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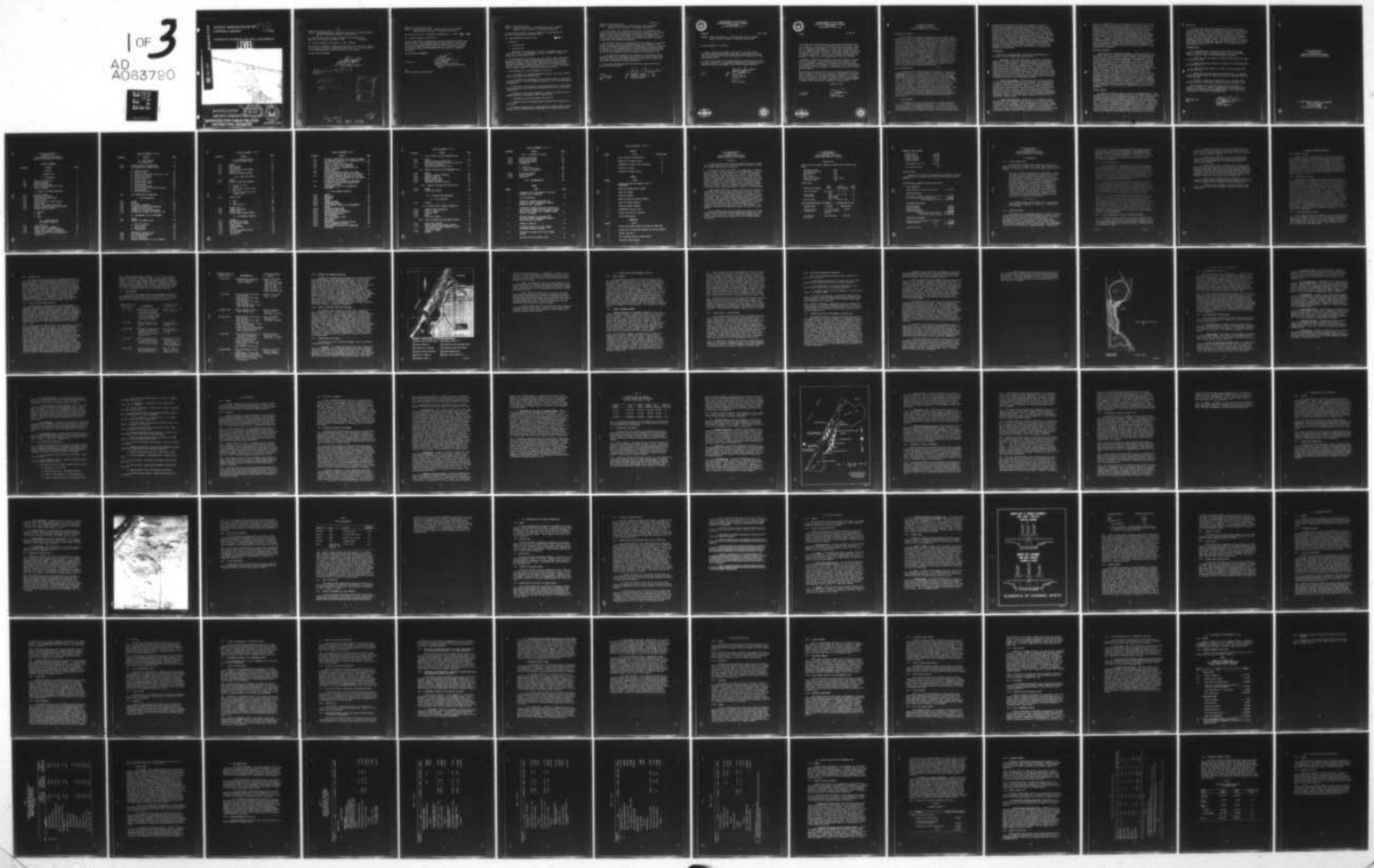


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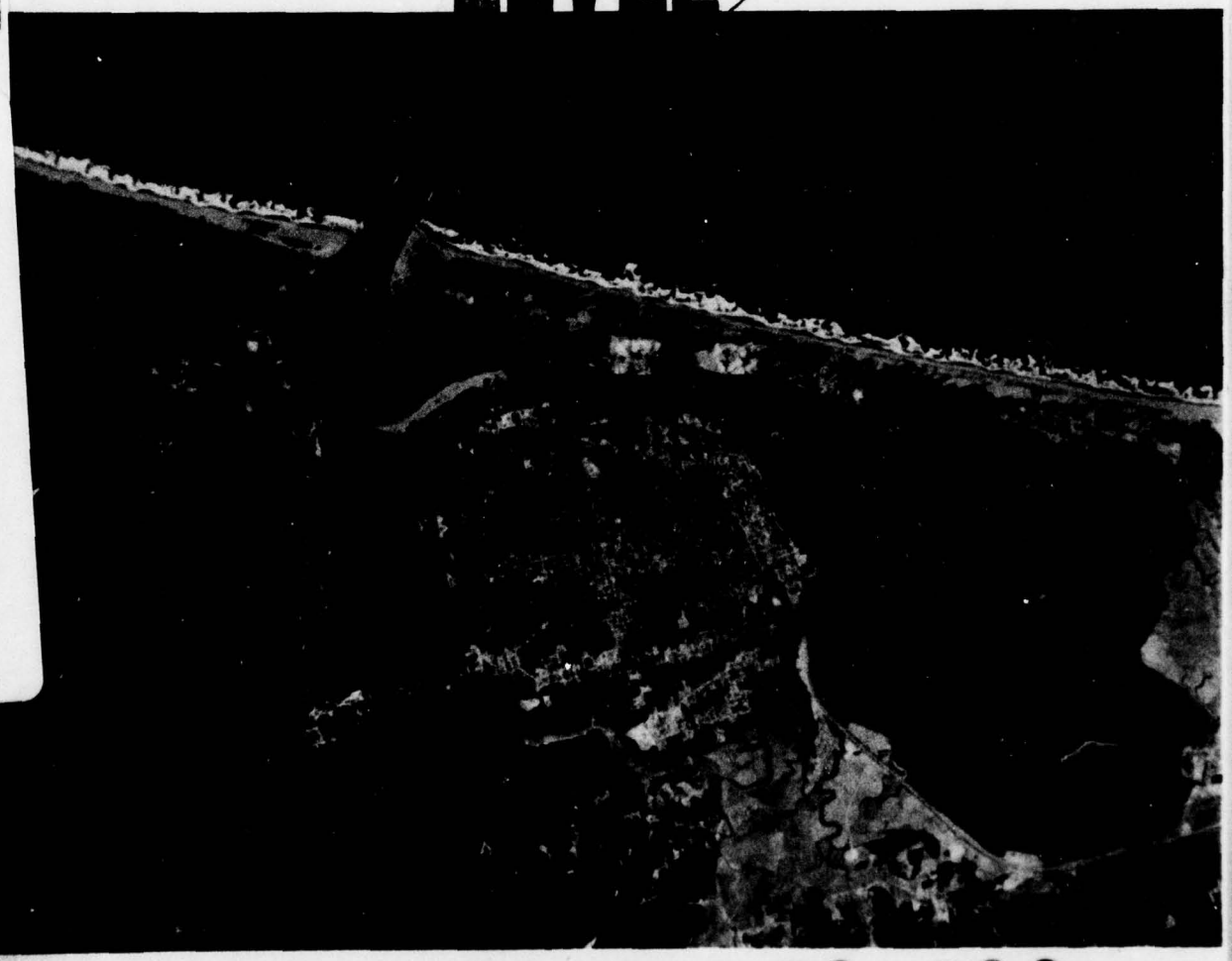
DESIGN MEMORANDUM NO. 1
GENERAL DESIGN

HUMBOLDT HARBOR AND BAY, CALIFORNIA



NAVIGATION IMPROVEMENT

U.S. ARMY CORPS OF ENGINEERS - SAN FRANCISCO DISTRICT

AUGUST 1976

SPDPD-U (23 Aug 76) 3d Ind (6)
SUBJECT: Design Memorandum No. 1, General Design and EIS, Humboldt Harbor and Bay, California - Navigation Improvements

DA, South Pacific Division, Corps of Engineers, 630 Sansome Street, Room 1216, San Francisco, California 94111 18 MAR 1977

TO: District Engineer, San Francisco ATTN: SPNED-NN

The District is reminded to comply with provisions of EC 1165-2-125, Application of Federal Regulations Implementing Section 404 to Civil Works Projects, in the scheduling of your future work effort on this project.

FOR THE DIVISION ENGINEER:

WILLIAM E. VANDENBERG
Colonel, CE
Deputy Division Engineer

(14) DESIGN MEMO-1

(12) 287p.

(11) Aug 76

File

DAEN-CWP-W (23 Aug 76) 2nd Ind
SUBJECT: Design Memorandum No. 1, General Design and EIS, Humboldt Harbor and Bay, California - Navigation Improvements

DA, Office of the Chief of Engineers, Washington, D. C. 20314 MAR 4 1977

TO: Division Engineer, South Pacific

Subject combined GDM is approved as a basis for preparation of plans and specifications. The recommended change in utilization of disposal sites as noted in the Addendum (Reevaluation of Disposal Sites) to the Final Environmental Impact Statement is concurred in. The FEIS was published in the Federal Register of 28 January 1977 and CEQ has not commented adversely.

FOR THE CHIEF OF ENGINEERS:

wd all incl

V. L. RATHBURN
Colonel, Corps of Engineers
Assistant Director of Civil Works,
Pacific

CF:
District Engineer, San Francisco

SPDPD-U (23 Aug 76) 1st Ind
SUBJECT: Design Memorandum No. 1, General Design and EIS, Humboldt Harbor and Bay, California - Navigation Improvements

DA, South Pacific Division, Corps of Engineers, 630 Sansome Street, Room 1216, San Francisco, California 94111

TO: HQDA (DAEN-CWP-W) WASH DC 20314

SEP 1976

1. References:

a. ER 1110-2-1150.

b. ER 1105-2-507.

c. DAEN-CWP-W 2nd Indorsement, 2 July 1975 to SPNED-NN basic letter, 5 May 1975, subject: Humboldt Harbor and Bay, California - Request to Combine Phase I and Phase II GDM.

2. In accordance with references 1a, 1b and 1c above, twenty (20) copies each of the combined General Design Memorandum, August 1976, the Final Environmental Impact Statement (EIS), August 1976, the District Engineer's Statement of Findings, 17 August 1976, and the Division Engineer's concurrence of SOF, 22 September 1976 (Inclosures 1, 2, 3 and 4, respectively), for the subject project are forwarded for appropriate action.

3. Also transmitted for your information and use are:

a. Two copies of the District Engineer's Notice of Initiation of AE&D studies, 21 November 1973 (Inclosure 5).

b. Two copies of the Transcript of Public Meeting held on 8 March 1974, the announcement of the Public Meeting and mailing list for the announcement (Inclosure 6).

c. Two copies of the Transcript of Public Meeting held on 7 April 1976, the announcement of that meeting and the mailing list for the announcement (Inclosure 7).

d. Originals of the District Engineer's Statement of Findings and the Division Engineer's indorsement thereto (Inclosure 8).

e. Supplemental Economic Data Sheet (Inclosure 9).

f. Summary Economic Re-evaluation Report, August 1976 (Inclosure 10) (20 copies).

4. By separate correspondence, a post-authorization change report for this project is being forwarded (ATTN: DAEN-CWP-W) for review and processing.

27 SEP 1976

SPDPD-U (23 Aug 76) 1st Ind
SUBJECT: Design Memorandum No. 1, General Design and EIS, Humboldt Harbor and Bay, California - Navigation Improvements

5. The ARA benefits were analyzed but were found to be negligible and therefore they were not considered in the benefit evaluation. The inclosed Summary Economic Re-evaluation Report was prepared to facilitate your response to the request of the Bureau of the Budget (now OMB) made in their 4 June 1968 letter commenting on the Survey Report (see page vi of House Document 330, 90th Congress, 2d Session).

6. The economic, social, and environmental effects relating to the proposed project have been carefully evaluated, displayed and coordinated. The project is economically feasible and has strong support from local interests. Accordingly, it is recommended that the inclosed General Design Memorandum be approved as a basis for preparation of plans and specifications for the project and that appropriate action be taken to file the EIS with CEQ.

7. In accordance with paragraph 21 of reference 1a, the Division office intends to approve all supplements and any feature design memorandum (FDM) which might be subsequently found necessary for this project, except for those FDM's specifically requiring OCE approval.

8. Minor errors found during SPD review have been noted on the Errata Sheet inclosed within GDM.

William E. Vandenberg Col CE

for RICHARD M. CONNELL
Brigadier General, U. S. Army
Division Engineer

10 Incl
1 - 5 Relisted
Added 5 Incls
as

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

SPNED-NN

23 AUG 1976

SUBJECT: Design Memorandum No. 1, General Design and EIS, Humboldt Harbor and Bay, California - Navigation Improvements

Division Engineer, South Pacific

1. Twenty copies each of subject final reports are transmitted in accordance with paragraph 20a ER 1110-2-1150, together with two copies each of transcripts for two public meetings held in connection with post authorization studies.

2. Also, twenty copies of the Summary Economic Re-evaluation Report are inclosed in accordance with previous understanding of processing requirements per statement in paragraph 1-02 of subject design memorandum.

Karl F. Schmid LTC

5 Incl
as

for H. A. FLERTZHEIM, JR.
Colonel, CE
District Engineer

Karl F. Schmid
LTC, CE
Deputy District Engineer

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

SPNED-E

19 JAN 1977

In accordance with the provisions of the National Environmental Policy Act of 1969, P.L. 91-190, the San Francisco District of the U.S. Army Corps of Engineers has prepared the inclosed final environmental statement for Navigation Improvements to be constructed at Humboldt Harbor and Bay, Humboldt County, California. This final statement was prepared in response to comments on the draft environmental statement which was circulated in March 1976. These letters of comment are reproduced in Appendix 14. Responses to the comments may be found in Section 9.

In November - December 1976 additional information related to disposal areas was developed. One land disposal site (13C) discussed in the final environmental statement was eliminated and two viable alternative disposal areas were evaluated. Discussion of these two alternative disposal areas has been furnished in the Addendum to the Final Environmental Statement.

Detailed plans and specifications will be developed beginning 30 days after the date of this letter or the date of announcement of the statement's availability in the Federal Register, whichever is the later. During this 30 day period, anyone may submit comments on the statement to me at the address given above. Construction is currently scheduled to begin in May, 1977 and to be completed in January, 1979.

Sincerely yours,

1 Inclosure
As stated

H. A. FLERTZHEIM, JR.
Colonel, CE
District Engineer

STATEMENT OF FINDINGS
NAVIGATION IMPROVEMENT
HUMBOLDT HARBOR AND BAY, CALIFORNIA

AUTHORITY AND PURPOSE

I have reviewed and evaluated, in the light of the overall public interest, the final environmental statement and general design memorandum which describe the project in detail. Existing tonnages and trends in oceanborne commerce in Humboldt Harbor have been determined, with a finding that the need for navigation improvements is more critical now than anticipated when the project was authorized in 1968 on the basis of projections and findings set forth in the Project Document (H. D. No. 330, 90th Congress, 2d Session). The economics of the project have been completely reevaluated and I agree that timely initiation of the work of deepening the North Bay Channels from their existing 30-foot depth to their authorized depth of 35 feet is imperative to efficient and safe operation of the harbor in its accommodation of the larger, deep draft vessels now in use for transocean shipment of logs, lumber, wood pulp, chips and other bulk forest products. Economic transportation, particularly waterborne transportation, is fundamental to maintenance of a competitive timber industry and the economic well-being of the five county tributary area of Humboldt Bay and Harbor.

PUBLIC PARTICIPATION

The general need for deeper channels in Humboldt Bay and specific navigation problems have been expressed by the Humboldt Bay Bar Pilots Association and numerous shippers who are incurring added costs and delays from steamer cancellations and more expensive overland freight rates for ship loadings at more distant ports in the San Francisco Bay area. These statements and others on environmental concerns are contained in transcripts of public meetings held in Eureka, California, on 23 May 1961, 8 March 1974 and 7 April 1976 in connection with the authorization studies. I have forwarded copies of the transcripts directly to the Division Engineer and to interested Congressmen. Other copies have been furnished to the local harbor district and local libraries. Certain minor changes in design details and mitigation reflect formal review comments by Federal and Non-Federal agencies and citizen responses to the draft Environmental Statement circulated in March 1976.

RATIONALE FOR DESIGN

I have directed that the rationale for the recommended design be based on evaluation of three main parameters: (a) Social Need, (b) Economics, and (c) Environmental Constraints. The cost of transporting dredged material to a suitable disposal site or sites is the most significant engineering matter relating to project formulation and construction.

Although numerous alternative sites were considered, extensive environmental assessments and evaluations described in this report and the accompanying Environmental Statement have confirmed that approximately 2.2 million cubic yards of material to be removed from project channels with a hydraulic pipeline dredge can be economically deposited on the beach and dune areas in the vicinity of the municipal airport on the Samoa Peninsula with minimum adverse effects. The recommended plan for construction contemplates use of a government-owned hopper dredge, as envisioned in the Project Document, for bend widening in the vicinity of the harbor entrance, where rough sea conditions make use of a pipeline dredge impractical. About 200,000 cubic yards of material below project mile one would be removed in this manner and disposed at EPA approved site SF-3, located about 1.5 nautical miles southwest of the jetties.

ALTERNATIVES

Some of the more significant alternatives considered prior to arriving at the recommended plan are as follows:

a. No-Action. Under this alternative, the project area would remain as is. There would not be any adverse effects from dredging or disposal on natural resources. Inefficient shipping operations from tidal delays, back-tracking to deeper ports and under-utilization of cargo space of the larger vessels would continue. Failure to provide timely improvements in navigation access likely would cause a loss in competitive position of Humboldt Harbor as a shipping terminus for basic forest products and could affect the economic activity of a large timber producing area of northern California. The no-action alternative is not considered responsive to documented need for deeper navigation channels in Humboldt Bay, and is not in the public interest.

b. Scope of Improvement. Under my direction, various increments of channel deepening and widening were considered. The optimum amount of project investment at this time depends on the cost of dredging and disposal and future maintenance, as well as the projected benefits in transportation savings derived from improvement of a particular navigation channel reach or feature. The plan of improvement recommended herein has been found representative of the optimum scope of navigation improvement feasible at this time on the basis of existing and projected waterborne commerce, vessel size trends, operating costs and costs of alternative transport modes.

c. Disposal Alternatives. Constructive use of dredged material could increase total benefit derived from project construction and two possibilities were considered. Some dredged material was found suitable for possible use as embankment fill for a segment of the proposed Eureka freeway. However, this alternative was discarded due to indefinite financing and right-of-way acquisition schedule by the State of California and possibly higher construction costs than with alternative methods.

Deposit of dredged material on an eroding shore area opposite the harbor entrance was rejected because of its greater distance from channels and imperfect knowledge on environmental effects and possible increased shoaling rates. Numerous other potential disposal sites inventoried in the Humboldt Bay Master Plan were progressively eliminated as more costly, unavailable or environmentally unacceptable; until the final iterative process left ocean disposal, beach disposal and land disposal in the vicinity of the airport on the Samoa Peninsula as viable alternatives. I consider these sites to have the least overall adverse environmental effects. The beach disposal site, tentatively recommended in the Draft Report, February 1976, and eliminated in the text of the Final Environmental Statement, August 1976, has been reconsidered as a viable disposal area in addition to the land sites as described in data provided by the Addendum.

MITIGATION MEASURES

I have approved the following mitigation. Salt water effluent from the dredge slurry will contaminate some groundwater resources found as a freshwater lens under the dunes. However, domestic and industrial use of this limited resource has been supplanted by availability of better quality supplied imported from the Mad River. The effect of saltwater percolation through the dune to underlying waters is not considered to be economically significant or irreversible, since rainfall will flush away the saltwater. The Humboldt Bay Harbor, Recreation and Conservation District has agreed to monitor groundwater effects and mitigate any damage by providing hook-ups to municipal supplies for eight residences in Fairhaven that still rely on shallow domestic water wells. The local sponsor has furnished a letter of intent and resolution, in accordance with the provisions of Section 221 of P.L. 91-611. The draft agreement includes provisions that the local sponsor will take certain measures for continued propagation of certain plant colonies (Erysimum menziesii) found on the proposed disposal sites. Specifically, several acres of the plant's habitat will be fenced and reserved for the purpose of monitoring and studying its growth characteristics. Also, various measures designed to reestablish native vegetation on the sites will be performed.

PROJECT IMPACTS

I consider that surface effects of deposit of dredged material on the proposed sites are minor and significantly less than possible adverse effects of other alternative sites considered in this study. Other alternatives considered and evaluated for disposal of dredged material are described in the Environmental Statement and addendum and the General Design Memorandum. No homes or businesses will be displaced by the project. Some wildlife habitat will be degraded from dredged material and salt contamination. The socio-economic impacts of the project on employment and stimulation of the regional economy of the five-county tributary area are definitely positive, compared with the possible adverse effects on local business from loss of competitive port position under the no-action alternative.

CONCLUSION

I conclude that the proposed improvement would allow improved access by deep-draft vessels to existing and potential harbor facilities and allow improvement of the recognized port contribution to employment, business and industrial activity in Northern California. Export of forest products harvested from a large timber growing area tributary to the port has been found significant to the national interest of maintaining a favorable balance of trade. The estimated first cost of the improvement would be $6,600,000. Estimated annual benefits are $697,000 and estimated annual charges are $308,000. The resulting benefit-to-cost ratio is 2.3 to 1.

RECOMMENDATIONS

It is recommended that the United States modify the existing project at Humboldt Harbor, California in accord with the following items (as shown on Plate 2 of the environmental statement):

a. Widen the North Bay Channel at channel bends at Mile 0.75, Mile 2.00, and Mile 2.60;

b. Deepen the North Bay Channel to a depth of 35 feet between Mile 0.75 and Mile 4.29;

c. Deepen the Eureka Channel to a depth of 35 feet between Mile 4.29 and Mile 5.00;

d. Deepen and widen the Samoa Channel between Mile 4.29 and Mile 5.84 by increasing the channel depth to 35 feet and increasing the width to 400 feet; and

e. Provide a turning basin beyond Mile 5.84 at the upper end of the Samoa Channel, 35 feet deep, 1,000 feet wide and 1,100 feet long.

The above items of work would be constructed by the Corps of Engineers provided that, prior to commencement of construction, local interests will undertake certain specific items of local cooperation, as described in the General Design Memorandum.

21 Dec 76
DATE

H. A. FLERTZHEIM, JR.
Colonel, CE
District Engineer

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

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DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

SYLLABUS

A plan of improvement for navigation channels and aids to navigation in Humboldt Bay was authorized by the River and Harbor Act of 1968 (P.L. 90-483), 90th Congress, 2nd Session.

The District Engineer now submits a recommended plan of improvement that departs in minor respects from that recommended in the Project Document (H.D. No. 330, 90th Congress, 2d. Session). The recommended plan of improvement includes deepening the North Bay, Samoa and Outer Eureka channels from their existing 30-foot depth to a depth of 35 feet below mean lower low water, and widening certain bends in the North Bay Channel, as authorized. The recommended plan of improvement also proposes the widening of the Samoa Channel from its currently designated width of 300 feet to 400 feet in order to better accommodate passage of large cargo vessels, and also, recommends a 1,000-foot wide by 1,100-foot long by 35-foot deep turning basin at the head of the Samoa Channel.

Approximately 190,000 cubic yards of material would be removed by a Government-owned hopper dredge in widening the bend in the vicinity of project Mile 0.75 at the beginning of the North Bay Channel. The remaining portion of the project dredging would be accomplished by hydraulic pipeline dredge. Total estimated dredging quantity is 2.4 million cubic yards. Material removed by hopper dredge would be disposed of at the EPA approved nearshore ocean disposal site approximately 1.5 nautical miles outside the harbor entrance. Material excavated by the hydraulic pipeline dredge would be placed on two land disposal sites in the vicinity of the Eureka Municipal Airport on the Samoa Peninsula. The estimated construction time required to complete the project is twenty months.

Total estimated project costs are $6,660,000, of which $5,580,000 would be Federal costs and $1,080,000 would be non-Federal costs. The benefit to cost ratio is 2.3 to 1.0. Project data and major items of project costs and benefits are summarized in the following Pertinent Data sheets.

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

PERTINENT DATA

TIDAL ELEVATION AT EUREKA, HUMBOLDT BAY (MEAN LOWER LOW WATER (MLLW) DATUM):

Extreme High Water	10.00	
Mean Higher High Water	6.70	
Mean High Water	6.00	
Mean Tide	3.00	
Mean Low Water	1.20	
Mean Lower Low Water	0.00	(datum)
Extreme Low Water	-3.00	

PROJECT DATA:

Feature to be Dredged	Width (feet)	Mileage (statute miles)	Depth (feet)
North Bay Channel	varies 400 to 1,200	0.5 to 4.29	35
Samoa Channel	400	4.29 to 5.84	35
Turning Basin	1,000 (width) 1,100 (length)		35
Eureka Channel	400	4.29 to 5.00	35

Total estimated Volume to be Dredged - 2,400,000 cubic yards.

Disposal Sites	Location	Quantity (CY)
Nearshore Ocean Disposal Site	1.5 nautical miles offshore of harbor entrance	190,000
Land Disposal (2 sites)	Samoa Peninsula	2,210,000

COMMERCE (1974), IN TONS

Foreign Imports	11,053
Foreign Exports	983,308
Coastwise receipts	393,785
Fishery receipts	9,421
Internal Transfer	11,269
Total Commerce over Piers	1,408,836
Total Vessels Calling	308

PROJECT PURPOSE:

Improvement of navigation by deepening and enlargement of channels in Humboldt Bay to eliminate tidal delays and improve vessel maneuverability.

ESTIMATED COSTS, BENEFITS AND BENEFIT-COST RATIO:

Project Benefits	
Annual Savings in Transportation Costs	$ 697,000
Federal First Costs	
100 percent of general navigation facilities	$ 5,540,000
U.S. Coast Guard Aids-to-Navigation	40,000
Total Federal First Costs	$ 5,580,000
Non-Federal First Costs	
Lands and Damages	$ 10,000
Retention Works	685,000
Utility Relocations	200,000
Berthing Improvements	185,000
Total Non-Federal First Costs	$ 1,080,000
Total First Costs of Project	$ 6,660,000
Annual Costs of Project	
Interest and Amortization @ 3 1/4 percent	$ 271,000
Added Maintenance	37,000
Total	$ 308,000
Benefit-Cost Ratio	2.3

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

I - INTRODUCTION

1-01. PROJECT AUTHORIZATION

The improvement of Humboldt Harbor and Bay, California, was authorized by the River and Harbor Act of 1968, Public Law 90-483, 90th Congress, 2nd Session, approved 13 August 1968, which reads in part as follows:

> "Sec. 101. That the following works of improvement of rivers and harbors and other waterways for navigation, flood control, and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and supervision of the Chief of Engineers, in accordance with the plans and subject to the conditions recommended by the Chief of Engineers in the respective reports hereinafter designated. The provisions of section 1 of the River and Harbor Act approved March 2, 1945 (Public Law Numbered 14, Seventy-ninth Congress, first session), shall govern with respect to projects authorized in this title; and the procedures therein set forth with respect to plans, proposals, or reports for works of improvement for navigation or flood control and for irrigation and purposes incidental thereto, shall apply as if herein set forth in full.
>
> * * * * * * * *
>
> * * * * Humboldt Harbor and Bay, California: House Document Numbered 330, 90th Congress, 2d session, at an estimated cost of $2,430,000."

1-02. PURPOSE AND SCOPE

The purpose of this design memorandum is to reaffirm, and revise as appropriate, the plan of improvement recommended in House Document No. 330, hereinafter referred to as the Project Document. The scope of investigation and review is set forth in ER 1110-2-1150, Post-Authorization studies. A combined Phase I and II General Design Memorandum has been prepared because the authorized plan of improvement is a relatively simple and non-controversial project. The Environmental Statement (ES) is published as a companion document. Detailed cost

and benefit data contained in this design memorandum and appendices are also the basis for a separately-bound report: the Summary Economic Re-evaluation Report, to be processed through higher authority to the President's Office of Management and Budget as required in the Project Document. The final ES will be forwarded to the President's Council on Environmental Quality for processing in accordance with procedures outlined in ER 1105-2-507.

1-03. PROJECT DOCUMENT PLAN

The authorized plan of improvement as contained in the Project Document recommended that the existing navigation project in Humboldt Harbor and Bay be modified by widening and deepening of the North Bay, Samoa, and Outer Eureka Channels from their existing 30-foot depth to 35 feet (mean lower low water datum) and providing an anchorage area 1,200 feet wide by 1,200 feet long, and 35 feet deep in the North Bay. The estimated total first cost was $3,043,000 of which $2,430,000 was the Federal cost for construction and $613,000 was non-Federal. These recommended improvements are shown on Plate 1.

1-04. In forwarding the survey report to the Secretary of the Army, the Chief of Engineers concurred generally with the recommendations of the Board of Rivers and Harbors, and further recommended that the North Spit disposal area be enlarged to take care of dredged material in lieu of Indian (Gunther) Island. This decision was based on consideration of adverse effects that material disposal could have on the preservation of an archaeological site and salt marsh habitat around the island.

1-05. In a letter dated 4 June 1968 from the Executive Office of the President, Bureau of the Budget, the Director noted that the unavailability of the Indian Island site for material disposal would result in increased costs for the project with a consequent lowering of the benefit-to-cost ratio from 1.2 to 1.01 for the North Bay channel portion of the project. He advised that before any request for funds to initiate construction of the project is made, "the Bureau of the Budget would expect a re-analysis of the benefits and cost of the project with particular attention to the economic justification of the North Bay Channels." This analysis appears in the previously mentioned Summary Economic Re-evaluation Report.

1-06. LOCAL COOPERATION SPECIFIED IN THE PROJECT DOCUMENT

The local cooperation specified in the Project Document states that "..... prior to construction, local interests in addition to the local cooperation required for the existing project, through the medium of a public body legally and financially qualified to assume the necessary obligations, agree to:

a. Provide and maintain at local expense adequate wharf and terminal facilities in the North Bay, Eureka, and Samoa Channels open to all on equal and reasonable terms for the storage, handling, and shipment of lumber and general commerce;

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

c. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the costs of such retaining works;

d. Hold and save the United States free from all claims for damages to wharves, piers, and other marine and submarine structures due to initial dredging work and subsequent maintenance dredging; and

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

II - RESUME OF EXISTING CONDITIONS

2-01. PROJECT LOCATION

Humboldt Bay is a landlocked harbor on the coast of Northern California, located about 225 nautical miles north of San Francisco and about 156 nautical miles south of Coos Bay, Oregon. The entrance is protected by two rubble-mound jetties about one-half mile apart and extending from the ends of two long, narrow sand spits separating the shallow bay from the ocean. The bay extends south and north from the entrance with the width varying from one-half mile to about four miles. Total length of the bay is about 14 miles. Hydrographic soundings and navigation aids are shown on U.S. Coast and Geodetic Survey Chart No. 5832, 43rd. ed. The following paragraphs summarize the existing conditions in greater detail.

2-02. TOPOGRAPHY AND GEOLOGY

Humboldt Bay is situated within the Northern Coast Ranges physiographic province of California. The bay is shallow with extensive mudflats and shoals. The sandspits that separate the bay from the ocean have well-developed beaches throughout their length. The North Spit is about a mile wide with timbered dune deposits on its northern half. The South Spit is narrower and lower in elevation. Lands adjacent to the bay are mostly flat or rolling terraces. These terraces are bordered on the east and north by rugged mountains. Late Pleistocene and Recent sediments in the bay are composed of various mixtures of loose unconsolidated sands, silts, and clays with some gravel horizons. Depth to bedrock in the southern part of the bay is about 130 feet. Thickness of these sediments to the north and east is unknown, but exceeds the depth of wells drilled to 375 feet along the east shore of Arcata Bay. Jacoby and Freshwater Creeks discharge into the north end of the bay, and Elk River and Salmon Creek discharge into the central and southern end, respectively. Total drainage area tributary to Humboldt Bay is 223 square miles. Mad River Slough at the north end of the Bay was formerly the terminus of Mad River, which now discharges directly to the ocean just north of Humboldt Bay.

2-03. TIDAL RANGE AND WAVE ACTION

Tidal range between MLLW and MHHW is 6.4 feet at the south jetty and 6.7 feet at Eureka. (See the table of Pertinent Data prefacing this memorandum for datum references.) The entrance channel is exposed to high waves generated in the North Pacific Ocean. Waves in excess of 30 feet in height render the harbor entrance channel impassable to ships for several days at a time each winter.

2-04. TRIBUTARY AREA

The principal inbound commodities entering Humboldt Harbor are petroleum receipts. The principal outbound commodities are forest products, which originate in the heavily-forested north coastal regions of Humboldt, Mendocino, Siskiyou, Del Norte, and Trinity Counties and, to a lesser extent, southern Oregon. The principal cities in the Humboldt Bay area are Eureka and Arcata with populations in 1970 of about 24,300 and 9,000 residents, respectively. Together they form an urban distribution center serving a five-county tributary area with a population of about 250,000. The current timber cut in the tributary area is estimated to be 2.5 billion board feet annually, and consists mostly of redwood and Douglas fir. It is significant to note that commerce resulting from this yield is continuing to increase, due to improved technology in the timber industry for utilization of resources.

2-05. STATUS OF EXISTING CORPS PROJECTS

The first Corps of Engineers project for the improvement of navigation in Humboldt Bay was adopted by the River and Harbor Act of 3 March 1881. Under this Act a 10-foot deep channel, 240 feet wide, was dredged to Eureka. The Samoa and Arcata channels, and one to Hookton in the South Bay, were dredged shortly thereafter. Subsequent improvements authorized between 1930 and 1952 provided for deepening and widening of these channels, as well as dredging a new channel and a turning basin at Fields Landing in the South Bay. Construction of the south jetty was authorized in 1884. This project was modified in 1888 and in 1891 to provide for two parallel rubble-mound jetties which were entirely rebuilt in 1939.

2-06. The extent of the existing Federal deep-draft navigation channels and jetty improvements is shown in Plate 1. The existing Federally-maintained navigation channels in Humboldt Bay include the Bar and Entrance Channel that tapers from 1,600 feet wide at seaward mile 0.91 to 500 feet at seaward mile 0.18, thence 500 feet wide to mile 0.75. This channel is maintained to an authorized depth of 40 feet. The channel lies between rubble-mound jetties which are about one-half mile apart. The harbor entrance channel is not centered between the jetties, but lies adjacent to the south jetty. The north half of the entry between the jetties is occupied by a shallow sand shoal. The south jetty is about 5,100 feet long and the north jetty is about 4,500 feet long. The North Bay Channel, 400 feet wide and 30 feet deep, is aligned along a fairly deep natural channel adjacent to the North Spit for about four miles to the junction of the Samoa and Eureka Channels. The latter channel is dredged along two miles of water fronting the city of Eureka. The Samoa Channel crosses Indian Island Shoal for a distance of about one mile to Samoa on the North Spit and is 300 feet wide and 30 feet

deep. The Outer Eureka Channel from mile 4.3 to mile 5.0 is 400 feet wide and maintained to a depth of 30 feet. The Inner Eureka Channel from mile 5.0 to mile 6.3 is 400 feet wide and maintained to a depth of 26 feet. The Fields Landing Channel is 300 feet wide and maintained to a depth of 26 feet. There is a 600 x 800-foot turning basin at the end of the Fields Landing Channel (mile 3.16) that is maintained to a depth of 26 feet. The Arcata Channel (extreme North Bay) is no longer used for commercial navigation and has not been maintained since 1931.

2.07. PRIOR REPORTS

There have been numerous reports concerning Humboldt Harbor and Bay, either alone in in combination with other localities. The reports and legislative documents authorizing the various features and stages of improvement for navigation in the Bay are tabulated as follows:

Adopted by River and Harbor Act of	Recommendation	Document Containing Report
3 March 1881	Channel 10 feet deep by 350 feet wide to be dredged along Eureka waterfront, thence 8 feet deep by 200 feet wide to natural channel to west and dredging Mad River Shoal to 8 feet	House Ex. Doc. 59, 46th Cong., 3rd sess.
5 July 1884	Construct South jetty and continue channel improvements	River and Harbor Appropriations Act of 1884
5 August 1886	$75,000 for Continuing Improvement of Harbor with provision for title to 12 acres of land to be conveyed to U.S.	River and Harbor Appropriations Act of 1886
3 July 1892	Map and estimates of cost for continuing harbor improvements with provision for two parallel jetties	Annual Report by Chief of Engineers p. 3120 Annual River and Harbor Appropriations Acts from 1892-1899
3 March 1899	Continuing harbor improvements with provision for two parallel jetties	House Doc. 528, 55th Cong., 2d sess., dated June 8, 1898

Adopted by River and Harbor Act of	Recommendation	Document Containing Report
25 June 1910	Rebuilding the jetties and channel improvements to Arcata & Hookton	House Doc. 950, 60th Cong., 1st sess., dated April 16, 1908 House Doc 204, 61st Cong., 2d sess. House Doc. 326, 61st Cong., 2d sess., dated 6 & 13 May 1909
3 July 1930	Eureka Channel 20 feet deep, 300 feet wide Samoa Channel 20 feet deep, 250 feet wide Arcata Channel 18 feet deep, 150 feet wide Fields Landing Channel 20 feet deep, 250 feet wide	House Doc. 755, 69th Cong., 2d sess.
30 August 1935	Entrance Channel, 30 feet deep, 500 feet wide	Rivers and Harbors Committee Doc. 14, 74th Cong., 1st sess.
26 August 1937	Eureka Channel, 26 feet deep, 400 feet wide Samoa Channel, 26 feet deep, 300 feet wide Fields Landing Channel, 26 feet deep, 300 feet wide Turning basin off Fields Landing wharf, 26 feet deep, 600 feet wide and 800 feet long	Rivers and Harbors Committee Doc. 11, 75th Cong., 1st sess.
16 July 1952	Bar and Entrance Channel, 40 feet deep, tapered from 1,600 feet to 500 feet North Bay Channel, 30 feet deep, 400 feet wide Eureka Channel, 30 feet deep to mile 5.0 Samoa Channel, 30 feet deep	Rivers and Harbors Committee Doc. 143, 82nd Cong., 1st sess.
13 August 1968	North Bay Channel, 35 feet deep Samoa Channel, 35 feet deep Eureka Channel, 35 feet deep Widen turns at mile 0.75 & 2.60 1,200 x 1,200 ft anchorage in North Bay	House Doc. 330, 90th Cong., 2d sess. (Project Document)

2-08. TERMINAL AND TRANSFER FACILITIES

Substantial investments have been made in new terminal facilities, berthing improvements and transportation facilities in the ten years since survey investigations were completed in 1965. There are eight docks serving dry cargo vessels and six oil terminals. All of the docks, except the new pulp mill dock owned by Crown-Simpson, and the oil terminal facilities are "public" docks regulated by the California Public Utilities Commission under authority of the Wharfinger Act. Figure 1 shows the location of the major deep water terminal and pier facilities on Humboldt Bay. The newest major improvement is a 10-acre wood chip terminal recently constructed by the North Coast Export Company. Shipments of wood chips from this terminal were initiated in September 1975. A detailed description of current ownership and usage of water-front facilities in Humboldt Bay was published in the Humboldt Bay Master Plan, July 1975, by the Humboldt Bay Harbor, Recreation and Conservation District. A more detailed description of these facilities and current commerce is contained in Appendix A.

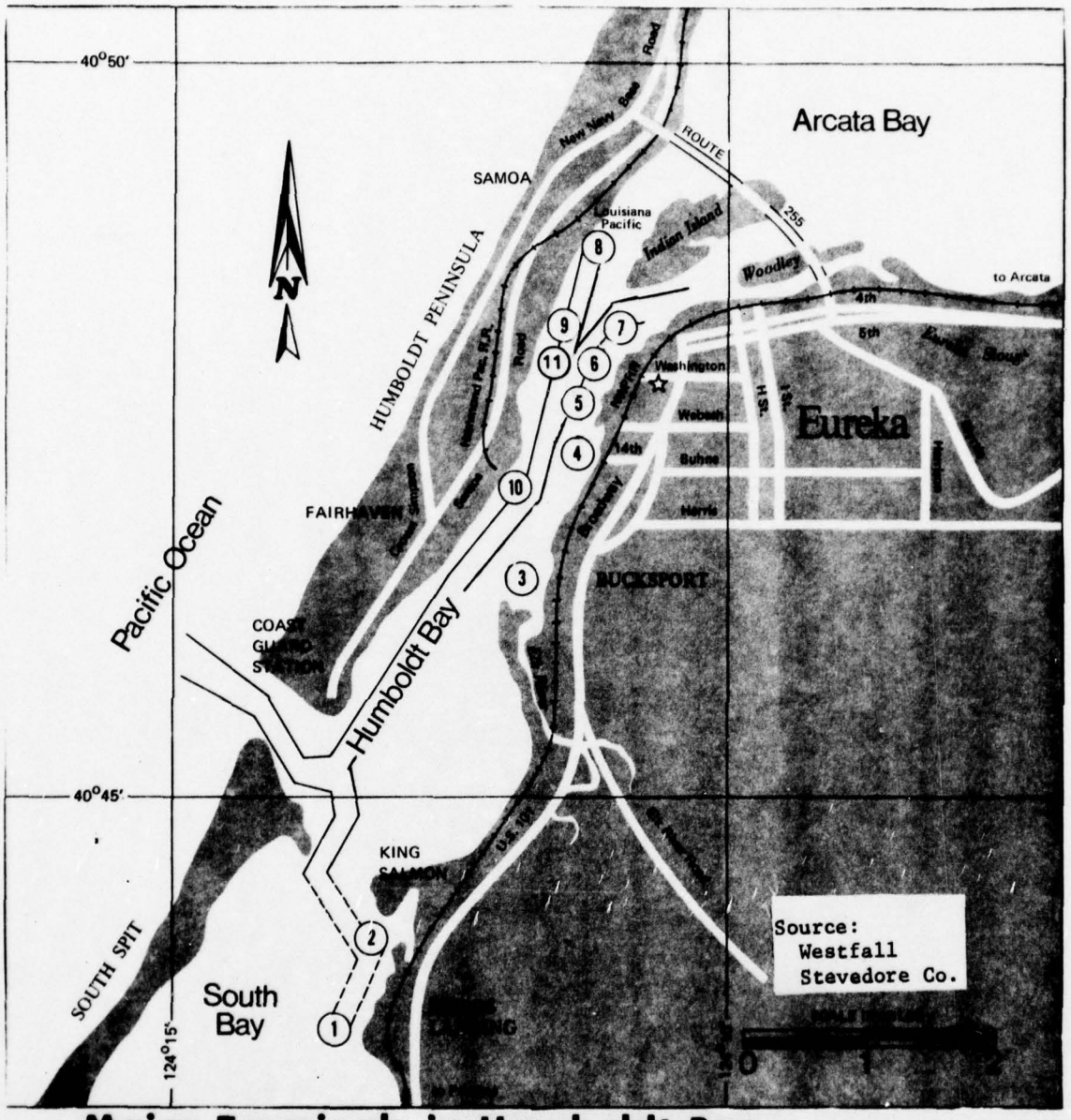
2-09. BRIDGES, SUBMARINE CABLES AND PIPELINES

The highway bridge to Samoa on the North Spit, completed in 1971, is shown on Plate 1. This bridge has no effect on deep-draft vessels presently in use. The only known commercial user which operates north of the bridge and beyond the Eureka Channel is a tug and barge operation serving an oil company. A review of permit applications and coordination with utility companies and public agencies reveals that several new cable installations, a gas pipeline and a municipal water main have been installed across the bay since publication of the Project Document. Other submarine telephone and power cables have been abandoned or replaced. Also, there are plans for construction of a large sewer main from Eureka to a regional treatment plant to be built on the North Spit. Locations of all known and proposed utility crossings are shown on Plate 10. Plans for relocation or abandonment of certain of these facilities to accommodate project dredging are discussed in Section VI of this memorandum.

2-10. TRANSPORTATION FACILITIES

The Humboldt Bay area is served by highway, rail, air and water transportation systems.

a. Highways. U.S. Highway 101 connects the coastal communities within the tributary area with the San Francisco Bay area to the south and with Crescent City and the Oregon coast to the north. The highway consists of four lanes, generally with controlled access. The California Department of Transportation (CALTRANS) has plans for a freeway improvement through the city of Eureka to the Elk River Bridge, a four-lane



Major Terminals in Humboldt Bay

1. PACIFIC DOCK–KRAMER SALES
2. OLSON TERMINALS
3. STANDARD OIL COMPANY
4. EUREKA FOREST PRODUCTS
5. UNION OIL COMPANY
6. HUMBOLDT DOCK "A"
7. HUMBOLDT DOCK "B"
8. LOUISIANA PACIFIC REDWOOD DOCK
9. LOUISIANA PACIFIC CHIP BERTH
10. CROWN SIMPSON DOCK
11. NORTH COAST EXPORT CO.

FIGURE 1

crossing about one mile south of the city limits. The main east-west artery is U.S. 299, which connects the Humboldt Bay area with a vast local and hinterland timber-producing area stretching across northern California, as well as with Interstate 5 which runs north and south through the Central Valley.

b. Rail. The Northwestern Pacific Railroad (NWPRR) connects the Eureka area with the cities to the south for freight services only; forest products are the chief commodity shipped from the area. Various private railroads connect interior lumbering operations with the NWPRR and harbor facilities.

c. Air. Three airports serve the Eureka area. The County-owned Eureka-Arcata Airport, located about 15 miles north of Eureka at McKinleyville, provides commercial service for passengers and cargo. The county-owned Murray Field Airport, located about two miles northeast of Eureka, handles most of the local light-plane traffic. The city-owned Eureka Municipal Airport, located on the North Spit, is also utilized by private pilots and corporate aircraft.

d. Water. Humboldt Bay is the only deep water port between San Francisco Bay and Coos Bay, Oregon. The port is used by both foreign and domestic vessels and is also the base for a fleet of small craft, primarily commercial fishing vessels.

III - CURRENT NEEDS AND DEVELOPMENT OBJECTIVES

3-01. PUBLIC MEETINGS

Post-authorization studies were initiated on 2 January 1974. The initial public meeting was held at the County Courthouse in Eureka on 8 March 1974 to review features of the project as authorized and to determine if any departures from the plan of improvement recommended in the Project Document appear warranted in the light of current needs, construction costs and environmental goals. It was attended by about 70 people, with more than 20 statements submitted for the record. There were no objections to the project as authorized; however, concern on the inadequacy of the existing channels and hazards posed to safe navigation by larger vessels now calling at Humboldt Bay were expressed and a number of specific proposals for channel improvements and material disposal were submitted. Recent shipping and waterborne commerce data, which indicated that current shipping tonnages exceeded those projections published in the Project Document, were also submitted. (A final public meeting was held in Eureka on 7 April 1976 to describe particulars of the plan recommended in this memorandum. It is described in Paragraph 17-02).

3-02. CURRENT OCEANBORNE COMMERCE

Commercial shipping is an important contributor to the local economy. Waterborne commerce through Humboldt Harbor has, historically, consisted of export of forest products, and receipt of petroleum products and chemicals. The forest products, which include logs, wood chips, wood pulp, staves, mouldings, lumber, plywood, veneers, and miscellaneous wood products, accounted for an average of about two-thirds of the waterborne commerce from 1964 to 1974. In addition to the export of forest products, the harbor also receives petroleum products and chemicals, and serves local manufacturing, processing and wholesaling establishments. As noted, current statistics indicate a significant increase in the value and tonnage of certain commodities as compared with the projections used in the Project Document.

3-03. Total waterborne commerce in Humboldt Harbor increased from 423,000 tons in 1960 to 1,220,000 tons in 1970, compared with the 890,000 tons projected in the Project Document. Record shipments of 1,493,000 tons were achieved in 1968. However, a 105-day long longshoremen's strike in 1971 and month-long work stoppage in 1972 resulted in abnormally low tonnages of 1,114,000 tons and 1,074,000 tons, respectively, for those years. Shipments of 1,432,000 tons for 1973 and 1,398,000 tons for 1974 were recorded. The balance of exports over imports transiting Humboldt Harbor was worth about $56 million to the national economy in 1972, according to data presented at the public meeting of 8 March 1974.

3-04. Export of lumber and other forest products, exclusive of wood pulp, totaled 495,000 tons in 1970 and 655,000 tons in 1974; the Project Document projected only 258,000 tons for 1970. Exports of wood pulp, the largest single forest product in the Bay's waterborne commerce, increased from 50,000 tons in 1966 to 251,000 tons in 1970, and to 339,000 tons in 1974; the Project Document estimated only 150,000 tons by 1970. Export of wood chips, an important new export commodity, increased from 84 tons in 1968 to 410 tons in 1970, and to 272,000 tons in 1974; it is expected to increase further with use of the newly completed North Coast Export Company pier adjacent to the Samoa Channel. The export of logs has fluctuated over the past ten years; the tonnage decreased to 431,200 tons in 1970 and 292,000 tons in 1974 from a peak of 714,000 tons in 1968. Japan has been the primary source of demand for logs. However, export quotas, rising prices of logs in the United States, and a slowdown of construction activities in Japan have limited the export volume.

3-05. Refined petroleum products are shipped into the harbor; increases have been in proportion to the local population and economic growth. Chemical products are imported to serve the wood pulp industry, and volumes have closely followed that of the pulp export. Several hundred commercial fishing boats are homeported within Humboldt Bay, and there are important fish processing facilities. Fish landings in 1974 totaled 9,400 tons. (Detailed data on waterborne commerce is given in Appendix A.)

3-06. VESSEL TRAFFIC - SHIPPING TRENDS

Recent shipping trends have accentuated the navigational difficulties in the harbor. There has been a rapid increase in the size of ships as smaller ships are retired and replaced by larger ships. A significant disparity is noted between the projections included in the Project Document and current data for ships with a draft 26 feet or greater. Projections shown in the Project Document estimated that 25 vessels with a draft of 26 feet or greater would enter Humboldt Bay in 1970; however, the actual number was 149 in 1970 and 104 in 1974. It is noted that while the total waterborne commerce increased from 1,220,000 tons in 1970 to 1,398,000 tons in 1974, as previously discussed in paragraph 3-03, fewer vessels were used in 1974. The current trend is toward use of larger vessels which require less trips. Of the 149 vessel trips in 1970, only 26 exceeded 30 feet in draft as compared to 104 vessel trips in 1974 of which 37 exceeded 30 feet in draft.

3-07. Correspondingly, operating costs have also increased with the increase in vessel size. Inadequate depths in the existing channels cause delay to vessels traversing the channels, resulting in additional increased operating costs, delays in shipment, and light-loading.

3-08. DIFFICULTIES ATTENDANT TO NAVIGATION

The current conditions which make navigation hazardous to vessels are as follows:

a. Occasional high wave action through the Bar and Entrance Channel prevents vessels from entering or leaving the harbor.

b. Restricted widths in the channel, especially at turns, prevent larger vessels from safe maneuvering operations.

c. Inadequate depths prevent safe passage of, and cause transit delays, to the larger vessels.

d. Lack of a turning basin in the North Bay requires vessels either to maneuver beyond the channel limits and be subjected to potential grounding, or to wait until high tide for adequate channel depth before maneuvering for a turnaround.

3-09. Because of inadequate navigational channels in the harbor and the hazards to the user vessels, business has been lost to the local economy because of cancellation and/or diversion of vessels to Coos Bay or San Francisco Bay. Alternative overland routes are more costly in fuel and transport rates.

3-10. PLANNING OBJECTIVES OF THE HUMBOLDT BAY MASTER PLAN

The Humboldt Bay Harbor, Recreation and Conservation District, established on April 17, 1973, is responsible for developing the Bay to its ultimate potential as a harbor and port, and conserving the natural resources of the area. A master plan is required to carry out this responsibility. Since Humboldt County has been designated as a Title IV Redevelopment Area under the Public Works and Economic Development Act of 1965, the County has been eligible for continuing financial assistance from the Economic Development Administration of the U.S. Department of Commerce. The Harbor District applied for and received an EDA Technical Assistance Grant in 1974 to assist in the preparation of a master plan. A report was prepared by contract with a consulting firm and completed in July 1975. The Master Plan, which is general in nature, provides a framework within which detailed planning, environmental and economic analysis, and construction of specific projects can occur. The report also includes economic and environment data, ownership maps of properties on and around the Bay, and recommended means of implementing the Master Plan. The results of this study are briefly discussed in the following subparagraphs.

a. Humboldt Bay has a multiplicity of demands, uses, and overlapping governmental jurisdictions. For study purposes, the Humboldt Bay environ was divided into three planning areas: North Bay, Middle Bay, and South Bay. These areas are shown on Figure 2.

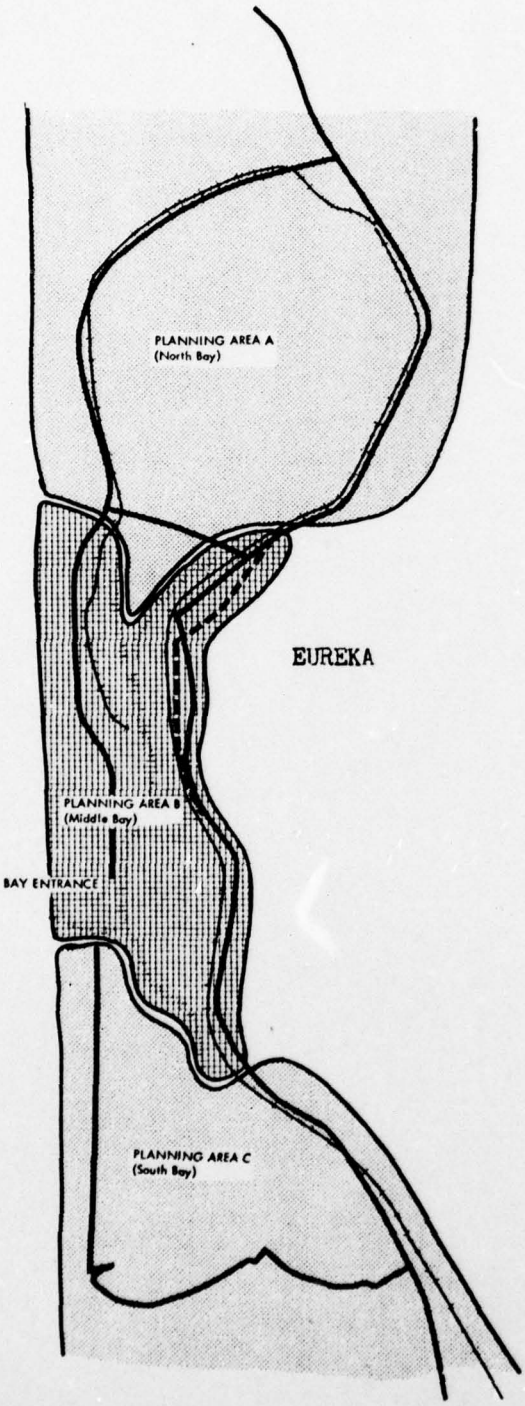
b. The North and South Bays, including the adjacent agricultural lands, contain an abundance of important habitat areas and natural resources. There is little development on the adjacent lands, and none of the existing development requires water access with the exception of the Arcata boat ramp. Geological faults and flooding of low-lying areas are common to these areas. In general, these areas are designated for conservation to include for the following uses: natural resources, wildlife habitat, public access, education, scenic views, recreation, mariculture, and agriculture. Most of the South Bay and a significant portion of the North Bay have been designated as the Humboldt Bay National Wildlife Refuge, to be acquired and administered by the U.S. Fish and Wildlife Service.

c. The Middle Bay, on the other hand, has a distinctly different character than the North and South Bays. Commercial and industrial establishments, supported by the water, air, rail and highway transportation systems, are located in this area. The prominent feature is the presence of the entrance channel from the ocean and ship channels to King Salmon and Fields Landing, Fairhaven, Samoa, and Eureka. Important natural resources and habitats are found primarily at the mouth of Elk River and on the dunes of the North Spit. The Master Plan generally designates that development be concentrated in the Middle Bay. New developments in port-related industry, commercial facilities and the commercial fishing industry should be located in this area; however, the dunes on the North Spit and the Elk River area need to be conserved and protected.

d. The Master Plan states that since the deepwater shipping channels are vital to the continuation and development of the port, the Harbor District should support efforts to maintain and improve the navigational facilities. It further recommends that, because there is a fixed amount of waterfront lands in the Bay on shipping channels, that industry requiring direct access to these channels be given top-priority consideration for development, and that no long-term commitments for a lesser use be made which would restrict future harbor development.

e. The study estimates that additional berthing facilities will be needed for about 633 small boats by 1990. About 20 percent of the berths will be used for recreation boats and the remaining for commercial fishing boats. Services to the existing harbors are either inadequate or lacking, which has had a negative impact on the commercial fishing industry in the Bay. The plan proposes a number of possible sites for small-craft harbor development.

f. To support existing and projected waterborne commerce in the Bay, the Master Plan recommends that the existing channels be deepened in accordance with the plans proposed by the Corps of Engineers (Project Document Plan). The plan of improvement proposed in this memorandum is the same as the Project Document Plan, with some modifications as to the exact features to be dredged.



Source: Humboldt Bay Master Plan

HUMBOLDT BAY PLANNING AREAS

NORTH

FIGURE 2

IV - INVESTIGATIONS AND COORDINATION

4-01. PREAUTHORIZATION INVESTIGATIONS

Prior reports are listed in paragraph 2-07. The survey report incorporated in the Project Document was prepared in response to Congressional resolutions made in 1955 and 1960. An Environmental Statement was not required when preauthorization studies were made; however, coordination with fish and wildlife agencies was carried out in accordance with the Fish and Wildlife Coordination Act of 1958 (48 Stat. 401, as amended). A report by the U.S. Fish and Wildlife Service was published as an appendix to the Project Document; their views and recommendations on the dredged disposal plan were adopted and recommended in the Project Document, which was to enlarge the disposal site on the North Spit in lieu of using Indian (Gunther) Island.

4-02. The initial public meeting was held in Eureka on 23 May 1961 to obtain the views of interested parties; hydrographic surveys of the area were made in June 1962 and June 1964 to estimate dredging quantities; foundation explorations were made concurrently to determine the soil characteristics of the dredge materials; and coordination was carried out with various governmental agencies and private interests to formulate the plan of improvement. The investigation also included economic studies of existing and projected waterborne commerce and analysis of alternative project features. The Humboldt County Board of Supervisors submitted resolutions on 2 July 1963 and 26 July 1966 approving the recommended plan of improvements and expressing its intent to meet the requirements of local cooperation.

4-03. POST-AUTHORIZATION INVESTIGATIONS

Post-authorization engineering and design studies for construction of project were initiated on 2 January 1974. These investigations encompass the following:

a. Economic Analysis. Economic studies were made of current and projected vessel traffic and commerce transiting Humboldt Harbor and Bay, with a re-analysis of benefits expected to result from improvement of various project features. This analysis is in Appendix B of this report.

b. Channel Design. Investigation of environmental and engineering factors (wind, current, waves, tides, and vessel characteristics) that influence the manuvering of large vessels in confined channels were made to select specific channel dimensions.

c. Comparative Dredging and Transport Costs. The distance from dredging sites to a suitable disposal site or sites has a significant effect on project cost and economic justification. Preliminary cost estimates were made for different dredging methods using alternative channel improvements and disposal sites to determine which features of project improvement deserved further detailed study investigation.

d. Hydrographic Surveys. The existing project channels are periodically surveyed to determine maintenance dredging requirements. Additional survey coverage was provided for areas outside the existing channel for evaluation of possible sites for a turning basin. The applicable surveys used in this report were made in August 1974 and September 1975.

e. Soils Investigations. Considerable data concerning types of sediments found in Humboldt Bay are available from maintenance dredging records. Additional site investigations and samples were taken in 1974 for soil classification and laboratory analysis for potential pollutants. Also, a large number of sediment samples were taken in connection with a benthic survey (see below) of the North Bay channels of Humboldt Bay. Details of soils and pollution investigations appear in Appendix C.

f. Benthic Survey. A benthic survey of the North Bay channels was made by the Humboldt State University Foundation between September 1974 and July 1975 to assess benthic resources that might be impacted by the proposed project. The survey included a computer-assisted analysis to correlate the accretion/erosion of various bottom areas with the types and numbers of organism in each. Impacts of project dredging on the benthic community are discussed in Section IX. Details are shown in the Environmental Statement.

g. Archaeological Survey. Cultural resources investigations of potential disposal sites were conducted by a consultant on contract with the San Francisco District in 1974 and by District personnel in 1975 in compliance with Executive Order 11593. Results were used to assess impacts of project construction activities on these sites (See Section IX). Details are discussed in the Environmental Statement.

h. Littoral Drift Study. Findings from a previous littoral drift study (September 1973) made by the San Francisco District - to assess possible effects of a dam on Mad River - were used to evaluate potential effects of ocean and ocean beach alternatives for disposal of dredged material.

i. Shoaling Study. Maintenance dredging records were analyzed and a special investigation of shoaling patterns and rates in the "Middle Grounds" at the entrance to the North Bay Channel was undertaken to estimate future maintenance costs for possible increments of channel improvement considered in this report.

j. Environmental Studies. Various marine, meteorological, hydrological, and geological data were also analysed to determine the design parameters for the project and to evaluate the effects of these environmental parameters on the proposed plan of improvements.

k. Aerial Photography and Remote Sensing. Recent aerial photographs were utilized to update cultural changes which have occurred since publication of the most recent quadrangle maps (1973) by the U.S.G.S. In addition, infrared color photographs produced from NASA-supported remote sensing research were used to assess seasonal current changes, relationships between shoreline configuration and shoaling patterns, existing water quality characteristics of Humboldt Bay and adjacent ocean waters, and vegetation characteristics of potential disposal sites.

l. Land Ownership. A listing of parcel ownerships and assessor maps published in the Humboldt Bay Master Plan was used to delineate the approximate extent of disposal areas and subarea property lines on the North Spit. This information will be utilized by the local sponsor in securing legal agreements for construction rights-of-way and disposal sites.

m. Utility Relocations. Pipeline and cable crossings in the Bay were located through contact with the various utilities and agencies, and by review of the permit applications in the San Francisco District office. Details are discussed in Paragraph 6-11.

4.04 POST-AUTHORIZATION COORDINATION

The San Francisco District of the Corps of Engineers, has maintained coordination throughout the study with various Federal, State, and local agencies; private business, commercial, and industrial enterprises; and interested groups and individuals. Agencies and groups contacted, and subjects of interest, include the following:

a. U.S. Department of Agriculture, Sea Grant Program: Impact on sea resources.

b. U.S. Department of Commerce, Economic Development Administration: Humboldt Bay Master Plan.

c. Environmental Protection Agency: Dredge disposal criteria.

d. U.S. Department of the Interior:

(1) National Park Service: Archaeological sites.

(2) Bureau of Land Management: Land disposal sites.

(3) Bureau of Outdoor Recreation: Land disposal sites.

(4) U.S. Fish and Wildlife Service: Impacts of dredging and dredge disposal sites.

e. U.S. Department of Transportation, United States Coast Guard: Aids to navigation.

f. California Department of Fish and Game: Impacts of dredging and dredge disposal sites.

g. California Department of Navigation and Ocean Development: Use of dredged material for beach replenishment.

h. California Department of Transportation: Use of dredged material as borrow material in highway fill.

i. California Coastal Zone Conservation Commission, North Coast Region: Conformance to coastal plan.

j. North Coast Regional Water Quality Control Board: Water quality standards in the bay and ocean.

k. California Department of Water Resources: Influence of proposed project on salt water intrusion and ground water.

l. California State Lands Division: Jurisdiction of dredged material removed from State-owned tide lands.

m. California Department of Public Health: Effects of turbidity on shellfish.

n. Humboldt Bay and Harbor, Recreation and Conservation District: Alternatives, dredge disposal sites, and local assurances.

o. Humboldt Bay Wastewater Authority: New sewerage system.

p. County of Humboldt, Planning Department: Dredge disposal sites.

q. City of Eureka: Navigational improvements and dredge disposal sites.

r. City of Arcata: Navigational improvements and dredge disposal sites.

s. Humboldt Bay Bar Pilots: Navigational requirements.

t. Westfall Stevedore Company: Commercial development and requirements.

V - PLAN FORMULATION

5-01. GENERAL

The plan formulation portion of the study considered a number of alternative plans. Alternatives considered were (1) "no action" (2) various channel dredging configurations including the Project Document plan; and (3) various plans for disposal of dredged materials.

5-02. CRITERIA

Appropriate criteria to permit development of the most satisfactory plan include general, technical, economic, social, and environmental standards and guidelines. These were applied using the data gathered in the previously mentioned post-authorization investigations. General criteria call for the recommended plan to be consistent with local and regional goals and guidelines for land and water resources uses; this would include consistency with the Humboldt Bay Master Plan.

5-03. Technical criteria call for the recommended plan to make provision for: (1) vessel access - including adequate channel width, depth, curvature, turning areas, and navigation clearances - recognizing the influence of waves, tides, currents, and vessel size and operating characteristics; (2) utility services - protection or relocation, as needed, of existing power, water, and other utilities services which cross the project channels; and (3) maintenance of water quality standards through proper dredge disposal practices.

5-04. Economic criteria call for: (1) tangible benefits exceeding project economic costs - including the provision that each separable unit of improvement should provide benefits at least equal to the cost of the improvement; (2) cost estimates based on design layouts, quantity estimates and annual maintenance at 1975 price levels; and (3) a 50-year economic life, using an interest rate of 3-1/4 percent as specified in the Project Document. (Use of this rate is in accordance with Section 80b of P.L. 93-251, the Water Resources Development Act of 1974.)

5-05. Environmental criteria call for minimizing adverse impacts on water quality, and land and air resources. Birds, aquatic animals and plants, archaeologic sites, and benthos that might be impacted by the proposed alternatives should be identified and mitigation measures devised, if necessary.

5-06. Social and other criteria include assessing and minimizing adverse social impacts; assuring that activities attracted to project area are consistent with current uses; and conducting the study in full cooperation with interested Federal and non-Federal agencies, local groups and individuals through conferences, public meetings, correspondence, and similar procedures.

5-07. "NO ACTION" ALTERNATIVE

Current investigations reveal that, due to increased vessel traffic, the need for the recommended navigation improvements is more critical now than anticipated when the survey investigation was conducted in 1962-65. The "no action" alternative would not require any widening, deepening, or extension of navigation in Humboldt Bay. Nor, of course would there be any dredge material to be disposed of. However, the existing channel depths are inadequate to accommodate current, fully-loaded, dry cargo vessel traffic, without significant tidal delays. Thus important economic benefits would be foregone under the "no action" alternative. Beneficial effects would include no impacts on fauna and flora and habitats both within the channel and at the disposal sites proposed for the action alternatives. As discussed subsequently under "Environmental Analysis," these impacts do not appear to be great, and since the economic benefits would be large, the "no action" alternative has been set aside as unresponsive to documented needs for navigation improvements.

5-08. ALTERNATIVE NAVIGATION IMPROVEMENTS

Post-authorization studies include a review and economic evaluation of alternatives including certain proposals made at the public meeting held in Eureka on 8 March 1974. No specific recommendations or testimony on the need for an anchorage area adjacent to the North Bay Channel was presented at the public meeting; however, there were specific proposals for widening the 110-degree bend at the beginning of the North Bay Channel; for widening the Fields Landing Channel; and enlarging the turning basin at Fields Landing.

5-09. The basis for the extent of authorized channel deepening and bend widening has been examined and reaffirmed. The major shipping terminal activity within Humboldt Bay will continue at existing docks near the northern end of the authorized channel deepening at distances of about four to six miles from the entrance. Therefore, as authorized, the entire length of the North Bay Channel (Mile 0.75 to mile 4.29), Samoa Channel (Mile 4.29 to Mile 5.84), and a portion of the Eureka Channel (Mile 4.29 to 5.00) would have to be deepened to provide complete vessel access. No reduction in the length of the authorized project channels would be warranted nor would new or extended channels be justified since there are no planned deep-draft facilities which would require extensions. However, as described below, a new turning basin at the head of the Samoa Channel is considered necessary to serve current and projected needs of existing terminals on the channel.

In addition, reanalysis of certain improvements which were found economically infeasible during the preauthorization studies revealed insufficient economic change to justify their current recommendation. Deepening of the Bar and Entrance Channel to 45 feet would result in estimated benefits of $160,000 per year; with incremental annual costs of $213,000, the resulting benefit to cost ratio would be 0.7 to 1. Deepening of the Fields Landing Channel to 30 feet would

have estimated annual benefits of $132,000 as compared to incremental annual costs of $165,000, with a resulting benefit to cost ratio of 0.8 to 1. Since the benefit-cost ratio for both of the proposals is less than unity the judgment of the preauthorization studies was reaffirmed.

5-11. Investigations reveal that some departures from the Project Document Plan (see also Section VII) appear to be warranted, as follows.

a. Anchorage Area. There no longer appears to be justification for the 1,200 feet by 1,200 feet by 35 feet deep anchorage area included in the authorized plan. With the advent of larger, deeper-draft vessels, and steadily rising operating cost, there is a strong incentive for ship operators to reduce ship turn-around times. This in turn tends to reduce the need for anchorage areas. Total dollar benefits attributed to the anchorage in the Project Document plan were $43,000 per year, based on savings in operating costs, estimated to be $33,000 from being at anchor rather than at sea, and damage reduction due to lessening of collisions - estimated at $10,000. Currently, approximately 15 deep-draft vessels per year find it necessary to anchor within the bay (excluding, of course, the customary time spent transferring cargo at the wharf and docks). The typical time at anchorage ranges from two to four hours per occurrence. Current information indicates that an anchorage area would not result in increased usage of the bay by vessels for anchorage, therefore savings in operating costs are now considered to be insignificant. Navigation safety could be improved by an anchorage; however, there have been no collisions in the bay involving deep-draft vessels since 1963, despite an increase in traffic. Therefore, it is now believed to be unwarranted to claim any significant damage-reduction benefits for anchorage. Based on the foregoing considerations, incremental justification for this separable item of improvement is thus lacking. (Refer also to Paragraph B-37, Appendix B.) Moreover, as noted previously, local interests no longer actively support its construction. On this basis, it has been deleted as a project feature.

b. Bend Widening. As part of the Project Document Plan, bend widening was recommended in the North Bay channel at Miles 0.75 and 2.60. During the investigation it was noted that the channel bend at Mile 2.00 had a degree of turn greater than that at Mile 2.60 and should, therefore, also be widened. This item was not included in the Project Document because it was believed that the most likely location (although not specifically designated) for the proposed anchorage area was adjacent to the North Bay Channel at Mile 2.00, and if the anchorage area were constructed, there would have been adequate width at the turn without specifically designating bend widening at that point. The deletion of the anchorage area thus requires specific widening of the channel bend at Mile 2.00.

c. Widening of the Samoa Channel. The existing Samoa Channel, extending from Mile 4.29 to Mile 5.84, is 30 feet deep and 300 feet wide. Three shipping terminals with an important share of Humboldt Bay vessel traffic are located adjacent to this channel. The Project Document plan calls for deepening to 35 feet, but would retain the 300-foot

channel width. However, based on a technical channel width criteria (applied to vessels operating in a one-way channel under semi-restricted conditions) and comments of harbor pilots, this width is substandard. Using a typical design vessel with a beam of 100 feet, the required channel width would be about 400 feet. Therefore, because of the need for improved vessel handling and safety, a widening of the Samoa Channel to 400 feet has been included as part of the project to be recommended in this memorandum.

d. Turning Basin at the Head of the Samoa Channel. Vessels using the terminals on the Samoa Channel would benefit from provision of a turning basin at the head (northern end) of the channel. At the present time, berthing vessels either turn, with some difficulty, at the northern end of the channel, requiring maneuvering outside of the project limits or else they turn at the Samoa-Eureka Channel junction and back up the Samoa Channel to the docks. Economic analysis revealed that benefits of $108,000 per year as compared to annual cost of $87,000 would result from construction of a turning basin, which would be approximately 1,100 feet by 1,000 feet, in size. Therefore the basin is incrementally justified, and has been added as a project feature. (Refer to Paragraph 12-10 and Appendix B for the incremental analysis of this feature) Establishment of a turning basin at the Samoa-Eureka Channel junction does not appear warranted at this time since vessels can presently turn with little or no encroachment outside project lines, nor would the expected traffic levels require a separate turning basin.

5-12. Alternative channel depths were also investigated. These investigations reveal that maximum net benefits occur at the authorized depth of 35 feet, confirming that this would be the optimum depth. At depths less than 35 feet, tidal delays are significantly increased; at greater depths, additional incremental benefits would be minimal since the projected user vessels would not, in general, be of a deep enough draft to require added depth at the lowest tidal stages. Incremental differences result solely from changes in tidal delay benefits, changes in topping off and vessel back-tracking benefits are negligible for the range of incremental depths about the optimums and were assumed to be unchanged for the depths considered. The comparative costs and benefits of alternative depths are shown in Table 1.

TABLE 1

COMPARATIVE COSTS AND BENEFITS
FOR PROJECT DOCUMENT PLAN, AS MODIFIED
(Nov 1975 Price Levels @ 3-1/4%)

Channel Depth	First Cost	Annual Cost	Annual Benefits	Net Benefits	Benefit/ Cost Ratio
34 feet	$5,535,000	$ 255,000	$ 545,000	$ 290,000	2.1
35 feet	6,660,000	308,000	646,000	338,000	2.1
36 feet	8,075,000	375,000	647,000	272,000	1.7

5-13. The navigation features of the reaffirmed Project Document Plan, with the just-described modifications, are treated in detail in Section VI, "Recommended Plan of Improvement."

5-14. ALTERNATIVES FOR DISPOSAL

As noted above, the "no action" alternative has been removed from consideration, and the Project Document plan with modifications to improve project operations has been reaffirmed as to general physical extent and depth of dredging. However, completion of planning also requires formulation of disposal alternatives and selection of the best location.

5-15. Ocean disposal, in-bay, beach and land sites were considered as alternatives for disposal of dredged materials. Because of strong wave action, it would be necessary to use a Government-owned hopper dredge to deepen the southern extremity of the North Bay Channel from Mile 0.50 to Mile 1.0. Ocean disposal at an EPA-approved site would thus be indicated for materials from that area. The balance of the material would be deposited in a land site after excavation by a hydraulic pipeline dredge, as authorized in the Project Document.

5-16. Generally, where the haul distance is short, as is the present case, the use of the hopper dredge is the least expensive means for dredging and disposal operations. However, Corps policy generally precludes the use of Government-owned hopper dredges for new work dredging, except as noted above, in areas of strong wave action. Therefore, since there are no privately-owned hopper dredges in this country at the present, the

hydraulic pipeline dredge is currently the most economical alternative means of construction for the authorized project. The use of a clamshell dredge with barge haul to the ocean disposal site was investigated during the preliminary plan formulation stage and was found to be about 50 percent more costly for project dredging and disposal than a pipeline dredge with land disposal. In addition, aquatic disposal is generally less environmentally acceptable than land disposal. Therefore, the potential use of the clamshell dredge has been eliminated from further consideration in this memorandum.

5-17. Possible alternative disposal sites considered are listed below. Site locations are shown on Figure 3. The rationale for selection of the preferred locations is discussed subsequently.

a. Deep-Ocean Site. A deep-ocean disposal site at Latitude 40°0'20"N, Longitude 124°25'00"W has been designated by the Environmental Protection Agency (EPA) for disposal of materials unacceptable for disposal in nearshore or inland waters. This location is about 9.3 nautical miles northwest of the entrance to Humboldt Bay.

b. Nearshore Ocean Site. A nearshore ocean disposal site at Latitude 40°45'44"N, Longitude 124°15'42"W, has been designated by EPA for disposal of less-polluted or non-polluted materials. The location is about 1.5 nautical miles outside, and to the south, of the harbor entrance. Since the predominant littoral drift is to the south, it is expected that material disposed of at this site would not contribute to shoaling of the entrance channel. This site is currently being used by the Corps for disposal of dredged materials from annual maintenance of existing navigation channels in Humboldt Bay.

c. In-Bay Site. The California Department of Navigation and Ocean Development has suggested that consideration be given to placement of dredged material in the vicinity of Buhne Point, an eroding reach of shoreline opposite the entrance to Humboldt Bay. This plan would not require retention dikes and could provide added protection to the tracks of the Northwestern Pacific Railroad, which already has some rubble revetment protection.

d. Ocean Beach Site. Placement of dredged material on the ocean beach of the North Spit directly west of the Samoa Channel has also been considered. The proposed site begins about 2.7 miles north of the harbor entrance. Diking would not be necessary. However, to lessen environmental impacts, specifically upon the offshore Dungeness crab fishery, disposal should preferably be carried out during the winter rainy season, when background turbidity is normally high (because of river runoff) and the crab population is further offshore.

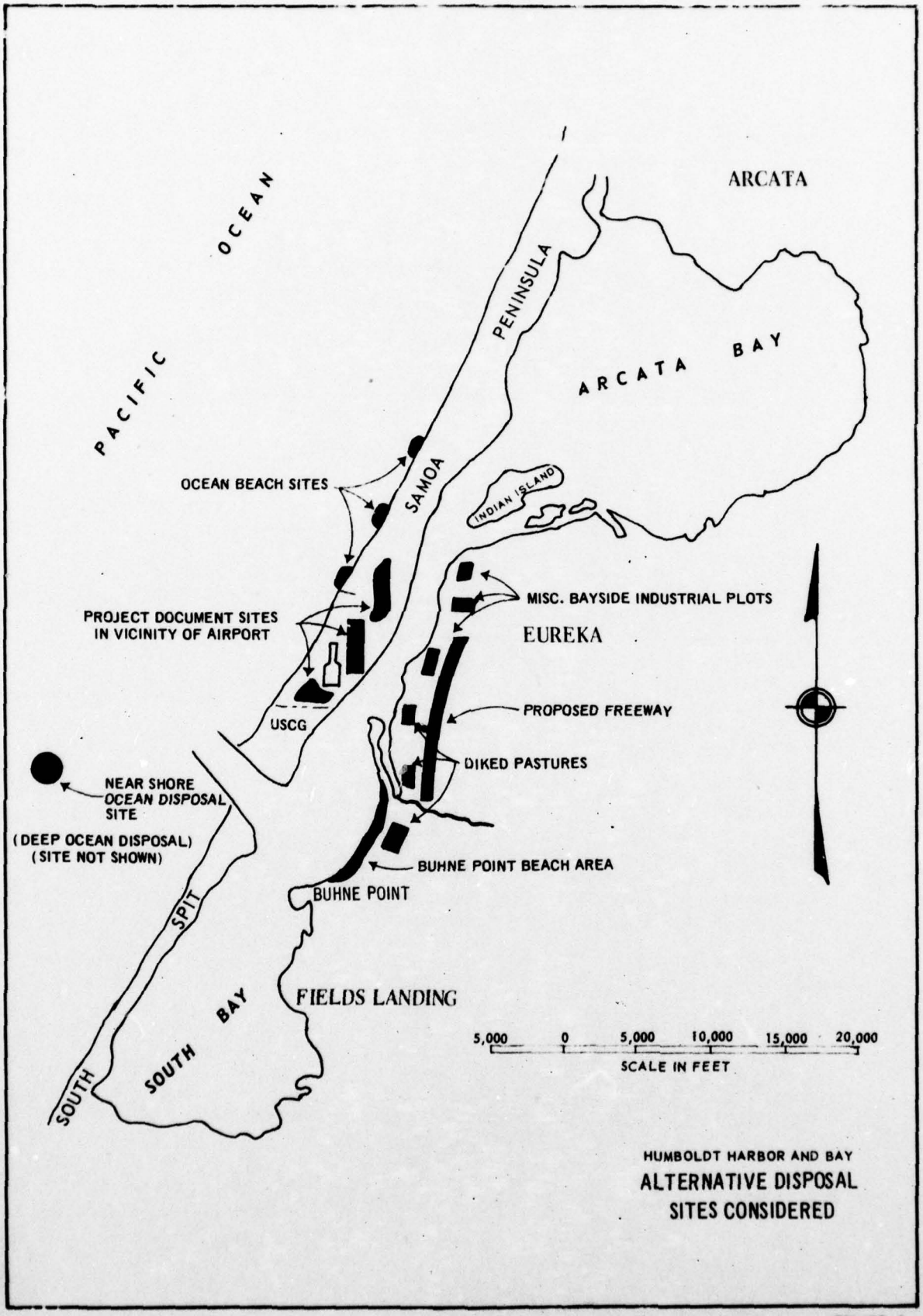

PACIFIC OCEAN
ARCATA
PENINSULA
ARCATA BAY
OCEAN BEACH SITES
SAMOA
INDIAN ISLAND
MISC. BAYSIDE INDUSTRIAL PLOTS
PROJECT DOCUMENT SITES IN VICINITY OF AIRPORT
EUREKA
USCG
PROPOSED FREEWAY
DIKED PASTURES
NEAR SHORE OCEAN DISPOSAL SITE
(DEEP OCEAN DISPOSAL) (SITE NOT SHOWN)
BUHNE POINT BEACH AREA
BUHNE POINT
SPIT
SOUTH BAY
FIELDS LANDING
SOUTH
5,000 0 5,000 10,000 15,000 20,000
SCALE IN FEET
HUMBOLDT HARBOR AND BAY
ALTERNATIVE DISPOSAL SITES CONSIDERED

FIGURE 3

e. North Spit Site. A 290-acre land area in the vicinity of the Eureka Airport on the North Spit was designated for disposal in the Project Document plan. The site has the advantages of generally being close to the center of mass of the channel dredging; has the required capacity; and, is in a sand dune area which can be readily shaped to provide confining dikes. The site has been subdivided into several subareas for further consideration, based on ownership, drainage, economics and environmental acceptability. These subareas are described subsequently.

f. Freeway Site. This location is along the route of the planned Federal-State extension of U.S. Highway 101 through the city of Eureka, specifically an elevated freeway segment from Hawthorn Avenue to the Elk River Bridge, which would require approximately 1.5 million cubic yards of fill material. The California Department of Transportation (CALTRANS) proposed the use of this site as a cooperative effort. Major economic advantages could conceivably result from construction use of project material in a hydraulic fill in lieu of borrow from land sources.

g. Other Miscellaneous Land Sites. Other land sites were considered in addition to the already-noted land disposal sites on the North Spit and along the proposed freeway embankment. These included low-lying, undeveloped areas along the Eureka waterfront. The Humboldt Bay Master Plan envisions future development of most of these areas as industrial or port-related terminal storage areas. Many of these sites are quite close to the proposed channel deepening area; however, they are in several different ownerships and generally have small capacities. Marshy pasture lands and other undeveloped parcels south of the Eureka corporate limits were also considered.

5-18. SCREENING OF DISPOSAL ALTERNATIVES

Under the provisions of the Project Document, the local sponsor, The Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD), would be responsible for providing disposal sites and for construction of retention dikes and drainage facilities. The above-mentioned alternatives were developed and screened in cooperation with the HBHRCD and other interested agencies. As the study progressed, the less desirable sites were withdrawn from consideration due to various constraints such as cost, environmental impact, and availability.

5-19. The deep-ocean disposal site was removed from consideration for disposal of dredge material since soil and pollution tests indicated that none of the samples taken within the authorized improvements are polluted according to current EPA criteria for disposal in a shallow marine environment (see Appendix C). Therefore, the EPA-approved nearshore ocean disposal site was selected for disposal of material to be excavated by hopper dredge in North Bay Channel from Mile 0.50 to Mile 1.0.

5-20. In-bay disposal at Buhne Point was removed from consideration because it is believed that beach replenishment would be only temporary since the site, which is directly opposite the bay entrance, is subjected to strong wave action which would likely move much of the material into the Fields Landing and North Bay Channels. Also, although retention dikes would not be required, this very fact would prevent clarification of tailwaters before draining into the Bay with the probbability of high-level turbidity that would exceed acceptable water quality standards.

5-21. The freeway site was withdrawn from consideration because of the excessive costs for retention dikes resulting from the necessarily elongated configuration of the fill. Moreover, and most importantly, there no longer appears to be a likelihood of parallel time-phasing of funding for design and construction by CALTRANS due to general delays in the State highway construction program.

5-22. As noted previously, the Project Document site on the North Spit is fairly close to the channel and is physically adaptable for disposal use. In addition, most of the subareas within this site would drain to the ocean which would avoid concern about direct impacts on bay water quality. Much of the area is in public ownership under the control of the city of Eureka and is available for disposal use. This area is considered to be the most acceptable of those considered and was selected as the primary disposal site. The optimal choice of subareas for disposal within this general location is discussed subsequently.

5-23. Disposal on the ocean beach on the North Spit was also considered as a secondary disposal site. Disposal on the beach could be an acceptable means of disposing a part of the project dredging, provided, as noted previously, that it is scheduled during or close to the winter season to protect the crab fishery, and that only sandy material be deposited at this site. However, there is some uncertainty about increased shoaling at the Bar and Entrance Channel since the predominant littoral drift is southward. Moreover, possible sediment effects upon adjacent underwater outfalls of the Louisiana-Pacific and Crown Zellerbach pulp mills cannot be accurately predicted. Therefore, this site has been dropped from consideration.

5-24. The other potential disposal areas considered included a small site on the North Spit that is outside the Project Document site and miscellaneous low-lying locations on the city of Eureka waterfront. These latter sites have been proposed for use as possible future industrial sites. They are favorably located insofar as proximity to the proposed dredging; pumping costs would be relatively low. With adequate retention time of the tailwaters, it is expected that turbidity and other water quality impacts on bay water would be acceptable. However, the disposal capacity of these sites is small. Therefore, local-interest

costs for retention dikes would be relatively high for the volumes involved, and another major disposal site would still be required. Because of their locations and existing conditions, the use of some of these sites, in all likelihood, would require mitigation measures. In addition, these parcels are in various private ownerships which would pose a problem of availability. For these reasons, none of these sites are recommended at this time. However, if, at the time of project dredging, all the necessary permits have been obtained by the owner or owners, it may be feasible to deliver the dredged materials to some of these sites. These comments also apply to the marshy pasturelands south of the corporate limits. Filling these pastures would also have adverse impacts on wildlife.

5-25. OPTIMIZATION OF NORTH SPIT DISPOSAL SITE

As previously described, the 290-acre area on the North Spit which was authorized in the Project Document is reaffirmed as to general suitability for material disposal. As part of the investigation, the area was divided into discrete subareas for development of specific site plans for diking, disposal and drainage. Three major subareas were identified as physically, economically and environmentally suitable for disposal use: Sites 13A, 13B and 13C (Refer to Plate 8). Site 13A, west of the Crown-Simpson pulp mill, has an area of 80 acres and could accommodate approximately 1.9 million cubic yards of material. This site is owned by the Simpson Timber Company. Site 13B, adjacent to the easterly side of the Eureka Airport, has an area of 60 acres and could accommodate approximately 1.8 million cubic yards. Site 13C, south of Eureka Airport, has an area of 50 acres and could accommodate approximately 820,000 cubic yards. Both sites 13B and 13C are on lands controlled by the city of Eureka.

5-26. Utilization of these sites would require perimeter diking, a settling area for clarification of dredge effluent, and drainage trenches. Material would be supplied to the sites by overland and floating pipelines connected to a hydraulic pipeline dredge. A barge-mounted booster pump would be required at an intermediate location on the pipeline.

5-27. Sites 13B and 13C have been offered by the city of Eureka to the Harbor District for use as disposal sites. However, Site 13A does not appear to be available due to lack of interest by the owner. The use of this site would interfere with existing railroad facilities serving the pulp mill. Therefore, Sites 13B and 13C, in combination, were selected as the primary disposal site.

5-28. The stated capacity of Sites 13B and 13C was limited by the dune topography. Increasing capacity by raising the height of the retention dikes was also considered. This would, however, increase the diking volumes disproportionately; and, would cover the dune crests completely, thus destroying the irregular, hummocky topography of the area and slowing the rate of natural revegetation. Hence, it was decided that the use of both subareas 13B and 13C would be required to contain an

estimated 2.21 million cubic yards of dredged material to be removed by pipeline dredging. Retention dikes of from two feet to 20 feet in height would contain an estimated 1.8 million cubic yards of material below the 30-foot contour in subarea 13B. Similar dikes would hold an estimated 820,000 cubic yards in subarea 13C.

5-29. In summary, on the basis of the post-authorization investigations, the Project Document plan with some modification as to scope of navigation improvement and the plan of disposal, was reaffirmed as described above. This plan is described in detail in the following section.

VI - RECOMMENDED PLAN OF IMPROVEMENT

6-01. GENERAL

The recommended project consists of deepening and widening of existing channels to improve access to existing commercial terminals within Humboldt Bay. The new plan recommends that the existing project be modified to provide for: (a) deepening of the North Bay Channel to a depth of 35 feet between Mile 0.75 to Mile 4.29; (b) widening of the channel bends in the North Bay Channel at Mile 0.75, Mile 2.00, and Mile 2.60; (c) deepening the Eureka Channel to a depth of 35 feet between Mile 4.29 and Mile 5.00; (d) deepening and widening of the Samoa Channel between Mile 4.29 and Mile 5.84 by increasing the channel depth to 35 feet, and increasing the existing 300-foot channel width to 400 feet; and (e) a turning basin beyond Mile 5.84 at the upper end of the Samoa Channel, 35 feet deep and 1,000 feet wide by 1,100 feet long.

6-02. Local interests are required to provide disposal areas for dredged materials, including necessary retaining dikes, bulkheads, and embankments. Disposal of dredged material would be at two primary disposal sites on the North Spit, designated as Sites 13B and 13C, with disposal capacities of about 1,800,000 and 820,000 cubic yards, respectively.

6-03. Works to be constructed by the Corps of Engineers would be paid for in their entirety by funds provided by the United States and would consist of dredging in the project channels to provide dimensions described in Paragraph 6-04, below. Aids to navigation would be provided by the U.S. Coast Guard with funds of the United States.

6-04. CHANNELS AND TURNING BASIN

The channel and basin improvements consist of dredging approximately 2.4 million cubic yards of material. Channels would be dredged to project depth with a two-foot allowance for overdepth dredging. Side slopes would be one vertical on two horizontal. The plan improves navigation access by providing increased depths for the convenient passage of deep-draft vessels and increased and extended dimensions for improved steerage. The location and description of the channel and basin improvements are defined by areas as follows: (Refer also to Plates 1 through 7).

a. North Bay Channel. The existing North Bay Channel, extending from Mile 0.75 to Mile 4.29 is 400 feet wide and 30 feet deep (at mean lower low water). The recommended improvements consist of widening the channel at three bends located at Miles 0.75, 2.00, and 2.60, and deepening the entire length of the channel to 35 feet.

b. Eureka Channel. The existing 400-foot wide Eureka Channel, from Mile 4.29 to Mile 5.00 is 30 feet deep, and from Mile 5.00 to Mile 6.30, 26 feet deep. The recommended improvement consists of deepening the portion of the channel from Mile 4.29 to Mile 5.00 to 35 feet.

c. Samoa Channel. The existing Samoa Channel is 30 feet deep, 300 feet wide and extends from Mile 4.29 to Mile 5.84. The recommended improvements would deepen and widen the entire channel length to provide a depth of 35 feet and a width of 400 feet.

d. Turning Basin. A new turning basin, 35 feet deep, 1,000 feet wide, and 1,100 feet long would be provided at the head of the Samoa Channel, immediately beyond Mile 5.84.

6-05. DREDGING AND DISPOSAL SITES

Approximately 190,000 cubic yards of material would be dredged from the North Bay channel, between Mile 0.50 and Mile 1.0, and disposed of at a nearshore ocean disposal site approximately 1.5 nautical miles southwest of the harbor entrance. This work would be accomplished by a Government-owned hopper dredge. The balance of the dredging consists of 2.21 million cubic yards to be removed from the North Bay, Eureka, and Samoa Channels, and the new turning basin at the head of the Samoa Channel. This material would be placed on two disposal areas on the North Spit adjacent to the Eureka Airport. The two sites are designated as 13B and 13C. Figure 4 is a photographic illustration of the disposal site plan. Location and a cross-section are shown in Plates 8 and 9.

6-06. Site 13B covers an area of about 60 acres on the northeasterly side of the airport between the main highway and a drag strip which parallels the airport runway. Approximately 1.8 million cubic yards would be accommodated. Retention dikes would vary in height from a maximum of 20 feet (+30 feet elevation, mean sea level) near the highway to 10 feet near the drag strip. Filling would begin on the lower (westerly) side near the drag strip and proceed upslope toward the highway. Tailwaters would be retained in a low area in the northwest corner of the site for settling and clarification, prior to discharge to the ocean to the west.

FIGURE 4

6-07. Site 13C occupies about 50 acres on the southwesterly side of the airport. Approximately 820,000 cubic yards would be accommodated. As in the case of Site 13B, height of dike would vary, ranging up to 20 feet, and filling would proceed in the same general fashion. Tailwaters would be collected in a nearby depression, behind a road embankment west of the runway, which would act as a settling pond before discharge to the ocean.

6-08. REAL ESTATE REQUIREMENTS

The local sponsor, the HBHRCD, would be required to obtain easements for passage of dredge pipes across public and private properties and roads to reach the disposal sites adjacent to the Eureka Airport. Use of these land disposal sites will require agreement with the City of Eureka. In addition, agreement would have to be obtained from the Humboldt County Road Department to allow dredge pipe crossings.

6-09. At this time, the HBHRCD has not obtained specific easements for the necessary rights-of-way. A resolution, however, has been obtained from the City Council offering use of the land disposal sites. (Refer to Appendix E). No problems are expected in obtaining the other necessary easements since the areas involved are generally undeveloped, with low-intensity uses which would not be hampered by temporary use as dredge pipe rights-of-way.

6-10. UTILITY RELOCATIONS

As specified in the Project Document, all utility relocations must be accomplished at local expense. Utility crossings requiring relocation are shown on Plate 10 and described in Table 2.

TABLE 2

UTILITY RELOCATION

Permit No.	Owner	Feature	Possible Relocation
PN2-1940	PT&T	Telephone Cable	Yes
PN62-66	PG&E	Two 12KV Cable (elec.)	Yes
PN61-10	PG&E	10-3/4" O.D. Gas Line	No
PN55-33a	PT&T	Telephone Cable	Yes
PN71-5	Humboldt Bay Municipal Water District	27" I.D. Pipe	No

6-11. Owners of these utilities have been advised that the permits issued for these installations require the removal or relocation at their expense, in the event they were found to interfere with current or future navigation improvements. The owners have responded in writing that they will cooperate in providing deeper burial for such facilities, as necessary. It may be necessary to bury the two 12KV submarine electric power cables owned by the Pacific Gas and Electric Company (PG&E) to a deeper depth to insure against damage by project dredging or future maintenance operations. The existing bottom of the bay at the PG&E cable crossings is several feet below the 35-foot design depth proposed for the channel and the cables are buried in a trench under an unknown depth of cover. Since these cables serve only as auxiliary backup facilities for distribution of electricity, the company has indicated a preference for temporarily cutting off service during construction, in lieu of relocating them at this time. The same indeterminate relocation requirement applies to the Pacific Telephone cables.

6-12. AIDS TO NAVIGATION

The proposed channel widening would require the relocation of five existing buoys and the addition of new buoys due to the provision of a new turning basin. The existing and proposed aids to navigation are shown on Plates 2 through 7.

6-13. BERTHING IMPROVEMENTS BY LOCAL INTERESTS

An item for berthing improvements was included in the Project Document as a necessary part of the overall plan. The estimated cost of this non-Federal investment item was based on dredging approximately 300,000 cubic yards from certain deep water berths in the North Bay

channels to provide berthing depths commensurate with the 35-foot depth recommended for project channels. Review of dredging permits shows that many of these improvements have already been accomplished by local interests. Since 1965, approximately 440,000 cubic yards have been dredged from berthing areas in the North Bay, Eureka and Samoa Channels, including about 70,000 cubic yards during the recent construction of the North Coast Export Company pier. Current depths of berthing areas average 32 feet below MLLW. It is estimated that removal of 100,000 cubic yards will be required to bring the berthing area depths to the required 35 feet.

VII - DEPARTURES FROM THE PROJECT DOCUMENT PLAN

7-01. GENERAL

The plan recommended in this memorandum is essentially the same as that recommended in the Project Document. Departures from the Project Document plan consist of: (a) deletion of the North Bay anchorage area; (b) widening of one additional channel bend in the North Bay Channel; (c) widening of the Samoa Channel; and (d) addition of a turning basin at the head of the Samoa Channel. These changes are discussed in subsequent paragraphs.

7-02. ANCHORAGE AREA

The Project Document recommended the dredging of an anchorage area in the North Bay, at an undetermined location between the Entrance Channel and Indian (Gunther) Island, 35 feet deep, 1,200 feet wide and 1,200 feet long. This area has been deleted from the recommended plan due to a current lack of justification. Studies indicate that benefits to user vessels would be negligible.

7-03. BEND WIDENING

The Project Document recommended widening of channel bends in the North Bay Channel at Miles 0.75 and 2.60. During the current studies it was determined that widening of an additional bend at Mile 2.00 in the North Bay Channel was advisable. This feature has thus been added to the recommended plan.

7-04. WIDENING OF THE SAMOA CHANNEL

The Project Document recommended deepening the entire length of the Samoa Channel to 35 feet from the existing 30-foot depth, but would have retained the existing width, which is 300 feet. However, it has been determined that the channel should be widened to adequately serve user vessels. Therefore, under the recommended plan, the channel would be widened to 400 feet for its entire length between Mile 4.29 and Mile 5.84.

7-05. TURNING BASIN AT THE HEAD OF THE SAMOA CHANNEL

No new turning basins were recommended in the Project Document. The current studies revealed that vessels using the terminals on the Samoa Channel would benefit from provision of a turning basin at the head of the channel and that the benefits received would exceed the costs. Therefore, a turning basin, 35 feet deep, approximately 1,000 feet wide and 1,100 feet long, has been added to the recommended plan as a project feature.

7-06. DISPOSAL OF DREDGED MATERIAL

The Project Document authorized the placement of dredged material within a 290-acre land area on the North Spit. The recommended plan of disposal would utilize two sites totalling 110 acres within the authorized 290-acre area. Currently, it is estimated that 2.21 million cubic yards of material would require land disposal and that the recommended sites have an adequate capacity of about 2.62 million cubic yards. In the Project Document, dredging quantities were estimated to be 3.75 million cubic yards, exclusive of hopper dredging volume of 87,000 cubic yards. The difference is due to departures made in project features and to changes in the channel bathymetry, resulting from natural forces and periodic channel maintenance.

7-07. MODIFICATIONS IN THE REQUIRED ITEMS OF LOCAL COOPERATION

The authorized items of local cooperation appear in paragraph 1-06, as items (a) through (e). The current items of local cooperation, include the authorized provisions (with a modification to item [d]) and five additional provisions listed as items (f) through (j). These items have been added to assure that the construction, operation, and maintenance of the project will satisfy current Corps policy and specific legislation by Congress concerning land acquisition, navigation, and environmental and social concerns. Item (g) has been added to assure that adequate berthing spaces will be provided for large vessels, outside of the project limits, and is in conformance with current berthing clearance criteria; item (i) provides for environmental protection approximately restoring the disposal site to pre-existing conditions; and item (j) assures that local residents will be assured of adequate drinking water. The modification to item (d) and items (f) and (h) are generally applied provisions presently required to fulfill legal requirements set forth by Congress. The complete list of the currently required items of local cooperation follows below. The modifications and additions have been underlined for clarity.

a. Provide and maintain at local expense adequate wharf and terminal facilities in the North Bay, Eureka, and Samoa Channels open to all on equal and reasonable terms for the storage, handling, and shipment of lumber and general commerce.

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

c. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial disposal of spoil, and also necessary retaining dikes, bulkheads, and embankmentments therefor or the costs of such retaining works.

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

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

f. Comply with all pertinent provisions of Public Law 91-646 in the land acquisition program.

g. Prohibit construction of new terminals and related structures within 125 feet of the project lines along the North Bay and Samoa Channels.

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

i. Provide for revegetation of the upland disposal sites including stockpiling and restoration of a sufficient amount of topsoil to adequately reseed the area with native vegetation, and provide special measures to insure propagation of any rare plants found on the sites in accordance with plans and specifications prepared by the Corps of Engineers.

j. Monitor ground water quality in active wells that may be affected by dredge material disposal and undertake measures necessary to provide adequate drinking water.

VIII - BASIS FOR DESIGN

8-01. GENERAL

Technical criteria used in design are in accordance with standard guidelines and practices of the Corps of Engineers. Various aspects of design are described in subsequent paragraphs.

8-02. DESIGN OF NAVIGATION FEATURES

Physical considerations in design of channels and related features include tides, currents, waves, wind, fog, waterway geometry, bottom material characteristics, shoaling potential and vessel characteristics. Navigation improvements should be constructed no larger than needed; however, expected future requirements based on changes in vessel sizes or frequency of usage must also be recognized. Pertinent physical considerations are as follows:

a. Geology and Soils. A report on geology and soils, including materials to be dredged and seismic considerations, is provided in Appendix C. Most of the material consists of clean sands, with interlayers of silt in the upper reaches.

b. Climate. The average annual rainfall at Eureka is 52 inches. Due to marine influence, the temperature range is moderate. Stormy periods occur during the winter season between November and April. Extended periods of fog are common in the summer months. The prevailing winds are from the north-northwest.

c. Tidal Range and Wave Action. The tidal range between mean lower low water and mean higher high water is 6.4 feet at the harbor entrance and 6.7 feet at Eureka. Extreme low water at Eureka is 3.0 feet below mean lower low water. Vessels with loaded drafts in excess of 26 feet currently find it necessary to wait for the higher tidal stages before entering or leaving the harbor. (See Figure B-2, Appendix B for the time-stage relationship of the mean tidal cycle at Eureka). The entrance channel is exposed to high waves accompanied by high winds generated by local coastal storms, and to high waves (swell) unaccompanied by wind, produced by distant, offshore storms. High waves can occur year-round, but wave action is more severe and frequent during the winter season. At times, during the winter storm season, wave action makes the harbor entrance impassable. Available statistics indicate that significant waves in excess of 30 feet occur annually.

d. Currents. Tidal currents follow the general channel directions. In the North Bay Channel, the velocity is less than 2 knots, and does not exceed 3 knots. Between the jetties, the velocity is about 2 knots, with a maximum of about 4 knots.

e. Vessel Characteristics and Design Vessel. Most cargo vessels calling at Humboldt Bay within the foreseeable future are anticipated to have loaded drafts ranging from 26 to 31 feet. There would be very few vessels with drafts exceeding 31 feet. Vessel lengths of larger user vessels range from 600 to 750 feet, with beam widths of 80 to 100 feet. (A discussion of the current and projected vessel fleet is contained in Appendix B). The design vessel selected to aid in design of the North Bay and Samoa Channels has the following dimensions: length - 640 feet; beam - 100 feet; and maximum loaded draft - 30 feet (based on the ship being loaded to capacity with wood chips).

8-03. CHANNEL DEPTH

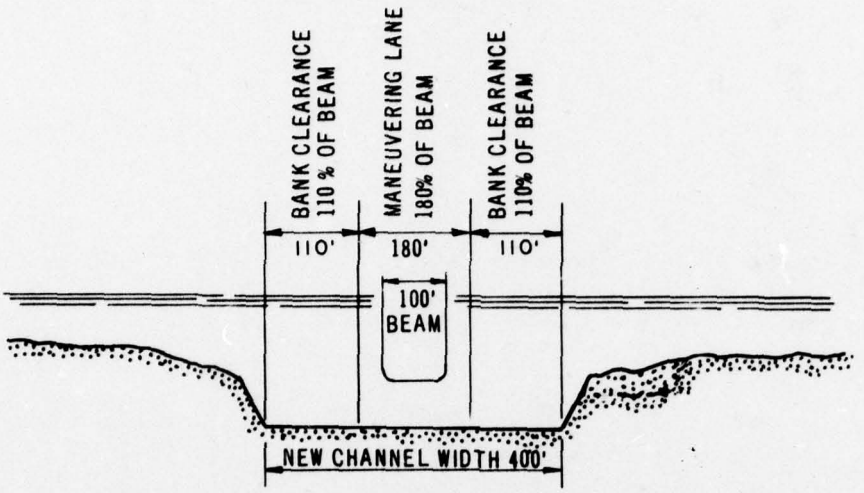
In design of channels and other navigation features, adequate clearances between the vessel keel and the bottom must be provided. Clearance factors are provided to provide for vessel squat, trim, and maneuverability, as described below.

a. Squat. Sinkage, or squat, is the term given to the hydraulic phenomenon which causes the lowering of the water surface immediately surrounding the vessel which, in turn, results in the lowering of the level of the vessel. It increases with higher speeds and decreases with an increase in the depth of water under the keel. The amount of squat is dependent upon the speed of the vessel through the water, the distance between the keel and the bottom, the trim of the vessel, the cross-sectional area of the channel and whether the channel is located in a wide or narrow waterway, whether the vessel is passing or overtaking another vessel, the location of the vessel relative to the centerline of the channel, and the characteristics of the ship itself. Based on observations of similar conditions to those which could be expected for the channels considered in this report, an allowance of 2 feet has been made for vessel squat.

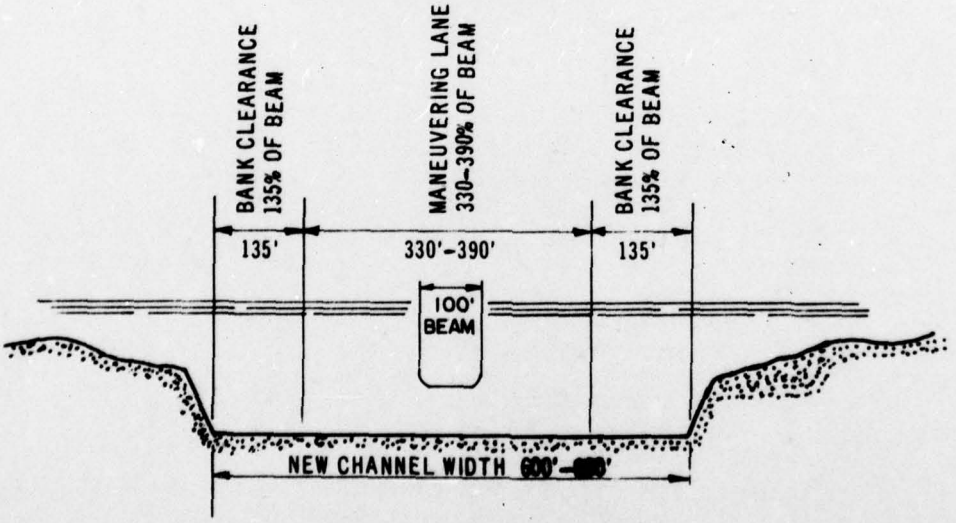
b. Trim. A vessel is often trimmed so that the stern is from 1 to 2 feet deeper than the bow. With the stern lowered, a vessel has better handling characteristics and can ride over the waves rather than plough through them. One foot has been allowed for trim.

c. Maneuverability. No precise determination of the effect of shallow water on steering is available, but it is generally recognized that a vessel becomes difficult to handle and requires large rudder angles when speed is reduced in shoal water. An allowance of 2 feet has been made for maneuverability of the vessel and for pitching and rolling of the vessel. The total clearance required between the keel and the bottom is thus 5 feet, as tabulated below:

NORTH BAY & SAMOA CHANNELS
ONE WAY TRAFFIC
STRAIGHT CHANNEL



NORTH BAY CHANNEL
ONE WAY TRAFFIC
CHANNEL IN TURNS



ELEMENTS OF CHANNEL WIDTH

FIGURE 5

Navigation Factor[1/]	Allowable Depth in Feet
Squat	2 feet
Trim	1 foot
Maneuverability	2 feet
TOTAL CLEARANCE	5 feet

1/ Principal reference: Corps of Engineers - Report No. 3 of the Committee on Tidal Hydraulics, Chapter 10, Design of Channels for Navigation, May 1965.

8-04. Based on this clearance, operating minimum channel depths would normally be 5 feet greater than the loaded vessel draft. For example, an operating channel depth of 35 feet would be required for safe passage of the selected design vessel with a 30-foot draft. It should be noted that provision of an adequate operating depth for the largest user vessels at all tidal stages is often not economical and that some tidal delay should be accepted. In this particular case, it has been determined that the proportion of user vessels with drafts of 31 feet or greater is not expected to be large enough to justify channel deepening below 35 feet, MLLW. (See Appendix B for vessel trips by draft). By the previously-described procedures of maximization of net benefits it was determined that the optimum channel depth would be 35 feet, MLLW. Deepening to this depth can be justified by incremental benefits in reduced tidal delays to the projected vessel fleet, but above this depth incremental benefits are negligible. (Refer also to Section V, Plan Formulation). Thus, a 35-foot depth has been selected as the design depth for all navigation features.

8-05. CHANNEL WIDTHS

The minimum width required for safe navigation in a channel is dependent upon such factors as vessel dimensions and bottom and bank clearances, traffic frequency, and wave, wind, and current conditions. Based on one-way traffic conditions to assure good vessel controllability, the total channel width should be 380 percent of the beam of the design vessel for a straight channel. Three elements are included in this percentage allowance: a central maneuvering lane of 180 percent of the vessel beam, and bank clearance lanes on either side of 110 percent of the vessel beam. (Reference: Report No. 3 of the Tidal Hydraulics Committee). These percentages are increased proportionately at channel bends, depending on the degree of the turn. The design criteria and resulting channel widths for the North Bay and Samoa Channels for the 100-foot beam design vessel, in both straight and turn alignments, are shown in Figure 5. These calculations confirm the adequacy of the existing 400-foot channel width in the North Bay Channel, and indicate that the Samoa Channel width should be increased to 400 feet. The existing 300-foot width, as confirmed by conversations with harbor pilots,

is clearly inadequate, especially in view of the heavy use of the terminals on the channel, which currently handles about 52 percent of the commerce in North Humboldt Bay. Calculations also indicated that the maximum bend width at Mile 2.00 and 2.60 should be 650 feet and 590 feet, respectively. The bend at Mile 0.75 should be increased by a variable amount, up to 200 feet. This turn is at an exposed location and especial attention was given to the environmental factors of waves, currents and shoaling - thus, this width was selected in consultation with experienced harbor pilots.

8-06. CHANNEL SIDE SLOPES

The channel will be dredged to side slopes of 1V on 2H. These slopes are based on experience from maintenance dredging in the bay. Except for minor sloughing, they will be stable.

8-07. TURNING BASIN

Turning basins should normally provide a minimum of 150 to 180 percent of the design vessel length for tug-assisted turnarounds, with added space being highly desirable. Thus, the 640-foot long design vessel for the Samoa Channel would require a turning area with an approximate diameter of 950 to 1,130 feet. The turning basin designed for the upper end of the Samoa Channel is generally rectangular in plan, with approximate dimensions of 1,100 feet wide by 1,000 feet long, which should normally provide adequate turning space.

8-08. DISPOSAL AREA RETENTION WORKS

As described in paragraphs 6-06 and 6-07, retention dikes for the disposal area would be site-adapted to allow filling with a minimum of diking. Dikes would be constructed from existing soils in the disposal area and from dredged materials (consisting mostly of fine to medium grain sands with some silt). The height of the dikes would vary from 2 to 20 feet. For stability, the dikes would have a 12-foot crest, with a 1V on 2H inside slope and a 1V on 3.5H outside slope. Adequate ponding areas would be available for clarification of the effluent prior to discharge over weirs to drainage trenches leading to the ocean beach.

IX - ENVIRONMENTAL ANALYSIS

9-01. GENERAL

Detailed environmental analysis of the existing project area, and of the impacts of the recommended project and the alternatives considered, has been provided in the accompanying Environmental Statement to this report. Summary information is given in the following paragraphs.

9-02. ENVIRONMENTAL SETTING

The primary study area consists of Humboldt Bay, a northern California harbor about 225 nautical miles north of San Francisco and 156 nautical miles south of Coos Bay, Oregon. The bay is separated from the open ocean by two long, narrow spits, which are separated by an entrance channel. The entrance, which is stabilized by parallel rubble-mound jetties, and certain interior channels are maintained by the Federal Government to allow use of the bay for commercial shipping and fishing boats which use docks at Eureka, Samoa, and Fields Landing. The major commodities handled are outbound forest products such as logs, lumber, and wood pulp. The climate of the area is moist and moderate, well-suited for the continued long-term production of timber. Important fish and wildlife resources exist in the bay and its environs.

9-03. THE BAY AND BAY WATERS

The bay varies in width from one-half mile to four miles and is 14 miles long. The daily mean tidal range (between mean lower low water and mean higher high water) varies from 6.4 to 6.7 feet, depending on location. The water surface area at high tide is 24.5 square miles, falling to 7.8 square miles at low tide. The average tidal discharge at the entrance is 100,000 cubic feet per second. The main navigation channels are maintained by dredging. Four small streams discharge into the bay: two at the north end, one in the central portion, and one at the south end. They and their sloughs are under tidal influence up to two miles inland. The tidal flood plains are uniformly level marshland and mudflats. Several other sloughs exist in the north end of the bay.

9-04. The southern arm of the bay extends about four miles south from the entrance, gradually widening to the south. A dredged channel extends two miles from the entrance to Fields Landing, which is about midway along the east side of the bay.

9-05. North of the entrance a fairly deep natural channel (the North Bay Channel), which is maintained to a 30-foot depth, courses near the spit for about four miles to the junction of the Samoa Channel and Eureka Channel. The latter channel is dredged for nearly two miles along the Eureka waterfront. The Samoa Channel, which carries most of the tidal flow to and from the north end of the bay (Arcata Bay), is dredged about one mile further across Indian Island Shoal to the village

of Samoa on the spit. It then continues in its natural state through the shoal water of Arcata Bay, ultimately joining the mile-long Arcata Channel, a long-abandoned navigation channel which at one time served the city of Arcata.

9-06. Water temperatures within the bay generally range between 50° and 60°F, although shallow areas have a greater range due to solar warming. Relatively high salinities approaching open sea conditions occur during the summer and fall months. Lower and more variable salinities occur during the winter and spring, being influenced by runoff from the creeks which enter the bay.

9-07. Although relatively unpolluted, bay waters do receive discharges of municipal wastewaters and industrial effluents. It is expected that water quality will improve when existing plans of the California State Water Quality Control Board are implemented. All such discharges are to be eliminated as soon as practicable. To meet their obligations, Humboldt County, Arcata, Eureka and other adjacent communities have formed a municipal wastewater authority to collect sewage for secondary treatment and to construct an outfall to the open ocean, so as to eliminate all sewage discharges to the bay.

9-08. GROUND WATER

Groundwater bodies occur around the bay within recent aeolian and alluvial Plio-Pleistocene unconsolidated non-marine sediments. The locale in which ground water could be affected by the recommended project is on the barrier spit north of the harbor entrance (Samoa peninsula), where bodies of fresh water with thicknesses up to and exceeding 70 feet float on salt water. Recharge in this area is entirely from the deep percolation of rainfall. Ground water has historically provided the principal water supply to the U.S. Coast Guard installation at the south end of the peninsula. However, higher quality water has recently been supplied by a municipal water district which imports water from the Mad River; only a few private users still depend on the local supply.

9-09. BOTTOM SEDIMENTS

Large areas of the bay are quite shallow, with extensive mudflats in Arcata Bay and the South Bay. Bottom sediments are composed of sand, silt and clay. Within the natural and dredged channels, the winnowing effect of the current has greatly reduced the proportion of fines so that sands and gravelly fractions predominate, except in certain reaches where current velocities are generally lower. Within the North Bay Channel, the bottom substrate consists of loose-to-dense sands with occasional traces of silt, fine gravel, and shell fragments. Most of the bottom of the Eureka Channel also conforms to this latter description; the north end is, however, underlain by soft clay. In the south end of the Samoa Channel, the channel bottom is also underlain by loose-to-dense sand with occasional traces of silt, gravel and shell. In the north end, the Channel is underlain by firm clay with shell fragments.

9-10. HABITATS

At least eight different wildlife habitats exist in the open waters of Humboldt Bay and numerous others in the surrounding land areas. Open-water habitats that would be affected by the recommended project harbor fairly diverse populations of fish and benthic organisms. In all, Humboldt Bay provides habitat for 95 species of fish. The substrate of existing channels, which are regularly dredged, has lower habitat values than undisturbed areas.

9-11. The land areas on the North Spit that would be used as disposal sites for the recommended dredging are dune deposits, lightly to well-vegetated, with locally-characteristic plants. Noticeable plants include two species of lupines, goldenrod, sand strawberry, sand verbena, and Menzie's wallflower (Erysimum menziesii). Important wildlife species include the black-tailed deer, black-tailed jackrabbits, several kinds of mice, and the California quail.

9-12. RARE AND ENDANGERED SPECIES

Four species of birds which occur within the area are considered to be endangered: the clapper rail; the peregrine falcon; the California brown pelican; and the southern bald eagle. In addition, three rare and endangered species of vascular plants occur in the vicinity, although not on the coastal strand nor near the project channels. Though not currently listed in the Federal Register as "Endangered" or threatened, the species, Erysimum menziesii, has been found on the proposed disposal sites and adjacent areas of the strand. This species is of limited geographic distribution and likely will be included on a list of "Threatened" species being compiled by the Secretary of the Interior under provisions of Section 7 of the Endangered Species Act of 1973.

9-13. AIR POLLUTION

The air quality in the Humboldt Bay area is generally considered to be of fair to good quality. Major sources of pollutants are from industry and motor vehicles.

9-14. RECREATION

Being a lightly-populated area, Humboldt Bay's recreational opportunities are primarily associated with the natural features of northwestern California ocean beaches, coastal lagoons and estuaries, freeflowing streams, and inland forests and wilderness areas - including the Redwoods National Park and several State parks. These opportunities include such activities as fishing, hunting, boating, camping, picnicking and nature study.

9-15. CULTURAL, ARCHEOLOGICAL, AND HISTORIC FEATURES

The Humboldt Bay area was inhabited by Indians of the Wiyot linguistic group prior to settlement in the 1850's by whites. Approximately 70 archeological sites of the Wiyots are known to exist on or near the bay. A number of existing structures date from the early days of settlements, although most are not of great historical interest. There is one National Historic Register property nearby at Indian (Gunther) Island which has a number of important archeological sites.

9-16. ENVIRONMENTAL IMPACTS OF THE RECOMMENDED PROJECT

The environmental impacts of the recommended plan are discussed in the following paragraphs.

9-17. IMPACTS ON WATER QUALITY

Since most of the dredging would be performed by a hydraulic pipeline dredge, the turbidity effects will be minimized. In addition, since the channel bottom consists chiefly of sand, the induced turbidity will dissipate almost immediately by settling. In the northern ends of the Samoa and Eureka Channels where silt and clay are present, material would be suspended for several hours, with subsequent dispersal by tidal currents. The channel deepening would not have measurable short or long-term impacts on water quality.

9-18. Dredged materials to be deposited on the North Spit would be placed within retention dikes, and dredge waters would be drained to the ocean after passing through settling ponds and weirs. The water draining into the ocean from the ponds would generally be clear, and minimal turbidity would be created in the surf zone. The actual volume of such drainage is uncertain, since a large proportion of dredge water can be expected to percolate directly into the underlying sand dunes.

9-19. Although it is considered unlikely, it is possible that certain domestic wells within one-half mile of the primary North Spit disposal sites could be contaminated by the percolation of saline water. As many as eight households could be affected; fortunately, virtually all of these could easily be connected to the local water system which uses another source. If contamination did occur, it is expected that groundwater quality would ultimately be restored by the infiltration of rainfall; however, it is impossible to estimate how long this might take. In the event that any domestic water wells are found to be degraded by the disposal operation, the Harbor District has agreed to bear the expense of connecting these residences to the existing municipal water supply lines.

9-20. Except for temporary turbidity, water quality impacts from disposal of hopper-dredged material at the nearshore ocean disposal site are expected to be minimal. The volume involved, about 190,000 cubic yards, is considerably less than the annual maintenance volumes which are disposed of at the same site.

9-21. IMPACTS ON HABITATS AND ORGANISMS

Adverse impacts of dredging on habitats and organisms could result from sediment removal and disturbance. In some areas fish may experience clogged gills, but most would be able to swim away unharmed. Fish eggs and larvae forms may be adversely affected, but repopulation within 6 to 12 months can be expected.

9-22. An extensive and fairly diverse community of benthic animals, consisting predominately of shellfish, live in and near the channel to be dredged. This community would be destroyed by dredging. There would also be some impact on food supply for fish; however, considerable benthos would remain in the rest of the bay for fish to feed upon. Since the North Bay Channel is dredged almost annually, rapid recolonization can be expected.

9-23. IMPACTS ON WILDLIFE AND VEGETATION

Impacts of disposal on wildlife and wildlife habitat at the recommended land sites would include destruction of site vegetation and displacement of wildlife from the site with increased mortality among the displaced animals, principally rodents. Some "islands" of pre-existing vegetation would remain at the tops of the higher dunes. Reseeding and natural revegetation would create a habitat generally similar to that formerly present, except that depressions would largely be eliminated, reducing opportunities for plants which prefer moister locales. Revegetation will include measures to insure the continued propagation of the species, Erysimum menziesii, several hundred of which are found on each of the two disposal sites (See Para. 17-05 and 17-17).

9-24. IMPACTS ON CULTURAL, ARCHEOLOGICAL, AND HISTORIC FEATURES

No properties listed in the National Historic Register will be affected by the recommended project nor will any other known cultural or historic sites. Site inspection did not reveal any archeological sites within the proposed disposal areas, pipeline routes, or drainage ditches. If such sites do exist, they would already have been disturbed due to the shifting nature of the dune deposits.

9-25. OTHER IMPACTS

There would be a negligible increase in air pollution as a result of the project's growth-stimulating effects. Impacts on recreation would also be negligible.

9-26. ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

The adverse environmental effects that cannot be avoided should the proposed project be carried out are: (a) turbidity within the bay during dredging and at the nearshore ocean disposal site when material

is discharged; (b) destruction of organisms and alteration of benthic habitats within the area of the bay bottom which would be dredged; and (c) possible groundwater contamination on the Samoa peninsula from percolation of disposal tailwaters.

9-27. RELATIONSHIP BETWEEN SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Short-term benefits from the recommended dredging would occur in the form of more efficient ship operation and increased commerce, with attendant secondary benefits. (In this case, the 50-year project life is considered to be short term; long-term effects on the environment are measured in centuries). There would also be a short-term impact on benthic habitat but recovery would occur within a matter of months. Short-term impacts at land disposal sites would also occur with revegetation requiring several years to return the area to a natural state. Long-term productivity will be minimally affected by this project since there would be little effect on benthic productivity.

9-28. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES RESULTING FROM DREDGING AND DISPOSAL ACTIVITIES

Irretrievable resource commitments include project expenditures for labor, fuel and other materials and equipment depreciation. In addition, benthic organisms and some inhabitants of land disposal areas would be destroyed. This project does not appear to involve any irreversible commitment of resources since the deepened channels would eventually return to their pre-existing shallower state without regular maintenance; benthic organisms would repopulate the affected areas; and wildlife habitat at the land disposal site would be restored naturally.

9-29. ENVIRONMENTAL ANALYSIS OF ALTERNATIVES CONSIDERED

As discussed in Chapter V - "Plan Formulation," several alternatives were considered in lieu of the recommended project. These included: "no action," different areas of possible channel and navigation improvements with alternative channel depths; and different disposal sites. The environmental factors were important determinants in the screening and selection of alternatives, especially the disposal sites. For purposes of comparison with the environmental impacts of the recommended plan, impacts of the alternatives are summarized below.

a. "No Action." Under this alternative, the project area would remain as is. There would not be any adverse effects from dredging or disposal on natural resources. As noted, this alternative was not selected since adverse economic impacts do appear to be large, and there is a demonstrated need for navigation improvements.

b. Alternative Areas of Channel Dredging and Alternative Depths. As described in Paragraphs 5-08 through 5-10, lengthening or shortening of the channels was investigated but was rejected because economic needs would not be served. Construction of the Project Document plan was also considered but for economic and operational reasons was modified to delete an authorized anchorage area, add a turning basin at the head of the Samoa Channel, and widen the Samoa Channel. In addition, alternative channel depths were investigated. However, the selection of the authorized 35-foot channel depth was reaffirmed since it provided maximum net benefits. All of the above considered alternatives would have impacts which would not be qualitatively different from the recommended plan. In addition, the quantitative difference between the Project Document plan and the recommended plan would be small.

c. Alternative Disposal Sites.

(1) Deep-Ocean Site. This site was briefly considered but was removed from consideration since the dredge material was determined to be acceptable for disposal at a closer, more economical site. If this site were used, environmental impacts would consist of temporary turbidity during disposal and possible smothering of benthic organisms.

(2) Nearshore Ocean Site. This site would be used for disposal of 190,000 cubic yards of hopper dredging as part of the recommended project construction. In addition, this site was briefly considered for disposal of all dredging within the bay. However, this proposal would require the use of clamshell dredges with barge hauling, which is more expensive than hydraulic pipeline dredging with land disposal and has somewhat greater environmental impacts due to higher induced turbidity during dredging. If this site were used, environmental impacts would, as at the more distant site, consist of temporary turbidity and possible smothering of benthic organisms.

(3) In-Bay Site Near Buhne Point. Placement on the beach at this location was rejected because strong wave action would move the material from the beach into nearby navigation channels. Environmental impacts, if this site were used, would include possible smothering of organisms on the beach face and adjacent bottom areas and turbidity during construction, which in all probability, would exceed acceptable water quality standards of the North Coastal Region Water Quality Control Board.

(4) Freeway Site. Placement of dredged material on the freeway site was rejected because of excessive costs for retention dikes and the likelihood of delays in freeway construction. If this alternative were used, environmental impacts due to filling would be limited since most of the area would be urban; however, a small area of saltwater marsh would be destroyed. Groundwater contamination of uncertain extent could result from percolation of impounded tailwaters.

(5) Miscellaneous Land Sites. Miscellaneous sites including low-lying, undeveloped lands on the Eureka waterfront were considered, but were rejected due to their small disposal capacities and the multiple ownerships involved. Environmental impacts of possible filling on these sites would vary depending upon location. Impacts would consist primarily of destruction of saltwater marshes, although some of the sites considered are essentially barren upland parcels. Marshy pasturelands south of the Eureka city limits were rejected due to adverse effects on wildlife as well as small disposal capacities and multiple ownerships.

(6) Site 13A, North Spit Site. Environmental impacts resulting from the use of this site would be essentially the same as those on the adjacent sites (13B and 13C) selected as disposal locations for the recommended plan. If this site were to be used, the principal impacts would consist of destruction of most site vegetation and increased mortality among the displaced animals, and possible local contamination of groundwater from percolation of disposal tailwaters. In addition, disposal on the site would interfere with existing railroad facilities serving an adjacent pulp mill. The land owner, who also has an interest in the mill, is not interested in filling at this time. Therefore, disposal on Site 13A was also rejected.

(7) Ocean Beach Site. This location was considered as a secondary disposal site. However, it was ultimately rejected because of uncertainty about increasing shoaling of the Bar and Entrance Channel and the adjacent underwater outfalls of the Louisiana-Pacific and Crown Zellerbach pulp mills. If this site were used, the environmental impacts would consist of turbidity in the surf zone and nearby offshore waters. Since a commercial Dungeness crab fishery operates off of these beaches from December through early summer, it would be necessary to limit the disposal period to the winter season when the crabs are further offshore. In addition, beach disposal should be limited to sandy materials to protect the crabs from possible turbidity effects.

X - SOCIO-ECONOMIC ANALYSIS

10-01. GENERAL

The social and economic profile of existing conditions in the Humboldt Bay area and socio-economic impacts of the recommended project and alternatives are discussed in detail in Appendices A and D, respectively.

10-02. Existing socio-economic conditions in the Humboldt Bay area are characterized by a stable population, high unemployment, low disposable income, heavy dependence on the timber resource and increasing deep-draft waterborne shipment of lumber and other forest products.

10-03. POPULATION

The Humboldt County population increased from about 42,000 in 1930 to a peak of about 105,000 in 1960, then declined to about 100,000 in 1970, and presently stands at about 103,000. Most of the increases were in the 1940's and 1950's as a result of the building boom after World War II. The population decline between 1960 and 1970 was the result of outmigration due largely to severe cutbacks in employment in the lumber industry. The recent increases are mostly attributable to the opening of the College of the Redwoods and the doubling of enrollment at Humboldt State University.

10-04. EMPLOYMENT

Historically, the lumber industry has provided the greatest employment opportunities in Humboldt County, accounting for nearly 28 percent of total employment in 1970 and decreasing to about 24 percent in 1974. In recent years, the decline in employment within the lumber industry has been more than offset by increases in other employment sectors, primarily in government, services, finance, and wholesale and retail trades. While total employment increased from about 36,600 in 1970 to about 36,900 in 1974, the total labor force increased from 38,000 to 44,400 for the same period. This greater increase in the total labor force compared to total employment has resulted in unemployment rates of about 10 percent in 1970 and about 12 percent in 1974, one of the highest in the State of California.

10-05. INCOME

In 1971, the median disposal income per household for Humboldt County was about $7,580 compared to the median for the State of $9,120. Wages and salaries in Humboldt County has consistently accounted for about 60 percent of total income with proprietor's income and property income accounting for about eight and 13 percent, respectively. Unemployment and social security incomes, which have shown a marked increase in the past few years, total about 15 percent. The relatively low median disposal income, together with the high unemployment and social security incomes, is indicative of a stagnant economy.

10-06. TIMBER RESOURCES

Over the 6-year period, 1960-1965, the five-County tributary area (Del Norte, Humboldt, Mendocino, Siskiyou and Trinity) to Humboldt Bay produced an average of about three billion board feet of timber annually. Since then, production has declined, reaching about 2.5 billion board feet in 1970, and the current sustained-yield level of about 2.3 billion board feet. It is expected that timber production will stay at the present level for the foreseeable future.

10-07. WATERBORNE COMMERCE

While timber production declined from 2.9 billion board feet in 1965 to 2.5 billion board feet in 1970, waterborne shipment of lumber and forest products increased from 723,000 tons to 1,664,000 ton for the same period. After the slow-down caused by waterfront strikes in 1971-72, shipments are again on the rise, reaching nearly 1,400,000 tons in 1974. The reasons for the increasing shipment are two-fold: foreign demands and technological advances in the lumber industry which allow utilization of a greater percentage of each tree harvested. (For additional discussion on waterborne commerce, refer to Section XII.)

10-08. SOCIO-ECONOMIC IMPACTS OF THE RECOMMENDED PROJECT

Project construction will produce long-term savings in transportation costs in the amount of $697,000 annually, and a limited number of short-term construction jobs and related socio-economic effects. Transportation cost savings realized from the project are a national economic benefit and provide the primary economic justification for project construction. Project economic benefits are discussed in detail in Section XII. Other socio-economic impacts, both direct and indirect are discussed below.

10-09. CONSTRUCTION EMPLOYMENT

With the exception of a small amount of dredging by a Government-owned hopper dredge at the harbor entrance where hazardous sea conditions exist, project dredging would be by contracted equipment (hydraulic pipeline dredge) and services. It is estimated that about 18 construction workers would be employed for a minimum of 20 months to complete project contract dredging. In addition, a number of heavy equipment operators would be employed for an estimated 36 man-months in the construction of dikes for the retention of dredging material. It is also estimated that about 80 percent of the total $6.0 million construction cost, or $4.8 million, would be spent in Humboldt County in the form of wages of about $2.2 million, and operational supplies and services, $2.6 million.

10-10. SECONDARY ECONOMIC IMPACT

Secondary economic impacts are those that are induced by the direct impacts. For instance, direct income of construction workers, when spent locally, would create additional jobs and incomes for others as well as tax revenues for the various levels of government. In the Humboldt Bay area, studies have estimated the indirect impacts to be about 1.6 times the direct impacts. Therefore, the recommended project would generate secondary economic impacts of about $7.7 million ($4.8 million x 1.6) for a total economic impact of $12.5 million over the construction period. The economic impacts of a large construction project usually drops drastically upon project completion. However, some economic impacts generally persist and continue to add to the gross national product, often due to the new business and services generated from such a project.

10-11. PUBLIC FACILITIES AND SERVICES

The recommended project, because it would employ only a small number of workers for a relatively short period of time, is expected to place little or no pressure on public facilities and services such as housing and public schools for the construction workers and their families.

10-12. TRANSPORTATION SERVICES

Due to rugged terrain and its relatively isolated location, Humboldt Bay and its tributary area are more dependent on the economies of waterborne commerce than most of California. Improvement and maintenance of efficient navigation facilities for the shipment of lumber and forest products, the primary industry of the area, would significantly contribute to the general economic and social well-being of the people of the Humboldt Bay area.

10-13. PORT EMPLOYMENT

There are 34 full-time employees that work in marine cargo handling and towing and tugboat services in the Humboldt Bay Harbor area. These jobs provide a yearly payroll of about $415,000. Other direct employment related to oceanborne commerce includes freight forwarders, warehousemen, truckers and others. However, these numbers are not known. It is expected that the recommended project would have only a minor beneficial impact on this employment.

10-14. LOCAL AND REGIONAL GROWTH

The recommended project is not expected to produce substantial impacts toward regional growth, but is believed to be significant for maintaining existing economic activity with moderate growth. It is not possible to predict if failure to improve port facilities could cause a sudden drop in business activity due to loss of a competitive position;

but cancellation of port calls by larger, more economically-efficient vessels could occur in the highly competitive international shipping industry. Recreational boating should benefit from channel deepening in Humboldt Bay as the use of larger commercial vessels would mean fewer vessel trips, less traffic congestion and more maneuvering area for small craft.

10-15. LOCAL LAND USE

Deposition of dredged material at the authorized and recommended disposal sites would provide some land enhancement potential sometime in the future. However, there are no definite plans for development at this time, and therefore, no benefit can be identified. Placement of dredged material on Site 13B could make this dune area less desirable for its present informal use by recreational vehicles, but would not preclude continuation of such use in the future. The use of Site 13C would temporarily degrade the existing wildlife habitat. However, the dredged material is more fertile than the dune deposits and could be more conducive to growth of vegetation. It would be less prone to erosion than the existing dune deposits. Therefore, the disposal of dredged materials on these sites is expected to increase their long-term carrying capacity.

10-16. Site plans for the disposal areas are designed to promote retention of moisture and revegetation. Local interests would be specifically required to revegetate the sites.

10-17. TAX REVENUE

It is estimated that potential local tax revenue that would be generated by the direct and secondary economic impacts ($12.5 million) of the recommended project would amount to about $750,000 over the construction period.

10-18. PROPERTY VALUE AND BUSINESS ACTIVITY

Project construction activities are not expected to have a significant effect on property values due to the small labor force involved. However, long-term increases in value of waterfront industrial property due to the project are expected to be more significant. Moderate growth in business and industrial activities in the project area can be projected based on the capability of the deeper channels to accommodate modern cargo vessels.

10-19. LOCAL GOVERNMENTAL ENTITIES

Project construction is contingent on the ability and willingness of non-Federal interests to meet certain obligations as specified in the Project Document. These obligations have been assumed by the Humboldt Bay Harbor, Recreation and Conservation District, a county-wide district created by the California State Legislature. The City of Eureka is assisting the District in furnishing the land disposal areas.

10-20. SOCIO-ECONOMIC ANALYSIS OF ALTERNATIVES CONSIDERED

Other alternatives considered for construction would have proportionately different impact depending on the scope of improvement. Quantitative analysis of these impacts was not undertaken.

a. "No Action". Under this alternative, the project area would remain unchanged. There would not be any stimulation of the local economy by contractor and employee expenditures during construction of navigation improvements. Shipping problems would continue due to tidal delays and inability to fully utilize cargo capacity. Continuance of these problems may affect the competitive position of Humboldt Harbor and, indirectly, the tributary area, as a whole.

b. Alternative Areas of Channel Dredging and Alternative Depths. Quantitative dollar impacts of these alternatives would vary with the size of the construction contract. Post-construction impacts would be very similar to those of the recommended plan.

c. Alternative Disposal Sites. Alternative disposal sites considered included: deep and nearshore ocean locations; in-bay at Buhne Point; on-land at the proposed CALTRANS freeway site; miscellaneous waterfront locations in the city of Eureka; and Site 13A on the North Spit. Post-construction socio-economic impacts of the ocean locations, the in-bay site, and Site 13A would be minimal since land enhancement would be either lacking or negligible. The freeway site, if utilized, could have provided a cost savings to CALTRANS, which could then use the savings on capital improvements elsewhere. However, since these benefits would be applied statewide, the socio-economic benefits would be diffuse, rather than specific to a particular area. Filling at the miscellaneous waterfront sites would appear to create land enhancement benefits to local interests; however, at the present time it is questionable if a use (presumably industrial) of such sites would occur. Therefore, a projection of social and economic benefits cannot be made.

XI - COST ESTIMATE FOR THE RECOMMENDED PLAN

11-01. GENERAL

The total first cost for the recommended project is estimated to be $6,660,000, including a cost of $5,580,000 to the United States and $1,080,000 to local interests. The cost to local interests excludes self-liquidating items such as structures, roads, and utilities.

11-02. SUMMARY ESTIMATED OF FIRST COSTS

A summary of the estimated first costs for the project, based on November 1975 price levels is given in Table 3.

TABLE 3

SUMMARY OF ESTIMATED FIRST
COST FOR NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

No. *	Item	Total
	FEDERAL COSTS	
.07	Channel Dredging **	$ 4,945,000
.30	Engineering and Design	346,000
.31	Supervision and Administration	249,000
	Total Cost of General Navigation Facilities (Cost to Corps of Engineers)	$ 5,540,000
	Aids-to-Navigation, U.S. Coast Guard	40,000
	Total Federal Cost	$ 5,580,000
	NON-FEDERAL COSTS	
	Lands and Damages	$ 10,000
	Retention Works	685,000
	Utility Relocations	200,000
	Dredging of Berths	185,000
	Total Non-Federal Costs **	$ 1,080,000
	TOTAL COST OF PROJECT	$ 6,660,000

* Cost account number defined in ER 11-2-240.
** Includes appropriate contingency (see detailed cost estimate, Paragraph 11-05).

11-03. COMPARISON OF PRESENT ESTIMATE OF FIRST COSTS WITH PREVIOUS ESTIMATES

A comparison of the present estimate of first costs with the Project Document cost and with latest approved project cost estimate (PB-3) is shown in Table 4.

TABLE 4

COMPARISON OF PRESENT ESTIMATE OF FIRST COSTS
WITH PROJECT DOCUMENT COST AND LATEST
APPROVED PROJECT COST ESTIMATE (PB-3)
HUMBOLDT HARBOR AND BAY, CALIFORNIA
(In $1,000)

No.	Item	Project Document Plan (July 1965 Price Levels)	Project Document Plan (PB-3 Estimate 1 October 1975)	Recommended Plan (November 1975 Price Levels)
	FEDERAL COST			
.09	Channel Dredging	2,289.0	4,740.0	4,945.0
.30	Engineering and Design	45.0	225.0	346.0
.31	Supervision and Administration	66.0	135.0	249.0
	Total Cost to Corps of Engineers	2,400.0	5,100.0	5,540.0
	Cost to U.S. Coast Guard for Aids to Navigation	30.0	30.0	40.0
	Total Federal First Cost	2,430.0	5,130.0	5,580.0
	NON-FEDERAL COST			
	Lands and Damages	-	-	10.0
	Retention Works	113.0	235.0	685.0
	Relocations	100.0	210.0	200.0
	Dredging of Berths	400.0	805.0	185.0
	Total Non-Federal First Cost	613.0	1,250.0	1,080.0
	TOTAL PROJECT FIRST COSTS	3,043.0	6,380.0	6,660.0

11-04. The differences in costs between the present estimate and the previous approved estimates are explained below:

a. Federal Costs:

(1) Dredging. The estimated dredging costs for the Project Document plan were based on the excavation and disposal of 87,000 cubic yards of material by hopper dredge and 3,746,000 cubic yards by hydraulic pipeline dredge at unit prices of $0.34 and $0.53, respectively, with a resulting cost, including contingencies, of $2,289,000. The latest PB-3 estimate (1 October 1975) of $4,740,000 was based on proportionate estimates of inflation applied to the Project Document plan. The current estimate for the recommended plan of $4,945,000 is based on the excavation and disposal of 190,000 cubic yards of material by hopper dredge and 2,210,000 cubic yards by hydraulic pipeline dredge at unit prices of $0.90, and $1.50 to $1.90, respectively. The recommended plan has a higher cost than the other estimates due principally to inflationary increases in the cost of dredging. These inflationary increases more than offset the reduction in estimated dredging quantities from 3,833,000 cubic yards in the Project Document to 2,400,000 cubic yards for the recommended plan. The recommended plan has lower quantities than the Project Document plan due to elimination of anchorage-area dredging of 1,211,000 cubic yards and survey data indicating that dredging volumes would be less than anticipated. This reduction was partially offset by the addition to the recommended plan of a turning basin at the head of the Samoa Channel and widening of the Samoa Channel.

(2) U.S. Coast Guard Aids to Navigation. The PB-3 estimate for aids to navigation of $30,000 was unchanged from the Project Document Plan. The current estimate of $40,000 reflects increases in equipment and installation costs.

(3) Engineering and Design. The PB-3 estimate for this item was $180,000 above the Project Document cost due to increases in Federal salary levels, building rentals and additional costs for environmental analysis and assessment. The current cost for engineering and design shows a further increase of $121,000 due primarily to an increased scope of investigation and coordination including added environmental, economic, and engineering studies, particularly with regard to disposal areas.

(4) Supervision and Administration. The PB-3 estimate of $135,000 was $69,000 above the Project Document figure due to increases in Federal salary levels. That figure has been further increased by $114,000 to $249,000, to reflect recent experience which shows that actual costs in supervision and administration exceed the assumed percentage of total dredging costs given in the latest PB-3 estimate.

b. Non-Federal Costs:

(1) Lands and Damages. No allowance was made for this item in the Project Document Plan and the latest PB-3 estimate. It has been included to cover the estimated administrative cost of obtaining easements and short-term leases for rights-of-way for dredge pipelines and contractor access, at an estimated cost of $10,000. This total includes minor costs to cover possible water connections for eight residences.

(2) Retention Works. The estimated cost for this item in the Project Document was $113,000 - which was increased to $235,000 in the latest PB-3 estimate due to increases in price levels for diking and drainage control works. The current estimate shows a further increase of $450,000 for a total cost of $685,000 due to refinements in quantity and cost estimates and increased price levels.

(3) Relocations. The Project Document Costs for relocations were increased by $110,000 in the PB-3 estimate to a total of $210,000 to account for increases in price levels. The current estimate for this item is $200,000, reflecting a refined cost estimate.

(4) Dredging of Existing Berthing Facilities. The latest PB-3 estimate for this item was $805,000, an increase of $405,000 over the Project Document estimate, based on increases in price levels for dredging. This cost was based on the excavation and disposal of approximately 400,000 cubic yards of material from the berthing areas. However, in the ten years since completion of the pre-authorization studies, local interests have completed most of the required deepening on their own initiative. The current estimate of $185,000 for the recommended plan is, therefore, based on the removal of the remaining volume of 100,000 cubic yards.

11-05. DETAILED ESTIMATE OF FIRST COST

The detailed estimate of project first cost is shown in Table 5, based on November 1975 price levels.

TABLE 5

DETAILED ESTIMATE OF FIRST COSTS
FOR NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA
(November, 1975 Price Levels)

Cost Account No.*	Item	Quantity	Unit	Unit Price	Amount
	FEDERAL COSTS				
.09	CHANNEL DREDGING				
	Hopper Dredging Bend widening and deepening in vicinity of Mile 0.75 (Mile 0.5 to Mile 1.0) by use of Government-owned Hopper dredge; hauled to Nearshore ocean disposal site 1.5 nautical miles to sea (Lat. 40° 45'44"N, Long. 124° 15'42"W)				
	Mobilization and Demobilization	1	Job	L.S.	$ 50,000
	Standard dredging, to -35 ft: MLLW	127,000	cu. yds.	$0.90	114,300
	Two-feet overdepth dredging	63,000	cu. yds.	0.90	56,700
	Subtotal				$221,000
	Contingency, ± 15%				34,000
	Total, Hopper dredging, by Government dredge				$255,000

TABLE 5 (Cont'd)

Cost Account No.*	Item	Quantity	Unit	Unit Price	Amount
	Hydraulic Pipeline Dredging				
	Mobilization and Demobilization	1	Job	L.S.	$200,000
	Subtotal				200,000
	North Bay Channel deepening and bend widening to Mile 4.29				
	Standard dredging, to -35 ft. MLLW	510,000	cu. yds	1.50	765,000
	Two-foot overdepth dredging	290,000	cu. yds	1.50	435,000
	Subtotal				1,200,000
	Samoa Channel deepening and widening to Mile 5.84				
	Standard dredging, to -35 ft. MLLW	470,000	cu. yds	1.90	893,000
	Two-foot overdepth dredging, to -37 ft. MLLW	180,000	cu. yds	1.90	342,000
	Subtotal				1,235,000

TABLE 5 (Cont'd)

Cost Account No.*	Item	Quantity	Unit	Unit Price	Amount
	Outer Eureka Channel deepening to Mile 5.0				
	Standard Dredging, to -35 ft. MLLW	81,000	cu. yds	1.90	$ 153,900
	Two-foot overdepth dredging,	79,000	cu. yds	1.90	150,100
	Subtotal				304,000
	Samoa Turning Basin, 1,000 x 1,100 ft.				
	Standard Dredging to -35 ft. MLLW	483,000	cu. yds	1.90	917,700
	Two-foot overdepth dredging	117,000	cu. yds	1.90	222,300
	Subtotal				1,140,000
	Subtotal, Hydraulic Pipeline Dredging, by contract				4,079,000
	Contingency ± 15%				611,000
	Total, Contract Dredging				4,690,000
	Total Dredging (Government and Contract)				$4,945,000

TABLE 5 (Cont'd)

Cost Account No.*	Item	Quantity	Unit	Unit Price	Amount
.30	ENGINEERING AND DESIGN, ±7%				$ 346,000
.31	SUPERVISION AND ADMINISTRATION ±5%				249,000
	TOTAL, Corps of Engineers Cost				5,540,000
	Aids-to-Navigation, U.S. Coast Guard**				40,000
	TOTAL, FEDERAL FIRST COSTS				$5,580,000
	NON-FEDERAL COSTS**				
	Lands and Damages				10,000
	Subtotal				10,000
	Retention Works				
	Excavation & Dike Placement	311,000	cu. yds	2.00	622,000
	Drainage Control Structures	1	Job	L.S.	41,000
	Restoration & Revegetation	110	acres	200	22,000
	Subtotal				$ 685,000

TABLE 5 (Cont'd)

Cost Account No.*	Item	Quantity	Unit	Unit Price	Amount
	Utility Relocations				
	Submarine Telephone Cables	2	Job	50,000	$ 100,000
	Submarine Power Cables	2	Job	50,000	100,000
	Subtotal				200,000
	Berthing Improvements				
	Dredging	100,000	cu. yds	1.50	150,000
	Diking	17,500	cu. yds	2.00	35,000
	Subtotal				185,000
	TOTAL, NON-FEDERAL CONTRACT COST				$1,080,000
	TOTAL PROJECT FIRST COST***				$6,660,000

* Cost account number as defined in ER 11-2-240.
** Includes contingencies, engineering and design, and supervision and administration.
*** Excludes preauthorization study costs.

XII - ECONOMIC ANALYSIS OF THE RECOMMENDED PLAN

12-01. GENERAL

Economic studies consisted of: (a) assemblage of a social and economic profile of existing conditions in the project area; (b) projections of vessel traffic and cargo based on a review of historical records and current conditions, with an analysis of resulting project benefits; and (c) a socio-economic assessment of the effects of the recommended project. Study results are described in detail in Appendices A, B, and D, respectively. The following paragraphs summarize and compare project benefits and costs.

12-02. SUMMARY OF TANGIBLE BENEFITS

Tangible dollar benefits in transportation savings would result from navigation improvements. These benefits are considered to be general in nature. It was determined that there are no strictly local benefits, such as land enhancement, that would be applicable. Land enhancement benefits at the primary disposal sites would be negligible. This matter is discussed in detail in Paragraph B-39, Appendix B.

12-03. Transportation benefits consist of three categories of savings in vessel operating costs: elimination of tidal delays; more efficient use of cargo capacity; and elimination of vessel backtracking - as described below (a full explanation appears in Appendix B):

a. Elimination of Tidal Delays. Under current project conditions, considerable time is lost by deep-draft vessels awaiting higher tides so they can operate in the North Bay. Within Humboldt Bay, an operating minimum channel depth is normally five feet greater than the loaded vessel draft. With the existing channel depth of 30 feet at mean lower low water and the mean diurnal tidal range of 6.4 feet, vessels drawing 26 feet or greater will encounter significant delays in the North Bay Channel. Assuming regular arrival of vessels throughout the mean daily tidal cycle, the hours of delay, with and without the recommended deepening to 35 feet, were determined for the decades from 1980 through 2030, using a projected vessel fleet. Benefits were determined by multiplying average vessel operating costs by the reduction in tidal delays. Equivalent average annual benefits for elimination of tidal delays amount to $288,000.

b. Topping Off with Lumber and Other Forest Products. Part of the lumber produced in the Humboldt Harbor tributary area is shipped into the San Francisco Bay area by rail or truck for topping off on deep-draft vessels destined for overseas markets. (Topping off, in this case, means d[illegible]loading lumber to bring the vessel to its maximum practical loaded draft.) With present depth restrictions, this practice could be expected to continue, and to increase since there is a trend

to increased use of deep-draft vessels in the lumber trade. But, with provision of a deeper channel, lumber which would otherwise be sent to the Bay area by truck or rail for topping off would instead be placed directly on vessels departing from Humboldt Harbor. Therefore, cost savings would result, essentially equal to the differential transport costs between land and sea transport. A survey of current and expected industry practice was made to determine a projected division of such savings by trade routes, and a weighted savings per ton of top-loaded cargo was estimated. When applied to projected vessel traffic that would be topped off, equivalent average annual benefits amount to $316,000.

c. Elimination of Vessel Backtracking. Because of restricted channel depths, about nine deep-draft vessels per year currently backtrack from Humboldt Harbor to fully load before proceeding to foreign ports. These ships, which are greater than 21,000 deadweight tons, normally begin from Vancouver, British Columbia and work their way southward to Humboldt Harbor. To complete loading, they must "backtrack" either to Vancouver, or more commonly to Coos Bay, Oregon to fully load. These return trips, which are not projected to increase over the project life, would be eliminated by provision of a 35-foot deep channel in Humboldt Harbor. These vessels could then be fully loaded with lumber produced within the Humboldt Bay tributary area. In all, 143 hours of additional vessel operating hours would be eliminated annually with an estimated cost savings of $93,000 per year.

12-04. Transportation savings are summarized in Table 6.

TABLE 6

SUMMARY OF BENEFITS

Category	Average Annual Benefits
Savings in Transportation Costs	
Elimination of tidal delays	$ 288,000
Topping off with lumber and other forest products	316,000
Elimination of vessel backtracking	93,000
Total	$ 697,000

12-05. SECONDARY BENEFITS

Besides the transportation savings benefits discussed in the previous paragraph, other secondary and intangible benefits would result as a result of the project and project construction. These benefits, which have been discussed in Section X, are provided in detail in Appendix D.

12-06. The most notable of these benefits are the direct economic impacts during construction resulting from expenditures of about $4.8 million by the contractor and his employees and indirect economic impacts of about $7.7 million induced by the direct expenditures. Also, the direct and indirect economic impacts would generate about $750,000 in local tax revenue during the construction period.

12-07. Reliable estimates of the long-term economic effect of the project are difficult to make. However, it is believed that the provision of improved channels would stimulate local and regional growth by improving the competitive position of Humboldt Harbor.

12-08. ANNUAL PROJECT COSTS

Estimated annual project costs for the project modification are $308,000, composed of amortization of the project first costs of $271,000 and increased annual maintenance costs of $37,000, as discussed below:

a. Amortization of Project First Costs. Amortization of the project first costs of $6,660,000, based on an applicable interest rate of 3-1/4 percent and project economic life of 50 years, is $271,000 annually.

b. Increased Annual Maintenance Costs. Dredging records indicate an average of 48,200 cubic yards of material is removed annually from existing project channels within the various reaches of the recommended project modification. An empirical formula was used to estimate the increased dredging required to maintain the project improvements, taking into account existing dredging quantities, existing channel areas, additional area from channel widening, and increased channel depth. The resultant increased maintenance quantities are 28,200 cubic yards annually. Assuming the continued use of Government-owned hopper dredges for maintenance of project channels, the estimated average annual increase in maintenance dredging cost as a result of the recommended project modification is $37,000. Detailed computations by project reaches are shown in Table 7.

12-09. BENEFIT-TO-COST RATIO

With estimated annual benefits of $697,000 and estimated annual costs of $308,000, the benefit-to-cost ratio is therefore 2.3 to 1. Incremental economic justification for each project reach is discussed in Paragraph 12-10.

TABLE 7

ESTIMATED INCREASE IN PROJECT CHANNEL MAINTENANCE QUANTITY AND COST

Channel Reach	X	Y	Z	W	D	Q[1/]	Unit Cost	Estimated Increase in Annual Maintenance Cost
NORTH BAY CHANNEL (Middle Grounds - Mile 0.5 - 1.0)	140,000	44,800	13,000	4,200	6,200	10,400	0.95	$10,000
NORTH BAY CHANNEL (Mile 1.0 - 4.3)	764,000	52,000	22,000	1,500	8,500	10,000	1.30	13,000
OUTER EUREKA CHANNEL (Mile 4.3 - 5.0)	167,000	0	11,700	0	4,200	4,200	1.60	7,000
SAMOA CHANNEL (Mile 4.5 - 5.8)	280,000	70,000	1,500	400	700	1,100	1.70	2,000
SAMOA TURNING BASIN (Mile 5.8 - 6.3)	0	156,000	0	900[2/]	1,600[2/]	2,500[2/]	1.95	5,000
Total			48,200	7,000	21,200	28,200		$37,000

1/ Terms for empirical formula $Q = \frac{(Z+W)(d_2)^2}{(d_1)^2} - Z$ defined as follows:

X is area of existing channel bottom in square yards
Y is additional area from channel widening in square yards
Z is average annual maintenance for the specific channel segment in cubic yards
W = $\frac{(X+Y)}{X} Z - Z$, the increased maintenance quantity in cubic yards estimated to result from channel widening
Q = total estimated increased maintenance dredging quantity in cubic yards estimated due to widening and deepening for depth factor $\frac{(d_2)^2}{(d_1)^2}$ where d_1 is existing depth and d_2 is new design depth
D = difference Q - W = increased maintenance dredging due to deeper and wider channel

2/ Proportioned on basis of new maintenance area 156,000 S.Y./70,000 S.Y. between turning basin and Samoa Channel widening

12-10. INCREMENTAL ECONOMIC ANALYSIS

Allocation of the total project benefits to the various channel reaches was analyzed, based on existing deep-draft vessel calls, new terminals, and projected vessel trips. The benefits thus allocated to the Samoa Channel were further analyzed to determine the portion assignable to the recommended turning basin. Benefits attributable to the turning basin were based on additional vessel operating costs due to delays. These apply to those larger vessels using the Samoa Channel that are required to wait for a high tide to turn around in the area beyond the end of the channel under existing conditions. Details are included in Appendix B. Benefit-to-cost ratios for the separate reaches are shown in Table 8, which indicates all project elements to be economically justified.

TABLE 8

COMPARISON OF BENEFIT AND COST
BY CHANNEL REACHES

Channel Reach	Annual Benefit	Annual Cost	Benefit-to-Cost Ratio
North Bay Channel	$202,000	$114,000	1.8
Eureka Channel	133,000	28,000	4.8
Samoa Channel	362,000	166,000	2.2
Channel	(255,000)	(79,000)	(3.2)
Turning Basin	(107,000)	(87,000)	(1.2)
Total	$697,000	$308,000	2.3

XIII - SCHEDULE FOR DESIGN AND CONSTRUCTION

13-01. GENERAL

Project construction would consist of dredging and disposal. The major portion of the dredging would be performed by hydraulic pipeline dredging, under contract, and a smaller portion would be by Government hopper dredge, using hired labor. The respective quantities for each method are 2,210,000 cubic yards and 190,000 cubic yards.

13-02. SCHEDULE AND FUNDING

Funds in the amount of $500,000 are included in the FY 1977 budget for initiation of project construction in 1977. Plans and specifications for the contract dredging would be completed in January and construction would begin in May 1977. Completion would follow 20 months later, in January 1979 (FY 1979). Diking for the retention works would be constructed, at the expense of local interests, prior to initiation of the contract dredging.

13-03. Therefore, as currently scheduled, the total time to complete both phases of construction would be about two years from the spring of 1977 to early 1979. Federal funds for the Corps of Engineers would be required as shown in Table 9. Plans for hopper dredging would be completed in January 1978 and construction would begin in the following spring (FY 1978), with scheduled completion two months later.

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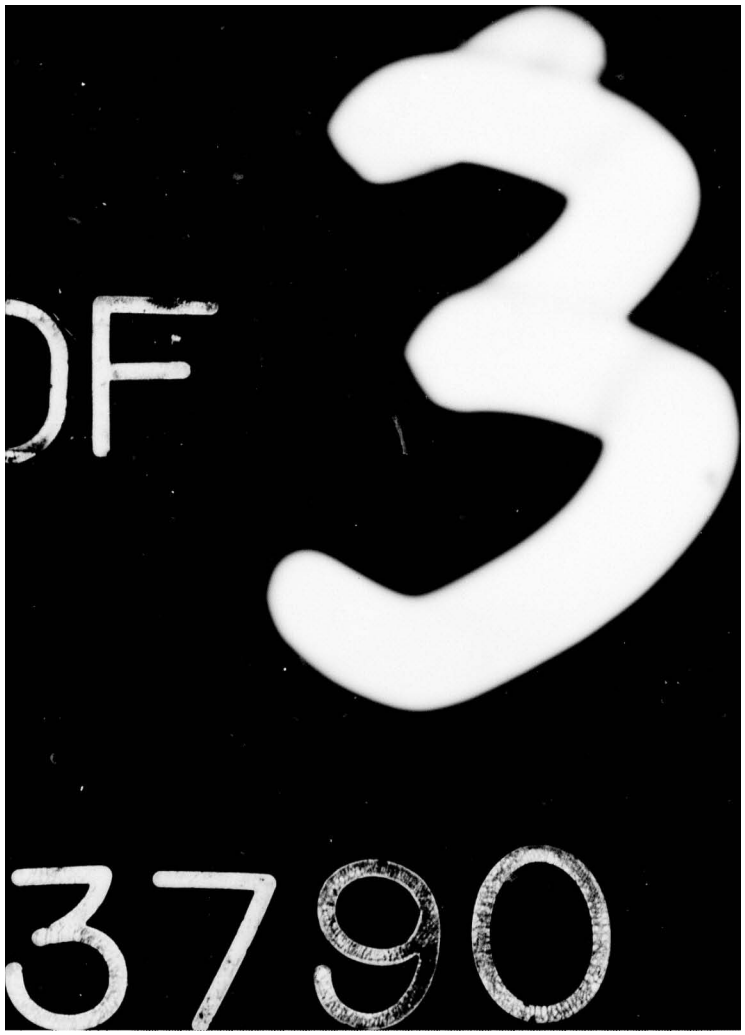
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TABLE 9

REQUIRED CORPS OF ENGINEERS FUNDS

Fiscal Year	Funds Budgeted	Funds Required	Work Items
1977	$ 500,000		Initiate & Complete Plans & Specifications for Contract Dredging Initiate Contract Dredging
1978		$3,500,000	Initiate & Complete Hopper Dredging Continue Contract Dredging
1979		$1,340,000	Complete Contract Dredging

XIV - OPERATION AND MAINTENANCE

14-01. Channel maintenance within project limits would be a Federal civil-works responsibility of the Corps of Engineers. Aids to navigation would be operated and maintained at Federal expense by the U.S. Coast Guard. Berthing maintenance and maintenance of landside facilities would be the responsibility of local interests.

14-02. The existing project is maintained annually by Government hopper dredge. Most of the volume is removed from the Bar and Entrance Channel which must be dredged annually. The Fields Landing Channel to the South Bay is also maintained annually. The North Bay, Eureka, and Samoa Channels are maintained at irregular intervals. With the proposed project changes, the average annual maintenance quantities would increase, but there would not be an increase in the frequency of dredging, since the shoaling rates are generally moderate to slight in the North Bay, Eureka, and Samoa Channels. With the changes, annual maintenance costs would increase by $37,000 to a total of $109,000. The $37,000 increment includes consideration of a 2-foot allowance for overdepth dredging.

XV - COST ALLOCATION

15-01. GENERAL

Project costs include only non-self-liquidating features. Specifically, for Federally-constructed improvements, these items consist of deepening, widening, and extension of the existing project through dredging, including delivery of the dredged material at the disposal site. Non-self-liquidating items, to be provided by local interests, consist of lands and damages, utility relocations, retention works for dredged materials, and excavation for vessel berths outside of the project limits. Excluded self-liquidating items which would be provided by local interests include wharfs, land structures, equipment and utilities.

15-02. All tangible benefits, which are solely transportation savings, are general in nature. Local benefits, such as land enhancement are considered to be negligible. Therefore, following normal policy, the Federal Government would bear all costs for new dredging and future maintenance of the channels and aids to navigation. Local interests would bear a significant portion of total project first cost in meeting their obligations, as listed in the succeeding paragraph.

XVI - PROPOSED LOCAL INTEREST COOPERATION

16-01. ITEMS OF LOCAL COOPERATION

The proposed items of local cooperation that are required for project implementation are listed. The local, cooperating agency would be the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD), a duly constituted entity with adequate financial capability to carry out all required items of local cooperation as listed below:

a. Provide and maintain at local expense adequate wharf and terminal facilities in the North Bay, Eureka, and Samoa Channels open to all on equal and reasonable terms for the storage, handling, and shipment of lumber and general commerce;

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

c. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the costs of such retaining works;

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

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

f. Comply with all pertinent provisions of Public Law 91-646 in the land acquisition program;

g. Prohibit construction of new terminals and related structures within 125 feet of the project lines along the North Bay and Samoa Channels;

h. Establish regulations concerning discharge of pollutants in waters of the harbor by users thereof, which regulations shall be in accordance with applicable laws or regulations of Federal, State and local authorities responsible for pollution prevention and control;

i. Provide for revegetation of the upland disposal sites including stockpiling and restoration of a sufficient amount of topsoil to adequately reseed the area with native vegetation and provide special measures to insure propagation of any rare plants found on the sites in accordance with plans and specifications prepared by the Corps of Engineers; and,

j. Monitor ground water quality in active wells that may be affected by dredge material disposal and undertake measures necessary to provide adequate drinking water.

16-02. In addition, the HBHRCD will be required to give the United States a right to enter, at reasonable times and in a reasonable manner, lands which the HBHRCD owns or controls, for access to the disposal sites for the purpose of inspecting, repairing, and maintaining the dikes and drainage works if the HBHRCD for any reason fails to repair and maintain them in accordance with the items of cooperation.

16-03. LETTER OF INTENT

The Commissioners of the HBHRCD have reviewed these requirements and certified their assent by a letter of intent dated 15 July 1976, acknowledging their review of the draft formal agreement and concurring with its provisions. The letter of intent and recent resolution of the HBHRCD are included in Appendix E.

16-04. DISPOSAL SITES

The disposal sites recommended in this memorandum are controlled by the city of Eureka. Through the intermediation of the HBHRCD, the Eureka City Council has indicated their willingness to allow use of land by Resolution No. 6630 dated 16 December 1975. (See also Appendix E.)

16-05. COSTS

The estimated costs of local cooperation would be $1,080,000. Of this amount, $695,000 for lands and damages, and retention works would be expended by the HBHRCD. The balance of $385,000 would be expended by other local interests for utility relocations and dredging of vessel berths.

16-06. PRINCIPAL OFFICERS

The principals responsible for fulfillment of the items of local cooperation are the five commissioners and the executive officer of the Humboldt Bay Harbor, Recreation and Conservation District, as listed below:

William J. Startare, Commissioner,
2nd Division (President)

Robert E. Davenport, Commissioner,
1st Division

James A. Gast, Commissioner,
3rd Division

H. N. Christensen, Commissioner,
4th Division

Richard L. Ridenhour, Commissioner,
5th Division

Jack B. Alderson, Executive Officer

16-07. They may be contacted at the district offices at 1122 Fifth Street (P.O. Box 134), Eureka, California 95501.

XVII - VIEWS OF FEDERAL AND NON-FEDERAL AGENCIES

17-01. As noted in paragraph 4.04, the San Francisco District has maintained post-authorization coordination with a wide range of governmental agencies, interested groups and individuals. In addition, draft copies of this memorandum and the accompanying Environmental Statement were widely distributed for review. Appendix E contains resolutions of local support and correspondence from Federal and non-Federal reviewers pertinent to the General Design Memorandum. Public meetings to explain and describe the proposed project were held in Eureka, California, on 8 March 1974 and on 7 April 1976. Results of these actions are summarized below.

17-02. FINAL PUBLIC MEETING

Most of the statements made and letters submitted for the record of the public meeting of 7 April 1976 and prior meetings strongly supported deepening of the Humboldt Bay Channels to aid in the shipment of forest products and assist the economy of the area. Transcript copies of these meetings have been previously furnished directly to interested Congressmen and local libraries. The record includes statements by individual citizens, industry representatives, labor unions, harbor pilots, stevedores, local government and environmental organizations. Concerns that were expressed by a number of interests included possible shoaling effects that could result from the use of the customary offshore disposal site for material to be excavated by hopper dredge; effects of land site disposal on wildlife habitat; effects of channel deepening on Bay hydrodynamics and water temperatures; assurances of maintaining adequate drinking water to users whose supply might be affected if the Samoa Spit aquifer is degraded by dredge tailwaters; possible sanding of existing and proposed offshore outfalls if the contingency ocean beach disposal site were to be used; and concern regarding the adequacy of the proposed channel widening in the vicinity of Buoys 8, 10 and 12. Most of these concerns also appeared in formal review comments that were received after circulation of the draft General Design Memorandum and draft Environmental Statement and are addressed in the following paragraphs.

17-03. REVIEW COMMENTS FROM FEDERAL AGENCIES

Appendix E contains correspondence exhibits from the United States Department of the Interior, U.S. Department of Commerce, U.S. Department of Agriculture, U.S. Environmental Protection Agency, U.S. Department of Transportation, and U.S. Department of Health, Education and Welfare. Most of these review comments and others included in the Environmental Statement referred specifically to that document. Hence, only those comments specific to the General Design Memorandum or of some significance to its provisions are addressed. Comments of specific application to the Environmental Statement are discussed in detail in that document.

17-04. In a letter dated 26 May 1976, the National Park Service, Western Region, U.S. Department of the Interior, commented on both the draft General Design Memorandum and draft Environmental Statement, requesting additional information on the archeological impacts of the disposal operation and requesting that the impacts of the pipelines and drainage ditches servicing the disposal areas should be noted. During the site inspections no archeological sites that would be disturbed by these facilities were found and this has been noted in the General Design Memorandum. The other comments related primarily to the Environmental Statement and responses appear in the "Comments" section of that document.

17-05. In a letter dated 5 March 1976, the U.S. Fish and Wildlife Service, U.S. Department of the Interior, stated that it had no adverse comments on the draft General Design Memorandum. The agency did express concern about minimizing possible habitat loss at disposal site 13C and requested that they be informed prior to dike construction so that their staff might assist in the exact placement of the eastern retention dike at the site. As requested, the San Francisco District will arrange for coordination with the Service prior to construction. In follow-up letters of 21 July and 28 July 1976, the Service responded to District inquiry about the concern raised by some groups regarding Menzie's wallflower (Erysimum menziesii). This plant is not presently listed by the Secretary of the Interior as a "Threatened" or "Endangered" species, but is under consideration for inclusion on an expanded list of "Threatened" species to be published in the Federal Register at some future time in accordance with provisions of Section 7 of the Endangered Species Act of 1973. However, the Service pointed out that this plant, nonetheless, is of very limited geographic distribution and that every reasonable consideration should be given to its protection. Special measures for collection and fencing off some outstanding colonies of Erysimum menziesii and revegetation of the disposal sites are considered reasonable and adequate to insure propagation of this plant and others native to similar type dune habitat found on the Samoa Peninsula.

17-06. Consolidated comments from review of the draft General Design Memorandum and Environmental Statement are contained in a letter received 14 June 1976 from the Office of the Secretary, U.S. Department of the Interior. All of the Department's comments referred to the Environmental Statement and are specifically addressed in that document. However, it is significant to note in this design memorandum that meeting objectives for preservation of any significant archeological finds during construction will require continued coordination and attention during preparation of contract plans and specifications.

17-07. The National Geodetic Survey, U.S. Department of Commerce, advised that sufficient advance notification be given of any impending disturbance or destruction of survey monuments in a letter dated 21 April 1976. The Corps is aware of the location of some monuments in the vicinity of the construction site and will take measures for their protection.

17-08. The Soil Conservation Service, U.S. Department of Agriculture, replied in a letter dated 12 April 1976 that there were no controversial items in the Environmental Statement within the realm of their expertise and responsiblities.

17-09. All review comments received from Region IX, U.S. Environmental Protection Agency were in reference to the Environmental Statement; they are specifically addressed in the final statement.

17-10. In a letter dated 26 January 1976, the Commander, Twelfth Coast Guard District, U.S. Department of Transportation, noted that widening the Samoa Channel might require relocation of some newly installed lighted pile structures and two new aids to navigation for the proposed turning basin. The project cost estimate is sufficient to cover the cost of these aids to navigation.

17-11. The Federal Aviation Administration (FAA) has informably advised that construction activities in the vicinity of the municipal airport on the Samoa Peninsula will comply with all applicable regulations for safe operation of aircraft. Specific interpretation of FAA regulations in location of dikes, slopes for drainage ditches and other engineering design matters will be coordinated during preparation of plans and specifications for the retention works.

17-12. RESOLUTIONS AND REVIEW COMMENTS BY STATE AND LOCAL AGENCIES

The need for and a request for timely construction of navigation improvements in Humboldt Bay is exhibited in a resolution dated 2 March 1976 by the Humboldt County Board of Supervisors. The "Resolution Concerning Deposition of Dredge Spoils on Eureka Municipal Airport Property in Connection with U.S. Army Corps of Engineers' Proposed Harbor Improvement Project" furnished by the City of Eureka on 16 December 1975 was essential to successful formulation of the project plan recommended in this design memorandum and demonstrates the breadth of support for the project. In a letter dated 15 July 1976, the project sponsor the Humboldt Bay Harbor, Recreation and Conservation District acknowledged review of the draft report, including all items of required non-Federal participation; and stated their intent to execute a formal agreement containing such provisions, in compliance with Section 221 of Public Law 91-611. The letter of intent is backed by a resolution by the Board of Harbor Commissioners, passed 7 July 1976.

17-13. In their letter of 7 May 1976, the Department of Planning for Humboldt County stated that the recommended dredging and disposal action conforms with the General Plan 2020 for land use adopted by Humboldt County.

17-14. By a letter dated 13 May 1976, the California State Resources Agency transmitted consolidated comments on the draft General Memorandum and Environmental Statement received from the following State reviewing agencies: Departments of Fish and Game, Food and Agriculture, Health, Navigation and Ocean Development, Parks and Recreation, Transportation, and Water Resources; the Energy Resources, Conservation and Development Commission; the Public Utilities Commission; the State Lands Commission; the Air Resources Board; the Solid Waste Management Board; and the Water Resources Control Board. The proposals for disposal of dredged material were approved, subject to further review and evaluation of design plans prior to construction, by the North Coast Regional Water Quality Control Board. An additional minor comment regarding bulk sediment analyses is treated under the Coordination, Comments, and Response section of the Environmental Statement. Concern was also expressed about the possibility that groundwater degradation at the North Spit might affect the water supply of nearby residences and mitigation measures were recommended. As a result of this comment the local sponsor, the Humboldt Bay Harbor Recreation and Conservation District, has agreed to monitor water quality in the wells supplying these homes and to take appropriate measures to supply adequate drinking water, if required. This action has also been added as an item of required local interest cooperation.

17-15. In a letter dated 28 May 1976, the North Coastal Regional of the California Coastal Zone Conservation Commission commented on the draft Environmental Statement. There were two concerns of general significance. The first was similar to that expressed by the U.S. Fish and Wildlife Service about minimizing habitat loss at disposal site 13C (see paragraph 17-05). Therefore, the San Francisco District will also coordinate with the Commission prior to construction of the retention dike.

17-16. The Commission is also concerned that a species of vascular plant, Erysimum menziesii, would be endangered by use of the proposed land disposal sites and that use of the site would conflict with the Coastal Plan policy of protecting and restoring rare and endangered plants and their habitats. Recent investigation by the San Francisco District confirms that this species does exist within the disposal area. At the present time it is not on the Federal Register List of Threatened or Endangered Fauna and Flora (1 July 1975), but the Commission states that it is expected to be added.

17-17. In response to concern for the perpetuation of this species, a reserve area of several acres of stabilized dune habitat will be fenced and used in a program to study and perpetuate the species. This will be a responsibility of the Humboldt Bay Harbor, Recreation and Conservation District. The Corps plans and specifications will include measures to protect the species from incidental construction activity. (Refer also to the Coordination, Comment and Response section of the environmental statement for additional details.)

17-18 COMMENTS BY OTHERS

By letter dated 9 April 1976, Winzler and Kelly, Consulting Engineers, Eureka, California, stated that they had reviewed the draft Environmental Statement and questioned the proposed location of the contingency dredge disposal site on the ocean beach beginning about 2.7 miles north of the Humboldt Bay entrance. They were concerned that disposal of dredge material at the site could conceivably affect, by shoaling, two existing nearby industrial outfalls and a proposed sewage outfall which they are designing for the Humboldt Bay Wastewater Authority. After consideration of this comment and noting that the capacity of the selected land disposal sites exceeds the estimated disposal volume by approximately 400,000 cubic yards, it was decided that the contingency disposal site was not necessary and it has therefore been eliminated.

17-18. By letter dated 7 April 1976, Captain B. T. Bessellieu, speaking for the Humboldt Bay Bar Pilots Association expressed support of the plan to deepen the channel to 35 feet but stated that the proposed channel widening would be inadequate in the vicinity of Buoys 8, 10 and 12. As shown in the plans, the channel would have been widened 200 feet easterly at the entrance to the North Bay Channel, then tapering back to the existing 400-foot width at Buoy 10. Captain Bessellieu indicated that a full 200-foot widening should be carried as far as Buoy 10 and that the channel could then taper back to the existing width in the vicinity of Buoy 12. He stated that, otherwise, conditions would be unacceptable for larger vessels during heavy weather conditions. This proposal has been incorporated in the recommended plan.

17-19. SUMMARY

In reference to all of the above comments, the project cost estimate is adequate to cover specific measures related to design and installation or relocation of aids to navigation, protection of existing survey monuments, burial of certain drainage culverts near the airport runway and reasonable measures for mitigation and site restoration as listed in this report and the Environmental Statement. Non-Federal obligations to provide environmentally acceptable disposal sites and site restoration and mitigation measures are considered adequate and in conformance with all existing Federal, State and local regulations. Coordination with FAA, the National Park Service, the California Water Quality Control Board and other interested agencies will be continued during preparation of contract plans and specifications and through the project construction phase.

XVIII - STATEMENT OF FINDINGS

18-01. AUTHORITY AND PURPOSE

Prior studies and reports and the current General Design Memorandum for navigation improvements for Humboldt Harbor, California, have been reviewed and evaluated in the light of overall public interest. Existing tonnages and trends in oceanborn commerce transiting Humboldt Harbor have been determined, with a finding that the need for navigation improvements is more critical now than anticipated when the project was authorized in 1968 on the basis of projections and findings set forth in the Project Document (H.D. No. 330, 90th Congress, 2d Session). The economics of the project have been completely reevaluated and it has been found that timely initiation of the work of deepening the North Bay Channels from their existing 30-foot depth to their authorized depth of 35 feet is imperative to efficient and safe operation of the harbor in its accommodation of the larger, deeper draft vessels now in use for transocean shipment of logs, lumber, wood pulp, chips and other bulk forest products. Economic transportation, particularly waterborne transportation, is fundamental to maintenance of a competitive timber industry and the economic well-being of the five-county tributary area of Humboldt Bay and Harbor.

18-02. PUBLIC PARTICIPATION

The general need for deeper channels in Humboldt Bay and specific navigation problems have been expressed by the Humboldt Bay Bar Pilots Association and numerous shippers who are incurring added costs and delays from steamer cancellations and more expensive overland freight rates for ship loadings at more distant ports in the San Francisco Bay area. These statements and others on environmental concerns are contained in transcripts of public meetings held in Eureka, California, on 8 March 1974 and 7 April 1976 in connection with these post authorization studies. Copies of the transcripts have been forwarded directly to interested Congressmen, the local harbor district, and local libraries. Certain minor changes in design details and mitigation measures have been incorporated in the General Design Memorandum to reflect formal review comments by Federal and Non-Federal agencies and citizen responses to the drafts of the General Design Memorandum and Environmental Statement circulated in March 1976.

18-03. RATIONALE FOR DESIGN

The rationale for the recommended design hinges on evaluation of three main parameters: (a) Social Need, (b) Economics, and (c) Environmental Constraints. The cost of transporting dredged material to a suitable disposal site or sites is the most significant engineering matter relating to project formulation and construction. Although numerous alternative sites were considered, extensive environmental assessments and evaluations described in this report and the accompanying Environmental Statement have confirmed that approximately 2.2 million cubic yards of material to be removed from project channels with a hydraulic pipeline dredge can be economically deposited on dune areas in the vicinity of the municipal airport on the Samoa Peninsula with minimal adverse effects. The recommended plan for construction contemplates use of a government-owned hopper dredge, as envisioned in the Project Document, for bend widening in the vicinity of the harbor entrance, where rough sea conditions make use of a pipeline dredge impractical. About 200,000 cubic yards of material below project mile 1.0 would be removed in this manner and disposed at an EPA approved shallow marine site about 1.5 nautical miles southwest of the entrance jetties.

18-04. ALTERNATIVES

Some of the more significant alternatives considered prior to arriving at the recommended plan are as follows:

a. No-Action. Under this alternative, the project area would remain as is. There would not be any adverse effects from dredging or disposal on natural resources. Inefficient shipping operations from tidal delays, back-tracking to deeper ports and under-utilization of cargo space of the larger vessels would continue. Failure to provide timely improvements in navigation access likely could cause a loss in competitive position of Humboldt Harbor as a shipping terminus for basic forest products and could affect the economic activity of a large timber producing area of northern California. The no-action alternative is not considered responsive to documented need for deeper navigation channels in Humboldt Bay.

b. Scope of Improvement. Various increments of channel deepening and widening were considered. The optimum amount of project investment at this time depends on the cost of dredging and disposal and future maintenance, as well as the projected benefits in transportation savings derived from improvement of a particular navigation channel reach or feature. The plan of improvement recommended herein has been found representative of the optimum scope of navigation improvement feasible at this time on the basis of existing and projected waterborne commerce, vessel size trends, operating costs, and cost of alternative transport modes.

c. Disposal Alternatives. Constructive use of dredged material could increase total benefit derived from project construction and two possibilities were considered. Some dredged material was found suitable for possible use as embankment fill for a segment of the proposed Eureka freeway. However, this alternative was discarded due to indefinite financing and right-of-way acquisition schedule by the State of California and possibly higher construction costs than with alternative methods. Deposit of dredged material on an eroding shore area opposite the harbor entrance was rejected because of its greater distance from channels and imperfect knowledge on environmental effects, including possible increased channel shoaling rates. Numerous other potential disposal sites inventoried in the Humboldt Bay Master Plan were progressively eliminated as more costly, unavailable or environmentally unacceptable. The final iterative process left only ocean disposal and land disposal in the vicinity of the airport on the Samoa Peninsula as the only viable alternatives. These sites were found to have the least overall adverse environmental effects. The contingency beach disposal site tentatively recommended in the draft reports has been eliminated, due to risk of contributing to sand fouling an ocean outfall from the Crown Simpson pulp mill.

18-05. MITIGATION MEASURES

Salt water effluent from the dredge slurry will contaminate some groundwater resources found as a freshwater lens under the dunes. However, domestic and industrial use of this limited resource has been supplanted by availability of better quality supplies imported from Mad River. The effect of saltwater percolation through the dune to underlying waters is not considered to be economically significant or irreversible, since normal rainfall, in excess of 40 inches a year, would flush away the saltwater. The Humboldt Bay Harbor, Recreation and Conservation District has agreed to monitor groundwater effects and mitigate any damage by providing free hook-ups to municipal supplies for eight residences in Fairhaven that still rely on shallow domestic water wells. The local sponsor has furnished a letter of intent and resolution, in accordance with provisions of Section 221 of P.L. 91-611 (See Appendix E). The draft agreement also includes provision that local sponsor will take certain measures for continued propagation of certain plant colonies (Erysimum menziesii) found on the proposed disposal sites. Specifically, several acres of the plant will be fenced and reserved for the purpose of monitoring and studying its growth characteristics. Also, various measures designed to reestablish other native vegetation on the sites will be performed.

18-06. PROJECT IMPACTS

Surface effects of deposit of dredged material on two sites of about sixty acres each, east and south of the small airport, owned by the City of Eureka, are considered minimal and less significant than possible adverse effects at all other alternative sites considered in this study. Other alternatives considered and evaluated for disposal of dredged material are described in this report and the Environmental Statement. No homes or businesses will be displaced by the project. Some wildlife habitat will be degraded from deposition of dredged material and salt contamination with consequent displacements. The socio-economic impacts of the project on employment and stimulation of the regional economy of the five-county tributary area are definitely positive, compared with the possible adverse effects on local business from possible loss of competitive port position under the no-action alternative.

18-07. CONCLUSION

The proposed improvement would allow improved access by deep-draft vessels to existing and potential harbor facilities and allow improvement of the recognized port contribution to employment, business and industrial activity in northern California. Export of forest products harvested from a large timber growing area tributary to the port has been found significant to the national interest of maintaining a favorable balance of trade. The estimated first cost of the improvement would be $6,600,000. Estimated annual benefits are $697,000 and estimated annual charges are $308,000. The resulting benefit-to-cost ratio is 2.3 to 1.

XIX - RECOMMENDATIONS

19-01. It is recommended that the United States modify the existing project at Humboldt Harbor, California in accord with the following items (as shown on Plate 1 of this memorandum):

a. Deepen the North Bay Channel to a depth of 35 feet between Mile 0.75 and Mile 4.29;

b. Widen the North Bay Channel at channel bends in the vicinity of Mile 0.75 (from zero at Mile 0.5 tapering to 200 feet at the junction with the west side of the Fields Landing Channel, and 200 feet from the east side of the Fields Landing Channel to Mile 1.17, then tapers to 50 feet at Mile 1.67); Mile 2.00 (from 50 feet at Mile 1.67, tapers to 250 feet at Mile 1.87, then tapers to zero at Mile 2.08); and Mile 2.60 (from zero at Mile 2.4, tapers to 190 feet at Mile 2.61, then tapers to zero at Mile 2.79).

c. Deepen the Eureka Channel to a depth of 35 feet between Mile 4.29 and Mile 5.00;

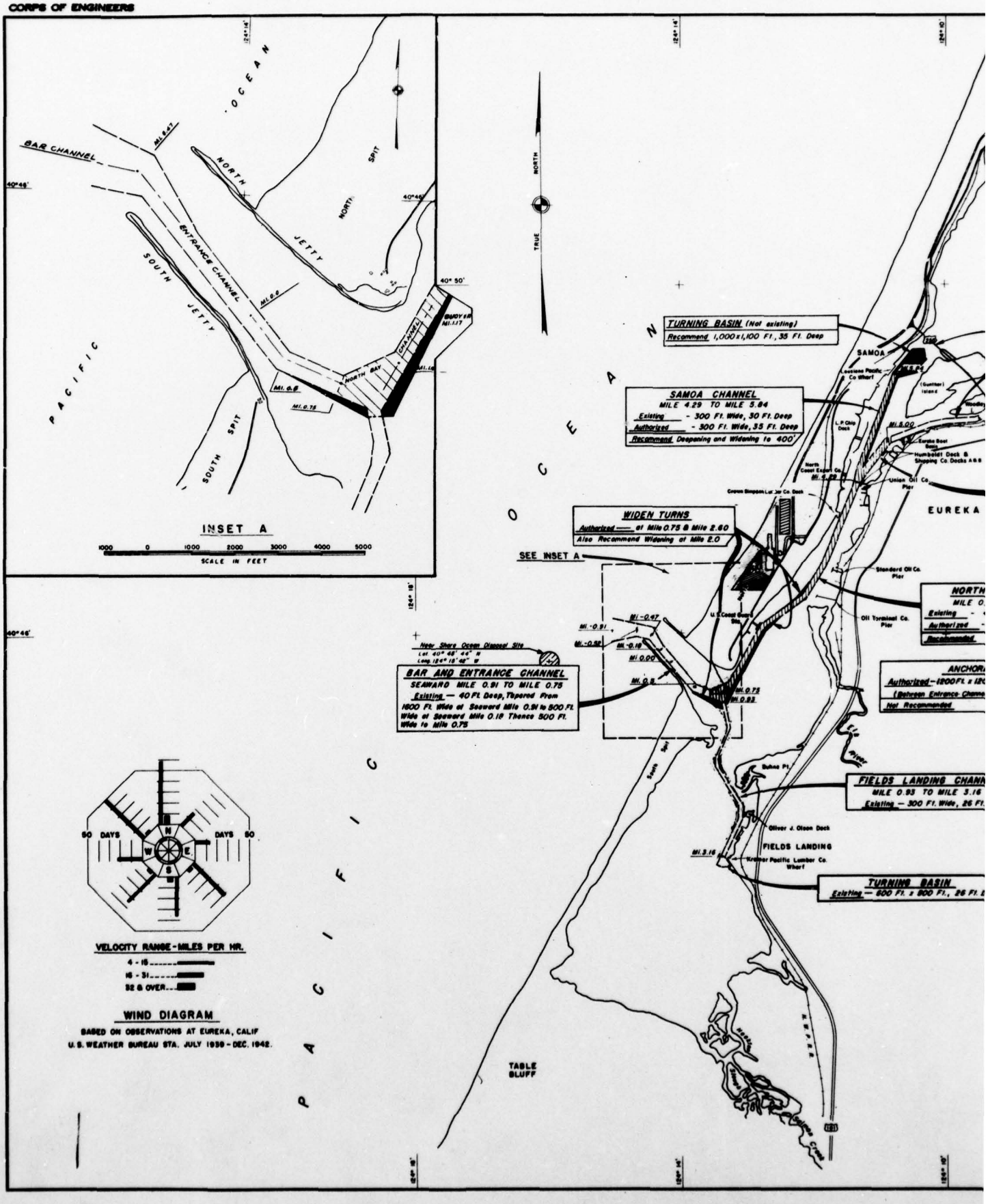
d. Deepen and widen the Samoa Channel between Mile 4.29 and Mile 5.84 by increasing the channel depth to 35 feet and increasing the width to 400 feet; and

e. Provide a turning basin beyond Mile 5.84 at the upper end of the Samoa Channel, 35 feet deep, 1,000 feet wide and 1,100 feet long.

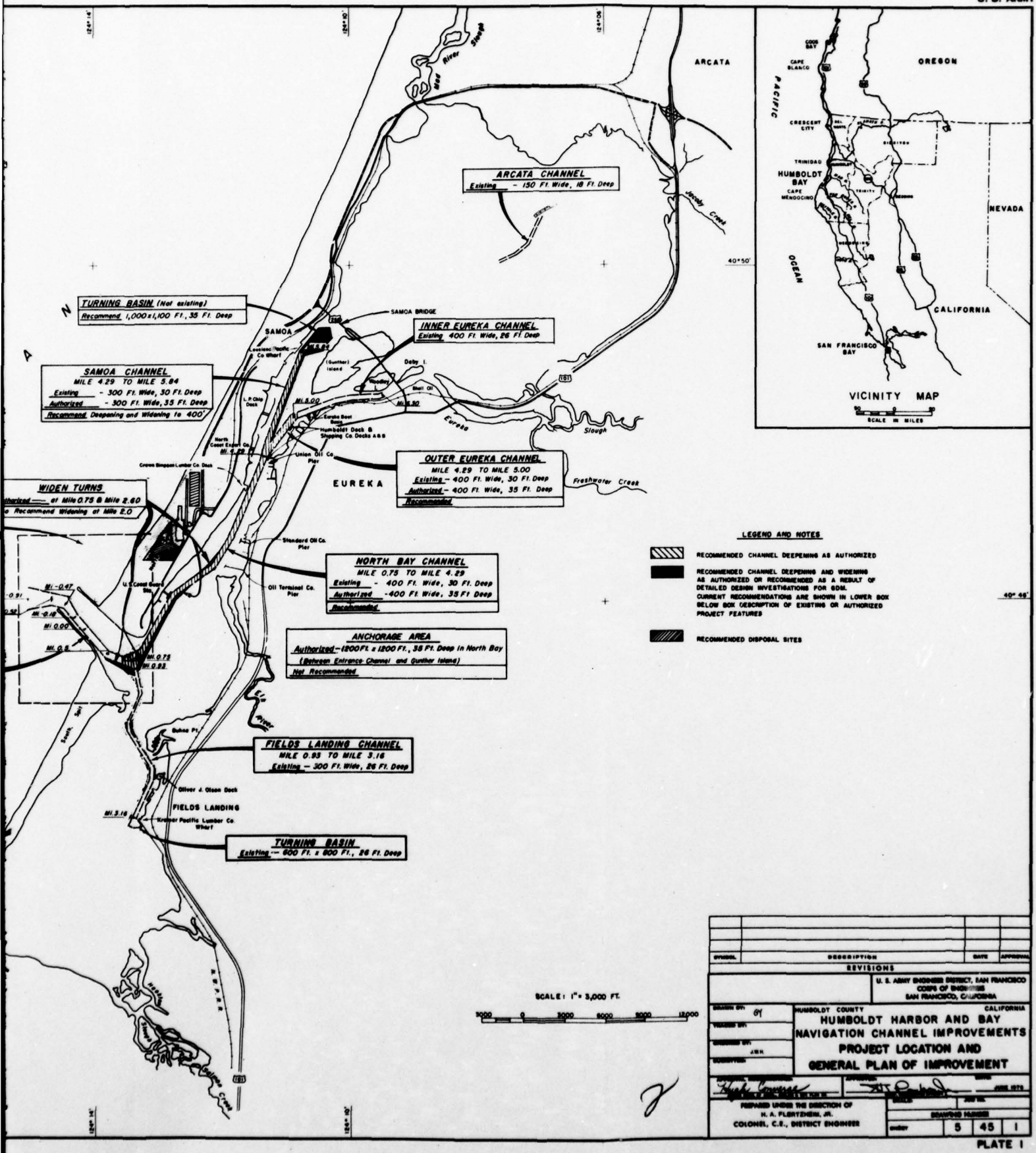
19-02. The above items of works would be constructed by the Corps of Engineers provided that, prior to commencement of construction, local interests will undertake certain specific items of local cooperation, as described in Section XVI.

H. A. FLERTZHEIM, JR.
Colonel, CE
District Engineer

CORPS OF ENGINEERS



U. S. ARMY



SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DESIGN BY: GY
DRAWN BY:
CHECKED BY: J.E.H.
QUANTITIES:

HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT HARBOR AND BAY NAVIGATION CHANNEL IMPROVEMENTS

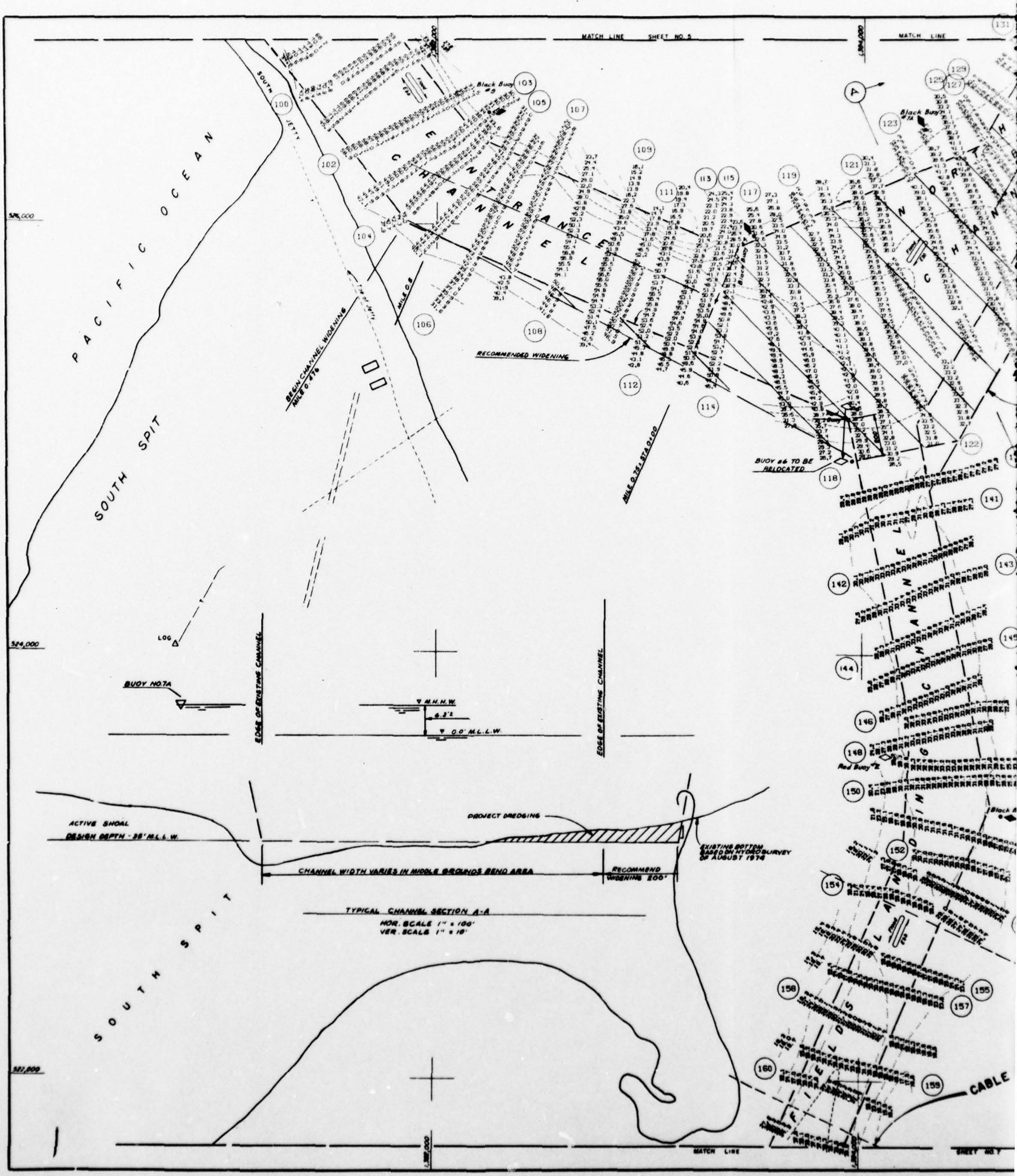
PROJECT LOCATION AND GENERAL PLAN OF IMPROVEMENT

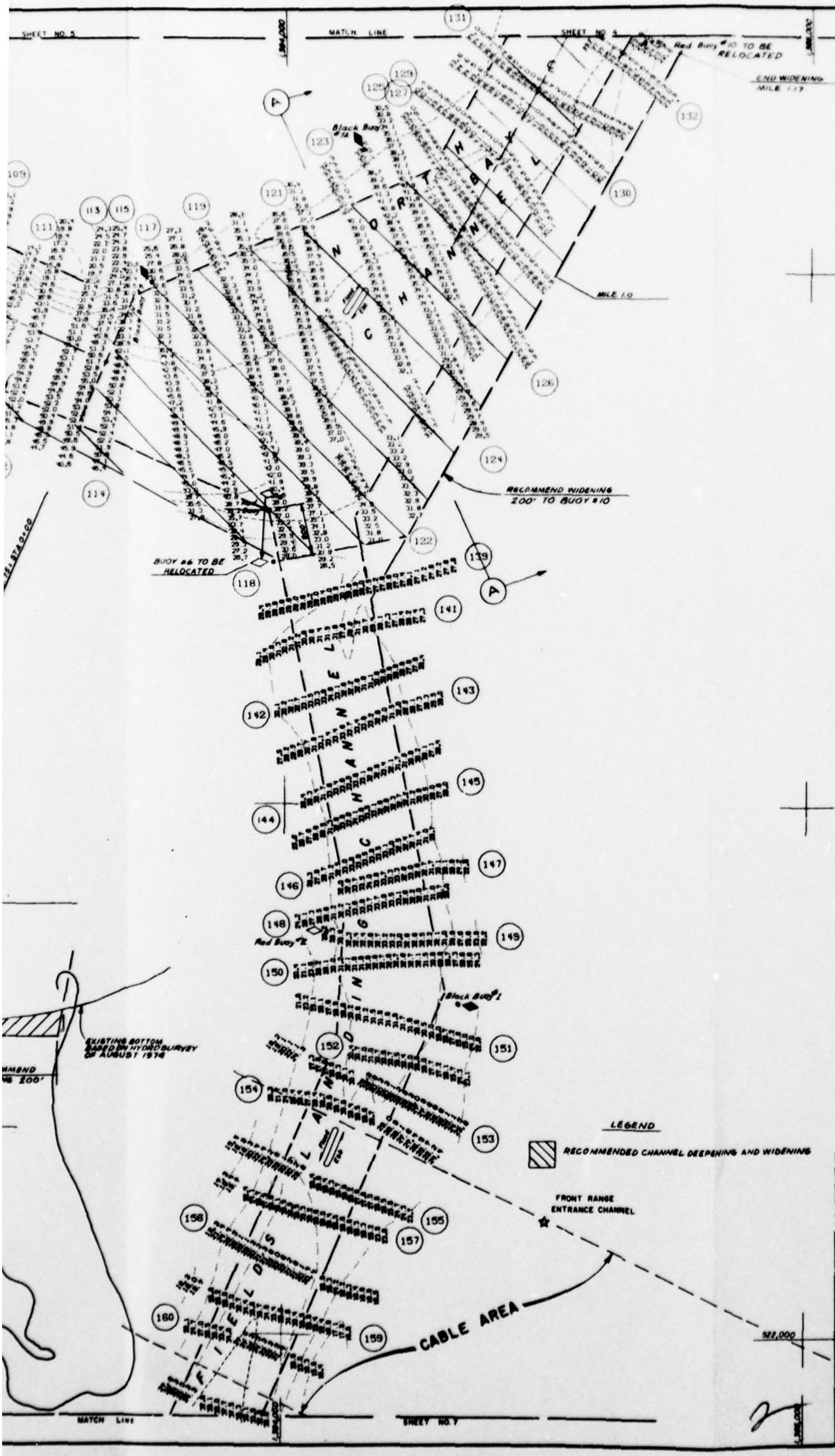
APPROVED: JUNE 1970

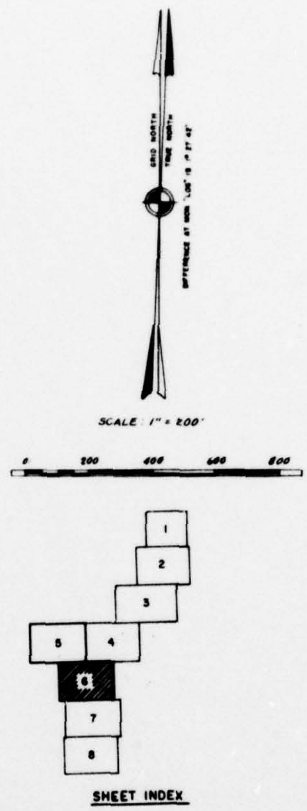
PREPARED UNDER THE DIRECTION OF
H. A. FLEETWOOD, JR.
COLONEL, C.E., DISTRICT ENGINEER

DRAWING NUMBER
5 45 1

PLATE 1


MATCH LINE SHEET NO. 5
MATCH LINE
PACIFIC OCEAN
SOUTH SPIT
SOUTH JETTY
ENTRANCE CHANNEL
NORTH CHANNEL
FIELDS LANDING CHANNEL
Black Buoy
RECOMMENDED WIDENING
BEGIN CHANNEL WIDENING
BUOY #6 TO BE RELOCATED
LOG
BUOY NO.7A
EDGE OF EXISTING CHANNEL
EDGE OF EXISTING CHANNEL
M.H.H.W.
0.0' M.L.L.W.
ACTIVE SHOAL
DESIGN DEPTH - 35' M.L.L.W.
PROJECT DREDGING
EXISTING BOTTOM BASED ON HYDROSURVEY OF AUGUST 1974
CHANNEL WIDTH VARIES IN MIDDLE GROUNDS BEND AREA
RECOMMEND WIDENING 200'
TYPICAL CHANNEL SECTION A-A
HOR. SCALE 1" = 100'
VER. SCALE 1" = 10'
Red Buoy
CABLE
MATCH LINE
SHEET NO. 7





NOTES:

SURVEYED BY THE CORPS OF ENGINEERS ON 22, 25, 26 AND 29 AUGUST 1974. SOUNDINGS WERE PLOTTED BY ELECTRONIC COMPUTER.

SOUNDINGS REFER TO THE DATUM OF MEAN LOWER LOW WATER AT THE LOCALITY.

SOUNDINGS WERE TAKEN BY FATHOMETER AND ARE SHOWN TO THE NEAREST FOOT AND TENTHS OF A FOOT.

PLANE GRID, BEARINGS AND COORDINATES ARE BASED ON THE STATE OF CALIFORNIA COORDINATE SYSTEM, (LAMBERT CONFORMAL PROJECTION) ZONE I CALIFORNIA, AS DESCRIBED IN SPECIAL PUBLICATION NO. 253, PUBLISHED BY THE NATIONAL OCEAN SURVEY.

PROJECT DEPTHS ARE AS FOLLOWS:
- BAR & ENTRANCE CHANNEL - 40 FEET.
- NORTH BAY, SAMOA TO MILE 5.0 & EUREKA CHANNEL - 30 FEET
- FIELDS LANDING CHANNEL & MILE 5.0 TO "R" STREET IN EUREKA CHANNEL - 26 FEET.

(5) INDICATES THE NUMBER & BEGINNING OF A LINE OF SOUNDINGS.

SOUNDINGS ARE BASED ON TIDE GAGES REFERENCED TO U.S.C. & G.S. BENCH MARKS AS FOLLOWS:
- EUREKA & SAMOA CHANNELS - B.M. NO. 4 (1908) ELEV. 13.61' M.L.L.W.
- ENTRANCE & NORTH BAY CHANNELS - B.M. NO. 9 (1937) ELEV. 10.86' M.L.L.W.
- FIELD LANDING CHANNEL - B.M. NO. 9 (1925) ELEV. 8.02' M.L.L.W.

SYMBOL	DESCRIPTION	DATE	APPROVAL

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY: C.S. & L.K.H.
TRACED BY:
CHECKED BY: J.W.H.
SUBMITTED:

HUMBOLDT COUNTY — CALIFORNIA

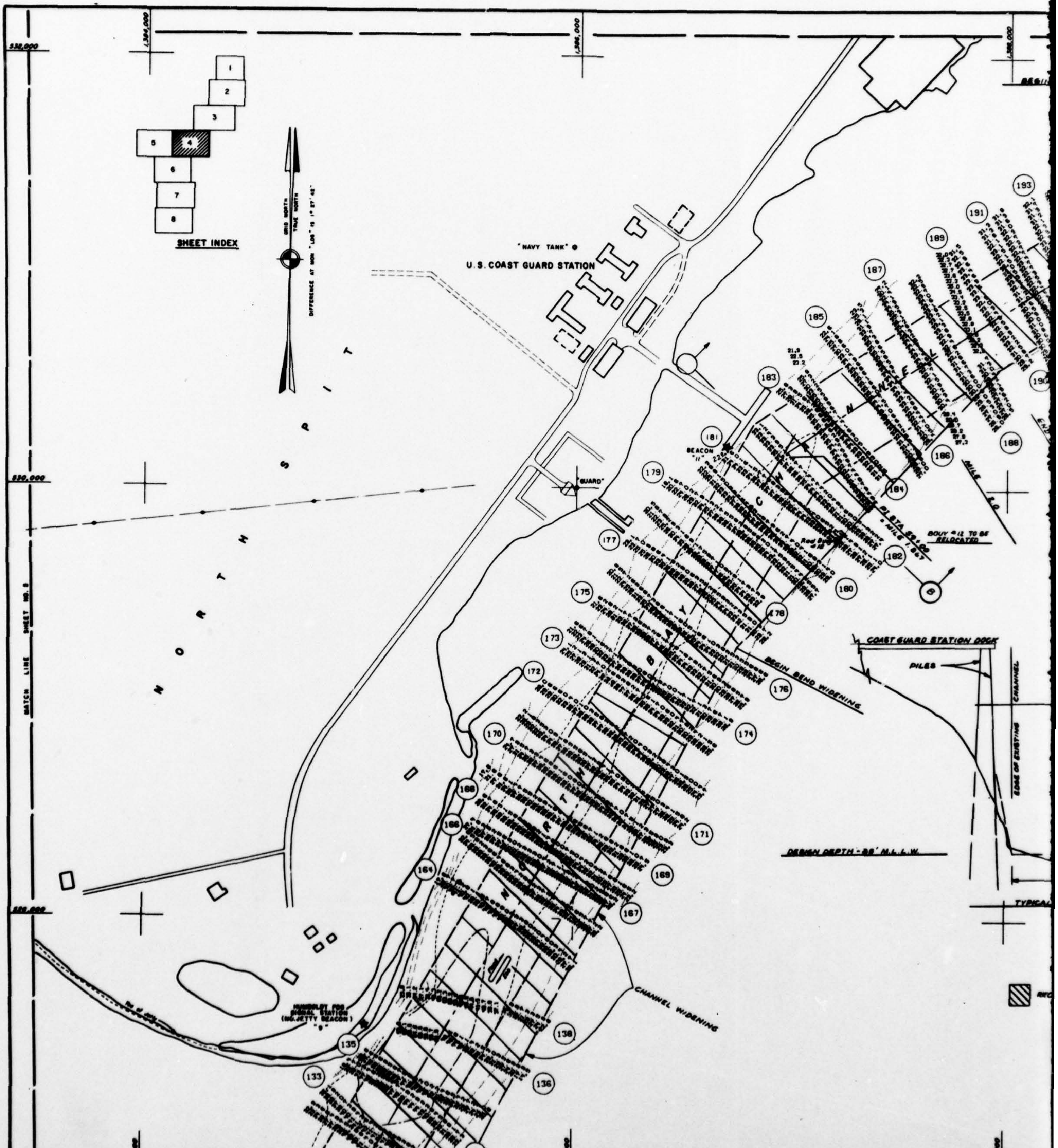
HUMBOLDT BAY
NAVIGATION CHANNEL IMPROVEMENTS
NORTH BAY CHANNEL
MIDDLE GROUNDS

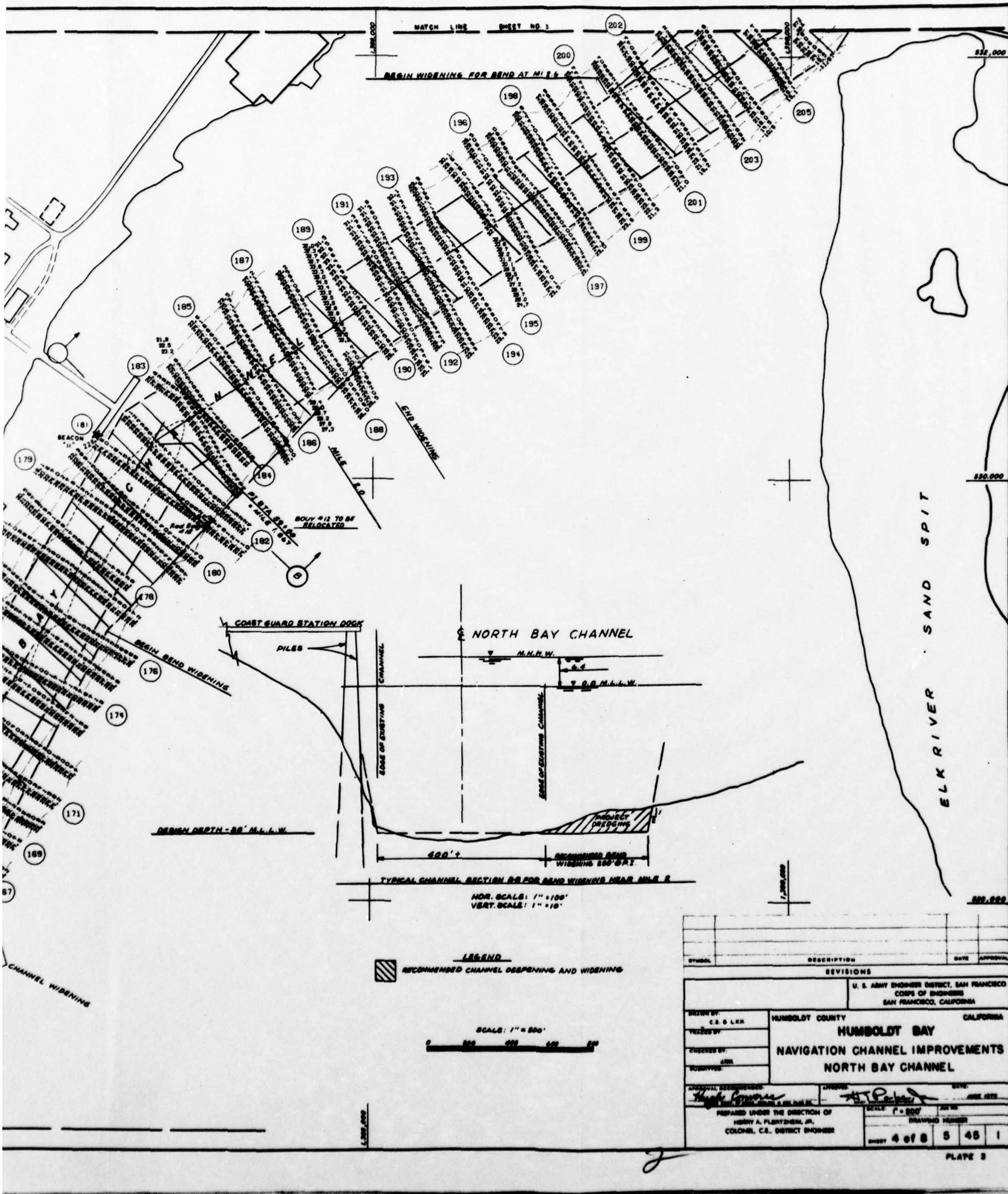
APPROVAL RECOMMENDED: Hugh Converse
APPROVED: [signature]
DATE: JUNE 1976

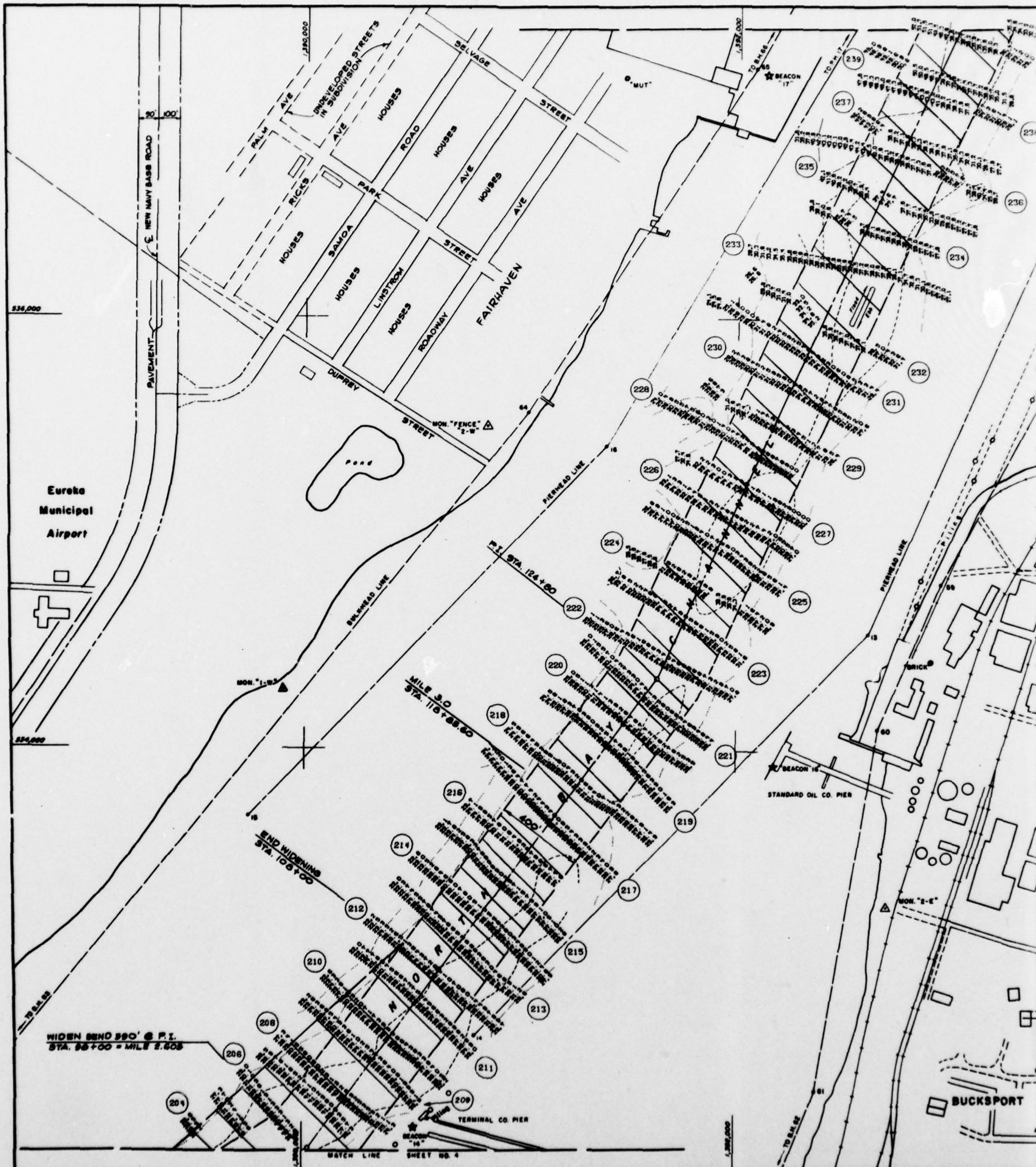
PREPARED UNDER THE DIRECTION OF
HENRY A. FLERTZHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER

SCALE: 1" = 200'
JOB NO.:
DRAWING NUMBER
SHEET 6 of 8 | 5 | 45 | 1

PLATE 2


SHEET INDEX
"NAVY TANK"
U.S. COAST GUARD STATION
NORTH SPIT
"GUARD"
BEACON "11"
COAST GUARD STATION DOCK
PILES
BEGIN BEND WIDENING
CHANNEL WIDENING
DESIGN DEPTH -35' M.L.L.W.
HUMBOLDT FOG SIGNAL STATION (NO. JETTY BEACON) "9"
MATCH LINE SHEET NO. 5
MATCH LINE SHEET NO. 6
EDGE OF EXISTING CHANNEL
BOUY #12 TO BE RELOCATED
MILE 6.0
133
134
135
136
138
164
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
193
330,000
332,000
328,000


MATCH LINE SHEET NO. 3
BEGIN WIDENING FOR BEND AT MI 2.6
BEACON "11"
BOUY #12 TO BE RELOCATED
END WIDENING
MILE 3.0
BEGIN BEND WIDENING
CHANNEL WIDENING
ELK RIVER · SAND SPIT
COAST GUARD STATION DOCK
PILES
℄ NORTH BAY CHANNEL
M.H.H.W.
0.0 M.L.L.W.
EDGE OF EXISTING CHANNEL
PROJECT DREDGING
DESIGN DEPTH - 35' M.L.L.W.
400'±
TYPICAL CHANNEL SECTION B-B FOR BEND WIDENING NEAR MILE 2
HOR. SCALE: 1" = 100'
VERT. SCALE: 1" = 10'
LEGEND
RECOMMENDED CHANNEL DEEPENING AND WIDENING
SCALE: 1" = 800'
SYMBOL
DESCRIPTION
DATE
APPROVAL
REVISIONS
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
DRAWN BY: C.S. & L.K.H.
TRACED BY:
CHECKED BY:
SUBMITTED:
HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT BAY
NAVIGATION CHANNEL IMPROVEMENTS
NORTH BAY CHANNEL
APPROVAL RECOMMENDED:
APPROVED:
DATE:
PREPARED UNDER THE DIRECTION OF
HENRY A. FLERTZHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER
SCALE: 1" = 800'
DRAWING NUMBER
SHEET 4 of 8
5
45
1
PLATE 3


Eureka
Municipal
Airport
NEW NAVY BASE ROAD
PAVEMENT
SELVAGE
STREET
PALM
AVE
UNDEVELOPED STREETS IN SUBDIVISION
HOUSES
RICKS
PARK
ROAD
SAMOA
LINSTROM
ROADWAY
FAIRHAVEN
DUPREY
STREET
MON. "FENCE"
Pond
BEACON "17"
"MUT"
PIERHEAD LINE
BULKHEAD LINE
MON. "1-W"
P.I. STA. 124+60
MILE 3.0
STA. 115+86.60
END WIDENING
STA. 105+00
WIDEN BEND 390' @ P.I.
STA. 96+00 = MILE 2.603
400'
BEACON 15
STANDARD OIL CO. PIER
TERMINAL CO. PIER
BEACON "14"
MATCH LINE SHEET NO. 4
BRICK
MON. "2-E"
BUCKSPORT
536,000
534,000
1,380,000
1,386,000
204
206
208
209
210
211
212
213
214
215
216
217
218
219
220
221
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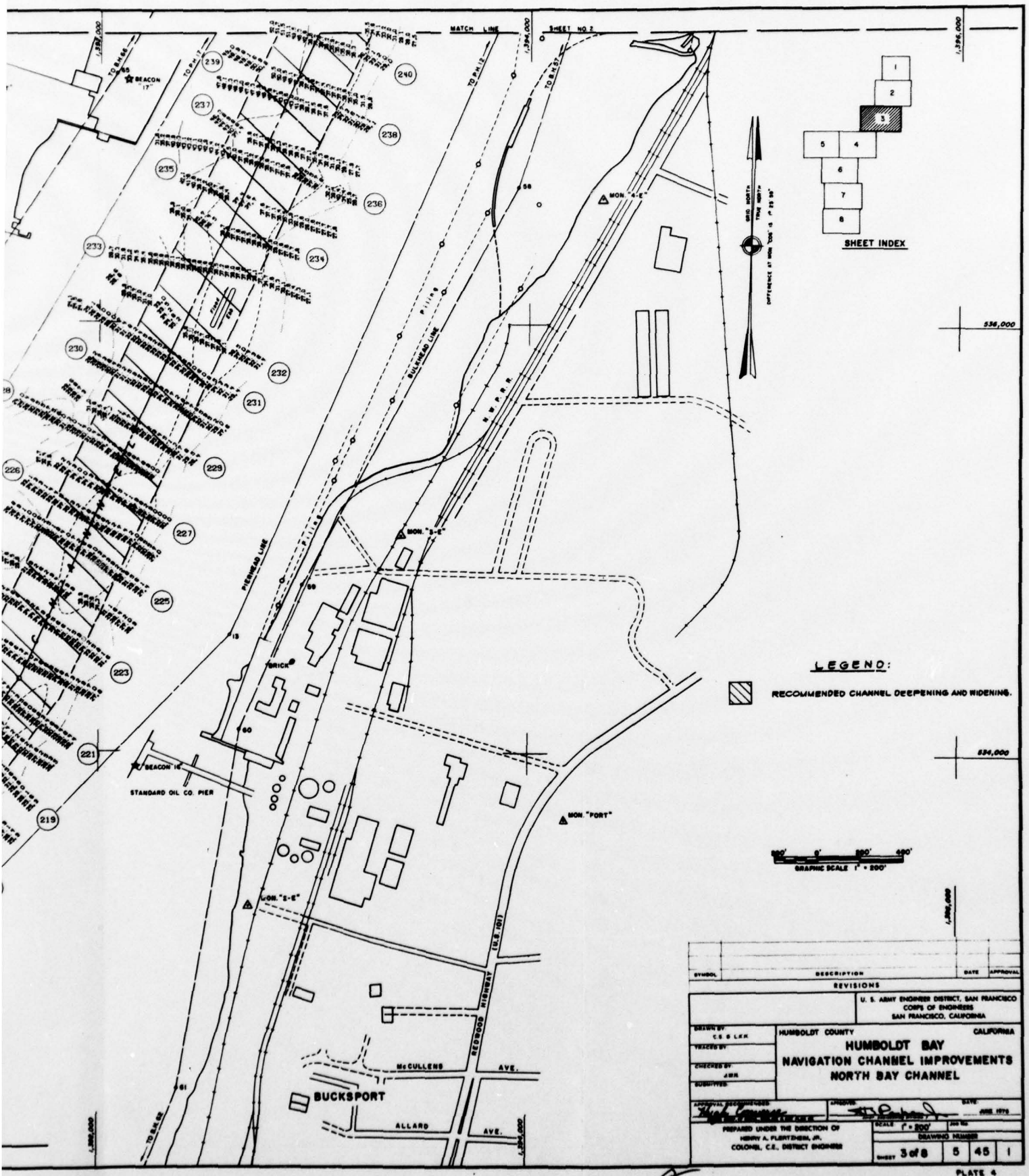


SYMBOL	DESCRIPTION	DATE	APPROVAL
REVISIONS			

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY C.S.S. LEK
TRACED BY
CHECKED BY JWR
SUBMITTED

HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT BAY
NAVIGATION CHANNEL IMPROVEMENTS
NORTH BAY CHANNEL

APPROVAL RECOMMENDED
CHIEF, ENGINEERING DIVISION

APPROVED
DATE: JUNE 1970

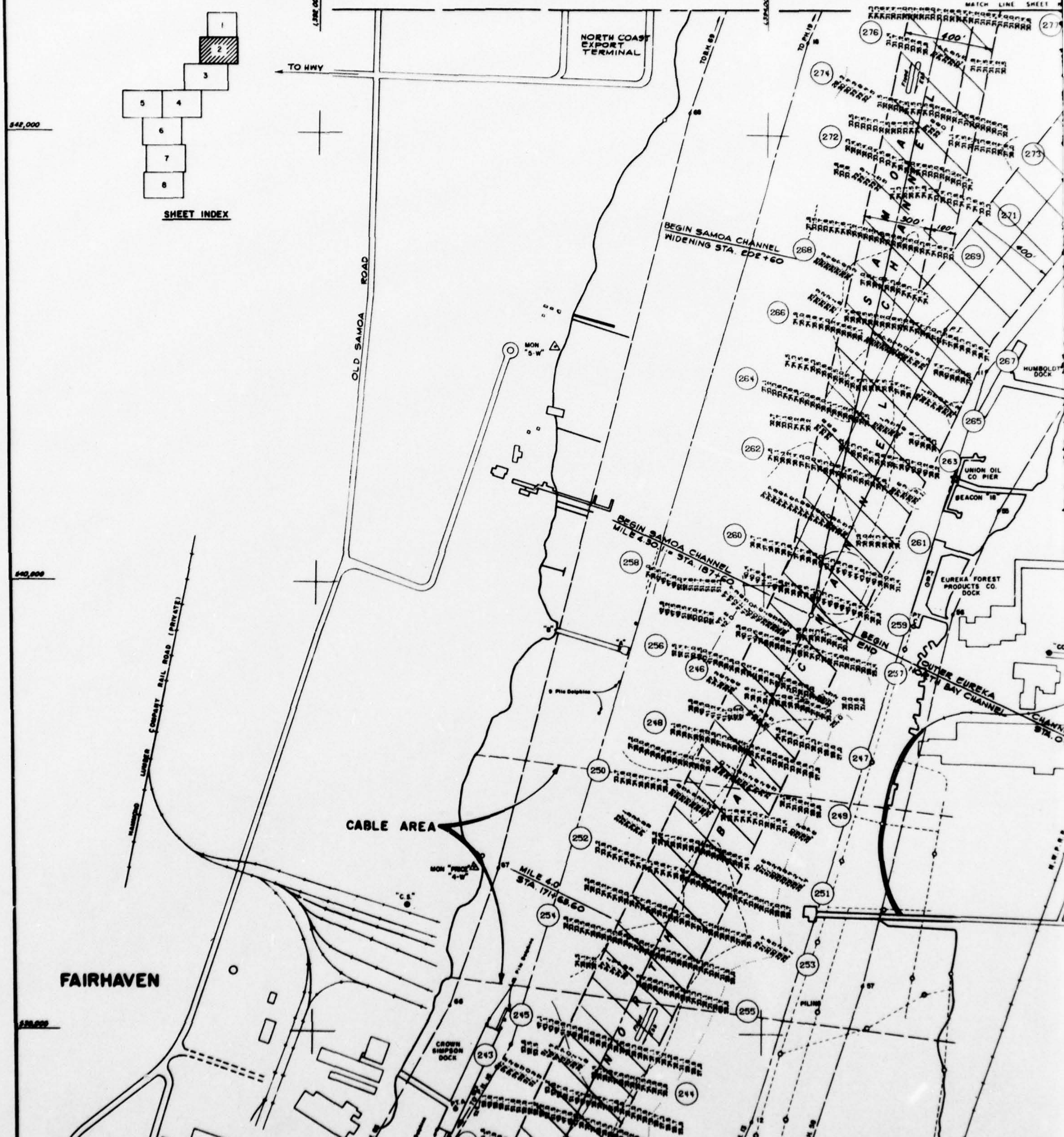
PREPARED UNDER THE DIRECTION OF
HENRY A. FLEMTHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER

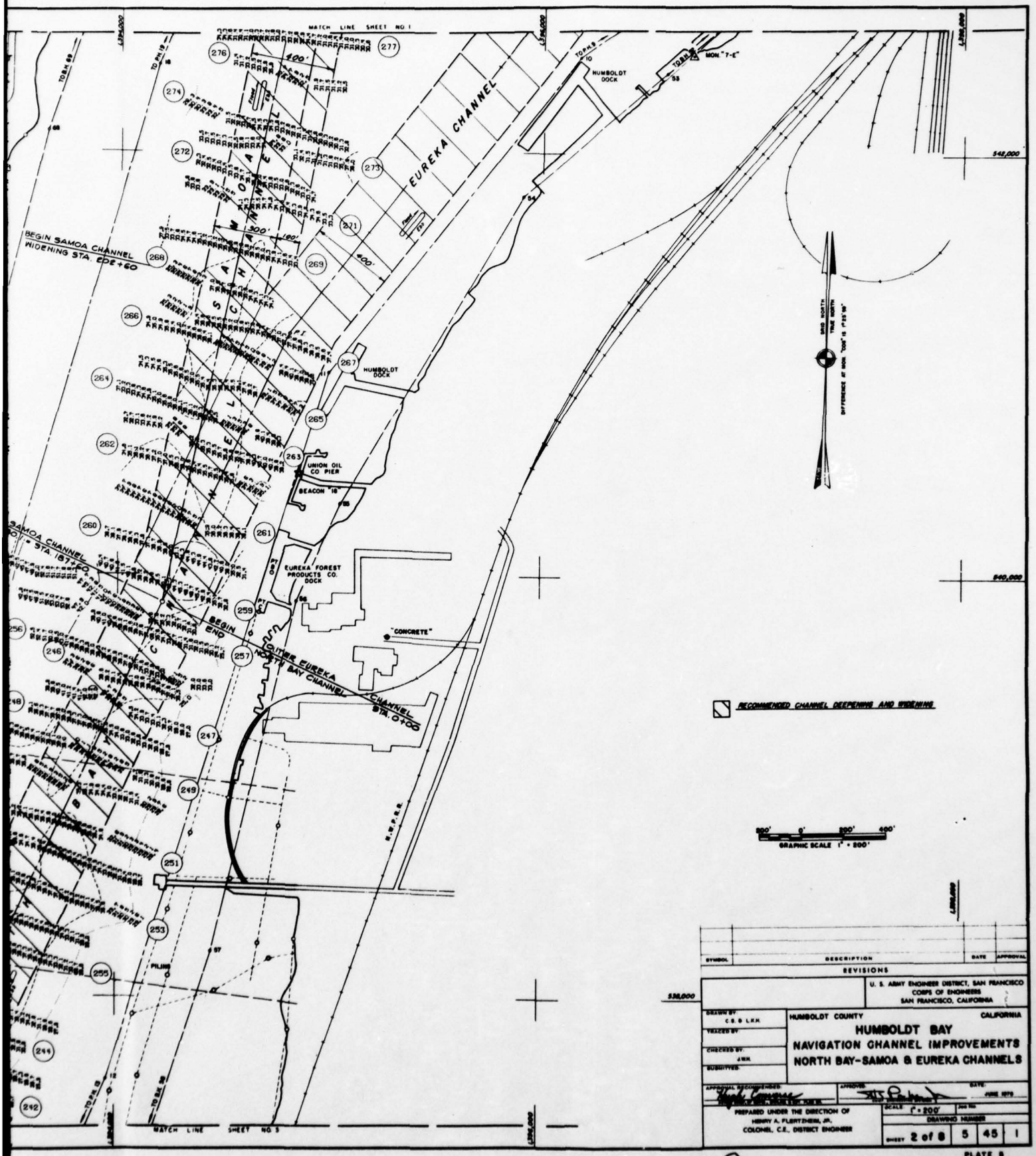
SCALE 1" = 200' JOB NO.

DRAWING NUMBER

SHEET 3 of 8 | 5 | 45 | 1

PLATE 4


SHEET INDEX
NORTH COAST EXPORT TERMINAL
TO HWY
OLD SAMOA ROAD
COMPANY RAIL ROAD (PRIVATE)
BEGIN SAMOA CHANNEL WIDENING STA. 202+60
BEGIN SAMOA CHANNEL MILE 4.30 STA. 187+60
MILE 4.0 STA. 171+68.60
HUMBOLDT DOCK
UNION OIL CO PIER
EUREKA FOREST PRODUCTS CO. DOCK
OUTER EUREKA
NORTH BAY CHANNEL
CABLE AREA
CROWN SIMPSON DOCK
FAIRHAVEN
PILING
MATCH LINE SHEET NO. 3



SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY: C.S. & L.R.H.
TRACED BY:
CHECKED BY: J.W.R.
SUBMITTED:

HUMBOLDT COUNTY CALIFORNIA

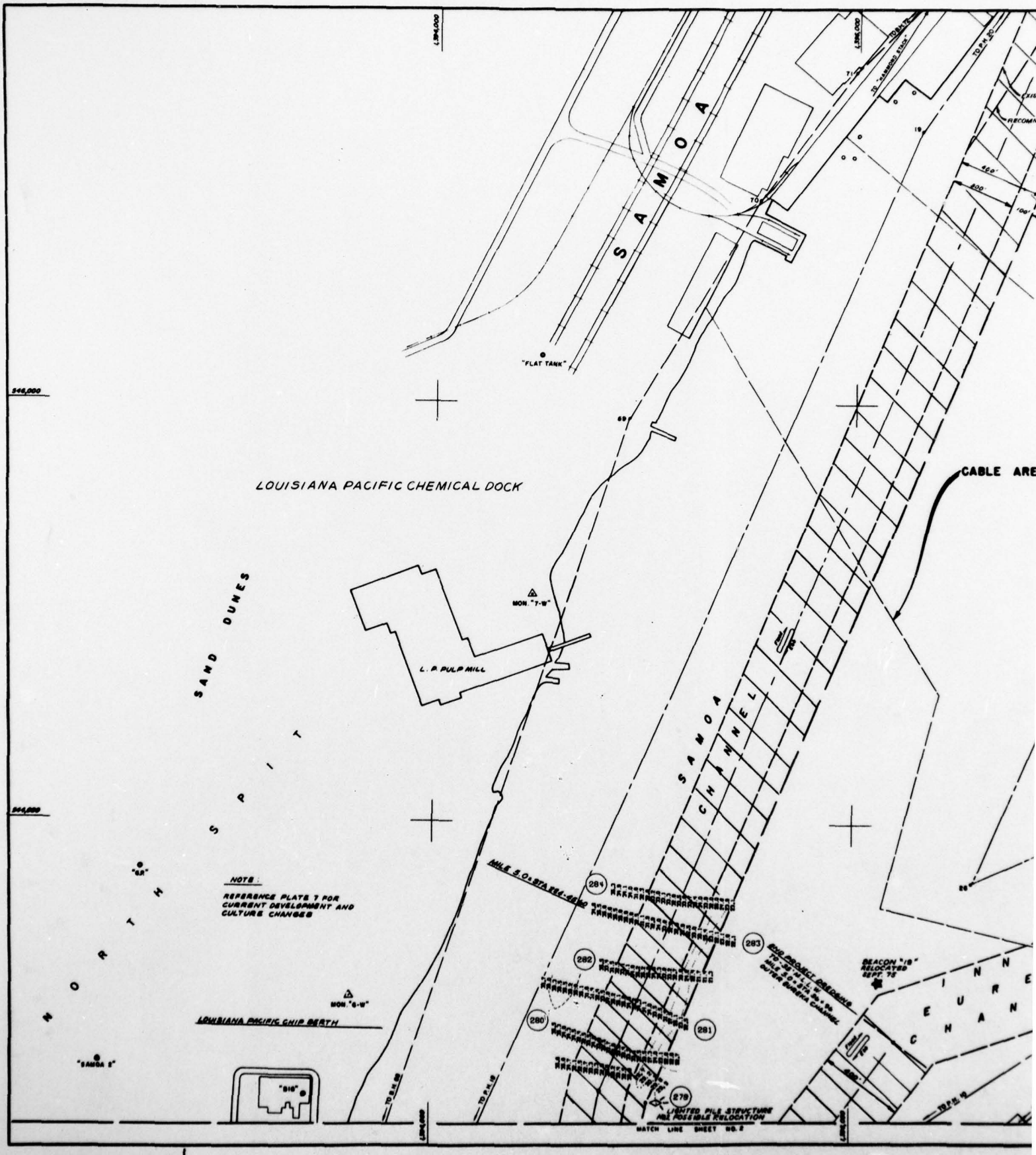
HUMBOLDT BAY
NAVIGATION CHANNEL IMPROVEMENTS
NORTH BAY-SAMOA & EUREKA CHANNELS

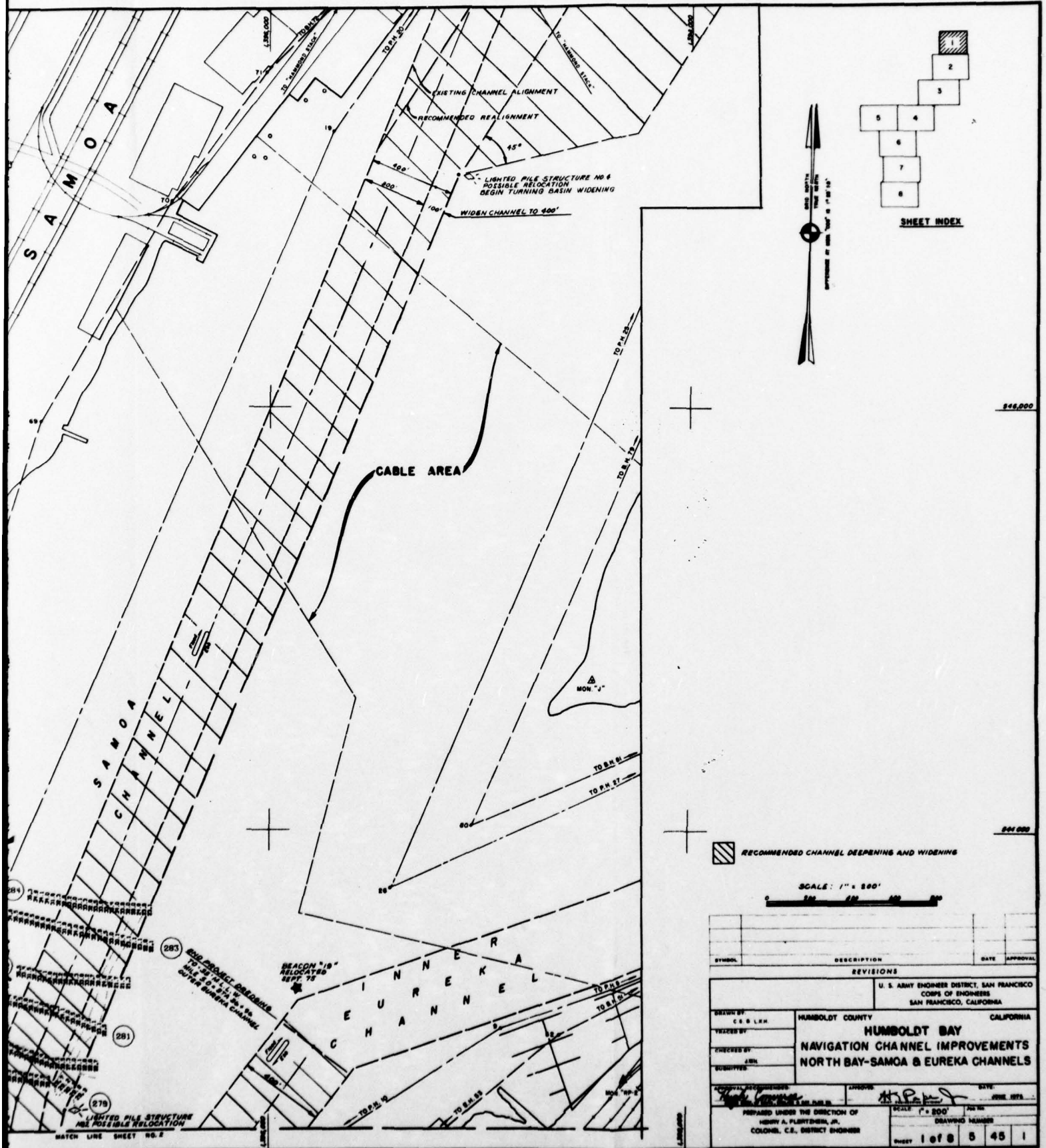
APPROVAL RECOMMENDED:
APPROVED:
DATE: JUNE 1959

PREPARED UNDER THE DIRECTION OF
HENRY A. FLEMMING, JR.
COLONEL, C.E., DISTRICT ENGINEER

SCALE 1" = 200'
DRAWING NUMBER
SHEET 2 of 8 | 5 | 45 | 1

PLATE 2


SAMOA
"FLAT TANK"
LOUISIANA PACIFIC CHEMICAL DOCK
CABLE ARE
SAND DUNES
MON. "7-W"
L. P. PULP MILL
SAMOA CHANNEL
NORTH SPIT
NOTE:
REFERENCE PLATE 7 FOR CURRENT DEVELOPMENT AND CULTURE CHANGES
MON. "6-W"
LOUISIANA PACIFIC CHIP BERTH
"SAMOA 2"
"816"
284
283
282
281
280
279
BEACON "18" RELOCATED SEPT. '75
LIGHTED PILE STRUCTURE AND POSSIBLE RELOCATION
MATCH LINE SHEET NO. 2



SYMBOL	DESCRIPTION	DATE	APPROVAL
REVISIONS			

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DRAWN BY: C.S.B. L.K.H.
TRACED BY:
CHECKED BY: J.D.H.
SUBMITTED:

HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT BAY
NAVIGATION CHANNEL IMPROVEMENTS
NORTH BAY-SAMOA & EUREKA CHANNELS

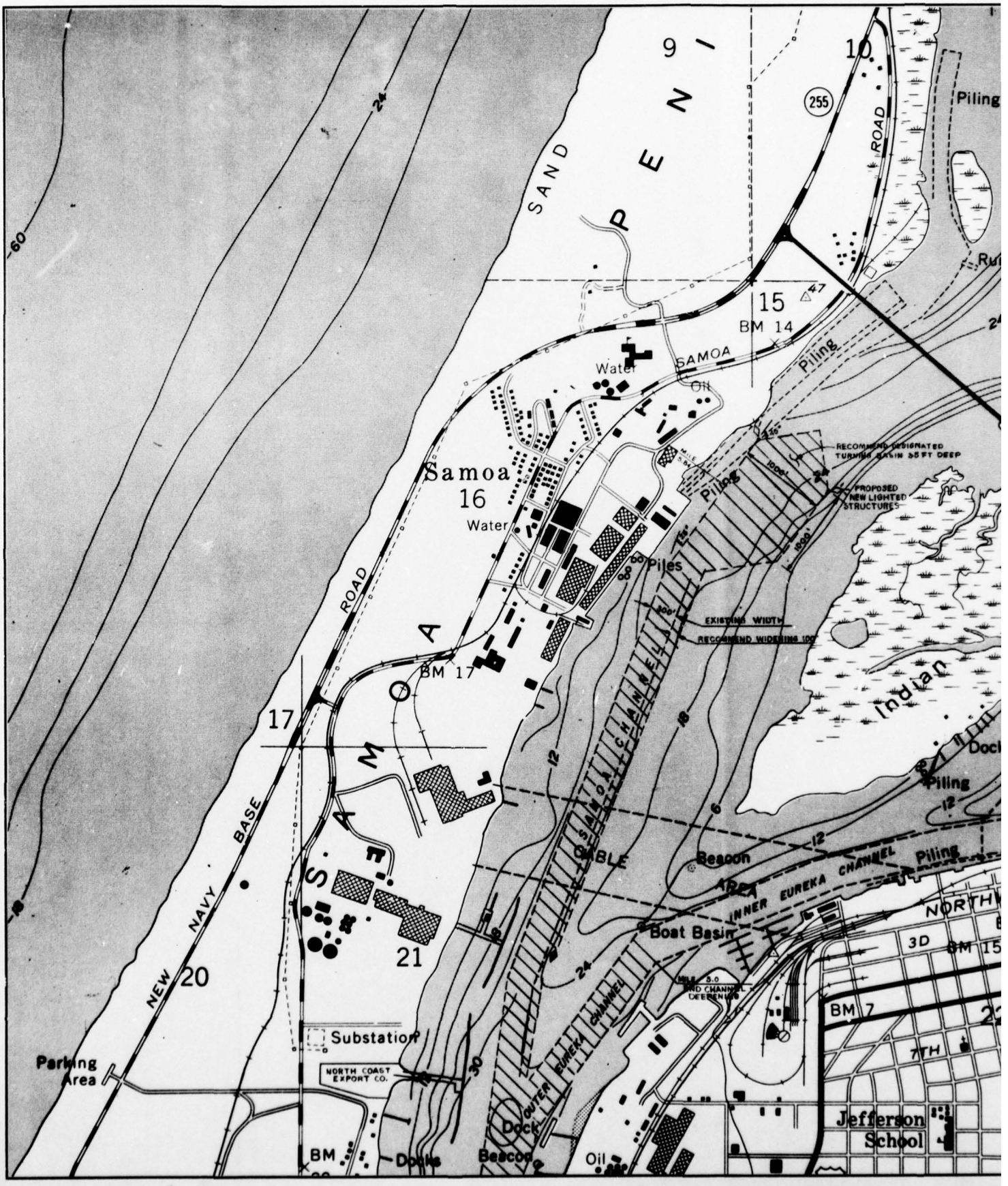
APPROVED: DATE: JUNE 1975

PREPARED UNDER THE DIRECTION OF
HENRY A. FLEMMER, JR.
COLONEL, C.E., DISTRICT ENGINEER

SCALE: 1" = 200'

DRAWING NUMBER: Sheet 1 of 8 | 5 | 45 | 1

PLATE 6


SAND
PENI
9
10
255
ROAD
Piling
15
47
BM 14
SAMOA
Water
Oil
Piling
RECOMMEND DESIGNATED TURNING BASIN 35FT DEEP
PROPOSED NEW LIGHTED STRUCTURES
Samoa
16
Water
Piles
EXISTING WIDTH
RECOMMEND WIDENING 100'
ROAD
BM 17
SAMOA
17
Indian
Piling
CABLE
Beacon
AREA
INNER EUREKA CHANNEL
Piling
NORTH
Boat Basin
3D
BM 15
NEW NAVY BASE
20
21
Substation
Parking Area
NORTH COAST EXPORT CO.
BM
Docks
Beacon
Oil
OUTER EUREKA CHANNEL
Dock
BM 7
7TH
Jefferson School

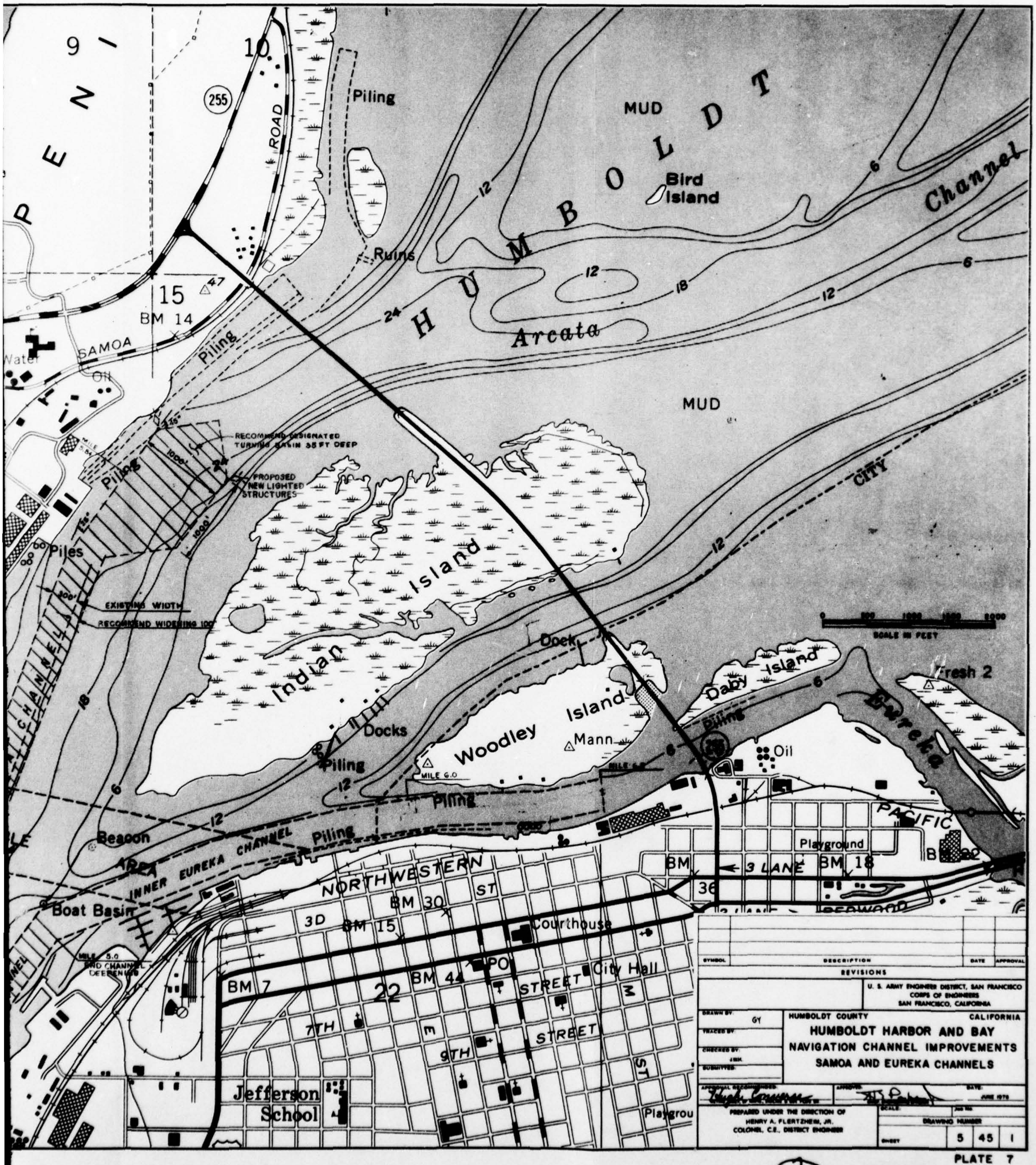
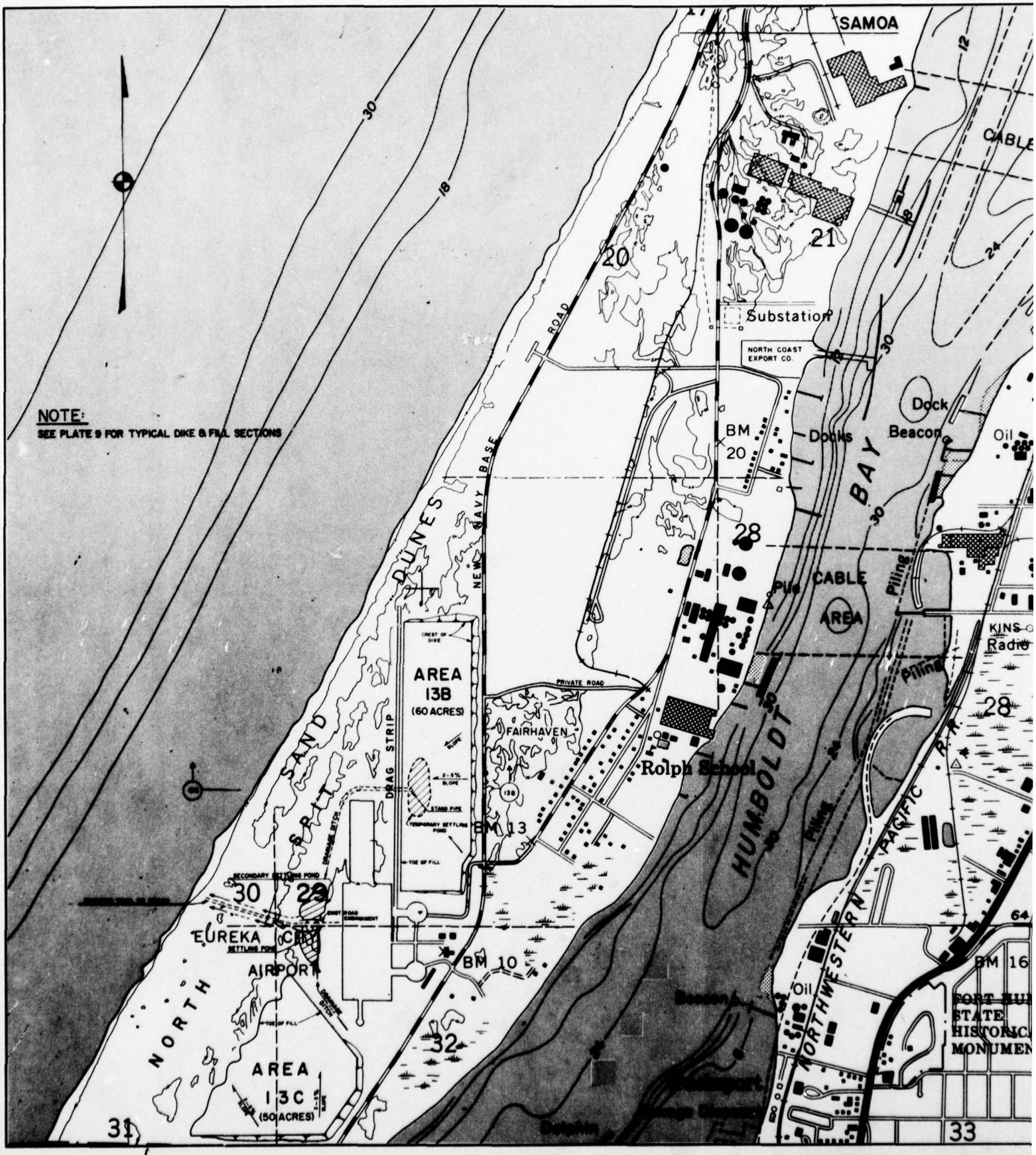

HUMBOLDT
Arcata Channel
MUD
Bird Island
Piling
Ruins
SAMOA
BM 14
RECOMMEND DESIGNATED TURNING BASIN 38 FT DEEP
PROPOSED NEW LIGHTED STRUCTURES
EXISTING WIDTH
RECOMMEND WIDENING 100'
Indian Island
Woodley Island
Daby Island
Dock
Docks
Piles
Mann
Oil
Fresh 2
Eureka
CITY
PACIFIC
Beacon
INNER EUREKA CHANNEL
Boat Basin
END CHANNEL DEEPENING
NORTHWESTERN ST
3D
7TH
9TH
STREET
Playground
Courthouse
City Hall
Jefferson School
BM 30
BM 15
BM 44
BM 7
BM 18
3 LANE
SCALE IN FEET
REVISIONS
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS
SAMOA AND EUREKA CHANNELS
PREPARED UNDER THE DIRECTION OF
HENRY A. FLERTZHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER
5 45 1

PLATE 7


NOTE:
SEE PLATE 9 FOR TYPICAL DIKE & FILL SECTIONS
SAMOA
CABLE
Substation
NORTH COAST EXPORT CO.
NEW NAVY BASE ROAD
SAND DUNES
DRAG STRIP
AREA 13B (60 ACRES)
AREA 13C (50 ACRES)
FAIRHAVEN
PRIVATE ROAD
BM 13
BM 10
BM 20
Rolph School
HUMBOLDT BAY
Docks
Dock
Beacon
Oil
Piling
Pile
CABLE AREA
KINS Radio
NORTHWESTERN PACIFIC R.R.
EUREKA AIRPORT
NORTH SPIT
BM 16
20
21
28
30
29
32
31
33
64

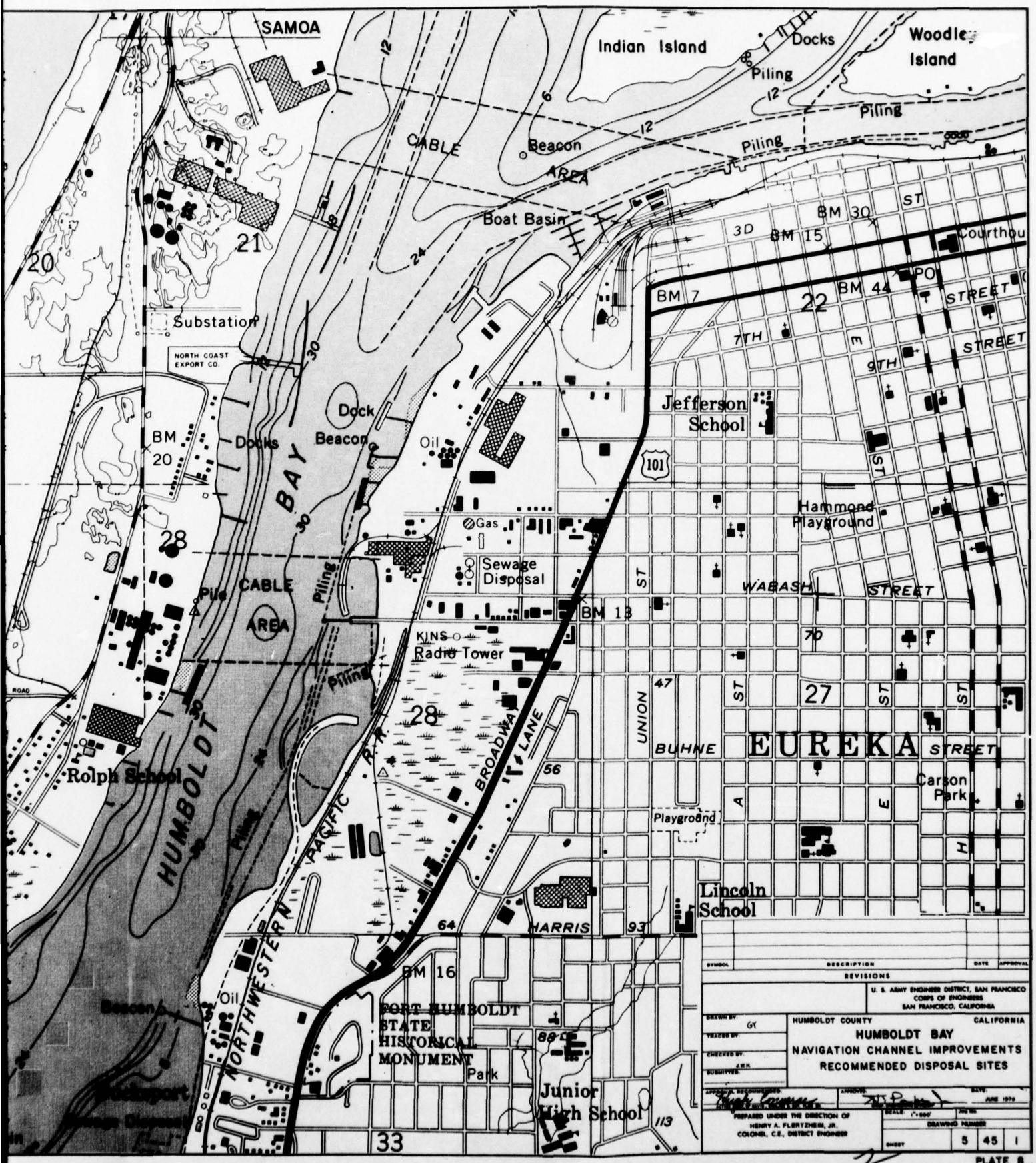
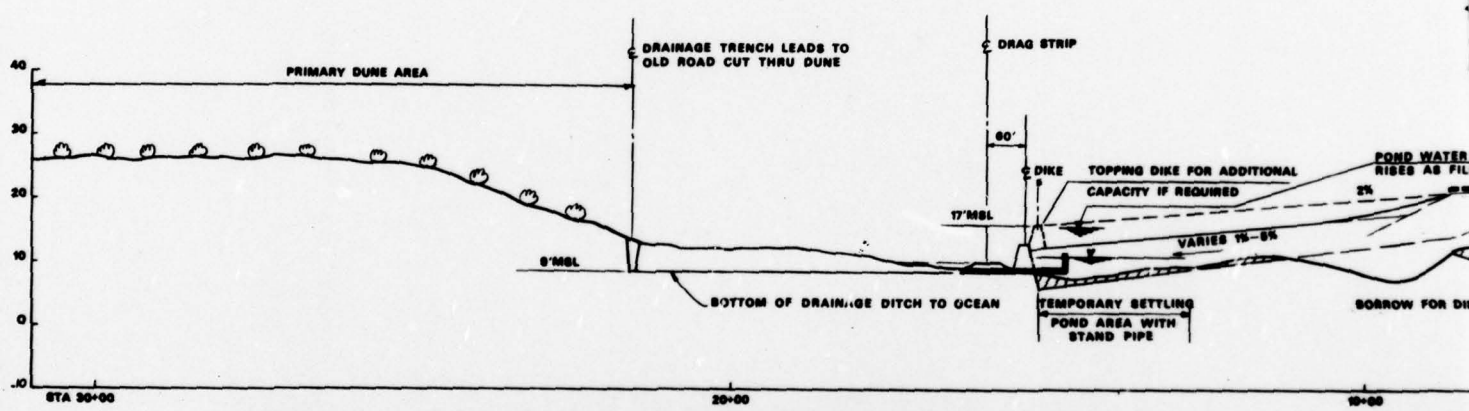
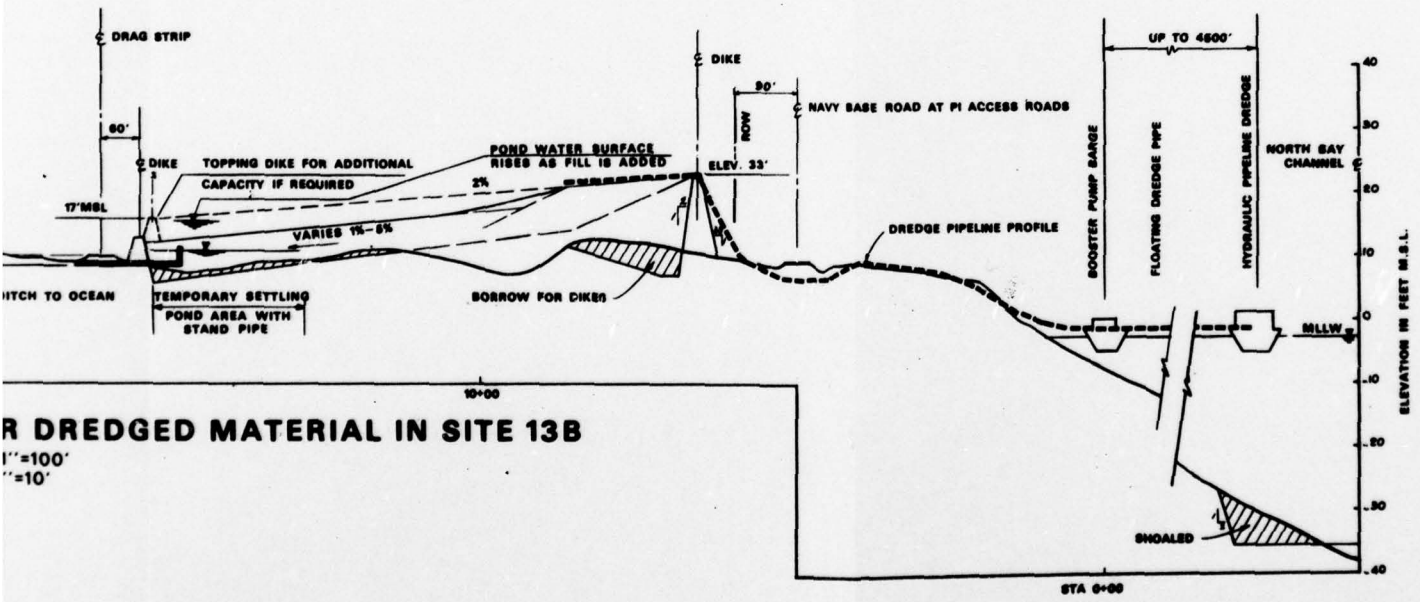

SAMOA
Indian Island
Docks
Piling
Woodley Island
CABLE AREA
Beacon
Boat Basin
BM 30
BM 15
Courthou
BM 7
BM 44
PO
STREET
7TH
9TH
Substation
NORTH COAST EXPORT CO.
Jefferson School
Dock
Beacon
Docks
BM 20
Oil
101
Hammond Playground
Gas
Sewage Disposal
WABASH STREET
BM 13
KINS
Radio Tower
CABLE AREA
Pile
Piling
EUREKA
BUHNE
UNION
BROADWAY
LANE
Carson Park
Playground
Rolph School
HUMBOLDT BAY
NORTHWESTERN PACIFIC R.R.
Lincoln School
HARRIS
BM 16
Oil
Beacon
FORT HUMBOLDT STATE HISTORICAL MONUMENT
Park
Junior High School
33
REVISIONS
SYMBOL
DESCRIPTION
DATE
APPROVAL
U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA
DRAWN BY GY
TRACED BY
CHECKED BY J.W.H.
SUBMITTED
HUMBOLDT COUNTY CALIFORNIA
HUMBOLDT BAY
NAVIGATION CHANNEL IMPROVEMENTS
RECOMMENDED DISPOSAL SITES
APPROVED RECOMMENDED
APPROVED
DATE JUNE 1970
PREPARED UNDER THE DIRECTION OF
HENRY A. FLERTZHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER
SCALE 1"=800'
DRAWING NUMBER
SHEET 5 45 1

PLATE 8



TYPICAL DIKE AND FILL SECTIONS FOR DREDGED MATERIAL IN SITE 13B

HOR SCALE: 1"=100'
VER SCALE: 1"=10'



R DREDGED MATERIAL IN SITE 13B

l"=100'
"=10'

SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

HUMBOLDT COUNTY CALIFORNIA

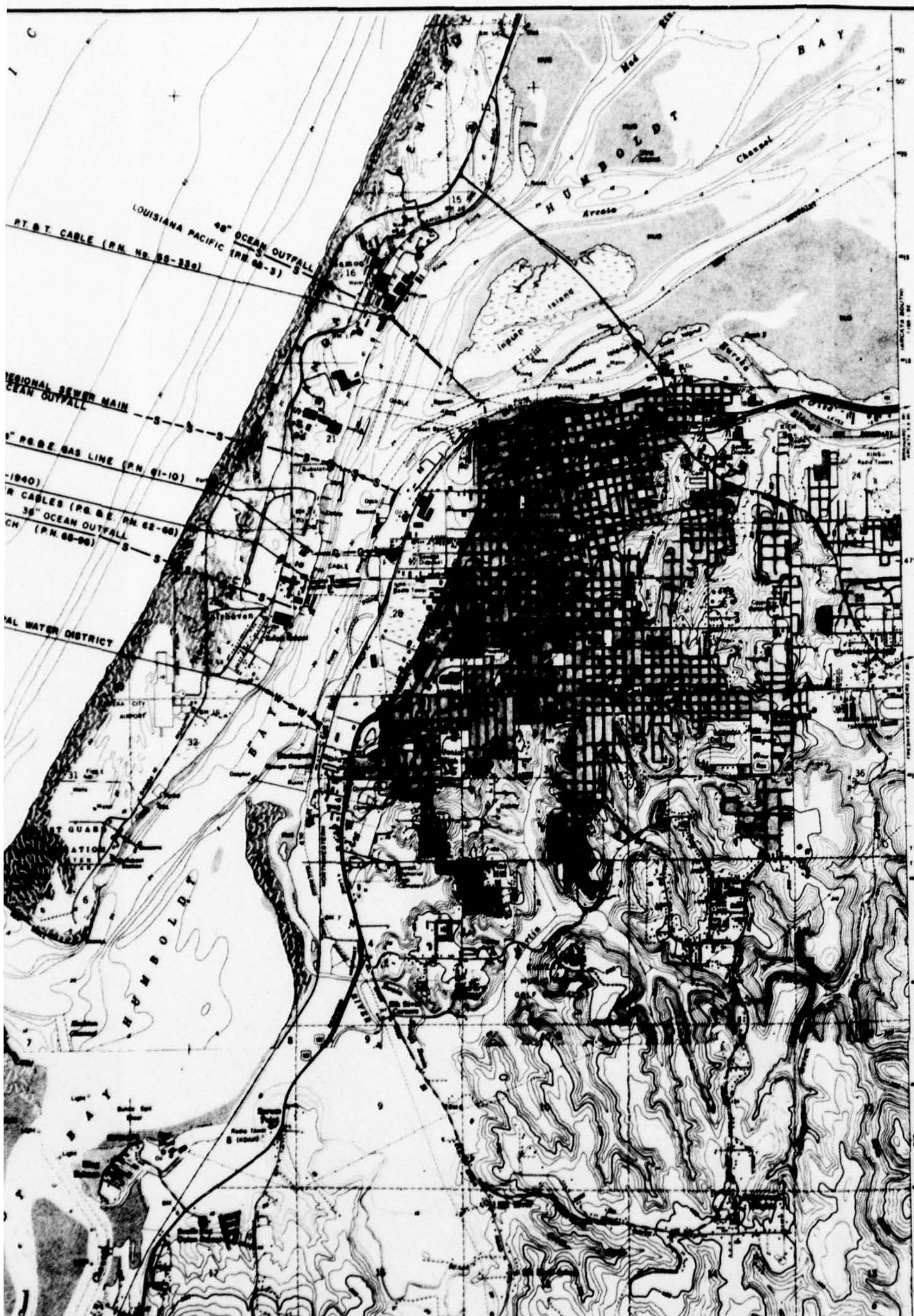
HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS
TYPICAL DIKE AND FILL SECTIONS

PREPARED UNDER THE DIRECTION OF
HENRY A. FLORTHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER

DRAWING NUMBER
5 45 1

PLATE 9


PACIFIC
OCEAN
LOUISIANA PACIFIC
48" OCEAN OUTFALL
P.T. & T. CABLE (P.N. No. 65-33a)
PROPOSED REGIONAL SEWER MAIN AND OCEAN OUTFALL
10-3/4" P.G. & E. GAS LINE (P.N. 61-10)
P.T. & T. CABLE (P.N. 2-1940)
2-2KV ELECTRIC POWER CABLES (P.G. & E. P.N. 62-66)
CROWN ZELLERBACH
36" OCEAN OUTFALL
(P.N. 65-96)
27" I.D. HUMBOLDT BAY MUNICIPAL WATER DISTRICT
(P.N. 71-8)
47'30"
PACIFIC OCEAN
HUMBOLDT BAY
SOUTH BAY



LEGEND

EXISTING AND PROPOSED UTILITY BAY CROSSINGS AND OCEAN OUTFALLS

——T—— SUBMARINE TELEPHONE CABLES (PACIFIC TELEPHONE & TELEGRAPH CO.)

——E—— SUBMARINE ELECTRIC POWER CABLES (2)(PACIFIC GAS & ELECTRIC CO.)

——G—— SUBMARINE GAS LINE (P.G. & E. COMPANY)

——W—— SUBMARINE WATER MAIN (HUMBOLDT BAY MUNICIPAL WATER DISTRICT)

— —S— — PROPOSED REGIONAL SEWAGE MAIN AND WASTEWATER OUTFALL.

——S—— WASTEWATER OUTFALLS (2) FROM PULP MILLS

NOTE

TENTATIVE RELOCATION ROUTES (DEEPER BURIAL BY OWNER) INDICATED BY SAME SYMBOLS WITH HEAVY LINE.

SCALE 1:24 000

SYMBOL	DESCRIPTION	DATE	APPROVAL
REVISIONS			

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

HUMBOLDT COUNTY — CALIFORNIA

HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS
UTILITY RELOCATIONS

DRAWN BY: GY
CHECKED BY:

PREPARED UNDER THE DIRECTION OF
HENRY A. FLERTZHEIM, JR.,
COLONEL, C.E., DISTRICT ENGINEER

SCALE: 1" = 2000'

DRAWING NUMBER: 5 | 45 | 1

PLATE 10

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX A

SOCIAL AND ECONOMIC PROFILE FOR EXISTING CONDITIONS

U.S. Army Engineer District, San Francisco
Corps of Engineers
211 Main Street
San Francisco, California 94105

DESIGN MEMORANDUM NO. 1

GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX A

SOCIAL AND ECONOMIC PROFILE
FOR EXISTING CONDITIONS

TABLE OF CONTENTS

TABLES

APPENDIX A

TABLE OF CONTENTS
(Cont'd)

TABLES (Cont'd)

FIGURES

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX A

SOCIAL AND ECONOMIC PROFILE FOR EXISTING CONDITIONS

A-1. PROJECT LOCATION

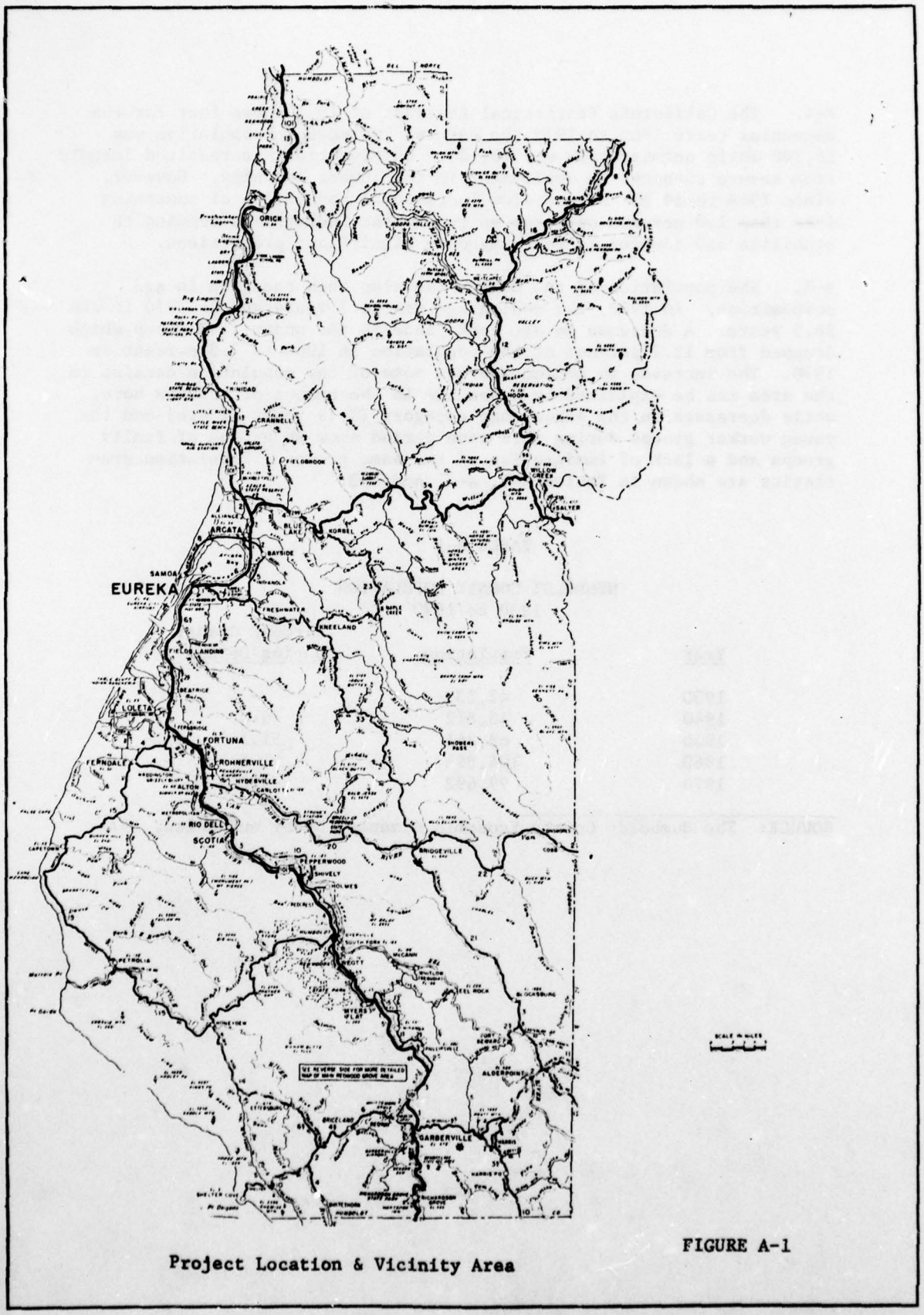
Humboldt Bay is a landlocked harbor on the coast of Northern California, located about 225 nautical miles north of San Francisco, California, and about 156 nautical miles south of Coos Bay, Oregon. The entrance is protected by two rubble-mound jetties about one-half mile apart and extending from the ends of two long, narrow sand spits separating the shallow bay from the ocean. The width of the bay varies from one-half mile to about four miles. The bay extends south and north from the entrance. Total length of the bay is about 14 miles. The project location and vicinity area tributary to commerce is shown on Figure A-1.

A-2. PURPOSE AND SCOPE

This appendix reviews recent trends in development of the social and economic baseline conditions presently existing in Humboldt County, California, with particular emphasis on development of Humboldt Harbor and Bay as an important port for the receipt of consumer goods and export of forest products from a large tributary area of Northern California. The statistical data on waterborne commerce, sustained timber yield and existing terminal facilities presented in this appendix were used to derive the projections of future shipping trends and estimate of project benefits contained in Appendix B. Also, social and economic data contained herein were utilized in evaluation of the specific impacts expected to result from the proposed project improvements. These social, economic, and environmental evaluations are summarized in Appendix D, which is intended to satisfy requirements of Section 122 of the River and Harbor Act of 1970 (PL 91-611).

A-3. POPULATION

According to the U.S. Census of April 1970, the population in Humboldt County has more than doubled from 42,233 in 1930 to 99,692 in 1970. Much of the increase occurred in the 1940's and the 1950's as a result of the building boom after World War II When decennial population figures recorded changes of more than 50 percent.



Project Location & Vicinity Area

FIGURE A-1

A-4. The California Statistical Abstract of 1971 shows that for the decennial years 1960 to 1970 the natural increase in population was 10,900 while outmigration was 16,100. Outmigration has resulted largely from severe cutbacks in employment in the lumber industry. However, since 1968 there has been a slow increase in population of something less than 1.0 percent per year as the lumber industry is tending to stabilize and tourism is reaching more significant proportions.

A-5. The population of the County has also been changing in age composition. In 1960, the median age was 26.7 years and in 1970 it was 26.9 years. A decrease in age took place in the under five group which dropped from 12.3 percent of the population in 1960 to 7.3 percent in 1970. The increase in median age and some of the population decline in the area can be explained by a decline in the number of infants born, while decreases in the school age category (5-19 years of age) and the young worker groups during this same period show an exodus of family groups and a lack of immigration of the same groups. Population statistics are shown in Tables A-1, A-2, and A-3.

TABLE A-1

HUMBOLDT COUNTY POPULATION
1930 to 1970

Year	Population	Percent Change During Decade
1930	42,233	-
1940	45,812	6.0
1950	69,241	51.1
1960	104,892	51.5
1970	99,692	-5.0

SOURCE: The Humboldt County Economic Almanac, Groby and Ehlen, 1971.

TABLE A-2

HUMBOLDT COUNTY POPULATION
BY URBAN COMMUNITIES 1970 - 1974

	1970 1/	1973 2/	1974 2/
EUREKA	24,337	24,400	24,450
ARCATA	8,985	10,600	11,100
TRINIDAD	330	350	360
BLUE LAKE	1,234	1,170	1,200
FERNDALE	1,370	1,360	1,380
RIO DEL	2,817	2,810	2,830
FORTUNA	4,203	4,370	4,390

SOURCE: 1/ U.S. Census of Population, California, 1970.
2/ Area Manpower Review, Eureka Labor Market, *Humboldt County, HRD, March 1975.*

TABLE A-3

HUMBOLDT COUNTY POPULATION
AGE DISTRIBUTION
1960 - 1970

	1960		1970	
Age	Number	% of Total	Number	% of Total
Under 5 Years	12,891	12.3	7,548	7.6
5-19 Years	30,615	29.2	30,199	30.2
20-39 Years	28,158	26.8	27,204	27.3
40-64 Years	26,008	24.8	26,076	26.2
65 and Older	7,220	6.9	8,665	8.7
TOTAL	104,892	100.0	99,692	100.0
Median Age	26.7		26.9	

SOURCE: U.S. Census of 1960 and 1970.

A-6. FAMILIES

In the mid-1960's, the birth rate in Humboldt County was 15.2 percent as compared with the Statewide birth rate of 17.3 percent. Together with the outward migration of younger people seeking more favorable job opportunities, there has been developing an increasingly older population.

A-7. Elementary school enrollment has declined from 19,492 in 1962 to 17,671 in the 1969-1970 school year and still declining, while elementary school enrollment throughout the State has been steadily increasing.

A-8. Most of the 25,386 families in the County in 1970 (89.1 percent) were husband-wife families while only 8.5 percent had a female head of family. Fifty-six point nine percent of the families had children with an average household size of three. Eighty-one point eight percent of all children lived in a husband-wife family, 9.3 percent lived in a family with a female head and 8.9 percent lived in other quarters. Family statistics are shown in Tables A-4 and A-5.

TABLE A-4

FAMILY CHARACTERISTICS OF HUMBOLDT COUNTY RESIDENTS - 1970

	Total Number	Percent of Total
Families		
Husband-Wife	22,608	89.1
Female-Head	2,150	8.5
Other	628	2.4
Total	25,386	100.0
Families with Children	14,457	56.9
Families without Children	10,929	43.1
Total	25,386	100.0
Average Size of Household	3	-
Children		
In Husband-Wife Families	27,563	81.8
In Families with Female Head	3,140	9.3
Other	2,980	8.9
Total	33,683	100.0

TABLE A-5

AVERAGE DAILY ATTENDANCE
AT HUMBOLDT COUNTY SCHOOLS, 1970-71

Schools	Average Daily Attendance, 1970-71
Elementary School Districts	15,266
High School Districts	6,918
Unified School District	2,583
Adult Classes	540
Redwoods Jr. College District	2,816
TOTAL	28,123

SOURCE: Directory of Public Schools 1971-72 - Humboldt County.

A-9. DEMOGRAPHIC CHARACTERISTICS

According to 1970 Census figures, 95,300 people or 95.6 percent in the County were caucasians and 3,100 or 3.1 percent were Indians which were the only numerically significant ethnic group. About 46,900 of all inhabitants or 47.0 percent were urban dwellers and 52,800 or 53.0 percent were farm or rural non-farm which included rural communities of less than 2,500 inhabitants and densely settled urban fringe areas or suburbs.

A-10. With a 1970 population of 24,337 or 24.4 percent of the total County population, Eureka was the only significantly large community in the County although Arcata is now commencing to move up very fast. In January 1974, the overall County population had grown to 102,800. Eureka experienced the smallest increase to 24,450 (See Table A-2). Twenty miles away Arcata was having the greatest increase, from 8,985 in 1970 to 11,100 in 1974, mostly attributable to the opening of the College of the Redwoods and the doubling in enrollment at Humboldt State University. The in-migration of students has brought about an increase in the 18-24 year age group of over 40.0 percent. Selected demographic data are shown in Table A-6.

TABLE A-6

SELECTED DEMOGRAPHIC CHARACTERISTICS
OF HUMBOLDT COUNTY POPULATION - 1970

	Number	Percent of Total
Sex		
Male	50,535	50.7
Female	49,157	49.3
TOTAL	99,692	100.0
Ethnicity		
White	95,342	95.6
Negro	461	0.5
Indian	3,055	3.1
Other	852	0.8
TOTAL	99,710	100.0
Residence		
Urban	47,045	47.2
Rural	52,647	52.8
TOTAL	99,692	100.0

SOURCE: U.S. Census of the Population, 1970.

A-11. EMPLOYMENT

The decline in population from 1960 to 1970 can be attributed primarily to a decline in employment opportunities in the lumber industry. There has been an increase in employment in services, wholesale and retail trade, finance, government and manufacturing other than lumber-related industries. Most of these goods and services constitute "basic" employment which in turn induces development and sets the levels of the service industry that cater to local consumers and business establishments. The increase in property income between 1960 and 1970, which includes rental income, reflects increased demand for property used to provide more eating and drinking establishments, motels, hotels, retailing and other services for tourists and local residents. The "exporting" employees spend a portion of their income locally, thereby creating income and employment opportunities for non-exporting industries. The level of employment and income in the County is determined both by the amount and the kinds of goods sold to non-residents and by the relative multiplying effects that are created by local purchasers of goods and services produced in the County. However, these industrial sectors which are experiencing some growth do not offer the same income opportunities or wage rates as those for industries which are declining or are stabilizing.

A-12. Future growth in employment and total income still centers primarily on "export-base" industries. Diversification occurs slowly because of the absence of major resources which would attract new industries, the lack of diversity of skills, the distance from major markets and the absence of major tourist attractions outside of the Redwood National Park.

A-13. Even though total employment has been increasing, unemployment and unemployment claims have also been increasing. There are no strong indications as yet of any substantial growth in new industries though the economy of the County has stabilized somewhat since the decline of the lumber industry in the 1960's. Employment data are shown in Tables A-7 and A-8.

TABLE A-7

EMPLOYMENT - HUMBOLDT COUNTY
1970 - 1974

	1970	1971	1972	1973	1974
Civilian Labor Force	38,025	40,000	41,450	41,550	44,350
Employed	32,625	32,850	34,750	36,050	36,925
Agriculture	1,425	1,425	1,425	1,425	1,425
Construction	950	850	975	1,000	1,075
Manufacturing	9,225	9,025	9,350	9,350	8,925
Food	(850)	(725)	(650)	(550)	(600)
Lumber	(7,875)	(7,800)	(8,150)	(8,200)	(7,675)
Other	(500)	(500)	(550)	(600)	(650)
Transportation, Communications & Utilities	2,075	2,050	2,150	2,250	2,350
Trade	5,800	6,025	6,425	6,875	6,975
Wholesale	(975)	(1,000)	(1,050)	(1,175)	(1,150)
Retail	(4,825)	(5,025)	(5,375)	(5,700)	(5,800)
Finance	775	825	975	1,050	1,125
Services	4,500	4,525	4,950	5,575	5,900
Government	7,875	8,125	8,500	8,525	9,200
Federal	(600)	(650)	(625)	(625)	(675)
State & Local	(7,275)	(7,475)	(7,875)	(7,900)	(8,525)
Unemployed	3,825	4,225	3,925	4,500	5,375
Unemployment Rate	10.1	10.6	9.5	10.8	12.1

Source: Area Manpower Planning Report, Eureka Labor Market Are (Humboldt County), HRD, March 1975.

TABLE A-8

MAJOR PRIVATE EMPLOYERS IN HUMBOLDT COUNTY - 1971

Company	No. of Employees	Type of Business
Manufacturing Employment		
Georgia Pacific Corporation	1,750	Lumber
Crown Simpson Corporation	210	Lumber
Fluhrer Bakeries, Inc.	75	Bakery products
Halvorsen Lumber Products	65	Sawmill--remanufacturing plant
Precision Lumber Company	45	Lumber
Bayley Suit, Inc.	40	Manufacture diving suits
Nor-Cal Industries, Inc.	20	Steel fabricating
Coca Cola Bottling-Eureka	19	Beverages
Eureka Printing	15	Printing
Pepsi Cola	14	Beverages
Bearing and Transmission Pro	13	Manufacture and distribution of chains
Eureka Boiler Works	12	Steel fabrication
Non-Manufacturing Employment		
Eureka Fisheries, Inc.	450	Seafood
Lazios Seafoods	260	Wholesale seafood
Pacific Telephone	250	Phone services
A. Paladini, Inc.	125	Wholesale seafood
Northwestern Pacific RR	125	RR com-freight transport
Mercer Fraser	110	Ready-mixed concrete
Times-Standard	110	Publication of daily news
Brizard-matthews Machinery	60	Contractor

A-14. INCOME

Disposable income is often used to determine the market for goods and services in a given area. The total buying income for Humboldt County in 1971 has been estimated at $331,155,000. The median buying income per household was $7,578, compared to the median for the State of $9,123.

A-15. In 1971 more than one-fourth of the households (26.6 percent) in Humboldt County were estimated to have an annual cash income of $5,000 to $8,000; 10.7 percent have a cash income of $3,000 to $5,000; and, 16.8 percent have a cash income of less than $3,000. Only 12.1 percent had incomes over the $15,000 level. This income distribution was considerably lower than that estimated for the State. According to the 1960 Census, the median family income in Humboldt County was $6,282. Fourteen percent of the families had an income under $3,000 and 17.0 percent had an income of $10,000 per annum or more. Since 1960, the Consumer Price Indices have escalated by more than 36.0 percent. Therefore, $10,000 in 1960 dollars is equivalent to $13,675 in 1971 dollars.

A-16. Wages and salaries in Humboldt County have consistently accounted for about 60.0 percent of total income. Proprietors income, a declining proportion of total income, has remained stable, and property income has been increasing with wages and salaries holding its share of the total income. Unemployment and Social Security has shown a marked increase in the past few years. Selected income data are shown in Tables A-9, A-10, and A-11.

TABLE A-9

HUMBOLDT COUNTY
DISPOSABLE INCOME PER HOUSEHOLD
1971

Income per Household 1/	Percent of All Households	
	Humboldt County	California
$0-3,000	16.8	14.0
$3,000-5,000	10.7	9.4
$5,000-8,000	26.6	18.4
$8,000-10,000	16.3	14.6
$10,000-15,000	17.5	24.1
$15,000 and Over	12.1	19.5

1/ Minus Taxes.
SOURCE: Sales Management Magazine - 1972 Survey of Buying Power.

TABLE A-10

PER CAPITA INCOME

	1960	1968	Percent Change
Humboldt County	$2,274	$3,095	36
State of California	$2,710	$4,012	48
United States	$2,215	$3,412	54

SOURCE: California Statistical Abstract, 1971.

TABLE A-11

HUMBOLDT COUNTY
PERSONAL INCOME BY SOURCE
1970

Source	Personal Income ($000's)	Percent of Total
Wages and Salaries	$213.3	60.5
Other Labor Income	11.8	3.4
Proprietor's Income	29.7	8.4
Property Income	45.3	12.9
Transfer Payments	52.2	14.8
TOTAL	$352.3	100.0

SOURCE: Sales Management Magazine - 1972 Survey of Buying Power.

A-17. AGRICULTURE

Agricultural employment experienced very slow growth since 1970 and is now declining and will continue to do so because of increased mechanization and efficiency though the industry is stabilizing. For instance, row crop production which at present is constrained by potential flood damage and urbanization would increase income but would not do much for employment because of advanced methods of cultivation and harvesting. It is expected that agriculture will continue in this vein well into the future as long as rigid zoning is upheld.

A-18. TIMBER RESOURCES

Forest products shipped through Humboldt Bay originate mainly in three California counties, Humboldt, Del Norte and Trinity; lesser amounts originate in two adjacent counties, Mendocino and Siskiyou. In addition, a very small amount is brought into the area from southern Oregon for trans-shipment. For purposes of estimating the prospective waterborne shipments from Humboldt Bay, the tributary area of Humboldt Harbor and Bay is considered to comprise the five northwestern California counties of Del Norte, Humboldt, Mendocino, Siskiyou and Trinity. Over the 6-year period, 1960-1965, production has averaged 2.99 billion board feet annually, with a low of 2.65 billion board feet in 1960 and a high of 3.16 billion board feet in 1963. The estimated timber cut in 1970 of 2.5 billion board feet is equal to the estimated long-term sustained yield for timber grown in the tributary area. This is somewhat less than the 3.0 billion board feet of sustained yield quoted in the Project Document. However, it is considered more significant to note that commerce resulting from whatever estimate is accepted as representative of the sustained yield of this resource is continuing to increase, due to technological advances in the timber industry that allow utilization of larger percentage of each tree harvested. This effect and effect of other market variables on projected future commerce is discussed in Appendix B. The production of lumber and other forest products in the five-county tributary area are shown in Table A-12.

TABLE A-12

LUMBER AND OTHER FOREST PRODUCT PRODUCTION IN
DEL NORTE, HUMBOLDT, MENDOCINO, SISKIYOU AND TRINITY COUNTIES

Year	Billion Board Feet Cut
1960	2.649
1961	2.892
1962	3.145
1963	3.164
1964	3.146
1965	2.916
Average 1960-1965	2.985
1970 1/	2.500

SOURCE: Historical Data, California Division of Forestry, USDA Forestry Service, 1970.

1/ Cut in 1970 has been estimated as equal to sustained long-term yield of timber in tributary area by the U.S. Forest Service.

A-19. MANUFACTURING

Manufacturing is still the major source of employment in Humboldt County though it has been declining in importance in the past few years. Over 90 percent of manufacturing jobs are in lumber and wood processing or in the food industry.

A-20. In 1974 lumber industry employment reached its highest point in June rather than later in the summer as usual. Logging and plywood were the first operations curtailed and hardest hit by the poor lumber market resulting from the nationwide construction slowdown. Unsold inventories of sawmill products necessitated cutbacks in production but plywood plant employment will be the most responsive to changes in demand due to small inventories on hand. One positive trend in the wood processing employment pattern is in pulp mills because of expanding demand for paper throughout the county. This should bring about a continued increase in paper pulp jobs. In the last few summers light fish catches have resulted in less work at local fish canneries. However, with completion of a new fish processing plant sometime in 1976, Humboldt County expects to be able to compete with Coos Bay, Oregion and Crescent City for receiving fish catches. Therefore, employment in fish processing will probably increase. After 1980, however, Eureka may lose some fish processing business because of the potential development of new processing facilities in San Francisco.

A-21. In the early 1970's two out of five employed residents in Humboldt County were white collar workers, which is characteristic of natural resource-based economies where logging and related wood products manufacturing, fishing, agriculture, and related food processing, and tourism are major sources of employment. In neighboring areas, as well as the state, white collar workers outnumbered blue collar workers by a considerable margin. By the mid-1970's the County's white collar payroll is approaching comparability with the blue collar payroll.

A-22. TRANSPORTATION FACILITIES

Coastal communities are connected by U.S. Highway 101. The main east-west artery is U.S. 299 that connects the Humboldt Bay and harbor areas with a vast local and hinterland timber-producing area that stretches across northern California. These highways have been expanded to four-lane freeways north and south of Eureka, and the California Department of Transportation (CALTRANS) has plans for a freeway improvement through the City of Eureka to the Elk River Bridge, which is a four-lane crossing about one mile south of the city limits. Interstate 5 and U.S. 99 serve as the primary north-south route for the Central Valley and areas east of Redding. The Northwestern Pacific Railroad connects Eureka with the San Francisco Bay area. Private logging railroads connect interior lumbering operations with the NWPRR and harbor

facilities. The old logging railroad shown on Plate 1 of the Project Document has been replaced by a new spur on the North Spit. Scheduled airlines serve the area from the Arcata-Eureka Airport located about 20 miles north of Eureka. Some local feeder lines operate out of the Eureka Municipal Airport at Murray Field between Eureka and Arcata. A city-owned airport on the Samoa Peninsual is utilized by private pilots and corporate aircraft.

A-23. SERVICES

The current general slowdown in economic activity in Humboldt County is not generally reflected in the services industry (See Table A-7). Especially in those supplying medical or health care and in finance, insurance and real estate. Services oriented to the needs of the local community are providing the major share of the growth. The more frequent use of restaurants, beauty parlors, dry cleaners, laundries, and other services are occurring as an increasing number of women take jobs outside the home.

A-24. GOVERNMENT

Government has already overtaken manufacturing as a major source of payrolls in the County and is expected to increase (See Table A-7). As Federally funded public service jobs are filled, local government employment will continue to rise. State and Federal Government are also expanding but mainly due to seasonal hiring of temporary fire fighting crews and park personnel.

A-25. FISCAL STABILITY

Public protection and health and sanitation have experienced the largest increase in cost along with County government and education. Despite the high level of unemployment in Humboldt County (12.1 percent in 1974), Public Assistance expenditures have not increased rapidly. As a result, County expenditures (6.7 percent per annum) have not grown much greater than inflation over the last five years.

A-26. Property tax revenues have increased more slowly than other major sources of revenues. Excluding all special district, the general County property tax rate has risen only 3 percent a year. The slow growth rate of other taxes such as the sales tax is indicative of a relatively stagnant County economy. Although, on the plus side, Humboldt County has achieved a measure of financial stability by managing within the constraints of its resources. Though increases in the property tax base were forestalled with construction of two pulp mills in the 1960's, time and inflationary increases will bring about greater pressure for property tax increases in this decade.

A-27. TERMINAL AND TRANSFER FACILITIES

Various changes in ownership and usage of piers and terminal facilities in Humboldt Bay have occurred since publication of the Project Document. Substantial new investments have been made in new terminal facilities, berthing improvements and transportation facilities in the ten years since survey investigations were completed in 1965. There are eight docks serving dry cargo vessels and six oil terminals. All of the docks, except the new pulp mill dock owned by Crown-Simpson and the oil terminal facilities are "public" docks regulated by the California Public Utilities Commission under authority of the Wharfinger Act. Figure A-2 shows the location of the major terminal and pier facilities on Humboldt Bay. The newest major improvement is a 10-acre wood chip terminal recently constructed by North Coast Exporters. Shipments of wood chips from this terminal were initiated in September 1975. Figures A-3 and A-4 are aerial views of two typical docks in Humboldt Bay.

A-28. A detailed description of current ownership and usage of water-front facilities in Humboldt Bay was published in the Humboldt Bay Master Plan, July 1975, Humboldt Bay Harbor, Recreation and Conservation District. Narrative description of major facilities listed below are extracted from that report.

> The largest dock on the Bay is owned by Louisiana-Pacific Corporation. Louisiana-Pacific Corporation was created from the assets of the Georgia Pacific Corporation in January, 1973 as a result of action by the Federal Trade Commission. Louisiana-Pacific Corporation has three large facilities in Samoa: pulp mill, appraised value: $33.3 million; sawmill, $6.45 million; plywood mill, $5.7 million.
>
> Simpson Timber Company, a subsidiary of Simpson Building Supply Company of Seattle, Washington, has sawmill, remanufacturing, and plywood operations in Korbel, Arcata, Klamath and Fairhaven on the Samoa Peninsual. The Fairhaven plywood plant was purchased from U.S. Plywood, and is adjacent to the Crown-Simpson Pulp Company.
>
> The pulp mill is a joint venture with equal share owned by Crown Zellerbach Corporation and Simpson Timber Company. About 200 employees work at the pulp mill. Wood pulp is moved from this plant by rail and shipped to California markets and by ship to foreign ports. The Crown-Simpson dock is the newest dock on the Bay and is reached by ocean-going vessels coming up the 30 feet deep North Bay Channel.

The United States Coast Guard occupies the southern end of the Samoa Peninsula. Their dock is on the North Bay Channel. The Coast Guard is established in this location with administrative buildings and living quarters, and there appear to be no plans to either reduce or enlarge this station. They appear to have excess land for their needs.

Midway between the Louisiana-Pacific dock and the Crown-Simpson dock on the Samoa Peninsula is the site of a new wood chip export facility being built and operated by North Coast Exports. North Coast Exports is a joint venture of local lumber companies which plans to begin exporting wood chips by July, 1975. Their pier will be 1500 feet long and constructed of wood pilings and concrete and capable of handling the largest oceangoing cargo ships able to navigate the North Bay Channel.

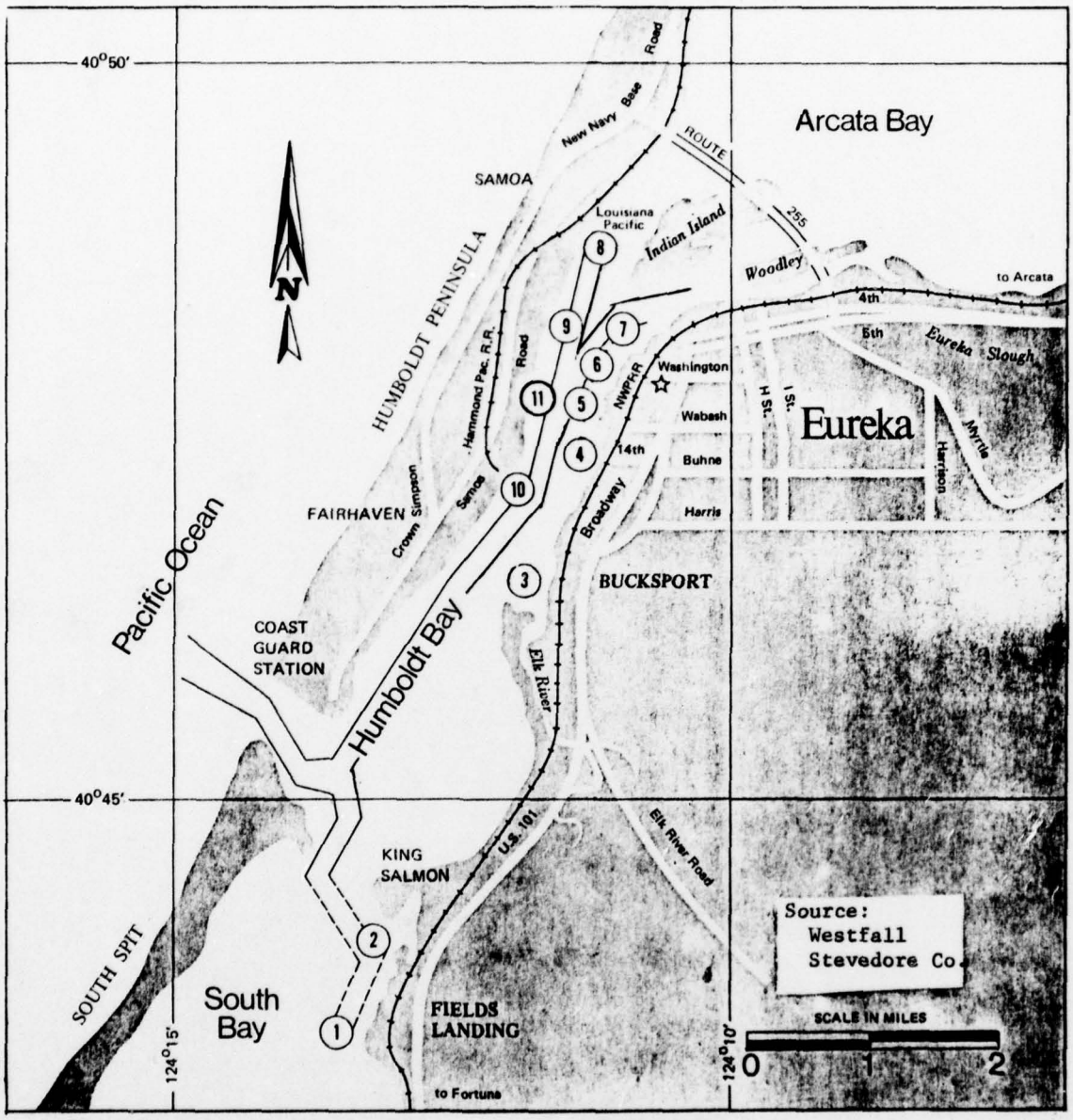
The Louisiana-Pacific pulpmill on the Samoa Peninsula was begun in 1965 and employs about 300 workers. Barges bring in large quantities of sodium hydroxide and chlorine for use in the pulp making process. The finished product is then shipped out to ports all over the world. These freighters use the Louisiana-Pacific dock, the only dock in Humboldt Bay able to accommodate two vessels at one time.

Immediately adjacent to the pulp mill are the Louisiana-Pacific sawmill and plywood plant, which together employ about 1,100 workers. Lumber and plywood move by the Northwestern Pacific Railraod from these plants to the San Francisco and Los Angeles markets and by ship to the same markets and foreign ports.

At the foot of Washington Street in Eureka are Humboldt Docks A and B which are owned by Louisiana Pacific. Dock B is no longer being used, and the City of Eureka is negotiating for its purchase for use as a commercial fish landing dock.

Two oil companies have private docks capable of unloading tankers: Union Oil Company and Standard Oil Company of California. Both companies unload petroleum products from the deepwater of the North Bay Channel into their storage tanks for consumption in the local area. Shell Oil has its storage tanks near the Eureka slough in quite shallow water and must use barges to bring in its gasoline, distillate fuel oil, and residual fuel oil. Room for expansion should be set aside as import volumes increase.

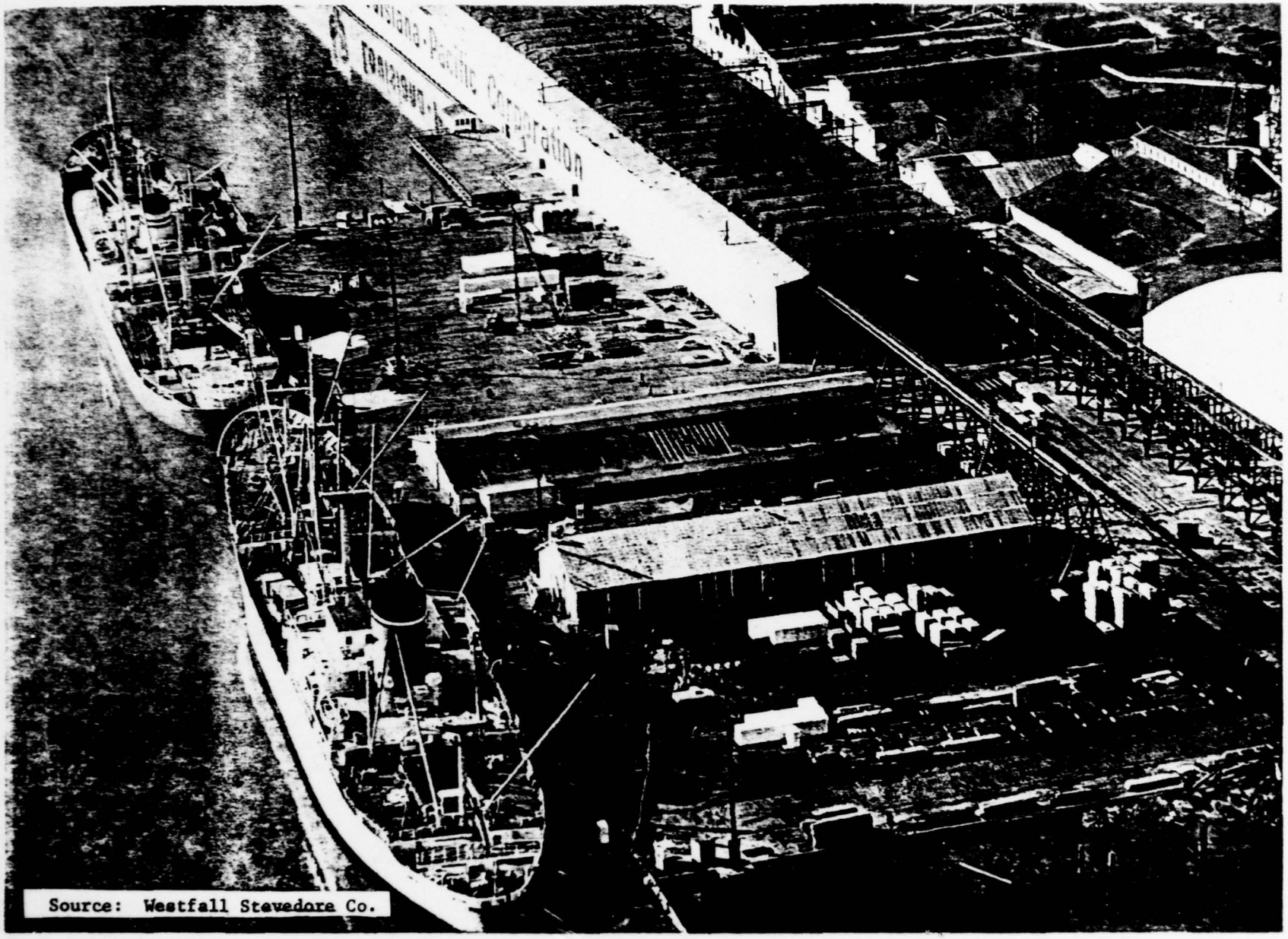
Eureka Forest Products, Inc. owns one of the seven docks on the Bay capable of handling dry-cargo vessels. It is located at the foot of 14th Street, and is used for the export of logs. Another exporter of logs is the Schmidbauer Lumber Company at the foot of Clark Street. Schmidbauer exports redwood, spruce, Douglas fir and white fir.



Docks

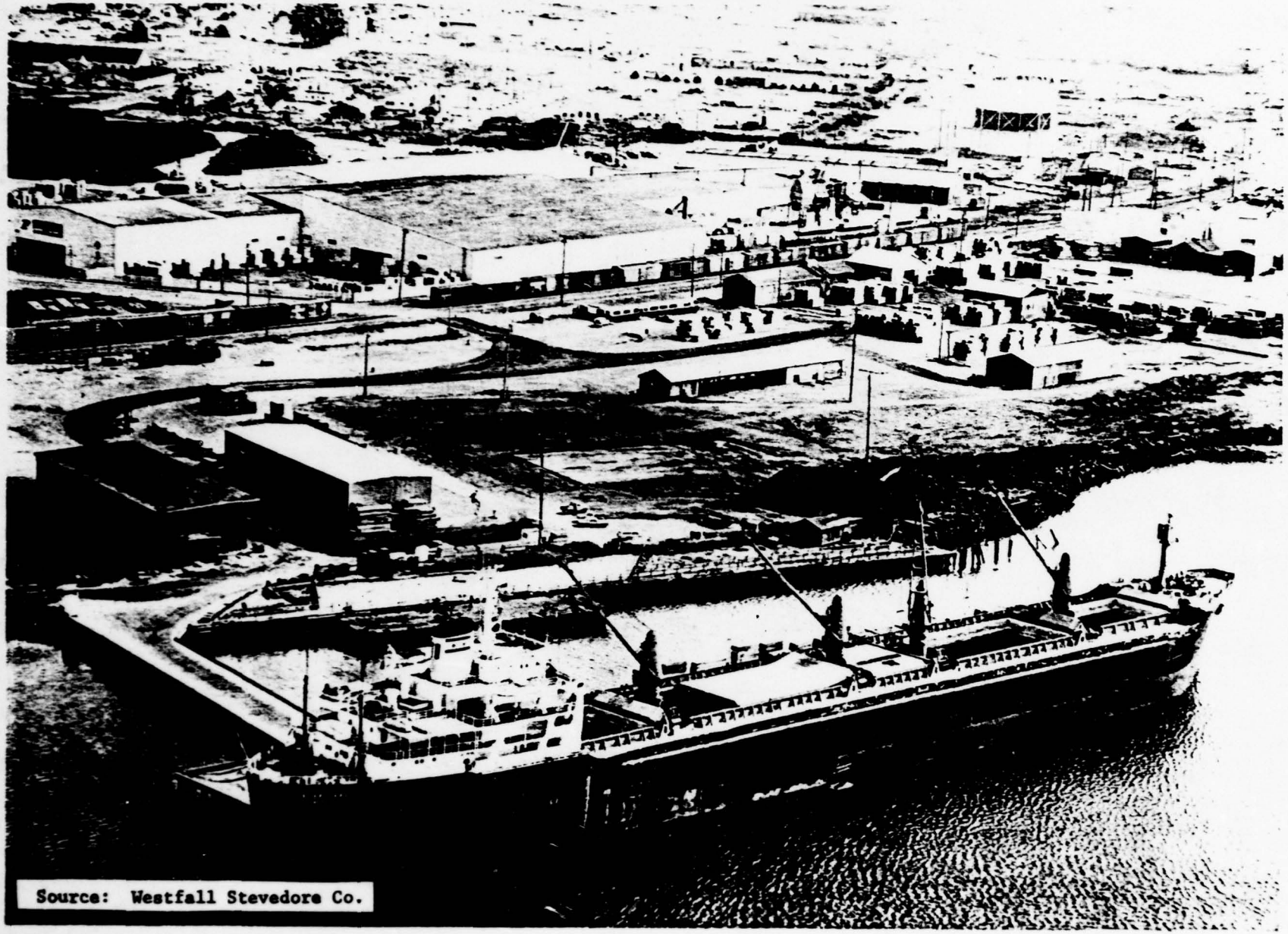
1. PACIFIC DOCK–KRAMER SALES
2. OLSON TERMINALS
3. STANDARD OIL COMPANY
4. EUREKA FOREST PRODUCTS
5. UNION OIL COMPANY
6. HUMBOLDT DOCK "A"
7. HUMBOLDT DOCK "B"
8. LOUISIANA PACIFIC REDWOOD DOCK
9. LOUISIANA PACIFIC CHIP BERTH
10. CROWN SIMPSON DOCK
11. NORTH COAST EXPORT CO.

FIGURE A-2



Louisiana Pacific Redwood Dock @ Samoa

FIGURE A-3



Source: Westfall Stevedore Co.

Humboldt Dock & Shipping Co. Berth "B" ⑦, foot of Washington Street, Eureka.

FIGURE A-4

A-29. Two other major terminal facilities known as the Pacific Lumber Company Dock and Olson Terminal are located at Fields Landing in the South Bay. In addition to the major terminal facilities described above, there are several other waterfront facilities, such as the Oil Terminal Company, that have received deep-draft vessels in the past, but are served by ocean-going barges under present marketing arrangements. Figure A-5 from the Master Plan shows the location of all existing commercial and recreational waterfront facilities on Humboldt Bay.

A-30. STATISTICS ON WATERBORNE COMMERCE

Statistics on waterborne commerce for major ports in the United States are compiled under supervision of the Division Engineer, U.S. Army Engineer Division, Vicksburg, Mississippi; and are published annually under the title: Waterborne Commerce of the United States, Part 4. Statistical data extracted from these reports for the year 1974 are reproduced in Table A-13.

TABLE A-13

HUMBOLDT HARBOR AND BAY
CALIFORNIA

FREIGHT TRAFFIC, 1974

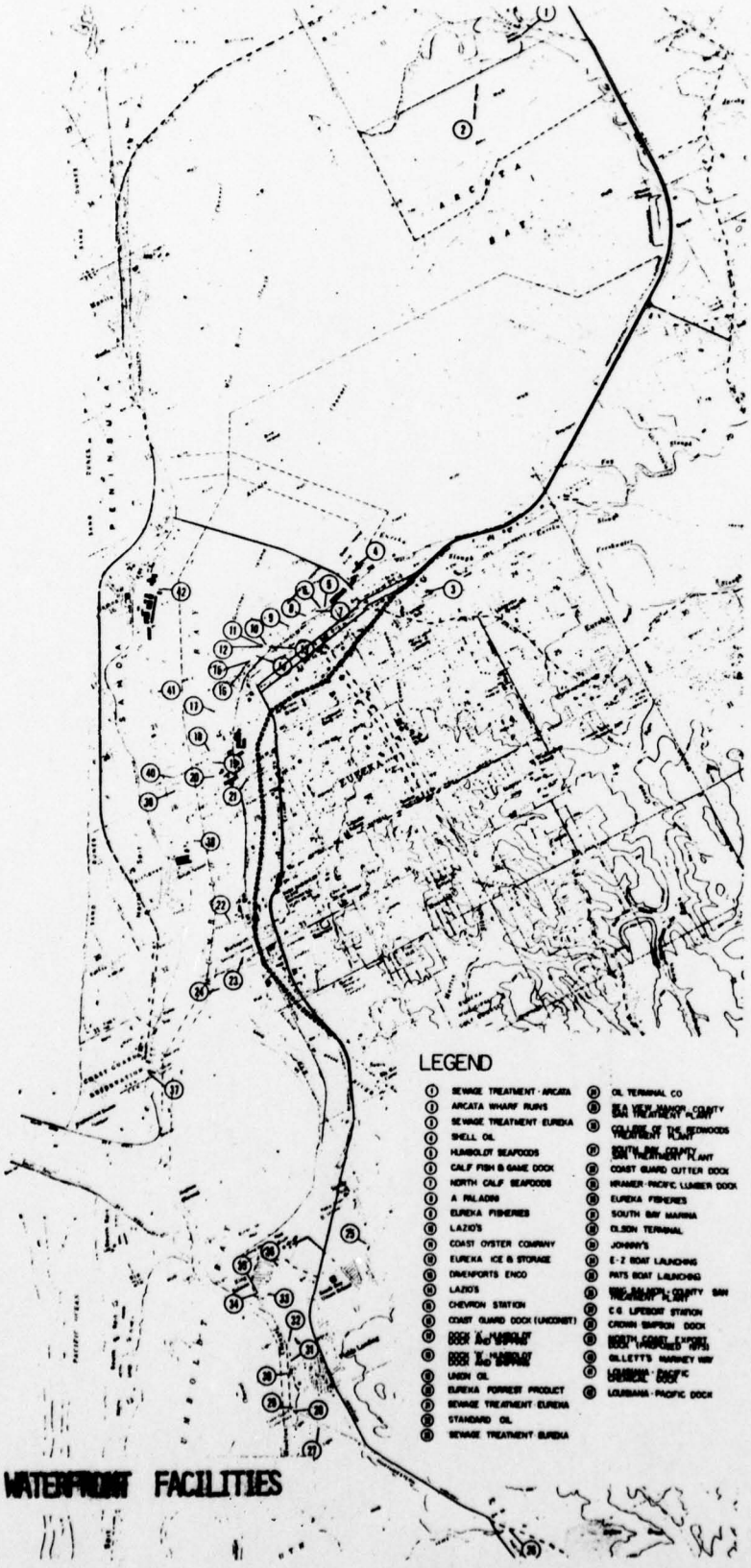
(SHORT TONS)

COMMODITY	TOTAL	FOREIGN		DOMESTIC	
		IMPORTS	EXPORTS	COASTWISE RECEIPTS	INTERNAL RECEIPTS
TOTAL	1,197,567	11,053	983,108	393,785	9,421
0911 FRESH FISH, EXCEPT SHELLFISH	9,013				9,013
0912 SHELLFISH, EXCEPT PREPARED	408				408
2021 DAIRY PRODUCTS, NEC	19		19		
2034 VEGETABLES AND PREP, NEC	1		1		
2049 GRAIN MILL PRODUCTS, NEC	4		4		
2099 MISCELLANEOUS FOOD PRODUCTS	11		11		
2411 LOGS	292,121		292,121		
2413 FUEL WOOD, CHARCOAL, WASTES	10,953		10,953		
2415 PULPWOOD, LOG	36,323		36,323		
2416 WOOD CHIPS, STAVES, MILLINGS	272,417		272,417		
2421 LUMBER	41,766		41,766		
2431 VENEER, PLYWOOD, WORKED WOOD	1,066		1,066		
2491 WOOD MANUFACTURES, NEC	25		25		
2611 PULP	339,404	11,040	328,364		
2810 SODIUM HYDROXIDE	54,925			54,925	
2819 BASIC CHEMICALS AND PROD, NEC	12,039			12,039	
2891 MISCELLANEOUS CHEMICAL PROD	18,300			18,300	
2911 GASOLINE	165,390			165,390	
2912 JET FUEL	521			521	
2914 DISTILLATE FUEL OIL	98,949			98,949	
2915 RESIDUAL FUEL OIL	45,661			45,661	
2991 PETROLEUM AND COAL PROD, NEC	5		5		
3011 RUBBER AND MISC PLASTICS PROD	1		1		
3111 LEATHER AND LEATHER PRODUCTS	5	5			
3291 MISC NONMETALLIC MINERAL PROD	42		42		
3316 IRON AND STEEL PLATES, SHEETS	123		123		
3411 FABRICATED METAL PRODUCTS	70		70		
3511 MACHINERY, EXCEPT ELECTRICAL	8	8			
TOTAL TON-MILES, 7,766,091.					

COMPARATIVE STATEMENT OF TRAFFIC

(SHORT TONS)

YEAR	VESSEL TRAFFIC	RAFTED	TOTAL	YEAR	VESSEL TRAFFIC	RAFTED	TOTAL
1965	570,634	152,813	723,447	1970	1,220,390	443,980	1,664,370
1966	712,875	177,231	890,106	1971	1,113,955		1,113,955
1967	815,558	207,075	1,022,633	1972	1,074,126		1,074,126
1968	1,492,773	222,910	1,715,683	1973	1,431,538		1,431,538
1969	1,273,024	397,329	1,670,353	1974	1,197,567		1,197,567



WATERFRONT FACILITIES

FIGURE A-5

A-31. These statistics indicate significant increases in the total tonnage of oceanborne commerce shipped from Humboldt Harbor and Bay from those projections used in the Project Document to estimate the incremental benefit value of the authorized navigation improvements. Total oceanborne commerce transiting Humboldt Bay increased from 423,000 tons in 1960 to 1,220,390 tons in 1970; compared with 890,000 tons projected in the Project Document. Exports of wood pulp from two new mills on the Samoa Peninsual have climbed from 50,000 tons in 1966 to 339,000 tons in 1974. The Project Document estimated only 150,000 tons would be shipped in deep draft vessels by 1970. The 1974 export shipment for wood pulp exceeded the 330,000 tons projected in the Project Document for year 2020. Export of wood chips, a relatively new commodity, increased from an initial export of 84 tons in 1968 to 270,000 tons in 1974, and future exports of this commodity are expected to double or triple in the next few years. Some indication of the relative importance of the various terminal facilities and major docks in Humboldt Bay in contributing to the total commerce can be gained from reference to Table A-14, which lists the 1974 gross receipts for some of these facilities.

TABLE A-14

HUMBOLDT BAY - 1974

PIER RECEIPTS EXPRESSED IN SHORT TONS

	LUMBER	LOGS	PLYWOOD	PULP	DISCHARGED PETROLEUM	DISCHARGED CHEMICALS	GENERAL COMMOD.	CHIPS	TOTAL
YEAR - 1974									
Standard Oil					79,409.6				79,409.6
Union Oil					57,346.0				57,346.0
Oil Terminals					145,899.0				145,899.0
Humboldt Dock	33,912.1		837.6						34,749.7
Louisiana Pacific	392.2	13,687.9		180,244.2		53,231.0		305,421.0	552,976.3
Crown Simpson				139,515.8	30,650.3	38,300.0			208,466.1
Kramer Dock		3,748.3							3,748.3
Olson Terminals		198,719.2							198,719.2
Eureka Forest Products	1,574.3	125,948.3							127,522.6
TOTAL YEAR - 1974	35,878.6	342,103.7	837.6	319,760.0	313,304.9	91,531.0		305,421.0	1,408,836.8
YEAR - 1974									
January	3,389.2	24,207.3	80.7	18,078.7	27,254.1	8,731.0		32,294.0	114,035.0
February	6,815.6	36,691.3	--	39,782.4	18,239.2	4,213.0		31,240.0	136,981.5
March	3,244.7	17,283.4	3.1	30,627.4	19,627.4	8,802.0		--	79,050.4
April	3,547.6	37,908.9	113.2	22,690.9	26,617.9	8,741.0		26,693.5	126,313.0
May	2,091.0	34,823.9	23.3	32,045.4	27,855.7	5,682.0		29,911.0	132,432.3
June	7,681.2	11,102.1	187.4	23,099.0	25,949.1	6,392.0		--	74,410.8
July	2,377.5	56,209.6	110.9	19,841.1	32,457.1	9,674.0		27,722.0	148,392.2
August	436.5	23,067.4	110.9	29,255.6	30,066.6	8,634.0		41,441.0	133,012.0
September	1,825.6	13,687.0	--	25,858.0	40,787.2	6,456.0		52,663.0	141,276.8
October	895.5	34,371.9	41.8	25,708.8	29,300.5	6,069.0		23,712.5	120,100.0
November	1,847.9	40,355.9	166.3	21,067.8	21,171.4	10,387.0		18,694.0	113,670.3
December	1,726.3	12,415.0	--	31,704.9	14,516.3	7,750.0		19,050.0	87,162.5
TOTAL YEAR - 1974	35,878.6	342,103.7	837.6	319,760.0	313,304.9	91,531.0		305,421.0	1,408,836.8
YEAR - 1974									
1ST QUARTER	13,449.5	78,182.0	83.8	88,488.5	64,583.1	21,746.0		63,534.0	330,066.9
2ND QUARTER	13,319.8	83,834.9	323.9	77,835.3	80,422.7	20,815.0		58,604.5	335,156.1
3RD QUARTER	4,639.6	92,964.0	221.8	74,954.7	103,310.9	24,764.0		121,826.0	422,681.0
4TH QUARTER	4,469.7	87,122.8	208.1	78,481.5	64,988.2	24,206.0		61,456.5	320,932.8
TOTAL YEAR - 1974	35,878.6	342,103.7	837.6	319,760.0	313,304.9	91,531.0		305,421.0	1,408,836.8

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX B

PROJECTIONS OF WATERBORNE COMMERCE AND PROJECT BENEFITS

U.S. Army Engineer District, San Francisco
Corps of Engineers
211 Main Street
San Francisco, California 94105

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX B

PROJECTIONS OF WATERBORNE COMMERCE AND PROJECT BENEFITS

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APPENDIX B

PROJECTIONS OF WATERBORNE COMMERCE AND PROJECT BENEFITS

B-1. GENERAL

The estimated benefits that would accrue from the proposed improvements at Humboldt Harbor and Bay are those which would result directly from the improvements and are reducible to tangible monetary values. These benefits include savings in transportation and related costs due to: (a) Elimination of tidal delays; (b) Topping off with lumber and other forest products; (c) Savings of vessel operating costs due to backtracking at sea; and (d) Elimination of vessel delays due to waves in the bar and entrance channel. The background and calculations for these benefits are presented below.

B-2. BASIS FOR ECONOMIC PROJECTIONS

Economic projections for development of Humboldt Harbor are based upon the following assumptions:

a. The economic expansion of underdeveloped nations bordering the Pacific Basin and in Asia will be accelerated for the 50-year period of projection.

b. Demand for United States lumber and other forest products will increase with the expansion of the domestic and foreign economies.

c. The area tributary to Humboldt Bay is capable of producing sufficient lumber and other forest products to meet projected foreign demands.

d. The trend towards utilization of large cargo carriers in foreign trade will continue during future years.

e. Following established international trends, the average draft of future fleets calling at Humboldt Harbor will increase during the next 50 years.

B-3. All projections and future monetary values have been presented as average annual equivalents by use of compound interest methods using a 3-1/4 percent interest rate and assuming that the economic life of projected improvements is 50 years. The use of the 3-1/4 percent interest rate is in accordance with Section 80(b) of the Water Resources Development Act of 1974.

COMMERCE

B-4. LUMBER PRODUCTION IN THE HUMBOLDT BAY TRIBUTARY AREA

Forest products shipped through Humboldt Bay originate mainly in three California counties, Humboldt, Del Norte and Trinity; lesser amounts originate in two adjacent counties, Mendocino and Siskiyou. In addition, a very small amount is brought into the area from southern Oregon for trans-shipment. For purposes of estimating the prospective waterborne shipments from Humboldt Bay, the tributary area of Humboldt Harbor and Bay is considered to comprise the five northwestern California counties of Del Norte, Humboldt, Mendocino, Siskiyou and Trinity. The production of lumber and other forest products in this five-county area for the years 1960-1965 is shown in Table B-1. Over the 6-year period, production has averaged 2.99 billion board feet annually, with a low of 2.65 billion board feet in 1960 and a high of 3.16 billion board feet in 1963.

B-5. FUTURE LUMBER PRODUCTION

Future production in the five tributary counties of Humboldt, Del Norte, Trinity, Mendocino and Siskiyou is based on historical records and estimates of future western production contained in "California's Forest Industries, Prospects for the Future," by Daniel D. Oswald, USDA Forest Service Resource Bulletin FNW-35, 1970. The North Coast area is projected to harvest less timber between now and the year 2000 than has been harvested annually for the last 15 years. The same source predicts that the timber harvest in the region will decline 29 percent, from 2.9 billion board feet in 1965 to about 2.1 billion board feet by 2000. This decline reflects the fact that the privately held timber lands in the area have been cut at a high rate for the last 20 years and that further harvesting must await the maturing of new growth. However, growth is projected to increase on private lands during the period 2000-2020, accounting for a projected moderate increase in the timber harvest to about 2.3 billion board feet in 2020 and to about 2.6 billion board feet in 2030. Current and projected log production is shown in the table below.

TABLE B-1

LUMBER AND OTHER FOREST PRODUCT PRODUCTION IN
DEL NORTE, HUMBOLDT, MENDOCINO, SISKIYOU AND TRINITY COUNTIES

Year	Billion Board Feet Cut
1960	2.649
1961	2.892
1962	3.145
1963	3.164
1964	3.146
1965	2.916
Average 1960-1965	2.985
1970 1/	2.500
1980	2.094
2000	2.058
2020	2.256
2030	2.600

1/ Estimated. Data are not available beyond 1965. The estimate for 1970 and projections beyond 1970 are the latest available.

Source: Historical data, California Division of Forestry; projections, USDA Forest Service, 1970.

B-6. FUTURE WATERBORNE EXPORTS OF LUMBER AND OTHER FOREST PRODUCTS

Future timber production in the tributary area and waterborne shipments of forest products from Humboldt Bay are shown in Table B-2.

a. In the 10-year period from 1960 to 1970, the trend of timber production in the five counties first increased from 2.649 billion board feet to 2.916 billion board feet in 1965 and then declined to about 2.5 billion board feet in 1970. During the same period, the trend of total waterborne shipments of forest products from Humboldt Harbor rose by about 150 percent, from about 210,000 tons to nearly 500,000 tons. In relation to the total waterborne commerce, the trend of the foreign segment (exports) rose about 300 percent in the same period, from approximately 75,000 tons to over 290,000 tons. Thus, exports increased at double the rate of increase for total waterborne shipments. The marked rise in foreign shipments started with an upswing in the export of logs and wood chips to Japan. This activity peaked in 1968 and is again on the increase. In 1973, 171,000 tons or about 101 million board feet of wood chips were exported to Japan. In 1975, an additional wood chip export facility has been opened. Moreover, there are presently two ten-year contracts to supply chips to foreign countries and a third contract is under negotiation. Considering these factors, exports of forest products by waterborne shipments are expected to continue at least at current levels.

b. During the period from 1960 to 1964, waterborne shipments of forest products from Humboldt Bay amounted to about 4.3 percent of the total North Coast (five-county) production. By the period from 1970 to 1973, this percentage had risen to nearly 11 percent, reflecting the trends in exports discussed above. Considering an expected continuation of exports via waterborne shipments, the percentage discussed above is projected to be at least eleven percent (waterborne shipments as a percent of total North Coast timber production). If this percentage were to remain constant in the future, then waterborne shipments of forest products would be about 190 million board feet in 1980, 185 million board feet in 2000, and 203 million board feet by 2020. However, given the past and expected future trends in exports of lumber and other forest products, a decline of waterborne shipments seems highly unlikely. Even with a decline in lumber production, it is expected that waterborne shipments of forest products will remain at least at present levels. As indicated in Table B-2, waterborne shipments of forest products totaled 267 million board feet in 1970. If about the same volumes are shipped in 1980, the percentage of total five-county production will be about 13 percent. Holding this percent constant through 2020 indicates that total waterborne shipments of forest products will remain approximately constant through 2000 and increase to 293 million board feet by 2020, and 338 million board feet by 2030.

TABLE B-2

FUTURE TIMBER PRODUCTION IN THE FIVE-COUNTY TRIBUTARY AREA AND WATERBORNE SHIPMENTS OF FOREST PRODUCTS FROM HUMBOLDT BAY

		Waterborne Shipments		
Year	Production in Five-County Tributary Area (MM bd. ft.) 1/	In Percent of Total 5-County Production	Total Shipment 3/ (MM bd. ft.)	Tons
1962	3,145			
Average 1960-64	2,999	4.3	128	216,000
1970	2,500	10.7	267 2/	450,000
1980	2,094	13.0	270	457,000
1990				
2000	2,058	13.0	268	452,000
2010				
2020	2,256	13.0	293	494,000
2030	2,600	13.0	338	570,000

1/ Source: "California's Forest Industries, Prospects for the Future," by Daniel D. Oswald, USDA Forest Service Resource Bulletin FNW-35, 1970, pp.23.

2/ Average from 1970 to 1973.

3/ Exclusive of wood pulp.

c. These projections of waterborne shipments are considered to be conservative in spite of the projected decline in timber production as borne out by the actual shipments shown in Table A-13 for the years 1970 to 1974. Total projected shipment is a small percentage of production, and the projected decline in production should not have a major impact on foreign shipments. Both domestic and foreign demands for lumber products are expected to grow. However, this increase in demand will be offset to some degree by the more efficient use of cut timber as discussed in Paragraph A-18.

B-7. FUTURE DRY CARGO VESSEL TRIPS

The estimated number of vessel trips in 1980, the first year of project life, is based on the estimated tonnage carried by deep-draft vessels in 1970. This increased tonnage, expressed as a ratio of the expected tonnage in 1980 to the current tonnage (the average over the period 1970-1973), reduced by the cubage factor[1/] and multiplied by the current number of vessel trips (1970), gives the estimated number of vessel trips as follows:

$$\text{Number of vessel trips in 1980} = \frac{457,000}{450,000} \times 385 \times \frac{1}{1.07} = 364$$

There is a slight decrease in the number of trips because exports of forest products are expected to remain roughly constant while the size of vessels will get larger. The size is indicated by the cubage factor which describes expected increases in vessel capacity as shown in Figure B-1. In the same manner as above, the estimated number of vessel trips was computed by 10-year intervals for the period 1980-2030[2/]. The computations and results are shown below and Table B-3.

$$1990 = \frac{454,000}{450,000} \times 385 \times \frac{1}{1.08} = 359$$

$$2000 = \frac{452,000}{450,000} \times 385 \times \frac{1}{1.09} = 355$$

$$2010 = \frac{474,000}{450,000} \times 385 \times \frac{1}{1.09} = 372$$

$$2020 = \frac{494,000}{450,000} \times 385 \times \frac{1}{1.09} = 388$$

$$2030 = \frac{570,000}{450,000} \times 385 \times \frac{1}{1.09} = 447$$

1/ The cubage factor is an estimate of the effect increasing vessel size will have on the number of vessels needed to haul a given tonnage of lumber or forest products.

2/ Exclusive of trips carrying wood pulp.

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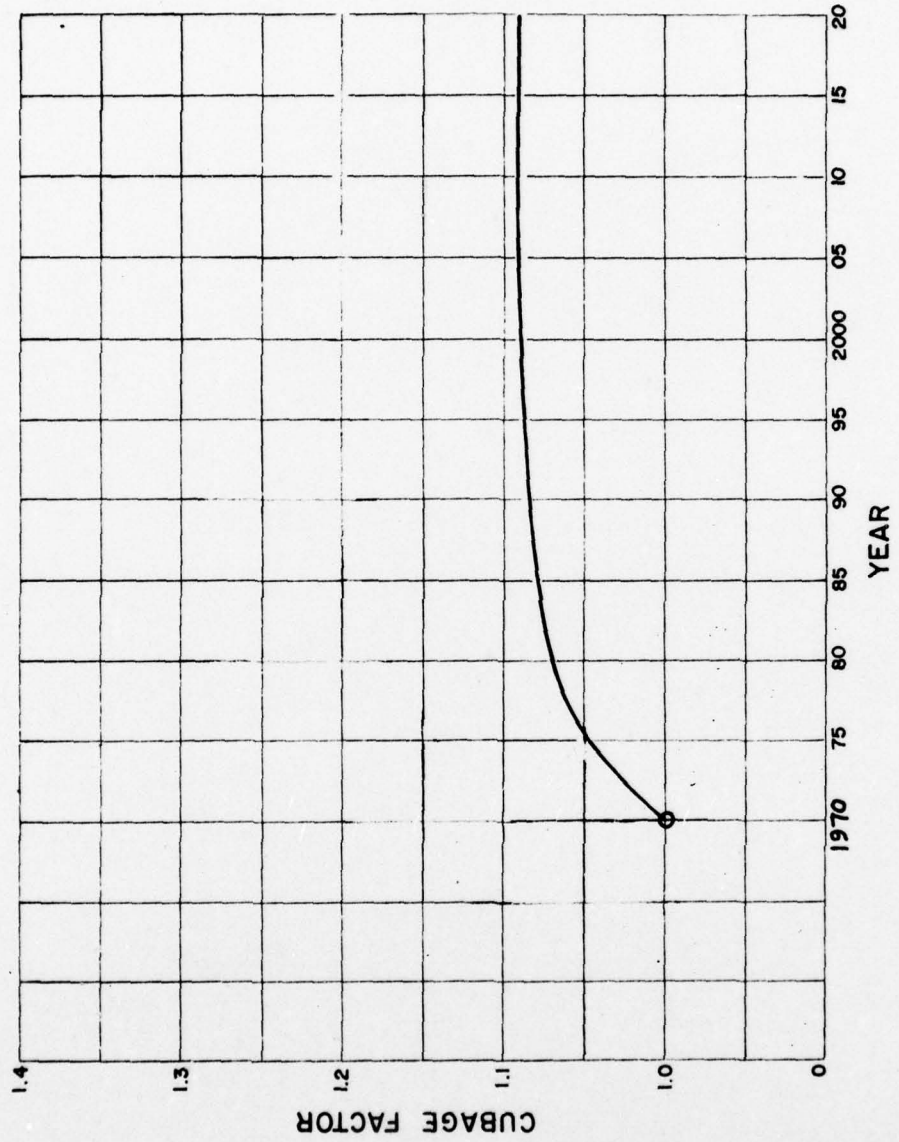

HUMBOLDT HARBOR AND BAY
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VESSEL CUBAGE FACTOR
1970-2020

FIGURE B-1

TABLE B-3

FUTURE DEEP-DRAFT DRY-CARGO VESSEL
TRIPS IN HUMBOLDT BAY, 1980-2030

Year	Number of Vessel Trips
1980	364
1990	359
2000	355
2010	372
2020	388
2030	447

B-8. FUTURE DRY-CARGO VESSEL TRIPS BY ACTUAL INBOUND AND OUTBOUND DRAFTS

A factor that will increase vessel drafts in Humboldt Harbor is the trend toward larger vessels in order to benefit from economies of scale. The rising costs of fuel, labor, and ship construction require larger ships to minimize the unit cost of shipping. At Humboldt Harbor, for example, the average draft of all dry-cargo vessel traffic (outbound, greater than 18 feet) increased from about 23 feet in 1963 to 26 feet in 1972. Moreover, the average draft of outbound vessels greater than 25 feet (in draft) increased from about 27 feet in 1963 to about 28.5 feet in 1972. Tables B-4 and B-5 show the drafts and average drafts for all dry-cargo vessel traffic (outbound) and for vessels greater than 25 feet in draft. The standard deviations shown in Table B-5 indicate the following: Assuming a normal distribution of the data used to calculate the averages (for each year), then it is known statistically that $(1-1/k^2)$ percent of the observations in a given year will fall within k standard deviations of the mean (average) value. Thus, for 1972, $(1-1/2^2) = 75$ percent of all observations should fall within 2 standard deviations or $(2)(3.14) \approx 6.28$ feet of the average draft of 26 feet.

TABLE B-4

DRY-CARGO VESSEL TRAFFIC IN HUMBOLDT BAY[1/]
(Number of Trips)

Draft (Ft.)	1963		1964		1965		1966		1967		1968		1969		1970		1971		1972	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
34														1				2		
32									1	1		1		2		1		1		2
31								2	1			5	1	9		3	1	5		6
30		1			1	1			1	8		13	5	18	1	21	2	13	5	19
29		3		2	1	3	2	6	2	15	3	31	4	18	7	23	3	12	6	11
28	2	7		5	1	5	3	6	4	15	1	10	5	13	10	19	4	10	6	8
27	1	7	1	3	1	5	2	11	4	13	5	15	7	14	8	21	9	8	12	14
26	6	7	4	6	6	6	5	11	5	16	7	28	7	23	16	19	9	10	10	14
25	9	14	3	12	3	7	7	5	14	12	11	14	14	17	10	10	3	9	10	18
24	8	19	9	9	3	10	6	14	13	20	8	27	16	14	14	12	6	8	8	21
23	11	9	9	12	9	19	6	10	19	13	17	21	16	13	10	14	7	13	13	5
22	12	17	9	9	14	11	19	10	18	13	23	17	14	16	18	18	15	4	11	11
21	17	17	14	9	8	9	9	22	18	22	18	15	19	8	15	8	8	6	17	4
20	15	13	7	7	15	17	17	8	20	12	31	14	24	16	22	5	12	7	19	2
19	11	12	10	8	13	5	16	4	19	8	29	15	31	7	23	3	10	1	7	4
18 & Under	41	8	31	14	33	13	34	16	41	16	103	30	43	21	50	27	30	11	21	7
Drafts> 25 Ft.	34		21		30		48		86		119		127		149		89		113	
Drafts< 26 Ft.	233		172		189		203		278		393		289		259		150		178	
TOTALS	133	134	97	96	108	111	126	125	180	184	256	256	206	210	204	204	119	120	145	146
COMBINED TOTAL	267		193		219		251		364		512		416		408		239		291	

> Indicates Greater Than
< Indicates Less Than

1/ Includes trips carrying wood pulp.

TABLE B-5

AVERAGE DRAFTS OF ALL DRY CARGO
VESSEL TRAFFIC, HUMBOLDT BAY

Year	Draft (Weighted Average) All Vessels (outbound) 1/	Draft (Weighted Average) Vessels greater than 25 feet (outbound)	Standard Deviation All Vessels	Standard Deviation Greater than 25 feet
1963	23.1	27.4	2.79	1.15
1964	23.2	27.2	2.69	1.11
1965	23.1	27.4	2.75	1.23
1966	23.8	27.4	2.99	1.38
1967	24.5	27.9	3.26	1.44
1968	24.9	28.1	3.41	1.63
1969	25.5	28.4	3.56	1.85
1970	26.0	28.2	3.15	1.52
1971	26.0	28.7	3.50	1.90
1972	26.0	28.5	3.14	1.77

1/ Data from Table B-4 was used to calculate these averages. Vessels 18 feet and under in draft were excluded.

B-9. ESTIMATED AND PROJECTED DISTRIBUTION OF VESSEL TRIPS BY VESSEL DRAFT IN HUMBOLDT HARBOR

As indicated by Tables B-4 and B-5, the average draft of vessels entering Humboldt Bay has shifted dramatically since the Project Document was completed. According to spokesmen for exporting and shipping companies, the drafts of vessels using Humboldt Bay will continue to increase as they have in the recent past. In order to form a basis for projecting vessel drafts, the vessel trip distributions for 1963 through 1971 were computed from data in Table B-4. Then the percent of the total for each draft was calculated. For example, Table B-6 below shows the actual vessel drafts and the percent of vessels for the year 1970. Such percentages were computed for each year from 1963 through 1971.

TABLE B-6

ESTIMATED DISTRIBUTION OF VESSEL TRIPS BY VESSEL DRAFT
IN HUMBOLDT HARBOR, 1970
(Based on a 30-foot channel)

Actual vessel draft (ft.)	1970 No. of vessels[1/]	Percent of vessels
20 or less	123	32
21	22	6
22	33	9
23	23	6
24	25	6
25	19	5
26	33	9
27	27	7
28	27	7
29	28	7
30	21	5
31 or more	4	1
TOTAL	385	100%

1/ Exclusive of wood pulp.

B-10. In projecting vessel drafts, simple least squares regression was used to extend the trends which occurred from 1963 to 1971[1/]. The technique used in the Project Document was discarded because it was felt to be inferior to the technique used in this report. The least squares regression technique is illustrated as follows. First the decision was made to project the percentage of total vessel trips taken by vessels of a given draft. In 1963, for example, vessels drawing 27 feet in draft were 3 percent of all vessel trips, and this percentage increased to 7 by 1970 (see tabulation below).

1/ Judgment and the advice of knowledgeable persons in the shipping industry were also used to formulate the projections.

Actual Vessel Draft	Humboldt Bay Percent of Vessels of a Given Draft 1963 %	1970 %
20 or less	37	32
21	13	6
22	11	9
23	8	6
24	10	6
25	9	5
26	5	9
27	3	7
28	3	7
29	1	7
30	0	5
31 or more	0	1
	100	100

B-11. This percentage of vessel trips was calculated for each year through 1971, for vessels drawing 27 feet. Then a least square regression line was computed as follows: The percent of vessel draft was regressed against time (the independent variable). This provided the best fitting line to the points corresponding to a plot of the percent of vessels drawing 27 feet against the years 1963 through 1971. The year 1972 was excluded because of the occurrence of a shipping strike. This least squares trend line was then extended to the year 1980 by changing the independent variable (time) to 1980. This yielded a projection that the percent of vessels drawing 27 feet in 1980 will be about 11 percent (compared to 7 percent in 1970). This process was then done for each vessel draft (from 20 feet or less to 31 feet or more). The sum of the projected percentages came close to 100 percent. Because the sum of the projected percentages was not equal to 100, judgment and the advice of knowledgeable persons in the shipping industry were used to make small adjustments so that the total would equal 100. The projections of the percent of vessels drafts for 1980 are shown in the next tabulation. After 1980, the distribution of vessel drafts was changed by judgment to the year 2000 and held constant thereafter.

Actual Vessel Draft	Percent of Vessels of a Given Draft		
	1980	1990	2000
	%	%	%
20 or less	25	23	20
21	4	3	3
22	4	3	3
23	4	4	3
24	4	5	4
25	5	5	4
26	11	11	12
27	11	12	13
28	10	11	12
29	9	9	10
30	9	9	10
31 or more	4	5	6
	100	100	100

B-12. Discussion with port interests, shippers, and others indicates that these projections are reasonable and probably conservative. The projected percentages and corresponding numbers of trips are shown in Table B-7.

TABLE B-7

ESTIMATED DISTRIBUTION OF VESSEL TRIPS BY VESSEL DRAFT
IN HUMBOLDT HARBOR, 1970-2030
(Based on a 35-foot channel)

Actual Vessel Draft (Ft.)	1970	1980	1990	2000	2010	2020	2030	1970	1980	1990	2000	2010	2020	2030
	Percent							Trips 1/						
20 or less	32	25	23	20	20	20	20	123	91	83	71	75	77	89
21	6	4	3	3	3	3	3	22	15	11	11	11	12	13
22	9	4	3	3	3	3	3	33	15	11	11	11	12	13
23	6	4	4	3	3	3	3	23	15	15	11	11	12	13
24	6	4	5	4	4	4	4	25	15	18	14	15	15	18
25	5	5	5	4	4	4	4	19	18	18	14	15	15	18
26	9	11	11	12	12	12	12	33	39	39	43	45	47	54
27	7	11	12	13	13	13	13	27	39	43	46	48	50	58
28	7	10	11	12	12	12	12	27	36	39	43	45	47	54
29	7	9	9	10	10	10	10	28	33	32	35	37	39	45
30	5	9	9	10	10	10	10	21	33	32	35	37	39	45
31 and more	1	4	5	6	6	6	6	4	15	18	21	22	23	27
TOTALS	100	100	100	100	100	100	100	385	364	359	355	372	388	447

1/ Exclusive of wood pulp.

B-13. FUTURE WATERBORNE EXPORTS OF WOOD PULP

Two pulp mills operate at Humboldt Bay. The combined annual production of these two mills is approximately 440,000 tons. Both mills have facilities for docking or loading deep-draft vessels, and both have recently exported 90 to 95 percent of their outputs by deep-draft vessels. Thus, about 400,000 tons of pulp annually are being shipped out of Humboldt Bay to foreign ports in the Pacific Basin and Asia. Spokesmen for the two pulp mills feel that, barring a war or international calamity, exports of wood pulp will continue near present levels. Moreover, according to industry sources, all pulp mills in this area will operate almost completely on chips residual to sawmill and plywood plants, not on standing timber. Thus, the volume of lumber and other forest products available for overseas shipments will not be diminished by projected pulp mill operations. Information furnished by the owners of the two pulp mills indicates that of the 440,000-ton annual output of the two mills, approximately 400,000 tons have recently been exported by deep-draft vessel. The conservative estimate of 350,000 tons has been used in this report. This was done in part to reflect uncertainty.

B-14. FUTURE DRY-CARGO VESSEL TRIPS CARRYING WOOD PULP

From information furnished by shippers and pulp mill operators, the average lift of wood pulp per vessel trip is presently about 13,000 short tons. Currently, two pulp mills at Humboldt Bay produce about 300,000 tons per year for export. Thus, under present conditions, exports of wood pulp account for about 23 loaded ships per year. These trips represent loaded wood pulp vessels on an outbound run. Inbound vessels traveling without the cargo should encounter no significant tidal delays attributable to insufficient channel depths. Over the next 50 years, the average lift of wood pulp per vessel is expected to reach a maximum of about 19,000 tons. However, exports from the pulp mills are expected to peak at about 435,000 short tons per year (maximum capacity for two mills). Thus, the number of loaded ships per year should remain at about 23 (435,000 divided by 19,000). The pulp mill owners indicate that pulp will be carried by vessels having a loaded design draft similar to the draft of other deep draft vessels. The following table gives the distribution by draft of vessels carrying wood pulp for the period 1970 to 2030.

TABLE B-8

ESTIMATED DISTRIBUTION BY DRAFT OF VESSEL TRIPS
CARRYING WOOD PULP FROM HUMBOLDT HARBOR,
1970 - 2030

Vessel Draft	1970	1980	1990	2000	2010	2020	2030
28	7	6	5	5	5	4	4
29	9	9	9	8	7	7	6
30	6	6	6	6	6	6	6
31 or over	2	2	3	4	5	6	7
TOTAL	23	23	23	23	23	23	23

B-15. The Project Document estimated that 230,000 tons of wood pulp would be shipped by deep-draft vessels. However, the total waterborne movements of wood pulp were estimated to be about 500,000 tons, the extra 270,000 tons being shipped by barge. The total of 500,000 tons of pulp produced (after 1980) was based on the assumption that a third pulp mill would be built which is no longer forthcoming. Moreover, all pulp produced in Humboldt Bay is now being moved by deep-draft vessel. Thus the estimated average of 350,000 tons of pulp from the two existing mills annually in Humboldt Bay is expected to be moved completely by deep-draft vessels in the future, similar to current practice.

B-16. PROJECTED DISTRIBUTION OF ALL VESSEL TRIPS BY VESSEL DRAFT IN HUMBOLDT HARBOR

Combining the estimated future vessel trips by draft for vessels carrying lumber and other forest products with those carrying wood pulp gives a summary of all estimated dry-cargo vessel trips by draft at Humboldt Harbor for the period 1970 to 2030, as shown in Table B-9.

TABLE B-9

PROJECTED DISTRIBUTION OF ALL VESSEL TRIPS
BY VESSEL DRAFT IN HUMBOLDT HARBOR,
1970 - 2030

Actual Vessel Draft (Ft.)	1970	1980	1990	2000	2010	2020	2030
20 or less	123	91	83	71	75	77	89
21	22	15	11	11	11	12	13
22	33	15	11	11	11	12	13
23	23	15	15	11	11	12	13
24	25	15	18	14	15	15	18
25	19	18	18	14	15	15	18
26	33	39	39	43	45	47	54
27	27	39	43	46	48	50	58
28	33	42	44	48	50	51	58
29	37	42	41	43	44	46	51
30	27	39	38	41	43	45	51
31 and over	6	17	21	25	27	29	34
TOTAL	408	387	382	378	395	411	470

B-17. DRY-CARGO VESSEL COSTS

Tabulated in Table B-10 are average dry-cargo vessel operating costs (in port) by vessel type for United States flag vessels. Costs originally were based on July, 1972 cost levels. However, the data in Table B-10 have been updated from 1972 to 1975 using an average weighted increase in vessel cost for this period which was estimated to be 1.53[1/]. The updating methodology was based on the relationship between 1972 and 1975 tanker costs.

1/ All vessel cost data are from the Transportation and Coastal Zone Planning, OCE.

TABLE B-10

UNITED STATES FLAG GENERAL CARGO VESSEL
OPERATING COSTS

Costs per Hour in Port		Vessel Draft Fully Loaded (feet)
C2	$531	26.5
C3	635	29.5
C4	739	31.5
C5	898	34.0

B-18. At the present time, operating costs of foreign flag vessels are more than 1/3 less than for United States flag vessels. It is believed, however, continually rising labor costs in foreign countries will diminish the present gap between United States and foreign flag vessel operating costs. The mean hourly costs presented in Table B-11 are adjusted costs, allowing for the estimated fleet composition in the foreign and domestic trades and the progressively narrowing differential in operating costs between United States and foreign flag vessels. According to shipping spokesmen, very few 34-foot draft ships will enter Humboldt Harbor without deeper channels. This is because ships with a 34-foot draft must wait for the highest part of the tidal cycle. Accordingly, the average of the costs for the C2 to C4 vessels will be used in the table which follows. This average is felt to be most reasonable since, as indicated in Table B-9, most of the larger vessels visiting Humboldt Bay are between 26 and 31 feet in draft.

TABLE B-11

ADJUSTED MEAN HOURLY DRY-CARGO VESSEL OPERATING COSTS

Year	(In Port) U.S. Flag Dry-Cargo Vessel Operating Cost (Aver. from Table B-10)	Estimated Future Distribution of Shipments to Foreign Ports	Percent of Shipments in Col.(3) that are made in foreign flag vessels	Ratio of Foreign to U.S. flag vessel operating Costs	Adjusted Hourly Cost
(1)	(2) ($/hr.)	(3) (%)	(4) (%)	(5)	(6)
1970	635	96	100	0.57	347 1/
1980	635	96	100	0.59	360
1990	635	96	100	0.61	372
2000	635	96	100	0.63	384
2010	635	96	100	0.65	396
2020	635	96	100	0.67	408
2030				0.70	427

1/ Foreign Flag - (0.96 (100) 0.57 x $635 =$347)).

EVALUATION OF BENEFITS

B-19. GENERAL

On the basis of the foregoing data concerning commerce and vessel traffic in Humboldt Harbor, this section will explore the need for and the benefits to be obtained from the proposed improvements in the harbor. Project benefits have been distributed between the North and South Bays. Historically, deeper-draft vessels (those drawing up to 31 feet) have used the North Bay. This traffic accounts for 75 percent of the harbor total. South Bay traffic has consisted mainly of barges and lighter draft vessels (those drawing a maximum of 27 feet). Forest products, the principal commodities shipped from the harbor, are loaded mainly in the North Bay. There is no reason to believe that this distribution pattern will change in the future.

Benefits evaluated herein consist of transportation savings due to:

a. Elimination of vessel time lost awaiting favorable tides in the interior channels for those vessels drawing 22-31 feet that can presently enter the harbor.

b. Provision of adequate depths for the larger vessels (those drawing 31-34 feet) which are unable to fully load (top off) due to inadequate channel depth.

c. Savings of vessel operating costs (at sea) which result from shippers having to backtrack vessels from Humboldt Bay to other ports in order to fully load their vessels before departing to a foreign destination.

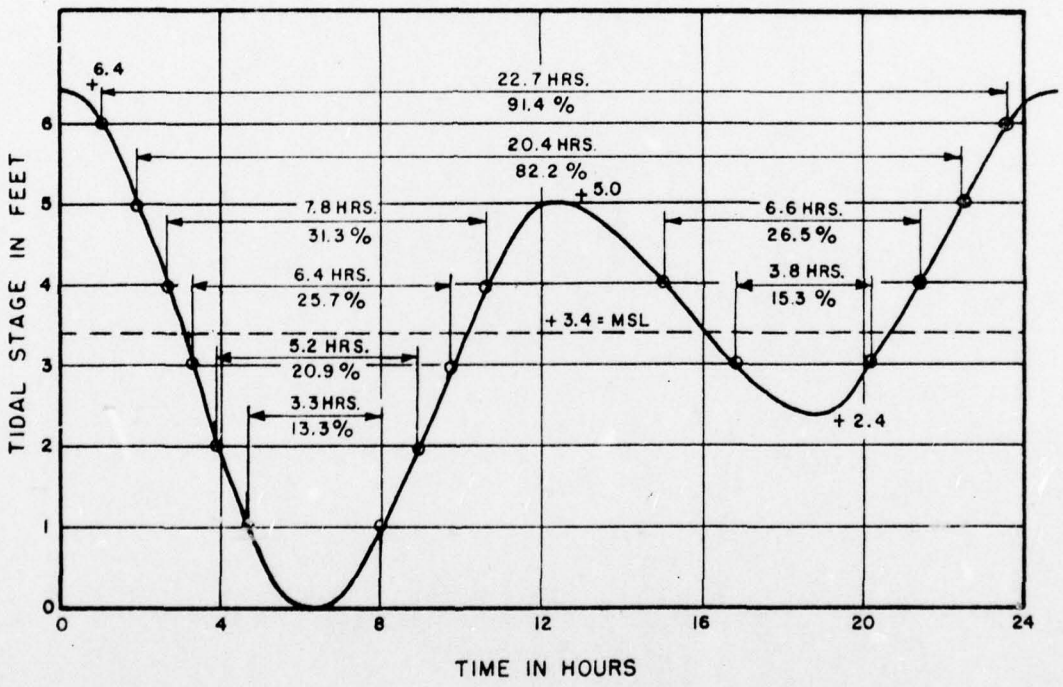
d. Elimination of vessel time lost awaiting favorable wave conditions in the Bar and Entrance Channel.

B-20. SAVINGS IN TRANSPORTATION COSTS, ELIMINATION OF TIDAL DELAYS IN INTERIOR CHANNELS

Local interests state that under existing project conditions, considerable time is lost by vessels awaiting favorable tides in both the North and South Bays. A pre-requisite for a deep-draft vessel to operate safely and efficiently under its own power is sufficient water under the keel to compensate for squat, trim and keel clearance. For ships operating in Humboldt Bay, a channel depth of at least 5 feet more than the vessel draft, as measured when the vessel is motionless, is required. Thus, under current conditions, vessels drawing 26 feet or more will encounter delays in the North Bay Channels, and vessels drawing 22 feet and more will encounter delays in the South Bay Channel.

B-21. To estimate the time interval that vessels must wait for favorable tides, a mean tide curve was drawn for Humboldt Bay. From this curve, which is shown in Figure B-2, the mean depth of water throughout a complete lunar cycle of 24.8 hours can be determined.

B-22. Assuming a 5-foot allowance for squat, trim and keel clearance, Figure B-2 shows that for a tide of 3 feet, a vessel drawing 28 feet could be delayed a maximum of 6.4 hours. The computation is based on the assumption that vessels will characteristically arrive and depart at regular intervals throughout the daily tidal cycle. Thus, for vessels of a particular draft, the probability of delay would be in direct proportion to the period of time when sufficient depth of water was not available (see Tables B-12 and B-13). Vessel delays due to tides for 1980-2030 are shown in Table B-14. These delays are considered to be national economic losses because shoreside facility operations are geared to scheduled ship arrivals.



NOTE: BASED UPON LUNAR DAY OF 24.84 HOURS

HUMBOLDT HARBOR AND BAY
CALIFORNIA

MEAN TIDE CURVE
SOUTH JETTY

FIGURE B-2

TABLE B-12

VESSEL DELAYS IN NORTH BAY CHANNELS DUE TO TIDES, 1980

Vessel Draft (Ft.)	Trips Per Year	Probability of Delay 1/ (percent)	Waiting Time (Average Hours Per Delay)	Total Hours
(1)	(2)	(3)	(4)	(5)
31	17	91.4	11.3	175.6
30	39	82.2	10.2	327.0
29	42	31.3 2/ and 26.5 3/	3.9 and 3.3	51.3 36.7
28	42	25.7 2/ and 15.3 3/	3.2 and 1.9	34.5 12.2
27	26 4/	20.9	2.6	14.1
26	26	13.3	1.6	5.5
25	12	0	0	0
Total Trips	204		Total Delay	657
Adjustment for Delays under Proposed Channel Conditions (35 feet):				
31	17	13.3	-1.6	-3.6
			Net Hours Delay	653

1/ For existing project depth of 30 feet.
2/ First tidal curve depression. (LLW)
3/ Second tidal curve depression. (HLW)
4/ For drafts of 27 feet and less, trips to Fields Landing have been netted out.

TABLE B-13

VESSEL DELAYS IN FIELDS LANDING CHANNEL DUE TO TIDES, 1980

Vessel Draft (Ft.)	Trips Per Year	Probability of Delay [1] (percent)	Waiting Time (Average Hours Per Delay)	Total Hours
(1)	(2)	(3)	(4)	(5)
27	13[4]	91.4	11.3	134.2
26	13	82.2	10.2	109.0
25	6	31.3[2] and 26.5[3]	3.9 and 3.3	7.3 5.3
24	5	25.7[2] and 15.3[3]	3.2 and 1.9	4.1 1.5
23	5	20.9	2.6	2.7
22	5	13.3	1.6	1.1
Total Trips	47		Total Delay	265.2
Adjustment for Delays under Proposed Channel Conditions (30 feet):				
27	13	20.9	-2.6	-7.1
26	13	13.3	-1.6	-2.8
			Net Hours Delay	255.3

1/ For presently authorized project depth of 26 feet.
2/ First tidal curve depression. (LLW)
3/ Second tidal curve depression. (HLW)
4/ For drafts of 27 feet and less, North Bay traffic has been netted out.

TABLE B-14

VESSEL DELAYS DUE TO TIDES, 1980-2030

Year	North Bay Channels (Hours)	Fields Landing Channel (Hours)
1980	653	255
1990	685	322
2000	760	366
2010	802	384
2020	845	392
2030	984	442

B-23. A summary of the benefits resulting from the elimination of vessel time lost awaiting favorable tides in the North Bay Channels and in Fields Landing Channel is given in Table B-15.

TABLE B-15

SUMMARY OF SAVINGS RESULTING FROM THE ELIMINATION OF TIDAL DELAY COSTS

Channel	Year	Average Hourly Vessel Cost [1/]	Hours of Delay [2/]	BENEFIT (Total Cost of Delay) [3/]
North Bay Channels	1980	360	653	$235,100
	1990	372	685	254,800
	2000	384	760	291,800
	2010	396	802	317,600
	2020	408	845	344,800
	2030	427	984	420,200
		Average Annual Benefit		$288,000
Fields Landing Channel	1980	360	255	91,800
	1990	372	322	119,800
	2000	384	366	140,500
	2010	396	384	152,100
	2020	408	392	159,900
	2030	427	442	189,000
		Average Annual Benefit		$132,000

1/ See Table B-11
2/ See Table B-14.
3/ Discounted at 3-1/4% interest, 50-year project life.

B-24. SAVINGS IN TRANSPORTATION COSTS - TOPPING OFF WITH LUMBER AND OTHER FOREST PRODUCTS

Redwood products comprise a very important portion of foreign bound shipments from Humboldt Harbor. In 1974, lumber was only about four percent of the total foreign exports from Humboldt Bay. Moreover, less than one percent of the total cut lumber is transported by ship from Humboldt Harbor. As a result, a large potential exists for transporting additional lumber by ship. Since Humboldt is the closest tidewater port to the tributary redwood production area, the ability to move that commodity economically by waterborne carrier is an important factor in determining the future number of trips from the port. The trend is toward increased use of deep-draft vessels, particularly in foreign trade; therefore, during the next 50 years there should be an appreciable increase in the number of vessels drawing 31 feet of more that will want to call at Humboldt Harbor to top off. Shippers estimate that these larger vessels will be used to export lumber from Humboldt Bay if deeper channels are provided. Much of this lumber is presently transported to San Francisco and southern California by truck and rail.

B-25. If, in the future, channel depths in Humboldt Harbor are insufficient to permit use of the harbor by deeper draft vessels for topping, lumber originating in the Humboldt area will have to be transported to San Francisco Bay ports, the nearest ports deep enough to accommodate these vessels. 1/

B-26. A substantial portion of the lumber produced in the area tributary to Humboldt Harbor is customarily shipped into the San Francisco Bay area by railroad or truck (mainly for trans-shipment within the continental United States). In addition, lesser amounts of lumber are trucked to San Francisco for topping off on deep-draft vessels destined for overseas markets. With the proposed improvements at Humboldt Bay, the lumber which is now trucked to San Francisco for topping off would instead be placed directly on vessels departing from Humboldt Bay. Without the proposed improvements, the tonnage required for topping by deep-draft vessels will be transported to San Francisco Bay ports by truck. The lowest cost for transporting lumber originating in the Humboldt area to San Francisco area ports for loading on deep-draft vessels is equivalent to $13.40 2/ 3/ per ton.

1/ This holds true whether a vessel approaches Humboldt Harbor from the south or from the north. Although a vessel approaching Humboldt from the north would pass the deep-water port of Astoria, Oregon, the cost of transporting redwood products originating in the Humboldt area to Astoria by land carrier is prohibitive. Consideration has been given to the possibility of having such vessels partially load in San Francisco, travel sufficiently light to Humboldt to permit their clearing the existing channel with a deckload of lumber, then return to San Francisco to complete loading. This laternative has been discarded because carriers have advised that under no circumstances would they pursue such a course.

2/ According to lumber industry sources, the gross cost of land transportation to San Francisco is at least $16 per short ton, and the average cost to truck lumber to the Humboldt docks is at least $2.60 per short ton. Thus, the net alternative land cost to San Francisco is $13.40 per short ton.

3/ San Francisco Harbor is the nearest deep water port to Humboldt Bay. This is the net of the cost of trucking lumber to San Francisco.

B-27. Since those vessels which would "top-off" if the channels were deepened would already be calling for other cargoes, channel deepening would result in a full savings of the cost of transporting the lumber to San Francisco Bay port for topping off, except for a minor increase in tidal delays for the departing vessels - which would reduce the net transport savings to $13.28 per ton as shown in Tables 16a and 16b, below. 1/ In addition, based on interviews with major shipping and stevedoring companies involved in Humboldt Harbor, it is considered likely that some vessels will call at Humboldt Harbor specifically for deck-loading. However, since these movements cannot be readily predicted, they have been excluded from the analysis. 2/ 3/

TABLE B-16a

EXTRA VESSEL DELAYS IN NORTH BAY CHANNELS
DUE TO DECK LOADING LUMBER, 1980

Vessel Draft (Ft.)	Trips Per Year	Probability of Delay (percent)	Waiting Time	Total Hours of Delay
34	1	31.3 &	3.9	1.2
		26.5	3.3	0.9
33	2	25.7 &	3.2	1.6
		15.3	1.9	0.6
32	2	20.9	2.6	1.1
31	2	13.3	1.6	0.4
Total Trips	7			
		Total Delay		5.8

1/ Only about 50% of the projected vessels with a draft loading capacity in excess of 30 feet have been used to estimate deck load tonnages that would be loaded directly in Humboldt Bay (see Table B-17, footnote 2) if sufficient channel depths are made available. This is because only about 50 percent of such vessels are of a type or inclination to accept deck cargoes. Further, the probabilities of tidal delays for 31 through 35 foot draft vessels departing Humboldt Bay with a deck load in a 35 foot channel are the same as for 26 through 30 foot draft vessels departing in a 30 foot channel. Table B-17 indicates the estimated number of deck-loaded vessels in excess of 30 feet in draft will be 7 for 1980 (with 30 or 35 foot channels).

2/ Interview with Mr. Leslie M. Westfall, Westfall Stevedoring Company, Eureka, California, 9 February 1976.

3/ Interview with Capt. Ole Kalve, Star Shipping Company, San Francisco, California, 10 February 1976.

A summary of the costs due to extra tidal delays from deck loading is shown below for the years 1980 through 2030 (based on tables such as the above for the years 1990 through 2030).

TABLE B-16b

COSTS OF EXTRA VESSEL DELAYS DUE TO DECK LOADING

Year	North Bay Channels (hours)	Average Hourly Vessel Cost	Total Cost of Delay		Cost Per Ton
1980	5.8	$360	2090	17,500	.12
1990	6.6	372	2460	22,500	.11
2000	7.5	384	2880	25,000	.12
2010	9.6	396	3800	27,500	.14
2020	9.6	408	3920	27,500	.14
2030	10.5	427	4480	27,500	.16
	Average Annual Cost		$2969		$0.12
	Net Transport Savings:		$13.40-0.12 = $13.28/TON		

TABLE B-17

SUMMARY OF SAVINGS ATTRIBUTABLE TO VESSELS[1/]
DECK-LOADING LUMBER IN HUMBOLDT HARBOR

Year	Number of Trips (Vessels Drawing 31 Feet or More)[2/]	Total Deck Load (Tons)	Weighted Average Saving Per Ton	Benefit (Total Savings[5/])
(1)	(2)	(3) (2)x2,500[3/]	(4)	(5) (3)x(4)
1980	7	17,500	$13.28	$232,000
1990	9	22,500	13.28	299,000
2000	10	25,000	13.28	332,000
2010	11	27,500	13.28	365,000
2020	11	27,500	13.28	365,000
2030	13	27,500	13.28	365,000
		Average Annual Benefit =		$316,000

1/ Those drawing 31 feet or more.
2/ See Table B-7. According to local shippers, only about half of the projected vessels (over 30 feet in draft) departing Humboldt Bay are of a suitable design or inclination to accept lumber or log cargoes on deck. Hence, only about 50% of the projected vessel calls have been used to estimate the tonnage and the savings in land transportation cost resulting from a 35-foot channel.
3/ Average deckload per trip = 2,500 tons.
4/ See Tables B-16a and B-16b.
5/ Discounted at 3-1/4% interest.

B-28. SAVINGS OF VESSEL OPERATING COSTS (AT SEA) OCCURRING BECAUSE SHIPPERS HAVE TO BACKTRACK IN ORDER TO FULLY LOAD THEIR VESSELS

A current survey of West Coast shipping operations indicates that about 9 deep-draft vessels per year have to backtrack from Humboldt Bay in order to fully load their vessels before departing for a foreign destination. 1/ 2/ According to shippers, such backtracking occurs because of inadequate channel depths at Humboldt Harbor.

B-29. Backtracking occurs among deep-draft vessels greater than 21,000 tons deadweight which sail between Vancouver, B.C., Coos Bay, Oregon, Humboldt Bay, and overseas. It is estimated that with the present channel depths in Humboldt Bay, about 9 deep-draft vessels a year are unable to fully load with lumber or forest products. As a result of not being fully loaded in Humboldt, these vessels must travel either to Vancouver, B.C. or Coos Bay before heading overseas. These deep-draft vessels normally start from Vancouver and work their way down the coast to Humboldt Bay. The extra travel is called backtracking. For example, if the depth in Humboldt Harbor were adequate, such a vessel could partially load in Vancouver or Coos Bay and complete loading in Humboldt Harbor prior to departing for an overseas destination. Under present conditions, however, a deep-draft vessel drawing 30-34 feet which arrives from B.C. or Coos Bay will have to return to B.C. or Coos Bay in order to fully load before departing for a foreign destination. Such a return trip would be eliminated by having a 35-foot channel in Humboldt Bay.

B-30. Although it would be most efficient to stop at Humboldt Bay first (while unloaded), this is not possible for the vessel trips discussed above (paragraph B-30). According to shippers, vessels generally come from Europe or Japan. Vessels coming from Europe travel through the Panama Canal and up the coast. Some of these vessels carry cargo destined for Vancouver or Coos Bay. Thus, a ship goes past Eureka to its destination and unloads its cargo. Once the cargo is unloaded, the vessel can return to Eureka to partially load and then must backtrack to Vancouver or Coos Bay to be fully loaded. Similarly, a vessel coming from Japan may also want to unload in Vancouver or Coos Bay before traveling south to Eureka. Because of the limited channel depths in Humboldt Bay, such vessels can only partially load there and must travel to another port in order to fully load. Thus, shipping companies must incur additional transportation costs referred to as "backtracking" costs. These would be eliminated with deeper channels at Humboldt Bay.

B-31. With a 35-foot channel depth at Humboldt Bay, existing vessels would no longer have to backtrack either to Coos Bay or Vancouver, B.C. Shippers estimate that this would eliminate about 143 hours of vessel travel at sea per year. Data used to calculate the number of hours is shown in Table B-18.

1/ Interview with Captain Ole Kalve, Operations Manager, Star Shipping (U.S.W.C.) Inc., 235 Montgomery St., San Francisco, Calif.

2/ Interview with Phillip Steinberg, Pacific Merchant Shipping Association, 635 Sacramento St., San Francisco, California.

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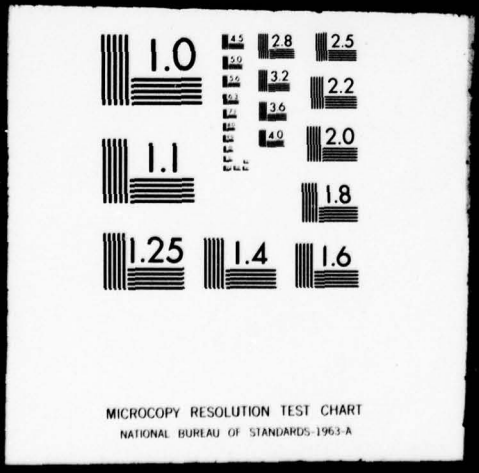

TABLE B-18

LOST VESSEL TIME DUE TO BACKTRACKING

Distance from Humboldt Bay to:[1] (miles)		Average vessel speed
Vancouver, B.C.	Coos Bay	
598	156	16 knots

Sailing time from Humboldt Bay to; (hours at sea)		No. of trips backtracking from Humboldt Bay to:	
Vancouver, B.C.	Coos Bay	Vancouver, B.C.	Coos Bay
37.4	9.8	2	7

Total hours backtracking

(37.4) (2) + (9.8) (7) = 143.4 hours

1/ Distance from sea buoy to sea buoy.

B-32. Shippers indicate that all the vessels involved in backtracking are foreign flag ships over 21,000 tons deadweight. Data from the Office are the Chief of Engineers[1] indicate that the vessel operating cost at sea for such vessels is $650 per hour. Thus, if about 143 additional hours per year are required, the total cost of backtracking amounts to about $93,000 per year. Since this backtracking would be eliminated with a project at Humboldt Bay, $93,000 will be credited as an average annual project benefit.

1/ Office of the Chief of Engineers, Transportation and Coastal Zone Planning Division, updated from 1972 to 1975 using an average weighted increase in vessel cost for this period which was estimated to be 1.53.

B-33. SAVINGS IN TRANSPORTATION COSTS, ELIMINATION OF VESSEL DELAYS DUE TO WAVES IN BAR AND ENTRANCE CHANNEL

The available data for waves offshore of Humboldt Bay were those contained in two reports: "Wave Statistics for Seven Deep-Water Stations Along the California Coast" and "Ten Most Severe Storms," prepared in 1960 for the Corps of Engineers by National Marine Consultants. Although these data are for deep-water conditions, they are considered to be applicable because wave refraction diagrams show wave refraction at the Humboldt Bay Bar and Entrance Channel to be negligible and that conditions associated with deep-water generally prevail.

B-34. In the Pacific Ocean offshore from Humboldt Bay, waves greater than 10 feet in height occur generally in the period from mid-October through mid-April. The average annual frequency distribution of wave heights in deep water near Humboldt Bay is shown in Table B-19 in terms of maximum wave height, H_{max}. The average annual frequency distribution includes waves from the directions south-southeast and south have not been included as waves from these three directions would not affect navigation in the Bar and Entrance Channel.

B-35. By deepening the Bay and Entrance Channel to 45 feet, a certain amount of lost vessel time will be eliminated. It is assumed that vessels in the Bar and Entrance Channel will require a clearance of one-half the wave height in addition to the 5 feet required for squat and trim[1/]. The frequency distribution of maximum wave heights, the required vessel clearances and the resultant vessel delays for traffic in the year 1990 are shown in Table B-19 for the present 40 foot channel and the proposed 45 foot channel. Taking vessel delays for all years from 1980 to 2030 gives an average annual benefit of about $160,000.

1/ One-half of the wave height is 10 feet.

TABLE B-19

AVERAGE ANNUAL FREQUENCY DISTRIBUTION OF H_{max} OFFSHORE OF HUMBOLDT BAY AND THE SAVINGS IN LOST VESSEL TIME ATTRIBUTABLE TO DEEPENING THE BAR AND ENTRANCE CHANNEL

H_{max}	H/2	H/2 + 5	Draft to Clear 2/o Delay	Days/Yr H_{max} Equaled or Exceeded	No. Vessels Per Year of Draft Clearance Subject to Delay		Number Vessels Delayed/ Year
(1)	(2)	(3)	(4)	(5)	(6)		(7)
Present Conditions - 40' Channel + 3' Tide (43') (1990 Traffic)							
10	5	10	33	174	-		
12	6	11	32	126	-		
14	7	12	31	78	21 x 78/365	=	4.49
16	8	13	30	46	38 x 46/365	=	4.79
18	9	14	29	30	41 x 30/365	=	3.37
20	10	15	28	20	44 x 20/365	=	2.41
22	11	16	27	15	43 x 15/365	=	1.77
24	12	17	26	11	39 x 11/365	=	1.18
26	13	18	25	8	18 x 8/365	=	.39
28	14	19	24	6	18 x 6/365	=	.30
30	15	20	23	4	15 x 4/365	=	.16
32	16	21	22	2	11 x 2/365	=	.06
34	17	22	21	0			
				TOTAL			18.92

TABLE B-19 (Cont'd)

AVERAGE ANNUAL FREQUENCY DISTRIBUTION OF H_{max} OFFSHORE OF HUMBOLDT BAY AND THE SAVINGS IN LOST VESSEL TIME ATTRIBUTABLE TO DEEPENING THE BAR AND ENTRANCE CHANNEL

H_{max}	H/2	H/2 + 5	Draft to Clear 2/o Delay	Days/Yr H_{max} Equaled or Exceeded	No. Vessels Per Year of Draft Clearance Subject to Delay		Number Vessels Delayed/ Year
(1)	(2)	(3)	(4)	(5)	(6)		(7)
Proposed Conditions - 45' Channel + 3' Tide (48')							
10	5	10	38	174	-		
12	6	11	37	126	-		
14	7	12	36	78	-		
16	8	13	35	46	-		
18	9	14	34	30	-		
20	10	15	33	20	-		
22	11	16	32	15	-		
24	12	17	31	11	21 x 11/365	=	0.63
26	13	18	30	8	18 x 8/365	=	0.83
28	14	19	29	6	41 x 6/365	=	0.67
30	15	20	28	4	15 x 4/365	=	0.48
32	16	21	27	2	11 x 2/365	=	0.24
34	17	22	26	0			
				TOTAL			2.86

It may be assumed that each vessel so delayed represents a loss of $6,500 in lost vessel time (approximately 24 hours). Annual benefit would then be (18.92 - 2.86) $6,500) (1.53) = $16.06 x $9,950 or, say, $160,000/years (updated from 1972 to 1975 using an average weighted increase in vessel cost for this period estimated to be 1.53).

B-36. SAVINGS IN DAMAGES - PROVISION OF AN ANCHORAGE AREA

One category of benefits which was included in the Project Document but which is not included here as follows: Savings in damages - provision of an anchorage area in the North Bay. The Project Document estimated total benefits of $43,000 annually included $33,000 for reduced vessel operating costs and $10,000 for damage reductions due to lessening of collisions. The $33,000 annual reduction of vessel operating costs was based on the expectation that vessels seeking refuge from storms and those awaiting berths in the harbor would be induced to use the anchorage area, thereby incurring lower operating costs while anchored as compared to waiting costs "at sea." It was estimated that 32 vessels per year would be affected, 12 of which would be seeking refuge and 20 awaiting berths. However, recent information received from local interests is that approximately 15 vessels per year currently anchor in the Bay while waiting for berthing space or for other reasons, and the typical time at anchorage is about two to four hours per occurrence. These vessels can be anchored adequately in the existing navigation channels for the limited period involved. If an anchorage areas were provided, it would not provide any savings in operating costs to these vessels. Moreover, it is now believed that an anchorage area would provide no inducement for vessels seeking refuge from storms since most deep-draft vessels are capable of operation under virtually all experienced storm conditions. Therefore, it is considered that operation cost savings would be negligible or lacking entirely. The $10,000 annual reduction in damages due to lessening of collisions was primarily based on figures derived from a collision in 1963 when a Navy destroyer ran into a Japanese cargo vessel. However, from 1963 to the present, no major damages have been sustained by vessels in Humboldt Harbor. Thus, it is believed that no benefits should be claimed under present conditions since a single occurrence is deemed insufficient to undertake a frequency analysis of damages. Based on the foregoing considerations, it is evident that the anchorage cannot be justified since benefits are now considered to be negligible.

B-37. AREA REDEVELOPMENT BENEFITS (ARA BENEFITS)

A project at Humboldt Bay and Harbor will generate some area redevelopment benefits. Area redevelopment benefits are limited to the evaluation of those benefits associated with the use of labor for project construction and operation that would otherwise be unemployed or underemployed in the absence of the project. However, general consensus is that the area redevelopment impact is minimal and so effort to thoroughly document area redevelopment benefits is not warranted.

B-38. LAND ENHANCEMENT BENEFITS

Certain local interests have suggested that lands on the North Spit, adjacent to the Municipal Airport, including the recommended disposal sites, could be developed for industrial uses. Therefore, possible land enhancement benefits due to filling of the disposal sites have been considered. For an enhancement to be credited, an increment of $6,000 per acre in sale value of the lands would be required to offset the cost for retention works (dikes and drainage structures), which amount to $663,000 for 110 acres. However, it is evident that no increment would be realized since the land is already physically suitable for such development with normal investments for access, grading, utilities, etc. These investment requirements would, in fact, be changed detrimentally by placement of dredge material since the material would be placed on a slope to facilitate drainage and minimize diking costs.

B-39. Investigations also reveal that there are no known plans or prospects for development. The nearby pulp mill has adjacent lands of its own should expansion be required. The immediate proximity to the Municipal Airport, of itself, cannot provide a stimulus to development without major changes in airport usage and facilities, and more remote than the region's principal general aviation airport, Murray Field, which is about two miles northeast of Eureka. Moreover, the possibility of development may be permanently precluded by land use zoning since the general area has been included for reservation as open space under the proposed North Coast Regional Plan of the Califonia Coastal Zone Conservation Commission. Therefore, no enhancement benefits can be claimed.

B-40. A summary of benefits is presented in Table B-20.

TABLE B-20

SUMMARY OF AVERAGE ANNUAL BENEFITS
(Dollars)

Benefit[1/]	Interior Channels: North Bay[2/]	Interior Channels: Fields Landing	Anchorage Area (North Bay)	Bar and Entrance Channel	GRAND TOTAL
Savings in Transportation and Related Costs:					
Elimination of tidal delays	288,000	132,000	-	-	
Topping off with lumber and other forest products	316,000	-	-	-	
Savings of vessel operating costs due to back-tracking at sea	93,000	-	-	-	
Elimination of vessel delays due to waves in bar and entrance channel	-	-	-	160,000	
TOTALS	697,000	132,000	-	160,000	938,000

1/ Discounted at 3-1/4% interest, 50-year project life.
2/ Please note that the authorized project is the North Bay Channel and therefore, only those benefits, $697,000, should be used in comparison of benefits versus cost.

B-41. SENSITIVITY OF BENEFITS TO ALTERNATIVE RATES OF INTEREST

The rate of interest authorized for this project is 3-1/4 percent. This was the rate used in Table B-20. Table B-21 shows the benefits for two other interest rates. The benefits for each rate of interest are arrayed from left to right for each type of benefit. The grand totals reflect the sums of each type of benefit for each rate of interest.

TABLE B-21

SENSITIVITY OF AVERAGE ANNUAL BENEFITS
TO DIFFERENT RATES OF INTEREST
(Benefits in 1,000's of dollars)

RATES OF INTEREST
(The benefits corresponding to these rates of interest are arrayed in sets from left to right)

	Percent											
	3-1/4		5-5/8		6-1/8		6-7/8					
	North Bay				Fields Landing				Bar and Entrance Channel			
Elimination of tidal delays	288	275	273	271	132	126	125	123				
Topping off with lumber and other forest products	316	305	303	300								
Saving of Vessel operating costs due to back tracking	93	93	93	93								
Elimination of vessel delays due to waves in bar and entrance channel									160	155	153	150
TOTALS	697	673	669	664	132	126	125	123	160	155	153	150

B-42. GENERAL ECONOMIC ANALYSIS

As shown in the foregoing tables the respective annual benefits (at 3-1/4%) for improvements of the North Bay channels, Fields Landing Channel, and the Bar and Entrance Channel are currently estimated to be $132,000, and $160,000 respectively. The Fields Landing Channel and the Bar and Entrance Channel were not included in the original project authorization because estimated projects costs exceeded estimated benefits. Present engineering studies indicate that costs for these two features ($165,000 and $213,000 respectively) still exceed the benefits, thus reaffirming the judgment of the preauthorization studies (See Paragraph 5-09). The following incremental analysis concerns the individual elements of the navigation features in the North Bay.

B-43. INCREMENTAL ECONOMIC ANALYSIS - CHANNEL REACHES

Analysis of vessel traffic records for Humboldt Bay shows that 144 vessels with drafts exceeding 27 feet called at the lumber and forest products terminals in the North Bay in 1974. Of the 144 vessel trips, 48 (33 percent) were recorded for three major terminals along the North Bay Channel, 31 (22 percent) for three piers along the Eureka Channel, and 65 (45 percent) for two major terminals along the Samoa Channel.

B-44. In 1975, a new wood chip terminal began operation along the Samoa Channel with a schedule of 20 vessel calls per year. Adjusting the 1974 vessel traffic to reflect the addition of this new terminal would indicate a percentage distribution of current deep-draft vessel traffic of 29 percent for the North Bay Channel, 19 percent for the Eureka Channel and 52 percent for the Samoa Channel. It is believed this percentage distribution is representative of future vessel traffic that would be calling on terminals of each respective channel reach in the North Bay. Therefore, applying these percentages to the total annual project benefits yields annual benefits of $202,000 to the North Bay Channel, $133,000 to the Eureka Channel, and $362,000 to the Samoa Channel.

B-45. The derivation of channel deepening benefits for the Samoa Channel, $362,000 annually, assumed that vessels would be able to operate efficiently in the channel, including the ability to turn around. Currently, vessels using the Samoa Channel are taken to the end of the channel for turning outside the channel limits. Because of unfamiliarity with the depths outside the channel limits, the pilots would not attempt to turn vessels greater than 27 feet draft except at a high tide. According to the pilots, ships with drafts of 27 to 31 feet typically incur an average of two and one-half to three hours of delays waiting for a high tide.

B-46. Shown below are projections of vessel trips for the North Bay for 1980 from Tables B-7 and B-8 for vessels exceeding 27 feet in draft. As previously discussed, about 52 percent of all vessels transiting the North Bay call at terminals along the Samoa Channel. Applying this percentage and average waiting time to the projected vessel traffic for the North Bay yield the total hours of delay for 1980 as shown in Table B-22.

TABLE B-22

ESTIMATED HOURLY DELAYS
FOR VESSELS WAITING TO TURN
AT UPPER END OF SAMOA CHANNEL

Draft	Total Number of Vessel Using the North Bay - 1980	Estimated Number Using Samoa Channel-1980	Waiting Time (Average Hours Per Delay)	Total Hours of Delay
31	17	9	3.0	27
30	39	20	3.0	60
29	42	22	2.5	55
28	42	22	2.5	55
27	39	20		50
TOTAL	179	93		247

B-47. Applying the above methodology to projected vessel traffic for the decades 1990 to 2030 (Tables B-7 and B-8), and using OCE vessel operating cost data from Table B-11 give an average annual equivalent delay cost of $107,000. This is taken as the benefits for providing a turning basin at the upper end of the Samoa Channel. Thus, of the total benefits of $362,000 attributable to the samoa Channel, $255,000 is assigned to channel deepening and $108,000 to the recommended turning basin. Details of delay costs are shown in Table B-23.

TABLE B-23

AVERAGE ANNUAL EQUIVALENT DELAY COST
DUE TO INADEQUATE TURNING BASIN AT
UPPER SAMOA CHANNEL

Year	Average Hours Vessel Cost	Hours of Delay	Total Cost of Delay
1980	$360	247	$ 88,900
1990	372	259	96,300
2000	384	280	107,500
2010	396	294	116,400
2020	408	307	125,300
2030	427	353	150,700
	Average Annual Equivalent (@ 3-1/4%)		$107,000

B-48. INCREMENTAL BENEFITS

Based on the preceding analyses, the total average annual benefits of $697,000 that would result from project modification are allocated to each channel reach as shown in Table B-24.

TABLE B-24

INCREMENTAL BENEFITS BY REACHES

Reach	Average Annual Benefits
North Bay Channel	$202,000
Eureka Channel	133,000
Samoa Channel:	362,000
Channel	(255,000)
Turning Basin	(107,000)
TOTAL	$697,000

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX C

GEOLOGY AND SOILS

U.S. Army Engineer District, San Francisco
Corps of Engineers
211 Main Street
San Francisco, California 94105

DESIGN MEMORANDUM NO. 1

GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX C

GEOLOGY AND SOILS

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APPENDIX C

GEOLOGY AND SOILS

C-1. PURPOSE AND SCOPE

The purpose of this appendix is to present the geology and soils conditions for the proposed improvement of the North Bay, Eureka and Samoa navigation channels in the Humboldt Harbor and Bay. Included are the geology, groundwater conditions of the project area, foundation exploration, testing for pollutants, soils that will be encountered in the proposed channel dredging project, and proposed channel slopes and retaining dikes for the dredged materials.

GEOLOGY

C-2. GENERAL

Humboldt Bay is located some 200 miles northwest of San Francisco along the coastal margin of the northern Coast Ranges geomorphic province of California. South Bay and Arcata Bay, which is connected by a relatively narrow strait, comprise what is collectively known as Humboldt Bay. The bay is a narrow shallow body of water about 12 miles long varying from about 0.5 to 4.0 miles in width.

C-3. TOPOGRAPHY

The topography of the bay is relatively flat and characterized by Humboldt Bay, tidal flats, and slightly elevated flat or gently rolling terraces. A northeast trending sand spit, several thousand

feet wide, separates the bay from the Pacific Ocean. The spit has a well developed sand beach along its entire length. Humboldt Bay is bordered on the south by Table Bluff ridge and on the north and east by rugged mountains. Freshwater and Jacoby Creeks discharge into Arcata Bay on the north and Elk River and Salmon Creek discharge into the central portion of Humboldt Bay and into South Bay, respectively. These streams and their corresponding sloughs are tidal from one to two miles inland from their mouths. The flood plains are uniformly level marshland and mudflats. There are many smaller tidal sloughs at the north end of the bay near Arcata. The Mad River slough is an abandoned mouth of the Mad River extending inland for about three miles. The present mouth of the Mad River is located approximately five miles north of Humboldt Bay.

C-4. GEOLOGY

a. Until late Pleistocene time, the area occupied by Humboldt Bay consisted of coalescing flood plains of the Mad River, Freshwater Creek and Jacoby Creek on the north, and Elk River and Salmon Creek on the south. Subsequently, the recession of the continental glaciers, along with subtle crustal adjustments, caused a substantial rise in sea level and the gradual inundation of the lower portions of the coalescing flood plains. Shoreline bars then developed along the coast of the drowned valleys to form the present seaward margin of Humboldt Bay. These northeast trending, long-shore drift controlled sand spits separate Humboldt Bay, along its entire length, from the Pacific Ocean and are almost continuous except for a narrow bay entrance located near the central portions of the bay.

b. Miocene to Pleistocene age sediments exposed in the hills adjacent to Humboldt Bay form a series of northwest trending folds that plunge westward beneath the bay area. Late Pleistocene to recent alluvial and deltaic sediments have accumulated to cover and fill the drowned portions of the folds and troughs. These sediments underlie the present water of the bay and adjoining tidal areas, marshlands and deltas at the mouths of tributary streams. The sediments are composed of mixtures of loose, unconsolidated sands, silts, and clays, with some gravel layers. The total thickness of these beds below the waters of the bay is unknown; however, water well logs of borings in areas adjacent to main channels indicate that the thickness is approximately 130 feet in the South Bay and the narrow central portion of Humboldt Bay, and exceeds 375 feet along the eastern shoreline of Arcata Bay.

c. Surface sediments within the main tidal channels are predominantly fine grained sand containing shells and some gravel. Exceptions to this include the Eureka Inner Channel and the extreme northern portion of the Samoa Channel were the bay bottom sediments are comprised of silts and organic clays. The tidal flats consist mostly of mixtures of clays and silts while the salt marsh areas contain organic silty clays and peat-like deposits.

d. Humboldt Bay is situated between the Freshwater fault on the north and east, and the Little Salmon - Table Bluff faults to the south. Two faults, that are considered as possible branches or continuations of the Little Salmon Fault, pass under the bay near the bay entrance and the south end of the North Spit. Recent studies indicate that at least some portions of these faults may have undergone movement within the past two million years; however, no evidence of recent surface displacement

has been discovered (See Plate C-5, Geology and Plate C-6, Humboldt Bay Cross-Section).

C-5. GROUNDWATER

a. Groundwater bodies in the Humboldt Bay region occur principally within the recent alluvium and dune sand deposits, unconsolidated Pleistocene terrace deposits, and the poorly consolidated Pleistocene Hookton and Plio-Pleistocene Carlotta formations. The primary aquifers around the immediate periphery of the bay consist of alluvial deposits, the Hookton and Carlotta formations, and the dune sands that form the western shoreline of the bay.

b. The thickness of the alluvial deposits varies from 130 feet to over 375 with fresh water produced mainly from various horizons at shallow depths of less than 70 feet below the ground surface. The Hookton and Carlotta formations produce water both by artesian flow and from various depths to over 600 feet.

c. In the north barrier spit (Samoa Peninsula) bodies of fresh water float on salt water as a result of the lower specific gravity of the fresh water. Fresh water has been produced from near the surface to depths of over 70 feet. No fresh water has been discovered to date in the south barrier spit. The total thickness of the dune sand comprising the spits is unknown, but is thought to be in excess of 100 feet.

d. Groundwater recharge of the alluvial deposits and the Hookton and Carlotta formations results mainly from deep percolation of rainfall along with seepage from adjacent streams and rivers; however, recharge of the fresh water bodies within the coastal dune sand is almost entirely from deep percolation of rainfall.

e. Saltwater encroachment has occurred in portions of alluvial deposits north of Arcata Bay along areas adjacent to the Mad River Slough and within surficial deposits along the tidal reach of streams flowing into the bay. Groundwater in the alluvium terrace deposits, and Hookton and Carlotta formations is predominantly calcium magnesium bicarbonate type water. However, as a result mostly of the diffusion of saltwater across the interface between the fresh water and saltwater and by percolation of precipitation over dissolved salts deposited by ocean spray, the water in the north spit is of the sodium chloride type. Under existing conditions, the sands of the north spit are open to intrusion by saline water on both the seaward and bay sides.

f. No new avenues for saltwater intrusion into fresh water aquifers will be exposed as a result of the proposed dredging in Humboldt Bay. However, the placement of sediments dredged from the bay onto the North Spit disposal areas will affect underlying fresh water aquifers in several ways. These include the changing of the configuration of natural catchment basins, altering the thickness as well as the type material through which recharge waters percolate, and introducing large volumes of highly saline water to the disposal area through hydraulic emplacement procedures with the possibility of infiltration of significant amounts of these waters into the underlying groundwater bodies.

C-6. SEISMICITY

a. Humboldt Bay is located near one of the most seismically active regions in California. The majority of the earthquakes occur on active faults in the ocean floor off the coast of Cape Mendocino and extending seaward along the Gorda Escarpment in an area about

50-80 miles southwest of Eureka (See Plate C-4, Earthquake Epicenters). A branch of the active San Andreas Fault Zone extends onland at Shelter Cove some 50 miles southwest of Eureka while the main fault zone swings northwestward to intersect the Mendocino Fault Zone. The Freshwater Fault located south of Arcata and projected beneath Arcata Bay is considered active by some, postulated on the assumption that it may have been the source of a 1954 magnitude 6.5 earthquake. Clusters of epicenters suggest that other faults in the area may be active at depth.

b. Statistically, this region experiences three or four magnitudes 4.0-4.9 events per year; one magnitude 5.0-5.9 event per year; one magnitude 6.0-6.9 event every 5 years and one major event greater than magnitude 7.0 every 28 years (Reference 16).

c. Since Humboldt Bay is within a seismically active region, it can be expected that this area may be subjected periodically to shocks of varying intensity as a result of continued seismic activity originating from the San Andreas Fault Zone and the offcoast Cape Mendocino area.

C-7. LIQUEFACTION POTENTIAL

Liquefaction potential is generally associated with cohesionless unconsolidated, saturated, fine grained sandy sediments. The logs of borings show bay bottom sediments within the project reach consist predominantly of fine grained sands with some areas of silt and clay. The sands and silts may experience liquefaction as a result of ground motions originating from earthquakes in the region. Liquefaction of these sediments could result in subaqeous landslides along

channels and/or varying degrees of differential settlement in adjacent bay bottom areas.

C-8. TSUNAMI POTENTIAL

Tsunamis are sea waves generated principally by seismic disturbances. Historically, the tsunamis that have reached the California coast originated as a result of distant earthquakes. California earthquakes have not produced any recorded tsunamis. The most recent tsunamis to strike the northern California coast occurred in the years 1960 and 1964. Moderate to severe damage with loss of life occurred at Crescent City to the north while Humboldt Bay incurred little or no damage as a result of the seismically induced waves. Inundation of lowlying peripheral areas of the bay did not occur during either tsunami: however, potentially damaging, strong currents resulted from the rapid changes in the water level within the bay. Recurrence of a similar tsunamis could induce strong currents which might change the configuration of channel slopes and contribute sediment to the channel bottom. The possibility of recurrence of a tsunami striking Humboldt Bay does exist; however, it is improbable that extensive damage or run-up would occur in the bay as a result of a tsunami.

SOILS

C-9. SUBSURFACE EXPLORATION

Exploration of the Humboldt Bay bottom in the project area was conducted during June and July of 1974 and also in May 1975. A total of 34 exporation holes were made. The exploration holes were made in the project area and in the adjacent areas. Holes in the vicinity

of the project area were made to study the effect of possible movement of sediments in the bay. The depth of holes varied from 1 to 23 feet below the existing bay bottom. Samples were taken from exploration holes for soils identification and testing for pollutants. The samples were 2-1/8-inch diameter in size and were taken in plastic liners located inside the push tube sampler. In some exploration holes blow counts to drive the 2-1/2-inch diameter sampler were recorded. Locations of exploration holes are shown on Plate C-1. Logs of exploration holes are shown on Plates C-2 and C-3. Locations of pollutant test samples are shown on the logs of exploration holes.

C-10. LABORATORY TESTING FOR POLLUTANTS

Soil and water samples from exploration holes were taken to the laboratories for chemical analysis for pollutants, sieve analysis and water content determination. Laboratory tests performed are presented in subparagraphs a, b, c and d.

a. Sieve Analyses. The analyses were run according to Engineering Manual, EM-1110-2-1906, "Laboratory Soils Testing," 30 May 1970. Gradation curves of typical soils in North Bay, Eureka and Samoa Channels are shown Figures C-1, C-2, and C-3, respectively. Results of sieve analysis are shown on Figures C-4 and C-5 and Tables C-6 through C-8, Plates C-2 and C-3.

b. Bulk Sediment Analysis. Tests for mercury, cadmium, lead, zinc, and oil and grease were run according to "Preliminary Sampling and Analytical Procedures for Evaluating the Disposal of Dredged Materials," Laboratory Support Branch, Environmental Protection Agency, Region IX, April 1974. Results of bulk sediment analysis are shown on Tables C-1 and C-2.

c. Standard Elutriate Test. The test was run according to 40 CFR, Part 230, "Discharge of Dredge or Fill Material in Navigable Waters," Environmental Protection Agency. The mercury, copper, cadmium, lead, zinc, and oil and grease were run according to methods for "Chemical Analysis of Water and Wastes," Environmental Protection Agency, National Environmental Research Center, Analytical Control Laboratory, Cincinnati, Ohio. Results of standard elutriate tests are shown on Tables C-3, C-4 and C-5.

d. Water Content. Water content was determined for six samples. The results of water content tests are shown on Figures C-4 and C-5, and logs of exploration holes, Plate C-3.

e. Conclusions. All samples in the bulk sediment analysis and all but four samples in the standard elutriate tests are within the maximum limits set by the Environmental Protection Agency, Region IX, for marine (shallow) and estuarine water disposal and 40 CFR, Part 230, Section 230.4.3. The four samples exceeding the pollution criteria, located all outside the authorized improvement, are marked by an asterisk and are shown on Table C-4.

C-11. SUBSURFACE CONDITIONS

a. Channels Bottom. Logs of exploration holes indicate the following channel bottom conditions for the proposed channel deepening project:

(1) North Bay Channel. The soils below the channel bottom consist of loose to dense sands with an occasional trace of silt, fine gravel and shell fragments.

(2) Eureka Channel. For most of the channel except in the north end, the channel bottom soils consist of loose to dense sands

with an occasional trace of silt, fine gravel and some shell fragments. In the north end of channel the bottom is underlain by soft clay.

(3) Samoa Channel. In the south end, the channel bottom is underlain by loose to dense sands with an occasional trace of silt, fine gravel and some shell fragments. Along the middle reach of the channel the bottom is underlain by silty sand containing shell fragments. In the north end of the channel the bottom is underlain by firm clay with shell fragments.

The above materials can be easily dredged and no dredging problems are anticipated.

b. Dredge Disposal Areas. The dredged material will be disposed of on the North Spit, covered mostly by sand dunes made of fine to medium grained sand with some silt.

C-12. CHANNEL SLOPES

The channel slopes will be dredged to 1V on 2 H. Experience from maintenance dredging in the Humboldt Bay indicates that, except for minor sloughing, these slopes will be stable. A typical section of the proposed channel is shown on Plate 4 of the Main Report.

C-13. RETAINING DIKES FOR THE DREDGED MATERIALS

The retaining dikes will be constructed from the existing soils in the dredge disposal areas and from the dredged soils. These soils consist mostly of fine to medium grained sands with some silt. The retaining dikes will have a 12-foot crest, 1V on 2H inside slope and 1V on 3.5H outside slope. The height of the dikes will vary from 2 to 20 feet. The dikes will have a one-foot freeboard. A typical section of the proposed retaining dikes is shown on Plate 9 of the Main Report.

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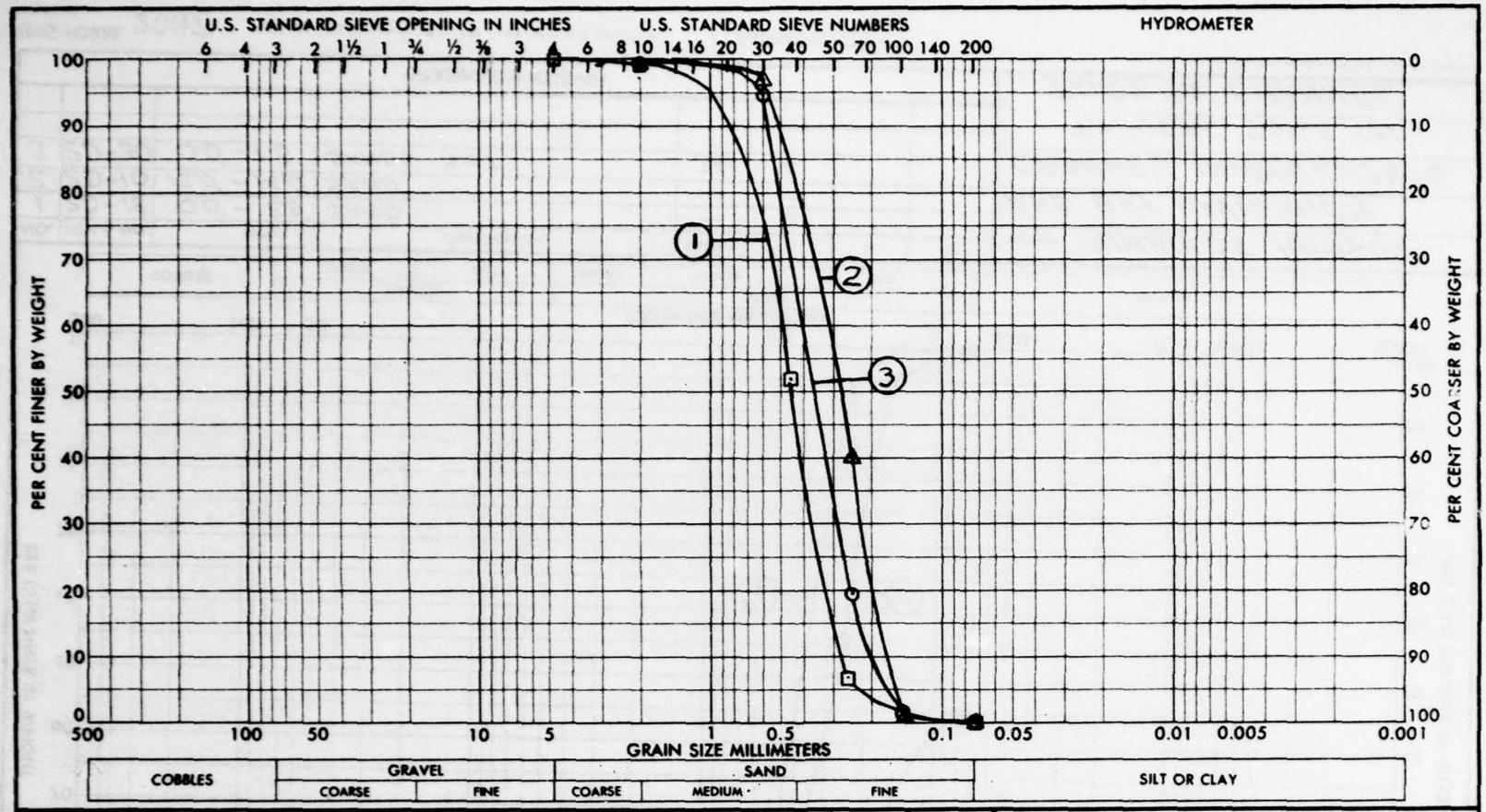

NO.	HOLE NO.	DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
1	2D-34	0.0'-1.5'	SAND	21			
2	2D-22	0.0'-2.5'	SAND	—			
3	2D-17	0.0'-2.5'	SAND	—			

GRADATION CURVES

PROJECT HUMBOLDT HARBOR AND BAY NAVIGATION CHANNEL IMPROVEMENTS TYPICAL SOILS IN NORTH BAY CHANNEL

FIGURE C-1

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE. (TRANSLUCENT)

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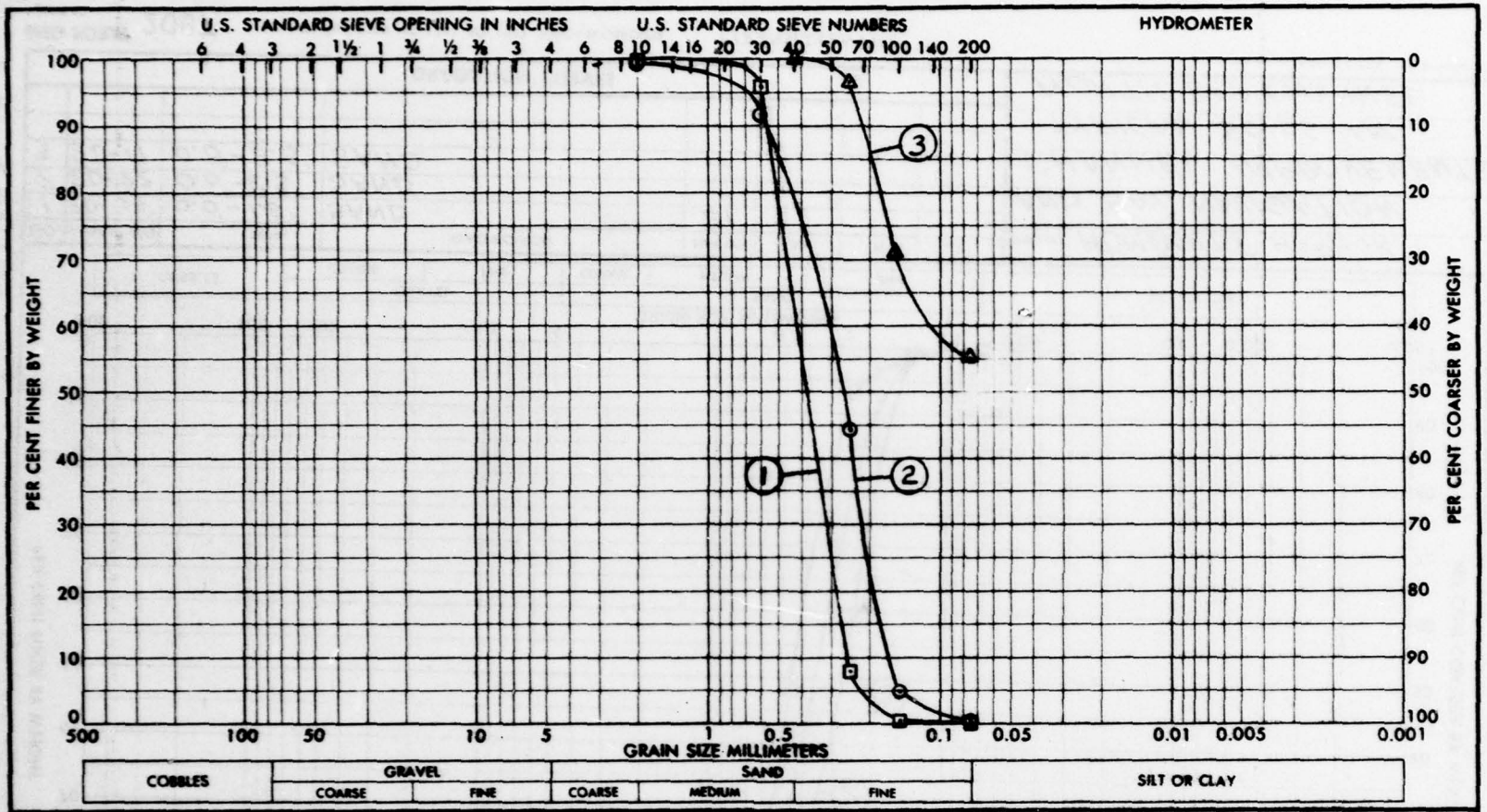


NO.	HOLE NO.	DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
1	2D-18	0.0' - 2.5'	SAND	—	□		
2	2D-10	13.0' - 14.0'	SAND	—	○		
3	2D-30	0.0' - 1.5'	SANDY SILT	36	△		

GRADATION CURVES

PROJECT HUMBOLDT HARBOR AND BAY NAVIGATION CHANNEL IMPROVEMENTS

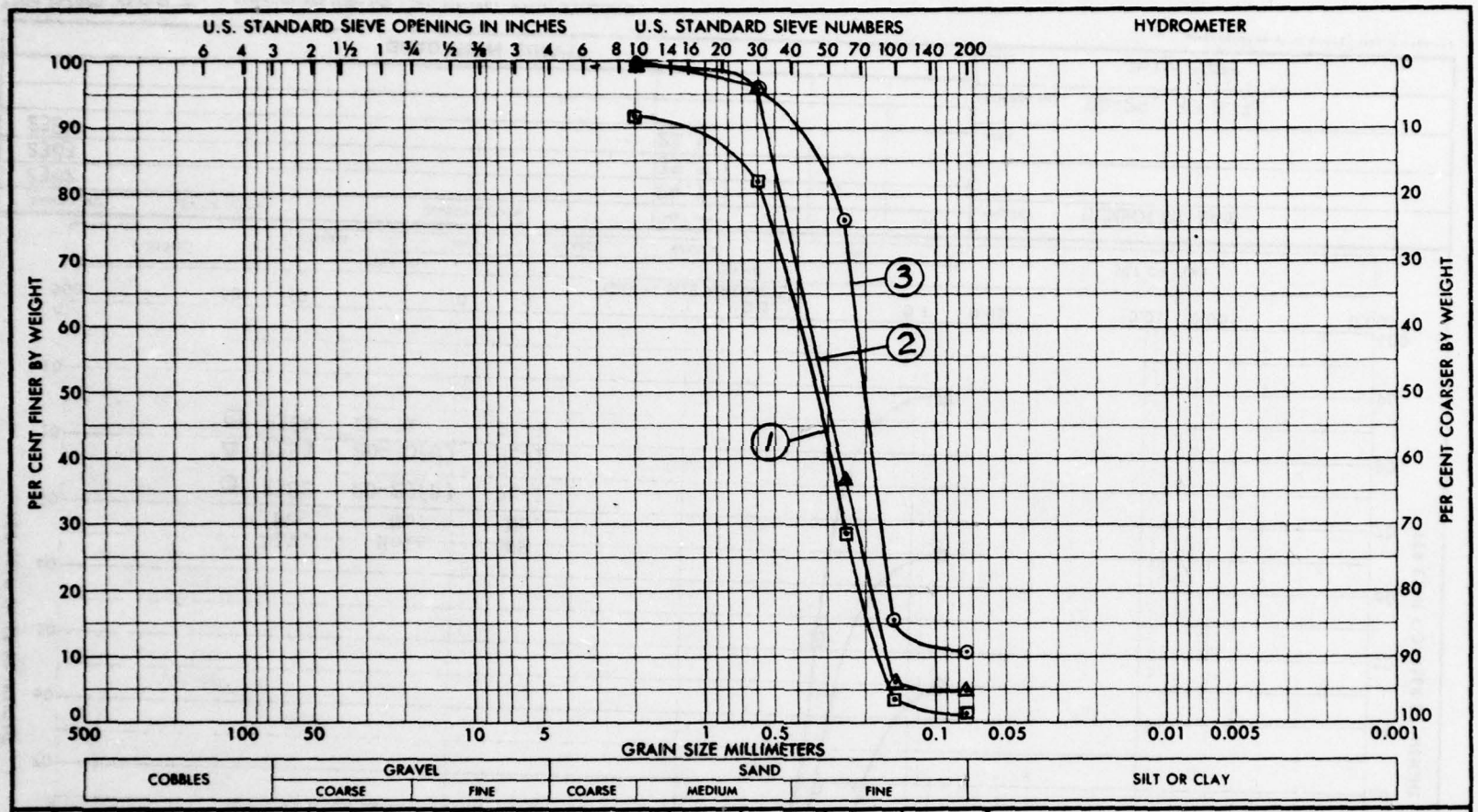
TYPICAL SOILS IN EUREKA CHANNEL

FIGURE C-2

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE. (TRANSLUCENT)

U.S. GOVERNMENT PRINTING OFFICE 1963 OF—709-126



NO.	HOLE NO.	DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
1	2D-9	0.0'-2.5'	SAND				
2	2D-8	0.0'-2.5'	SAND				
3	2D-7	0.0'-2.5'	SAND				

GRADATION CURVES

PROJECT HUMBOLDT HARBOR AND BAY NAVIGATION CHANNEL IMPROVEMENTS

TYPICAL SOILS IN SAMOA CHANNEL

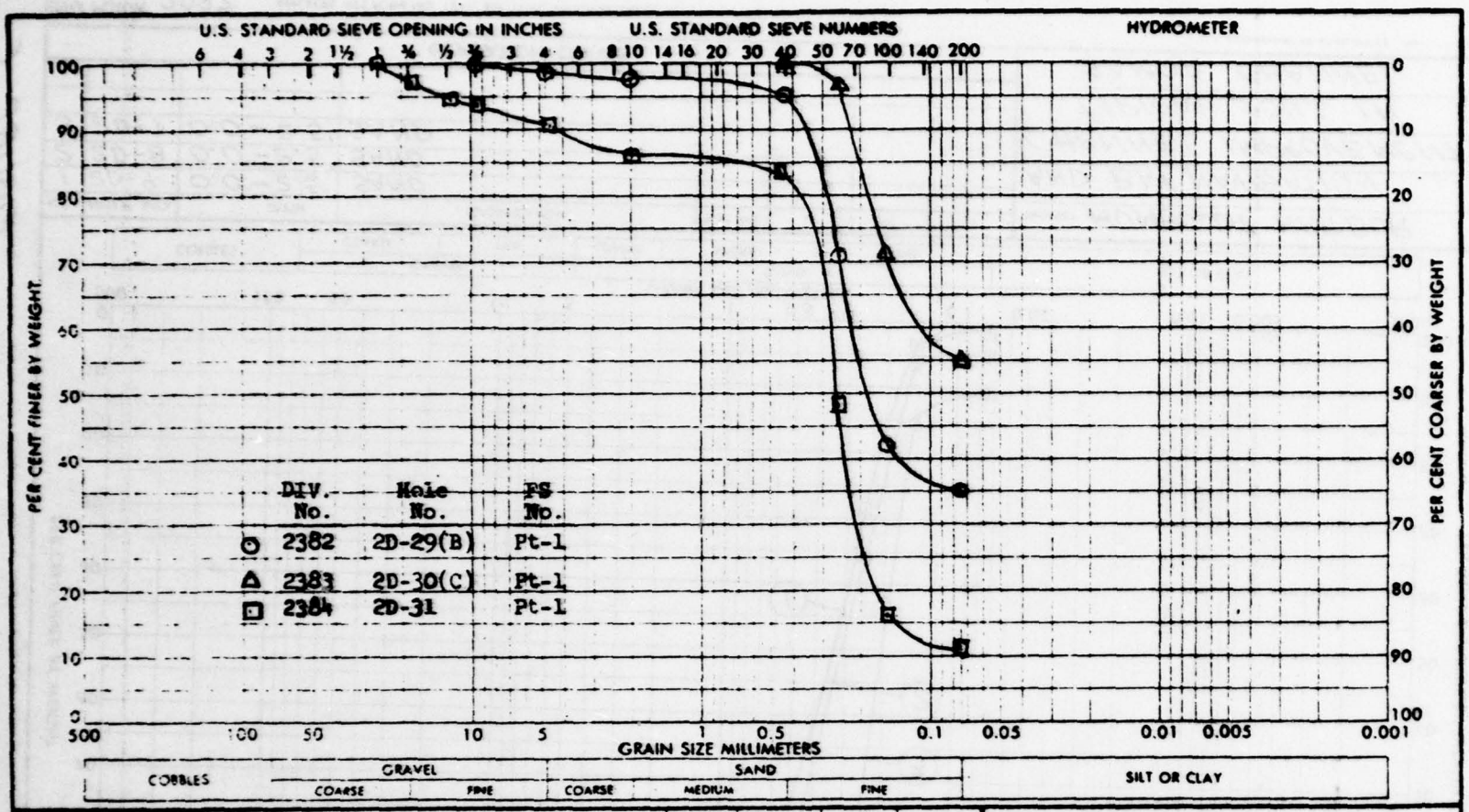
FIGURE C-3

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO. 1241, SEP 1962, WHICH IS OBSOLETE.

(TRANSLUCENT)

U.S. GOVERNMENT PRINTING OFFICE 1963 [illegible]—709-126



SAMPLE NO	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
2382			24.7			
2383			35.5			
2384			21.4			

GRADATION CURVES

PROJECT HUMBOLDT BAY

AREA

BORING NO 2D-29, 30 & 31

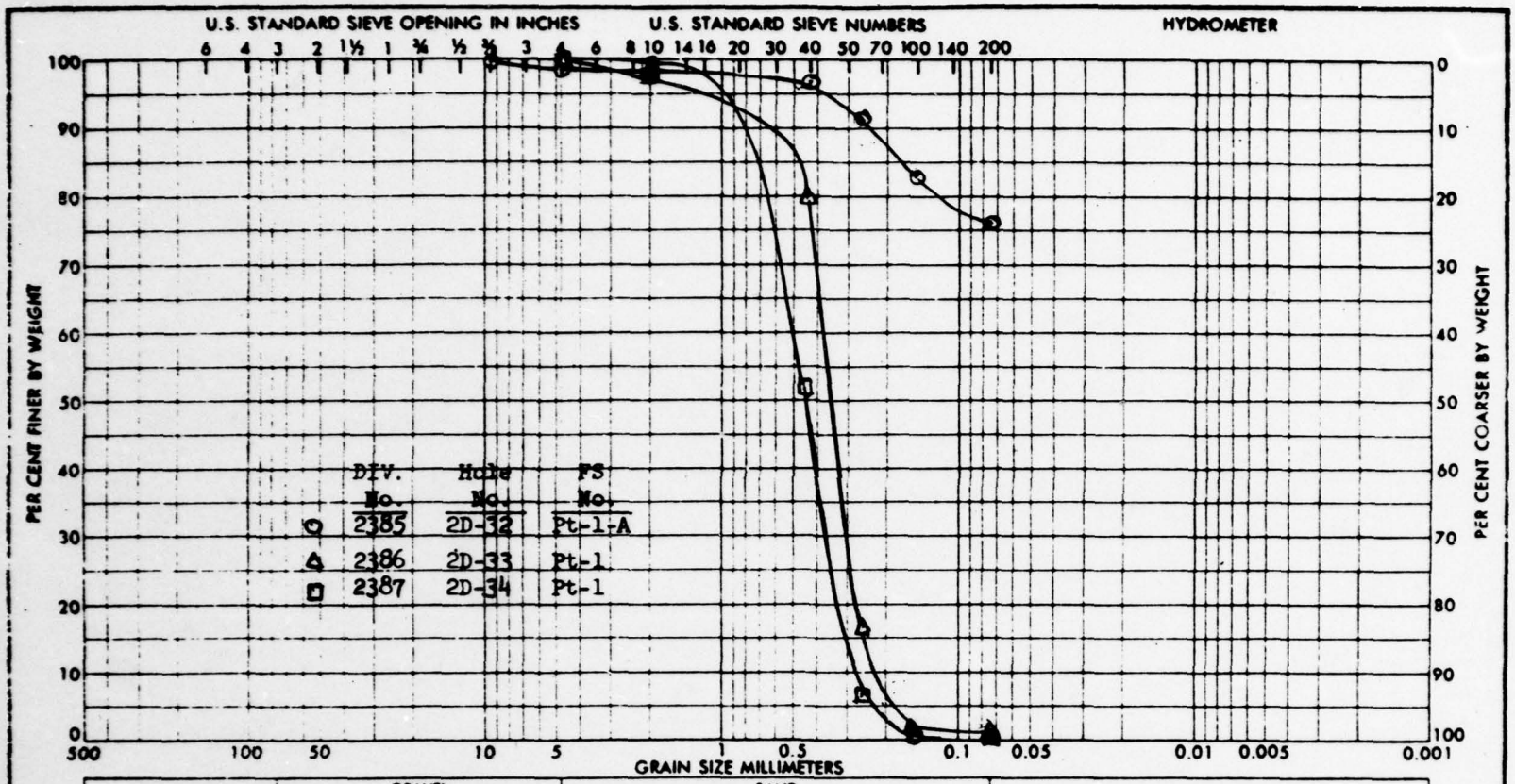
DATE July 1975

FIGURE C-4

ENG FORM 2087 REPLACES WES FORM NO 1241, SEP 1962, WHICH IS OBSOLETE

MAY 63

U S GOVERNMENT PRINTING OFFICE 1963 O-709-126



SAMPLE NO	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI
2385			42.9			
2386			22.9			
2387			21.0			

GRADATION CURVES

PROJECT: HUMBOLDT BAY

AREA:

BORING NO: 2D-32, 33 & 34

DATE: July 1975

FIGURE C-5

ENG FORM 2087
1 MAY 63

REPLACES WES FORM NO 1241, SEP 1962, WHICH IS OBSOLETE

U S GOVERNMENT PRINTING OFFICE 1963 O-700-124

TABLE C-1

HUMBOLDT HARBOR AND BAY
BULK SEDIMENT ANALYSIS

August 21, 1974
Results on samples received from the U.S. Army Corps of Engineers Project: Humboldt

SAMPLE #	OIL & GREASE (mg/kg dry)	CADMIUM (mg/kg dry)	LEAD (mg/kg dry)	ZINC (mg/kg dry)	MERCURY (mg/kg dry)
2D-1 PT-1	1000	.4	8.8	76	.1
2D-1 PT-2	750	.2	12	80	.7
2D-1 PT-3	730	.2	10	77	.9
2D-1 PT-4	570	.2	6.2	62	.1
2D-2 PT-1	710	.2	14	99	.2
2D-2 PT-2	810	.2	12	88	.3
2D-2 PT-3	740	.2	14	91	.1
2D-3 PT-1	1400	.2	13	80	.3
2D-3 PT-2	660	.2	14	82	.1
2D-5 PT-1	880	.1	8.0	81	.2
2D-5 PT-2	810	.2	12	74	.4
2D-6 PT-1	190	.1	8.9	38	.2
2D-9 PT-2	230	.1	8.0	45	.2
2D-11 PT-1	750	.2	8.9	77	.2
2D-11 PT-2	180	.2	8.4	62	.2
2D-12 PT-1	450	.2	8.9	80	.2
2D-12 PT-2	360	.2	7.6	55	.3
2D-13 PT-1	350	.2	6.2	55	.3
2D-13 PT-2	610	.2	6.2	51	.1
2D-15 PT-1	370	.3	8.0	77	.1
2D-20 PT-1	860	.3	8.9	55	.3

TABLE C-2

HUMBOLDT HARBOR AND BAY
BULK SEDIMENT ANALYSIS

CORPS OF ENGINEERS - SAN FRANCISCO DISTRICT
CHEMICAL TESTS OF SAMPLES

NAME & ADDRESS
OF LABORATORY: SOUTH PACIFIC DIVISION
P.O. Box 37, Sausalito, CA 94965
UNIT OF MEASUREMENT: parts per million of dry weight

PROJECT TITLE: HUMBOLDT BAY
DATE OF SAMPLE: 22-24 May 1975
TYPE OF TEST (Bulk Sediment Analysis or Standard Elutriate): Bulk sediment Analysis

SAMPLE NO.	SAMPLE DEPTH	MERCURY	CADMIUM	LEAD	ZINC	OIL & GREASE
2D-29(B)	33.0 - 34.5	0.3	0.2	4	56	112
2D-30(C)	35.5 - 37.0	0.2	0.3	5	65	238
2D-31(D)	42.0 - 43.5	0.2	0.3	4	35	32
2D-32(A)	32.5 - 34.0	0.2	0.3	4	56	47
2D-33(F)	40.0 - 40.8	0.1	0.1	4	39	133
2D-34(H)	50.0 - 51.5	0.1	0.2	4	34	18
E.P.A. Max. Limits for Marine (shallow) and Estuarine Water		1.5	3.0	180	300	4,000

TABLE C-3

HUMBOLDT HARBOR AND BAY
STANDARD ELUTRIATE TEST

August 21, 1974
Results on samples received from the U.S. Army Corps of Engineers

Project: Humboldt

SAMPLE #	IOD mg/l	SAMPLE #	IOD mg/l	SAMPLE #	IOD mg/l
2D-4 PT-1	24	2D-17 PT-1	17	2D-27 PT-1	7.2
2D-4 PT-2	16	2D-17 PT-2	4.8	2D-27 PT-2	7.2
2D-4 PT-3	10	2D-18 PT-1	0	2D-27 PT-3	8.8
2D-4 PT-4	2.3	2D-19 PT-1	35	2D-27 PT-4	11
2D-4 PT-5	5.2	2D-21 PT-1	25	2D-27 PT-5	13
2D-4 PT-6	3.6	2D-21 PT-2	21	2D-27 PT-6	11
2D-4 PT-7	6.2	2D-21 PT-3	13	2D-27 PT-7	5.4
2D-4 PT-8	10	2D-21 PT-4	6.4	2D-27 PT-8	7.2
2D-4 PT-9	9.2	2D-22 PT-1	9.6	2D-28 PT-1	6.8
2D-7 PT-1	110	2D-23 PT-1	0	2D-28 PT-2	8.2
2D-8 PT-1	8.8	2D-24 PT-1	0	2D-28 PT-3	1.2
2D-8 PT-2	120	2D-24 PT-2	10	2D-28 PT-4	11
2D-9 PT-1	37	2D-24 PT-3	5.6	2D-28 PT-5	7.2
2D-10 PT-1	31	2D-24 PT-4	20	2D-28 PT-6	7.2
2D-10 PT-2	19	2D-24 PT-5	25		
2D-10 PT-3	38	2D-25 PT-1	0		
2D-10 PT-4	16	2D-25 PT-2	33		
2D-10 PT-5	46	2D-25 PT-3	11		
2D-10 PT-6	21	2D-25 PT-4	11		
2D-14 PT-1	17	2D-26 PT-1	1.2		
2D-14 PT-2	57	2D-26 PT-2	4.2		
2D-14 PT-3	49	2D-26 PT-3	15		
2D-16 PT-1	3.6	2D-26 PT-4	10		

TABLE C-4

HUMBOLDT HARBOR AND BAY
STANDARD ELUTRIATE TEST

August 21, 1974
Results on samples received from the U.S. Army Corps of Engineers

Project: Humboldt

SAMPLE #	IOD mg/l	BOD mg/l	SUSPENDED SOLIDS mg/l	TOTAL PHOSPHOROUS mg/l	NITRATE NITROGEN mg/l	KJELDAHL NITROGEN mg/l	ORGANO HALOGENS ug/l
2D-1 PT-1	> 187	6.4	98	.02	.13	9.6	.02
2D-1 PT-2	> 187	6.7	69	.03	.11	7.2	.06
2D-1 PT-3	> 187	4.6	160	.02	.08	11. *	.01
2D-1 PT-4	175	1.9	56	.03	.04	12. *	.02
2D-2 PT-1	> 187	1.6	98	.06	.14	6.3	.01
2D-2 PT-2	> 187	8.0	51	.05	.19	8.7	.01
2D-2 PT-3	> 187	3.0	51	.04	.12	13. *	.01
2D-3 PT-1	130	5.0	57	.04	.13	8.2	.04
2D-3 PT-2	> 187	4.4	42	.04	.20	7.8	.04
2D-5 PT-1	> 187	3.0	81	.03	.14	4.3	.02
2D-5 PT-2	180	4.9	52	.03	.03	9.6	.03
2D-6 PT-1	89	1.1	40	.01	.08	.36	< .01
2D-9 PT-2	77	1.0	350	.02	.02	1.1	.02
2D-11 PT-1	160	3.8	250	.01	.34	5.1	.02
2D-11 PT-2	120	1.7	460 *	.05	.16	5.9	.02
2D-12 PT-1	> 170	2.9	340	.06	.02	2.2	.03
2D-12 PT-2	110	1.5	320	.07	.10	6.2	.04
2D-13 PT-1	> 170	1.2	330	.03	.08	2.8	.03
2D-13 PT-2	> 170	1.0	280	.01	.04	4.3	.02
2D-15 PT-1	97	2.0	240	.4	.03	3.2	.01
2D-20 PT-1	120	11.	290	.01	.05	2.8	.02
Receiving Water		2.9	35	.05	.07	.10	< .01

* EXCEEDS POLLUTION CRITERIA

TABLE C-5

HUMBOLDT HARBOR AND BAY
STANDARD ELUTRIATE TEST

NAME & ADDRESS
OF LABORATORY: SOUTH PACIFIC DIVISION
P.O. Box 37, Sausalito, CA 94965
UNIT OF MEASUREMENT: mg/l
All elutriate results are times a dilution factor of 10

PROJECT TITLE HUMBOLDT BAY
DATE OF SAMPLE: 22 - 24 May 1975
TYPE OF TEST (Bulk Sediment Analysis or Standard Elutriate): Standard Elutriate

SAMPLE NO.	SAMPLE DEPTH	COPPER	MERCURY	CADMIUM	LEAD	ZINC	OIL & GREASE
Disposal site water		0.01-	0.0007	0.009	0.020	0.080	6.4
2D-29(B)	33.0 - 34.5	0.001-	0.00001-	0.0001-	0.001-	0.002	0.34
2D-30(C)	35.5 - 37.0	0.001	0.00006	0.0001-	0.001-	0.002	0.32
2D-31(D)	42.0 - 43.5	0.001-	0.00004	0.0001-	0.001-	0.004	4.80
2D-32(A)	32.5 - 34.0	0.001-	0.00005	0.0001-	0.001-	0.003	0.68
2D-33(F)	40.0 - 40.8	0.001-	0.00005	0.0001-	0.001-	0.001	0.42
2D-34(H)	50.0 - 51.5	0.001-	0.00005	0.0001-	0.001-	0.001	0.48

TABLE C-6

HUMBOLDT HARBOR AND BAY
SIEVE ANALYSIS

August 21, 1974
Results on samples received from the U.S. Army Corps of Engineers

Project: Humboldt

SCREEN ANALYSIS HUMBOLDT HARBOR AND BAY

	2D-4 PT-1	2D-4 PT-2	2D-4 PT-3	2D-4 PT-4	2D-4 PT-5	2D-4 PT-6	2D-4 PT-7	2D-4 PT-8
+ 3/8	2.6	0	1.9	0	0	(A) 0 (B) 0	0	0
+ 10	36.7	2.2	6.4	2.3	.5	.4 .7	.7	0
+ 30	12.7	4.7	3.7	2.6	2.0	3.8 1.3	2.3	.7
+ 60	25.4	64.8	61.1	51.9	63.1	68.4 46.9	67.7	54.4
+ 100	11.5	26.9	25.6	41.5	34.1	27.2 50.4	28.9	44.0
+ 200	1.4	1.0	.9	1.3	.2	.2 .6	.3	.8
- 200	9.7	.4	.4	.4	.1	0 .1	.1	.1

	2D-4 PT-9	2D-7 PT-1	2D-8 PT-1	2D-8 PT-2	2D-9 PT-1	2D-10 PT-1 (Top)	2D-10 PT-1 (Bottom)	2D-10 PT-2	2D-10 PT-3
+ 3/8	0	0	0	1.7	0	0	19.8	4.6	0
+ 10	.5	.4	1.6	1.9	8.1	6.7	12.8	6.6	.9
+ 30	2.1	4.3	2.9	6.4	10.3	21.1	8.1	11.4	3.4
+ 60	51.5	19.6	59.0	26.1	53.0	46.8	29.8	28.9	42.5
+ 100	45.1	60.4	30.4	39.8	25.1	19.1	25.0	40.4	48.7
+ 200	.5	4.9	1.1	8.2	1.8	3.6	2.1	4.4	4.0
- 200	.2	10.4	5.0	15.9	1.7	2.7	2.4	3.7	.5

	2D-10 PT-4	2D-10 PT-5	2D-10 PT-6	2D-14 PT-1	2D-14 PT-2	2D-14 PT-3	2D-16 PT-1	2D-17 PT-1
+ 3/8	0	0	0	0	4.3	.6	0	0
+ 10	.8	2.0	1.2	.9	10.2	10.3	.3	.7
+ 30	16.9	23.1	6.9	2.1	7.0	6.7	2.7	4.8
+ 60	62.5	46.5	47.3	51.1	43.6	18.8	80.2	74.9
+ 100	19.3	27.6	39.6	40.6	26.6	48.8	16.3	18.5
+ 200	.4	.6	4.6	3.2	3.4	7.8	.3	1.0
- 200	.1	.2	.5	2.1	4.9	7.0	.2	.1

TABLE C-7

HUMBOLDT HARBOR AND BAY
SIEVE ANALYSIS

August 21, 1974
Results on samples received from the U.S. Army Corps of Engineers Project: Humboldt

SCREEN ANALYSIS HUMBOLDT HARBOR AND BAY

	2D-17 PT-2	2D-18 PT-1	2D-19 PT-1	2D-21 PT-1	2D-21 PT-2	2D-21 PT-3	2D-21 PT-4	2D-22 PT-1
+ 3/8	0	0	0	21.8	1.6	0	0	0
+ 10	.3	.2	.7	27.7	7.0	.5	.5	.6
+ 30	10.9	4.3	4.6	12.7	2.5	2.5	2.4	2.4
+ 60	68.8	87.7	69.6	21.9	50.5	69.0	80.1	56.9
+ 100	19.2	7.4	23.4	9.9	35.0	27.4	17.0	39.4
+ 200	.7	.3	1.8	2.5	2.0	.5	0	.7
- 200	.1	.1	.4	3.5	1.4	.1	0	0

	2D-23 PT-1	2D-24 PT-1	2D-24 PT-2	2D-24 PT-3	2D-24 PT-4	2D-24 PT-5	2D-25 PT-1	2D-25 PT-2
+ 3/8	0	0	0	0	0	0	0	0
+ 10	.2	.5	2.1	.7	.7	.6	.1	.2
+ 30	26.4	34.0	39.6	7.0	16.8	13.9	2.9	2.3
+ 60	71.3	62.9	51.4	81.0	45.6	64.2	90.3	88.5
+ 100	2.0	2.5	6.3	11.1	35.0	21.0	6.6	8.8
+ 200	.1	.1	.3	.1	1.7	.2	.1	.1
- 200	0	0	.3	.1	.2	.1	0	.1

	2D-25 PT-3	2D-25 PT-4	2D-26 PT-1	2D-26 PT-2	2D-26 PT-3	2D-26 PT-4	2D-27 PT-1	2D-27 PT-2
+ 3/8	0	0	0	0	0	0	0	0
+ 10	0	.2	.4	0	.1	0	1.1	2.1
+ 30	1.8	3.5	15.9	3.3	4.9	4.3	6.0	8.6
+ 60	86.6	77.8	74.8	85.7	86.5	86.2	58.5	61.0
+ 100	10.8	18.4	8.5	10.9	8.4	9.4	33.8	25.1
+ 200	.3	.1	.3	.1	.1	.1	.5	.2
- 200	.5	0	.1	0	0	0	.1	0

TABLE C-8

HUMBOLDT HARBOR AND BAY
SIEVE ANALYSIS

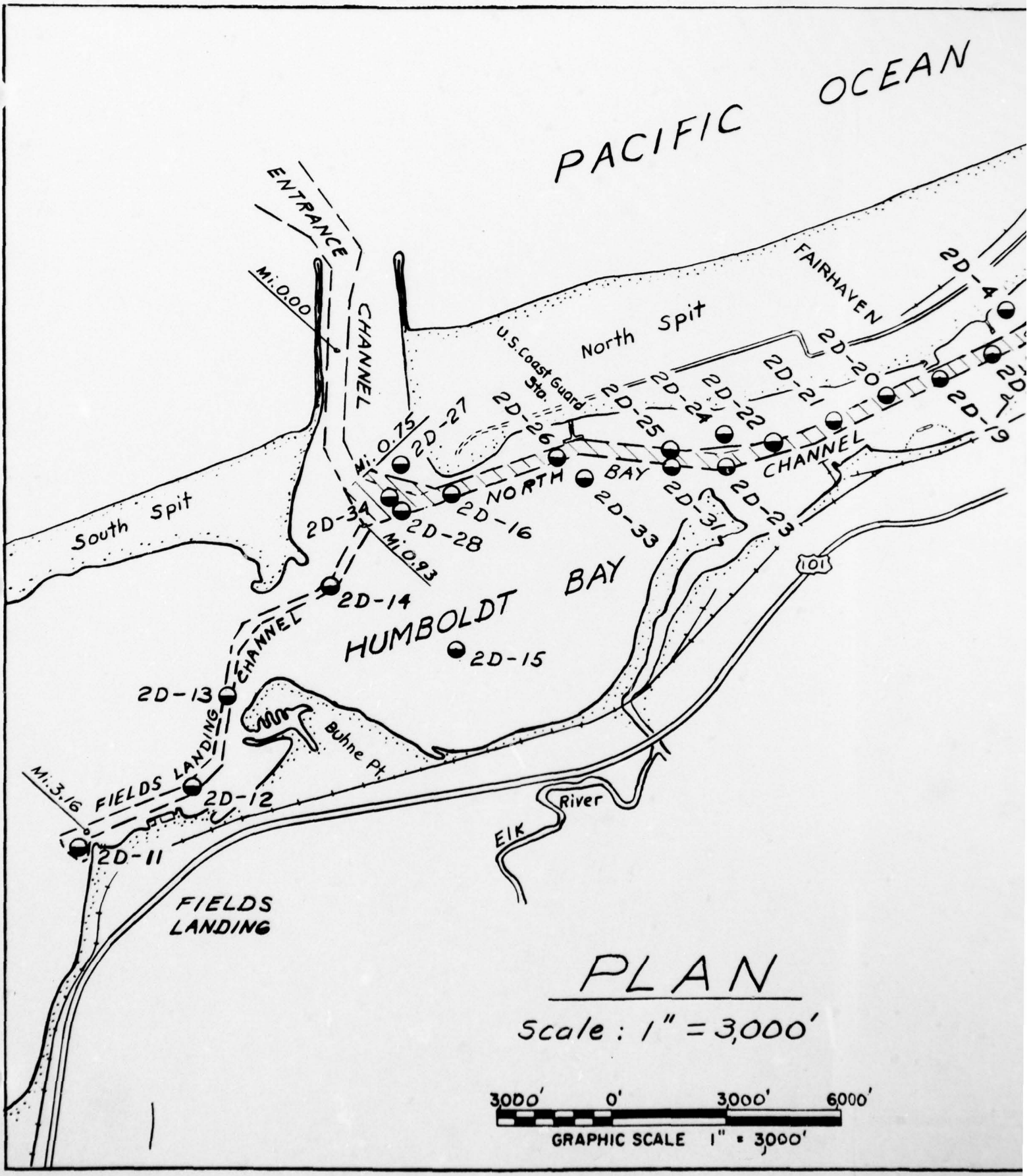
August 21, 1974
Results on samples received from the U.S. Army Corps of Engineers

Project: Humboldt

SCREEN ANALYSIS HUMBOLDT HARBOR AND BAY

	2D-27 PT-3	2D-27 PT-4	2D-27 PT-5	2D-27 PT-6	2D-27 PT-7	2D-27 PT-8	2D-28 PT-1	2D-28 PT-2
+ 3/8	0	0	0	0	0	0	0	0
+ 10	1.8	1.3	6.2	.5	1.4	1.5	.2	0
+ 30	18.0	14.4	5.4	11.7	26.8	24.5	.4	2.6
+ 60	63.5	67.8	63.6	64.7	60.6	64.6	34.6	61.4
+ 100	16.5	16.2	24.5	22.9	11.1	9.2	62.4	35.4
+ 200	.1	.2	.2	.2	.1	.1	2.3	.6
- 200	.1	.1	.1	0	0	.1	.1	0

	2D-28 PT-3	2D-28 PT-4	2D-28 PT-5	2D-28 PT-6
+ 3/8	0	0	0	0
+ 10	0	16.6	48.7	.3
+ 30	.7	28.0	13.5	2.3
+ 60	36.0	39.1	28.5	59.5
+ 100	60.5	15.9	9.1	37.5
+ 200	2.6	.3	.2	.3
- 200	.2	.1	0	.1


PACIFIC OCEAN
ENTRANCE CHANNEL
Mi. 0.00
Mi. 0.75
Mi. 0.93
Mi. 3.16
U.S. Coast Guard Sta.
North Spit
South Spit
FAIRHAVEN
NORTH BAY CHANNEL
HUMBOLDT BAY
FIELDS LANDING CHANNEL
FIELDS LANDING
Buhne Pt.
EIK River
101
2D-4
2D-19
2D-20
2D-21
2D-22
2D-23
2D-24
2D-25
2D-26
2D-27
2D-28
2D-31
2D-33
2D-34
2D-16
2D-14
2D-15
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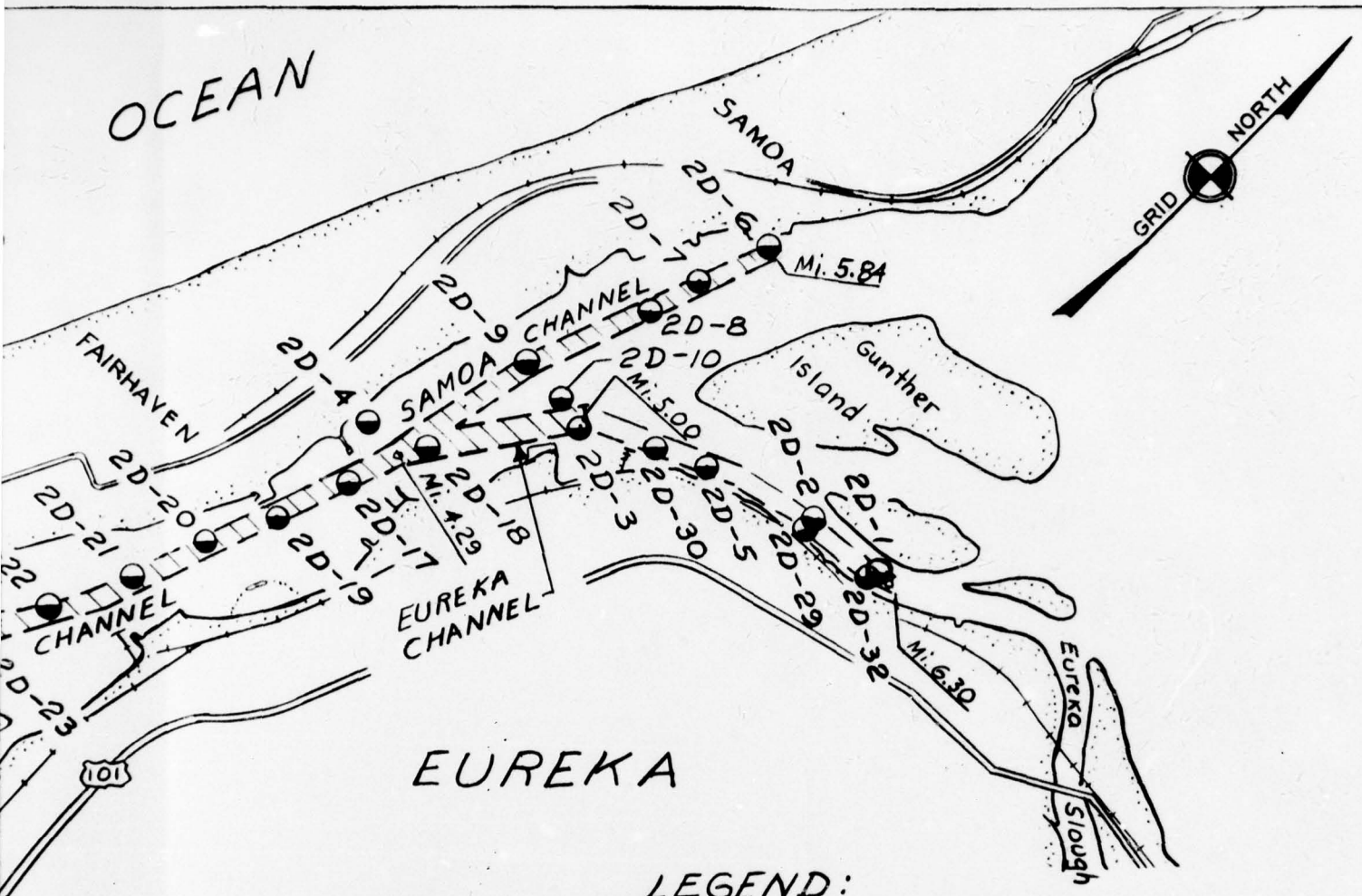
2D-11
PLAN
Scale: 1" = 3,000'
3000' 0' 3000' 6000'
GRAPHIC SCALE 1" = 3,000'



LEGEND:

● 2D-1 EXPLORATION HOLE

PROPOSED DEEPENING OF THE CHANNEL TO ELEV. -35'

NOTE:

LOGS OF EXPLORATION HOLES ARE SHOWN ON PLATES C-2 AND C-3

N

000'

000' 6000'

= 3000'

HUMBOLDT COUNTY CALIFORNIA

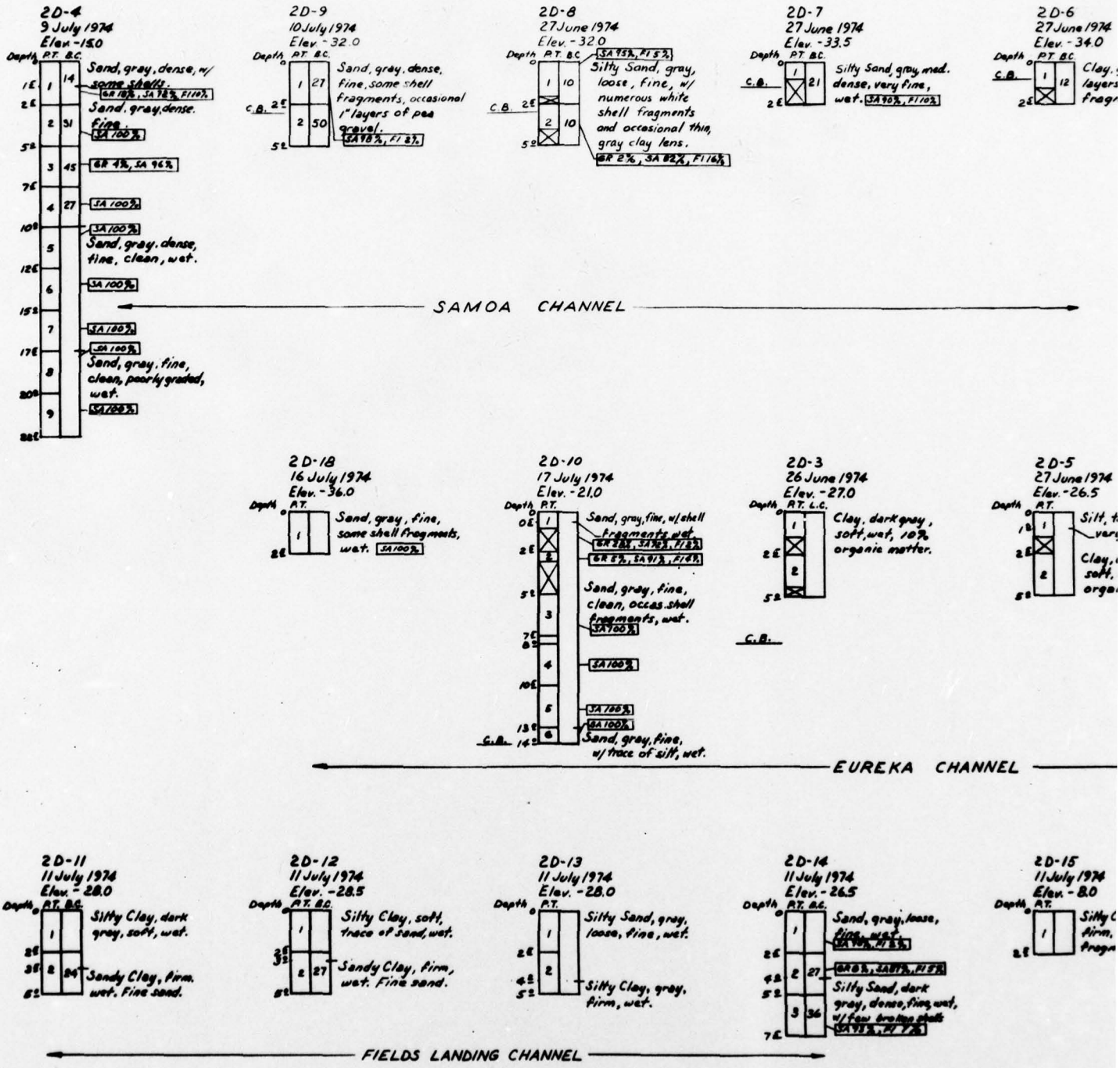
HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS

LOCATIONS OF EXPLORATION HOLES

FILE NO. 5-5-3

2

PLATE C-1


2D-4
9 July 1974
Elev -15.0
Depth
P.T. B.C.
Sand, gray, dense, w/ some shells.
GR 18%, SA 78%, FI 10%
Sand, gray, dense. fine.
SA 100%
GR 4%, SA 96%
SA 100%
SA 100%
Sand, gray, dense, fine, clean, wet.
SA 100%
SA 100%
SA 100%
Sand, gray, fine, clean, poorly graded, wet.
SA 100%
2D-9
10 July 1974
Elev - 32.0
Depth
P.T. B.C.
C.B.
Sand, gray, dense, fine, some shell fragments, occasional 1" layers of pea gravel.
SA 98%, FI 2%
2D-8
27 June 1974
Elev. - 32.0
Depth
P.T. B.C.
SA 95%, FI 5%
C.B.
Silty Sand, gray, loose, fine, w/ numerous white shell fragments and occasional thin gray clay lens.
GR 2%, SA 82%, FI 16%
2D-7
27 June 1974
Elev. - 33.5
Depth
P.T. B.C.
C.B.
Silty Sand, gray, med. dense, very fine, wet.
SA 90%, FI 10%
2D-6
27 June 1974
Elev. - 34.0
Depth
P.T. B.C.
C.B.
Clay, layers
Fragm
SAMOA CHANNEL
2D-18
16 July 1974
Elev. - 36.0
Depth
A.T.
Sand, gray, fine, some shell fragments, wet.
SA 100%
2D-10
17 July 1974
Elev. - 21.0
Depth
P.T.
Sand, gray, fine, w/ shell fragments, wet.
GR 88%, SA 9%, FI 3%
GR 5%, SA 91%, FI 4%
Sand, gray, fine, clean, occas. shell fragments, wet.
SA 100%
SA 100%
SA 100%
SA 100%
C.B.
Sand, gray, fine, w/ trace of silt, wet.
2D-3
26 June 1974
Elev. - 27.0
Depth
A.T. L.C.
Clay, dark gray, soft, wet, 10% organic matter.
C.B.
2D-5
27 June 1974
Elev. - 26.5
Depth
A.T.
Silt, f
very
Clay,
soft,
orga
EUREKA CHANNEL
2D-11
11 July 1974
Elev. - 28.0
Depth
P.T. B.C.
Silty Clay, dark gray, soft, wet.
Sandy Clay, firm, wet. Fine sand.
2D-12
11 July 1974
Elev. - 28.5
Depth
P.T. B.C.
Silty Clay, soft, trace of sand, wet.
Sandy Clay, firm, wet. Fine sand.
2D-13
11 July 1974
Elev. - 28.0
Depth
P.T.
Silty Sand, gray, loose, fine, wet.
Silty Clay, gray, firm, wet.
2D-14
11 July 1974
Elev. - 26.5
Depth
P.T. B.C.
Sand, gray, loose, fine, wet.
SA 90%, FI 8%
GR 8%, SA 87%, FI 5%
Silty Sand, dark gray, dense, fine, wet, w/ few broken shells
SA 93%, FI 7%
2D-15
11 July 1974
Elev. - 8.0
Depth
A.T.
Silty C
firm,
Fragm
FIELDS LANDING CHANNEL

GENERAL NOTES

1. Elevations indicate approximate ground surface at boring location based on the datum of Mean Lower Low Water.
2. Soil descriptions as described by the field inspector are shown to the right of the log, along with laboratory gradation tests.
3. Locations of exploration holes are shown on Plate B-1

LEGEND

P.T. = Push Tube Sample.

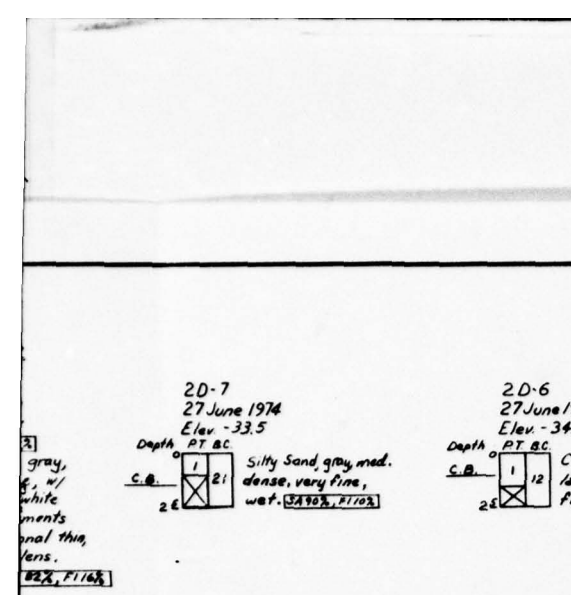
GR 18%, SA 72%, FI 10% = Laboratory Gradation Test: Gravel 18%, Sand 72%, Fines 10%

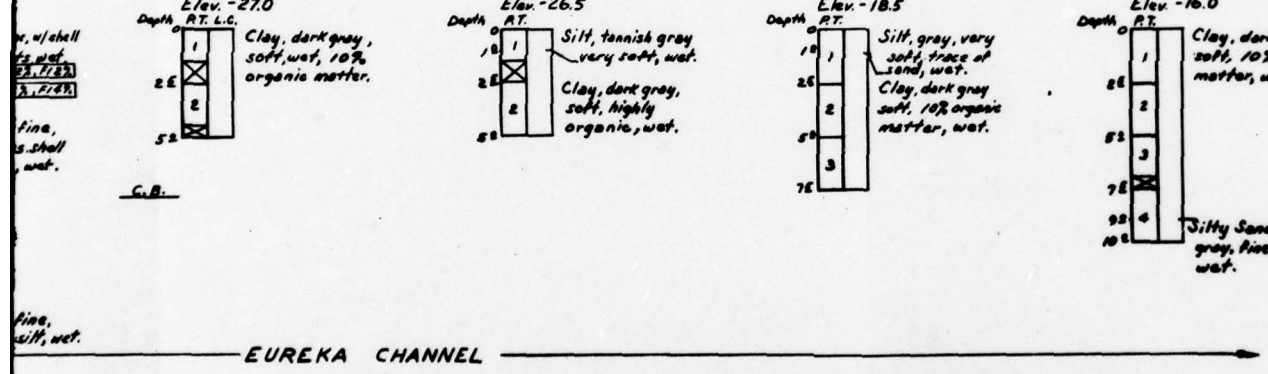
C.B. = Proposed Channel Bottom

☒ = No Recovery

W=21% = Natural Water Content 21%

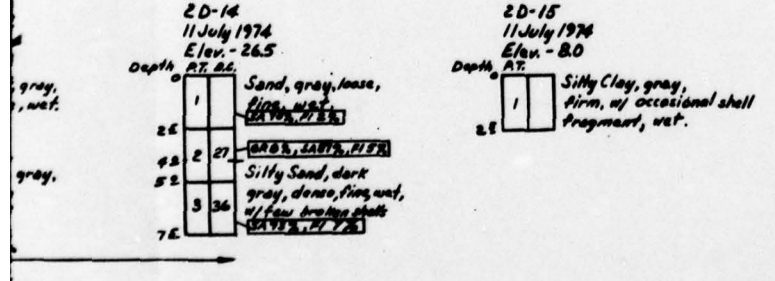
B.C. = Blow Count: Number of blows required to drive a 2½-inch diameter sampler 2½ feet by using a 140-pound hammer with a 30-inch drop.





EUREKA CHANNEL

NOTE: Additional logs of exploration holes in Eureka channel are shown on Plate C-3



DESIGNED	DESCRIPTION	DATE	APPROVED
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

DESIGNED BY H.D.
HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS

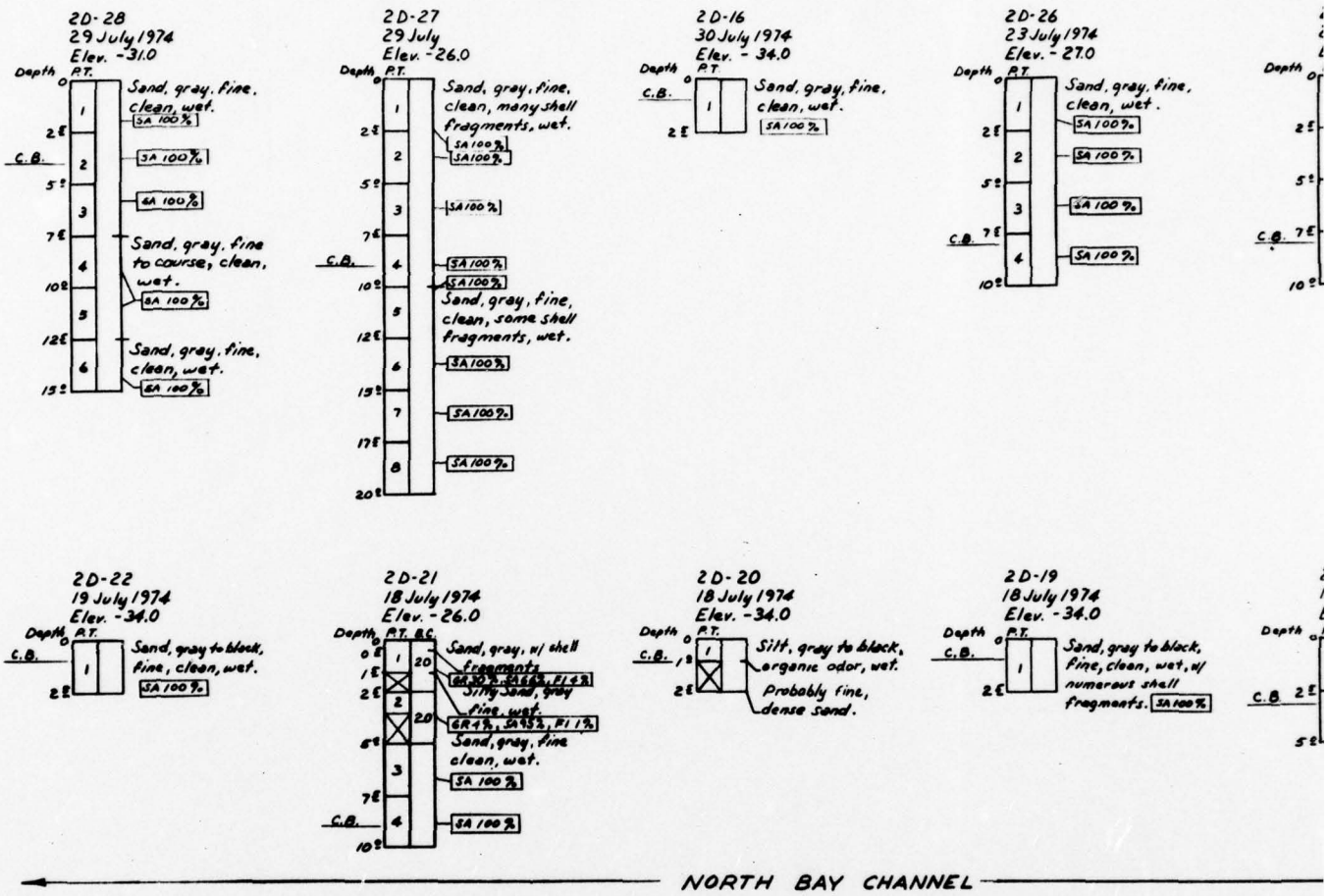
V.O.

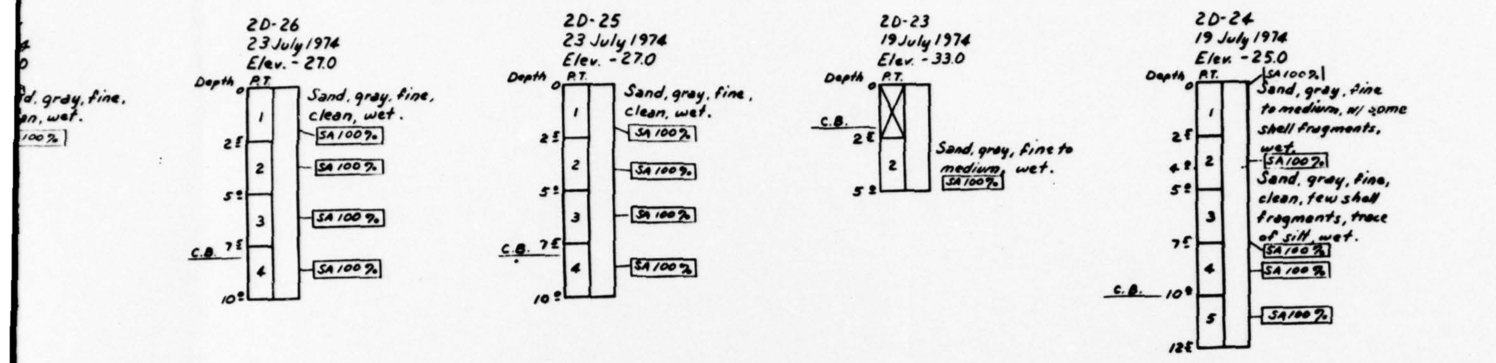
LOGS OF EXPLORATION HOLES

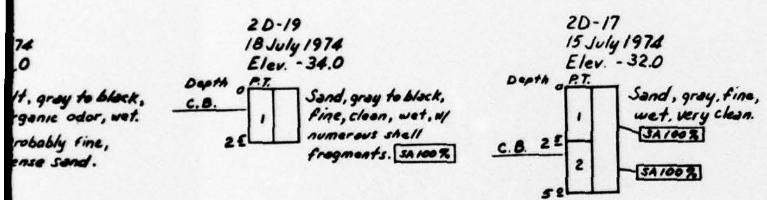
PREPARED UNDER THE DIRECTION OF
HENRY A. FLEISCHER, JR.
CHIEF, C.E. DISTRICT ENGINEER

DRAWING NO. 2 5 5 3

PLATE C-2


2D-28
29 July 1974
Elev. -31.0
Depth
P.T.
Sand, gray, fine, clean, wet.
SA 100%
C.B.
Sand, gray, fine to course, clean, wet.
Sand, gray, fine, clean, wet.
2D-27
29 July
Elev. -26.0
Sand, gray, fine, clean, many shell fragments, wet.
Sand, gray, fine, clean, some shell fragments, wet.
2D-16
30 July 1974
Elev. - 34.0
Sand, gray, fine, clean, wet.
2D-26
23 July 1974
Elev. - 27.0
Sand, gray, fine, clean, wet.
2D-22
19 July 1974
Elev. -34.0
Sand, gray to black, fine, clean, wet.
2D-21
18 July 1974
Elev. - 26.0
B.C.
Sand, gray, w/ shell fragments
Silty Sand, gray fine, wet.
Sand, gray, fine clean, wet.
2D-20
18 July 1974
Elev. -34.0
Silt, gray to black, organic odor, wet.
Probably fine, dense sand.
2D-19
18 July 1974
Elev. -34.0
Sand, gray to black, fine, clean, wet, w/ numerous shell fragments.
NORTH BAY CHANNEL
2D-34
24 May 1975
Elev. -45.5'
Sand, gray to black, dense, fine, numerous shell fragments, wet.
SA 100%
W = 21%
2D-33
23 May 1975
Elev. -40.0'
Sand, gray, dense, very fine to fine, wet.
GA 98%, FI 2%
W = 23%
2D-31
22 May 1975
Elev -42.0'
Silty Sand, gray, dense, wet.
GR 9%, SA 80%, FI 11%
W = 21%
2D-30
22 May 1975
Elev. -35.5'
Sandy Silt, brown to gray mottled, soft, wet.
Silty Sand, gray, loose, wet.
SA 45%, FI 55%
W = 36%
NORTH BAY CHANNEL
EURE

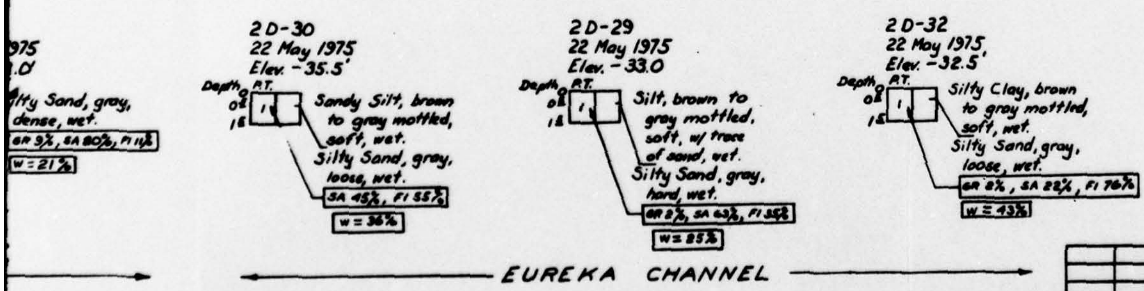




NOTES:

1. Legend and General Notes are shown on Plate C-2.
2. Additional logs of exploration holes in Eureka channel are shown on Plate C-2.

BAY CHANNEL



SYMBOL	DESCRIPTION	DATE	APPROVAL
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, SAN FRANCISCO
CORPS OF ENGINEERS
SAN FRANCISCO, CALIFORNIA

HUMBOLDT COUNTY — CALIFORNIA

HUMBOLDT HARBOR AND BAY NAVIGATION CHANNEL IMPROVEMENTS

LOGS OF EXPLORATION HOLES

Drawn by: N.D. V.O.
Checked by: V.O.

PREPARED UNDER THE DIRECTION OF
HENRY A. FLERTZHEIM, JR.
COLONEL, C.E., DISTRICT ENGINEER

Scale: AS SHOWN

Sheet 3 | 5 | 5 | 3

PLATE C-3

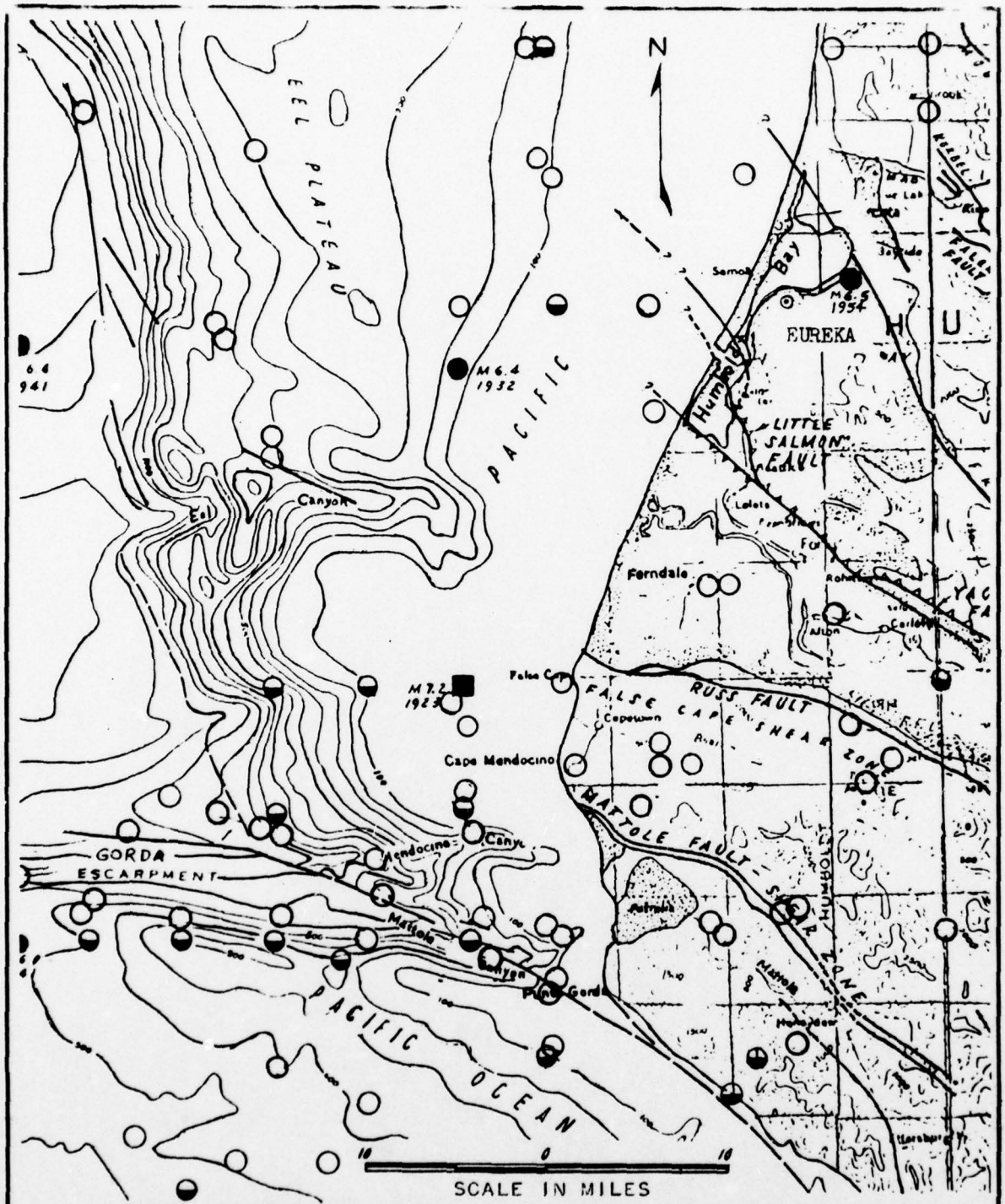
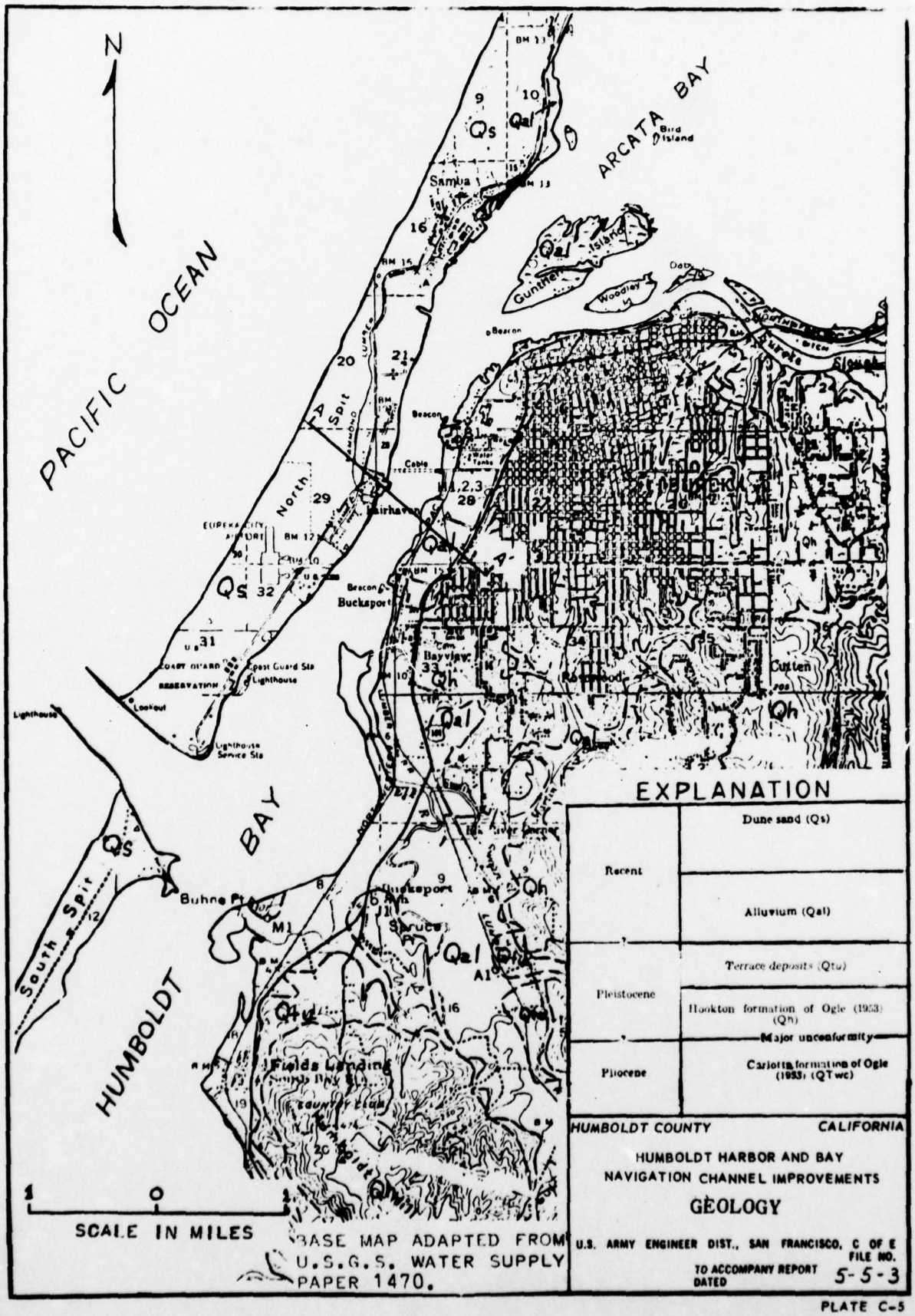

N
EEL PLATEAU
PACIFIC
M6.4 1932
M7.2 1923
M6.5 1954
EUREKA
Humboldt Bay
LITTLE SALMON FAULT
Samoa
Ferndale
Cape Mendocino
FALSE CAPE SHEAR ZONE
RUSS FAULT
MATTOLE FAULT - SHEAR ZONE
GORDA ESCARPMENT
Eel Canyon
Mendocino Canyon
Mattole Canyon
Punta Gorda
PACIFIC OCEAN
10 0 10
SCALE IN MILES
EXPLANATION
○ Magnitude 4.0 - 4.9
◒ Magnitude 5.0 - 5.9
● Magnitude 6.0 - 6.9
■ Magnitude 7.0 - 7.9
Note: Period of record 1934-1971 with selected earthquakes prior to 1934 noted.
HUMBOLDT COUNTY CALIFORNIA
HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS
EARTHQUAKE EPICENTERS
IN SHEET SHEET NO.
U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
DRAWN: FILE NO.
TRACED: TO ACCOMPANY REPORT
CHECKED: DATED
5-5-3

PLATE C-4



EXPLANATION

Recent	Dune sand (Qs)
	Alluvium (Qal)
Pleistocene	Terrace deposits (Qtu)
	Hookton formation of Ogle (1953) (Qh)
	Major unconformity
Pliocene	Carlotta formation of Ogle (1953) (QTwc)

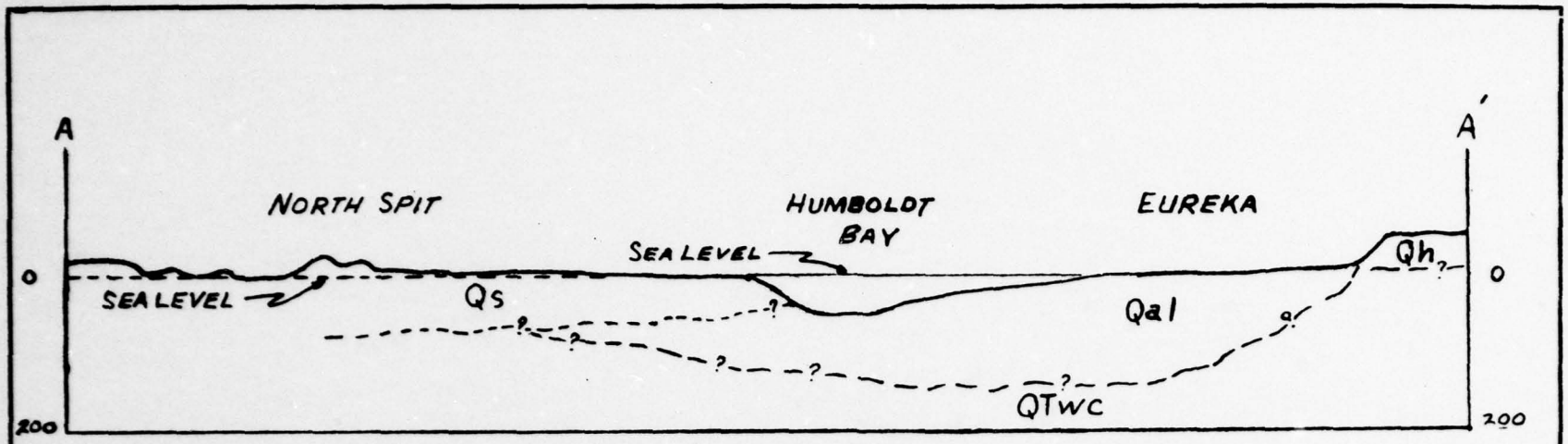
HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS

GEOLOGY

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
FILE NO.
TO ACCOMPANY REPORT DATED 5-5-3

PLATE C-5



GEOLOGIC SECTION A-A'

1000 0 1000

SCALE IN FEET

VERTICAL SCALE 5 TIMES HORIZONTAL SCALE

EXPLANATION

Recent	Dune sand (Qs)
	Alluvium (Qal)
?	
Pleistocene	Hookton formation of Ogle (1953) (Qh)
?	Major unconformity
Pliocene	Carlotta formation of Ogle (1953) (QTwc)

HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT HARBOR AND BAY
NAVIGATION CHANNEL IMPROVEMENTS

HUMBOLDT BAY
CROSS-SECTION AA'

U.S. ARMY ENGINEER DIST., SAN FRANCISCO, C OF E
FILE NO. 5-5-3
TO ACCOMPANY REPORT
DATED

PLATE C-6

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX D

SOCIO-ECONOMIC EFFECTS OF THE PROJECT

U.S. Army Engineer District, San Francisco
Corps of Engineers
211 Main Street
San Francisco, California 94105

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX D
SOCIO-ECONOMIC EFFECTS OF THE PROJECT

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GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX D
SOCIO-ECONOMIC EFFECTS OF THE PROJECT

D-01. SCOPE AND PURPOSE

This appendix summarizes the short term and long term social and economic effects of project construction. These evaluations are made in response to requirements set forth by Section 122 of Public Law 91-611, River and Harbor Act of 1970. Environmental effects are evaluated in the Environmental Statement, a companion report to this General Design Memorandum.

D-02. PROJECT LOCATION AND DESCRIPTION

Humboldt Bay is a landlocked harbor on the coast of Northern California, located about 255 nautical miles north of San Francisco, California, and about 156 nautical miles south of Coos Bay, Oregon. Harbor improvements where first authorized in the River and Harbor Act of 1881, with numerous stages of improvements in jetties and deep-draft navigation channels authorized by subsequent Acts. The current project is for deepening the North Bay channels from 30 feet to 35 feet, as authorized by the River and Harbor Act of 1968. Also, proposed project improvements include provision for widening the Samoa Channel from 300 to 400 feet, dredging a 1,100-foot long by 1,000-foot wide turning basin at the end of the Samoa Channel, and widening certain bends. The proposed project improvements will require dredging an estimated 2.4 million cubic yards of material to be disposed in the ocean and at certain land sites, as described in the Main Report, Total estimated project cost is $6,660,000.

D-03. NATIONAL ECONOMIC DEVELOPMENT

Project construction will produce a limited number of short-term construction jobs; more importantly, the authorized harbor improvement will produce long term savings in transportation costs, estimated to have primary benefits equal to $651,000 per year over the next 50 years. In fact, such improvements in the depth of navigation channels are critical in maintaining existing waterborne commerce passing through the port, which serves a large tributary region comprising all or part of five Northern California counties. Exports of forest products from the tributary area served by the port are highly significant toward maintenance of a favorable balance of trade for the Nation. In addition to long-term socio-economic effects, the proposed project will produce a number of short-term effects, as discussed in the following paragraphs.

D-04. CONSTRUCTION EMPLOYMENT

The U.S. Army Corps of Engineers will employ a Government-owned hopper dredge to accomplish about 190,000 cubic yards of the project dredging near the harbor entrance, where hazardous sea conditions preclude use of contracted equipment and services. A hydraulic pipeline dredge will be used to excavate an estimated 2.2 million cubic yards of material from project channels. The contractor's dredging plant has been estimated to include the following:

a. One 1,200 H.P. MULTWOMAH CLASS hydraulic suction dredge with 20-inch intake and 16-inch discharge.

b. One 1,700 H.P. BAXTER CLASS Booster pump barge.

c. 35,000 feet of 16-inch dredge pipe.

d. Two pipe barges, service launch and other auxiliary dredging equipment.

e. Two bulldozers and trucks or 3 self-powered scraper-haulers for retention dike construction.

f. Other equipment and supplies associated with heavy construction.

D-05. It is estimated that about 18 construction workers will be employed for a minimum of about 20 months to complete the project, as listed below:

Dredge crew	6 men
Barge crew	2 men
Anchor Barge crew	2 men
Pipe barges	5 men
Shore crew	3 men
Total	18 men

D-06. In addition to the dredging crew, a number of heavy equipment operators will be employed for an estimated 36 man-months in construction of dikes for retention of dredged material.

D-07. The plant described above is estimated capable of dredging an average of 100,000 cubic yards of material per month. Monthly operating costs are roughly estimated to amount to $33,000 for equipment rental and $90,000 in wages and operating costs. Dredging about 2,200,000 cubic yards is estimated to require a minimum 20 months; however, the contract terms must allow contingency time, so it will probably have a term of 30 months. Total work contracted by the Corps and/or local sponsor is estimated to amount to about $5,000,000 for dredging and $685,000 for diking and control of water. Other smaller items of project cost for utility relocations and berthing improvements probably will be contracted by responsible local entities. It is estimated about 80 percent of the total $6,000,000 construction cost will be spent in Humboldt County in the form of wages of about $2,220,000, and operational supplies and services, $2,580,000.

D-08. SECONDARY ECONOMIC EFFECTS

Besides jobs and incomes related directly to project construction there are secondary or indirect jobs and incomes created by the direct impacts. When the direct incomes are spent locally, this in turn creates secondary impact in terms of jobs, payrolls or income and tax revenue. The direct plus the indirect impacts equal the total impact. In many economic impact studies, the relationship between the direct impact and the total impact is expressed in terms of a "multiplier," a number which when multiplied by the direct impact from a given source will indicate the total impact induced by that source. Such multipliers are by nature only rough estimates. Other studies of the North Coast of California have estimated a multiplier for Humboldt Bay of about 2.6. This implies that if about $4.8 million of labor and operating cost is spent locally, the total impact will be about 2.6 times $4.8 million or approximately $12.5 million over a 2 to 2-1/2 year period. The economic impacts of a large construction project will drop drasticly upon completion of the project (in the present case, by 1979), but some economic impacts generally persist and continue to add to the gross national product, often due to the new business and services generated from such a project.

D-09. PUBLIC FACILITIES AND SERVICES

During construction of a project, the labor force engaged in the construction will have to be housed and education provided for children of the construction workers relocating to the job site. Humboldt County government officials indicate that no public housing will be needed for this project. Rather, the private housing market will be able to handle the needs of the workers involved. Indeed, only about 18 workers will be brought into the area. Moreover, industry spokesman (of dredging companies) indicates that the workers hired from outside Eureka will stay only for a maximum of 20 months and therefore will not likely bring any dependents into the area. Hence, workers will place little or no pressure on public schools or child-related services.

D-10. TRANSPORTATION SERVICES

Improvement of navigation channels in Humboldt Bay is essential toward maintenance of existing commerce generated by advantageous transportation rates for export of a large volume of forest products from a five-county tributary area of Northern California and for shipment of large tonnages of pulp and lumber products manufactured in the immediate vicinity of the port terminals. Project improvements are essential for efficient utilization of existing transfer and terminal facilities. The city of Eureka and the surrounding tributary area are more dependent on the economics of waterborne commerce than most other areas of California, due to rugged terrain and somewhat isolated location from main interstate highway and rail routes.

D-11. Forest products historically have been the most significant commodities in Humboldt Bay's waterborne commerce, including logs, wood chips, stoves, mouldings, lumber, plywood, veneers and miscellaneous wood products. Lumber products and wood pulp have accounted for an average of approximately two-thirds of waterborne commerce from 1964 to 1974. The only other significant commodities are chemicals (mainly sodium hydroxide and chlorine for use in pulp processing) and petroleum products (gasoline and fuel oil). Most of these products are expected to hold steady or increase along with increase in local population and employment. However, wood chips, previously burned as waste, began to be a significant export product in 1971. Since then, exports have increased from 14,245 tons per year to 171,840 tons. Other characteristics of waterborne commerce are discussed in Appendices A and B.

D-12. PORT EMPLOYMENT

Data collected by the California State Employment Development Department indicates that about 34 full-time employees work in the water-related jobs of marine cargo handling and towing and tugboat services. The average wage in these jobs is a little over $12,000 per employee per year, for a total yearly payroll of about $415,000. Other employment directly related to ocean shipping includes administrative workers who arrange for the movement of deep-draft vessels, truck or rail employment related to shipping, and miscellaneous service employees employed in freight forwarding, public warehousing, inspection and weighing, packing and crating. A detailed survey has not been made to determine the extent of such employment. It is expected that the recommended project will have only a minor beneficial impact on this employment.

D-13. LOCAL AND REGIONAL GROWTH

Losses of income or employment due to a failure to dredge channels deeper are difficult to estimate. Such differences in business activity can only be measured on a with and without project basis, holding all other factors the same. It is not possible to predict the time when failure to improve port facilities could cause a sudden drop in business activity due to loss of a competitive position; but cancellation of port calls by larger, more economic vessels is one indication that such a development could occur in the highly competitive economics of the international shipping industry. Deepening the channels will accentuate the trend toward retirement of smaller cargo vessels in favor of fewer trips by larger ships. Recreational boating in Humboldt Bay should experience more ease of access to and from recreational areas, more maneuverability and less traffic congestion. These factors should enhance the recreational boating experience. The navigation channel improvement project is not expected to produce substantial impacts toward regional growth, but is significant toward maintaining existing economic activity with moderate growth.

D-14. LOCAL LAND USE

Deposit of dredged material at various alternative sites considered in this investigation could provide potential enhancement of certain privately held bayside industrial lands in the City of Eureka. Also, consideration was given for constructive use of dredged material as fill for a proposed freeway improvement. However, these alternative sites were progressively eliminated in the course of study due to environmental objectives or lack of economic engineering feasibility. Various types of potential future land use are possible for the recommended disposal sites in vicinity of the municipal airport on the Samoa Peninsula. However, there are no definite plans for development at this time. Placement of dredged material on Site 13B would make this dune area less desirable for its present informal use by for recreational vehicles, but would not preclude continuation of such use in the future. Deposit of dredged material on Site 13C would temporarily degrade wildlife habitat. However, the disposal of dredged material on these sites is expected to increase their long-term carrying capacity. The dredged material is more fertile than the dune deposits and is expected to be more conducive to growth of vegetation. It will be less prone to wind erosion than existing dune deposits. Site plans for the disposal areas are designed to promote retention of moisture and revegetation, but will not preclude other types of future land use, as may be permitted by local and regional authorities.

D-15. TAX REVENUES

Local and county governments receive revenue from retail sales and use taxes, local property taxes, and city business, license or franchise taxes. The sales tax is levied against retail sales of tangible personal property, while the property taxes are levied against real and personal property. During construction of the project, about $4.8 million will be spent for labor and operations over a period of about two and a half years. It is estimated that about $2.6 million will be spent locally for petroleum products, housing, food, clothes and other items. If this amount is spent on retail sales of tangible personal property, 6 percent of $2.6 million ($156,000) will be collected by the State of California as a sales tax. Of this tax, 1 percent or about $16,000 will be returned through subvention to local taxing jurisdictions. In this case the local taxing jurisdiction will most likely be the incorporated cities of Eureka and Arcata. In addition, another 1/4 percent will be returned to the county (about $4,000). The 1 percent returned to local taxing jurisdictions can be used for any purpose, while the 1/4 percent returned to the County must be used for public transportation. Moreover, historically the State of California has spent a large proportion of the 4-3/4 percent kept by the State for public education. This is returned to local school systems on the basis of educational need. Besides the tax revenues just described, additional revenues will be created by the indirect income ($7.7 million) which will be generated by about $4.8 million in construction expenditures in the local economy. Potential tax revenues generated by indirect economic effects from project construction are estimated to total $750,000 over a 2-3 year period.

D-16. PROPERTY VALUES AND BUSINESS ACTIVITY

Project construction activities are not expected to have a significant effect on property values due to the small labor force involved. Inflation and long-term increases in value of waterfront industrial property due to the project are expected to be more significant. Real increases in values are not readily predictable as they depend on complex economic factors, governmental actions and general economic climate of the region in relation to other ports of California and the Nation. Moderate growth in business and industrial activity in the project area is predicted on sustained yield of timber resources, fisheries and adequate transportation, particularly water related facilities and adequate depths for navigation channels to accommodate modern cargo vessels.

D-17. LOCAL GOVERNMENTAL ENTITIES

Project construction is contingent on ability and willingness of non-Federal interests to meet certain obligations as specified in the Project Document. These obligations have been assumed by the Humboldt

Bay Harbor, Recreation and Conservation District, documented by pertinent correspondence and draft agreements shown in Appendix E. The sponsoring agency is a County-wide district created by certain enabling acts and amendments passed by the State of California under its Harbors and Navigation code (S.B. 706 approved and filed June 30, 1972). The District has county-wide taxing authority, but relies heavily on co-operation from other local governments to met it obligations. The City of Eureka has resolved to assist the District in furnishing suitable areas for disposal of dredged material on property it controls.

DESIGN MEMORANDUM NO. 1
GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX E

PERTINENT CORRESPONDENCE

U.S. Army Engineer District, San Francisco
Corps of Engineers
211 Main Street
San Francisco, California 94105

DESIGN MEMORANDUM NO. 1

GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX E

PERTINENT CORRESPONDENCE

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RESOLUTIONS AND REVIEW COMMENTS FROM STATE AND LOCAL AGENCIES

OTHER VIEWS AND COMMENTS

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GENERAL DESIGN
NAVIGATION CHANNEL IMPROVEMENTS
HUMBOLDT HARBOR AND BAY, CALIFORNIA

APPENDIX E

PERTINENT CORRESPONDENCE

E-1. INTRODUCTION

Coordination has been maintained throughout the study with a wide range of governmental agencies, private interests, and individuals. The drafts of this design memorandum and the accompanying Environmental Statement were submitted for interagency review, and for review by local groups, in March 1976. Formal review comments and replies that were received from Federal and Non-Federal agencies are contained in this appendix. It also includes letters from private organizations and individuals that resulted in minor changes in design or provisions listed in the draft reports.

Replies and actions regarding certain of these comments are discussed in Section XVII of this design memorandum. Section XVII of the report replies to review comments which either related specifically to the draft design memorandum or are of general significance. Comments of specific application to the draft Environmental Statement are discussed in the Coordination, Comment and Response section of that document. Other comments and many statements of support for the project are contained in transcripts of public meetings held on 8 March 1974 and 7 April 1976. Two copies of these meeting transcripts accompany this report; and other copies have previously been furnished directly to interested Congressmen, and local libraries.

United States Department of the Interior

NATIONAL PARK SERVICE

WESTERN REGION

450 GOLDEN GATE AVENUE, BOX 36063

SAN FRANCISCO, CALIFORNIA 94102

IN REPLY REFER TO:

L7619

(WR)REQ

May 26, 1976

Mr. H. A. Flertzheim, Jr.
District Engineer
Corps of Engineers
100 McAllister Street
San Francisco, California 94102

Dear Mr. Flertzheim:

We have reviewed the Draft General Design Memorandum and the Draft Environmental Impact Statement for the Navigation Improvement Project in Humboldt Bay, California. The following comments are provided for your technical assistance only and do not represent formal review comments from the Department of the Interior.

Neither the discussion of the archeological surveys given on page 35 nor the discussion of the impacts on pages 52 and 62 of the draft statement and pages 42 and 44 of the draft design memorandum makes any reference to the pipelines to be used to carry the dredged materials to the disposal sites and the drainage ditch and pipeline pictured in figure 4 of the draft design memorandum. These areas should be in the survey of the contingency beach disposal site, which will be performed before the final statement is released.

Further, we are unable to judge the adequacy of the archeological surveys mentioned on page 35 of the draft statement. No indication is made of the intensity of the survey, nor the precise location of the area covered by the survey. This information, along with the name of the qualified professional individual or institution who conducted the survey, should be included in the final statement.

In light of the potential for buried or obscured sites in the disposal site areas mentioned on page 35, we recommend that a competent professional archeologist familiar with the situation in the project area be consulted regarding whether or not the use of an exploratory back hoe across the disposal sites would be advisable.

Copies of any archeological reports should be made available to the Western Archeological Center, P. O. Box 49008, Tucson, Arizona 85717.

We hope these comments will be helpful in the future preparation of this environmental statement.

Sincerely yours,

Bruce M. Kilgore

Bruce M. Kilgore
Associate Regional Director,
Resource Management and Planning

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1500 N.E. IRVING STREET
P.O. BOX 3737
PORTLAND, OREGON 97208

Reference: ES

APR 2 6 1976

Colonel H. A. Flertzheim, Jr.
District Engineer
San Francisco District, Corps of Engineers
100 McAllister Street
San Francisco, California 94102

Your reference:
SPNED-NN
March 5, 1976

Dear Colonel Flertzheim:

This responds to your referenced letter asking for our review and comments on the draft editions of General Design Memorandum No. 1, Humboldt Harbor and Bay, California, and its companion Environmental Statement.

Our review of the draft environmental statement will be transmitted to you by separate letter. We have completed our review of General Design Memorandum No. 1 and have no adverse comments.

In a telephone discussion with Mr. George Kostal of your staff on April 5, 1976, personnel of our Sacramento office were informed that your agency desires some statement concerning the adequacy of our previous letters on this project. Our official report on this project was released June 12, 1963. That report is somewhat out-of-date because the proposed project features have been changed since project authorization in 1958. We believe, however, that your current project plan reflects an adequate consideration of fish and wildlife resources, that reasonable mitigating measures have been incorporated into the plan, and that updating our detailed report would not provide any additional information of significance. We therefore have no objection to commencement of project construction as now planned.

We wish to inform you that concern for a unique habitat type associated with spoil site 13C has recently surfaced. Many species of passerine birds accidental to the West Coast are sighted by bird watchers in the willow-type habitat at the eastern portion of this site. Most of this habitat will not be impacted by the project; however, onsite consideration of the exact placement of the eastern spoil retention

dike at site 13C could possibly minimize habitat loss without appreciably affecting project cost or spoil site capacity. We ask that our Sacramento office be notified prior to construction of dikes at spoil site 13C so that we can have Service personnel onsite to assist in this matter.

We appreciate your cooperation in planning for this project and the opportunity to review the General Design Memorandum.

Sincerely yours,

William H. Meyer

Acting William H. Meyer
Regional Director

cc:

Humboldt Bay NWR, Eureka
Paul Springer, FWS, Arcata
Roger Barnhart, FWS, Arcata
NMFS, Tiburon
Dir., CDF&G, Sacramento
CCZCC, North Coast Region, Eureka
Humboldt Bay Harbor, Recreation and
Construction District, Eureka
ES, Sacramento

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Division of Ecological Services
2800 Cottage Way, Room E-2727
Sacramento, California 95825

July 21, 1976

Colonel H. A. Flertzheim, Jr.
District Engineer
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Flertzheim:

In connection with the Humboldt Harbor and Bay channel deepening project, your staff recently became aware of the occurrence of a rare plant, Menzie's wallflower (Erysimum menziessi), in the vicinity of the north spit spoil disposal sites. The Resource Agency of California has expressed concern for this particular plant as it is considered to be endangered by some groups. It is not, however, presently under consideration for inclusion in the forthcoming United States List of Endangered Flora. Thus, we do not anticipate that the provisions of the Endangered Species Act of 1973 will apply to the channel project insofar as Menzie's wallflower is concerned. This plant is, nonetheless, of very limited geographic distribution and every reasonable consideration should be given to its protection. Please advise if there is any way we may assist your project planners toward that end.

Sincerely,

James D. Carson

James D. Carson
Acting Field Supervisor

cc: ARD-Env (ES), USFWS, Portland

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

United States Department of the Interior

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

Colonel H. A. Flertzheim, Jr.
District Engineer
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105

July 28, 1976

Dear Colonel Flertzheim:

Our letter of July 21, 1976, concerning the Humboldt Harbor and Bay channel deepening project and the effect of spoil deposition on Menzie's wallflower (Erysimum menziessi) requires correction. Whereas the plant is not currently under consideration for classification as an Endangered species (as stated in our previous letter), it could quite possibly be designated a Threatened species. The provisions of section 7 of the Endangered Species Act of 1973 apply to each classification.

A list of plants proposed for designation as Endangered was published in the Federal Register on June 16, 1976. A list of plants proposed for designation as Threatened is in preparation but has not yet been published in the Register. It is our understanding that the list of proposed Threatened species, when published, will likely include Menzie's wallflower. As we understand the provisions of the Act, the channel deepening project could not be constructed--as now planned--if it is determined that spoil deposition or other project activity would jeopardize the continued existence of any Endangered or Threatened plant, as a species, or result in the destruction or modification of habitat of such species when determined by the Secretary of the Interior to be critical habitat.

In view of present circumstances, we urge the Corps of Engineers to give full consideration to alternate spoil sites and recommend that as much information as possible be assembled concerning the status of Menzie's wallflower to permit a sound judgment with respect to anticipated project impacts on the species. Your staff has indicated to us that these matters will be addressed in the Final Environmental Impact Statement.

Please advise if further clarification is required.

Sincerely,

James D. Carson

James D. Carson
Acting Field Supervisor

cc: ARD-Env (ES), USFWS, Portland, OR

United States Department of the Interior
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

PEP ER-76/576

JUN 14 1976

Dear Colonel Flertzheim:

The Department of the Interior has reviewed the draft environmental statement and general design memorandum for Humboldt Harbor and Bay, California. We have the following comments on the draft statement for your consideration.

General Comments

The document adequately discusses matters of concern to the Department's Bureau of Outdoor Recreation and Geological Survey. Also the document satisfactorily describes fish and wildlife of the project area and project effects on these resources.

Specific Comments

Page 1, Section 1.002: A discussion of postproject maintenance dredging requirements should be included.

Page 7, Section 2.010: The reference of exploration holes being made in Humboldt Bay bottom in the project vicinity to study effects of possible sediment movement needs elaboration. A summation of findings would be helpful.

Page 21, Section 2.075: This discussion of fish resources is satisfactory. However, sampling techniques should be explained to permit informed judgment relative to gear selectivity. Sampling primarily by trawling in bay channels does not fully disclose ecosystem relationships. This discrepancy need not be corrected but should be acknowledged. West Coast bays function as nursery areas for many species of fish. This aspect of the bay ecology should be emphasized.

Page 23, Section 2.084: Gunther Island has been renamed Indian Island. Black oyster catchers are a relatively scarce bird species

even in their native coastal habitat; thus, the reference to them is somewhat misleading. Only the double-crested cormorant nests on the Arcata wharf ruins.

Page 23, Section 2.087: The southern bald eagle is listed as endangered, not threatened, by the Secretary of the Interior.

Page 35: Neither the discussion of the archeological surveys given on this page nor the discussion of the impacts on pages 52 and 62 of the draft statement and pages 42 and 44 of the draft design memorandum makes any reference to the pipelines to be used to carry the dredged materials to the disposal sites and the drainage ditch and pipeline pictured in Figure 4 of the draft design memorandum. These areas should be in the survey of the contingency beach disposal site, which will be performed before the final statement is released.

Further, we are unable to judge the adequacy of the archeological surveys mentioned on this page. No indication is made of the intensity of the survey, nor the precise location of the area covered by the survey. This information, along with the name of the qualified professional individual or institution who conducted the survey, should be included in the final statement.

In light of the potential for buried or obscured sites in the disposal site areas, we recommend that a competent professional archeologist familiar with the situation in the project area be consulted regarding whether or not the use of an exploratory back hoe across the disposal sites would be advisable.

Copies of any archeological reports should be made available to the Western Archeological Center, P. O. Box 49008, Tucson, Arizona 85717.

Page 47, Section 4.000: Some additional impacts of dredging on the shallow portions of the bay are erosion, accretion, and altered circulation.

Page 59, Section 4.054: The impact of conveying spoil by pipe from the booster pump barge to the spoil site has not been discussed.

Use of the term "barren sand dunes" (pages 3 and 59) is misleading. Although usually not visible, life forms do exist in bare sand. Habitation by lower forms and hunting or access by

higher forms are common uses. There is a definite inconsistency in the statement on page 3 about minor impacts on habitat and the loss of animals statement on page 59.

Page 62, Section 4.069: Willow-type habitat on the North Spit in the vicinity of disposal site 13C is unique in that it attracts bird species common to only the eastern United States. Site 13C, as presently designed, would eliminate fragments of this habitat type temporarily and perhaps permanently.

Page 73, Section 7.001: Does "erosional processes" mean that the dredged spoil will blow or wash away? This should be further discussed.

Page 73, Section 7.002: If the indirect impacts of the project on shallow water portions of the bay are significant, then significant adverse impacts on long-term productivity would seem possible. We suggest this matter be addressed in the text.

Page 74, Section 8.003: Evaluational changes may affect the area's capability to sustain temporary wet areas, with associated vegetation types (i.e., willows) and animal populations.

We hope these comments will assist you in preparation of the final statement.

Sincerely yours,

(Sgd) Stanley D. Doremus

Deputy Assistant Secretary of the Interior

Colonel H. A. Flertzheim, Jr.
District Engineer
San Francisco District, Corps of Engineers
100 McAllister Street
San Francisco, California 94102

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Md. 20852

Date: April 21, 1976

Reply to
Attn of:

Subject: DEIS 7603.47 - Humboldt Harbor and Bay, California

To: Director, Office of Ecology and
Environmental Conservation, NOAA

The National Geodetic Survey does not have any comments on subject draft environmental impact statement, other than the possible impact on monuments of the National Geodetic Control Networks.

Bench marks, triangulation stations, and traverse stations have been established by the National Geodetic Survey in the vicinity of the proposed project. Construction required for the project could result in destruction or damage to some of these monuments.

The National Geodetic Survey requires sufficient advance notification of impending disturbance or destruction of monuments so that plans can be made for their relocation. The National Geodetic Survey recommends that provision be made in the project funding to cover costs of monument relocation.

Gordon Lill
Deputy Director
National Ocean Survey

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Science and Technology
Washington, D.C. 20230

April 27, 1976

U. S. Army Engineer District
San Francisco
100 McAllister Street
San Francisco, California 94102

Dear Sir:

This is in reference to your draft environmental impact statement entitled "Humboldt Harbor and Bay, Humboldt County, California." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving eight copies of the final statement.

Sincerely,

Sidney R. Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

Enclosure Memo from: Mr. Gordon Lill
National Ocean Survey

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
2828 Chiles Road, Davis, CA 95616

April 12, 1976

H. A. Flertzheim, Jr.
Colonel, CE
District Engineer
Department of the Army
100 McAllister Street
San Francisco, California 94102

Dear Colonel Flertzheim:

We acknowledge receipt of the draft environmental statement concerning Navigation Improvements in Humboldt Harbor and Bay, Humboldt County, California that was addressed to the Soil Conservation Service on March 11, 1976, for review and comment.

We find no conflict with any Soil Conservation Service on-going or planned program or project. We have reviewed the above draft environmental statement and find that there are no controversial items in the statement within the realm of the Soil Conservation Service's expertise and responsibilities.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

G. H. STONE
State Conservationist

cc: K. L Williams, Director, WTSC, SCS, Portland, Oregon
R. M. Davis, Administrator, USDA, SCS, Washington, D. C. 20250
Fowden G. Maxwell, Coordinator of Environmental Quality Activities, Office of the Secretary, USDA, Washington, D. C. 20250
Council on Environmental Quality, 722 Jackson Place, N. W., Washington, D. C. 20006 - Attn: General Counsel (5 copies)
Ralph Bishop, AC, SCS, Santa Rosa, California
Fran Morrell, SCS, Eureka, California

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
100 CALIFORNIA STREET
SAN FRANCISCO, CALIFORNIA 94111

Colonel H. A. Flertzheim, Jr., District Engineer
Corps of Engineers
San Francisco District
100 McAllister Street
San Francisco CA 94102

MAY 10 1976

Dear Colonel Flertzheim:

The Environmental Protection Agency has received and reviewed the Draft Environmental Statement for a Navigation-Improvement Project in Humboldt Bay, California.

EPA's comments on the draft environmental statement have been classified as Category Lo-2. Definitions of the categories are provided on the enclosure. The classification and the date of EPA's comments will be published in the Federal Register, in accordance with our responsibility to inform the public of our views on proposed Federal actions under Section 309 of the Clean Air Act. Our procedure is to categorize our comments on both the environmental consequences of the proposed action, and the adequacy of the environmental statement.

The draft statement notes that Dungeness crab are found in offshore waters. If it is shown that the crabs are likely to be present at SF-3, the impacts resulting from use of the site should be discussed in the final statement, as well as all alternatives to its use. The location of an alternative site in the vicinity of SF-3 that will have less impact on crab populations should be explored.

The draft statement makes no mention of maintenance dredging requirements. The final statement should discuss these requirements including frequency, amount, characterization of material, proposed sites for disposal, and analysis of impact. The final Statement should also indicate how much dredged material is proposed for disposal at site SF-3.

EPA appreciates the opportunity to comment on this draft environmental statement, and requests one copy of the final environmental statement when available.

Sincerely,

Paul De Falco, Jr.
Regional Administrator

Enclosure

cc: Council on Environmental Quality

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS
Commander (oan)
Twelfth Coast Guard Dist.
630 Sansome Street
San Francisco, CA 94126
(415) 556-2560

5740/5
Humboldt Bay
26 January 1976

From: Commander, Twelfth Coast Guard District
To : District Engineer, U.S. Army Engineer District,
San Francisco

Subj: Aids to Navigation, Humboldt Bay

Ref : (a) CofE ltr SPNED-NN, 15 Dec 1975
(b) CofE ltr SPNED-NN, 13 June 1975
(c) CCGD12 ltr 5740/5, 25 June 1975
(d) CofE ltr SPNED-NN, 6 Nov 1975

1. The proposed deepening and widening of the Humboldt Bay Channels, as relating to aids to navigation, has been reviewed as requested in reference (a).

2. The following comments are made beginning with the project from seaward:

Drawing No. 5-2, Sheet 6
The widening of the turn between buoys 5 and 10 will require the relocation of Humboldt Bay Lighted Bell Buoy 8. This can be done routinely and no additional cost is involved.

Drawing 5-2, Sheet 4
The widening of the turn opposite the T-dock at the U. S. Coast Guard station may require slight relocation of Humboldt Bay Lighted Buoy 12. In reality, the proposed widening at this turn already is marked by present position of Buoy 12 outside the channel. Therefore, no additional aids are considered necessary.

Drawing 5-2, Sheets 3 and 4
The widening of the channel in the vicinity of Humboldt Bay Light 14 does not require additional aids.

Drawing 5-2, Sheet 2
The widening of the Samoa Channel and turning basin were not included in the proposed navigation improvements furnished with reference (b). In September of 1975, as part of our buoy to structure program, the buoys marking the Samoa Channel were replaced by single pile structures for lights 2, 3, and 4. Structures 2 and 4 were placed well outside the channel to accomodate future maintenance dredging of the existing

5740/5
Humboldt Bay
26 January 1976

Subj: Aids to Navigation, Humboldt Bay

300-foot channel. However, they appear to be approximately on the new proposed easterly channel line of the 400-foot channel. The penetration of the piles for lights 2 and 4 is approximately 45 feet. It is emphasized the positions were determined by sextant angles using Chart C&GS 5832 and are approximate. It is recommended you determine the exact position and if, and how far the piles would have to be moved easterly as a result of the widening. If this is necessary it should be included as part of the widening cost. Cost of removal and relocation is estimated at approximately $5,000 per structure. Marking of the turning basin, if considered necessary by the users, may require an aid at the northwest and east corners and would cost approximately $12,000. Funding for the additional aids, if through normal Coast Guard aids to navigation program, would require from two to three years.

3. One set of drawings showing the approximate location of the relocated and additional aids is returned herewith.

D. R. FOSTER
By direction

Encl: (1) Drawings
(Plates 1 thru 7)

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGIONAL OFFICE
50 FULTON STREET
SAN FRANCISCO, CALIFORNIA 94102

OFFICE OF
THE REGIONAL DIRECTOR

OFFICE OF ENVIRONMENTAL AFFAIRS

April 14, 1976

H.A. Flertzheim, Jr., Colonel
C.E. District Engineer
Department of the Army
San Francisco District,
Corps of Engineers
100 McAllister Street
San Francisco, California 94102

RE: Draft Environmental Impact Statement Concerning Navigation Improvements in Humboldt Harbor and Bay, Humboldt County, California

Dear Sir:

The above Draft Environmental Impact Statement has been reviewed in accordance with the interim procedures of the Department of Health, Education and Welfare as required by Section 102 (2) (c) of the National Environmental Policy Act, PL 91-190.

The material provided appears to describe adequately the impacts of the proposed action as well as the alternatives that were presented. The major concerns of this department are related to possible impacts upon the health of the population, services to that population and changes in the characteristics of the population which would require a different level or extent of services. Our review does not identify problems related to these specific concerns.

The opportunity to review this statement was appreciated.

Sincerely,

James D. Knochenhauer
Regional Environmental Officer

cc: OS/OEA
CEQ

BOARD OF SUPERVISORS, COUNTY OF HUMBOLDT, STATE OF CALIFORNIA

Certified copy of portion of proceedings, Meeting on March 2, 1976

RESOLUTION NO. 76-32

URGING DEEP DREDGING OF
HUMBOLDT BAY IN 1977

WHEREAS, the Congress of the United States has authorized a Harbor Improvement Project, (dredging of Humboldt Bay) to more adequately meet the needs of modern shipping and commerce; and

WHEREAS, the United States Army Corps of Engineers San Francisco District office had indicated its capability to initiate the project in its fiscal 1977 rather than 1978 budget, as is currently scheduled;

NOW, THEREFORE, BE IT RESOLVED that the Board of Supervisors of the County of Humboldt hereby urges United States Congressman Don Clausen and United States Senators Alan Cranston and John Tunney to take the action necessary to obtain the reestablishment of the Harbor Improvement Project in the fiscal 1977 budget in order to meet the needs of the shipping industry and the economy of Humboldt County.

Adopted on motion by Supervisor Renner, seconded by Supervisor Peterson and the following vote:

AYES: Supervisors— Renner, Murguia, Peterson, Bass, Dorsey
NOES: Supervisors— None
ABSENT: Supervisors— None

STATE OF CALIFORNIA,)
County of Humboldt) ss.

I, DONALD R. MICHAEL, County Clerk of the County of Humboldt, State of California, and ex-officio Clerk of the Board of Supervisors of the County of Humboldt, do hereby certify the foregoing to be a full, true and correct copy of the original made in the above entitled matter by said Board of Supervisors, at a meeting held in Eureka, California, as the same now appears of record in my office.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the Seal of said Board of Supervisors Mar. 2, 1976

DONALD R. MICHAEL
County Clerk and ex-officio Clerk of the Board of Supervisors of the County of Humboldt, State of California.

By Donald R. Michael
Deputy Clerk.

RESOLUTION NO. 6630

RESOLUTION CONCERNING DEPOSITION OF DREDGE SPOILS ON EUREKA MUNICIPAL AIRPORT PROPERTY IN CONNECTION WITH U.S. ARMY CORPS OF ENGINEERS' PROPOSED HARBOR IMPROVEMENT PROJECT

WHEREAS, the importance of waterborne commerce and the value of natural and man-made resources of Humboldt Harbor and Bay are recognized as most essential and beneficial to the social and economic well-being of the Nation, Humboldt County and the City of Eureka in particular; and

WHEREAS, this City owns or controls certain land resources for which it is considered to be in the public interest to furnish as a site for deposit of material to be dredged from navigation channel improvements described in House Document No. 330 and authorized by the Congress in the River and Harbor Act of 1968; and

WHEREAS, this Council has the legal authority to dedicate certain public resources for specified uses;

NOW THEREFORE, BE IT RESOLVED by the Council as follows:

Section 1. That Council reaffirms its support of the navigation improvement of Humboldt Bay as authorized by the U. S. Congress. Council expresses its desire to cooperate with the U. S. Army Corps of Engineers and with the Humboldt Bay, Harbor, Recreation & Conservation District in satisfying the non-federal obligations expessed in the project document for said navigation improvement by providing approximately one hundred ten (110) acres of City-owned property in the

vicinity of the Municipal Airport on the Samoa Peninsula for deposit of dredged material, provided that the use of all or any portion of such property for such purpose shall be in accordance with mutually acceptable plans and specifications; and, further provided that such plans and usage are found to be in the general public interest on the basis of public hearing and environmental assessments to be prepared by the Corps of Engineers in an Environmental Statement for the project.

Passed, approved and adopted by the Council of the City of Eureka, County of Humboldt, State of California, on the 16th day of December, 1975, by the following vote:

AYES: COUNCILMEN Howard, Goodwin, Cobine, Mengel
NOES: COUNCILMEN None
ABSENT: COUNCILMEN Diltz

s/ Sam J. Sacco
MAYOR OF THE CITY OF EUREKA

ATTEST: s/ Patricia A. Banducci
City Clerk of the City of Eureka

PLANNING DEPARTMENT

COUNTY OF HUMBOLDT

520 "E" STREET EUREKA, CALIFORNIA 95501

PHONE (707) 445-7541

May 7, 1976

Department of the Army
San Francisco District
Corps of Engineers
100 McAllister Street
San Francisco, CA 94102

Subject: Comments on Environmental Statement for Navigational Channel Improvements within Humboldt Harbor and Bay, Humboldt County, California

Gentlemen:

I appreciate the opportunity to comment on the subject report and commend your agency on the thoroughness of the study. Our few comments focus almost exclusively on the land disposal aspects of the project.

COMMENTS:

Under "Relationship of the Proposed Action to Land Use Plans" section 3.005 (pg.46), your report makes the following statement: "The recommended action appears to conform with the recommendations and land use plans outlined in the Humboldt Bay Master Plan (see plate 19) and in the Humboldt County General Plan 2020".

We assume that this "recommended action" includes the project in its entirety, namely, the two principal project components which consists of the dredging operation and the ultimate disposition of the dredged material. If this is the case, this section of your report could be expanded to include relevant textual excerpts from the Harbor Bay Master Plan which more specifically support the "recommended action".

It would also be helpful if the approximate locations of the recommended disposal sites were superimposed on plate 19.

Perhaps if both suggestions given above were incorporated into the revised report the ambigious term "appears to conform" could be replaced with the more positive assertion "The recommended action conforms with the recommendations and land use plan.....".

In conclusion we find your report adequate in its present form. Our comments are intended principally to clarify the relationship between the proposed project and adopted plans.

Very truly yours,

HUMBOLDT COUNTY PLANNING DEPARTMENT

Stanley R. Mansfield
Planning Director

R. London

Robert J. London
Associate Planner

RJL/dp

CC: Ron Holden, CAO
Board of Supervisors
Don Tuttle, Natural Resources Analyst

OFFICE OF THE SECRETARY
RESOURCES BUILDING
1416 NINTH STREET
95814
(916) 445-5656

Department of Conservation
Department of Fish and Game
Department of Navigation and Ocean Development
Department of Parks and Recreation
Department of Water Resources

EDMUND G. BROWN JR.
GOVERNOR OF
CALIFORNIA

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

THE RESOURCES AGENCY OF CALIFORNIA

SACRAMENTO, CALIFORNIA

MAY 1 3 1976

Colonel H. A. Flertzheim
District Engineer
San Francisco District, Corps of Engineers
Department of the Army
100 McAllister Street
San Francisco, CA 94102

Dear Colonel Flertzheim:

The Design Memorandum No. 1 and the Draft Environmental Impact Statement for Navigation Channel Improvements in Humboldt Harbor and Bay, which you submitted to the Office of Planning and Research (State Clearinghouse), have been reviewed by the state agencies concerned. This review fulfills requirements under Part II of the U. S. Office of Management and Budget Circular A-95, and the National Environmental Policy Act of 1969.

The reports have been reviewed by the Departments of Fish and Game, Food and Agriculture, Health, Navigation and Ocean Development, Parks and Recreation, Transportation, and Water Resources; the Energy Resources Conservation and Development Commission; the Public Utilities Commission; the State Lands Commission; the Air Resources Board; the Solid Waste Management Board; and the State Water Resources Control Board.

The project will include the removal of 2,400,000 cubic yards of material from the major navigation channels in order to increase the depth from 30 feet to 35 feet. We do not believe that the removal of an additional five feet is likely to have an adverse effect on local ground water supplies. However, we are concerned with potential water quality problems which may result from the disposal of dredged material on Samoa Peninsula.

Recommendation

The Final EIS should contain revisions responding to specific comments listed on page 2.

General Comments

The proposals for handling dredged material by utilizing ocean dumping, land disposal, and possibly a limited amount of ocean beach disposal, meet with the approval of the staff of the California Regional Water Quality Control Board, North Coast Region. Specific features and control measures necessary to meet water quality requirements will be reviewed and evaluated in connection with design plans prepared by the Corps of Engineers.

Specific Comments

1. The discussion and presentation of bulk sediment analyses (Paragraph 2.017 and Appendix 11) make reference to 1973 Environmental Protection Agency dredged spoil disposal criteria which have since been revised. Dredge Material Disposal Criteria - Revision 1 (November 1975) are the applicable regulations which should be included for comparison with the results of sediment analyses.

2. The EIS states that the ground water under North Spit could be degraded and might affect the water supply of eight homes. As a mitigation measure, we recommend that the Corps of Engineers monitor ground water quality of the eight wells during and following the dredging operations. If the ground water quality is significantly degraded by the saline spoil, we believe that the Corps should accept responsibility for the cost of connecting the eight homes to the existing water distribution system. As a cost-competitive alternative mitigation measure, the Corps could consider paying the cost of connecting the eight homes to the existing water distribution system; then there would be no monitoring or other follow-up costs.

Thank you for the opportunity to review this material.

Sincerely,

CLAIRE T. DEDRICK
Secretary for Resources

By E. Frank Gordon

cc: Director of Management Systems
State Clearinghouse
Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814
(SCH No. 76032206)

STATE OF CALIFORNIA EDMUND G. BROWN JR., Governor
RONALD REAGAN, Governor

CALIFORNIA COASTAL ZONE CONSERVATION COMMISSION
NORTH COASTAL REGIONAL COMMISSION
1656 UNION STREET, ROOM 150
P. O. BOX 4946
EUREKA, CALIFORNIA 95501
(707) 443-1623

May 28, 1976

Mr. Dick Baily
Army Corps of Engineers
100 McAllister Room 711
San Francisco, California 94102

Dear Mr. Baily:

In our telephone conversation last week, I mentioned some of the Coastal Commission staff's concerns about the Army Corps of Engineers dumping dredging spoils on the property next to the City of Eureka's airport on the Samoa Penninsula.

GENERAL COMMENTS:

Our concerns are similar to those expressed by the U.S. Fish and Wildlife Service. These low spots among the dunes support healthy stands of willows and other water tolerant species which are extremely important to various species of wildlife. If these areas are chosen by the Corps to deposit the dredge spoils, the runoff and drainage from the spoils should be designed in such a manor as to not enter these low areas containing the willows. As you know, the salt water coming from the dredge spoils would kill the vegetation, thereby severly reducing its value for wildlife species.

After reviewing slides and other pictures of the proposed spoils dump site, it seems that we would have very few concerns for site 13 B and the western half of area 13 C as far as willow habitat is concerned. However, it appears that the eastern half of area 13 C contains portions of this important willow habitat type.

Although we would probably prefer the offshore dumping of dredge spoils, we realize this adds quite a considerable cost to the project. I feel we could work out the exact boundaries for the dredge spoil areas by walking the property with a member of your staff and delineating the portions of areas 13 B and 13 C that we would be most concerned with.

SPECIFIC COMMENTS:

On page 23, paragraph 2.088, states that there are no rare and endangered vascular plants in this area. Even though the Inventory of Rare and Endangered Vascular Plants of California did not mention the fact that Erysimum menziesii is found in the Eureka quadrangle map, I believe Humboldt State University has specimens of this species and were collected close to, if not on the area proposed for the dumping of dredge spoils. It is also listed in appendix two of this report. For further information on this matter, you should contact either Dr. John Sawyer or Dr. James P. Smith of the Botany Department at Humboldt State University.

Comments on paragraph 4.402 on page 57 would be similar to the above paragraph.

STATE OF CALIFORNIA

EDMUND G. BROWN, JR., Governor

CALIFORNIA COASTAL ZONE CONSERVATION COMMISSION
NORTH COASTAL REGIONAL COMMISSION
1656 UNION STREET, ROOM 150
P. O. BOX 4946
EUREKA, CALIFORNIA 95501
(707) 443-1623

Mr. Dick Baily
Army Corps of Engineers
100 McAllister Room 711
San Francisco, California 94102

Comments on paragraph 4.074 on page 62 would also be similar.

The latest information I have concerning rare and endangered plants is that the rare and endangered plant mentioned above is going to be added to the Federal Register of Threatened or Endangered Fauna or Flora which is dated July 1, 1975.

Policy 26 of the Coastal Plan calls for the protection and restoration of rare and endangered plants and habitat types. If the dredge spoil site has this rare and endangered plant on it, the Coastal Plan policy would be not to permit this site.

The statements in paragraphs 3.001, 3.002, and 3.003 on page 46 are a misinterpretation of Coastal Plan Policies. Dredging, marinas, port facilities, etc. are coastally dependent, however, the placement of dredge spoils is not coastally dependent, that it does not have to be placed on land adjacent to the bay.

You mention policy 26 in the Coastal Plan as referring to fragile habitats. Actually policy 27 is the policy that refers to these fragile areas.

Paragraph 4.055 on page 59 states there would be a loss of resident species in the disposal area. It doesn't mention that the loss of this habitat will also affect migratory species.

Paragraph 4.056 on Page 59 states that the dredge spoils would make it easier to develop this area. This area, as recommended by the Coastal Commission, should remain undeveloped and kept in open space.

Appendix 8 is somewhat misleading in that you have ommitted the Casual and Accidental bird records in this appendix. There are approximately 34 species of birds in these two catagories that have been recorded on the spoils site or similar habitat along the North Spit. This shows the extreme importance of this habitat type. For further information on bird species recorded on or near this site, you should contact Dr. Stanley W. Harris at Humboldt State University.

STATE OF CALIFORNIA
EDMUND G. BROWN, JR. Governor
RONALD REAGAN, Governor

CALIFORNIA COASTAL ZONE CONSERVATION COMMISSION
NORTH COASTAL REGIONAL COMMISSION
1656 UNION STREET, ROOM 150
P. O. BOX 4946
EUREKA, CALIFORNIA 95501
(707) 443-1623

Mr. Dick Baily
Army Corps of Engineers
100 McAllister Room 711
San Francisco, California 94102

I am sure you are aware of the fact that a permit to deposit these dredge spoils on these sites will require a permit from the Coastal Commission.

Thank you for the opportunity to review this report. We will be looking forward to working with you on this particular project.

Yours truly,

Wayne Woodroof

Wayne Woodroof

WW:lp

cc: Dr. S. Harris
Dr. J. Sawyer
Dr. J. Smith
F. Smith U.S. Fish & Wildlife Service
G. Monroe California Dept. of Fish & Game

HUMBOLDT BAY
HARBOR, RECREATION, AND CONSERVATION
DISTRICT
(707) 443-0801
P. O. Box 134
Eureka, California 95501

July 15, 1976

Colonel Henry A. Flertzheim
District Engineer
U.S. Army Corps of Engineers
211 Main Street
San Francisco, CA 94105

Re: U.S. Army Corps of Engineers letter of 23 June.

Dear Colonel Flertzheim;

This letter is acknowledging the review of the District Board of Commissioners of the final Environmental Statement, the General Design Memorandum, and the draft letter of agreement. It is our understanding that the letter of agreement need not be executed at this time. The District understands the requirements and intends to fulfill the non-Federal responsibilities and does intend to execute a final agreement when required prior to commencing project construction.

The District intends to fulfill items of local responsibility on the Humboldt Harbor and Bay, California Improvement Project, substantially in accordance with Federal legislation authorizing such project (Section 101 of 82 STAT. 731), together with those modifications and additional provisions as required by subsequent Federal legislation and policy as specifically set forth herein, to wit:

a. Provide and maintain at local expense adequate wharf terminal facilities in the North Bay, Eureka, and Samoa Channels open to all on equal and reasonable terms for the storage, handling and shipment of lumber and general commerce.

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

c. Provide without cost to the United States all lands, easements, and rights-of-way required for construction and subsequent maintenance of the project and for the aids to navigation upon the request of the Chief of Engineers, including suitable areas determined by the Chief of Engineers to be required in the general public interest for initial disposal of spoil, and also necessary retaining dikes, bulkheads, and embankments therefor or the costs of such retaining works;

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

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

f. Comply with all pertinent provisions of Public Law 91-646 in the land acquisition program.

g. Prohibit construction of new terminals and related structures within 125 feet of the project lines along the North Bay and Samoa Channels.

h. Establish regulations concerning discharge of pollutants in waters of the harbor by users thereof, which regulations shall be in accordance with applicable laws or regualtions of Federal, State and local authorities responsible for pollution prevention and control.

i. Provide for revegetation of the upland disposal sites including stockpiling and restoration of a sufficient amount of topsoil to adequately reseed the area with native vegetation and provide special measures to insure propagation of any rare plants found on the sites in accordance with plans and specifications prepared by the U.S. Army Corps of Engineers.

J. Monitor ground water quality in active wells that may be affected by dredge material disposal and undertake measures necessary to provide adequate drinking water.

Yours very truly,

William J. Startare

WILLIAM J. STARTARE, President
Board of Commissioners

WJS:JBA:sw
enclosure

HUMBOLDT BAY HARBOR, RECREATION,
AND CONSERVATION DISTRICT

RESOLUTION NO. 76-8

RESOLUTION BY THE BOARD OF COMMISSIONERS OF THE HUMBOLDT BAY HARBOR, RECREATION AND CONSERVATION DISTRICT CONCERNING THE UNITED STATES ARMY CORPS OF ENGINEERS PROPOSED HARBOR IMPROVEMENT PROJECT.

WHEREAS, construction of the Humboldt Harbor and Bay, California Improvement Project was authorized by the River and Harbor Act of 1968, approved 13 August 1968 (Public Law 90-483), 90th Congress, 2d Session; and

WHEREAS, the importance of this waterborne commerce is economically vital to the well-being of the Humboldt Bay area; and

WHEREAS, the local area is already affected by double digit unemployment and an economy sorely in need of assistance.

NOW THEREFORE BE IT RESOLVED, that the Board of Commissioners of Humboldt Bay Harbor, Recreation and Conservation District desires the United States of America to commence this project at the earliest opportunity.

PASSED AND ADOPTED by the Board of Commissioners of the Humboldt Bay Harbor, Recreation, and Conservation District at a duly called meeting held on the 7th day of July, 1976, by the following polled vote:

AYES: Commissioner Davenport
Commissioner Startare
Commissioner Gast
Commissioner Ridenhour

ABSENT: Commissioner Christensen

William J. Startare

WILLIAM J. STARTARE, President
Board of Commissioners

ATTEST:

Richard L. Ridenhour

RICHARD L. RIDENHOUR, Secretary
Board of Commissioners

WINZLER & KELLY
CONSULTING ENGINEERS
A Corporation

JOHN R. WINZLER - CE 9878
ROBERT F. KELLY - CE 11005
RONNIE N. CLIFFORD - CE 14071

633 THIRD STREET • P.O. BOX 1345 • EUREKA, CALIFORNIA 95501 • PHONE (707) 443-8326

9 April 1976

U.S. Army Corps of Engineers
San Francisco District
100 McAllister Street
San Francisco, California

Gentlemen:

Re: Draft Environmental Statement
Humboldt Harbor and Bay California
Navigation Improvement

We have reviewed the draft environmental statement for the subject project. As the engineers for the Humboldt Bay Wastewater Authority responsible for the design of an ocean outfall we are concerned about a specific impact of the project which was not identified in the EIS.

The location of the contingency dredge spoil disposal site (Site 17 of Plate 23) on the ocean beach is adjacent to the proposed ocean outfall line. It is also adjacent to two existing ocean outfall lines. The existing lines have experienced operational difficulties due to sanding in of their diffuser sections. Although the proposed outfall line is somewhat longer than the existing lines, and is being designed to prevent sanding in of the diffuser under natural conditions, we are concerned that the possible disposal of a large volume of dredge spoil at the contingency site could adversely affect the operation of the outfall.

We are requesting that this problem be investigated and addressed in the final environmental statement, and assurance provided that there would be no adverse effect on the operation of the proposed outfall. We have attached a preliminary plan and profile for the proposed outfall to assist you.

If you should have any questions regarding this matter, please call.

Very truly yours,

WINZLER AND KELLY

Richard Dornhelm

Richard B. Dornhelm

RBD:dlf

HUMBOLDT STATE UNIVERSITY • Arcata, California 95521 • (707) 826-3245

DEPARTMENT OF BIOLOGY

3 June 1976

Mr. H. E. Pape, Jr.
Chief, Engineering Division
Department of the Army
San Francisco District, Corps of Engineers
100 McAllister Street
San Francisco, CA 94102

Dear Mr. Pape:

Thomas Nelson, our Herbarium Botanist, turned over to me your letter of 25 May 1976 for answering because I have been in contact with the local Coastal Commission. I am taking the liberty of sending you a copy of a recent letter pertaining to the occurrence of rare and endangered vascular plants on the Samoa Peninsula.

Now having seen a copy of the Environmental Statement, it appears to me that there is little doubt as to the occurrence of Erysimum menziesii (Hook.) Wettst. in Disposal Site 13C and probably in Site 13B. Several specimens on deposit in the Humboldt State University Herbarium and recent field observations provide documentation. I doubt that the endemic Orthocarpus castillejoides Benth. var. humboldtiensis Keck occurs on the proposed disposal sites. It is a salt marsh plant.

These local populations of Erysimum menziesii may well be the last in California where the species still flourishes.

Sincerely yours,

J P Smith

James Payne Smith, Jr.
Associate Professor of Botany
Director of the Herbarium

Humboldt Bar Pilots Association

Member of the American Pilots Association

Phone 443-3559
Area Code 707

P. O. Box 3555
Eureka, California 95501

Cable
HUMBAR

April 7, 1976

U.S. Army Corp. of Engineers
100 McAllister Street
San Francisco, California 94102

I, as a Humboldt Bay Bar Pilot, heartily approve of the plans for dredging the channel to 35 feet, but - and this is an extremely important but - not until after the corner by Buoys #7- #8- and #10 where we have to bring in ships through a 110 degree turn is taken care of.

I would like to refer back to my letter dated March 8, 1974 including the drawing on EXHIBIT 5 where I suggested relignment of the channel from light 6 through the 110 degree turn, entering the North Bay Channel to Buoy 12. You will note from Buoy 8, we taper the width to Buoy 12 which makes the channel approximately 200 feet wider at Buoy 10.

This is because we fight strong current and heavy swells from 3 to 5 feet frequently during the winter months making it extremely difficult to turn a large vessel. Your channel recommendation tapers the widening to Buoy 10. This is not acceptable to me for bringing in the larger vessels greater than 660 feet or vessels with deeper drafts, for basically what we will have is a larger turn which will be unusable and will have to approach a small entrance to the upper bay between light 9 and buoy 10.

With your recommendation we have defeated the purpose of widening the channel to the east. We would be better off to widen to the west if Buoy 10 is going to be your stop point.

Humboldt Bar Pilots Association

Member of the American Pilots Association

Phone 443-3559
Area Code 707

P. O. Box 3555
Eureka, California 95501

Cable
HUMBAR

In conclusion, it is extremely important that widening of the channel from the turn through and including Bucy 10 up to Bucy 12 to reduce the funneling affect of the channel as is proposed by the Corp. of Engineers.

Thank you,

Capt. B.T.Bessellieu
Humboldt Bay Bar Pilot

END
3-79