Oakland Harbor Navigation Improvement (-50 Foot) Project

Volume I:

Final Feasibility Study

SCH No. 97072051

Prepared by

Port of Oakland
State Lead Agency

With Assistance from

U.S. Army Corps of Engineers
San Francisco District
Federal Lead Agency

MAY 1998

PORT OF OAKLAND/U.S.ARMY CORPS OF ENGINEERS

NOTICE OF AVAILABILITY

FINAL ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT/ FEASIBILITY STUDY (FEIS/R/FS)

OAKLAND HARBOR NAVIGATION IMPROVEMENT (50-FOOT) PROJECT

LEAD STATE AGENCY: Port of Oakland

LEAD FEDERAL AGENCY: Department of the Army, U.S. Army Corps of Engineers

Notice is hereby given that a Final Environmental Impact Statement/Environmental Impact Report and Final Feasibility Study (FEIS/R/FS) has been prepared by the Port of Oakland and the U.S. Army Corps of Engineers (USACE), San Francisco District to evaluate the impacts associated with the proposed Oakland Harbor Navigation Improvement (50-foot) Project, Alameda County, California.

The FS is normally prepared by the USACE to identify a federal interest in a proposed navigation improvement project. The FS is necessary in order to gain Congressional authorization and funding for the project pursuant to the Water Resources Development Act (WRDA) of 1986. Under the provisions of Section 203 of the WRDA, the Port prepared this feasibility analysis directly, co-sponsored with the USACE the EIS/EIR documentation, and is submitting the studies directly to the Secretary of the Army with the intent of obtaining authorization for the project to be included in the WRDA of 1998.

SUMMARY

The Port of Oakland proposes to deepen the federal channels of Oakland Harbor and Port-maintained berths to a depth of 50 feet below mean lower low water (MLLW) in order to accommodate the newest generation of deep-draft container ships. The proposed navigation improvements would involve the dredging and disposal of 12.8 to 14.5 million cubic yards (mcy) of bottom sediments. The proposed dredging and sediment reuse/disposal is anticipated to last up to 4 years, beginning sometime around February 2000 and ending by February 2004. The federal portion of the project would involve dredging the navigation channels. As the local sponsor, the Port has the sole responsibility for the berth deepening that would occur with this project.

Proposed Navigation Improvements

The maximum extent of the proposed improvements includes the elements listed below, although all of the listed improvements would not be done under each dredging option.

- Channel deepening and widening (federal action):
    - The Oakland Entrance Channel and Approach;
    - The Outer Harbor Channel; and
    - The Inner Harbor Channel from the Entrance Channel to just past the Howard terminal.

- Berth deepening (local sponsor action):
    - The following berths would be deepened to 50-feet: 22-26, 30, 32, 33, 35, 37, 55-58, 60-63, 67, and 68.
- Turning basin improvements:
    - Deepening and slightly widening the Outer Harbor turning basin to a 1,600-foot diameter; and
    - Deepening and enlarging the Inner Harbor turning basin to a 1,500-foot diameter.
- Infrastructure modifications:
    - Modifying the Bay Area Rapid Transit (BART) anode structure and cable (the project would not affect the BART tube itself); and
    - Lowering or relocating all existing submarine utilities within the project area as necessary, including the Alameda sewer pipeline crossing the Inner Harbor Channel.

Dredging Options

Five possible dredging options, plus the no-project alternative, were initially considered. The project sponsors also considered dredging somewhere in between the existing 42-foot depth and the proposed 50-foot depth. Three of the five initial dredging options were eliminated from further study because they would not meet the project's objectives. The project sponsors also eliminated consideration of dredging to a depth less than 50 feet because the optimal channel depth for the largest vessels calling at the Port is at least 50 feet.

This FEIS/R/FS analyzes in detail the no-project alternative plus dredging options B and F. Only one of the dredging options would be implemented. Each dredging option is combined with a set of dredged material reuse/disposal options into project alternatives.

Dredged Material Reuse/Disposal Options

Twenty (20) dredged material reuse/disposal options were initially considered. Of these 20, eight are analyzed in detail in this FEIS/R/FS. These eight are: Vision 2000 Upland, New Berth 21, Middle Harbor Enhancement Area, Former NAS Alameda, SF-DODS, Hamilton Wetlands Restoration, Montezuma Wetlands Restoration, and Various Landfills.

Project Alternatives

The project alternatives consist of either dredging option B or F plus a set of dredged material reuse/ disposal options. Fifteen (15) project alternatives are analyzed in detail in this FEIS/R/FS.

Impacts

Significant unavoidable impacts would occur for all alternatives in two resource areas: air quality and noise. For the following resource areas there would be significant but mitigable impacts under any of the alternatives: surface water resources, geology and groundwater, biological resources, transportation, hazardous materials and contaminated wastes, and public services.

The Selected Plan (referred to in the Feasibility Study as the National Economic Development Plan)

The Selected Plan is identified in the FEIS/R/FS as dredging option F to a depth of 50-feet, with the following reuse/disposal options: Middle Harbor Enhancement Area, Vision 2000 Upland, Various Landfills, and Hamilton Wetlands Restoration or Montezuma Wetlands Restoration or SF-DODS. In the event that the Hamilton Wetlands Restoration project is not permitted by the project sponsor within the timeframe necessary for construction, or if project construction costs are not supportable by the project, reuse of dredged material at the Montezuma Wetlands Restoration project could accomplish many of the same habitat restoration benefits. In the event that neither of the Hamilton or Montezuma sites is available before the midpoint of the 50-foot dredging project, the material designated for wetland restoration would be disposed of at SF-DODS.

AVAILABILITY AND REVIEW OF THE DOCUMENT:

The public review period for the FEIS/R/FS is from Friday, May 29, 1998 to 5:00 P.M. Monday, June 29, 1998, or 30 days after the Notice of Availability is filed in the *Federal Register*.

The Final EIS/R/FS is available for review at the following locations:

San Francisco Public Library, Stegner Center: Civic Center, Larkin and Grove Street, San Francisco, CA

West Oakland Branch Library: 1801 Adeline Street, Oakland, CA

Oakland Public Library: 125 14th Street, Oakland, CA

City of Alameda Public Library: 2264 Santa Clara Avenue, Alameda, CA

MTC/ABAG Library: 101 8th Street, Oakland, CA

San Leandro Public Library: 300 Estudillo Avenue, San Leandro

University of California Institute of Governmental Studies Library: 109 Moses Hall, Berkeley, CA

University of California Institute of Transportation Studies: 409 McLaughlin Hall, Berkeley, CA

Fairfield-Suisun Library: 1150 Kentucky Street, Fairfield, CA

Petaluma Regional Library: 100 Fairgrounds Drive, Petaluma, CA

Sonoma County Central Library: 3rd and "E" Street, Santa Rosa, CA

Marin County Library: 1720 Novato Blvd., Novato, CA

Corps of Engineers, San Francisco District, 333 Market Street, San Francisco, CA (415) 977-8543*.

Port of Oakland, Environmental Department, 530 Water Street, Oakland, CA (510) 272-1250*.

*Please call for an appointment

The document will also be available on the Internet (without Appendices) as of May 29, 1998, at http:\\www.portofoakland.com.

One hundred (100) copies of the FEIS/R/FS will be available free of charge on a first-come first-served basis (one per person), and may be picked up Monday through Friday between 8 A.M. and 5 P.M. at the Port of Oakland, 530 Water Street, Oakland, CA. For information on obtaining a document call Gudrun Putz at (510) 272-1250.

Availability of Documents Referenced in the FEIS/R/FS

Close to 350 documents are referenced in the Final EIS/R/FS. Documents produced by government agencies are available for review at those agencies. Most of the remaining referenced documents are available for review at at least one of the following locations. Please contact Gudrun Putz of the Port of Oakland at (510) 272-1250 to confirm document locations.

Port of Oakland
530 Water Street
Oakland, CA 94607
Attn: Gudrun Putz
(510) 272-1250

SAIC
816 State Street, Suite 500
Santa Barbara, CA 93101
Attn: Marianne Lipshutz
(805) 966-0811

Corps of Engineers
333 Market Street
San Francisco, CA 94105
Attn: Eric Jolliffe
(415) 977-8543

Comments on the Final EIS/R/FS

Comments concerning the Final EIS/R/FS must be submitted no later than 5:00 P.M. on June 29, 1998, or 30 days after the Notice of Availability is published in the *Federal Register,* to:

Policy Review Branch
HQ U.S. Army Corps of Engineers
CECW-AR(IP)
7701 Telegraph Road
Alexandria, VA 22315-3861

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OAKLAND INNER AND OUTER HARBORS

Alameda and San Francisco Counties, California

REPORT ON THE FEASIBILITY STUDY FOR DEEP DRAFT IMPROVEMENTS

1.0 INTRODUCTION

1.1 STUDY AUTHORIZATION

This study has been prepared pursuant to the authority provided by the Congress of the United States through the Water Resources Development Act of 1986 (P.L. 99-662) §203 (§203 WRDA 86), which reads:

SEC. 203 STUDIES OF PROJECTS BY NON-FEDERAL INTEREST

1. Submission to Secretary.-A non-Federal interest may on its own undertake a Feasibility Study of a proposed harbor or inland harbor project and submit it to the Secretary. To assist non-Federal interests, the Secretary shall, as soon as practicable, promulgate guidelines for studies of harbors or inland harbors to provide sufficient information for the formulation of studies.

2. Review by Secretary.-The Secretary shall review each study submitted under subsection (a) for the purpose of determining whether such study and the process under which such study was developed comply with Federal laws and regulations applicable to Feasibility Studies of navigation projects for harbors or inland harbors.

3. Submission to Congress.-Not later than 180 days after receiving any study submitted under subsection (a), the Secretary shall transmit to the Congress, in writing, the results of such review and recommendations the Secretary may have concerning the project described in such plan and design.

4. Credit and Reimbursement.-If a project for which a study has been submitted under subsection (a) is authorized by any provision of Federal law enacted after the date of such submission, the Secretary shall credit toward the non-Federal share of the cost of construction of such project an amount equal to the portion of the cost of developing such study that would be the responsibility of the United States if such study were developed by the Secretary.

1.2 STUDY PURPOSE AND SCOPE

The purpose of this study is to evaluate the need for improved deep draft navigation channels in the Oakland Inner and Outer Harbors and to determine the solution that best serves related economic, physical, social and environmental considerations. Pursuant to Section 203 WRDA 86 and the implementation guidance contained in Engineering Regulation No. 1165-2-122 dated 26 August, 1991 (ER 1165-2-122), this study is directed at determining the extent of both the Federal and the non-Federal participation in improving the Oakland Harbor channels and at identifying the National Economic Development plan, which has the greatest net economic benefit consistent with protecting the Nation's environment.

1.3 LOCAL SPONSOR

The local sponsor for this Study is the Port of Oakland located in Oakland, California. This Study is being funded in its entirety by the Port of Oakland, which is conducting the Study consistent with § 203 WRDA 86. Study participants and coordination are described below.

1.3.1 Study Participants

The study participants are the Port of Oakland (Port) and the U.S. Army Corps of Engineers (Corps).

1.3.2 Study Coordination

This Study is being prepared pursuant to §203 WRDA 86. On September 23, 1996, the Port of Oakland (the local sponsor) and the Corps of Engineers signed a Memorandum of Agreement, prepared pursuant to the Intergovernmental Cooperation Act, providing for the Port to hire the Corps to prepare portions of the Feasibility Study. The Corps filed a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the study on July 16, 1997. The Port filed a Notice of Preparation (NOP) of an Environmental Impact Report (EIR) to comply with the California Environmental Quality Act on July 18, 1997. On August 5, 1997 the Port and the Corps conducted an EIS/R/FS scoping meeting to initiate the Feasibility phase of the study. The Notice of Availability for the Draft Environmental Impact Statement/Report on the Oakland Harbor Deep Draft Navigation Improvement Project was filed on February 13, 1998. The public comment period on the Draft EIS/R closed on March 30, 1998.

Because any new work could have water quality, air quality and ocean water impacts, close coordination with Region 9 of the U.S. Environmental Protection Agency (EPA) is being conducted as per the Clean Water Act, the Clean Air Act and the Marine Protection, Research and Sanctuaries Act (MPRSA, "Ocean Dumping Act").

Coordination with the U.S. Fish and Wildlife Service (USFWS) was initiated in August 1997 when the Corps prepared and began to negotiate the scope of work to prepare the Coordination Act Report. USFWS provided a planning aid letter in January 1998. In March 1998, USFWS provided a Draft Fish and Wildlife Coordination Act Report (DCAR) for the Feasibility Study. USFWS is currently finalizing the Coordination Act Report. The Port and Corps have submitted a Section 7 Endangered Species Act Biological Assessment to the USFWS. A Biological Opinion is expected from the USFWS in June 1998.

Coordination with other agencies and the general public has also occurred at various points during study execution. Other agencies include the National Marine Fisheries Service, U.S. Coast Guard, California Department of Fish and Game, the California Coastal Conservancy, the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB), the Bay Area Air Quality Management District, the San Francisco Bay Conservation and Development Commission (BCDC), the State Historic Preservation Officer (SHPO), Oakland Landmarks Preservation Board, City of Oakland, City of Alameda, U.S. Navy, U.S. Army, Oakland Base Reuse Authority (OBRA), Alameda Reuse and Redevelopment Authority (ARRA), San Francisco Bar Pilots Association, Alameda County Public Works Agency, and the East Bay Regional Park District. Public coordination included inclusion of the Sierra Club, the Save San Francisco Bay Association, and the Golden Gate Audubon Society in the planning process.

A public hearing was held on March 4, 1998 to solicit comments on the Draft Feasibility Report and EIS/R, the results of which have been included in this final Feasibility Report and EIS/R.

1.4 PREVIOUS STUDIES

The Oakland Harbor has developed over a long period of time, with the Inner Harbor beginning in what was a natural estuary known as San Antonio Creek. The first Federal improvement was authorized by the Rivers and Harbors Act adopted 23 June 1874. The most recent improvements (dredging to -42 feet mean lower low water [MLLW]) were authorized by Section 202 of the Water Resources Development Act of 1986 (P.L. 99-662). 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 Corps in June 1994.

In addition to studies specifically related to improvements to the Oakland Harbor, some of which are included as appendices to this FS or the accompanying EIS/R, numerous reports have been prepared concerning San Francisco Bay. The major reports and legislative documents of interest to this study are listed below.

1. Hydrodynamic Evaluation for Oakland Inner Harbor Channel: Hartman Consulting Group - 1997.

2. Waterborne Commerce of the United States (1997) - These annual statistics on Pacific Coast ports shows the cargo tonnage handled by the Port of Oakland.

3. San Francisco Bay Plan and Amendments: Bay Conservation and Development Commission - 1996.

4. Long-term Management Strategy (LTMS) for the Placement of Dredged Material in the San Francisco Bay Region, Draft Policy Environmental Impact Statement/Programmatic Environmental Impact Report: U.S. Environmental Protection Agency - 1996.

5. Waterborne Geophysical Surveys of the Oakland Inner and Outer Harbor: Pelagos - 1994.

6. Final Supplemental Environmental Impact Report/Environmental Impact Statement Oakland Harbor Deep Draft Navigation Improvement - 1994.

7. Oakland Harbor 42-foot Deep Draft Navigation Improvement Project General Design Memorandum - 1994.

8. Waterborne Geophysical Surveys of the Oakland Inner and Outer Harbor: John Chance - 1994 and Waterways Experiment Station - 1992.

9. Evaluation of Upland Disposal of Oakland Harbor, California, Sediment; Volume I: Turning Basin Sediments - 1992.

10. Ecological Evaluation of Proposed Dredged Material from Oakland Harbor Berthing Areas - 1992.

11. Long Term Management Strategy for Dredged Material Disposal in the San Francisco Bay Region - 1992.

12. Evaluation of Upland Disposal of Oakland Harbor, California, Sediment; Volume II: Inner and Outer Harbor Sediments - 1991.

13. Historical Research of Land Use and Industry in the Federal Ship Channel Study Area, Oakland, California - 1990.

14. San Francisco Bay Area Seaport Plan and Amendments: Bay Conservation and Development Commission and Metropolitan Transportation Commission - 1982 (approved 1989).

1.5 PLANNING PROCESS OF THE CORPS OF ENGINEERS

To ensure that the Feasibility Study meets the requirements of the Corps, the Port has used the Corps' planning methodology. Six major steps comprise the Corps' planning methodology. These include: (1) specification of water and related land resources problems and opportunities; (2) inventory, forecast, and analysis of water and related land resource 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 the recommended plan based upon the comparison of the alternative plans. Planning is a dynamic process requiring iteration of the various steps. Through iteration of the various planning steps, the study becomes refined as new data are gathered. These planning steps are conducted and reported in a two-stage planning process consisting of a Reconnaissance phase and a Feasibility phase. The Reconnaissance phase was completed in July 1997.

As described in section 1.1, this Feasibility Study is being undertaken by a non-Federal sponsor, the Port of Oakland, located in Oakland, California. The Port has conducted its own Reconnaissance activities for this proposed project. Port Maritime Economics staff identified problems including transportation inefficiencies and loss of cargo volumes, and opportunities to improve service. Port Engineering staff evaluated several preliminary project plans at a comparative level of detail. The Port has conducted on-going community relations activities to identify potential concerns and opportunities that could be addressed through water and related land resources planning.

The second and final phase of the planning process, the Feasibility Study phase, which is the focus of this report, further evaluates the plans to address the planning objectives. The alternative plans are evaluated and a plan is selected and recommended for implementation. The approved Final Feasibility Report will be presented to the Congress of the United States through the Water Resources Development Act of 1998.

1.6 REPORT ORGANIZATION

This Feasibility Report is divided into seven Chapters. Chapter 2 (Study Area Description) which follows, provides a description of the Bay and Harbor and of the physical, biological, and socio-economic conditions of the area. Chapter 3 describes the problems and needs which are the focus of this study. Chapter 4 focuses on the development of a recommended plan based on the evaluation of the planning objectives, construction options, environmental constraints, and engineering considerations. Chapter 5 presents a detailed description of the National Economic Development (NED) plan based on the Corps' economic model. Coordination and public involvement are discussed in Chapter 6 and the study conclusions and recommendations are presented in Chapter 7.

2.0 STUDY AREA DESCRIPTION

2.1 DESCRIPTION OF THE STUDY AREA

2.1.1 Harbor Location and Description

The Port of Oakland and the Oakland Inner and Outer Harbors are located on the eastern side of the San Francisco Bay in the counties of Alameda and San Francisco, California (Figure 2.1).

The Port of Oakland is a complete multi-faceted transportation and distribution center providing access to modern marine terminals specializing in containerized shipments of cargo from Pacific Rim and other Asian countries, and Europe. This world-class Port is the largest on the San Francisco Bay, the third largest container port on the North American West Coast and the fifth largest container port in the nation. The Port is located on the east side of the San Francisco Bay, about 8 miles inside the Golden Gate. Oakland Harbor consists of the Outer Harbor and the Inner Harbor. The tidal range between mean lower low water (MLLW) and mean higher high water (MHHW) is approximately 6.4 feet (from approximately 0 feet MLLW to +6.4 feet MLLW). Observed extreme water levels at NOAA Station 941-4750 at Alameda indicate that the estimated highest high water level is +9.25 feet MLLW, and the estimated extreme lowest low water level is -2.75 feet MLLW.

The Outer Harbor is located immediately south of the San Francisco-Oakland Bay Bridge. The authorized Federal channel in the Outer Harbor is maintained at -42 feet MLLW and provides access to the Port of Oakland's berthing areas which serve container, break-bulk, and roll-on/roll-off deep-draft vessels.

The Inner Harbor, locally called "the estuary," separates the cities of Alameda and Oakland and was developed in the natural estuary of San Antonio Creek, which extends landward to Brooklyn Basin. The Inner Harbor begins at Project Mile 0.45. It includes an Entrance Reach, Inner Harbor Reach, Grove Street to Brooklyn Basin Reach, Brooklyn Basin Reach, Park Street Reach, and a Tidal Canal that connects with the San Leandro Bay at Project Mile 8.5. The Entrance Reach and Inner Harbor Reach are maintained at -42 feet MLLW. Upper reaches of the Inner Harbor serve privately-owned facilities along the estuary, and are maintained at lesser depths. Two submarine highway tubes between Oakland and Alameda pass under the channel at Project Mile 4.6 and 4.7. Also, there are four bridge crossings over upstream reaches of the channel.

The San Francisco Bar channel provides access to vessel traffic entering the San Francisco Bay. The approximate location of the Bar channel is shown in Figure 2.1. The Bar channel is maintained at -55 feet MLLW. Tidal conditions, channel depth, and swelling restrict operating vessels to a draft of -50 feet MLLW.

There is a wide mix of land uses along the Inner Harbor channel. The Inner Harbor channel provides access to Port of Oakland berthing areas which serve container vessels at several terminals. The farthest upstream terminals are the Howard Terminal located at the beginning of the Grove Street to Brooklyn Basin Reach, and a conventional break-bulk terminal at Ninth Avenue, adjacent to the Brooklyn basin. Other uses along the Inner Harbor include shipping and transportation operations, steel fabrication and manufacturing, residential housing, parks, and commercial establishments catering to

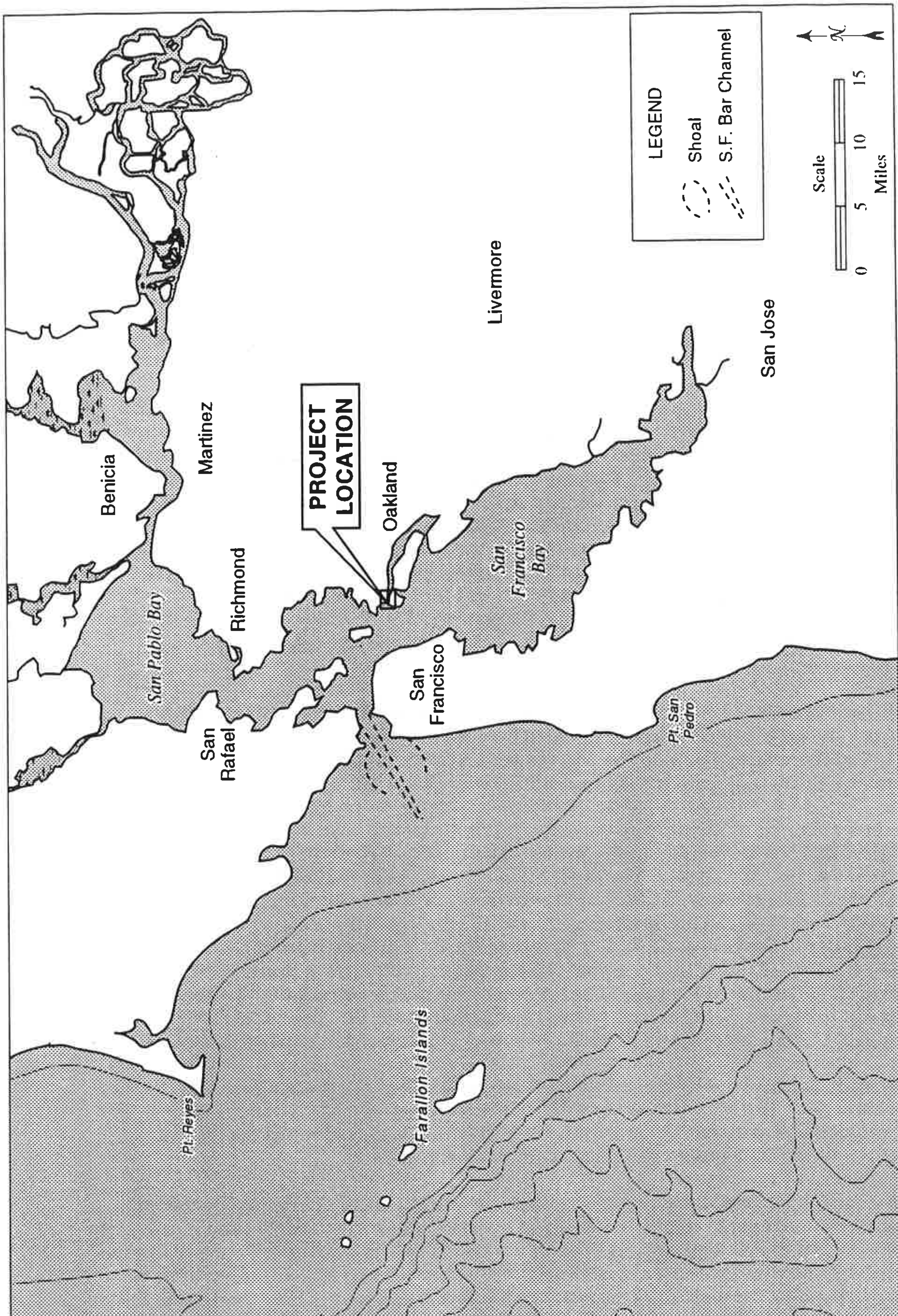

Figure 2.1

PROJECT LOCATION

recreational boaters and tourists. Leisure activities include fishing, sightseeing, and sailing.

The Port is currently planning a major terminal facilities expansion project (known as Berths 55-58) and upgrade of an existing intermodal rail facility (known as the Joint Intermodal Terminal [JIT]) at the former Fleet and Industrial Supply Center Oakland (FISCO). Subsequent to its listing through the Base Realignment and Closure (BRAC) process FISCO is being conveyed to the Port of Oakland. The FISCO conversion to civilian maritime use includes development of new marine terminals along the Inner Harbor channel, utilizing both FISCO property and Port of Oakland-owned waterfront property along the Inner Harbor. The Port of Oakland waterfront property along the Inner Harbor is currently being leased to the Union Pacific (UP) Railroad. A programmatic Environmental Impact Statement and Environmental Impact Report (EIS/EIR) have been prepared. The Record of Decision was signed in August 1997. The Port is proceeding with supplemental environmental documentation and design for Berths 55 - 58 and the JIT facilities. The new facilities are scheduled to be completed (including construction of channel bank improvements) by December 2000, that is, to be fully operational prior to the completion of the dredging proposed by this Feasibility Study.

Operations along the Outer Harbor consist primarily of berthing areas and portions of the Oakland Army Base, which is being closed under the BRAC Act. The Reuse Plan for the Oakland Army Base contemplates maritime use for the western portion of the Oakland Army base, consistent with on-going Port operations in the area.

The Port's location on the east side of the 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 the transfer of cargo between sea and land modes of shipment. Figure 2.2 provides the location of some key terminal facilities along the Oakland Inner Harbor and Outer Harbor channels, including the location of Berths 55-58 and the JIT. Figure 2.3 shows typical specialized equipment currently being used to handle containerized cargo in the Port of Oakland.

2.1.2 Existing Navigation Project

Navigation channel improvements presently authorized and maintained for the Oakland Inner and Outer Harbor are shown on Figure 2.4 and include:

- <u>Entrance Channel:</u> 42 feet deep, approximately 1800 feet long, widening from 900 feet to 1,000 feet wide from the west entrance to the entrance to the Inner and Outer Harbor channels.

- <u>Outer Harbor Channel:</u> 42 feet deep and 8,700 feet long west of the Outer Harbor turning basin, and 42 feet deep and 4,000 feet long north of the Outer Harbor turning basin. In addition, there is a 1,300-foot-long "dogleg" that extends east from the northern end of the Outer Harbor channel. The western portion of the Outer Harbor channel narrows from 1,000 feet at the end of the Entrance channel to 600 feet wide 7,100 feet east of the Entrance channel, where the Outer Harbor channel bends to the east. The Outer Harbor channel then widens over the next 1600 feet to meet up with the west end of the turning basin. The northern portion of the Outer Harbor channel is 900 feet wide along its entire length; the "dogleg" narrows from 800 feet at its entrance to 600 at its eastern end.

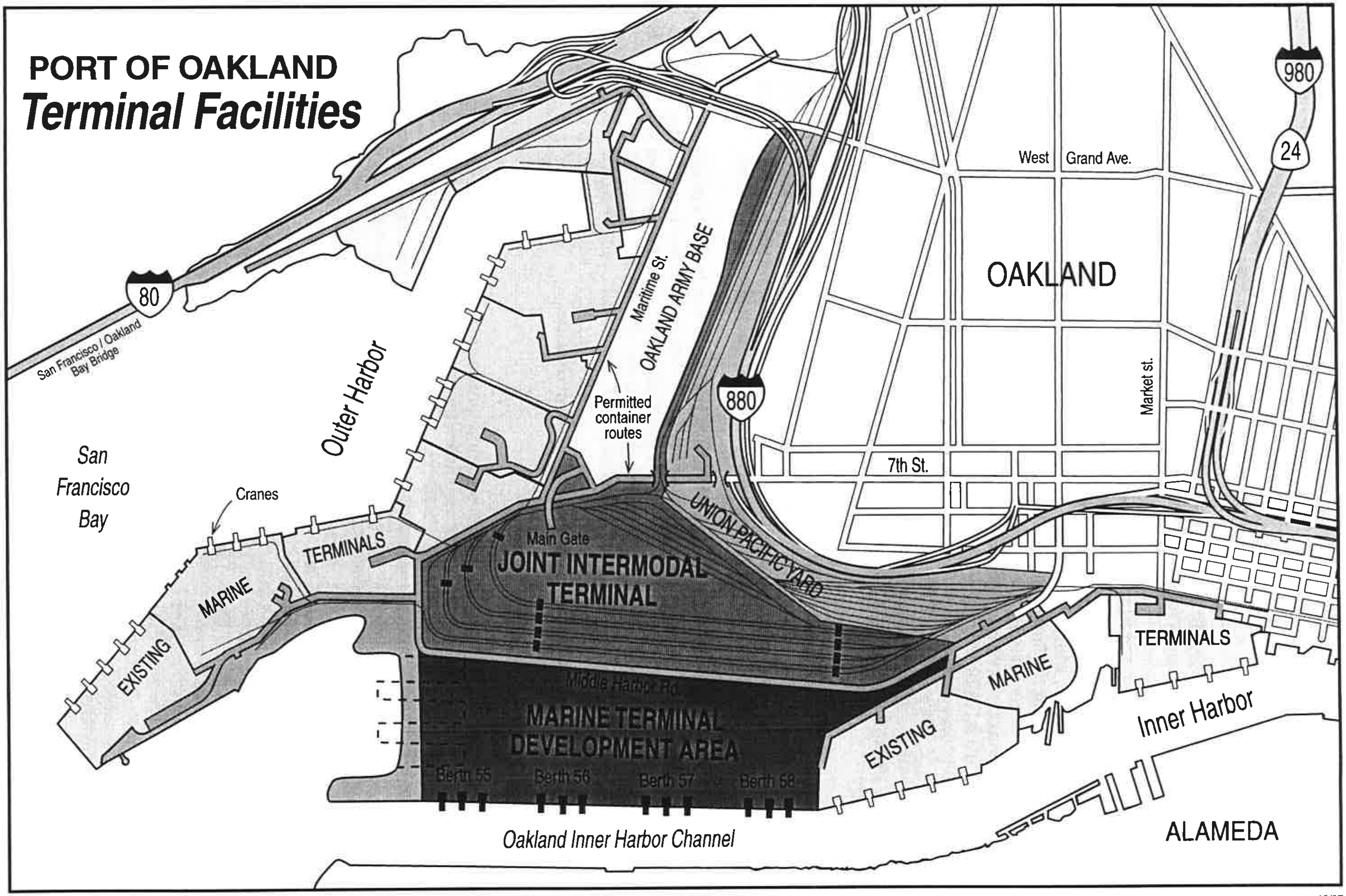
PORT OF OAKLAND
Terminal Facilities
980
24
West
Grand Ave.
OAKLAND
80
San Francisco / Oakland Bay Bridge
Maritime St.
OAKLAND ARMY BASE
Outer Harbor
880
Market st.
Permitted container routes
7th St.
San Francisco Bay
Cranes
TERMINALS
Main Gate
JOINT INTERMODAL TERMINAL
UNION PACIFIC YARD
MARINE
EXISTING
TERMINALS
MARINE
Middle Harbor Rd.
MARINE TERMINAL DEVELOPMENT AREA
EXISTING
Inner Harbor
Berth 55
Berth 56
Berth 57
Berth 58
Oakland Inner Harbor Channel
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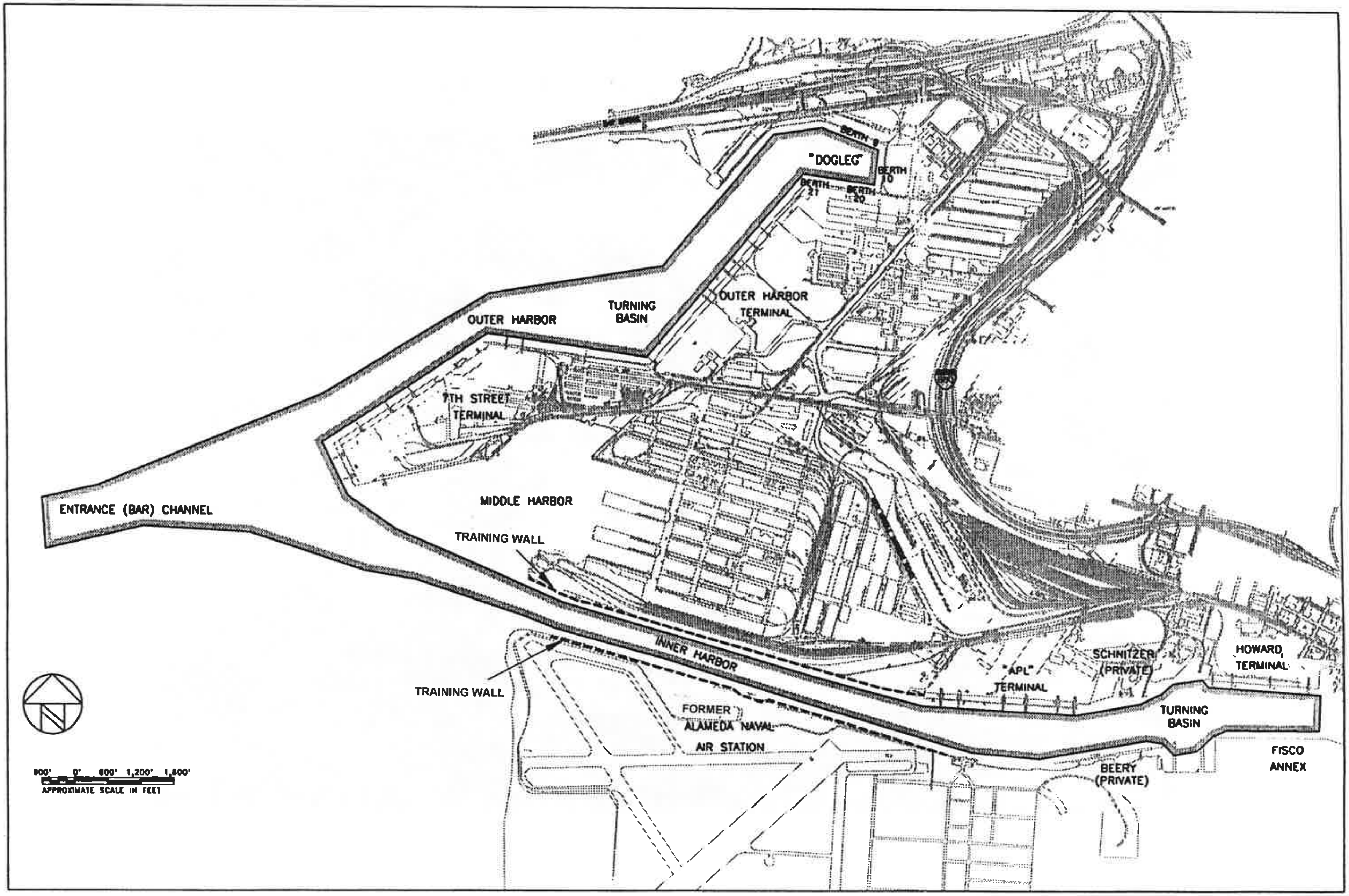
Figure 2.2

Typical Berth and Cranes

Figure 2.3



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- Inner Harbor Channel: The Inner Harbor channel is divided into six segments. The first and second segments (Entrance Reach and Inner Harbor Reach) are proposed to be part of the navigation improvement project. This portion of the channel is currently between 38 and 42 feet deep, and extends 18,800 feet from the end of the Entrance channel to the Inner Harbor turning basin. A small portion of the Inner Harbor Reach extends 1,700 feet east of the Inner Harbor turning basin. The Inner Harbor channel narrows from 2,200 feet wide at the start of the Entrance Reach to 480 feet wide immediately south of the former Fleet and Industrial Supply Center Oakland (FISCO), and then widens again to 700 feet at the mouth of the turning basin. The Inner Harbor channel east of the turning basin narrows from 800 feet at the end of the turning basin to 700 feet at the end of the Inner Harbor Reach.

  The existing authorized Federal Project also includes a channel 35 feet deep and 600 feet wide from the east end of the -42 foot project to the west end of Government Island. From there, a channel 35 feet deep and 500 feet wide extends through the Brooklyn Basin to a triangular area 35 feet deep and about 2700 feet long with a maximum width of 300 feet at the western end of Brooklyn Basin. A channel also extends along the north side of Brooklyn Basin. It is 35 feet deep and 300 feet wide for 1,300 feet, then 25 feet deep and 300 feet wide for 3,700 feet. It leads to a turning basin at the east end of the Brooklyn Basin which is 35 feet deep, 500 feet wide, and 1,200 feet long. Finally, the Federal Project includes a channel in the tidal canal 35 feet deep and 275 feet wide from the east end of Brooklyn Basin to Park Street, and a channel 18 feet deep from Park Street to San Leandro Bay. The total Inner Harbor channel length is 8-1/2 miles from San Francisco Bay to San Leandro Bay.

- Outer Harbor Turning Basin: The Outer Harbor turning basin is located at the main bend in the Outer Harbor channel, with its mouth located approximately 8,700 feet east of the eastern end of the Entrance channel. It is currently maintained at 42 feet deep and 1,480 feet wide.

- Inner Harbor Turning Basin: The Inner Harbor turning basin is located approximately 18,800 feet east of the entrance to the Inner Harbor. The Inner Harbor turning basin is 42 feet deep, and 1,200 feet wide.

- Middle Harbor: The Middle Harbor is located near the entrance to the Inner Harbor channel. It served the FISCO piers and wharves when FISCO was operational. The Middle Harbor area would be converted to an aquatic habitat area as part of the proposed project. This area is referred to as the Middle Harbor Enhancement Area (MHEA).

Existing Navigation Project features include parallel rubble-mound jetties at the entrance to the Inner Harbor. These jetties were constructed during the late 1800s as training walls to confine the flow of the San Antonio Estuary to scour a channel. The north jetty is 9,500 feet long, and the southern jetty is 12,000 feet long. The jetties serve no navigational function, but have been determined to be eligible for inclusion in the National Register of Historic Places.

Four bridges cross the tidal canal. No bridges cross the channel within the proposed project limits. The authorized project for deepening the Outer Harbor and Entrance channel to -42 feet was completed in May 1997. The Inner Harbor channel deepening has also largely been completed, and will be finished in June 1998. The San Francisco Bar channel, which provides access to the Oakland Harbor is maintained at -55 feet MLLW.

2.1.3 Population Centers

California. The state of California is the third largest state in the Union in terms of land mass and the largest in terms of population. The state's location on the west coast of the United States makes it a part of the Pacific Rim and therefore a critical link in the Pacific Rim trade with the growing markets of Asia, the Philippines, and other countries on the Rim.

San Francisco Bay Area. The San Francisco Bay Area includes Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma counties with 6.5 million people distributed over 7,000 square miles of land. The San Francisco Bay has a surface area of 435 square miles, surrounded by 276 miles of shoreline. San Francisco Bay has some natural deep water channels, but 40 percent of the Bay is less than 6 feet deep at low tide. Harbor development in the Bay began more than 140 years ago in support of trade and transportation needs of pioneer gold miners and merchants. Development and maintenance of shipping channels in the 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.

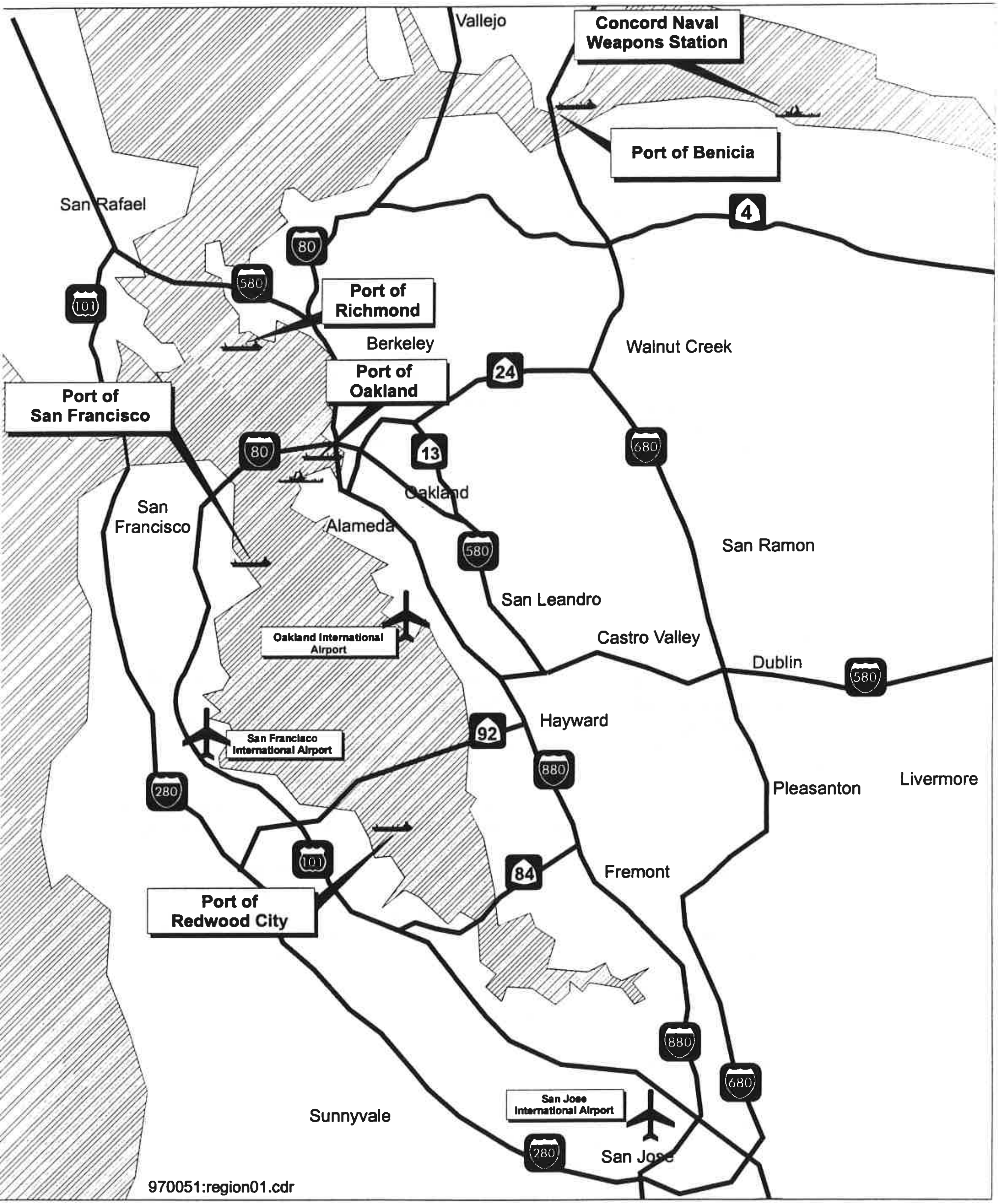
Alameda County. Alameda County is one of nine counties touching the San Francisco Bay. It is one of the largest counties of California, both in terms of population and in terms of land area. The County population is about 1.38 million. [1] The principal cities are Oakland, Alameda, San Leandro, and Hayward.

2.1.4 Transportation

The San Francisco Bay Area is served not only by water-borne transportation, but also by highways, rail, and air transportation. Figure 2.5 shows the major freeways, ports and airports in the San Francisco Bay Area. Two major rail lines, the Burlington Northern/Santa Fe and Union Pacific serve the Bay Area. Interstate Highway 80 and its many spurs (280, 380, 580, 680, 780, 880, and 980) comprise the major highway system serving the San Francisco Bay Area. Interstate Highway 80 connects San Francisco (its western terminus) with New Jersey (its eastern terminus). The Oakland/Alameda County area is served by portions of Interstate Highways 80, 580, 880, and 980. Portions of Interstate Highway 880 adjacent to the Port were destroyed in the 1989 Loma Prieta earthquake. area. A portion of Highway 880, from East 23rd Street to the Bay Bridge, was rebuilt and reopened in July of 1997. Highway 880 will open in its entirety by Fall of 1998, improving traffic flow in and out of the Port

Interstate Highway 5 runs north-south along the western U.S. coast from the Canadian to the Mexican border. The Oakland/Alameda County area is connected to Interstate Highway 5 south via Interstate Highways 580 and 205, and Interstate Highway 5 north via Interstate Highway 80.

[1] Source: State of California, Department of Finance, Demographic Research Unit, updated September 17, 1997.



Dowling Associates, Inc.

Figure 2.5
Major Freeways, Ports & Airports

Railroad service connects the Oakland/Alameda County area with the rest of the nation. Several major east-west rail lines terminate in Oakland. Direct service is available to all major cities east of California. In addition, the area is served by several major north and south rail routes, providing direct links to Los Angeles, Portland, and Seattle, as well as numerous smaller communities.

The Bay Area is served by three major airports that provide commercial airline passenger and freight service. The airport closest to the project area is the Metropolitan Oakland International Airport (MOIA), located at the southern edge of the City of Oakland. MOIA is part of the Port of Oakland, and currently handles the highest volume of air cargo of the three Bay Area airports. The other two airports are San Francisco International Airport and San Jose International Airport.

Water-borne transportation includes the Port of Oakland, as well as the various smaller/specialty ports (such as the ports of San Francisco and Richmond), and several fuel terminals associated with petroleum refineries in the Bay Area. Passenger traffic is accommodated via an extensive network of ferries. In the future, ferry service may also be used to transport local cargo. Water-borne transportation within the Port of Oakland is discussed in detail in section 3 of this Feasibility Report.

2.2 ENVIRONMENTAL CONDITIONS

The following is an overview of the environmental conditions of Oakland Inner and Outer Harbors and the San Francisco Bay. The EIS/R accompanying this Feasibility Report provides a detailed discussion of the information summarized below.

2.2.1 Physical Conditions

Climate. The climate of the project area is classified as Mediterranean, characterized by cool, dry summers and mild, wet winters. The major influence on the regional climate is the Eastern Pacific High, a strong persistent anticyclone. Seasonal variations in the position and strength of this system are a key factor in producing weather changes in the area.

The Eastern Pacific High attains its greatest strength and most northerly position during the summer, when it is centered west of Northern California. In this location, the High effectively shelters California from the effects of polar storm systems from the North Pacific. Due to the large-scale atmospheric subsidence associated with the High, an elevated temperature inversion often occurs along the West Coast. The base of this inversion is usually located from 1,000 to 3,000 feet above mean sea level, depending on the intensity of subsidence and the prevailing weather condition. Vertical mixing is often limited to the base of the inversion, trapping air pollutants in the lower atmosphere. Marine air trapped below the base of the inversion is often condensed in fog and stratus clouds by the cool Pacific Ocean. This condition is typical of the warmer months of the year from roughly May through October. Typically, the stratus forms offshore and moves into coastal areas during the evening hours. As the land heats up the following morning, the clouds will burn off to the immediate coastline, then move back onshore the following evening.

As the winter approaches, the High begins to weaken and shift to the south, allowing polar storms to pass through the region, These storms produce periods of cloudiness, strong shifting winds, and precipitation. The number of days with precipitation can vary greatly from year to year, resulting in a wide range of annual precipitation totals.

Storm conditions are usually followed by periods of clear skies, cool temperatures, and gusty northwest winds as the storm systems move eastward. Precipitation is generally lowest along the coastline and increases inland toward higher, mountainous terrain. Annual precipitation totals for the Metropolitan Oakland International Airport ranged from 8.64 to 29.37 inches during a 38-year period of record (1948 through 1986), with an annual average of 18.05 inches (NOAA 1986). About 90 percent of rainfall occurs during the months of November through April.

The average high and low temperatures at the Metropolitan Oakland International Airport in July are 70.9°F and 56.9°F, respectively. January average high and low temperature are 55.2°F and 42.0°F. Extreme high and low temperatures recorded from 1948 through 1986 were 107.0°F and 7.0°F, respectively (NOAA 1986). Temperatures within the Bay are generally less extreme, due to the moderating effect of the Pacific Ocean.

The proximity of the Eastern Pacific High and a thermal low pressure system in the Central Valley region to the east produces a general west to northwest air flow along the Central and Northern California coast for most of the year. The persistence of these breezes is a major factor in minimizing air quality impacts on the people that live in the region. As this flow is channeled through the Golden Gate Bridge, once inside the Bay, it branches off to the northeast and southeast. As a result, winds often blow from the southwest in the Berkeley area and from the northwest in the South Bay. Easterly winds that blow toward the offshore water also occur, but are mainly nocturnal and wintertime land breezes. These land breezes may extend many miles offshore during the colder months of the year until daytime heating reverse the flow onshore.

Geology. The proposed project and reuse/disposal sites are located within the general region of the San Francisco Bay, an irregular group of connected water bodies (including Suisun and San Pablo bays) totaling approximately 400 square miles. The San Francisco Bay and the Bay Area are located within the Coast Ranges Geomorphic Province of California, which is characterized by a system of northwest-southeast trending longitudinal mountain ranges and valleys that are controlled by faulting and folding. The Bay itself started to form in the Late Pleistocene due to subsidence associated with localized oblique displacements on the San Andreas and Hayward Faults. Flooding of the area occurred several times with Pleistocene sea level fluctuations.

Oakland Harbor was constructed in a natural drainage channel, San Antonio Creek, that is located within the broad low-lying plain that borders the eastern shore of San Francisco Bay. Elevations on the Bay plain in the vicinity of the Oakland Harbor vary from 0 to about 30 feet above mean sea level, and continue in a gradual rise to the base of the Berkeley-Oakland Hills further to the east. Materials beneath the Bay plain consist of relatively thick, unconsolidated sediments of marine and continental origin deposited during Pleistocene and Recent geologic time. Bedrock underlying the sediments is Franciscan age sandstone and shale, which forms the eastward dipping floor of a trough-like depression created by regional warping and faulting. The lower several hundred feet of these deposits in the part of the Bay that includes the Oakland Harbor have been designated the Alameda Formation. The Alameda Formation, which consists of clays and sands, was dissected and eroded prior to deposition of the Old Bay Mud (Yerba Buena Formation). After deposition, the Old Bay Mud was eroded, and the Merritt Sand of the San Antonio Formations was deposited. The Merritt Sand is a dune sand deposit. The Merritt Sand deposits were in turn eroded, and the deeper channels filled with soft, unconsolidated marine clays and silts (Young Bay Mud) as the sea level rose. In the project area, the older formations are 400 to 600 feet thick, while the thickness of the Young Bay Mud varies from a few feet along the northeast side of the Outer Harbor area to over 50 feet in the western reaches.

Hydrology. According to the San Francisco Bay Region Regional Water Quality Control Board Basin Plan, the Oakland Harbor is located within the East Bay Plain groundwater basin. The primary aquifers in the east Bay Plain are the San Antonio Formation (between the Young and the Old Bay Muds), and the Alameda Formation. The Merritt Sand member of the San Antonio Formation contains some groundwater, but is not considered a primary water supply aquifer because of its limited distribution and thickness. In addition, withdrawal of substantial quantities of water may lead to saltwater intrusion. The Merritt Sand has historically produced an aggregate yield of less than 330 gallons per minute, with a single highest well yield of 110 gallons per minute. The general groundwater flow direction is toward the harbor channels; however, groundwater gradients are very flat, especially at high tide.

Hydrogeological testing conducted in support of the proposed project (Appendix E) indicated that the groundwater quality in the Merritt Sand aquifer is poor within the project area, due to high salinity. The high salinity is the result of seawater intrusion. Seawater intrusion is not a recent occurrence, and its effects can be seen at a distance from the harbor channels.

Sedimentation. The proposed project is located within the San Francisco Bay/Delta estuarine system. The San Francisco Bay/Delta estuarine system drains over 40 percent of the land area in the state of California. Shoaling of navigation channels results from a combination of new sediments entering the system (primarily from the Sacramento/San Joaquin rivers) and resuspension of existing sediment resulting from fluvial, tidal, and wind-driven waves and currents. Annual amounts of new and resuspended sediments for the entire San Francisco Bay Area are estimated to be 8 million cubic yards (mcy) and 100 mcy, respectively. Average annual maintenance dredging volumes in the Oakland Harbor channels have been in the range of 370,000 cy between 1976 and 1991.[2] Based on the analysis of historical data, the maintenance dredging volumes would increase by approximately 112,000 cy combined for the Inner and Outer Harbor channels, if the proposed improvements are made. This represents an approximately 30 percent increase over the historical volume.

Wave Conditions. Waves follow predominant winds from the west-northwest. By themselves, wave conditions are generally not a problem in the entrance to the Oakland Harbor. However, wind and waves, combined with currents at the entrance to the Oakland Harbor, present a navigational challenge for pilots entering either the Inner Harbor or the Outer Harbor. The Entrance Reach and approach reaches to both the Inner Harbor and Outer Harbor were widened as part of the -42 foot project to address this condition.

Currents. The currents at the fork of the Outer and Inner Harbor channels run basically perpendicular to both channels. Ebb currents run in a northwest direction, with maximum velocities exceeding 2 knots. They tend to set ships toward the northern bank of the channel. Flood currents run in a southeasterly direction. Both ebb and flood currents are of concern when running strong. Generally, ships must enter the

[2] More recent maintenance dredging quantities are not available because new work construction has been on-going since 1992.

Entrance Channel on the up-current side to avoid being grounded on the down-current bank of the channel.

Wind. Winds in the Oakland Harbor are predominantly from the west-southwest through the west-northwest.

Seismicity. The San Francisco Bay Area is well known as a seismically-active region. Historically, numerous moderate to strong earthquakes are related to the San Andreas and Hayward fault systems. The Port of Oakland, however, does not lie within an Alquist-Priolo Earthquake Fault Zone, and active or potentially active faults are not known to cross the Port area.

The Bay Area fault system is composed of four major faults: the San Andreas fault, the Northern and Southern segments of the Hayward fault, and the Concord and Calaveras faults. Combined, the probability of an earthquake of magnitude 7 (M7) or greater occurring on one of these faults between 1990 and 2020 has been estimated at 67 percent. The Hayward fault lies approximately 4.5 to 7.0 miles east of the Oakland Harbor. The San Andreas fault, which traverses the San Francisco Peninsula, lies approximately 11.5 to 14.0 miles to the west. The Concord and Calaveras faults, which lie at the foot of the Diablo Range, are located approximately 20 miles to the east. Other, lesser faults are present throughout the region. Because of the low strength of the Bay Mud and comparably steep cut slopes in the existing harbor area it is assumed that local slope failures will occur during moderate to strong earthquakes.

In 1990, the Working Group on California Earthquake Probabilities divided the San Andreas fault into segments (U.S.G.S. Circular 1053, 1990). Those segments near and in the San Francisco Bay Area and their probabilities of producing an M7 or greater earthquake were listed as:

- San Francisco Peninsular Segment: 25 percent chance of an M7 earthquake or greater within the next 30 years.

- North Coast Segment: 2 percent chance of an M8 or greater earthquake within the next 30 years.

In 1988, the Working Group had assigned a 30 percent chance of an M7 or greater earthquake within the next 30 years to the Santa Cruz Mountain segment of the San Andreas fault. The southern portion of this segment produced a M7.1 earthquake in October 1989 (the Loma Prieta earthquake). The northern portion of this segment has been assigned an 18 percent chance of a M6.5 or greater earthquake within the next 30 years.

The Working Group has also assigned earthquake probabilities to the Northern East Bay segment and Southern East Bay Segment of the Hayward fault. The northern segment has been assigned a 23 percent probability of a M7 or greater earthquake over the next 30 years, while the southern segment has been assigned a 28 percent probability of the same magnitude earthquake during the next 30 years. If both segments rupture simultaneously, the event could be as great as a M7.5 earthquake.

The Loma Prieta earthquake imparted ground motions in the Oakland Harbor area that probably exceeded 0.15g peak acceleration. The peak acceleration in the fill at Treasure Island was measured at 0.16g, while an acceleration of 0.29g was recorded at a 14th Street wharf in the Oakland Outer Harbor. The foundation geology at the wharf is reported to be Bay Mud. Even so, no significant failures of the channel side slopes or unusual quantities of operations and maintenance (O&M) dredged material have been reported. The Port experienced liquefaction-related ground failures at several of its piers. The ground failure occurred as a result of liquefaction of the hydraulic fills of sand and silt that underlie the storage yard.

2.2.2 Biological Resources

The underlying sediment within the project area consists of Merritt Sands, which are fine grain and highly compacted. A variable layer of silty mud (Young Bay mud) covers the Merritt Sands in many areas. Much of the sedimentation occurred during the Gold Rush era during the 1840s and 1850s; however, some sedimentation occurs annually during heavy flows from the Delta . When the Harbor is dredged, the overlying fine sediments are removed and the Merritt Sands are re-exposed. As a result, the biological habitat in the area is highly variable due to the alteration of the substrate from silty mud to coarse sand to silty mud as more sedimentation occurs.

The vertical boundaries of the current dredge area are from the high tide line to -44 feet MLLW (-42 feet plus 2 feet overdepth) in the maintained channels. This vertical habitat, with two exceptions, primarily consists of riprap with silts and clays to fine gravel interspersed among the rocks. One exception in the Inner Harbor is the training wall, which consists of large rocks that fit tightly together with minimal crevices for sand or gravel to settle. The other exception, in the Outer Harbor, is the gravel beach located at the western end of the area. The hard substrate (riprap and training wall) provides habitat for sessile organisms such as barnacles and limpets. The crevices between the rock riprap provide habitat for a variety of small crabs and bay mussels. In most areas of both the Outer Harbor and the Inner Harbor, the riprap, which holds the fill that the facilities are built on, continues down to the deep water. Near the bottom, rock habitat becomes altered by the sedimentation covering the rocks. In both the Inner and Outer Harbor, a shallow subtidal zone (0 to 20 feet deep), consisting of muddy/sandy shoal, provides habitat to a large community of macroinvertebrates.

In summary, the affected aquatic environment is characterized by deep-dredged channels bordered by mud/sand shoals and a rocky shoreline. The overall habitat diversity is relatively low, but it has both marine and estuarine characteristics and a large depth range. The evaluation of biological resources is based on biological surveys and literature reviews which are documented in the EIS/R.

Plankton Community. Phytoplankton are an important part of the base of the food chain in most water bodies. The classes of phytoplankton present in the study area include diatoms (Bacillariophyceae), coccolithophores (Haptophyta), dinoflagellates (Pyrrophyta,) silicoflagellates (Chrysophyta), cryptomonads (Cryptophyceae), and green algae (Chlorophyceae) (SAIC 1994). Diatoms are often less abundant during certain times of the year when flagellated algae may predominate. These flagellated algae include cryptomonads *Chroomonas* and *Cryptomonas*, and the green algae *Pyramimonas*. Protozoan populations can also be significant and form part of a "microbial loop" that represents an alternative trophic input to the zooplankton.

Copepods can be the most abundant taxonomic group of zooplankton found in the Bay. At times, zooplankton components include a variety of fish larvae such as anchovy, herring, gobies, and silversides, as well as various stages of decapod larvae including *Crangon* and *Cancer* and an assortment of larval stages of other macroinvertebrates. Besides these meroplanktonic forms (i.e., species that are planktonic for only part of their life cycle), conspicuous zooplankton include temporary invasions or blooms of large gelatinous forms such as various medusae and cetenophores.

Benthic Community. Benthic infauna is an important food source for the aquatic community. Many of the bottom dwelling fish such as white croaker feed on polychaetes and other infaunal species. Many of the benthic organisms found in San Francisco Bay are introduced species, presumably brought in with ship ballast, such as the clam *Potamorcorbula amurensis* and the recently introduced sea slug *Philine auriformis* (which were quite abundant in the project area). Many introduced species are well adapted to the dynamic conditions in San Francisco Bay.

The benthic community in a given location is correlated with the grain size of the substrate in the area. The shallow subtidal and deep dredged areas are predominantly soft sediments and the rocky intertidal and pilings are hard substrate environments. The shallow subtidal soft substrate community in the Outer Harbor is dominated primarily by crustaceans. Rocky intertidal zones and pilings in the affected area are inhabited by sessile organisms with marine affinities such as the native Bay mussel, many species of algae, bryozoans, sponges, and tunicates. This habitat (particularly the rocky intertidal zone) is quite diverse with 50 to 70 species being observed in a single low tide event.

Fish and Decapod Crustaceans. Decapods inhabit an ecotone between the benthic and pelagic (open water) communities. Like the benthic community, the decapods are an important food source for fishes. Crangon shrimp are common food items for many fishes of the Bay and Delta, including striped bass, American shad, green and white sturgeon, and Pacific tomcod.

The summer 1997 species sampling event indicated that the Outer Harbor deep dredged channel had a slightly more diverse selection of crabs than the Inner Harbor. The decapods specific to the Outer Harbor included the blue-spotted shrimp and the hairy rock crab. The decapods abundant in both areas included black shrimp, broken-back shrimp, sand shrimp, Dungeness crab, graceful rock crab, Pacific rock crab, and red rock crab. Black shrimp, sand shrimp, Dungeness crab, and red rock crab were also abundant in the shallow subtidal region of the Outer Harbor.

A wide variety of fish inhabit the affected environment. The Oakland Harbor contains estuarine, marine, and anadromous fishes. Among them are various flatfish, surfperch, gobies, sculpin, silversides, pipefish, sharks, and rays. Common flatfish are English sole, speckled sanddab, starry flounder, and California halibut. Other common bottom fish include bay goby, Pacific staghorn sculpin, white croaker, Pacific tomcod, shiner perch, and plainfin midshipman.

The northern anchovy, a pelagic marine species, occurs year-round. Anchovies serve as an important food source for many fish and bird species such as salmon, halibut, pelicans, terns, and grebes. Pacific herring enter the estuary in the winter and early spring to spawn, particularly in rocky areas, along aquatic vegetative covered substrates, and on pilings. Pacific herring are also an important forage food.

Aquatic Birds. A total of 43 bird taxa were sighted during winter surveys, mostly over open water. By far, the greatest numbers were seen over the Outer Harbor shoal, where thousands of diving ducks (especially scaups and scoter) and hundreds of grebes of various species were counted. The grebes were also abundant in the deep dredged areas. A total species list for all birds sighted in the Inner Harbor and Outer Harbor is provided in the EIS/R.

During the summer 1997 surveys, 27 bird taxa were observed, but only a few hundred individuals were counted. Thus, the total summer bird population was less than 4 percent of the number of individuals seen during the winter surveys. Most of the species and over 30 percent of the total birds were seen in the Inner Harbor channel. Western gulls were the most abundant species overall. The highest counts by site were the western sandpiper (the Inner Harbor channel), double-crested cormorant (the Outer Harbor shoal), and western gull (the Outer Harbor channel).

Threatened and Endangered Species. Five bird species of concern are found in the vicinity of the proposed dredged area. The Double-crested cormorant (Phalacrocorax auritus), a California State Species of Special Concern, and the American peregrine falcon (Falco peregrinus anatum), a state and Federal endangered species, are expected to occasionally forage within the proposed dredge area and vicinity. For the California least tern (Sterna anthillarum browni), the California brown pelican (Pelecanus occidentalis californicus), and the Western snowy plover (Charadrius alexandrunus nivosus), the proposed dredge area is not a likely critical foraging habitat. The nesting area for the California Least Tern is protected in the USFWS controlled refuge on the western side of Former Alameda Naval Air Station. In recent surveys conducted for the Port during the 1997 breeding season, foraging attempts by California Least Terns in the entire dredging area represented less than 7 percent of the of the total foraging dives recorded (4 percent in the Inner Harbor, and 2.5 percent in the Outer Harbor). An additional 5 percent of foraging dives occurred in the Middle Harbor. The results of the survey are documented in the EIS/R.

Chinook salmon of any race are only rarely encountered in the proposed dredge area. Only two fall-run chinook salmon were captured during the habitat evaluation survey. The presence of the fall-run chinook is strongly indicative of the possibility that other runs such as the winter-run chinook salmon (a state and Federal government listed endangered species) might also use this area to a limited extent. The Harbor Seal is both Federally and State listed endangered, and may occasionally be found foraging in the vicinity.

The proposed dredge area also supports one sensitive habitat, eelgrass beds (Zostera marina). Eelgrass habitat typically provides a refuge area for larval and juvenile fishes and supports foraging activities for birds and other animals.

2.2.3 Socio-Economic Conditions

The San Francisco Bay Region is expected to add about 1.5 million new residents between 1990 and 2010. Emerging from the 1990 - 1993 recession, the economy should generate long-term economic activity that will create a demand for about 861,000 new jobs by 2010. New high technology industries will be an important new source of jobs during this period. However, traditional sectors of the economy will continue to grow and provide most of the jobs in the economy. Regionally, more jobs will be added to the service sector during the forecast period than any other job sector. The service sector is estimated to increase by over 465,000 jobs (ABAG, 1994). Countering this expected growth trend is the closure of numerous military facilities and the loss of associated jobs. Major military facilities in the San Francisco Bay that have closed or will close within the current Federal fiscal year include Naval Station Treasure Island, Naval Air Station Alameda, Oakland Army Base, Fleet and Industrial Supply Center Oakland (including its Alameda Annex and Point Molate Fuel Depot), Naval Medical Center Oakland, Public Works Center San Francisco, and DOD Housing Facility Novato.

Government maritime services operating in the Bay Area formerly constituted a significant component of the economy which relies on marine resources. The government provided maritime related services through the U.S. Navy, U.S. Coast Guard, U.S. Army Corps of Engineers, and U.S. Customs Bureau. Of these, the U.S. Navy was one of the most significant maritime employers in the San Francisco Bay/Delta region. Through payroll and operating funds, the service spent nearly $4.0 billion in the area during 1990. Of the eight major U.S. Navy facilities within the Bay Area, five naval sites are being converted to civilian uses. Thus, the government's need for maritime services has declined drastically in the past several years.

Taxable retail sales in the Bay Area are expected to reach $80.4 billion in constant 1995 dollars by 1998. This is equivalent to 8.4 percent real growth between 1990 and 1998. Real taxable sales increased in 1994 after three years of decline. Retail sales are concentrated in the most populous counties, with Santa Clara County accounting for 29 percent of retail sales and Alameda County accounting for almost 21 percent in 1994.

Housing production, especially of units affordable to moderate and lower income households, and high housing prices remain the most serious constraints to the economic health of the region. High housing prices have negatively affected disposable income which in turn has affected taxable sales. The reduction in real growth in taxable sales has affected local governments' tax bases and their ability to finance services and infrastructure.

San Francisco Bay and connected waterways comprise one of the largest natural harbors in the world. Maritime activities supported by San Francisco Bay and the adjoining Sacramento-San Joaquin Delta include deep draft cargo shipping, military facility operations, commercial fishing, ship repair, recreational fishing, water-based transportation (ferries), recreational boating, and tourism.

The ports of the San Francisco Bay and its adjoining delta are a major center for foreign trade. The Ports of Oakland, San Francisco, Redwood City, and Richmond are situated on San Francisco Bay; the Sacramento and Stockton ports are located in the Sacramento-San Joaquin River Delta. These maritime trade facilities include approximately 150 piers, wharves, and docks. The region's ports handled foreign trade valued at about $34 billion in 1992 (USACE 1994). The Port of Oakland is the primary container port for the area.

The continental shelf and slope off San Francisco support a range of commercial fisheries. The principal market species in this region include Dungeness crab, market squid, salmon, tuna, flatfishes, a variety of rockfishes, thornyheads, and sablefish. Within the entire San Francisco region (from Point Arena to Point San Pedro, offshore to a distance of 200 nmi) some of the most productive commercial fisheries areas are in the Gulf of the Farallones. The estimated value of all major commercial fisheries within the San Francisco region in 1986 totaled over $23.6 million (US EPA 1993). The San Francisco Bay area commercial fishing fleet consists of approximately 1,100 vessels. The San Francisco Port vicinity is the base for the majority of the commercial and charter fishing industries in the Bay Area; Oakland and Sausalito provide the majority of berths for the remaining fleet.

In addition to these maritime activities in the Bay Area, a variety of other commercial and recreational uses are dependent on the maintenance of accessibility throughout the

Bay and its associated waterways. Recreational boating is available from approximately 65 marinas in the Bay Area. These private marine facilities provide about 19,800 slips throughout the region and generated approximately $168.4 million (1990 dollars) in revenues for the Bay Area (Ogden Beeman & Associates 1990).

Finally, ferry services and/or tourist ships are available from the cities of Alameda, Larkspur, San Francisco, Sausalito, Sonoma, Tiburon, and Vallejo. Cruise ship calls also produce revenues through passenger spending. These two industries provided the region with approximately $60.9 million in revenues in 1990 (Ogden Beeman & Associates 1990).

3.0 PROBLEMS AND NEEDS

3.1 GENERAL

The condition of deep-draft vessel navigation in the Oakland Harbor and Harbor Entrance channel is the focus of this section, which describes the public concerns and problems and opportunities developed during the study. This section also identifies the Planning Constraints and the Planning Objectives used in plan formulation. This information is required to move into the next major step of the planning process, which is the formulation of specific solutions and plans (Plan Formulation, Chapter 4).

The Federal interest is to alleviate problems by taking advantage of opportunities in ways that contribute to National Economic Development (NED). Contributions to NED are defined as increases in the value of the national output of goods and services. The NED objective must be accomplished without unreasonable environmental effects.

3.2 PUBLIC CONCERNS

Public concerns may be expressed directly, such as at a public meeting, or indirectly through Government representatives and agencies, and statutory requirements. Local concern for deep draft navigation at the Port of Oakland is evidenced by the initiation of the Feasibility Study by the Port. A scoping meeting was held at the start of the feasibility phase to identify specific public concerns; the community also had the opportunity to comment on the Draft FS document at the public hearing and during the 30-day public comment period.

The following public concerns have been expressed during this study:

1) The existing navigation channels are inadequate to provide safe and efficient passage for existing deep draft vessels. The existing channel depth cannot accommodate the latest generation vessels if they are fully loaded. In addition, given present channel depths, widths, and alignments, vessel maneuvering problems are experienced in the channels. These problems are expected to worsen if deeper draft, longer length vessels are brought into Oakland Harbor.

2) Efficient deep draft navigation in San Francisco Bay is a major component of the economic engine of Oakland, Alameda County, and the remainder of the San Francisco Bay Area. The Port of Oakland has lost cargo traffic to other ports because the current channel depths are inadequate to accommodate the new generation of container vessels. Inadequate navigation infrastructure will impede future economic growth and activity in the San Francisco Bay Area.

3) San Francisco Bay and its natural resources are ecologically and economically sensitive. Navigation activities have the potential to impact the natural character and features of the San Francisco Bay. Dredging and deposition of dredged material to enhance natural habitats is beneficial and desirable.

4) The project will enable the Port of Oakland to increase its throughput of container cargo, resulting in increased traffic through the Port. The impacts of the increased traffic, and resulting impacts on air quality and noise levels may fall

disproportionately on the West Oakland community. The West Oakland community is a socially and economically disadvantaged community; thus the construction of the proposed project may raise environmental justice concerns.

5) Limited taking of property is required to enlarge the Inner Harbor turning basin. The affected property owners would prefer an alternate alignment that does not require taking their property.

6) Some of the dredged material is proposed to be reused for construction fill at the former Fleet and Industrial Supply Center Oakland (FISCO). The Navy is currently completing a remedial investigation/feasibility study (RI/FS) program at FISCO, and is concerned about the impact that placement of any material would have on the RI/FS program.

7) Proposed Port maritime development and dredging of the channels will create an opportunity to improve public access to the San Francisco Bay shoreline. Improved and additional public access to the shoreline is desired by the local community.

3.3 PROBLEMS AND OPPORTUNITIES

Public concerns addressed within the scope of this investigation are directly related to problems that can be solved through water and related land resources 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 perspective. This study has identified problems and opportunities related to commercial shipping, navigational safety, wetland enhancement, estuarine habitat improvement, and public shoreline access improvement. Feasibility level investigations of the Oakland Harbor navigation problems confirmed that the problem was limited to deep draft vessel issues only. While many shallow draft vessels, including barges, tugs, fishing boats, Coast Guard rescue craft, recreational, and commercial fishing vessels share the use of the Oakland Harbor Federal channels with the deep draft vessels, shallow draft operators have not expressed concern about channel depth.

3.3.1 Problem No. 1: Navigational Inefficiencies

Since the introduction of containerized cargo in the 1950s, six generations of container ships have evolved. Channel depths at the Oakland Harbor became marginal when second and third generation container ships with drafts from 33 to 41 feet were brought into use. Fourth generation container ships with drafts of up to 42 feet necessitated the most recent improvements to the Oakland Harbor, deepening the channels to -42 feet MLLW, which are currently being completed. However, the current channel depth is marginal and constrains access for the fifth generation container ships which have a draft of 42 to 46 feet. Sixth generation vessels are starting to come on line as well; sixth generation vessels have drafts of 46 feet or greater (up to 47.5 feet at the present time). The evolution of larger container ships is illustrated on Figure 3.1.

The deep draft fifth and sixth generation container ships experience significant tidal delays, with the result being that many of the shipping lines either bring these ships into Oakland only partially loaded or refuse to bring those ships into Oakland and are considering bypassing Oakland altogether. The deep draft vessels may encounter tidal delays of several hours entering Oakland Harbor. More importantly, as a result of

Evolution of Container Ships

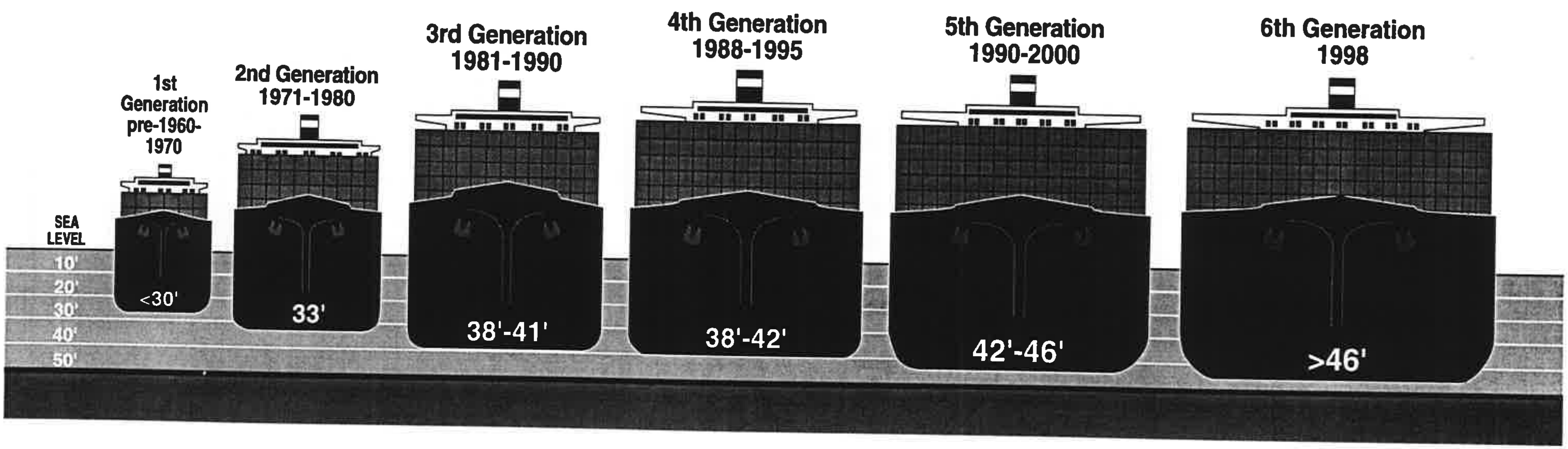


Figure 3.1

delays in unloading, vessels may have to delay their departures a full tidal cycle (tidal cycles vary from approximately 10.5 to 14 hours), which is difficult to make up at sea.

Vessel lengths and beams have also increased, from 450 feet and 90 feet for the first generation container ships to greater than 1,100 feet and 150 feet for the largest of the sixth generation vessels. Insufficient depth causes expensive delays, and the current size of the turning basins limit the length of vessels operating in the Oakland Harbor. Over 70 percent of the shippers currently using the Oakland Harbor are alliance members, which means that they either have or will have access to sixth generation vessels within the next year. The Port of Oakland has seen greater than a 100 percent increase in the use of large vessels from 1996 to 1997.

The existing channels depths do not allow for the efficient movement of deep-draft vessel commerce. These deep-draft vessels that currently call at Oakland have vessel load capacities that are constrained by the existing channel depths. The various shippers/shipping companies at Oakland Harbor have indicated their concerns with the existing channel depths and how they would change their vessel operations in response to improved channel depths. The existing Oakland Harbor deep-draft vessel transportation inefficiencies are due to vessel light-loading practices, economies of scale, vessel rerouting, and transportation mode (e.g., truck vs. ship). For example, the large, fifth and sixth-generation vessels cannot enter or depart from the Oakland Harbor fully loaded. The depth of the channel limits the operating draft of the vessel which, in turn, limits the vessel load. With a deeper channel, vessels can load to design capacity. A larger load distributes the fixed operating costs over a larger volume to reduce the cost per ton of cargo. A deeper channel also reduces the need for vessels to top-off at other harbors, allowing the vessel to load fully before sailing to an overseas destination.

In summary, there are two basic problems associated with commercial shipping in Oakland. They are: (1) inefficiencies in commodity transport related to economies of scale, and (2) tidal delays for container ship passages. These problems result directly from the existing depth of the navigation channel and the size of the turning basins.

3.3.2 Problem No. 2: Navigational Safety

Deepening of the Oakland Inner and Outer Harbor channels to -42 feet by the Corps will be completed in June 1998. That deepening project followed lengthy evaluation, analysis, and subsequent delays due to conflict over proposed disposal of dredged material from that project. The -42 foot project has helped improve navigation safety by widening the approach from the Entrance Channel into the Inner and Outer Harbor channels. Nonetheless, some safety concerns remain and are exacerbated by the fifth and sixth generation of container vessels.

Consistent with the results of the Port's Inner Harbor Hydrodynamic Study, which included model simulation of the hydrodynamic forces between passing vessels and berthed vessels, several San Francisco Bar Pilots expressed concern over the existing Inner Harbor channel width at the westernmost approach as the channel transitions from the Entrance Reach to the Inner Harbor. Strong cross currents and exposure to wind at this location require higher operating speeds, which make entering the channel a difficult navigational maneuver as it currently goes from open water to a narrow channel mouth. The Port's Inner Harbor Berth Development project will widen the channel. However, in addition deeper water (-50 feet MLLW) is required to reduce potential lateral forces to acceptable (tolerable) levels. Based on the Hydrodynamic Study conducted for this project, a channel depth of -50 feet MLLW represents the minimum required depth at a channel width of 750 feet at the Inner Harbor Channel entrance. Finally, the turning basin will have to be enlarged to accommodate the new generation, larger vessels. Currently, the turning basin requires use of navigational aids to allow safe turning of large vessels.

Based on the results of the studies performed as a part of the -42 foot project as well as applying the results of the Inner Harbor Hydrodynamic Study, it was assumed that the existing channel widths (with the exception of the turning basin) were adequate for the current one-way traffic that currently operates in the Outer Harbor. Any channel widening in the Outer Harbor channel was only considered for the possibility of operating two-way vessel traffic in the Outer Harbor channel. To safely accommodate sixth generation vessels, limited widening is required for the Outer Harbor turning basin.

In addition, the trend in vessel design has been and continues to be toward larger vessels. The larger vessels may be less maneuverable in confined navigation channels due to increases in all key dimensions, including length, draft, and beam. Some of these increases in dimensions are off-set by improved design of rudders and features such as bow and stern thrusters. Maneuverability problems can result from a significant increase in windage and the impact from the vessel hull's mass on the tidal current within the Oakland Inner Harbor, especially when turning or bringing the vessels into berth. San Francisco Bay Bar Pilots find themselves balancing environmental effects (wind and current) with control mechanisms (vessel's main engine, bow thrusters, and escort tugs) to safely transit and maneuver increasingly larger vessels with correspondingly greater mass and momentum.

3.3.3 Opportunity No. 1: Growth of Containerized Cargo

Trade along the Pacific Rim is growing at a rapid pace; capturing a greater portion of this trade will benefit the Nation. The Port of Oakland is in a unique position to provide increased capacity for Pacific Rim trade, without subjecting shippers to the congestion currently experienced in the Southern California ports. The Port has planned a significant capacity expansion project (the Vision 2000 project) to allow for increased growth in container movement through the Port. However, the full benefits of the proposed expansion project can only be realized if the new fifth and sixth generation vessels can be accommodated at Oakland Harbor.

3.3.4 Opportunity No. 2: Wetland Enhancement

Several sections of the Water Resources Development Act provide the opportunity for wetland enhancement using dredged materials. This was a successful goal of the Sonoma-Baylands wetlands restoration project which was accomplished with the beneficial reuse of dredged material from the -42 foot project. Beneficial reuse of dredged materials, including wetland and estuarine habitat restoration, was a goal in developing the various disposal options for the proposed navigation improvement project. The disposal options for the proposed project therefore include the proposed Hamilton Wetlands Restoration, Montezuma Wetlands Restoration, and Middle Harbor Enhancement Area.

3.3.5 Opportunity No. 3: Creation of Shallow Water Habitat

Partially as a result of historical dredging activities along the Bay margin, shallow water habitat, including valuable eelgrass habitat, has been adversely impacted. The departure of the Navy from FISCO coupled with the relatively small size of the Middle Harbor area creates an opportunity for restoring the Middle Harbor area to its pre-dredging condition. The proposed Middle Harbor Enhancement Area uses dredged material from the proposed channel deepening project to create highly desirable subtidal shallow water habitat, tidal flats, eelgrass beds, and rocky islands, which will enhance the habitat value in that area.

3.4 PLANNING OBJECTIVES

Based on the analysis of the identified problems, needs, and opportunities, and the existing physical, human, and environmental conditions of the study area, planning objectives were identified to direct the formulation and evaluation of alternative plans. The order of the planning objectives listed below does not indicate their level of urgency or their priority.

Safety: Improve deep draft navigation safety in the Oakland Harbor and in the Entrance channel.

Efficiency: Maximize the efficient use of Oakland Harbor and San Francisco Bay by commercial deep draft vessels. This objective is fundamental to improving the efficiencies of existing and future operations with respect to transportation costs; loading, and unloading; and other costs associated with the movement of waterborne commerce. This objective is consistent with Federal planning guidelines and the primary goal of contributing to the Nation's economic development consistent with applicable environmental laws, regulations, and policy. Specific objectives include reducing tidal delays and increasing economies of scale.

Environmental: Maintain and improve environmental resources to the maximum extent practical. This objective concerns compliance with Federal, state and local environmental statutes, regulations, laws, and policies, and is characterized by the following environmental goals:

- Avoid any unacceptable adverse impact on environmental resources.
- Where impacts are not avoidable, provide justifiable mitigation.
- All significant unavoidable impacts must be minimized.
- Improve or restore environmental quality wherever possible without adding undue cost or compromising the primary planning objectives.
- Maximize the beneficial reuse of dredged materials to enhance or create wetland or estuarine areas.
- Maximize the beneficial reuse of dredged material to create shallow water habitat.

3.5 PLANNING CONSTRAINTS

Planning constraints are defined as overriding concerns that must be considered in the formulation of a plan. Planning constraints are of such importance that they may not be bartered or exchanged in the planning process. Two potential planning constraints were identified for this study:

(1) The continued existence of the California Least Tern, an endangered species that occasionally feeds in the project area and nests in the project vicinity, cannot be jeopardized by the implementation of the project.

(2) The limiting depth for the harbor channels is set by the San Francisco Bar channel, which currently has a depth of -55 feet MLLW. Tidal conditions and channel depth restrict operating vessels to a draft of -50 feet MLLW.

4.0 PLAN FORMULATION

4.1 OVERVIEW

The purpose of this section is to develop a Final Array of Plans from which the recommended plan can be selected. Each plan is comprised of a different combination of components. The "plan components" which must be considered include the following:

1. Entrance channel
2. Outer Harbor channel and turning basin
3. Inner Harbor channel and turning basin
4. Dredged material disposal sites
5. Channel depth

The evaluation of each of these categories of components, with the end result being a combination of components, comprise the Final Array of Plans. The Final Array is then evaluated in terms of the Planning Objectives and required Evaluation Criteria, as specified by the Corps planning guidance, to select a recommended plan.

4.2 "WITHOUT PROJECT" PLAN

The Corps planning guidance requires analysis of a "without" project plan as one of the alternatives. Also, to comply with the requirements of the National Environmental Policy Act (NEPA), a "no action" plan must be included in the alternative array. The "without project" plan is synonymous with the No Action Plan. The "without project" plan also forms the basis against which all other alternative plans are measured.

The No Action Plan would retain the existing 42-foot deep navigation channel, with its periodic maintenance dredging program. As larger ships attempt to come into Oakland, the increasing navigation hazard of the relatively shallow water would increase tidal delays for commercial shipping, and would prevent some vessels from using the harbor entirely. The existing depths would therefore limit the size of vessels which could or would utilize the Oakland Harbor. With the global alliances of international shipping carriers and their use of larger container vessels, many of those carriers would be forced into using smaller vessels than they have access to (thus increasing costs by increasing the number of trips required), or to bear the costs of expensive tidal delays or light-loading of cargo.

The "without project" condition includes the Port's new marine terminal development along the Inner Harbor. The development consists of the construction of a tugboat wharf and four new container wharves, and approximately 250 acres of associated container yard space. As part of the new marine terminal development project (the Berths 55 to 58 project), the Port will excavate the northern bank of the Inner Harbor, thereby creating an area of new water between the new berths and the existing -42 foot channel line. This new, wedge-shaped area of water effectively widens the existing channel, and will be deepened to -42 feet MLLW (commensurate with the existing channel depth) as part of the Berth 55 to 58 project .

4.3 CHANNEL COMPONENTS AND TURNING BASIN LOCATION

4.3.1 Entrance Channel

The Entrance channel is an integral part of both the Inner and Outer Harbor channels because it is required to provide access to the Harbor channels. The configuration of the Entrance channel is not complex, and only one design was considered. The proposed Entrance channel design includes slight widening of the channel at its entrance to provide more direct access to natural deep water, and to allow vessels to enter the Entrance channel further to the north. This will improve navigation safety by allowing vessels to enter the Outer Harbor channel more directly, thereby avoiding collisions with the wharves.

4.3.2 Outer Harbor Channel

Two configurations of the Outer Harbor channel were considered. They differ in the amount of widening performed. Under the first configuration, the channel would be widened to 1,000 feet along its entire length, providing an added margin of safety between moving and berthed vessels. Under the second configuration, only minimal widening of the channel would be performed, for construction of a larger turning basin. The two configurations are shown in Figures 4.1 and 4.2. Both configurations were retained for consideration in developing alternatives. The advantage of the wider channel is improved safety in that the vessels can transit through the channel further away from berthed vessels. The primary advantage of the narrower channel configuration is that less dredged material is generated, resulting in lower costs and somewhat lesser environmental impacts.

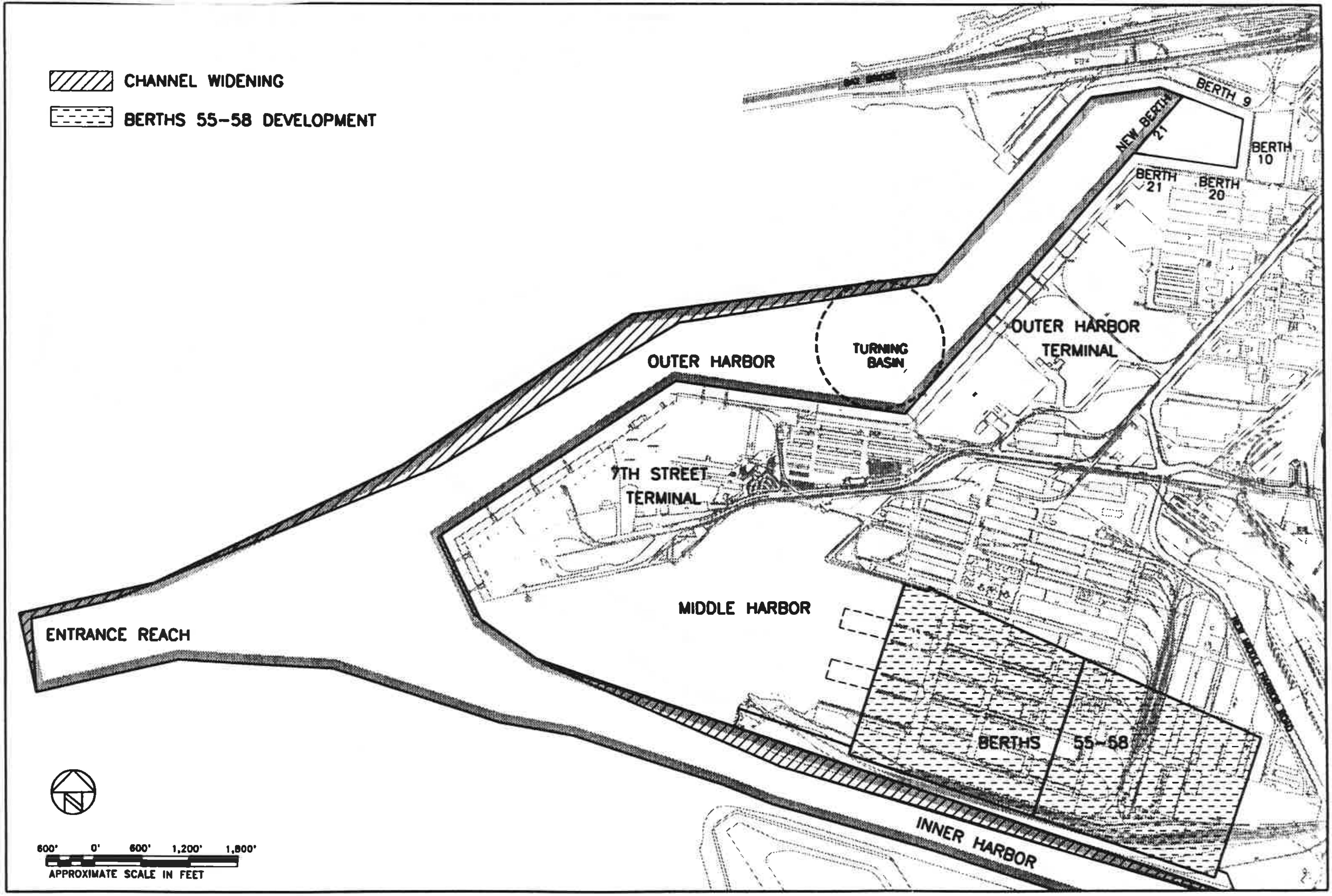
4.3.3 Inner Harbor Channel

Only one configuration of the Inner Harbor channel was considered. The Inner Harbor channel must be widened to 750 feet at the western edge of the proposed new berths to safely accommodate the larger sixth generation vessels while also allowing moored vessels to be present at existing berths (APL and Howard terminals) and in the area of the new berths (Figure 4.3).

4.3.4 Navigation Considerations

A full ship simulation study has not yet been conducted for the proposed project. The design by the Port of Oakland for the channels and turning basins used in this current feasibility study is based upon long operating experience with the existing project, and the insights provided by the computer-aided ship simulation performed for the currently authorized -42 foot project. The schedule constraints of the current feasibility study did not permit the completion of a ship simulation study specific to the design vessel anticipated for the recommended project. Therefore, it was not possible to confirm all aspects of the design prior to the completion of the feasibility study. This design is considered adequate, based on the evaluation and confirmation of the highly experienced San Francisco Bar Pilots. The design presented in this document will be confirmed and, if necessary, further refined during the post-authorization design phase by a ship simulation study specifically addressing the issues related to additional depth and the revised ship characteristics.

The Port developed the channel configurations and turning basin designs based on two existing studies: the Hydrodynamic Evaluation for Oakland Inner Harbor channel and



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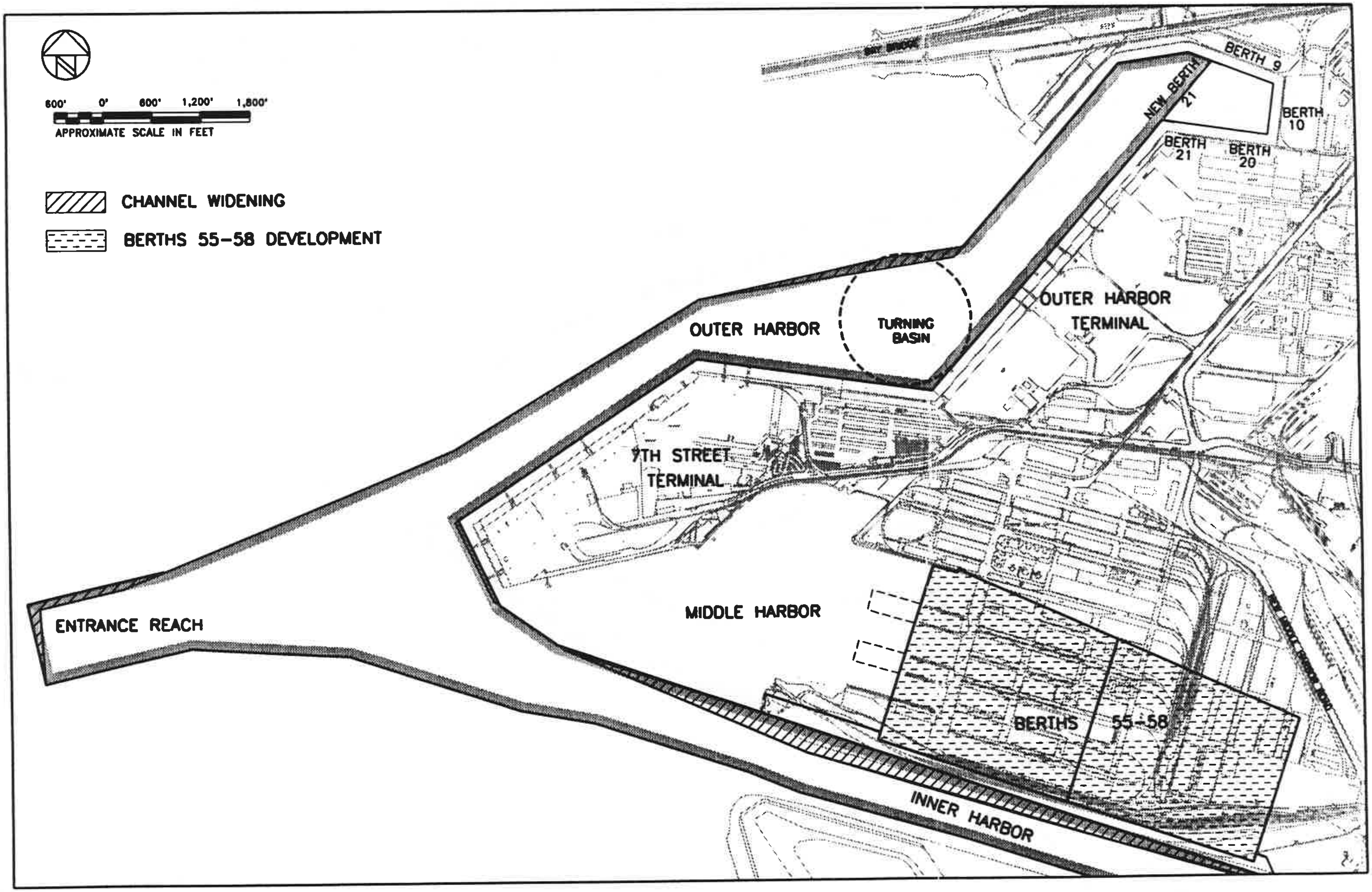

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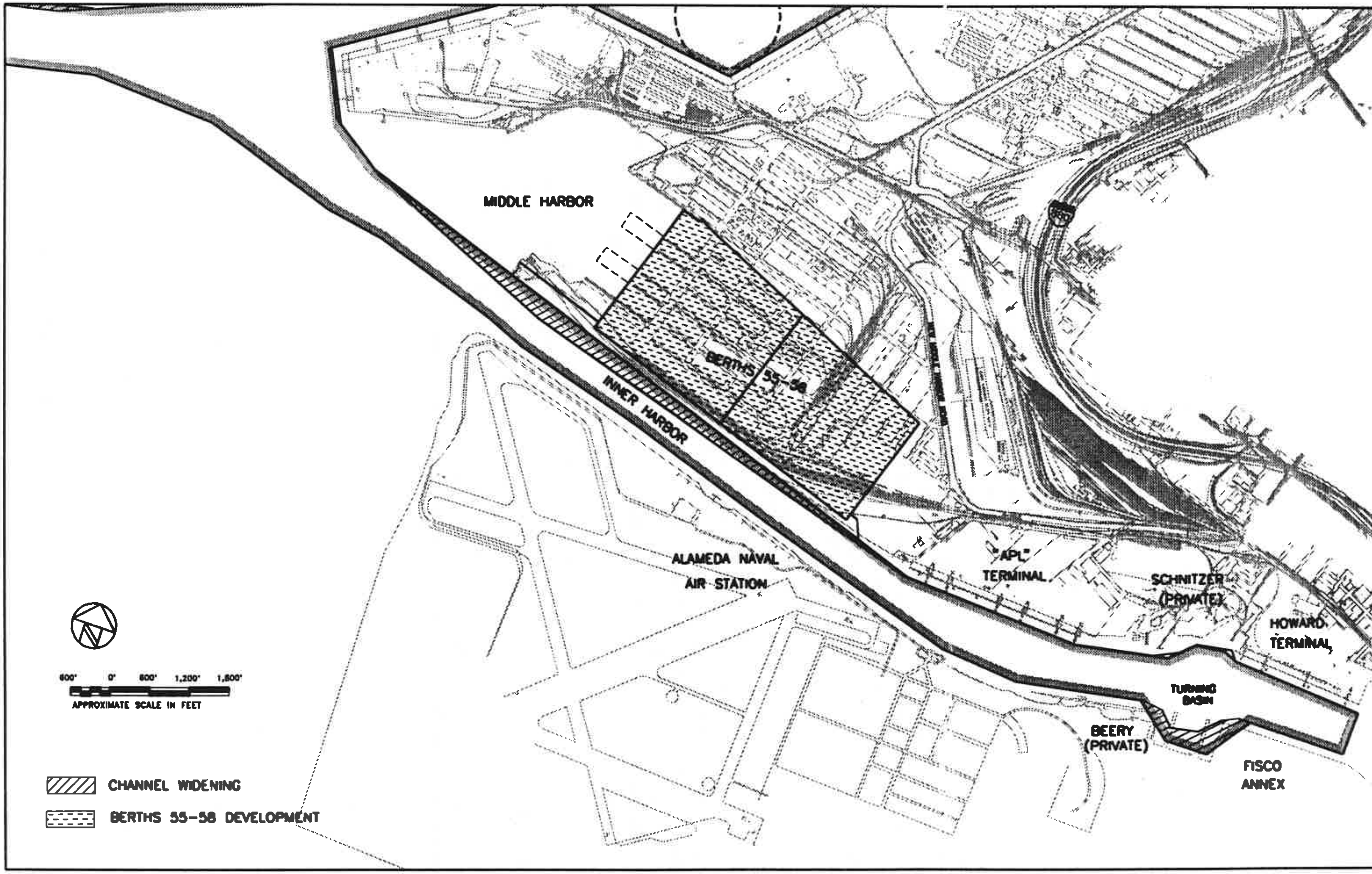

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the ship simulation conducted for the turning basin for the -42 foot channel deepening project, as well as available information (including input from the San Francisco Bar Pilots) regarding squat[1] requirements (see appendices A.4 through A.6). The results of the ship simulation for the -42 foot project turning basin are discussed in section 4.3.6, which discusses the Inner Harbor turning basin component.

The Hydrodynamic Study used computer modeling to estimate and graph the relationships among exerted forces (prop wash, vessel wake, and pressure fields), various channel dimensions, and vessel speeds. Pressure fields were the only form of exerted forces determined to have a significant effect.

A range of channel dimensions and vessel speeds were evaluated in the pressure fields model. Channel depths evaluated ranged from -48.4 feet. to -56 feet MLLW. Channel widths used in the assessment ranged from 600 feet to 1,000 feet. Vessel speeds modeled ranged from 4 to 10 knots. To determine the required channel width and depth, the study assumed that presently reported container vessel speeds in the Oakland Inner Harbor would continue to apply. Currently, vessels enter Oakland Entrance channel at approximately 10 knots and the Inner Harbor channel at 8 knots. They then quickly decelerate and are traveling at speeds of 5 to 6 knots when passing the APL terminal. They are thus traveling at approximately 7.5 knots when passing the westernmost berth planned as part of the Vision 2000 Program.

High speeds are required when entering the Inner Harbor channel to maintain maneuverability and safety when traveling through the currents at the entrance of the Inner Harbor. The Entrance channel leading to the Inner Harbor entrance has a beam set current that creates maneuvering challenges, especially during a maximum flood and ebb currents. For example, a large container ship entering the harbor must maintain a speed of about 10 knots and "crab" counter-clockwise into the flood current. This ship speed is required to allow sufficient capability for abruptly turning the vessel clockwise into the Inner Harbor channel, and to maintain steerage until the ship passes out of the beam set currents and into the constrained Inner Harbor channel.

The study determined that the most substantial reduction in force results from slowing the vessel speed. However, there is no viable means for slowing the vessels while maintaining control at the entrance to the Inner Harbor channel. Tractor tugs alone cannot be used to control the vessels because most of their tug power is consumed just keeping up with a ship at speeds above 7 knots. Dead-slow speed for these large container ships is about 6 knots. Thus tractor tugs cannot be used to maintain control of the large vessels at the high speeds required to enter the channel.

Other conclusions of the Hydrodynamic Study include the following:

- Altered channel width has a more pronounced effect on forces when the vessel speed is fast (e.g., approximately 10 knots).

- Deepening the channel effectively reduces the forces on berthed vessels if the passing vessel is moving quickly.

- Force reductions created by deeper channels are diminished as the channel is widened.

[1] Squat is the term that describes the fact that vessels in motion typically sit deeper in the water than their draft depth would indicate, because the traveling vessel causes the water level around the hull to depress below the still water surface. Squat is also referred to as dynamic sinkage.

The study concludes that the channel must be a minimum of 750 feet wide and 50 feet deep at the westernmost berth of the planned Inner Harbor development, and may narrow to 600 feet wide at the existing APL terminal. With these channel dimensions, berthed vessel motion during passage of an incoming, heavily loaded, Post-Panamax container ship is predicted to reduce loading/unloading efficiency to about 80 percent of normal for a period of about 10 minutes. The Port considers this level of efficiency impact to be acceptable.

4.3.5 Outer Harbor Turning Basin

The current Outer Harbor turning basin is located at a bend in the Outer Harbor channel with marine terminals berths adjacent to the south and east of the basin and open water to the north and west. It is approximately 1,480 feet in diameter. Given the Corps guidance regarding the size of turning basins, and the length of the design vessel, the Port determined that the Outer Harbor Turning basin would be enlarged slightly to 1,600 feet. Using Corps guidance, the " default" design size for the turning basin would be approximately 1,700 feet (1.5 times the length of the design vessel). As indicated above, ship simulation modeling will be performed during advanced design studies to determine/refine the need for this widening.

4.3.6 Inner Harbor Turning Basin

Extensive analysis and engineering design effort resulted in the current 1,200-foot-diameter Inner Harbor turning basin being located where it is today. Prior to the construction of the new turning basin during the -42' project, vessels longer than 750 feet calling at the Inner Harbor turned at a basin constructed by the Port adjacent to Coast Guard Island, approximately 4 miles beyond the Port's Howard Terminal. These vessels had to cross two submarine highway tunnels with a limiting depth of -35 feet MLLW. With the construction of the -42 foot project and the new location of the turning basin near the Howard Terminal, this constraint was eliminated; however, concerns over costs and impacts to adjacent land-side property owners limited the size of the basin to an approximately 1,200-foot diameter circle. Based on ship simulation studies and extensive work with the San Francisco Bay Bar Pilots, the basin was determined to be adequate for a 960-foot design vessel.

The new design vessel is approximately 180 feet longer and cannot safely turn in this 1,200-foot basin. Without the enlargement of the turning basin, the design vessel cannot call at the Inner Harbor. Therefore, this study identified the need to enlarge the turning basin. Using the standard Corps criteria the design vessel would require a 1,710-foot turning basin. The Port has determined that given the sheltered location of the turning basin, 1,500 feet is likely to be adequate (i.e., the proposed turning basin will provide 50 feet more clearance relative to the design vessel than the current 1,200-foot diameter turning basin provides for the 960-foot design vessel). In addition, senior captain Mr. Kurt B. Braendekilde from Maersk's headquarters in Copenhagen came to the Port in 1996 to evaluate the Inner Harbor turning basin and indicated that he did not foresee any problems turning the design vessel in a 1,500-foot turning basin at the proposed location. The aids to navigation installed as part of the -42 foot channel deepening project would be relocated as part of the turning basin expansion.

Eight potential alignments of the turning basin were considered (Appendix M). The proposed alignment of the 1,500-foot Inner Harbor turning basin was selected based on a screening analysis which considered several factors including cost and environmental effects. Appendix M.1 provides a detailed description of the turning basin optimization analysis; Appendix M.2 provides geotechnical design information for the selected alignment. With the proposed alignment, three property owners (the City of Alameda, Gateway Properties, and the U.S. Navy) will be affected.

A ship simulation model for the Inner Harbor turning basin will be performed during the design phase and, together with the geotechnical design study, will be used to refine the turning basin design. Extensive debris and material found to be not suitable for unconfined aquatic disposal (NUAD) were removed from the Inner Harbor turning basin widening areas during the -42 foot project. The presence of NUAD sediment in the widening areas has been confirmed by recent sediment sampling, and the Port anticipates that extensive debris will also be encountered during the proposed project.

4.4 DREDGED MATERIAL

4.4.1 Sediment Quality

The reuse/disposal site options available for dredged sediment are largely dependent on the quality of the sediment, and may also be limited by the economics of the project. The Port has performed sediment sampling and testing for all channel areas considered for deepening and widening. Depending on the channel configuration selected, estimated dredged material volumes range from 12.8 million cubic yards (mcy) to 14.5 mcy. The estimated volumes were divided into five categories based on sediment quality. The Dredged Materials Management Organization (DMMO) is responsible for approving the dredged material classifications. DMMO has concurred with the following classifications:

- SUAD (Tier I Exclusion) and Wetland Cover: Approximately 10.7 to 12.7 mcy[2] are suitable for unconfined aquatic disposal (SUAD), based on the Tier I exclusion analysis.

- Wetland Non-Cover: Approximately 1.5 to 3.0 mcy of dredged material are suitable for use as wetland non-cover material (i.e., the material may be used in wetland creation or restoration projects, but may not be used in the top 3 feet). Wetland non-cover quality criteria are set forth in Wolfenden and Carlin, 1992.[3] A portion of this material may meet the criteria for SUAD for in-Bay disposal.

- Construction Fill: The material is not suitable for use in wetland creation/restoration, but may be used in a confined aquatic fill area to create fast land, or may be used as upland fill without any treatment. Up to 500,000 cy of dredged sediment may require upland placement.

- Landfill Material: This material contains elevated levels of chemicals. Up to 100,000 cy of material (including debris) are included in this category.

The detailed information regarding sediment quality and classification is provided in Chapter 3 of the accompanying EIS/R. The only dredged material that could not be beneficially reused is material that meets the statutory definition of hazardous waste.

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[2] Ranges, where shown, reflect the potential ranges in quantities associated with the dredging plan selected.

[3] Wolfenden, J.D., and M.P. Carlin. 1992. Interim Sediment Screening Criteria and Testing Requirements for Wetland Creation and Upland Beneficial Reuse. RWQCB, San Francisco Bay Region, Oakland, CA.

The sediment testing results indicated that there is no material within the proposed dredging area that would be classified as hazardous waste. The methodology and results of the sediment testing are discussed in detail in section 3 of EIS/R accompanying this Feasibility Report. Test results are presented in Appendix H.

The most restrictive and expensive disposal option would involve removal of sediments to a regulated landfill. Material that cannot be placed in an aquatic environment but which does not require disposal in a landfill, can be placed in an upland site for either permitted Bay fill or other upland construction uses. The Port's maritime development program includes placing Bay fill and raising existing site elevations at FISCO as part of the development of new terminals (Berths 55 - 58). Wetland non-cover material can be placed back into the aquatic environment, but requires a 3-foot cap of cleaner (wetland cover or SUAD) material. Wetland cover material may be reused in wetland reconstruction projects such as Hamilton or Montezuma. Finally, SUAD (Tier I exclusion) material may be used at any reuse location, and can also be disposed of at SF-DODS.

Material potentially requiring disposal in a regulated landfill or treatment prior to use as construction fill was only encountered in the Inner Harbor turning basin. The presence of these contaminated sediments is most likely due to the filled-in dry-dock pits that have not been used since the 1940s. Prior to being taken off-site or treated for reuse as construction fill, this material will be dried at a rehandling facility located on Port property. It can then be treated and reused or hauled (by truck or rail car) to the appropriate landfill.

Material requiring upland placement (construction fill) was also encountered in the Inner Harbor turning basin. Up to 500,000 cy requiring upland placement may be encountered in the Inner Harbor turning basin. The Port's Vision 2000 development program provides an opportunity for the material to be placed upland by being incorporated into the fill for that project. Wetland non-cover material is found in several locations in the Inner Harbor and Outer Harbor. The majority of this material is fine-grained, soft sediment encountered in the first several feet of deepening. The remainder of the dredged material can be used in any construction or habitat restoration/creation project.

4.4.2 Dredged Material Disposal Site Options

Twenty sites were initially considered as potential dredged material reuse or disposal locations (Figure 4.4). To determine which sites are suitable for use as part of the proposed project, the EIS/R applied several screening criteria, which included the requirement that the site would be available (infrastructure in place and permitting completed) to receive dredged material by October 2000. Potential reuse/disposal sites that did not meet the screening criteria were eliminated from further consideration in the EIS/R and in the alternatives development process for this Feasibility Study. However, should any of the sites that were not considered further become available within the required time frame, and logistics and costs permit, they may be used as alternate reuse/disposal sites at the discretion of the Corps, provided they were fully evaluated in the EIS/R. In other words, if technically and economically advisable, the Corps may select fully evaluated dredged material reuse/disposal options other than those selected in this FS.

The following dredged material reuse/disposal site options were considered for the Oakland Harbor Deep Draft Navigation study:

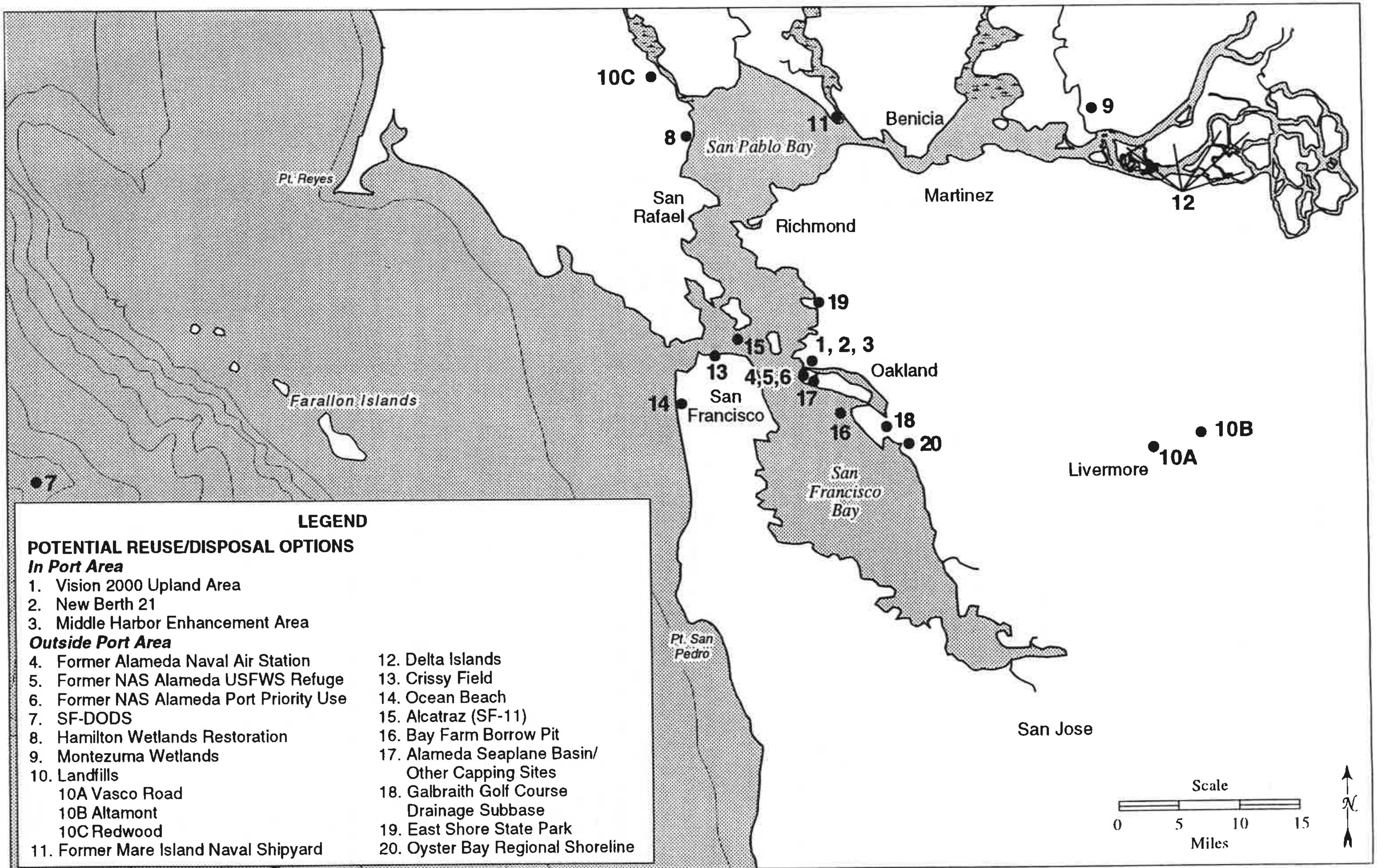


Figure 4.4

POTENTIAL REUSE/DISPOSAL OPTIONS

San Francisco Deep Ocean Disposal Site (SF-DODS). This is the designated deep ocean disposal site for the San Francisco Bay Area. It is currently operational and available to receive up to 4.8 mcy of material per year. Consistent with its designation process, this site is to be used only when other reuse/disposal sites are unavailable or unable to meet the capacity demands associated with the dredging schedule. This site can accept only SUAD material.

Former Mare Island Naval Shipyard. Three potential areas at the former Mare Island Naval Shipyard were considered: the dredge ponds, wetland restoration, and general fill or landfill capping. The Mare Island dredge ponds are currently being maintained; however, a recent feasibility study suggested that the dredge ponds on Mare Island would be too expensive for the city of Vallejo to use. This option was eliminated from further consideration because there is no stable project description for this project, and it appears highly unlikely that the required permits, infrastructure, and environmental documentation will be in place within the required time frame. Also, the Port expects that there would be large tipping fee.

Delta Islands. Under this reuse option, dredged material would be used to strengthen and maintain levees on islands located in the western portion of the Delta. A rehandling facility to receive dredged material will be permitted and constructed in the near future. However, the existing environmental documentation does not support the use of sediments from saline environments for this purpose. There are also a considerable number of historic resources on the Delta islands that could be impacted by the placement of dredged materials. Finally, use of the Delta islands to receive dredged materials from a saline environment also conflicts with the State Water Resources Control Board's Non-Degradation Policy. This option was thus removed from further consideration as a reuse/disposal option for the project.

Vision 2000 Upland Area. This area comprises 818 acres of upland property that will be redeveloped into marine terminals and a joint intermodal rail yard as part of the Port's Vision 2000 program. It includes a portion of new land to be created in the area between the former Navy piers at FISCO. As part of the Berth 55 - 58 project, the area between the finger piers will be diked off and filled to create approximately 31 acres of new fastland. Dredged sediments from the proposed dredging project would only be placed on upland locations, which may include the new land created by the Berths 55 - 58 project. Up to 2.5 mcy of dredged material from the proposed project may be used at this area to raise grades prior to construction of the new terminals. This option was retained for further consideration.

New Berth 21. An area of open water currently comprising the northeastern-most extent of the Outer Harbor channel, bordered by Berths 8 and 9 to the north, Berth 10 to the east, and Berths 20 and 21 to the south (the "dogleg," see Figure 2.4) may be filled in the future as part of the replacement of the Port's Berth 21. The area that may be filled is approximately 27 acres, and roughly square in shape. The "dogleg" area is approximately 1300 feet long, and is difficult for modern ships to access. It may be completely inaccessible for sixth generation container vessels. A portion of the land that may be filled is part of the Oakland Army Base, which is being closed through the Base Realignment and Closure (BRAC) process. Although the Port expects to obtain this land (which has been designated for maritime-related uses in the Reuse Plan), because of delays in the base closure process, the Port may not be able to obtain the land and complete the development, planning and environmental review process on a timely basis. While this reuse/disposal option was retained for consideration in the EIS/R because of the area's designation for maritime use, the degree of uncertainty associated with the timing of this potential reuse/disposal option prevents its selection in the feasibility study. Thus, New Berth 21 was not selected as a reuse/disposal option for the proposed project. However, should the area become available on a timely basis, it would be very cost-effective to reuse dredged material as fill in this area. Because this reuse/disposal option was fully evaluated in the EIS/R it may be used at the discretion of the Corps, if it becomes available and is cost-effective.

Middle Harbor Enhancement Area (MHEA). Due to the closure of FISCO and the Port's plan to create four new berths and a tug wharf along the Inner Harbor, the Middle Harbor area is no longer required for active maritime operations. However, past Navy operations have resulted in the presence of contaminated sediments in this area. In addition to capping the sediments, the Port proposes to create a shallow water habitat area in the Middle Harbor to enhance the vitality and productivity of local wildlife. The proposed project can receive up to 7 mcy of sediment, and is currently in the process of being designed and permitted. It is expected to be available in time for the proposed project.

Crissy Field. Remediation and restoration are required at Crissy Field in the Presidio. However, the project sponsor requested that this area be removed from consideration as a dredged material reuse area. Therefore, this potential reuse location was removed from further consideration.

Ocean Beach Nourishment. Replacement of sand removed by natural wave and current actions would help sustain the viability of Ocean Beach. However, the project sponsor requested that this area be removed from consideration as a dredged material reuse area. Therefore, this potential reuse location was removed from further consideration.

Former NAS Alameda – Construction Fill. Under this reuse option, the Port would deliver up to 750,000 cubic yards of clean fill to the former NAS Alameda (now called Alameda Point) for use in future projects. This reuse option would represent a very cost-effective source of fill required for the redevelopment of Alameda Point. An appropriate stockpile area is available, and permitting is possible within the desired time line. However, planning of the redevelopment program is still in the very preliminary stages, so that exact quantity requirements cannot be defined. Therefore, this reuse option has been eliminated from further consideration in the FS. As with the New Berth 21 reuse/disposal option, however, the EIS/R fully evaluated this option because it met the criteria developed for the EIS/R. Thus, if the Alameda Reuse and Redevelopment Authority (ARRA) determines in the future that it wishes to receive dredged material, the Corps, at its discretion, may choose this reuse/disposal option.

Former NAS Alameda – USFWS Refuge. This reuse option would involve delivering clean dredged material to Alameda Point for use in restoring the wildlife refuge area located in the southwestern portion of the former base. However, restoration plans are still uncertain, and no project schedule has been developed. In addition, the land is currently still under Navy control, and has not been transferred to USFWS. Therefore, this reuse option was removed from further consideration.

Former NAS Alameda – Port Priority Use. The Port Priority Use designation in the Seaport Plan has been removed from Alameda west to the Inner Harbor submarine tunnel crossings. In addition, Port of Oakland facilities are located north of Alameda, and ground transportation from Alameda Island to the mainland is heavily constrained (limited tunnel and bridge capacity). Thus, there is no local sponsor who is interested in pursuing port use of the former NAS Alameda, and this reuse option has been eliminated from further consideration.

Aquatic Disposal Site SF-11 (Alcatraz). This potential disposal location is designated primarily for the disposal of smaller quantities of maintenance dredging material. It is not designated for use by new projects. Therefore, this potential disposal option was removed from further consideration.

Hamilton Wetlands Restoration. This potential reuse option is a wetlands restoration project that is designed to accept SUAD (including wetland cover) dredged material from a variety of dredging projects to assist with the restoration process of former wetlands at the former Hamilton Army Airfield, Antenna Field, and ball fields. The Hamilton Wetlands Restoration project sponsor is very interested in receiving dredged material from the proposed deepening project. The environmental documentation for this project has not been completed. It is uncertain whether the required permits and facilities would be in place in time for the proposed project, although it is likely that this reuse option will be available during the later stages of the proposed project. Nonetheless, the project represents a positive reuse of dredged material and is located relatively close to the Port, and is therefore highly desirable if available on a timely basis. Because this reuse site has high potential environmental benefits, and may be available during a portion of the construction period, this option has been retained for further consideration.

Montezuma Wetlands Restoration. This potential reuse option is a wetlands restoration project that is designed to accept SUAD (including wetland cover) and wetland non-cover dredged material from a variety of dredging projects to assist with the restoration process. Wetland non-cover material can comprise no more than 33 percent of the total dredged material delivered. As with the Hamilton Wetlands Restoration site, the environmental documentation for this project has not been completed, and it is uncertain whether the required permits and facilities would be in place in time for the proposed project. In addition, the project sponsor proposes to charge a tipping fee for accepting dredged material. Nonetheless, because this reuse option represents a positive reuse of dredged material and is therefore desirable if available on a timely basis, it was retained for further consideration.

Bay Farm Borrow Pit. Clean dredged materials could be used to refill the Bay Farm Borrow Pit. The potential project sponsor, the Corps, has no plans to begin the process of designating this site as a dredged material disposal site. In addition, the City of Alameda has also objected to this site for use as a dredged material disposal site for this or any other Port project. Therefore, this potential reuse option has been eliminated from further consideration.

Alameda Seaplane Basin and Other Capping Sites. Clean dredged material could be used to cap contaminated sediments in place. However, the potential project sponsor for the Alameda Seaplane Basin is not interested in capping as a remedy because capping would constrain future use of the area, and no other potential capping sites have been identified. Thus, this reuse/disposal option has been removed from further consideration.

Various Landfills. Under this disposal option, up to 100,000 cy of moderately to severely contaminated sediments would be temporarily dried on site at a rehandling facility, and then transported to a local or out of state landfill for confined disposal.

Adequate landfill space is currently available. This option has been retained for further consideration.

East Shore State Park. Under this reuse option, clean dredged material would be used to help construct a new park. Although the project sponsor has expressed interest in receiving the material, it is unlikely that permits and the required environmental documentation would be in place in time for the proposed project. Thus, this site has been eliminated from further consideration.

Oyster Bay Regional Shoreline. Under this reuse option, clean dredged material would be used to enhance an existing shoreline that is slated to provide public access. Although the project sponsor has expressed interest in receiving the material, it is unlikely that permits and the required environmental documentation would be in place in time for the proposed project. Thus, this site has been removed from further consideration.

Galbraith Golf Course Drainage Subbase. Approximately 2 to 2.5 feet of drainage subbase is required to be placed at the Galbraith Golf Course as part of the reconstruction of the golf course. However, clean dredged material from this project may not be available in time for the reconstruction project, and will more likely be delivered from another Port project (e.g., the last stage of the -42 foot project or the Berth 55 - 58 project). Therefore, this potential reuse option has been eliminated from further consideration.

Thus, based on an evaluation of the sponsor's desire to accept dredged material, and the ability of the sponsor to ensure that the required environmental document, permits, and infrastructure will be in place in the time frame required, six reuse/disposal options were retained for further consideration in the FS. These six reuse/disposal options are:

- SF-DODS (capable of receiving SUAD material only),
- Vision 2000 Upland Area (capable of receiving all types of material that may be generated under the proposed project),
- Middle Harbor Enhancement Area (capable of receiving SUAD/wetland cover, and wetland non-cover material),
- Hamilton Wetlands Restoration (capable of receiving SUAD/wetland cover material),
- Montezuma Wetlands Restoration (capable of receiving SUAD/wetland cover material, and limited wetland non-cover material), and
- Various Landfills (to receive material requiring landfill disposal only).

The MHEA is considered the first choice because it results in the creation of habitat, is in the center of the dredging area and can accept a large quantity of dredged material. The Vision 2000 Upland Area ranks second; it also provides beneficial reuse for dredged material. The Hamilton and Montezuma Wetlands Restoration projects rank third and fourth, respectively; they provide environmental restoration benefits, but require longer transport distances. The Montezuma site is located much further away from the project location than Hamilton, which results in higher transportation costs and greater air quality impacts. Finally, SF-DODS and Various Landfills rank fifth, because these options are strictly disposal options, and do not provide for any type of reuse. If other nearby beneficial reuse/disposal sites (e.g., New Berth 21 or Former NAS Alameda Construction Fill) become available in time for the construction of the project, they would take precedence over disposal at SFDODS. Thus, within the constraints of sediment quality, sediment generated by the proposed project would be reused or disposed of in the order of preference listed.

4.4.3 Dredging Methods

Several types of dredging equipment may be used to accomplish the proposed project. The three primary types of equipment are described below. The dredges will most likely be electric-powered dredges. No differences in performance characteristics are expected from electric-powered dredges compared to diesel-powered dredges. Electric powered dredges provide significant environmental benefits compared to diesel-powered dredges (i.e., air quality impacts are reduced substantially, and electric powered dredges are much less noisy).

Clamshell Or Excavator Dredge And Barge. The clamshell dredge removes sediment by a bucket which is dropped through the water and into the sediment. The bucket is raised and dumped into a barge which is subsequently hauled to the disposal site with a tug boat. Disposal is either accomplished by bottom dumping (in which the scow hinges open with the sediment falling to the bottom), direct pump-out from the scow, or off-loading with another clamshell dredge. An excavator (or dipper) dredge operates in a similar manner except that the bucket is manipulated with hydraulically controlled mechanical arms instead of being suspended by cable. Turbidity occurs as the bucket bites into the sediment, as it travels up through the water, and as it breaks the surface of the water. Consolidated material tends to remain in a mass when disposed, even at high energy sites. Clamshell and excavator dredges can be equipped with a variety of bucket types and sizes for different types of sediment. This type of dredging is preferable for contaminated sediments where turbidity is a concern and where the introduction of slurry water might cause discharge problems at the disposal site. These types of dredges use diesel-electric motors and can easily be converted to fully electric dredges.

Hydraulic Cutterhead Dredge. The hydraulic cutterhead dredge is a suction pump-type dredge that utilizes a revolving cutterhead to bite into and loosen the bottom material. This type of dredge is especially suited to dredging consolidated or compacted materials and can be used to remove soft rock deposits. Some of the Merritt Sands are expected to be cemented, thus the power provided by the hydraulic cutterhead dredge is particularly desirable. The dredged material is transported directly from the dredge site through floating and/or submerged pipelines and discharged directly into the disposal site. With the use of the booster pumps, it is possible to pump the material as far as 25,000 feet. Thus, this dredging method can be used to move material from the furthest reaches of the Inner and Outer Harbor channels to the MHEA. This type of dredge can also be converted to full electrical operation; one such electric cutterhead dredge is currently in operation.

Hopper Dredge. Hopper dredges are typically self-propelled ocean-going vessels which suction pump soft unconsolidated materials into a temporary storage hopper built into the hull of the vessel. Once the hopper has been filled, the dredge normally proceeds to the disposal site where the material is bottom dumped. The hopper dredge can be very effective at removing softer unconsolidated material from underlying harder strata. Due to its self-propelled nature, this type of dredge is more difficult to convert to full electric operation. It is not anticipated that hopper dredges will be required for the proposed project.

4.5 FORMULATION OF THE PLAN

The five project components described in section 4.3 were combined into six potential project plans. All action plans would use the six reuse/disposal options identified above; the disposal options would be used in order of preference, as long as capacity is available to accept the various classes of dredged sediment (SUAD/wetland cover, wetland non-cover, construction fill, and landfill material) that may be generated by the project.

4.5.1 Plan A - "Without" Project Plan

This plan would retain the existing 42-foot deep navigation channel, with its periodic maintenance dredging program. The Outer Harbor turning basin would remain at 1,480 feet, and the Inner Harbor turning basin would remain at 1,200 feet.

4.5.2 Plan B - Full Project Plan

This plan of improvement would deepen the Outer Harbor and widen the Outer Harbor to 1,000 feet to improve the safety for moored vessels. The plan also includes deepening and widening the Inner Harbor channel, and enlarging the existing Inner Harbor turning basin. During the reconnaissance phase, it was believed that a 1,000 foot-wide channel would allow for two-way traffic. However, based on discussions with the San Francisco Bar Pilots, the proposed width would still be too narrow, and two-way traffic would still be constrained by the size of the turning basin.

4.5.3 Plan C - Full Inner Harbor Improvements

This plan of improvement would deepen and widen the Inner Harbor channel and enlarge the Inner Harbor turning basin, with no improvements for the Outer Harbor channel. Partners within the global shipping alliances are located in both the Inner and the Outer Harbors. The presence of alliance partners in both the Inner and the Outer Harbors necessitates treating the Inner and Outer Harbor channels as a single functioning harbor. Construction of only the Inner Harbor would hamper the realization of benefits from the project because the shipping alliances make decisions on vessel fleet utilization based on the depths of both channels. The costs to dredge the Inner Harbor and the Outer Harbor are similar, and the economic analysis indicates that there are substantial benefits to deepening both harbors. Therefore, Plan C was dropped from further consideration.

4.5.4 Plan D - Full Outer Harbor Improvements

This plan of improvement would deepen and slightly widen the Outer Harbor channel and slightly enlarge the Outer Harbor turning basin, with no improvements for the Inner Harbor. As described for Plan C, above, the presence of alliance partners in both the Inner Harbor and the Outer Harbor necessitates treating the Inner and Outer Harbor channels as a single functioning harbor. Construction of only the Outer Harbor would hamper the realization of benefits from the project because the shipping alliances make decisions on vessel fleet utilization based on the depths of both channels. Again, costs to dredge the Inner Harbor and the Outer Harbor are similar, and the economic analysis indicates that there are substantial benefits to deepening both harbors. Therefore, Plan D was dropped from further consideration.

4.5.5 Plan E - Full Outer Harbor Improvements and Selected Inner Harbor Improvements

This plan of improvement would deepen and widen the Outer Harbor channel, enlarge the Outer Harbor turning basin, deepen the Inner Harbor, and enlarge the Inner Harbor turning basin. No widening of the Inner Harbor channel would be included in this plan.

This plan is a relic of the planning process; it was created before the Port initiated the development of its new marine terminals development along the Inner Harbor. The proposed widening of the Inner Harbor channel under the other action plans is limited to deepening of a narrow strip of newly submerged land created as a result of the Port maritime development program. Widening of the Inner Harbor is required to allow vessels to pass moored vessels at the new berths. Thus, Plan E was eliminated from further consideration.

4.5.6 Plan F - Selected Outer Harbor Improvements and Full Inner Harbor Improvements

This plan of improvement would deepen the Outer Harbor channel, slightly enlarge the Outer Harbor turning basin, deepen the Inner Harbor channel, and enlarge the Inner Harbor turning basin. Only very limited channel widening in the Outer Harbor would be included in this plan.

Based on the economic value of deepening both the Inner and Outer Harbors, only plans addressing both the Inner and Outer Harbors (Plans B and F) were retained for further consideration in this study. The potential benefits are large, and deepening only a portion of the channels fails to satisfy all the plan objectives (i.e., safety and efficiency gains would be limited to the portions of the channels that were deepened), and is not acceptable to the shippers in alliances (greater than 70 percent of the shippers calling on the Port are part of alliances). The plan of action thus includes all five project components. Plan B offers only minimal benefits when compared to Plan F, and requires the dredging of an estimated additional 2.5 mcy of material. Because further evaluation during the feasibility study phase showed that two-way traffic in the Outer Harbor could not be accomplished with a 1,000-foot wide channel, Plan B was also eliminated from further consideration.

Table 4.1 summarizes the evaluation and screening of the channel design options which were considered, and Table 4.2 summarizes the disposal sites which were considered.

The following section evaluates the Final Array of Alternative Plans, which consists of the action plan (Plan F) discussed above and the No Action Plan. The No Action Plan is included in the Final Array because its inclusion is required by NEPA and by Corps planning guidelines.

4.6 FINAL ARRAY OF ALTERNATIVE PLANS

The Final Array of Alternative Plans includes one action alternative (Action Plan F) and the No Action alternative. The action plan includes reuse of dredged material at the MHEA (7.0 mcy), the Vision 2000 Upland Area (0.5 mcy), and the Hamilton Wetland Restoration site (5.2 mcy), and disposal of up to 100,000 cy at a landfill, and corresponds to alternative F-2 presented in the EIS/R. The proposed reuse/disposal strategy for the

Table 4.1. Summary of Evaluation and Sceening of Channel Design Options Considered

Plan Option	Description	Carried Forward	Reason
A	No Action Plan	Yes	Required by NEPA and Corps Planning Guidelines
B	Deepen Outer Harbor and widen Outer Harbor to 1,000 feet, deepen and widen Inner Harbor, enlarge existing Inner Harbor turning basin	No	Two way traffic cannot be accomplished with a 1,000-foot wide channel; requires additional dredging of an estimated 2.5 mcy
C	Deepen and widen the Inner Harbor channel and enlarge Inner Harbor turning basin	No	Does not address Outer Harbor -- fails to satisfy all plan objectives
D	Deepen and slightly widen Outer Harbor channel and slightly enlarge Outer Harbor turning basin	No	Does not address Inner Harbor-- fails to satisfy all plan objectives
E	Deepen and widen Outer Harbor channel, enlarge Outer Harbor turning basin, deepen Inner Harbor channel	No	Does not provide sufficient width in the Inner Harbor for safe passage of vessels; relic of the planning process
F	Deepen Outer Harbor channel, slightly enlarge Outer Harbor turning basin, deepen and widen Inner Harbor channel, enlarge Inner Harbor turning basin	Yes	Based on economic value of deepening the Inner and Outer Harbors; includes all five project components; satisfies all plan objectives

Table 4.2. Summary of Disposal Sites

Disposal Site(s):	Carried Forward	Reason
San Francisco Deep Ocean Disposal Site	Yes	Available; large capacity; default disposal location for SUAD material
Former Mare Island Naval Shipyard	No	No stable project description; cultural resources concerns; potentially large tipping fee
Delta Islands	No	Does not support the use of sediments from saline environment
Vision 2000 Upland Area	Yes	Berth 55-58 project will begin before the -50 foot project; permits will be in place
New Berth 21	No	Site may not be available on a timely basis
Middle Harbor Enhancement Area	Yes	To create a shallow water habitat area
Crissy Field	No	Project sponsor requested this area be removed from consideration
Ocean Beach Nourishment	No	Project sponsor requested this area be removed from consideration
Former Alameda NAS-Construction Fill	No	Uncertain whether sponsor wants dredged material
Former Alameda NAS-USFWS Refuge	No	Restoration plans are still uncertain and no project schedule has been developed
Former Alameda NAS-Port Priority Use	No	Port Priority Use designation for this area has been removed from Seaport Plan
Aquatic Disposal Site-SF-11 (Alcatraz)	No	Designated for use by maintenance dredging projects
Hamilton Wetlands Restoration	Yes	Highly desirable environmental restoration project
Montezuma Wetlands Restoration	Yes	Desirable environmental restoration project
Bay Farm Borrow Pit	No	No intent by project sponsor to designate as dredged material disposal site
Alameda Seaplan Basin and other Capping Sites	No	No interest from potential project sponsor in capping as a remedy
Various Landfills	Yes	Adequate landfill space is currently available
East Shore State Park	No	Unlikely that permits and required environmental documentation will be in place in time for -50 project
Oyster Bay Regional Shoreline	No	Unlikely that permits and required environmental documentation will be in place in time for -50 project
Galbraith Golf Course Drainage Subbase	No	Clean dredged material may not be available in time for golf course reconstruction project

action plan maximizes the environmental reuse (all wetland non-cover or better material is reused for environmental restoration or habitat creation). Use of Hamilton assumes that the site is available and construction costs are feasible for the Port and the Federal Government. If the Hamilton site is not available, the material currently slated for Hamilton may be reused at the Montezuma Wetlands Restoration site (subject to the same availability and financial feasibility considerations), or could be disposed of at SF-DODS.

Action Plan F is shown in Figure 4.5. In addition to the channel and turning basin widening and deepening described above, the figure shows related project activities that will be completed by the Port of Oakland. The Port will deepen the berths along the Inner and Outer Harbor channels, and will create new terminal facilities (Berths 55 - 58) as part of its Vision 2000 development program.

Effectiveness, economic, and environmental considerations were the primary factors in identifying the Final Array of alternative plans. Prior to analyzing the Final Array of plans against the evaluation criteria and calculating a benefit to cost ratio for the selected plan, the optimum project depth must be identified.

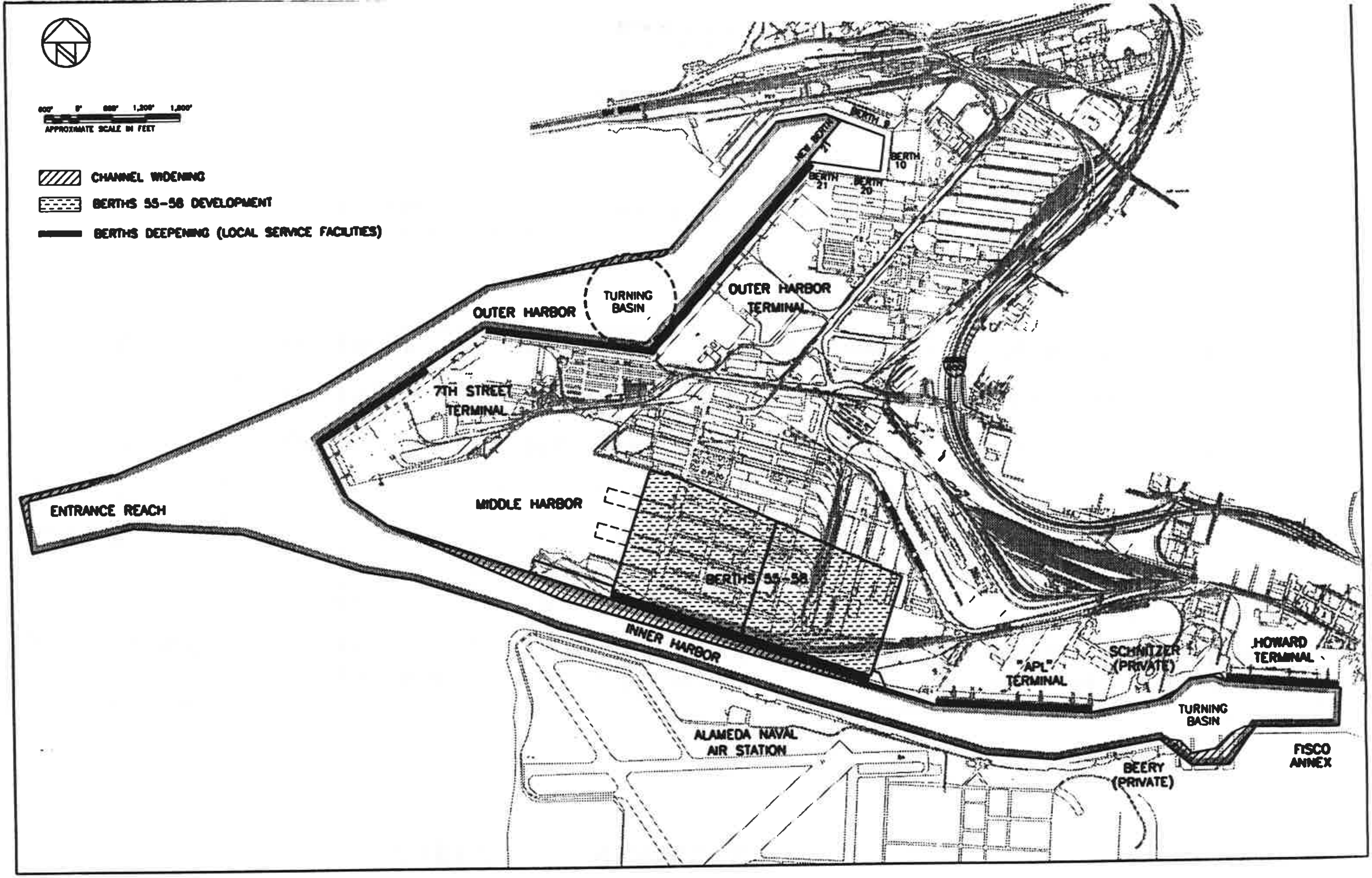
4.7 CHANNEL DEPTH DETERMINATION

The current channel depth in the Entrance and Outer Harbor channels is -42 feet MLLW, and most of the Inner Harbor channel is also at -42 feet MLLW. Dredging of the Inner Harbor channel to -42 feet MLLW is expected to be completed in June 1998. The project evaluated consistent depths for all three channels, with a maximum depth of -50 feet MLLW. The San Francisco Bar channel provides access to vessel traffic entering the San Francisco Bay. Tidal conditions and channel depth restrict operating vessels to a draft of -50 feet MLLW. This is consistent with the proposed Oakland Harbor improvements (including the maximum channel depths evaluated) and would require no further improvement to obtain full utilization of the proposed Oakland Harbor channel improvements.

To optimize channel depths, a 1-foot incremental analysis was performed using a model described in Appendix A.7 (Economic Analysis). The model focused on the benefits derived from navigation efficiencies and performed an optimization of the channel depths ranging from -45 to -50 feet MLLW. The analysis showed the optimum channel depth (i.e., the channel depth which provides the maximum net benefits) for both the Inner and the Outer Harbor channels to be -50 feet MLLW. Table 4.3 shows the net benefit determination for channel depth optimization. The corresponding optimization curves are shown in Figure 4.6. Thus, Plan F at the -50 foot depth was identified as the NED Plan. Plan F at -50 feet MLLW is also the locally preferred plan (LPP). Channel depths greater than -50 feet MLLW were not considered in the evaluation for several reasons:

- The San Francisco Bar channel is currently maintained at -55 feet MLLW; this depth limits total vessel draft to 50 feet (i.e., is consistent with a -50 foot MLLW Inner and Outer Harbor channel depth);

- The maximum channel depth in the Outer Harbor is also constrained by the presence of the Bay Are Rapid Transit (BART) transbay submarine rail tunnel (known locally as the BART Transbay Tube). The top of the armor rock is at -53 feet MLLW in the project area; and



T:\ENG\PUBLIC\MHD\SOFT\PLANS (XREF: BASE)

PORT OF OAKLAND

530 WATER STREET OAKLAND, CALIFORNIA

CHIEF ENGINEER ______ PEG. ENGINEER NO.

APPROVED ______ ASS'T CHIEF ENGINEER ______ PEG. ENGINEER NO.

RECOMMENDED ______ PEG. ENGINEER NO.

PRELIMINARY DRAWING
ENGINEERING PROJECT MANAGEMENT DEPT.

ACTION PLAN F

FIGURE 4.5

DATE 1-22-98
SCALE
SHEET 1 OF 1 SHEET
FILE AA-

TABLE 4.3. ANNUAL NET BENEFITS

Dredging Depth	Total Investment Cost (a)	Annual Investment Cost (b)	Annual Benefit	Annual Net Benefit	Benefit/Cost Ratio
-45	$109,080,000	$8,029,000			
-46	—	—	$148,761,000	—	—
-47	—	—	$157,268,000	—	—
-48	$180,682,000	$13,300,000	$160,571,000	$147,271,000	12.07
-49	$183,227,000	$13,487,000	$177,204,000	$163,717,000	13.14
-50	**$185,405,000**	**$13,648,000**	**$178,046,000**	**$164,398,000**	**13.05**

Note:
(a) Escalated to mid-point of construction
(b) Cost Recovery Factor (7.125% and 50 years) = 0.07361

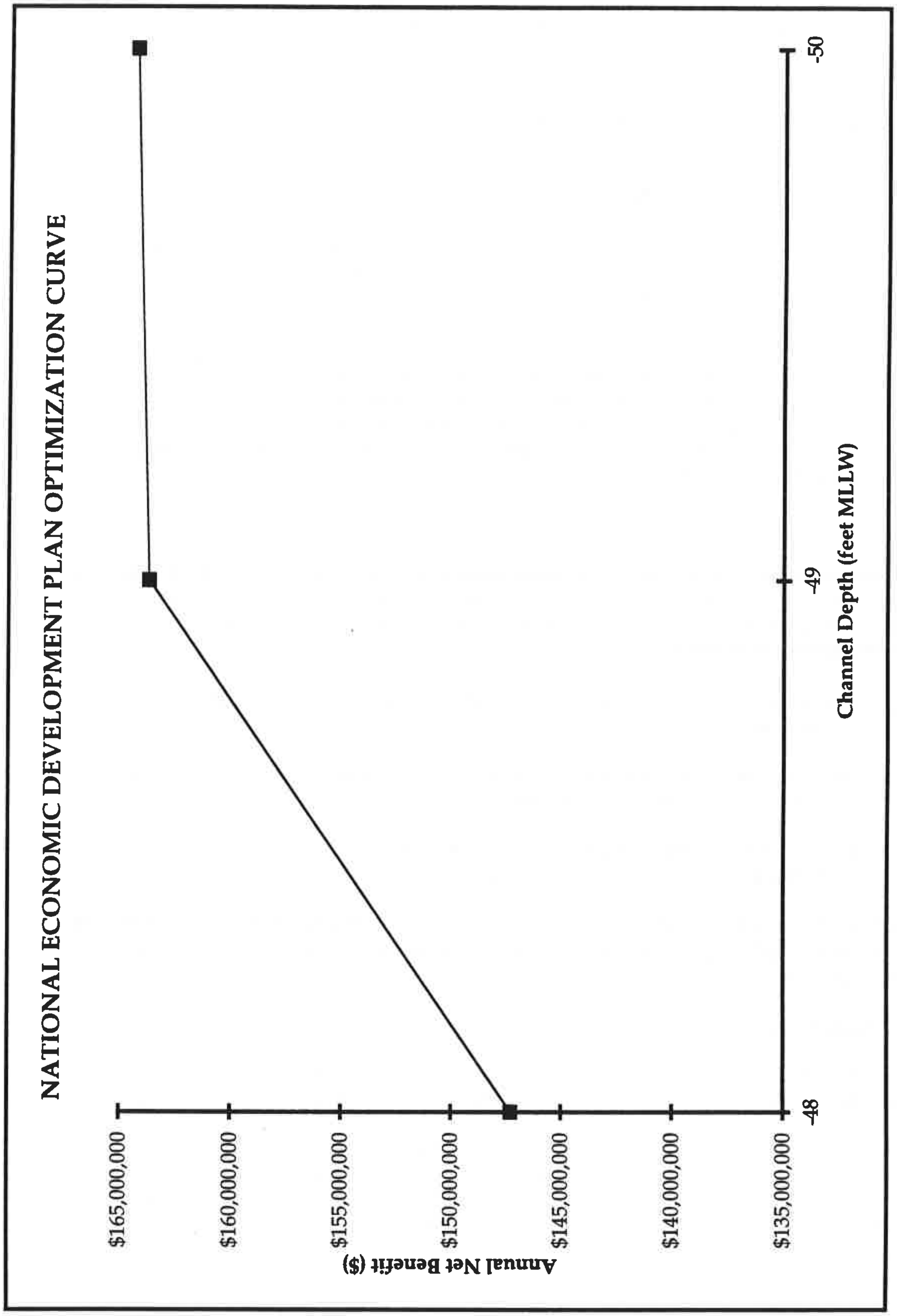

NATIONAL ECONOMIC DEVELOPMENT PLAN OPTIMIZATION CURVE
Annual Net Benefit ($)
$165,000,000
$160,000,000
$155,000,000
$150,000,000
$145,000,000
$140,000,000
$135,000,000
-48
-49
-50
Channel Depth (feet MLLW)

Figure 4.6

- Current projections of future vessel designs by the shipping companies using the Port of Oakland indicate that while vessel capacity may continue to increase, the anticipated maximum draft will remain in the 48-foot range.

Thus, operational constraints and future design trends both led to the decision to limit the evaluation of proposed channel depths to -50 feet MLLW.

4.8 PLAN EVALUATION

As described above, the Action Plan F at -50 feet MLLW was identified as the NED/LPP. Action Plan F and the No Action Plan were tested against specific evaluation criteria which are set forth in the Corps' Principles and Guidelines for planning (ER 1105-2-100). The following summarizes this evaluation.

The criteria presented below are used to evaluate project plans under Federal guidelines. These criteria are also used to narrow the alternatives to a recommended plan. The four evaluation criteria used in plan formulation are effectiveness, efficiency, completeness, and acceptability. A description of the criteria and the plan evaluation by criterion is provided below.

4.8.1 Effectiveness

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities (efficient fleet operations and navigation safety). Effectiveness is a measure of a plan's ability to achieve the desired output and can be evaluated as follows:

1. Plans must represent sound, safe, acceptable engineering solutions to the problems and needs.

2. Plans must be technically achievable and cannot contain obstructions which prevent accomplishment of the desired output.

3. Plans must be realistic and state-of-the art. However, they must not rely on future research and development of key components.

The action plan meets the effectiveness criterion, whereas the No Action Plan does not achieve the desired output. The Action Plan addresses the problems identified in the planning process.

4.8.2 Efficiency

Efficiency is the extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities.

1. Plans must be economically efficient and justified. That is, when costs and benefits are accounted for, the benefits must exceed the costs. The plan which creates the greatest net benefits, or contributes the most to National Economic Development, is considered the most efficient.

2. Plans must be efficient in other resource areas also. They must represent near optimal use of all resources including land, water, transportation, infrastructure, and energy resources.

Action Plan F selected over the No Action Plan under this criterion, since no action does not provide increased benefits and adds nothing to National Economic Development. Action Plan F at -50 feet MLLW is the NED Plan, and is therefore considered the most efficient plan. Action Plan F minimizes impacts to the environment by minimizing the amount of land required to construct the project, and by minimizing the amount of energy required to dispose of the dredged material.

4.8.3 Completeness

Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective. This criterion assures that all measures required to achieve the desired outputs, structural or non-structural, are included in the plan or are at least addressed.

Based on this criterion, Action Plan F and the No Action Plan are both complete. Required permitting, real estate, and related issues have been addressed in this FS. All plans are ranked equally under this criterion.

4.8.4 Acceptability

Acceptability is the workability and viability of the alternative plans with respect to acceptance by state and local entities, as well as the public, and compatibility with existing laws, regulations, and public policies.

The local (West Oakland) community is concerned about potential increases in truck traffic and the potential for degradation in air quality. The City of Alameda has expressed concerns over potential impacts to ferry operations during the dredging program. In addition, both City of Alameda and a private property owner have expressed concerns regarding the proposed alignment of the Inner Harbor turning basin.

The general public and agencies with an interest in navigation improvements prefer Action Plan F because it accomplishes the full objectives of the project. Local public interest groups support the construction of the MHEA, which is dependent on dredged material from the proposed project (i.e., it requires large volumes of clean or relatively clean fill that would be prohibitively expensive to obtain in any other way). In addition, local public interest groups also strongly favor the construction of the Hamilton Wetlands Restoration project. Action Plan F at -50 feet MLLW would generate sufficient dredged material so that both the MHEA and the Hamilton Wetlands Restoration project (if available on a timely basis) could be supported by the proposed project.

4.9 PLAN EVALUATION BY RESOURCE ACCOUNT

The Corps' Principles and Guidelines for the planning process have established four specific categories or "accounts" which are used to facilitate evaluation and display the effects of alternative plans. These accounts are: national economic development (NED), environmental quality (EQ), regional economic development (RED), and other social effects (OSE). These four accounts encompass all significant effects of a plan on the human environment as required by the National Environmental Policy Act of 1969 (NEPA). They also encompass social well-being as required by section 122 of the Flood Control Act of 1970. The EQ account shows effects on ecological, cultural, and aesthetic attributes of significant natural and cultural resources that cannot be measured in monetary terms. The OSE account shows urban and community impacts and effects on life, health, and safety. The NED account shows effects on the national economy. The RED account shows the regional incidence of NED effects, income transfers, and employment effects (ER 1105-2-100, Chapter 5, section 1, Principles and Guidelines, paragraph 5-8). Each of these resource accounts, and the results of the evaluation are described below.

4.9.1 National Economic Development (NED) Account

The NED account identifies beneficial and adverse effects on the nation's economy. Beneficial effects in the NED account are increases in the economic value of the national output of goods and services from a plan. Adverse effects in the NED account are the opportunity costs of resources used in implementing a plan. The NED Plan is the plan that maximizes the economic benefits to the Nation.

Action Plan F at -50 feet MLLW is the NED Plan. Action Plan F minimizes the navigational inefficiencies (constraints) associated with lack of adequate channel depth. A detailed analysis of project costs and benefits is provided in Chapter 5. The No Action Plan provides no added economic benefits.

4.9.2 Environmental Quality (EQ) Account

The EQ account is a means of displaying the effects of alternative plans on the NEPA "human environment". This is essential to a reasoned choice among alternative plans. Beneficial effects in the EQ account are favorable changes in the ecological, aesthetic, and cultural attributes of natural and cultural resources. Adverse effects in the EQ account are unfavorable changes in the ecological, aesthetic, and cultural attributes of these same resources.

The environmental impacts of Action Plan F and the No Action Plan are presented in detail in the accompanying EIS/R. Action Plan F may result in the loss of a small area of eelgrass habitat and other shallow water habitat; the creation of the MHEA will result in the creation of eelgrass beds and other shallow habitat of equal or greater area. The only potentially unavoidable significant impacts identified by the EIR/S are noise during construction, and air quality during the construction phase. These impacts would occur with the Action Plan. The Port is working with the local community to develop a mitigation plan for air quality that would address potential air quality impacts during operation of this project and from the cumulative effect of several related projects. The potential noise impacts are associated with night-time dredging. These potential noise impacts, and well as air quality impacts during construction, could be minimized by the suggested mitigation of using electric dredges. Concerns have been expressed about the potential impacts of the project is it results in the introduction of exotic organisms to the Bay through vessel discharge of ballast water. The EIS/R concludes that it cannot be determined what, if any, adverse impact Action Plan F might have. Nonetheless, the EIS/R recommends several mitigation measures.

Action Plan F presents the opportunity for significant wetland and shallow water habitat restoration through the creation of the MHEA project and potentially significant contributions to the Hamilton Wetlands Restoration project. The potential contributions to environmental restoration make Action Plan F the optimal plan for wetland restoration.

4.9.3 Regional Economic Development (RED) Account

The RED account registers changes in the distribution of regional economic activity that results from each alternative plan. Two measures of the effects of the plan on regional economies are used in this account, regional income and regional employment. The positive effects of regional income and employment include the sum of the NED benefits that accrue to that region, plus transfers of income and employment to the region from areas outside the region, considering transfers of economic activity, indirect effects, and induced effects. The regional economic impact of the Port of Oakland is estimated to stretch from Oakland north to the Oregon border, and south to Bakersfield.

The economic analysis developed by the Corps assumes that economic growth will be constant, regardless of the channel depth (i.e., is the same for the No Action Plan and Action Plan F). The increased seaport activity is expected to create new jobs and economic opportunities for maritime businesses such as terminal operators, shipping lines, freight forwarders, warehouses, container repair and leasing, government, railroads and trucking that will compensate for some of the losses in maritime activities due to the departure of the U.S. Navy and U.S. Army from Bay Area bases. The action plans may help the Port of Oakland capture an increased portion of the Pacific Rim trade growth, thereby helping the Bay Area and the Nation to maintain their competitiveness in the international arena.

4.9.4 Other Social Effects (OSE) Account

The OSE account is a means of displaying information on alternative plan effects from perspectives that are not reflected in the other three accounts. These include:

1. Harbor and community impacts including income distribution, employment distribution, population distribution and composition; fiscal condition of governments; quality of community life; and transportation, utility, and other infrastructure systems.

2. Life, health, and safety effects; reflects the risks associated with loss of life, injury to citizens, and catastrophic damages to property and essential public services.

3. Displacement effects; the displacement of people, businesses, and other activities.

Economic growth has been assumed to be constant regardless of channel depth. Action Plan F increases safety in the Oakland Harbor and Entrance channels. There is an on-going public debate about how local residents, especially in neighboring West Oakland, would actually benefit from jobs and new business from Port expansion activities that would be facilitated by the deeper channels.

West Oakland has absorbed numerous urban renewal and infrastructure projects, such as the East Bay Municipal Utilities District wastewater treatment plant, U.S. Regional Post Office, West Oakland BART station, and the Cypress Freeway. These projects have increased pollution and reduced the quality of life in West Oakland without providing much direct economic benefit for residents. West Oakland activists want to ensure that the Port takes measures to balance the needs and concerns of the community with the requirements of the project and ensure that West Oakland receives its fair share of the anticipated benefits of the project.

West Oakland is primarily an African-American community, and, in addition to environmental problems, many residents deal with economic hardships from low-income jobs and high unemployment (up to 40 percent for African-American males in West Oakland). Air pollution, dust, noise, and truck traffic associated with the Port's Vision 2000 projects, as well as the upcoming conversion of Oakland Army Base and East Bay Bridge reconstruction, are expected to have adverse effects on West Oakland residents. These effects would be greatest during construction activities, but could also be a permanent nuisance due to the increased ship, train, truck, and car traffic that these projects would allow in the area.

Another social effect is associated with the disruption to existing properties that will be associated with the widening of the Inner Harbor turning basin. The proposed alignment minimizes the overall social and economic impact of the disruptions (see analysis in Appendix M.1); however, limited disruptions are unavoidable. Two of the three affected property owners, the City of Alameda and a private property owner, have expressed concerns over the proposed impact to their property. The Port is working with the affected business to evaluate whether contemplated design modifications could minimize potential business disruptions. The U.S. Navy also owns property that may be affected, however, it has not expressed any concerns. Thus, Action Plan has both positive (increased safety for vessels) and negative impacts. The No Action Plan and Action Plan F were rated equally for this account.

5.0 SELECTED PLAN

5.1 CONSIDERATIONS IN PLAN SELECTION

Based on the evaluation of the action plans by the criteria specified in section 4.8 and resource accounts (section 4.9), the Action Plan is ranked superior to the No Action Plan. The Action Plan has the greatest net economic benefit. As a result, it has been designated the National Economic Development (NED) Plan. Action Plan F is also the selected Locally Preferred Plan (LPP). This chapter presents the Action Plan in detail, including the specifics of design, costs, benefits, and other related unique elements.

Final selection of the selected plan included a detailed impact analysis and evaluation of the Action Plan and the No Action Plan. The detailed environmental impact analysis of these alternatives is presented in the EIS/R. A summary of the impacts of the two alternatives (the Action Plan and the No Action Plan) by system of accounts is presented in Table 5.1. A discussion of the trade-off analysis of how each of these plans rate in terms of planning objectives and other specified evaluation criteria follows.

The action alternative with a channel depth of -50 feet MLLW maximizes NED benefits. Benefits are provided from the reduction in vessel light loading practices and reduction in vessel trips required to transport the same amount of cargo. No transportation benefits would be provided under the No Action Plan. Costs and related issues are discussed in detail in section 5.6.

The Action Plan results in environmental impacts which would not occur under the No Action Plan. These impacts are discussed in detail in the accompanying EIS/R. Primary impacts include short-term impacts on water quality and air quality during construction, impacts on air quality during operation, noise impacts during construction, temporary loss of benthic habitat due to construction, and a change in benthic habitat from shallow water habitat (i.e., -20 feet MLLW or less) to deep water habitat (i.e., greater than -20 feet MLLW) for a small area. The Action Plan would provide an environmental benefit through the creation of the Middle Harbor Enhancement Area, and potentially with beneficial reuse of the material for habitat restoration (e.g., use at the Hamilton Wetlands Restoration site or Montezuma Wetlands Restoration site [hereafter referred to as Hamilton and Montezuma, respectively]).

From the perspective of community and social well being, the Action Plan would provide benefits as compared to the current situation, i.e., the No Action Plan. The project-related improvements would help keep the Port of Oakland competitive in the maritime industry, which in turn would benefit the local economy.

The navigation improvements would minimize navigation safety issues for deep draft vessels using Oakland Harbor and Entrance channels, thus providing safer conditions for all users. The Action Plan would also provide benefits from a regional development standpoint. The maritime industry would be strengthened for the entire region making it more attractive to maritime-related industries, and fostering further connections with the Pacific Rim.

Table 5.1. Summary of Impacts by System of Accounts
Action Plan F and No Action Plan

Resource Category	No Action	Action Plan F
NATIONAL ECONOMIC DEVELOPMENT	No national economic development benefits	National economic benefits in the form of efficiencies of scale in transportation.
ENVIRONMENTAL QUALITY		
Air Quality	No change from existing condition.	Temporary impacts during construction and on-going operational impacts as a result of growth.
Biological Resources	No change from existing condition.	During construction: Temporary turbidity during construction and limited loss of eelgrass habitat. After construction: Extensive new shallow water habitat created at MHEA, and potential for significant habitat restoration project support at Hamilton or Montezuma.
Contaminated Waste	No change from existing condition.	Removal of up to 20,000 cy of contaminated sediment from the aquatic environment.
Cultural Resources	No change from existing condition.	If former Todd Shipyard determined NRHP-eligible, potential impact from Inner Harbor turning basin.
Geology/Soils/ Groundwater	No change from existing condition.	No change from existing condition.
Noise	No change from existing condition.	Potential exceedances of applicable noise ordinances during construction.
Recreation and Public Access	No change from existing condition.	No change from existing condition.
Seismicity	No change from existing condition.	Potential slope instability along wharf banks after deepening.
Surface Water Resources	No change from existing condition.	No change from existing condition.
Ground Traffic	No change from existing condition.	Increase in truck traffic, requiring mitigation at several intersections.
Vessel Traffic	Increase in number vessels with growth, leading to potential congestion.	Reduced increase in new vessels due to larger capacity vessels able to utilize Oakland Harbor.
Visual Resources	No change from existing condition.	No change from existing condition.
Water Quality	No change from existing condition.	Temporary turbidity effects during construction.

Table 5.1. Summary of Impacts by System of Accounts
Action Plan F and No Action Plan

Resource Category	No Action	Action Plan F
REGIONAL ECONOMIC DEVELOPMENT		
Employment/Labor Force	Stagnant maritime-related employment.	Slight increase in local employment during construction. Project will enable current employment levels to be maintained.
Business and Industrial Activity	Stagnant maritime-related commerce. Growth will be limited to any growth attainable from local economic growth.	Slight increase in maritime-related business activity.
Local Government Finance	No change from existing condition.	No change from existing condition.
OTHER SOCIAL EFFECTS		
Public Facilities/Services	No change from existing condition.	Relocation of BART anode cables and US Navy sewer line required.
Natural Resources	No change from existing condition.	Increased shallow water habitat at MHEA. Support for increased wetlands areas if Hamilton and Montezuma projects are available.

5.2 DESCRIPTION OF THE PLANS

5.2.1 General Design Considerations

The selected and locally preferred plan includes deepening and selective widening of the Entrance channel, Inner and Outer Harbor channel, and Inner and Outer Harbor turning basins (Figures 5.1a through 5.1e).

The design of general navigation features (GNF) was accomplished in accordance with Corps criteria, procedures, and standards to accommodate the actual and projected vessels calling at Oakland Harbor. The information on the vessels and their operations in the navigation channels was obtained from the vessel sponsors, shippers, and pilots.

5.2.2 Channel Design

The navigation improvements were designed using standard Corps criteria for one-way vessel traffic including:

1. EM 1110-2-1607, "Tidal Hydraulics."
2. EM 1110-2-1613, "Hydraulic Design of Deep Draft Navigation Channels."
3. ER 1110-2-144, "Deep Draft Navigation Project Design."

The channel designs also considered information obtained on actual operations in the Oakland Harbor, in addition to a hydrodynamic study (Appendix A.4), standard vessel squat criteria provided by the San Francisco Bar Pilots (see Appendix A.5), and the ship simulation for the design of the -42 foot Project (Appendix A.6).

5.2.3 Design Vessel

Vessels operating in Oakland Harbor vary from pleasure craft (power and sail boats) to large container ships. The channel design is based on providing safe passage for the largest, least maneuverable ships expected to call at Oakland Harbor in the foreseeable future. The main vessel characteristics considered for deep draft channel design are beam, draft, and length. Other important characteristics are maneuverability (including whether or not equipped with bow and stern thrusters), operating speeds, side surface area (sensitivity to cross winds), yaw, wave generation (wake), squat, and trim. Lesser characteristics related to this project are heave, pitch, roll, sway, and surge.

The design and dimensions of the project channels and turning basins are based on the largest deep draft vessel expected to be using the channels. This vessel is referred to as the "design vessel" and is defined as the most cost efficient vessel (or vessels) expected to call at Oakland on a predictable and economic basis. Existing shipping operations in Oakland Harbor were evaluated and the largest vessel for each type of operation was identified. This included identification by shippers of the largest vessels they anticipated using with improved channels.

Other factors considered included identification of the largest vessels currently used in comparable trades at the deeper draft ports on the west coast, and identification of the largest existing vessel used for handling the commodities currently transported in and out of the Oakland Harbor. As stated previously, the majority (greater than 95 percent) of the vessels calling at Oakland are container vessels.

Based on this analysis, the design vessel selected is the new "extended K-Class" (also referred to as S-Class) container ship, which is designed to carry in excess of 6,500 TEU.[1] Extended K-Class vessels have a 48-foot draft. Dimensions of the extended K-Class design vessel are: Length 1,139 feet, and Beam 140 feet.

5.2.4 Navigation Considerations for Channel Design

Channel depth is based on the economic optimization with required vessel underkeel clearances. Vessel bottom clearance factors considered for the semi-protected conditions of the Oakland Harbor include vessel squat, trim, and maneuverability.

Squat (also referred to as "dynamic sinkage") is the term for the hydraulic phenomenon associated with the lowering of the water surface immediately surrounding a vessel under way, thus causing the vessel to "sit" lower in the water than while the vessel is at rest. Based on criteria for the semi-protected channels considered in this study and the current vessel operating speeds, an allowance of 2 feet was selected for vessel squat. Squat is strongly dependent on vessel speed; the squat used in this analysis may understate the amount of squat experienced by some of the vessels entering the Oakland Harbor. As shown in Appendix A.5, at 10 knots (the speed at which vessels enter the Entrance Channel) a vessel with a block coefficient of 0.7 (the average block coefficient used in the Hydrodynamic Study) may experience as much as 4.6 feet of squat. The large container vessels enter the Inner Harbor channel at a speed of approximately 8 knots; at 8 knots, the squat requirement is still 2.9 feet.

No precise information on the effect of shallow water on steering was available, but it is generally recognized that a vessel becomes difficult to handle and requires large rudder angles when speed is reduced in shallow water. Winds, waves, and cross-currents are important factors included in vessel maneuverability concerns through the entrance to the Oakland Inner and Outer Harbors. Based on pilot recommendations and the safety requirements imposed by most shipping lines using the Oakland Harbor, an allowance of 2 feet has been made for maneuverability, pitching, and rolling of a vessel navigating the channels.

Trim recognizes the fact that to improve vessel handling, shippers are likely to load their vessels so that the stern sits slightly lower in the water than the bow. An additional clearance of 1 foot has been allowed for trim. The overall clearance allowed for the design vessel between the ship keel and the channel bottom in the semi-protected portion of the project is 5 feet, consisting of 2 feet of squat, 2 feet of underkeel clearance for safety and maneuverability, and 1 foot of trim. For ease of reference in the remainder of this document, this 5-foot requirement is referred to as "required depth in addition to design draft."

5.2.5 Channel Side Slopes

The current channel side slopes are roughly 1-vertical to 3-horizontal, and were developed in part by allowing natural sloughing of the banks after dredging. These slopes will have an acceptably high safety factor and are expected to perform well both statically and during strong seismic shaking. The stability of the side slopes is largely controlled by the presence of the Young Bay Mud, a fat and compressible, structurally

[1] TEUs (which stand for twenty-foot equivalents) are a measure of a vessel's capacity, and refer to the number of 20-foot equivalent units that a vessel could carry. Typical containers range in length from 20 feet to over 45 feet.

weak clay. In general, the proposed channel limits are set back far enough from the existing shoreline to accommodate the same 1-vertical to 3-horizontal slopes with the widening and deepening of the channels.

The geotechnical investigation has concluded that the shoreline slopes from Point Alameda to the Ferry Landing currently are marginally stable and are expected to perform poorly during a major earthquake. Significant impacts associated with the deepening and these marginally stable slope areas can be mitigated by relocating the channel limit approximately 25 feet to the north. To maintain the desired 750-foot channel width, the Port's Berth 55-58 project has been located to accommodate this channel line relocation.

The existing shoreline along the portion of the Inner Harbor turning basin is also expected to perform poorly during a major seismic event. The proposed deepening of the turning basin would require significant excavation in order to provide more stable 3:1 sideslopes. Bulkhead walls could be used to reduce the amount of excavation required and would improve the stability of this section of shoreline.

In all other areas of the project the proposed new slopes are expected to perform well, under both static and seismic loading. The new bank along the Port's Berth 55-58 project will be designed and constructed in accordance with Port of Oakland seismic design criteria.

5.2.6 Design Of Channels

The following are the feasibility level design features of the Selected Plan:

(1) The Entrance channel would be deepened to -50 feet MLLW plus overdepth, with widening on the north side of the channel beginning at the west end of the channel to the east end of the entrance channel (maximum width of 1, 000 feet, tapering to the existing width of 900 feet at the eastern end).

(2) The Outer Harbor channel would be deepened to -50 feet MLLW plus overdepth along its entire length. Limited widening is planned for the Outer Harbor channel to accommodate the wider turning basin.

(3) The Outer Harbor turning basin would be deepened to -50 feet MLLW plus overdepth, and enlarged to a diameter of 1,600 feet to accommodate the design vessel.

(4) The Inner Harbor channel would be deepened to -50 feet MLLW plus overdepth along its entire length, with widening along the northern boundary, from approximately mile 40+00 (the center of the mouth of the Middle Harbor) to mile 135+00 (the western boundary of the APL terminal). Widening would straighten the channel alignment from the entrance to the Inner Harbor to the western end of the APL terminal. This would provide a channel width of 750 feet at the western end of the Port's planned new Inner Harbor marine terminals. No widening is planned for the Inner Harbor channel east of the APL terminal.

(5) The Inner Harbor turning basin would be deepened to -50 feet MLLW plus overdepth and widened from 1200 feet to 1500 feet. The widening would occur on the southern end of the existing turning basin to minimize the taking of land and economic impact on business operations adjacent to the turning basin. The other options considered (see Appendix M) created significantly greater negative

economic effects and in all cases but one also involved substantially more dredging and excavation with associated higher construction costs.

5.2.7 Local Service Facilities

In addition to providing commensurate depths at the Port berths, significant work will have to be done to the berths in order to maintain their structural performance after berth deepening. All the berths within the Port area, with the exception of Berths 20, 21, 34, 38, and 40 (none of which are expected to have large vessels calling there), are planned for deepening. Berths 20 and 21 are being used by Sealand, which currently utilizes a variety of vessel sizes at their facility in the Oakland Outer Harbor. Their smaller vessels can call at Berths 20 and 21, while the deep draft vessels can call at their Berth 22, which will be deepened.

5.3 DISPOSAL SITES

The estimated volume of dredged material to be removed under the NED/LPP Plan is 12.8 mcy. As explained in section 4.4.1, the sediment to be dredged was divided into five categories. The classifications were determined based on the chemical concentrations detected in the sediment and the leachability potential for materials with elevated levels of chemicals. The sediment testing is discussed in detail in the EIS/R (see section 3 and Appendix H). The locations of the potential reuse/disposal areas are shown in Figure 4.4.

As explained in section 4.4.2, there is a preferred order for using the various reuse/disposal sites. The MHEA is considered the first choice because it results in the creation of habitat, is close to the dredging area, is cost-effective, and can accept a large quantity of dredged material. The Vision 2000 Upland Area ranks second; it also provides beneficial reuse for dredged material, is very close to the dredging area, and is cost-effective. The Hamilton and Montezuma Wetlands Restoration projects rank third and fourth, respectively; they provide environmental restoration benefits, but require longer transport distances. The Montezuma site is located much further away from the project location than Hamilton, and thus likely to be less cost-effective. In addition, the increased transportation distance also increases air quality impacts, which are potentially significant impacts for the proposed project. Finally, SF-DODS and Various Landfills rank fifth, because these options are strictly disposal options, and do not provide for any type of reuse. If other nearby beneficial reuse/disposal sites (e.g., New Berth 21 or Former NAS Alameda Construction Fill) become available in time for the construction of the project, they would take precedence over disposal at SFDODS. Thus, within the constraints of sediment quality, sediment generated by the proposed project would be reused or disposed of in the order of preference listed.

5.3.1 Middle Harbor Enhancement Area

The Middle Harbor Enhancement Area (MHEA) can accept SUAD, wetland cover, and wetland non-cover material. The estimated total capacity of the MHEA is 7.0 mcy. Wetland non-cover and wetland cover quality material will be reused preferentially at the MHEA. With the NED Plan, the MHEA would receive approximately 1.5 mcy of wetland non-cover material and 5.5 mcy of SUAD/wetland cover material.

5.3.2 Vision 2000 Upland Area

The Vision 2000 Upland Area can accept SUAD, wetland cover, and wetland non-cover material, and construction fill (untreated or treated fill). The material would first be dried to a minimum of 50 percent solids, and then placed by conventional earthmoving equipment. If necessary (i.e., if required as part of a regulatory agency permit), the dried material may be treated with lime or a similar material to reduce the solubility of leachable compounds.

The estimated capacity of the Vision 2000 Upland Area is 2.5 mcy. Construction fill will be reused preferentially at the Vision 2000 Upland Area. With the NED Plan, the Vision 2000 Upland Area would receive up to 320,000 cy of construction fill and 180,000 cy of wetland non-cover material. The remaining capacity of the site would be used to accommodate material from the bank cut completed as part of the Berth 55 - 58 project, which is separate from the channel deepening project.

5.3.3 Hamilton Wetlands Restoration Site

The Hamilton Wetlands Restoration site is slated to receive SUAD material only, including wetland cover material. Excess SUAD material from the proposed project would be hauled to the Hamilton Wetlands Restoration site, if the site is available during construction. With the NED Plan, approximately 5.2 mcy would be available to be placed at Hamilton. The Hamilton Wetlands Restoration site is the planned, preferred location for the disposal/reuse of the 5.2 mcy of SUAD material.

5.3.4 Montezuma Wetlands Restoration Site

The Montezuma Wetlands Restoration site is slated to receive SUAD material and small amounts (less than 33 percent) wetland non-cover material. Excess SUAD material from the proposed project could be hauled to the Montezuma Wetlands Restoration site, if the site is available during construction, disposal/reuse is cost-effective compared to SFDODS, and the closer Hamilton site is not available. With the NED Plan, up to 5.2 mcy of SUAD material would be available to be placed at Montezuma. However, as noted earlier, air quality impacts associated with longer transportation distances must be evaluated carefully prior to making the decision to transport dredged materials to Montezuma.

5.3.5 San Francisco Deep Ocean Disposal Site

Excess SUAD material would be hauled to the SF-DODS. The suitability of the material for disposal in the ocean was determined based on sediment sampling and testing which was performed in 1997. Dredged sediment may be hauled to SF-DODS if the Hamilton or Montezuma wetlands restoration projects are not available on a timely basis or are not cost-effective. With the NED Plan, the dredged material that would have to be disposed of at SF-DODS is the balance of the 5.2 mcy remaining after providing material to Hamilton or Montezuma. SFDODS does not provide beneficial reuse of dredged material.

5.3.6 Various Landfills

Material that is not suitable for use as construction fill would be sent to a landfill. Based on the sediment sampling and analytical testing performed to date, the total quantity of material likely to be transported to a landfill is not expected to exceed 100,000 cy, including debris (which is expected to be encountered during the construction of the Inner Harbor turning basin).

5.4 DREDGING PLAN

As a part of the related Port maritime development project (the Vision 2000 project), the northern bank of the Inner Harbor channel will be excavated and dredged to widen the channel. The new berths are designed to accommodate berth depths as deep as -55 feet MLLW, but will initially be dredged to a depth of -44 feet (plus 2 feet overdepth), consistent with the current -42 feet MLLW channel depth. The area between the new berths and the existing channel will be excavated to a depth of -42 feet (plus 2 feet overdepth). The Selected Plan will relocate the channel line to include this area. The new berths will deepened commensurate with the Selected Plan. The material from the bank excavation will be reused in the maritime development program as fill for the Port's berths 55 - 58 project (both aquatic fill and upland fill). This creates the opportunity for contaminated sediments (e.g. the Inner Harbor turning basin) to be contained within the Berth 55 - 58 construction fill.

Therefore, the first item of work for the proposed channel deepening project would be the construction of the Inner Harbor turning basin. A clamshell or excavator-type dredge would be used to construct the basin. Following demolition of the obstructing wharves and construction of the necessary bulkheads, the turning basin would be dredged and excavated. The dredged material will be transported via scow to the Port's Vision 2000 construction site and off-loaded there with a second clamshell rig.

The second item of work would involve the construction of the MHEA. An armored dike would be constructed along the edge of the new channel at the mouth of the Middle Harbor. It would likely be constructed by bottom dumping and/or using a flat barge and pushing off with a bulldozer to deliver the material for the structure. Because portions of the structure will be constructed to elevations above mean sea level, the final phase of construction would require a crane-mounted barge to place the top surface of rock. The first phase of dredging of the channels would involve using a clamshell or excavator dredge to remove the softer Young Bay Muds (YBM) which have been determined to be suitable for placement as Wetland Non-Cover (WNC). The WNC material would be transported via scow and bottom dumped into the MHEA to create subbottom contours to support the MHEA creation (including internal containment structures). A detailed plan for placement will have to be designed to provide the correct contours to accomplish the design of the MHEA. Two clamshell rigs could operate in different areas of the channel to dredge simultaneously during this phase with a total production estimated at 10,000 cy/day.

Upon completion of the dredging for the WNC material, a cutterhead dredge would be utilized to dredge the deeper depths of the channels, starting with the Inner Harbor. The cutterhead dredge would discharge directly into the MHEA. Following placement of the soft mud, sands would be placed carefully over the mud to reduce resuspension of these soft sediments. Resuspension of soft sediments could result from displacement caused by placement of the sands. Careful spreading of the sands could include either moving the discharge from a hydraulic dredge (with a diffuser to spread the material and facilitate low energy settling of the slurry) around the site or the careful placement of the sands from bottom-dump scows (i.e., in thin passes). If there is insufficient volume of material to be dredged from the Inner Harbor to complete the MHEA, a portion of the sediments from the Outer Harbor channel would also be dredged and placed in this manner.

The balance of the channel dredging would be done with clamshell or excavator dredges placing the material into scows for transport to the Hamilton Wetland Restoration site. If Hamilton is unavailable or use of the site is not appropriate for any reason, the material may be taken to the Montezuma site. If Montezuma is unavailable or use of the site is not appropriate for any reason, the material may be taken to SF-DODS. Off-loading at Hamilton or Montezuma would be accomplished with the use of unloading pump operations similar to the operation used at the Sonoma-Baylands site. Disposal at SF-DODS would be done by bottom dumping. Two to three dredges could operate simultaneously, with the number of available scows being the limiting factor in the number of dredges operating. A fleet of 3 scows per dredge is considered efficient for this type of operation.

A small quantity of material from the berths to be dredged was found to be not suitable for unconfined aquatic disposal and would have to be contained together with the turning basin material in the Port's Vision 2000 Upland site. The remainder of the berth dredging would utilize clamshell or excavator dredges with placement at either Hamilton, Montezuma or SF-DODS, as indicated above.

The preferred method for deepening and widening the Oakland Harbor and Entrance channels is dredging by clamshell dredge or by hydraulic cutterhead dredge. The Entrance and Inner and Outer Harbor channels are all located in relatively protected areas that allow the use of fixed plant operations. Fixed plant operations also allow the use of electric dredges, which will likely be required by the project to avoid significant air quality impacts. Electric dredges would also benefit the project by reducing construction-related noise.

The clamshell dredge would be used for softer Young Bay Muds, both to reduce the volume of water diluting the clayey material, and to minimize potential water quality impacts due to dispersion of sediments. The Young Bay Muds typically contain the highest concentrations of contaminants and, as such, the control afforded by the clamshell dredge is highly desirable. The clamshell dredge would be used for the Inner Harbor turning basin, Inner and Outer Harbor berths, and shallow widening areas. Using a three-shift operation, daily production rates are estimated at 2,000 to 5,000 cy.

The hydraulic cutterhead dredge would be used for the bulk of the dredging operations. The hydraulic cutterhead dredge evolved from mining (tunneling) equipment and, as such, is especially well suited to the cemented Merritt Sands that proved difficult to dredge during the -42 foot project. The hydraulic cutterhead dredge has an integral pumping system/pipeline that can be used to deliver dredged material directly to a local reuse/disposal site, thereby reducing air quality impacts and costs. The density of the sands and the depth of dredging requires using a cutterhead dredge with a minimum pipeline size of 26 inches. The pipeline would be sunk to the bottom of the channel to avoid interfering with vessel traffic. If necessary, a narrow trench could be dug to below -42 feet MLLW for the pipeline. Using a 3-shift operation, estimated production rates are on the order of 32,000 cy per day.

5.5 OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance dredging of the Federal channels is generally the responsibility of the Federal government. However, pursuant to WRDA 86 the additional cost to perform maintenance dredging below a depth of -45 feet MLLW is shared equally with the non-

Federal sponsor (i.e., the Port). The process used to estimate the O&M dredging quantities is outlined below and described in detail in Appendix B.3. Other maintenance requirements include initial operation and monitoring of the MHEA.

5.5.1 Estimated Operations and Maintenance Dredging Quantities

The historical records of maintenance dredging for the Federally Authorized channel at Oakland Harbor were analyzed to determine if previous changes in the dimensions and depths or the channel have caused changes in the rate of shoaling. There is an extensive period of record showing the quantities of maintenance dredging material removed from the Federally authorized channel at Oakland Harbor. The complete period of record is from 1931 to 1997. In this time frame, there have been three occasions when there was a significant change in the Federally authorized channel. One was in 1931, one in 1942, and one in 1974-1975.

There has also been a significant change beginning in 1991. Since 1991, the preponderance of dredging at Oakland has been the result of new work. Only one year of data exists for maintenance dredging requirements for the Outer Harbor since 1991. This consists of recent volume calculations of the -42 foot Outer Harbor project resulting from a year of shoaling. Results of condition surveys conducted in March 1998 indicate that only 210,000 cy (including advance maintenance and overdepth) are required to be dredged.

The period of record was broken down into three segments. Each segment represents a period following an event of significant change. During each period, there was no recorded change in the depth or width of the authorized project until the next event of significant change. The three periods are 1932 to 1941, referred to as "Period A," 1943 to 1973 referred to as "Period B," and 1976 to 1991 referred to as "Period C." The years between segments are years in which new work construction occurred.

During Period A, the average dredging quantity was 304,758 cy and during Period C it was 373,134 cy. However, during Period B the average annual dredging was 700,116 cy. The greater depth of -35 feet in the Outer Harbor than the -30 feet in the Inner Harbor, could have resulted in a sediment trap situation in the Outer Harbor. Under the recommended project plan both the Inner and Outer Harbor will be at the same depth, and the sediment trap situation will not exist.. Therefore, the post project condition will more closely approximate Period A or Period C than Period B.

The analysis suggests that the recommended -50 foot deepening of both the Inner and Outer Harbor together will result in a modest increase in the shoaling rate. The analysis suggests that the shoaling rate for the authorized Oakland Harbor project as a whole is relatively constant when the Inner and Outer Harbors are maintained at the same depth. However, when the Outer Harbor is deeper than the Inner Harbor, the shoaling rate greatly increases. Alternatively, some of the higher volumes in Period B may have been associated with dredging to support war-time efforts and/or the practice of side-casting dredged material.

Based on the preceding analysis, the future maintenance dredging required for the recommended plan to deepen the Inner and Outer Harbors was estimated by comparing Period A (1932 through 1941) with Period C (1976 through 1991). During Period A, the Inner and Outer Harbors were both maintained at a depth of -30 feet. During Period C both the Inner and Outer Harbors were maintained at a depth of -35 feet. The average annual maintenance dredging increased by approximately 70,000 cubic yards when the depth increased by 5 feet. Therefore there was an average increase of 14,000 cubic yards per foot of increased depth.

The alternatives for the proposed channel deepening project were evaluated for optimization of costs and benefits and cost sharing based on an increase in maintenance dredging of 14,000 cubic yards per foot of added depth. Thus, it is estimated that the annual increase in maintenance dredging for the NED Plan with a depth of -50 feet MLLW would be approximately 112,000 cy. The cost to move this material to Alcatraz Airfield is estimated to be $3.05 per cubic yard. The annual incremental dredging cost would be $411,000 (including a 20 percent contingency). Similar calculations were performed for all the alternative dredging depths, and the results used in the optimization analysis presented below. It must be clarified that these volumes are only estimates, and that actual shoaling rates are expected to vary significantly from year to year, depending on rainfall. In addition, the average shoaling rates may vary significantly from these projections.

Section 101(b) of WRDA 86 requires that the "..Federal interests shall be responsible for an amount equal to 50 percent of the excess cost of operation and maintenance for such project over the cost which the Secretary determines would be incurred for the operation and maintenance of such project if such project had a depth of 45 feet." Thus, under section 101(b) the Port of Oakland as the local sponsor is responsible for 50 percent of the incremental annual O&M dredging cost for depths in excess of -45 feet MLLW. The excess for O&M dredging beyond -45 feet MLLW is estimated to be approximately $260,000 per year for dredging approximately 70,000 cy per year.

5.5.2 Operations and Maintenance During Construction

During the 4 to 5 year construction period for the proposed project, it is anticipated that shoaling will occur in the channels being dredged. This same situation led to substantial construction claims during the construction of the -42 foot project. Therefore, the operations and maintenance program for the Oakland Inner and Outer Harbor channels should be closely coordinated with the deepening project.

5.5.3. Operation and Maintenance of Disposal/Reuse Sites

Under the proposed plan, dredged materials will be delivered to the MHEA and the Hamilton Wetlands Restoration site. The distribution and site management costs associated with placement of dredged materials at Hamilton will be borne by the Hamilton project. Costs for monitoring the MHEA (for a 10-year period) have been included in the project costs. Project costs also reflect project costs associated with planting and other initial habitat management efforts. Monitoring of the MHEA is required to confirm hydrodynamic modeling, and track consolidation and subsidence curves to predict final site elevations. Water quality, bathymetry, current velocities, and tidal range data, as well as biological colonization of the created habitat areas would be used to verify modeling and direct any necessary minor adjustments in the final designs to maximize potential success in the habitat design.

5.6 PROJECT ECONOMICS

The following section describes the derivation of the costs and benefits used in the analysis leading to determination of the optimized National Economic Development (NED) Plan. The section also presents the rationale for and determination of the required cost sharing between Federal Government and the Port of Oakland.

The NED Plan is defined as the plan which makes the greatest net contribution to National Economic Development. The NED account used in the evaluation of alternatives, addresses that part of the National Environmental Policy Act, as defined in 40 CFR 1508.4 that identifies beneficial and adverse effects to the economy. The NED Plan is the plan which maximizes the net benefits of an alternative. The average annual benefits less the average annual costs are greatest for the NED Plan.

In this study, the NED Plan has been determined to be the plan which dredges the selected layout for channels and turning basins to a depth of -50 feet MLLW. The LPP is also the plan which dredges the channel to a depth of -50 feet MLLW.

5.6.1 Cost Estimate Assumptions

Cost estimates for the alternative plans considered are based on April 1998 price levels, using costs developed by the Port of Oakland specifically for this project, as well as recent information on contractor bids for other construction projects conducted by the Corps. The cost estimates include contingencies for each cost item based on an analysis of the accuracy of information used for the design and costs. Contingencies assigned to the various cost items ranged from 0 percent to 25 percent. The cost estimate includes the estimated cost for engineering and design as well as supervision and administration of construction.

The cost estimate assumes that the Contractor will be working 24 hours a day in 3 8-hour shifts, 7 days a week. It is anticipated that dredging would be performed by a combination of clamshell dredges and a hydraulic cutterhead dredge. For dredged material designated for construction of the MHEA, dredged material would be placed either directly by pumping through a pipeline from the face of the hydraulic cutterhead dredge, or by bottom dumping material from scows filled by clamshell dredges. Approximately half the material in this area would be placed by bottom dumping, and half would be placed by pumping.

For dredged material designated for upland disposal at the Vision 2000 Upland Area, the dredged material would be placed in scows by a clamshell dredge, transported as close to the upland area as possible, and then placed directly on land by another clamshell dredge. Material would be delivered at a minimum of 50 percent solids, and can therefore be dried in place. For dredged material designated for any off-Port habitat restoration or creation project (e.g., Hamilton or Montezuma), barges would transport the material to designated off-loading point for the facility. For material designated for ocean disposal, barges would transport the dredged material to SF-DODS, then bottom dump the material. Finally, for contaminated sediment to be disposed of at local landfills, the material would be dredged by clamshell and delivered via scows to a lined rehandling facility located on the Vision 2000 Upland Area. The material would be off-loaded using a second clamshell dredge, and will be dried to approximately 70 percent solids using conventional earth-moving equipment. Decant water and any stormwater run-off would be captured in an adjacent lined cell, and discharged under permit after being tested appropriately. Once the sediment has dried sufficiently, it would be loaded onto trucks or rail cars for transport to the designated landfill(s).

Mobilization and demobilization is based on the preparation, transfer, set-up, and removal of required plant and equipment. The estimate assumed that mobilization of the cutterhead dredge would require approximately 14 days. The pipeline associated with the hydraulic cutterhead dredge would be placed in a trench dug below the existing channel bottom, to protect it from passing vessels. In addition to the creation of a trench, the pipeline requires delivery, setup, and removal.

Clamshell dredges and scows are readily available. The estimated mobilization/ demobilization time for clamshell dredges is 14 days. Up to two clamshell dredges may be used simultaneously on this project. An additional 2 days of mobilization/ demobilization time will be required to prepare and set up the dredge. The estimated mobilization/demobilization time for scows is up to 10 days (i.e., they are all expected to be mobilized from the West Coast). The estimate assumes that 6 scows will be required. The necessary trucks or rail cars to transport dredged material to landfills can be mobilized within 7 days. The dredging may have to be completed with electric dredges. In that case, the time required to retrofit the equipment may extend the mobilization period significantly.

The hydraulic cutterhead dredging plant consists of a self-propelled, 27-inch diameter cutterhead dredge and pipeline. The hydraulic cutterhead dredge has a total combined rating of 10,000 horsepower to operate the cutterhead, ladder pump, and, if required, booster pump (depending on the distance that sediment will be pumped). A standard 21-cy clamshell dredge has a 2,200 hp power plant. Both the hydraulic cutterhead dredge and the clamshell dredge(s) will be accompanied by a survey boat and tender tugs, as needed. The survey vessel is assumed to be equipped with 340 horsepower and all necessary hydro-surveying equipment.

Aids to navigation work would involve moving the aids to navigation installed at the Inner Harbor turning basin as part of the -42 foot project and the light that will be removed as part of the MHEA levee construction. The Port and Corps currently do not anticipate that further aids to navigation will be required. The proposed Inner Harbor turning basin widening will result in a turning basin that is larger relative to the design vessel than the Inner Harbor turning basin designed for the -42 foot project. Nonetheless, ship simulation studies will determine whether further aids to navigation are required.

The potential costs associated with the use of electric dredges are reflected in the use of a higher contingency factor (25 percent compared to the standard 20 percent) for Navigation, Ports, and Harbors costs calculated in the MCACES. The cost differential associated with this increase in contingency is approximately $4,500,000.

Delivery times to the various reuse/disposal sites will depend on the distance and equipment used to transport material to the site. SF-DODS is located approximately 50 nautical miles west of the Golden Gate Bridge in over 8,000 feet of water. The distance from the project site to SF-DODS is 58 nautical miles. The MHEA is located within the project area. Much of the material to be reused at MHEA would be placed directly by the hydraulic cutterhead dredge; barge travel time to the MHEA is expected to be minimal. The MHEA is approximately 190 acres in size, and would be used to develop shallow water habitat. Materials placed in this area could have a dual purpose: they will serve to create the shallow water area, and could also serve to cap contaminated sediments associated with former Navy operations.

Delivery to Hamilton or Montezuma, or any other habitat restoration or creation project outside of the Port area, is currently expected to be similar to the use of any other multi-user site: i.e., the material would be delivered to a designated location, and the local project sponsor for the habitat restoration/creation project would determine where on the facility the material would be placed. The Hamilton site is located 15 miles north of the project area, and the Montezuma site is located 27 miles northeast of the project area.

The Vision 2000 Upland Area is located within the project area. Barge travel time to the Vision 2000 Upland Area is expected to be minimal. The Vision 2000 Upland Area upland reuse site would utilize approximately 31 acres of land to receive construction fill which is not suitable for any form of aquatic disposal. A rehandling facility for contaminated material to be transported to local landfills may also be constructed at the Vision 2000 Upland Area, or at other areas at the former FISCO. The rehandling facility would require construction of the appropriate containment cells, a weir structure to control decant water and stormwater, and earthmoving equipment to help move the sediment to dry it more quickly. A liner may also be required when the more contaminated sediments are being handled.

As indicated earlier, up to 100,000 cy of contaminated sediment may be transported to a landfill. The material would first be dried at a rehandling facility located on the Vision 2000 Upland Area. Once dried to approximately 70 percent solids, the material would be loaded onto trucks or rail cars using conventional earthmoving equipment. Depending on the degree of contamination encountered, the material may either be disposed of in local (Bay Area) landfill, or will be shipped to a landfill in Utah.

Other assumptions used in the cost estimate include:

• Dredged Material (by Convention):	50% sand/silty sand 50% clay
• Dredge Depth Required Overdepth:	1 foot
• Dredge Depth Tolerance:	1 foot
• Dredge Rate: (Clamshell)	2,000 to 5,000 cy/day
(Hydraulic Cutterhead)	30,000 to 34,000 cy/day
• Travel Time to SF-DODS (round trip):	20 hours
• Available Hours Per Dredging Day:	24 hours/day
• Effective Time:	65%
• Monthly Ownership:	12 mo/yr[2]
• Contingencies:	0% to 25%, as appropriate
• Mobilization/Demobilization (Total)	$2,950,000
• Preconstruction Engineering and Design	$570,000
• Construction Supervision/Administration	$4,370,000

Project costs to be borne by the local sponsor include relocation of up to four BART tube anode cables (estimated cost: $1,620,000), and the deepening (relocation) of the sewer line running across the Inner Harbor from Alameda to Oakland (estimated cost: $2,660,000),. The costs of relocating these facilities would be shared 50 - 50 between the Port as NFS and the owner of the facilities assuming they are deep draft public utilities at the time they are required to be moved. In addition, the Port would bear the costs of deepening and other necessary modifications to the berths in the Inner and Outer Harbors (i.e., local service facilities).

Project cost estimates for various dredging depths are provided in Appendix B.2 (MCACES Summaries) and are summarized in Table 5.2.

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[2] Note that this assumption (65 percent utilization for 12 mo/yr) is consistent with the Corps Equipment Manual EP 1110-1-8, which assumes a 9 mo/yr continuous (100 percent) utilization.

TABLE 5.2. Summary of Dredging Volumes and First Costs

Dredging Depth	-45 feet (d)	-48 feet	-49 feet	-50 feet
Total Dredging Volume (cubic yards) (a)	5,703,000	9,931,000	11,362,000	12,794,000
Total GNF	$76,715,000	$112,797,000	$114,208,000	$115,138,000
Total LERR	$16,756,000	$17,179,000	$17,179,000	$17,179,000
Total Local Service Facilities	$9,723,000 (e)	$41,086,000	$42,041,000	$43,128,000
Other Costs (b)	$418,000	$575,000	$626,000	$678,000
Total Project First Costs (c)	$93,889,000	$171,637,000	$174,054,000	$176,123,000

Note:

(a) Total dredging volume includes material from Inner Harbor turning basin that requires confined disposal, and one foot required overdepth and one foot of tolerance.

(b) Aids to navigation and O&M dredging during construction

(c) Before escalation to mid-point of construction

(d) Using -45 foot MLLW increment of -50 foot MLLW project plan

(e) Most Port berths are already dredged to -46 feet MLLW. Only Port Berths 32 and 33 will require retrofit if the channel is deepened to -45 feet MLLW.

5.6.2 Description of the NED Plan

The NED Plan consists of deepening Oakland Harbor and the Entrance channel to a depth -50 feet MLLW, with 2 feet combined of overdepth and tolerance. An estimated 12.8 mcy would be dredged. As stated earlier, approximately 7.0 mcy would be deposited at the MHEA, 500,000 cy would be reused upland at the Vision 2000 Upland Area, and up to 5.2 mcy could be used for wetland restoration at Hamilton or Montezuma (if available and cost-effective). Alternatively, the excess material would be disposed of at SF-DODS. Up to 100,000 cy may also be taken off-site to a landfill.

The scheduled construction start date for the NED Plan is February 2000. The construction midpoint date is April 2002. Dredging for the NED Plan would require approximately 48 to 54 months, including mobilization and demobilization.

5.6.3 Project Costs for the -45 Foot Plan

The quantity and cost estimate for dredging to a depth of -45 feet MLLW is presented in Table 5.2 and Appendix B.2. The estimated costs are for the -45 foot MLLW increment of the NED Plan. The information in Appendix B.2 was used in the calculation of cost sharing between the Federal Government and the Port of Oakland (see section 5.6.8, Cost Apportionment, and section 5.6.9, Cost Sharing). The rate of cost sharing for GNF changes at -45 feet. Above -45 feet the rate is 75 percent Federal, 25 percent non-Federal; below -45 feet the standard rate for cost-sharing is 50 percent Federal, 50 percent non-Federal, down to the depth of the NED Plan.

5.6.4 Project Economic Benefits

Appendix A.7 to this Feasibility Report presents the economic analysis used to estimate the benefits resulting from deepening the Oakland Harbor and Entrance channels. The benefits consist primarily of the transportation savings and the reduction in shoreside operating costs associated with tidal delays. Additional impacts such as the reduction of risk of vessel grounding are recognized, but were not quantified for this analysis. The benefits are based on a comparison of the differences in estimated costs for vessel operations under "with" and "without" project conditions.

For the benefit and optimization analysis, the benefits resulting from alternative depths of dredging must be compared under the same projections of future conditions. All projections of future conditions are to some extent uncertain and dependent upon factors including the opinions of those making the projections. The benefit projections are summarized in Table 5.3. The benefits are calculated at the discount rate of 7 1/8 %, which is the statutorily correct rate for calculations in Federal fiscal year 1998.

The benefits were computed within the context of a multiport analysis. The existing and projected future "with" and "without" project operations of the vessels that use Oakland Harbor were examined and incorporated into the analysis. The economic analysis assumed that there will not be a significant shift to competing ports under the No Action Plan, because most of the cargo brought to Oakland is locally produced or consumed. Another important issue considered in the analysis is whether carriers would consider servicing Bay Area customers by rail or truck from another West Coast Port. This concern is prompted by carriers that have sailing rotations that "straddle" the Bay Area, i.e., that call at Southern California and Pacific Northwest ports. However, given the lack of sufficient land-side transportation resources, and the large Bay Area

TABLE 5.3.
AVERAGE ANNUAL BENEFITS

Dredging Depth	Average Annual Benefit
-45	
-46	$148,761,000
-47	$157,268,000
-48	$160,571,000
-49	$177,204,000
-50	$178,046,000

population, it is unlikely that carriers would reroute cargo entirely.[3] Nonetheless, the Port's operating experience leads it to believe that shippers will modify their fleet mixes based on the depth of the channels.

Two benefit categories were developed for the Oakland Harbor economic analysis: Economies of Scale and Tidal Delay Reduction. Economies of scale reflect the reduced cost of transporting more containers per vessel, with a resulting reduction in the number of trips required. Tidal delay reductions reflect the costs associated with keeping a vessel at sea or at berth while waiting for sufficient water depth for safe passage.

5.6.5 Calculation of Average Annual Costs

The determination of the NED Plan is based on a comparison of average annual benefits and average annual costs. The average annual costs are computed for a project life of 50 years and an interest rate determined by stature. The interest rate currently applicable for Federal Fiscal Year 1998 is 7 1/8 percent. The interest rate is used to calculate the cost of interest during construction, to reflect the cost of the money used for construction. The calculations are based on a 4.5-year construction period and with equal quarterly payments. The present worth of the interest during construction costs is determined and added to the total estimated first cost of construction. This cost is used to calculate an average annual cost, or annualized first cost. Estimated costs for operation and maintenance of the completed project (calculated in the manner discussed previously) are added to the annualized first costs, for a total average annual cost for each alternative depth of dredging for the selected layout of channels and turning basins. The calculation of total average annual costs is shown in Table 5.4.

5.6.6 Calculation of Net Benefits and Benefit to Cost Ratios

The calculation of net benefits (average annual benefits in excess of average annual costs) and benefit to cost ratios (average annual benefits divided by average annual costs) are provided below and summarized in Table 5.5.

The benefit/cost ratio for the NED Plan with a -50 foot MLLW channel depth is 12.6 to 1. This B/C ratio is the ratio of the annual benefits, $178,046,000 (rounded), to the annualized cost (including interest during construction) of $14,088,000 (rounded). Net Annual Benefits are $163,958,000 (rounded).

5.6.7 Determination of NED Plan

The NED Plan is defined as the plan which makes the greatest net contribution to National Economic Development. The NED Plan is the plan which maximizes the net benefits of an alternative. The average annual benefits less the average annual costs are greatest for the NED Plan. Table 5.5 shows that the NED Plan is the -50 foot MLLW dredging depth alternative.

As is also shown on Table 5.5, the difference in net annual benefits between the -49 foot MLLW depth plan, and the NED plan is only approximately $681,000. However, this

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[3] Nonetheless, as shown in the letters from carriers also provided in Appendix A.7, this assumption contradicts the position of certain carriers, who are unwilling to bring the sixth generation vessels into Oakland unless the channel is deepened to -50' MLLW. Thus, assuming that the percentage of large vessels brought into Oakland correlates linearly with channel depth likely overstates the benefits from large vessels achievable at shallower depths.

TABLE 5.4. AVERAGE ANNUAL COSTS

Dredging Depth	Estimated First Costs	Interest During Construction (a)	Total Investment Cost	Annualized Investment Cost (b)	Annual O&M (c)	Total Average Annual Costs
-45	$103,619,000	$5,461,000	$109,080,000	$8,029,000	$154,000	$8,183,000
-46	—	—	—	—	—	—
-47	—	—	—	—	—	—
-48	$171,637,000	$9,045,000	$180,682,000	$13,300,000	$308,000	$13,608,000
-49	$174,054,000	$9,173,000	$183,227,000	$13,487,000	$360,000	$13,847,000
-50	$176,123,000	$9,282,000	$185,405,000	$13,648,000	$411,000	$14,059,000

Notes:
(a) Escalation Factor = 1.0527
(b) Cost Recovery Factor (7 1/8% and 50 years) = 0.07361
(c) Based on $3.06/cy placement cost (plus 20% contingency) at Alcatraz

TABLE 5.5. ANNUAL NET BENEFITS

Dredging Depth	Total Investment Cost (a)	Annual Investment Cost (b)	Annual Benefit	Annual Net Benefit	Benefit/Cost Ratio
-45	$109,080,000	$8,029,000			
-46	—	—	$148,761,000	—	—
-47	—	—	$157,268,000	—	—
-48	$180,682,000	$13,300,000	$160,571,000	$147,271,000	12.07
-49	$183,227,000	$13,487,000	$177,204,000	$163,717,000	13.14
-50	**$185,405,000**	**$13,648,000**	**$178,046,000**	**$164,398,000**	**13.05**

Note:
(a) Escalated to mid-point of construction
(b) Cost Recovery Factor (7.125% and 50 years) = 0.07361

incremental annual benefit is achieved for an incremental first cost (including escalation to mid-point of construction) of only $2,178,000. In addition, the incremental annual cost (including incremental O&M dredging) is only $212,000, leading to a B/C ratio of 3.2:1 for the incremental dredging depth, with an overall B/C ratio of 13:1. Thus, choosing the -50 foot MLLW depth plan as the NED Plan is fully justified by the project economics.

5.6.8 Cost Apportionment

The proposed apportionment of first costs between the Federal Government and the Port of Oakland for the recommended plan is in accordance with Section 101 of WRDA 86 and Section 210 of WRDA 96, which requires non-Federal interests to provide the following:

(1) 25 percent of the cost of construction of the portion of the project which has a depth in excess of 20 feet, but not in excess of 45 feet; plus

(2) 50 percent of the cost of construction of the portion of the project which has a depth in excess of 45 feet.

(3) An additional 10 percent of the cost of construction of the project in cash over a period not to exceed 30 years, at an interest rate determined pursuant to §106. The value of lands, easements, rights-of-way, relocations, and dredged material disposal areas provided may be credited toward this payment, except that for deep draft harbors (deeper than -45 feet), there is a limitation to one-half of the costs for utility relocations.

(4) Share in the costs of operation and maintenance (O&M) of the project for deep draft harbors in an amount equal to 50 percent of the excess of the cost of the O&M of such project over that which would be incurred for O&M if such project had a depth of 45 feet.

(5) The NFS is required to provide all lands, easements rights-of-way, and utility relocations (LERRs) for cost-shared projects for which they shall receive credit. This is in accordance with the provisions of WRDA, and will be included as an obligation of the NFS in the Project Cooperation Agreement.

(6) 35 percent of the cost of construction of the project which provides environmental/habitat restoration benefits.

As discussed further in Appendix B, there may be a number of alternatives available for consideration and adoption regarding the allocation of costs of construction for the project to the extent that aquatic habitats are protected, restored, or created. These alternatives range from a standard cost share applicable to any navigation project (Federal/NFS cost share 75 percent/25 percent down to -45 feet MLLW and 50 percent/50 percent for depth greater than -45 feet MLLW, as described above), to a combination of cost-sharing on a navigation benefits basis plus cost sharing for the Hamilton and/or Montezuma options on the 65 percent Federal/35 non-Federal basis, to various other possible cost sharing arrangements which will depend on the application of various Federal statutes and ultimate determinations and decisions by the Secretary of the Army - ASA (CW) and Congress.

As explained in detail in Appendix B.4, the Port believes that an appropriate cost share allocation for this project would be 75 percent Federal/25 percent non-Federal to the

-45 foot MLLW depth, 65 percent Federal/35 percent non-Federal for the Hamilton increment of the project between -45 feet MLLW and -50 feet MLLW, and 50 percent Federal/50 percent non-Federal for the remainder of project depth. This proposed cost-share based on the following project-specific issues:

(1) The Port has invested considerable funds to enable reuse of NUAD and SUAD dredged material at the Middle Harbor Enhancement Area. Use of the MHEA will reduce the GNF component of the project approximately $100,000,000 when compared to the only other alternative available for constructing a project with over 1.5 mcy of NUAD material.[4]

(2) Habitat benefits accrue from the entire project, including removal of 0.5 mcy of contaminated sediments to be dredged from the Inner Harbor turning basin. Both the MHEA and proposed reuse at Hamilton provide substantial habitat benefits.

(3) In addition to habitat benefits, reuse of dredged material at the MHEA and Hamilton also saves the Federal Government money in its Installation Restoration program, because capping and/or sediment removal costs are reduced by the amount of the NFS cost-share at both locations.

(4) Both the MHEA and Hamilton wetlands restoration are projects that are being completed in conjunction with base closure (BRAC) activities, that represent the cutting edge of conversion to beneficial civilian and ecological reuse.

(5) The Bay Area has been especially hard hit by the BRAC process; the proposed navigation project facilitates conversion and reuse of two closed bases.

These issues are discussed in greater detail in section 5.11. Appendix B.4 provides a summary of the various statutes that may applicable to habitat project completed in conjunction with a navigation project, as well as associated cost sharing calculations.

5.6.9 Cost Sharing Calculations

Based on the preceding criteria and the information presented in section 5.6.2 through 5.6.8, the standard and proposed cost sharing for the NED/LPP are provided below. Table 5.6 summarizes the cost share percentages, and the costs allocated to the Federal Government and the Port of Oakland using the standard cost share formulas. Table 5.7 summarizes the cost share percentages, and the costs allocated to the Federal Government and the Port of Oakland using the proposed environmental restoration cost share for the Hamilton Wetlands Restoration increment of the project. With this cost share allocation, the Federal Government share of the project is $86,889,000, and the Port of Oakland cost share is $94,024,000, escalated to mid-point of construction.

If the -50 foot MLLW NED Plan without habitat restoration is used to calculate the cost sharing, the Federal share of the Plan is $81,379,000 and the Port of Oakland share is $104,051,000. In either case, the estimated incremental annual O&M dredging cost is $493,000, of which the Port would be responsible for $130,000 (50 percent of the incremental O&M dredging cost below -45 feet MLLW.)

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[4] These cost savings compare the -50 foot project GNF costs with the MHEA to the -48 foot project GNF costs without the MHEA. The volume of NUAD material is essentially constant for all project depths greater than -45 feet MLLW, because the NUAD material is the shallowest material.

TABLE 5.6. Cost Share Allocation Using Standard Allocation Formulas

Factor	Cost	Rate for Federal Cost Share	Federal Cost Share	Rate for NFS Cost Share	NFS Cost Share
GNF Construction to -42 to -45 feet MLLW	$76,715,000	75%	$57,536,000	25%	$19,179,000
GNF Construction to -45 to -50 feet MLLW	$38,423,000	50%	$19,212,000	50%	$19,212,000
Total GNF	$115,138,000				
LERR Cost (a)	$17,179,000	0%	$0	100%	$17,179,000
LSF Cost	$43,142,000	0%	$0	100%	$43,142,000
Aids to Navigation	$265,000	100%	$265,000	0%	$0
O&M Dredging, -42 to -45 feet MLLW	$153,000	100%	$153,000	0%	$0
O&M Dredging, -45 to -50 feet MLLW	$260,000	50%	$130,000	50%	$130,000
Total Project Cost (-50 feet MLLW)	$176,137,000		$77,296,000		$98,842,000
10% Cash Contribution from NFS for GNF to -50 feet MLLW					$11,513,800
LERR Credit (c)					($11,513,800)
Cost Share Allocations			$77,296,000		$98,842,000
Escalation to Mid-Point of Construction (b)		44%	$81,369,000	56%	$104,051,000

Notes:

(a) LERR/LSF costs are the same for all project depths

(b) Escalation Factor = 1.0527

(c) Maximum available LERR credit = $15,102,000

TABLE 5.7. Proposed Cost Share Allocation Using Environmental Restoration Allocation Formulas for Hamilton Wetlands Restoration

Factor	Cost	Rate for Federal Cost Share	Federal Cost Share	Rate for NFS Cost Share	NFS Cost Share
GNF Construction from -42 to -45 feet MLLW	$76,715,000	75%	$57,536,000	25%	$19,179,000
GNF Construction from -45 to -50 feet MLLW (Excluding Hamilton)	$3,469,000	50%	$1,735,000	50%	$1,735,000
Hamilton Habitat Restoration to -50 feet MLLW	$34,954,000	65%	$22,720,000	35%	$12,234,000
Total GNF	$115,138,000				
LERR Cost (a)	$17,179,000	0%	$0	100%	$17,179,000
LSF Cost	$43,142,000	0%	$0	100%	$43,142,000
Aids to Navigation	$265,000	100%	$265,000	0%	$0
O&M Dredging, -42 to -45 feet MLLW	$153,000	100%	$153,000	0%	$0
O&M Dredging, -45 to -50 feet MLLW	$260,000	50%	$130,000	50%	$130,000
Total Project Cost (-50 feet MLLW)	$176,137,000		$82,539,000		$93,599,000
10% Cash Contribution from NFS for GNF to -50 feet MLLW (c)					$8,018,400
LERR Credit (d)					($8,018,400)
Cost Share Allocations			$82,539,000		$93,599,000
Escalation to Mid-Point of Construction (b)		47%	$86,889,000	53%	$98,532,000

Notes:

(a) LERR/LSF costs are the same for all project depths

(b) Escalation Factor = 1.0527

(c) 10 percent cost share is not applicable to environmental restoration component

(d) Maximum available LERR credit = $15,102,000

As shown in Tables 5.6 and 5.7, no non-Federal contribution is needed to cover the requirement for an additional payment of 10 percent of the cost of the GNF. The amount of LERRs costs which can be credited toward this 10 percent is greater than the amount required under any cost share arrangement.

5.7 REAL ESTATE REQUIREMENTS

The NFS is required to provide all lands, easements, rights-of-way, and utility relocations (LERRs) that are necessary for a navigation project for a harbor. This is in accordance with the provisions of WRDA, and will be included as an obligation of the NFS in the Project Cooperation Agreement. The NED/LPP Plan is for dredging to a depth of -50 feet MLLW. The project features that may have real estate requirements are the required upland portions of the turning basin in the Inner Harbor, a temporary disposal site at Berth 55, stockpile and temporary construction areas for disposal at the Vision 2000 Upland site, the disposal site at Hamilton Army Airfield (which includes a temporary pipeline easement and levee easement), and two utilities: the U.S. Navy sewer pipeline and the BART Anode cables. The total acreage required for these features, to include all temporary stockpile areas, work areas, and access areas is 93.5 acres.

The Real Estate Plan for this project is included as Appendix C to this Feasibility report.

5.8 ENVIRONMENTAL IMPACTS

The attached EIS/R presents the project's environmental impacts in detail. The primary impacts deal with short-term effects resulting from the dredging and dredged material disposal operations. The project related impacts have been evaluated in the EIS/R. The EIS/R documents the selected plan's (identified as Alternative F-2 in the EIS/R) compliance with environmental requirements. As indicated in the EIS/R all requirements for a Section 404(r) exemption have been met, however, state permitting requirements for disposal areas still apply.

5.9 MITIGATION PLANS/OTHER COMMITMENTS

In accordance with paragraph 7-35 of Engineering Regulation 1105-2-100, the planning of Corps projects shall ensure that project-caused adverse impacts to fish and wildlife resources have been avoided or minimized to the extent practicable, and that remaining unavoidable significant adverse impacts are compensated to the extent justified. The Recommended Plan and the NED Plan, if not the same, shall contain sufficient mitigation to ensure that either plan selected will not have more than negligible net (including mitigation) adverse impacts on fish and wildlife resources.

Justification of mitigation features recommended in projects is based on consideration of the monetary and non-monetary values of the last increment of losses prevented, reduced, or replaced, and shall be at least equal to the combined monetary and non-monetary costs of the last added increment, so as to reasonably maximize overall project benefits.

5.10 RISK AND UNCERTAINTY

The United States economy is becoming increasingly tied to a global economy relying on international trade. Over 99 percent of intercontinental trade is by sea. A modern port, capable of maintaining fast and consistently scheduled cargo transshipment, is a critical component of efficient trade.

The primary risk and uncertainty for the proposed Port of Oakland deepening project is related to the economic viability and volatility of the containerized cargo transportation industry. The Port of Oakland is primarily an export port, shipping raw materials to the Pacific Rim and importing finished goods. It should be noted that even with the current economic slow-down in Asia, the Port's cargo volume has remained constant. The Port handles discretionary cargo bound for the Midwest as well as regional cargo bound for the San Francisco Bay Area and Northern and Central California.

Containerized cargo is shipped by ocean carriers who form alliances and vessel sharing agreements to achieve economies of scale. Carriers calling at the Port of Oakland are currently organized into three large alliances and three smaller ones. The specific memberships are in a nearly continual state of transition as new agreements evolve.

Containerized cargo carriers search for greater efficiencies and productivity when making decisions in setting up shipping routes. Factors impacting decision making include distance between ports, depths of channels and berths, terminal operating costs, cranes, cargo handling areas, intermodal infrastructure, and labor agreements.

Carriers will divert discretionary cargo to other ports if channel and berth depths are inadequate, terminal operations are inefficient, and/or intermodal infrastructure is non-competitive. Regionally destined cargo can also be diverted to other ports, and then trans-shipped back to Northern California by rail or truck, if marine terminal operations become prohibitively costly due to draft restrictions imposed as a result of insufficient channel and berth depths.

As discussed earlier, fifth and sixth generation container ships, considered to be the most efficient vessels in the current fleet mix, require up to 48 feet of depth at berth, and an additional 5 feet of water in addition to design draft when maneuvering, i.e., a total depth of -53 feet MLLW.[5] Insufficient depth results in expensive tidal delays and inefficient use of labor in the loading and unloading of these vessels.

The Port of Oakland must expand and upgrade its facilities to accommodate larger, more efficient vessels. If the Port does not, it will revert to the role of a regional feeder port. The Port of Oakland is responding to this challenge with a three pronged strategy of improving intermodal rail facilities, expanding/reconfiguring terminal operations, and deepening navigational channels and berths.

5.11 SELECTED PLAN

As discussed earlier in this report, the NED Plan has been identified. It consists of a -50 foot MLLW project, and is the same plan as the LPP. The standard for selecting a Recommended Plan is laid out in Section 5.16 of ER 1105-2-100. In this case, in addition

[5] The 5 feet of water in addition to draft are required if the vessel is out of trim by 1 foot; if the vessel is perfectly trimmed, it only requires 4 feet of water in addition to draft : 2 feet for squat, and 2 feet for safety (underkeel clearance).

to the direct navigation benefits resulting in a -50 MLLW NED Plan, other environmental and economic concerns lead to a conclusion that a -50 foot MLLW project, with disposal of material in Middle Harbor, at the Hamilton Wetland Restoration Project, and in upland construction within the Port should be the recommended plan. First, reuse of dredged material at the MHEA and Hamilton Wetland Restoration Project would provide substantial environmental benefits from the portion of Oakland material that could be reused at those sites. With the material from the Oakland project beginning implementation of the Hamilton project, the site would be returned to habitat decades sooner than would be possible with other restoration techniques. Further, once the site has been prepared using Oakland material, it would be available for Federal maintenance material.

Second, reuse of dredged material at Hamilton and in Middle Harbor (the Fleet Industrial Supply Center Oakland, FISCO) provides substantial national benefits in reuse of closed military bases. A joint reuse project will reduce the cost of preparing Hamilton for reuse as a restored wetland by the amount contributed by the NFS, and may reduce the costs of remediating off-shore sediments at FISCO. Those costs cannot be quantified precisely, but they are substantial.

Third, implementation of this project as a cooperative effort utilizing the input of the Management Committee of the Long Term Management Strategy (LTMS) would provide an important model for implementation of the LTMS. Implementation of the LTMS remains a key goal of the Corps.

Finally, implementation of a -50 foot MLLW project at Oakland, done in a coordinated effort that begins the conversion of FISCO to a modern container shipping port, will also enhance military preparedness. During the Desert Storm operation, more of the long term shipping of goods was accomplished using container facilities than using military wharves.

For these reasons, the Port believes that the Assistant Secretary of the Army for Civil Works should select the -50 foot MLLW project depth, with a disposal alternative that includes dredged material reuse for habitat creation in Middle Harbor and at the Hamilton Wetlands Restoration site, and with cost sharing for environmental restoration at the Hamilton Wetlands Restoration site pursuant to Section 210 of WRDA 96. In the event that the Hamilton restoration project is not available within the time frame necessary for construction, disposal of the dredged material at the Montezuma wetlands project would accomplish many of the same habitat restoration purposes. In the event that neither site is ready before the midpoint of construction, the material designated for Hamilton and/or Montezuma would be disposed of in the ocean, but in that event, cost-sharing for this material would be limited to the standard navigation features cost share of 50 percent Federal/50 percent non-Federal.

5.12 PLAN IMPLEMENTATION

5.12.1 Institutional Requirements

The proposed schedule is summarized in Appendix A.9 of this report. The following are key project milestones:

- Report Forwarded to the U.S. Congress — May. 1998
- President Signs Authorizing Legislation — Sept. 1998

• Project Appropriation	Oct.	1999
• PCA Executed	Oct.	1999
• Final Permit Received	Nov.	1999
• Real Estate Acquisition Completed	Nov.	1999
• Construction Contract Awarded	Dec.	1999
• Start Construction	Feb.	2000
• Project Construction Completed	Jun.	2004

The project is scheduled to be authorized in the Water Resources Development Act (WRDA) of 1998. Following congressional authorization, the project would be eligible for construction funding. The project will be considered for inclusion in the President's budget based on national priorities, magnitude of the Federal commitment, economic and environmental feasibility, level of local support, willingness of the NFS to fund its share of the project cost, and budgetary constraints that may exist at the time of funding.

Once the United States Congress appropriates Federal construction funds, the Corps and the Port of Oakland would enter into a project cooperation agreement (PCA). The PCA would define the Federal and non-Federal responsibilities for funding, implementing, operating and maintaining the project.

The majority of the construction funding would be required in Federal fiscal years 2000 through 2004. The Water Resources Development Act of 1986 requires that the NFS pay 25 percent of the cost of construction of the project to -45 feet MLLW, and 50 percent for depths deeper than -45 feet MLLW. However, because the deeper depths will be constructed in connection with habitat restoration, the Federal cost share should rise to 65 percent for the habitat restoration.

The NFS is also required to pay an additional ten percent of the total cost of the non-habitat restoration GNF of the project in cash over a period not to exceed 30 years. The value of lands, easements, rights-of-way, and relocations are credited to this payment. The credit received is limited, however, to the ten percent cash contribution required from the local project sponsor. The restoration component of the work does not require a 10 percent cash contribution. The available LERR credit exceeds the 10 percent contribution.

5.12.2. Division of Responsibilities

In addition to the cost sharing responsibilities discussed in section 5.6, the Federal Government and non-Federal interest have certain responsibilities in connection with the development and operation and maintenance of general navigation projects which are set forth in Federal law and will be incorporated into a Project Cooperation Agreement (PCA) after the project is authorized. The following general provisions describing the responsibilities of the NFS may be included as part of the PCA:

a. Provide, during construction, funds needed to cover the non-federal share of construction costs;

b. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the GNF (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance and for which a contract for the facility's construction or improvement was not awarded on or before October 12, 1996):

(i) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

(ii) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet but not in excess of 50 feet;

(iii) 35 percent of the costs attributable to dredging for the portion of the project to which Section 210 of WRDA 96 (habitat restoration) applies;

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of GNF (except for that portion of the costs covered by Section 210 of WRDA 96). The value of lands, easements, rights-of-way, and relocations provided by the NFS for the GNF, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the GNF, the NFS shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the GNF;

d. Provide lands, easements, and rights-of-way, and perform or ensure the performance of relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the GNF (including lands, easements, and rights-of-way, and relocations necessary for dredged material disposal facilities),

e. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations;

f. Accomplish removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the GNF for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the GNF;

h. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the GNF, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

i. Perform, or cause to be performed, investigations for hazardous substances as are determined necessary to identify the existence and extent of hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the GNF, subject to permissible cost recovery from responsible parties. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the NFS with prior specific written direction, in which case the NFS shall perform such investigations in accordance with such written direction;

j. Assume financial responsibility, subject to permissible cost recovery from responsible parties including the Federal Government, as between the Federal Government and the NFS, for necessary cleanup and response costs of CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the GNF;

k. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the GNF, and inform affected persons of applicable benefits, policies, and procedures in connection with said act;

m. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army;"

n. Provide a cash contribution equal to the non-Federal cost share of the project's total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of 1 percent of the total amount authorized to be appropriated for commercial navigation; and

o. In the case of a deep-draft harbor, provide 50 percent of the excess cost of operation and maintenance of the project over that cost which the Secretary determines would be incurred for operation and maintenance if the project had a depth of 45 feet.

6. COORDINATION AND PUBLIC INVOLVEMENT

6.1 PUBLIC MEETINGS, WORKSHOPS, AND REPORT CIRCULATION

The San Francisco District of the Corps of Engineers (Corps), in conjunction with the Port of Oakland, conducted a public scoping meeting on August 5, 1997, during the initial stages of the Feasibility Study phase. On March 4, 1998, the Corps and the Port conducted a public comment meeting to provide the interested public with an opportunity to express their views on the study alternatives. Concurrently, the Corps and the Port conducted a public hearing on the Draft Feasibility Report/Environmental Impact Statement/Report.

6.2 FEASIBILITY STUDY INVOLVEMENT

Coordination with USFWS was initiated in the Feasibility Study phase, and the USFWS provided a planning aid letter in December 1997. In February 1998, the USFWS provided a Draft Fish and Wildlife Coordination Act Report for the Feasibility Study. USFWS is currently finalizing the Coordination Act Report.

Region 9 of the U.S. Environmental Protection Agency has been a major participant in the study as per its authority under Section 102 of the Marine Protection, Research and Sanctuaries Act, the Clean Water Act, and the Clean Air Act.

Coordination with other agencies and the general public has also occurred at various points during study execution. These other agencies include the National Marine Fisheries Service, U.S. Coast Guard, California Department of Fish and Game, the California Coastal Commission, California Regional Water Quality Control Board, the Bay Area Air Quality Management District, the California Coastal Conservancy, the Bay Conservation and Development Commission (BCDC), the State Historic Preservation Officer (SHPO), Oakland Landmarks Preservation Board, City of Oakland, City of Alameda, U.S. Navy, U.S. Army, Oakland Base Reuse Authority (OBRA), Alameda Reuse and Development Authority (ARRA), San Francisco Bar Pilots Association, Alameda County Public Works Agency, and the East Bay Regional Park District. Public coordination included inclusion of the Sierra Club, the Save San Francisco Bay Association, and the Golden Gate Audubon Society into the planning process..

6.3 CIRCULATION OF THE FEASIBILITY REPORT

This Draft Feasibility Report and Draft Environmental Impact Statement/Report was circulated for comments to a wide range of Federal, state, and local agencies including the following:

Federal:

- U.S. Department of the Interior, Office of Environmental Review
- U.S. Environmental Protection Agency, Region 9
- U.S. Fish and Wildlife Service
- U.S. Department of Commerce, National Marine Fisheries Service
- U.S. Coast Guard
- U.S. Navy
- U.S. Army

State of California

- Department of Fish and Game
- California Coastal Commission
- Regional Water Quality Control Board
- Bay Area Air Quality Management District
- State Historic Preservation Officer
- Department of Toxic Substances Control
- California Coastal Conservancy
- California Department of Transportation (CalTrans)

Local

- Alameda County
- City of Oakland
- City of Alameda
- BCDC
- ARRA
- OBRA
- Alameda County Public Works Agency, and
- East Bay Regional Park District
- Alameda County Congestion Management Agency
- Bay Area Air Quality Management District
- BART
- EBMUD
- Solano County

The Report will also be made available to all known private organizations and citizens who have an interest in the study.

6.4 VIEWS OF THE LOCAL SPONSOR

The non-Federal sponsor, the Port of Oakland, prepared this Feasibility Report and has worked closely with the Corps in conducting the Feasibility Study. To date, all required local funds have been provided and the sponsor is committed to cost share in the construction project. Therefore, the locally preferred plan and the selected plan both consiss of -50 foot MLLW Entrance, Outer Harbor, and Inner Harbor channels and corresponding Inner and Outer Harbor turning basins.

The Port of Oakland has given high priority to authorization of the project in the Water Resources Development Act of 1998, targeting construction to begin during Federal fiscal year 2000.

7.0 CONCLUSIONS AND RECOMMENDATIONS

I have given careful consideration to all significant aspects of this study in the overall public interest, including engineering and economic feasibility, as well as social and environmental effect. The selected and locally preferred plan for improvement described in this report provides the implementable solution for navigation improvements at the Oakland Harbor, Oakland, California.

I have also assessed the Port of Oakland's financial capability and ascertained that it is reasonable to expect that ample funds will be available to satisfy the non-Federal sponsor's financial obligation for the project (reference Appendix A.10 to this Feasibility Report).

I recommend that the existing Federal navigation project at Oakland Harbor, authorized by the Water Resources Development Act of 1986, be modified to provide -50 feet MLLW Entrance, Outer Harbor, and Inner Harbor channels, -50 feet MLLW Inner and Outer Harbor turning basins, and selective widening in all of these areas, with such further modifications thereto as in the discretion of the Chief of Engineers may be advisable. In view of the exceptional habitat and other social values that could be accomplished by constructing this project to -50 feet MLLW, I further recommend that a project-specific cost-sharing allocation be made as follows: (1) 75 percent Federal/25 percent non-Federal share of the construction cost to -45 feet MLLW; (2) 65 percent Federal/35 percent non-Federal cost share for the increment of the project below -45 feet MLLW that includes disposal/reuse at the Hamilton Wetlands Restoration site; (3) 50 percent federal/50 percent non-Federal cost share for the remaining increment between -45 feet MLLW and -50 feet MLLW; and (4) 10 percent additional cash for items (1) and (3), with credit for any lands, easements, rights of way, and relocations (LERR) applied against the additional cash (a 10 percent contribution is not required for the Hamilton Wetlands Restoration increment).

The total investment cost is estimated to be $185,405,000. It is estimated that incremental annual costs of approximately $411,000 will be incurred for maintenance dredging (additional shoaling of the project channels with the project in place is expected to be quite limited). Thus, the estimated total project annual cost is $14,059,000. The incremental annual maintenance dredging costs for the project increment below -45 feet MLLW will be cost shared by the local sponsor at 50 percent Federal/50 percent non-Federal. The non-Federal sponsor's share of the incremental annual O&M dredging cost is estimated to be $130,000. With estimated average annual benefits of $178,046,000 in waterborne commerce transportation cost savings, the proposed project is economically feasible with a benefit-to-cost ratio of 13.0:1 and annual net benefits of $164,398,000, thereby warranting Federal participation.

The recommendations contained herein reflect the information available at this time and current Corps policies governing formulation of individual projects. The Selected Plan is designed to include reuse of dredged material at habitat restorations projects outside of the Port (e.g., the Hamilton or Montezuma Wetlands Restoration projects). Reusing dredged materials in the restoration of wetlands brings a significant environmental benefit. Separable costs for restoration may be allocated to a purpose of ecosystem restoration and costs allocated in accordance with Section 210 of WRDA 96.

The Selected Plan may not reflect program and budgeting priorities inherent in the formulation of the national Civil Works Construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation of funding. However, prior to transmittal to the Congress, the sponsor, the State, interested Federal Agencies, and other parties should be advised of any modifications and should be afforded an opportunity to comment further.

Date: 5/8/98

JOSEPH WONG
Director of Engineering
Port of Oakland

Date: 5/8/98

CHARLES FOSTER
Executive Director
Port of Oakland