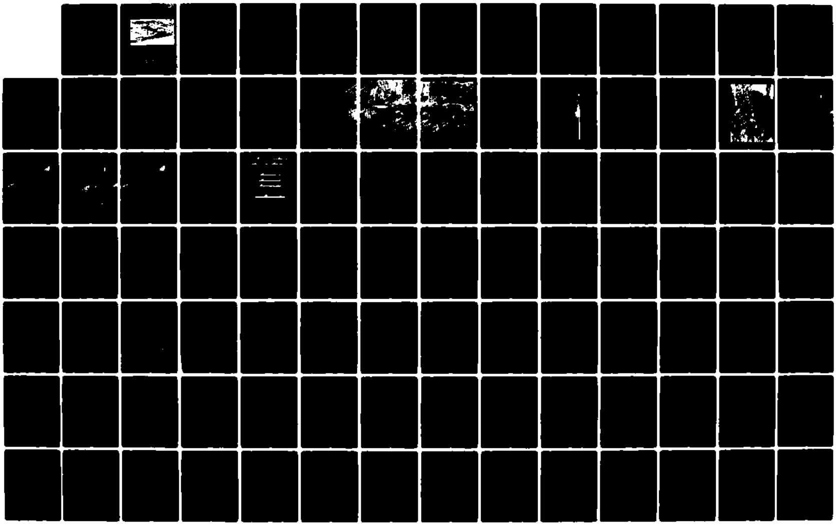
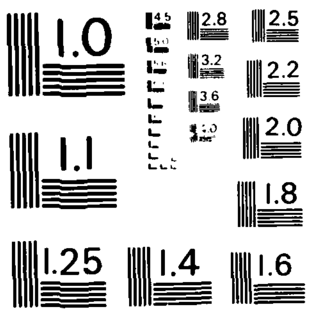
AD-A131 508 FEASIBILITY STUDY AND ENVIRONMENTAL IMPACT STATEMENT OAKLAND INNER HARBOR..(U) CORPS OF ENGINEERS SAN FRANCISCO CA SAN FRANCISCO DISTRICT JUN 83 1/3

UNCLASSIFIED F/G 13/2 NL

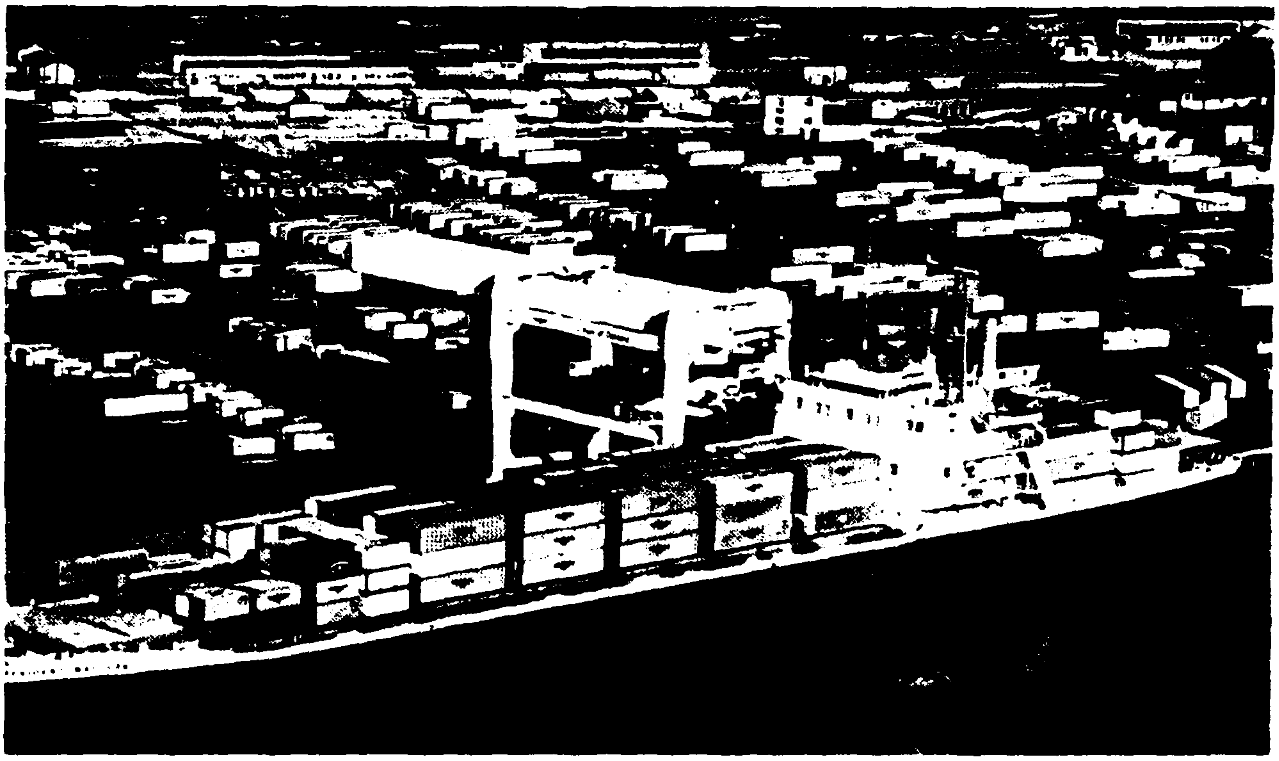




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DRAFT
FEASIBILITY STUDY AND
ENVIRONMENTAL IMPACT STATEMENT

OAKLAND INNER HARBOR
CALIFORNIA



DEEP-DRAFT NAVIGATION

**United States Army
Corps of Engineers**
*...Serving the Army
...Serving the Nation*

San Francisco District

JULY 1983

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A131	3. RECIPIENT'S CATALOG NUMBER 508
4. TITLE (and Subtitle) OAKLAND INNER HARBOR, ALAMEDA COUNTY, CALIFORNIA FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT STATEMENT, DRAFT		5. TYPE OF REPORT & PERIOD COVERED DRAFT 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) U.S. Army Corps of Engineers, San Francisco Dist. 211 Main Street San Francisco, California 94105		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Corps of Engineers, San Francisco Dist. 211 Main Street San Francisco, California 94105		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Office of Chief of Engineers U.S. Department of the Army Washington, D.C. 20314		12. REPORT DATE June 1983 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Navigation
Environmental Impacts
Dredging
Disposal

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A combined Draft Feasibility Report and Environmental Impact Statement for proposed navigation improvements at Oakland Inner Harbor, Alameda County, California. The planning process and the design considerations that led to the selection of the plan and its alternatives as well as the environmental consequences resulting from the implementation of those plans are discussed in the report.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA
DEEP DRAFT NAVIGATION IMPROVEMENTS

DRAFT FEASIBILITY STUDY
ENVIRONMENTAL IMPACT STATEMENT

SYLLABUS

The purpose of this study is to investigate navigation conditions at Oakland Inner Harbor and to determine whether the provision for improvement of existing deep-draft channels is advisable. Oakland Inner Harbor Channel provides deep-draft access for the Port of Oakland.

It was found that the growth of foreign and coastwise shipments and the introduction of larger vessels in the World Pacific Basin Fleet have rendered the existing Federal project channel and turning basin inadequate and inefficient for modern transportation needs. Traveling and maneuvering of the vessels are restricted and the channel is too shallow for larger containerships which must await high tide to navigate the channel.

Various solutions to the navigation problems in the Oakland Inner Harbor Channel were analyzed. The most practicable and feasible plan consists of deepening the existing Oakland Inner Harbor Channels, from -35 feet, mean lower low water (MLLW), to -43 feet, MLLW, and widening the channel at a number of places to permit optimum utility of restricted channel dimensions.

The estimated total cost of the selected plan is $27.1 million. Using a 7-7/8 percent discount rate and 50-year period of economic evaluation, the annual charges would be $2.2 million, and the annual project benefits are $34.9 million. Therefore, the benefit/cost ratio would be 15.9 to 1.

It is recommended that the foregoing plan of improvement be adopted as a modification of the existing Federal project for Oakland Inner Harbor.

TABLE OF CONTENTS

TABLES

FIGURES

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

SECTION 1 - INTRODUCTION

AUTHORIZATION

1.01 The Congress of the United States has directed the U.S. Army Corps of Engineers to investigate the feasibility of deepening Oakland Inner Harbor. The Resolution, dated May 10, 1977, reads as follows:

> "Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Oakland Harbor, California, published as House Document Number 353, 87th Congress, 2nd Session, and other reports, in order to develop recommendations for most effective, efficient and economic means for improvement of the inner harbor and waterways, including consideration of an increase of channel project depth for the four-mile reach between the inner harbor entrance and the vicinity of the Clay Street piers and widening of the entrance bar channel."

PURPOSE AND SCOPE

1.02 The purpose of this study is to evaluate the need for an improved deep-draft navigation channel in the Oakland Inner Harbor and to determine the solutions that best serve related physical, biological, social and economic considerations. Pursuant to the authorizing congressional resolution, this study is directed at determining the extent of Federal participation in improving the Oakland Inner Harbor Navigation Channel.

STUDY PARTICIPANTS AND COORDINATION

1.03 The San Francisco District received information from a wide range of transportation interests, governmental agencies, and local citizens in response to a notice of study initiation dated [illegible] November 1979 and an initial public meeting held on 12 February 1980. Copies of the transcript of the public meeting were distributed to libraries and the Port of Oakland. A statement submitted by the Port of Oakland noted their "lead-sponsor role calling for the improvement of Oakland Inner Harbor Channel," and their resolution to extend "fullest cooperation and assistance to the Corps in formulating the most expeditious means to implement this project." A second public meeting was held on 14 July 1980. Twelve speakers presented oral statements at the meeting. Twenty-one written statements commenting on the need for the proposed project and proposals for modifications to the plan presented were received (See Appendix I). The proposed modifications included the addition of channel widening near American President Lines Berths C and D, and the addition of a turning area at the Grove Street Pier.

PRIOR CORPS REPORTS ON OAKLAND INNER HARBOR PROJECT

1.04 The Inner Harbor has developed over a long period of time, in what was a natural estuary known as San Antonio Creek. The first Federal improvement was authorized by the River and Harbor Act adopted 23 June 1874. The most recent improvements were authorized by the River and Harbor Act of 1962, Public Law 87-874, 87th Congress, 2d Session. Plans for deepening a portion of the Inner Harbor from 30 feet to a present depth of 35 feet below mean lower low water datum were described in House Document 353. Some departures from the Project Document Plan on types of dredging equipment used, project cost and plan for disposal of dredged material were described in a General Design Memorandum prepared by the San Francisco District in December 1972. The status of authorized improvements is presented in paragraph 2.08.

OTHER STUDIES AND REPORTS

1.05 Other studies and reports of interest to this investigation are:

Waterborne Commerce of the United States - Part 4 of these annual statistics on Pacific Coast ports shows major growth in cargo tonnage handled by the Port of Oakland.

San Francisco Bay Area In-Depth Study - This survey of regional navigation needs includes a range of commodity projections. As a part of the In-Depth Study, a report, "San Francisco Bay Area Cargo Forecast," was prepared by Recht, Hausrath and Assoc., which indicates that container tonnages will increase at various rates. These projections are being used for long-range planning of effecient port operations and future expansions of Bay Area ports.

Oakland Outer Harbor (Deepening), California - Deep-Draft Navigation Improvements - This 1978 feasibility report recommends deepening navigation channels in the Outer Harbor (including the entrance Bar Channel) from 35 to 42 feet to accommodate fourth-generation containerships. The number of vessels calling at container berths in the Outer Harbor increased from 250 in 1965 to 838 in 1974. The report was transmitted to the President's Water Resources Council in March 1980.

MTC/BCDC Port Planning Project Phase II Study - This study by the Metropolitan Transportation Commission and the San Francisco Bay Conservation and Development Commission has a series of 13 working papers including "Harbor Capacity Analysis" and other subjects pertinent to the planning of efficient port operations in the San Francisco Bay Area. The Phase II studies focused on further screening of 175 potential marine terminal development sites and updating of the waterborne commerce forecasts developed on June 1981. Channel deepening analysis consisted of evaluating existing bay channels at depths of -45 feet MLLW, preparing cost estimates in increments of 2 feet from existing depths to -45 feet MLLW, and calculating operational benefits attributable to channel deepening. Comparison of benefits to costs of deepening was favorable for Oakland Inner Harbor Channel (west of the Posey and Webster Street traffic tubes) and for the Oakland Bar Channel.

San Francisco Harbor and Bay, Collection and Disposal of Floating Debris - A reconnaissance study on the debris problem was completed by the San Francisco District in 1978. Studies were assumed as a result of fuscal year 1983 funding.

San Francisco Bay to Stockton, California, House Document No. 208, 89th Congress, 1 Session - This document includes recommendations for deepening the 2,000-foot wide navigation channel through the bar at the mouth of San Francisco Bay from 50 to 55 feet below MLLW. This portion of authorized work was completed in 1974. Engineering and design for other segments of authorized improvement to be officially known as the "John F. Baldwin Ship Channel" is continuing.

Dredge Disposal Study, San Francisco Bay and Estuary - This study is a series of reports (14 appendices and Main Report) on impacts and interactions of dredging and disposal operations on the environment. The study, which was completed in 1978, quantified impacts of dredging and disposal operations on specific environmental elements and systems, including "Water Column," "Biological Community," "Crystalline Matrix," "Pollutant Distribution", and ocean, land and marsh ecologies.

Reconnaissance Report, Oakland Inner Harbor, California, February 1981 - This report describes initial studies and includes a Plan of Investigation and schedules for more detailed evaluations.

Stage 2 Plan Formulation Document, Oakland Inner Harbor, California, September 1981 - This document describes and discusses alternative measures that were considered, screened, and proposed for further analysis.

THE PLANNING PROCESS

1.06 The planning process consists of six major steps: (1) Specification of water and related land resources problems and opportunities; (2) Inventory, forecast and analysis of water and related land resources conditions within the study area; (3) Formulation of alternative plans; (4) Evaluation of the effects of the alternative plans; (5) Comparison of alternative plans; and (6) Selection of recommended plan based upon the comparison of alternative plans. The planning process is dynamic with the various steps being iterated one or more times. This process of iteration, which may occur at any step, sharpens the focus of the study as new data are obtained. The planning tasks, as they have been accomplished in the study, are described throughout this report.

REPORT ORGANIZATION

1.07 This report is divided into seven sections as follows.

1. Introduction.

2. Problem Identification. This section presents the results of the inventory, forecast and analysis of water and related land resources conditions in the study area. It also specifies the problems and opportunities that the study will address in terms of planning objectives specific to the study area.

3. Formulation of Preliminary Plans. This section describes the formulation of preliminary plans which are evaluated and then screened.

4. Assessment and Evaluation of Candidate Plans. This section describes the plans which are potential candidates for recommendation.

5. Comparison of Candidate Plans. This section presents the system of accounts, designation of a NED Plan, and the tentative selection of a plan.

6. Conclusions and Recommendations. This section presents the conclusions and recommendations of the study.

7. Draft EIS. This section is a draft of the environmental impact statement prepared persuant to the National Environmental Policy Act.

SECTION 2 - PROBLEM IDENTIFICATION

2.00 This section represents the first step of the planning process, the specification of the water and related land resources problems and opportunities that the study will address. The step starts with the identification of public concerns and investigation of the study area and culminates in expression of the identified problems and opportunities as planning objectives specific to the study area. Planning constraints are also identified in this step, since they are developed concurrently with the planning objectives. The purpose of both the objectives and constraints is to guide the formulation of alternative plans.

NATIONAL OBJECTIVES

2.01 Federal and Federally-assisted water and related land planning attempts to achieve National Economic Development (NED), a national objective. Contributions to NED are increases in the value of the national output of goods and services. Plans are formulated to alleviate problems and take advantage of opportunities in ways that contribute to the NED objective.

PROJECT LOCATION AND VICINITY

2.02 The Port of Oakland is the largest container port on San Francisco Bay and is among the largest container ports on the Pacific Coast. The Port is located on the east side of San Francisco Bay, about eight miles inside the Golden Gate. The Inner Harbor Channel is locally called "The Estuary." This channel separates the City of Alameda from the City of Oakland. Figure 1 shows the project location and vicinity.

2.03 SAN FRANCISCO BAY AREA. The San Francisco Bay Area includes nine counties with five million people distributed over 7,000 square miles of land. Most of the population resides in San Francisco, Oakland, Hayward, San Jose, Alameda and numerous other metropolitan areas that fringe the bay. San Francisco Bay has a surface area of 435 square miles, surrounded by 276 miles of shoreline. The Bay has some natural deep water channels, but 40 percent of the Bay is less than six feet deep at low tide. Harbor development in the Bay began more than 100 years ago in support of trade and transportation needs of pioneer gold miners and merchants. Development and maintenance of deep-draft shipping channels in San Francisco Bay has been an important mission of the U.S. Army Corps of Engineers since Congressional authorization of the first Federal navigation improvement project in 1868.

2.04 ALAMEDA COUNTY. Alameda County is one of nine counties touching San Francisco Bay. It is one of the larger counties of California in both population and land area. County population is about 1.1 million. Principal cities are Oakland, Alameda, Berkeley, San Leandro, and Hayward.

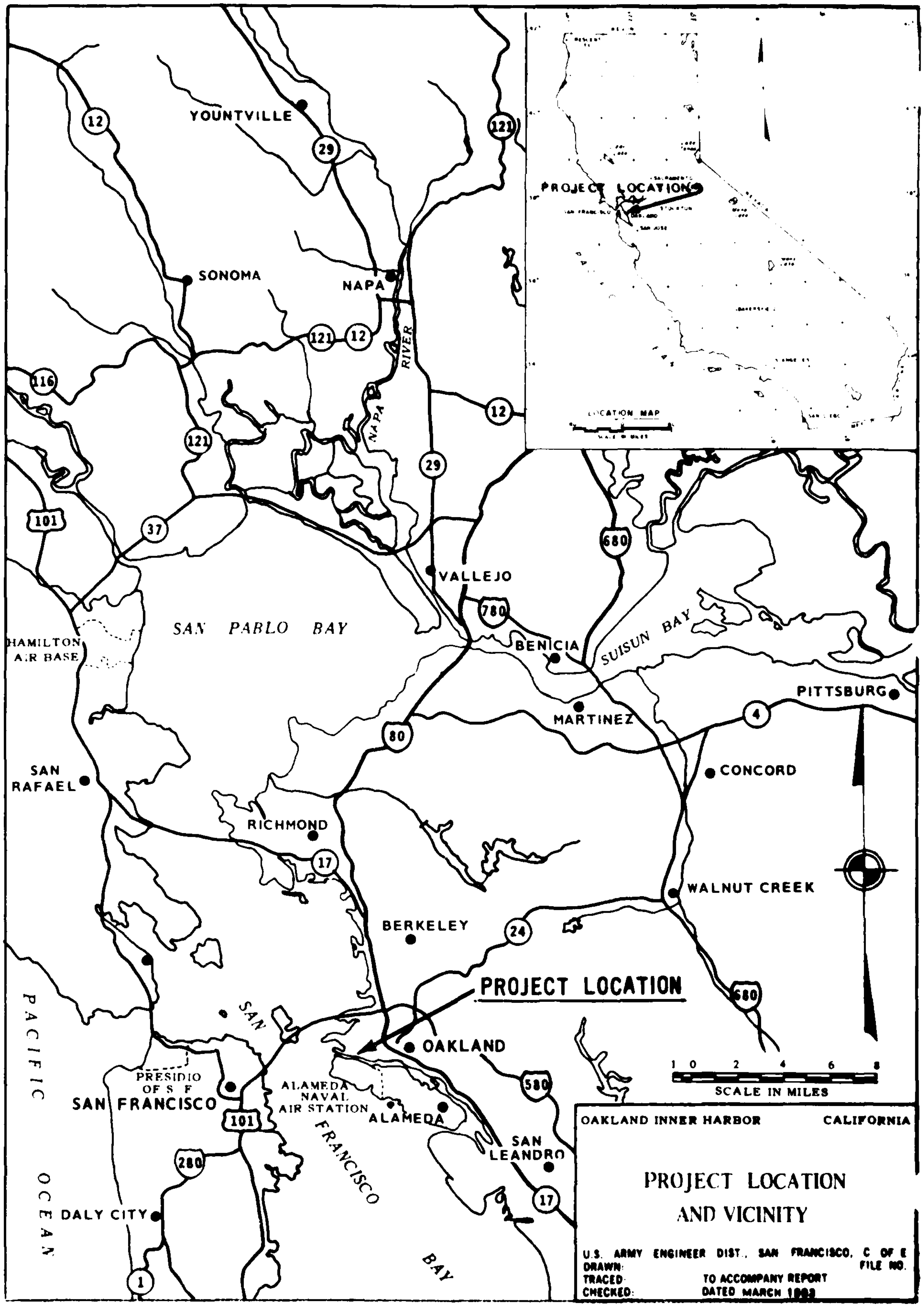

PROJECT LOCATION
LOCATION MAP
YOUNTVILLE
SONOMA
NAPA
NAPA RIVER
VALLEJO
SAN PABLO BAY
HAMILTON AIR BASE
BENICIA
SUISUN BAY
PITTSBURG
MARTINEZ
CONCORD
SAN RAFAEL
RICHMOND
WALNUT CREEK
BERKELEY
PROJECT LOCATION
PACIFIC OCEAN
SAN FRANCISCO BAY
OAKLAND
PRESIDIO OF S F
SAN FRANCISCO
ALAMEDA NAVAL AIR STATION
ALAMEDA
SAN LEANDRO
DALY CITY
0 2 4 6 8
SCALE IN MILES
OAKLAND INNER HARBOR
CALIFORNIA
PROJECT LOCATION
AND VICINITY
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN:
FILE NO.
TRACED:
TO ACCOMPANY REPORT
CHECKED:
DATED MARCH 1983

FIGURE 1

2.05 STUDY AREA. The Port of Oakland is a complete transportation/distribution center with deepwater access to modern marine terminals handling everything from general cargo to containerized shipments. The Port's location on the east side of San Francisco Bay is near the western terminus of major rail and highway networks. Specialized port storage and handling facilities provide a speedy and efficient means for interfacing air, sea and land cargo shipments. The overview legend and map, Figure 3, indicate the location of some key terminal facilities along the Inner Channel. Figure 4 shows some of the specialized equipment used to handle containerized cargos.

2.06 The Port of Oakland has an Outer Harbor, a Middle Harbor and an Inner Harbor, as shown on Figure 2. A common entrance known as the Bar Channel provides access to these harbor areas. The Inner Harbor begins at project mile 0.45. It includes an Entrance Reach, an Inner Harbor Reach, Grove Street to Brooklyn Basin Reach, Brooklyn Basin Reach, Park Street Reach, and a Tidal Canal that connects with San Leandro Bay at mile 8.5. Upper reaches of the Inner Harbor serve the Port of Alameda and other privately-owned facilities along the estuary. Two submarine highway tubes between Oakland and Alameda pass under the channel at mile points 4.6 and 4.7, and there are numerous submarine cable and utility crossings. Also, there are several bridge crossings over upstream reaches of the channel.

2.07 There is a wide mix of land use along the channel. Uses include shipping and transportation operations, ship building, outfitting and repair, steel fabrication and manufacturing, residential housing, parks and commercial establishments catering to recreational boaters and tourists. Over fifty percent of Alameda County's recreational boating moorages are located at Jack London Square and other marinas along the estuary. More than 3,000 pleasure craft are berthed in about 20 marinas. The Port of Oakland and City of Alameda have provided overlooks and mini-parks for public access to the waterfront. Leisure activities include fishing, sightseeing and sailing.

STATUS OF EXISTING FEDERAL PROJECT IMPROVEMENTS IN OAKLAND INNER HARBOR

2.08 Deep-draft navigation channel improvements presently authorized and maintained for Oakland Inner Harbor are shown on Figure 3. The project also includes parallel rubble-mound jetties at the entrance to Inner Harbor (the north jetty is 9,500 feet long and the south jetty is 12,000 feet long). Three highway bridges cross the tidal canal, two of which (at Park Street and High Street) have been replaced by local interests. Reconstruction of the Fruitvale Avenue Highway Bridge by the Corps was completed in December 1973 and turned over to local interests for operation and maintenance. The railroad bridge at Fruitvale Avenue is maintained and operated by the Corps of Engineers. The authorized project was completed February 1975, except deepening the tidal canal to 35 feet from Fortmann Basin to Park Street (RHA 1962) and to 25 feet above Park Street (RHA 1927) which was deauthorized November 1977.

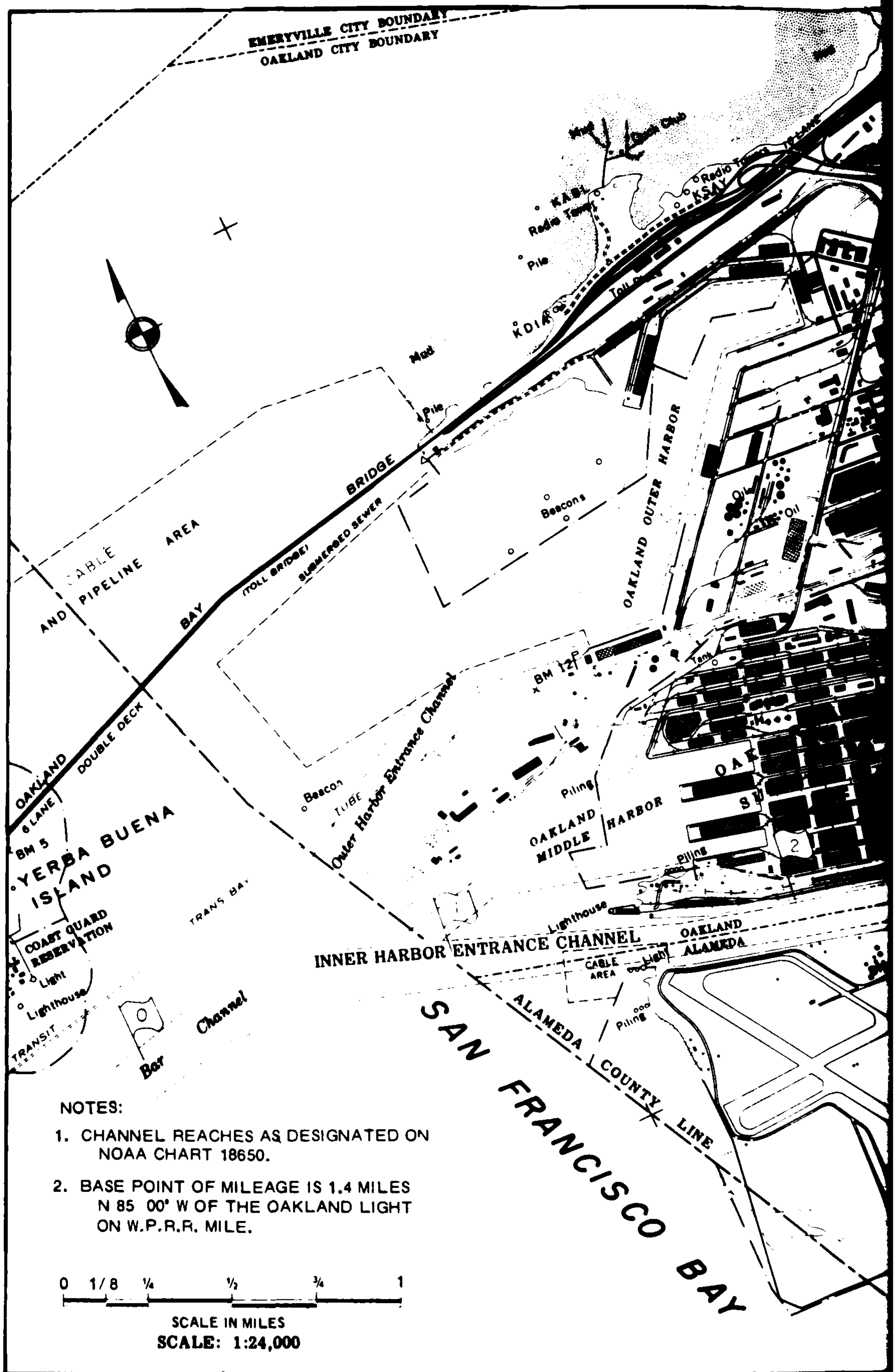
OVERVIEW OF OAKLAND HARBOR

(A PARTIAL LISTING OF TERMINAL FACILITIES)

1. Piers 6 & 7 - (Oakland Army Base Complex)
2. Berth 10 - (Port of Oakland)
3. SeaPac Terminal Berths 8, 9 - (SeaPac Services, Inc.)
4. Outer Harbor Public Container Terminal, Berth 6 (Crescent Wharf & warehouse)
5. Outer Harbor Conventional Cargo Terminal, Berth 5 (Neptune Orient Line)
6. Outer Harbor Public Container Terminal, Berth 4 (Mersk lines)
7. Oakland Container Terminal Berths 2, 3 (Oakland Container Terminal Co.)
8. Matson Terminal - Berth D, E (Matson Terminals, Inc.)
9. Matson Terminal Berth F (Ro-Ro) - (Matson Terminals, Inc.)
10. Seventh Street Public Container Terminal - Berths G, H, I (Marine Terminals Corp.)
11. Seventh Street Public Container Terminal - Berth J (Marine Terminals Corp.)
12. Berth 0 - (Port of Oakland)
13. Western Pacific Railroad/Intermodal Center
14. Southern Pacific Railroad/Intermodal Center
15. United States Lines Container Terminal - (United States Lines)
16. American President Lines/Seatrain Terminal - (American President Lines)
17. Charles P. Howard Terminal
18. Ninth Avenue Terminal - (Marine Terminals Corp.)

ALAMEDA SIDE

19. Encinal Terminals
20. Todd Shipyard


EMERYVILLE CITY BOUNDARY
OAKLAND CITY BOUNDARY
KABL
Radio Tower
Pile
KDIA
KSAY
Mud
Toll Plaza
BAY BRIDGE
(TOLL BRIDGE)
SUBMERGED SEWER
CABLE AND PIPELINE AREA
OAKLAND DOUBLE DECK
6 LANE
Beacons
OAKLAND OUTER HARBOR
Oil
BM 12
Tank
Outer Harbor Entrance Channel
Beacon
TUBE
Piling
OAKLAND MIDDLE HARBOR
BM 5
YERBA BUENA ISLAND
COAST GUARD RESERVATION
Light
Lighthouse
TRANSIT
TRANS BAY
Bar Channel
INNER HARBOR ENTRANCE CHANNEL
CABLE AREA
OAKLAND
ALAMEDA
ALAMEDA COUNTY LINE
SAN FRANCISCO BAY
NOTES:
1. CHANNEL REACHES AS DESIGNATED ON NOAA CHART 18650.
2. BASE POINT OF MILEAGE IS 1.4 MILES N 85 00' W OF THE OAKLAND LIGHT ON W.P.R.R. MILE.
0 1/8 ¼ ½ ¾ 1
SCALE IN MILES
SCALE: 1:24,000

LAKESIDE PARK
LAKE MERRITT (TIDAL)
Boathouse
Museum
Auditorium
Peralta Park
TRANSIT
Park
Park
8TH
BM 16
HWY TUBES
CABLE AREA
Jack London Square
Grove St Pier
HARBOR
INNER
OAKLAND
OAKLAND
ALAMEDA
Marina
Drive-in Theater
6 LANE
BM 5
BELT
ALAMEDA
INNER HARBOR REACH
BM 11
OAKLAND
ALAMEDA
BM 11
BM 11
BM 6
Beacon
ALAMEDA NAVAL AIR STATION
BM 6
BM 14
BM 10
Lights
Light
BREAKWATER
LINE
BAY
Ballena Bay
ROBERT CROWN MEMORIAL STATE BEACH
KSAY
Oil
Oil
Tank
Piling
Piling


LAKESIDE PARK
LAKE MERRITT (TIDAL)
Boathouse Museum
Auditorium
Peralta Park
TRANSIT
HWY TUBES
BROOKLYN BASIN
Brooklyn Basin
Government Island
COAST GUARD ALAMEDA BASE
Jack London Square
CABLE AREA
HARBOR
OAKLAND
ALAMEDA
Marina
Cable Area
Drive-in Theater
Dry Dock
Dry Docks
TIDAL CANAL
WESTERN
SOUTHERN
LINCOLN
CENTRAL
City Hall
ALAMEDA
BELT
ENCINAL
CLINTON AVE
BM 5
Mud
Radar Reflector
ROBERT CROWN MEMORIAL STATE BEACH
BREAKWATER
ALAMEDA COUNTY
CALIFORNIA
OAKLAND INNER HARBOR
PROJECT AREA
IN SHEET
SHEET NO
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF
DRAWN V.P.K
FILE NO
TRACED
TO ACCOMPANY REPORT
CHECKED
DATED FEB. 25, 1983

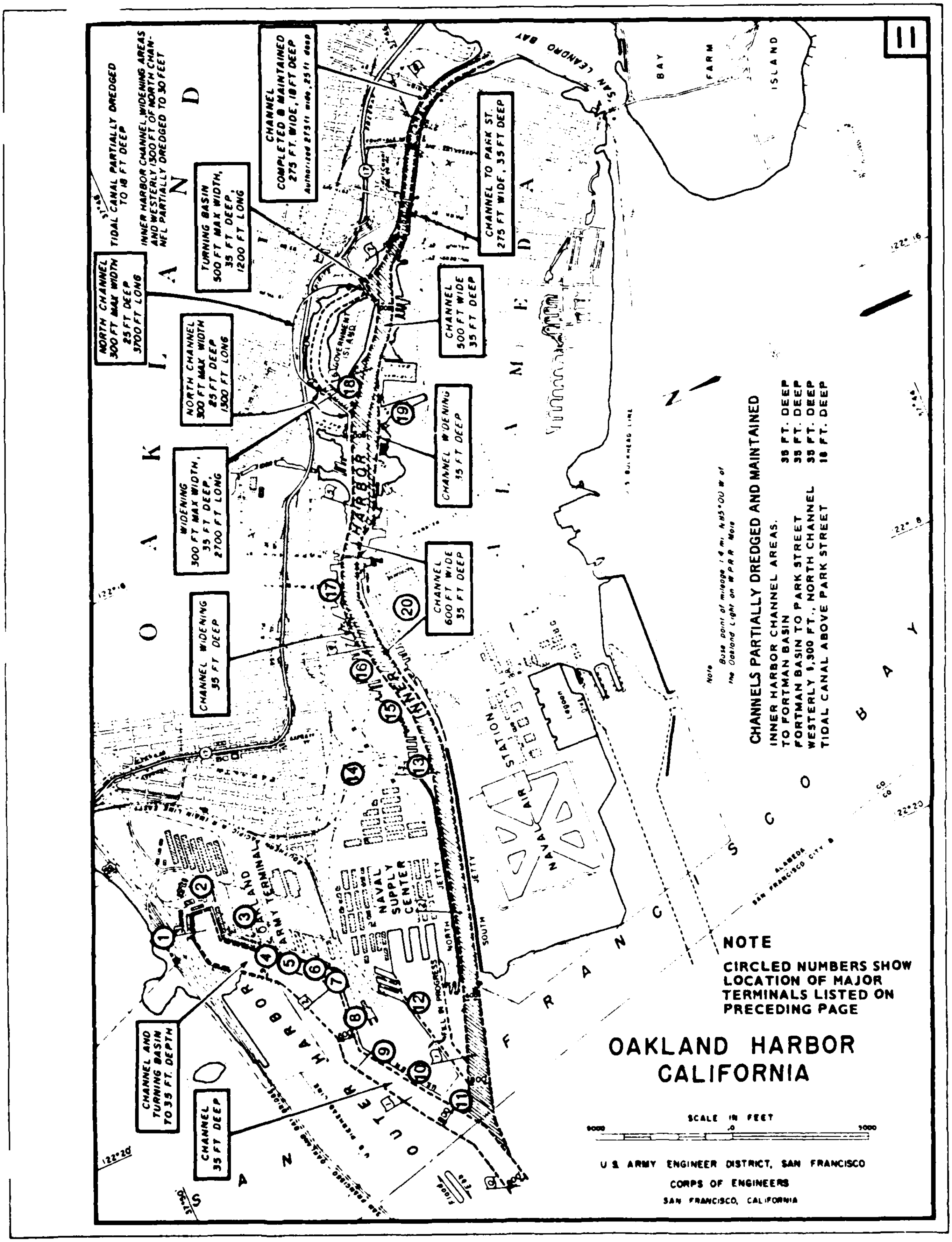

OAKLAND HARBOR
CALIFORNIA
NOTE
CIRCLED NUMBERS SHOW LOCATION OF MAJOR TERMINALS LISTED ON PRECEDING PAGE
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
CHANNELS PARTIALLY DREDGED AND MAINTAINED
INNER HARBOR CHANNEL AREAS. TO FORTMAN BASIN 35 FT. DEEP
FORTMAN BASIN TO PARK STREET 35 FT. DEEP
WESTERLY 1,300 FT., NORTH CHANNEL 35 FT. DEEP
TIDAL CANAL ABOVE PARK STREET 18 FT. DEEP
TIDAL CANAL PARTIALLY DREDGED TO 18 FT DEEP
INNER HARBOR CHANNEL, WIDENING AREAS AND WESTERLY 1300 FT OF NORTH CHANNEL PARTIALLY DREDGED TO 30 FEET
CHANNEL COMPLETED & MAINTAINED 275 FT WIDE, 18 FT DEEP
TURNING BASIN 500 FT MAX WIDTH, 35 FT DEEP, 1200 FT LONG
NORTH CHANNEL 300 FT MAX WIDTH 25 FT DEEP 3700 FT LONG
NORTH CHANNEL 300 FT MAX WIDTH 25 FT DEEP 1300 FT LONG
WIDENING 300 FT MAX WIDTH, 35 FT DEEP, 2700 FT LONG
CHANNEL WIDENING 35 FT DEEP
CHANNEL TO PARK ST. 275 FT WIDE, 35 FT DEEP
CHANNEL 500 FT WIDE 35 FT DEEP
CHANNEL WIDENING 35 FT DEEP
CHANNEL 600 FT WIDE 35 FT DEEP
CHANNEL AND TURNING BASIN TO 35 FT. DEPTH
CHANNEL 35 FT DEEP
OAKLAND
ALAMEDA
SAN FRANCISCO BAY
SAN LEANDRO BAY
BAY FARM ISLAND
INNER HARBOR
OUTER HARBOR
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
NAVAL AIR STATION
GOVERNMENT ISLAND
NORTH JETTY
SOUTH JETTY
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

FIGURE 3

FIGURE 4 – CONTAINER LOADING EQUIPMENT AT PORT OF OAKLAND

PUBLIC CONCERNS

2.09 Concerns are the public's perceptions of needs and desires. By eliciting information from the public about the range of needs which the study could address, subsequent planning activities can be directed to respond to public perceptions. Public concerns may be expressed directly, such as at a public meeting or indirectly through government representatives, agencies and statutory requirements.

2.10 PUBLIC MEETINGS. Public concerns were expressed at an initial public meeting held on 13 February 1980 and at a second public meeting on 14 July 1982. Concerns expressed initially included the needs for widening the Entrance Bar Channel, deepening the channel, enlargement of existing or development of new turning basins and the need for channel improvements upstream from the Alameda Tubes. Concerns were also expressed regarding location of submarine pipelines and cables, encroachment of piers and barges on the navigational channel and other navigational safety and use aspects. The concern regarding possible hazards and congestion on local streets and the airport landing zone that could result from the relocation or replacement of the tubes, was also documented. After preliminary plans were formulated and candidate plans established, the results were presented at a second public meeting held on 14 July 1982. Although support for a plan was acknowledged, several specific concerns were raised. These concerns included the lack of maneuvering areas and potential encroachment into the Todd Shipyard dry dock and mooring facilities above project mile 3.0. In general, concerns expressed a need for and support of channel improvements to encourage safe and efficient port facilities utilization by users.

2.11 OTHER CONCERNS. Public concerns have also been expressed indirectly through various agency policies and statutory requirements. These statutory requirements reflect public concerns which are held nationally. Concerns of this nature are listed below:

Commercial Shipping. The public concern for improving Oakland Inner Harbor is reflected in the Resolution which authorized this study.

Wetlands. The public concern for maintaining and enhancing wetlands is reflected in Executive Order 11990 (Wetland Protection). This public concern is reinforced by the Chief of Engineers Wetland Policy and the State of California Wetland Policy.

Water Quality. The public concern for maintaining and enhancing water quality is reflected in the Clean Water Act, Section 404. The U.S. Fish and Wildlife Service has expressed concern for San Francisco Bay water quality resulting from the disposal of dredged material. Also, the California Department of Water Resources and Water Quality Control Board have expressed concern about possible effects of channel deepening on aquifers under the estuary.

Air Quality. The public concern for maintaining and enhancing air quality is reflected in the Clean Air Act.

Endangered Species. The public concern for the preservation of endangered species is reflected in the Endangered Species Act as amended. The U.S. Fish and Wildlife Service has expressed specific concern about the listed California least tern.

Cultural Resources. The public concern for maintaining and enhancing cultural resources is reflected in the National Historic Preservation Act of 1966 (P.L. 89-655).

Bay Fill. The public concern for limiting fill in San Francisco Bay is reflected in the San Francisco Bay Plan (Bay Conservation and Development Commission), which provides policies for protection of the Bay's natural resources.

PROBLEMS, NEEDS AND OPPORTUNITIES

2.12 Public concerns addressed within the scope of this investigation are directly related to problems that can be solved through water and related land resource management. While the evaluation of public concerns reflects the range of needs which the public perceives, this section describes the problems and opportunities from a technical viewpoint. This study has identified problems and opportunities related to commercial shipping, navigational safety and wetland enhancement.

2.13 IMPROVEMENT OF PORT FACILITIES. The Port of Oakland has completed construction of the new Charles P. Howard Terminal between Market and Grove Streets at about mile 3.5 along the Inner Harbor. Figure 5 is an artists' view of Port plans for this facility, which includes dredging of berthing areas and foundation for dikes and structural fill. The total estimated cost of the new terminal is $43,000,000. The Port's master plan envisions construction of other facilities to handle projected needs for increased capacity to ship containerized cargoes. Figure 6 shows potential development of the Port. The City of Alameda has developed the Encinal Terminals Master Plan for construction of improved berthing and terminal facilities. A Draft Environmental Impact Report was prepared in September 1982.

2.14 GROWTH OF CONTAINERIZED CARGO. Between 1974 and 1979, the average annual increase of container traffic at the Port of Oakland was between six and seven percent per year. Approximately 1,800,000 short tons of cargo was the 1978 base for the Oakland Inner Harbor by three shipping companies, American President Lines Ltd., United States Lines and Seapac. The new Charles P. Howard Container Terminal has two berths and adds approximately 400,000 short tons per year to the Port's containerized cargo handling capacity. Port officials estimate the new terminal will be operating at full capacity by 1986, when approximately 2,200,000 tons of container cargo is projected to be moving over the waterway. For this study, the increase in commerce is estimated to continue growing at the annual rate of six percent per year to 2006 when approximately 6.9 million tons of general cargo would be moving over the Inner Harbor channels. These projections are explained in greater detail in Appendix B.

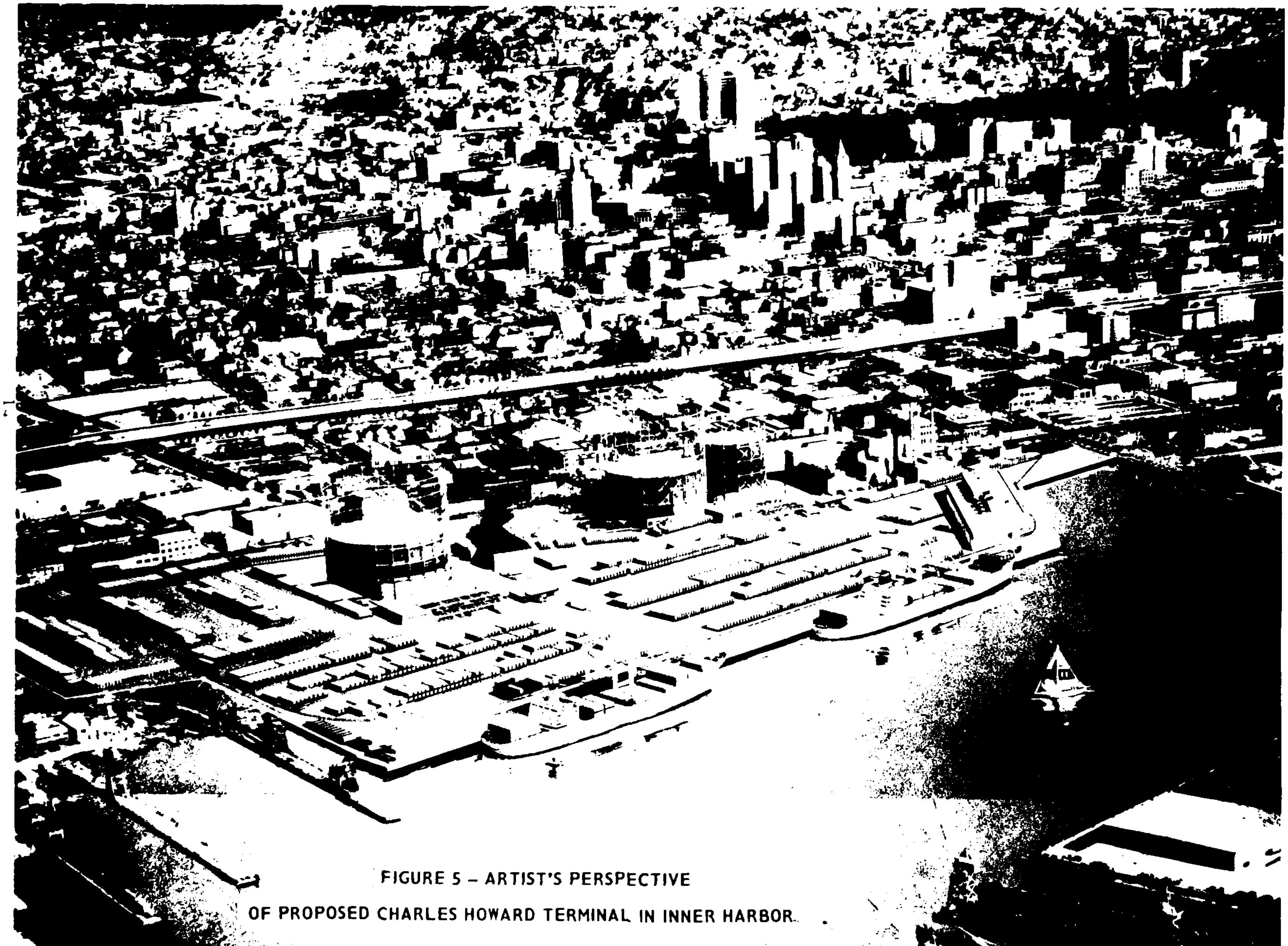
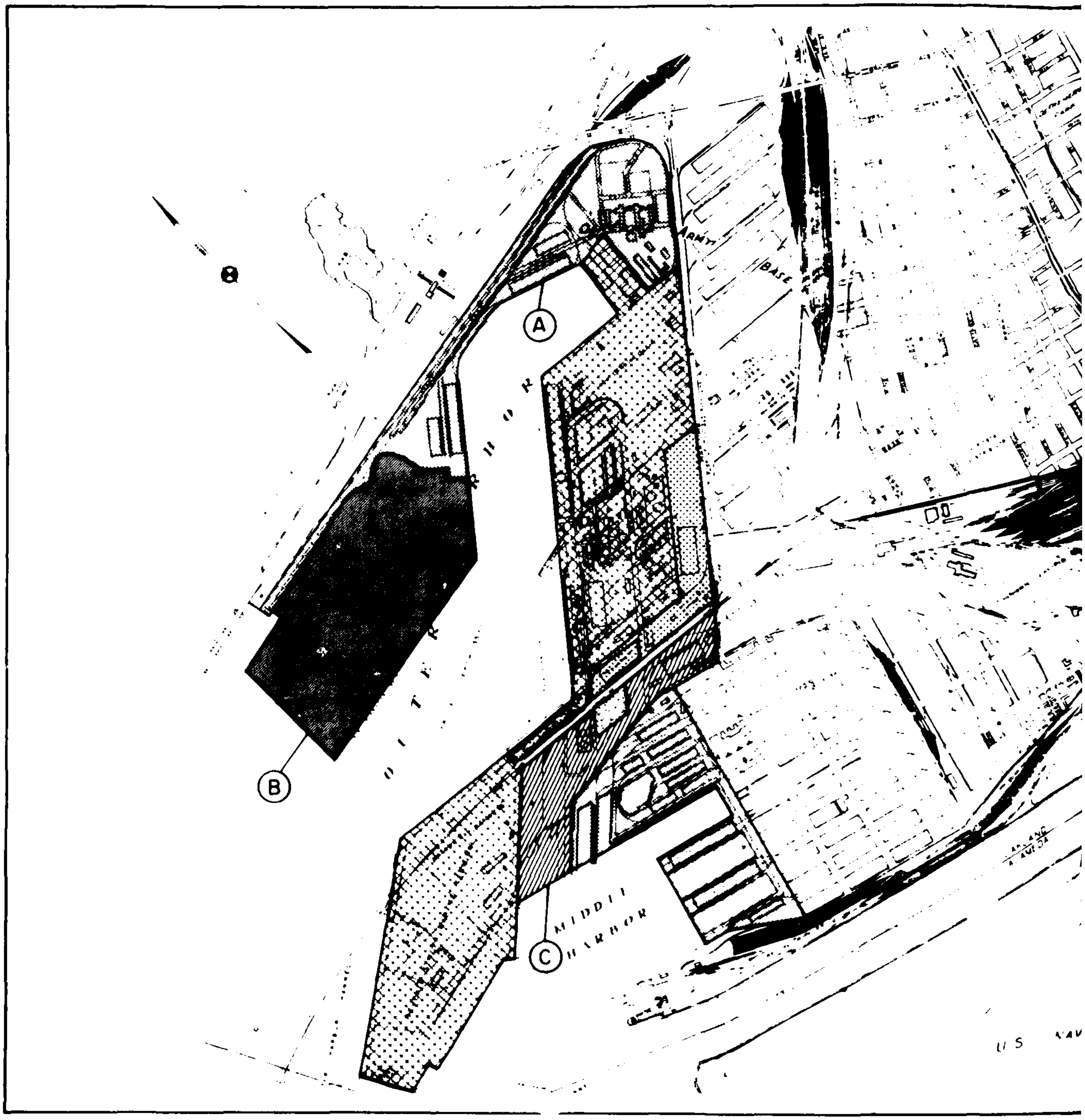
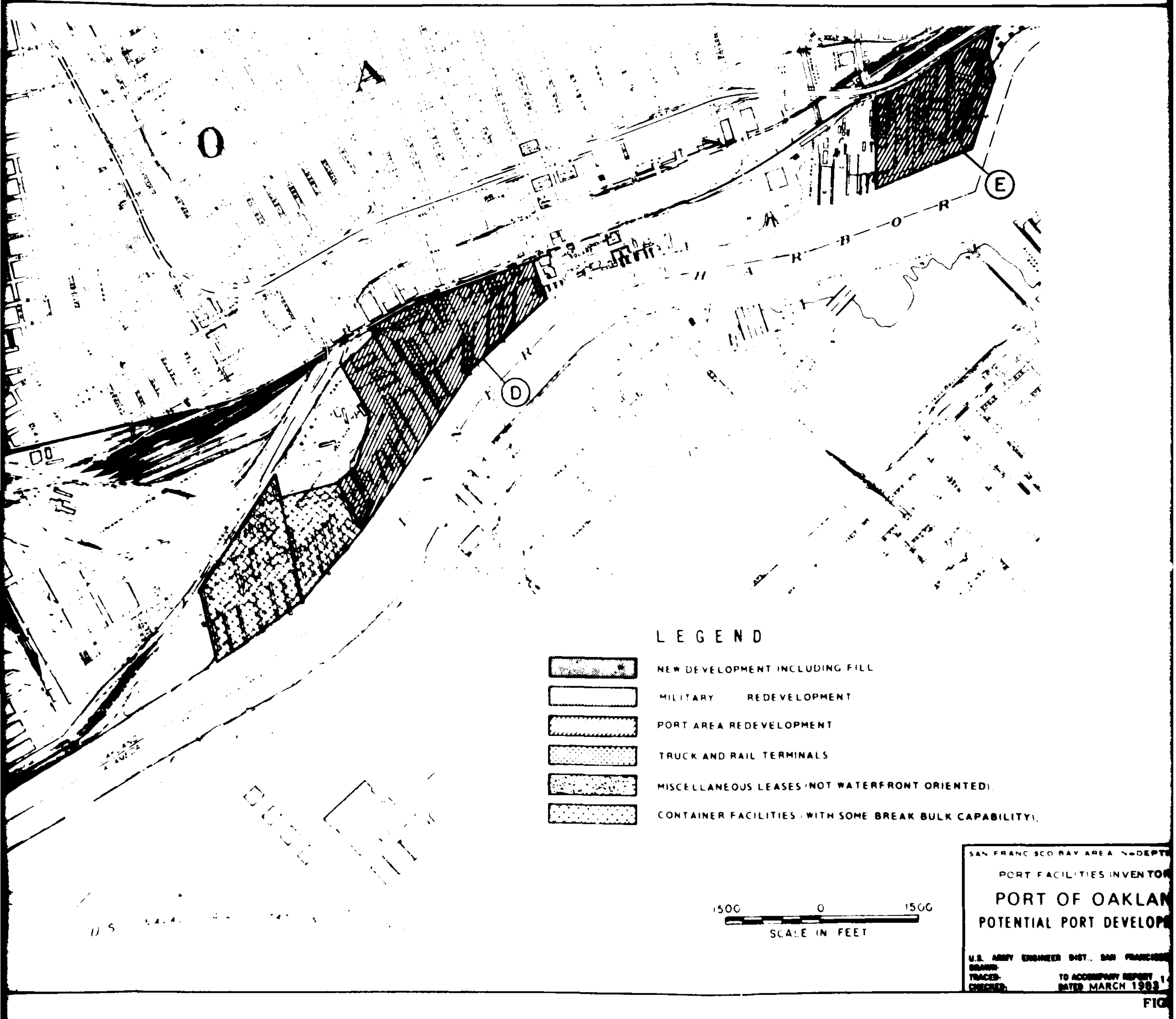
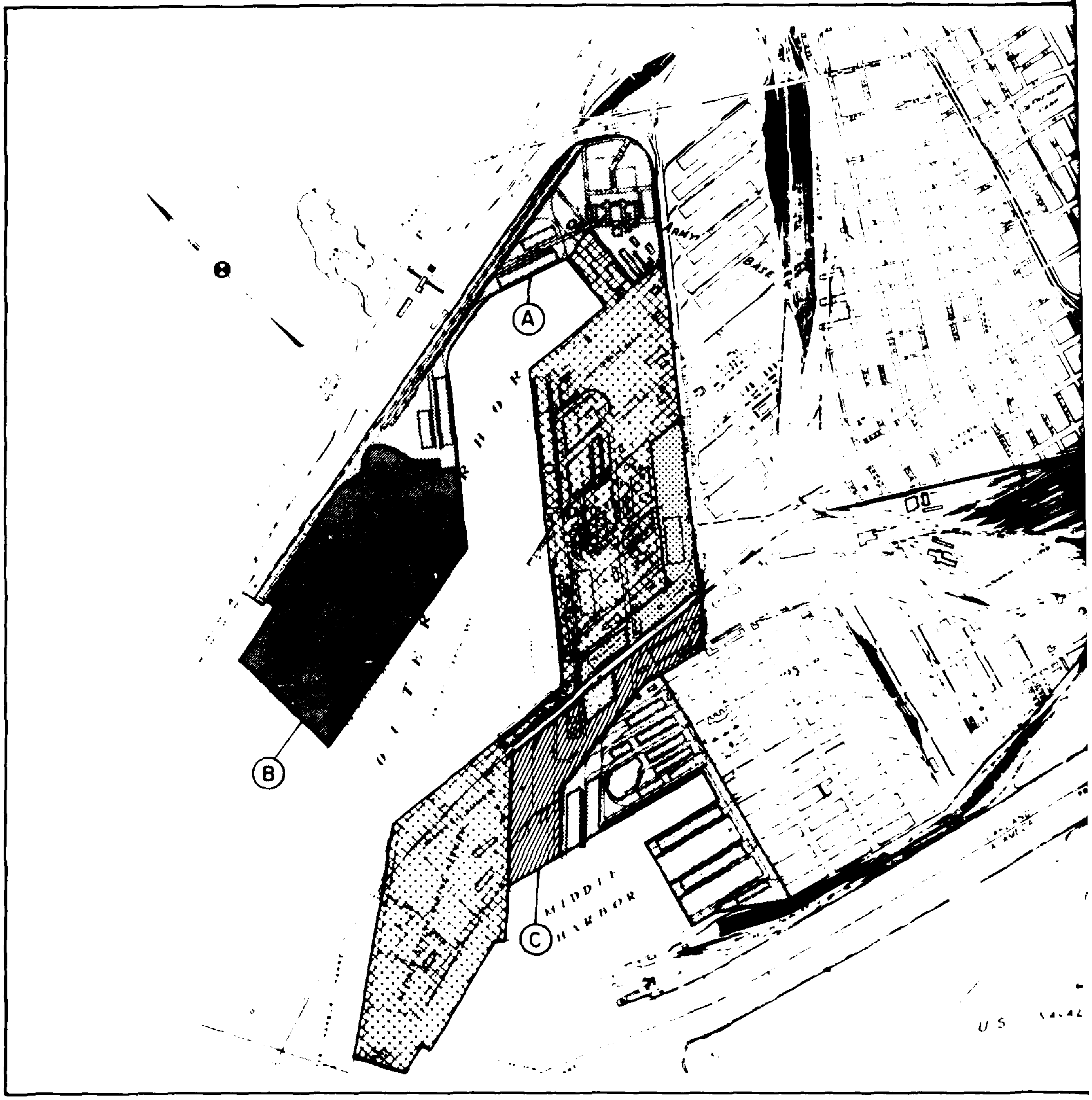


FIGURE 5 – ARTIST'S PERSPECTIVE
OF PROPOSED CHARLES HOWARD TERMINAL IN INNER HARBOR.


A
B
C
HARBOR


O
A
H A R B O R
E
D
LEGEND
NEW DEVELOPMENT INCLUDING FILL
MILITARY REDEVELOPMENT
PORT AREA REDEVELOPMENT
TRUCK AND RAIL TERMINALS
MISCELLANEOUS LEASES (NOT WATERFRONT ORIENTED)
CONTAINER FACILITIES (WITH SOME BREAK BULK CAPABILITY)
1500 0 1500
SCALE IN FEET
PORT FACILITIES INVENTOR
PORT OF OAKLAN
POTENTIAL PORT DEVELOP
DATED MARCH 1983
FIG


A
B
C
ARMY
BASE
MIDDLE
HARBOR

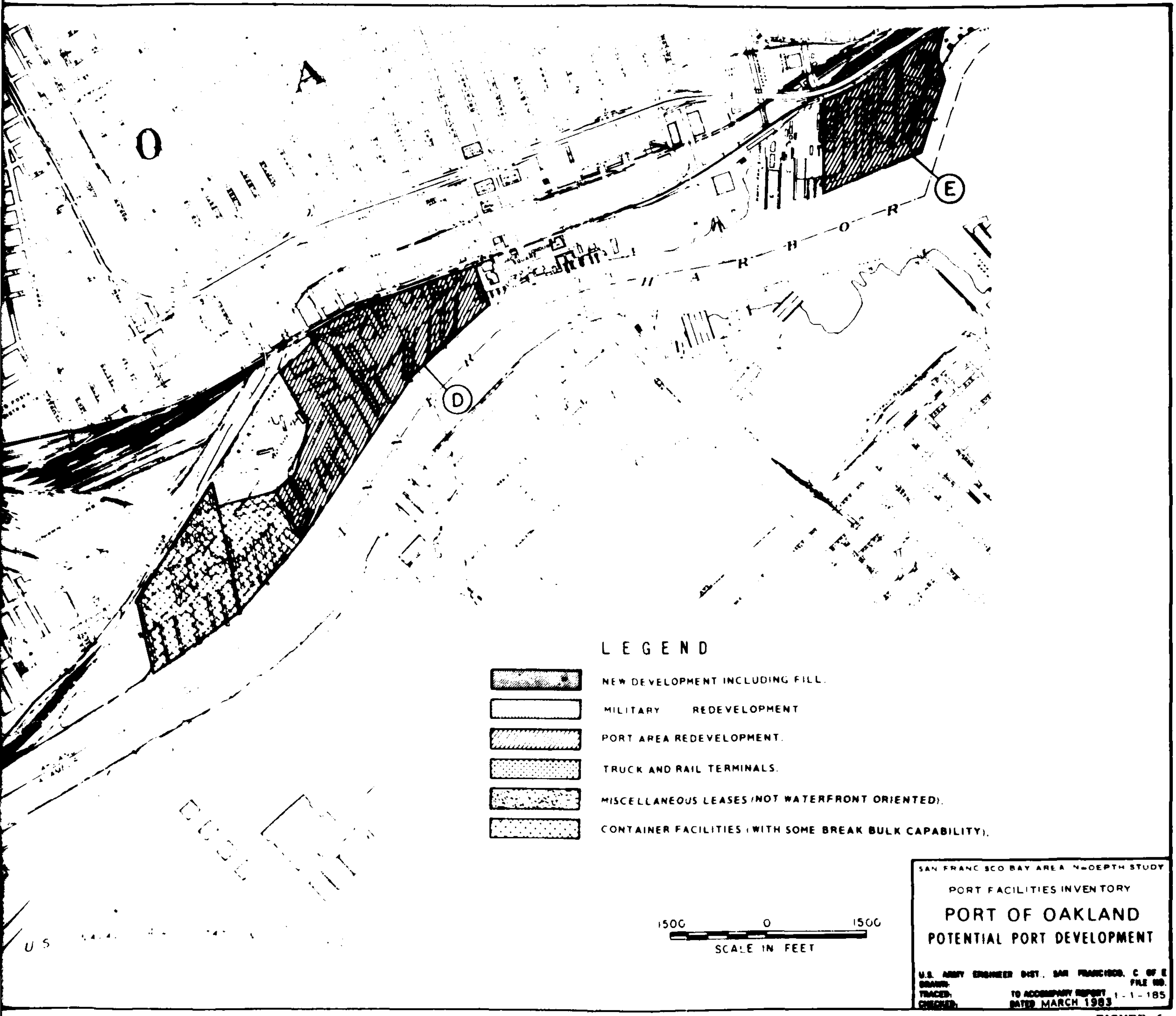

O
A
D
E
LEGEND
NEW DEVELOPMENT INCLUDING FILL.
MILITARY REDEVELOPMENT
PORT AREA REDEVELOPMENT.
TRUCK AND RAIL TERMINALS.
MISCELLANEOUS LEASES (NOT WATERFRONT ORIENTED).
CONTAINER FACILITIES (WITH SOME BREAK BULK CAPABILITY).
1500 0 1500
SCALE IN FEET
SAN FRANCISCO BAY AREA DEEP-DEPTH STUDY
PORT FACILITIES INVENTORY
PORT OF OAKLAND
POTENTIAL PORT DEVELOPMENT
FILE NO.
1-1-185
MARCH 1983

FIGURE 6

2.15 COMMERCIAL SHIPPING. Since the introduction of containerized cargo in the 1950's, four generations of containerships have evolved. Channel depths at Oakland Inner Harbor became marginal when second and third generation containerships with drafts from 30-33 feet were brought into use. Vessel delays while waiting for high water became more pronounced when deeper draft vessels operate in the 35-foot deep navigation channel. Fourth generation containerships with drafts of 38 feet or greater would experience even longer delays or would not be able to operate in the Inner Harbor channel. The evolution of larger containerships is illustrated on Figure 7. Vessel lengths and beams have increased from 450 feet and 90 feet for the first generation containerships to greater than 900 feet in length and 105 feet in beam for the fourth generation. The C-9, C-8 and D-9 designations are representative of fourth generation container ships. Insufficient depth of the Inner Harbor Channel causes expensive delays. Larger vessels must wait up to 12 hours for high tides to provide sufficient water depth for navigation. The new Charles P. Howard Terminal and adjacent berthing areas are being designed to accommodate large containerships with loaded drafts of 38 feet. Associated with commercial shipping are two basic problems (1) tidal delays for containership passages and (2) efficiencies in commodity transport related to economies of scale. Both of these problems are directly related to the existing depth of the navigation channel. Estimated transportation costs, including costs for tidal delays are presented in Appendix B.

2.16 NAVIGATIONAL SAFETY. The Oakland Inner Harbor channel, which was originally designed for two-way passage of small vessels, has become inadequate for passage of large containerships. The existing 800-foot channel width at the Bar Channel limits the maneuvering of longer containerships because of external forces upon the vessels such as wind, current and wave action during periods of bad weather. Pilots have requested that widening the Entrance Bar Channel to 1,000 feet be investigated. Based on available information at this time, an 800 feet width appears to be adequate. The proposed project will be simulated on a computer during the advanced engineering and design stage under the authority of the Oakland Outer Harbor improvements. After such simulation a determination wil be made as to the most appropriate width for the Bar Channel. The pilots have also suggested that channel widenings at project mile 3.0 and near the Grove Street Pier in the Inner Harbor Channel would facilitate tug assisted turning of large vessels at these locations during slack tide.

2.17 WETLAND ENHANCEMENT. Section 150 of the Water Resources Development Act of 1976 provides the opportunity for marsh creation with dredged materials to restore the environmental attributes of wetlands aggravated by historic marsh destruction. However public and institutional policy opposing further filling of submerged lands within San Francisco Bay restricts the development of marsh in the Bay in areas of intertidal mudflats. Therefore, marsh creation within the confines of San Francisco Bay can only be considered for areas behind existing dikes, none of which exist in the Oakland Inner Harbor project area.

SIGNIFICANT RESOURCES

2.18 This subsection describes the resources identified in the study which may be significantly affected by implementation of the preliminary plans presented in this report. The resources that are considered significant are

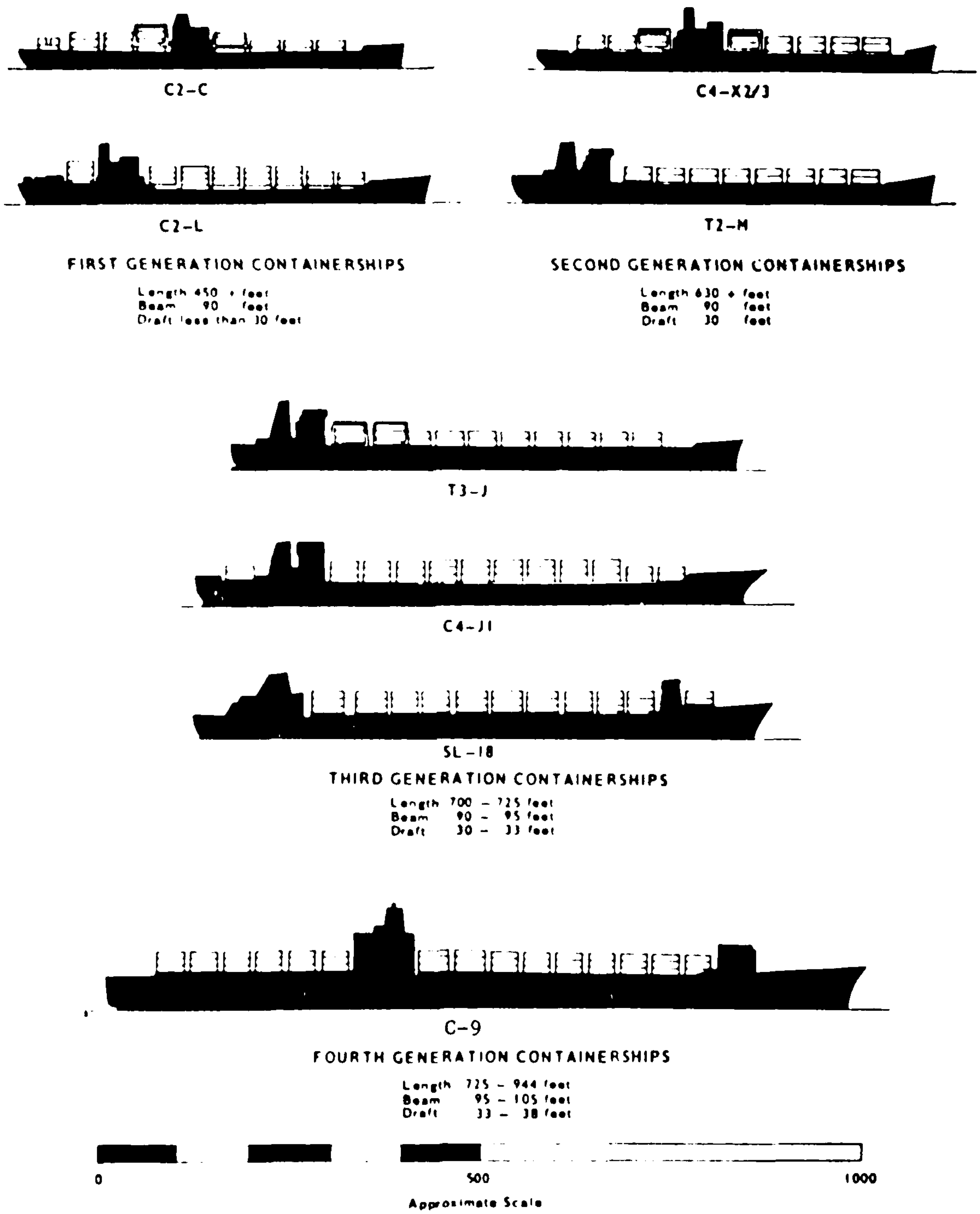


FIGURE 7 EVOLUTION OF CONTAINERSHIPS

those identified in laws, regulations, guidelines or other standards of national, regional, or local agencies or groups. Except for navigational safety, commercial shipping and wetlands which have been described in the preceding subsection, the significant resources identified in the study are described below.

2.19 WATER QUALITY. This resource is considered to be signficant based on the concerns of the Clean Water Act of 1977. Water quality of the Inner Harbor is below that of Central San Francisco Bay. Poor circulation is a factor. Turbidity is low in this part of San Francisco Bay. Storm drainage, and seasonal and diurnal temperature fluctuations affect water quality. Water quality parameters are directly related to the interaction of sediment disturbances and water column effects at the dredged and disposal sites under consideration. Water quality parameters of concern include: concentrations of dissolved oxygen, heavy metals, petroleum hydrocarbons and pesticides. Some groundwater has been pumped from wells penetrating the Meritt Sand. Brackish water of limited use has been pumped from other aquifers at shallower depths in the study area. Concerns related to potential impact upon groundwater aquifers have been expressed by the California Department of Water Resources.

2.20 AIR QUALITY. Because the San Francisco Bay Area topography is dominated by a large, shallow basin ringed by hills, this area has the potential for trapping and accumulating air pollutants. Lack of ventilation during warm, sunny days (primarily May to October) fosters the development of photochemical oxidants. Motor vehicles provide the highest percentages of highly reactive organic gases, oxides of nitrogen, and carbon monoxide; stationary sources are responsible for most of the particulate matter and sulfur-dioxide emissions. Projections of the Bay Area Air Pollution Control District (BAAPCD, 1975) show levels of these emissions increasing in the next 10 years.

Oakland Inner Harbor is located in the San Francisco Bay Area Air Basin, an area designated as an Air Quality Maintenance Area (AQMA). A detailed air quality analysis has been performed for this study to evaluate impacts on the regional air quality (See Appendix F). Air quality is included as a significant resource based on the concerns of the Clean Air Act Amendments of 1977.

2.21 BENTHOS. This resource is considered significant because of its relationship to components of the food chain. Associated with the bottom of the channel and adjacent areas are a variety of marine organisms which include worms, crustaceans, and assorted shellfish. Many marine invertebrates have a free-floating larval stage, which after a period, reach a stage at which they migrate to the bottom. By this method, bottom organisms reestablish in areas that have been dredged. However, the overall productivity of a community is reduced because of the time requirement for recovery and limited number of organisms with the ability to adapt to such an environment. Historically, annual maintenance dredging has resulted in a relatively unproductive biotic regime in the harbor. Some coelenterates, annelids, a few bryozoans, and arthropods still inhabit the estuary. The most predominant invertebrates are gaper and little-neck clams and ghost shrimp. Resultant shoaling of excavated channel bottoms also contributes to an unstable community structure. No extensive shellfish bed exists in the immediate vicinity of Oakland Inner Harbor. The area on the southern shore of the Bay Bridge approach includes mudflat habitat.

2.22 ENDANGERED SPECIES. Essential nesting habitat for the endangered California least tern includes an area of land and airspace at Alameda Naval Air Station. The site is approximately 25 acres at the south end of the airstrip, fronting San Francisco Bay. Potentially negative effects would occur if the nesting or feeding habitats were impacted.

2.23 ENERGY. In relation to efficiency of use of Oakland Inner Harbor by commercial vessels, energy consumption plays a significant role. Energy resources have assumed greater economic and environmental values due to limited quantity use and higher cost. The present national concern for conservation of energy resources mandates efficient navigation at Oakland Inner Harbor and will be treated as a significant resource. The measure of this resource for comparative purposes will be indicated by savings in ship operating costs and costs for disposal of dredged material.

2.24 TRANSPORTATION AND TRAFFIC. Port operations are dependent and have a significant effect on land transportation systems. Port-generated truck traffic and railroad operations contribute to air pollution and sometimes jam up traffic on city streets and the Nimitz Freeway. The Posey and Webster Street Tubes allow traffic to pass beneath the existing navigation channel.

2.25 CULTURAL RESOURCES. Cultural resources include any site, structure, object or data significant in history, architecture, science, archeology or culture. On the basis of a cursory evaluation, there is a strong likelihood that the Posey and Webster Street Tubes would qualify for the National Register of Historic Places and the National Architectural and Engineering Record. The significance of the resource would be evaluated in compliance with Section 106 of the National Historic Preservation Act, before recommending any navigation improvement requiring removal or modification of the tubes.

2.26 HYDROGRAPHY. This refers to the physical characteristics of the submerged bottom. Any proposed channel dredging will result in significant changes to the channel bottom; therefore hydrography will be discussed as an important element in the study area even though it is not a resource. Physical characteristics of the harbor's hydrology that may be impacted due to changes in the channel bottom are wave action, water circulation and sedimentation. Technical evaluation of the interaction of ships with hydrographic elements is given in Appendix C.

OTHER STUDY AREA CHARACTERISTICS

2.27 To more fully understand the study area, the following characteristics are described. These characteristics differ from significant resources in that they would not be significantly affected by implementation of the preliminary plans presented in this report.

2.28 GEOLOGY. The Port of Oakland is situated on a low-lying tidal plain adjacent to the east side of San Francisco Bay. The tidal plain is about five miles wide between the Bay and the Berkeley Hills to the east. A thick layer of unconsolidated marine and continental sediments of Pleistocene and Recent origin underlies the project site. Sediments are underlain by consolidated Franciscan rocks of Jurassic-Cretaceous age at a depth of about 100 feet below the surface.

2.29 SEISMICITY. The San Francisco Bay Area is well known as a region of high seismic activity. The Hayward Fault lies about 2.5 miles east of the harbor. Six moderate earthquakes (magnitude 4.0-5.0) have been recorded on this active fault since 1934. The San Andreas Fault lies about eight miles to the west. The strike of these faults is in a north-northwest direction.

2.30 SOILS AND SUBSURFACE CONDITIONS. The very soft silty clay, called "Younger Bay Mud," has been removed in previous dredging cycles from some locations in the channel bottom. Most port improvements are founded on piles to denser materials. Materials below the Younger Bay Mud consist of stiff clays and irregular lenses of sand, silts and some gravel deposited during interglacial periods. Depth of these older materials is from 30 to more than 50 feet below the surface.

2.31 TIDAL DATA. Tides in Oakland Harbor range from -2.5 feet below mean lower low water datum to +8.5 feet. Other tidal planes and cycle times for this location are shown on Figure 8.

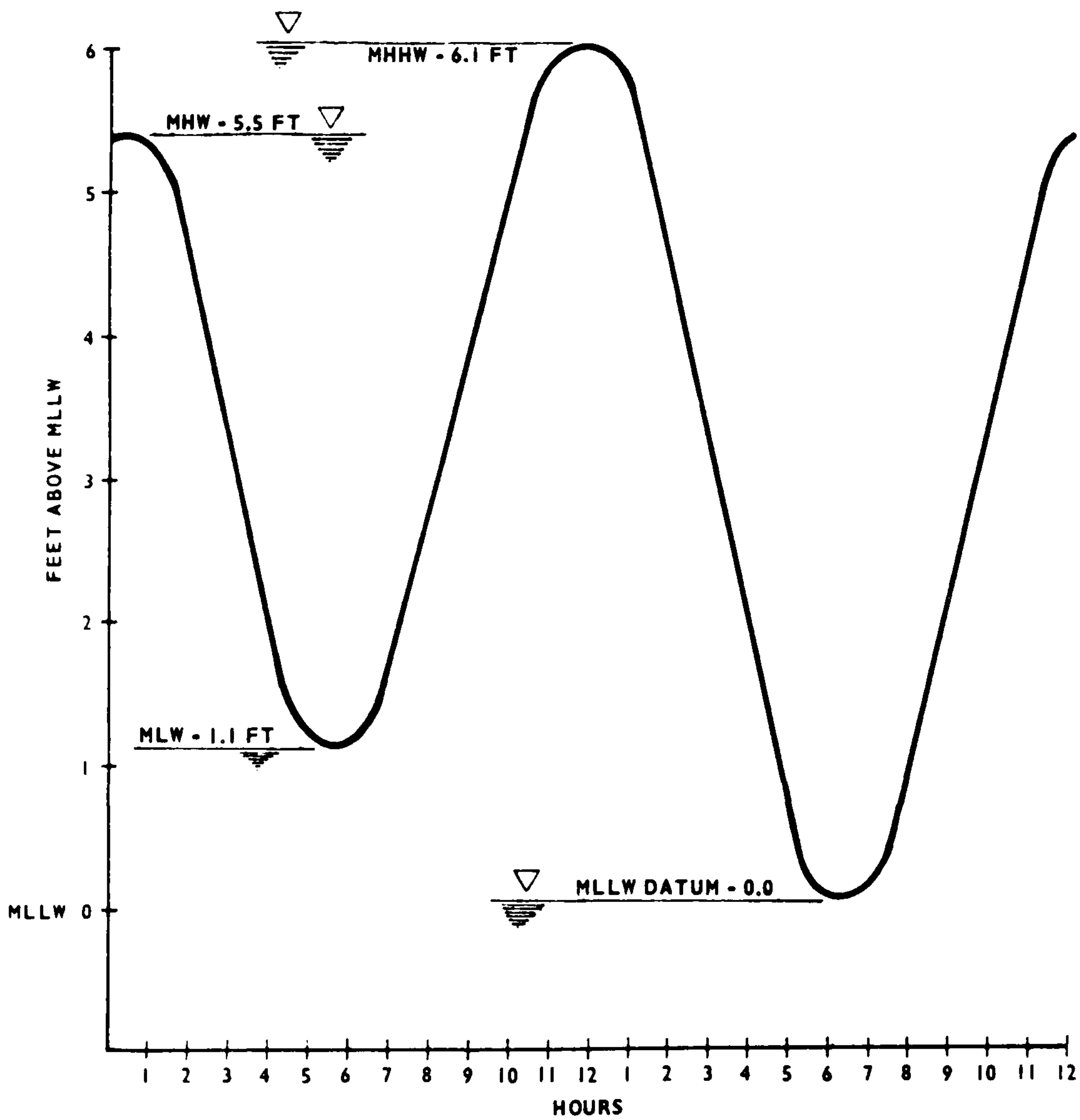
2.32 AQUATIC PLANTS. Phytoplankton (free-floating microscopic plants or algae) comprise most of the plantlife in the estuary. The shallow muddy floors of the Inner Harbor support growths of some larger algal forms, especially *Bryopsis corticulans*, *Ulva sp.*, and *Gracilaria sjoestedtii*.

2.33 FISH. At least 25 species of fish, mostly non-game species, may be found in the harbor on occasion. These include three species of shark, and two species each of rays and smelt. The gamefish striped bass and American shad are occasionally taken. The most predominant species are shiner perch and pile perch. The channel does provide relatively calm, open-water feeding habitat for juvenile fish.

2.34 WILDLIFE HABITAT. In general, the Oakland Estuary is not considered an important wildlife area compared to other areas of San Francisco Bay where wetland complexes exist. In some of the tidal areas, one may find a limited number of shorebirds, diving ducks, grebes, gulls and cormorants at low tide. However, the lack of marshy habitat in the project area, combined with the density of urban and industrial development, limits wildlife populations.

PLANNING CONSTRAINTS

2.35 Planning constraints are overiding concerns that must be considered in the development of plans. Planning constraints reflect the combination of expressed public concerns and the existence of a significant resource related to that concern. Planning constraints are so important that they may not be bartered or exchanged in the planning effort. All but one of the planning constraints identified thus far in the study relate to requirements of specific acts. The planning constraints are as follows:



ESTIMATED HIGHEST WATER LEVEL	8.5 FEET
MEAN HIGHER HIGH WATER	6.1 FEET
MEAN HIGH WATER	5.5 FEET
MEAN TIDE LEVEL	3.3 FEET
MEAN LOW WATER	1.1 FEET
MEAN LOWER LOW WATER	0.0 FEET
ESTIMATED LOWEST WATER LEVEL	-2.5 FEET

Tidal data from NOAA Station 941 4779 on Wharf at end of Seventh Street

ALAMEDA COUNTY CALIFORNIA

OAKLAND HARBOR

TIDAL DATA

U.S. ARMY ENGINEER DIST., SAN FRANCISCO. C OF E
DRAWN: FILE NO
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED MARCH 1983

FIGURE 8

Water Quality. The Corps must evaluate the impacts of the discharge of dredged or fill material into waters of the United States in accordance with the Clean Water Act, Section 404. The objective of this Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. A Section 404 evaluation report is included with the EIS and will be submitted to Congress for an exemption to the Clean Water Act, if a favorable recommendation to Congress is made. In response to the concern expressed by the U.S. Fish and Wildlife Service, disposal of dredged material in San Francisco Bay would be performed during ebb tide or as close to ebb tide as possible.

Air Quality. The Corps must evaluate the impacts of a proposed action in accordance with the Clean Air Act. The objective of this Act is to protect and enhance the quality of the Nation's air resources. The Act requires Federal agencies to perform an Air Quality Analysis for projects located within Air Quality Maintenance Areas to determine the effect of the proposed action upon the local Air Quality Maintenance Plan.

Wetlands. In accordance with Executive Order 11990 (Wetland Protection) the Corps must avoid, to the extent possible, the long and short-term adverse impacts associated with destruction or modification of wetlands. The Corps must also avoid undertaking and providing support for new construction (draining, dredging, channelizing, filling, diking, impounding, and related activities) located in wetlands, unless the agency head finds: (1) no practicable alternative, and (2) all practical measures have been taken to minimize harm to wetlands.

Endangered Species. There is a need to avoid disrupting habitats of endangered and threatened species which might be present in the study area in conformance with the Federal Endangered Species Act of 1973. Section 7 (a) of this act, requires, among other things, that Federal agencies, in consultation with and with the assistance of the Secretary of the Interior, insure that their activities do not jeopardize the continued existence of endangered or threatened species or destroy or adversely modify the critical habitat that supports such species. A biological assessment for the listed California least tern, which indicates that potential for adverse effect upon its foraging for food may result from implementation of the recommended plan of this study, is included in this report (Appendix D).

Cultural Resources. The Corps must evaluate cultural resources in the project area to determine if they are eligible for listing on the National Register of Historic Places. There is a strong likelihood that the Posey and Webster Street tubes would qualify for the National Register of Historic Places and the National Architectural and Engineering Record. The significance of the resource would be evaluated in compliance with Section 106 of the National Historic Preservation Act if they might be impacted by any proposed action (Appendix H).

Channel Depth and Width Restrictions. The Posey and Webster Street Tubes restrict upper reaches of the navigation channel to its present depth of -35 feet MLLW without major modification or replacement of the tubes. Jetties and terminals along the Inner Harbor also restrict the width and channel depth unless special stabilization measures are to be considered. No such stabilization measures have been incorporated into the recommended plan.

PLANNING OBJECTIVES

2.36 Planning objectives are statements of the water and related land resource management problems and needs specific to the study area that reflect public desires. The planning objectives identified for this study are:

- To reduce tidal delays for containership passages between the harbor entrance and terminals in Oakland Harbor.
- To increase economies of scale for waterborne commerce passing through the Port of Oakland and other terminals located along the Inner Harbor channels.
- To increase navigational safety for containership passages and turn around in the Inner Harbor.
- To enhance or create wetland areas with the use of dredged material outside of the immediate study area.

SECTION 3 - FORMULATION OF PRELIMINARY PLANS

3.00 This section presents the formulation and evaluation of preliminary plans. Initially, management measures were identified which could address the planning objectives. These management measures were then evaluated and screened. Those management measures remaining were then combined to form the preliminary plans. This section concludes with the evaluation and screening of the preliminary plans.

MANAGEMENT MEASURES

3.01 As a basis for formulating preliminary plans, a variety of means for managing resources were identified to address the specified planning objectives. These means, referred to as management measures, are the "building blocks" or plan components that can be combined to form alternative plans. The management measures identified in this study can be classified as one of three plan components: (1) Dredging Sites, (2) Dredging Methods; and (3) Disposal Sites. A brief description and a summary of the environmental impacts of the alternative management measures considered in this study are presented in the following paragraphs.

NO ACTION

3.02 This measure would retain the existing 35-foot deep navigation channel with its periodic maintenance dredging program. The most significant change would be the increasing navigation hazard as bigger ships come into Oakland Inner Harbor. This would increase tidal delays for commercial shipping. Existing depths would limit the size of the vessels that could utilize the harbor. The no action alternative is the basis from which the impacts of other alternatives are measured and therefore, by definition, causes no impacts.

NON-STRUCTURAL MEASURES

3.03 Non-structural measures could address navigation hazards and inefficiencies in commercial shipping if problems existed that were caused by factors other than the existing channel configuration. Since no inefficiencies that were not entirely attributed to the existing channel dimensions were identified, no non-structural measures were identified.

DREDGING SITES

3.04 4-MILE REACH. This measure initially called for deepening of the reach of channel from the harbor entrance to Clay Street Piers from 35 to the optimum depth of 43 feet below mean lower low water datum. There would be a short-term adverse effect from sediment disturbance during dredging, such as increased turbidity and a depressed dissolved oxygen level. Long-term effects would depend on use of the channel and regulations to control water pollution. Bottom organisms living in the dredged area would be removed and displaced from the channel; however, replenishment of the disturbed areas by bottom species can be expected. Deepening of this reach would have a significant benefit to existing and future deep-draft vessels expected in the harbor, by reducing potential hazards and delays.

3.05 6-MILE REACH. This measure calls for deepening of the reach from the harbor entrance to Fortmann Turning Basin from 35 to 43 feet below mean lower low water datum. This would require replacement of the Posey and Webster Street submarine traffic tubes with a high-arch bridge. The measure would have short-term adverse effects due to dredging. Removal of the two traffic tubes could significantly increase turbidity. Removal of the tubes and bridge construction would require temporary rerouting of traffic, which would adversely impact air quality in localized areas outside the project area. Rerouting of traffic due to tube removal could also temporarily affect fuel consumption by usual automobile traffic. There would be resulting increases in noise, air pollutants and travel time for the rerouted traffic as well as secondary impacts to area residents. The Posey and Webster Street traffic tubes are considered historic structures. Removal of them would be a significant adverse effect.

3.06 WIDENED BAR CHANNEL. The Bar Channel leading to Oakland Outer and Inner Harbors is presently 800 feet wide. Because of physical conditions of the area, including tides, currents and winds, the navigation of large ships within this existing 800 foot width has been an expressed concern of the pilots associations. A 1,000-foot wide channel was considered in the preliminary plan formulation stage of this study. However, after review of the authorized Oakland Outer Harbor improvements, it was decided that the Bar Channel width should remain at 800 feet until further investigations determine otherwise. Under the post-authorization design stage of the Oakland Outer Harbor navigation project, the width of the Bar channel will be re-examined for suitability to support unrestricted two-way traffic for the large vessels presently in operation during all tidal conditions with the assistance of pilots associations. A computer simulation will be performed during this post-authorization stage for the Oakland Outer Harbor project to determine the appropriate Bar Channel width.

3.07 DEEPEN THE BAR CHANNEL. This measure would deepen the Bar Channel from the 42-foot depth, authorized for the Oakland Outer Harbor project, to 43 feet, MLLW, to provide for adequate access from the Bar channel to the Inner Harbor Channels. As with widening, there would be a short-term increase in turbidity and depression in dissolved oxygen content due to dredging. Deepening of the channel may improve navigation and allow larger ships access to the inner harbor under all tidal conditions; thus, benefiting commercial shipping and possible lowering fuel consumption.

DREDGING METHODS

3.08 HOPPER DREDGE. The hopper dredge is a self-propelled ocean-going vessel which removes material from the bottom of the bay or ocean by scraping and sucking through pipes known as drag pipes, which are trailed on the sides of the vessel. The dredged material is pumped into bins or hoppers in the vessel, from which it can be discharged by bottom dumping. Because of its size, the hopper dredge disturbs bottom sediment as it moves. However, this occurs with any deep-draft vessel. The cutting motion of the dredge also disturbs sediments. During loading, overflow periods return sediments to the water column. The dredging activity does not have a detectable long-term effect on water quality. The Corps hopper dredges are based in Portland, Oregon. The use of Government-owned hopper dredges for maintenance dredging in San Francisco Bay has been dependent upon availability. The availability of privately-owned hopper dredges in the San Francisco Bay area is limited. Because of the "stiff" nature of sediments found in portions of the Oakland Inner Harbor Channels, the use of hopper dredges is precluded.

3.09 CLAMSHELL DREDGE AND BARGE. The Clamshell removes sediment by a bucket which is dropped through the water and is then worked into the sediment. The bucket is raised and dumped into a barge, which when full carries the sediment to the disposal site where it is discharged by bottom dumping or direct pumpout. Turbidity occurs as the clamshell bucket bites into the sediment and breaks free when it is hoisted. The bucket also loses sediment as it is lifted through the water and as it breaks free of the water surface and is swung to the barge. Consolidated material tends to remain in mass when disposed and would remain consolidated through the water column, even at high energy disposal sites. Material breakdown would depend upon plasticity of the sediments or liquid content and the current velocities generated by tidal influence, which would affect the rate in which the sediment is able to break apart and disperse. This dredging method was forwarded for consideration in those preliminary plans which considered aquatic disposal. It was subsequently dropped from consideration because of the potential mounding of consolidated clays at the Alcatraz disposal site.

3.10 HYDRAULIC DREDGE. Hydraulic pipeline dredges remove bottom sediment by sucking and pumping through a pipeline. This removal process yields a product different from the in-place sediment removal by a clamshell dredge, because in removing sediment the suction dredge requires water to form a slurry mixture. The hydraulic cutterhead suspends the least amount of sediment per dredge activity. Materials can be transported by barge or transported by pipeline as far as two or three miles with dredge pumps alone, and farther with remote booster units. The length of a fixed or temporary pipeline could be a hazard to navigation over long distances and would have significant adverse effects in heavily used channels. Barge transport and dump at a designated aquatic disposal site in conjunction with this alternative measure, was selected for further consideration in lieu of clamshell and barge to avoid the potential mounding of consolidated clays at the Alcatraz disposal site.

DESIGNATED DISPOSAL SITES

3.11 100-FATHOM (OCEAN). The site (SF 7) is located south of the Farallon Islands at Latitude 37°31'45"N and Longitude 122°59'00"W, 29.6 nautical miles from the Golden Gate. This site is located within the Farallon Islands Marine Sanctuary. The depth is 100 fathoms or 600 feet. This site had been generally considered when use of land or bay aquatic disposal sites were precluded. The decision to use this site was made on a case-by-case basis in accordance with ocean dumping criteria, 40 CFR 227-228. Mixing characteristics are not as pronounced at this site as other sites. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. The long distance from Oakland Inner Harbor would significantly increase the amount of fuel used, as compared to other disposal methods.

3.12 S.F. CHANNEL BAR (OCEAN). This site (SF 8) is parallel to and 6,000 feet south of the San Francisco Bar Channel five miles outside the Golden Gate. The site is used for maintenance disposal of sand. Placement of silty-clay at the site could result in longer periods of turbidity. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. However, organisms inhabiting the Bar are generally evolved for efficient locomotion and the ability to escape after sustained burial. The expected dissimilarity between bottom sediments at this site and Bay sediments from Oakland Inner Harbor may result in a greater potential for adverse bottom impacts. The long distance to the channel bar site, although less than to the 100-fathom site, would also significantly increase the fuel consumption of the deepening project, as compared to the use of disposal sites located closer to the project site.

3.13 BAY DISPOSAL. There are three Bay aquatic disposal sites designated as suitable for dredged material disposal. Carquinez Strait (SF 9) located 0.8 nautical miles from Mare Island Straits entrance; San Pablo Bay (SF 10) located 2.6 nautical miles northeast of Point San Pedro; and Alcatraz (SF 11) located about 0.3 nautical miles south of Alcatraz Island.

3.14 Due to the distance of SF 9 and 10 from Oakland Inner Harbor, and the closer proximity of SF 11 to the Golden Gate Bridge, the Alcatraz Site has been selected for further consideration. It is preferable environmentally. The site is characterized as a deep, high energy area, dynamic both physically and biologically. Material dispersion of unconsolidated sediments is expected to occur within several minutes. Associated with sediment disturbance are certain temporary chemical changes in the water column. Since Bay mud is typically in an oxygen deficient state, oxygen is taken from the water column when the sediment is resuspended during disposal. This oxygen reduction in the water is localized at the disposal site and is temporary. Toxic substances, also associated with Bay sediments, have not been found to be readily released from sediment attachment and into the water column.

3.15 The Alcatraz disposal site is considered a high energy area characterized by high currents and scouring of the bottom. Some animals residing in this area could experience burial during disposal if consolidated material (stiff clays) did not readily disperse. If unconsolidated material is disposed, it is expected that losses at the disposal site would be minimal since non-mobile bottom organisms would not be adversely affected. Prolonged increases in turbidity over ambient levels could, among other effects, impair filter feeding organisms. Impacts upon marine organisms in the water column (plankton and fish) resulting from the proposed disposal activities would be very temporary and localized due to the non-continuous discharge schedule.

3.16 PORT OF OAKLAND FILL. This is a potential fill site in Oakland Outer Harbor next to the east approach to the Bay Bridge. It is a 190-acre site, primarily Bay. This site is the only alternative for nearby fill. By filling the site, the capacity of the Outer Harbor could be nearly doubled. The need for such expansion is not expected until about year 2000 and may be accommodated at more favorable sites. Bay fill could significantly affect water circulation in Oakland Outer Harbor, impacting sedimentation and thus maintenance dredging requirements. The potential for short-term degradation of local water quality could increase due to reduced circulation.

3.17 Fill would cover a considerable amount of benthic habitat. There also is an area of mud flat at the site. Covering of organisms that inhabit the mud flat would be a significant adverse impact on higher trophic levels that depend on them for food, diving waterfowl and bottom feeding fish in particular. Some type of mitigation would be required for any Bay fill. Fill activities would have some minor impacts on the navigation channel at Oakland Outer Harbor by adding dredge, barge and/or pipeline into the existing traffic area. A development on the fill would increase the amount of vessel activity in the navigation channel. Fill and ultimate port development would significantly benefit commercial shipping at Port of Oakland and would increase traffic and cargo transportation activities in the area. This development would create traffic and resultant air quality impacts.

3.18 PUMP TO DELTA. The use of pipelines for long distance transport of dredged material to reconstruct existing peripheral levees on the Delta Islands was considered. Additional costs would be incurred due to the need for retention dikes to contain and to process or "condition" the slurry dredged material for fill purposes. Extended time would be required to drain, evaporate and scarify the bay mud before it is suitable for the repair and reinforcement of levees. Also, the use of dredged material for levee enhancement is limited to selected sites because of the low erosion resistance of most to the dredged material in the Bay. Because of the potential for dike failure and area settling, and because of the rehandling and transportation costs involved, as well as the navigational problems presented by direct pipelines, transporting material to the Delta levees is not considered feasible at this time.

3.19 MARSH CREATION. Restoration of marsh at various salt ponds in the South Bay has been considered in other projects. Once used for disposal, the area would be consolidated, graded and planted and the external dikes breached to restore tidal action to the area. The pump distance for this measure would be about 30 miles. Land acquisition by non-Federal interest, distance to potentially restorable sites, and limited capacity of the sites prohibit further consideration of marsh creation at sites in the South Bay. Opposition by agencies and interest groups to filling of submerged lands within San Francisco Bay restricts the development of marsh in areas of open water and intertidal flats.

3.20 UPLAND DISPOSAL. Except for potential adverse impacts on groundwater, disposal of dredged material on upland sites generally has less specific environmental constraints. Also, disposal on nearby land sites may have significantly lower energy costs. Several potential dry land disposal sites were investigated. The most favorable site was considered to be some vacant lands north of Webster Street in Alameda. However, use of such lands for disposal of dredged material would conflict with private plans for urban development in the near future. The City of Alameda has revised its land use plan to accommodate a proposed residential and commercial development to be arranged around a man-made lagoon. The same views generally prevail concerning disposal of dredged material on other valuable urban lands in the project area.

FORMULATION OF PRELIMINARY PLANS

3.21 A preliminary evaluation of management measures was conducted to screen those measures which would not be forwarded for the formulation of preliminary plans. This is done so that the array of preliminary plans would be of a managable size. All of the dredge sites were forwarded for further consideration in the formulation of preliminary plans. The site SF-7 for deep ocean disposal is now situated within the bounds of the Farallon Islands Marine Sanctuary. As such, approval from the Department of Commerce must be obtained in addition to complying with criteria governing ocean disposal. Pumping dredged material to the Delta and marsh creation were not forwarded because of the high costs for pumping the dredged material. In addition, land acquisition outside of the project area would be necessary to accomodate marsh development. Limited capacity of these areas to accept dredged material would only supplement aquatic disposal. The Port of Oakland fill was forwarded because of a potential for additional economic benefits. No upland sites are available. The aquatic disposal site near Alcatraz was the only aquatic site considered further because it is both the most cost effective of all the designated aquatic sites and it is the most environmentally acceptable of those sites within the Bay. The plans for disposal are the deciding factors in the selection of dredging methods. The management measures forwarded for further consideration were combined to form four distinctly different plans of improvement. Descriptions of these preliminary plans are presented in the paragraphs that follow.

DESCRIPTION OF PRELIMINARY PLANS

3.22 PLAN A - NO ACTION. The Corps of Engineers would continue to maintain the project channel widths and depths as presently authorized and shown on Figure 3. Maintenance work is accomplished with hopper dredges that dispose of dredged material at an EPA approved site near Alcatraz Island. A total volume of 1,000,000 cubic yards of material has been removed from the Oakland Inner Harbor over the past five years by maintenance dredging operations. Nearly 2,000,000 cubic yards was removed in 1974 in deepening the project from 30 to 35 feet. The design channel depths of 35 feet below mean lower low water datum can safely accommodate a vessel with a static draft of about 30 feet through all phases of the tidal cycle. Deeper draft vessels incur delays in sailing or entering the harbor. The No Action plan assumes the 800-foot entrance Bar Channel will have been deepened to 42-feet in accordance with recommendations for improvements in the Outer Harbor Project Report.

3.23 PLAN B - CHANNEL DEEPENING FOUR-MILE REACH TO CLAY STREET PIERS. This Plan of improvement would deepen a 4-mile reach of the navigation channel from the entrance to Oakland Harbor via the Bar Channel to the Clay street Piers at project mile 4.3 in the Inner Harbor, and widening certain reaches as shown on Figures 10, 11, 12, 13 and 14. Deepening the Bar Channel to minus 42 feet, MLLW, has already been authorized in the report for the Oakland Outer Harbor navigation project. During preliminary plan formulation, Plan B consisted of deepening the Bar Channel to 43 feet and widening the Bar Channel to 1,000 feet. Other elements of this preliminary plan included the additional widening of the shoal area on the north side of the Inner Harbor entrance reach shown on Figure 10. This would provide more tolerance for safe entry of large vessels headed for terminals in the Inner Harbor or turning into the

Middle Harbor. Bend widening proposed at project mile 3.0 would provide for the minimum clearance that design criteria indicates should be provided for the design vessel with an overall length of 860 feet to safely negotiate a 29^{o} turning angle. The proposed widening will also facilitate tug-assisted turn-around of large containerships berthed at the American President Lines terminal opposite Todd Shipyards. The preliminary plan of improvement for the widening and deepening of project channels to 43 feet would require dredging and disposal of an estimated 6.4 million cubic yards of material. This would be accomplished by clamshell dredge with barge disposal at the Alcatraz disposal site.

3.24 PLAN C - CHANNEL DEEPENING FOUR-MILE REACH WITH PIPELINE DISPOSAL. Plan C includes the same scope of improvement as described for Plan B, except the plan for construction would use a hydraulic suction-dredge and pipeline disposal of dredged material on a 190-acre site next to the Bay Bridge. Location of the potential disposal site is shown on Figure 6. This fill would produce new land for future expansion of the Port of Oakland.

3.25 PLAN D - CHANNEL DEEPENING OF SIX-MILE REACH. This alternative plan for deepening a 6-mile reach of the Inner Harbor to -43 feet MLLW would allow fourth-generation container ships undelayed access to Encinal Terminals near the Fortmann turning basin. This plan would require an expensive relocation or replacement of the Webster Street and Posey Tubes. Material excavated with a clamshell dredge would be loaded into large barges for disposal at the Alcatraz disposal site.

ASSESSMENT AND EVALUATION OF PRELIMINARY PLANS

3.26 SUMMARY OF IMPACTS. The impacts of preliminary plans on significant resources are summarized in Table 1. This table is compiled from the detailed impact assessments of the management measures presented in Appendix A. A comparative economic evaluation of the estimated cost of these plans is shown in Table 2.

SCREENING OF PRELIMINARY PLANS

3.27 The No Action alternative and Plan B were selected for more detailed design and evaluation efforts. Alternatives for disposing of dredged material on a mud flat (Plan C) and for deepening a six mile reach of channel (Plan D) were eliminated from further consideration on the basis of economic, environmental and cultural impact evaluations performed in early iterations of the planning steps. Implementation of Plan C would have filled a significant area of Bay, covering a large area of bottom habitat and would have been opposed by Federal, State and local agencies and conservation groups. This alternative was eliminated from further consideration based on adverse environmental effects. Implementation of Plan D would not be economically feasible. This alternative would necessitate relocation of the Webster Street and Posey tubes which would be expensive and have adverse effects on traffic and local government finances. The tubes are also of historic importance. This alternative was eliminated from further consideration based on excessive costs and adverse effects on a significant historic resource.

3.28 During the reiteration process it was determined that dredging by clamshell of stiff clays in the amounts proposed may lead to mounding at the Alcatraz disposal site. As a result, hydraulic cutterhead dredging, which breaks up the material and pumps the suspended sediments through the water column via a pipe, was determined to be the appropriate method of dredging. In conjunction with this dredging method, disposal by barge at the Alcatraz site remained the appropriate disposal method.

3.29 Public input, related to the proposed channel dimensions, from the July 1982 public meeting identified the following concerns: (1) the probability of encroachment upon the drydock of Todd Shipyards and, (2) the need for additional maneuvering areas near project mile 3.0 and at the terminus of the project. Further investigation of channel dimensions indicated that constraints of the jetties along the inner harbor entrance reach superceded applicable channel design width. Further analysis and input led to provisions for channel widenings at two specific locations within the Inner Harbor Channel.

Because of the concerns raised after formulation of the preliminary plans, the following modifications were made to Plan B:

1) During the preliminary plan formulation stage, the present 800-foot Bar Channel width was reviewed. An increased width of 1,000 feet, was considered based on recommendations from the pilots. However, the issue of channel width at the Bar Channel is being deferred to post authorization design studies to be performed for the Oakland Outer Harbor deepening project. Computer simulation will determine if modification of the recommended 800 feet width is appropriate. In the event the Bar Channel width should be increased, deepening of the entire bar channel to a 43-foot depth would be required for access into the Oakland Inner Harbor Channels.

2) Two bend widenings in the Inner Harbor Channel, one at about project mile 3.6 with a maximum channel width of 800 feet, and the other at the terminus of the project, have been incorporated into Plan B.

3) The quantity of dredged material is estimated to be about 5.1 million cubic yards rather than the 6.4 million cubic yards presented in the preliminary plan formulation document.

4) Dredging is to be performed by hydraulic cutterhead dredge with barge disposal at the Alcatraz disposal site.

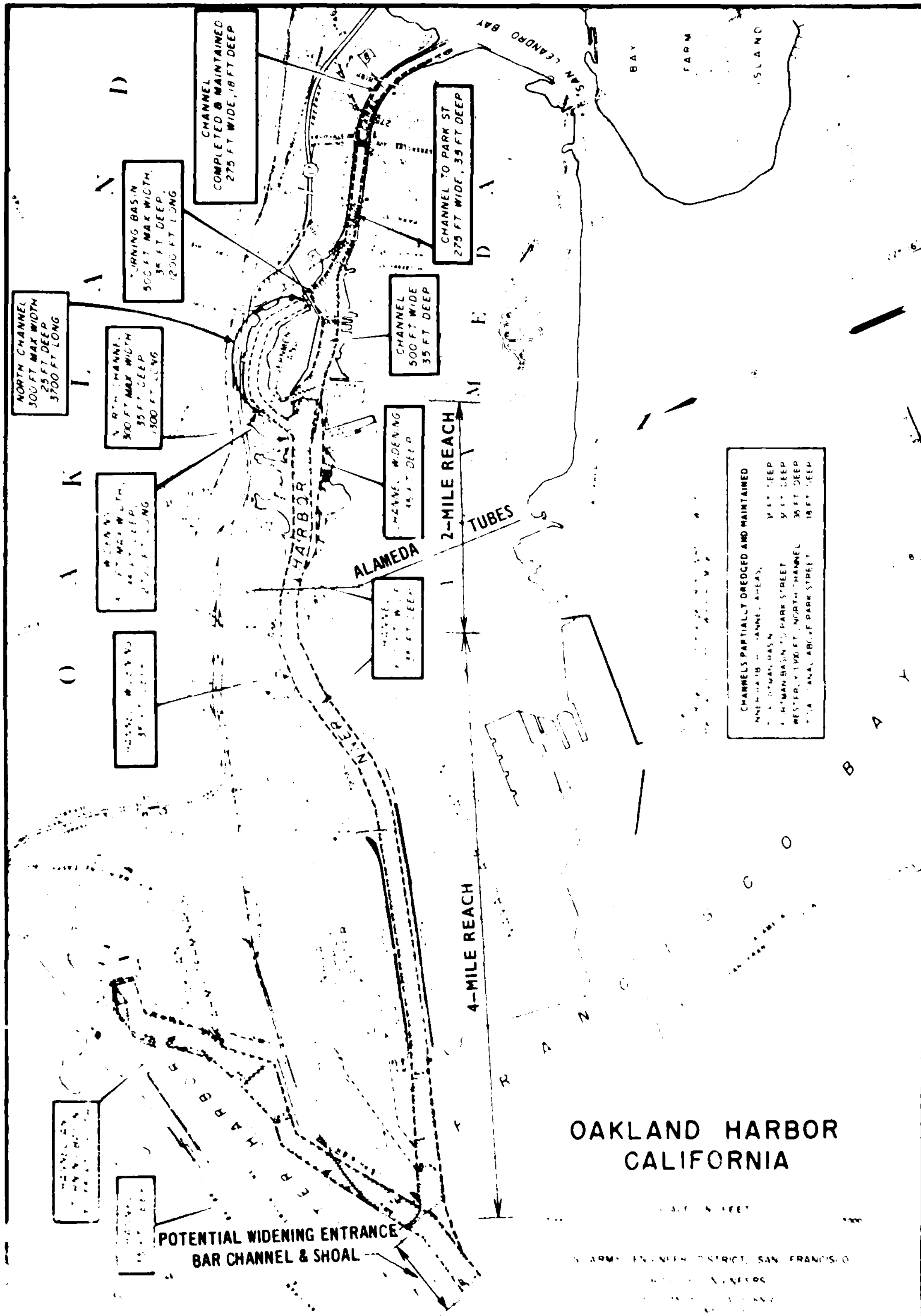

OAKLAND HARBOR
CALIFORNIA
SAN LEANDRO BAY
BAY FARM ISLAND
CHANNEL COMPLETED & MAINTAINED 275 FT WIDE, 18 FT DEEP
CHANNEL TO PARK ST 275 FT WIDE, 35 FT DEEP
CHANNEL 500 FT WIDE 35 FT DEEP
NORTH CHANNEL 300 FT MAX WIDTH 25 FT DEEP 3700 FT LONG
2-MILE REACH
4-MILE REACH
ALAMEDA TUBES
POTENTIAL WIDENING ENTRANCE
BAR CHANNEL & SHOAL

FIGURE 9

TABLE 1

IMPACTS OF ALTERNATE PLANS ON SIGNIFICANT RESOURCES

SIGNIFICANT RESOURCES / PLANS*	No Action	4-mile reach entrance widening, clamshell dredge, Alcatraz disposal	4-mile reach entrance widening, hydraulic dredge, Bay fill in Outer Harbor	6-mile reach entrance widening, clamshell dredge, Alcatraz disposal
Water Quality	No significant impact	Short-term increase in turbidity plus a depressed dissolved oxygen level due to sediment disturbance.	Short-term increase in turbidity plus a depressed dissolved oxygen level due to sediment disturbance.	Short-term increase in turbidity plus a depressed dissolved oxygen level due to sediment disturbance.
Benthos	No significant impact	Removal and displacement of bottom organisms by dredge.	Removal and displacement of bottom organisms by dredge. Fill would eliminate 190 acres of habitat.	Removal and displacement of bottom organisms by dredge.
Energy	No significant impact	No significant short-term impacts. The efficient use of a deeper channel could reduce fuel consumption.	No significant short-term impacts. The efficient use of a deeper channel could reduce fuel consumption. Development of the fill would involve more fuel consumption than other plans.	Significant short-term impacts on fuel consumption due to traffic disruption. Long-term impacts could benefit fuel consumption due to efficient channel use.
Hydrography	Continued channel maintenance at -[illegible] feet MLLW.	Channel would be deepened and maintained at -43 feet MLLW.	Channel would be deepened and maintained at -43 feet MLLW.	Channel would be deepened and maintained at -43 feet MLLW.
Commercial Shipping	Tidal delays would adversely affect commercial shipping.	Efficient use of a deeper channel by larger ships would significantly benefit commercial shipping.	Efficient use of a deeper channel by larger ships would significantly benefit commercial shipping.	Efficient use of a deeper channel by larger ships would significantly benefit commercial shipping.
Navigation Safety	Larger vessels expected to use the channel will experience problems with unchanged depths and widths.	Increased depth and width of the channel will reduce hazards of channel use.	Increased depth and width of the channel will reduce hazards of channel use.	Increased depth and width of the channel will reduce hazards of channel use.
Air Quality	No significant impact	No significant short-term impacts. Efficient use of a deeper channel could benefit air quality.	No significant short-term impacts. Long-term affects would be an unknown combination of benefits of efficient channel use and detriment of additional Port development on fill.	Significant short-term decrease in local air quality due to traffic rerouting. Long-term efficient channel use could benefit air quality.
Wetlands	No significant impact	No significant impact	Significant loss of mudflat habitat at disposal site	No significant impact
Endangered Species	Least tern nests on Alameda Naval Air Station.	No significant impact	No significant impact	No significant impact
Transportation and Traffic	No significant impact	No significant impact	No significant impact	Disturbance to traffic until bridge constructed between Oakland and Alameda.
Cultural Resources	No significant impact	No significant impact	No significant impact	Removal of Posey and Webster Street tubes would be a significant adverse impact.

* Although there are [illegible] possible alternatives using combinations of the management measures, only four are considered in this table.

** Secondary impacts due to changed land use were not assessed in this table.

TABLE 2

PRELIMINARY ECONOMIC COMPARISON OF COSTS FOR ALTERNATIVE PLANS OF IMPROVEMENT
(Amounts in Thousands of Dollars)
(January 1981 Price Levels)

ITEM	DEEPENING 4-MILE REACH TO 42' WITH DISPOSAL AT ALCATRAZ	DEEPENING 4-MILE REACH TO 42' WITH DISPOSAL ON LAND SITE FOR FUTURE PORT EXPANSION	INCREMENTAL COST/BENEFITS INCREASE OVER PLAN B FOR DEEPENING 2-MILE REACH FROM CLAY ST TO FORTMANN BASIN
ESTIMATED FEDERAL DREDGING & DISPOSAL COSTS	28,000	25,000	9,000
ENGINEERING & DESIGN	2,000	3,000	2,000
SUPERVISION & ADMINISTRATION	1,000	1,000	1,000
AIDS TO NAVIGATION BY USCG	Minor Relocations	Minor Relocations	Minor Relocations
TOTAL ESTIMATED FEDERAL COSTS 5/	31,000	29,000	12,000
NON-FEDERAL OBLIGATIONS			
a. Lands for Disposal and/or Mitigation	None	Site in Public Ownership	None
b. Dike Construction	None	15,000	None
c. Utility Relocations 2/	No Estimate	No Estimate	No Estimate
d. Bridge & Highway Relocations	None	None	18,000
e. Dewatering & Industrial Site Preparation	None	No Estimate	None
f. Berthing & Terminal Improvements	3/	3/	4/
g. Grading, Planting & Other Constructive Mitigation Costs	None	No Estimate	None
h. Permit Applications & Other Local Administrative Costs	No Estimate	No Estimate	No Estimate
SUBTOTAL, LOCAL PROJECT COSTS	None 5/	15,000	18,000
TOTAL ESTIMATED PROJECT FIRST COSTS	31,000	44,000	30,000
EQUIVALENT ANNUAL I&A 6/	2,300	3,300	2,200
AVERAGE ANNUAL MAINTENANCE COSTS 7/	100	100	100
TOTAL ANNUAL PROJECT COSTS	2,400	3,400	2,300
EQUIVALENT ANNUAL NAV. BENEFITS	7,400	7,400	690
NET LAND ENHANCEMENT FROM FILLING	None	No Estimate	None
PRELIMINARY B/C RATIOS	3.1:1	2.1:1	0.3:1
NET NED BENEFITS OVER COSTS 8/	5,000	3,800+	None

1/ $29,625,503 prior expenditures for navigation improvements and maintenance dredging in Oakland Harbor through 30 September 1979 by U.S. includes $397,266 contributed by local interests.
2/ Relocation at owner expense is a condition of all permits issued.
3/ The Port of Oakland has construct-[illegible] new $43,000,000 Charles P. Howard Terminal between Market & Grove Streets along inner channel.
4/ Encinal Terminals has drawn plans for construction of improved berthing and terminal facilities.
5/ Comparative value. See text on Cost Apportionments for change in policy.
6/ Estimated I&A charges based on 7-1/8% rate effective in FY 1980 (crf = 0.07361).
7/ About $200,000 annually for maintenance of existing project.
8/ Preliminary cost/benefit figures in this table are comparable with each other, but not with more recent estimates for candidate plans in subsequent sections of this report.

SECTION 4 - ASSESSMENT AND EVALUATION OF CANDIDATE PLANS

4.00 Of the alternative plans considered in the previous section, two plans were identified as candidates for possible recommendation for implementation. These two plans have been subjected to more detailed analysis which is presented in this section of the report.

PLAN A - NO ACTION

4.01 DESCRIPTION. The no action alternative assumes the Corps of Engineers would continue to maintain the channel width and depths as shown on Figure 3. This maintenance work is accomplished with hopper dredges that dispose of dredged material at an EPA approved site near Alcatraz Island. A total volume of 1,000,000 cubic yards of material has been removed from the Oakland Inner Harbor over the past five years in maintenance dredging operations. The design channel depth of 35 feet below mean lower water datum can safely accommodate a vessel with a static draft of about 30 feet through all phases of the tidal cycle. Deeper draft vessels incur delays in sailing or entering the harbor. This inefficency adds to the cost of importing and exporting a wide variety of foreign and domestic goods. The candidate plan of no action assumes that the improvements already recommended for the Outer Harbor, including any widening and deepening to 42-feet of the entrance Bar Channel, will have been accomplished.

4.02 EVALUATION OF EFFECTS. The No Action alternative, by definition, would not cause impacts since it is the basis from which impacts are determined. Significant resources, for which the conditions are significantly different between Plan A and Plan B, are described in this section as a basis for comparing the impacts of the other candidate plan.

4.03 Water Quality. Except for occasional transient and localized pollution problems, water quality with the No Action Plan is expected to be about the same, if not improved, with continued implementation of regulatory programs. Deepening projects at Oakland Outer Harbor and Richmond Harbor will result in annual maintenance disposal of about 1,214,000 c.y. of additional material at the Alcatraz disposal site each year.

4.04 Benthos. The unproductive biotic regime in the Harbor is expected to continue with the No Action Plan. Annual maintenance dredging of the 35-foot channel causes the bottom community to be in a constant state of disruption.

4.05 Energy. Fuels and electricity are used for transporting cargo, workers and for operation of Port facilities. Burning of fuel oil is expected to increase in proportion with the large expected increase in waterborne commence and associated transportation costs detailed in Appendix B. Also future port expansion and development will increase the amount of energy consumed for process cargo handling and interfacing with land transportation systems.

4.06 Commercial Shipping. Economic projections in Appendix B show containerized cargo tonnages handled by terminals along the Inner Harbor increasing from 2,150,000 in 1986 to 6,895,000 by 2006. Tidal delays will become longer and more costly for larger vessels coming into service. Light loading of others would tend to increase transportation costs. Larger vessels would have limited access to the Inner Harbor terminal facilties.

4.07 Navigation Safety. The pilots responsible for safe passage of larger commercial vessels within the confines of the Inner Harbor face increased hazards and risk of accidents. The risk is directly proportional to the size and speed of the vessel, speed and the limited channel dimensions.

4.08 Hydrography. Hydrographic characteristics of existing channels are described in Appendix C and shown graphically on Figures 10, 11, 12, 13 and 14.

PLAN B OPTIMUM PLAN OF IMPROVEMENT

4.09 DESCRIPTION. The optimum plan of improvement calls for deepening navigation channels from 35 to 43 feet MLLW between the entrance to Oakland Harbor via the Bar Channel and the Clay Street Piers at Project Mile 4.3 in the Inner Harbor; and widening certain reaches as shown on Figures 10, 11, 12, 13 and 14. Since deepening the Bar Channel to minus 42 feet M.L.L.W has already been recommended in the report for the Oakland Outer Harbor (Deepening), dredging authorized for the Bar Channel as a result of this investigation would be minimal (from -42 feet, MLLW, to -43 feet, MLLW). The proposed widening shown on Figures 10, 11 and 12 for the shoal area on the north side of the Inner Harbor entrance reach would provide more tolerance for safe entry of large vessels headed for terminals in the Inner Harbor or turning into the Middle Harbor. Bend widening proposed at Project mile 3.0 would provide the minimum clearance design criteria for the design vessel (Asia Liner) with an overall length of 860 feet to safe . negotiate a 29° turning angle. The proposed widening will also facilitate tug assisted turn around of large containerships berthed at the American President Lines and U.S. Lines terminals opposite Todd Shipyards. The optimum plan of improvement for widening and deepening project channels to -43 feet MLLW would require dredging and disposal of an estimated 5,100,000 cubic yards of material. Material would be loaded on barges by use of hydraulic dredge and transported by barge for disposal to the EPA/CE approved Alcatraz disposal site. Total additional annual maintenance with the proposed improvements would be approximately 10,000 c.y.

4.10 BASIS FOR DESIGN. The following dimensions for channel widths were dictated by "Report No.#3", May 1965 by the Committee on Tidal Hydraulics, and consultation with Bay Pilots (See Appendix C)

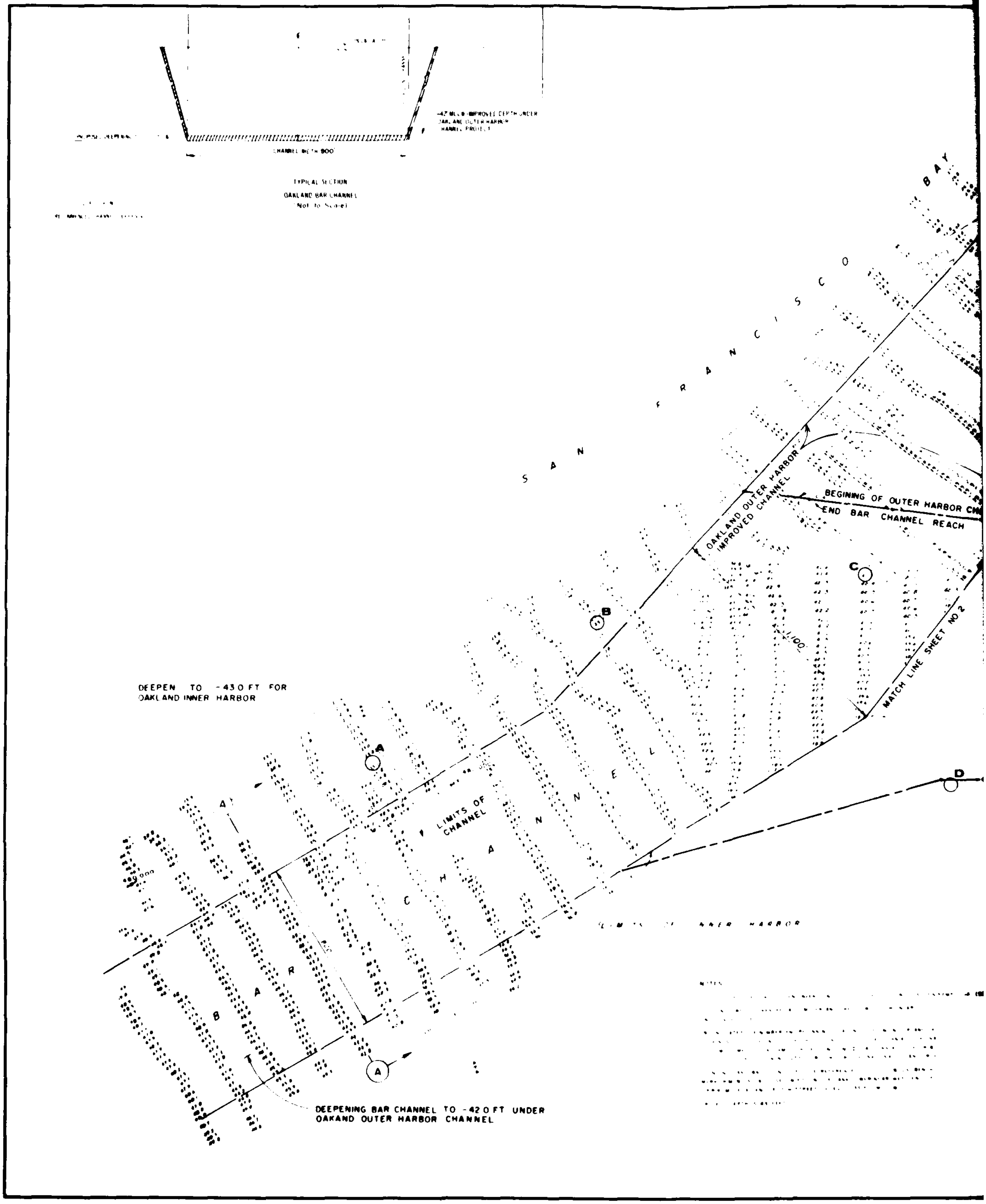
Design Widths

Bar Channel (existing entrance to Oakland Harbor both Outer and Inner)	800 ft.
Straight Channel (Inner Harbor Reach)	525 ft.(except where constrained by jetties to 462 feet)
Curved Channel (29° bend)	700 ft.

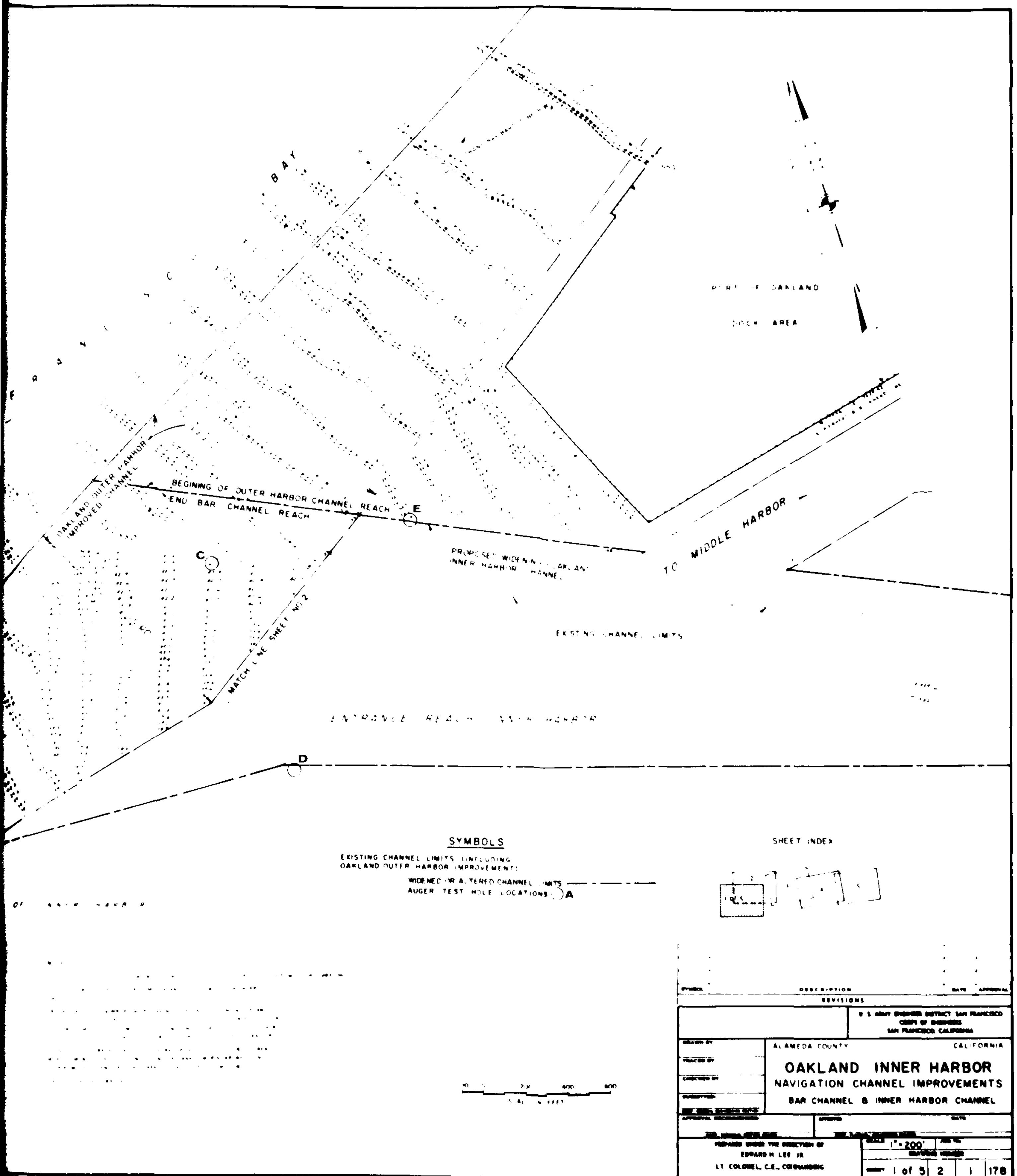
It was assumed that the bottom width of the channels could be reduced slightly where necessary to provide stable side slopes and to conform to the width allowed between the existing rubblemound jetties. The configuration of the proposed navigation channels is shown on foldout Figures 10 through 14.

4.11 CONSTRUCTION METHODS. Material to be dredged includes some stiff clays. A hydraulic dredge loading large, bottom dump barges would be the most cost-effective and energy efficient method of construction. Barges would be towed to the EPA approved disposal site in San Francisco Bay (S.F. - 11). Several barges may be loaded and towed together on ebb tide to reduce hauling costs. Disposal would occur on ebb tides only.

4.12 ESTIMATE OF PROJECT FIRST COSTS. An estimate of project first costs for the plan of improvement and methods of construction and disposal described in the preceding paragraphs is shown in Table 3. Quantities shown include 2 feet of overdepth dredging. This estimate includes the deepening of only the 800-foot wide Bar Channel. If the width of the Bar Channel is increased as a result of model testing, one foot of deepening would also be necessary. Additional costs would be associated with deepening any increase in width. A nominal amount of money for aids-to-navigation is shown, since minor relocations would be required. Improvements within the berthing areas to depths in excess of 38 feet have already been accomplished by the Port of Oakland and terminal leasees. Also included in the estimated costs (Engineering and Design) are funds to perform more detailed investigations related to usable groundwater aquifers situated in the areas adjacent Oakland Inner Harbor Channel (See Appendix G).

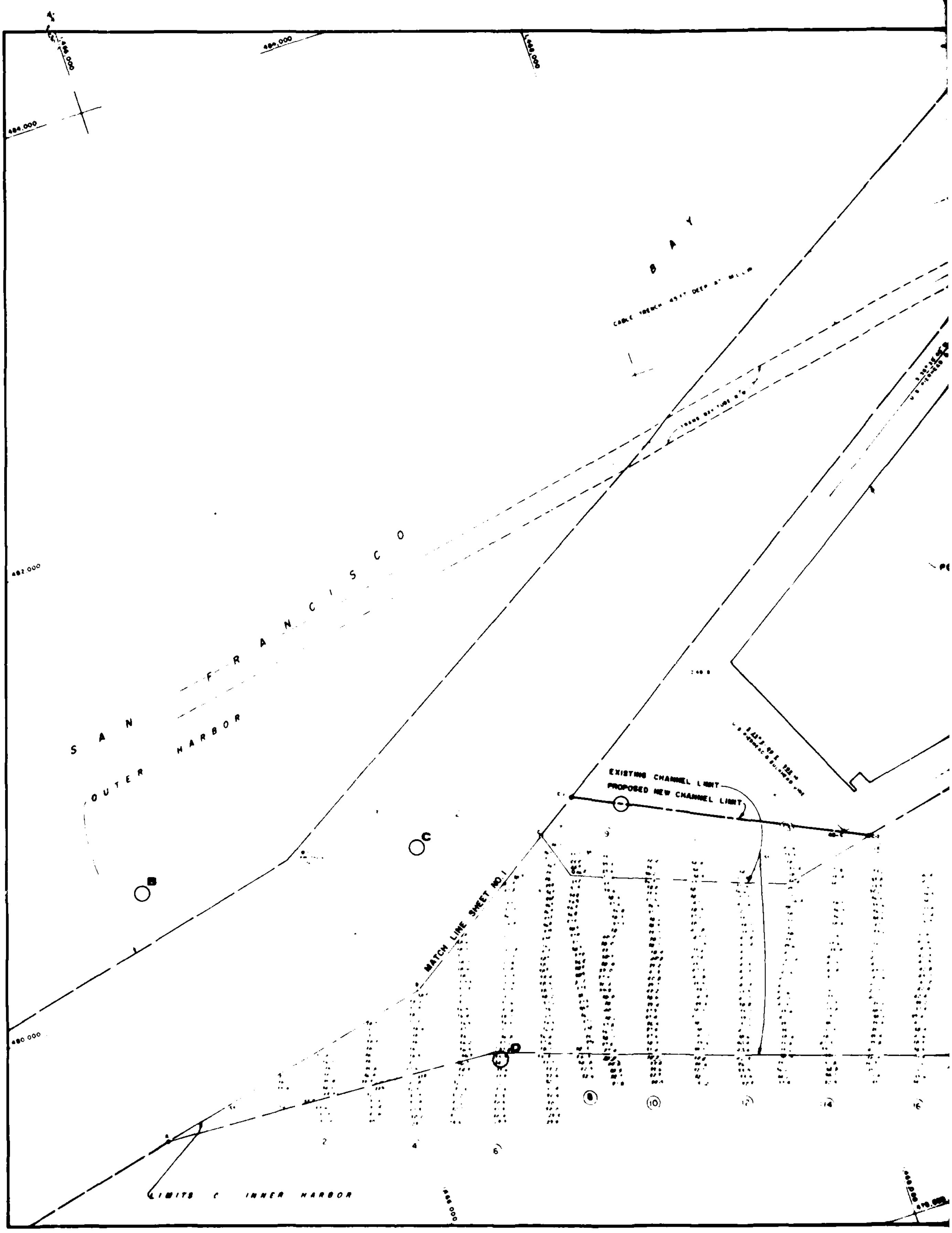


CHANNEL WIDTH 800'
TYPICAL SECTION
OAKLAND BAR CHANNEL
(Not to Scale)
SAN FRANCISCO BAY
OAKLAND OUTER HARBOR IMPROVED CHANNEL
BEGINING OF OUTER HARBOR CH
END BAR CHANNEL REACH
C
B
A
D
MATCH LINE SHEET NO.2
DEEPEN TO -43.0 FT FOR OAKLAND INNER HARBOR
LIMITS OF CHANNEL
BAR CHANNEL
DEEPENING BAR CHANNEL TO -42.0 FT UNDER OAKAND OUTER HARBOR CHANNEL

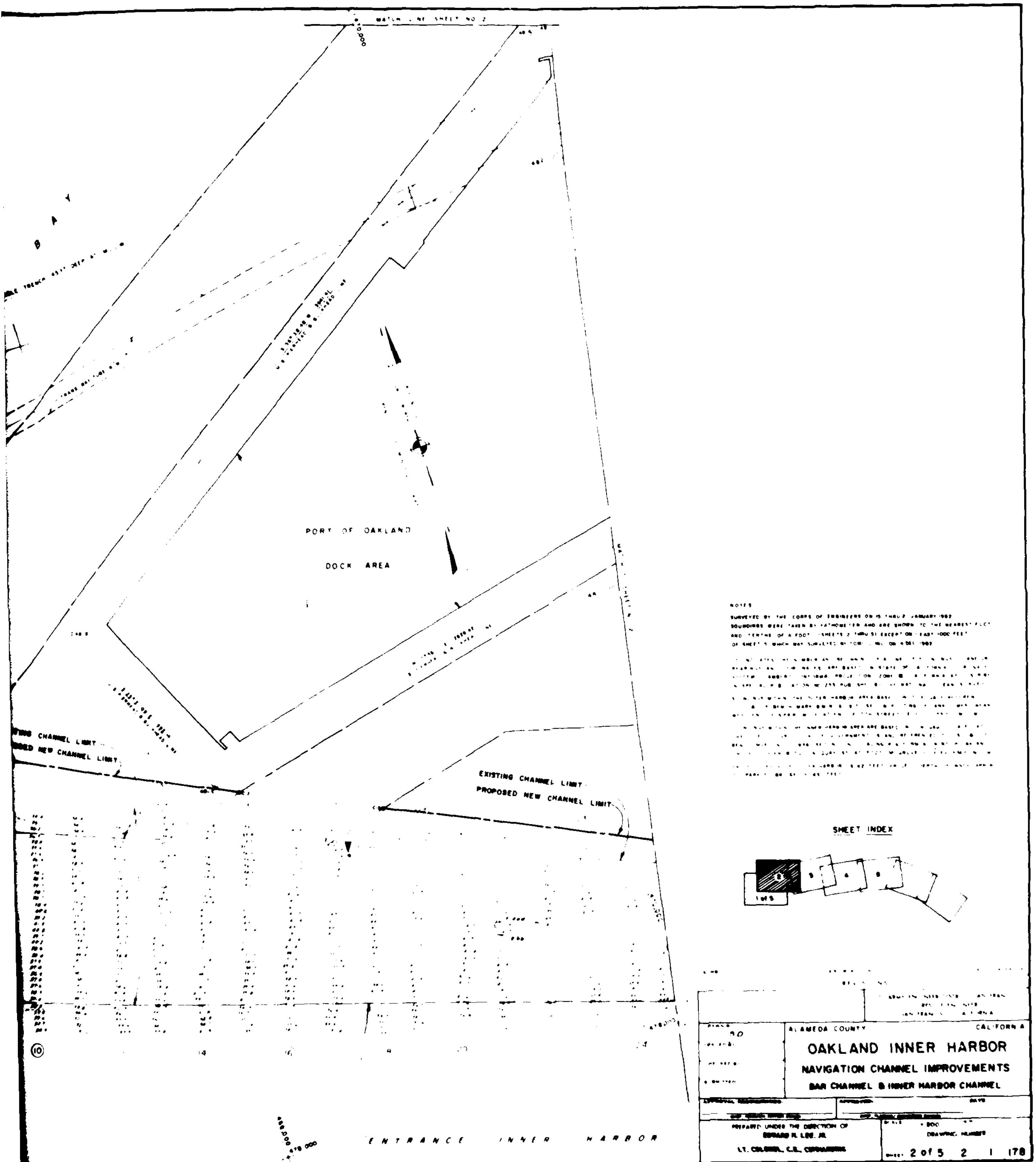


BAY
PORT OF OAKLAND
DOCK AREA
OAKLAND OUTER HARBOR IMPROVED CHANNEL
BEGINING OF OUTER HARBOR CHANNEL REACH
END BAR CHANNEL REACH
E
C
D
TO MIDDLE HARBOR
EXISTING CHANNEL LIMITS
MATCH LINE SHEET No 2
SYMBOLS
EXISTING CHANNEL LIMITS (INCLUDING OAKLAND OUTER HARBOR IMPROVEMENT)
WIDENED OR ALTERED CHANNEL LIMITS
AUGER TEST HOLE LOCATIONS A
SHEET INDEX
DESCRIPTION
REVISIONS
ALAMEDA COUNTY
CALIFORNIA
OAKLAND INNER HARBOR
NAVIGATION CHANNEL IMPROVEMENTS
BAR CHANNEL & INNER HARBOR CHANNEL
EDWARD H LEE JR
LT COLONEL, C.E., COMMANDING
1" = 200'
1 of 5
2
1
178

(FIGURE 10)

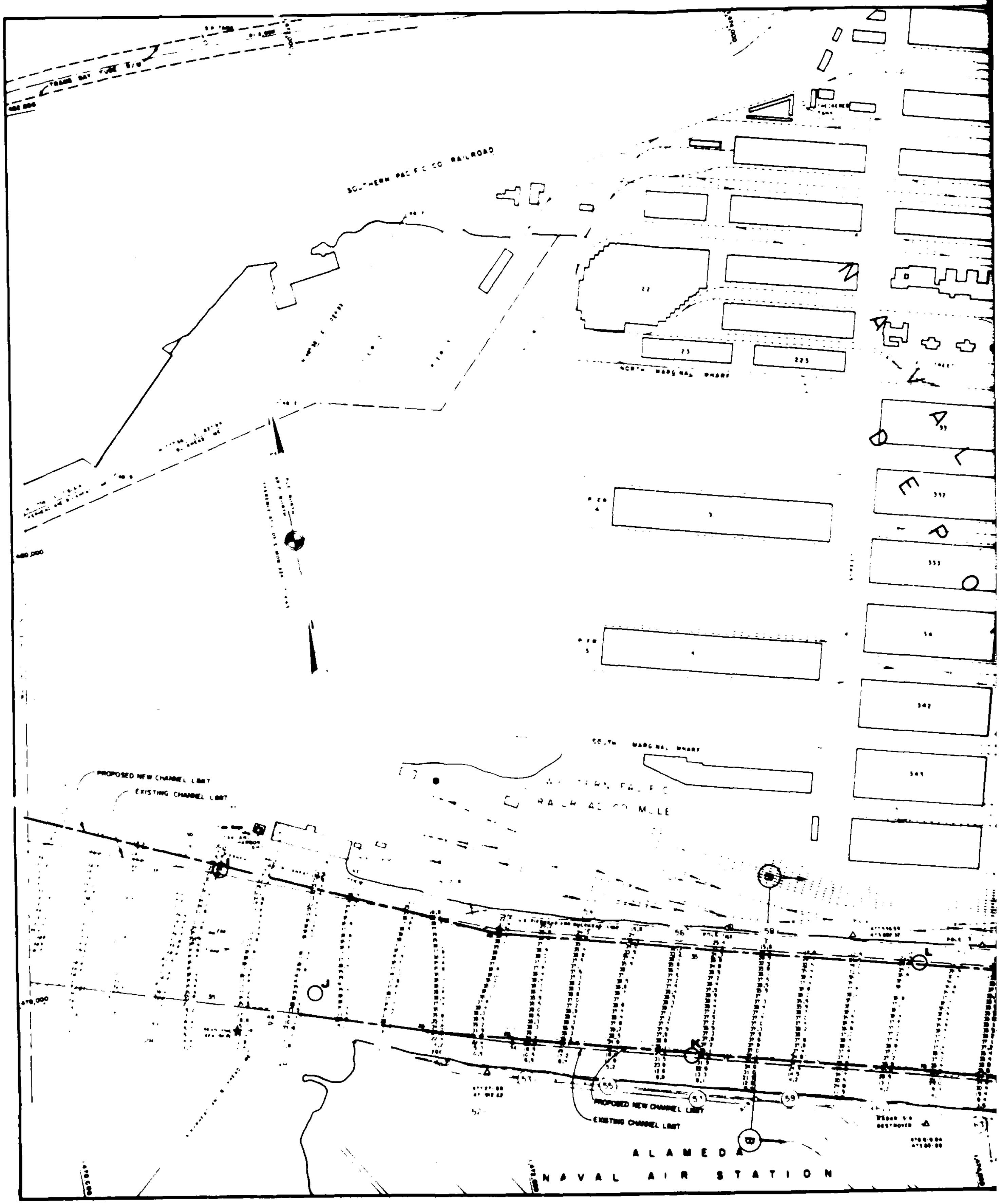


SAN FRANCISCO BAY
OUTER HARBOR
EXISTING CHANNEL LIMIT
PROPOSED NEW CHANNEL LIMIT
MATCH LINE SHEET NO. 1
LIMITS OF INNER HARBOR
B
C
D
482,000
480,000
484,000

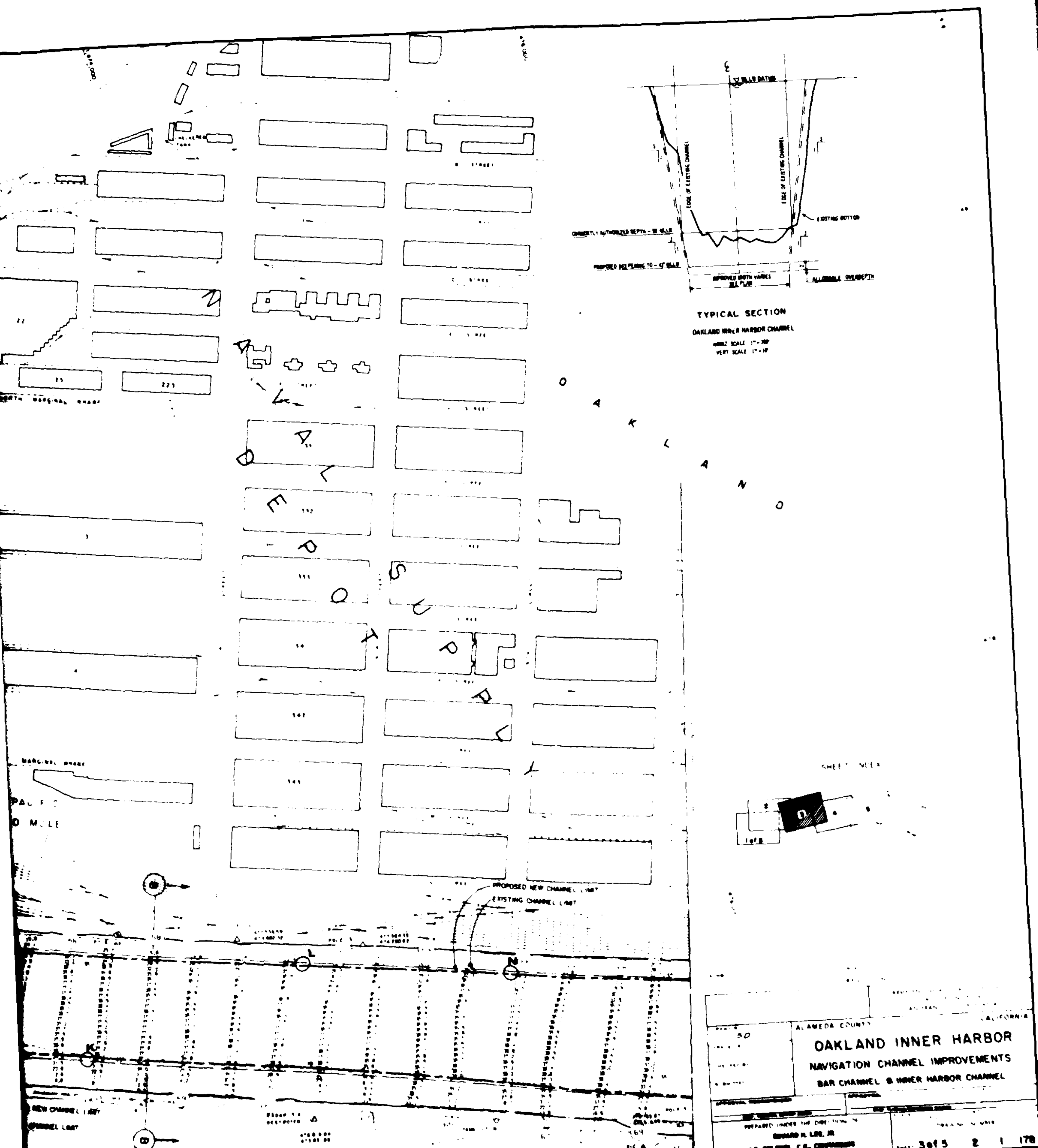


PORT OF OAKLAND
DOCK AREA
EXISTING CHANNEL LIMIT
PROPOSED NEW CHANNEL LIMIT
ENTRANCE INNER HARBOR
SHEET INDEX
ALAMEDA COUNTY
OAKLAND INNER HARBOR
NAVIGATION CHANNEL IMPROVEMENTS
BAR CHANNEL & INNER HARBOR CHANNEL
PREPARED UNDER THE DIRECTION OF
LT. COLONEL, C.E., COMMANDING
DRAWING NUMBER
2 of 5 2 1 178

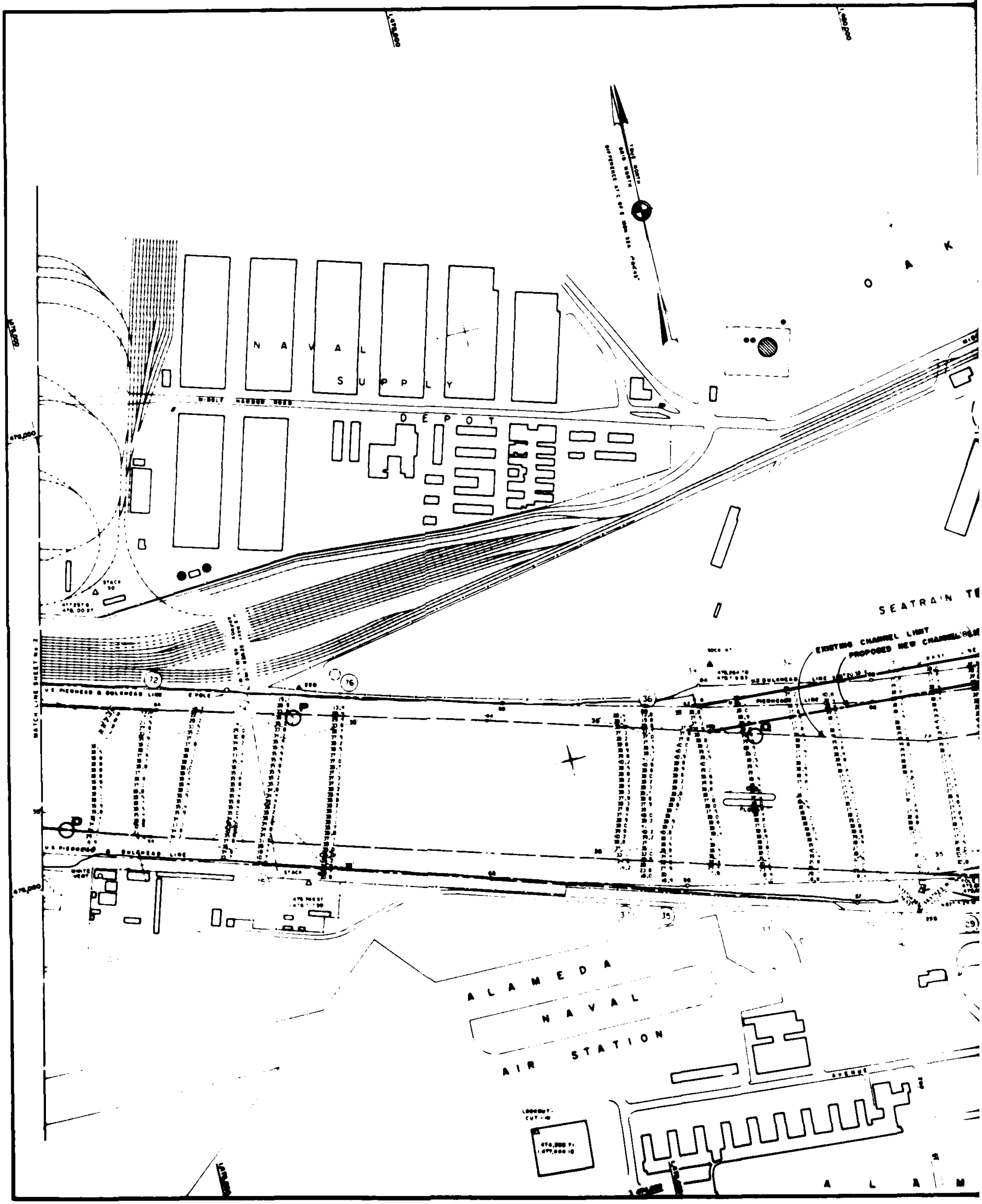
(FIGURE 11)

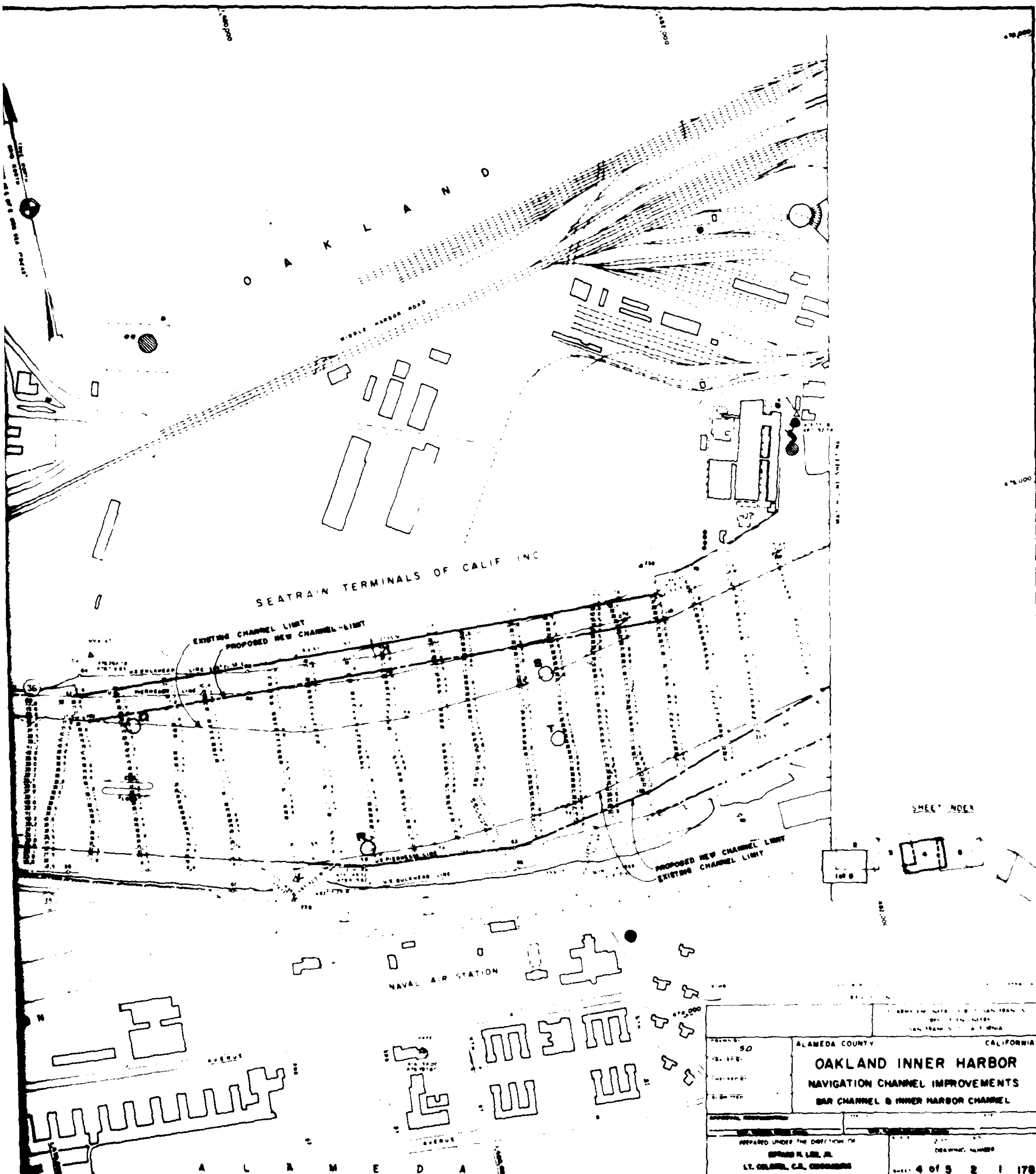


SOUTHERN PACIFIC CO RAILROAD
NORTH MARGINAL WHARF
SOUTH MARGINAL WHARF
PROPOSED NEW CHANNEL LIMIT
EXISTING CHANNEL LIMIT
PROPOSED NEW CHANNEL LIMIT
EXISTING CHANNEL LIMIT
ALAMEDA
NAVAL AIR STATION
480,000
470,000

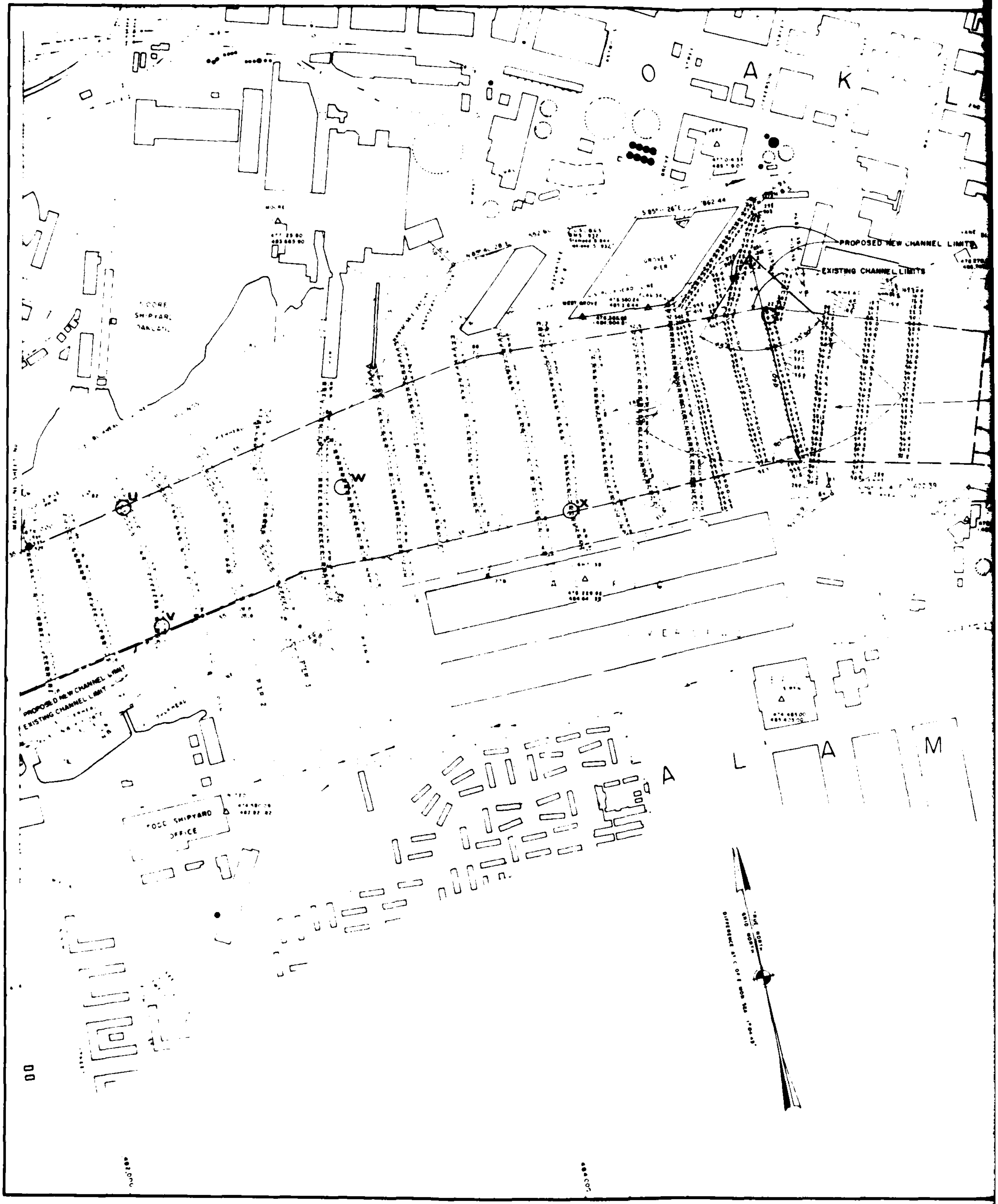

TYPICAL SECTION
OAKLAND INNER HARBOR CHANNEL
EDGE OF EXISTING CHANNEL
EXISTING BOTTOM
ALLOWABLE OVERDEPTH
OAKLAND
PROPOSED NEW CHANNEL LIMIT
EXISTING CHANNEL LIMIT
ALAMEDA AIR STATION
ALAMEDA COUNTY
CALIFORNIA
OAKLAND INNER HARBOR
NAVIGATION CHANNEL IMPROVEMENTS
BAR CHANNEL & INNER HARBOR CHANNEL
LT. COLONEL, C.E., COMMANDING
3 of 5

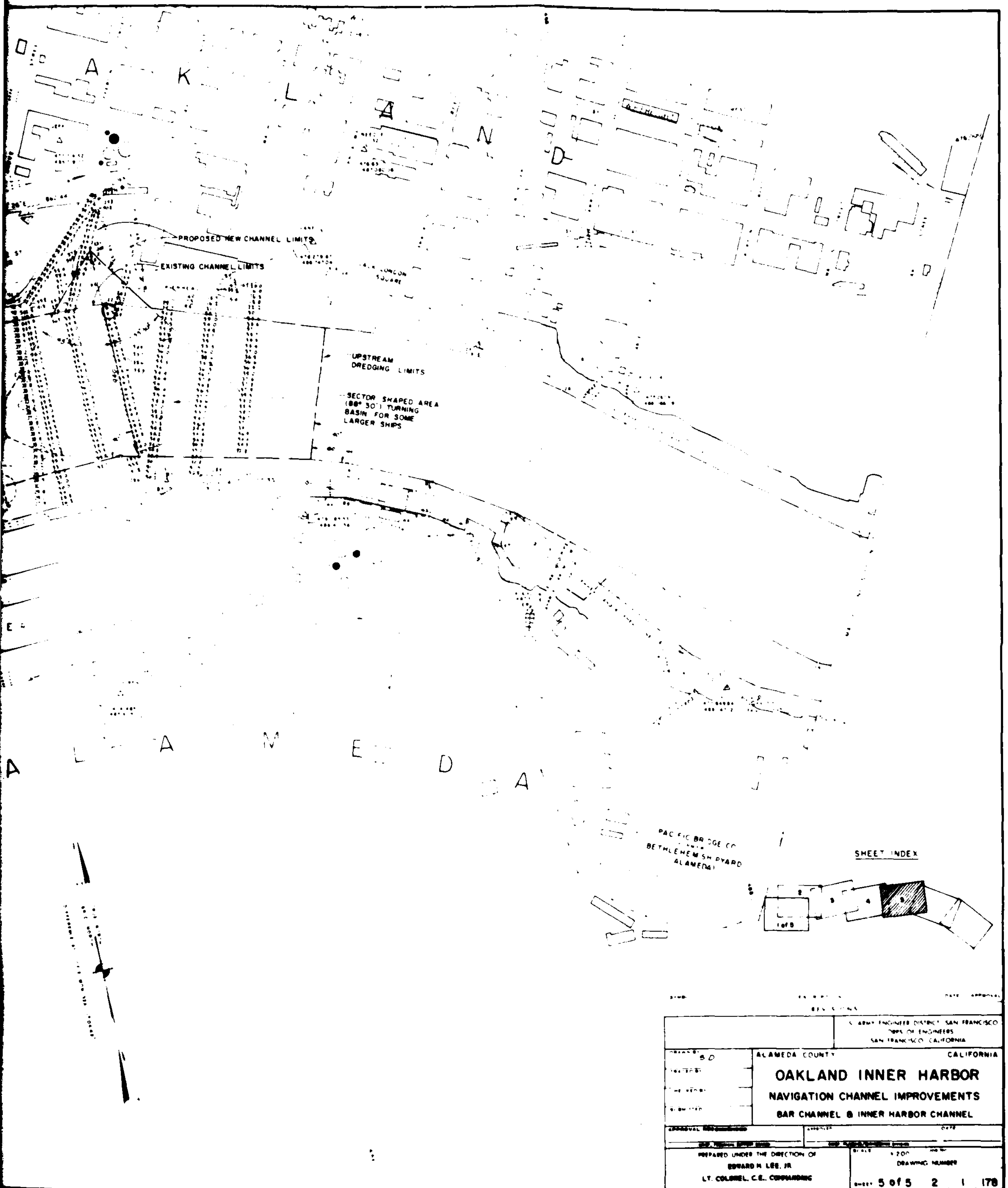
(FIGURE 12)


NAVAL SUPPLY DEPOT
OAK
SEATRAIN TE
EXISTING CHANNEL LIMIT
PROPOSED NEW CHANNEL
ALAMEDA NAVAL AIR STATION
ALAM


O A K L A N D
SEATRAIN TERMINALS OF CALIF INC
EXISTING CHANNEL LIMIT
PROPOSED NEW CHANNEL LIMIT
PROPOSED NEW CHANNEL LIMIT
EXISTING CHANNEL LIMIT
SHEET INDEX
NAVAL AIR STATION
AVENUE
A L A M E D A
ALAMEDA COUNTY
CALIFORNIA
OAKLAND INNER HARBOR
NAVIGATION CHANNEL IMPROVEMENTS
BAR CHANNEL & INNER HARBOR CHANNEL
DRAWING NUMBER
4 of 5
2 1 178

(FIGURE 13)


O A K L
A L A M
PROPOSED NEW CHANNEL LIMITS
EXISTING CHANNEL LIMITS
PROPOSED NEW CHANNEL LIMIT
EXISTING CHANNEL LIMIT
U
V
W
X
MOORE SHIPYARD OFFICE


OAKLAND
PROPOSED NEW CHANNEL LIMITS
EXISTING CHANNEL LIMITS
UPSTREAM DREDGING LIMITS
SECTOR SHAPED AREA (88° 30') TURNING BASIN FOR SOME LARGER SHIPS
ALAMEDA
PACIFIC BRIDGE CO.
BETHLEHEM SHIPYARD (ALAMEDA)
SHEET INDEX
REVISIONS
ALAMEDA COUNTY
CALIFORNIA
OAKLAND INNER HARBOR
NAVIGATION CHANNEL IMPROVEMENTS
BAR CHANNEL & INNER HARBOR CHANNEL
SAN FRANCISCO CALIFORNIA
PREPARED UNDER THE DIRECTION OF
EDWARD H. LEE, JR
LT. COLONEL, C.E., COMMANDING
DRAWING NUMBER
SHEET 5 of 5 2 1 178

(FIGURE 14)

TABLE 3

ESTIMATE OF PROJECT FIRST COSTS
OAKLAND INNER HARBOR

Cost Acct. No.	Item	Quantities	(Feb. 1983 Construction price levels) Amount
09	DREDGING (NAVIGATION) CHANNELS		
	a. Mob. & Demob.	Job L.S	$ 465,000
	b. Dredging	(5,100,000 C.Y. @ $ 3.90)	19,850,000
	Subtotal		20,300,000
	Contingencies (±20%)		4,000,000
	TOTAL DREDGING		24,300,000
30	ENGINEERING AND DESIGN (±4%) 1/		1,000,000
31	SUPERVISION AND ADMINISTRATION (±2%)		500,000
	Subtotal		25,800,000
	Navigation Aids (U.S.C.G.) and Relocation (U.S. Navy)		1,300,000
	TOTAL ESTIMATED PROJECT FIRST COST		27,100,000

1/ Includes Phases 2 and 3 groundwater investigation ($260,000) in addition to ± 4% engineering and design cost.

2/ Total does not include cost for additional deepening of Bar Channel if required by increase in width.

4.13 ANNUAL COSTS. Annual costs consist of interest and ammortization charges on first cost, plus additional estimated annual dredging costs resulting from maintenance of deeper channels. A capital recovery factor corresponding to an interest rate of 7-7/8 precent over a fifty year period was used to calculate I & A charges equal to $2,200,000 annually. Additional project maintenance costs are estimated at $45,000 for dredging an additional 10,000 C.Y. Although annual maintenance dredging for the new channel improvements could be accomplished by the Corps' hopper dredge, this maintenance may be performed by contract in the future. The estimated annual maintenance costs is based on clamshell dredge with barge disposal, since material to be removed would be unconsolidated silt, clay and sand.

4.14 METHOD OF BENEFIT DETERMINATION. Container operations were evaluated in accordance with the procedure used by the Board of Engineers for Rivers and Harbors (BERH) in its evaluation of the Oakland Outer Harbor Project. That procedure used a future distribution of West Coast Container vessels developed by the U.S. Maritime Administration (MARAD). The projected tonnage of cargo carried by each class of ship was based upon its carrying capacity and share of the projected cargos delivered to West Coast Ports. Vessels serving terminals in the Inner Harbor are expected to increase in size in accordance with the MARAD distributions for future years, assuming channel depths are adequate to accommodate these more efficient carriers. Estimated annual benefits for alternative channel depths are shown in Table 4. Derivation of benefits is detailed in Appendix B.

TABLE 4

ECONOMIC OPTIMIZATION
OAKLAND INNER HARBOR

(Alternative Depths for Plan B)

Design Channel Depth below MLLW in Ft.	Increment of Deepening in Feet	Estimated Annual Cost of Project ($000)	1/ Estimated Annual Project Benefits ($000)	Benefit to Cost Ratios	Net Annual Benefits ($000)
37	2	560	16,800	30.0	16,240
42	7	1,700	32,800	19.3	31,100
43	8	2,200	34,900	15.9	32,700
45	10	3,000	34,900	11.6	31,900

1/ Includes proportional amounts for additional maintenance dredging.

4.15 ECONOMIC OPTIMIZATION. Comparative cost-benefit figures in Table 4 show deepening project channels to 43 feet would maximize net benefits over costs. The analysis indicates the tentatively selected plan of improvement for deepening Inner Harbor channels to 43-feet would have a benefit-to-cost ratio of 15.9 to 1. Net benefits would equal $32.7 million annually.

4.16 EVALUATION OF EFFECTS. The impacts of Plan B on significant resources in the study area are summarized in the following paragraphs. An assessment of the potential for cultural resources along the section of harbor covered by Plan B is presented in Appendix H. Effects on resources of high priority national concern are summarized in Table 5.

4.17 Water Quality. Implementation of the plan for deepening and widening navigation channels in the Inner Harbor would cause a short term increase in turbidity and reduction in dissolved oxygen levels at dredging and disposal areas. These impacts would not cause any significant degradation of water quality at these locations. The California Department of Water Resources has conducted a preliminary investigation on possible disturbance to the salt water-fresh water interface of usual aquifers (See Appendix C). It was stated in the State's report: "State policy requires that any action relating to water quality must conform with the State Water Resources Control Board's non-degradation policy (Resolution Number 68-16). That resolution states that existing high quality of water will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of water, and will not result in water quality less than standards prescribed by policies of the State Water Resources Control Board." Further investigation must be performed to verify the potential for adverse effects and to develop specific mitigation measures to eliminate or minimize the impact. The Corps of Engineers will properly mitigate any adverse environmental effects of the proposed project.

4.18 Benthos. The tentatively selected plan of improvement would generally have minimal effects on benthos since the dredging would occur in Inner Harbor and entrance channels presently maintained by the Corps of Engineers. About 31 acres adjacent the channel, not presently maintained, will be deepened. Use of sheet piling to reduce the amount of excavation required to widen a bend at project mile 3 was considered, but was ruled out as uneconomical.

4.19 Energy. Current and projected increases in transportation costs and energy expeditures can be significantly reduced by more efficient operations. Transportation savings will accrue from the use of larger ships transporting goods over the waterway at reduced unit cost.

4.20 Commercial shipping. Benefits equal to $34,886,000 a year in transportation savings, due to reduced tidal delays and lower unit costs for waterborne commerce passing through terminals along the Inner Harbor are estimated to result from deepening channels to 43 feet.

4.21 Navigation Safety. Deeper channels with widening at certain locations would reduce the risk of grounding vessels now in service and larger container vessels with drafts of 43 feet and greater, which are expected to be in service by 1986. This would also reduce the risk of collision.

4.22 Hydrography. Deepening navigation channels would not change the volume of the tidal prism or current patterns. However, deeper channels would drop more sediment. Maintenance of navigation channels to a design depth of 43 feet is estimated to add 10,000 cubic yards to the average 200,000 c.y. removed annually from the Inner Harbor in maintaining currently authorized depths.

4.23 Endangered and Threatened Species. Deepening and widening navigation channels would not directly impact upon the nesting site of the California least term. The two-year construction period may cause localized disturbances from turbidity in areas that may be used for foraging during the nesting season. Section 7 consultation has been requested in conjunction with the review period of the Draft Environmental Impact Statement by the U.S. Fish and Wildlife Service.

4.24 ITEMS OF LOCAL COOPERATION. On July 15, 1981, the Department of the Army, on behalf of the Administration, transmitted proposed legislation to Congress that would provide for full recovery of certain operation, maintenance and construction or rehabilitation costs for deep draft channels and ports with authorized depths greater than 14 feet. When such legislation is enacted, Corps of Engineers expenditures for modifications to the Oakland Inner Harbor Project will be subject to recovery as provided in the proposed legislation. Accordingly, non-Federal interests would be required to reimburse the Federal government for construction of navigation features of the recommended plan, and all subsequent expenditures for operation, maintenance and rehabilitation; except for expenditures assigned by the Secretary of the Army to governmental vessels in non-commercial service.

4.25 The entire amount of the Federal construction or rehabilitation expenditures to be reimbursed, including the interest during construction and interest on the unpaid balance, would be reimbursed within the life of the project, but would not be continued for more than fifty years after the date the project becomes available for use. The interest rate for reimbursement purposes would be determined by the Secretary of the Treasury based on the average market yields on outstanding obligations of the United States. Reimbursements are periodically adjusted to result in the payment of actual operation and maintenance costs. The non-Federal public body would be authorized to recover its reimbursement obligations pursuant to this requirement by the collection of fees for the use of project by vessels in commercial waterway transportation.

4.26 Any recommendation by the reporting officers for deep draft improvement of navigation channels in Oakland Inner Harbor would be contingent on prior agreement by the local sponsor to satisfy the following items of local cooperation:

a. Provide and maintain, at local expense, adequate wharf and terminal facilities in Oakland Harbor open to all on equal and reasonable terms for the storage, handling, and shipment of general and specialized cargos.

b. Provide and maintain, without cost to the United States, depths in berthing areas and local access channels serving the terminals and wharves commensurate with the depths provided in the related project channels.

c. Provide, without cost to the United States, all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers.

d. Hold and save the United States free from all claims for damages to wharves, piers, and other marine and submarine structures due to initial dredging work and subsequent maintenance dredging, except where such damages are due to the fault or negligence of the United States or its contractors.

e. Accomplish, at local expense, all alterations as may be required to sewer, water supply, drainage, cableways, and other utility and State highway facilities.

f. Prohibit construction of new terminals and related structures within 125 feet of the project channel lines.

g. Maintain and enforce regulations concerning discharge of pollutants in waters of the harbor by users thereof. Regulations shall be in accordance with applicable laws or regulations of Federal, State and local authorities responsible for pollution prevention and control.

h. Assure continued public ownership of the Port and its administration for public use, during economic life of the project.

i. Provide and maintain public access to waterfront parks, boat ramps, parking areas and other public use facilities open and available to all on equal terms.

j. Agree to reimburse the Federal government for all expenditures for the construction of navigation features of the recommended plan, and all subsequent expenditures for operations, maintenance and rehabilitation, except for expenditures associated with Coast Guard navigation requirements and national defense transportation requirements as determined by the Secretary of the Army.

FOUR CRITERIA

4.27 The candidate plan has been evaluated in accordance with four criteria (Section VI, 1.6.2) specified by the Water Resources Council in "Economic and Environmental Principles and Guideline for Water and Related Land Resources Implementation Studies," published in March 1983.

4.28 Completeness. New ships are on order and most of the other self-liquidating improvements in berthing areas and cargo handling facilities necessary for full realization of project benefits have already been accomplished or are being built by the Port of Oakland and other terminal leasee.

4.29 Functional Effectiveness. Deepening the entrance and Inner Harbor Channels to 43-feet would eliminate tidal delays for all container vessels now in service. However, it should be noted that the next evolution in container vessels size most likely will be equal to the height of a container, i.e. about 10-feet. These vessels would experience approximately the same amount of tidal delay in a 43-foot channel as 33-foot draft vessels incur with a 35-feet channel depth. Maintaining the appropriate width of the Bar Channel to Oakland Harbor (as determined by the simulator model) would allow unrestricted two-way passage of vessels. Plan B does not address the planning objective to create new wetland habitat, but it does make positive contributions to the other planning objectives to reduce tidal delays, increase transportation economy and improve navigational safety, while minimizing adverse environmental effects.

4.30 Economic Efficency. The tentatively selected plan for deepening channels to 43-feet would produce maximum net benefits over costs.

4.31 Public Acceptability. Data and evaluations are insufficient, at this stage of study, to conclude that the candidate plan would not have any adverse effects on groundwater resources of significant value. The Plan B scope of improvement appears to be in full compliance with all other WRC designated environmental statutes, as indicated on Table 6.

TABLE 5

EFFECTS ON RESOURCES OF PRINCIPAL NATIONAL RECOGNITION

Types of Resources	Principal Sources of National Recognition	Measurement Of Effects
Air Quality	Clean Air Act, as amended (42 USC 1857h-7 et seq).	No effect.
Areas of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended (16 USC, 1451 et seq).	No effect.
Endangered and threatened species critical habitat	Endangered Species Act of 1973, as amended (16 USC, 1531 et seq).	Request for consultation on least tern foraging at Oakland Inner Harbor.
Fish and Wildlife habitat	Fish & Wildlife Coordination Act (16 USC Sec 661 et seq).	Loss of 31-acres of benthic habitat.
Floodplains and Floodplain Management	Executive Order 11988,	No effect.
Historic and Cultural Properties	National Historic Preservation Act of 1966, as amended (16 USC, Sec 470 et seq).	No effect on two submarine traffic tubes considered eligible for listing in the National Register of Historic Places.
Prime and unique farmland	CEQ Memorandum of August 1, 1980 Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act.	Not present in planning area.
Water Quality	Clean Water Act of 1977 (33 USC 1251 et seq).	Short term increase in turbidity and depressed dissolved oxygen levels in dredging and disposal areas. Effects on groundwater indeterminate.
Wetlands	Executive Order 11990, Protection of Wetlands Clean Water Act of 1977 (42 USC, 1857h-7, et seq).	No effect.
Wild and Scenic Rivers	Wild and Scenic Rivers Act, as amended (16 USC 1271 et seq).	Not present in planning area.

TABLE 6

COMPLIANCE WITH WRC-DESIGNATED ENVIRONMENTAL STATUTES

Federal policies	Compliance
Archeological and Historic Preservation Act, 16, USC, 469, et seq.	Full compliance
Clean Air Act, as amended, 42, USC, 1857h-7, et seq.	Full compliance
Clean Water Act (Federal Water Pollution Control Act) 33 USC 1251 et seq.	Partial compliance*
Coastal Zone Management Act, 16, USC, 1451, et seq.	Full compliance
Endangered Species Act, 16 USC, 1531, et seq.	Full compliance
Estuary Protection Act, 16 USC, 1221, et seq.	Not Applicable
Federal Water Project Recreation Act, 16, USC, 460-1(12), et seq.	Full compliance
Fish and Wildlife Coordination Act 16, USC, 661, et seq.	Full compliance
Land and Water Conservation Fund Act, 16, USC, 4601-4601-11, et seq.	Not applicable
Marine Protection, Research and Santuary Act, 33, USC, 1401, et seq.	Not applicable
National Environmental Policy Act, 42, USC, 4321, et seq.	Full compliance
National Historic Preservation Act, 16, USC, 470a, et seq.	Full compliance
Rivers and Harbors Act, 33 USC, 403, et seq.	Full compliance
Watershed Protection and Flood Prevention Act, 16, USC, 1001, et seq.	Not applicable
Wild and Scenic Rivers Act, 16, USC, 1271, et seq.	Not applicable

NOTES

a. Full Compliance - Having met all requirements of the Statute for the current stage of planning (pending review of this document).

b. Partial Compliance - Not having met some of the requirements that normally are met in the current stage of planning.

c. Non-Compliance - Violation of a requirement of the statute.

d. Not applicable - No requirements for the statute required compliance for the current stage of planning.

* Effects on groundwater indeterminate at this stage of study. See recommendations of California Department of Water Resources in Appendix G.

SECTION 5 - COMPARISON OF CANDIDATE PLANS

5.00 In the Summary Comparison of Alternative Plans, Table 7, the major elements of the candidate plans are summarized and compared along with brief statements of the plans impacts. Contributions of the candidate plans to the four accounts of National Economic Development (NED), Environmental Quality (CEQ), Regional Economic Development (RED) and Other Social Effects (OSE), are also shown in Table 7.

DESIGNATION OF NED PLAN

5.01 Comparison of alternative project benefits and costs in Tables 2 and 4 shows the plan B scope of navigation channel improvements to a depth of 43 feet below MLLW datum would produce maximum benefits over costs. Therefore, this plan is designated the NED plan.

TENTATIVE SELECTION

5.02 Plan B, the optimized plan of improvement, has been tentatively selected pending resolution of uncertainties, in paragraphs numbered two and three, in Section 5.03 below and coordination with other Federal, State and local agencies.

UNCERTAINTIES

5.03 Uncertainties that have been identified in the study are described as follows:

1. Projections of commodity flows in the San Francisco Bay area are subject to many uncertainties. The report "San Francisco Bay Area Cargo Forecast," on which the projections in this study are based, recognizes these uncertainties and presents high, baseline and low forecasts. The baseline forecast has been used in this study since it is considered to be the most likely to occur. The benefits associated with other forecasts are presented in Appendix B, Economics.

2. Field data from an assessment by the California State Department of Water Resources was not able to identify the extent of effects deepening project channels would have on groundwater resources (See Appendix G). The Department recommends a three-phase program to further appraise the value of the resource and quantify the risk of adverse effects from the project. The first phase of the Department's program (to evaluate the resource) has been undertaken in this stage of the study, which included provision for some additional exploration and testing of sediments and water samples. Analyses of these recent data have not allowed a conclusive determination of project effects, but more extensive exploration and monitoring (Phase 3) is warranted. More intensive study will be incorporated in the post authorization stage of study. The Corps of Engineers is committed to properly mitigate for any adverse effects of the proposed project.

3. The difference between the authorized 42-foot depth for the Bar Channel and 35-foot depth for the Inner Harbor Channel and the recommended 43-foot depth has been assumed in determining quantities of material to be

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIGATION CHANNEL IMPROVEMENTS	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
A. PLAN DESCRIPTION			
1. Scope of navigation channel improvements	No improvement of existing deep draft channels currently maintained to authorized depth of -35 ft, MLLW, from harbor entrance to Fortmann Basin.	A 4.3 mi, reach of the Bar Channel and Inner Harbor would be deepened to -43 ft, MLLW. Inner Harbor Entrance Reach and a bend at about project mile 3.0 would be widened.	Both plans assume the 800-ft wide entrance Bar Channel will have been deepened to -42 ft, MLLW, in accordance with recommendations in 1978 report on Oakland Outer Harbor (deepening).
2. Construction method and sites for disposal of dredged materials.	No additional construction	Clamshell dredge would load bottom dump barges for disposal at site SF-11 in S.F. Bay near Alcatraz island.	Planning aid letter from U.S. F&WS indicates preference for hopper dredging for construction.
3. Aids-to-navigation	Existing federal aids maintained by U.S.C.G.	Minor relocation of existing aids by U.S.C.G.	
4. Project maintenance	Existing project channels maintained to authorized depths by Government-owned hopper dredge ships disposing of about 200,000 c.y. annually from Inner Harbor at Alcatraz site (SF-11) in San Francisco Bay.	Estimated increase of 10,000 c.y. annually for channel depth in 4.3 mile reach.	May be maintained by contract in future.

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIAGATION CHANNEL IMPROVEMENTS CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
B. CONTRIBUTION TO PLANNING OBJECTIVES			
1. Reduce tidal delays	Tidal delays and associated costs will increase significantly as size of containerships and cargo tonnages handled via Inner Harbor Terminals grows in accordance with In-Depth Study projections.	Would eliminate tidal delays for 75% of all container vessels projected to be in service by 1996.	
2. Increase economies of scale	Lower unit transport costs projected to occur with larger, more fuel efficient container vessels will not be fully realized with existing channel contraints.	Would produce significant savings in waterborne transportation costs (primarily for exports) by eliminating practice of light loading larger vessels.	
3. Navigational safety	Risk of collision and groundings will increase in proportion to size of vessels utilizing channels.	Channel widening and deepening would reduce risk of accidents.	

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIAGATION CHANNEL IMPROVEMENTS CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
4. Enhance or create new wetlands	No effect	No effect	No viable sites for enhancement of wetlands with dredged material were identified in this study.
C. SYSTEM OF ACCOUNTS			
1. National Economic Development			
Commercial shipping (containerized cargoes)	Projected increase from 2 to about 7 million short tons via Inner Harbor terminals between years 1986 and 2006.	Projected to increase from 2 to about 7 million short tons via Inner Harbor terminals between years 1986 and 2006.	Selected as key indicator for purpose of economic analysis in Appendix B. Other cargoes are handled via Inner Harbor.
Estimated annual savings (project benefits) in waterborne transport costs with more efficient vessel access.	0	$34,900,000	Equivalent discounted value rounded.

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIGATION CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
Estimated project first cost	0	$27,100,000	Based on February 1983 construction price levels.
Equivalent annual I&A charges	0	$ 2,200,000	CFR = 0.0 for interest rate 7-7/8%, 50 yr. period.
Net NED benefits over costs	N/A	$32,700,000	
Preliminary benefit-to-cost ratio	N/A	15.9 to 1	
2. <u>Environmental Quality Account</u>			
Hydrography	Present configuration of tidal estuary (Inner Harbor Channel) due to dredging, construction of jetties, fill and other development activities.	Deepening and widening navigation channel to the dimensions described above would not affect the tidal prism. Deeper channels would trap more sediment.	
Benthos	Productivity and diversity limited by natural conditions, pollution and regular maintenance dredging and disposal operations.	Proposed channel widening would subject an additional 31 acres of undisturbed benthic habitat to periodic maintenance dredging operations.	Fish and Wildlife Coordination Act, NEPA, and others.

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIGATION CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
Water Quality (surface)	Less turbid, but lower quality than Central Bay Regular maintenance dredging causes short-term turbidity and depressed dissolved oxygen levels in excavation and disposal areas.	Maintenance of deeper navigation channels would add add on estimated 10,000 c.y. dredged annually from Inner Harbor. Short term turbidity and depressed oxygen levels in dredging areas and at disposal site not expected to cause any long-term degradation in water quality.	Clean Water Act of 1977 (33 U.S.C. 1251 et seq). Also, California State Water Quality Control Board Standards.
Water Quality	The existing channel cuts some sand and gravel lens of irregular and unknown extent. Fresh water has been pumped from some aquifers found at depths from 150 to 250 feet; and from shallow wells in Meritt Sand, which blankets Alameda Island.	Dredging would expose some sand lens of unknown extent to salt water. Data insufficient to prove no adverse effects on resource.	Reference assessment by Calif. DWR in Appendix G.
3. Regional Economic Development			
Commercial Shipping	Transportation costs are reflected in the prices of goods.	Savings in transportation costs would decrease prices of goods.	

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIGATION CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
4. Other Social Effects			
Navigation Safety	The estuary is heavily utilized by boaters and commercial vessels. Risk of accidents is a function of speed, size and number of vessels using the waterways.	Channel widening and deepening would reduce risk of accidents.	
Energy	Waterborne transportation generally least consumptive per ton of cargo carried. Total expenditures for transportation expected to increase.	Larger, more efficient container vessels and vessel access to terminals will reduce consumption per unit of cargo delivered.	
D. PLAN RESPONSE TO EVALUTION CRITERIA			
1. Functional Effectiveness	Existing channel width dimensions at some locations inadequate to safely accommodate current and projected vessel usage. Inadequate depths cause expensive tidal delays and these costs will increase significantly with larger vessels now on order.	Would significantly reduce navigation hazards and risk of accidental groundings and collisions. Would eliminate tidal delays and light loading for most vessels now in service.	

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIGATION CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
2. Economic Efficiency	Estimates of current and future transportation costs for containerized cargos based on constraints of existing channel dimensions.	Economically feasible with benefit-to-cost ratio of 15.9 to 1.	
3. Completeness	Local interests are improving cargo handling facilities.	Since a commitment by the local sponsor to furnish items of local cooperation is required prior to project implementation, the plan is considered complete.	
4. Acceptability	Concerns expressed by pilots, shipping companies local, state and Federal officials.	Effects on groundwater indeterminate at this time. In full compliance with all all other WRC designated environmental statutes listed in Table 6.	Public meetings, correspondence and involvement from initiation of study.

TABLE 7

SUMMARY COMPARISON OF ALTERNATIVE PLANS

DESCRIPTION	PLAN A NO ACTION BASELINE CONDITIONS AND PROJECTIONS	PLAN B DEEP DRAFT NAVIGATION CHANNEL IMPROVEMENTS (WITH DISPOSAL AT ALCATRAZ)	NOTES ON GUIDELINES, STANDARDS AND TECHNIQUES USED FOR MEASUREMENT AND APPRAISAL OF NET EFFECTS
E. IMPLEMENTATION			
Total estimated project first cost (Corps construction)	$0	$27,100,000	Based on February 1983 construction price levels.
Estimated increase in project maintenance costs (Corps)	$0	$ 45,000	
Total estimated annual cost of project	[illegible]	$ 2,245,000	CFR = 0.0 for 7-7/8 interest rate, for 50 yr. period.

dredged. For the purpose of this report, the existing 800 foot Bar Channel width has been maintained. Related studies for the Oakland Outer Harbor may result in an increased Bar Channel width. Deepening to attain the recommended 43-foot depth would be accomplished as a part of the Oakland Inner Harbor project whatever is recommended as the width of the Bar Channel.

4. Endangered species consultation will be conducted concurrently with this Draft EIS. The biological assessment as required by Section 7 of the Endangered Species Act, as amended, is attached to this report (See Appendix D). Further correspondence will be included with the Final EIS, as appropriate.

SECTION 6 CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

6.01 Studies to date indicate that:

a. Deepening the lower 4 mile reach of project channels in Oakland Inner Harbor to -43 feet, MLLW, with widening at appropriate locations is engineeringly, economically and environmentally feasible.

b. Maximum net benefits would result from deepening the channels to -43 feet below MLLW datum.

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

OAKLAND INNER HARBOR, CALIFORNIA

ABSTRACT: The U.S. Army Corps of Engineers, San Francisco District, is studying the feasibility of deepening Oakland Inner Harbor channel in Alameda County, California. The existing navigation channel (35 feet deep and 600 to 800 feet wide) is becoming increasingly inadequate for the larger container and non-container vessels using the channel. Various management measures were studied and a preliminary assessment evaluated four plans. Two were eliminated due to environmental and/or economic problems. This draft environmental impact statement assesses the impacts of the two remaining feasible alternatives, (1) no action and (2) deepen 4 miles of Inner Harbor channel.

Send your comments to the District Engineer

If you would like further information regarding this statement, please contact:

Mr. Les Tong
Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105
Telephone (415) 974-0439
FTS phone 454-0439

NOTE: This statement incorporates figures and analyses in the preceeding text and attached appendices.

DRAFT ENVIRONMENTAL IMPACT STATEMENT

SECTION 1 - SUMMARY

MAJOR CONCLUSIONS AND FINDINGS

1.01 The major conclusions and findings are stated in the following paragraphs:

A. Most Likely Alternative Future. The Port of Oakland is updating its facilities at the Outer and Inner Harbors. Encinal Terminals in Alameda also plan to renovate berthing and terminal facilities in the future.

B. NED Plan The selected plan would deepen 4.3-miles of channel from 35 to 43 feet below MLLW datum, and would produce maximum net benefits over costs. Hence, this alternative satisfies the definition of an NED plan.

C. Selected Plan. Improvement of deep draft navigation channels in the Bar Channel and Inner Harbor to project Mile 4.3 with disposal of dredged material at Alcatraz is tentatively selected. The proposed widening of the entrance to Inner Harbor, mile three of the Inner Harbor Channel and the upper terminus of the project and deepening of deep draft navigation channels to 43-feet MLLW would require removal of an estimated 5,100,000 c.y. of material. Total estimated project cost is $27,100,000, based on February 1983 construction price levels.

D. Findings Regarding Section 404 of Clean Water Act:

1. No significant adaptions of the guidelines were made relative to this evaluation.

2. Of the three designated open water disposal sites in San Francisco Bay, the use of the Alcatraz Island site, SF-11, would result in the most amount of dredged material leaving the Bay system.

3. The planned disposal of dredged material at the Alcatraz site would not violate any applicable State water quality standards. Short term turbidity will occur during each discrete dump. Turbidity generated by the disposal activity will be temporary. The disposal operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. Use of the selected disposal site will not harm any endangered species or their critical habitat or violate protective measures of any marine sanctuary or wildlife refuge.

5. The proposed disposal of dredged 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 escosystem diversity, productivity and stability and recreational, aesthetic, and economic values will not occur.

6. Steps to minimize potential adverse impacts of the discharge on aquatic systems include disposal on ebb tide to permit movement of dredged sediments out of the Bay system.

7. On the basis of the guidelines the proposed disposal site for the discharge of dredged material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the affected aquatic ecosystem.

E. Findings Regarding Protection of Wetlands, Executive Order 11990:

1. Dredging sites and the selected disposal site are not located in or near wetlands.

2. No harm to any wetland area as a result of plan implementation is expected to occur.

3. The proposed action complies with this executive order and satisfies the Chief of Engineers Wetlands Policy.

F. Findings Regarding Cultural Resources: Based on investigations to evaluate the potential for prehistoric and historic cultural resources along the area of the Oakland Inner Harborcovered by Plan B, the following findings were made: Deepening and widening of the channel would not impact recorded prehistoric or historic resources, and in all likelihood, would not result in discovery of presently unknown resources of these types (See Appendix H).

G. Findings Regarding Floodplains Executive Order 11988:

1. The proposed action is not located in any base floodplain.

2. The proposed action does not have any impacts in any floodplain nor will it indirectly support floodplain development.

3. The proposed action is in compliance with this executive order.

RELATIONSHIP TO APPLICABLE LAWS, POLICIES AND PLANS

1.02 The following paragraphs list principal environmental laws, policies or plans of Federal, State or local governments applicable to the proposed navigation improvements for Oakland Inner Harbor. Table EIS-1 provides a summary of alternative plans compliance with these laws, policies and plans.

A. Clean Air Act. The objective of the Clean Air Act (P.L. 91-604; 84 Stat. 1704, 42 U.S.C. 1857 et seq) is to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population. Under this Act the Administrator of the Environmental Protection Agency has established a set of Ambient Air Quality Standards but the primary responsibility for the prevention and control of air pollution is left to the states and local agencies. In areas where the Ambient Air Quality Standards are not expected to be met by a certain date, the State or local agency would have to develop an Air Quality Maintenance Plan outlining control measures that would be implemented to achieve or maintain the air quality of a specific region. The Act requires

Federal agencies to perform an Air Quality Analysis for projects located within Air Quality Maintenance Areas to determine the effect of the proposed action upon the local Air Quality Maintenance Plan. It has been determined that emissions will not be increased by implementation of the proposed navigation improvements based on the assumption that there will be no change in the amount of cargo estimated for handling with existing port development. Emissions may be reduced by use of larger, more efficient ships (see Appendix F).

B. National Environmental Policy Act (NEPA). NEPA (P.L. 91-190; 83 Stat. 852, 42 U.S.C. 4321-4327) establishes a national environmental policy to insure that Federal actions do not contribute to environmental problems. Federal agencies are required to comply with procedures as established by the Act and published as Federal regulations. NEPA directs all Federal agencies to include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed environmental impact statement. This environmental impact statement fulfills the requirements of NEPA.

C. Clean Water Act, Section 404. The objective of the Clean Water Act (P.L. 95-217; 33 U.S.C. 1344) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Section 404(b) of the Clean Water Act, as amended in 1977, requires that the Corps evaluate the impacts of the discharge of dredged or fill material into waters of the United States in order to make specified determinations and findings. A State Water Quality Certificate must be obtained for the discharge unless an exception is approved by Congress. In this case, an evaluation as specified in Section 404(b) 1 is attached (Appendix E) to the Feasibility Report and EIS to be submitted to Congress for authorization, in lieu of the requirements of obtaining a State Certificate. Use of the EPA approved aquatic site (SF-11) in San Francisco Bay near Alactraz is the least environmentally damaging alternative for disposal of dredged material. Disposal at Alcatraz would not have any significant adverse impact on the aquatic environment.

D. Fish and Wildlife Coordination Act (FWCA). The FWCA (P.L. 85-624, 72 Stat. 563, 16 U.S.C. 661 et seq) requires that whenever any channel is proposed or authorized to be deepened, federal agencies responsible for such action must first consult with FWS and the State agency exercising administration over wildlife resources. Federal agencies must make the reports and recommendations of the FWS and the State agency an integral part of the reports for engineering surveys when submitted to Congress for authorization of construction. The project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits. The U.S. Fish and Wildlife Service and California Resources Agency have provided comments and recommendations (see Appendix D). Disposal activities will be scheduled on ebb tide only to minimize adverse effects upon the aquatic environment.

E. Endangered Species Act, Section 7. Section 7(a) of the Act, P.L. 93-205 (87 Stat. 884, 16 U.S.C. 1531 et seq), requires, among other things, that Federal agencies, in consultation with and with the assistance of the Secretary of the Interior (FWS), insure that their actions do not jeopardize the continued existence of endangered or threatened species or destroy or adversely modify the critical habitat that supports such species. The U.S. Fish and Wildlife Service has indicated that the listed California least tern is found in the vicinity. A biological assessment (Appendix D, NATURAL RESOURCES) discusses this endangered species in relation to deepening Oakland Inner Harbor. FWS review of the biological assessment, and consultation to fulfill the requirements of the act, have been requested concurrent with review of this document.

F. Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA). This is an Act to regulate the transportation for dumping, and the dumping, of material into ocean waters. A project at Oakland Inner Harbor with ocean disposal must conform to Sections 102 and 103 of this Act which involve criteria for ocean dumping and permits for ocean dumping. However, ocean dumping is not being considered for this project.

G. Executive Order 11990 (Wetland Protection). This policy states that Federal agencies should avoid to the extent possible the long and short-term adverse impacts associated with destruction or modification of wetlands. The agency shall also avoid undertaking and providing support for new construction (draining, dredging, channelizing, filling, diking, impounding, and related activities) located in wetlands, unless the agency head finds: (1) no practicable alternative, and (2) all practical measures have been taken to minimize harm to wetlands. Environmental, economic, and other pertinent factors may be taken into account. No significant impact is expected to result from the plan tentatively recommended in this report.

H. Executive Order 11593 (Preservation and Enhancement of Cultural Resources). This executive order directs Federal agencies to assume leadership in preserving and enhancing the nation's cultural heritage, to survey and nominate to the National Register historic properties under their jurisdiction, to refrain from impairing historic properties under their control and to initiate measures to ensure that their programs and policies contribute to the preservation and enhancement of non-federally owned historic resources (Appendix H).

I. National Historic Preservation Act of 1966 (NHPA). This Act created the National Advisory Council to advise the President and Congress on matters involving historic preservation. In performing the above, the Council reviews and comments upon activities licensed by the Federal Government which would have effects upon properties listed in the National Register of Historic Places, or those eligible for listing. There are currently no Register properties in the project area, although the Posey and Webster Streets traffic tubes as well as other identified historic structures along the Inner Harbor, may be eligible for listing in the National Register of Historic Places. Implementation of the tentatively selected plan would not directly impact any identified historic property along the Inner Harbor considered eligible for inclusion in the Register (See Appendix H).

J. Chief of Engineers Wetland Policy. This policy declares wetlands to be vital areas constituting productive and valuable public resources. Alteration or destruction of wetlands is discouraged as contrary to the public interest. Wetland functions considered important to the public interest are delineated in the July 19, 1977 Federal Register. Cumulative effects of small changes in wetlands often result in major wetland impairment. Therefore, Federal projects affecting a particular wetland site will be evaluated with respect to the complete and interrelated wetland area. No construction activity will occur in wetlands delineated as important to the public interest, unless the District Engineer concludes the benefits of the alteration outweigh the damage to the wetlands and the alteration is necessary to realize the benefits. The District Engineer must demonstrate the need to locate the project in the wetland and must evaluate the availability of feasible alternative sites. The tentatively selected plan is not expected to have any significant effect on wetland values.

K. Section 4, Estuaries-Inventory-Study. Public Law 90-454 (82 Stat. 625). Congress, in this Act, recognizes, preserves and protects the responsibilities of the States in protecting, conserving and restoring the estuaries in the United States. The Act also directs all Federal agencies to give consideration to estuaries and their natural resources and their importance for commercial and industrial developments, and to include in all project plans and reports affecting such estuaries and resources submitted to Congress, a discussion by the Secretary of the Interior of such estuaries and such resources and the effects of the project upon them and his recommendations thereon. The Secretary of the Interior shall make his recommendations within ninety days after receipt of such plans and reports. See above discussion regarding the Fish and Wildlife Coordination Act.

L. Water Resources Development Act, Section 150, P.L. 94-587 (WRDA). This legislation furnishes the Chief of Engineers with authority to plan and establish wetland areas in connection with dredging required for water resources development projects based on the following finding:

(1) The benefits of the wetland area justifies the cost above that required for alternative methods of disposal.

(2) The increased cost of wetland development does not exceed $400,000.

(3) Reasonable evidence exists that the wetland area will not be substantially altered or destroyed by natural or man-made causes. Management measures for establishment of wetlands, as provided in this Act, were considered in this study. However, conditions in the vicinity of the proposed project do not permit the establishment of wetland areas without changing existing mudflats or shallow water areas.

M. Coastal Zone Management Act (CZMA) 1972. The Act establishes national policy to preserve, protect, develop and where possible restore or enhance the resources of the Nation's coastal zone. It directs all Federal agencies engaged in programs affecting coastal zones to cooperate and participate with State and local governments and regional agencies in implementing the purposes of this Act. It has been determined that deepening the harbor would not be contrary to the BCDC plan. (See N below).

N. San Francisco Bay Plan (Bay Conservation and Development Commission). This regional plan establishes policies formulated by the McAteer-Petris Act limiting bay fill in San Francisco Bay to developments considered essential to the public interest. The Bay Plan provides a comprehensive and enforceable basis for protecting the Bay as a natural resource benefiting both present and future generations, and developing the Bay and its shoreline to the highest potential with a minimum of Bay filling. Appropriate uses of the shoreline are also discussed in the text of the Bay Plan. The Policy on port use in the Bay Plan calls for redevelopment at Oakland Inner Harbor. The following Dredging Policies will be satisfied by the tentatively selected plan.

(1) If a Bay aquatic disposal site is used, sedimentation resulting from dredging will be minimized by conducting disposal at a designated location where the maximum amount will be carried outside the Bay on ebb tide.

(2) The dredging will not result in unnecessary filling solely to dispose of dredged sediment.

(3) The designated disposal area will be selected with due consideration to being least harmful to the ecology of the Bay.

(4) The proposed channel improvements will be designed to prevent undermining of adjacent dikes and fills.

(5) The proposed improvement will not damage underground aquifers.

This proposed channel deepening for Oakland Inner Harbor must be compatible with the policies of dredging in the San Francisco Bay Plan.

O. State Water Quality Control Policy for Enclosed Bays and Estuaries. This policy establishes a program to control toxic effects through a combination of source control for toxic material, upgraded wastewater treatment, and improved dilution of wastewater. Requirements and prohibitions applicable to dredging and disposal operations include: compliance of dredged material with Federal criteria (see paragraph C above of Clean Water Act Section 404) for determining acceptability for disposal into bay waters and certification of compliance by the Regional Water Quality Control Board; and prohibition of direct or indirect discharge of silt, sand, soil, clay or other earthen material from onshore operations in quantities which unreasonably affect or threaten to affect beneficial uses. Refer to paragraph C., Clean Water Act, Section 404, for a discussion of compliance with Federal criteria.

P. State of California Wetland Policy. This policy recognizes the value of marshlands and other wetlands. Basically, the Resources Agency and its various departments will not authorize or approve projects that fill or otherwise harm or destroy coastal, estuarine, or inland wetlands. Exception may be granted if all the following conditions are met: (1) project is water dependent; (2) no feasible, less environmentally damaging alternative is available, (3) the public trust is not adversely affected; and (4) adequate compensation is part of the project. Compensation measures must be in writing, and long-term "wetland habitat value" of involved project and mitigation lands must not be less after project completion. The tentatively selected plan is not expected to have any significant effect on wetland values.

Q. Oakland Comprehensive Plan, Land Use Element. Oakland Inner Harbor development is projected to remain transportation, commercial, manufacturing and government with some open space with public access.

R. Alameda Comprehensive General Plan. Land use along the Inner Harbor is projected to remain primarily military and industrial in the study area.

AREAS OF CONTROVERSY

1.03 No areas of controversy have been identified.

UNRESOLVED ISSUES

1.04 A preliminary assessment of groundwater impacts has been performed by the California Department of Water Resources (see Appendix G). Further investigation is necessary to determine the extent of effects, if any, upon the two groundwater formations found in the project area. A Section 7 Consultation in accordance with the Endangered Species Act, as amended, has been requested with the Sacramento Endangered Species Office with the 90-day period coinciding with the review period of this Draft EIS. When the biological opinion is rendered, the Federal action that may be required to satisfy any issues raised by the Sacramento Endangered Species Office will be addressed in the Final EIS.

TABLE EIS-1

RELATIONSHIP TO ENVIRIONMENTAL REQUIREMENTS

ENVIRONMENTAL REQUIREMENTS	PLANS: PLAN A No Action	PLAN B 4-mile Reach including Bar Channel by Hydraulic Dredge with Alcatraz Disposal
Clean Air Act	N/A*	N/A
Clean Water Act, Section 404 (CWA)	Partial	Partial
National Environmental Policy Act (NEPA)	Full	Full
Fish & Wildlife Coordination Act (FWCA)	Partial	Partial
Section 7, Endangered Species Act	Full	Full
Marine Protection, Research & Sanctuaries Act	N/A	N/A
Executive Order 11990 (Wetland Protection)	Full	Full
Executive Order 11593 (Cultural Resources)	Full	Full
National Historic Preservation Act	See EO 11593 above	See EO 11593 above
Chief of Engineers Wetland Policy	See EO 11990 above	See EO 11990 above
Section 4, Estuaries Inventory Study	See FWCA above	See FWCA above
Section 150, Water Resources Development Act	N/A	N/A
Coastal Zone Management Act	See BCDC below	See BCDC below
Bay Conservation & Development Plan (BCDC)	Full	Full
State Water Quality Control Policy	See CWA above	See CWA above
State Wetland Policy	Full	Full
Oakland Plan	Full	Full
Alameda Plan	Full	Full

*NOTE: N/A = not applicable, see text discussion.
Full = meets requirements for the current stage of planning, see text discussion.
Partial = does not meet requirements for current stage of planning, see text discussion.

SECTION 2 - NEED FOR AND OBJECTIVES OF ACTION

STUDY AUTHORITY

2.01 The Congress of the United States has directed the U.S. Army Corps of Engineers to investigate the feasibility of deepening Oakland Inner Harbor by resolution dated 10 May 1977. (See the Main Report).

PUBLIC CONCERNS

2.02 Public concerns were expressed at an initial public meeting held 13 February 1980. Concerns indicated the need to deepen the Inner Harbor Channel and widen the entrance Bar channel, as well as to develop new or improve existing turning basins. Concerns were also expressed about channel navigational hazards, encroachments and possible project impacts on cables, pipelines, submarine highway tubes and airport landing zones. Public concerns which have indirectly been expressed in various laws and policies include wetland protection, air and water quality control, cultural resource protection, and protection of the Bay's natural resources.

PLANNING OBJECTIVES

2.03 Analysis of public concerns resulted in the following planning objectives:

a. Reduce tidal delays for containership passages between the harbor entrance and terminals in Oakland Harbor.

b. Increase economies of scale for waterborne commerce passing through the Port of Oakland and other terminals located along the Inner Harbor channels.

c. Increase navigational safety for containership passages and turnarounds in the Inner Harbor.

d. Enhance or create wetland areas with the use of dredged material outside of the immediate study area.

SECTION 3 - ALTERNATIVES

INTRODUCTION

3.01 Various management measures were considered to meet the established planning objectives. These management measures were screened and then formulated into four alternative plans of navigation improvement. Two of these plans were eliminated from detailed planning stages as stated below.

PLANS ELIMINATED FROM FURTHER STUDY

3.02 Plan C - Four Mile Reach Plus Entrance Widening by Hydraulic Dredge with Bay Fill at Outer Harbor. This plan would deepen the 4-mile reach of Inner Harbor from the entrance to the Clay Street Piers from 35 to 43 feet below mean lower low water. The material would be dredged by hydraulic dredge and pumped via pipeline to a 190-acre site next to the Bay Bridge. The fill would create land for future Port of Oakland expansion. Implementation of this plan would have filled a significant area of Bay, covering a large area of bottom habitat and would have been opposed by Federal, State, and local agencies and conservation groups. This alternative was eliminated from further consideration, based on adverse environmental effects.

3.03 Plan D - Six Mile Reach Plus Entrance Widening By Clamshell Dredge With Disposal At Alcatraz. This plan would deepen the 6-mile reach of Inner Harbor from the entrance to Fortman Turning Basin from 35 to 42 feet below mean lower low water. The material would be dredged by clamshell and barged for disposal at Alcatraz. This alternative would necessitate relocation of the Webster Street and Posey Tubes which would be an expensive task and would have adverse effects on traffic patterns and local air quality. The tubes are also of historic importance and relocation would be opposed by Federal and State agencies and local interest groups. This alternative was dropped due to excessive costs and adverse effects on a significant historic resource, and the potential for mounding of the Alcatraz disposal site as a result of the clamshell dredging method.

PLANS CONSIDERED IN DETAIL

3.04 Plan A - No Action. Oakland Inner Harbor would continue to be maintained at 35 feet below mean lower low water. Maintenance work is generally performed by hopper dredge with disposal at the Alcatraz disposal site.

3.05 Channel maintenance dredging is expected to continue. The activity results in short-term disturbances to the channel bottom. Disposal of dredged material from maintenance dredging in the Bay, including Oakland Inner Harbor, is expected to continue. Presently, average annual disposal at the Alcatraz site totals about 3.4 million cubic yards from public and private maintenance dredging activities. Of that amount, about 200,000 cubic yards comes from Oakland Inner Harbor.

3.06 The Port of Oakland has begun construction of facilities capable of handling projected increases in containerized cargos. This commerce is expected to be carried at lower unit transportation cost in larger vessels.

Alameda also plans to enlarge its berthing and terminal facilities. Already, ships with deeper drafts experience delays while waiting for higher tides. Maintaining a 35-foot depth would limit access by deeper draft containerships to high water conditions and continue to cause delays in sailing departures. The existing harbor entrance would continue to hinder maneuvering of long containerships.

3.07 The Port of Oakland, although capable of providing facilities to handle increased shipment of containerized cargos would fail to realize the full benefit of its investestments, due to the inefficient movement of vessels in the Inner Harbor. Present channel dimensions require light-loading, larger vessels. This and delays tend to increase vessel operating and transportation costs. The Port of Oakland would, however, probably be fully utilized.

3.08 Projected increases in cargo would require more trips by current-size vessels or deeper draft ships at partial load capacity. These trips would impact air quality, although changes would probably not be significant since ship emissions are not considered significant sources of air pollutants. The biotic environment at Oakland Inner Harbor and Alcatraz is expected to maintain present integrity. Periodic maintenance dredging will disturb marine communities. Development of the Inner Harbor will increase the landside vehicle use in the area as cargo volume increases. This will result in local increase in traffic and transportation, as well as air quality, impacts.

3.09 Plan B - Four Mile Reach Channel Deepening by Hydraulic Dredge with Disposal at Alcatraz. This alternative would deepen the 4-mile reach between the entrance and Clay Street piers from 35 to 43 feet below mean lower low water by hydraulic dredge. The Bar Channel will also be deepened to -43 feet, MLLW. Material would be loaded on barges and transported for disposal at the EPA approved Alcatraz disposal site. Initial work would remove 5,100,000 cubic yards of material. Total annual maintenance with the proposed improvements would be approximately 210,000 cubic yards. Cost estimates are based on 24 months of continuous dredging and disposal operations. A specific time schedule for initiation and completion of dredging and disposal has not been defined.

3.10 The proposed dimensions for the entrance Bar Channel and Inner Harbor Channel are shown on Figures 10 through 14 in the main report.

3.11 The Alcatraz disposal site (SF-11) is located about 1/3 mile south of Alcatraz Island. The site has a 1000-foot radius and an average depth of 85 feet. The site annually receives about 2.1 million cubic yards of material from Corps maintenance work and an additional 1.3 million cubic yards of material from other interest's acitivities. Implementation of this alternative plan would add about 10,000 cubic yards per year from increased channel maintenance requirements to be disposed of at the Alcatraz disposal site.

ALTERNATIVE DREDGED MATERIAL DISPOSAL SITES

3.12 Various disposal alternatives were considered: Land disposal, inland water disposal at the historically-used Alcatraz disposal site, ocean disposal at the EPA designated 100-fathom disposal site, ocean water disposal at San Francisco Bar Channel, Bay fill, marsh creation and delta levee repair.

Early planning eliminated all but land disposal, the 100-fathom disposal site and the Alcatraz disposal site. It was determined that there were no available land sites near Oakland Inner Harbor with adequate capacity to accommodate the estimated volume of excavated material. The use of dredged material as a saleable commodity was not considered because of the lack of a storage area, the need to separate unusable sediments, and associated problems.

3.13 Based on the current regional criteria (contained in Public Notice 78-1, dated November 1978), governing dredged material disposal in inland waters, material to be dredged from the deepened and widened Oakland Inner Harbor channel complies with sediment criteria for disposal at the Alcatraz disposal site. Water and sediment analyses have been completed (see Appendix E). The Alcatraz disposal site has the largest volume of the three inland water disposal areas in San Francisco Bay, suitable to receive dredged material.

3.14 The 100-fathom ocean disposal site was considered as a contingency disposal site. Disposal at the 100-fathom site would have to conform with Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 and the Ocean Dumping Criteria of January 11, 1977. If ocean disposal were to be implemented, requirements of the ecological evaluation required by Section 103 must be satisfied.

COMPARATIVE IMPACTS OF ALTERNATIVE PLANS

3.15 Table EIS-2 is a summary comparison of impacts of the two plans considered in detail on significant resources. Impacts of alternative plans on the significant resources are described in paragraphs 5.01 through 5.19, and summarized in Tables 1 and 8 in the Main Report.

TABLE EIS-2

IMPACTS OF ALTERNATE PLANS
ON SIGNIFICANT RESOURCES

SIGNIFICANT RESOURCES	NO ACTION	4-MILE REACH PLUS ENTRANCE WIDENING BY HYDRAULIC DREDGE WITH ALCATRAZ DISPOSAL
Water Quality	No significant impact	Short-term increase in turbidity plus a depressed dissolved oxygen level due to sediment disturbance. Groundwater contamination has not yet been affirmed.
Benthos	No significant impact	Removal and displacement of 31.1 acres of bottom by dredge.
Energy	No significant impact	No significant short-term impacts. The efficient use of a deeper channel could reduce fuel consumption.
Hydrography	No change to existing conditions.	Increased depth would serve projected vessel traffic. Annual maintenance dredging would increase.
Commercial Shipping	Tidal delays would adversely affect commercial shipping.	Efficient use of a deeper channel by larger ships would significantly benefit commercial shipping.
Navigation Safety	Larger vessels expected to use the channel will experience problems with unchanged depths and widths.	Increased depth and width of the channel will reduce hazards of channel use.
Rare and Endangered Species	Nesting success has been of concern mainly due to predation at the nest site.	Short-Term impact on use of inner harbor channel for foraging during construction period

SECTION 4 - AFFECTED ENVIRONMENT

INTRODUCTION

4.01 The environmental setting of the region and study area is briefly described in the following paragraphs. The purpose of the description is to provide a general idea of the environmental relations that exist in the study area. Elements of the environment that are significantly impacted by the detailed plan are discussed in SECTION 5 - EFFECTS OF ALTERNATIVE PLANS ON SIGNIFICANT RESOURCES.

4.02 Regional Environmental Setting. Oakland Inner Harbor, California, is located on the eastern side of San Francisco Bay, about 8 miles southeast of the Golden Gate bridge. The Port of Oakland handles the most tonnage of the 15 areas of entry in the San Francisco Customs District. Along with the Port of Richmond, Oakland is a critical transfer point for petroleum products, transport equipment, food, animals and a wide range of cargos shipped in containers. Boating and fishing are the principal recreational uses of the Bay and harbor.

4.03 Definition of the Study Area. The term "study area" is defined as the area primarily impacted by implementation of the proposed action. Impacts discussed apply to the study area, unless otherwise stated. The study area includes Oakland Inner Harbor, the Port of Oakland, and cities of Oakland and Alameda, plus access channels to the Inner Harbor.

ENVIRONMENTAL CONDITIONS OF THE STUDY AREA

4.04 The proposed navigation improvements are specifically within the Inner Harbor, which is the 35-foot deep channel maintained between Oakland and Alameda.

4.05 In the harbor area, elevations vary from sea level to about 30 feet, gradually rising to the base of the Berkeley Hills. In the Harbor area, adjacent to the channel almost all the land is reclaimed and developed for industry and commerce. The 35-foot maintained channel varies from about 550 to 800 feet wide.

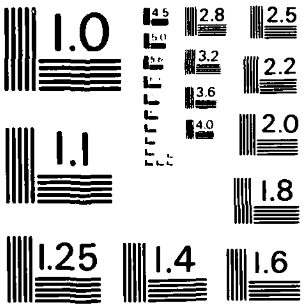
4.06 The harbor lies in a seismically active area and can be subjected to major earthquakes from the San Andreas and Hayward Faults. Results of quakes could be vibration-induced slides of the channel margins; possible damage to buildings and other structures along the channel would depend on their location and construction.

4.07 Water quality of the Inner Harbor tends to be lower than that of Central San Francisco Bay. Poor circulation plus the addition of waste materials generated within the area are primary factors. Sewage effluent from ships, storm sewer releases, seasonal and diurnal temperature fluctuations affect water quality. Turbidity is low in this part of San Francisco Bay. Sediment samples taken in 1971 for deepening of the channel from 30 to 35 feet showed four stations which were high in mercury and four which exceeded the current criteria for lead at the time. These stations were near or above the Posey

AD-A131 508 FEASIBILITY STUDY AND ENVIRONMENTAL IMPACT STATEMENT OAKLAND INNER HARBOR..(U) CORPS OF ENGINEERS SAN FRANCISCO CA SAN FRANCISCO DISTRICT JUN 83

2/3

UNCLASSIFIED F/G 13/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Tube, around Government Island, outside the currently proposed study area. Sediment samples taken from the Inner Harbor have been analyzed using current analytical procedures for disposal into open waters of the bay. No potential for adverse effect has been identified. Two aquifers are located in the harbor which may be exposed by deepening the channel.

4.08 The San Francisco Bay Area topography, a large, shallow basin ringed by hills, has the potential for trapping and accumulating air pollutants. Lack of ventilation during warm, sunny days (primarily May to October) foster the development of photochemical oxidants. Motor vehicles provide the highest percentages of highly reactive organic gases, oxides of nitrogen, and carbon monoxide: stationary sources are responsible for most of the particulate matter and sulfur-dioxide emissions. Projections of the Bay Area Air Pollution Control District (BAAPCD, 1975) show levels of these emissions increasing in the next 10 years. Oakland Inner Harbor is located in the San Francisco Bay Area Air Basin, an area designated as an Air Quality Maintenance Area (AQMA).

4.09 At least 25 species of fish, mostly non-game species, may on occasion be found in the harbor. These include three species of shark, and two species each of rays and smelt. The gamefish striped bass and American shad are occassionally taken in the area. The most predominant species are shiner perch and pile perch. Fish populations are relatively low, due mainly to lack of foraging material.

4.10 In some of the algal growth near the southern reach of the estuary, one may find a limited number of shorebirds, diving ducks, grebes, gulls and cormorants at low tide. The lack of marshy habitat in the project area combined with the density of urban and industrial development limits wildlife populations in this channel area.

4.11 Oakland Inner Harbor is heavily committed to commercial activities. Modern cargo handling facilities coupled with convenient access to major highway and railroad facilities have contributed toward the Port of Oakland's current standing as the most active container port on San Francisco Bay and one of the most important shipping centers on the Pacific Coast.

4.12 Over fifty percent of Alameda County's recreational boating moorages are located at Jack London Square, Brooklyn Basin and other locations along the central to eastern perimeter of Alameda. The estuary is well protected from most storms and is ideal for small boat harbors. Approximately 20 marinas in the area berth about 2,300 recreational boats. Several public access spots along the Inner Harbor provide recreation for fishing enthusiasts. Vessel traffic in the estuary (Oakland Inner Harbor) is a mix of commercial, governmental and recreational vessels. The U.S. Coast Guard Vessel Traffic System (VTS) has maintained a record of vessel movements for large ships and commercial tugs. Each movement is defined as a single trip from one point to another within the territory. Based on a 10% random sample of the VTS record for 1981, about 4,000 vessel movements for the estuary were derived. There are about 2,500 public marina berths located in the Inner Harbor east of channel mile 4. Two small-boat launching ramps are also available for trailered out-board motorboats. It has been estimated that recreational boaters generate about 78,000 vessel movements annually, mostly occurring during weekends (typical weekday movements were assumed to be 100; peak weekend movements estimated to be 1,800 movements based on a percentage of vacant berths during the 1 July 1979 weekend - Draft EIR, Encinal Terminal Master Plan, September 1982). Commercial vessels are not and will not be subject to significant boating congestion problems because of their operation in the channel during weekdays avoiding peak recreational boating times. The small boaters easily recognize the presence of the large commercial vessels in the channel and are more aware of the channel traffic conditions when the large ships are maneuvering in the channel. Conditions used to set a conceptual carrying capacity of boating traffic would include the peak moment of average summer weekend boating with no unusual circumstances affecting boating in the most dense reach. Conditions occurring during most heavily used times, such as holiday weekends, special regattas and races in the estuary are not used to set carrying capacity because reasons for such boating would bias "average use". Such special organized events can attract large numbers of boaters or detract boaters because of advanced notification of such group participatory events.

ENVIRONMENTAL RELATIONSHIP MATRIX

4.13 The Environmental Relationship Matrix Figure EIS-1 shows relationships between elements that exist within the study area. These relationships were used to identify and assess the ecosystem's response to natural and manmade changes, either directly or indirectly, associated with the tentatively selected plan and its alternatives.

4.14 When analyzing the environmental relationship matrix, it should be remembered that elements listed in columns act upon those listed in rows and that the relationships indicated are the primary relationships that exist within the study area. Environmental elements listed on Figure EIS-1 are defined in Appendix A.

IMPACTED SIGNIFICANT RESOURCES

4.15 Water Quality. This basic environmental attribute is defined as a significant resource on the basis of concerns expressed in the Clean Water Act of 1977. Water quality parameters are directly related to the interaction of sediment disturbances and water column effects at the dredged and disposal sites under consideration. Water quality parameters of concern include:

FIGURE EIS-1

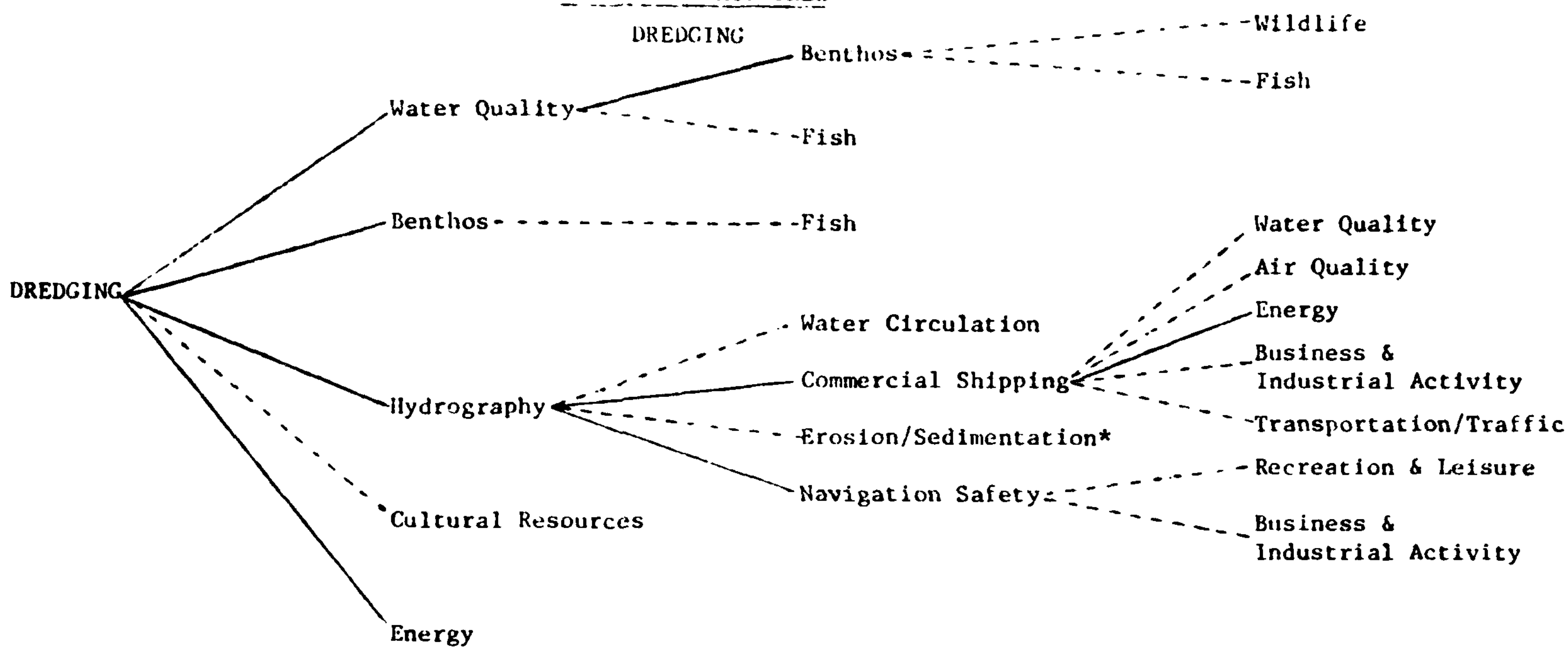
OAKLAND INNER HARBOR
ENVIRONMENTAL RELATIONSHIP MATRIX

PASSIVE ELEMENTS \ ACTIVE ELEMENTS	PHYSICAL ENVIRONMENT	Topography	Hydrography	Geologic Hazards	Water Quality	Water Circulation	Wave Action	Erosion/Sedimentation	Sediment Quality	Prime & Unique Agric. Land	Air Quality	Noise	BIOLOGICAL ENVIRONMENT	Plankton	Benthos	Fish	Wildlife	Wetland Vegetation	Rare & Endangered Species	SOCIO-ECONOMIC ENVIRONMENT	Number of Inhabitants	Government & Civic Activity	Land Use	Displacement of Population	Desirable Community Growth	Desirable Regional Growth	Community Cohesion	Aesthetic Quality	Cultural Resources	Recreation & Leisure	Transportation/Traffic	Public Facilities & Services	Local Government Finance	Business-Industrial Activity	Natural Resources	Manmade Resources	Employment/Labor Force	Agricultural Activity	Commercial Shipping	Energy	Navigation Safety
PHYSICAL ENVIRONMENT																																									
Topography																																									
Hydrography		M																																							
Geologic Hazards		M	M																																						
Water Quality				T		C		T													T		M							S											
Water Circulation			M	T			C																																		
Wave Action			T	M				T																																	
Erosion/Sedimentation			S			S	S																																		
Sediment Quality																																									
Prime & Unique Agricultural Land																																									
Air Quality		T																				M	M								C			M							
Noise																					S										M			M							
BIOLOGICAL ENVIRONMENT																																									
Plankton					C	S																																			
Benthos			S		C	S		T																																	
Fish			S		C	S								M	M																										
Wildlife											S	M		S	S	M																		T							
Wetland Vegetation			T																															T							
Rare & Endangered Species		C						C				C																													
SOCIO-ECONOMIC ENVIRONMENT																																									
Number of Inhabitants																																									
Government & Civic Activity											C								C		S			C					C												
Land Use		T		S							S	S										M																	M		
Displacement of Population				C																																					
Desirable Community Growth																																									
Desirable Regional Growth																						T																			
Community Cohesion																								T					C												
Aesthetic Quality						S					M						S																								
Cultural Resources								T																																	
Recreation & Leisure					T		S				M	M				M					S													M							M
Transportation/Traffic																					M	M																	C		
Public Facilities & Services											C										M												C								
Local Government Finance																																									
Business-Industrial Activity											M										M									T							M				M
Natural Resources																																									
Manmade Resources				T																																					
Employment/Labor Force																								M										C					C		
Agricultural Activity																																									
Commercial Shipping																						C	C														M				C
Energy																				M			M	T							C								C		
Navigation Safety				C		T		T			S																			S				M							

LEGEND (PRIMARY RELATIONSHIPS):
C = Critical
M = Moderate
S = Slight
T = Theoretical but not identified in study area.

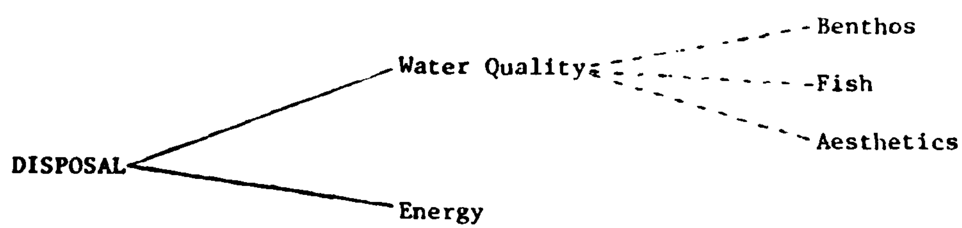
GENERAL IMPACT TREE

DREDGING



GENERAL IMPACT TREE

DISPOSAL



——— has significant impact on

- - - - - has moderate impact on

* a possible impact unknown at this time

concentrations of dissolved oxygen, heavy metals, petrolum hydrocarbons, pesticides, and turbidity. Since most of the effects of dredging and disposal activities upon the chemical and physical properties of water quality have been identified as short-term in previous studies, existing values for salinity, temperature, dissolved oxygen concentration, pH and suspended solids are not expected to change. In order to compare the extent of the short-term impact of the alternative plans, attention was directed to the duration of the dredging, disposal operations and the expected volume of material to be disposed, including the expected maintenance dredging quantities. In addition to the above concerns, two usable aquifers have been identified in the project area that may be affected by channel deepening. State policy requires that any action relating to water quality must conform with the State Water Resources Control Board's Resolution 68-16, October 1968. Further investigations to determine the extent of potential degradation are necessary. The Corps of Engineers will properly mitigate any adverse effects of the recommended project upon usable groundwater resources.

4.16 Benthos. This element is considered a significant resource because of its relationship to components of the food chain. Benthic organisms in the channel area to be dredged and aquatic disposal site would be directly impacted. The areas considered for deepening are existing channel routes. Some additional areas are considered for widening. Associated with the bottom of the channel and adjacent areas are a variety of marine organisms which include worms, crustaceans, and assorted shellfish. With annual maintenance dredging of existing channels, community stability of benthic life is limited. Resultant shoaling of excavated channel bottoms also contributes to unstable community structure in the channel bottom. No extensive shellfish bed exists in the immediate vicinity of Oakland Inner Harbor. Since most areas to be dredged serve existing navigation purposes and are dredged annually, deepening is not expected to have severe disruptive effect upon the bottom. Most, if not all, bottom organisms found in Oakland Inner Harbor channels are expected to be adapted to change. Studies, conducted throughout the Bay specifically for dredging and disposal activities, have shown that limited recolonization occurs after dredging. This recolonization indicates the resiliency of some types of bottom fauna to reestablish soon after excavation. Since detailed studies of the benthic communities at Oakland Inner Harbor have not been conducted for this study, the measure of project impacts on this significant resource is assumed to be proportional to area of widening for the proposed improvement of navigation channels in addition to the usual loss due to maintenance dredging.

4.17 Energy. In relation to efficiency of use of Oakland Inner Harbor by commercial vessels, energy consumption plays a significant role. Energy resources have assumed greater economic and environmental values due to continued high use and higher costs. The present National concern for conservation of energy resources has application to efficient navigation use at Oakland Inner Harbor and will be treated as a significant resource. The measure of this resource for comparative purposes will be indicated by savings based on travel distance for shipping and expenses for dredging and disposal activities.

4.18 Hydrography. This refers to the physical characteristics of the submerged bottom. Any proposed channel dredging will result in significant changes to the channel bottom; therefore hydrography will be discussed as an important element in the study area even though it is not a resource. Physical characteristics that may be impacted due to changes in the channel bottom are wave action and water circulation.

4.19 Commercial Shipping. Containership sizes have gradually increased since the initial development, which employed small freighters (surplus Liberty Ships) with a an overall length of less than 400-feet and draft of about 26-feet. Third generation containerships have lengths in excess of 700 feet and drafts up to 33-feet. Fourth generation containerships and other cargo vessels now on the way have drafts of 35 feet and greater. These vessels will experience even longer delays or may not be able to operate in the channel at all. Some of these vessels have lengths in excess of 900 feet. The Asia Liner with a length of 860 feet is representative of the C-9 class vessels. As vessels become larger, existing channels and turning basins become inadequate. The increased transport capacity and potential for lower unit costs afforded by more efficient carriers is vital to national interest and accounts.

4.20 Navigation Safety. This is not a significant resource, but has been identified as significantly impacted by the project and is therefore listed here. The pilots responsible for safe passage of large commercial vessels within the confines of the Inner Harbor face increased hazards and risk of accidents. The risk is directly proportional to the size vessel, limited channel dimensions and number of small craft utilizing the same waterway.

4.21 Endangered Species. There is a known nesting site of the California least tern (*Sterna albifrons browni*) at Alameda Navel Air Station adjacent to Oakland Inner Harbor. The least tern is considered a significant resource. Project impact on the tern and its habitat has been assessed in accordance with Section 7 of the Endangered Species Acts, as amended and the coordination with the U.S. Fish and Wildlife Service is described in the ENVIRONMENTAL EFFECTS Section of this report and Appendix D.

OTHER SIGNIFICANT RESOURCES

4.22 This subsection discusses those resources which were identified in the study area during early planning for this project, but which are not significantly affected by either the No Action or Tentatively Selected plans. Each resource will be discussed here, but will not be included in SECTION 5 - EFFECTS OF ALTERNATIVE PLANS ON SIGNIFICANT RESOURCES.

4.23 Air Quality. Air Quality is defined as a significant resource in accordance with the Clean Air Act Amendment of 1977. The project is located within an Air Quality Maintenance Area and at a later stage in planning an Air Quality Analysis may be required to determine impacts on the local Air Quality Maintenance Plan. However, it is expected that emissions will not be increased by proposed navigation improvements, based on no change in the amount of cargo estimated for handling with existing port development (see Appendix F).

4.24 Wetlands. Wetlands have been identified as a significant resource by the laws and policies outlined in the preceeding sub-section RELATIONSHIP TO APPLICABLE LAWS, POLICIES AND PLANS. However, the only wetland in the planning area that might be affected by alternatives considered in this study is a mudflat next to the Bay Bridge approach. The alternative for disposing of dredged material at this site was eliminated in the reconnaissance study on the basis of its adverse effects.

4.25 Transportation and Traffic. Port operations are dependent and have a significant effect on land transportation systems. Port-generated truck traffic and railroad operations contribute to air pollution and sometimes impact traffic on city streets and the Nimitz Freeway. The Posey and Webster Street Tubes allow traffic to pass beneath the existing navigation channel. Although transportation and traffic are significantly impacted by Port operations, no significant changes are expected by implementing either of the tentative alternatives.

4.26 Cultural Resources. On the basis of a cursory evaluation, it is likely that the Posey and Webster Street traffic tubes would be eligible for inclusion to the National Register of Historic Places and the National Architectural and Engineering Record. Because the tentatively selected Plan B would not impact these two tubes, further evaluation of the significance of these resources in compliance with Section 106 of the National Historic Preservation Act, has not been undertaken.

4.27 Additional cultural resources have been identified along the Inner Harbor, but because of their location outside the Plan-B project area, there is presently no further documentation and/or evaluation warranted. Appendix H discusses these resources, as well as provides an assessment of the potential for unknown cultural resources within the Plan-B study area.

4.28 In summary, the results of the above-mentioned assessment indicated a very low potential for prehistoric sites to exist along either bank of the Inner Harbor channel, or at the bottom of the present channel. The areas forming the current channel banks were either tidal flats or submerged landforms prior to importation of fill. It is very unlikely, though not impossible, that prehistoric cultural resources would have been situated in such environmental contexts. This determination is supported by the fact that major prehistoric shellmounds discovered in the Oakland/Alameda region during the early 1900s were found on land above sea level, commonly along estuary and bay shorelines.

4.29 The results of this research also indicated that there is very little or no potential for historic cultural resources to exist in the Plan-B project area, either at the bottom of the present channel in bay mud and sediments, or along the banks under the layer of imported fill. Remnants of maritime vessels that had participated in trans-oceanic trade were the primary historic resources considered in the research. It is possible that such ship remnants once existed in the Plan-B area since it is known that many vessels were abandoned in the Inner Harbor prior to the 1930s. However, because the cumulative channel improvements have extensively altered the channel over the years, and a Works Progress Administration project removed abandoned vessels in the 1930s and 1940s which were obstacles to ship traffic in the harbor, it is highly unlikely that any abandoned and/or sunken ship remnants have been preserved in the areas of the proposed Plan-B improvements.

SECTION 5 - EFFECTS OF ALTERNATIVE PLANS

5.01 This subsection briefly describes the effects of alternative plans on the significant resources identified earlier. The evaluation is for the no action alternative and an optimum plan of improvement labled Plan B. A summary comparison of impacts is presented on Table EIS-2 of this statement.

WATER QUALITY

5.02 Present Conditions. Waters in Oakland Harbor are generally less turbid than other areas of the bay, due to depths and protection from wind and waves common to more open fetches. However, the overall water quality is below that of Central San Francisco Bay. Point sources of pollution from storm drainage and poor circulation are contributing factors to lower quality surface waters. This assessent is based on previous studies and references listed in Natural Resources Appendix D and index for this report. Some groundwater has been pumped from wells penetrating the Merritt Sand and Alameda Formation. Brackish water of limited use (lawn and garden irrigation) has been pumped from other aquifers at shallower depth. It has not been determined whether local users will utilize of groundwater in the future.

5.03 Plan A - No Action. Except for occasional transient and localized pollution problems, water quality under the no action plan is expected to be about the same, if not improved, with continuing implementation of regulatory programs. With the deepening of Oakland Outer and Richmond harbors, about 1,214,000 c.y. of additional material will be disposed at Alcatraz each year.

5.04 Plan B - Optimum Plan of Improvement. The volume of initial dredging for this plan is estimated to be 5,100,000 c.y. The estimated construction time for new dredging work is twenty-four months. Implementation of this plan will not cause any significant degradation of water quality in Oakland Inner Harbor, only temporary turbidity increases and depressed dissolved oxygen levels. Ambient water quality is expected to return after the initial dredging is completed. Maintenance of navigation channels to a design depth of 43 feet is estimated to add 10,000 c.y. to the average 200,000 c.y. removed annually from the Inner Harbor.

5.05 Channel deepening may degrade groundwater quality by disturbing the salt water-fresh water interface. The State has expressed concern about impacting ground water quality. Further study will be pursued and the Corps of Engineers will properly mitigate any adverse effect that may result from Channel deepening (see Appendix G).

BENTHOS

5.06 Present Conditions. The Oakland Harbor Area is not rich in bottom fauna. Some locations in the harbor were dredged as early as 1874 and annual maintenance dredging of the 35-foot channel causes the bottom community to be in a constant state of flux. Many marine invertebrates have a free-floating larval stage which, after a period, reach a stage at which they migrate to the bottom. By this method, bottom organisms reestablish in areas that have been dredged. However, the overall productivity of a community is reduced because of the time requirement for recovery and limited number of organisms with the ability to adapt to such an environment. Historically, annual maintenance dredging and the heavy pollution associated with commerial shipping have resulted in a relatively unproductive biotic regime in the harbor. Some Coelenterates, Annelids, a few Bryozoans, and Arthropods still inhabit the estuary, and at certain times, polychaetes are abundant. The most predominant invertebrates are gaper and little-neck clams and ghost shrimp. Phytoplankton (free-floating microscopic plants, algae) makes up the principal plant life in the estuary. The shallow muddy floors of the Inner Harbor support growths of some larger algal forms: Chiefly Bryopsis corticulans, Ulva sp., and Gracilaria sjoestedtii.

5.07 Plan A - No Action. Due to deepwater navigation and maintenance dredging in Oakland Inner Harbor, the existing channel bottom would be kept in a state of change. Disposal operations at the Alcatraz disposal site are expected to continue, with possible additions of maintenance dredged material if Richmond and Oakland Outer Harbors are deepened.

5.08 Plan B - Optimum Plan of Improvement. The tentatively selected plan of improvement would generally have minimal effects on benthos since the dredging would occur in Inner Harbor and entrance channels presently maintained by the Corps of Engineers. However, widening at certain locations along the Inner Harbor would impact benthic communities not normally stressed by annual maintenance activities. Initial and future maintenance dredging would impact an additional 31.1 acres of benthic habitat.

ENERGY

5.09 Present Conditions. Fuels and electricity are used for transporting cargo, workers and operation of Port facilities.

5.10 Plan A - No Action. Energy consumption would increase with respect to the use of waterborne commerce if the channel is not deepened. The shipping industry is expected to increase vessel sizes. Without deepening, the channel could not accommodate fully-loaded deep-draft vessels. Either smaller vessels or larger vessels with lighter loads would experience tidal delays. Future port expansion and development would increase the amount of energy consumed to process cargo handling at the port.

5.11 Plan B - Optimum Plan of Improvement. This plan would maintain the existing channel configuration at a deeper depth. Benefits derived from channel deepening consist of transportation savings on cargo passing through Oakland Inner Harbor and savings in travel time. Transportation savings would accrue due to the use of larger ships transporting goods over the waterway, reducing the unit cost of transport.

HYDROGRAPHY

5.12 Present Conditions. In the San Francisco Bay complex, dredged shipping channels are out of equilibrium with the natural sedimentation processes. Maintenance of dredged channels is required for navigation purposes, since the channels, with few exceptions, will tend to regain the equilibrium depth of their surroundings. Sediment settling in deepened channels may be derived directly from sediment inflow to the Bay or it may be derived from some part of the resuspension-recirculation-redeposition cycle. Shoaling (sedimentation) rates in the dredged channels are not constant but vary from year to year, depending on the varible sediment inflow volume, wind-wave action and current velocities. During a season of exceptionally high sediment inflow into the Bay, dredged channels will normally experience higher sedimentation rates than usual. The same process occurs in the shallow areas where the energy level is low and accumulation of sediment is greatest. Similarly, flow velocities in dredged channels are usually not great enough to maintain depths required for navigation purposes. For this reason, sediment that accumulates in navigation channels will remain there until they are dredged.

5.13 Plan A - No Action. The existing depth of Oakland Inner Harbor navigation channel is -35' MLLW. Annual maintenance dredging of the channels is expected to continue. Existing hydrographic conditions would not change.

5.14 Plan B - Optimum Plan of Improvement. The plan would create a 43-foot deep channel which would serve vessel traffic projected to 2035. Annual maintenance dredging would increase to 210,000 c.y. About 10,000 c.y. would be added to the existing annual maintenance dredging quantities. The deeper channels would not change the volume of the tidal prism or current patterns.

COMMERCIAL SHIPPING

5.15 Present Conditions. Tidal delays tend to become more pronounced when deeper draft vessels operate in the 35-foot deep navigation channel. This has a negative effect on efficiency in commodity transport.

5.16 Plan A - No Action. Economic projections in Appendix B show containerized cargo tonnages handled by terminals along the Inner Harbor increasing from 2,150,000 in 1986 to 6,895,000 by 2006. Tidal delays will become longer and more costly for larger vessels coming into service. Light loading of others would tend to increase transportation costs. Larger vessels would have limited access to the Inner Harbor terminal facilities. Plans to redevelop Inner Harbor facilities would not achieve full potential for effectiveness.

5.17 Plan B - Optimum Plan of Improvement. Benefits equal to $34,866,000 a year in transporatation savings, due to reduced tidal delays and lower unit costs for waterborne commerce passing through terminals along the Inner Harbor, are estimated to result from deepening channels to 43 feet.

NAVIGATION SAFETY

5.18 Present Conditions. The Inner Harbor was originally designed for two-way traffic. Increased ship lengths and widths have made this impossible. In addition, the entrance channel requires widening to insure adequate maneuvering safety. An adequate area for the entrance and Inner Harbor channels would reduce hazards.

5.19 Plan A - No Action. Tidal conditions would determine adequate depths for safe passage of larger deep-draft vessels. Maneuvering at the entrance channel would be very limited. The risk of hazards or accidents is assumed to be directly proportional to the size of vessels, speed, channel dimensions, and number of boats utilizing the channel.

5.20 Plan B - Optimum Plan of Improvement. This plan would adequately meet the navigational safety objective.

ENDANGERED AND THREATENED SPECIES

5.21 Present Conditions. The least tern colony site is located on the Alameda Naval Air Station. The Naval Air Station serves as an active base for both aircraft and ocean-going vessels. It is bounded by water on three-sides; Oakland Inner Harbor Channel lies to the north. This nesting colony is considered to be the principal northern California nesting colony of the California least tern. Nesting sucess since 1979 has not been consistent. Only in 1981 was nesting success considered very good. Although the 1982 nesting activity at tha Naval Air Station was high (75 nests recorded), no young were known to survive. Management and monitoring programs implemented by the U.S. Navy in conjunction with the Golden Gate Audubon Society will continue through 1983.

5.22 Plan A - No Action. At this time, it is difficult to predict the future productivity of the nesting least terns at the Naval Air Station. The lack of construction activities related to channel deepening in the Oakland estuary would not necessarily affect the future reproduction success of the least terns since factors associated with the nesting site are presently influencing the outcome of survival of young. Although continued attempts in the future to improve the success of this nesting colony are anticipated, the limited number of young surviving during the last four years is foreboding.

5.23 Plan B - Optimum Plan of Improvement. Implementation of this plan would require about a two-year period of construction. No direct effects upon the nesting site would occur from project construction. However, dredging would occur in the Oakland estuary over this period of time. Short-term effects would include increased turbidity at the dredging site, increased traffic due to barge hauling dredged material to the disposal site and increased activity in the estuary from the dredging equipment. Existing available information is not adequate to define the role the Oakland estuary plays in the foraging habits of the least tern. Limited observations made during the 1982 nesting season indicated that most tern feeding occurred to the south and southeast of the nesting site. However, because of the sensitive nature of the nesting colony and its limited reproductive success, any disturbance related to foraging, however slight, must be considered potentially harmful. Consultation with the U.S. Fish and Wildlife Service in accordance with the requirements of Section 7, Endangered Species Act, as amended, has been requested in conjuction with the review period of this Draft Environmental Impact Statement (see Appendix D).

SECTION 6 - PUBLIC INVOLVEMENT

6.01 Public Involvement Program. A Reconnaissance Report on results of stage 1 studies was distributed to a limited number of State and Federal Agencies, the Port of Oakland and local interests in Alameda in February 1981. This Reconnaissance Report described initial studies and included a plan of study. Comments generated included: (1) existing intertidal habitat along the inner harbor shore should not be lost; (2) potential for greater environmental effects from new dredging or channel widening should be discussed; (3) any dredging work to be performed should be accomplished by least environmentally damaging method or mix of methods; (4) the availability of hopper dredges should be clarified; (5) Port of Oakland fill was opposed; (6) emphasis was placed on potential for adverse effects upon Posey and Webster Streets tubes; (7) impacts to State highways and local arterials for traffic and transportation impacts generated by growth potential should be assessed; (8) disposal of dredged material at the Alcatraz site should be performed on ebb tide; (9) until demonstrated otherwise, the Merrit Sand and Alameda Formation are considered to be usable significant sources of groundwater. The intermediate public meeting to discuss findings of the plan formulation document was held in July 1982. A stage 2 report, or plan formulation document, was prepared and received limited distribution. At this public meeting, widespread support was demonstrated by various users representatives. Additional significant comments were provided: (1) two maneuvering areas should be incorporated into the proposed channel improvements - one at middle harbor terminal and a second at the Grove Street slip; (2) feasibility of commercial uses of sandy material; and (3) turn widening at mile three would impact mooring and dry dock facilities of Todd Shipyards. A final public meeting will be held after circulation of the Draft Feasibility Report and Environmental Impact Statement.

6.02 Required Coordination. Remaining coordination to be completed with the circulation and review of this Draft EIS includes: (1) the receipt of the U.S. Fish and Wildlife Service biological opinion in accordance with the Endangered Species Act; (2) filling of the Final EIS with EPA; (3) concurrence from the State Historic Preservation Officer on cultural resources; and (4) compliance with the Fish and Wildlife Coordination Act requirements to include the Final Report of the U.S. Fish and Wildlife Service in the report to be submitted for project authorization.

6.03 Statement Recipients.

I. FEDERAL

-Advisory Council on Historic Preservation

-Federal Maritime Commission, Pacific District

U.S. Department of Commerce
- -Region IX
- National Oceanic and Atmospheric Administration
    - -National Marine Fisheries Services, Southwest Region

Maritime Adminstration
-Western Region
-Economic Development Administration

U.S. Department of the Interior
-Office of the Secretary, Pacific Southwest Region
-Regional Environmental Officer
Fish and Wildlife Services
-Region 1
-Division of Ecological Services
-Endangered Species Office
Geological Survey
National Park Service
-Interagency Archaeological Services
-Western Region

U.S. Department of the Navy
-Twelfth Naval District
-Navy Public Works Center, San Francisco Bay Region

U.S. Department of Transportation
Coast Guard, Twelfth District
-Aids to Navigation Branch
-Vessel Traffic Service
-Federal Highway Administration, Region IX

U.S. Environmental Protection Agency
Region IX
-Librarian
-EIS Coordinator
-Office of Federal Activities

U.S. Representatives in Congress
-Honorable Eugene A. Chappie
-Field Representative to Eugene A. Chappie, Chico
-Honorable Ronald V. Dellums
-Field Representative to Ronald V. Dellums, Oakland

U.S. Senators
-Honorable Alan Cranston
-Field Representative to Alan Cranston, San Francisco
-Honorable Pete Wilson
-Field Representative to Pete Wilson, San Francisco

II. STATE

Business, Transportation and Housing Agency
-Department of Transportation
-CALTRANS

The Resources Agency
-Air Resources Board, Evaluation and Planning Branch
-Department of Conservation

Department of Fish and Game
- -Region 3
- -Marine Research Branch

-Department of Boating and Waterways
-Department of Navigation and Ocean Development
-California Regional Water Quality Board, San Francisco Bay Region (under Water Resources Control Board)
-Department of Water Resources, Statewide Planning Branch
-California State Lands Commission
-San Francisco Bay Conservation and Development Commission
-State Historic Preservation Officer

-State Clearinghouse, Office of Planning and Research

III. REGIONAL, COUNTY AND CITY

Alameda County
-Board of Supervisors
-Planning Department
-Department of Public Works

Association of Bay Area Governments
-Executive Director
-Plan and Project Review Division

-BART, Director of Planning

-Bay Area Air Pollution Control District

City of Alameda
-Postmaster
-Bureau of Electricity

City of Oakland
-Mayor
-Director of City Planning
-Main Library
-Postmaster

City of Richmond
-Planning Director
-Main Library
-Postmaster

City of San Francisco
-Environmental Review Officer
-Main Library

-East Bay Regional Park District

-Metropolitan Transportation Commission

IV. INTEREST GROUPS (including conservationists, ecologists, environmentalists, pilot associations, recreational boating associations, educational institutions and local businesses)

-American President Lines, LTD

-Bar Pilots Association

-California Inland Pilots Association Custom House

-California Tomorrow

-California Wildlife Federation

-Center for Urban Affairs, Northwestern University

-Department of Biology, S.F. State University

-Ecology Center (Berkeley, San Francisco)

-Environmental Defense Fund

-Golden Gate Audubon Society

-Kaiser Engineers

-Law's School of Marine Engineering

-League of Women Voters

-National Audubon Society, Western Representative

-Oakland Chamber of Commerce

-Oceanic Society, S.F. Bay Chapter

-Ohlone Audubon Society

-People for Open Space

Port of Oakland
- -Director
- -Board of Harbor Commissioners

-Port of Redwood City

-Port of Richmond

-Port of San Francisco

-Ports & Terminals Bureau, Inc., Northern California

-Save San Francisco Bay Association

-Shipyard and Marine Ship Laborer's Union No. 886

Sierra Club
- -S.F. Office
- -Conservation Chairman, S.F. Bay Chapter

-Society of California Archaeology, California State University

-Todd Shipyard Corporation, San Francisco Division

-United States Lines

6.04 Public Views and Responses (Appendix I). Several public views and concerns had major influence on the study and were incorporated into the assessment and evaluation process of the study. Briefly, some of the public concerns and their roles in the conduct of the study are described below:

-Potential for greater environmental (ecological) effects from new dredging or channel widening should be discussed. The Bar Channel width would not be altered from that width determined to be adequate for safety in the Oakland Outer Harbor project (as mentioned previously, model studies will be performed to determine the appropriate width at the Bar Channel). Channel widening of the inner harbor channels considered in this analysis is the minimum required for safe navigation.

-Disposal of dredged material at the Alcatraz disposal site should be performed on ebb tide. This recommendation was incorporated into the disposal operation.

-Two maneuvering areas should be considered in the proposed improvements. After analysis, these recommendations were incorporated into the proposed improvements within the physical constraints of the channel configuration existing at the two locations.

-Because of the potential for adverse effects upon the Posey and Webster Streets tubes (underground traffic corridors), a distance of about 650 feet has been maintained to provide a buffer area between the upper limit of the channel improvements and the tubes.

-The Merrit Sand, and Alameda Formation aquifers have been identified as potential usable sources of groundwater. Further intensive study has been included to identify the extent of the aquifer and to establish mitigative measures to alleviate or remove the potential for adverse effects.

-The improvements proposed during plan formulation were noted to affect mooring and dry dock facilities of Todd Shipyards. As a result, channel widening at about mile three was reduced to avoid such encroachment.

LIST OF PREPARERS

Name and Responsibility	Expertise	Experience	Professional Discipline
Richard Stradford (Cultural Resources)	Archaeology	2 Years Cultural Resource Managment	Archaeologist
Lester Tong (EIS Coordinator)	Biology	10 Years EIS and	Zoologist
Frank Andres (Economist)	Economics	16 Years, Transportation and Navigation Economics	Economist
Robin Mooney (Chief of Project Evaluation Section)	Navigation and Coastal Planning	11 Years, EIS, and Technical Reports,	Civil Engineer
Frank Best	Engineering	Years, Engineering and Design	Civil Engineer

The above listed staff were primarily responsible for preparing this Draft EIS.

INDEX

INDEX (Cont'd)

INDEX (Cont'd)

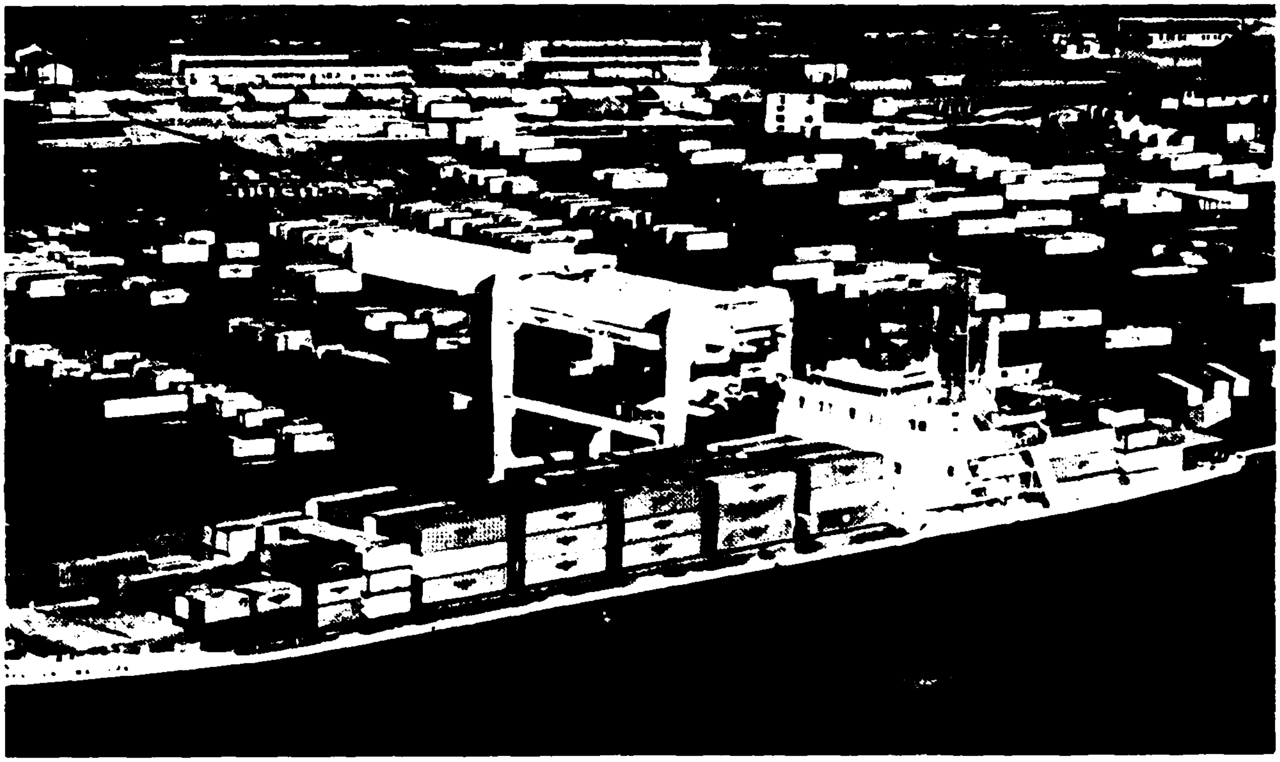
INDEX (Cont'd)

INDEX (Cont'd)

FEASIBILITY STUDY AND
ENVIRONMENTAL IMPACT STATEMENT

OAKLAND INNER HARBOR
CALIFORNIA

APPENDICES



DEEP-DRAFT NAVIGATION

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

San Francisco District

JULY 1983

OAKLAND INNER HARBOR, CALIFORNIA

CONTENTS

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

APPENDIX A

ENVIRONMENTAL ASSESSMENT OF MANAGEMENT MEASURES

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

JUNE 1983

APPENDIX A

ENVIRONMENTAL ASSESSMENT OF MANAGEMENT MEASURES

TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX A

ENVIRONMENTAL ASSESSMENT OF MANAGEMENT MEASURES

METHODOLOGY

A broad range of alternative management measures for improvement of the deep draft navigation channels in Oakland Inner Harbor were considered in this study. Preliminary evaluation of the impacts of alternative scopes of channel dredging and sites for disposal of dredged material began with the construction of "Impact Trees" shown on Figures 1 and 2. This procedure was used to identify resources likely to be beneficially or adversely affected by the alternative management measures. A qualitative assessment of impacts that alternative management measures would have is shown in Table A-1. Definitions of Study Area Elements are listed on Table A-2.

MANAGEMENT MEASURES

Narrative descriptions of alternative dredging sites and disposal sites evaluated in this study are provided in the following paragraphs. Descriptions of dredging methods are described in the main report but not in this appendix since their impacts occur at the dredging sites and disposal sites. The narrative for each management measure includes a summary of the preliminary assessment of impacts that the measure would have on significant resources in the study area.

NO ACTION. This alternative would retain the existing 35-foot deep navigation channel with its periodic maintenance dredging program. The most significant change would be the increasing navigation hazard as bigger ships come into Oakland Inner Harbor. This would increase transportation delays for commercial shipping. The no action alternative is the basis from which the impact of other alternative plans are measured and therefore by definition causes no impacts.

DREDGING SITES

4-MILE REACH. This measure includes deepening of the reach from the harbor entrance to Clay Street Piers from 35 to 43 feet below mean lower low water datum. There would be a short-term adverse effect from sediment disturbance of dredging activities; there would be an increase in turbidity and a depressed dissolved oxygen level due to dredging. Long-term effects would depend on use of the channel and regulations to control water pollution. Bottom organisms living in the dredged area would be removed and displaced from the channel, however replenishment of the disturbed areas by bottom species can be expected. Deepening of this reach would have a significant benefit to existing and future deep-draft vessels expected in the harbor, by reducing potential hazards and delays.

6-MILE REACH. This measure includes deepening of the reach from the harbor entrance to Fortman Turning Basin from 35 to 43 feet below mean lower low water datum. This would include replacement of the two submarine tubes with a high arch bridge and extension of the 4-mile reach to include a larger area of the Inner Harbor. The measure would also involve short-term adverse effect of turbidity due to dredging. Removal of the Posey-Webster Street tubes could significantly increase this turbidity. Removal of the submerged tubes and bridge construction would require temporary rerouting of traffic which would adversely impact air quality in localized areas outside the project area. Rerouting of traffic due to tube removal could also temporarily affect fuel consumption by usual automobile traffic. Removal of the submerged tubes would have a temporary adverse impact on traffic. Although temporary, the effect would be significant for Naval Air Station traffic, College of Alameda traffic, and buses and cars which would be rerouted until a bridge was constructed. There would be resulting increases in noise, air pollutants and travel time for the rerouted traffic as well as secondary impacts to area residents. The Posey-Webster Street submerged traffic tubes are considered an historic structure. Removal of them would be a significant adverse effect.

WIDENED ENTRANCE BAR CHANNEL. Increasing the existing Bar Channel width from 800 feet to 1,000 feet was considered during the initial plan formulation stage of this study. However, advanced engineering and design studies for the authorized Oakland Outer Harbor navigation improvements are also underway. Since a model simulator for Oakland Outer Harbor improvements will be performed in the advanced design stage, width consideration to support unrestricted two-way traffic for large vessels presently in operation during all tidal conditions of the Bar Channel would be investigated. For purposes of this report, the Bar Channel width will remain 800 feet until such further investigations determine otherwise. Any modification to the Bar Channel width undertaken under the Oakland Outer Harbor improvements would not significantly affect the Oaklnad Inner Harbor improvements. Since the difference in recommended chanel depths between the two projects is only one foot.

DEEPENED ENTRANCE BAR CHANNEL. This measure involves deepening the 42 foot deep entrance Bar Channel, authorized by the Oakland Harbor project an additional foot to 43 feet for better access of larger ships into Oakland Inner Harbor. The 43-foot depth was determined to have the maximum net benefits for the Oakland Inner Harbor facilities.

DISPOSAL SITES

100-FATHOM (OCEAN). The site (SF 7) is located south of the Farallon Islands at Latitude 37°31'45"N and Longitude 122°59'00"W, 29.6 nautical miles from the Golden Gate. The depth is 100 fathoms or 600 feet. Determination to use this site is on a case-by-case basis. The site is now located within the newly-designated Point Reyes/Farrallon Islands Marine Sanctuary and is no longer available for use, although a replacement site may be designated in the future. Mixing characteristics are not as pronounced as found other sites. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. The long distance from Oakland Inner Harbor would significantly increase the amount of fuel used, versus other disposal methods.

BAR (OCEAN). This site (SF 8) is parallel to and 6,000 feet south of the San Francisco Bar Channel five miles outside the Golden Gate. The site has been used for sand disposal. Placement of silty-clay at the site could result in longer periods of turbidity. Disposal could increase the probability of introducing dissimilar sediments into the littoral environment. Increased bottom turbidity and associated dissolved oxygen depression have the potential to smother benthic organisms at the site. However, organisms inhabiting the Bar are generally evolved for efficient locomotion and the ability to escape sustained burial. The long distance, although less than the 100-fathom site, would significantly increase the fuel consumption of a deepening project, versus use of closer disposal sites.

BAY DISPOSAL. There are three Bay aquatic disposal sites which have been designated for continued use as dredged material desposal sites. Carquinez Strait (SF 9) is 0.8 nautical miles from Mare Island Straits entrance; San Pablo Bay (SF 10) is 2.6 nautical miles northeast of Point San Pedro; Alcatraz (SF 11) is about 0.3 nautical miles south of Alcatraz Island.

Due to the distance of SF 9 and 10 from Oakland Inner Harbor and the closer proximity of SF 11 to the Golden Gate Bridge, the Alcatraz Site has been selected for further evaluation. It is preferable environmentally. The site is characterized as a deep, high energy area, dynamic both physically and biologically. Material dispersion of unconsolidated sediments is expected to occur within several minutes. Associated with sediment disturbance are certain temporary chemical changes in the water column. Since Bay mud is typically in an oxygen deficient state, oxygen is taken from the water column when the sediment is resuspended during disposal. This oxygen reduction in the water is localized at the disposal site and is short-lived. Toxic substances also associated with Bay sediments have not been found to be readily released from sediment attachment and into the water column.

The Alcatraz disposal site is considered a high energy area characterized by high currents and scouring of the bottom. Animals residing in this area will experience some burial during disposal because consolidated material (stiff clays) will not be readily dispersed. It is expected that losses at the disposal site would be minimal since marine organisms in the water column (plankton and fish) will not be adversely affected. Prolonged increases in turbidity over ambient levels could, among other effects, impair filter feeding organisms. Any such effect resulting from the proposed disposal activities would be very temporary and localized due to the non-continuous discharge schedule.

PORT OF OAKLAND FILL. This is a potential fill site in Oakland Outer Harbor next to the east approach to the Bay Bridge. It is a 190-acre site, primarily Bay. This site is the only alternative for nearby fill. By filling the site, the capacity of the Outer Harbor could be nearly doubled. The need for such expansion is not expected until about year 2000 and may be accommodated at more favorable sites. Bay fill could significantly affect water circulation in Oakland Outer Harbor, impacting sedimentation and thus maintenance dredging requirements. The potential for short-term degradation of local water quality could increase which reduced circulation.

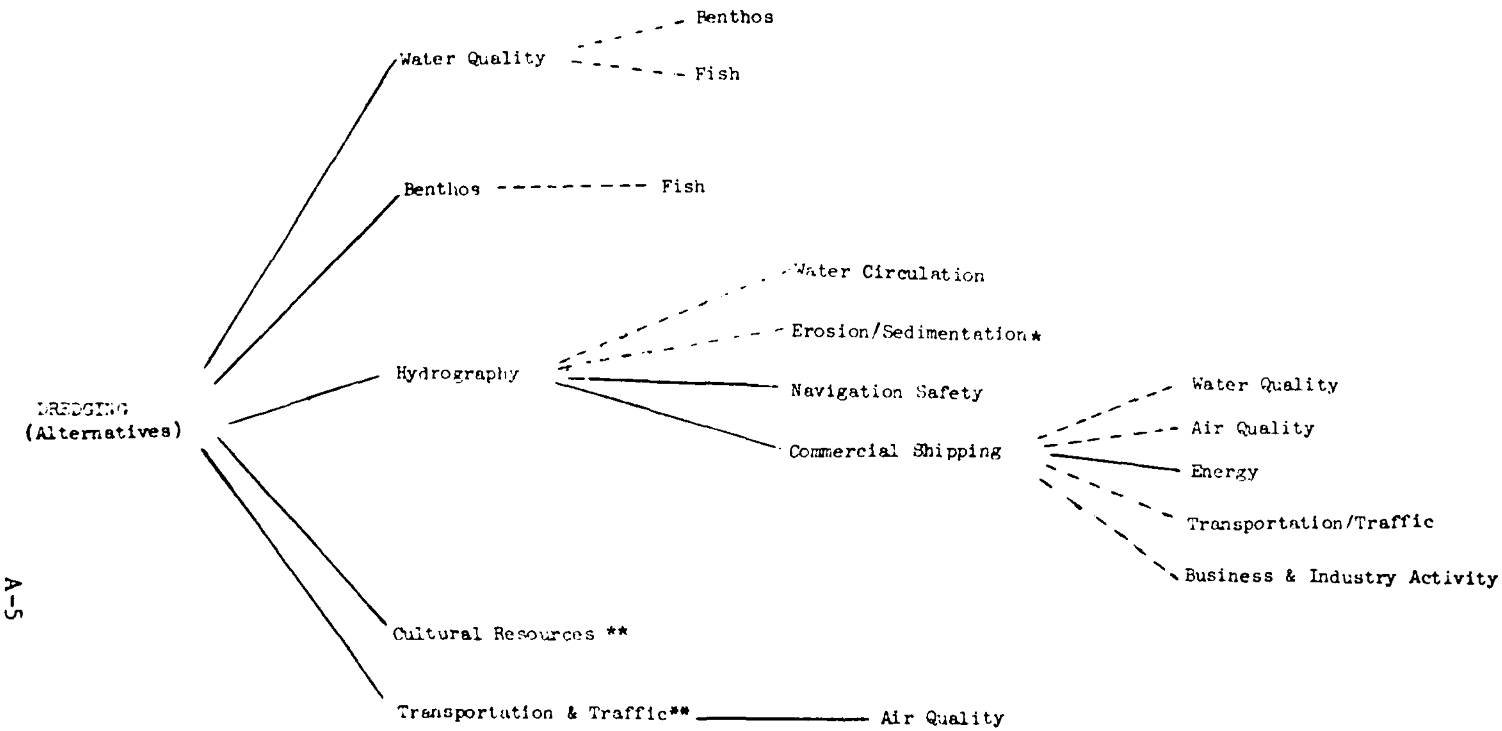
Fill would cover a considerable amount of benthic habitat. There also is an area of mud flat at the site. Covering of organisms that inhabit the mud flat would be a significant adverse impact on higher trophic levels that depend on them for food; diving waterfowl and bottom feeding fish in particular. Some type of mitigation would be required for any Bay fill. Fill activities would have some minor impacts on the navigation channel at Oakland Outer Harbor by adding dredge, barge and/or pipeline into the existing traffic area. A development on the fill would increase the amount of vessel activity in the navigation channel. Fill and ultimate port development would significantly benefit commercial shipping at Port of Oakland and would increase traffic and cargo transportation activities in the area. Future studies would be needed to evaluate traffic and resultant air quality impacts if this alternative is seriously considered.

PUMP TO DELTA. The use of pipelines for long distance transport of dredged material to reconstruct existing peripheral levees on the Delta Islands has received serious consideration. Additional costs would be incurred due to the need for retention dikes to contain and to process or "condition" the slurry dredged material for fill purposes. Extended time would be required to drain, evaporate and scarify the Bay mud before it is suitable for the repair and reinforcement of levees. Also, the use of dredged material for levee enhancement is limited to selected sites because of the low erosion resistance of most to the dredged material in the Bay. Because of the potential for dike failure and area settling, rehandling and transportation costs involved, as well as the navigational problems presented by direct pipelines; transporting material to the Delta levees is not considered feasible at this time.

MARSH CREATION. Section 150 of the Water Resources Development Act of 1976 provides for marsh creation with dredge sediments to restore the environmental quality lost by historic marsh destruction. Restoration of marsh at various salt ponds in the South Bay has been considered in other projects, but their locations and limited capacity have hampered implementation. If used for disposal, the area would be consolidated, graded and planted and the external dikes breeched to restore tidal action to the area. The pump distance for this measure would be about 30 miles from Oakland Inner Harbor.

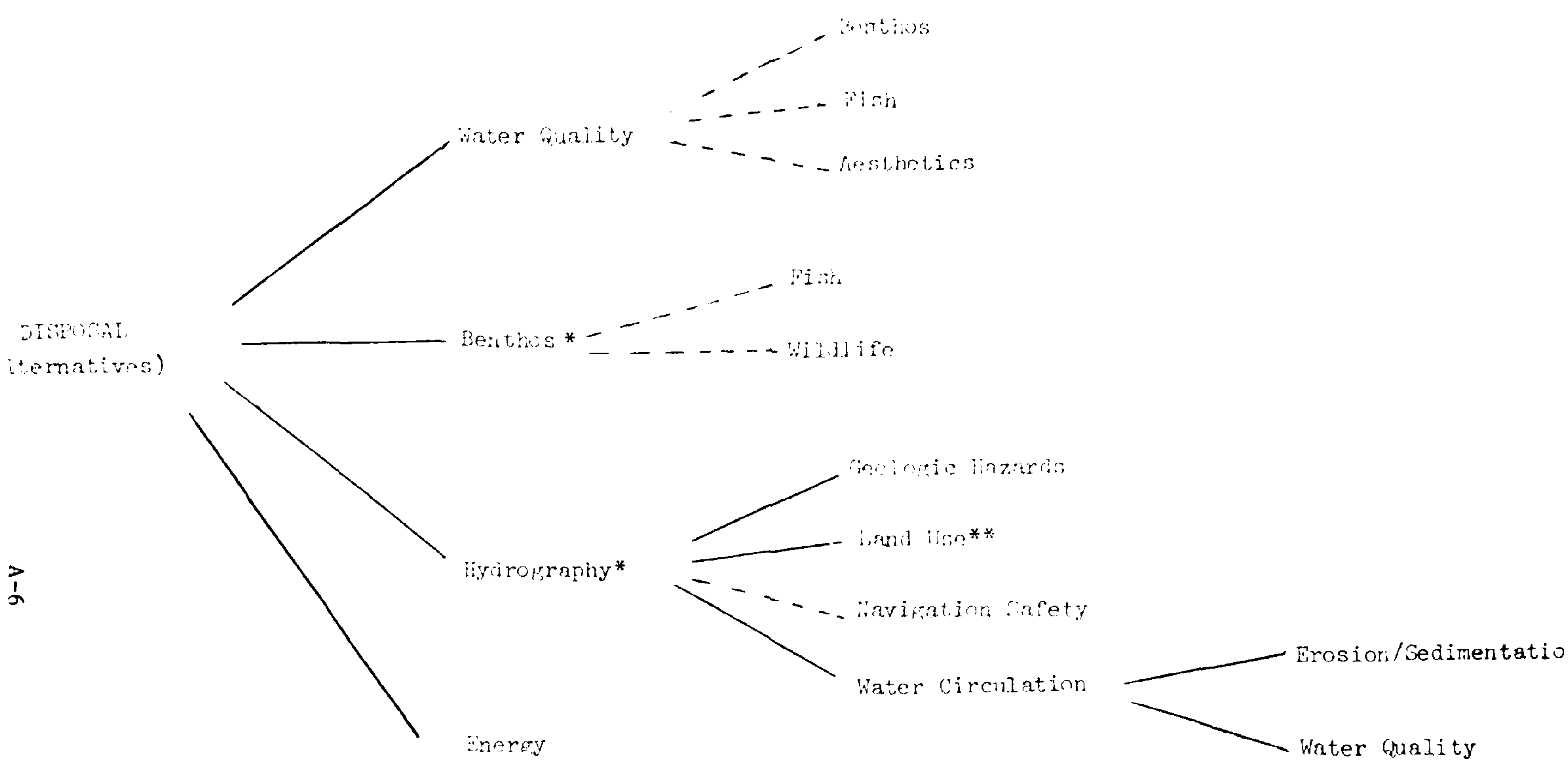
UPLAND DISPOSAL The only upland disposal site known to exist in the study area is a proposed development called Alameda Marina Village on 156 acres of land in Alameda, along the Inner Harbor Channel east of the Webster Street and Posey tubes. Although the area is a potential recipient over the next 7 to 10 years for some dredge material, the developer has stated that excavation activities planned for development of the area will create an excess of material over that required for fill and therefore fill from a Corps project is not needed. Due to the lack of an available upland disposal site, this management measure was not considered feasible.

GENERAL IMPACT TREE
DREDGING



——— has significant impact on
---- has moderate impact on
* a possible impact unknown at this time
** 6-mile reach only

GENERAL IMPACT TREE
DISPOSAL



* Bay fill only
** Significant secondary impacts due to land use change (Bay fill) not assessed.

—— Has significant impact on
---- Has moderate impact on

TABLE A-1

IMPACTS OF MANAGEMENT MEASURES

ELEMENTS / MANAGEMENT MEASURES	No Action	4-Mile Reach	6-Mile Reach	Dredge Entrance Inner/Outer Harbor	Deepen Entrance Bar Channel	Disposal 100-Fathom	Disposal Bar	Bay Aquatic Disposal	Bay Fill Outer Harbor	Pump to Delta	Create Marsh
PHYSICAL ENVIRONMENT Topography	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Elevation of area due to fill.	Elevation of area due to fill.	Elevation of area due to fill.
Hydrography	No change	Deepen 4 miles of channel to -43 feet MLLW.	Deepen incremental 2 miles of channel to -43 feet MLLW.	Deepen shoal between Inner & Outer channel intersection plus 8[illegible]-foot wide entrance bar channel to -43 feet MLLW.	Deepen 1000-foot wide channel to -43 feet MLLW.	No impact	No impact	No impact	Loss of harbor water area due to fill.	Unknown impact	Unknown impact
Geologic Hazards	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Unstable Bay Mud is a geologic hazard when used as fill.	Unstable Bay Mud is a geologic hazard when used as fill.	Unstable Bay Mud is a geologic hazard when used as fill.
Water Quality	No change	Temporary increase in turbidity, depressed dissolved oxygen levels.	Temporary increase in turbidity, depressed dissolved oxygen levels.	Temporary increase in turbidity, depressed dissolved oxygen levels.	Temporary increase in turbidity, depressed dissolved oxygen levels.	Mixing characteristics not as pronounced as other sites.	Silty clay could result in longer periods of turbidity.	Temporary turbidity & depressed dissolved oxygen levels during disposal.	Potential for degradation as circulation patterns are altered.	Unknown impact	Short-term impact during disposal, grading & initial introduction of tidal action.
Water Circulation	No change	Deeper channel would increase water circulation in the Inner Harbor.	Deeper channel would increase water circulation in the Inner Harbor.	Deeper area would increase water circulation at the channel intersection.	Deepened area would increase water circulation of the entrance bar channel.	No impact	No impact	No impact	Alteration of circulation patterns by fill of harbor.	Unknown impact	Unknown impact
Wave Action	No change	Unknown impact	Unknown impact	Unknown impact	Unknown impact	Unknown impact	Unknown impact	Unknown impact	Unknown impact	No impact	Unknown impact

TABLE A-1 CONT'D

IMPACTS OF MANAGEMENT MEASURES

ELEMENTS / MANAGEMENT MEASURES	No Action	4-Mile Reach	6-Mile Reach	Dredge Entrance Inner/Outer Harbor	Widen Entrance Bar Channel	Disposal 100-Fathom	Disposal Bar	Bay Aquatic Disposal	Bay Fill Outer Harbor	Pump to Delta	Create Marsh
Erosion/ Sedimentation	No change	Unknown impact	Unknown impact	Unknown impact	Unknown impact	No impact	No impact	No impact	Unknown impact	Unknown impact	Unknown impact
Sediment Quality	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Unknown impact	Unknown impact	Unknown impact
Air Quality	No change	No impact	Posey/Webster Street Tubes removal would impact air quality due to re-routed traffic.	No significant impact	No impact	No impact	No impact	No impact	Secondary impacts not assessed.	No impact	No impact
Noise	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Secondary impacts not assessed.	No impact	No impact
BIOLOGICAL ENVIRONMENT											
Plankton	No change	Unknown impact	Unknown impact	Unknown impact	Unknown impact	No significant impact.	No significant impact.	No significant impact.	Loss of habitat.	No significant impact.	Unknown impact
Benthos	No change	Dredging removes and displaces bottom organisms.	Dredging removes and displaces bottom organisms.	Dredging removes and displaces bottom organisms.	Dredging removes and displaces bottom organisms.	Disposal has the potential to smother benthos.	Disposal has the potential to smother benthos.	No significant impact.	Smothering of benthos and loss of habitat.	Unknown impact	Unknown impact
Fish	No change	No significant impact	No significant impact.	No significant impact.	No significant impact.	Disposal has the potential to disturb fish.	Disposal has the potential to disturb fish.	No significant impact.	Loss of habitat due to Bay fill.	Unknown impact	Unknown impact
Mammals	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Unknown impact	Added habitat value for wildlife.
Wetland Vegetation	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Unknown impact	Unknown impact	Added habitat value for wetlands.
Rare and Endangered Species	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Unknown impact	Unknown impact	Added habitat value for species dependent on wetlands.

TABLE A-1 CONT'D

IMPACTS OF MANAGEMENT MEASURES

ELEMENTS / MANAGEMENT MEASURES	No Action	4-Mile Reach	6-Mile Reach	Dredge Entrance Inner/Outer Harbor	Widen Entrance Bar Channel	Disposal 100-Fathom	Disposal Bar	Bay Aquatic Disposal	Bay Fill Outer Harbor	Pump to Delta	Create Marsh
SOCIO-ECONOMIC ENVIRONMENT											
Number of Inhabitants	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Government & Civic Activity	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Current emphasis against Bay fill.	Some agencies favor this action.	Current emphasis is for marsh creation.
Land Use*	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Addition of developable land.	Addition of developable land.	Addition of wetland, considered beneficial by many agencies and groups.
Desirable Community Growth	No change	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.	No impact	No impact	No impact	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.
Desirable Regional Growth	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Community Cohesion	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Advocated by many groups in Bay area.
Aesthetic Quality	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Significant impact from loss of 190 acres harbor to developable fill.	Negative impact of equipment and fill, temporarily.	Beneficial impact of restored wetland with resultant wildlife use.
Cultural Resources	No change	No impact	Significant impact by loss of Posey Tube.	No impact	No impact	No impact	No impact	No impact	Unknown impact	Unknown impact	Unknown impact
Recreation & Leisure	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Boating	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Transportation & Traffic	No change	No significant impact.	Significant impact on vehicle traffic between Oakland & Alameda due to loss of Posey/Webster Street Tubes.	No impact	No impact	No impact	No impact	No impact	Disturbance to traffic due to fill and development.	No impact	No impact
Public Facilities	No change	No significant impact.	No significant impact.	No significant impact.	No significant impact.	No impact	No impact	No impact	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.

* Significant secondary impacts, due to change in land use as a result of management measure implementation, were not considered in this report.

TABLE A-1 CONT'D

IMPACTS OF MANAGEMENT MEASURES

ELEMENTS / MANAGEMENT MEASURES	No Action	4-Mile Reach	6-Mile Reach	Dredge Entrance Inner/Outer Harbor	Widen Entrance Bar Channel	Disposal 100-Fathom	Disposal Bar	Bay Aquatic Disposal	Bay Fill Outer Harbor	Pump to Delta	Create Marsh
Local Government Finance	No change	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.	No impact	No impact	No impact	Secondary impacts not assessed.	No impact	No impact
Business/Industrial Activity	No change	Dredging will benefit businesses dependent on commercial shipping	Dredging will benefit businesses dependent on commercial shipping.	Dredging will benefit businesses dependent on commercial shipping.	Dredging will benefit businesses dependent on commercial shipping.	No impact	No impact	No impact	Area for development would benefit business and industrial growth in the Port.	No impact	No impact
Natural Resources	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Fill would eliminate 190 acres of Bay.	No impact	Beneficial restoration of former marsh.
Man-Made Resources	No change	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Employment/Labor Force	No change	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.	Secondary impacts not assessed.	No impact	No impact	No impact	Secondary impacts not assessed.	Unknown impact	No impact
Commercial Shipping	Existing depths will adversely affect future use of larger, deeper vessels.	Significantly benefit future use of deeper draft vessels.	Significantly benefit future use of deeper draft vessels.	Significantly benefit future use of deeper draft vessels.	Significantly benefit future use of deeper draft vessels.	No impact	No impact	No impact	Addition of developable land would benefit shipping industry at the Port.	No impact	No impact
Energy	No change	More efficient use of the channel would reduce fuel consumption.	More efficient use of the channel would reduce fuel consumption. Rerouted traffic would require more fuel consumption.	More efficient use of the channel would reduce fuel consumption.	More efficient use of the channel would reduce fuel consumption.	Travel distance would consume considerable amounts of fuel.	Travel distance would consume considerable amounts of fuel.	Less fuel consumption than ocean disposal.	No significant impact due to fill activities.	Pump distance would consume fuel as would equipment at the disposal site.	Pump distance would consume fuel as would equipment at the disposal site.
Navigation Safety	Existing depths & widths would be less safe for larger & deeper draft vessels.	Deeper channel would benefit safe use of the channel.	Deeper channel would benefit safe use of the channel.	Deeper and wider channel would benefit safety of the channel.	Deeper and wider channel would benefit safety of the channel.	No significant impact	No significan impact	No significant impact	No significant impact	Pipeline could be a hindrance to navigation.	Unknown impact

TABLE A-2

DEFINITIONS OF STUDY AREA ELEMENTS

PHYSICAL ENVIRONMENT

Topography - The surface features of the study area.

Hydrography - The underwater features of the study area.

Geologic Hazards - Hazards stemming from the geology, such as seismicity, liquefaction and tsunamis.

Water Quality - Quality of the water as it pertains to established criteria.

Water Circulation - Movement and mixing of water.

Wave Action - The action of waves.

Erosion/Sedimentation - Removal and deposition of material by water.

Prime & Unique Agricultural Land - Cropland, pastureland, rangeland, forest land or other land, but not urban built-up land, which is capable of being used as (1) prime or lands whose value derive from their general advantage as cropland due to soil and water conditions; or (2) unique of lands whose value derive from their particular advantage for growing specialty crops. The U.S. Soil Conservation Service determine these designations.

Sediment Quality - The chemical and physical properties of sediments in the study area.

Air Quality - The condition of the air in and adjacent to the study are in terms of its fitness to support life.

Noise - Sound without value.

BIOLOGICAL ENVIRONMENT

Plankton - Free floating microscopic plant and animal life.

Benthos - Bottom dwelling flora and fauna.

Fish - Free swimming cold-blooded aquatic animals.

Wildlife - The fauna found in the project area.

Wetland Vegetation - Plants which tolerate or are adapted to saturated soil conditions.

Rare & Endangered Species - Flora and fauna that has been designated as rare or endangered by State and Federal authorities.

TABLE A-2
continued

SOCIO-ECONOMIC ENVIRONMENT

Number of Inhabitants - Number of people inhabiting the study area.

Government and Civic Activites - Activities by government entities at various levels.

Land Use - Use of the land within the study area.

Displacement of Population. The act whereby an entity acquires land and associated facilities, requiring residents to move elsewhere.

Desirable Community Growth - Community growth is defined as an increase in community population with a corresponding increase in community services and facilities. Community growth is desirable when it is consistent with stated community goals and values.

Desirable Regional Growth - The rates of economic and population growth in a region that are consistent with publicly defined objectives.

Community Cohesion - Community cohesion is the unifying force of a group due to one or more characteristics providing a commonality.

Aesthetic Quality - Aesthetics refer to the perception of natural and manmade beauty and the judgment involved in deciding what is beautiful.

Cultural Resources - Any building, site, district, structure, object, data or other material significant in history, architecture, science, archeology or culture.

Recreation & Leisure - Any form of play, amusement or relaxation engaged in during leisure time and facilities utilized in such activities.

Transportation and Traffic - Transportation is defined as the type, ease and degree of accessibility to desired locations by people from both local and regional points or origin. Traffic is defined as the movement of vehicles along roadways within the study area.

Public Facilities & Services - The availability and adequacy of facilities and services for the public.

Local Government Finance - Tax revenues, bonds, property values, public facilities and public services are some of the component parts of local government finance.

Business & Industrial Activity - Business and industrial activity comprises all producers of goods and services - they include all firms engaged in such production.

Natural Resources - Actual and potential forms of wealth existing in nature, including both living and non-living resources.

TABLE A-2
continued

Man-made Resources - Structures, objects, or sites which have been planned, designed and constructed by man.

Employment/Labor Force - Employment consists of remunerative engagement in any occupation, business, trade or profession. The labor force consists of all persons 16 years of age and over.

Commercial Shipping - The business of shipping goods by private enterprise.

Energy - Power from the burning of fossil fuels, the operation of nuclear power plants, the tapping of geothermal and hydroelectric power sources, and other sources such as the wind, the sun, tidal action, and hydrogen.

Navigation Safety - The safe operation of water craft upon a waterbody.

Agricultural Activity. - Agriculture is the production of plants and animals useful to man, including processing and distribution for man's use.

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

APPENDIX B
ECONOMIC EVALUATION

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

JUNE 1983

OAKLAND INNER HARBOR CALIFORNIA
APPENDIX B
ECONOMIC EVALUATION

GENERAL

B-1. Presented in this section is an evaluation of benefits associated with the deepening of Oakland Inner Harbor. These benefits vary from $16,951,000 average annual for 37 feet to $35,296,000 for 45 feet (Table B-13).

B-2. A proposed project is considered economically justified if the average annual benefits equal or exceed the average annual costs. If more than one channel depth is justified, than the optimum depth, which has the greatest net benefits, is selected for recommendation. For purposes of analysis the project is considered to have an economic life of 50 years. Project year one is considered to be 1986. All benefits and costs are in January 1981 price levels, and were calculated using the FY-82 Federal discount rate of 7-5/8 percent.

THE NEED FOR CONTAINER FACILITIES

B-3. Underlying the desire for improved navigational channels at Oakland Inner Harbor is the need for additional container facilities in the Bay Area. Recent studies conducted by the San Francisco District Army Corps of Engineers indicate that the existing facilities at Bay Area ports are insufficient to meet long-term needs of container operations in the Bay Area.

B-4. Non-container shippers also use the channel, but an examination of their current and projected operating drafts indicated they would not benefit from the channel deepening. Consequently, they were not included in the benefit evaluation.

CURRENT CONTAINER COMMERCE

B-5. At present, there are three shipping companies (American President Lines, Ltd., United States Lines, and Seapac Container Service) with a total of 26 vessels involved in container traffic in the Oakland Inner Harbor. According to data supplied to the Corps of Engineers by American President Lines, the average weight per (TEU) container was 6.54 short tons inbound and 12.43 short tons outbound. Given the differences in average weight per container and in percent of empty containers inbound and outbound (50 percent and 11 percent, respectively, 1974), vessels on the average are light loaded by approximately one foot. The commodities carried by each of the three container lines serving the same route tend to be similar; consequently, the same container weights were applied to container data supplied by the United States Lines and Seapac Container Service for which the data were supplied in units of containers. The resulting base-year (1978) tonnages were determined to be about 1.8 million short tons. As a check, the Port of Oakland was asked to provide the percentage of total Inner Harbor tonnage represented by each of the carriers for 1978. The resulting figure for total tonnage at Oakland Inner Harbor was also approximately 1.8 million short tons.

CONTAINER CARGO PROJECTIONS

B-6. Future container cargo for Oakland Inner Harbor was projected relying on the recently completed San Francisco Bay Area Cargo Forecast prepared under contract for the Corps 1/. This study indicated container tonnages would increase at different rates on different routes. On Trade Route 29, in which the companies using the Inner Harbor are involved, the following "baseline" growth rates were projected for the Bay Area as a whole: 1978-1990, 9.5% per year; 1990-2000, 5.5%; 2000-2020, 5%. The projected container tonnages for Oakland Inner Harbor are shown on Table B-2.

B-7. The new Charles P. Howard Container Terminal was constructed by the Port of Oakland within the Inner Harbor in 1982 and consists of two berths. The terminal includes an area of approximately 42 acres. Approximately 2,150,000 tons of container cargo is projected to be moving over the waterway by 1986. This represents a 19% increase over base year (1978) tonnage. For this evaluation the increase in commerce was estimated to increase at that point (with the 4th terminal) at the annual rate of 6 percent per year up to 2006 at which time it is assumed the total tonnage handled at Oakland Inner Harbor would level off. This is considered consistent with the contract study and further reflects limitations and specific development at the Inner Harbor. The cargo forecast study also included "high" and "low" projections, the results of which are shown in paragraph B-18.

TABLE B-2

CONTAINER TONNAGES, 1986-2036
BASE PROJECTION
OAKLAND INNER HARBOR
(Short Tons)

TRADE ROUTE	1986	1996	2006-2036
Far East (Route 29)	2,150,000	3,850,000	6,895,000

RECENT CONTAINER MOVEMENTS

B-8. Data for the first six months of 1979 on Table B-3 indicate growth rates consistent with the container cargo projections.

1/ Recht Hausrath & Assoc. and Temple, Barker & Sloan, Inc., June 1981, This study was conducted as part of the Corps of Engineer's In Depth Study for the ports in San Francisco Bay.

TABLE B-3

DISTRIBUTION OF 1979 CONTAINER MOVEMENTS, OAKLAND INNER HARBOR

Draft *	Offloaded (TEU's)	Onloaded	Total (TEU's)**	%	Round Trips
24'	6,736	8,336	15,072	7	10
30'	6,452	7,218	13,670	7	9
31'	24,504	28,176	52,680	26	30
32'	24,950	25,348	50,298	25	37
33'	27,298	34,722	62,020	30	43
34'	2,892	4,174	7,066	3	4
Unknown	1,752	1,608	3,360	2	3
	94,584	109,582	204,166	100	

*Figures are rounded

**The average weight per loaded container, 6.54 short tons inbound and 12.43 short tons outbound, was supplied by American President Line and applies to the other lines as well. Application of these factors to the number of containers offloaded and onloaded indicates 1,980,000 short tons of containerized cargo was handled by container terminals in the Inner Harbor in 1979.

METHOD OF ANALYSIS

B-9. Oakland Inner Harbor is located adjacent to the Oakland Outer Harbor. An analysis of ship operating practices revealed that vessels expected to call at Oakland Inner Harbor will tend to travel the same Far East route and service the same general areas as those presently calling at the Oakland Outer Harbor. This similarity between container operations at Oakland Inner Harbor and Oakland Outer Harbor suggested application of the BERH procedure used in its analysis of Oakland Outer Harbor. (See Board of Engineers for Rivers and Harbors (BERH) "Digest Of Economic Analysis, Report to the Board of Engineers for Rivers and Harbor, Oakland Outer Harbor, California", June 1978.) This was consequently used as a methodology in the Oakland Inner Harbor analysis.

VESSEL FLEET COMPOSITION

B-10. At the present time, the drafts containerships utilized at Oakland Inner Harbor are being constrained by the existing 35-foot depth.

Recently vessels have been developed with drafts of approximately 35' that are designed to carry greater tonnages than in the past. These new containerships are operated at suboptimum levels of efficiency compared to vessels that carry larger cargoes with deeper drafts. Given these recent developments in the container vessel fleet, the calculation of benefits was based on the existing vessels at the port with an array of optimum vessels for every depth being phased in over the first decade of the projection period. The composition of the vessel fleet was based upon a projection to the year 2000 of the Pacific Basin container carrying vessels, prepared by the Office of Maritime Technology, U.S. Maritime Administration (MARAD). 1/ Tables B-4, 5 and 6 appending the text show the percent distribution of cargo expected to be carried in various draft ships with different channel depths by decade.

1/ "A Study of the Future Requirements for Ships That Will be Engaged in the U.S. World Trade for Both the Short and Long Term," U.S. Maritime Administration.

TABLE B-4

PERCENT CONTAINER CARGO CARRIED IN VARIOUS
SIZE SHIPS AT VARIOUS PROJECT DEPTHS 1/

FOREIGN TRADE
1986

Maximum Draft	Alternative Channel Depths (FT)						
(FT)	35	37	40	41	42	43	45
29	3.2	2.4	1.9	1.8	1.8	1.8	1.8
30	6.6	4.7	3.7	3.5	3.4	3.4	3.4
31	7.1	5.1	4.0	3.8	3.8	3.7	3.7
32	12.4	9.6	8.1	7.9	7.8	7.7	7.7
33	16.1	11.7	9.3	8.9	8.8	8.7	8.7
34	28.1	25.5	24.1	23.9	23.8	23.7	23.7
35	26.4	24.3	23.2	23.0	22.9	22.9	22.9
36		9.1	8.1	8.0	8.0	7.9	7.9
37		7.5	6.8	6.7	6.6	6.5	6.5
38			4.1	4.0	4.0	4.0	4.0
39			4.5	4.5	4.4	4.4	4.4
40			2.2	2.9	2.9	2.9	2.9
41				1.1	1.1	1.1	1.1
42					0.7	0.6	0.6
43						0.6	0.6

1/ From the MarAd Pacific Basin containership mix adjusted for Oakland Inner Harbor.

TABLE B-5

PERCENT CONTAINER CARGO CARRIED IN VARIOUS SIZE SHIPS AT VARIOUS PROJECT DEPTHS 1/

FOREIGN TRADE
1996

Maximum Draft (FT)	Alternative Channel Depths (FT) 35	37	40	41	42	43	45
29	2.7	1.7	1.1	1.0	0.9	0.8	0.8
30	4.2	2.2	1.1	0.8	0.6	0.4	0.4
31	4.7	2.6	1.3	1.1	0.9	0.7	0.7
32	9.7	6.7	3.9	3.5	3.2	3.0	3.0
33	15.0	9.5	6.7	6.5	6.1	5.6	5.6
34	33.4	28.9	26.2	25.5	25.1	24.8	24.8
35	30.2	26.7	24.5	24.1	23.8	23.5	23.5
36		11.1	9.3	8.9	8.6	8.4	8.4
37		10.5	8.8	8.4	8.3	7.9	7.9
38			6.0	5.8	5.6	5.5	5.5
39			6.6	6.3	6.1	5.9	5.9
40			4.5	5.1	5.0	4.8	4.8
41				3.0	2.9	2.9	2.9
42					2.9	2.9	2.9
43						2.9	2.9

1/ From the MarAd Pacific Basin containership mix adjusted for Oakland Inner Harbor.

TABLE B-6

PERCENT CONTAINER CARGO CARRIED IN VARIOUS SIZE SHIPS AT VARIOUS PROJECT DEPTHS 1/

FOREIGN TRADE
2006-2036

Maximum Draft (FT)	Alternative Channel Depths (FT) 35	37	40	41	42	43	45
29	1.2	0	0	0	0	0	0
30	0.8	0	0	0	0	0	0
31	2.6	0	0	0	0	0	0
32	6.0	2.5	0	0	0	0	0
33	14.2	8.7	2.7	1.3	0.7	0	0
34	39.2	34.7	34.0	32.1	31.3	30.6	30.6
35	35.9	32.4	30.2	29.6	28.9	28.2	28.2
36		11.1	9.3	8.8	8.6	8.4	8.4
37		10.5	8.8	8.3	8.1	7.9	7.9
38			6.0	5.7	5.6	5.5	5.5
39			6.6	6.1	6.0	5.9	5.9
40			2.4	5.0	4.9	4.8	4.8
41				3.1	3.0	2.9	2.9
42					2.9	2.9	2.9
43						2.9	2.9

1/ From the MarAd Pacific Basin containership mix adjusted for Oakland Inner Harbor.

VESSEL FLEET COSTS (CURRENT & FUTURE)

B-11. Costs for the fleet of containerships are listed on Table B-7. All cargo was assumed to be carried directly between Oakland Inner Harbor and the Far East port. Cost data utilized in this analysis were obtained from January, 1981 OCE cost estimates made for foreign containerships. OCE data was corrected to reflect the fact that a ship labeled 30-foot draft in fact has a draft of 35 feet, representative of the C-9 vessels which utilize Oakland Inner Harbor. A ship of 35-foot draft included in the OCE data, which appears to be a modified SL-7 vessel, was eliminated as not being representative of the configuration of vessels of the Port. 1981 OCE data was utilized for vessels up to a 35-foot draft. The costs for the remainder of the fleet were based on OCE 1979 vessel cost data, increased to reflect the relationships that exist between the 1979 and 1981 vessel cost data for the smaller vessels. Table B-8 shows estimated future transportation costs without any improvement in project channel depths. Tables B-9 through B-12 show reductions in total estimated future shipping costs (per unit of cargo) with deep channels of 37-feet, 42-feet, 43-feet, and 45-feet.

B-12. The transportation costs for the existing and optimum fleets shown on Tables B-7 and B-8 were calculated as follows:

Costs Without Delays.

(a) Projected tonnage was allocated to vessels in the fleet according to projected MARAD percentages.

(b) The tonnage moved by each vessel each year was multiplied by the cost of moving one ton for this vessel (Table B-7) to yield the cost of moving this tonnage.

(c) The costs of moving the tonnages for each size vessel were totaled to obtain the total cost per year for a certain size channel.

Delay Costs.

(d) Vessel tonnages were adjusted for one-foot light loading.

(e) Light loaded vessel tonnages were multiplied by 2 for a round trip (Col. 6, Tables B-8 through B-12).

(f) The total tonnage carried by each size of vessel (Step a) was divided by the tonnage carried on each round trip to yield the number of trips.

(g) This trip figure was adjusted (was divided) by the "exchange" factor to reflect empty containers, yielding more trips.

(h) The feet of tide needed by each vessel was calculated: subtract 1 foot, light loaded; add 6 feet for required clearance; subtract the channel depth from the result. Example, for a 31 foot vessel and a 35-foot channel: 31 - 1 = 30, +6 = 36, - 35 = 1 foot of the tide required for safe passage.

T. B-7

TRANSPORTATION COSTS PER TON FOR VARIOUS SIZE CONTAINERSHIPS 1/
EXISTING FLEET, 1986-2036
FAR EAST TRADE ROUTE
(4,536 Nautical Miles)

Max. Draft (Ft)	Speed (Kts)	Hours at Sea	$/Hr at Sea	Cost at Sea ($)	Hours in Port	$/Hr in Port	Cost in Port ($)	Total Cost ($)	Short Tons 2/ Per Ship Full Load	Short Tons 3/ Per Foot Light-Loaded	$/Ton One Foot Light-Loaded
27	18.0	252.0	1,291	325,332	168.0	693	693	441,756	7,200	648	67.42
28	18.4	246.5	1,350	332,775	164.3	790	790	462,572	8,200	721	61.85
29	18.8	241.3	1,420	342,646	160.9	820	820	474,584	9,100	792	57.12
30	19.2	236.3	1,500	354,450	157.5	850	850	488,325	10,100	858	52.84
31	19.6	231.4	1,560	360,984	154.3	880	880	496,768	11,000	913	49.25
32	20.0	226.8	1,621	367,643	151.2	921	921	506,898	12,000	972	45.97
33	20.7	219.1	2,212	484,649	146.1	1,185	1,185	657,778	14,400	1,123	49.54
34	21.3	213.0	2,484	529,092	142.0	1,330	1,330	717,952	16,800	1,310	46.35
35	22.0	206.2	2,738	564,576	137.5	1,660	1,660	792,826	29,400	1,999	28.93
36	22.3	203.4	2,820	573,588	135.6	1,730	1,730	808,176	30,700	2,088	28.25
37	22.7	199.8	2,900	579,420	133.2	1,780	1,780	816,516	31,900	2,105	27.40
38	23.0	197.2	3,000	591,600	131.5	1,840	1,840	833,560	33,600	2,111	26.47
39	23.0	197.2	3,190	629,068	131.5	1,960	1,960	886,808	38,000	2,117	24.71
40	23.0	197.2	3,330	656,676	131.5	2,040	2,040	924,936	41,500	2,125	23.49
41	23.0	197.2	3,400	670,480	131.5	2,090	2,090	945,315	43,500	2,132	22.85
42	23.0	197.2	3,480	686,256	131.5	2,130	2,130	966,351	45,500	2,230	22.33
43	23.0	197.2	3,550	700,060	131.5	2,180	2,180	986,730	47,600	2,237	15.14

1/ All values are for 1/2 of a round trip, without tidal delay, with all cargo unloaded at Oakland, BERH-PLN Op. Cit., Table 8 of Oakland Outer Harbor (Deepening).

2/ Total short tons = No. containers carried x 12 long tons per container x 112 percent.

3/ Reduction for assumed 1-foot light loading.

(i) It was assumed that vessels would not wait for more than 5 feet of tide.

(j) The number of trips for each size vessel was multiplied by an average cost per hour (average of cost per hour at sea and in port) and by the hours of delay (the average waiting time needed to obtain the required feet of tide, read from the tidal curve in Figure 8, Main Report) to yield the delay cost for each size vessel.

(k) Delay costs for the vessels were added to obtain the total delay cost.

Total Costs.

(l) Total annual transportation costs equal costs without delays plus delay costs.

PROJECT BENEFITS

B-13. Table B-13 summarizes the differences in estimated transportation costs between the without project condition (35 foot channel) and various channel depths by decade. For example, a 35-foot channel in 1986 has total costs of $93,319,126 (Table B-8) - $82,369,252 total costs for a 42-foot channel (Table B-10) = $10,949,894 (Table B-13). Each difference in estimated savings in future transportation costs is then discounted to account for delay in realization of such benefits and summed for each alternative channel depth.

RISK AND UNCERTAINTY

B-14. An evaluation heavily reliant upon forecasted (not known with certainty) future values contains considerable uncertainty and thus a range of likely values should be considered.

The proceeding benefit evaluation draws upon the "baseline" projections in the recently completed San Francisco Bay Area Cargo Forecast (June 1981). Other scenarios are also possible and were developed in the Cargo Forecast Study.

B-15. The "high" forecast doubles the basic growth rate used in this report until project year 1 and then adopts the high rate established in the Forecast. The "low" rate presumes one-half of the basic growth rate until project year 1 and then uses 4% per year until 2006. This is slightly lower than the low projection rate in the Forecast report but is consistent with the concept used in this report of limited availability for future growth in the Inner Harbor.

B-16. Transportation savings have been calculated for these rates at the various depths and are presented on Table B-13. As to be expected, the benefits are generally higher and lower for the high and low growth rates respectively. This will have corresponding effects on project optimization. Benefits for the high growth rate range from $24,282,000 for a depth of 37 feet to $50,750,000 for a depth of 45 feet. For the low rate the benefits range from $14,897,000 for 37 feet to $31,005,000 for 45 feet.

TABLE B-8

CONTAINER CARGO TRANSPORTATION COSTS
WITHOUT PROJECT (35 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
35 FT. - FAR EAST - 1986 -- Tonnage: 2,150,000 -- Container Exchange Factor: 0.45											
29	3.2	68,800	57.12	3,929,856	16,616	9.20	-1	0	1,120	0	3,929,856
30	6.6	141,900	52.84	7,497,996	18,484	17.06	0	0	1,175	0	7,497,996
31	7.1	152,650	49.25	7,518,013	20,174	16.82	1	0.5	1,205	10,134	7,528,147
32	12.4	266,600	45.97	12,255,602	22,056	26.86	2	0.7	1,271	23,897	12,279,499
33	16.1	346,150	49.54	17,148,271	26,554	28.97	3	1.4	1,699	68,908	17,217,179
34	28.1	604,150	46.35	28,002,353	30,980	43.34	4	2.4	1,907	198,359	28,200,712
35	26.5	569,750	28.93	16,482,868	54,802	23.10	5	3.6	2,199	182,869	16,665,737
	100.0	2,150,000		92,834,959						484,167	93,319,126
35 FT. - FAR EAST - 1996 -- Tonnage: 3,850,000 -- Container Exchange Factor: 0.48											
29	2.7	103,950	57.12	5,937,624	16,616	12.55	-1	0	1,120	0	5,937,624
30	4.2	161,700	52.84	8,544,228	18,484	18.23	0	0	1,175	0	8,544,228
31	4.7	180,950	49.25	8,911,788	20,174	18.69	1	0.5	1,205	11,261	8,923,049
32	9.7	373,450	45.97	17,167,497	22,056	35.28	2	0.7	1,271	31,389	17,198,886
33	15.0	577,500	49.54	28,609,350	26,554	45.31	3	1.4	1,699	107,774	28,717,124
34	33.5	1,289,750	46.35	59,779,913	30,980	86.73	4	2.4	1,907	396,946	60,176,859
35	30.2	1,162,700	28.93	33,636,911	54,802	44.20	5	3.6	2,199	349,905	33,986,816
	100.0	3,850,000		162,587,311						897,275	163,484,586
35 FT. - FAR EAST - 2006 to 2036 -- Tonnage: 6,895,000 -- Container Exchange Factor: 0.51											
29	1.2	82,740	57.12	4,726,109	16,616	9.77	-1	0	1,120	0	4,726,109
30	0.8	55,160	52.84	2,914,654	18,484	5.85	0	0	1,175	0	2,914,654
31	2.6	179,270	49.25	8,829,048	20,174	17.42	1	0.5	1,205	10,496	8,839,544
32	6.0	413,700	45.97	19,017,789	22,056	36.78	2	0.7	1,271	32,723	19,050,512
33	13.2	979,090	49.54	48,504,119	26,554	72.30	3	1.4	1,699	171,973	48,676,092
34	39.3	2,709,735	46.35	125,596,217	30,980	171.50	4	2.4	1,907	784,921	126,381,138
35	35.9	2,475,305	28.93	71,610,574	54,802	88.57	5	3.6	2,199	701,156	72,311,730
	100.0	6,895,000		281,198,510						1,701,269	282,899,779

T/ B-9

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (37 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
37 FT. - FAR EAST - 1986 -- Tonnage: 2,150,000 -- Container Exchange Factor: 0.45											
29	2.4	51,600	57.12	2,947,392	16,616	6.90	0	0	1,120	0	2,947,392
30	4.7	101,050	52.84	5,339,482	18,484	12.15	0	0	1,175	0	5,339,482
31	5.1	109,650	49.25	5,400,283	20,174	12.08	0	0	1,205	0	5,400,283
32	9.6	206,400	45.97	9,488,208	22,056	20.80	0	0	1,271	0	9,488,208
33	11.7	251,550	49.54	12,461,787	26,554	21.05	1	0.5	1,699	17,882	12,479,669
34	25.5	548,250	46.35	25,411,388	30,980	39.33	2	0.7	1,907	52,502	25,463,890
35	41.5	881,500	28.93	25,501,795	54,802	35.74	3	1.4	2,199	110,029	25,611,824
	100.0	2,150,000		86,550,335						180,413	86,730,748
37 FT. - FAR EAST - 1996 -- Tonnage: 3,850,000 -- Container Exchange Factor 1 0.48											
29	1.7	65,450	57.12	3,738,504	16,616	8.21	0	0	1,120	0	3,738,504
30	2.2	84,700	52.84	4,475,548	18,484	9.55	0	0	1,175	0	4,475,548
31	2.6	100,100	49.25	4,929,925	20,174	10.34	0	0	1,205	0	4,929,925
32	6.7	257,950	45.97	11,857,962	22,056	24.37	0	0	1,271	0	11,857,962
33	9.5	365,750	49.54	18,119,255	26,554	28.70	1	0.5	1,699	24,381	18,143,636
34	28.9	1,112,650	46.35	51,571,328	30,980	74.82	2	0.7	1,907	99,877	51,671,205
35	26.8	1,031,800	28.93	29,849,974	54,802	39.23	3	1.4	2,199	120,773	29,970,747
36	11.1	427,350	28.25	12,072,638	57,224	15.56	4	2.4	2,275	84,958	12,157,596
37	10.5	404,250	27.40	11,076,450	59,590	14.13	5	3.6	2,340	119,031	11,195,481
		3,850,000		147,691,584						449,020	148,140,604
37 FT. - FAR EAST - 2006 -- Tonnage: 6,895,000 -- Container Exchange Factor: 0.51											
32	2.5	172,375	45.97	7,924,078	22,056	15.32	0	0	1,271	0	7,924,078
33	8.7	599,865	49.54	29,717,312	26,554	44.29	1	0.5	1,699	37,624	29,754,936
34	23.7	2,392,565	46.35	110,895,388	30,980	151.43	2	0.7	1,907	202,144	111,097,532
35	32.5	2,240,875	28.93	64,828,514	54,802	80.18	3	1.4	2,199	246,842	65,075,356
36	11.1	765,345	28.25	21,620,996	57,224	26.23	4	2.4	2,275	143,216	21,764,212
37	10.5	723,975	27.40	19,836,915	59,590	23.82	5	3.6	2,340	200,660	20,037,575
		6,895,000		154,823,203						830,486	255,653,689

TABLE B-10

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (42 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
42 FT. - FAR EAST - 1986 -- Tonnage: 2,150,000 -- Container Exchange Factor: 0.45											
29	1.8	38,700	57.12	2,210,544	16,616	5.18	-8	0	1,120	0	2,210,544
30	3.4	73,100	52.84	3,862,604	18,484	8.70	-7	0	1 175	0	3,862,604
31	3.8	81,700	49.25	4,023,725	20,174	9.00	-6	0	1,205	0	4,023,725
32	7.8	167,700	45.97	7,709,169	22,056	16.90	-5	0	1,271	0	7,709,169
33	8.8	189,200	49.54	9,372,968	26,554	15.83	-4	0	1,699	0	9,372,968
34	23.8	511,700	46.35	23,717,295	30,980	36.70	-3	0	1,907	0	23,717,295
35	50.6	1,087,900	28.93	31,472,947	54,802	44.11	-2	0	2,199	0	31,472,947
	100.0	2,150,000		82,369,252						0	82,369,252
42 FT. - FAR EAST - 1996 -- Tonnage: 3,850,000 -- Container Exchange Factor: 0.48											
29	0.9	34,650	57.12	1,979,208	16,616	4.34	-8	0	1,120	0	1,979,208
30	0.6	23,100	52.84	1,220,604	18,484	2.60	-7	0	1,175	0	1,220,604
31	0.9	34,650	49.25	1,706,513	20,174	3.58	-6	0	1,205	0	1,706,513
32	3.2	123,200	45.97	5,663,504	22,056	11.64	-5	0	1,271	0	5,663,504
33	6.1	234,850	49.54	11,634,469	26,554	18.43	-4	0	1,699	0	11,634,469
34	25.1	966,350	46.35	44,790,323	30,980	64.99	-3	0	1,907	0	44,790,323
35	23.8	916,300	28.93	26,508,559	54,802	34.83	-2	0	2,199	0	26,508,559
36	8.6	331,100	28.25	9,353,575	57,224	12.05	-1	0	2,275	0	9,353,575
37	8.3	319,550	27.40	8,755,670	59,590	11.17	0	0	2,340	0	8,755,670
38	5.6	215,600	26.47	5,706,932	62,978	7.13	1	0.5	2,420	8,627	5,715,559
39	6.1	234,850	24.71	5,803,144	71,766	6.82	2	0.7	2,575	12,293	5,815,437
40	5.0	192,500	23.49	4,521,825	78,750	5.09	3	1.4	2,685	19,133	4,540,958
41	2.9	111,650	22.85	2,551,203	82,736	2.81	4	2.4	2,745	18,512	2,569,715
42	2.9	111,650	15.14	1,690,381	86,540	2.78	5	3.6	2,805	28,072	1,718,453
	100.0	3,859,000		131,885,910						86,637	131,972,547

TABLE B-10 (Cont'd.)

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (42 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
42 FT - FAR EAST - 2006 to 2036 -- Tonnage: 6,895,000 -- Container Exchange Factor: 0.51											
33	0.7	48,265	49.54	2,391,048	26,554	3.57	-4	0	1,699	0	2,391,048
34	31.3	2,158,135	46.35	100,029,557	30,980	136.59	-3	0	1,907	0	100,029,557
35	28.9	1,992,655	28.93	57,647,509	54,802	71.30	-2	0	2,199	0	57,647,509
36	8.6	592,970	28.25	16,751,403	57,224	20.32	-1	0	2,275	0	16,751,403
37	8.1	558,495	27.40	15,302,763	59,590	18.38	0	0	2,340	0	15,302,763
38	5.6	386,120	26.47	10,220,596	62,978	12.02	1	0.5	2,420	14,544	10,235,140
39	6.0	413,700	24.71	10,222,527	71,766	11.30	2	0.7	2,575	20,368	10,242,895
40	4.9	337,855	23.49	7,936,214	78,750	8.41	3	1.4	2,685	31,613	7,967,827
41	3.0	206,850	22.85	4,726,523	82,736	4.90	4	2.4	2,745	32,281	4,758,804
42	2.9	199,955	22.33	4,464,995	86,540	4.53	5	3.6	2,805	45,744	4,510,739
	100.0	6,895,000		229,693,135						144,550	229,837,685

TABLE B-11

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (43 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
43 FT. - FAR EAST - 1986 -- Tonnages: 2,150,000 -- Container Exchange Factor: 0.45											
29	1.8	38,700	57.12	2,210,544	16,616	5.18	-9	0	1,120	0	2,210,544
30	3.4	73,100	52.84	3,862,604	18,484	8.79	-8	0	1,175	0	3,862,604
31	3.7	79,550	49.25	3,917,838	20,174	8.76	-7	0	1,205	0	3,917,838
32	7.7	165,550	45.97	7,610,334	22,056	16.68	-6	0	1,271	0	7,610,334
33	8.7	187,050	49.54	9,266,457	26,554	15.65	-5	0	1,699	0	9,266,457
34	23.7	509,550	46.35	23,617,643	30,980	36.55	-4	0	1,907	0	23,617,643
35	50.9	1,094,350	28.93	31,659,546	54,802	44.38	-3	0	2,199	0	31,659,546
	100.0	2,150,000		82,144,966						0	82,144,966
43 FT. - FAR EAST - 1986 -- Tonnage: 3,850,000 -- Container Exchange Factor: 0.48											
29	0.8	30,800	57.12	1,759,296	16,616	3.86	-9	0	1,120	0	1,759,296
30	0.4	15,400	52.84	813,736	18,484	1.74	-8	0	1,175	0	813,736
31	0.7	26,950	49.25	1,327,288	20,174	2.78	-7	0	1,205	0	1,327,288
32	3.0	115,500	45.97	5,309,535	22,056	10.91	-6	0	1,271	0	5,309,535
33	5.6	215,600	49.54	10,680,824	26,554	16.92	-5	0	1,699	0	10,680,824
34	24.8	954,800	46.35	44,254,980	30,980	64.21	-4	0	1,907	0	44,254,980
35	23.5	904,750	28.93	26,174,418	54,802	34.39	-3	0	2,199	0	26,174,418
36	8.4	323,400	28.25	9,136,050	57,224	11.77	-2	0	2,275	0	9,136,050
37	7.9	304,150	27.40	8,333,710	59,590	10.63	-1	0	2,340	0	8,333,710
38	5.5	211,750	26.47	5,605,023	62,978	7.00	0	0	2,420	0	5,605,023
39	5.9	227,150	24.71	5,612,877	71,766	6.59	1	0.5	2,575	8,485	5,621,362
40	4.8	184,800	23.49	4,340,952	78,750	4.89	2	0.7	2,685	9,191	4,350,143
41	2.9	111,650	22.85	2,551,203	82,736	2.81	3	1.4	2,745	10,799	2,562,002
42	2.9	111,650	22.33	2,493,145	86,540	2.69	4	2.4	2,805	18,109	2,511,254
43	2.9	111,650	15.14	1,690,381	90,726	2.57	5	3.6	2,865	26,507	1,716,888
	100.0	3,850,000		130,083,418						73,091	130,156,509

TABLE 1 (Cont'd.)

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (43 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
43 FT. - FAR EAST - 2006 to 2036 -- Tonnage: 6,895,000 -- Container Exchange Factor: 0.51											
34	30.6	2,109,870	46.35	97,792,475	30,980	133.53	-4	0	1,907	0	97,792,475
35	28.2	1,944,390	28.93	56,251,203	54,802	69.57	-3	0	2,199	0	56,251,203
36	8.4	579,180	28.25	16,361,835	57,224	19.85	-2	0	2,275	0	16,361,835
37	7.9	544,705	27.40	14,924,917	59,590	17.92	-1	0	2,340	0	14,924,917
38	5.5	379,225	26.47	10,038,086	62,978	11.81	0	0	2,420	0	10,038,086
39	5.9	413,700	24.71	10,222,527	71,766	11.30	1	0.5	2,575	14,549	10,237,076
40	4.8	337,855	23.49	7,936,214	78,750	8.41	2	0.7	2,685	15,807	7,952,021
41	2.9	206,850	22.85	4,726,523	82,736	4.10	3	1.4	2,745	15,756	4,742,279
42	2.9	199,955	22.33	4,464,995	86,540	4.53	4	2.4	2,805	30,496	4,495,491
43	2.9	199,955	15.14	3,027,319	90,726	4.32	5	3.6	2,865	44,556	3,071,875
	100.0	6,895,000		225,746,094						121,164	225,867,258

TABLE B-12

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (45 Feet)
FAR EAST (Foreign Trade)

(1) Draft (Ft)	(2) Cargo % Dist.	(3) Annual Tonnage	(4) Cost Per Ton ($)	(5) Transit Cost ($)	(6) Tons Per Round Trip	(7) Round Trips	(8) Tide Needed (Ft)	(9) Delay Time (Hrs)	(10) Avg. Cost/Hr At Sea & Port ($/Hr)	(11) Delay Cost ($)	(12) Total Cost ($)
45 FT. - FAR EAST - 1986 -- Tonnage: 2,150,000 -- Container Exchange Factor: 0.45											
29	1.8	38,700	57.12	2,210,544	16,616	5.18	-11	0	1,120	0	2,210,544
30	3.4	73,100	52.84	3,862,604	18,484	8.79	-10	0	1,175	0	3,862,604
31	3.7	79,550	49.25	3,917,838	20,174	8.76	-9	0	1,205	0	3,917,838
32	7.7	165,550	45.97	7,610,334	22,056	16.68	-8	0	1,271	0	7,610,334
33	8.7	187,050	49.54	9,266,457	26,554	15.65	-7	0	1,699	0	9,266,457
34	23.7	509,550	46.35	23,617,643	30,980	36.55	-6	0	1,907	0	23,617,643
35	50.9	1,094,350	28.93	31,659,546	54,802	44.38	-5	0	2,199	0	31,659,546
	100.0	2,150,000		82,144,966						0	82,144,966
45 FT. - FAR EAST - 1996 -- Tonnage: 3,850,000 -- Container Exchange Factor: 0.48											
29	0.8	30,800	57.12	1,759,296	16,616	3.86	-11	0	1,120	0	1,759,296
30	0.4	15,400	52.84	813,736	18,484	1.74	-10	0	1,175	0	813,736
31	0.7	26,950	49.25	1,327,288	20,174	2.78	-9	0	1,205	0	1,327,288
32	3.0	115,500	45.97	5,309,535	22,056	10.91	-8	0	1,271	0	5,309,535
33	5.6	215,600	49.54	10,680,824	26,554	16.92	-7	0	1,699	0	10,680,824
34	24.8	954,800	46.35	44,254,980	30,980	64.21	-6	0	1,907	0	44,254,980
35	23.5	904,750	28.93	26,174,418	54,802	34.39	-5	0	2,199	0	26,174,418
36	8.4	323,400	28.25	9,136,050	57,224	11.77	-4	0	2,275	0	9,136,050
37	7.9	304,150	27.40	8,333,710	59,590	10.63	-3	0	2,340	0	8,333,710
38	5.5	211,750	26.47	5,605,023	62,978	7.00	-2	0	2,420	0	5,605,023
39	5.9	227,150	24.71	5,612,877	71,766	6.59	-1	0	2,575	0	5,612,877
40	4.8	184,800	23.49	4,340,952	78,750	4.89	0	0	2,685	0	4,340,952
41	2.9	111,650	22.85	2,551,203	82,736	2.81	1	0.5	2,745	3,857	2,555,060
42	2.9	111,650	22.33	2,493,145	86,540	2.69	2	0.7	2,805	5,282	2,498,427
43	2.9	111,650	15.14	1,690,381	90,726	2.57	3	1.4	2,865	10,308	1,700,689
	100.0	3,850,000		130,083,418						19,447	130,102,865

TABLE B-12 (Cont'd.)

CONTAINER CARGO TRANSPORTATION COSTS
ALTERNATIVE PLAN (45 Feet)
FAR EAST (Foreign Trade)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Draft (Ft)	Cargo % Dist.	Annual Tonnage	Cost Per Ton ($)	Transit Cost ($)	Tons Per Round Trip	Round Trips	Tide Needed (Ft)	Delay Time (Hrs)	Avg. Cost/Hr At Sea & Port ($/Hr)	Delay Cost ($)	Total Cost ($)
45 FT. - FAR EAST - 2006 to 2036 -- Tonnage: 6,895,000 -- Container Exchange Factor: 0.51											
34	30.6	2,109,870	46.35	97,792,475	30,980	133.53	-6	0	1,907	0	97,792,475
35	28.2	1,944,390	28.93	56,251,203	54,802	69.57	-5	0	2,199	0	56,251,203
36	8.4	579,180	28.25	16,361,835	57,224	19.85	-4	0	2,275	0	16,361,835
37	7.9	544,705	27.40	14,924,917	59,590	17.92	-3	0	2,340	0	14,924,917
38	5.5	379,225	26.47	10,038,086	62,978	11.81	-2	0	2,420	0	10,038,086
39	5.9	413,700	24.71	10,222,527	71,766	11.30	-1	0	2,575	0	10,222,527
40	4.8	337,855	23.49	7,936,214	78,750	8.41	0	0	2,685	0	7,936,214
41	2.9	206,850	22.85	4,726,523	82,736	4.10	1	0.5	2,745	5,627	4,732,150
42	2.9	199,955	22.33	4,464,995	86,540	4.53	2	0.7	2,805	8,895	4,473,890
43	2.9	199,955	15.14	3,027,319	90,726	4.32	3	1.4	2,865	17,328	3,044,647
	100.0	6,895,000		225,746,094						31,850	225,777,944

TABLE B-13

AVERAGE ANNUAL CONTAINER BENEFITS
($000)

Year	Estimated Transportation Savings For Alternative Channel Depth 37'	42'	43'	45'	Decade Factor 7-7/8%	Discounted Benefits For Alternative Project Depths 37'	42'	43'	45'
Base Projection									
1986	6,588,378	10,949,874	11,174,160	11,174,160	.27835	1,833,875	3,047,897	3,110,327	3,110,327
1996	15,343,982	31,512,039	33,328,077	33,381,721	.39578	6,072,841	12,471,834	13,190,586	13,211,817
2006	27,246,090	53,062,094	57,032,521	57,121,835	.18546	5,053,060	9,840,896	10,577,251	10,593,815
2016	27,246,090	53,062,094	57,032,521	57,121,835	.08690	2,367,685	4,611,096	4,956,126	4,963,887
2026	27,246,090	53,062,094	57,032,521	57,121,835	.04072	1,109,461	2,160,688	2,322,364	2,326,001
2036	27,246,090	53,062,096	57,032,521	57,121,835	.01279	348,477	678,664	729,446	730,588
						16,785,395	32,811,075	34,866,100	34,936,435
High Projection									
1986	7,840,170	13,030,350	13,297,250	13,297,250	.27835	2,182,311	3,626,998	3,601,290	3,701,290
1996	22,494,278	46,196,649	48,858,961	48,937,603	.39578	8,902,785	18,283,709	19,337,399	19,368,524
2006–2036	39,724,799	77,364,533	83,153,416	83,283,635	.32587	12,945,120	15,054,102	27,097,203	27,139,638
						24,030,216	36,964,805	50,135,892	50,209,452
Low Projection									
1986	6,127,192	10,183,383	10,391,969	10,391,969	.27835	1,705,504	2,834,545	2,892,605	2,892,605
1996	14,269,903	29,306,196	30,995,112	31,045,001	.39578	5,647,742	11,598,806	12,267,245	12,286,990
2008–2036	22,750,485	44,306,848	47,622,155	47,696,732	.32587	7,413,701	14,438,272	15,518,631	15,542,934
						14,766,947	28,871,623	30,678,481	30,722,529

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

APPENDIX C

BASIS FOR
DESIGN AND DETAILED COST ESTIMATES

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

JUNE 1983

APPENDIX C
BASIS FOR DESIGN AND DETAILED COST ESTIMATES
OAKLAND INNER HARBOR, CALIFORNIA

C-1 The existing entrance to the Oakland Inner and Outer Harbor is the 800 foot wide Oakland Bar channel providing entry from San Francisco Bay deep water across the shoal southeast of Yerba Buena Island for a distance of about .4 mile to a junction between the Inner Harbor Channel and Outer Harbor Channel. It is assumed this entrance channel (Oakland Bar) currently maintained at -35 feet mean lower low water (MLLW) will have been deepened to 42 feet under the Oakland Outer Harbor Project. The Inner Harbor project improvement would result in the further deepening of the Oakland Bar Channel from 42 feet to 43 feet (MLLW). Continuing from the junction with the Bar Channel the existing Inner Harbor Channel extends east to San Leandro Bay a distance of about 8.5 miles. The proposed improvements extends from the junction, to near Clay Street a distance of about 3.6 miles. This reach of the existing Inner Harbor varies in width from 510 feet to 800 feet with widening at angle points, and is maintained at an authorized 35 feet depth MLLW. Project improvement of the west 1.1 mile of this reach would involve widening to provide a transition section from the Bar Channel, varying from about 1150 feet to 462 feet. Width for the next .8 mile consists of a long transition, varying from 462 feet (reduced from 510 feet) at the west end to the existing width of 600 feet at east end. The remaining 1.7 miles of channel is basically designed for 600 foot width with some channel widening for bends and turning basins at sites near Seatrain Terminals of California Inc. and Charles P. Howard Terminal. The Inner Harbor Channel Improvements would furthermore include deepening of these channels (from the channel junction upstream) from -35 foot to -43 foot MLLW. For plan and sections of proposed channel improvements, see Figure No. 10 through 14 of the main report.

GENERAL GEOLOGY.

C-2 The Oakland Inner Harbor is located on a low-lying tidal plain adjacent to the east side of the San Francisco Bay. The plain is about five miles wide between the Bay and Berkeley Hills to the east. A thick layer of unconsolidated marine and continental sediments of Pleistocene and Recent origin underlies the project site. Sediments are underlain by consolidated Franciscan rocks of the Jurassic-Cretaceous age at a depth of about 100 feet below the surface.

The San Francisco Bay Area is an area of high seismic activity. The Hayward Fault lies about 2.5 miles east of the project site. Six moderate earthquakes (magnitude 4.0 - 5.0) have been recorded on this active fault since 1934. The San Andreas Fault lies about eight miles to the west of the project site. The strike of these faults is in a north-northwest direction.

SOILS

C-3 Subsurface boring explorations to a depth around -47 feet mean lower low water, MLLW, indicate silty clay (Bay Mud), silty sands, sandy-silty clays, and fat clays to be the predominate soil types at the site. Locations of logs are shown on Figure No. 10 through 14 of the main report and logs on Figure C-4 of this appendix.

Stability analyses were performed based on the "Modified Swedish Arc Method" and the "after construction case", demonstrated that a 3 horizontal on 1 vertical slope is stable for all static conditions. Thus, the 3 horizontal on 1 vertical was selected for the project improvement. This slope was selected based on the restrictions within the boundary limits and the need for stability under minor seismic forces. Design parameters were based on the undrained conditions of the clays and sands. Design parameters used were as follows:

Design Parameters

Soil Type	Phi, 0	Cohesion, C
Clays	0	350 Psf
Sand	32	0

Under static conditions the factor of safety is 1.5 using the above parameter values.

DESIGN CRITERIA

C-4 The judgement of pilots and port officials was considered in combination with technical guidance contained in Report No. 3 Committee on Tidal Hydraulics and DAEN-CWE-HD Engineer Regulation 1110-2-1404 "Deep Water Navigation Project Design" dated 24 September 1981. Criteria for design of the Inner Harbor Channel is restrictive (Reach from 1.1 to 1.9 miles east of the channel junction) and thus assumes some larger ships (800' to 900' in length) may experience delays during periods of winter storms.

DESIGN CONSTRAINTS

C-5 Existing jetties, wharves and side slopes impose a constraint against providing certain channel dimensions at some locations in the Inner Harbor. The authorized width of channel to Fortman Basin is 600 feet, however, a bottom width considerably less than 600 feet exists at some constricted locations along the channel with the currently authorized design depth of 35 feet. A minimum bottom width of 510 feet exists in a straight section of channel at Project Mile 1.5. Deepening of channels within the constraints of the rock slopes of the jetties requires a corresponding reduction in channel width. This does not detract from the safety or usefulness of the channel where one way passage for large vessels is in accordance with safe piloting practices already in effect, with allowance for some delays for adverse weather conditions.

DESIGN VESSEL

C-6 The "Asia Liner" and "President Hoover" are representative of the largest containerships which call at berths in the Inner Harbor. The "Asia Liner" is 805 feet long and has a beam of 105 feet. Her loaded draft is reported to be 37 feet. The still larger "President Lincoln", largest containership ever built in the United States, called on the Oakland Inner Harbor early in November 1982. This ship is 860 feet in length, has a beam of about 105 feet and has a loadline draft of 35 feet. Berths at the new Charles P. Howard Terminal being constructed by the port of Oakland are designed to accomodate D-9 class vessels such as the "Sea-Land Patriot." These new diesel powered containerships are slightly smaller than those first mentioned. D-9 class vessels are 745 feet long, 100 feet in beam, and 26,500 dead weight tons and draw 31 feet of draft. To develop desirable channel dimensions, a design vessel was selected which is 805 feet long with a beam of 105 feet. Design requirements for channel depth clearances are shown by Figure C-3.

CHANNEL WIDTHS

The minimum width required for safe navigation in a channel is dependent on vessel size and maneuverability, traffic congestion, winds, waves, currents, bottom and bank conditions, visibility, and mode of operation (e.g. one or two-way passage, with or without pilotage or tug assistance). Since these conditions vary from one end of the project to the other, it has been subdivided into four reaches for the purpose of this analysis. Individual width allowances for various channel alignment and traffic conditions are expressed as percentages of the beam width of the design vessel (105 feet), as illustrated on Figures C-1 and C-2.

C-7 THE BAR CHANNEL. This channel 0.4 mile long serves Oakland Outer, Middle, and Inner Harbors, is unconfined, in sand and mud, is subject to transverse winds and currents, which is used for two way traffic under normally good conditions but fails to meet recommended width criteria for two way ship passage. The channel would be previously improved under the Oakland Outer Harbor Project by deepening to 42 feet (MLLW). Channel width of the improved channel remains at 800-feet based on dual conditions for one-way and two-way traffic under condition No. 1 assumes excellent to good conditions, with light winds, light currents, good visibility and no extreme shoaling. Condition No. 2 consists of extremely poor conditions involving high currents, cross currents, high winds at a 9 knot velocity with 5^{o} rudder angle. Basis of the 800-foot wide channel, (for two-way ship passage, consists of 180% of beam width (design ship) for maneuvering lanes, 100% of beam width for the ship clearance lane, and 150% of beam width for bank clearance lanes - See Figure C-1. 1/ 2/

C-8 THE CHANNEL JUNCTION. The entrance channels for the Outer Harbor and for the Middle and Inner Harbors meet at the channel junction. The bottom is sand and mud. The tidal current gyre results in transverse currents from opposite directions on bow and stern at certain times during the tidal cycle. The channel is unconfined and not protected from cross winds. Ships entering or leaving the Inner Harbor Entrance Channel must make a 30^{o} turn. The width varies with a maximum width of about 1175 feet near the junction.

1/ Planning and Designing Deep Draft Navigation Channels, Richard Waugh, Jr. 1978-Deep Draft Navigation Channel Design Conference-Waterways Experiment Station 16-18 May 1978

2/ Design of Channels for Navigation, J.B. McAleer el.a.l Chapter X (Section No. 5 of 1978 Deep Draft Navigation Channel Design Conference-Waterways Experiment Station 16-18 May 1978)

C-9 OAKLAND INNER ENTRANCE CHANNEL. This reach provides straight access to the Inner Harbor, and by a turn of about 35°, access to the Oakland Middle Harbor facilities of the Oakland Naval Supply Center. The bottom is sand and mud, the channel is unconfined. Ships are subject to cross winds and the eddy shed by the Seventh Street Terminal during flood tides. The channel will be operated two-way to the mouth of the Middle Harbor and one-way east of that point. For two-way operation, provision was made for bank clearances of 150%, maneuvering lanes of 280%, and a ship clearance lane of 100%, for a total width of 1,000 feet. The channel would be tapered down to a width adequate for only one-way operation. To allow for recovery of Inner-Harbor bound vessels from the 30° turn at the west end, where one-way traffic is provided for there is an allowance of 150% for bank clearances and 200% for a maneuvering lane, producing a total width requirement of 525 feet (however at one point this width must be reduced to 462 feet to conform to the rock jetty restraint). This channel reach extends east from the channel junction for about 1.1 miles.

C-10 OAKLAND INNER HARBOR REACH TO END OF PROJECT. This is a confined channel reach of about 2.5 miles in length which is subject to mild longitudinal currents and prevailing winds acting closely in alignment with the channel. The westerly reach (approximately .8 mile in length) is quite limited in width due to containment between two historical rubblemound jetties which form the channel banks. Other than these rock slopes the entire channel reach consists of fine sands, marine clays and silt presenting minimum hazards to vessels upon contact. Width consideration for this entire channel reach is based on one way ship passage under pilotage. For the westerly reach of channel a conservative value of 180% of the design vessel beam is allowed for width of maneuvering lane. Because of favorable currents and winds within Oakland Estuary, clearance lanes are conservatively limited to 120% of beam width for the design vessel. Thus a minimum channel reach of 462 feet (corresponds to the width restraint imposed by the locations of the existing rock jetties at the 43-foot channel depth) is designated for the westerly channel reach. This design is predicated upon ship passages accompanied by normal good wind and current conditions under navigation by skilled and experienced pilots. Larger ships (800'-900') may experience occasional delays under conditions which are less favorable. For the remaining 1.7 mile channel reach, east of the restricted width reach, less conservative channel width criteria would be applied. Bank clearances would be 150% and the maneuvering lane would be 200%, providing a minimum channel width of 525 feet. This reach includes two bends of about 30° each, for which an additional 175 feet would be provided for an overall channel width of 700 feet.

Widening of the bend at Project Mile 3.0 (Measured from West end of the Bar Channel) and construction of a limited turning basin at the east end of the Charles P. Howard terminal will both facilitate tug assisted turns of long containerships utilizing the improved channel. These widened channel areas are an optimization of the channel configuration for use of turning ships for channel exit. Use of these areas, when ship dimensions and drafts permit, is more time efficient than turning several miles upstream in the Fortman Basin. Location and configuration of proposed channel widening is shown on foldout Figures 10 through 14 in the main report.

CHANNEL DEPTH

C-11 It is not economically optimum to design channel depths adequate to accomodate the largest vessels projected to call at terminals along the Inner Harbor without delays, but channel dimensions have been provided which are adequate to accomodate most foreign and domestic ships expected to be serviced over the near term. Vessels such as the Asia Liner (the design ship) report a draft of 37 feet when loaded. For safe passage of this ship, additional depth allowances of 1 foot for squat, 2-foot for trim, and 3-foot for safe bottom clearance are provided. It was thus determined that the proposed channel depth should be 43 feet MLLW. For factors affecting channel depth, see Figure C-1. Projections indicate that a channel depth of 43-foot MLLW will accomodate 75% of containerships, expected to be in service by 1996, with no tidal delays.

ESTIMATES OF PROJECT COSTS

C-12 BASIS FOR FEDERAL COSTS

a. Equipment

Dredging quantities and cost estimates in this report assume deep draft channels would be dredged to design depth across the full width of bottom as indicated by the lines and sections shown on Drawings Figures 10 through 14 of the main report. Dredging of this project requires the use of a high capacity (i.e. 24" dia) hydraulic dredge in order that dredged material will be discharged as a slurry. The analysis also incorporated a supporting plant for the dredge and holding scows (4,000 c.yd. minimum capacity) for dredged material. The project estimate is based on a 2-year construction period to dredge the estimated c.y. of material located between the -42 depth established for the Oakland Bar Channel (under the Oakland Outer Harbor Channel Project) or currently maintained depth of -35 feet MLLW within the Inner Harbor Channel, and the proposed depth of -43 feet MLLW for the Inner Harbor Channel. A dredging production capability varying up to a maximum of 290,000 c.y. per month was used for this estimate. Disposal was assumed to be made on ebb tide cycles at the Alcatraz deepwater site at about seven miles distance.

b. Dredged Material Disposal. Material will be transported to the Alcatraz disposal site, where due to the production buildup while awaiting favorable ebb tide cycles, it will be retained in several 3,000 c.y. scows which will serve as holding basins. Hydraulically, dredged materials would be acceptable for disposal at the Alcatraz site. Disposal at the site is to be synchronized with the ebb tides as model studies have shown that this would allow the transport of up to 80 percent of the disposed material to the ocean. [1/]

c. Navigation Aids. Channel widening in various reaches will make necessary the relocation or installation of new navigation aids at angle points and channel boundaries. These relocations or installations would be made by the U.S. Coast Guard at an estimated cost of $50,000.

d. Price Level. Costs are developed on the basis of other Bay Area dredging projects on February 1983 price levels. First costs are shown on Table No. C-1.

1/ San Francisco Bay and Tributaries Appendix V, Sedimentation and Shoaling and Model Tests, 1967, San Francisco District, Corps of Engineer.

TABLE C-1
ESTIMATE OF FEDERAL FIRST COST
OAKLAND INNER HARBOR
(February 1983 Price Levels)

Item	Description	Quantity	Unit	Unit Price	Amount
	Mobilization and Demobilization	1	Job	L.S.	$ 465,000
	Dredging				
	(1) Standard Dredging (Bar Channel -42 feet to -43 feet and Inner Harbor Channel -35 feet to -43 feet)	3,580,000	c.y.	3.90	13,962,000
	(2) Overdepth (2 feet)	1,510,000	c.y.	3.90	5,889,000
		SUBTOTAL			20,316,000
		CONTINGENCIES (± 20%)			4,057,000
		Subtotal			$ 24,370,000
	Supervision & Administration (2%)				490,000
	Engineering & Design (4%) 1/				960,000
	Subtotal				$ 25,820,000
Relocation of 16" Dia Sewer Line (U.S. Navy)					1,200,000
Navigation Aids (USCG)					50,000
		TOTAL FEDERAL FIRST COST			$ 27,100,000

Note: Interest during construction (for dredging) has been derived on a total construction cost of $24,300,000 over a 2-year period. Using the current discount rate at 7 7/8%, the present worth of the Federal cost of interest during construction (for dredging) totals $2,550,000.

1/ Includes $260,000 for a groundwater contamination study.

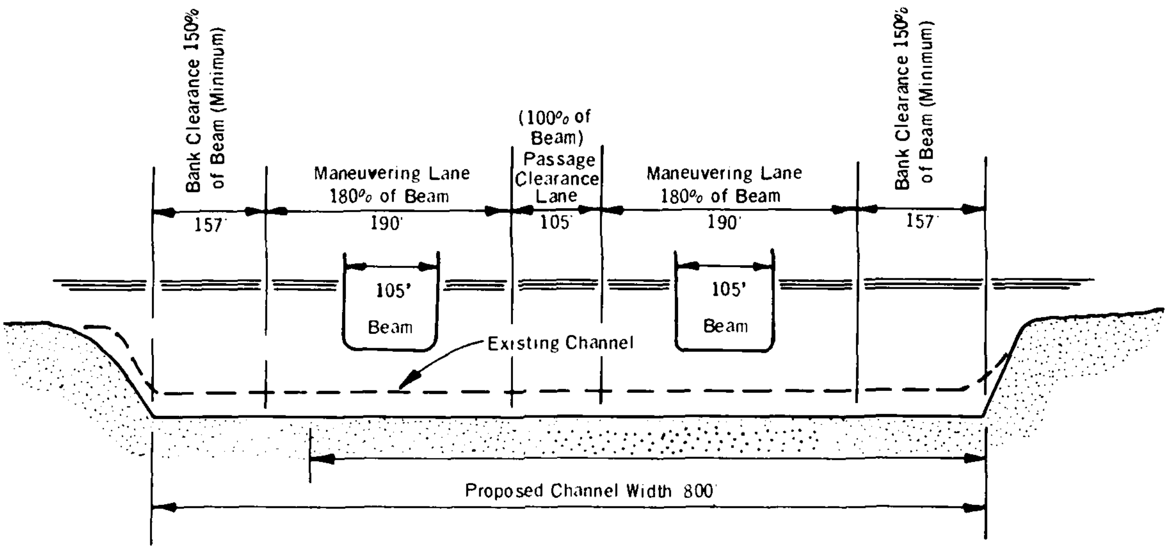
C-13 Basis for Non-Federal Costs

Under traditional cost sharing guidance there is no requirement for cost participation by Non-Federal Interests. However, full recovery of Federal costs assigned to commercial navigation, in accordance with the Administration's 15 July 1982 proposed legislation is presently under consideration.

MAINTENANCE

C-14 Federal. Based on experiences for maintaining Oakland Bar Entrance Channel and the Oakland Inner Harbor Channel an estimated average of 25,000 and 202,000 c.y. of material respectively is dredged annually. Maintenance is an annual dredging cycle at an average annual cost of $1,320,000 (Feb 1983 price level). Dredging of these channels will not appreciably increase the annual dredging quantity. Evaluation of the improved channel indicates that there will be an annual increase of maintenance dredging of approximately 10,000 c.y. due to the areas of channel widening. Based on the increased annual dredging of the 10,000 c.y. the average annual cost would be $45,000. This would be the increased average annual cost attributable to the improved project.

C-15 Non-Federal. The berthing areas located adjacent to the Oakland Inner Harbor Channel are currently maintained by local interests to depths in excess of the 38-foot depth MLLW. The assumption has been made that the 43-foot depth improved channel will not increase the non-federal maintenance dredging.

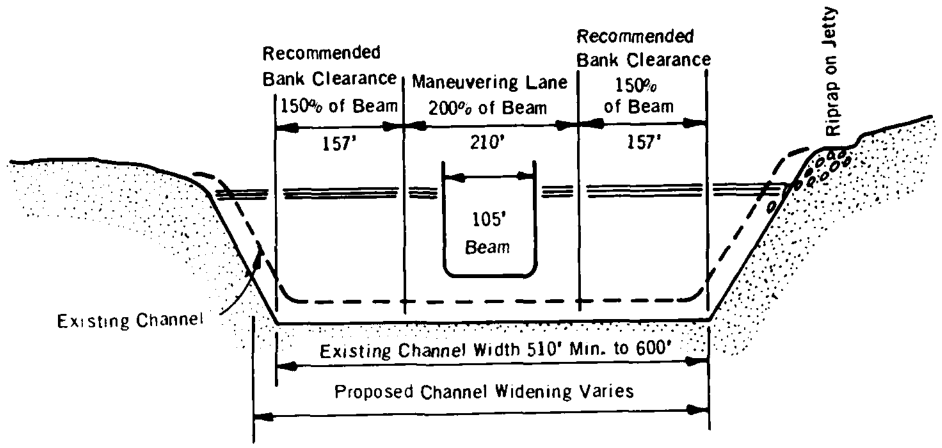


BAR CHANNEL

TYPICAL SECTION

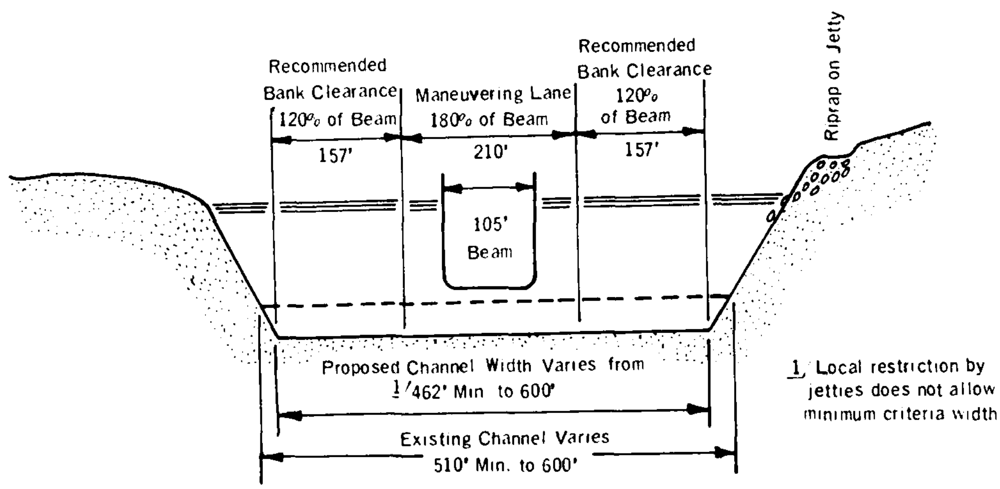
OAKLAND BAR ENTRANCE CHANNEL

FIGURE C-1. - ELEMENTS OF CHANNEL WIDTH.



NORMAL REQUIREMENT

TYPICAL SECTION



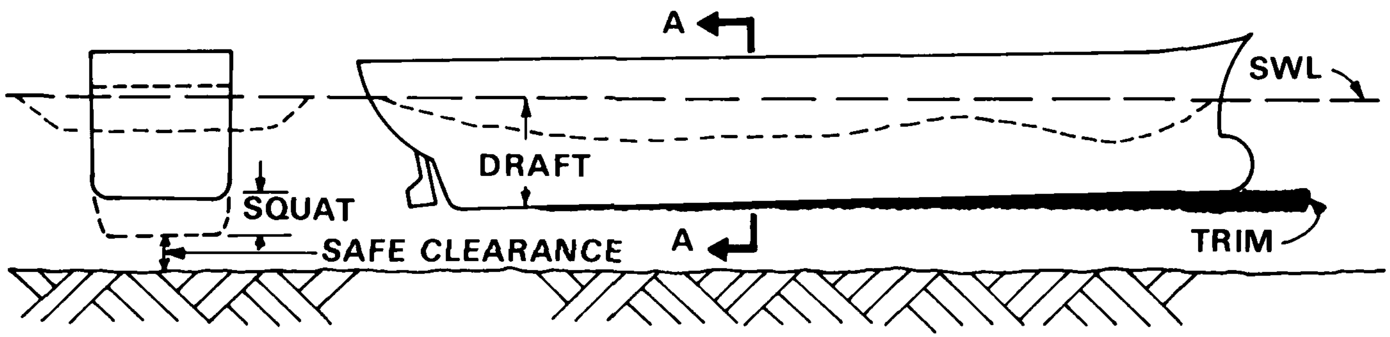
CHANNEL LIMITED BY RUBBLE MOUND JETTYS

TYPICAL SECTION

OAKLAND INNER HARBOR CHANNEL

FIGURE C-2. - ELEMENTS OF CHANNEL WIDTH.

FACTORS AFFECTING CHANNEL DEPTH



NAVIGATION FACTOR	ALLOWABLE DEPTH IN FEET (Other Ships)	ALLOWABLE DEPTH IN FEET (Container Ship)
SQUAT	1	1
TRIM	2	1/ 3
SAFE CLEARANCE	2	3
TOTAL	5	7

1/ President Lincoln (Containership)

FIGURE-C-3

OAKLAND-INNER HARBOR, ALAMEDA COUNTY, CALIFORNIA

APPENDIX D
NATURAL RESOURCES

JUNE 1983

APPENDIX D
NATURAL RESOURCES
OAKLAND INNER HARBOR, CALIFORNIA

TABLE OF CONTENTS

APPENDIX D
NATURAL RESOURCES
OAKLAND INNER HARBOR, CALIFORNIA

GENERAL

D-1 The following reports are sources of data on natural resources in the study area.

A. Appendix D, Dredge Disposal Study, San Francisco Bay and Estuary, Biological Communities, U.S. Army Engineer District, San Francisco, CA, August 1975.

B. Environmental Statement, Oakland Outer Harbor California Feasibility Report, U.S. Army Enginer District, San Francisco, CA, September, 1979.

C. Final Composite Environmental Impact Statement, Maintenance Dredging, Existing Navigation Projects, San Francisco Bay Region, CA, U.S. Army Engineer District, San Francisco, CA December 1975.

D. Port of Oakland Benthic Sampling Survey, Madrone Associates, February 1976.

E. Letter dated 19 May 1981 from U.S. Fish and Wildlife Services (FWS) Division of Ecological Services, Sacramento, California.

F. The California Least Tern Recovery Plan (1981).

G. A Breeding Survey of the California Least Tern, 1972.

H. "Application of Ecological Information to Habitat Management for the California Least Tern," Progress Report No. 4, Massey and Atwood, Oct 82

BIOLOGICAL RESOURCES

D-2 A survey performed in the early 1970's by Stanford Research Institute found 1[illegible]7 identified tax at a sampling site in the Inner Harbor. Six of these make up 94.6 percent of the total number of specimens. Streblospio benedicti was the most abundant polychaete (worm) with Exogone lourei the second most abundant of the molluses, the Gem clam (Gemma gemma) was the most common. Molluses of some abundance were Macoma nasuta, Macoma inquinata, Myspella sp and Musculus senhousia. A survey performed by Madrone Associates in 1976 for Port of Oakland's market street Terminal noted that the most conspicuous organisms present in the benthos were polychaete worms Cirriformia spiralranchia and Cirratulus cirratus and the bent-nose clam (Macoma nausta).

D-3 Most plants and animals occupying the water column of the central bay also utilize the harbor. The population density and diversity of phyto-and zooplankton are probably similar in both the bay and harbor. There presently is not information available to indicate a difference in fish composition between the harbor and the bay. It is expected that fish species found in adjacent areas of the bay, including the anadromous forms which migrate through, enter and use the harbor at times during their life cycles. The mammals of the bay, which includes sea lions, seals and porpoises, probably do not utilize the harbor to any extent due to human activity. (FWS, 1981).

D-4 Water birds utilize the harbor just as they do the rest of the bay. Some species of gulls and terns are present in the harbor year round while others are seasonal visitors. Migratory waterfowl use the area during migration and some spend the winter in and adjacent to the project area. Diving ducks and other diving birds feed in the harbor and use it for resting. (FWS, 1981).

RARE AND ENDANGERED SPECIES

D-5 On March 6, 1981, a request for a list of endangered and threatened species was made to the Area Office of the U.S. Fish and Wildlife Service (F&WS). On 2 April 1981, the F&WS provided a list with only the California least tern indicated as occuring in the area of the proposed Oakland Inner Harbor navigation improvements. A request for consultation was made by letter dated 14 June 1982 based on the determination that shallow feeding areas of the California least tern adjacent Oakland Inner Harbor Channel, which may support the nesting colony at Alameda Naval Air Station, would be disrupted during construction activities. By letter dated 1 July a982, F&WS replied denying initiation of consultation because of non-conformance with guidelines of proposed draft regulations implementing Section 7 coordination. The biological assessment provided to F&WS on 14 June 1982 has been incorporated into this report.

D-6 The historical breeding range of the California Least Tern (Sterna albifrons browni) which has been usually described as extending from Moss Landing in Monterey County to San Jose del Cabo in Southern Baja California, also includes San Francisco Bay. However, San Francisco Bay was not confirmed as a breeding area until 1967. Losses of nesting and feeding habitat have been responsible for the decline in numbers . Least terns are colonial but do not nest in dense concentrations as do other terns. They normally select a nesting site on an open expanse of sand, dirt and/or dried mud with loose substrate adjacent to a lagoon estuary or a wetland where food is available. Such a nesting site is located at the Alameda Naval Air Station adjacent to the Oakland Inner Harbor Channel. Essential habitat includes an area of land and air space comprising approximately 25 acres at the south end of the airstrip and fronting San Francisco Bay. The proposed channel deepening is not expected to affect the continued breeding of the California Least Tern at the Alameda Naval Air Station location.

No cumulative effect upon the nesting habitat at the Alameda Naval Air Station has been identified due to the proposed navigational improvements.

FISH AND WILDLIFE COORDINATION

D-7 The U.S. Fish and Wildlife Service Planning Aid Letter dated 19 May 1981 includes the following recommendations:

A. The deposition of dredged material at the Alcatraz site be done only during the ebb flow of the tides.

B. The widening of the entrance channel and triangular shoal be held to the minimum size required to assure navigational safety.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Division of Ecological Services
2800 Cottage Way, Room E-2727
Sacramento, California 95825

May 19, 1981

District Engineer
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Sir:

This planning aid letter discusses the effects that proposed improvements for navigation at Oakland Inner Harbor, Alameda County, California, would have on fish and wildlife resources. This letter does not constitute the report of the Secretary of the Interior on the project within the meaning of Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. et seq.). It is for inclusion in your report being prepared pursuant to a May 10, 1977, resolution by the Committee on Public Works of the U.S. House of Representatives requesting a review of the Oakland Inner Harbor in order to recommend the most effective, efficient and economic means for improvement of the inner harbor and waterways. Our analysis is based on engineering data provided by the Corps of Engineers prior to April 1981. Information in this report regarding fish and wildlife resources has been reviewed by personnel of the California Department of Fish and Game and the National Marine Fisheries Service. These personnel generally concur with our recommendations.

EXISTING PROJECT

Oakland Inner Harbor was first modified by the U.S. Army Corps of Engineers pursuant to the River and Harbor Act of 1874. The most recent improvements were authorized by Congress in 1962. An entrance channel 35 feet deep and 800 feet wide extends from deep water in San Francisco Bay across a shoal area southeast of Yerba Buena Island and then narrows to 600 feet in the main channel. The inner harbor channel is 35 feet deep and extends for a distance of about 6 miles to Fortman Basin. Other project features include parallel rubble-mound jetties at the entrance to the inner harbor, a turning basin, interior channels and a tidal canal connecting San Leandro Bay.

PROPOSED IMPROVEMENTS

The Corps of Engineers' reconnaissance report contains an evaluation of four plans. Plan A is the no project alternative in which the Corps would continue to maintain the channel widths and depths of the project as presently authorized. Plan B would include deepening a 4-mile reach of the channel from the harbor entrance to the Clay Street Piers from 35 to 42 feet below MLLW, widening the entrance bar from 800 to 1,000 feet, and removal of a triangular shoal in the entrance channel. Plan C would be similar to Plan B except that a hydraulic suction-dredge and pipeline would be used for disposal of some of the dredged material on a 190-acre site on the south side of the Bay Bridge adjacent to the Oakland Outer Harbor. Plan D would be similar to Plan B except that a 6-mile reach of the inner harbor channel from the entrance to Fortman Basin would be deepened to 42 feet below MLLW and two submarine highway tubes would be replaced with a high arch bridge.

Under Plans B and D, about 6.8 and 8.9 million cubic yards respectively of bottom sediments would be excavated by clamshell dredge to obtain the desired dimensions during the construction period of 18 months or less. Maintenance of the proposed navigation project would require an increase in the removal of dredged material from 150,000 to 230,000 cubic yards on an average annual basis. Except for pumping a portion of the excavated material to a landfill site next to the Bay Bridge under Plan C, all dredged material would be disposed of in deep water at the Alcatraz site (SF-11) since analysis of the bottom sediments indicate that the Environmental Protection Agency's criteria for disposal of dredged material in inland waters would not be exceeded.

The existing project is designed to accommodate two-way traffic of 35-foot draft vessels. Deepening the channel to 42 feet below MLLW would allow passage of the larger containerships with drafts in excess of 35 feet with no tidal delay, unless they were turned around upstream from the Alameda tubes in Fortman Basin at mile six. Slips near the Clay Street piers at mile four are used sometimes for turning vessels and some widening proposed for the project under study would allow some vessels to be turned around with tugboats at other locations in the inner harbor at slack tide.

FISH AND WILDLIFE RESOURCES

Fish and wildlife resources in the project area are typical of those found in the subtidal portions of San Francisco Bay. Channel modifications and human activity have, however, reduced the value of the harbor for wildlife.

Benthic organisms are removed from the channel or disturbed by dredging operations and prop wash from deep-draft vessels. These activities probably prevent the benthic community of annelids, molluscans and arthropods from attaining the same species diversity and abundance as in non-disturbed deep-water areas of the Bay.

Most plants and animals occupying the water column of the central bay also utilize the harbor. The population density and deversity of phytoplankton and zooplankton are similar in both the bay and harbor. There presently is no information available to indicate that there is a difference in fish composition between the harbor and the bay. It is expected that fish species found in adjacent areas of the bay, including the anadromous forms which migrate through, enter and use the harbor at times during their life cycles. The mammals of the bay, which include sea lions, seals and porpoises, probably do not utilize the harbor to any extent due to human activity.

Water birds utilize the harbor just as they do the rest of the bay. Some species of gulls and terns are present in the harbor year round while others are seasonal visitors. Migratory waterfowl use the area during migration and some spend the winter in and adjacent to the project area. Diving ducks and other diving birds feed in the harbor and use it for resting.

The California least tern may be present in the project area. The Service has requested the Corps to prepare a Biological Assessment to determine if the proposed project would have an impact on the tern.

PROJECT IMPACTS

Plan A would not cause any further impacts on fish and wildlife resources other than those which already occur due to maintenance dredging activities and disposal of excavated material in the aquatic environment.

Under Plans B, C and D, deepening the Oakland Inner Harbor channel would cause an increase in the amount of maintenance dredging. Benthic organisms would be removed from the channel and most would die on the barge or when deposited at the disposal site. High turbidity and a reduction in dissolved oxygen levels may cause some stress to fish and benthic organisms but the impact is not expected to be significant. Widening the entrance channel and the triangular shoal would result in an additional loss of benthic organisms since these areas have not been dredged previously. This loss, however, would be short-term since bottom-dwelling organisms in the project area would repopulate in much the same distribution and density as existed previously.

At the Alcatraz site, mounding would occur but previous studies indicate that strong currents probably would remove and redistribute the material throughout the bay and in the ocean. The impact of dumping more spoils dredged from the Oakland Inner Harbor on aquatic organisms would be minor. However, the cumulative impact of continually dumping large amounts of spoils at the Alcatraz site from other navigation projects in the Bay over an extended period of time could cause greater than usual stress on benthic organisms.

A considerable amount of open-water habitat in the Bay, plus some tidal mudflats, would be filled under Plan C. This would result in a significant loss of benthic organisms and adversely impact animals at higher trophic levels that depend on them for food, such as bottom-dwelling fish, diving birds and shorebirds. This loss would be permanent if the area filled is used to develop new land for the future expansion of the Port of Oakland facilities. Filling would also cause a reduction in water circulation, increase sedimentation, and result in some degradation of local water quality.

DISCUSSION

Construction of the proposed navigation improvement under Plans B, C and D would disrupt and destroy the benthic community more than under existing maintenance dredging operations. Dredging the triangular shoal and widening the entrance channel would result in additional losses of aquatic re[illegible] [illegible] areas have not been dredged before. Although the Service [illegible] disposal within the Bay, use of the Alcatraz site would have a lesser long-term adverse impact on aquatic organisms than disposal at other sites within the Bay. Adverse impacts of spoil disposal on these resources could be minimized if disposal of dredged material at the Alcatraz site is done during the ebb flow of the tide.

The proposal under Plan C to fill a 190-acre site in the open-water portion of San Francisco Bay would have unacceptable impacts on fish and wildlife resources and would be contrary to Executive Order 11990 (Preservation of Wetlands). Consideration should be given instead to marsh creation and restoring tidal action to areas behind dikes. We recognize that there may not be any potential fill areas in the project vicinity. However, use of dredged material for marsh creation does present an opportunity to enhance fish and wildlife resources in the Bay.

RECOMMENDATIONS

To protect fish and wildlife resources in the Oakland Inner Harbor project area from unnecessary damage, the Fish and Wildlife Service recommends that:

1. The deposition of dredged material at the Alcatraz site be done only during the ebb flow of the tide.

2. The widening of the entrance channel and triangular shoal be held to the minimum size required to assure navigational safety.

Please advise us of your proposed action regarding these recommendations.

Sincerely,

James J. McKevitt
Field Supervisor

cc: Dir., CDFG, Sacramento
Reg. Mgr., CDFG, Reg. III, Yountville
NMFS, Tiburon
NMFS, Terminal Island
FWS, ES, Washington, D.C.

Resources Building
1416 Ninth Street
95814

(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Forestry
Department of Boating and Waterways
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

THE RESOURCES AGENCY OF CALIFORNIA
SACRAMENTO, CALIFORNIA

Air Resources Board
California Coastal Commission
California Conservation Corps
Colorado River Board
Energy Resources Conservation and Development Commission
Regional Water Quality Control Boards
San Francisco Bay Conserv. and Development Commission
Solid Waste Management Board
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board

Colonel Paul Bazilwich, Jr.
U.S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

June 5, 1981

Dear Colonel Bazilwich:

The State has reviewed the Reconnaissance Report, Oakland Inner Harbor, Deep-Draft Navigation, submitted through the Office of Planning and Research. This review, in accordance with OMB Circular A-95, was coordinated with the San Francisco Bay and State Lands Commissions, the Air Resources and Water Resources Control Boards, and the Departments of Boating and Waterways, Conservation, Fish and Game, Parks and Recreation, Water Resources, Health, and Transportation.

The Department of Fish and Game (DFG) has the following concerns which the Corps may wish to consider at this stage of project planning:

1. Existing intertidal habitat along the shore in Oakland Inner Harbor should not be lost to bulkheading or other efforts proposed to provide slope stabilization.

2. New dredging at the inner/outer channel triangle or widening of the entrance bar channel may have a greater environmental impact than does deepening channels already subject to periodic maintenance dredging. These potential impacts should be considered in decision making and discussed in the EIS.

3. Any dredging should be done by means of the least damaging method or mix of methods. Past studies have indicated that the hopper dredge is an environmentally preferred dredging method, and hopper dredges are used for maintenance dredging of the existing navigation channel. This report, however, indicates that the proposed deepening would be done using a clamshell dredge and barge combination, because hopper dredges are reportedly not available to contractors on the west coast at this time. DFG would like to have this lack of availability of hopper dredges clarified, and to see a discussion of environmental and economic comparisons of the hopper dredge versus clamshell-barge.

It is evident from this report that the Corps prefers using the Bay disposal site near Alcatraz Island (SF 11) for this project. DFG has no objection to consideration of using SF 11 or a deepwater ocean disposal site, if one were available. This, of course, is contingent upon the dredged materials meeting requirements for disposal at those sites. The 100-fathom ocean site (SF 7) is within the newly-designated Point Reyes-Farrallon Islands Marine Sanctuary and may not be available for use, although a replacement site may be designated in the future.

Because the other alternative disposal sites were given such negative evaluations in this report, DFG sees no need to comment specifically on each. It may be worthwhile, however, to indicate that DFG concurs with the report's conclusion that the Port of Oakland Fill alternative is not justified. We would object to use of the San Francisco Bar (ocean) site (SF 8) for materials from the proposed project, based upon expected volumes and sediment types.

Questions regarding DFG comments should be directed to Rolf Mall, DFG, 350 Golden Shore, Long Beach 90802 or (213) 590-5155.

The report adequately reflects Caltrans' position that the channel cannot be lowered over the Posey and Webster Street tubes without their relocation or replacement. Replacement of these tubes with a high-arch bridge that would provide navigational clearances would pose severe dislocation, traffic, and cost impacts at the bridge approaches, particularly at the Oakland approach. The cost analysis in Table 4 does not appear to account for the approach facilities. The report should include a sketch that depicts the replacement structure in plan and profile.

If a replacement structure is to be considered further as a viable alternative, the bridge and its appurtenant approaches and facilities should be staged to be complete and operational before removing the tubes. Concept details should be analyzed in the EIS.

Subsequent environmental documents should also quantitatively assess the impacts to State highways and local arterials for traffic and transportation impacts generated by the growth potential expected if the channel is upgraded. Regional impacts are likely.

We greatly appreciate having been given the opportunity to review this document.

Sincerely,

JAMES W. BURNS
Assistant Secretary for Resources

(SCH 81042134)
cc: Office of Planning and Research

BIOLOGICAL ASSESMENT
OAKLAND INNER HARBOR CHANNEL

ON-SITE INSPECTION

The Port of Oakland is located on the east side of San Francisco Bay, about eight miles inside the Golden Gate. The Oakland Inner Harbor Channel is locally called "the Estuary". This channel separates the City of Alameda from the City of Oakland. No on-site inspection has been performed, since the alameda Naval Air Station has been under surveillance since 1980 by joint contract between the U.S. Navy and the local chapter of the Audubon Society. The presence of the least tern in the vicinity of the project area has been documented.

INTERVIEW EXPERTS

The following persons have been contracted and the proposed project discussed:

Paul Kelly, Wildlife Biologist, California Department of Fish and Game, California Least Tern Recovery Team member

Laura Collins, Project Leader for the Alameda Naval Air Station Least Tern surveillance program (1980-1983)

REVIEW LITERATURE

The historical breeding range of the California Least Tern, which has been usually described as extending from Moss Landing in Monterey County to San Jose del Cabo in Southern Baja California, also includes San Francisco Bay. However, San Francisco Bay was not confirmed as a breeding area until 1967. The Oakland Inner Harbor Channenl is located adjacent to a known least tern breeding site located at the Alameda Naval Air Station. In 1977, at least forty pairs nested on an asphalt apron on the airfield. Essential habitat includes an area of land and airspace comprising about 25 acres. This area is one of only four nesting sites located in San Francisco Bay. The nesting season extends from April through August. Limited observations made during the 1982 survey provided some insight into the foraging behavior of the terns. The nesting California least terns in San Francisco Bay obtain most of thier food from the shallow areas adjacent their nesting sites. Terns have been observed occasionally foraging in the Oakland Inner Harbor Channel which is less than one mile north from the Alameda Naval Air Station nesting site. However, most feeding activity was observed at the shallow water areas associated w'th the southern shoreline of the Air Station and Ballena Bay, a little over two miles to the southeast of the nest site. Fish known to be eaten by terns include in order of importance: Northern anchovy (Engraulis mordax), topsmelt (Atherinops affinis), various surfperch (Embiotocidae), killifish (Fundulus parvipinnis), mosquitoefish (Gambusia affinis), and other species

Losses of nesting and feeding habitat have been responsible for the decline in numbers of terns. Heavy pressure on nesting areas at the Alameda Naval Air Station resulting from predation by natural enemies and by domestic animals and from human disturbances, have also limited successful least tern nesting and productivity.

References:

Atwood, Jonathan L., at el, "California Least Tern Census and Nesting Survey, 1977", Nongame Wildlife Investigations, California Department of Fish and Game, Job V-2. 11, Final Report, December 1977.

Collins, Charles T., et al, "Report on the Feeding and Nesting Habits of the California Least Tern in the Santa Ana River Marsh Area, Orange County, California", U.S. Army Corps of Engineers, Los Angeles District, Contract No. DACW09-78-C-008, june 1979.

Colline, Laura T. and Bailey, Stephen F., California Least Tern Nesting Season at Alameda Naval Air Station (1980-1982).

Massey, Barbara W., "A Breeding Study of the California Least Tern, 1971", Wildlife Management Branch Administrative Report No. 71-9, November 1971.

U.S. Fish and Wildlife Service, California Least Tern Recovery Plan, U.S.F.W.S., Region 1, in cooperation with the California Least Tern Recovery Team, April 1980.

DISCUSSION OF REVIEW AND ANALYSIS OF EFFECTS

No impact upon the Alameda Naval Station nesting site will result from the proposed construction at Oakland Inner Harbor Channel. Dredging activities will temporarily disturb the northern feeding areas of the least tern in the Oakland Inner Harbor Channel during two nesting seasons during construction (surface area is about 17.5 acres). However, shallow water areas to the west, south and southeast will still be available for foraging. After construction, the northern feeding range is expected to again be available for foraging purposes. Based on the limited observations made during the 1982 survey, the importance of the Oakland Inner Harbor Channel as a foraging area to the nesting least terns can not be accurately determined. The observations do point out that a large foraging effort occurred near the breakwaters immediately south of the nest site, and that the inner harbor channel was not often frequented during the observation period. Implementation of the proposed action will disrupt a limited portion of the least tern's feeding range. No other effects on the endangered least tern is expected. There are no other threatened or endangered species known to inhabit the project area.

ANALYSIS OF ALTERNATIVE ACTIONS

The U.S. Navy is now undertaking a program for the development of a nest management plan at the alameda Naval Air Station. The major problem of successful nesting at the Air Station has been related to predation by feral cats and natural predators resulting in severe losses to young tern chicks. Problems that may relate to successful foraging have not been identified because of the effort to secure the nesting area. Some actions that may be considered in relation to the proposed action include:

(1) Conduct dredging activity only during the period from September through March. This would complicate the construction contracting process and would result in additional cost for either increased mobilization and demobilization or an increased cost for the retention of the services of the contractor. This would also increase the duration and expense of the construction period by at least ten months if not longer. The result would be an increase in time and funding. Logistically, the mobilization of equipment to perform the work in such a manner would not be practical. This is not a reasonable measure to consider further.

(2) Implement a short-term feeding facility near the nest site to supplement the tern's food supply. Stocking of small fish would continue through the construction period. There is no indication that such facilities would be attractive to the terns. It may also be difficult to exclude other predators from competing with the terns for the planted fish. This does not appear to be a reasonable measure to consider further.

(3) Implement surveillance of nesting and related activities with emphasis on foraging behavior to determine the importance and frequency of use of Oakland Inner Harbor Channel prior to construction. This would provide additional information in making a determination for recommendations to conserve the lease tern if needed.

(4) Conduct surveillance of the nesting least tern in conjunction with the dredging activities. This measure would allow construction to proceed and would also provide documentation that could correlate the effects of dredging activity with potential for significant adverse effects on successful nesting or feeding.

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

APPENDIX E

SECTION 404(b) EVALUATION

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

JUNE 1983

APPENDIX E

SECTION 404 (b) EVALUATION

I. PROJECT DESCRIPTION

A. Location. Oakland Inner Harbor Channel is located on the eastern side of San Francisco Bay in Alameda County. This channel separated the City of Alameda from the City of Oakland.

B. General Description. The proposed project includes deepening navigation channels between the entrance to Oakland Harbor via the Bar Channel and the Clay Street Piers and widening certain reaches including the shoal area on the north side of the Inner Harbor entrance reach. A more complete description is found in the text.

C. Authority and Purpose. By resolution dated 10 May 1977, Congress directed the Corps of Engineers to review the report on Oakland Harbor, California, published as House Document Number 353, 87th Congress, 2nd Session and other reports in order to develop recommendations for most effective, efficent, and economic means for improvement of the Inner Harbor and waterways, including consideration of an increase of channel project depth for the four-mile reach between the inner harbor entrance and the vicinity of the Clay Street piers and widening of the entrance bar channel.

D. General Description of Dredged Material:

1. The material to be dredged is comprised of sand, clays, and silts with sand comprising most of the material. Of thirteen random holes sampled, only five required elutriate analysis.

2. About 5.1 million cubic yards of material are to be dredged.

3. Material will originate from the existing Oakland Inner Harbor Channel, Alameda County, California.

E. Description of the Proposed Discharge Site.

1. The Alcatraz disposal site is located at the following coordinates: 37°49'17"N, 122°25'23"W, about one-third of a mile south of Alcatraz Island. The coordinates describe the center of the 2,000-foot diameter circular site.

2. The disposal site is an open-water, high energy location. Due to the magnitude and extent of currents, rapid dispersion of dredged sediments in slurry will occur.

3. A marine open-water habitat type exists at this location as this area is a corridor for anadromous species migrating to and from the Sacramento-San Joaquin estuary. Many other marine species are also known to migrate through this reach at some time during the year.

4. The estimated time frame for dredging and disposal operations is 24 months, beginning in 1987.

I. F. Description of Disposal Method: The project is expected to be dredged by hydraulic dredge/barge. Disposal will be accomplished by discrete bottom dump from the barge.

II FACTUAL DETERMINATION

A. Physical Substrate Determinations:

1. The average depth at the Alcatraz disposal site is about 85 feet.

2. Bottom sediments at the disposal site are mostly sand.

3. Complete dispersal of unconsolidated material is expected at this site.

4. Physical effects on benthos is minimal in this high energy area.

B. Water Circulation, Fluctuation and Salinity Determinations:

1. Water

a. Salinity will not be affected by disposal activities.

b. Water chemistry may be altered during disposal, but ambient conditions will return as mixing occurs.

c. Clarity is expected to be impacted during disposal, but ambient conditions will return rapidly.

d. Color will also be impacted as suspended solid concentration increases in the water column during disposal. As dispersion progresses, ambient color is expected to recover.

e. Odors are not expected to be impacted.

f. Taste is not expected to be impacted.

g. Dissolved oxygen will be reduced locally during the disposal. Dissolved oxygen concentrations should return to ambient after the discharge.

h. Nutrient levels will increase slightly at the discharge site, but will be absorbed in the Bay system as mixing occurs.

i. No eutrophication is expected as a result of disposal.

C. Suspended Particulate/Turbidity Determinations:

1. Disposal of dredged material at the Alcatraz site is expected to result in a temporary, localized increase in suspended solids in the water column. This will only last for a few minutes until the sediments are completely dispersed by currents.

2. No significant impact on the chemical or physical characteristics existing at the Alcatraz site will occur as a result of the disposal activity.

3. No significant effects on biota is expected with disposal at the Alcatraz site. Although an increase in suspended solids will be introduced, the duration of each discrete dump is of such a short time that the potential for adverse impact is minimal.

D. Contaminant Determination. Elutriate analysis of the five samples of dredged sediments indicate no significant concentration of contaminants present (See test data found near the end of this appendix). The five samples were elutriated with disposal site water and subject to chemical analysis for oil, grease, residual petroleum hydrocarbons, mercury, lead, zinc, cadmium, copper, PCB's and total identifiable hydrocarbons (TICH). The detected levels in the elutriate of oil and grease, mercury, lead, zinc, cadmium, copper and PCB plus TICH were all below the State water quality objectives. The concentrations of residual petroleum hydrocarbons of two samples did indicate a value greater than found at the Alcatraz site , but not in amounts that would result in degradation of water quality at the Alcatraz site due to the dipersal characteristics at the site. Elutriate data for the placement of underwater cables at the upper end of the proposed Oakland Inner Harbor Channel deepening project is presented at the end of this appendix for representation of sediment quality for the extended widening at the terminus of the project. Results of this elutriate analysis also demonstrates no significant concentrations of contaminants.

E. Aquatic Ecosystem and Organism Determination:

1. Short-term impacts in the water column at the disposal site may impact plankton present during disposal. Ambient conditions are expected to return after disposal operations have ended.

2. No impact on benthos at the disposal site is anticipated.

3. Short-term impact on nekton is expected during the construction period.

4. The aquatic food web is not expected to be altered by the disposal activity.

5. No special aquatic areas such as marine or estuarine sanctuaries, refuges or wetlands, mudflats, vegetated shallows or important aquatic sites will be modified or altered by the disposal.

6. No threatened or endangered species will be affected by the disposal.

7. No other wildlife species will be adversely impacted.

F. <u>Proposed Disposal Site Determinations:</u>

1. The mixing characteristics at the Alcatraz site will permit maximum dispersal of unconsolidated dredged material. The swift currents will rapidly assimilate unconsolidated material back into the Bay sediment regime.

2. The results of the elutriate analysis indicate no potential for adverse effect. Although one parameter tested, residual petroleum hydrocarbon, did show a slightly high concentration when compared with the ambient disposal site, concentration returned to an acceptable level over a short period of time. This parameter at the Alcatraz site after disposal is not expected to be detected in amounts over ambient concentrations.

II. C. 3. <u>Potential Effects on Human Use Characteristics:</u>

a. Disposal of dredged material at the Alcatraz disposal site will not impact groundwater aquifers. However, investigation of the Oakland Inner Harbor area indicated that groundwater aquifers may be affected from deepening. Preliminary analyses of ground water quality samples taken from water wells adjacent the Oakland Inner Harbor Channel by the California Department of Water Resources indicate that at least portions of both the Merritt Sand and Alameda Formations contain ground water that meets the California Secondary Drinking Water Standards. These formations should be considered usable aquifers until additional investigations can be performed to document complete descriptions of the formations and to determine the effects of the proposed deepening of the channel. Without additional information, it has been assumed that by implementing the project, these ground water aquifers would be degraded. This would violate the State's water quality policy of nondegradation, Resolution Number 68-16, which states that existing high quality water be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of water, and will not result in water quality less than standards prescribed by policies of the State Water Resources Control Board (See Appendix G). Additional informaiton shall be collected and every step will be taken to insure that adverse effects upon ground-water formations will be avoid.

b. Short-term impact upon recreation and commercial fishing may occur during disposal. However, use of area will not be eliminated. Fishing activity in the vicinity would return after disposal activities without adverse effect.

c. No water-oriented recreation, other than fishing, will be impacted.

d. Disposal and its accompanying localized turbidity will create a distraction at the disposal site that can be viewed at various vantage points around the Bay. This impact is, however, temporary in nature and the Bay system will retain its natural scenic qualities after disposal activities ha[illegible].

e. No parks, National and Historic Monuments, National Seashores, Wilderness Areas, research sites or similar preserves will be affected by the proposed disposal.

H. Determination of Cumulative Effects on the Aquatic System.

Sedimentation is the process of sediments circulating and depositing and is a phenomenon that occurs in all estuaries. Factors included in the sedimentation dynamics of the Bay include, but are not limited to, Delta inflow, wind generated waves, currents, and tidal influences. Dredged material is released at three designated sites within the Bay: Carquinez, San Pablo and Alcatraz. The long term distribution of dredged material discharged in the Bay is affected by the sedimentation dynamics.

Sediment inflow-outflow volumes within the San Francisco Bay system have been estimated on numerous occasions since 1917. The U.S. Geological Survey in 1961 was the first to use direct measurements of suspended loads being transported into the Bay system by all sources. Between 1957-1959 annual sediment inflow was estimated by U.S.G.S. to be 8.8 million cubic yards. Krone in 1966 estimated annual sediment inflows for the Bay system to be 10.5 million cubic yards using hydrologic data from 1922-1933 and U.S.G.S. measurements of suspended sediment for the years 1957-1965. From the estimated measurements of sediment inflow, sediment outflow from the Bay system to the ocean has been estimated. Of the sediment entering the Bay system, a portion is conveyed to the ocean via the Golden Gate and a portion retained in the Bay system.

Inflowing sediment is not directly carried to the ocean. A large percentage of the inflowing sediment remains in residence in the Bay for a number of years, being deposited, then resuspended, recirculated and redeposited elsewhere, ultimately being transported out of the Bay system. Some sediment is permanetly retained in the system. Corps estimates of dredged material placed into suspension within San Francisco Bay averaged over a 100-square mile area is about 400 cubic yards per square mile per day of dredging and disposal. For comparison, the amount of sediment suspended by wave action in shallow water has been estimated to be 6,500 cubic yards per day (for days when wind is 10 knots or greater).

Dredging of navigation channels and discharging at one of the disposal sites in the Bay has the effect of redistributing the sediments within the system. Accumulation of consolidated sediments has been identified at the Alcatraz site. Although this located in a high current velocity area which allows for rapid dispersion and recirculation, consolidated material along with debris and concrete rubble have also been disposed using clamshell dredging with barge disposal. Dredging with a hydraulic cutterhead will ensure for the disposal of unconsolidated sediments, and, in turn, will facilitate dispersion. The policy of selecting a site closer to the Golden Gate, such as the Alcatraz site, allows a higher percent of sediments to be transported to the ocean.

Roughly 2.5 million cubic yards of dredged sediments are discharged at Alcatraz from current Federal (civil and military) maintenance dredging annually. Implementation of several navigation improvement projects in San

Francisco Bay include disposal at Alcatraz. The authorized (Phase 2) John F. Baldwin Ship Channel would result in initial dredging of 8.1 million cubic yards over a two year period (assuming continous construction without budgetary constraints). Increased annual maintenance dredging would result in about 400,000 cubic yards. The recommended deepening at Oakland Outer Harbor Channel would result in initial dredging of about 6.3 million cubic yards over a two-year period. Additional annual maintenance dredging would result in about 300,000 cubic yards. Implementation of navigation improvements for Richmond Harbor channels would result in initial dredging of 7.2 million cubic yards over two years. Increased annual maintenance dredging would involve about 300,000 cubic yards. Although the increase in the amount of material to be disposed at Alcatraz is about 3.5 times above the existing level, the Bay system is capable of assimilating these quantities. The amount of material not leaving the Bay system would be recirculated and redistributed. As described previously, the annual inflow of sediments results in a circulation and distribution throughout the Bay system.

It should be noted that the disposal activity does not add sediments to the system, but redistributes them and results in the transport of sediments to the ocean. A forecasted schedule of new work assuming no scheduling or tidal constraints and maintenance dredging with disposal at Alcatraz is shown below:

Project Name/Year	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87	FY 88	FY 89	FY 90
Current Maintenance	2.3	2.3	2.9	2.3	2.3	2.9	2.3	2.9	2.3
John F. Baldwin			4.0	4.1	0.4	0.4	0.4	0.4	0.4
Oakland Outer Harbor				2.3	4.0	0.3	0.3	0.3	0.3
Richmond Harbor						4.0	3.2	0.3	0.3
Oakland Inner Harbor							1.5	1.6	2.0
TOTAL	2.3	2.3	6.9	8.7	6.7	7.6	7.7	5.4	5.3

Accumulation of material at the Alcatraz site is not expected with the increased amount of dredged material to be disposed since disposal will discharge unconsolidated sediments. Contaminant concentrations after disposal of dredged material are expected to remain at ambient levels or rapidly dilute to ambient levels. This observation is based on elutriate test results and the mixing zone at the Alcatraz site.

Scheduling of the new work projects has been staggered to most effectively utilize funds allocated for construction during a given fiscal year. This would also lessen the total quantity of material to be disposed in one year and would present a balanced construction schedule over a relatively short period. Although the construction time for the four projects extends over six years, this would also minimize the burden at the Alcatraz site if all four projects could be dredged at the same time.

H. Determinations of Secondary Effects on the Aquatic Ecosystem. No secondary effects resulting from disposal at the proposed Alactraz site are anticipated. Unconsolidated material disposed at the Alcatraz site will be carried to ocean waters outside of the Golden Gate or be absorbed by the Bay sediment dynamics and recirculated throughout the Bay system.

I. Considerations to Minimize Harmful Effects.

1. Two other suitable, open-water disposal sites were considered, but are located in more shallow water than found at the Alcatraz site. Although located closer to the project area, the large amount of material to be dredged was considered to be more appropriately disposed closer to the Golden Gate. Ebb tide disposal was incorporated specifically for the new work dredging to permit optimum conditions for passage of material to the ocean.

2. Disposal of "clean" material on dredged material is not necessary, since sediments characteristics and site characteristics preclude such application.

3. The dredging method recommended for use of the Alcatraz site will be limited to hydraulic dredge with barge disposal to minimize potential for mounding.

MONITORING

4. A monthly hydrographic survey shall be conducted during the construction period to determine bottom topography changes. In the unlikely event that significant mounding occurs over time (i.e. the rate of accretion exceeds the rate of erosion), the following actions would be taken:

a. Modifications to the dredging operations would be implemented. As an example, additional water could be pumped into the barge to enhance the liquid nature of the slurry, or air hoses could be placed in the barge to permit continual agitation of the dredged material and prevent consolidation of the clayey sediments; or

b. A suitable alternative site for receiving dredged material would be evaluated. An investigation to identify an appropriate Bay site where the potential for mounding would be acceptable would be accomplished. When such a site is identified, a determination of its utility as a disposal option for this project will be made.

c. If actions to minimize harmful effects (including, but not limited to, the above two actions) are not successful in permitting the completion of the project, further dredging would be discontinued.

A letter notice to interested agencies shall be furnished by the San Francisco District indicating the changes to be implemented with an estimation of the remaining quantity of material to be disposed. No administrative waiting period would be required.

OAKLAND INNER HARBOR DEEPENING

ANALYSIS OF SEDIMENTS

April 1982

AUTHORIZATION

1. Results of tests reported herein were requested by DA Form 2544 No. E86-82-3018 dated 25 January 1982, from the San Francisco District.

PURPOSE

2. The purpose of this study was to determine the amount of specified pollutants in samples of bottom sediments and to determine the grain size distribution.

SAMPLES

3. Sediment samples in plastic tubes and water samples in cubitaners were received on 22 and 29 January 1982.

TEST METHODS

4. a. Standard Elutriate. Petroleum hydrocarbons, mercury, cadmium, lead, zinc, oil and grease, and PCB and TICH were run according to "Ecological Evaluation of Proposed Discharge of Dredge Material into Ocean Waters," by EPA/Corps of Engineers.

b. Particle size and unit weight. Engineer Manual EM 1110-2-1906.

TEST RESULTS

5. Data are presented as follows:

a. Table 1 shows the results of tests.

b. ENG Forms show the gradation curve for the samples.

AD-A131 508 FEASIBILITY STUDY AND ENVIRONMENTAL IMPACT STATEMENT OAKLAND INNER HARBOR..(U) CORPS OF ENGINEERS SAN FRANCISCO CA SAN FRANCISCO DISTRICT JUN 83

3/3

UNCLASSIFIED F/G 13/2 NL

END
DATE
FILMED
9 83
DTIC

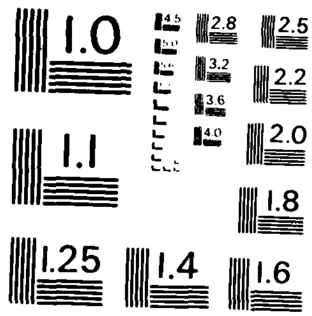
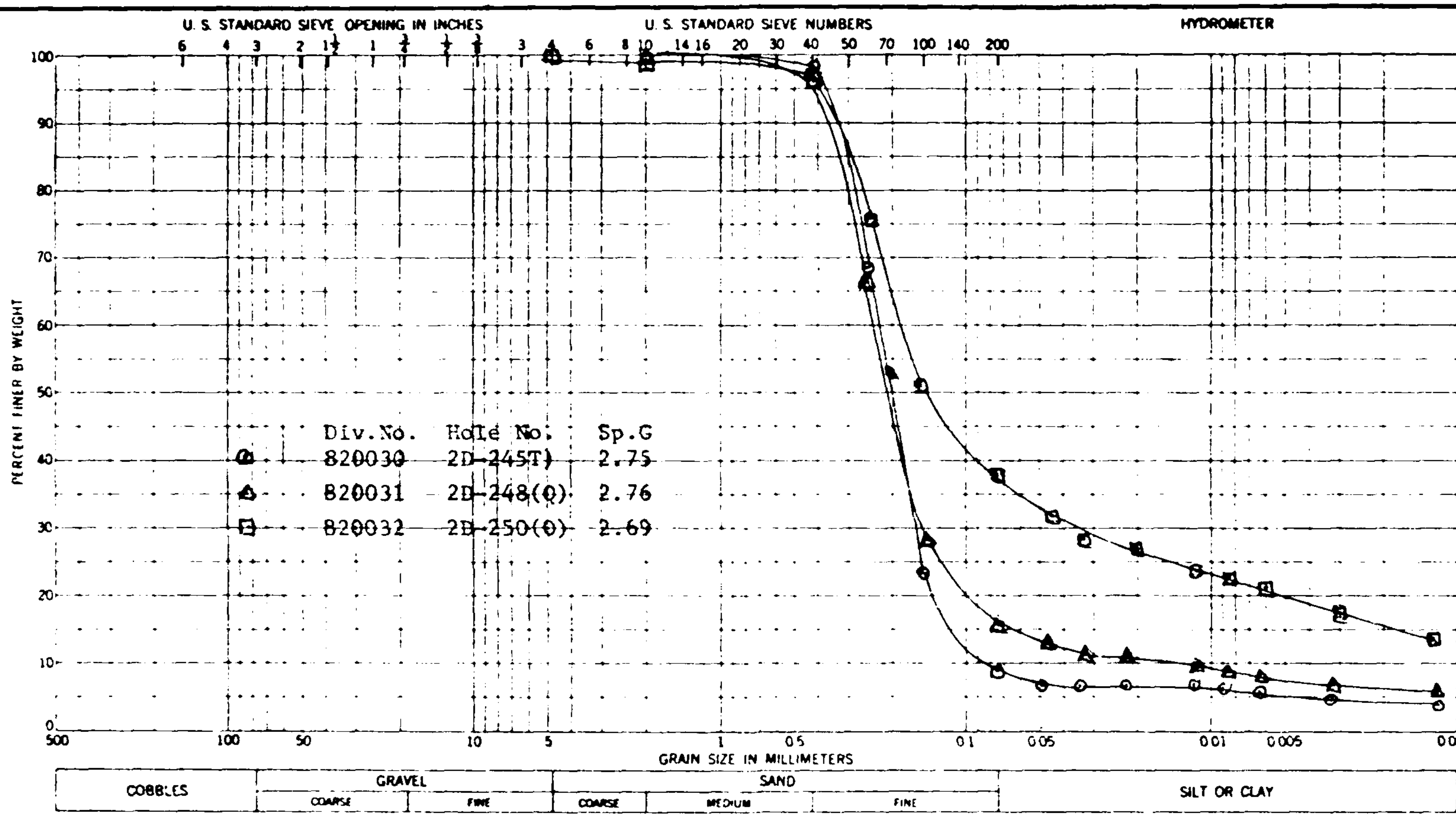

1.0
4.5
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6

TABLE 1

LIQUID PHASE CHEMICAL ANALYSIS
OF
OAKLAND INNER HARBOR

	Reported as Milligrams/Liter							Reported as Micrograms/Liter	
Field Sample No.	Oil & Grease	Residual Petroleum Hydrocarbons	Mercury (Hg)	Lead (Pb)	Zinc (Zn)	Cadmium (Cd)	Copper (Cu)	PCBs	Total Identifiable Chlorinated Hydrocarbons (TICH)
2D-240 (Y)	1-	0.2-	0.0006	0.077	0.023	0.0069	0.012	0.001-	0.001-
2D-250 (O)	1-	0.3	0.0005	0.071	0.016	0.0071	0.002	0.001-	0.001-
2D-253 (K)	1	0.3	0.0011	0.055	0.021	0.0078	0.002	0.001-	0.001-
2D-262 (D)	1	0.2-	0.0004	0.051	0.033	0.0063	0.008	0.001-	0.001-
2D-263 (F)	1	0.2-	0.0004	0.084	0.033	0.0079	0.018	0.001-	0.001-
ALC DIS	1-	0.2-	0.0004	0.084	0.043	0.0079	0.007	0.001-	0.001-
ALC DIS	1-	0.2-	0.0003	0.089	0.079	0.0089	0.023	0.001-	0.001-
ALC DIS	1-	0.2-	0.0004	0.083	0.051	0.0083	0.007	0.001-	0.001-



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI

Project: OAKLAND INNER HARBOR

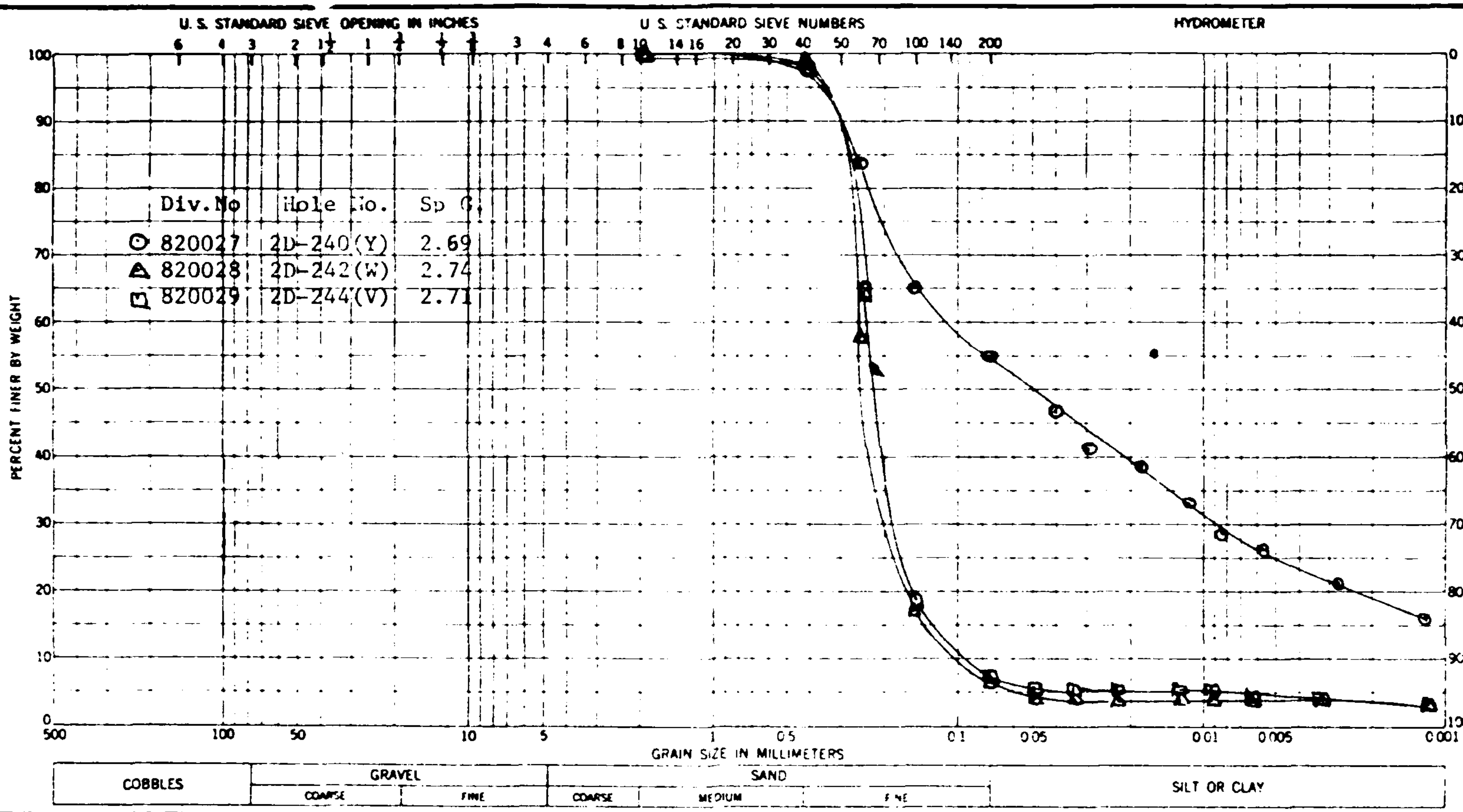
Area:

Boring No:

Date: MARCH 1982

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI

Project OAKLAND INNER HARBOR

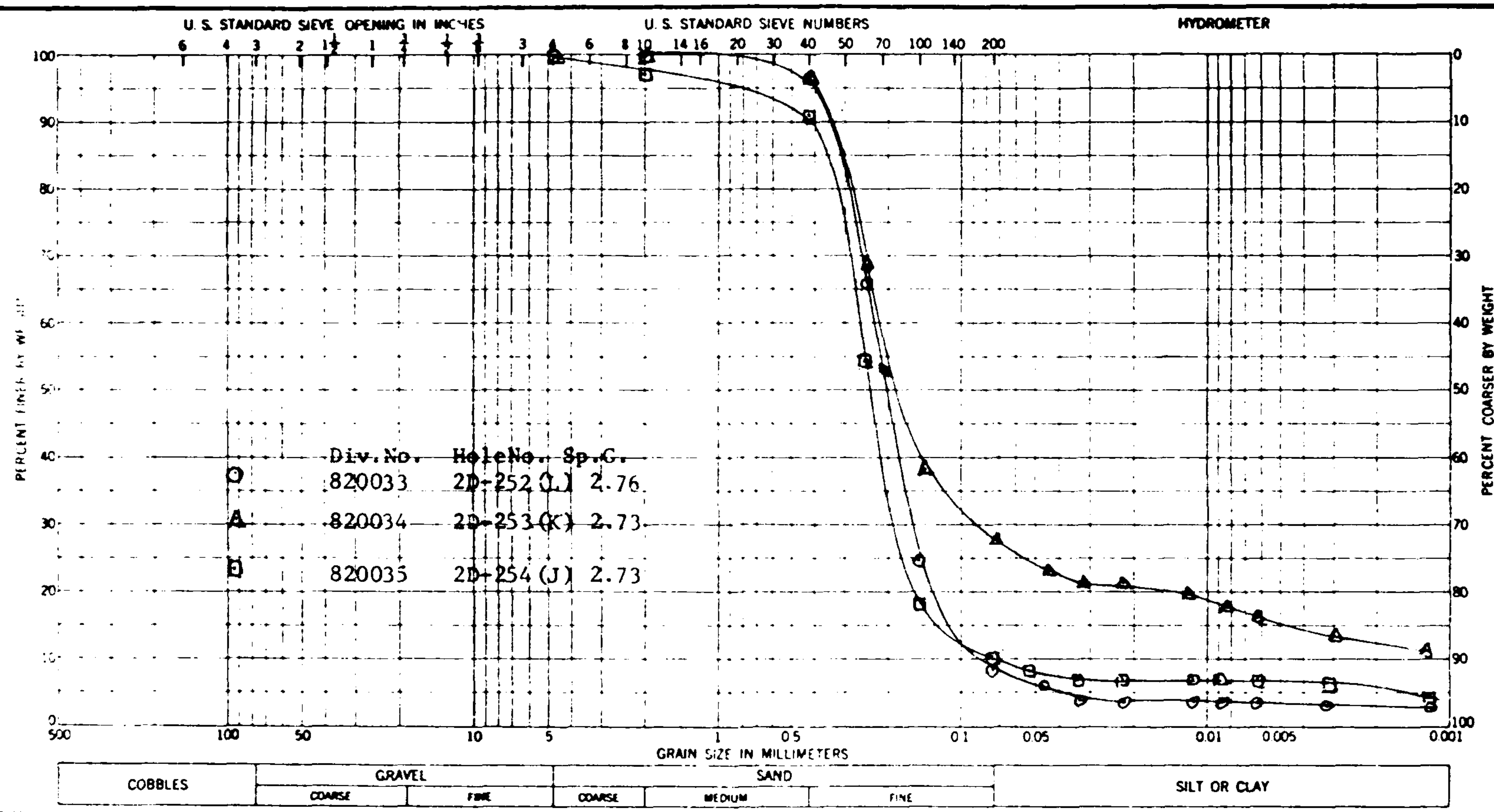
Area

Boring No

Date March 1982

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI

Project OAKLAND INNER HARBOR

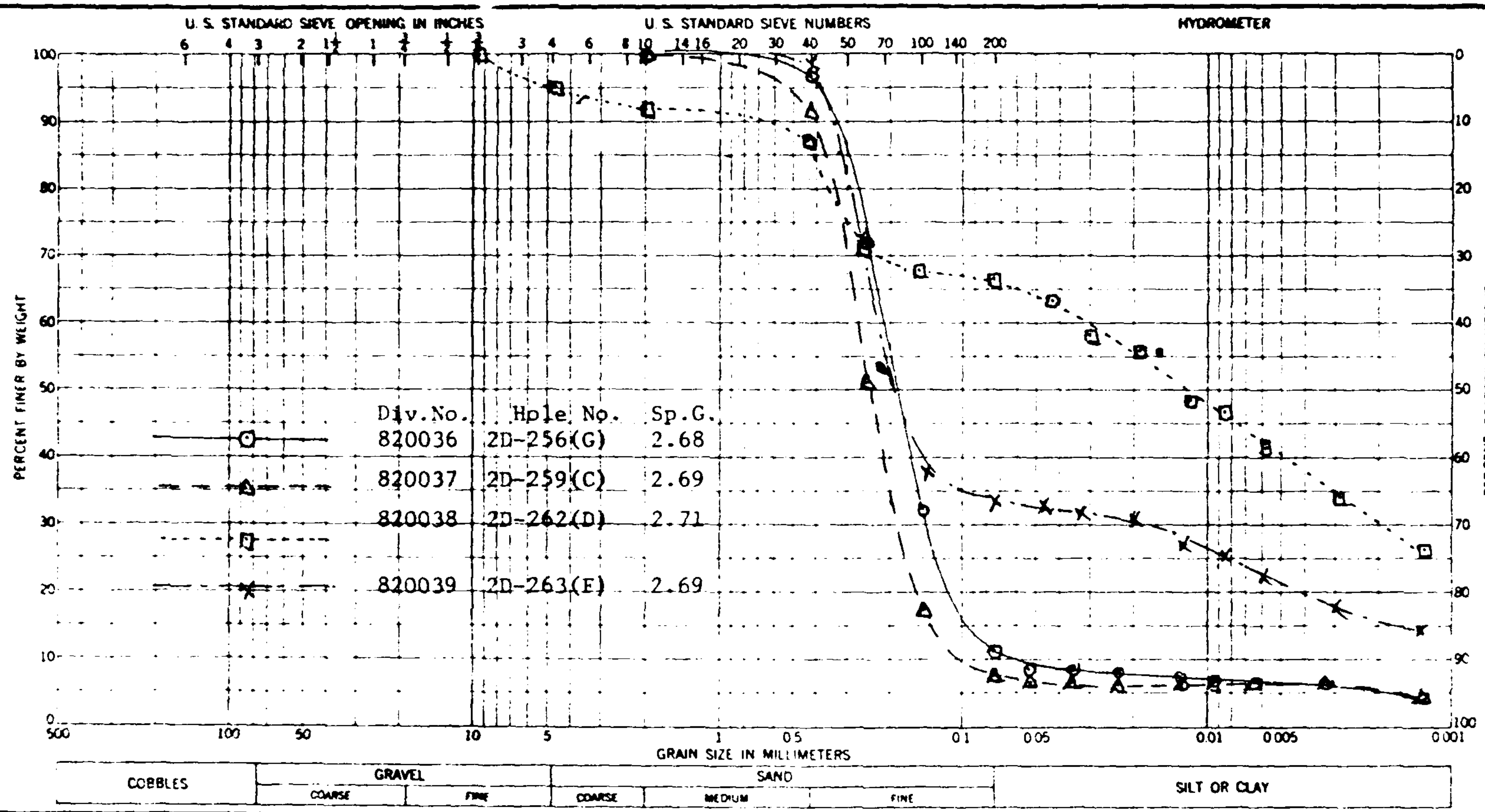
Area

Boring No

Date MARCH 1982

GRADATION CURVES

ENG FORM 1 MAY 63 2087



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI

Project OAKLAND INNER HARBOR

Area

Boring No

Date MARCH 1982

GRADATION CURVES

ENG FORM 2087

MEMORANDUM

TO: Lowell Shelton of R.W. Beck & Associates
Wallace Snapp of City of Alameda Bureau of Electricity
Greg Anderson of Anatec Laboratories, Inc.
Jeffrey Hahn of Cooper Engineers
Bernard Lewis of U.S. Army Corps of Engineers
Ray Newman of U.S. Army Corps of Engineers
Job File 2640-A

FROM: John Reeves of Cooper Engineers

DATE: March 1, 1983

SUBJECT: Elutriate Tests
Proposed Underwater 115 kv Cable Crossing
Oakland/Alameda Estuary
Oakland and Alameda, California
For the City of Alameda Bureau of Electricity
(Our Job No. 2640-A)

Attached to this memorandum are elutriate test data and Alcatraz Island Disposal Site Water test data for discussion at the March 1, 1983 meeting at the Sausalito office of the U.S. Army Corps of Engineers, as follows:

1. Figure 1, Plot Plan, showing the locations of the proposed cable crossing alignment by the City of Alameda Bureau of Electricity and five sites of soil sampling for elutriate tests by others.
2. Cadmium and lead concentrations for elutriate tests reported in our October 25, 1982 report*.
3. Cadmium and lead concentrations of Alcatraz Island Disposal Site water tests reported in our October 25, 1982 report.
4. Cadmium and lead concentrations of elutriate tests and Alcatraz Island Disposal Site water tests performed February 3 to 5, 1983, by Anatec Laboratories, Inc.

* "Report, Geotechnical Investigation, Proposed Underwater 115 kv Cable Crossing, Oakland/Alameda Estuary, Oakland and Alameda, California, For City of Alameda Bureau of Electricity" (Our Job No. 2640-A).

5. Table 1, Lead And Cadmium Concentrations Of Elutriate Tests Performed By Others.

6. Table 2, Lead And Calcium Concentrations Of Alcatraz Island Disposal Site Water Tests Performed By Others.

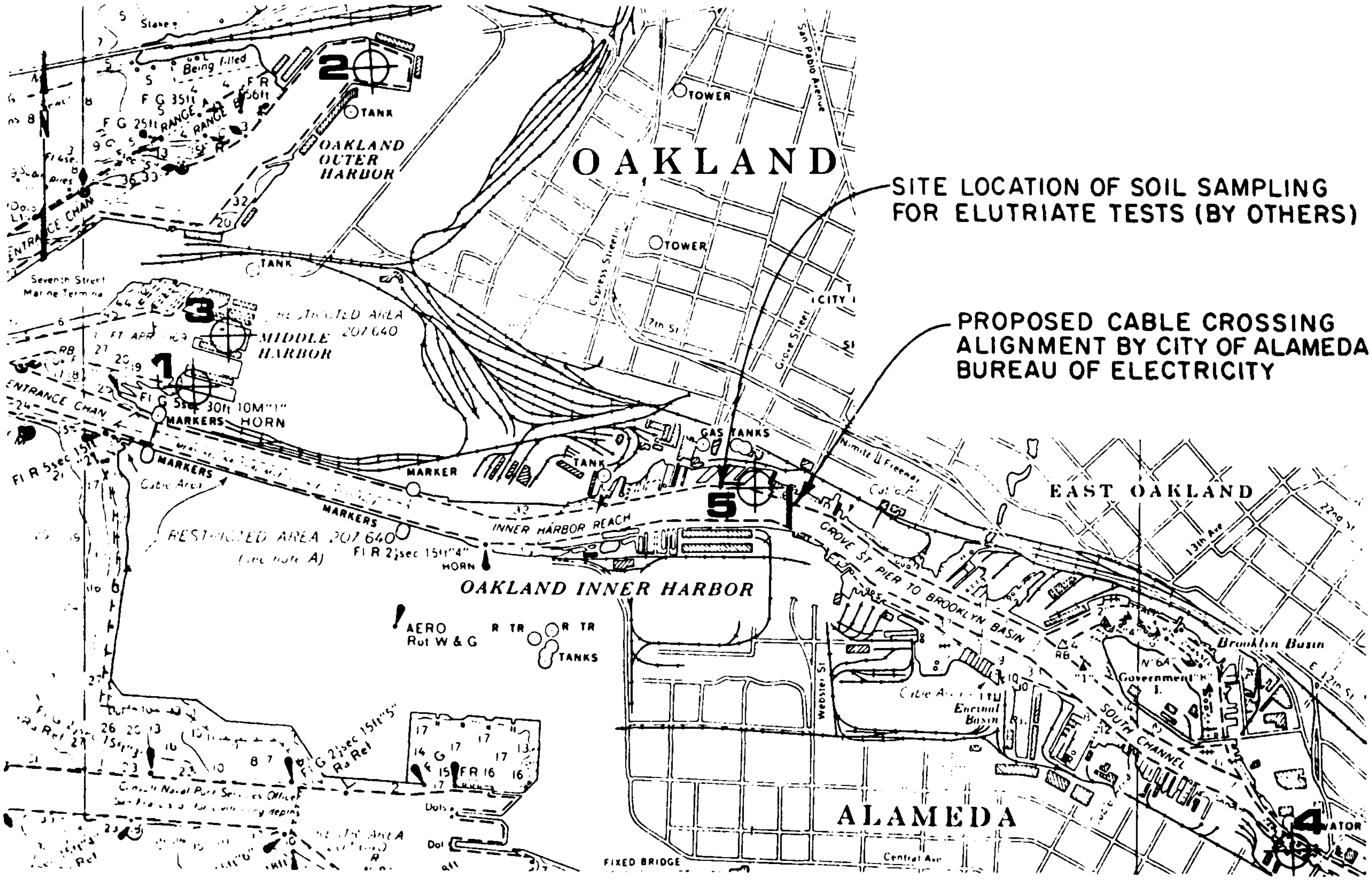
JOHN A. REEVES

JAR:ch

Attachments

By M.B. Date 2/28/83
Checked By
Job Number 2640-A Name CITY OF ALAMEDA Location

Revisions:
By Date
By Date



PLOT PLAN

SCALE: 1:40,000

REFERENCE:
NOAA UNITED STATES-WEST COAST CALIFORNIA
SAN FRANCISCO ENTRANCE
NAUTICAL CHART CATALOG No. 2, PANEL N

FIGURE 1

ANATEC
LABORATORIES
INC.

435 Tesconi Circle • Santa Rosa, California 95401 • 707-526-7200

TO: John Reeves
FOR: COOPER AND CLARK
SERIES: 172/002/5750-5761
PRESERVATION: EPA
RECEIVED: 27 & 29 SEP 82
ANALYSIS: 29 SEP - 12 OCT 82
REPORT: 12 OCT 82; amended 14 OCT 82

REPORT OF ANALYSIS
Cooper & Clark Job No. 2640-A;
City of Alameda Bureau of Electricity

NOTE 1): All analyses performed on disposal site depth-composited water eluates. Eluates were prepared by U.S. EPA/U.S. Army Corps of Engineers protocols.

NOTE 2): Elevation data is MLLW = elevation 0.0 feet.

Descriptor	Lab No.	Polychlorinated biphenyls (ug/L)	Oil & Grease (mg/L)
BORING 1; 9/22/82;			
ELEVATION -48'	5750	<0.20	<2.0
ELEVATION -60'	5751	<0.20	<2.0
ELEVATION -68'	5752	<0.20	<2.0
BORING 2; 9/23/82;			
ELEVATION -50'	5753	<0.20	<2.0
ELEVATION -55'	5754	<0.20	<2.0
ELEVATION -68'	5755	<0.20	<2.0
BORING 3; 9/24/82;			
ELEVATION -45'	5756	<0.20	<2.0
ELEVATION -55'	5757	<0.20	<2.0
ELEVATION -67'	5758	<0.20	<2.0
BORING 4; 9/24/82;			
ELEVATION -48'	5759	<0.20	<2.0
ELEVATION -59'	5760	<0.20	<2.0
ELEVATION -69'	5761	<0.20	<2.0
BORING 5A; 9/27/82;			
ELEVATION -41'	5762	<0.20	<2.0
ELEVATION -53'	5763	<0.20	<2.0
ELEVATION -65'	5764	<0.20	<2.0

Descriptor	Lab No.	Cadmium (ug/L)	Lead (ug/L)	Mercury (ug/L)
BORING 1; 9/22/82;				
ELEVATION -48'	5750	57	610	<0.20
ELEVATION -60'	5751	57	610	0.54
ELEVATION -68'	5752	47	480	2.3
BORING 2; 9/23/82;				
ELEVATION -50'	5753	47	610	1.1
ELEVATION -55'	5754	36	610	0.73
ELEVATION -67'	5755	36	480	1.1
BORING 3; 9/24/82;				
ELEVATION -45'	5756	47	480	1.4
ELEVATION -55'	5757	36	480	0.31
ELEVATION -67'	5758	26	610	0.31
BORING 4; 9/24/82;				
ELEVATION -48'	5759	26	580	1.8
ELEVATION -59'	5760	26	610	0.50
ELEVATION -69'	5761	26	610	0.63
BORING 5A; 9/27/82;				
ELEVATION -41'	5762	26	486	0.44
ELEVATION -53'	5763	47	610	0.41
ELEVATION -65'	5764	31	610	0.41

ANATEC
LABORATORIES
INC.

435 Tesconi Circle • Santa Rosa, California 95401 • 707-526-7200

TO: John Reeves
FOR: COOPER AND CLARK
SERIES: 172/001/5724-5729
PRESERVATION: EPA
RECEIVED: 27 SEP 82
ANALYSIS: 27 SEP - 12 OCT 82
REPORT: 12 OCT 82

REPORT OF ANALYSIS

Cooper & Clark Job No. 2640-A;
City of Alameda Bureau of Electricity

Descriptor	Lab No.	Polychlorinated biphenyls (ug/L)	Oil & Grease (mg/L)
1; 110 feet; 1050 hours	5724	<0.20	<2.0
2; 90 feet; 1055 hours	5725	<0.20	<2.0
3; 70 feet; 1100 hours	5726	<0.20	<2.0
4; 50 feet; 1115 hours	5727	<0.20	<2.0
5; 30 feet; 1130 hours	5728	<0.20	<2.0
6; 10 feet; 1140 hours	5729	<0.20	<2.0

Descriptor	Lab No.	Cadmium (ug/L)	Lead (ug/L)	Mercury (ug/L)
1; 110 feet; 1050 hours	5724	<15	58	0.85
2; 90 feet; 1055 hours	5725	<15	<50	1.0
3; 70 feet; 1100 hours	5726	<15	58	0.63
4; 50 feet; 1115 hours	5727	<15	75	0.41
5; 30 feet; 1130 hours	5728	20	66	1.0
6; 10 feet; 1140 hours	5729	<15	49	1.4

ANATEC LABORATORIES INC.

435 Tesconi Circle • Santa Rosa, California 95401 • 707-526-7200

TO: John Reeves
FOR: COOPER AND CLARK
SERIES: 172/006&007/1192-1196; 1177-1191
PRESERVATION: EPA
RECEIVED: 03 FEB 83; 1616 HRS; URGENT PRIORITY
ANALYSIS: 03 - 05 FEB 83
REPORT: 05 FEB 83 (V); 07 FEB 83 (W)

REPORT OF ANALYSIS
Cooper & Clark Job No. 2640-A;
City of Alameda Bureau of Electricity

NOTE 1: Water samples were collected near Alcatraz Island at slack tide following a flood tide, 03 FEB 83.

Descriptor	Lab No.	Lead (ug/L)	Cadmium (ug/L)
#1; 12 FEET	1192	<50	<5
#2; 36 FEET	1193	<50	<5
#3; 60 FEET	1194	<50	<5
#4; 84 FEET	1195	<50	<5
#5; 108 FEET	1196	<50	<5

NOTE 2: All analyses performed using disposal site depth-composited water eluates. Eluates were prepared by U.S. EPA/U.S. Army Corps of Engineers protocols.

NOTE 3: Elevation data is MLLW = elevation 0.0 feet.

Descriptor	Lab No.	Lead (ug/L)	Cadmium (ug/L)
BORING 1; 9/22/82			
ELEVATION -48'	1177	<50	<5
ELEVATION -54'	1178	<50	<5
ELEVATION -60'	1179	<50	<5
BORING 2; 9/23/82			
ELEVATION -40'	1180	<50	8
ELEVATION -50'	1181	<50	<5
ELEVATION -55'	1182	<50	<5

Descriptor	Lab No.	Lead (ug/L)	Cadmium (ug/L)
BORING 3; 9/24/82			
ELEVATION -45'	1183	<50	<5
ELEVATION -55'	1184	<50	<5
ELEVATION -62'	1185	<50	<5
BORING 4; 9/24/82			
ELEVATION -48'	1186	<50	6
ELEVATION -58'	1187	<50	7
ELEVATION -64'	1188	<50	<5
BORING 5A; 9/27/82			
ELEVATION -41'	1189	<50	<5
ELEVATION -53'	1190	<50	<5
ELEVATION -58'	1191	<50	<5

Greg Anderson, Director
Analytical Laboratories

/hs

TABLE I

LEAD AND CADMIUM CONCENTRATIONS OF ELUTRIATE TESTS PERFORMED BY OTHERS

SITE LOCATION (Ref.Fig.1)	BORING NO.	DATE SAMPLED	SAMPLE ELEVATION IN FEET (MLLW)	CONCENTRATION (Ug/L)	
				Lead	Cadmium
1	B-1	6/18/82	-37 to -43	<10	2
	B-2		-37 to -43	<10	<2
	B-3		-37 to -43	<10	<2
2	S-1	7/27/82	-36 to -42	<10	<2
	S-2		-39 to -42	<10	<2
	S-3		-37 to -43	<10	<2
	S-4		-34 to -40	<10	<2
3	P-1	7/27/82	-37 to -40	<10	<2
4	ZX-2	9/13/82	-15 to -22	< 1	<1
	ZX-3		-33	< 1	<1
	ZX-4		-32 to -35	< 1	<1
	ZX-5		-15 to -22	< 1	<1
5	1	11/3/82	-19 to -22	< 10	<2
	1		-24 to -27	< 10	<2

TABLE II

LEAD AND CADMIUM CONCENTRATIONS OF ALCATRAZ ISLAND DISPOSAL SITE WATER TESTS PERFORMED BY OTHERS

SAMPLE NO.	DATE SAMPLED	DEPTH (Ft.)	CONCENTRATION (Ug/L) Lead	Cadmium
1	6/17/82	30	< 10	< 2
		50	< 10	< 2
		75	< 10	< 2
2	7/27/82	30	< 10	< 2
		50	< 10	< 2
		75	< 10	< 2
		80	10	2
3	9/08/82	NR	< 0.1	< 0.1
4	10/29/82	30	< 10	< 2
		50	< 10	< 2

OAKLAND INNER HARBOR, ALAMEDA, CALIFORNIA

APPENDIX F

AIR QUALITY ANALYSIS

JUNE 1983

OAKLAND INNER HARBOR
APPENDIX F
AIR QUALITY ANALYSIS

TABLE OF CONTENTS

OAKLAND INNER HARBOR

APPENDIX F

AIR QUALITY ANALYSIS

1.0 INTRODUCTION

The purpose of this air quality analysis is to present, in summary form, the findings regarding the proposed project's impact upon the air quality in the study area and the regional air basin. To accomplish this objective, this appendix includes the following data: (1) a description of the basic assumptions about the Federal project which are of significance for this air quality analysis, (2) evaluates the short-term air quality impacts associated with project implementation, (3) evaluates the potential long-term impacts associated with operation of the completed harbor, i.e. future ship and vehicular emissions, (4) discusses possible mitigation measures, and (5) evaluates possible growth inducing impacts associated with the project.

2.0 EXISTING AIR QUALITY

2.1 Compliance With National Ambient Air Quality Standards.

One method commonly used to determine and describe the air quality within an area is to compare the recorded pollutant concentrations from selected monitoring stations to the National Ambient Air Quality Standards. Such a comparison will show how often the pollutant levels at the recording stations exceed or approach the standards and thus it will give a picture of the magnitude of the air pollution in the area under investigation. For this project the recorded data from the monitoring station in Oakland were used. The data are presented in Table F-1.

TABLE F-1

DAYS AIR QUALITY STANDARDS WERE EXCEEDED
OAKLAND MONITORING STATION

POLLUTANT	1978	1979	1980
Ozone (O_3	0	0	0
Carbon monoxide (CO)	9.9	0	0
Nitrogen dioxide (NO_2)	23	0	-
Sulfur dioxide (SO_2)	-	-	-
Total suspended particulates	-	-	-

Source: Bay Area Air Quality Management District (BAAQMD)

Note: Columns give number of days per year an air quality standard was exceeded; Federal standards for O_3 and CO, State standards for NO_2 and SO_2, both State (first number) and Federal (second number) for total suspended particulates.

2.2 Findings Regarding Existing Air Quality.

The data presented in Table F-1 show that except for the 1978 exceedence of CO and NO_2 the air quality in the vicinity of the Oakland recording station is in compliance with the Ambient Air Quality Standards. This would indicate that the air quality in Oakland meets the standards.

3.0 SHORT-TERM AIR QUALITY IMPACTS

3.1 Types of Short-Term Impacts.

Short-term air quality impacts would be generated by pollutants emitted from dredging equipment and by pollutants emitted by vehicles associated with the implementation of the project plan. The traffic-generated emissions are not considered significant in this case since very few workers would be involved in the dredging operations.

3.2 Short-Term Impacts due to Dredging Operations.

The deepening of the Federal Access channel in Oakland Inner Harbor could increase the emission to a significant degree if certain types of dredging equipment were used. According to the California Air Resources Board the primary pollutant of concern in the Bay Area Air Quality Maintenance Area would be the nitrogen oxides generated by diesel engine-powered dredges.

The California Air Resources Board (ARB) in its comments on the Richmond Harbor Deep Draft Navigation Improvements, Environmental Impact Statement identified nitrogen oxides (NO_x) as the primary pollutant of concern. The ARB also calculated a "worst case condition" under which three diesel engines would perform the dredging and approximately 950 pounds of NO_x would be emitted daily. Assuming that approximately the same dredging schedule would be maintained (14,000 cubic yards per day for 1.5 to 2 years) the same "worst case condition" would apply for the Oakland Inner Harbor dredging.

An emission of 950 pounds of NO_x daily would indeed be considered a significant source of air pollution. Such a source could cause temporary air quality degradation adjacent to and immediately downwind of the operating dredge. However, since a dredge is considered a point source for air pollutants, emissions from it would be controlled by a permit issued by the Bay Area Air Quality Maintenance District (BAAQMD). In other words, the dredge deepening the Federal access channel in Oakland Inner Harbor would require a permit from BAAQMD before dredging can commence.

The California Air Resources Board (ARB) in its comments on the Richmond Harbor EIS proposed that an electric dredge be used for the dredging operations to mitigate possible significant adverse impacts on air quality. The Corps of Engineers in its dredging specifications for the Oakland Inner Harbor will require that: (1) the dredging contractor meets all the requirements for stationary sources (point sources) established by the Bay Area Air Quality Maintenance District (BAAQMD) in its Air Quality Maintenance Plan, and (2) the contractor also secures all necessary permits required by the BAAQMD. Such compliance would prevent significant adverse air quality impacts to occur as a result of the dredging operations.

4.0 LONG-TERM IMPACTS RESULTING FROM PROJECT IMPLEMENTATION

4.1 Assumptions Regarding Future Conditions.

To determine the long-term impacts of project implementation, it is necessary to project the existing conditions in Oakland Inner Harbor study area into the future in terms of the total tonnage of cargo that would be handled by the harbor under without project conditions and under with project conditions so that a comparison between the two can be made. To accomplish such projections into the future certain assumptions must be made concerning vessel movements and cargo handling capacity. For Oakland Inner Harbor the following assumptions have been made: (1) the Port of Oakland, the project sponsor, is expanding the present port facilities in Oakland Inner Harbor regardless of whether the Federal channel is deepened, (2) the projected future tonnage of cargo handled by Oakland Inner Harbor is not dependent upon a deeper Federal channel since larger ships still would be able to enter the port by waiting for favorable tidal (high tide) conditions, (3) it is, therefore, assumed that the total tonnage of cargo handled by Oakland Inner Harbor would be the same under all future conditions so that the difference in total tonnage without and with project conditions equals zero.

4.2 Potential Long-Term Impacts Due to Ship Emissions.

No significant impacts upon air quality are expected due to ship emissions. Although there would be a slight difference in ship movements if the project is implemented (no waiting for favorable tide conditions by larger ships), these changes are not considered significant since emissions contributed by ships are very small when compared by the total emissions in the San Francisco Bay Area.

4.3 Potential Long-Term Impacts Due to Vehicular Traffic.

Since the total tonnage of cargo handled by the port would be the same with and without the project, no increase in vehicular traffic can be attributed to the project; consequently there is no long-term impacts upon air quality due to vehicular traffic.

5.0 MITIGATION MEASURES

No mitigation measures were developed for this project, since no significant impacts have been identified with project implementation. The "worst case condition" for short-term impacts would not be realized since the dredging contractor would be required to secure a permit for stationary source from the Bay Area Air Quality Maintenance District (BAAQMD) prior to commencing the dredging.

6.0 GROWTH INDUCING IMPACTS OF THE PROJECT AND ITS INFLUENCE ON AIR QUALITY

An analysis of the forecasted future conditions under the without project and with project conditions indicates that the proposed Federal project would not induce any growth in the study area or beyond. This finding is based on the basic assumption that the same tonnage of cargo would be handled by Oakland Inner Harbor under all future conditions.

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

APPENDIX G

PHASE 1 WATER WELL SURVEY
PROPOSED OAKLAND INNER HARBOR DEEPENING PROJECT

Results of Field Inventory, Sampling, and Laboratory Analysis
(USACE Letter of Agreement, June 16, 1982)

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
SEPTEMBER 1982

FOREWORD

The U. S. Army Corps of Engineers has proposed a project that would deepen Oakland Inner Harbor from -10.7 metres (-35 feet) to -13.7 metres (-45 feet) mean lower low water datum. In 1981, at the request of the Corps, the Central District undertook a brief reconnaissance study to try to determine what effects, if any, the deepening would have on the ground water resources in the area. The purpose of the study, which consisted of a compilation of office records and did not include field work, was to collect and analyze ground water data and literature. After evaluation of these data, further studies in three phases were recommended.

In 1982, the Corps requested that the Central District conduct field work to complete the Phase 1 tasks recommended in the 1981 reconnaissance report.

In response to this second request, this report describes the field work, the analysis of the data, and the conclusions and recommendations that have resulted from completion of the tasks that were outlined in Phase 1 of the reconnaissance report. Field data from this study include field location of wells, depth to ground water measurements, ground water sampling, and laboratory analysis based on combined data from the office study and field data from this study. The analysis discusses depths and uses of wells in the area, quality of ground water in the wells, and probable producing strata. It recommends additional ground water studies to assess the risk of ground water degradation. A second possible course of action is noted, but implementation of the second course of action would require demonstration that such action would be in conformance with the State Water Resources Control Board's nondegradation policy (State Water Resources Control Board Resolution No. 68-16).

Wayne MacRostie

Wayne MacRostie, Chief
Central District

State of California
EDMUND G. BROWN JR., GOVERNOR

The Resources Agency
HUEY D. JOHNSON, Secretary for Resources

Department of Water Resources
RONALD B. ROBIE, Director

CHARLES R. SHOEMAKER
Deputy Director

M. CATHARINE BERGREN
Assistant Director

ROBERT W. JAMES
Deputy Director

MARY ANNE MARK
Deputy Director

GERALD H. MERAL
Deputy Director

CENTRAL DISTRICT

Wayne MacRostie . . . . District Chief
Kenneth Woodward . . . . Chief, Planning Office
Robert L. McDonell . . . . Chief, Special Studies Branch

This report was prepared under the supervision of

Carl J. Hauge . . . . Chief, Geology Section

By

George Newmarch . . . . Associate Engineering Geologist

With assistance from

William C. Nickels . . . . Public Health Chemist I
Betty L. Swatsenbarg . . . . Geologic Aid
George Nakao . . . . Water Resources Technician II
Woodfin (Woody) P. Riley . . . . Water Resources Technician I
Judy L. Van Dyke . . . . Stenographer
Michael Finch . . . . Graduate Student Assistant

TABLE OF CONTENTS

Table of Contents
(Continued)

INTRODUCTION

At the request of the Corps of Engineers, the Central District of the California Department of Water Resources conducted a one-time field inventory (canvass) of all active and inactive wells within one mile of the harbor deepening project (Figure 1)*. The field inventory included one-time water quality sampling and depth to ground water measurements in wells where such sampling and measuring was possible. Time allotted for the study was July 1 to September 20, 1983, and the total amount of the contract was $13,555. This amount also covered the cost of an analysis of the field data by the Central District.

Purposes of the Study

The purposes of the field inventory and analysis were the following:

1. To obtain all possible water well data.

2. To determine adequacy of data for assessing the effects of the proposed harbor deepening on potential sources of fresh ground water.

Scope of the Study

In 1981, the Corps of Engineers requested that the Central District undertake a brief reconnaissance study to try to determine what effect, if any, deepening of Oakland Harbor would have on the ground water resources in the area. That study was primarily an office study which collected and analyzed ground water data and reports. The study resulted in recommendations for a series of further studies. The field inventory, depth to ground water measurements, ground water sampling, laboratory analyses, and this report are Phase 1 of that series of recommended studies. Data collected during the 1981 study were used to begin the field inventory.

The field inventory included location of water wells indicated by records on file at the Central District and by information obtained during the 1981 reconnaissance ground water study (California Department of Water Resources, 1981). During the field inventory, approximately 20 contacts were made in the field with local government, utility companies, private companies, and individuals to locate water wells not on record. Based on the above information, a street by street search was made for wells. Locations of field located water wells were plotted on a 1:24,000 scale map (Plate 1); depth to ground water measurements and ground water quality samples were taken when possible. The following information was also obtained for each located water well when possible:

* The Corps' proposal would deepen the channel from -10.7 metres (-35.0 feet) to -13.7 metres (-45.0 feet) mean lower low water datum (MLLW).

° Date drilled

° Driller

° Depth

° Interval cased

° Perforated interval

° Gravel packed interval

° Interval sealed

° Log of strata encountered

° Depth at which water was first encountered

° Standing level of water in well after completion

° Accessibility for measuring and sampling

° Method of drilling

° Present use.

Information that was obtained is included in Well Data Sheets and Water Well Drillers' Reports available in Department files. The Water Well Drillers' Reports are classified confidential by the State Water Code. Copies of these reports and other well data are being submitted under separate cover to the Corps to maintain the confidentiality of these records.

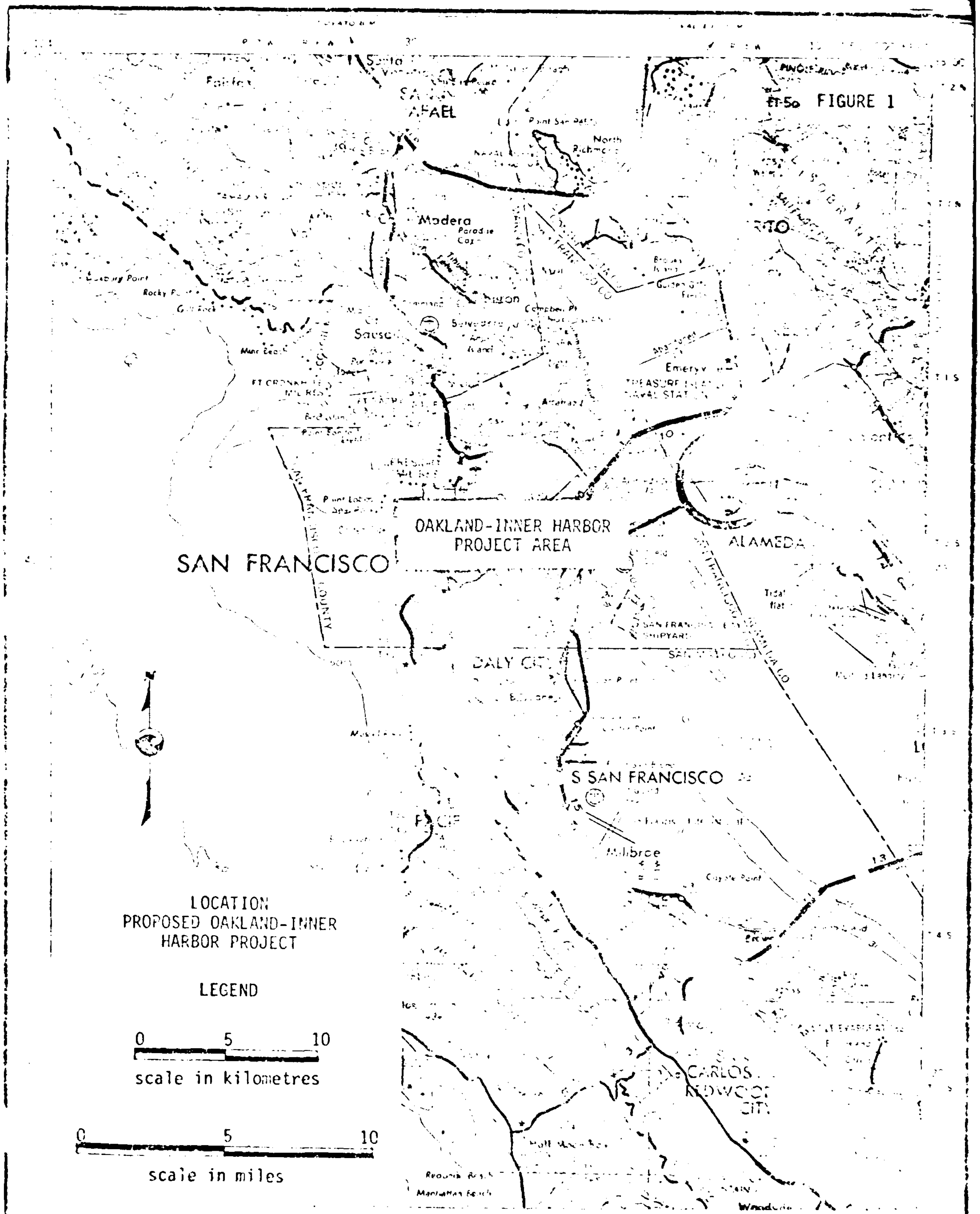


FIGURE 1
SAN RAFAEL
Madera
SAN FRANCISCO
OAKLAND-INNER HARBOR
PROJECT AREA
ALAMEDA
DALY CITY
S SAN FRANCISCO
Millbrae
LOCATION
PROPOSED OAKLAND-INNER
HARBOR PROJECT
LEGEND
0 5 10
scale in kilometres
0 5 10
scale in miles

RESULTS OF THE INVENTORY

The inventory includes the data collected during the 1981 reconnaissance study (California Department of Water Resources, 1981) and the field data collected during this study. The field data were combined with the office data from the 1981 report in making the geohydrologic interpretations for this report.

Results of the field location of wells, depth of ground water measurements, and ground water quality sampling are shown on the following illustrations and are discussed in a later section of this report.

Plate 1 shows the location of the 23 wells located in the field. It also indicates those from which a water sample was obtained and those in which the depth to ground water was measured.

Table 1 contains the following information:

a. A tabulation by State well number of field located wells (State well number includes Township, Range, Section, and 40 acre portion of the Section).

b. Which wells were sampled and measured.

c. Reasons why certain wells could not be sampled and/or measured.

d. Wells for which a Water Well Drillers' Report (log and construction information) is available.

Table 2 is a list of the field located wells, depths to ground water, and elevations of ground water in those wells. It also shows:

a. Depths to ground water in the wells

b. Elevations to ground water in the wells

c. Depths of the wells

d. Elevation of probable producing intervals

e. Names of probable producing formations.

Table 3 lists wells sampled for ground water quality. It gives the following information regarding ground water quality:

a. Results of laboratory analyses of ground water samples for (1) dissolved chlorides in milligrams per litre (mg/L), (2) specific conductance in micromhos per centimetre at 25 degrees Celsius.

b. Completed depths of wells sampled

c. Approximate ground water producing depth interval of sampled wells.

d. Probable aquifer producing the ground water.

Table 1

Proposed Oakland Inner Harbor Project
Field Inventory -- Existing Wells

Field Located, Sampled, Measured, July-August 1982

Location (State Well Number)	Well Sampled	Well Measured	Reason for Not Sampling or Measuring	Well Drillers' Report Available	Use of Well
1S/4W27Q1	No	Yes[2/]	No pump	No	Lawn and Stand-by fire
1S/4W34F3	No	No	Hit obstruction in well	No	Industrial
1S/4W34F4	Yes[1/]	Yes	--	Yes	Industrial
1S/4W34J2	No	No	Casing sealed	Yes	Abandoned
1S/4W35A2	Yes	No	Submersible pump, no opening into well	Yes	Stand-by irrigation
1S/4W35Ea	Yes	Yes	--	No	Lawn and garden
1S/4W35Eb	No	Yes	No pump	No	Lawn and garden
1S/4W35H	No	No	Well sealed	No	Sealed
1S/4W35H1	No	Yes	Power disconnected to pump	No	Not used, power disconnected
2S/3W6N1a	No	Yes	No pump	No	Observation well
2S/3W6N2b	No	Yes	No pump	No	Observation well
2S/4W3E1	Yes	Yes	--	Yes	Irrigation
2S/4W3F1	No	Yes	Partially caved in; not in use	No	Not used, was industrial
2S/4W5A1	No	Yes	No pump	Yes	Not used, was industrial
2S/4W10A1	No	No	No one home on 3 different days; dog in backyard	No	Irrigation
2S/4W10B	Yes	Yes	--	Yes	Stand-by garden
2S/4W10B1	Yes	No	Sealed	Yes	Law and garden
2S/4W10H	No	Yes	Pump broken	No	Lawn and garden
2S/4W11D1	Yes	Yes	--	Yes	Lawn and garden
2S/4W11E	No	No	Pump inoperative; casing sealed	No	Abandoned
2S/4W11E1	Yes	No	No opening into well	Yes	Lawn and garden
2S/4W11M	No	No	Top of casing sealed; no pump	No	Not used, was windmill
2S/4W12D	No	Yes	No pump	No	Abandoned

1/ See Table 3
2/ See Table 2

TABLE 2

Proposed Oakland Inner Harbor Deepening Project -- Field Inventory
Elevation and Depth of Ground Water in Measured Wells

Location (State Well Number)	Depth from Ground Surface to Ground Water in Well metres	(feet)	Elevation of Ground Water in Well metres	(feet)	Date Measured	Depth of Well metres	(feet)	Elevation of Probable Producing Interval(s)4/ metres	(feet)	Probable Producing Formation5/	Estimated Ground Surface Elevation4/ metres	(feet)
1S/4W27Q1	3.1	(10.1)	2.1	(6.9)	8/3/82	16.8	(55)	?		?	5	(17)
1S/4W34F4	34.0 1/	(111.6)	-31.0	(-101.6)	7/27/82	122	(400)	-58 to -113	(-190 to -370)	Alameda	3	(10)
1S/4W35Ea	7.5	(24.6)	3.2	(10.4)	8/11/82	27.7	(91)	?		?	11	(35)
1S/4W35Eb	9.7 2/	(31.8)	1.0	(3.2)	8/11/82	25.9	(85)	?		?	11	(35)
1S/4W35H1	7.3	(24.0)	4.0	(13.0)	8/3/82	45.7	(150)	?		?	11	(37)
2S/3W6N1a	1.6	(5.4)	-0.1	(-0.4)	8/13/82	9.1 3/	(30)	?		?	1.5	(5)
2S/3W6N2b	2.6	(8.5)	-1.1	(-3.5)	8/13/82	9.1 3/	(30)	?		?	1.5	(5)
2S/4W3E1	40.2 1/	(132.0)	-37.8	(-124.0)	7/27/82	108	(353)	-80 to -86) -101 to -104	(-262 to -282) (-332 to -342)	Alameda	2.4	(8)
2S/4W3F1	15.4	(50.5)	-13.6	(-44.5)	8/2/82	114.6	(376)	?		?	1.8	(6)
2S/4W5A1	11.3	(37.1)	-9.5	(-31.1)	7/27/82	152.4	(500)	-15 to -27	(-49 to -88)	?	1.8	(6)
2S/4W10B	1.8 3/	(6)	1.2	(4.0)	8/3/82	4	(12)	-1.5 to +0.5	(-5 to +2)	Surface Soils	3	(10)
2S/4W10H	1.6	(5.3)	2.3	(7.7)	8/10/82	12.2 3/	(40)	?		Merritt	4	(13)
2S/4W11D1	1.5	(5.0)	2.4	(8.0)	7/27/82	9	(29)	-0.5 to -5	(-2 to -17)	Merritt	4	(13)
2S/4W12D	9.3	(30.5)	-7.0	(-23.0)	8/5/82	103.9	(341)	?		?	2.1	(7)

1/ Well pumping at time of measurement
2/ Nearby well was pumped just before this measurement
3/ Approximate data furnished by owner
4/ Elevation calculations based on estimates from topographic maps
5/ When projected to Geologic Section A-A'

TABLE 3

Proposed Oakland-Inner Harbor Project
Field Inventory

Quality of Ground Water

Well Location (State Well Number)	Dissolved Chloride (mg/L)	Specific Conductance at 25° C (Micromhos/cm)	Date Sampled	Completed Depth of Well Metres (feet)	Approximate Producing Depth Interval Metres (feet)	Probable Producing Formation
1S/4W34F4	180	1030	7/27/82	122 (400)	61-116 (200-380)	Alameda
1S/4W35A2	155	1080	8/3/82	29 (95)	23-30 (75-100)	Alameda
1S/4W35Ea	28	426	8/11/82	27.7 (91)	Insufficient Information	Insufficient Information
2S/4W3E1	88	749	7/27/82	108 (353)	82-88 (270-290) 104-107 (340-350)	Alameda
2S/4W10B	11	281	8/3/82	4 (12)	1.5-3.7 (5-12)	Surface Soils
2S/4W10B1	39	856	8/5/82	11 (35)	3-9 (10-30)	Merritt
2S/4W11D1	6	287	7/27/82	9 (29)	4.6-9 (15-30)	Merritt
2S/4W11E1	25	422	8/5/82	7 (23)	4.6-9 (15-30)	Merritt

ANALYSIS OF DATA

Elevation of Ground Water

Elevation of ground water in wells was determined from measurements in 14 wells and elevation of ground surface estimates based on topographic maps (Table 2). Five of the wells measured were north of Inner Harbor and 9 were south of it. An analysis of the elevation of ground water data showed that an elevation of ground water contour map could not be drawn, and the direction of movement of the ground water could not be determined because of the following factors:

- The small number of measurable wells.
- Lack of uniform density of data points.
- The great variation in total depths of the measured wells.
- Insufficient well construction data for the measured wells.
- Insufficient well log information.

A comparison of the differences in elevations of ground water in fairly closely spaced wells such as the 3 located along Inner Harbor (2S/4W-3E1, 3F1, and 5A1), along with other data, indicate there is not aquifer continuity below that area. The heterogeneity was described by the 1981 reconnaissance study (California Department of Water Resources, 1981). The respective elevations of ground water of those wells were -37.8 metres (-124.0 feet), -13.6 metres (-44.5 feet), and -9.5 metres (-31.1 feet). Respective depths of the wells were 108.0 metres (353.0 feet), 114.6 metres (376.0 feet), and 152.4 metres (500.0 feet). The differences in elevation of ground water in the 3 wells is probably because the ground water was occurring in 3 different aquifers (a different one for each well), or in 3 zones that are each under a different piezometric head.

Wells 2S/4W-3F1 and 2S/4W-5A1 might be affected by the deepening of the harbor to elevation -13.7 metres (-45 feet) mean lower low water datum. However, neither well is now in use and ground water quality samples could not be obtained from them.

Quality of Ground Water

Eight wells were sampled for quality of ground water and the following analyses were made by the Department of Water Resources Water Quality Laboratory (Table 3):

1. Dissolved chloride in milligrams per litre (mg/L)

2. Specific conductance at 25° Celsius reported in micromhos per centimetre.

Dissolved chloride contents ranged from 6 to 180 mg/L and specific conductance from 426 to 1 080 micromhos/cm for samples from the 8 wells. Shallower wells, 4-28 metres (12-91 feet) had lower dissolved chloride content and specific conductance than deeper wells, 29-122 metres (95-400 feet) (Table 3). It is probable that the deeper wells (1S/4WF4, 35A2, and 2S/4W3E1) are producing ground water from the Alameda Formation. Three shallower wells (2S/4W10B1, -11D1, and -11E1) probably produce from the Merritt Sand (Figures 2 and 3). Shallow well 2S/4W10B probably produces from surface soils. The producing interval and formation could not be determined for Well 1S/4W35Ea because of lack of sufficient well construction data. Completed depth, approximate ground water producing interval(s), and probable producing formation are listed for each well on Table 3. Figure 3 is a geologic section on which is shown ground water quality information based on ground water quality sampling data gathered during this study. Ground water quality data from 5 sampled wells near the section were projected to the section. These data indicate probable producing formations and the corresponding specific conductance and dissolved chloride content at the locations shown. The location of the geologic section is shown on Plate 1 of this report. Surface geology is shown on Plate 2 of the reconnaissance report (California Department of Water Resources, 1981). Figure 2 contains an explanation of the lithology and symbols used on the geologic map and on the geologic section shown in this report (Figure 3).

The reconnaissance study report suggested a process by which the difference in ground water quality of the Merritt Sand and the Alameda Formation occurred (California Department of Water Resources, 1981). It suggested that portions of the Merritt Sand were deposited in brackish to saline water and contained highly mineralized waters at time of deposition. However, as the sea level became lower and portions of the formation were exposed above sea level, fresh water from precipitation may have percolated into the sand and diluted the mineralized waters or flushed it out of some areas. This is indicated by the low chloride content of the shallow wells northeast and southeast of the Inner Harbor (Plate 1).

The Alameda Formation was deposited primarily in marine water and would be expected to contain saline ground water. However, 3 of the wells inventoried during this study apparently produce relatively fresh water from this formation (Table 3). Whether the fresh water is the result of the flushing out of saline water or was included in the sediments at the time of their deposition has not been determined.

Water quality data from wells west of Geologic Section A-A' (Plate 1 and Figure 3) were projected onto that geologic section. The projected data indicate dissolved chloride content and specific conductance that might be expected at the general locations and depth intervals along that section. In general, the data indicate lower chlorides in the Merritt Sand than in the Alameda Formation at the location shown. Chloride contents of both formations at this general location are below recommended limits according to the Secondary Drinking Water Standards of the California Department of Health (copy attached in Appendix). Specific conductance is below recommended limits in the Merritt Sand and only slightly above in the Alameda Formation. The geologic section is based on one published by the U. S. Geological Survey (Radbruch, 1957); its location is shown on Plate 1.

Uses of Wells

The primary use of wells located during the survey was for lawn and garden irrigation (Table 1).

One operating industrial well was found. It was located at the Red Star Yeast Company (1S/4W34F4, see Tables 2 and 3).

DESCRIPTION OF GEOLOGIC UNITS IN THE VICINITY OF THE PROPOSED PROJECT

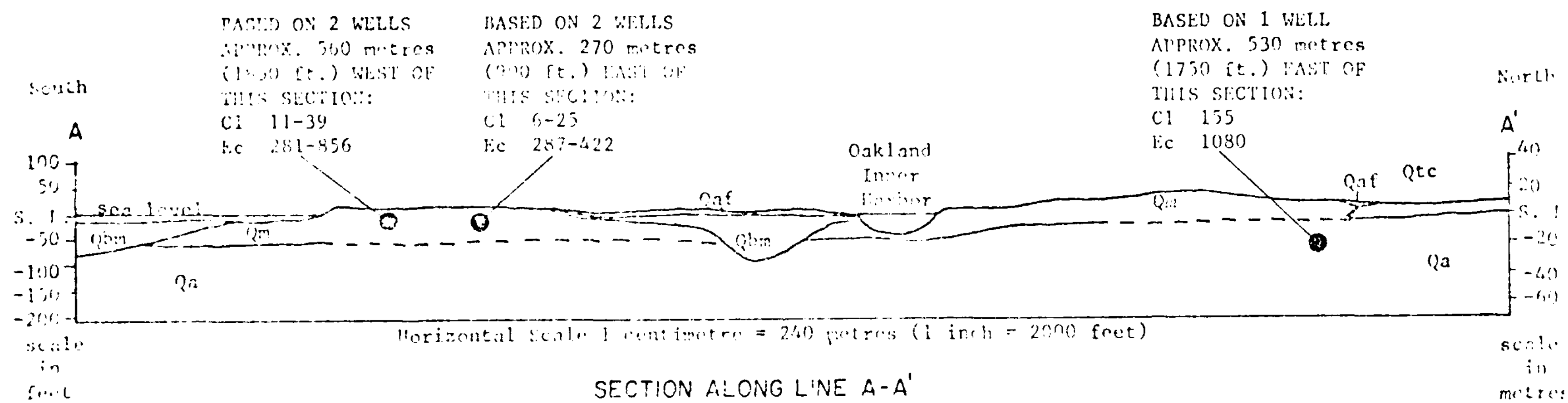
SOURCE: Radbruch, D. H. 1957

FIGURE 2

GEOLOGIC UNIT	LITHOLOGY	DISTRIBUTION AND THICKNESS	TOPOGRAPHIC FORM	ORIGIN OF DEPOSIT	PERMEABILITY	SLOPE STABILITY
[illegible]	Consists of miscellaneous refuse, [illegible], or sand dredged [illegible]	Along shore of bay and on Treasure Island. Maximum known thickness 2[illegible] feet.	Flat, level area a few feet above sea level.	Manmade.	Varies with composition.	Varies with composition; wet clay or loose sand must be supported in cuts.
[illegible]*	[illegible]	Fills ravines, mantles slopes and hilltops on Yerba Buena Island. Maximum known thickness 90 feet.	Ravine filling, follows contours of hills, forms flat benches in places.	Residual, derived from underlying sandstone of the Franciscan group, reworked by gravity, water, and wind.	High; medium where clayey.	Cuts steeper than the angle of repose of [illegible] must be supported. Slopes [illegible] present [illegible] slides numerous in [illegible]
[illegible]	[illegible]	Underlies water of bay and [illegible] artificial fill; ranges in thickness from a few inches to 85 feet; exposed on north side Alameda.	Slopes gently from landward edge toward the center of the bay; cut by meandering tidal channels.	Fine material held in suspension in bay water, deposited in quiet reaches of San Francisco Bay.	Low; most mud is saturated, however, as it is below water table.	[illegible] supported in cuts.
[illegible]	[illegible]	Covers Alameda and [illegible] part of Oakland, and [illegible] bay south and [illegible] of Alameda and [illegible] of Oakland. Thickness varies from a few inches to [illegible]	Where exposed at surface forms low, rounded hills.	Wind- and water-deposited beach and nearshore deposits.	High.	Should be supported in [illegible] consolidated and will stand for long periods of time in unsupported vertical [illegible]
[illegible]	[illegible]	Covers most of surface between Berkeley Hills and shore of bay [illegible]	Gently sloping coastal plain, in some places dissected by streams.	Alluvial fan material brought down from Berkeley Hills.	Moderate; some gravel lenses contain much water.	When dry will stand for long periods in vertical banks, [illegible] where water table is high, extensive sliding probable on steep slopes.
[illegible]	[illegible]	Underlies the bay and the coastal plain alluvium. Maximum known thickness 1,0[illegible] feet south of quadrangle.	No surface expression; exposed only in stream cuts and wave-cut banks.	Continental and marine sediments deposited in valley of San Francisco Bay.	Moderate to low; bulk of formation is saturated because it is below water table.	When dry will stand for long periods of time in steep banks, open cuts in soft clays below the water table should be supported.

* Reworked colluvium not shown in the geologic map in this report.

PROPOSED OAKLAND-INNER HARBOR PROJECT



SECTION ALONG LINE A-A'

SHOWING PROJECTED RESULTS OF SELECTED DATA

FROM THE WATER QUALITY SAMPLING PROGRAM OF JULY-AUGUST 1982

EXPLANATION

Cl — Dissolved Chlorides in Milligrams per Litre

Ec — Specific Conductance in Micromhos per Centimetre

◐ — Approximate Depth Zone from which Water of the Sample Was Produced (Based on Information Projected the Distance Indicated)

See Figure 2 for Explanation of Geologic Symbols and See the September 10, 1981 Reconnaissance Study for Details on the Geology.

Source: Radbruch, D. H., 1957, Areal and Engineering Geology of the Oakland West Quadrangle, Calif., USGS, Miscell. Geol. Invest. Map I-239

FIGURE 3

CONCLUSIONS

Twenty-three wells were field located. Depths to ground water measurements were obtained in 14 of those wells, and ground water quality samples were obtained from 8 wells. Only 5 wells could be both measured and sampled:

1S/4W34F4
1S/4W35Ea
2S/4W3E1
2S/4W10B
2S/4W11D1

Construction data were available for all those 5 except Well 1S/4W35Ea.

The following 3 of the field located wells are within 0.8 kilometre (0.5 mile) of Inner Harbor:

2S/4W5A1
2S/4W3E1
2S/4W3F1

All others are more than 0.8 kilometre (0.5 mile) away. Of the three wells adjacent to Inner Harbor, ground water could be sampled only in Well 2S/4W3E1. The sample contained 88 mg/L dissolved chlorides and had a specific conductance of 749 micromhos. Well construction and geologic data indicate that the well produces ground water from the Alameda Formation in zones located 82-88 metres (270-290 feet) and 104-107 metres (340-350 feet) below ground surface.

Dissolved chloride content of ground water from the 8 sampled wells ranged from 6 to 180 mg/L. This is within the 500 mg/L limit recommended by the California Secondary Drinking Water Standards. Specific conductance of the ground water from the 8 wells ranged from 281 to 1080 micromhos per centimetre. The recommended limit is 900 and the upper limit is 1600 micromhos per centimetre according to the California Secondary Drinking Water Standards.

The conclusions of the Department reconnaissance report (California Department of Water Resources, 1981) remain valid regarding possible disturbance of the salt water-fresh water interface and possible effects of such a disturbance. No new data was obtained during this study to dispel the thesis that removal of the clay could allow this interface to move further inland.

Analyses of ground water quality samples taken from water wells during this study indicate that at least portions of both the Merritt Sand and the Alameda Formation contain ground water that meets California Secondary Drinking Water Standards. Therefore, until proved otherwise, those formations should be considered usable aquifers.

Well data collected during this study are not sufficient to adequately define the thickness, lateral continuity, permeability, specific yield, or recharge capability of the Merritt Sand or the Alameda Formation. They are also not sufficient to determine the effects of the proposed project on those formations.

The use of ground water from wells is limited to a small number of wells most of which are more than 0.8 kilometre (0.5 mile) from Inner Harbor. Most of the wells are used for lawn and garden irrigation. Six such wells range in depth from 4 metres (12 feet) to 27.7 metres (91 feet). A seventh irrigation well is 108 metres (353 feet) deep. Only one producing industrial well was located. That well is at the Red Star Yeast Company approximately 1.2 kilometres (0.75 mile) north of Oakland Inner Harbor.

It is not known whether local landowners, industry, or local water purveyors will increase the use of ground water in the future. However, at the present time, the surface water supply is as cheap as or cheaper than ground water, and the quality of the imported surface water supply is higher than that of the ground water. Therefore, it may be expected that ground water demands will not increase as long as these conditions exist.

RECOMMENDATION

It is recommended that more data be collected as modified from Phase 2 (California Department of Water Resources Reconnaissance Report, 1981), to assess the risk of ground water degradation.

Phase 2

° Monitor the following wells for water level and water quality (dissolved chloride and specific conductance):

1S/4W34F4
2S/4W3E1
2S/4W10B
2S/4W11D1

° Construct additional water wells to be used for ground water level and ground water quality monitoring.

° Drill several pilot holes with a dual-tube, reverse rotary drilling rig to determine the feasibility of using the Merritt Sand and the Alameda Formation as sources of ground water.

° If evaluation of the data collected in Phase 2 indicates that the ground water contained in the Merritt Sand and Alameda Formation is unusable for some reason, no further exploration need be conducted and the channel can be deepened without concern that sea water intrusion will contaminate a usable aquifer.

If the data from Phase 2 indicate that the aquifers contain significant usable ground water resources, complete Phase 3 as follows:

Phase 3

° Drill exploratory holes on the centerline of the project at 61-metre (200-foot) centers or closer. Each hole should be drilled to a depth of 12.2 metres (40 feet) below present channel invert. An engineering geologist should log the holes, and water extracted from layers selected by the geologist should be analyzed for dissolved chloride. A dual-tube, reverse rotary drilling rig should be used. Each exploratory hole should be sealed after completion so that it does not become a conduit for sea water intrusion of the aquifers.

° If evaluation of the data collected in Phase 3 indicates that the ground water is unusable, or if usable aquifers are not intercepted, no further exploration need be conducted and the channel can be deepened without concern that sea water intrusion will contaminate a usable aquifer that constitutes a significant ground water resource.

° If the data indicate that the channel deepening will intersect aquifers that are presently protected by a lower permeability sedimentary layer, and that there is a chance that such an intersection will lead to greater sea water intrusion into aquifers that constitute significant ground water resources, then the costs and benefits of the proposed project should be compared to the costs and benefits of continued use of the ground water resources. Consideration should also be given to a final depth that is considerably less than -13.7 metres (-45 feet) MLLW.

All Phases

° Establish a subsidence leveling net tied to benchmarks well outside the area of possible influence of subsidence that may occur adjacent to the channel after the inner harbor is deepened. The leveling net should be surveyed as soon as possible to establish a datum before the project is begun.

No Mitigating Measures

A second possible course of action would be to proceed with the project and to compensate ground water users whose ground water is degraded. However, this course of action would present a potential conflict with the State's water quality policy of nondegradation, and could be pursued only if the project conformed with that State policy (See Appendix B). If this course of action is pursued, policy issues are raised that will have to be resolved with the State Water Resources Control Board and the California Regional Water Quality Control Board, San Francisco Bay Region.

State policy requires that any action relating to water quality must conform with the State Water Resources Control Board's nondegradation policy (State Water Resources Control Board Resolution Number 68-16[1/]). That resolution states that existing high quality of water will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of water, and will not result in water quality less than standards prescribed by policies of the State Water Resources Control Board.

1/ Appendix B

REFERENCES

Bay Area Rapid Transit District. Boring Logs along "M" line in Oakland. 1965.

__________. Soil Investigation B7200: Trans Bay Tube. 1965.

California Department of Public Works, Division of Bay Toll Crossings. Southern Crossing Foundation Exploration Log of Test Borings.

__________. Preliminary studies for an additional bridge across San Francisco Bay. 1947. 178 p.

__________. A report to Department of Public Works on additional soil crossings of San Francisco Bay. 1948. 144 p.

California Department of Public Works, Division of Highways. Plans for Construction on State Highway in Alameda County. Webster Street Tube, between Alameda and Oakland. 1955.

California Department of Public Works, Division of Water Resources, San Francisco Bay Salinity Control Barrier Investigation. 1954.

__________. Report to the California Water Project Authority on the Feasibility of Construction of Barriers in the San Francisco Bay System: Appendix "H", Geology. 1955.

California Department of Transportation. Southern Crossing: Alameda-Oakland Approach Preliminary Design Report. 1969.

California Department of Water Resources. Confidential Water Quality Analysis. 1913.

__________. Western Laboratories Confidential Water Quality Analysis. 1926.

__________. Alameda County Investigation, Bulletin 13. 1963.

__________. Water Well Standards: Alameda County, Bulletin 74-2 1964.

__________. Confidential Water Well Drillers' Reports of Alameda County. 1892-1978.

__________. Ground Water Quality Analyses of Alameda County. 1958-1980.

__________. Preliminary Assessment of the Effect of Deepening of Oakland Inner Harbor on the Ground Water Resources, A Reconnaissance Type Office Study. September 18, 1981.

__________. Water Action Plan Central and South San Francisco Bay Area (Central District report under review prior to publication). October 1982.

Dames & Moore. General Foundation Studies, Existing Substation "C" Oakland, California, for the Pacific Gas and Electric Company 1952.

__________. Preliminary Foundation Investigation Port of Oakland, Seventh Street Marine Terminal, South and West Sides. 1968.

East Bay Municipal Utility District. Well Data for Alameda County. 1953.

Freeze, R. Allan and Cherry, John A. "Groundwater". New Jersey. Prentice-Hall, Inc. 1979. 604 p.

Goldman, Harold B., Evaluation of Potential Geologic Hazards to Ground Water Aquifers, Pacific Gas and Electric Company. Proposed Oakland-Alameda Submerged Cable Crossing. June 25, 1980.

__________. Geologic and Engineering Aspects of San Francisco Bay Fill, California Division of Mines and Geology Special Report 97.

Helley, E. J. and Lajoie, K. R. Flatland Deposits of the San Francisco Bay Region, California -- Their Geology and Engineering Properties and Their Importance to Comprehensive Planning, USGS Professional Paper 943. 1979.

Hem, John D., Study and Interpretation of the Chemical Characteristics of Natural Water. USGS Water Supply Paper Second Edition. 1970. 363 pages plus 2 plates.

Hogenson, G. M. and Others. Effects of Proposed Salinity Control Barriers in San Francisco Bay, California Upon Ground Water Resources: Open File Report, U. S. Geological Survey, Menlo Park, California 1967.

Jenkins, Olaf P., Geologic Guidebook of the San Francisco Bay Counties, California Division of Mines Bulletin 154. 1951.

Lawson, A. C., Description of the San Francisco District, California: U. S. Geological Survey Geol. Atlas, Folio 193. 1914. 24 p.

Louderback, G. D., Geologic History of San Francisco Bay in Geologic Guidebook of the San Francisco Bay Counties. California Division of Mines Bulletin 154. 1951. p. 75-94.

Marlin, Imelda, Alameda, A Geographical History. Friends of the Alameda Free Library. 1977.

Mitchell, James K., Engineering Properties and Problems of the San Francisco Bay MUD: California Geology Special Report 82. 1963. pp. 25-32.

Nilsen, T. H., Preliminary Photointerpretation Map of Landslide and Other Surficial Deposits of the Concord 15-minute Quadrangle and the Oakland West, Richmond, and part of the San Quentin 7-1/2 minute Quadrangles, Contra Costa and Alameda Counties, California: Miscellaneous Field Studies Map MF-493, U. S. Geological Survey and U. S. Department of Housing and Urban Development. 1973.

Radbruch, Dorothy R. Areal and Engineering Geology of the Oakland West Quadrangle, California. USGS Map I-239. 1957.

Schlocker, J., Generalized Geologic Map of the San Francisco Bay Region, California: Basic Data Contribution 8, U. S. Geological Survey and Department of Housing and Urban Development. 1971.

Taliaferro, N. L., Geology of the San Francisco Bay Counties in Geologic Guidebook of the San Francisco Bay Counties: California State Division of Mines Bulletin 154. 1951. pp. 117-150.

Todd, David K., Ground Water Hydrology. New York. John Wiley and Sons, Inc. 1959. 336 p.

Trask, P. D. and Rolston, J. W., Engineering Geology of San Francisco Bay, California: California Geology Special Report 82. 1963. pp. 11-24.

Treasher, Ray C. Geology of the Sedimentary Deposits in San Francisco Bay, California: California Geology Special Report 82. 1963. pp. 11-24.

U. S. Department of the Navy, U. S. Naval Air Station, Alameda, California. Master Shore Station Development Plan, Part IV - Section 6, Area Development Plan, Utilities Domestic Water Distribution. 1968.

Webster, D. A., Map showing ranges in probable maximum well yield from water bearing rocks in the San Francisco Bay Region, California: Miscellaneous Filed Studies Map MF 431, San Francisco Bay Region Environment and Resources Planning Study, U. S. Geological Survey and U. S. Department of Housing and Urban Development. 1972.

________. Map showing areas in the San Francisco Bay Region where nitrate, boron, and dissolved solids in ground water may influence local or regional development: Miscellaneous Field Studies Map MF 432, San Francisco Bay Region Environment and Resources Planning Study, U. S. Geological Survey and U. S. Department of Housing and Urban Development. 1972.

APPENDICES

Article 8. Secondary Drinking Water Standards

64471. Applicability. (a) The secondary drinking water standards in this article shall be maintained to protect the public welfare, and to assure a supply of pure, wholesome and potable water. These standards specify maximum contaminant levels:

(1) At the point of delivery to the consumer which may adversely affect the taste, odor or appearance of drinking water.

(2) Which, if exceeded, may cause a substantial number of persons served by the community water system to discontinue its use.

(b) The local health officer shall ensure compliance with the requirements of this article by community water systems with less than 200 service connections and state small water systems.

64473. Maximum Contaminant Levels. (a) Distribution system water containing substances exceeding the maximum contaminant levels shown in Table 6 and 7 may be objectionable to an appreciable number of people, but is not generally hazardous to health.

Table 6

Consumer Acceptance Limits—Secondary Drinking Water Standards

Constituents	*Maximum Contaminant Levels*
Color	15 Units
Copper	1.0 mg/l
Corrosivity	Relatively low
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor—Threshold	3 Units
Foaming Agents (MBAS)	0.5 mg/l
Turbidity	5 Units
Zinc	5.0 mg/l

Table 7

Mineralization—Secondary Drinking Water Standards

Constituent, Units	*Maximum Contaminant Levels* *Recommended*	*Upper*	*Short Term*
Total Dissolved Solids, mg/l	500	1,000	1,500
or			
Specific Conductance, micromhos	900	1,600	2,200
Chloride, mg/l	250	500	600
Sulfate, mg/l	250	500	600

(b) The maximum contaminant levels listed in Table 6:

(1) Shall not be exceeded in:

(A) New community water systems.

(B) New sources developed for existing community water systems.

(2) Shall not be exceeded in existing community water systems. The distribution system water shall be free from significant amounts of particulate matter in all public water systems.

(c) In existing community water systems, if any maximum contaminant level in Table 6 is exceeded, the water supplier, pursuant to Section 4023, Health and Safety Code, may be required, following an investigation by the Department, to conduct a study.

(1) The investigation by the Department shall determine the extent of:

(A) Noncompliance with the maximum contaminant levels.

(B) Consumer dissatisfaction which is based upon the secondary drinking water standards.

(2) The study conducted by the water supplier shall:

(A) Be conducted in a manner and in accordance with a schedule acceptable to the Department and be completed in a period of time not to exceed one year.

(B) Be made by persons acceptable to the Department.

(C) Determine the degree of consumer acceptance of the water supply.

(D) Investigate the causes, methods of correction and estimate the cost of one or more alternative solutions.

(3) The results of the study conducted by the water supplier shall be made available to the:

(A) Users at an appropriately noticed public meeting.

(B) Department.

(C) Public Utilities Commission, if appropriate.

(d) The requirements of (b) (1) (B) and (b) (2) may be waived by the Department following the completion of an investigation as required in (c) based upon, but not necessarily limited to:

(1) Consumer acceptance of water not meeting the maximum contaminant levels shown in Table 6.

(2) Economic considerations.

(e) For the constituents shown on Table 7, no fixed consumer acceptance contaminant level has been established.

(1) Constituent concentrations lower than the Recommended contaminant level are desirable for a higher degree of consumer acceptance.

(2) Constituent concentrations ranging to the Upper contaminant level are acceptable if it is neither reasonable nor feasible to provide more suitable waters.

(3) Constituent concentrations ranging to the Short Term contaminant level are acceptable only for existing systems on a temporary basis pending construction of treatment facilities or development of acceptable new water sources.

(f) New services from systems serving water which carries constituent concentrations between the Upper and Short Term contaminant levels shall be approved only:

(1) If adequate progress is being demonstrated toward providing water of improved mineral quality.

(2) For other compelling reasons approved by the Department.

History: 1. Amendment of Table 6 in subsection (a) filed 1-15-78 (Register 78, No. 3).

STATE WATER RESOURCES CONTROL BOARD

RESOLUTION NO. 68-16

STATEMENT OF POLICY WITH RESPECT TO MAINTAINING HIGH QUALITY OF WATERS IN CALIFORNIA

WHEREAS the California Legislature has declared that it is the policy of the State that the granting of permits and licenses for unappropriated water and the disposal of wastes into the waters of the State shall be so regulated as to achieve highest water quality consistent with maximum benefit to the people of the State and shall be controlled so as to promote the peace, health, safety and welfare of the people of the State; and

WHEREAS water quality control policies have been and are being adopted for waters of the State; and

WHEREAS the quality of some waters of the State is higher than that established by the adopted policies and it is the intent and purpose of this Board that such higher quality shall be maintained to the maximum extent possible consistent with the declaration of the Legislature;

NOW, THEREFORE, BE IT RESOLVED:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

3. In implementing this policy, the Secretary of the Interior will be kept advised and will be provided with such information as he will need to discharge his responsibilities under the Federal Water Pollution Control Act.

BE IT FURTHER RESOLVED that a copy of this resolution be forwarded to the Secretary of the Interior as part of California's water quality control policy submission.

CERTIFICATION

The undersigned, Executive Officer of the State Water Resources Control Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on October 24, 1968.

Dated: October 28, 1968

Kerry W. Mulligan
Executive Officer
State Water Resources
Control Board

OAKLAND INNER HARBOR
ALAMEDA COUNTY, CALIFORNIA

APPENDIX H

A PRELIMINARY ASSESSMENT OF THE POTENTIAL FOR CULTURAL RESOURCES

U.S. ARMY CORPS OF ENGINEERS
SAN FRANCISCO DISTRICT

JUNE 1983

APPENDIX H

A PRELIMINARY ASSESSMENT OF THE POTENTIAL FOR CULTURAL RESOURCES ALONG A PORTION OF THE OAKLAND INNER HARBOR ALAMEDA COUNTY, CALIFORNIA

1.0 INTRODUCTION

1.1 The cultural resources assessment reported herein was undertaken in compliance with legal mandates set forth in the Archaeological and Historical Preservation Act of 1974 (Public Law 93-291) and Executive Order 11593, Protection and Enhancement of the Cultural Environment, 1971.

1.2 The goal of this assessment was to determine the potential for cultural resources within areas of the Oakland Inner Harbor currently proposed for the deep-draft navigation improvements. These areas are hereafter referred to collectively as the "study area." The proposed improvements would involve deepening and widening of the existing harbor channel (details given below), thus the study area includes channel-bottom sediments to be dredged and soils along the channel banks to be cut away.

1.3 Considering the type and location of the proposed improvements (i.e., dredging of submerged and subsurface sediments), the historic-period cultural resources addressed in this assessment included primarily ships or ship remnants which were abandoned or had sunk. Former piers and/or wharves, and large-scale artifacts related to abandoned ships and pierheads (e.g., engines of burned ships, pilings, railroad ties, cables, and other debris), were also considered. The prehistoric-period resoucres anticipated for the Inner Harbor area were primarily Native American shellmounds.

1.4 There was no on-site field reconnaissance made of the Inner Harbor only archival and literature reviews, and telephone interviews to achieve the study's goal. The results of this research indicated that no recorded cultural resources were situated on or near land which is planned for widening, and that there is very little or no potential for unrecorded resources being situated within the subsurface and submerged soils to be removed.

2.0 PROJECT LOCATION AND DESCRIPTION

2.1 The presently authorized Oakland Inner Harbor channel extends approximately 8.5 miles from the entrance channel near the western limit of the Alameda Naval Air Station east to San Leandro Bay. The reach of the Inner Harbor pertinent to this study is between the entrance channel and Clay St., a distance of about 4 miles, as shown on Figure 2 of the Main Report.

2.2 The proposed improvements for Plan B would include deepening the entrance Bar Channel, as well as widening at a few locations of bends and turning basins along the 4-mile reach. Other improvements would include deepening of the subject channel reach from the existing -35 feet to -43 feet mean lower low water (MLLW). The improvements for widening and deepening the channel would require dredging and disposal of an estimated 5,100,000 cubic yards of material. These materials would be transported to the disposal area off Alcatraz, a location which has been used for dredged materials since the 1930's. The reader is referred to Figures 10 through 14 of the Inner Harbor report for the plan and sections of proposed channel improvements (U.S. Army Corps of Engineers, 1981).

3.0 ENVIRONMENTAL SETTING: ESTUARY VERSES INNER HARBOR

3.1 The Inner Harbor was formerly known as the San Antonio Estuary, an arm of San Francisco Bay with its headwaters at the eastern end near Brooklyn Basin and Government Island. The natural estuary varied in depth from about two feet to 23 feet at low water and was bordered on both sides by wide expanses of mud flats and salt marshes (Jones 1934). The acuracy of this maximum depth information is in question since some of the initial dredging by the U.S. Government in the 1870s established the harbor channel at 20 feet deep and about 300 feet wide (Brookes 1983). Subsequent improvements over the years resulted in deepening the channel to -30 feet and then to the existing -35 feet, while the channel width was increased to 600-800 feet (Jones 1934; U.S. Army Corps of Engineers 1962).

3.2 The U.S. Geological Survey published a map which shows the approximate boundaries of former tidal flats, shores, ponds, and streams in the Oakland/Alameda area now filled or concealed (Radbruch 1959). It is clear that the artificial land forming the existing channel limits, along roughly the western three-quarters of the harbor reach presently studied, covers former areas of shallow water (evidently under water even at low tide), and that the channel limits along the remainder of the 4-mile stretch are situated on former tidal flats.

3.3 Reclamation of tidal flats and shallow-water areas by covering with artificial fill has produced flat land, thus permitting extensive industrial development along both sides of the harbor. The fill may consist of sand dredged from offshore areas (the primary material used along the east shore of San Francisco Bay), or possibly bay mud, sand-silt-clay mixtures, broken rock, and miscellaneous refuse (Radbruch 1959). It is also known that the materials excavated for the artificial Tidal Canal (easternmost end of the harbor) were used to fill tidal flats along the rim of the estuary, this taking place during the 1890s (Brookes 1983).

4.0 CULTURAL RESOURCES

4.1 Several sources of information were utilized to determine whether previously recorded cultural resources (i.e., prehistoric and historic archaeological sites) were situated along the subject reach of the harbor. While these sources are relevant to documented sites and features, it was necessary to consult publications to evaluate the likelihood of unrecorded cultural resources existing in the area of consideration. This latter evaluation was intended to focus primarily upon historic-period resources, specifically those related to the shipping industry of the harbor (e.g., abandoned ships and/or pier-heads, former shipbuilding features, etc.).

4.2 The following documents were checked in compliance with Section 106 of the National Historic Preservation Act of 1966 (Public Law 86-655) to identify any sites (i.e., Federally documented properties, States landmarks or points of interest) that might be of concern with respect to the currently proposed harbor improvements: National Register of Historic Places (Federal Register), California Inventory of Historic Resources (1976), and California Historical Landmarks (1979). No such cultural resources were found to be along the Inner Harbor section in question. The California State Office of Historic Preservation was contacted to check for historic properties recorded since 1976 (i.e., post-dating the above-mentioned published inventory of 1976); again, there were negative results. It should be mentioned that the scope of currently proposed harbor improvements precludes encroachment into the governmental and private facilities which may contain historically significant architectural/cultural features, as yet undocumented.

4.3 The pertinent archaeological site records, maps, and reports on file at the Northwest Information Center, Sonoma State University (Regional Office of the California Archaeological Inventory), were reviewed. No recorded cultural resources were found to be situated along the Inner Harbor reach under study.

4.4 The records indicated at least 10 prehistoric sites had been recorded in and around Oakland and Alameda, most of them being shellmounds discovered over 70 years ago (Nelson 1909), while the others were reported pre-1950 as occurrences of human bone and artifacts. The distribution of shellmounds --the most common resource found on the margins of San Francisco Bay and that which first received the attention of archaeologists -- clearly indicates that this type of settlement was nearly always established on landforms adjacent to, or in close proximity to, tidal flats, salt marshes, and shallow bodies of water. None of the shellmounds were situated along the study area, the closest ones appear to have been one to three miles away near the easternmost part of the estuary, Lake Merritt, and the Alameda side of San Leandro Bay, areas now extensively developed.

4.5 Two relatively recent cultural resources studies performed in the Inner Harbor area did not discover prehistoric sites (Chavez 1978; Brandt 1980). This is not considered unusual, however, since it is well known that many of the recorded prehistoric sites were destroyed and that field conditions due to development can often restrict thorough examination of an area.

4.6 The Inner Harbor and environs did not contain recorded historic-period cultural resources, as indicated by the Information Center files. Brandt (1980) identified historic buildings (e.g., residences, warehouses), bridges, shipbuilding slips, and docks in the Tidal Canal area, some of which were determined to be historically significant; this area is outside the present study area. The reach of the harbor presently under study is flanked by the Naval Air Station and Supply Depot, various shipyards, terminals, piers, etc., which may contain features of historical importance. To reiterate, the proposed improvements (specifically the widening) would not impact any structures part of these complexes since they are situated away from the existing channel limits.

4.7 Aside from the review of official records of recorded historic-period resources, preliminary research was completed regarding the potential for submerged abandoned ships or other features previously mentioned. The resulting information, coupled with the knowledge of the accumulative harbor improvements beginning pre-1900, was indicative that no submerged resources of significance would be encountered when the proposed improvements are carried out.

4.8 This preliminary research resulted in historical information about the growth of the Inner Harbor, its different periods of shipbuilding, and events related to abandoned ships. Of primary interest here is that the Inner Harbor apparently accumulated many abandoned ships over the years prior to the 1930s. Especially noteworthy was the Brooklyn Basin area at the harbor's eastern end (outside the study area), known as "Rotten Row," where Goldrush hulks, steam schooners, whalers, and other sailing vessels were abandoned. These ships fell into disuse largely because of slacking maritime trade, thus leaving such vessels without work and eventually resulting in their disrepair and neglect (Brookes 1983).

4.10 In the late 1930s, a project under the Works Progress Administration (WPA) was begun which removed the ships at Rotten Row. No details were retrieved regarding this removal project, although it appears that the purpose was to clear the harbor of visible obstacles which presented navigation hazards to visiting ships. It is considered likely that the WPA project removed additional vessels situated elsewhere in the harbor, if such ships were abandoned and resting within or close to the existing channel. No information was obtained regarding other harbor areas, however, nor was there discussion of removal of submerged vessels which could also have been navigation obstacles. Considering the purpose of the WPA project, it is reasonable to assume that known submerged vessels would have been removed as well. (e.g., those abandoned ships which burned, leaving the non-burnable parts to sink, and ships which sunk because of accidental collision).

5.0 DISCUSSION AND CONCLUSIONS

5.1 The results of the research described herein support a determination that there is very little or no potential for the existence of subsurface or submerged cultural resources (prehistoric and historic) within the study area.

5.2 The evidence that recorded prehistoric shellmounds, or any other type of substantial settlement, were not situated in areas adjacent to the original estuary is a primary factor in such a determination. Prior to the existence of the present-day San Francisco Bay (i.e., approximately 10,000 years ago when the sea level in the region was considerably lower than today), the area of San Antonio Estuary and environs may have been suitable for habitation by Native Americans. Archaeological resources resulting from such early hypothetical habitation would have been eventually submerged by rising sea levels, and possibly buried by bay sediments. It is considered highly probable that submerged prehistoric sites, if once situated on land where the estuary originated, have not been preserved due to the effects of the previous harbor improvements and development. In addition, the possibility is very remote that the remnant channel-bottom sediments contain prehistoric resources such as those described.

5.3 In terms of historic-period resources, the above determination takes several factors into consideration. Although there is documented use and development of the harbor since its inception, resulting in architectural features along the channel (e.g., piers, shipbuilding slips) and abandoned and sunken ships, the extensive previous harbor improvements have undoubtedly destroyed or severely damaged such cultural resources. This is especially true along the 4-mile section identified earlier. The proposed improvement for deepening the channel would dredge the existing bay sediments situated near the channel bottom (i.e., -35 feet MLLW), these sediments being formerly overlain by at least 15 feet of materials excavated after 1870. The approximate 15 feet of sediments dredged since 1870 are considered to have had more potential for submerged archaeological resources than the remaining materials proposed for removal.

5.4 Based upon the data generated herein, the proposed Plan B Inner Harbor improvement will not adversely affect known prehistoric or historic cultural resources, nor will the deepening and widening for the improvements encroach upon areas of suspected archaeological sensitivity.

6.0 RECOMMENDATIONS

6.1 In light of the findings reported herein, it is recommended that the currently proposed Inner Harbor improvements proceed as planned without further cultural resources studies. In the event that submerged/subsurface cultural resources such as those described in this report are encountered during the proposed Plan B deepening and widening activities, the San Francisco District Engineer should be notified so that compliance with Section 106 of the National Historic Preservation Act will be accomplished as outlined in 36 CFR 800.7 ("Resources Discovered during Construction").

REFERENCES CITED

Brandt, Steven

1980 "Cultural Resources Investigation of Operating Projects: Oakland Inner Harbor." U.S. Army Corps of Engineers, San Francisco District, In-House Report.

Brookes, Douglas S.

1983 "The Oakland Waterfront: 1850-1940." M. A. Thesis in Museum Studies, John F. Kennedy University.

California Historical Landmarks

1979 Published by the Resources Agency, Department of Parks and Recreation. State of California. Sacramento.

California Inventory of Historic Resources

1976 Published by the Resources Agency, Department of Parks and Recreation. State of California. Sacramento.

Chavez, David

1978 "Cultural Resources Evaluation of the Alameda Marina Village Project." Letter-report on file at the Northwest Information Center Sonoma State University ("S-1230").

Jones, Dewitt (Editor)

1934 "Port of Oakland." Published by the Works Progress Administration State Emergency Relief Administration, Project No. 3-F2-85.

National Register of Historic Places

1979 Federal Register, Annual and Cumulative Listing, and Monthly Supplements for 1980, 1981, and 1982.

Nelson, N.C.

1909 "Shellmounds of the San Francisco Bay Region." University of California Publications in American Archaeology and Ethnology, Vol. 4. University of California, Berkeley.

Radbruch, Dorothy H.

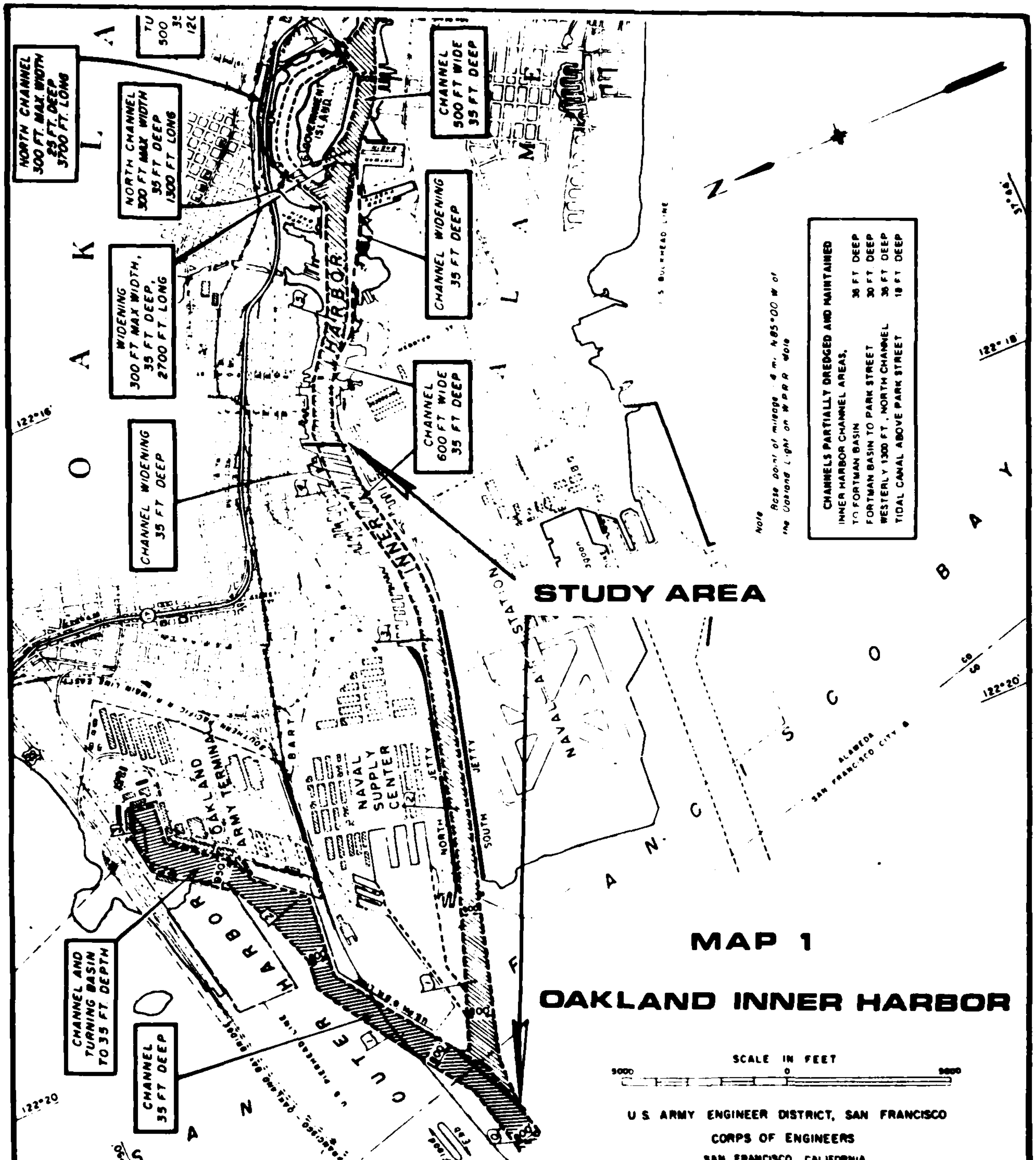
1959 "Former Shoreline Features along the East Side of San Francisco Bay, California." U.S. Gerological Survey Miscellaneous Geologic Investigations Map 1-298.

U.S. Army Corps of Engineers, San Francisco District

1973 "Final Environmental Impact Statement, Oakland Inner Harbor, Alameda County, California."

U.S. Army Corps of Engineers, San Francisco District

1981 "Stage 2 Plan Formulation Document, Oakland Inner Harbor, Alameda County, California: Deep-Draft Navigation.



MAP 1
OAKLAND INNER HARBOR
STUDY AREA
NORTH CHANNEL 300 FT. MAX WIDTH 25 FT. DEEP 3700 FT. LONG
NORTH CHANNEL 300 FT MAX WIDTH 35 FT DEEP 1300 FT LONG
WIDENING 300 FT MAX WIDTH, 35 FT DEEP, 2700 FT LONG
CHANNEL WIDENING 35 FT DEEP
CHANNEL 500 FT WIDE 35 FT DEEP
CHANNEL WIDENING 35 FT DEEP
CHANNEL 600 FT WIDE 35 FT DEEP
CHANNEL AND TURNING BASIN TO 35 FT DEPTH
CHANNEL 35 FT DEEP
OAKLAND
ALAMEDA
SAN FRANCISCO BAY
INNER HARBOR
OUTER HARBOR
OAKLAND ARMY TERMINAL
NAVAL SUPPLY CENTER
NAVAL AIR STATION
NORTH JETTY
SOUTH JETTY
BART
CHANNELS PARTIALLY DREDGED AND MAINTAINED
INNER HARBOR CHANNEL AREAS,
TO FORTMAN BASIN 35 FT DEEP
FORTMAN BASIN TO PARK STREET 30 FT DEEP
WESTERLY 1300 FT, NORTH CHANNEL 35 FT DEEP
TIDAL CANAL ABOVE PARK STREET 18 FT DEEP
122°16'
122°18'
122°20'
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
30 SEPTEMBER 1978

END

DATE
FILMED

9 — 83

DTIC