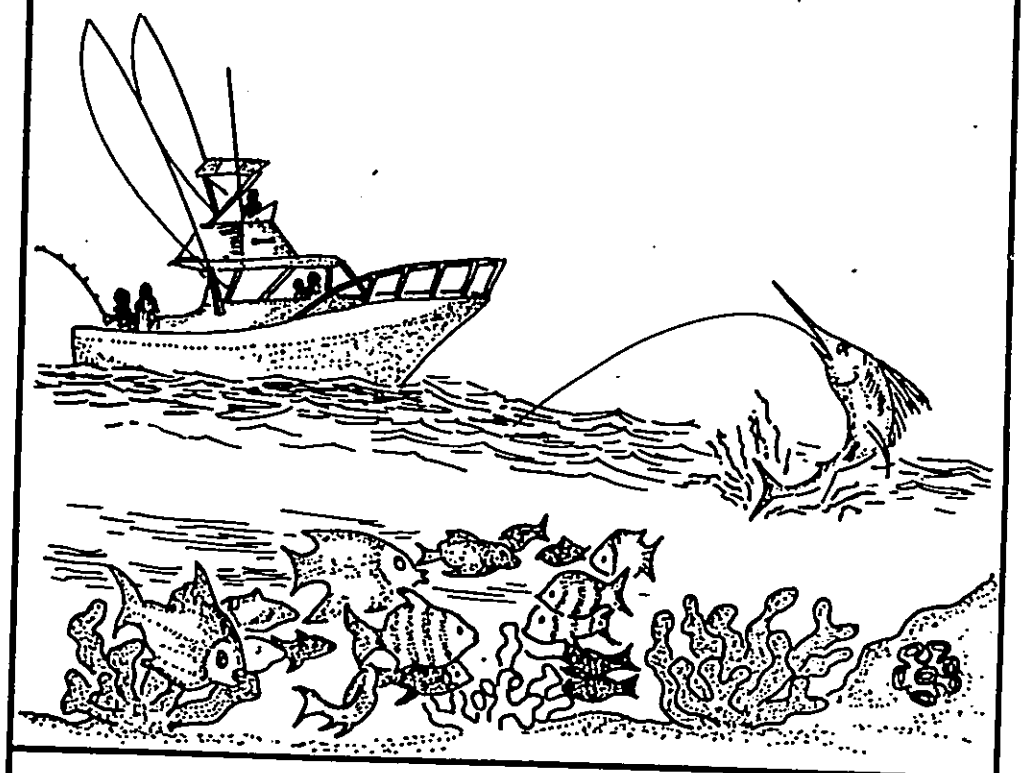
Thank you for your time. Your cooperation in filling out the questionnaire is greatly appreciated. Please put this questionnaire in the postage-paid envelope provided and mail it to us. If you have misplaced the envelope, please send this questionnaire to:

US Army Engineer District, Honolulu
ATTN: FCDED-PE
Bldg 230
Fort Shafter, HI 96858-5440

EXHIBIT E-2. KAHANA BAY CONTINGENT VALUATION SURVEY FOR NON-BOAT OWNERS AND FOLLOW-UP LETTERS

OAHU
BOATING SURVEY
FOR
NON-BOAT OWNERS





MAY 1985

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

REPLY TO ATTENTION OF

Dear Oahu Resident:

Many Oahu boaters have already responded to our boater survey expressing their thoughts and feelings on additional boating facilities for Oahu.

Unfortunately we have not yet received a completed survey from you. In order for the survey results to properly reflect the views of all Oahu boaters, we need completed survey questionnaires from as many people as possible. Your participation in this survey is important to us.

In case the first questionnaire we sent you has been lost or discarded, we have enclosed another copy with this letter. Please help us make your views and opinions count. By taking a little of your time to answer the survey and returning it to us, you will be contributing to a community effort to make wise choices that will affect the people of Oahu. Mahalo.

Sincerely,

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

Enclosure

OMB #0702-0016
APPROVAL EXPIRES: 10/31/86

PLEASE READ EACH QUESTION CAREFULLY. CHOOSE ONLY THE MOST APPROPRIATE ANSWER WHERE CATEGORIES ARE SUPPLIED, UNLESS OTHERWISE SPECIFIED. THEN MARK THE BOX TO THE LEFT OF THE ANSWER WITH AN "X".

For classification purposes, please record the Zip Code of your residence 96____

PART I. BOAT OWNING STATUS

1. a. Have you ever owned a boat?

   (1) |___| Yes (2) |___| No

   b. Do you currently own a boat?

   (1) |___| Yes (2) |___| No

   c. Do you plan to own a boat in the future?

   (1) |___| Yes (2) |___| No

   d. Do you presently share the use of someone else's boat?

   (1) |___| Yes (2) |___| No

IF YOU CURRENTLY OWN A BOAT REGISTERED IN HAWAII AND HAVE ALREADY RECEIVED OUR OAHU BOATER QUESTIONNAIRE, PLEASE DO NOT COMPLETE THIS SURVEY BUT RETURN IT UNCOMPLETED IN THE SELF-ADDRESSED, POSTAGE-PAID ENVELOPE.

PART II. PROPOSED PROJECT AT KAHANA BAY

The Corps of Engineers and the State of Hawaii are trying to determine the value of improved boating facilities on Oahu. One project under consideration is the improvement of the boat launching ramp at Kahana Bay. It is important for us to know how the people of Oahu would value the proposed improvements to this boat ramp.

The existing facility at Kahana Bay is limited to:

- Single-lane launch ramp
- Loading dock
- Parking for 6 trailer-cars and an additional 15 cars
- Restrooms
- Nearby access to picnic and camping areas
- Stub breakwater to partly affect wave surge
- Access to fresh water

Plans are being made to provide safer boat launching at Kahana Bay. The proposed changes include:

- Navigational aids (lights or buoys)
- An entrance channel and an additional breakwater to provide safe water access for entering and leaving Kahana Bay
- A turning basin to provide a safe area for boats to maneuver after launching and before retrieval
- An additional parking area

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2. Would you ever want to launch a boat at an improved boat launching ramp at Kahana Bay as we've described, if no other boating facilities are built or improved on Oahu?

(1) |___| Yes (2) |___| No

3. How do you feel about the proposed project at Kahana Bay?

(1) |___| I am in favor of the proposed project at Kahana Bay

(2) |___| I don't care, one way or the other, about the proposed project at Kahana Bay

(3) |___| I am against the proposed project at Kahana Bay

4. If the improvements to the Kahana Bay boat ramp site were made, it may be a good thing for the community as well as for boaters who plan to use the ramp. Please circle the value in the list below which is the highest dollar amount that you would contribute one time to a non-profit group to help pay the construction and maintenance costs of the boat ramp improvements to ensure that they would be made even if you never plan to use the boat ramp.

This is to help us determine the value of the facility.
THIS IS NOT A REQUEST FOR CONTRIBUTIONS.

(CIRCLE ONE)

$5000	$4000	$3000	$2500	$2000
$1500	$1000	$750	$500	$400
$300	$200	$150	$125	$100
$75	$50	$40	$30	$25
$20	$15	$10	$5	$0

If the amount that you would give is not shown on the list above, please write in the amount here. $_____.

5. Please mark the answer which best describes your reason for answering the above question the way you did.

(1) |___| That is what it is worth to me.

(2) |___| It's worth more to me, but it's all I can afford to contribute.

(3) |___| Not enough information is provided.

(4) |___| I did not want to place a dollar value.

(5) |___| I object to the way the question is worded.

(0) |___| Other (Specify) _____.

PART III. BACKGROUND INFORMATION

The following information will help our research staff analyze the results of the study properly.

6. Which of the following best describes your present status?

(1) |___| Employed full-time

(2) |___| Employed part-time

(3) |___| Retired

(4) |___| Not employed

(0) |___| Other _____
(Please specify)

7. What was the last grade of regular school that you completed?

(1) |___| No schooling

(2) |___| Grade school (1-8)

(3) |___| Some high school (9-11)

(4) |___| High school graduate (12)

(5) |___| Some college (13-15)

(6) |___| College graduate (16)

(7) |___| Post graduate (17+)

(8) |___| Other school after high school (such as secretarial, art or trade school)

8. Are you male or female?

(1) |___| Male (2) |___| Female

9. Are you married?

(1) |___| Yes (2) |___| No

10. Including yourself, how many persons live in your household?

_____ persons

11. What is your age? Mark the category that contains your age.

(1) |___| 15 - 19

(2) |___| 20 - 24

(3) |___| 25 - 29

(4) |___| 30 - 34

(5) |___| 35 - 39

(6) |___| 40 - 44

(7) |___| 45 - 49

(8) |___| 50 - 54

(9) |___| 55 - 59

(10) |___| 60 - 64

(11) |___| 65 - 74

(12) |___| 75 and over

12. Here is a list of income categories. Mark the category that best describes the combined annual income before taxes that you and all other members of your household received during 1984.

(1)	☐ Under $5,000	(6)	☐ $20,000 - $24,999
(2)	☐ $5,000 - $7,499	(7)	☐ $25,000 - $34,999
(3)	☐ $7,500 - $9,999	(8)	☐ $35,000 - $49,999
(4)	☐ $10,000 - $14,999	(9)	☐ $50,000 - $99,999
(5)	☐ $15,000 - $19,999	(10)	☐ $100,000 or more

13. How many years have you lived in Hawaii? _____ years.

14. Would you like us to send you a copy of the publication, "State of Hawaii Small Craft Navigation Facilities"? (If yes, record your mailing address below.)

(1) ☐ Yes (2) ☐ No

15. We are interested in your thoughts about the need for additional recreational facilities and your comments about this questionnaire. Do you have any comments?

Thank you for your time. Your cooperation in filling out the questionnaire is greatly appreciated. Please put this questionnaire in the postage-paid envelope provided and mail it to us. If you have misplaced the envelope, please send this questionnaire to:

U.S. Army Engineer District, Honolulu
ATTN: PODED-PE
Building 230
Fort Shafter, Hawaii 96858-5440

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

REPLY TO
ATTENTION OF

Dear Oahu Resident:

Recently we sent you a letter and a short survey questionnaire regarding new boating facilities on Oahu. We have not yet received your response and encourage you to spend a few minutes of your time to complete the questionnaire soon.

Although your decision to participate is completely voluntary, your personal response is very important in helping to determine whether additional boating facilities will be built on Oahu in the future. Please bear in mind that your responses to the survey will be kept completely confidential.

If, by the time you receive this letter, you have already mailed back your completed survey questionnaire, we deeply appreciate your kokua. Thank you very much.

Sincerely,

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858

REPLY TO
ATTENTION OF

Dear Oahu Resident:

Recenty we sent you a survey questionnaire regarding new boating facilities on Oahu. We have not yet received your response and encourage you to spend a few minutes of your time to complete the questionnaire soon.

Although your decision to participate is completely voluntary, your personal response is very important because only a small random sample of households on Oahu have received this survey. Your participation in this survey will give us a better idea of how the proposed project affects you--the non-boater.

This is your opportunity to make your views and opinions count--while the project is in its planning stages. Though your concern and awareness of boating may be minimal, please help us to accurately gauge community interest in this project by responding to our survey.

If you have already mailed back your completed survey questionnaire, please accept our thanks for your kokua and disregard this notice. Please bear in mind that your responses to this survey will be kept completely confidential.

Thank you for your cooperation.

Sincerely,

Michael M. Jenks
Colonel, Corps of Engineers
District Engineer

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

SOCIAL WELL-BEING ANALYSIS

APPENDIX F

APPENDIX F

KAHANA BAY NAVIGATION IMPROVEMENTS
SOCIAL WELL-BEING ANALYSIS

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I. INTRODUCTION

1. Section II of Appendix F summarizes pertinent 1980 Census profile data for the City and County of Honolulu (O'ahu); the Ko'olauloa District, which comprises a major portion of the "North Shore" of Oahu; and Census Tract 102.01, which includes the communities from Hau'ula to Ka'a'awa. This nesting of regions focuses successively more finely on the likely areas of potential environmental impact. There are no accurate or recent statistics for Kahana Valley itself.

2. Section III summarizes the results of a study by Paige Barbers & Associates conducted under contract to the US Army Corps of Engineers entitled "Social Issue Identification and Analysis for the Kahana Bay Navigation Improvements Study, Oahu, Hawaii." The complete report is available from the US Army Corps of Engineers upon request.

3. Section IV assesses the four alternative plans in relationship to the social well-being components. This "Other Social Effects" component analysis derives from the U.S. Water Resources Council's "Economic and Environmental Principles and Guidelines for Water and Related Land Resources" (February 3, 1983). An other social effects components analysis is not required by the new P&G, but encompasses the social well-being elements which are legally required by Section 122 of the Flood Control Act of 1970 (P.L. 91-611, 84 Stat. 1823) to be addressed in all water resources studies. These elements are combined in five sub-components: (a) urban and community impacts such as population, employment and income distribution and composition, fiscal condition of the local sponsoring government(s), and quality of community life; (b) life, health and safety; (c) displacement of people, businesses or farms; and (d) long-term productivity involving renewable resources.

II. SOCIOECONOMIC CHARACTERISTICS

1. Table 1 depicts selected socioeconomic characteristics of the potentially affect population. The regions selected are the island of O'ahu which for all practical purposes is synonymous with the City and County of Honolulu; the district of Ko'olauloa which comprises the eastern half of the "North Shore" of Oahu; and Census Tract 102.01 which is the smallest area including Kahana Valley for which census statistics are available.

2. Statistics for the City and County of Honolulu provide a baseline against which to evaluate whether any given characteristic for a smaller region appears (non-quantitatively) significantly different. For the purpose of scoping areas of potential social-environmental impact, the district of Ko'olauloa comprises the population which has the greatest potential to become new or significantly more intensive users of an improved launching ramp at Kahana Bay. Ko'olauloa extends from Waimea/Sunset Beach through Kahuku/La'ie to Ka'a'awa and its long stretch of coastline lies midway between the closest other protected navigation facilities at He'eia Kea Small Boat Harbor in Kane'ohe Bay and Haleiwa Small Boat Harbor in Waialua Bay. It is properly acknowledged that for the purposes of computing benefits, the entire island of Oahu is tributary to Kahana Bay; the existing launching ramp undoubtedly is used occasionally by residents from any part of O'ahu and perhaps could be expected to be more likely used by outsiders if it were protected.

3. Census Tract 102.01 comprises the region from Hau'ula through Punalu'u and Kahana Valley to Ka'a'awa. Most of the subsistence/commercial fishermen who normally launch out of Kahana Bay <u>apparently</u> reside in this smaller region and it is the population of this region which is likely to be most affected by implementation of one of the alternative plans, except for Kahana Valley itself. The only recent socioeconomic statistic for Kahana Valley is the population which is estimated by Kahana Valley community leaders to be about 130 persons living in thirty households (Paige Barber & Associates, 1985). There are also 1980 Census population figures for Hau'ula and Ka'a'awa which indicate the greatest growth for Census Tract 102.01 from 1970 to 1980 seems to have occurred in these two communities, rather than in outlying areas, including Kahana Valley.

4. Notable among these statistics is that the district of Ko'olauloa has the highest resident population growth rate on Oahu (almost 35%) from 1970-1980 and continued to rapidly grow from 1980 to 1983. The communities of Sunset Beach, Kuilima, and Hau'ula experienced most of this surge. In the next 10-15 years, further dramatic population growth in the district is likely to focus at the proposed expansion of the Turtle Bay Hilton (formerly Kuilima) resort complex at Kahuku Point, and at Punalu'u, where a new housing project is already under construction. The area of Ka'a'awa and particularly Kahana Bay is unlikely to experience substantial growth over the next fifteen years. In 1980, the median family income in the district of Ko'olauloa ($14,426) and Census Tract 102.01 ($16,717) was significantly lower than the county-wide median ($21,077). Likewise, the percentages of families with incomes below the national poverty level in

TABLE 1. SELECTED SOCIOECONOMC CHARACTERISTICS

	C & C Honolulu	Ko'olauloa District	Census Tract 102.01 (Hau'ula to Ka'a'awa)
1. Population (De facto population, April 1, 1980)			
1970	650,528/1	10,662/2	3,255
1980 (+%)	762,565 (+20.9%)	14,195 (+34.9%)	3,952 (+21.4%)
1983 ('70-'84%)	767,350 (+24.9%)	15,848 (+50.0%)	4,213 (+29.4%)
2. Income (Household Median Income in 1979 dollars, April 1, 1980)			
1980	$21,077/3	$15,426	$16,717/4
3. Poverty Status of Families (1979 dollars, April 1, 1980)/5			
Percentage Families:			
Under Nat'l Poverty Level	7.5%	13.5%	14.8%
100-124% of Poverty Level		9.1	5.8

/1 Table 9. "The State of Hawaii Data Book, 1984: A Statistical Abstract." Department of Planning and Economic Development, February 1985.

/2 Table 12, "The State of Hawaii Data Book, 1984..."

/3 Table 11, "The State of Hawaii Data Book, 1984..."

/4 Table 2, "The State of Hawaii Data Book, 1984..."

/5 Table 88a, "1980 Census of Population and Housing, Census Tracts, Honolulu, Hawaii, Standard Metropolitan Statistical Area, PHC80-2-183 (DRAFT)." U.S. Bureau of the Census (subsequently published June 1983). NOTE: Poverty level is based on Mainland poverty thresholds which are about 15 percent lower than those in effect in Hawaii. Thus these data understate the percent of families below poverty level in Hawaii.

Census Tract 102.01 was almost twice that of the county (island) level and this percentage was even higher among Kahana Valley families. The median family income for the residents of Kahana Valley is not known but it is probably much lower than even the district level.

6. According to "Investigative Report: Master Plan Study for Kahana Valley State Park" by H. Mogi-Planning and Research, Inc. (1974), homes in Kahana Valley are old and many are in poor conditions. This condition has not changed substantially as of 1985. According to Paige Barber & Associates (1985), some residents claim that these conditions pose serious health and safety problems. Because the question of land tenure is unsettled, residents are reluctant to begin repairs to homes with a firm commitment from the State of Hawaii Department of Land and Natural Resources, which owns the property. All of the valley residences are served by the County's water system and utilize cesspools for sewage disposal.

7. These limited statistics give additional meaning to the rural, "Hawaiian" lifestyle that predominates in the Ko'olauloa district and particularly at Kahana Bay. This is fully described in the Environmental Impact Statement. Over the next 10-15 years, new housing and resort developments in the district will challenge this old lifestyle.

III. SOCIAL ISSUE IDENTIFICAITON AND ANALYSIS

1. Scope and Methodology.

a. This Section summarizes the "Social Issue Identication and Analysis report which was prepared under contract (No. DACW83-85-M-0142) with the US Army Engineer District, Honolulu by Paige Barber & Associates [termed PB&A hereafter]. The tables identifying key informants and their consolidated issues and the contractor's recommendations (Management Opportunities) are reproduced verbatim in order to eliminate any bias by the Army Corps of Engineers in the summarization process. The original report is also available upon request. Comments by the US Army Corps of Enigneers preparer of this Appendix F are enclosed in brackets [].

b. Many of the statements in the original PB&A report which appear to represent facts. The "Social Issue Identification and Analysis" report identified various issues and concerns that selected key informants voiced about Kahana Bay, Kahana Valley and the four alternative project plans. These issues and concerns are perceptions held by those individuals, who in many cases were either elected heads or representatives of various public interest groups and/or had been identified by other key informants as potential opinion makers in the Hau'ula to Ka'a'awa region (Census Tract 102.01). To repeat, this study identified perceptions that various people held about the study area. The contract study was not required to verify if these perceptions were "accurate" or "factual."

c. "Accuracy" of facts can be culturally defined. If if a person's perceptions do not match currently accepted scientific or professional historical reality, that does not make those perceptions worthless. First, the so-called scientific "truth" may be based on incomplete information or a culturally biased viewpoint. Second, even if "perceptions" do not match "reality," that non-match may be significant information in itself, revealing gaps in the general education process or in the Army Corps of Engineers' public involvement program.

d. PB&A reviewed all pertinent published and unpublished information about social and cultural issues relating to Kahana Valley in order aid in the identification of publics (key informants and organizations/ agencies) and their issues and concerns. Forty-five interviews were conducted between December 18, 1984 and February 24, 1985 in open-ended and focused formats Table 2). The first interviews were with those individuals who had attended an Army Corps of Engineers public workshop in July 1983. Each of the interviews in this first phase of interviews was asked to identify other key informants and potential opinion makers. Lists of persons and organizations were also available in the minutes and testimonies of other public and private agencies, appendices of various reports, and records of community organizations. Some random interviews were conducted with boaters who were launching or retrieving their craft at the existing launch ramp. During interviews, additional names were suggested by those who were interviewed. It was noted that the interviews of actual boat ramp users should not be viewed as comprehensive because use of the ramp during the period of interviewing (winter months)

TABLE A: DESCRIPTION OF INTERVIEWED PUBLICS

PUBLICS	CONTACTS MADE	LOCATION	SIZE/ COMPOSITION	GATHERING PLACES/ COMMUNICATION
Government				
°U.S. Army Corps of Engineers	Dave Sox	Ft Shafter	n/a*	n/a
°Board of Water Supply	Herbert Minakawa	Honolulu	n/a	n/a
°State Dept of Transportation	Ian Birnie	Honolulu	n/a	n/a
°Dept of Land & Natural Resources State Parks Div	Bill Gorst June Shimana	Honolulu	n/a	n/a
°DLNR, State Historic Sites	Nathan Napoka	Honolulu	n/a	n/a
°Queen Lili'uokalani Children's Center	Gwen Kim	Honolulu/ Punalu'u	3 trustees	statewide/all
°Dept of Hawaiian Homes Lands	Georgiana Padeken	Honolulu	5 commissioners	statewide/all
°State Senate 8th District	Sen. Charles Toguchi	Windward/ Honolulu	n/a	n/a
°State House 15th District	Rep. Robert Nakata	Windward/ Honolulu	n/a	n/a

*not applicable

PUBLICS	CONTACTS MADE	LOCATION	SIZE/ COMPOSITION	GATHERING PLACES/ COMMUNICATION
<u>Government</u>				
State Dept of Health	Dr. Bruce Anderson	Honolulu	n/a	n/a
Government Consultant	Matthew Spriggs	Society of Hawn Archaeo-logists	n/a	n/a
Government Consultant	Dr. John Kraft (Geology Dept)	University of Denver	n/a	n/a
Office of Hawn Affairs	Charles Hopkins (former OHA staff	Honolulu	9 trustees (70-8,000)	statewide/all
Neighborhood Board	Barbara Kahana/ Cathy Mattoon	Windward	9 members	Hau'ula Satellite City Hall/all
<u>Community Groups and Organizations</u>				
Alu Like	Winona Rubin	Honolulu	11 State Bd (13,000+)	statewide/all
Ka'a'awa Commu-nity Assn.	Bob Stauffer/ Jim Muckridge	Ka'a'awa	50 families	Swanzy Park/per-sonal, phone, letter
Punalu'u Commu-nity Assn.	Creighton Mattoon	Punalu'u	60-80 families	QLCC Ctr, Punalu'u/ all
Hui Malama 'Aina o Kahana	Liliana Vincent	Kahana/ Honolulu	residents & former residents	Youth Ctr, Kahana/ all

PUBLICS	CONTACTS MADE	LOCATION	SIZE/ COMPOSITION	GATHERING PLACES/ COMMUNICATION
Community Groups and Organizations				
°Kanani O Kahana	* Elizabeth Kahala	Kahana	residents	Kahana/personal
°Unity Council	Beatrice Soga	Kahana	20 families & organizations	Youth Ctr, Kahana/all
°Native Hawn Legal Corp	Melodie McKenzie	Honolulu	n/a	statewide/all
°Kahana Advisory Board	** Charles Hopkins/ Beatrice Soga	Kahana/ Honolulu	45 representatives of community orgs and public agencies, 13 on steering committee	Orientation Ctr, Kahana/all
Fishermen	John Kahana	Hau'ula	n/a	Kahana Ramp
	Glen Yamashita	Ka'a'awa	n/a	Kahana Ramp
	George Keoho II	Hau'ula	n/a	Kahana Ramp
	Samuel Mainapo	Hau'ula	n/a	Kahana Ramp
	John Keuma	Ka'a'awa	n/a	Kahana Ramp
	Solomon Feliz	Hau'ula	n/a	Kahana Ramp
	Gabriel Hassel	Ka'a'awa	n/a	Kahana Ramp

*Elizabeth Kahala was not contacted. She is listed because she represents Kanani O Kahana.
**Charles Hopkins, former staff member of the Office of Hawaiian Affairs, also served as OHA's source.

PUBLICS	CONTACTS MADE	LOCATION	SIZE/ COMPOSITION	GATHERING PLACES/ COMMUNICATION
Fishermen	Kimo Mills	Kailua	n/a	Kahana Ramp
	Ron Johnson	Hau'ula	n/a	Kahana Ramp
	Vernon Soga	Kahana	n/a	Kahana Ramp
	Louis Agard	Honolulu	n/a	n/a
	Tsuneo Gorai	Kaneohe	n/a	n/a
Residents				
(*These individuals responded primarily as residents, however, they are also members of community organizations. During interviews, they made distinctions between their own views and that of the organizations they belonged to)	*Bob Stauffer	Ka'a'awa	n/a	n/a
	*Creighton Mattoon	Punalu'u	n/a	n/a
	*Cathy Mattoon	Punalupu	n/a	n/a
	*Barbara Kahana	Hau'ula	n/a	n/a
	*Beatrice Soga	Kahana	n/a	n/a
	*Charles Hopkins	Ka'a'awa	n/a	n/a
	Pua Martinez	Kahana	n/a	n/a
	*Benjamin Shaefer	Kahana	n/a	n/a
	Ernest Heen, Jr	Kaneohe	n/a	n/a
	*Jim Muckridge	Ka'a'awa	n/a	n/a
	*Howard Geiger	Ka'a'awa	n/a	n/a

is normally limited to only the most seasoned fishermen. Casual and recreational boaters were probably under-represented.

e. It must be emphasized that the selection of interviewees was never intended to be a statistically-valid representative sample of public opinion of any region. The PB&A report noted that most of the interviewees were selected because they held leadership positions or were perceived by others to have an influence on community views and opinions. It was presumed that if such persons officially represented a group or were percieved by members of that group as having an influence on community views and opinions, then that person's knowledge or point-of-view assumed a group perspective. The PB&A report never assued that those interviewed represented all the views held by members of the target area (Ka'a'awa to Hau'ula). These methodological con-straints are especially important in interpreting in Table 3 (Table B of the PB&A report), the "extent" to which various issues were expressed by certain groups.

f. From the individual that were interviewed, PB&A organized the individuals and the issues or opinions that expressed into four groups or publics: Government (listed as Public Officials in Table 3), Community Groups and Organizations (abbreviated as Community in Table 3), Fishermen, and Residents. Residents include those residing in Kahana valley itself as well as the communities of Hau'ula to Ka'a'awa. As noted on Table 2 (Table A in the PB&A report), some residents were also members of community organizations, but during the interview, they made distinctions between their personal views and those of the organizations to which they belonged.

2. Issues and Perceptions.

a. Table 3 is a detailed listing of the issues and perceptions identified through the review of pertinent documentation and an analysis of the interview responses. PB&A did not alter any of the opinions or views of those interviewed, because it was not the purpose of the PB&A study to judge whether views were accurate or not; it was the purpose of the study to identify what these view were, why interviewees held them, and whether they had any solutions to problems and issues that they deemed important. No respondents were prompted to offer an opinion on any particular subject or question. However, where clarification was needed to determine whether a view or opinion, that appeared significant to the study, was shared by more than one respondent, a specific question to that effect was posed.

b. In Table 3 under the "Who" column, the absence of a particular "public" meant that the members of that public who were interviewed did not express that particular viewpoint during the interviews. To have included all groups and inserted none under the "Extent" column would have implied that the viewpoint had been considered and deliberately dismissed. The "extent" determination is meant, as explained in Paragraph 1b and 1e above, only to indicate the degree to which issues were expressed among the individuals that were interviewed, and by extension of their roles as influential members of the community, the publics within which purview their viewpoints lay. The expression of intensity was based on the professional opinion of PB&A.

c. The columnar titles in Table 3 were defined by PB&A as follows:

(1) Issues -- the "what" and "why"; a descriptive, concise and complete definition for each particular issue stating, where appropriate, the reasons for the respondent's interest in a particular issue.

(2) Who -- a listing of those formal and informal publics which have an interest in each particular issue.

(3) Extent -- the degree to which each particular issue is expressed within a specific public. Extent is expressed by the following terms:

ALL an issue expressed by all members or organization in a public.

MOST an issue expressed by at least 50 percent

SOME an issue expressed by at least one of the members of a specific public

(4) Duration -- the length of time each particular issue has been of interest. Duration is expressed as follows:

I 1 to 3 years

II 4 to 8 years

III 8+ years

(5) Intensity -- the level of importance associated with each particular public. Intensity is expressed as follows:

HIGH
MEDIUM
LOW

(6) Source -- the identification of the source of information to define the issue. Some followup contact was necessary to clarify information.

(7) Classification -- the degree to which each particular issue has bearing on the proposed project. Each issue will hav either:

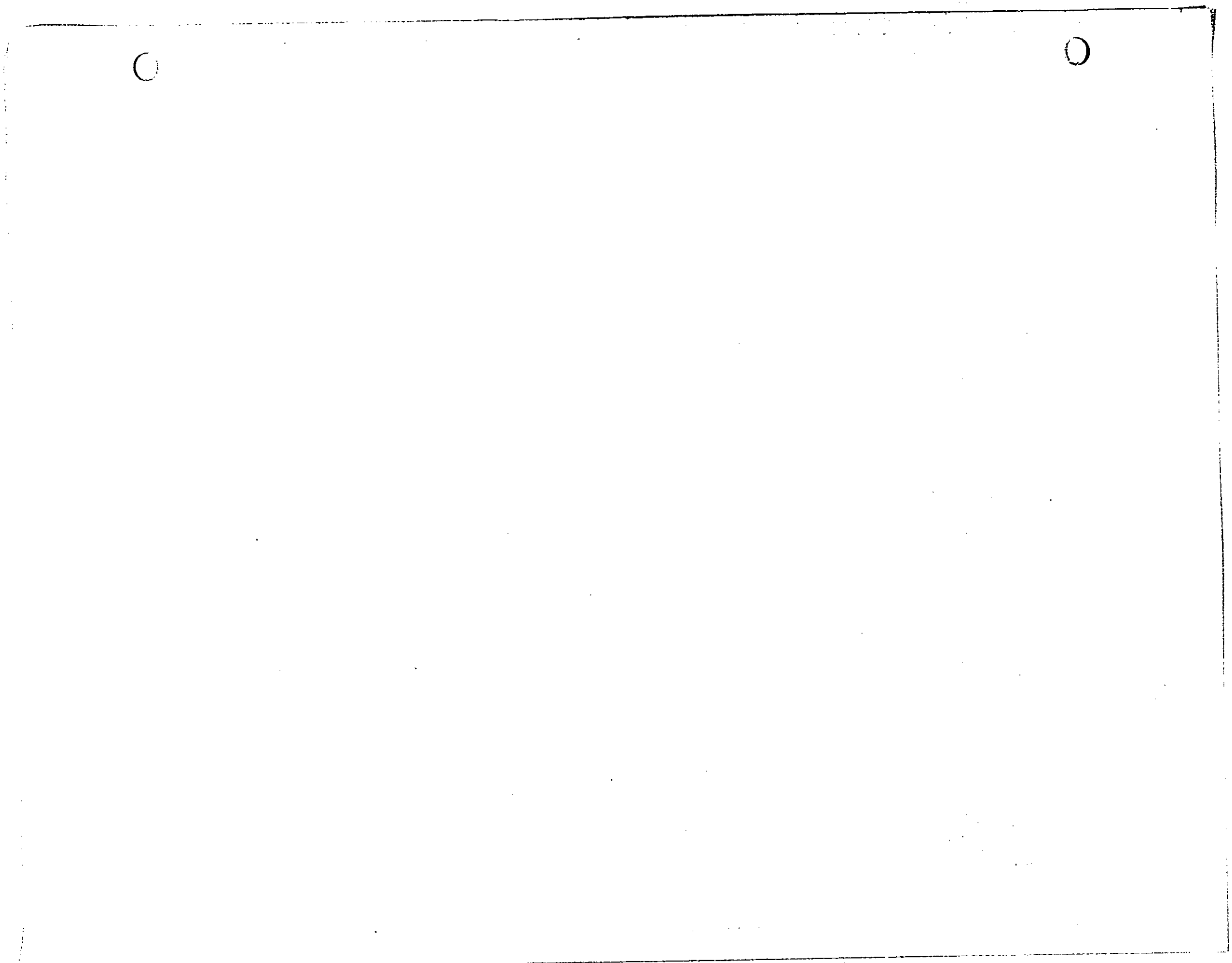
DIREECT bearing or
INDIRECT bearing

TABLE B: ISSUES AND PERCEPTIONS

ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Fishing and Boaters' Needs						
°There should be range lights and a bouy to aid in locating the channel during stormy conditions and at night	Fishermen	All	High	III	Interviews	Direct
°To extend the breakwall to reduce surge problems and aid in boat launchings and retrieval	Fishermen	Most	Medium	II	Interviews	Direct
°To provide mooring space for two boats (maximum) for emergency purposes	Fishermen	Some	Low	I	Interviews	Indirect
°The immediate ramp area should be dredged; it is shallow and several boat propellers have been broken	Fishermen	Most	High	II	Interviews	Direct
°There is a rock at the bottom by the ramp; if the rock is "sacred" don't touch it because it is part of our Hawaiian culture	Fishermen	Some	Low	II	Interviews	Indirect
°Most fishermen know about the ramp and can avoid breaking propellers; it's the guys that don't know the place that get into trouble	Residents Fishermen	Most Some	High Low	II II	Interviews Interviews	Indirect Direct
°Fishermen can use a small propeller when launching and switch to a larger one once they clear the shallow ramp area	Fishermen	Most	Medium	II	Interviews	Indirect
°Don't know why the fishermen are complaining about the conditions; this only occurs during the winter	Residents	Most	High	I	Interviews	Indirect

ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Fishing and Boaters' Needs						
°Take the ramp out; that way, no complaints from fishermen	Community Gps Residents	All Most	High High	I I	Interviews Interviews	Direct Direct
°If the ramp is improved, there will be more boats using the bay which will increase user conflicts	Community Gps	All	Medium	II	Interviews	Indirect
°The Makauea site is not a good one because wave and wind conditions are not favorable; may need to dredge	Fishermen Community Gp	Most Some	Medium Low	I I	Interviews Interviews	Indirect Indirect
°Best ramp location is near fishpond	Fishermen	All	High	II	Interviews	Indirect
°Malaekahana is a good alternative because it is midway, will not require dredging and is sheltered	Fishermen	All	High	II	Interviews	Indirect
Territoriality and Development						
°Ramp is being used mostly by "outsiders" and improvements will bring more "outsiders"	Residents	All	High	II	Interviews	Direct
°Ramp improvements will bring increased traffic congestion	Residents	All	High	II	Interviews	Direct
°Expand road and parking to accomodate more boats, trucks, trailers	Fishermen	Some	Medium	I	Interviews	Direct
°"Outsiders" are non-Kahana and non-Windward residents	Residents	Most	Medium	I	Interviews	Indirect

ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Territoriality and Development						
*There is a desire for the windward side to retain its "rural" character; to develop boating facilities at Kahana will contribute to the erosion of this "rural" character	Residents Community	Most All	High High	III III	Interviews Interviews	Direct Direct
Relationship With Other Projects						
*Alterations at the ramp should be delayed pending the completion of the Kahana Valley Plan	Community Residents Public Officials	All Most Most	High High Medium	III III III	Interviews Interviews Interviews	Direct Direct Direct
*New projects may cause delays in the plan	Community Residents	All Most	High High	III III	Interviews Interviews	Direct Direct
Land Tenure						
*The question of land tenure must be given the highest priority before consideration of other plans	Community Residents	All Most	High High	III III	Int/Documents Int/Documents	Indirect Direct
*The long delay in resolving the issue of land tenure has caused deep frustration among residents and community groups	Community Residents	All Most	High High	III III	Interviews Interviews	Indirect Direct
*The Corps' plans may result in further delaying the completion of the Kahana Valley plans; to prevent this from happening, the Corps should delay its planning process and participate in the Kahana Valley planning process so that there will be coordination	Community Residents	All Most	High High	III III	Interviews Interviews	Indirect Direct



ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Integrity of Ecosystem						
°Any major alteration to the ramp and breakwall will lead to sedimentation buildup in the bay and add to existing water quality and pollution problems	Community Residents Fishermen	All Most Most	High High Medium	II II II	Interviews Interviews Interviews	Direct Direct Indirect
Pressure on Natural Resources						
°Expanding the ramp will bring more boats into the bay and will affect the akule spawning	Community Residents	All All	Medium High	II II	Interviews Interviews	Indirect Direct
°Water development/diversion activities in the valley will reduce the necessary flushing action and add to the buildup of sedimentation in the bay	Community	All	High	II	Interviews	Direct
Historic Preservation						
°Placement of project near Huilua Fishpond would adversely effect the fishpond's cultural and historic significance	Community Residents	All Most	High High	III III	Interviews Interviews	Direct Direct
°Cultural and historic sites may be destroyed or damaged by the project, or access to these sites may be limited as a result of the project	Community Residents	All Most	High High	III III	Interviews Interviews	Direct Direct

ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Konohiki and Kuleana Rights						
*The issue of konohiki and kuleana rights should concern the Corps to the extent that the Corps must evaluate the effects of this project in relation to these rights	Community Residents Fishermen	All Most some	High High Low	III III I	Interviews Interviews interviews	Direct Direct Indirect
Economic Self-Sufficiency						
*Regular use of the ramp is for sport and recreational boating; fish caught is sometimes sold to offset costs of fuel, and personal use	Fishermen	All	High	III	Interviews	Direct
*Residents hope that Kahana Plan will result in some residents securing paid positions	Community Residents	Most Some	Medium Low	II II	Interviews Interviews	Indirect Indirect
*Residents receive fish from some of the fishermen who have a surplus	Community Residents	Some Some	Low Low	II II	Interviews Interviews	Indirect Indirect
*Residents hope that the Kahana Plan will result in reviving fishing activities in the stream, bay and fishponds (non-ramp activities)	Community Residents	All Most	High High	II II	Interviews Interviews	Direct Direct
Health and Safety						
*Expanding and improving the ramp will bring in more boats and add to the user conflict problem in the bay	Community Residents	Most Most	High High	II II	Interviews Interviews	Indirect Direct
*More boats using the ramp will increase pollution in the waters	Community Residents	All Most	High High	II II	Interviews Interviews	Indirect Indirect

ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Health and Safety						
•Expanding the breakwall will increase the sedimentation buildup in the bay	Community Residents	All Most	High High	II II	Interviews Interviews	Indirect Direct
•Dredging the ramp area will reduce the number of boat propellers now being broken	Fishermen	Most	High	II	Interviews	Direct
•Providing emergency mooring space for boats will enable boats to use the area as a safe refuge overnight	Fishermen	All	Medium	II	Interviews	Indirect
•If the weather is bad, nobody will be able to bring their boats in; if they can get in, the best place for the boats to moor is right in the bay because it is calmer there	Fishermen	Some	High	II	Interviews	Indirect
•Sometimes the skiers get in the way of the boats, but if they do, they are told to get bakc in their own area and they do so right away.	Fishermen Residents	Some Some	Low Low	I I	Interviews Interviews	Indirect Indirect
Distrust of Motives						
•Why is the Corps expanding the ramp when all we asked them to do is put in range lights and a bouy?	Community Residents	All Most	High High	I I	Interviews Interviews	Direct Direct

ISSUES: THE "WHAT" AND "WHY"	WHO	EXTENT	INTENSITY	DURATION	VERIFICATION	CLASSIFICATION
Distrust of Motives						
°There is a perception that the plan to improve Kahana's ramp is only a part of a longer-ranged plan to construct large harbors and piers on the windward side to accomodate "luxury" boats from the outside	Community Residents	All Most	High High	I I	Interviews Interviews	Direct Direct
°Since the complaints first went to the DOT (from the fishermen), what role is DOT playing in this?	Community	All	High	I	Interviews	Direct
Additional Comments						
°To properly work out the project details, the Corps should either participate in the Kahana Valley planning process or serve as a resource	Community Residents	All Most	High High	I I	Interviews Interviews	Direct Direct
°If the Corps is going to work on these types of plans (alternative sites), they should send engineers who will work closely with the local people; don't send "river" engineers; look at what happened in Waianae-they put the breakwall in the wrong place	Community Residents	All Most	High High	I I	Interviews Interviews	Direct Direct

3. Analysis of Community Issues.

a. The purpose of this section of the PB&A report was to synthesize groupings of statements, to clarify intent behind certain statements made by respondents, and to flesh out nuances and associations between statements. The generic assignment of certain statements to a particular group indicates that all of those individuals interviewed who identified themselves as belonging to that group or identified their viewpoints as associated with an group or organization expressed this issue or opinion. All of the opinions made in this section represent the perceptions of the interviewees, not Paige Barber & Associates (PB&A).

b. Fishing and Boaters' Needs. Fishermen who were interviewed recommended the following measures to enhance their safety while in the water: (1) installing range lights and a buoy; (2) dredging the ramp area; and (3) extending the breakwater. Mooring facilities were deemed "good to have" for those boats in need of repair which could not be immediately removed or for those boaters desiring overnight accomodations. Expansion of the parking area was seen as needed to avoid the overcrowding that now occurs on "good" fishing days. The "user conflicts" identified by community groups refer to fishermen vs. water skiers, swimmers vs. skiers, residents vs. outside ramp users, and canoe paddlers vs. fishermen. To date, the relationship between residents of Kahana Valley and fishermen from outside Kahana as been one of accomodation. However, improving the ramp area with any facilities beyond range lights and a buoy is seen as likely to create tensions.

c. Territoriality and Development. Any development which appears to benefit "outsiders" at the expense of community residents will be subject to much opposition by the residents.

d. Relationship with Other Projects. A Kahana Valley Plan is being developed by the recently appointed Kahana Valley Advisory Board, with participation by local governmental agencies, to guide the future development of the Kahana Valley State Historic Park. Participants in the Plan hope to complete their work by the end of 1985. [Note: This advisory board is very large and has been slow in effectively developing a plan. In June/July 1985, an executive director was named, Mr. Robert Stauffer (a Ph.D candidate at the University of Hawaii in History), to actively guide the actual preparation of a plan.] All community group representatives that were interviewed indicated that any new project would adversely affect the progress of completing the Kahana Valley Plan. Although a state legislative resolution (passed in 1984) that called for a morotorium on all projects in the valley specifically exempted the Corps' present study, the residents and community groups that were interviewed alike expressed the desire that the preparation of alternative plans by the US Army Corps of Engineers also should be delayed. PB&A noted that residents and community groups do not make distinctions between planning a project and its actual implementation or construction.

e. Land Tenure. It is the view expressed those residents, community groups, staffs of state agencies, and public officials who were interviewed that the issue of land tenure will be resolved at the completion of the Kahana Valley Plan by the end of 1985. Any development

in the Kahana ahupua'a that occurs before the issue of land tenure is resolved is viewed as triggering opposition from Kahana residents and windward community groups. Although the State of Hawaii contends it has total ownership of the ahupua'a, the issue of kuleana rights raised by descendents of former kuleana owners persists. This problem derives from the acquisition by the state of the ahupua'a from the estate of Mary Foster which was completed on December 31, 1984. However, Mary Foster had acquired, by the late 19th century, only 93 of the original 111 shares which were divided among 96 hui members which previously owned the ahupua'a. [It is presumed that some of those of former kuleana owners, whose present day descendents are pressing the issue of land tenure, may be among the 19th century hui members whose shares were not bought out by Mary Foster.]

f. Integrity of Ecosystems. The draft plan under review by the Advisory Board avoids any form of development that would be inconsistent with the natural (or present) setting of the Kahana ahupua'a. All community groups and some of the residents that were interviewed hold the view that extending the breakwater will threaten the integrity of the ecosystem by altering the course of the current in the bay and accelerating sedimentation buildup. Some community groups believe that extension of the breakwater will affect the underground fresh water springs near the fishpond.

g. Legends and Historic Sites. Many of the community leaders and residents that were interviewed fear that various known historic sites and and other places, objects or images associated with particular legends may be destroyed or damaged by the proposed Corps project. They are also concerned that construction and use of the ramp may limit access to these sites or places. Except for Huilua Fishpond, a rock in the bay identified as the high chief Palani turned to stone, and an image of woman--perhaps Papa, the mother of the human race--which can be seen at a certain time of the day underwater near the present ramp, none of the following sites, places, objects or images were specifically identified by any of the interviewees as being potentially affected by any of the proposed project alternative plans. Nonetheless, it seems clear from the respondents that there is a pervasive fear that Hawaiian cultural resources in general will be adversely affected by any major navigation improvements project. [Note: The EIS addresses those sites which the Corps believes may or may not be affected by the various project alternative plans.] The following list is derived from Sterling, Elspeth P. and Catherine C. Summers, "Sites of Oahu" (Bishop Museum, 1978); Robert Stauffer, "A Status Report on Kahana" (1984); and interviews. It was not within the contract scope of work for PB&A to verify accuracy of legends or the presence or absence of sites, places, objects or images.

Kanaloa's kneeprints indented in a rock close to the beach;
Kanaloa's footprint near Huilua ("twice-jointed") Fishpond;
Kanaloa's creation of Kapuwai O Kana spring near the fishpond;
Kauninio ko'a--a fishing alter seen at low tide in the bay;
Malau-o-kana (Kana's house) in Kahana Valley;
An underground passage from Huilua Fishpond to Kualoa Point;
Kapa'ele'ele ko'a--a fishing shrine on the Punalu'u ridge overlooking Kahana Bay;

A woman's image seen at certain times of the day submerged near the present ramp from a vantage point on the Punalu'u ridge above the ramp. A local resident suggested it may be the image of Papa, the mother of the human race;

A fishing lookout on the Ka'a'awa ridge used by spotters to alert villagers of schools of akule coming into the bay [same as Kapa'ele'ele ko'a];

Pu'u Kakane heiau--a stone terrace once located above Huilua Fishpond;

A rock in the bay said to have been Palani, a high chief turned to stone by Hi'iaka for the rudeness of surfing at Kahana;

Two springs--a brackish spring located inland and a fresh one near the beach which are said to have been altered by gods visiting to Kahana;

Huilua Fishpond, which was listed as a National Historic Landmark in 1962 and subsequently listed in the National Register of Historic Places.

h. Konohiki and Kuleana Rights. Residents, fishermen, and community groups tend to be confused about the meaning of the terms "konohiki rights" and "kuleana rights." The term konohiki historically referred to the authority and jurisdiction as well as the ali'i (chieftain class) individual who had that authority and jurisdiction to control the harvest or collection of the products of both the land and sea (to the surf line) on behalf of the chief. The term "konohiki rights" is now used most often in reference to fishing rights, rather than any individual's authority. A majority of the residents and most community groups acknowledge the State of Hawaii to be holding or acting as the konohiki of the Kahana ahupua'a. However, as noted in Paragraph 3e above, a number of kuleana descendents claim that their kuleana rights--limited rights to gather the land and sea products of the ahupua'a--still exist and indicate that this may be tested in the courts in the future. The Kahana Valley Advisory draft report states that the Army Corps of Engineers may need to take these traditions into consideration in cases where the Corps has regulatory jurisdiction in Kahana Valley or Kahana Bay or in consideration of alternative plans to improve navigation in or near Kahana Bay.

i. Economic Self-Sufficiency. Under the proposed Kahana Valley Plan, residents and community groups hope to revitalize traditional boating and fishing practices using inland streams and the bay. Canoes would be launched directly from the beach fronting the back of the bay. Few valley residents are expected to use the ramp for boat launching and those that were interviewed who now do use the ramp have indicated strong opposition to any improvements beyond range lights and buoy. Associated with this view of the future of Kahana valley and bay is the view expressed by all residents and community groups which were interviewed that the Corps' proposals to improve the ramp would contribute to increase boat activity adding to user conflicts, creating additional pollution and generating a sediment buildup in the bay. They also fear that dredging may cause fish poisoning. See Table 3 for other issues.

j. Distrust of Motives. Reiterating Table 3, most of the residents and all of the community groups that were interviewed expressed a belief the Corps may be using fishermens' complaints to expand the existing ramp

facilities for use by non-residents who own luxury boats as part of an elaborate plan to construct large piers and harbors throughtout the Windward Oahu coast to satisfy "outside" lobbying forces.

k. Political Conditions. The Corps alternative study plans are viewed by community groups on the Windward coast as a development plan. Based on the interviews, it is likely that these plans will be opposed by residents, community groups and leaders. PB&A indicates that community groups on the Windward coast enjoy a reputation for being well organized, having strong inter- and intra-communication linkages, and for being politically astute. These groups tend to access public official (elected and appointed) quickly to offer their points of view, voice their concerns, and advocate their positions. They are known to be easily and quickly aroused by plans that intend to "develop" the Windward coast to the extent that the rural character of the coast might be altered.

4. Management Opportunities.

a. The management opportunities listed Table 4 below were derived from studying the views and opinions of those interviewed and from an analysis of the most feasible options available to Army Corps of Engineers in its planning for this study. They represent the professional opinion of Paige Barber & Associates and are reproduced here verbatim for the record. Action on these recommendations has been taken into consideration by the Army Corps of Engineers and will be a subject for discussion at the planned public meeting in October 1985. The Paige Barber & Associates "Social Issue Identification and Analysis for the Kahana Bay Navigation Improvements Study, Oahu, Hawaii" report is not mentioned or addressed in either the Main Report or the Environmental Impact Statement.

TABLE 4. MANAGEMENT OPPORTUNTIES (Paige Barbers & Associates, 1985)

1. The Corps should delay its planning activities until such time as the Kahana Valley Plan is completed by the end of 1985.

   Proceeding at this time would trigger community and resident opposition and raise more questions on the Corps' motives behind its planning activities. This same opposition may give rise to the issue of distrusting the Corps' motives in its planning activities and may adversely impact other worthwhile activities being considered by the Corps in the Windward area.

2. The Corps should convene a meeting with the Kahana Advisory Board to review its alternative planning studies.

   Most community groups expressed the desire that the Corps' plans be in harmony with the Kahana Valley Plan. A meeting with the Kahana Advisory Board would provide the opportunity for the Corps to share its planning studies with those most active in the Windward area. This will not immediately quell anxieties, but it may serve as an opportunity for better communications over time. If the Corps is consistent in its interactions with the community, better communications will result over time. Any meeting planned with the Kahana Advisory Board should involve the State Department of Transportation (DOT) to clarify that the Corps responded to the DOT's request for assistance. At present, most community groups and residents view the Corps as acting on its own and having its own hidden agenda for enlarging the ramp and the Corps' link with the DOT should be made clear in future public meetings.

3. The Corps should serve as a resource to the Kahana Advisory Board.

   By providing information on its planning activities, the Corps would aid the Board in completing its plan in a comprehensive, expeditious manner. Another alternative suggested by one member of a community group was for the Corps to become a member of the Board. However, this latter alternative may not be possible in this stage of the Board's development.

4. The Corps should discuss the feasibility of providing minimal improvements at this time.

   Given the potential for strong opposition to anything more than range lights and a buoy in Kahana Bay, it may be more viable for the DOT to install these until more elaborate improvement plans can be dove-tailed with the Kahana Valley Plan or other alternatives found.

TABLE 4. (Cont'd)

5. The Corps should assign engineers who will work closely with the community in designing future projects

Some fishermen and some community groups have criticized the work performed by the Corps on the Waianae harbor and placement of the pier and ramp at Kahana Bay. Critics claim that these errors were the result of engineers who did not engage the advice of knowledgeable community residents and relied too much on technical information. Directing engineers to work with knowledgeable community residents will demonstrate the Corps' willingness to incorporate information that is valuable to the successful design and placement of physical structures in and adjacent to the ocean.

6. The Corps needs to understand and utilize the strong inter-relationships that exist among community groups

The Windward target area under study is highly organized, skilled in community advocacy, politically astute and maintains strong communication networks among its leaders and other organizations, agencies, and officials. The Windward area is perceived by its leaders and residents as being impacted upon by the threat of urban encroachment and water diversion strategies that threaten its rural characteristics and agricultural lifestyle. Many of these leaders and residents have a long involvement with public agencies and officials and for various reasons, have come to distrust the motives behind plans or activities they have little information on, or where outside pressure demands changes they are unable or unwilling to support. Moreover, what might appear to be a small, singular change is viewed as ushering in larger changes over time. These community leaders and residents do not view a project in isolation of other projects and are not adverse to taking position for or against these. The Corps will do much better in its overall strategies in involving community groups and residents early in planning and project activities to maximize the success of its projects. Even if community groups oppose those activities planned by the Corps, whether it be in the Windward area or elsewhere, it is important for these plans to receive the broadest exposure possible. By providing for this inter-action, both the Corps and the community will benefit for having had the exchange, as well as having the opportunity to possibly consider alternatives and to make adjustments to plans in meeting the needs of the communities in which they are implemented.

IV. OTHER SOCIAL EFFECTS ANALYSIS

1. Urban and Community Impacts.

a. Population, Employment and Income. Each of the four alternative plans would likely have similar direct effects in kind and magnitude. There will be minor employment and income benefits to the employees of the firm constructing the new facility with these benefits resulting in further indirect effects in the local county economy. These benefits would be felt in the Koolauloa district or Census Tract 102.01 (Hau'ula to Ka'a'awa) only if construction employees lived there. It seems apparent from the community residents and community leaders interviewed and the recommendations of the draft Kahana Valley Plan as quoted by Paige Barbers & Associates (1985), that the community perceives that any improvements to the existing ramp beyond range lights and buoys could result in pollution to the bay and user conflicts. If this were to occur, the project could be perceived to potentially but indirectly limit opportunities for Kahana Valley residents to achieve a degree of economic self sufficiency relyingtraditional fishing and boating techniques. The EIS discusses the effects of blasting and dredging during construction, but concludes there neither construction nor operation of the new improved launch ramp facility would have any adverse effects on the socioeconomic conditions of the region. The project by itself will not generate additional population growth, but it will become one of many recreational amenities of the region that will be a factor in people deciding to live in Ko'olauloa rather than in Ko'olaupoko (Kaneohe-Kailua region).

b. Local Fiscal Conditions. This project is to be cost-shared with the State of Hawaii in ratios tentatively identified in Paragraph IIID4 of the Main Report. Using current Federal guidelines, the State share would be $384,800 for the tentatively recommended plan (Alternative 1). The national Adminstration is currently reviewing cost sharing and financing across the entire spectrum of water resources development functions. Although no specific cost sharing policies applicable to the project have yet been established, it is anticipated that the states' level of financial participation will be greater than in the past. As in all state capital improvements projects, the priority of the Kahana project for state financing amongst all other state projects and compared to other Department of Transportation projects will depend on local political support. The state is fully capable of financing this project with no negligible fiscal impact on taxpayers.

c. Quality of Community Life.

(1) As described in the EIS and above, Kahana valley and bay has a unique, "laid-back" rural Hawaiian-style landscape and lifestyle. The state park was originally intended to be living historical park preserving Hawaiian traditions at somewhere between the 19th and 20th centuries. It is toward this goal that the Kahana Valley Plan would propose to guide the people and capital improvements in and planned for the valley and bay area. The draft plan avoids recommending any form of development that would be inconsistent with the ahupua'a "natural (read present) setting.

(2) Based on documents describing the present conditions and alternative futures of Kahana Valley Historic Park and the interviews of fishermen and residents in the community and of community leaders--and presuming that these residents and community leaders are echoing sentiments that could become an active political lobbying force--there seems to be strong opposition to continued Corps planning for this ramp improvement for the immediate (3-6 month) future, and mixed feelings about what form improvements to navigation problems in Kahana Bay should take. Notwithstanding the support for improvements by the fishermen (who are also residents of the community) interviewed--which notably did not include the casual or recreation boaters that will probably comprise the majority of future users of an improved launching ramp--it seems apparent that there is much uncertainty about what level of improvements are needed and whether or not it is the Kahana Bay ramp that should be improved. The same uncertainty shows in the comments received from 278 respondents to Contingent Value Method survey described in Appendix E. This survey was conducted and analyzed by Army Corps of Engineers economists. The survey looked at a random sample of boaters and non-boaters in O'ahu, stratified for boaters to look at a population in the Kane'ohe-Ka'a'awa area and a population for all of O'ahu. Because those active in the community are very few, the random sample tended to echo the sentiments of the so-called "silent majority." Of the 278 responses, 117 indicated support for a project at Kahana.

(3) Based on responses received by Paige Barbers & Associates (PB&A) from local fishermen, there was no apparent concern about "outsiders" or fear that ramp improvements might adverse affect the rural lifestyle of the region. It was the residents and community organization leaders who voiced these concerns. However in the reality of planning for capital improvements and for governmental budgeting for capital improvements, it is the vocal minority which is usually heard and which often prevails. Based on the interviews, these people do not seem opposed to improvements so much as distrustful of the Corps motives in constructing the improvements that are proposed--breakwater extension and dredging. They do apparently desire that the Corps planners work with the community in helping to plan the future of Kahana valley and bay.

2. Life, Health, and Safety.

a. None of the alternative plans seem to have any risk of failure that would affect the life, health or safety of boaters. One of the rationales for the proposed improvements is to provide a safe haven for boaters stranded at sea during high wave conditions. For boats between Kualoa Point and the Waimea Bay/Kahuku region, there is no protected harbor of refuge now available except for the Haleiwa Small Boat Harbor and the He'eia Kea Small Boat Harbor. The tentatively recommended improvements at Kahana Bay would not provide mooring space but would provide protection from design storm wave conditions behind the breakwater for hauling out of boats. Safety of boaters would be enhanced by the dredging of an entrance channel to a depth -8 feet (mean lower low water) which should eliminate broken propellers for boats which remain within the buoyed channel.

b. Most of the community groups and residents that were interviewed by PB&A indicated concern that the higher number of boats attracted to the improved launching ramp could result in user conflicts (boaters vs swimmers, skiers vs fishermen, and canoes vs. launched boats) in the bay. At present the Main Report (see also Appendix E) notes that the present volume of 436 launches (1980--probably underestimated) will increase twenty-fold to 8,000 launches. Neglecting greater use on weekends, that is grossly equivalent to 22 launches per day. Since the existing parking lot now can accomodate only six vehicles with trailers, the true capacity of the one-lane launch ramp is not likely to exceed a gross average of 10 launches per day, equivalent ot 4,000 annual launches. [The number of estimated launches will be re-evaluated in subsequent planning.] This is still about a ten-fold increase in use of that harbor, which if user conflicts occur now, is bound to increase the frequency of user conflicts in the future.

c. Another safety issue related to the forcasted dramatic increase in launch volume is parking and traffic flow. If the demand for launches begins to reach that which is forcast based on the Contingent Value Method analysis (higher than 8,000 annual launches--see Appendix E), on selected days, the parking of boater's vehicles and trailers will have to spill out of the small parking lot into the formal and informal parking areas of the Kahana Valley State Park. As currently designed, there is no room for expanding the existing parking lot without enlargening the filled area along the shoreline. The parking spill-out effects may cut into the attendance at the beach park and the valley facilities and could increase the likelihood of resentment against all boaters, especially those identified as being "outsiders." This condition could also affect the safety of those seeking parking spaces at the park and could affect safe traffic flow on the highway in relation to vehicles turning into and coming out of the small parking lot at the ramp and vehicles seeking parking spaces outside of formal parking area, such as along the highway.

3. Displacement. None of the alternative plans would result in the direct displacement of any people, businesses or farms.

4. Long-term Productivity.

a. According Paige Barber & Associates (1985), all community groups, most residents, and most fishermen that were interviewed voiced concerns that any major alteration to the ramp and breakwater will lead to sedimentation buildup in the bay and add to existing water quality and pollution problems. The unvoiced presumption by the Corps is that these individuals are concerned about, among other things, long-term productivity of bay fishery. A direct concern of all community organizations and residents that were interviewed by PB&A is that expanding the ramp will bring more boats into the bay and will affect the akule spawning.

b. It is the professional opinion of the Corps planners, ocean engineers and environmental biologists, that none of the alternative plans, particularly the tentatively recommended Plan 1, will have any adverse long-term effects on the fishery productivity of Kahana Bay. The Corps does acknowledge that the increased number of boaters (fishermen) will increase fishing pressure on the akule fishery at Kahana Bay and will

result in higher levels of boat-engine related pollutants discharging into the bay waters. The U.S. Fish and Wildlife Service concurs in these viewpoints, but also suggests that the breakwater will modify existing currents to the extent that sedimentation will occur in the entrance channel and turning basin, thus requiring periodic maintenance dredging. The Corps does not believe that this sedimentation will occur.

KAHANA BAY NAVIGATION IMPROVEMENT

OAHU, HAWAII

NATURAL RESOURCES

APPENDIX G

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:
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4 DEC 1984

CDR
DEP
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EA
Engr

Colonel Michael M. Jenks
District Engineer
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Colonel Jenks:

This is the Fish and Wildlife Service's Draft Coordination Act Report for the Kahana Bay Light Draft Navigation Improvement Project, Oahu, Hawaii. This report does not fully satisfy the requirements of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.). Final project plans and designs will be evaluated in a Final Coordination Act Report prepared by this office at a later date. We hope the information contained in this report will be valuable to your staff during the development of this study.

Sincerely yours,

Allan Marmelstein
Pacific Islands Administrator

cc: HDAR
NMFS - WPPO
Director, FWS, Washington, D.C. (AHR-ES/FD)
Regional Director, FWS, Portland, Oregon (AHR)

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DRAFT COORDINATION ACT REPORT
KAHANA BAY LIGHT DRAFT NAVIGATION IMPROVEMENT PROJECT
ISLAND OF OAHU, HAWAII

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
HONOLULU FIELD OFFICE

DECEMBER 1984

Prepared for the Honolulu District,
U.S. Army Corps of Engineers, Honolulu, Hawaii

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PREFACE

The draft report was prepared by Andy Yuen and includes available literature and data from recent Service field surveys conducted at Kahana Bay, Puu Mahie Point, and Makaua Beach Park. Quince Mento is acknowledged for his field support. Helene Takemoto, Physical Environmental Specialist, Environmental Resources Section, Planning Branch, U.S. Army Engineer Division, Pacific Ocean, provided the project engineering data.

PROJECT AREA DESCRIPTION

The proposed project sites are located along the windward coast of Oahu, Hawaii (Figures 1 and 2). The Kahana Bay site (Figures 3 and 4) is at the existing small boat launching ramp at Kapaeleele Point. The site consists of a launch ramp, groin with a wooden deck, and parking lot protected by a boulder revetment. The existing boat launch facility is bounded by Kahana Beach to the south and a cobble shoreline to the north. The substrate in the affected area appears to be dominated by a fine-grained sand (Reference 4 and field observations). No corals or hard-bottom habitats were observed in the vicinity of the existing boat ramp. Sediments in this area are predominantly calcareous with a small percentage of terrigenous and detrital materials (Reference 2). The water clarity during the survey was very poor with visibility less than 2.5 feet. This site is exposed to tradewinds and tradewind generated swells. The influence of Kahana stream, strong tradewinds, and surf are probably responsible for the high suspended sediment load. The shoreline at this site has been altered by the construction of the existing boat launch facility. Kahana Bay is classified as an accreting beach (Reference 7).

The Puu Mahie site (Figure 5)is located on the eastern point of Kahana Bay. The intertidal area is a basalt outcropping flanked by small sand areas. The immediate inshore substrate is a mixture of sand and consolidated limestone. The substrate in the offshore area consists of sand patches separating consolidated coral rubble and boulder outcrops (Reference 4 and field observations). This site is relatively shallow; approximately 500 feet offshore the depth was less than 6 feet deep. This site is protected from wave surge by Puu Mahie Point and the offshore fringing reef.

Makaua Beach site (Figure 6)is a narrow coral and basalt rubble beach exposed only at low tide. In the more protected areas of the beach, short sections of sand are present. A reef flat extends approximately 1,500 feet from the beach to an outer fringing reef. The reef flat grades slowly to about eight-feet near the fringing reef. The substrate consists of sand, shell fragments, basalt cobble, coral rubble, and coral boulders. Isolated live coral heads occur approximately 400-feet offshore. Makaua Channel cuts this fringing reef and extends partially into the reef flat. The inshore area of this site is subject to breaking waves and wave surge because of the opening in the

fringing reef (Makaua Channel). This surge causes continual resuspension of the fine sediments in the inshore areas. During the survey, the visibility was less than 2.5 feet within 200 feet of the shoreline. The visibility improved further offshore. The shoreline from Puu Mahie Point to Makaua Channel has had little net change in the vegetation and water line over a 26-year observation period. This section of shoreline has been classified as a stable beach (Reference 7).

PROJECT DESCRIPTION

Two alternatives are being considered for the Kahana Bay site. Alternative 1 consists of a 100-foot by 100-foot, 8-foot deep turning basin, a 50-foot wide, 8-foot deep entrance channel, a 20-foot by 80-foot mooring area, and a 195-foot long breakwater. Alternative 1A is similar to Alternative 1 except it does not include the mooring area for transient boats (Figures 3 and 4).

The Puu Mahie Point site consists of a 120-foot breakwater, a 60-foot wide, 8-foot deep, 800-foot long entrance channel, a 100-foot by 100-foot by 100-foot, 6-foot deep turning basin, a 320-foot revetted mole, a 180-foot revetment, a single lane launch ramp, and a 100-foot by 210-foot fill area (Figure 5).

The Makaua Beach Park site consists of a single lane launch ramp, a 120-foot breakwater, a 320-foot revetted mole, a 180-foot revetment, a 100-foot by 100-foot, 6-foot deep turning basin, and 60-foot wide, 8-foot deep, 280-foot entrance channel (Figure 6). The entrance channel will tap the existing Makaua Channel.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The three sites are characterized by a low relief topography, moderate wave surge exposure, sand and coral cobble dominated substrate, shallow water depth, and poor water clarity. The marine fauna for these sites are relatively depauperate in fish and corals. Coral cover is estimated to be less than 10%.

No corals or resident fishes were observed at the Kahana Bay site. The offshore area is dominated by a fine calcareous sand that is an extension of the neighboring Kahana Beach. The area is a popular crabbing and shore fishing spot for ulua and papio (Caranx spp.), aholehole (Kuhlia sandvicensis), oio (Albula vulpes), goatfish (Mulloidichthys spp.), and mullet (Mugil cephalus). The boulder revetment and groin provides habitat for manini (Acantharus triostegus), kupipi (Abudefduf sordidus), mamo (A. abdominalis), aholehole, (K. sandvicensis), milletseed butterfly fish (Chaetodon miliaris), and wrasses (DLNR, 1983). Large schools of akule (Selar crumenophthalmus) frequent the Bay (Reference 1). The marine macrobiota observed during the Service's survey is summarized in Table 1.

The Makaua Beach site is also relatively depauperate in fish and corals. This is probably a function of the low relief topography, poor water quality, and shifting substrate. From the

shoreline to about 200-feet offshore, the substrate is mainly sand with protruding cobble. Only the hinalea (Thalassoma duperrey) was observed here. Algae, particularly kala, (Sargassum spp.) and Acanthophora spicifera, are abundant in this inshore area. From 200-feet offshore, the substrate is mainly coral rubble and sand. Fish are mainly found near scattered boulders. Isolated live coral heads, mainly Pocillopora meandrina, occur on top of boulders or on the coral rubble. Coral cover here is estimated to be less than 5%.

The reef flat is a popular fishing site for octopus. The Federally listed threatened green sea turtle (Chelonia mydas) has been observed offshore of the Makaua Channel. Two Wandering Tattlers (Heteroscelus incanus) were observed foraging on the cobble beach. Other migratory shorebirds like the golden plover (Pluvialis dominica fulva) and the ruddy turnstone (Arenaria interpres) may use the beach as resting and feeding habitat. Makaua Beach is probably of limited value as shorebird habitat because of continual human disturbances (fishermen walking along the shoreline and noise from the Kamehameha Highway) and the narrowness of the beach. The marine macrobiota observed during the field survey is summarized in Table 2.

The Puu Mahie Point site had the most species of fish and corals compared to the other sites. This site, like the previous sites, is characterized by a low vertical relief and coral rubble substrate. The greater abundance of fishes and corals may be due to the more protected orientation of the site. Columniform Porites compressa are found at this site. The consolidated coral rubble supports various reef fish and algae. Coral cover here is estimated at less than 10%. Table 3 lists the marine biota found at this site.

The Kahana estuary and wetlands provide habitat for the Federally listed endangered Hawaiian Coot (Fulica americana alai) and Hawaiian Gallinule (Gallinula chloropus sandvicensis). These wetlands have the potential for increased productivity of endangered Hawaiian waterbirds (Reference 6). It is unlikely that the proposed project will have any direct impact on these endangered species.

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

The Service anticipates that the proposed project would have only a temporary impact on the marine resources at the Kahana Bay site. The predominantly sand bottom supports mainly transient bottom feeding fishes. These species would be displaced during the construction of the facility. The hard substrate communities inhabit man-made structures; hence the construction of the breakwater would increase the amount of hard substrate available for sessile benthic organisms. This would compensate for the loss of habitat when the existing groin is removed. The dredging of the turning basin and entrance channel would increase vertical relief along the edges. Under appropriate conditions, this may provide habitat for reef fish.

The Makaua Beach and Puu Mahie sites would be significantly altered by the proposed activities. The breakwater and revetments would increase the amount of hard substrate available for intertidal benthic organisms. The dredging of the turning basin and entrance channel would increase the amount of vertical relief at the edges and may provide increased habitat for reef fishes. The extensive dredging would destroy existing hard bottom communities at these sites. Loss of inshore habitat will result from the fill areas.

SUMMARY OF POTENTIAL ENVIRONMENTAL CONSEQUENCES

The three sites would have similar short-term environmental impacts associated with construction activities. There would be local increases in turbidity and sedimentation caused by the dredging. Since the inshore areas are already stressed by high turbidity and sedimentation associated with wave surge, nonpoint discharges, and stream runoff, the increased turbidity may further reduce the already low diversity of corals found in this area. The decreased light penetration due to increased turbidity may also affect algae growth. Populations of herbivorous and corallivorous fish may be affected by the reduction in algal and coral productivity. Attached benthic organisms may experience increased scouring and smothering effects.

The fills would smother sessile and slow-moving benthic animals and algae. This would affect primarily the Makaua Beach and Puu Mahie sites since these support hard bottom communities. The Kahana Bay site would be less impacted by the fill activities because of its predominantly sand bottom.

The improved boat launching facilities may encourage greater exploitation of the local fishery resources, particularly the akule fishery in Kahana Bay.

The long term impacts of the proposed facility are related to the use of the improvements by the public, changes in local current patterns, and resuspension of sediments caused by the dredging. The increased use of the boat launching facility increases the probability of accidental discharges of fuel and oil. There is the potential that the breakwater may block sediment transport and cause the build-up of sediments in the entrance channel and turning basins. If this occurs, maintenance dredging may be conducted periodically to keep the channel clear. Reduced water circulation in the turning basin may cause eutrophic conditions and locally reduce water quality.

MITIGATION RECOMMENDATIONS

The Service's Mitigation Policy (Reference 5) was formulated with the intent to ". . . protect and conserve the most important and valuable fish and wildlife resources while facilitating balanced development of the Nation's natural resources." The policy outlines internal guidance for Service staff and complements our participation under the Fish and Wildlife Coordination Act and

National Environmental Policy Act. The Mitigation Policy does not apply to threatened or endangered species; specific requirements for these resources are covered in the Endangered Species Act of 1973 (50 CFR 17).

The policy focuses on the mitigation of habitat value, and on impacts to fish and wildlife populations. Our recommendations for mitigation/compensation will be based upon the habitat values adversely affected by the project, and not by loss of acreage alone. Our habitat valuations and recommendations will be based upon thorough consideration of all relevant biological data.

Using scleractinian corals and reef fish as evaluation species, the Service ranks the Kahana Bay site as Resource Category 4 and the Puu Mahie and Makaua sites as a Resource Category 3 (Reference 5). Under the Resource Category 4 criteria, the habitat is of medium to low value for the evaluation species and the mitigation goal is to minimize loss of habitat. Under the Resource Category 3 criteria, the habitat is of high to medium value for the evaluation species and the habitat is relatively abundant on a national basis. The mitigation goal is no net loss of habitat while minimizing loss of habitat value at the affected area.

The Service believes Alternative 1A of the Kahana Bay site will have the least environmental impacts on fish and wildlife resources. Alternative 1 includes a mooring basin; this alternative would require more dredging and an increased potential for accidental petroleum and/or sewage discharge from transient boats docked in the mooring basin. The Service suggests that the Makaua Beach and Puu Mahie Point sites not be considered as sites for navigation improvements. These sites, while of medium value for the evaluation species, have a hard substrate that supports populations of algae, invertebrates, and fish.

Construction at the Kahana Bay site will disturb only a sand bottom habitat and will not affect productive reef flat environments. The Service recommends the following procedures to reduce the impact of construction on nearshore marine resources.

a. Dredge materials will be stored on land only and maintained behind berms above the influence of tides. Only clean runoff will be allowed to return to the ocean.

b. The explosive charges will be sand-bagged to reduce incidental fish kills.

c. Visual surveys will be conducted prior to blasting to insure that no green sea turtles are within 1,000-feet of the blast area.

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TABLE 1. MACROBIOTA FOUND AT THE KAHANA BAY BOAT RAMP SITE. NOVEMBER 1984.

ALGAE

Chlorophyta
- Ulva sp.
- Enteromorpha sp.

Rhodophyta
- encrusting coralline algae

Invertebrates

- Nerita picea
- Siphonaria normalis
- Littorina sp.
- Grapsus tenuicrustatus

TABLE 2. CHECKLIST OF THE MACROBIOTA FOUND IN THE INSHORE WATERS NEAR THE MAKAUA BEACH SITE, NOVEMBER 1984.

FISHES

Hemiramphidae
  Hemiramphus depauperatus Lay and Bennett
Mullidae
  Parupeneus multifasciatus (Quoy and Gaimard)
Chaetodontidae
  C. lunula (Lacepede)
  Chaetodon miliaris Quoy and Gaimard
Labridae
  Thalassoma duperrey Quoy and Gaimard
Zanclidae
  Zanclus cornutus Linnaeus
Acanthuridae
  Acanthurus triostegus
Monacanthidae
  Pervagor spilosoma (Clay and Bennett)

Algae

Chlorophyta
  Bornatella sphaerica (Zanardini) Solms and Laubach
  Codium edule Silva
  Dictyosphaeria cavernosa (Forskal) Boergesen
  Enteromorpha sp.
  Halimeda discoidea Decaisne
  Neomeris annulata Dickie
Phaeophyta
  Dictyota bartayresii Lamouroux
  Padina australis Hauck
  Sargassum obtusifolium J. Agardh
  S. polyphyllum J. Agardh
Rhodophyta
  Acanthophora spicifera (Vahl) Boergesen
  encrusting coralline algae

Corals

Acroporidae
  Montipora verrucosa (Lamarck)
Pocilloporidae
  Pocillopora meandrina Dana
Poritidae
  Porites compressa Dana

TABLE 3. CHECKLIST OF MACROBIOTA FOUND AT THE PUU MAHIE POINT SITE. NOVEMBER 1984.

Fish

Muraenidae
  Echidna nebulosa (Ahl)
Mullidae
  Mulloides vanicolensis (Cuvier and Vallenciennes)
Chaetodontidae
  C. lunula (Lacepede)
  Chaetodon miliaris Quoy and Gaimard
Labridae
  Thalassoma duperrey Quoy and Gaimard
  Coris sp. (juvenile)
Zanclidae
  Zanclus cornutus Linnaeus
Acanthuridae
  Naso brevirostris (Cuvier and Vallenciennes)
  Acanthurus nigrofuscus Forskal
  A. triostegus
  Ctenochaetus strigosus Bennett
Dactylopteridae
  Dactyloptena orientalis (Cuvier and Valenciennes)
Monacanthidae
  Pervagor spilosoma (Lay and Bennett)
Ostraciidae
  Ostracion meleagris Jenkins
  Lactoria fornasini (Bianconi)

Algae

Chlorophyta
  Halimeda discoidea Descaine
Phaeophyta
  Dictyota bartayresii Lamouroux
  Padina australis Hauck
  Sargassum obtusifolium J. Agardh
  S. polyphyllum J. Agardh
Rhodophyta
  Acanthophora spicifera (Vahl) Boergeson
  encrusting coralline algae

Corals

Acroporidae
  Montipora verrrucosa (Lamarck)
Pocilloporidae
  Pocillopora damicornis (Linnaeus)
  P. meandrina Dana
Poritidae
  Porites compressa Dana

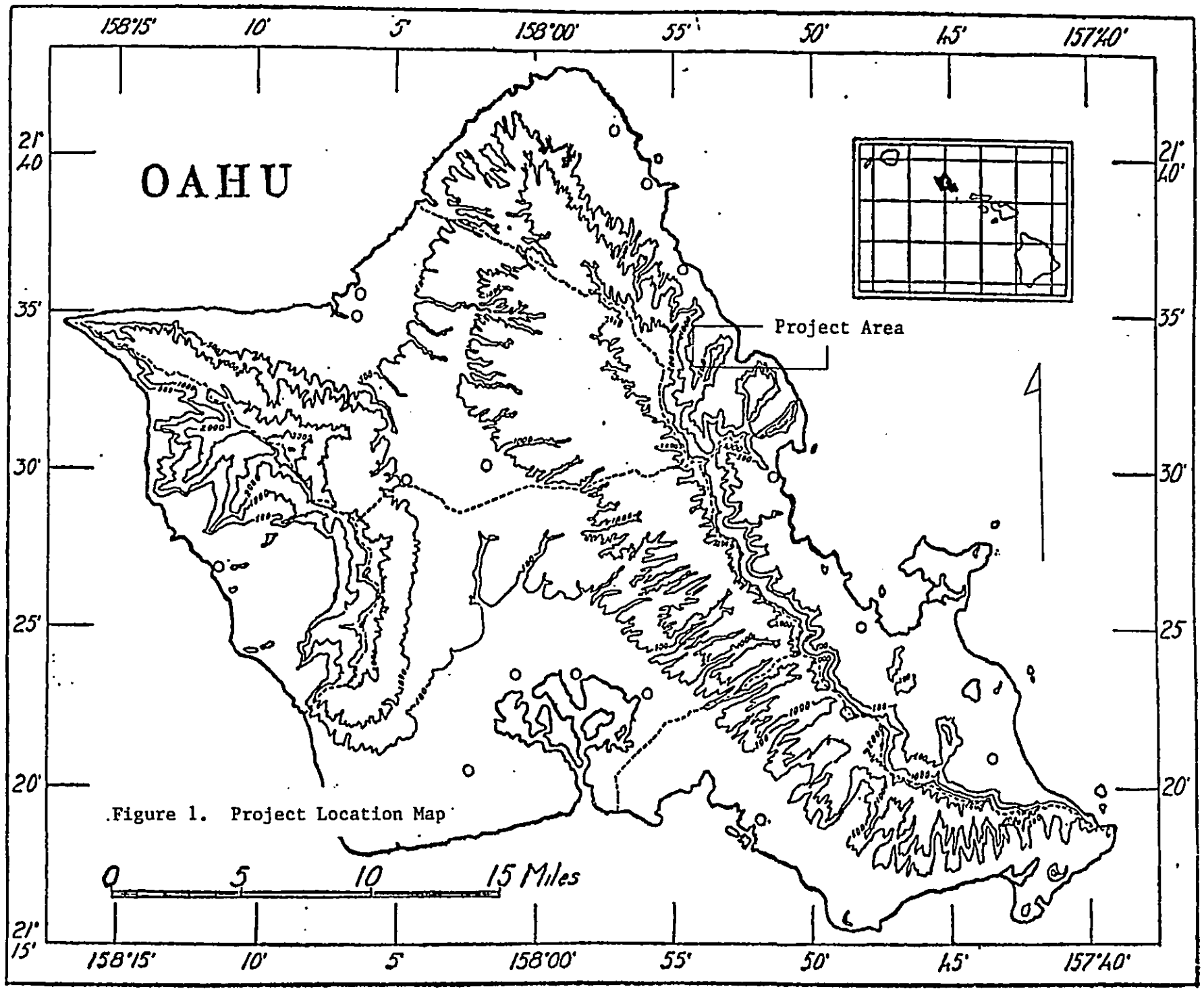


Figure 1. Project Location Map

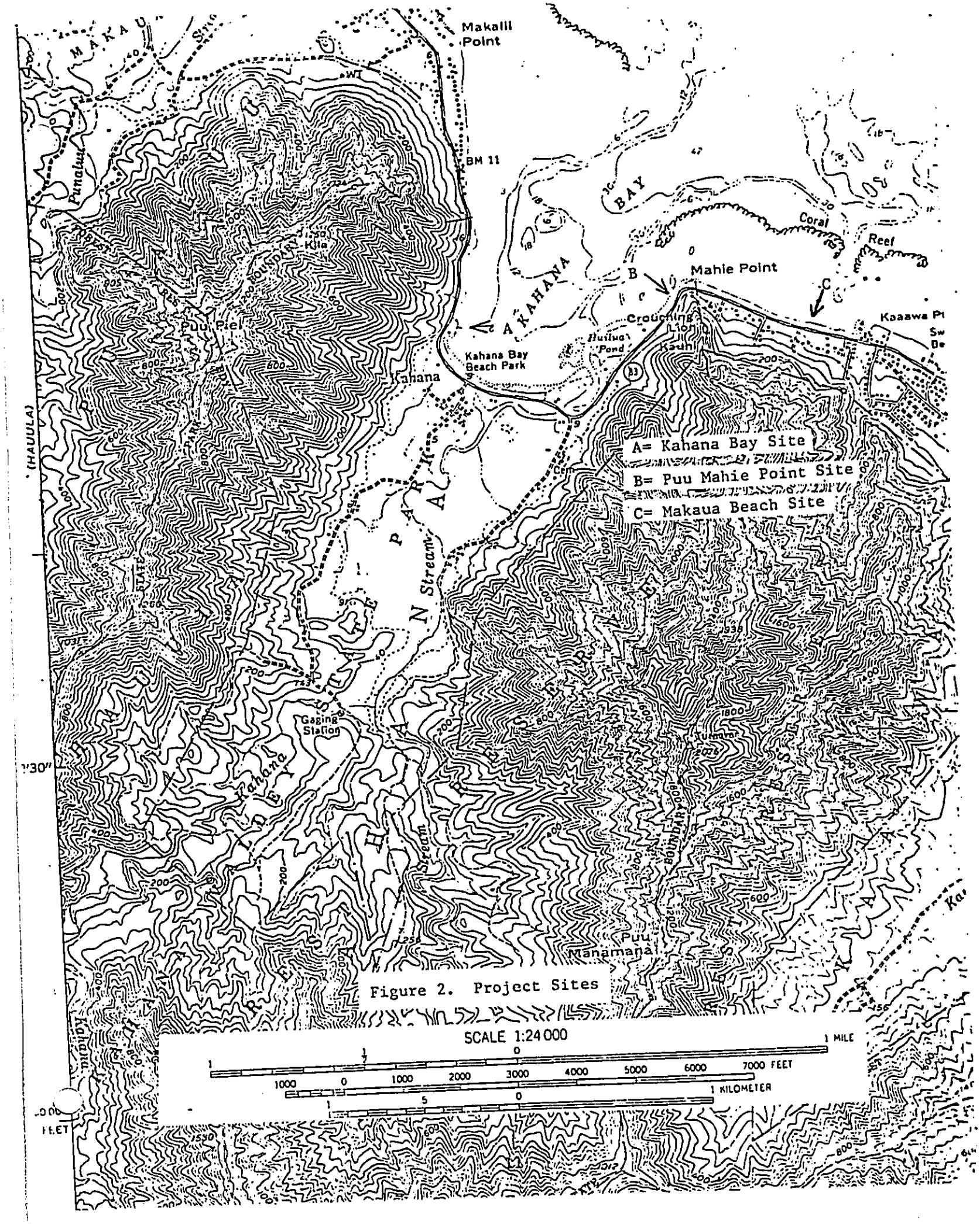
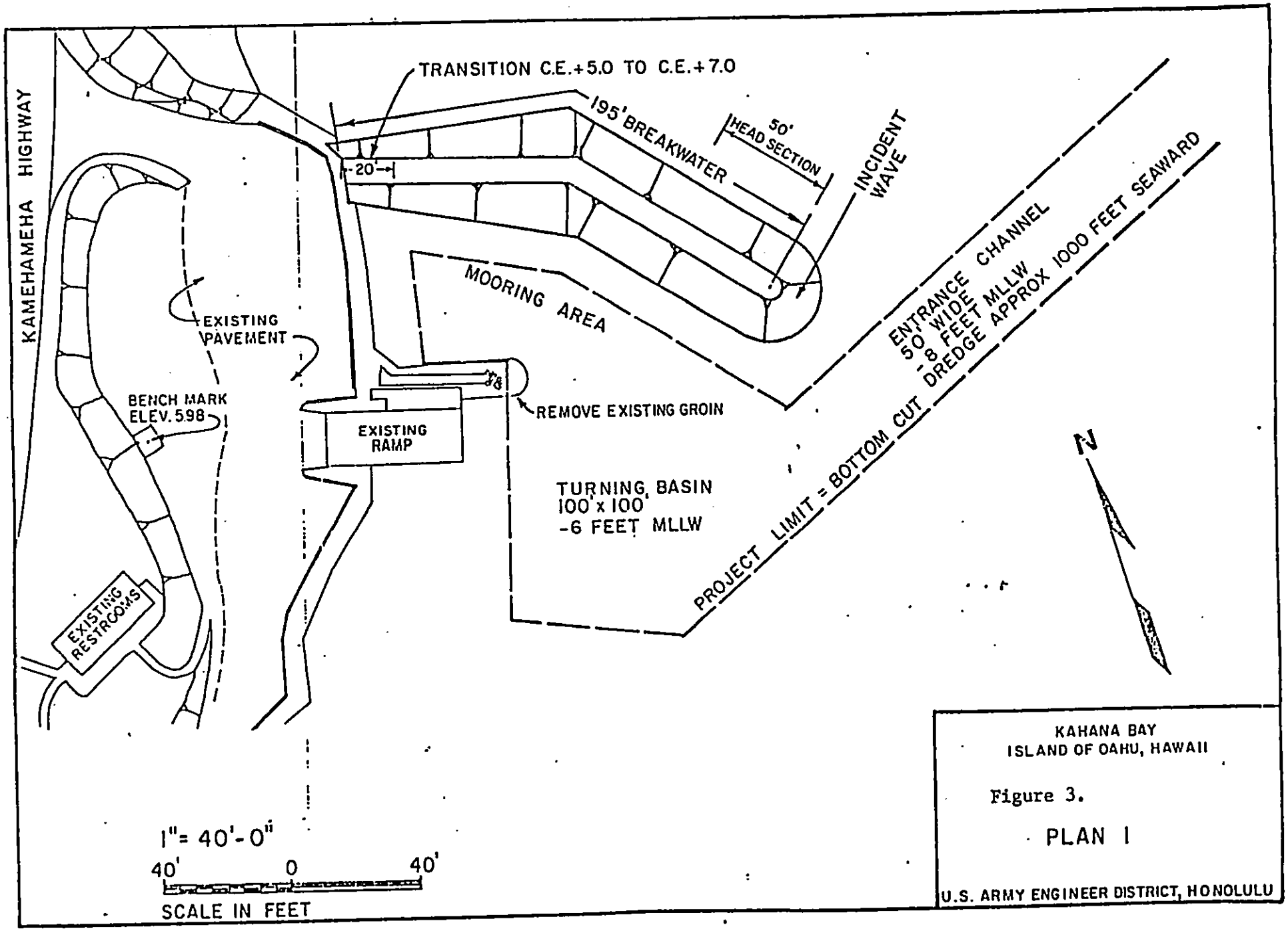


Figure 2. Project Sites

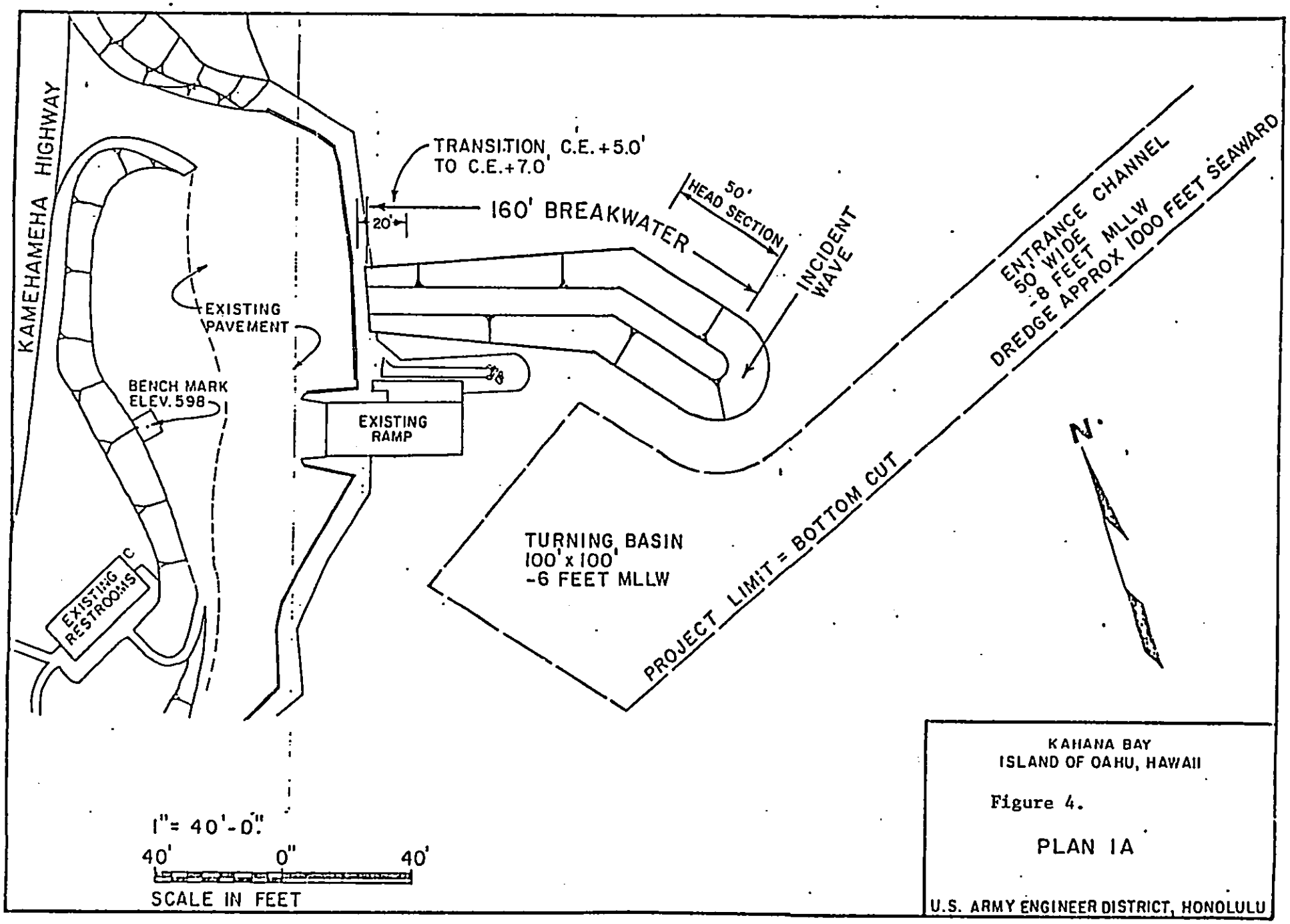


KAHANA BAY
ISLAND OF OAHU, HAWAII

Figure 3.

PLAN I

U.S. ARMY ENGINEER DISTRICT, HONOLULU



KAHANA BAY
ISLAND OF OAHU, HAWAII

Figure 4.

PLAN 1A

U.S. ARMY ENGINEER DISTRICT, HONOLULU

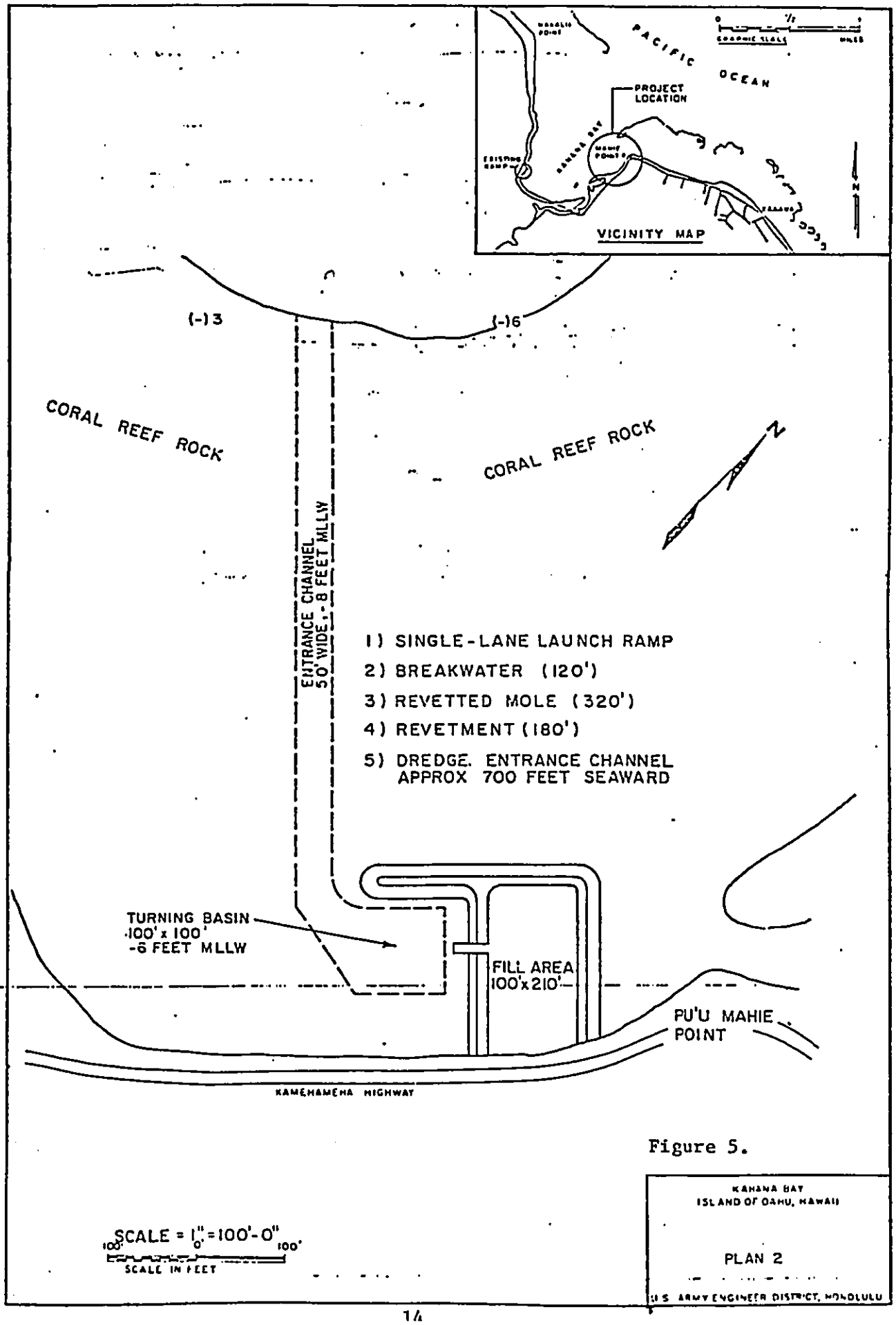

PACIFIC OCEAN
PROJECT LOCATION
VICINITY MAP
(-)3
(-)6
CORAL REEF ROCK
CORAL REEF ROCK
ENTRANCE CHANNEL
50' WIDE, -8 FEET MLLW
1) SINGLE-LANE LAUNCH RAMP
2) BREAKWATER (120')
3) REVETTED MOLE (320')
4) REVETMENT (180')
5) DREDGE. ENTRANCE CHANNEL
APPROX 700 FEET SEAWARD
TURNING BASIN
100' x 100'
-6 FEET MLLW
FILL AREA
100'x210'
PU'U MAHIE
POINT
KAMEHAMEHA HIGHWAY
SCALE = 1"=100'-0"
SCALE IN FEET
KANANA BAY
ISLAND OF OAHU, HAWAII
PLAN 2
U.S. ARMY ENGINEER DISTRICT, HONOLULU

Figure 5.

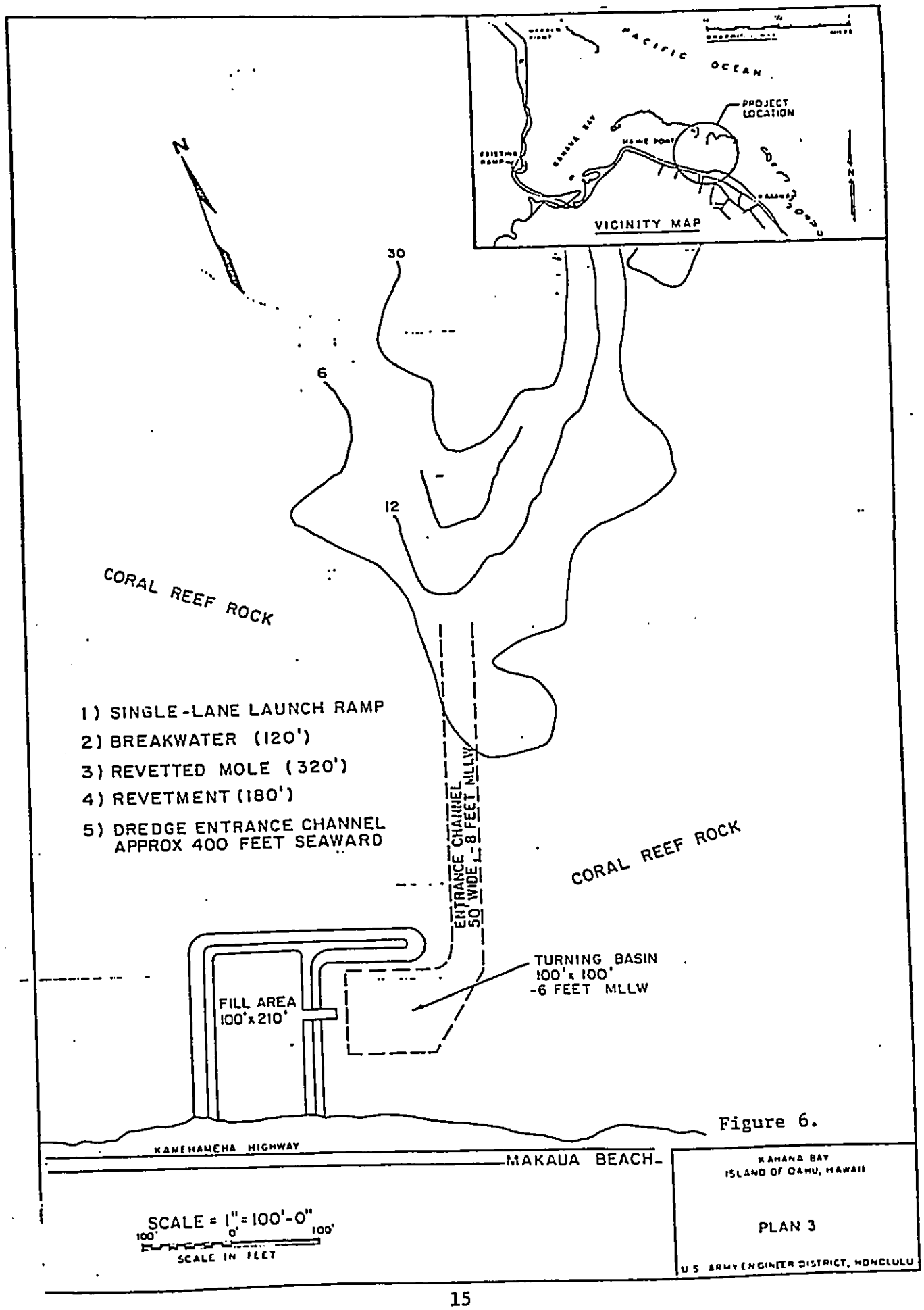

PACIFIC OCEAN
PROJECT LOCATION
KANEOHE BAY
MOKAPU POINT
EXISTING RAMP
VICINITY MAP
N
30
6
12
CORAL REEF ROCK
1) SINGLE-LANE LAUNCH RAMP
2) BREAKWATER (120')
3) REVETTED MOLE (320')
4) REVETMENT (180')
5) DREDGE ENTRANCE CHANNEL APPROX 400 FEET SEAWARD
ENTRANCE CHANNEL 50' WIDE -8 FEET MLLW
CORAL REEF ROCK
TURNING BASIN 100' x 100' -6 FEET MLLW
FILL AREA 100' x 210'
KAMEHAMEHA HIGHWAY
MAKAUA BEACH
SCALE = 1" = 100'-0"
100' 0' 100'
SCALE IN FEET
KANEOHE BAY
ISLAND OF OAHU, HAWAII
PLAN 3
U S ARMY ENGINEER DISTRICT, HONOLULU

Figure 6.