104th Congress, 2d Session – – – – – – – – – – – – House Document 104–231

HUMBOLDT HARBOR AND BAY, CALIFORNIA

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY DATED OCTOBER 30, 1995, SUBMITTING A REPORT TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS

JUNE 10, 1996.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed.

HUMBOLDT HARBOR AND BAY, CALIFORNIA

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U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1996

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LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310-0103

6 JUN 1996

Honorable Newt Gingrich
Speaker of the House
of Representatives
Washington, D. C. 20515

Dear Mr. Speaker:

In final response to a resolution adopted by the House Committee on Public Works and Transportation on September 23, 1982, the Secretary of the Army recommends authorization of a deep-draft navigation project at Humboldt Harbor and Bay, California. The proposal is described in the report of the Chief of Engineers dated October 30, 1995, which includes other pertinent reports and comments.

The views of the State of California and the Departments of the Interior and Transportation are set forth in the enclosed communications.

The recommended plan maximizes net national economic development benefits consistent with environmental quality. The plan provides for deepening the Bar and Entrance Channel to a depth of 48 feet below mean lower low water (MLLW); deepening the North Bay Channel, Samoa Channel, and Samoa Turning Basin to a depth of 38 feet below MLLW; widening the north side of the Entrance Channel an additional 200 to 275 feet; moving the southern edge of the Entrance Channel away from the South Jetty and to the north by 100 feet; and widening and realigning the entrance to the Samoa Turning Basin. Approximately 5.6 million cubic yards of dredged material would be deposited at the Environmental Protection Agency designated ocean disposal site in the Pacific Ocean. In addition, about 26,000 cubic yards of material, considered to be unsuitable for aquatic disposal, would be placed on a confined upland site located on the Humboldt Bay North Spit. Special precautions will take place during dredging to avoid adverse impacts on bird nesting on the adjacent Indian Island rookery, and herring run activity. The recommended project has negligible adverse impacts on fish and wildlife resources and separable mitigation is not required.

Based on October 1995 price levels, the estimated total cost of the recommended plan is $15,180,000, with a Federal cost of about $10,000,000, and a total non-Federal cost of about $5,180,000.

The Office of Management and Budget advises that there is no objection to the submission of the report to the Congress. A copy of its letter is enclosed in the report.

Sincerely,

H. Martin Lancaster
Assistant Secretary of the Army
(Civil Works)

Enclosure

COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

APR 16 1996

The Honorable H. Martin Lancaster
Assistant Secretary of the Army
for Civil Works
Pentagon - Room 2E570
Washington, DC 20310-0103

Dear Mr. Lancaster:

As required by Executive Order 12322, the Office of Management and Budget has completed its review of your recommendation for the report on Humboldt Harbor and Bay Deepening Project, California.

The Administration supports authorization of this project for construction in accordance with your recommendation. The Office of Management and Budget does not object to your submitting this report to Congress.

Sincerely,

T.J. Glauthier
Associate Director
Natural Resources,
Energy, and Science

COMMENTS OF THE STATE OF CALIFORNIA

The Resources Agency

Pete Wilson
Governor

Douglas P. Wheeler
Secretary

of California

California Conservation Corps • Department of Boating & Waterways • Department of Conservation
Department of Fish & Game • Department of Forestry & Fire Protection • Department of Parks & Recreation • Department of Water Resources

November 14, 1995

U. S. Army Corps of Engineers
Policy Review Branch
Policy Review and Analysis Division
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, Virginia 22310-3861

The State has reviewed the Humboldt Bay Harbor (Deepening) Final Feasibility Report and Environmental Impact Statement, Humboldt County, submitted through the Office of Planning and Research.

We coordinated review of this document with the California Coastal, and State Lands Commissions; the Air Resources, Integrated Waste Management, and North Coast Regional Water Quality Control Boards; and the Departments of Fish and Game, Parks and Recreation, Toxic Substances Control, and Transportation.

The Department of Parks and Recreation, Office of Historic Preservation and the California Coastal Commission have issued statements that the project meets their respective requirements. The North Coast Regional Water Quality Control Board has determined that a waiver of Report of Waste Discharge is appropriate for this project. The Department of Fish and Game states that the project is acceptable.

Thank you for providing an opportunity to review this document.

Sincerely,

for James T. Burroughs
Deputy Secretary and General Counsel

cc: Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814
(SCH 95093022)

The Resources Building Sacramento, CA 95814 (916) 653-5656 FAX (916) 653-8102

California Coastal Commission • California Tahoe Conservancy • Colorado River Board of California
Energy Resources, Conservation & Development Commission • San Francisco Bay Conservation & Development Commission
State Coastal Conservancy • State Lands Commission • State Reclamation Board

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COMMENTS OF THE DEPARTMENT OF THE INTERIOR

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

ER 94/956

JUL 21 1995

24 JUL RECD

Mr. David B. Sanford, Jr.
Acting Chief, Policy Review and Analysis Division
Directorate of Civil Works
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, VA 22315-3861

Dear Mr. Sanford:

The Department of the Interior has reviewed the Proposed Chief of Engineers Report and Final Environmental Impact Statement for Humboldt Harbor and Bay Deepening Project, Humboldt County, California. We have the following comments and recommendations.

BACKGROUND

The project would consist of deepening the Bar, the North Bay, the Samoa Channel and deepening and widening the entrance channel and the turning basin. Dredged materials would be disposed of at the Humboldt Open Ocean Disposal Site; the remaining 26,000 cubic yards of sediment contaminated with dioxin and copper would be disposed at the Louisiana Pacific Upland Disposal Site. The purpose of the project is to improve navigation within the channel for larger deep-draft vessels using the harbor. These comments are supported by and supplement our Fish and Wildlife Service's (FWS) Final Fish and Wildlife Coordination Act (FWCA) Report for the Humboldt Harbor and Bay Deepening Project, dated March 1995.

COMMENTS AND RECOMMENDATIONS

The Department's major concerns regarding the project have not been adequately addressed during project development. These concerns have been outlined in the FWCA and our comments on the draft document dated February 2, 1995. The Corps of Engineers has not fully evaluated the cumulative impacts of additional dredging in Humboldt Harbor and Bay. Long-term mitigation, monitoring, and remedial action plans must be included in the project to offset the impacts to the benthic community, eelgrass beds, and the ocean disposal site.

Although the Corps believes this deepening project does not require mitigation because the impacts are "short-term, localized and temporary," the secondary impacts caused by the project to wildlife in this area have not been fully evaluated. Thus, we

continue to recommend that the potential secondary impacts of the project be addressed in greater detail.

If the project proceeds as outlined, the adverse impacts resulting from this dredging project would not be adequately mitigated. Full mitigation must be provided for the following impacts: 1) loss of 45 acres of previously undredged harbor bottom, including benthic, flatfish, and dungeness crab habitats; and 2) secondary impacts caused by increased disturbance and traffic from larger vessels that would use Humboldt Harbor and Bay.

Until the impacts of the dredging project on the harbor, bay, and the ocean disposal site are fully analyzed and plans have been developed to mitigate for these impacts, the Department continues to oppose the Humboldt Harbor and Bay Deepening Project.

We appreciate the opportunity to comment on this proposed project. We also wish to make every effort to resolve our differences. Therefore, please contact the Fish and Wildlife Service's California State Office at (916) 979-2113.

Sincerely,

for Kenneth L. Masser

Willie R. Taylor
Director, Office of Environmental
Policy and Compliance

LETTER TO THE DEPARTMENT OF THE INTERIOR

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

30 OCT 1995

Policy Review and Analysis Division
Policy Review Branch

Mr. Willie R. Taylor
Director, Office of Environmental
Policy and Compliance
U.S. Department of Interior
Washington, D.C. 20240

Dear Mr. Taylor:

This is in response to your letter of July 21, 1995, in which you provided Department of Interior comments on the Proposed Chief of Engineers Report and Final Environmental Impact Statement for the Humboldt Harbor and Bay Deepening Project, California.

Your letter states that Department of Interior's major concerns regarding the project have not been adequately addressed and that long-term mitigation, monitoring, and remedial action plans must be included in the project to offset the impacts to the benthic community, eelgrass beds, and the ocean disposal site. More specifically, you stated that full mitigation must be provided for: (1) loss of 45 acres of previously undredged harbor bottom; and (2) secondary impacts to the water column, that would result from increased traffic and maintenance dredging.

As you know, there is a wide disparity between the U.S. Army Corps of Engineers San Francisco District (SFD) Office and the U.S. Fish and Wildlife Service (FWS) California State Office, in estimating project impacts and mitigation requirements. As a result, my staff has devoted considerable time analyzing reports and working with district personnel regarding this issue. This involvement in assessing the differences includes analysis and comment on both the draft and final project reports, including review of draft and final Coordination Act Reports (CAR). My staff attended a Feasibility Review Conference in August of 1994 during which these issues

were discussed and a representative of the FWS California State Office was in attendance. At that time, it was obvious that the FWS and SFD were using different policy and project assumptions to evaluate impacts and mitigation. Unfortunately, follow-up coordination with the FWS to clarify project scope and with-project conditions has not resulted in appropriate revisions to the final CAR. FWS still recommends significant mitigation in the form of habitat creation and the Corps recommends that no replacement habitat is needed. The following is my analysis of the situation.

The FWS mitigation recommendations are based on the results of a "modified" HEP analysis that was performed by FWS, without the assistance of the SFD or other resource agencies. This HEP analysis purports a loss of approximately 43 average annual habitat units (AAHUs) that would require mitigation. The losses estimated were based on the following: (1) 581 acres of existing channel deepening that would decrease the habitat suitability index for benthic organisms from 0.4 to 0.36 for a total AAHU loss of about 24; (2) 45 acres of "new channel" deepening that would decrease habitat suitability for benthic organisms from 0.7 to 0.36 for a loss of about 15 AAHUs; and (3) a loss of over four AAHUs to the water column in adjacent bay habitat. According to the FWS HEP analysis, water column losses would occur in the 581-acre and 45-acre areas of above work, as well as to adjacent bay habitat. The estimated loss to the water column is low because the loss would only occur during the period of construction and there would be no long-term project impact to the water column. As a result of these projected losses, FWS recommends creation of about 43 acres of optimum one cover type habitat (rock reef) or about half as many acres if a two cover type habitat (i.e., an upland channel cut that would create both benthic and water column habitat) is developed. Mitigation options range in cost from a low of $5.57 million to a high of $18.3 million.

There is a discussion on pages 125-126 of the CAR about the assumptions that were used in determining with-project values (habitat suitability) for the impacted areas. The major assumptions were: (1) greater deposition of materials in deepened channels along with increased maintenance

dredging; (2) increased ship traffic; and (3) a potential for the existence of eelgrass in the 45 acres of new channel.

I find that the above assumptions are incongruent with the projected with-project conditions. The SFD in both the draft and final feasibility study, reported a lower rate of shoaling, a reduced level of maintenance dredging compared to existing conditions, and a reduced level of ship traffic, because the port would be able to accommodate larger ships. Channel widening does involve deepening an area that is adjacent to the existing deep draft channel, but this area totalling 45 acres has been dredged in the past to deeper than 20 feet (deep subtidal benthic), has very little potential to contain eelgrass based on depth and recent surveys, and is not really "new channel" as it is characterized in the CAR. The proposed project would directly impact 9,000 square feet of shallow subtidal habitat (less than 20 feet deep), but this area is considered so small as to warrant the impact insignificant. Water column impacts resulting from dredging sand are of short duration and are, therefore, not significant enough to warrant mitigation.

The FWS also recommends mitigation for disposal of dredged material in the Humboldt Open Ocean Disposal Site (HOODS). The SFD has correctly told the FWS that their concerns related to the use of HOODS should be coordinated with EPA who has made the final determination regarding site designation. It should be pointed out that the intent of designating an ocean disposal site is to do so in a manner by which use of the site for disposal of suitable materials causes insignificant impact.

There are two other major factors that need to be weighed when evaluating the FWS mitigation recommendations. In a March 28, 1994, letter from the California Department of Fish and Game (DFG) to the FWS, DFG states that it would support mitigation, but the draft CAR "does not indicate if, or to what extent, any of these types of habitat modifications will actually take place...." DFG questions the use of HEP in this particular environment and quotes the CAR as stating that the Corps has made efforts to avoid

direct impacts to established eelgrass beds. FWS recommendations and its HEP analysis did not change substantially from the draft CAR commented on by DFG, to the final CAR currently under review. A second major factor that needs to be considered in evaluating FWS recommendations is the FWS response to SFD comments on the draft CAR. The SFD letter of February 7, 1995, made 43 comments on the draft CAR in which FWS assumptions, HEP analysis, and other matters were critiqued. FWS appended its responses to SFD comments to the final CAR, however, the bulk of FWS responses are simply "comment noted" or sometimes, "comment incorporated." There was virtually no refutation of any of the SFD comments.

Taking the above into account, I agree with the SFD assessment of impacts. I believe that the mitigation recommended by the FWS is based on inaccurate assumptions and application of the HEP analysis. I believe that the SFD has appropriately considered the mitigation recommendations made by FWS, has provided responses to those recommendations and, therefore, has fulfilled the requirements of the Fish and Wildlife Coordination Act. I believe that the recommended project has negligible adverse impact to fish and wildlife and separable mitigation is not required. Potential impacts to eelgrass beds can be avoided by adjusting the area of channel deepening. As an additional consideration to avoid potential impacts, a window of permissible days would be placed on dredging operations in the Samoa Turning Basin to avoid bird nesting on the adjacent Indian Island rookery. Also, a marine biologist would be on board the dredge during the herring spawning season to redirect the dredge work area away from any herring run activity.

In addition to the issue of mitigation, I would like to address a statement contained in the background information paragraph of your letter regarding the 26,000 cubic yards of dredged material ("contaminated with dioxin and copper") to be disposed on the Louisiana-Pacific Site. This 26,000 cubic yards of material is deemed "unsuitable for aquatic disposal" due to very trace amounts (0.3 picograms/gram) of dioxin. The detectable level for dioxin is 0.2 picograms/gram. Testing has not revealed any copper contamination in these sediments.

I want you to be assured, and I hope it is reflected in this letter, that we have given careful study and consideration to the recommendations made by you and the FWS California State Office.

Sincerely,

Arthur E. Williams

Arthur E. Williams
Lieutenant General, U.S. Army
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF TRANSPORTATION

U.S. Department
of Transportation

United States
Coast Guard

Commandant
U.S. Coast Guard

2100 Second St. S.W.
Washington, DC 20593-0001
Staff Symbol: G-MEP-3
Phone: (202) 267-0500

16452

JUL 31 1995

3479

Mr. David B. Sanford, Jr.
Policy Review Branch
Policy Review and Analysis Division
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, Virginia 22315-3861

Dear Mr. Sanford:

This is in response to your letter of May 18, 1995, in which you forwarded the proposed report of the Chief of Engineers, the report of the district engineer, and final environmental impact statement (FEIS) on Humboldt Harbor and Bay, California. We have reviewed the reports and the FEIS, and have no comments to offer.

Thank you for providing the Coast Guard the opportunity to review the above reports and FEIS.

Sincerely,

T. R. REILLY
Commander, U.S. Coast Guard
Chief, Environmental
Coordination Branch
By direction of the Commandant

HUMBOLDT HARBOR, CALIFORNIA

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

30 OCT 1995

CECW-PW (10-1-7a)

SUBJECT: Humboldt Harbor and Bay, California - 10182

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on improvements to the existing navigation project at Humboldt Harbor and Bay, California. It is accompanied by the reports of the district and division engineers. These reports are in final response to a resolution by the Committee on Public Works and Transportation of the United States House of Representatives adopted 23 September 1982. The study resolution requested review of prior reports on Humboldt Harbor and Bay with a view to determining the advisability of increasing the depth of and making other modifications with respect to the Humboldt Harbor and Bay project, in the interest of navigation and related purposes. Preconstruction engineering and design activities for the Humboldt Harbor and Bay project will be continued under authority of this resolution.

2. The reporting officers considered various alternative plans to promote transportation efficiencies and operational safety in Humboldt Harbor and Bay. They recommended a plan that consists of: (1) deepening the Bar and Entrance Channel to a depth of -48 feet mean lower low water (MLLW); (2) deepening the North Bay Channel, Samoa Channel, and Samoa Turning Basin to a depth of -38 feet MLLW; (3) widening the north side of the Entrance Channel, from the jetty heads to the turn into the North Bay Channel by an additional width varying from 275 feet at the jetty heads to 200 feet at the turn; (4) moving the southern edge of the Entrance Channel away from the South Jetty and to the north by 100 feet; and (5) widening and realigning the Samoa Turning Basin entrance. Approximately 5.6 million cubic yards of dredged sediments from this project would be deposited at the EPA designated Section 102 Humboldt Open Ocean Disposal Site in the Pacific Ocean. Approximately 26,000 cubic yards of material, considered to be unsuitable for unconfined aquatic disposal, would be placed on a confined upland dredged material site consisting of about 23 acres and located on Louisiana Pacific property on the Humboldt Bay North Spit. As an additional

consideration to avoid potential environmental impacts, a window of permissible days would be placed on dredging operations in the Samoa Turning Basin to avoid bird nesting on the adjacent Indian Island rookery. Also, a marine biologist would be on board the dredge during the herring spawning season to redirect the dredge work area away from any herring run activity. The recommended project has negligible adverse impact to fish and wildlife and separable mitigation is not required.

3. The April 1995 feasibility report recommended a less costly locally preferred plan, which provided for deepening the North Bay Channel, Samoa Channel, and Samoa Turning Basin to a depth of -38 feet MLLW, even though the feasibility report identified the National Economic Development (NED) plan as a depth of -39 feet MLLW. However, additional information obtained during Washington level review indicated that the NED plan is at a depth of -38 feet MLLW. The benefits attributable to deepening the channel would actually be less than reported in the feasibility report. The basis for this determination is that benefits attributable to wood chip exports are limited by the design draft of the specialized ships which carry this cargo. A reporting officer reanalysis confirmed that the economic optimum plan changed from -39 feet to -38 feet MLLW. There are two major commodities carried in two types of specialized ships which would benefit from the proposed improvement. About three fourths of the deepening benefits result from pulp and particle board exports. The loading capability (design drafts) of these specialized bulk carriers would not be less than the depth of the proposed improvement. Woodchip exports account for about one fourth of the benefits. However, the actual design draft of most of the ships in the world woodchip fleet place upward limits on the ability to benefit from the deepening to -38 or -39 feet MLLW. Therefore, the woodchip benefits were not attributed to channel depths deeper than -37 feet MLLW. The NED plan is now identified as deepening to -38 feet MLLW and this recommended plan is also the plan preferred by the non-Federal sponsor.

4. Based on October 1995 price levels, the first cost of the recommended plan is estimated at $15,180,000. Average annual benefits are $1,890,000 and average annual costs are $1,020,000 which results in net benefits of $880,000. The benefit cost ratio is 1.86 to 1. The Federal share of the first cost of the recommended plan is estimated at $10,000,000 and the non-Federal

share is estimated at $5,180,000, including the additional 10 percent non-Federal share of the general navigation features required by Public Law 99-662. The analysis is based on a discount rate of 7.75 percent and a 50 year period of economic analysis. Following construction, the Federal Government would operate and maintain the general navigation features of the project.

5. The feasibility study included initial investigations for a beneficial use of dredge material. Specific uses included beach nourishment, creation of a bird island in Humboldt Bay, protection of an eelgrass bed near North Spit Breakwater, and salt marsh restoration in the Humboldt Bay National Wildlife Refuge, South Bay. Although no specific plans for beneficial use are included in the recommended plan, these and other opportunities will be further investigated in preconstruction engineering and design (PED), under the authority of Section 204 of the Water Resources Development Act of 1992(P.L. 102-580).

6. Washington level review indicates that the recommended plan is technically sound, economically justified, and environmentally acceptable. The recommended project complies with applicable U.S. Army Corps of Engineers planning procedures and regulations. Also, the views of interested parties, including Federal, State, and local agencies have been considered.

7. In a letter dated 21 July 1995, the U.S. Department of Interior (DOI) expressed concerns regarding potential project environmental impacts. It is the position of DOI that long-term mitigation, monitoring, and remedial action plans must be included in the project to offset impacts to the benthic community, eelgrass beds, and the ocean disposal site. DOI states that full mitigation must be provided for (1) the loss of 45 acres of previously undredged harbor bottom, including benthic, flatfish, and dungeness crab habitats, and (2) secondary impacts to the water column, that would result from increased traffic and maintenance dredging. The reporting officers, supported by Washington level review, determined that DOI did not consider that the recommended project would result in a lower rate of shoaling, a reduced level of maintenance dredging compared to existing conditions, and a reduced level of ship traffic because the port would be able to accommodate larger ships. The recommended channel widening would result in

deepening an area that is adjacent to the existing channel, however, this area of 45 acres has been dredged in the past to deeper than -20 feet MLLW, has very little potential to contain eelgrass based on depth and recent surveys. The project would directly impact 9,000 square feet of shallow (less than -20 feet MLLW) subtidal habitat, but this area is considered so small as to make the impact insignificant. Water column impacts resulting from dredging sand would be of short duration, and therefore, would not be significant enough to warrant mitigation.

8. I concur in the findings, conclusions, and recommendations of the reporting officers, as modified to reflect the change in depth of the NED plan as set forth in paragraph 3 above, and accordingly, I recommend that the improvements to the existing project be authorized. My recommendation is subject to cost sharing, financing, and other applicable requirements of Public Law 99-662, as amended, for this kind of project. Also, this recommendation is subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including the following requirements:

a. Provide all lands, easements, rights-of-way, and suitable borrow and dredged or excavated material disposal areas, and perform or ensure the performance of all relocations, determined by the Federal Government to be necessary for the construction, operation and maintenance of the general navigation features.

b. Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the general navigation features. Such improvements may include, but are not necessarily limited to, retaining dikes, wasteweirs, bulkheads, embankments, monitoring features, stilling basins, and dewatering pumps and pipes.

c. Provide, during the period of construction, a cash contribution equal to 25 percent of the total cost of construction of the general navigation features.

d. Repay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, an additional 0 to 10 percent of the total cost of

construction of general navigation features depending upon the amount of credit given for the value of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas provided by the non-Federal sponsor for the general navigation features. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, right-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10 percent of the total cost of construction of the general navigation features.

e. For so long as the project remains authorized, operate and maintain the local service facilities and any dredged or excavated material disposal areas in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government.

f. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the general navigation features for the purpose of inspection and, if necessary, for the purpose of operating and maintaining the general navigation features.

g. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors.

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

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

j. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the general navigation features.

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

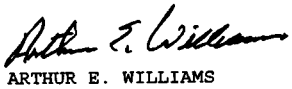
l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR, Part 24, in acquiring lands, easements, and rights-of-way required for construction, operation, and maintenance of the general navigation features; and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

m. Comply with all applicable Federal and State laws and regulations, including, but not limited to, section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled

"Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

n. As part of the payments required by Section 101(a)(1) and Section 101(a)(2) of Public Law 99-662, as amended, contribute to the payment of total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of one percent of the total amounts authorized to be appropriated for commercial navigation.

9. The recommendation contained herein reflects the information available at this time and current departmental policies governing formulation of individual projects. It does not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program nor the perspective of higher review levels within the executive branch. Consequently, the recommendation may be modified before it is transmitted to the Congress as a proposal for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the State of California, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.



ARTHUR E. WILLIAMS
Lieutenant General, U.S. Army
Chief of Engineers

REPORT OF THE DISTRICT ENGINEER

HUMBOLDT HARBOR AND BAY (DEEPENING)
Humboldt County, California
FEASIBILITY STUDY FOR NAVIGATION IMPROVEMENTS

EXECUTIVE SUMMARY

This Feasibility Report responds to the Committee on Public Works and Transportation of the U.S. House of Representatives 1982 Resolution to investigate navigation improvements to the Federal channels in Humboldt Harbor and Bay, California. The non-Federal sponsor is the Humboldt Bay Harbor, Recreation, and Conservation District.

The purpose of the study is to investigate the feasibility of Federal participation in improving commercial deep draft vessel navigation in Humboldt Bay. Based on the analysis of the identified problems, needs, and opportunities, the following planning objectives were formulated: (1) Improve deep draft navigation safety; (2) maximize the efficient use of the Bay and Harbor by commercial deep draft vessels; and (3) maintain and improve environmental resources to the maximum extent practicable.

The study alternatives which were developed include structural alternatives and a no-action plan. The plan which was selected involves a limited widening of the Entrance Channel; deepening of the Bar and Entrance, and Middle Ground of the North Bay Channels to -48 feet (MLLW datum) and deepening of the remaining North Bay channels to -38 feet and improving the Samoa Turning Basin. All "suitable" dredged sediments (approximately 5,600,000 cubic yards) would be disposed of at a proposed designated ocean disposal site. Approximately 26,000 cubic yards of "unsuitable" dredged sediments would be disposed of on land in a confined disposal area.

The annual benefits derived from the project would be $2,259,000. The first cost for construction would be $14,874,000 and the annualized cost $958,000. The net annual benefits would be $1,301,000.

The Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Humboldt Harbor and Bay (Deepening) Study is bound with, and immediately follows, this Feasibility Report. The EIS/EIR is easily identified by its blue paper, and is being circulated for public and agency review to meet the full requirements of the National Environmental Policy Act (NEPA), as well as to meet the requirements of the California Environmental Quality Act (CEQA).

HUMBOLDT HARBOR AND BAY (DEEPENING)

Humboldt County, California

FEASIBILITY STUDY FOR NAVIGATION IMPROVEMENTS

1. INTRODUCTION

1.1 STUDY AUTHORITY

This study is in response to the Committee on Public Works and Transportation of the U.S. House of Representatives Resolution, September 23, 1982 which reads:

> *"Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Humboldt Harbor and Bay, California, published as House Document No. 330, 90th Congress, 2nd Session, and other pertinent reports, with a view to determining the advisability of increasing the depth of and making other modifications with respect to the Humboldt Harbor and Bay Project, in the interest of navigation and related purposes."*

1.2 STUDY PURPOSE AND SCOPE

The federal interest in navigation is derived from the Commerce Clause of the Constitution and is limited to the navigable waters of the United States. Federal navigation improvements in or on these waters are in the general public interest and must be open to the use of all on equal terms. When facilities to accommodate and service vessels, or load and unload cargo are required as associated facilities to achieve the benefits of a federal project, they are entirely the responsibility of local interests.

The general navigation features in harbor areas considered eligible for federal participation include channels, jetties and breakwaters, and basins or water areas for vessel maneuvering and turning.

This study addresses the feasibility of navigation improvements to the federal channels in Humboldt Harbor and Bay, and to determine the extent of federal participation.

The purpose of the study is to investigate the navigation problems associated with the existing Federal projects in the Humboldt Harbor and Bay, and recommend improvements. The study alternatives include structural plans and a no-action plan. The associated benefits, costs, and environmental impacts are described.

1.3 LOCAL SPONSOR

The local sponsor for this Study is the Humboldt Bay Harbor, Recreation, and Conservation District (HBHRCD) located in Eureka, California. As required by the Water Resources Development Act of 1986, the local sponsor is funding 50 percent of the study cost. The City of Eureka is also participating, by providing their contribution directly to the HBHRCD.

Study Participants and Coordination

The San Francisco District of the Corps of Engineers (COE), in conjunction with the local sponsor, conducted two public workshops/scoping meetings in December 1988 during the initial stages of the Reconnaissance study phase. In July 1989, the Corps, together with the HBHRCD, conducted a public workshop in Eureka for the purpose of presenting the preliminary study alternatives and providing the interested public with an opportunity to express their views on these alternatives.

The COE and the HBHRCD signed the Feasibility Cost Sharing Agreement on July 12, 1990 and the COE filed a Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the study on August 28, 1990. Funding to start the feasibility study was received in early September 1990. On September 12, 1990 the COE and the HBHRCD conducted two public workshops and EIS scoping meetings to initiate the feasibility phase of the study. A supplemental NOI and Notice of Preparation (NOP) of an Environmental Impact Report (EIR) to comply with the California Environmental Quality Act, was filed on December 17, 1993. The Notice of Availability for the Draft Environmental Impact Statement/Report on the Humboldt Harbor and Bay (Deepening) Study was filed on December 16, 1994. The public comment period on the Draft EIS/EIR closed on January 30, 1995.

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

Coordination with the U.S. Fish and Wildlife Service (FWS) was initiated in the reconnaissance study phase and the Service provided a planning aid letter in May 1989. In May 1991, the FWS provided a Preliminary Draft Fish and Wildlife Coordination Act Report for the feasibility study. Following completion of additional studies such as eelgrass surveys, hydrodynamic and shoaling studies, and vessel simulation, the Fish and Wildlife Service provided a Draft Coordination Act Report in February 1994 and a Final Coordination Act Report in March 1995.

Coordination with other agencies and the general public has also occurred at various points during study execution. Other agencies include the National Marine Fisheries Service, U.S. Coast Guard, California Department of Fish and Game, the California Coastal Commission, and the California Regional Water Quality Control Board, and the North Coast Unified Air Quality Management District.

A public hearing was held on January 11, 1995 to solicit comments on the Draft Feasibility Report and EIS/EIR, the results of which have been included in this final Feasibility Report and EIS/EIR.

1.4 PREVIOUS STUDIES

There have been numerous reports prepared concerning Humboldt Harbor and Bay. The reports and legislative documents authorizing the various features and stages of navigation improvements in Humboldt Bay follow:

Adopted by River & Harbor Act of	Recommendation	Document w/ 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 west to natural channel; dredging Mad River Shoal to 8 feet deep	House Ex. Doc 59 Cong., 3rd sess.
5 July 1884	Construct South Jetty and continue channel improvements	River & Harbor Approp. Act of 1884
5 August 1886	$75,000 continued improvement of Harbor with provision for title to 12 acres of land to be conveyed to the U.S.	River & Harbor Appropriations Act of 1886
3 July 1892	Map & cost estimates for continuing Harbor improvements with provision for two parallel jetties	Chief of Engnrs Annual Report (p. 3120), Annual River & Harbor Approp Acts from 1892-1899.
3 March 1899	Continuing Harbor improvements with provision for two parallel jetties	House Doc. 528, 55th Cong., 2nd sess., dated 8 June 1898.
25 Jun 1910	Rebuilding the jetties and channel improvements to Arcata & Hookton	House Doc.950, 60th Cong., 1st sess., dated 16 April 1908, House Doc. 204, 61st Cong., 2nd sess. & House Doc. 326, 61st Cong., 2nd 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., 2nd sess.
30 Aug 1935	Entrance channel 30 feet deep & 500 feet wide	Rivers & Harbors Committee Doc.14, 74th Con.,1st sess.
26 Aug 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 & 800 feet long	Rivers & Harbors Committee Doc.11, 75th Cong., 1st sess.
16 Jul 1952	Bar & Entrance channel 40 feet deep, tapered from 1,600 feet to 500 feet wide; North Bay channel 30 feet deep & 400 feet wide; Eureka channel 30 feet deep to mile 5.0; Samoa channel 30 feet deep	Rivers & Harbors Committee Doc 143, 82nd Con, 1st sess.
Aug 1968	North Bay channel 35 feet deep; Samoa channel 35 feet deep; widen turns at mile 0.75 & 2.6; provide a 1,200 by 1,200 foot anchorage in North Bay	House Doc, 330, 90th Cong, 2d sess.

In addition, two studies to improve the Fields Landing Channel were completed in 1980 and 1985 at the request of the Humboldt Bay Harbor, Recreation, and Conservation District and under the authority of Section 107 of the River & Harbor Act of 1960, as amended. Section 107 provides the authority for the Secretary of the Army, acting through the Chief of Engineers, to plan, design and construct small river and harbor improvement projects not specifically authorized by Congress. The 1980 study resulted in a draft Detailed Project Report and Environmental Impact Statement which recommended: a Fields Landing Channel 32 feet deep; selected channel widening; and widening of the Turning Basin. This study was terminated due to the lack of necessary assurances from the local sponsor. The 1985 study resulted in an initial appraisal which recommended a Fields Landing Channel 32 feet deep from the Entrance Channel to approximately 400 feet south of Olsen Terminal (now known as the Humboldt Bay Forest Products Terminal). This study was also terminated at the request of the local sponsor.

1.5 PLANNING PROCESS OF THE CORPS OF ENGINEERS

Six major steps comprise the Corps of Engineers planning methodology. These include: (1) specification of water and related land resources problems and opportunities; (2) inventory, forecast, and analysis of water and related land resource conditions within the study area; (3) formulation of alternative plans; (4) evaluation of the effects of the alternative plans; (5) comparison of alternative plans; and (6) selection of the recommended plan based upon the comparison of the alternative plans. Planning is a dynamic process requiring iteration of the various steps. Through iteration of the various planning steps, the study becomes refined as new data is gathered. These planning steps are conducted and reported in a two stage planning process consisting of a Reconnaissance phase and a Feasibility phase.

In conducting the Reconnaissance Phase of this Study, which was completed in November of 1989, emphasis was placed upon identifying the problems and opportunities, and defining the planning objectives. Also, emphasis was placed upon developing preliminary plans to address the identified planning objectives. All preliminary plans received full consideration at a comparative level of detail. Public involvement and coordination with other agencies facilitated the identification of problems, concerns, and opportunities that could be addressed through water and related land resources planning.

The second and final phase of the planning process, the Feasibility Study Phase, which is the focus of this Feasibility Report, further evaluates the plans to address the planning objectives. The alternative plans are evaluated and a plan is selected and recommended for implementation. The approved Final Feasibility Report will be presented to the Committee on Public Works and Transportation in response to its resolution.

1.6 REPORT ORGANIZATION

This Feasibility Report is divided into seven Chapters. Chapter 2 (Study Area Description) which follows, provides a description of the Bay and Harbor and of the physical, biological, and socio-economic conditions of the area. Chapter 3 is concerned with the identification of the problems and needs, which are the focus of this study. Chapter 4 focuses on the development of a recommended plan based on the evaluation of the planning objectives, construction options, environmental constraints, and engineering considerations. Chapter 5 presents a detailed description of the Recommended Plan of Action. Coordination and Public Involvement are discussed in Chapter 6 and the Study Conclusions and Recommendations are presented in Chapter 7.

2 STUDY AREA DESCRIPTION

2.1 DESCRIPTION OF THE STUDY AREA

Harbor Location and Description

Humboldt Bay is an estuary located in Humboldt County on the coast of northern California, approximately 225 nautical miles north of San Francisco and 156 nautical miles south of Coos Bay, Oregon (Figure 1).

Humboldt Bay consists of two large bays connected by a long thalweg. The estuary is separated from the Pacific Ocean by two long sand spits varying in width from one-eighth mile to one mile. The entrance to Humboldt Bay is formed by two armored rubble mound type jetties approximately 2,000 feet apart. From the entrance, the Bay extends north and south for a distance of approximately 14 miles, varying in width from 0.5 miles to 4 miles, and covering an area of over 17,000 acres.

The tidal range between mean lower low water (MLLW) and mean higher high water (MHHW) is about 6.4 feet at the south jetty and 6.7 feet at Eureka. The Humboldt Bay Entrance Channel is exposed to high waves, at times exceeding 30 feet in height, during the winter months. The water surface of the Bay covers over 26 square miles at extreme high tide and about 8 square miles at minus low tide.

The Bay is part of a coastal terrace, at the foot of the surrounding steep mountains and narrow valleys. The landscape is typical of the Northern California coast. Much of the surrounding lands are covered by dense forests of California redwoods and Douglas fir. Humboldt Bay is the only harbor between San Francisco, California and Coos Bay, Oregon with deep draft channels.

Existing Navigation Project

The existing Federally authorized and maintained navigation channels in Humboldt Bay are shown on Figure 2 and include :

(1) Bar and Entrance Channel 40 feet deep, tapered from a width of 1,600 feet at seaward mile-0.90 to 500 feet at seaward mile-0.20 & then 500 feet wide to mile 0.8;

(2) North Bay Channel 35 feet deep & 400 feet wide between mile 0.75 & mile 4.29;

(3) Outer Eureka Channel 35 feet deep & 400 feet wide between mile 4.29 & mile 5.0;

(4) Inner Eureka Channel between mile 5.0 and mile 6.30 which is 26 feet deep and 400 feet wide;

(5) Samoa Channel, 35 feet deep and 400 feet wide between mile 4.29 and mile 5.84;

VANCOUVER
PACIFIC OCEAN
COOS BAY
156 NMI
EUREKA
225 NMI
SAN FRANCISCO
LOS ANGELES
NOT TO SCALE
LOCATION MAP

FIGURE 1

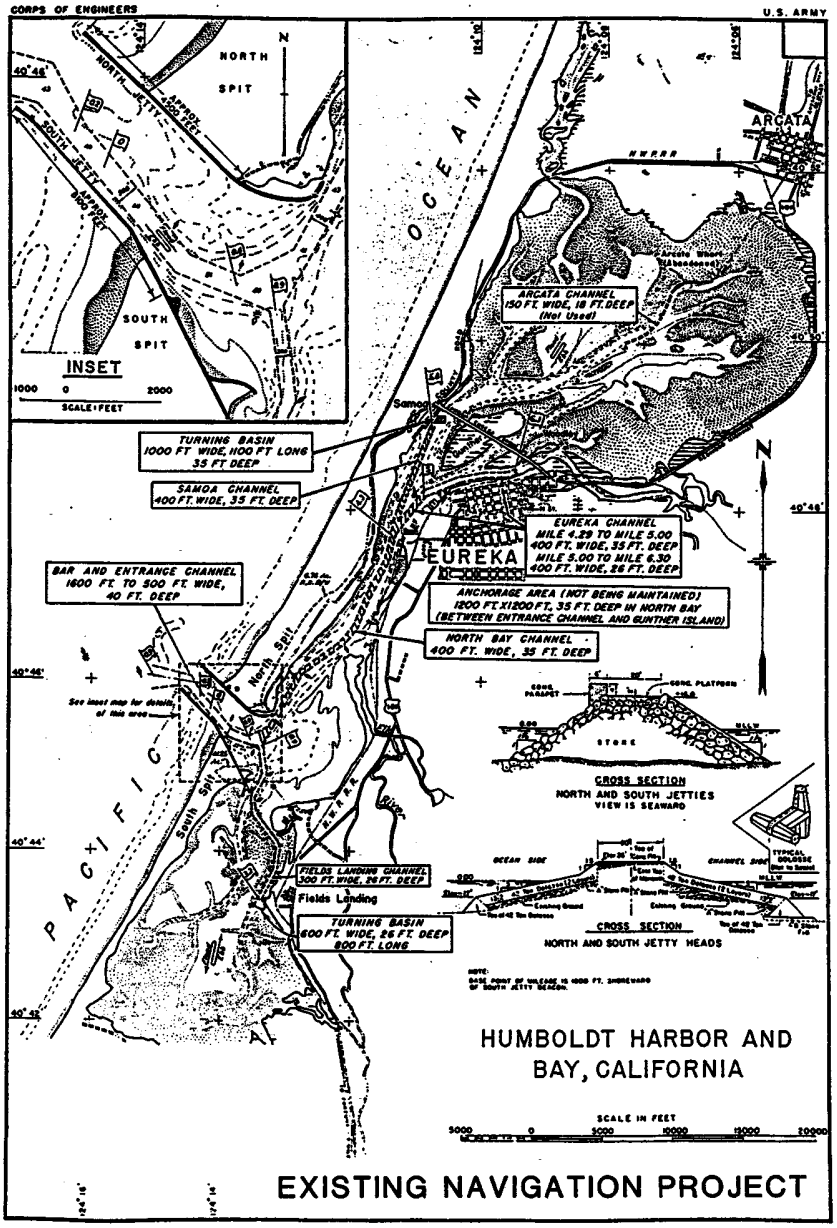

CORPS OF ENGINEERS
U.S. ARMY
NORTH SPIT
SOUTH SPIT
INSET
SCALE IN FEET
OCEAN
ARCATA
ARCATA CHANNEL
150 FT. WIDE, 18 FT. DEEP
(Not Used)
TURNING BASIN
1000 FT. WIDE, 1100 FT. LONG
35 FT. DEEP
SAMOA CHANNEL
400 FT. WIDE, 35 FT. DEEP
EUREKA
EUREKA CHANNEL
MILE 4.29 TO MILE 5.00
400 FT. WIDE, 35 FT. DEEP
MILE 5.00 TO MILE 6.30
400 FT. WIDE, 26 FT. DEEP
BAR AND ENTRANCE CHANNEL
1600 FT. TO 500 FT. WIDE,
40 FT. DEEP
ANCHORAGE AREA (NOT BEING MAINTAINED)
1200 FT. X 1200 FT. 35 FT. DEEP IN NORTH BAY
(BETWEEN ENTRANCE CHANNEL AND GUNTHER ISLAND)
NORTH BAY CHANNEL
400 FT. WIDE, 35 FT. DEEP
North Spit
South Spit
PACIFIC
FIELDS LANDING CHANNEL
100 FT. WIDE, 26 FT. DEEP
Fields Landing
TURNING BASIN
600 FT. WIDE, 26 FT. DEEP
800 FT. LONG
CROSS SECTION
NORTH AND SOUTH JETTIES
VIEW IS SEAWARD
CROSS SECTION
NORTH AND SOUTH JETTY HEADS
HUMBOLDT HARBOR AND
BAY, CALIFORNIA
SCALE IN FEET
EXISTING NAVIGATION PROJECT

FIGURE 2

(6) Turning Basin beyond mile 5.84 at the upper end of the Samoa Channel which is 35 feet deep and 1,000 feet wide by 1,000 feet long;

(7) Anchorage Area 35 feet deep and 1,200 feet wide by 1,200 feet long in the North Bay between the Entrance Channel and Gunther Island (the anchorage area is not maintained);

(8) Fields Landing Channel, 26 feet deep and 300 feet wide and a turning basin at mile 3.16 which is 600 feet wide and 800 feet long.

(9) Arcata Channel located in the extreme North Bay (18 feet deep and 150 feet wide) is no longer used for commercial navigation and has not been maintained since 1931.

Population Centers

Adjacent to the Bay are two population centers, Eureka and Arcata, and several smaller communities. Eureka, with a 1992 estimated population of 24,850, is the largest city on the Northern California Coast, and is also the county seat for Humboldt County. Arcata, with an estimated 1992 population of 14,700, is the location of Humboldt State University. Other communities in the Humboldt Bay area include Fairhaven, Fields Landing, King Salmon, and Samoa (Figure 3).

Transportation

The Humboldt Bay area is served not only by water-borne transportation, but also by highways, rail, and air.

U.S. Highway 101 is the major highway serving the Humboldt Bay Area. It traverses the area in a north/south direction, connecting the Oregon border to the north with Santa Rosa and the San Francisco Bay Area to the south. The Humboldt area is connected to Interstate Highway 5 via State Route 299.

Railroad service connects Arcata and Eureka with cities to the south for freight service only. There are railroad spurs serving all the docks and industries on the Humboldt Bay North Spit, which historically has been used primarily by the logging industry. There are no major railroad lines located north or east of the City of Arcata.

The major airport serving commercial airline passengers and freight is the Eureka-Arcata Airport. It is located about sixteen miles north of Eureka, near the community of McKinleyville.

Water-borne transportation is discussed in detail in other sections of this Feasibility Report.

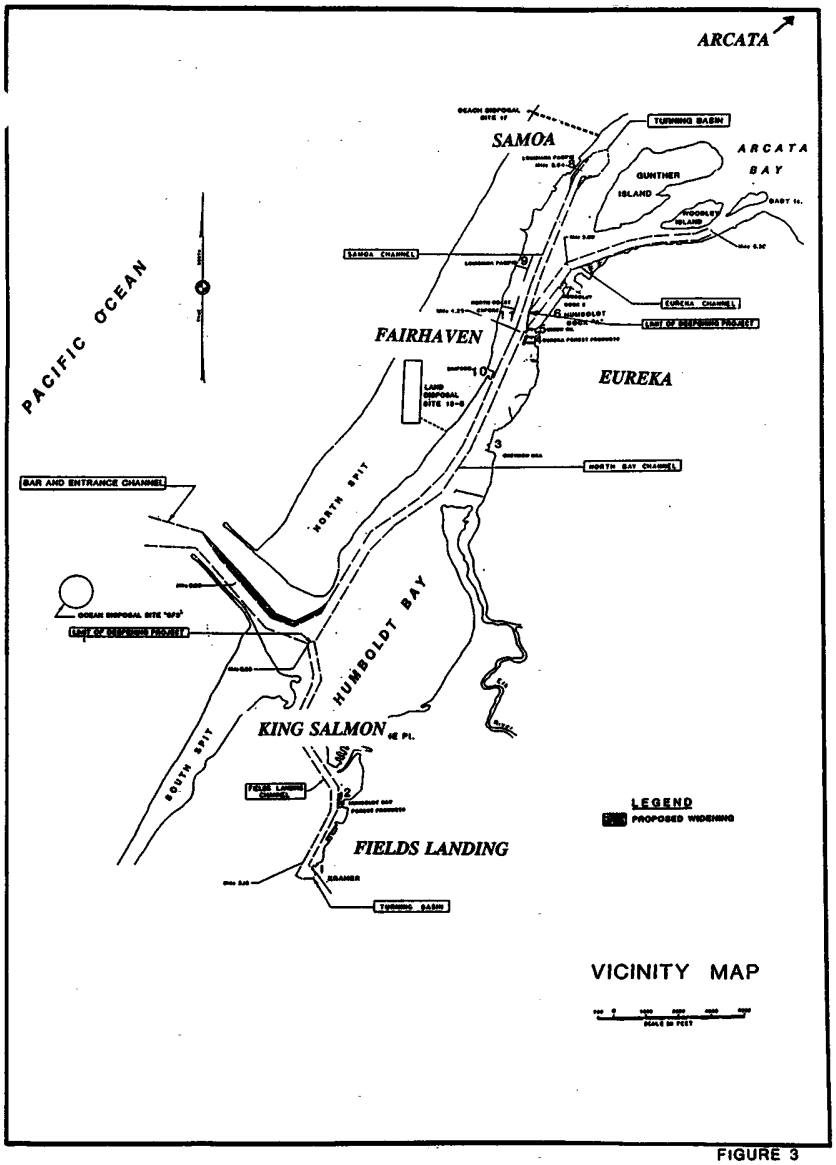

ARCATA
TURNING BASIN
SAMOA
ARCATA
BAY
GUNTHER
ISLAND
SAMOA CHANNEL
EUREKA CHANNEL
PACIFIC OCEAN
FAIRHAVEN
EUREKA
NORTH BAY CHANNEL
BAR AND ENTRANCE CHANNEL
NORTH SPIT
HUMBOLDT BAY
KING SALMON
SOUTH SPIT
FIELDS LANDING
TURNING BASIN
LEGEND
PROPOSED WIDENING
VICINITY MAP

FIGURE 3

2.2 ENVIRONMENTAL CONDITIONS

The following is an overview of the environmental conditions of Humboldt Harbor and Bay. The Environmental Impact Statement/Report (EIS/R) following this Feasibility Report provides a detailed discussion of the information summarized below.

Physical Conditions

Climate The Humboldt Bay area temperatures are moderated by the ocean. The average annual mean temperature is 52 degrees (F) with a variance of only 10 degrees from summer to winter along the coast. The summers are cool, with fog occurring from July through September. The average rainfall, occurring primarily in the winter, is 38 to 40 inches per year. During the winter season, severe storms, winds and squalls occur frequently along the coast.

Geology Humboldt Bay is located along the coastal margin of the northern Coastal Ranges geomorphic province of California. Sediments within the Bay range from fine to medium-grained sand containing shells and occasionally gravel to silty clay, locally with organic matter. The Entrance Channel, North Bay Channel, and Samoa Channel contain sediments that are predominantly sand. Exceptions to this include the upper half of the Samoa Turning Basin, and possibly a local area in the North Bay Channel opposite Fairhaven where bottom sediments of silty and sandy clays with some organic matter have been previously found.

Hydrology Jacoby and Freshwater 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 grasslands, marshlands, and mudflats. There are many smaller tidal sloughs at the north end of the Bay near Arcata. The Mad River slough is a former 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 and 13.5 miles north of the Entrance Channel. Tidal exchange to the Bay is through the Entrance Channel.

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.

Sedimentation In recent geologic history, gradual diminution in size of the Bay has occurred as various estuaries have filled with sediment and extended the east Bay margin westward. A majority of the shoaling in the navigation channels is from material carried to the Bay entrance by longshore drift along the Pacific Coast. The primary sources of this material are the Eel River, about ten miles south of the inlet to the Bay, and the Mad and Little Rivers, about 14 and 20 miles north of the inlet. Because of limited riverine drainage into the Humboldt Bay system, sediment of local fluvial origin is a small portion of the total sediment budget.

Wave Conditions The Humboldt Bay Entrance Channel is exposed to high waves produced by local coastal storms, accompanied by high winds, and is exposed to high waves or swells generated by distant Pacific storms. Both types of waves generally occur between November and April. Significant wave heights up to 26 feet occur on an annual basis. The

Humboldt Bay Entrance Channel is exposed to high waves, at times exceeding 30 feet in height during the winter months.

Since Humboldt Bay is a relatively large body of water, fairly large waves can be generated within the Bay by high winds. For example, southerly winds acting on the long fetch of water can be expected to generate a wave approaching three feet in height at the Eureka Channel.

Currents The Humboldt Harbor channels are aligned with the historic tidal drainage patterns of Humboldt Bay. As a result, tidal currents generally are parallel to the channels. In the North Bay Channel, the velocity is less than 2 knots, and does not exceed 3 knots. Between the entrance jetties, the velocity is about 2 knots, with a maximum of about 4 knots.

Seismicity The local seismic history is event active. Recent earthquakes include a 1954 event with a Richter magnitude 6.5, centered on the Mad River fault zone about 10 miles from Eureka. A Richter magnitude 7.0 earthquake occurred in November 1980 approximately 26 miles offshore of Patricks Point and approximately 33 miles from Eureka. A magnitude 7.2 earthquake occurred in April 1992, 27 miles south-southwest of the Humboldt Bay Entrance Channel and near the town of Petrolia. This earthquake was followed by two additional quakes of magnitudes 6.8 and 6.5, respectively. The aftershocks were located approximately 10 miles offshore of Cape Mendocino along the southern edge of the subduction zone. These three earthquakes caused extensive damage in the town of Ferndale located 13 miles south-southeast of Humboldt Bay. No damage to the jetties along the Entrance Channel was detected, and no damage was found to the breakwater and jetty at Buhne Point located approximately one mile southeast of the Entrance Channel.

Biological Resources

Originally Humboldt Bay and its adjacent wetlands covered more than 27,000 acres. It has since been reduced to approximately 17,000 acres. The major wetland types which exist in the Bay area are freshwater marsh, salt marsh, intertidal mud flats, shallow water bays, and tidal channels.

The flat pasture lands surrounding the Bay are interspersed with shallow drainage ditches, borrow pits, and various streams which create a myriad of freshwater marsh habitat. During the relatively dry summer months this habitat type is confined to the limits of the stream banks and comprises some 40 acres, but winter rains cause the waters to expand out over the lowlands, creating new areas of freshwater marsh. Depending on the amount of rainfall, this may increase the total area of freshwater marsh up to tenfold, or 400 acres, during the winter months. Permanent freshwater marshes are found at the southeast end of the Bay in the Salmon Creek and Elk River drainages extending into the area known as Beatrice Flat; and in the bottomlands to the north of the Bay, extending northward nearly to the Mad River and along the Mad River Slough.

The salt marsh habitat occurs only in remnant stands along the perimeter of the Bay, in tidal tributaries, and on islands within the Bay. The total salt marsh remaining is estimated at 970 acres, only 10-15% of the historical acreage. The largest single tract of salt marsh is on Indian Island, which lies north and west of the city of Eureka and contains 200 acres of salt marsh habitat. In the South Bay, salt marsh habitats are confined to small islets or narrow edge cover along the shoreline and tributary sloughs totalling another approximate 100 acres.

Intertidal mud flats are areas which are fully exposed at low tide and entirely inundated by water at high tide. They range from about -3 or -4 feet MLLW to 5 or 6 feet MLLW. Given their fluctuating nature, the exact acreage is difficult to quantify, but the average is about 7,200 acres. The largest areas of intertidal mud flats occur in the Arcata and South Bays.

The mud flats are rich in the invertebrate life upon which most of the avian wildlife of the Bay is dependent. It is here that the bulk of food organisms consumed by the Bay's fish and wildlife is produced and many of the vital life processes upon which the Bay's productivity depends take place. As a wildlife habitat, the mud flat is probably the most important area in the Bay. The total bird use days recorded here surpass that of all other habitat types. During low tide, the exposed mud flats are feeding grounds for thousands of shorebirds which move across the mud in search of small invertebrates with their long, probing bills.

Approximately 6,000 acres in the Bay can be classified as shallow water, with this habitat type most common in the Arcata and South Bays. The bottom of these areas are rarely, if ever, exposed completely at low tide and it is this characteristic that separates them from the neighboring mud flats. The vast majority of eelgrass growth is in these areas and is normally of sufficient density to prevent boat passage except where disturbed by oyster culture. Eelgrass is the major food of the black brant and other waterfowl species, including American widgeon, scaups, Canada geese, and pintail. In total, eelgrass beds account for about 20% of the shallow water habitat of the Bay. Humboldt Bay has one of the three largest stands of eelgrass in the Pacific Northwest region.

Tidal channels are naturally occurring trenches which are the deepest areas in the Bay and are situated almost always below MLLW. Beginning at the Bay Entrance, navigation channels proceed north to the Samoa and Eureka channels and south to Fields Landing. These channels are periodically dredged to maintain their authorized depths, which can be expected to exert some influence over the creatures therein. Eelgrass also grows in dense stands in and along the edges of some of these channels.

Humboldt Bay is one of the most important estuarine areas of the California coast in terms of wildlife resources. It is second only to San Francisco Bay in the variety and numbers of species which use it annually. The Bay forms a vital link in the chain of coastal wetlands which extend from the Arctic Circle to South America and provides habitat essential to the survival of migrating and wintering water birds. It also supports a large number of resident birds and mammals throughout the year.

Local wildlife populations undergo dramatic seasonal fluctuations. The highest numbers and greatest variety occur during the fall and winter months when migrant birds appear and numbers are changing constantly. Populations are generally more stable, and at much lower levels, during the summer months.

Mammals At least fifty species of mammals are found in the Humboldt Bay area and can be divided into terrestrial and marine species. Most of the terrestrial mammals are not directly associated with the Bay, but utilize the adjacent upland areas.

Marine mammal species are necessarily confined to the sea and salt water areas of the Bay and its tributary sloughs, and all are migratory. The Pacific harbor porpoise is a regular visitor, but is not normally found in large numbers. It is the only type of porpoise which commonly utilizes the Bay and is usually seen in deep water channels. Dolphins are seldom

seen in the Bay, but the Pacific bottlenose dolphin and common dolphin occur along the Humboldt coast. Seals and sea lions are usually seen close to the coast and sometimes in the Bay itself. The Stellar sea lion and California sea lion are commonly seen in the ocean and sometimes in the Bay and its tributary streams and sloughs. The harbor seal is by far the most common marine mammal of Humboldt Bay and large numbers of these animals can be seen at low tide on hauling out areas in the North and South Bays.

Birds. The most spectacular wildlife forms of Humboldt Bay are its birds, and over two hundred species have been recorded in the general area. Each fall and winter millions of migrating birds pass along the California coast on their southern trek, and most pause to rest and feed on or near the Bay for varying periods of time. Others may spend the entire winter locally without moving further south. The region also supports a large variety of year-round residential birds.

Humboldt Bay is ecologically most important to the water associated birds. The Bay lies along the Pacific flyway which extends from Alaska to South America. There are twenty-two species of ducks which commonly use Humboldt Bay. Arcata Bay supports over 70% of the duck use and the South Bay receives less than the remaining 30%. About 2% of the duck use occurs in the channel areas between the two bays.

Humboldt Bay historically contained the largest wintering populations of brant on the west coast of the United States and still provides habitat critical to the west coast black brant population. At one time wintering brant numbered as high as 10,000, but the current population is less than 100 birds. Most brant pass through the Humboldt area in the fall, pausing only for a short time to rest and feed before moving south. In late December, they begin to return in large numbers and Humboldt Bay is their first major "refueling stop". Many will stay in the Bay until late April to May before continuing their northern journey to ancestral breeding grounds. The South Bay is by far the most important brant area and 90% of the brant use is recorded there, the remainder being in Arcata Bay.

Fish. Humboldt Bay provides habitat for some ninety-five species of fish representing forty-one families. Some spend their whole lives within the confines of the Bay area, while others migrate out of the Bay after they develop into adults, and still others only visit the Bay to feed. Many of these species may seldom be seen, but all are an integral part of the Bay ecosystem. Each has its role as predator, scavenger, or prey.

Humboldt Bay is an important spawning and nursery ground for the Pacific herring. Herring enter the Bay in the winter and spring to spawn, depositing their eggs in clusters on eelgrass, algae, and rocks in shallow water. Northern anchovies enter the Bay in the spring and summer to feed, and both of these fish are important forage species for birds and game fish, such as salmon.

Eight members of the flounder group live at least part of their lives in Humboldt Bay, inhabiting the channels, and sandy and mud flat bottoms. English sole, California halibut, and starry flounder are examples of flounders found in the Bay.

The anadromous fish of Humboldt Bay include the chinook salmon, coho salmon, steelhead, and coastal cutthroat trout. All have similar life cycles in which the adults spend varying periods at sea before returning to freshwater streams to spawn. In past years, the tributaries of Humboldt Bay supported large populations of anadromous fish species. Tributaries which are still of some importance to these fish include Jacoby Creek, Eureka Slough, Ryan Slough, Freshwater Slough, and Elk River.

Threatened and Endangered Species. Five bird species of concern are found in the vicinity of Humboldt Bay. The California brown pelican (Pelecanus occidentalis californicus), American peregrin falcon (Falco peregrinus anatum), western snowy plover (Charadrius alexandrinus), marbled murrelet (Brachyramphus marmoratus), and Aleutian Canada goose (Branta canadensis) are Federal and State listed endangered species. An endangered species is one that is threatened with extinction throughout all or a significant portion of its range.

Three plant species have also been Federally listed as endangered. They are the western lily (Lilum occidentale), Menzie's Wallflower (Erysimum menziesii) and beach layia (Layia connosa). These three species can be found mostly on the sand dunes of the Humboldt Bay North Spit and at a few locations around the Arcata and South Bays. The winter-run chinook salmon (Oncorhynchus tshawytscha) is both Federally and State listed endangered, and may be found off the coastline near Humboldt Bay.

A list of Federally threatened or endangered marine mammals potentially occurring in the project area is limited to the Gray whale (Eschrichtius robustus). These whales migrate south from October until January, and return north from February through June, with December through April being the period of heaviest activity. During this time, they can often be seen within a few hundred yards of shore. Other whales which occur in the general vicinity but are not expected to be near the project area include the Fin whale (Balaenoptera physalus), Sei whale (Balaenoptera borealis), and Blue whale (Balaenoptera musculus), which are all found in coastal waters of California, but not usually close to the coast. The Sperm whale (Physter macrocephalus (catadon)) occurs off the coast but usually beyond the 500 foot depth contour. The Pacific Hump-back whale (Megaptera novaengliae) can be found close to the coast in summer months and the Right whale (Eubalaena glaciali) during the winter and spring migration periods.

Socio-Economic Conditions

The Humboldt County economy has grown slowly but fairly steadily over time in spite of the seasonal and cyclical variations to which it has been subjected. Although the forest products industry has been the economic mainstay of the County economy for many years, other fields provide employment opportunities as well. The other employment fields are: agricultural and fishery; construction and mining; manufacturing; transportation and public utilities; retail and wholesale; financial, insurance and real estate; personal and business services; and Federal, State and local government. Growth in these various employment fields is expected to remain fairly stable, with the exception of the seasonal changes in income (i.e., forest products, manufacturing and tourism related fields), often associated with the depressed economy in Humboldt County.

Humboldt has a long history of commercial fishing and ranks as one of the most productive areas on the west coast. Commercial fishing is the third largest industry in the Humboldt area. The commercial fish landings exceed those of all other ports north of Los Angeles and are comprised of different species than those of the larger ports south of Los Angeles. Processors in Eureka and Fields Landing fillet and pack seafood, shipping Humboldt County products throughout the United States and overseas.

A variety of fish and shellfish are caught year round in waters adjacent to the County. There are 45 different species which contribute to the commercial fishing effort. Of these, oyster culture is the largest commercial fishing activity within Humboldt Bay itself and is primarily limited to the North Bay, where a small amount of sea perches and clams are also

taken. The primary seafood groups caught commercially are groundfishes (flatfish and rockfish), albacore tuna, Dungeness crab, and salmon. Salmon is the most valuable fin fish on a per-pound basis and has historically sustained a large portion of the commercial fishery.

The land use pattern around the Bay is quite diversified. Residential, commercial and industrial zones are located in or near the cities of Arcata and Eureka, along the Samoa Spit, and at several other locations along the Bay shore. The Humboldt Bay National Wildlife Refuge was approved in 1971 and is managed by the U.S. Fish and Wildlife Service in the North and South Bays. It was established primarily to preserve and enhance those values associated with migratory birds but recognizes the many other uses of the Bay system as well. The refuge is authorized to encompass approximately 8,900 acres but not all of this acreage has been currently approved. The remainder of the land is devoted to agricultural or remains undeveloped. However, there is a general trend towards urban, commercial, or industrial development of these areas.

Humboldt Bay provides a multitude of outdoor recreational opportunities which are associated with its biological resources. The unique combination of redwood forests, rocky headlands, sandy beaches and estuaries make the Humboldt County coastline particularly attractive. The number of visitors to the area is ever-increasing, and their importance to the local economy is high. Cold air and water temperatures limit the use of the area for swimming, water skiing, and other such water contact sports. The greatest use is, therefore, closely tied to natural resources. The most significant consumptive resource use in the immediate area of the Bay is waterfowl hunting. There are many private hunting clubs in operation and many private landowners permit hunting on their farmlands. Upland game hunting species include pheasant, quail, doves, bandtailed pigeon, grouse, squirrels, and rabbits. Deer hunting is the major appropriative use of big game.

Humboldt Bay is one of the primary sport fishing areas in California. Anglers fishing in the Bay catch at least 41 species of fish, oysters, ten species of clams, and three species of crabs. Seven of California's twelve shellfish reserves are here. These areas are State lands which have been set aside for public clamming and oystering. The fishing effort can be separated into shore, pier, skiff and skindiving categories. Shore fishermen operate predominantly on the South Jetty and Buhne Point Jetty and catch the widest variety of species. Salmon are caught during the summer in the Bay Entrance, particularly from the jetties or in a boat between the jetties, but most are caught in the nearshore waters outside the Bay.

Non-consumptive uses of the Bay constitute by far the heaviest recreational use. These include surfing (Entrance Channel and North Jetty), nature study, photography and eco-tourism. The Humboldt Bay National Wildlife Refuge is a location for many of these uses and the numbers of people engaging in these types of activities is ever-increasing. The Audubon Society, Surfriders, and Sierra Club are among the environmental organizations with local chapters in the Humboldt area.

Finally, Humboldt Bay, with its wealth of natural resources and physical features, is highly attractive for educational and scientific purposes. It offers almost unlimited possibilities for the study of natural history, ecology and marine sciences. The College of the Redwoods and Humboldt State University concentrate in these fields that are not available at many other institutions, and provide research results on the many facets of the Bay environment.

3. PROBLEMS AND NEEDS

3.1 GENERAL

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

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

3.2 PUBLIC CONCERNS

Public concerns may be expressed directly, such as at a public meeting, or indirectly through Government representatives and agencies, and statutory requirements. Local concern for deep draft navigation in Humboldt Bay is evidenced by the initiation of the Study Authority. Since the study began, five public meetings have been conducted (three in the reconnaissance phase and two in the feasibility phase), to identify the specific problems of the public's concern.

The following public concerns have been expressed during this study:

a) The existing navigation channels are inadequate to provide safe passage for existing deep draft vessels. Given present channel depths, widths, and alignments, vessel maneuvering problems are experienced in the channels.

b) Efficient deep-draft navigation in Humboldt Bay is a major component of the economic engine of Humboldt County. Inadequate navigation works will impede future economic growth and activity in the Humboldt area.

c) Humboldt Bay and its natural resources are ecologically and economically sensitive. Navigation activities have the potential to significantly impact the natural character and features of the Humboldt Bay area.

Harbor Operation and Development Plan

A primary indicator of the "problems" requiring resolution for the Humboldt Bay area is the "Five Year Operation and Development Plan, 1991-1996" prepared by the local sponsor, the Humboldt Bay Harbor, Recreation, and Conservation District (HBHRCD, 1991). The Harbor Commission, the District's Chief Executive Officer, a Citizen's Advisory Committee, and the general public all made major contributions to the Plan. It expresses the needs of the Harbor District, the local communities, the marine industry, and natural resources interests.

The Plan states that the "Mission Statement" of the HBHRCD is *". . to plan for the orderly development of Humboldt Bay and other tidelands while promoting and enhancing natural resources. It shall serve all the people of Humboldt County by encouraging compatible uses of the bay and adjacent upland areas, developing and managing property, and delivering services to maritime related commerce, fishing, recreation, industry and accessory commercial activities (Page 8, HBHRCD, 1991)."*

The first "Strategic Objective" listed in the Plan is *"To enhance safety and access by deep dredging the entrance and channels of the bay and creating wider turning basins and anchorages (Pg 11)."* This theme was consistently reiterated throughout the Reconnaissance phase of the study and verified by certification of the Reconnaissance Study.

3.3 PROBLEMS AND OPPORTUNITIES

Feasibility level investigations of the Humboldt navigation problems confirmed that the Federal interest in the problem was limited to deep-draft vessel issues only. While many shallow draft vessels, including barges, tugs, fishing boats, Coast Guard rescue craft, recreational, and commercial fishing vessels share the use of the Humboldt Federal channels with the deep draft vessels, shallow draft operators have not expressed concern about navigating the channels. Additionally, the Feasibility investigation narrowed down the number of channels involved in deep draft vessel issues from five to three.

Five navigation channel design options were developed for the South Bay, which is primarily the Fields Landing Channel. However, it was determined that the proposed improvements to this Channel would benefit only one facility, the Humboldt Bay Forest Products Terminal, which is defined as a "Private For Profit Property" by Corps of Engineers Engineering Regulations (ER 1165-2-123, 31 August 1989 and 30 October 1992) and the Water Resources Development Act (WRDA) of 1990 (Public Law 101-640). It is the Corps determination that since the single user facility on the Fields Landing Channel is *"..privately owned and operated for profit.."*, federal participation in improvement of the Fields Landing reach of Humboldt Bay is not appropriate. The local sponsor was advised that the Fields Landing segment could only be included in this Feasibility Study if the local sponsor agreed to pay 100 percent of the Study cost for that segment of the Study, and should the Fields Landing segment be recommended for construction, the costs would be 100 percent non-federal. The local sponsor did not indicate any desire to exercise this option. Also, the Outer Eureka Channel was eliminated from this study as, at this time, it has no active deep draft terminals to serve and thus deep draft improvements for this channel could not be justified.

The investigation however, did find navigation problems of Federal interest in the Bar and Entrance Channel, the North Bay Channel, including its "middle ground" reach, and the Samoa Channel, including its associated Turning Basin. The navigation problems of the Bar and Entrance, North Bay and Samoa Channels consist of two concerns: safety and efficiency. Safety issues were related to channel alignments and the depth of the Bar, Entrance, and Middle Ground of the North Bay Channels. Efficiency issues involved only the depth of the interior channels (i.e., the North Bay, Samoa, and Samoa Turning Basin). Vessel underkeel clearance is both a safety and efficiency issue.

Problem No. 1. Navigation Safety:

Channel widening and realignment is needed to allow for safe transit of the vessels entering and leaving the Bay. A navigation simulation study performed using experienced harbor pilots from the Humboldt Bay area showed that deep draft vessel use of the Entrance Channel is not safe under existing conditions. The navigation simulation study is included as an attachment to the Engineering Analysis, Appendix A of this Report.

An example of this problem is that during the winter, with highly variable weather and sea conditions and four knot currents in the Entrance Channel, an outbound vessel cannot change its required heading from 320° to 285° in turning through the middle ground into the Entrance Channel. In addition, the trend in vessel design has been, and continues to be, to decrease the horsepower of the vessel power plant. Generally, over recent years, the deep draft vessels calling at Humboldt Harbor have gone from 16,000 horsepower to 8,000 horsepower (Humboldt Bay Bar Pilots Association, July 1989). The lower powered vessels require additional maneuvering room, as compared to higher powered vessels under the same sea conditions. The channel alignment between the Entrance Channel and North Bay Channel through the "middle ground" of the North Bay Channel is a safety problem to be addressed in Plan Formulation.

Problem No. 2. Navigation Inefficiencies:

The primary problems and opportunities relating to navigation improvements for Humboldt Harbor and Bay are related to the forest products industry, and its access to terminals in the Bay. The existing North Bay Channel depths do not allow for the efficient movement of deep draft vessel commerce. The deep draft vessels that currently call at Humboldt have vessel design drafts that are constrained by the existing channel depths. The various shippers/shipping companies at Humboldt Harbor have indicated their concerns with the existing channel depths and how they would change their vessel operations in response to improved channel depths. The existing Humboldt Bay deep draft vessel transportation inefficiencies are due to vessel light-loading practices, economies of scale, vessel rerouting, and transportation mode (i.e., truck vs. ship). An example of an existing transportation inefficiency due to vessel light-loading practices follows.

Large vessels cannot enter or depart from Humboldt Harbor fully loaded. The depth of the channel limits the operating draft of the vessel which in turn limits the vessel load. With a deeper channel, vessels can load more fully. A larger load distributes the fixed operating costs over a larger volume to reduce the cargo's cost per ton. A deeper channel also reduces the need for vessels to top-off at other harbors, allowing the vessel to load fully before sailing to an overseas destination.

Another example of an existing transportation inefficiency is that certain vessels, particularly those that transport pulp and particle board, travel extra distances just to accommodate Humboldt Harbor's channel depth constraint. With a deeper channel, transportation efficiencies are derived from reduced sailing distances from the expected changes in vessel sailing routes.

Cargo Volume Humboldt Harbor's total tonnage has increased substantially from the 1970's to the mid-1980's and has since remained stable. Due to environmental and market issues, a somewhat lowered stabilized level is expected in the future. Total waterborne commerce tonnage has averaged 1,467,000 short tons between 1983 and 1992.

The forest products that are being shipped through Humboldt Bay and Harbor facilities include lumber, logs, particle board, pulp, and wood chips. Appendix B to this Report, the Economic Analysis, provides detailed information concerning the shipment of these commodities.

Fleet Mix The world fleet changes in response to the growing needs of the particular industry it serves. In the case of the timber industry, the high value of the cargo and the sensitive nature of many forest products cargoes are the major influences that shape the vessel design and purpose, port handling and storage facilities, integration of shipping, storage, and inland distribution functions. Due to the adopted shipping practice of multi-port loading and discharge, a lumber vessel might load only 9-10,000 tons on a vessel of 35-40,000 dead weight tons (DWT). A given vessel could be delivering and picking up at a number of west coast ports, with various degrees of loading depending on the most efficient operations plan at that time.

Vessels used in the wood products trade are becoming larger and more fuel efficient, because of the economic efficiencies and lower cost per unit these vessels yield utilizing deeper channels. The highest percentage of vessels using Humboldt Harbor are in the 40-50,000 Dead Weight Ton (DWT) range. An examination of the shipping records of Humboldt Harbor for the last decade shows a gradual growth of utilization of larger vessels. It is reasonable to expect this trend to continue and the smaller vessels (15-30,000 DWT) will gradually be phased out and replaced by the larger ones.

3.4 PLANNING OBJECTIVES

Based on the analysis of the identified problems, needs, and opportunities, and the existing physical, human, and environmental conditions of the study area, planning objectives were identified to direct the formulation and evaluation of alternative plans. The order of the planning objectives listed below, should not be construed as an indication of urgency or priority.

1. Improve deep draft navigation safety in the Humboldt Harbor and Bay channels (safety). This objective is fundamental to improving safe navigation conditions for deep draft vessels entering, leaving, and using the Humboldt Harbor and Bay.

2. Maximize the efficient use of Humboldt Harbor and Bay by commercial deep draft vessels (efficiency). This objective is fundamental to improving the efficiencies of existing and future operations with respect to transportation costs; loading, and unloading; and other costs associated with movement of waterborne commerce. This objective is consistent with Federal planning guidelines and the primary goal of contributing to the Nation's economic development consistent with applicable environmental law, regulations, and policy.

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

a. Avoid any unacceptable adverse impact on environmental resources.
b. Where impacts are not avoidable, provide justifiable mitigation.
c. All significant unavoidable impacts must be mitigated to insignificance.
d. Improve or restore environmental quality wherever possible without adding undue cost or compromising the primary planning objectives.

3.5 PLANNING CONSTRAINTS

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

a. The development of navigation improvements for deep draft vessels can not adversely impact other maritime uses of Humboldt Bay and Harbor.

b. The marine resources of Humboldt Bay include eelgrass beds of high value, which are scarce throughout the Pacific Northwest and California. Humboldt Bay supports the only significant beds of eelgrass in California and Oregon. The U.S. Fish and Wildlife Service indicates that these beds should not be adversely impacted.

c. The development of navigation improvements for deep draft vessels should not adversely impact the approved Humboldt Bay National Wildlife Refuge, an 8,900 acre area bordering the Humboldt Bay waters. The refuge was established primarily to preserve and enhance values associated with migratory waterbirds, particularly the brant.

4. PLAN FORMULATION

4.1 OVERVIEW

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

1. North Bay Channel Depths and Turning Basin Location
2. Entrance Channel Configurations
3. Dredged Material Disposal sites

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

4.2 "WITHOUT PROJECT" PLAN

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

The No Action Plan would leave the Harbor and Bay channels in their existing condition. The navigation channels would continue to be inadequate in providing safe, efficient passage for deep draft vessels. This situation would continue to cause vessel delays and other transportation inefficiencies in the shipping industry. The safety of the Entrance Channel would not be improved and this would continue to put shippers at risk, as well as continue to discourage other shippers from using Humboldt Harbor and Bay facilities. Appendix B (Economic Analysis) indicates that future conditions with "no action" would have substantial impacts on navigation in Humboldt Bay.

4.3 CHANNEL COMPONENTS AND TURNING BASIN LOCATION

North Bay Channels

The North Bay Channel and the Entrance Channel are an integral unit in terms of access to North Bay terminals. The following three design variations have been evaluated. Each of the three North Bay Channel designs involve the same channels and essentially the same routes used by deep draft vessels. The Bay and Harbor channel configuration is not complex, and there is no alternative to using the Bar and Entrance. The navigation design features (width, alignment, etc.) of the channels were the primary variables in determining the channel design for the North Bay. Navigation simulation studies (Appendix A, Attachments 1 and 2) were used extensively to determine channel design features.

Navigation Simulation Study

To determine the ideal design for the North Bay channels, the San Francisco District retained the Navigation Branch of the Corps of Engineers Waterways Experiment Station (WES) to perform a detailed Navigation Simulation Study of the proposed Humboldt Harbor and Bay improvements. This study was conducted during 1991 and 1992 with assistance from pilots who work Humboldt Bay, the Humboldt Bay Harbor, Recreation, and Conservation District, and from Corps San Francisco District staff. The detailed results of this Study are presented in Attachments 1 and 2, Appendix A of this Feasibility Report. The following information is taken directly from the October 1992 WES report and summarizes the methodology, conclusions, and recommendations from the Navigation Simulation Study. Please note that Plans "A", "B", and "C" as described in Attachment 1 to Appendix A, coincide with Design Options 1, 2, and 3 of this Feasibility Report (A=1, B=2, C=3). The 1991 navigation simulation test results were subject to a re-analysis and verification of the tidal currents and installed in the simulator. Additional professional pilot tests were conducted in July of 1992. The navigation simulation reanalysis performed in 1992 used a more accurate representation of tidal variation in the study area.

Operational Situation

The initial navigation simulation study indicated that, with the existing channel configuration, it is nearly impossible to maneuver ships through the "Middle Ground Turn" in Humboldt Bay. With the help of Captain Burt Bessillieu of the Humboldt Bay Pilot Association, a review was initiated to provide additional guidance on operational considerations for accurate simulation testing. It was determined that ships are not brought in or out of Humboldt Bay except during a high/highwater and slight flooding current situation. This is done to avoid any ebb tide conditions which always increase swell heights near the Bar Channel, often leading to breaking waves over the bar. Since long period swells occur very frequently at the Humboldt Bay entrance, this has been found to be both prudent and effective in avoiding dangerous wave conditions.

Navigation Simulation Test Results

683 Foot-Long, 60,000 DWT Ship Professional pilot tests were initially conducted using an available design ship of 683 feet in length and 60,000 DWT capacity. Dimensional data for this and other ships are presented in Table 1. Composite ship track plots for all inbound and outbound simulation runs tested showed that the 60,000 DWT ship could not be maneuvered around the "Middle Ground" turn with the existing channel configuration. Outbound runs were especially difficult, with almost all tests resulting in the ship going aground near buoy No. 8 on the southern side of the channel.

A few tests of some of the proposed channel conditions were also made using this vessel, but these showed similar ship tracks and presented an equal level of difficulty as compared with the existing channel conditions.

585 Foot-Long, 41,000 DWT Ship As discussed above, the simulation test results showed that the 60,000 DWT ship could not be maneuvered around the "Middle Ground Turn" in the currents and conditions expected under "real world" normal operational situations. In order to provide meaningful data for determining the relative effectiveness of the alternative channel designs, a smaller ship with a shorter length and smaller mass was tested.

The results of simulation tests with the smaller 41,000 DWT ship are presented in Attachment 1 to Appendix A. They show that the professional pilot could consistently maneuver the ship around the "Middle Ground Turn" in a successful manner. Accordingly, the study concentrated on testing with this size ship, as it was more consistent with the known capability of the pilot in the "real world" situation.

Attachment 1 to Appendix A presents ship track plots of three tests with the existing channel configuration for two inbound and one outbound run. One of the inbound runs resulted in a grounding, but both inbound and outbound runs were judged to be considerably easier than with the larger 60,000 DWT ship.

TABLE 1

DESCRIPTION OF VESSELS SIMULATED

Test Condition & Ship Type	Length Feet	Beam Feet	Existing Draft Ft	Proposed Draft Ft	Design Cap DWT
Design Ship Bulk Carrier	650	100	33	39 (approx)	48,000
Initial Simulated Ship-Bulk Carrier	683	105	33	38	60,000
Final Simulated Ship Bulk Carrier	585	90	35	38	41,000
M/S Star Dover ** Bulk Container Carrier	600.09	102.03		39.47	43,090
Range of Current Usage Larger Ships	600-660	80-105		up to 16-36	45,000

** Typical ship using Humboldt Harbor, actual design dimensions.

Design Option 1 Test Runs Design Option 1 involves selective widening of the Bar, Entrance and North Bay Channels (Figure 4). In addition to the deepening of the channels (the depth determination is a plan component discussed later in this Chapter), this design option includes the following:

A. The Entrance Channel would be widened on the north side of the channel from the jetty heads through the "middle ground" to the turn into the North Bay Channel - this widening ranges from 460 feet in the Entrance channel to 200 feet in the "middle ground" area.

B. The Entrance Channel edge is moved north and away from the South Jetty by 100 feet.

C. The Samoa Turning Basin would be enlarged by widening the Turning Basin entrance.

Attachment 1 to Appendix A gives ship track plots for the Option 1 channel test condition with one inbound and two outbound runs. The ship tracks (reference Figure 16 of Appendix A, Attachment 1) stay well away from the north channel edge in the Entrance Channel and the turn maneuver through the Middle Ground turn is easier for Option 1 as compared with the existing channel conditions (reference Figure 15 of Appendix A, Attachment 1).

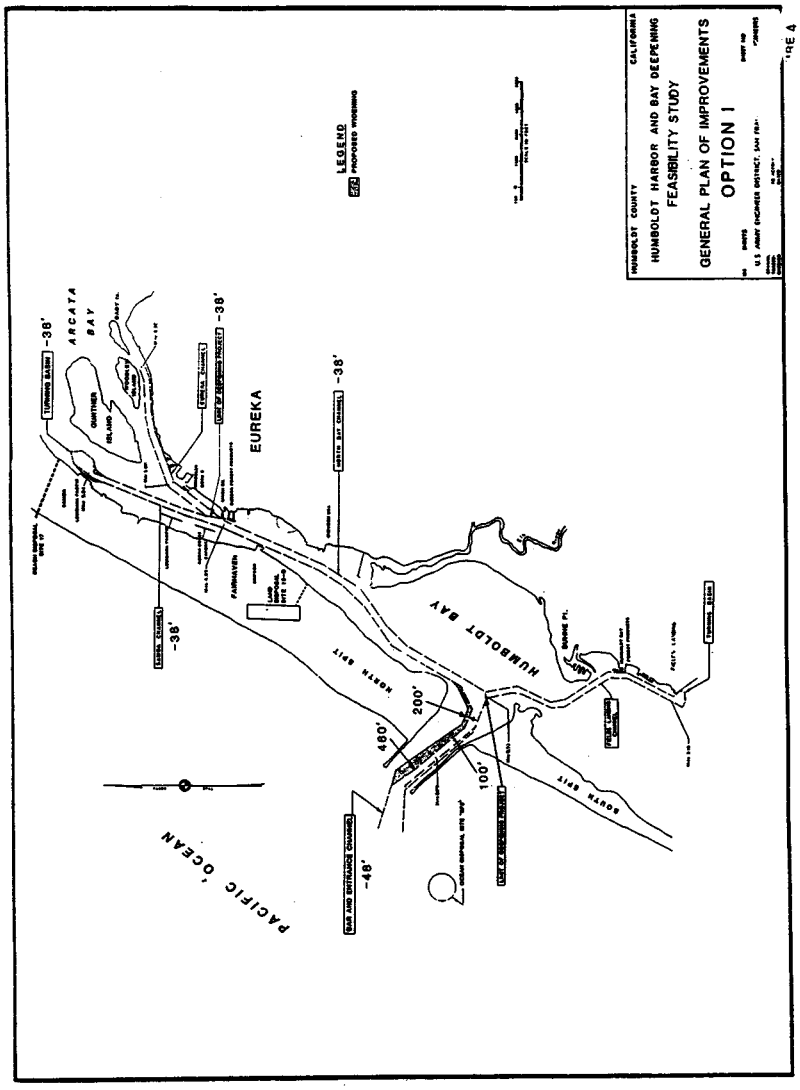
Design Option 2 Test Runs Design Option 2 consists of the presently maintained Bar, Entrance, and North Bay Channel boundaries, except deepened as in Design Option 1, and enlarging the Samoa Turning Basin. This North Bay design option does not include widening of the Entrance Channel. Figure 5 shows the details of Design Option 2.

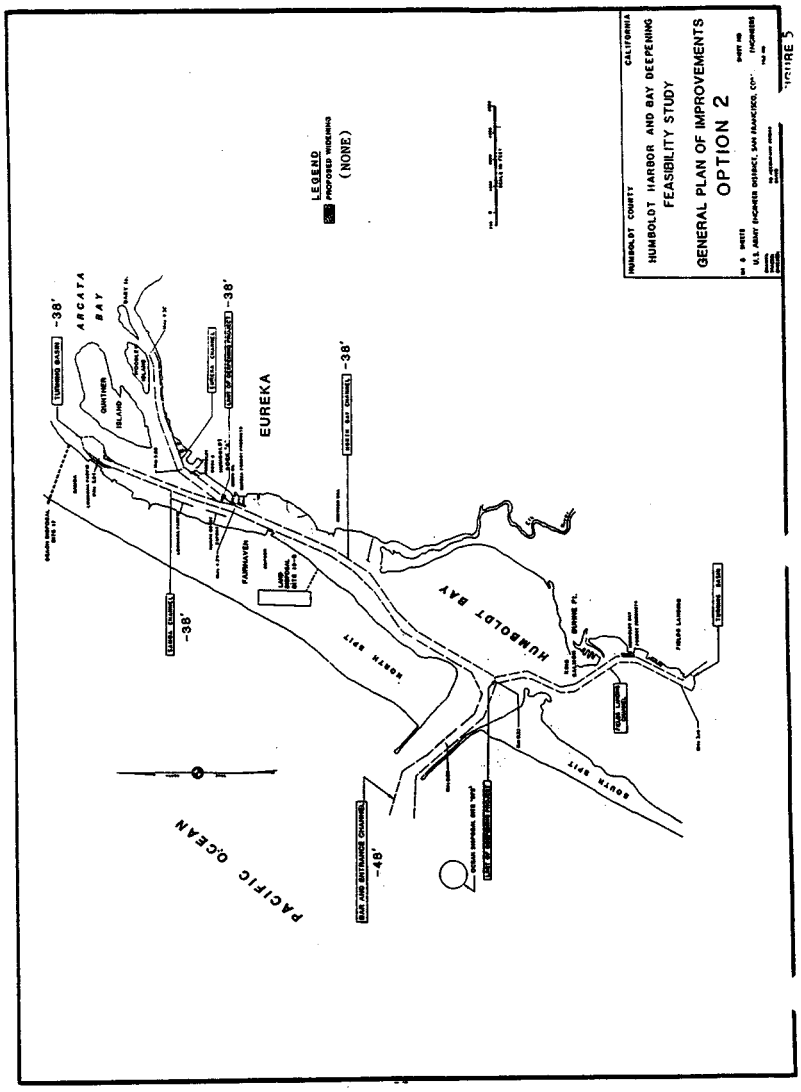
Design Option 2 channel simulation test results are presented in Figure 17 of Appendix A, Attachment 1, and indicates successful maneuvering through the Entrance Channel and the "Middle Ground" turns, but does show fairly close ship drifting situations near the north edge of the channel.

Design Option 3 Test Runs Design Option 3 increases the Entrance Channel width to a lesser degree than Design Option 1. This design option is identical with Option 1, but with a maximum width increase of 275 feet in the Entrance Channel rather than the 460 foot increase addressed in Design Option 1. Figure 6 shows the details for Design Option 3.

Test results for Design Option 3 channel conditions are presented in Figure 18, Appendix A, Attachment 1. Figure 18 shows the improved safety margin available on the north edge at the Entrance Channel and the greater degree of clearance around the "Middle Ground" turn. By comparing Figure 16 of Attachment 1, Appendix A, with Figure 18 of the same Attachment, it is possible to see that the increased width for Design Option 1 is not necessary and the Design Option 3 alignment of the Entrance Channel is adequate.

The 200 foot channel width increase on the inside of the Middle Ground turn provides the additional maneuvering room needed, as can be seen by comparing the results of the existing channel (Figure 15, Attachment 1, Appendix A) and Design Option 2 (Figure 17, Attachment 1, Appendix A) with the ship track plots shown for Design Option 1 (Figure 16, Attachment 1, Appendix A) and Design Option 3 (Figure 18, Attachment 1, Appendix A).


HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
GENERAL PLAN OF IMPROVEMENTS
OPTION I
LEGEND
PROPOSED WIDENING
EUREKA
ARCATA BAY
HUMBOLDT BAY
PACIFIC OCEAN
NORTH SPIT
SOUTH SPIT
-38'
-48'
480'
200'
100'


HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
GENERAL PLAN OF IMPROVEMENTS
OPTION 2
LEGEND
PROPOSED WIDENING
(NONE)
EUREKA
ARCATA BAY
HUMBOLDT BAY
NORTH SPIT
SOUTH SPIT
PACIFIC OCEAN
-38'
-48'
FAIRHAVEN
BAR AND ENTRANCE CHANNEL
TURNING BASIN
FIELDS LANDING

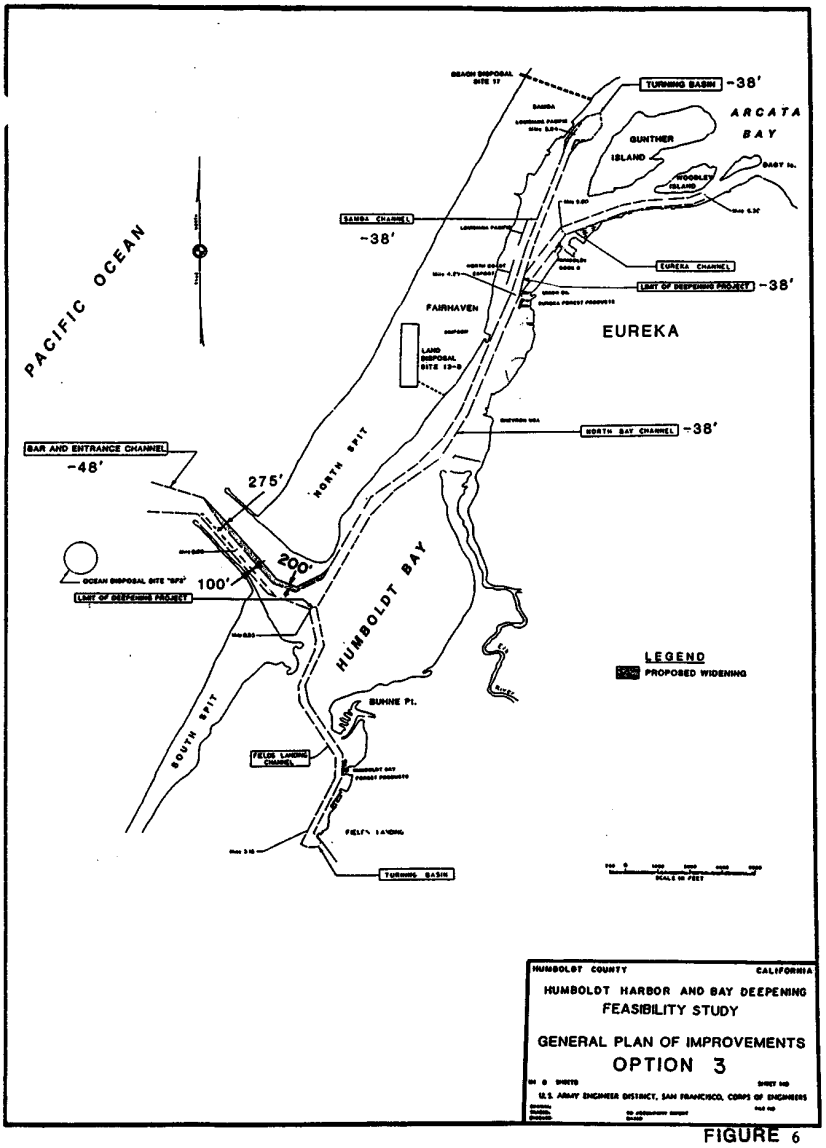

PACIFIC OCEAN
TURNING BASIN -38'
ARCATA BAY
GUNTHER ISLAND
SAMBA CHANNEL
-38'
EUREKA CHANNEL
LIMIT OF DEEPENING PROJECT -38'
FAIRHAVEN
EUREKA
LAND DISPOSAL SITE 13-B
NORTH BAY CHANNEL -38'
BAR AND ENTRANCE CHANNEL
-48'
275'
NORTH SPIT
200'
100'
OCEAN DISPOSAL SITE "BF2"
LIMIT OF DEEPENING PROJECT
HUMBOLDT BAY
SOUTH SPIT
BUHNE PT.
FIELDS LANDING CHANNEL
FIELDS LANDING
TURNING BASIN
LEGEND
PROPOSED WIDENING
SCALE IN FEET
HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
GENERAL PLAN OF IMPROVEMENTS
OPTION 3
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS

FIGURE 6

Summary and Results of the Navigation Simulation Study

The two ships used in the navigation simulation were the closest models in size to actual vessels using Humboldt Bay available for testing. The project design ship (650 foot length, 48,000 DWT) was smaller than the initial simulated 683 foot long, 60,000 DWT ship. On the other hand, the 585 ft long, 41,000 DWT ship used in the final simulation test series, while smaller than the design ship, was closer to typical ships, such as the M/V Star Dover, presently calling at Humboldt Harbor.

The comparative simulation test results, using the existing and three proposed alternative channel designs showed that Design Option 1 was the safest plan and provided the largest channel edge clearances. Design Option 3, however, was also satisfactory in terms of safety and, moreover, required substantially less dredging than Design Option 1. The professional pilot expressed a distinct preference for Design Option 3. A summary of the Samoa Turning Basin vessel simulation results is presented in the Turning Basin Location discussion below.

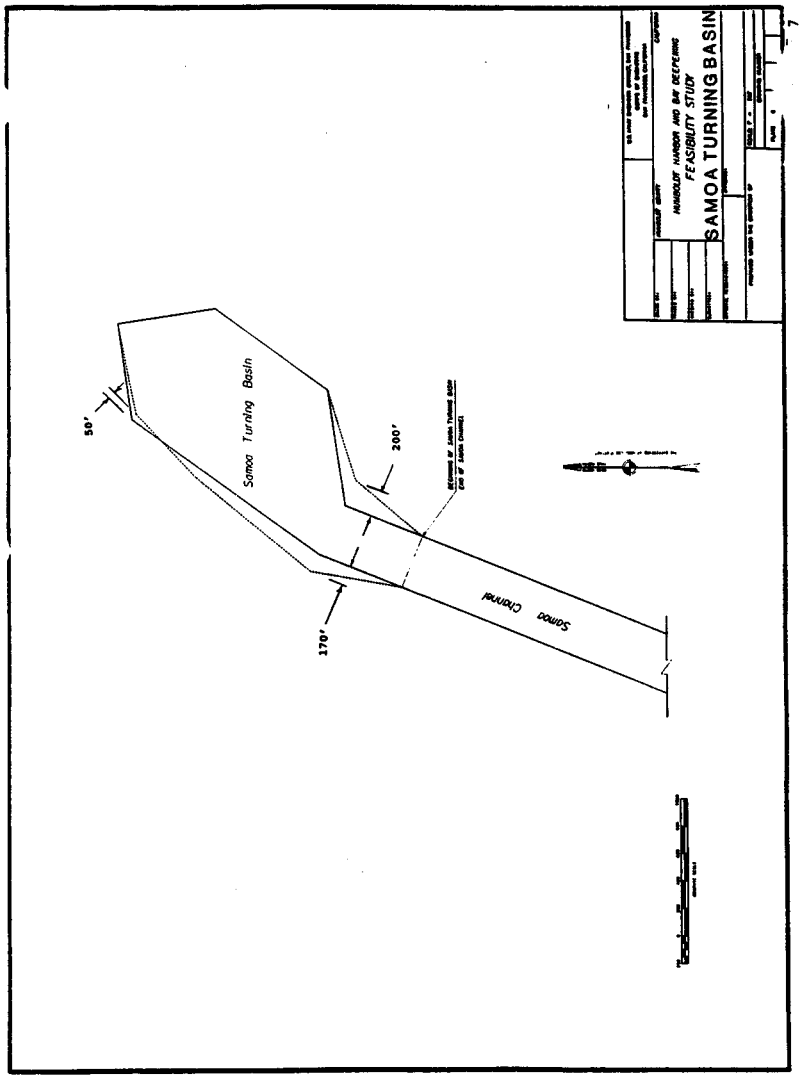
The shoaling study performed by the Corps Waterways Experiment Station (WES) also indicated that Design Option 3 would reduce shoaling, thereby reducing maintenance dredging requirements. This is discussed in Attachment 3 to Appendix A, the Engineering Analysis.

Turning Basin Location

North Bay Turning Basin A ship turning basin at channel depth will be required as part of the North Bay Channel configuration. Two locations have been evaluated (see Appendix A, Attachment 1): the existing Samoa Turning Basin area; and the point where the Samoa and Eureka channels branch from the North Bay Channel.

Samoa Turning Basin The entrance to the existing Samoa Turning Basin would be realigned as shown on Figure 7. The navigation simulation conducted for the North Bay Channels included evaluation of the Samoa Turning Basin. The simulation tests evaluated both the existing conditions and widening and re-alignment of the entrance into the Turning Basin. The tests indicated that the proposed improvements would increase safety. There would be greater room to maneuver ships, particularly under low receding flood tide currents. Figures 13 and 14 of Appendix A, Attachment 1, present the results of two Samoa Turning Basin tests conducted with the existing and proposed "wideners" to help improve safety when turning the ships.

North Bay Channel Turning Basin A turning basin was considered at the point where the Samoa and Eureka channels branch from the North Bay Channel (Figure 8). However, it is noted that the Corps of Engineers' practice has been against locating a turning basin at the confluence of two channels. This is to prevent congestion in the channels due to vessel turning and vessel transit.


50'
Samoa Turning Basin
200'
170'
Samoa Channel
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
SAMOA TURNING BASIN

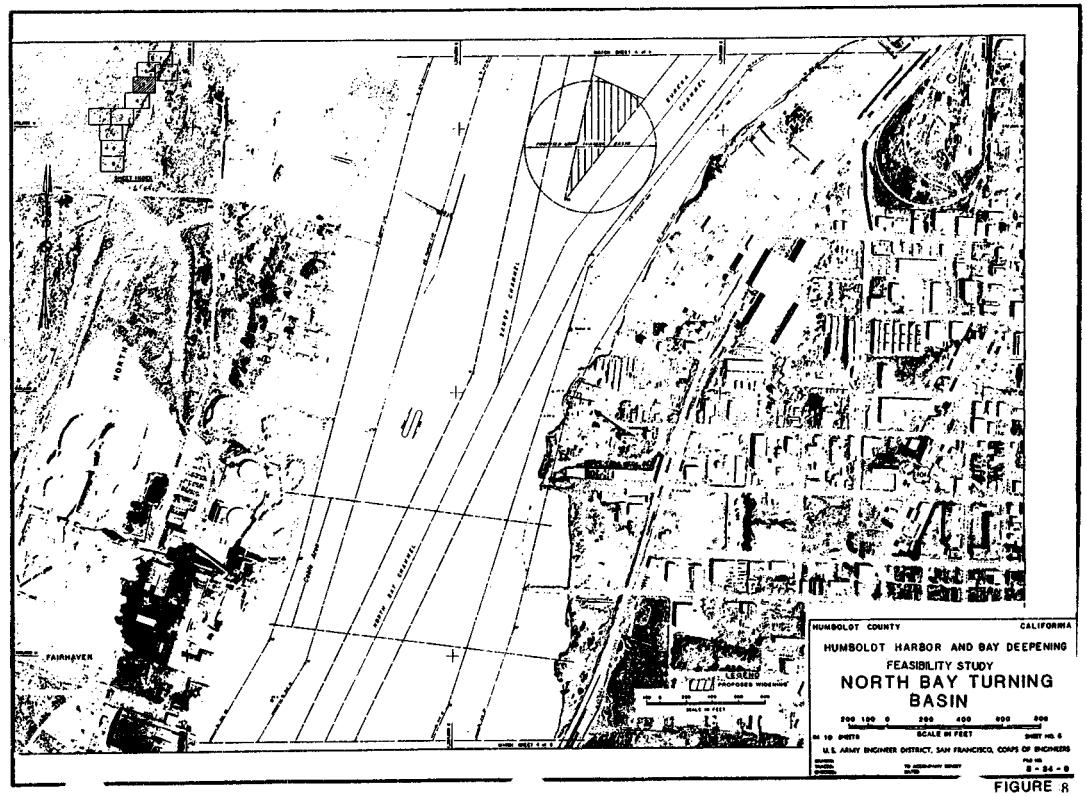

HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
NORTH BAY TURNING BASIN
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS
FAIRHAVEN
NORTH BAY CHANNEL
LEGEND
PROPOSED TURNING BASIN

FIGURE 8

4.4 DREDGED MATERIAL

Sediment Quality

The disposal site options available for dredged sediment are largely dependent on the quality of the sediment, and may also be limited by the economics of the project. Sediment sampling and testing has been conducted for all channel areas considered for deepening and widening. The tests indicated that all but about 26,000 cubic yards of the project total estimated 5,600,000 cubic yards of dredged sediment would be "suitable" for unconfined aquatic disposal. The estimated 26,000 cys of "unsuitable" material has trace amounts of dioxin which are well below levels considered to be hazardous, but which do not allow for unconfined aquatic disposal. This "unsuitable" material is located in the southwest portion of the Samoa Turning Basin (reference Figure 12). The methodology and results of the sediment testing are presented in the EIS/EIR, which accompanies this Feasibility Report.

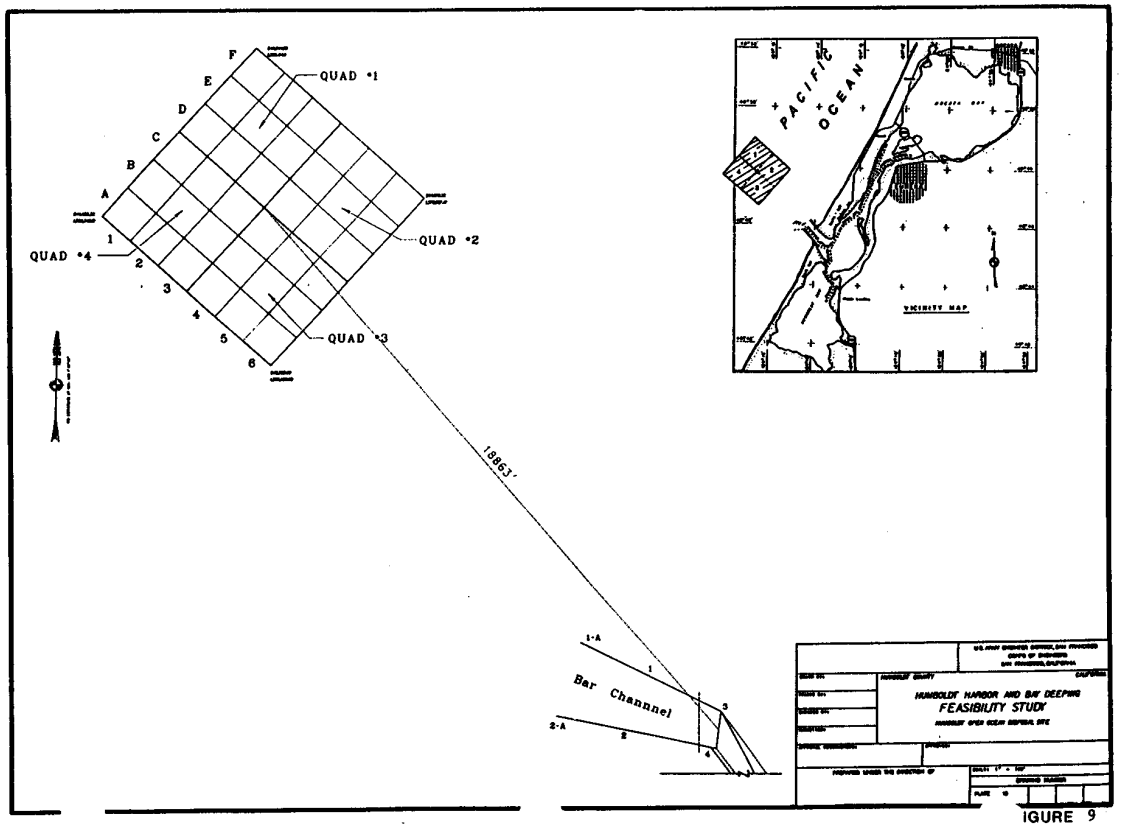
Dredged Material Disposal Site Options

The following dredged material disposal site options were considered for the Humboldt Harbor and Bay (Deepening) study:

Ocean Disposal. The Corps of Engineers, San Francisco District, has requested that the U.S. Environmental Protection Agency designate a permanent ocean dredged material disposal site (ODMDS) offshore of Humboldt Bay. This is being done in accordance with Section 102 of the Marine Protection, Research, and Sanctuaries Act of 1977. EPA indicates that final site designation is expected by September 1995. This site would be used as the disposal site for all material suitable for unconfined aquatic disposal, dredged in Humboldt Bay and Harbor. The location of this site is shown on Figure 9.

In association with this request, the Corps prepared a Zone of Siting Feasibility Analysis for the Humboldt Harbor and Bay Ocean Dredged Material Disposal Site, dated April 1989, which established an outer boundary within which to evaluate candidate ocean disposal sites for disposal of dredged material from Humboldt Harbor and Bay. Determination of the outer limit of the zone of siting feasibility (ZSF) is based upon an evaluation of the operational and economic constraints for authorized dredging and disposal projects in Humboldt Harbor and Bay. The ZSF concluded that an Ocean Dredged Material Disposal Site (ODMDS) should be located within a 4 nautical mile radius of the end of the Humboldt Bay jetty heads. The Humboldt ZSF boundary is based upon the operational considerations of plant availability, and weather and sea condition restrictions on plant operating time. After completion of the ZSF, the Corps conducted a Fisherman Outreach Study (WESCO 1990) to locate areas within the ZSF that local fishermen believed were not important fishing grounds. A site known as the Humboldt Offshore Ocean Disposal Site (HOODS) is now being considered by EPA for designation.

Beach Disposal. A previously used beach disposal site is located on the Humboldt Bay North Spit. Figure 10 shows the location. This site was used in the North Bay Channel improvement project completed in 1979 and has been used in subsequent maintenance dredging operations for the Woodley Island Marina.


QUAD #1
QUAD #2
QUAD #3
QUAD #4
A
B
C
D
E
F
1
2
3
4
5
6
18863'
1-A
2-A
Bar Channel
PACIFIC OCEAN
VICINITY MAP
HUMBOLDT HARBOR AND BAY DEEPING
FEASIBILITY STUDY

IGURE 9

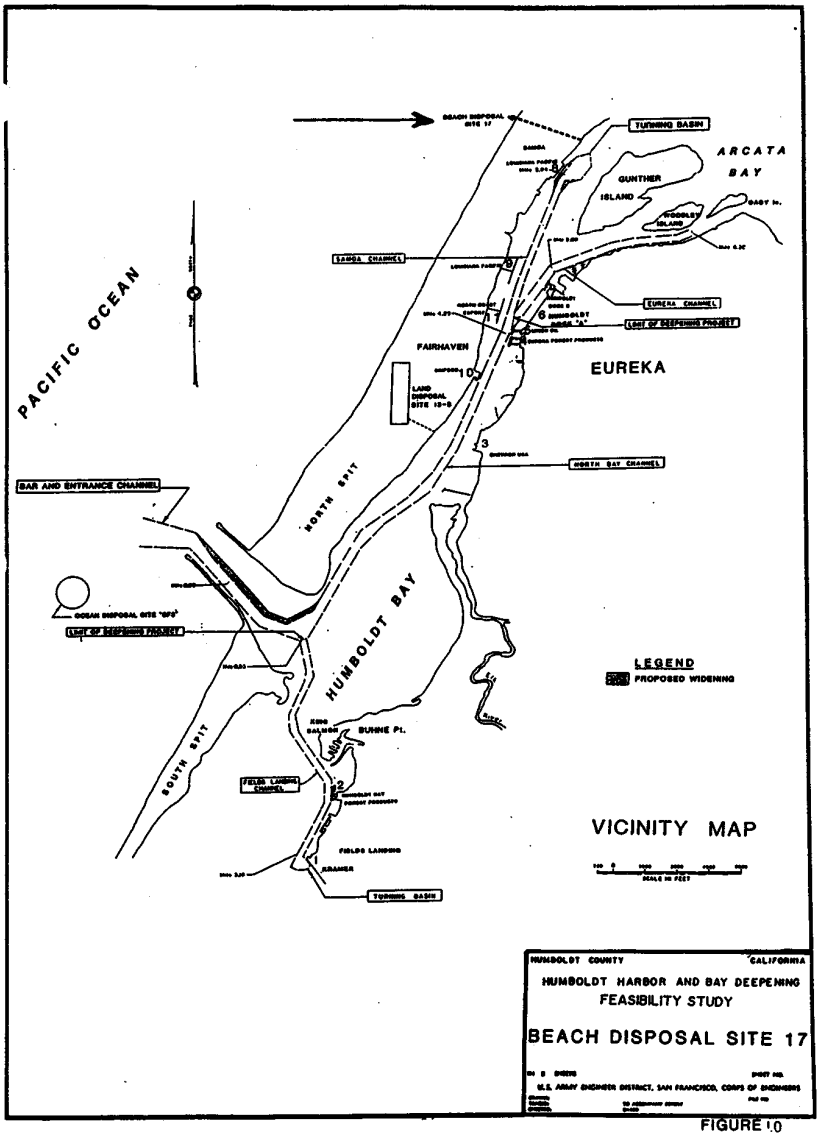

TURNING BASIN
ARCATA
BAY
GUNTHER
ISLAND
SAMOA CHANNEL
EUREKA CHANNEL
LIGHT OF DEEPENING PROJECT
PACIFIC OCEAN
FAIRHAVEN
EUREKA
LAND
DISPOSAL
SITE 13-B
NORTH BAY CHANNEL
BAR AND ENTRANCE CHANNEL
NORTH SPIT
HUMBOLDT BAY
LIGHT OF DEEPENING PROJECT
LEGEND
PROPOSED WIDENING
SOUTH SPIT
BUHNE PT.
FIELDS LANDING
CHANNEL
FIELDS LANDING
KRAMER
TURNING BASIN
VICINITY MAP
HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
BEACH DISPOSAL SITE 17
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS

FIGURE 10

Upland Disposal. A previously used 60 acre upland disposal site is located on the Humboldt Bay North Spit adjacent to the old Eureka Airport (Figure 11). This site was also used in the North Bay channel improvement project of 1979 and has been reserved for future improvement projects. This site currently can accommodate approximately 400,000 cubic yards of material and could potentially be enlarged to accommodate approximately 1,000,000 cubic yards.

A confined upland dredged material disposal site of about twenty-three acres, located on Louisiana Pacific property, has been utilized in the past for berth maintenance material, and is available for a limited quantity of dredged material from the proposed navigation improvement project. This site, which is located on the Humboldt Bay North Spit immediately adjacent to the Samoa Turning Basin, could accommodate the "unsuitable" material which will be removed from the immediately adjacent waterway (Figure 12).

4.5 FORMULATION OF THE PLAN

The combination of plan elements selected from the components that have been evaluated, results in a plan of action (or alternative plan) for the Humboldt Harbor and Bay navigation project. The plan of action only includes the North Bay, Samoa, and Samoa Turning Basin Channels, since the South Bay Fields Landing Channel has been eliminated from the study based on the single owner criteria and the Outer Eureka Channel has been eliminated from the study due to economic infeasibility. The action plan which has been developed is based on the selected North Bay, Design Option 3. Table 2 summarizes the evaluation and screening of the channel design options which were considered.

The following section evaluates the Final Array of Alternative Plans, which consists of the action plan discussed above and the No Action Plan. The No Action Plan is included in the Final Array, as it is the only alternative available if the Action Plan does not meet the plan formulation criteria. Also, its inclusion is required by the National Environmental Policy Act and by Corps planning guidelines.

Final Array of Alternative Plans

The Final Array of Alternative Plans includes one action alternative and the No Action alternative. Engineering and environmental considerations were the primary factors in identifying the Final Array of alternative plans.

Up to this point, navigation efficiencies were not a factor in the screening process. Each of the three primary channel Design Options provided improved access to the terminals. However, prior to analyzing the plans against the evaluation criteria and calculating a benefit to cost ratio for the selected plan, the optimum project depth must be identified.

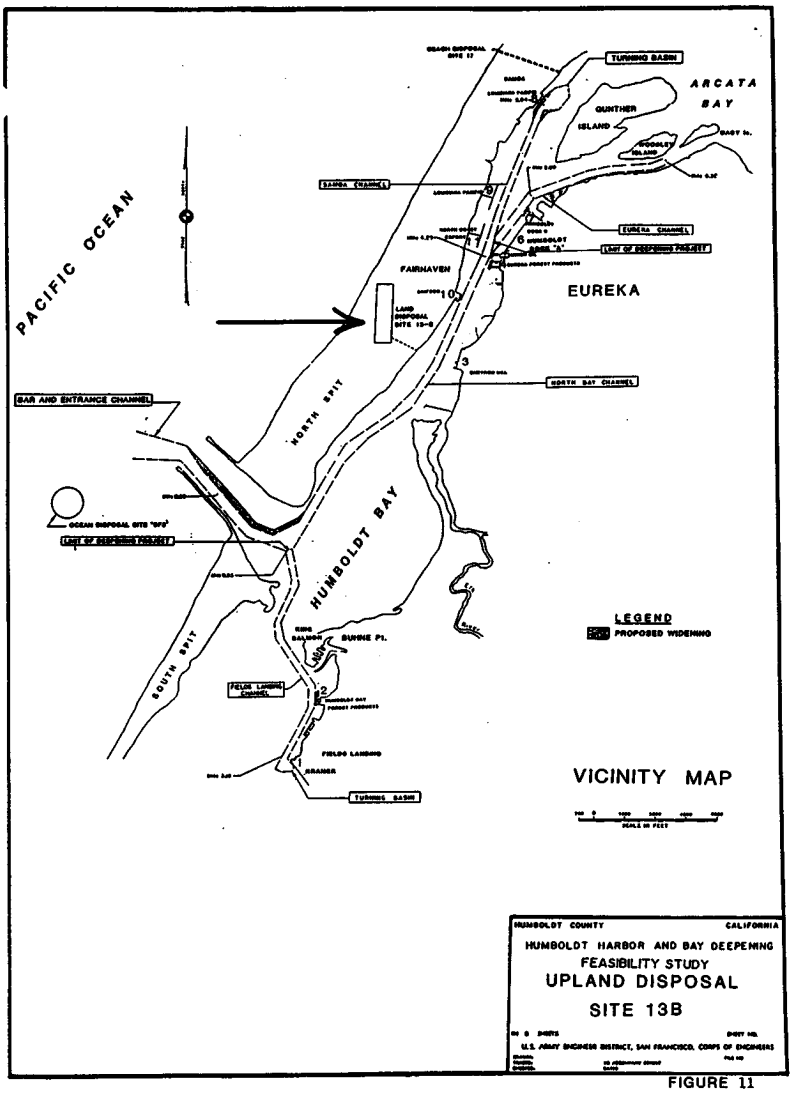
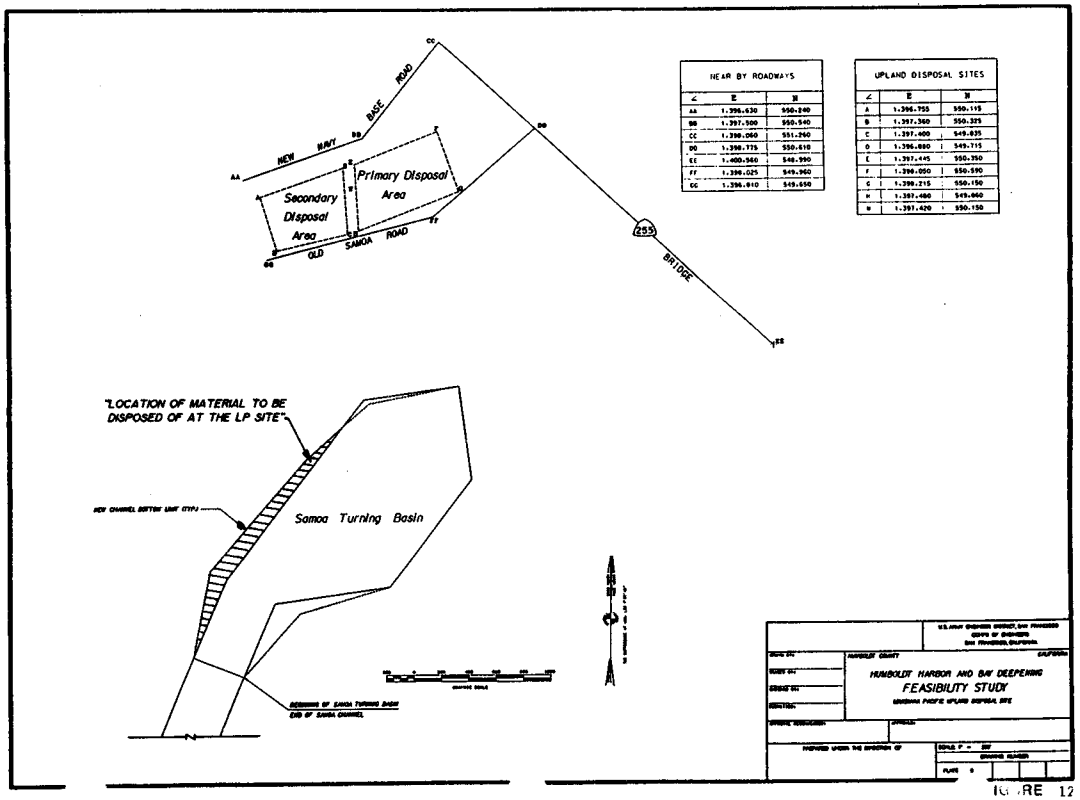

PACIFIC OCEAN
TURNING BASIN
ARCATA BAY
GUNTHER ISLAND
SAMOA CHANNEL
EUREKA CHANNEL
LIMIT OF DEEPENING PROJECT
FAIRHAVEN
EUREKA
LAND DISPOSAL SITE 13-B
NORTH BAY CHANNEL
BAR AND ENTRANCE CHANNEL
NORTH SPIT
HUMBOLDT BAY
OCEAN DISPOSAL SITE "DF3"
LIMIT OF DEEPENING PROJECT
SOUTH SPIT
SUNNIE PT.
FIELDS LANDING CHANNEL
FIELDS LANDING
DRAKER
TURNING BASIN
LEGEND
PROPOSED WIDENING
VICINITY MAP
HUMBOLDT COUNTY
CALIFORNIA
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
UPLAND DISPOSAL
SITE 13B
U.S. ARMY ENGINEER DISTRICT, SAN FRANCISCO, CORPS OF ENGINEERS

FIGURE 11



NEAR BY ROADWAYS

Z	E	N
AA	1,396,630	550,240
BB	1,397,500	550,540
CC	1,398,060	551,260
DD	1,398,775	550,610
EE	1,400,560	548,990
FF	1,398,025	549,960
GG	1,396,910	549,650

UPLAND DISPOSAL SITES

Z	E	N
A	1,398,755	550,115
B	1,397,360	550,325
C	1,397,600	549,835
D	1,396,880	549,715
E	1,397,445	550,350
F	1,398,050	550,590
G	1,398,215	550,150
H	1,397,480	549,060
W	1,397,420	550,150

FIGURE 12

TABLE 2

SUMMARY OF PLAN COMPONENTS: CHANNEL DESIGNS CONSIDERED SELECTION OF FINAL ARRAY

Design Option	Description	Carried Forward	Reason
1	North Bay: Widen Entrance to Max. of 460', Realign Samoa TB. Deepen to 38/48	No	Engineering Decision: Maximum Widening to 460' Not Necessary
2	North Bay: No Entrance Widening. Realign Samoa. Deepen to 38/48	No	Engineering Decision: No Widening Doesn't Resolve Navigation Problem at Entrance
3	North Bay: Widen Entrance to Max. of of 275'. Realign Samoa TB. Deepen to 38/48	Yes	Engineering Decision: Navigation Simulation and Bar Pilot Strongly Recommend this Plan
	North Bay Turning Basin: TB at Juncture of Eureka/Samoa Channels.	No	Engineering Criteria: Not Recommended to Locate TB at Confluence of two Channels
	Improve Samoa Turning Basin	Yes	Improvement of Existing Turning Basin
	Disposal Site(s):		
	Proposed Designated Ocean 102 Site	Yes	Designation in August 1995
	LP Site	Yes	At dredging location for "unsuitable" material
	Airport Site	No	Insufficient capacity; more costly than ocean disposal
	Beach Disposal	No	More costly than ocean disposal
	No Action Plan	Yes	Required by NEPA & Corps Planning Guidelines

4.6 CHANNEL DEPTH DETERMINATION

For the Bar and Entrance Channel and the North Bay Channel, the following paired channel depths were investigated:

Bar and Entrance (Feet MLLW)	North Bay (Feet MLLW)
-46	-36
-47	-37
-48	-38
-49	-39
-50	-40
-51	-41
-52	-42

The project benefits are derived from the deepening of the North Bay channels. However, to fully utilize channel deepening in the semi-protected inner channels, the exposed Bar and Entrance Channel must also be deepened. A ten foot channel depth differential between the inner channels and the Bar and Entrance was determined based on wave conditions at the entrance. Appendix A of this Feasibility Report includes wave height analysis.

For purposes of optimizing channel depths, a one-foot incremental analysis was performed using a model described in Appendix B (Economic Analysis). The model focused on the benefits from the timber industry and performed an optimization of the inner channel depths ranging from -36 to -42 feet MLLW. The analysis showed the optimum inner channel depth to be -39 feet MLLW (i.e., the channel depth which provides the maximum net benefits). Table 3 on the following page shows the net benefit determination for channel depth optimization. The optimization curves are shown in Table 4.

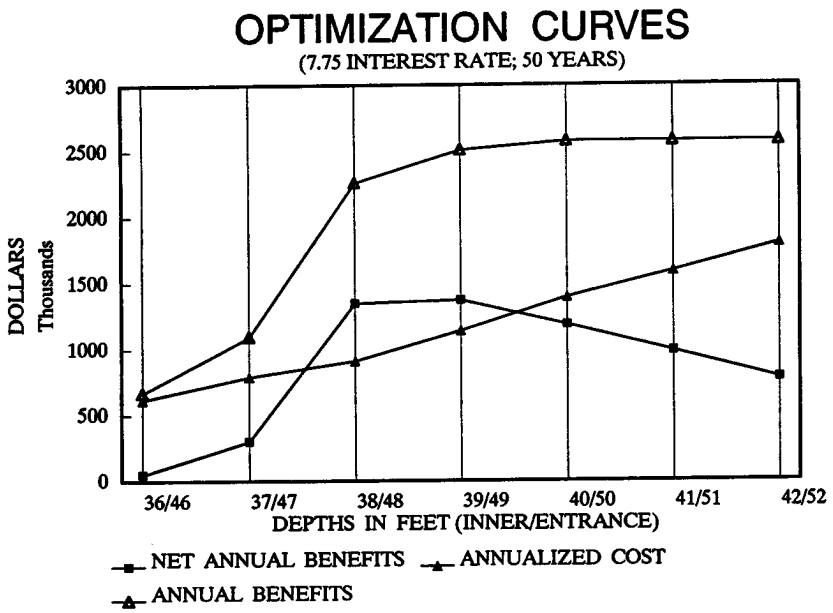
TABLE 3

NET BENEFIT DETERMINATION FOR OPTIMIZATION

DEPTH	FIRST COST	ANNUALIZED COST	ANNUALIZED COST MINUS O & M SAVINGS	ANNUAL BENEFITS	NET ANNUAL BENEFITS	B/C RATIO
36/46	$8,300,000	$695,020	$618,320	$667,600	$49,280	1.08
37/47	$11,900,000	$944,860	$792,660	$1,095,000	$302,340	1.38
38/48	$14,300,000	$1,135,420	$912,375	$2,259,000	$1,346,625	2.48
39/49	$17,000,000	$1,349,800	$1,139,000	$2,509,000	$1,370,000	2.20
40/50	$20,000,000	$1,588,000	$1,390,400	$2,574,000	$1,183,600	1.85
41/51	$22,300,000	$1,770,620	$1,586,220	$2,574,000	$987,780	1.62
42/52	$24,800,000	$1,969,120	$1,797,920	$2,574,000	$776,080	1.43

1_/ The First Costs presented in this table do not include interest during construction.
The selected plan cost estimate presented later in this report does include interest during construction.

TABLE 4


OPTIMIZATION CURVES
(7.75 INTEREST RATE; 50 YEARS)
DOLLARS
Thousands
3000
2500
2000
1500
1000
500
0
36/46
37/47
38/48
39/49
40/50
41/51
42/52
DEPTHS IN FEET (INNER/ENTRANCE)
NET ANNUAL BENEFITS
ANNUALIZED COST
ANNUAL BENEFITS

4.7 PLAN EVALUATION

The Action Plan and No Action Plan were tested against specific evaluation criteria which are set forth in the Corps' Principles and Guidelines for planning (ER 1105-2-100). The following summarizes this evaluation.

Evaluation Criteria

The criteria presented below are used to evaluate project plans under Federal Guidelines. These criteria are also used for narrowing of the alternative selection to a recommended plan. The four evaluation criteria used in plan formulation are effectiveness, efficiency, completeness, and acceptability.

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

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

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

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

The Humboldt action plan meets the criteria, whereas the no action plan does not achieve the desired output. The action plan solves the "problems" identified in the planning process.

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

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

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

The action plan is selected over the no action plan under this criteria, since no action does not provide increased benefits and adds nothing to National Economic Development.

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

The action plan is not yet complete, as it depends upon the U.S. EPA's designation of the ocean disposal site. This designation is scheduled to occur in August 1995, after which the action plan will be complete.

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

The no action plan is preferred by the U.S. Fish and Wildlife Service, based on their desire to maintain the existing environment. The general public and agencies with an interest in navigation improvements prefer the action plan.

4.8 PLAN EVALUATION BY RESOURCE ACCOUNT

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

National Economic Development Account (NED)

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

The action plan is designated the NED Plan as it maximizes increases in the economic value of the national output of goods and services. A detailed analysis of project costs and benefits is provided with the discussion of the selected plan in the following Chapter. The no action plan provides no economic benefits.

Environmental Quality (EQ) Account

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

The environmental impacts of the action plan and no action plan are presented in detail in the attached EIS/R. The primary impacts of the action plan are related to the temporary, and short term disruption of marine habitats during dredging and dredged material disposal operations.

Regional Economic Development (RED) Account

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

The action plan will not result in changes in the distribution of regional economic activity. The action plan will help maintain jobs now existing in the Humboldt Harbor and Bay area and will help sustain existing business activities.

Other Social Effects (OSE) Account

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

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

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

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

The action plan increases safety in the Harbor and Bay channels and will help maintain the economic viability of the timber industry in the Humboldt Bay area.

5. SELECTED PLAN

5.1 PLAN SELECTION

The Selected Plan has been developed using the screening process as prescribed by Corps of Engineers planning regulations. This Chapter presents the Selected Plan in detail, including the specifics of design, costs, benefits, and other related unique elements.

Final selection of a Plan included a detailed impact analysis and evaluation of the Action Plan and the No Action Plan. The detailed impact analysis of these alternatives is presented in the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) which has been prepared for this Study. A summary of the impacts of these two alternatives by System of Accounts is presented in Table 5. A discussion of the trade-off analysis on how each of these alternatives rate in terms of addressing planning objectives and other specified evaluation criteria follows.

The action alternative with an inner (i.e., North Bay) channel depth of -39 feet MLLW maximizes NED benefits as a result of the transportation savings for deep draft vessels using Humboldt Harbor and Bay facilities. Benefits are provided from: the elimination of vessel rerouting; reduction in vessel light loading practices; reduction of vessel trips required to transport the same amount of cargo; and a change in transportation mode (i.e. from truck to ship). None of these transportation benefits would be provided under the No Action alternative.

The action plan results in environmental impacts which would not occur under the no action alternative. These impacts are discussed in detail in the accompanying EIS/R. Primary impacts include short term, temporary impacts on water quality and air quality during construction, temporary loss of benthic habitat due to construction, and a change in benthic habitat from shallow water habitat (i.e., 20 feet MLLW or less) to deep water habitat (i.e., greater than -20 feet MLLW) for a small area, estimated at 9,000 square feet of substrate.

From the perspective of community and social well being, the action plan would provide benefits as compared to the current situation, i.e., the no action plan. The project related improvements would help keep Humboldt Harbor competitive in the maritime industry, which in turn would benefit the currently depressed local economy.

The navigation improvements would minimize navigation safety issues for deep draft vessels using Humboldt Harbor and Bay channels, thus providing safer conditions for all users, including those associated with the Bay's significant environmental resources.

The action plan would also provide benefits from a Regional Development standpoint. The maritime industry would be strengthened for the entire region making it more attractive to waterway dependent industries.

As discussed above, optimization of project benefits occurred with a -39 feet MLLW inner channel depth. However, the non-Federal sponsor is only able to financially afford and support deepening to -38 feet MLLW at this time. Corps regulations state *"Recommended projects which are smaller (less costly) than the NED plan will normally be considered favorable for an exception to the NED requirements (ER 1105-2-100, paragraph 5-16c).* An exception to the NED plan will be requested from the Assistant Secretary of the Army for Civil Works (ASA(CW)). Therefore, the selected and locally preferred plan is a -48 foot MLLW Bar, Entrance, and Middle Ground of the North Bay Channels and -38 foot MLLW North Bay Channel, Samoa Channel and Samoa Turning Basin.

TABLE 5
SUMMARY OF IMPACTS BY SYSTEM OF ACCOUNTS - ACTION PLAN VERSUS NO ACTION

RESOURCE CATEGORY	NO ACTION	ACTION ALTERNATIVE
NATIONAL ECONOMIC DEVELOPMENT	Does not provide any NED benefits	Provides NED benefits in the form of savings in transportation costs
ENVIRONMENTAL QUALITY		
Water Quality	No change from existing conditions	Temporary turbidity during construction
Sediment Quality	No change from existing conditions	Dredged material suitable for unconfined aquatic disposal placed at HOODS Dredged material unsuitable for unconfined aquatic disposal placed at LP Site
Air Quality	No change from existing conditions	Temporary, short-term exceedence of NCUAQMD emission significance thresholds for NO_x and PM_{10} during dredging and disposal activities at HOODS and LP Site. Mitigation measures described in EIS/EIR (Section 5.1) would reduce project emissions but not to insignificance. These air quality impacts are however, temporary, short-term, and construction related. Long-term reduction in emissions
Sedimentation & Erosion	No change from existing conditions	Sedimentation (i.e., shoaling) will be reduced
Noise Conditions	No change from existing conditions	Negligible increase in noise during construction
Aquatic Habitat	No change from existing conditions	Temporary disruption during construction
Riparian Habitat	No change from existing conditions	No project impact
Wetland Habitat	No change from existing conditions	No project impact
Eelgrass	No change from existing conditions	No disruption during construction. Eelgrass beds are being avoided.
Fishery	No change from existing conditions	Temporary disruption during dredging and aquatic disposal operation
Endangered Species	No change from existing conditions	No project impact
Cultural Resources	No change from existing conditions	No project impact (See Section 5.6 in EIS/EIR for further detail)
Aesthetics	No change from existing conditions	Short-term visual impact of dredge construction equipment

TABLE 5 (Continued)

RESOURCE CATEGORY	NO ACTION	ACTION ALTERNATIVE
REGIONAL ECONOMIC DEVELOPMENT		
Employment/Labor Force	Existing high unemployment rate	Some additional employment during construction Will help maintain existing workforce
Business & Industrial Activity	No change from existing conditions	Will help maintain marine-oriented industries
Local Government Finance	No change from existing conditions	Humboldt Harbor District, with contribution from the City of Eureka, is providing non-Federal share of project funds
OTHER SOCIAL EFFECTS		
Public Health & Safety	Unsafe Entrance Channel conditions will continue	Navigation safety improved
Public Facilities/Services	No change from existing conditions	No project impact
Recreation & Public Access	No change from existing conditions	No project impact
Traffic/Transportation	No change from existing conditions	Vessel safety will be improved
Man-made Resources	No change from existing conditions	No project impact
Natural Resources	No change from existing conditions	No project impact

(All Impact Categories are Discussed in Detail in the Attached EIS/EIR)

5.2 DESCRIPTION OF THE SELECTED PLAN

General Design Considerations

The selected and locally preferred plan includes deepening and selective widening of the Bar, Entrance, North Bay, Samoa Channels, and the Samoa Turning Basin (Figures 13 through 20).

The design of general navigation features was accomplished in accordance with Corps criteria, procedures, and standards, to accommodate the actual and projected vessels calling at Humboldt Bay and Harbor. The information on the vessels and their operations in the navigation channels was obtained from the vessel sponsors, shippers, and pilots. The navigation design was prepared in cooperation with the local sponsor, the HBHRCD.

Channel Design

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

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

The channel designs also considered information obtained on actual operations in Humboldt Bay and at the Entrance Channel in addition to a navigation simulation study and a hydrodynamics and sedimentation study, both of which are included as Attachments to Appendix A (The Engineering Analysis).

Design Vessel

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

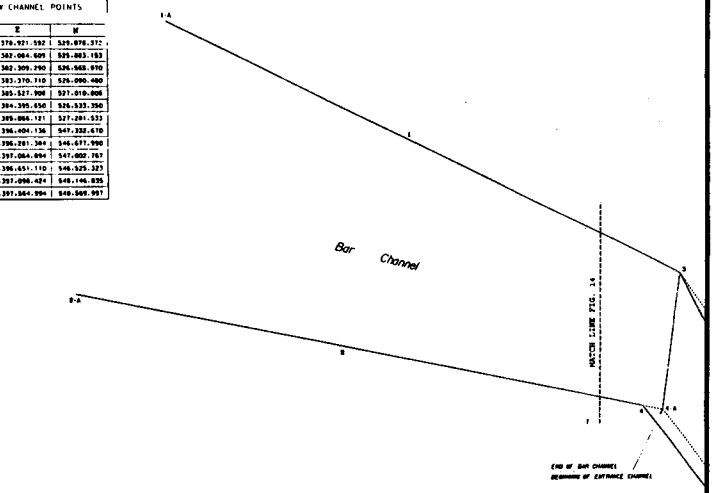
Other factors considered included identification of the largest vessels currently used in comparable trades at the deeper draft ports on the west coast, and identification of the largest existing vessel used for handling the commodities currently transported in and out of Humboldt Harbor.

EXISTING CHANNEL POINTS

#	E	N	#	E	N
1A	1,375,239.910	532,785.214	22	1,394,808.038	541,464.200
1	1,377,029.570	531,890.399	23	1,394,619.996	542,820.997
2A	1,374,593.462	530,773.005	24	1,395,064.067	542,702.881
2	1,376,552.029	530,368.019	25	1,396,526.194	547,269.067
3	1,378,047.265	530,000.494	26	1,396,681.182	547,079.458
4	1,378,768.408	529,900.494	27	1,397,524.994	548,599.997
4A	[illegible]	[illegible]	28	1,397,724.992	547,199.996
5	1,380,017.762	529,130.206	29	1,398,224.994	548,699.995
6	1,381,066.757	529,997.168	30	1,398,324.993	547,999.995
6A	1,382,084.609	529,883.153	31	1,398,130.999	545,190.999
7	1,382,182.868	526,483.458	32	1,398,364.738	542,854.540
8	1,383,997.347	524,876.218	33	1,398,325.270	543,982.186
9	1,383,368.250	525,871.080	34	1,398,466.947	543,600.043
10	1,384,316.147	524,814.818	35	1,399,291.678	544,239.117
11	1,384,535.079	524,275.721	36	1,399,370.837	543,846.273
12	1,386,770.977	529,264.350			
13	1,386,836.254	530,300.097			
14	1,387,986.317	530,573.560			
15	1,389,181.373	531,630.747			
16	1,390,712.625	532,025.903			
17	1,390,450.360	533,047.089			
18	1,391,806.253	534,326.212			
19	1,391,459.991	534,429.990			
20	1,394,991.987	541,048.384			
21	1,394,127.982	540,141.996			

NEW CHANNEL POINTS

#	E	N
4A	1,378,921.592	529,978.372
6A	1,382,084.609	529,883.153
7	1,382,309.240	526,568.910
9'	1,383,370.710	526,090.400
10A	1,385,527.908	527,010.006
11'	1,384,395.650	526,533.350
11A	1,385,066.121	527,281.533
25'	1,396,404.136	547,332.670
25A	1,396,281.304	546,677.990
26'	1,397,064.094	547,002.767
26A	1,396,651.110	546,525.327
27'	1,397,098.424	548,146.835
27A	1,397,564.994	548,569.997



SELECTED PLAN

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

HUMBOLDT COUNTY CALIFORNIA

HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
SCHEDULE OF SHOALING, HEAVY SHIP, BAR CHANNEL & EMBANKMENTS

PREPARED UNDER THE DIRECTION OF

SCALE 1" = —

PLATE 1

DRAWING # [illegible]

SHEET 13

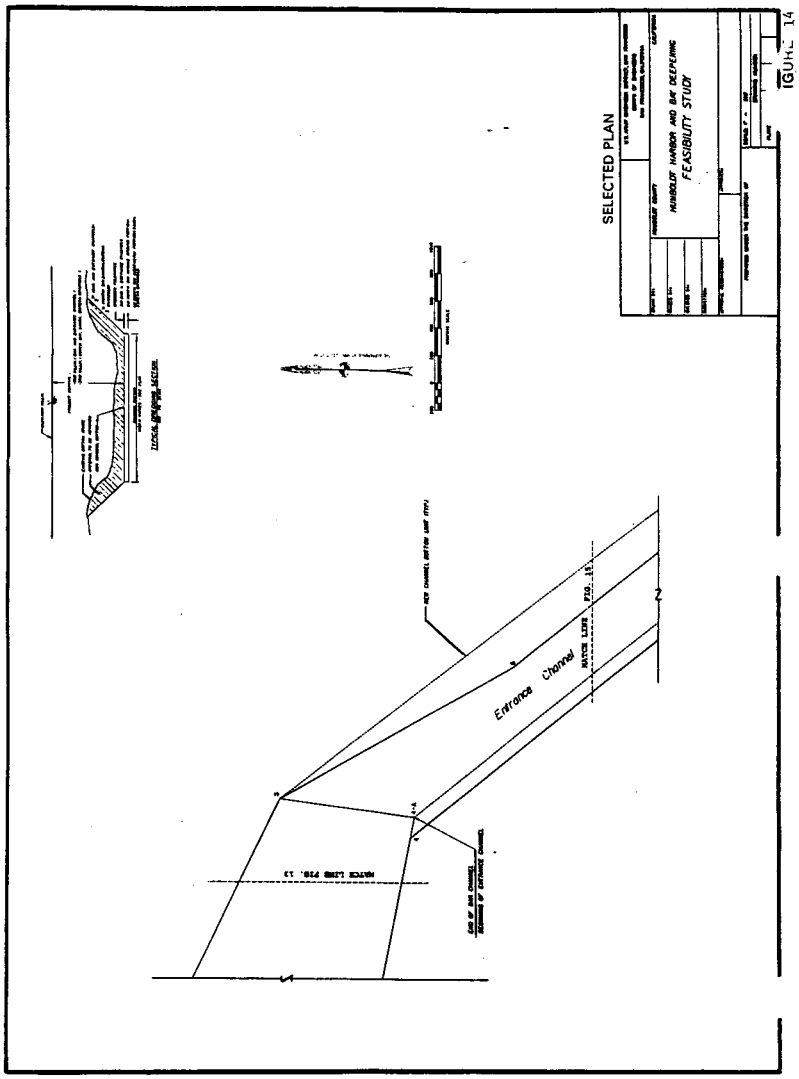

SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
Entrance Channel
MATCH LINE
MATCH LINE FIG. 13

FIGURE 14

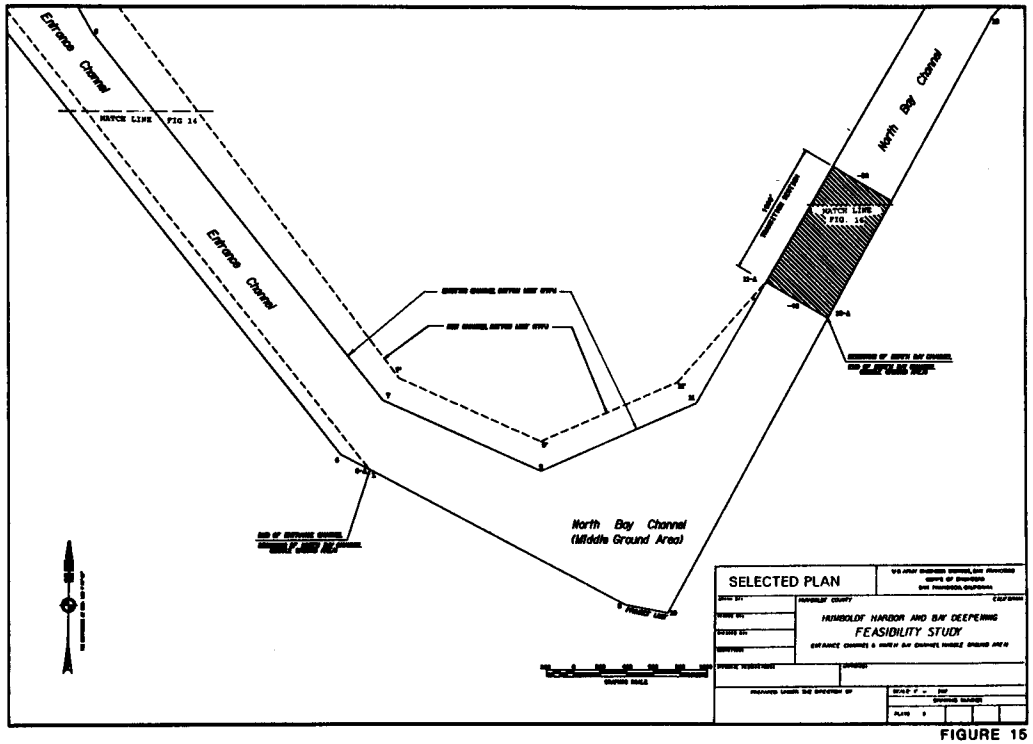

Entrance Channel
Entrance Channel
North Bay Channel
North Bay Channel
(Middle Ground Area)
MATCH LINE FIG 14
MATCH LINE FIG. 16
SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY

FIGURE 15

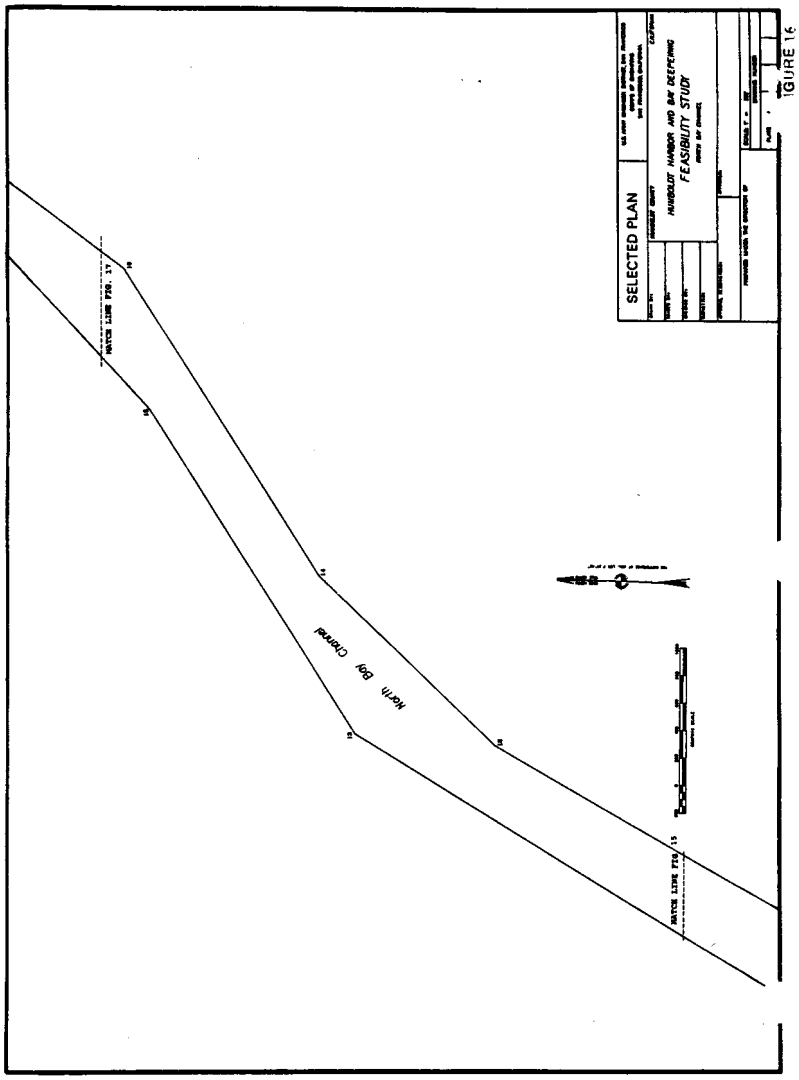

SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
MATCH LINE FIG. 17
MATCH LINE FIG. 15
NORTH BAY CHANNEL

FIGURE 16

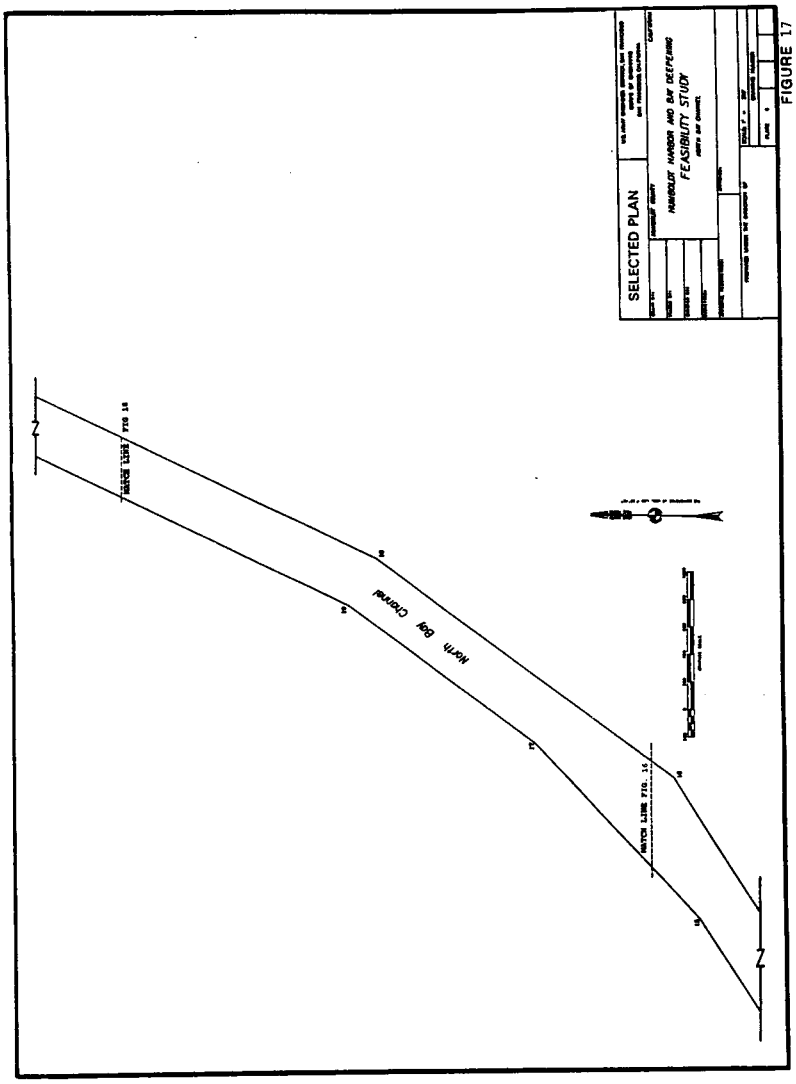

SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
North Bay Channel
MATCH LINE FIG. 16

FIGURE 17

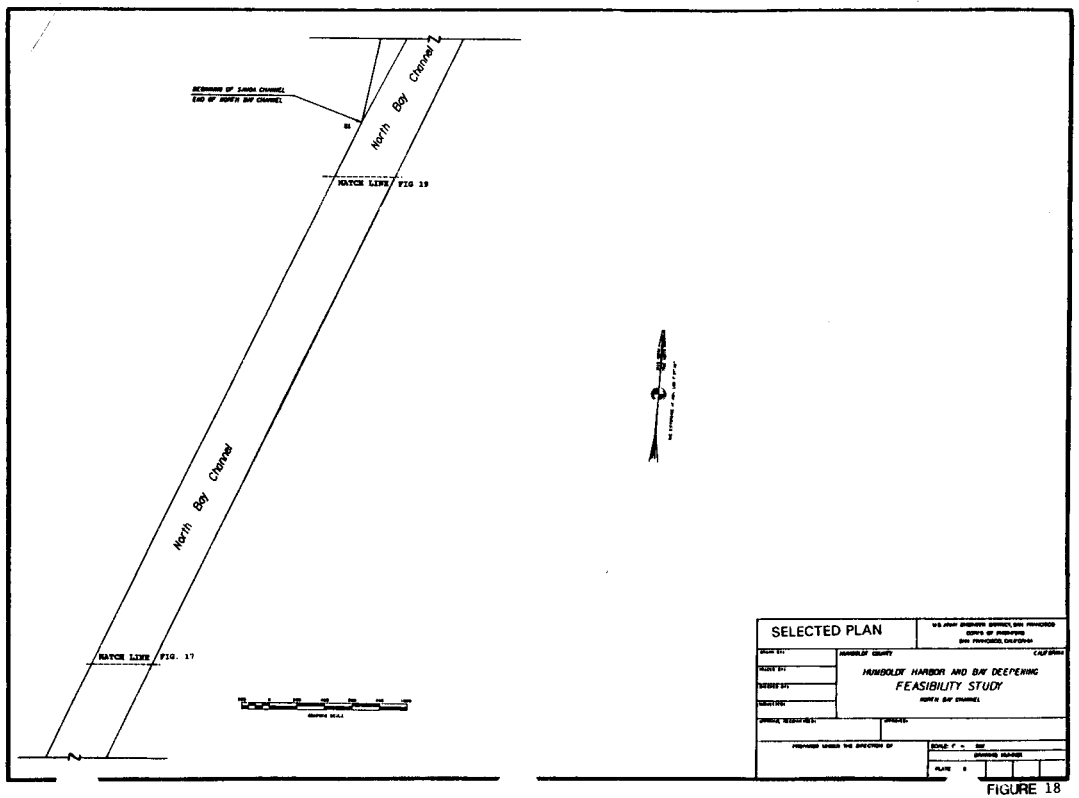
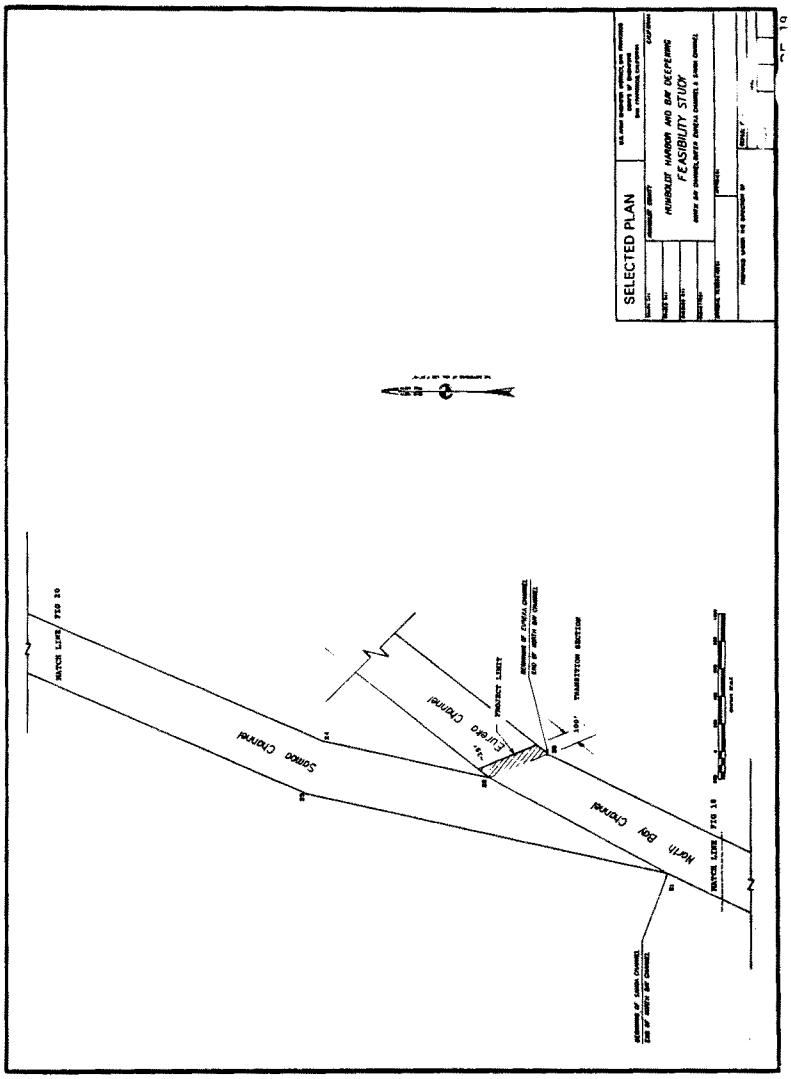
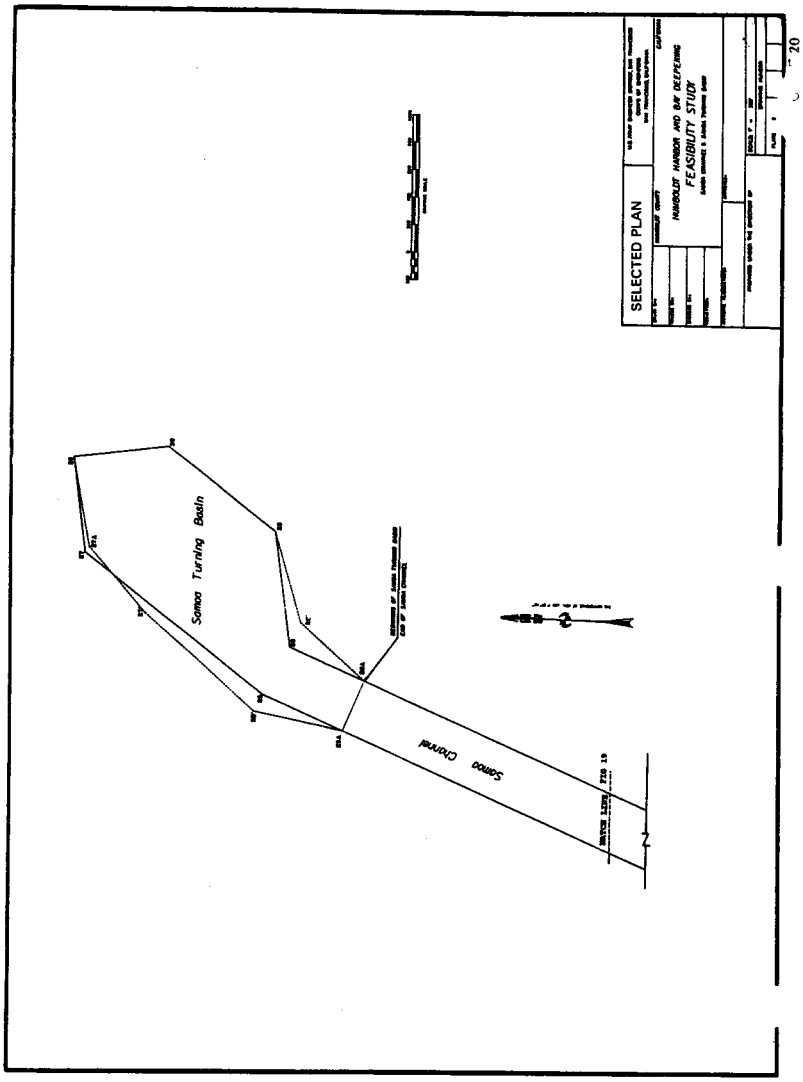

BEGINNING OF SAMOA CHANNEL
END OF NORTH BAY CHANNEL
North Bay Channel
North Bay Channel
MATCH LINE FIG 19
MATCH LINE FIG. 17
SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
NORTH BAY CHANNEL
HUMBOLDT COUNTY
CALIFORNIA

FIGURE 18


SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
Samoa Channel
Eureka Channel
North Bay Channel
PROJECT LIMIT
TRANSITION SECTION
MATCH LINE FIG 20
MATCH LINE FIG 18


SELECTED PLAN
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
Samoa Turning Basin
Samoa Channel

The following presents vessel dimensions by commodity carried, which are comparable to the largest vessels currently using Humboldt Harbor:

Commodity	DWT	Length(ft)	Max. Draft	Beam
Woodchips	46,595	675	37	100
	45,762	639	36.5	106
Particle Board	45,252	656	38.8	100
Pulp	45,065	658	39.3	101
Logs	36,138	622	36	91
	25,357	524	34	83
Petroleum	40,631	658	35	100
	40,631	658	35	102

All of these vessels were considered in the development of a design vessel which is a composite of vessels currently operating in the forest products trade. Dimensions of the design vessel are: Length 650 feet and Beam 106 feet.

Navigation Considerations For Channel Design

Various channel design considerations are presented in detail in the Engineering Analysis, Appendix A. Primary considerations and conclusions are summarized as follows.

Channel depth is based on the economic optimization with required vessel underkeel clearances. Vessel bottom clearance factors considered for the semi-protected conditions of the North Bay and Samoa Channels, and the Samoa Turning Basin, include vessel squat, trim, and maneuverability.

Squat recognizes the hydraulic phenomenon associated with the lowering of the water surface immediately surrounding the vessel underway thus causing the vessel to "sit" lower in the water. Based on criteria for the inner semi-protected channels considered in this study, an allowance of two feet was selected for vessel squat. This two foot allowance for squat is higher than average (reference EM-1110-2-1613) in order to accommodate higher vessel speeds observed in the long, relatively straight interior channels at Humboldt.

Vessels are often trimmed so that the stern is from one to two 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. A trim value of one foot was adopted for the selected design based on pilot information.

No precise information on the effect of shallow water on steering was available, but it is generally recognized that a vessel becomes difficult to handle and requires large rudder angles when speed is reduced in shallow water. In Humboldt Bay the channel depth transitional area, winds, waves, and cross-currents, are important factors included in vessel maneuverability concerns through the middle ground area of the North Bay Channel. On pilot recommendation, an allowance of two feet has been made for maneuverability, pitching and rolling of a vessel navigating the Humboldt Bay inner channels.

The overall clearance allowed for the design vessel between the ship keel and the channel bottom in the semi-protected portion of the project is five feet, summarized thus:

Squat	2 feet
Trim	1 feet
Safety & Maneuverability	2 feet
Inner Channel Vessel Underkeel Clearance	5 feet

Based on this vessel underkeel clearance, an operating minimum channel depth for semi-protected channels would normally be five feet greater than the loaded vessel draft (at midships). However, an adequate operating depth for the fully loaded design vessel, at all tidal stages, is not economical and some tidal delays are to be accepted.

The design depth of the Bar, Entrance, and Middle Ground of the North Bay Channels provides for additional vessel underkeel clearances due to its exposure to the open ocean. The existing five-foot differential depth between the Bar, Entrance, and "Middle Ground" Channels and the inner channels (-40 feet MLLW to -35 feet MLLW) was analyzed and increased using the new inner channel design depth (-38 feet MLLW). To meet this operational requirement for the Bar, Entrance, and "Middle Ground" Channels, a total of ten feet allowance for heave, pitch, and roll factors is required (reference Appendix A, Engineering Analysis, page 5.4). This extra allowance is consistent with other Corps projects and studies, (Columbia River Entrance Study, Coos Bay Oregon, San Francisco Bar Channel) as well as the Humboldt Bar Pilots recommendations. Therefore, the Bar and Entrance Channels with an operating depth of -48 feet MLLW are designed to accommodate the inner channel depth of -38 feet MLLW.

Channel Side Slopes

The proposed excavated side slopes for the Bar and Entrance Channel are recommended to be 1-vertical to 2-horizontal. This slope was selected based upon the consistency of the foundation sand materials in determining the appropriate angle of internal friction. An angle of internal friction of 35 degrees was selected and used in an infinite slope stability analysis. This analysis shows that a 1-vertical to 2-horizontal slope will have a static safety factor of 1.40. This slope will help to minimize the quantity of material to be excavated, thereby saving on the initial construction cost. There will still be a berm of sufficient width, 600 feet or greater, between the top of the northern side slope and the North Jetty, so there will be no erosion of the jetty due to undercutting.

Based upon experience with channels in the silty sand materials of San Francisco Bay, and upon the specified side slopes for Operation and Maintenance dredging in the Humboldt Bay North Bay Channel, 1985 to present, 1-vertical to 3-horizontal side slopes are proposed for the North Bay and Samoa Channels of the Humboldt Bay Navigation Channel Deepening Project.

Design Of Channels

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

(1) The Bar and Entrance Channel would be deepened to -48 feet MLLW with widening on the north side of the channel beginning at the west end of the jetties to the middle ground of the North Bay Channel (maximum widening of 275 feet) plus relocation of the southerly boundary, northerly 100 feet, for the same reach.

(2) The middle ground area of the North Bay Channel would be deepened to -48 feet MLLW with 200 feet of widening all along the northern boundary, from the Entrance Channel to approximately mile 1.1 where the widening tapers from 200 feet to 0 feet.

(3) The remainder of the North Bay Channel and the Samoa Channel, all would be deepened to -38 feet MLLW.

(4) The Samoa Turning Basin would be deepened to -38 feet MLLW and widened at its southerly approach from 400 feet to approximately 770 feet, with tapering widths both southerly and northerly of the 770 feet width.

5.3 DISPOSAL SITES

Ocean Disposal Site

As discussed in the previous Chapter, there are currently no U.S. Environmental Protection Agency (EPA) approved Section 102 (of the Marine Protection, Research, and Sanctuaries Act of 1977) permanent ocean disposal sites for Humboldt Harbor and Bay dredged material. The Corps of Engineers, San Francisco District has requested that the EPA designate an ocean dredged material disposal site offshore of Humboldt Bay (HOODS). EPA is scheduled to designate the Section 102 ocean disposal site in August 1995. (See Figure 9, for site location).

All dredged material from the navigation project which is suitable for unconfined aquatic disposal will be transported to this ocean site. The suitability of the material for disposal in the ocean was determined based on sediment sampling and testing which was performed during 1991 and 1992. The sediment testing is discussed in detail in the EIS/EIR.

Upland Disposal Site

From the estimated total of 5,600,000 cubic yards of material to be removed for the navigation project, only about 26,000 cubic yards have been identified as "unsuitable" for unconfined ocean disposal, based on the sediment testing. The sediment material displays slightly elevated levels of dioxin (site specific characteristics and general characteristics of dioxin are discussed in detail in the EIS/EIR). This "unsuitable" material is located in the southwestern portion of the Samoa turning basin, where the widening will occur (Figure 12).

Water overflow from the LP upland disposal site will be kept to a minimum by using the existing double basin design. Dredged material will be pumped into the main disposal basin with only high levels overflowing into the second basin. If the second basin water volume is exceeded, an effluent overflow pipe will be utilized. The overflow pipe leads into an open drainage ditch which flows into the Bay. The disposal operation and effluent discharge are being fully evaluated by the North Coast Regional Water Quality Control Board. The details of the evaluation and the assessment of potential impacts are discussed in the attached EIS/EIR.

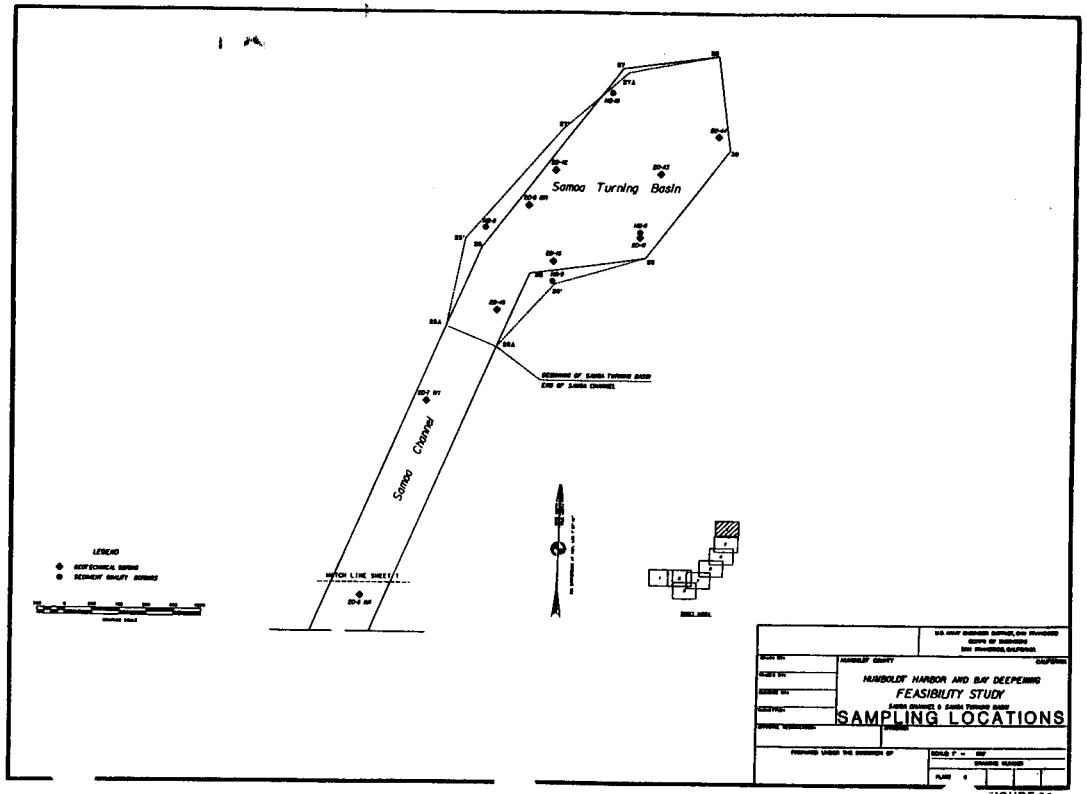

Samoa Turning Basin
Samoa Channel
LEGEND
HUMBOLDT HARBOR AND BAY DEEPENING
FEASIBILITY STUDY
SAMPLING LOCATIONS

FIGURE 21

5.4 DREDGING PLAN

The preferred method for deepening and widening the Humboldt Harbor and Bay channels is dredging by self-propelled hopper dredge. The Bar, Entrance, and the portion of the North Bay channel located in line with, and between, the north and south jetties, are located in an exposed ocean environment, subject to large swells, breaking seas, and strong currents. Fixed plant operations such as clamshell dredges with dump scows and hydraulic pipeline dredges would be subject to severe damage if operated in these channel reaches. In addition to being able to operate in an unprotected environment, hopper dredges are selected as the primary dredging method based on the suitability of bottom material, disposal site location, and cost effectiveness.

The use of a hydraulic cutterhead dredge was analyzed for the protected areas of the North Bay Channels. Hydraulic dredging is possible in the North Bay because of the availability of the Louisiana Pacific upland disposal site. However, hopper dredging is selected as the preferred method due to its lower dredging costs, for the material to be disposed at the LP upland site (reference the bottom of page 62).

5.5 OPERATION AND MAINTENANCE REQUIREMENTS

Maintenance dredging of the federal channels will remain the responsibility of the federal government. The estimated quantity of maintenance dredged material for the purpose of this Feasibility Study is based upon the Waterways Experiment Station's report titled Humboldt Bay Numerical Hydrodynamics and Sedimentation Study included in Attachment 3 to Appendix A. The study determined the impact of proposed deepening and widening of the present ship channels on the hydrodynamics and sedimentation within Humboldt Bay. Following are the estimated shoaling rates for the Base (i.e., existing conditions) and for the Selected Plan:

Annual Shoaling Rates (Cubic Yards)
-48 Feet MLLW Bar and Entrance
-38 Feet MLLW North Bay

Channel	Base	Selected Plan
Bar & Entrance	686,000	605,000
North Bay, and Samoa	105,000	67,000
Total	791,000	672,000

The results of the sedimentation study indicated that the selected plan has a significantly lower inflow of sediment when compared to the existing condition. This appears to be the result of the selected plan's lower water velocities combined with the small cross-sectional area at the Bay entrance inhibiting the flow of sediment from the ocean much more effectively than the existing channel geometry.

Conclusions of the hydrodynamics study indicate that with the deepening and/or widening of the channels, the velocities will decrease due to an increase in cross-sectional area, and the tide range will not be significantly changed.

Maintenance dredging unit costs are estimated to average $ 1.89 per cubic yard (cy) for the Bar, Entrance, North Bay, and Samoa channels, excluding mobilization and demobilization cost.

5.6 PROJECT ECONOMICS

The following section presents the costs and benefits for the Selected Plan. This is followed by presentation of the benefit to cost (B/C) ratio for the Selected Plan, the least cost and locally preferred plan and project cost apportionment.

Project Costs

Cost estimates for the alternative plans considered are based on October 1993 Price Levels, using the Dredge Estimating Program developed by the Corps of Engineers Jacksonville and Walla Walla Districts for dredging costs.

The cost estimates include contingencies for each cost item based on an analysis of the accuracy of information used for the design and costs. The cost estimate also includes the estimated cost for Engineering and Design as well as Supervision and Administration of construction.

Cost Estimates The project consists of deepening Humboldt Harbor and Bay to channel depths of: (1) -38 feet mean lower low water (MLLW), with 1 foot of tolerance; (2) -38 feet MLLW, with 2 feet of tolerance; and (3) -48 feet MLLW, with 3 feet of tolerance. An estimated maximum of 5,596,000 cubic yards would be dredged. Approximately 5,570,000 cubic yards would be deposited at the Humboldt Open Ocean Disposal Site (HOODS), and 26,000 cubic yards of material unsuitable for unconfined aquatic disposal would be deposited at the Louisiana Pacific (LP) upland disposal site.

The source for plant and equipment costs is the UPB 1992 database for Region VII, which is the latest Corps of Engineers database supplied for the Micro-Computer Aided Cost Estimating System (M-CACES). Labor costs are from the State of California wage rate determination sheet NC-63-3-12-92-1 for Dredge Operating Engineer. The cost estimate assumes that the Contractor will be working 24 hours a day in two-12 hour shifts, seven days a week. Aids to navigation costs were furnished by the 11th District, U.S. Coast Guard and are included as project costs.

Dredging would be performed by a hopper dredge. For dredged material designated for ocean open water disposal, the hopper would transport the dredged material to the HOODS site, then bottom dump the material. For dredged material designated for land disposal, the hopper would transport the dredged material to a floating platform and pipeline, at the northerly end of the Samoa Turning Basin, off-shore from the land disposal site. At the platform, the hopper's 24-inch diameter pumpout pipe would be connected to a 2,000 foot long pipeline which discharges into the LP upland disposal site. The hopper's pumpout system would then transfer the dredged material via the pipeline to the disposal site.

Mobilization and demobilization is based on the preparation, transfer, set-up, and removal of required plant and equipment. It is assumed that the time required for

mobilization and demobilization of the hopper dredge would be six days. The floating platform and 2,000 feet of 24-inch diameter pipe requires delivery, setup, and removal.

The hopper dredging plant consists of a self-propelled, 3,800 cubic yard, medium-sized hopper dredge and a survey vessel. The hopper dredge has a total combined horsepower of 8,000 to operate the drag arms, pumpout pump, jet pump, and other equipment. The survey vessel is assumed to be equipped with 340 horsepower and all necessary hydrosurveying equipment.

Aids to Navigation work would involve relocation of five buoys and two ranges. The work would include cost of new piling, new solar and lighting equipment, placement of aids, and survey of aid locations to 3rd order accuracy.

The Humboldt Open Ocean Disposal Site (HOODS) is one square nautical mile in area, at approximately -160 feet to -180 feet MLLW in depth, and approximately 3.75 miles from the west end of the Humboldt Harbor Jetties.

The Louisiana Pacific (LP) upland disposal site utilizes 12 acres of the 23 acre parcel for dredged material disposal. The site is located near the intersection of Samoa Cookhouse Road and New Navy Road, northeast of Samoa, Humboldt County. The primary disposal area would require: excavation by dozers to provide capacity for dredged material disposal; the existing weir (inflow) to the secondary disposal area and outfall structure (overflow) would be inspected and made operable; and the existing effluent drainage ditch maintained prior to initial material deposition.

The scheduled construction start date is August 1997 and the construction midpoint date is January 1998. Hopper dredging will require approximately twelve months, including mobilization and demobilization. Assumptions used in the cost estimate include:

Dredge Material:	100% sand/silty sand
Dredge Rate:	2,700 cy/hr to 3,300 cy/hr
Pipeline Pumpout Rate:	500 cy/hr
Dredge Travel Speed to Disposal:	8.1 mph
Dredge Travel Speed from Disposal:	10 mph
Available Minutes Per Dredging Day:	1,440 min/day
Effective Time:	75 - 85%
Operating Work Days Per Month:	29.4 days/mo
Dredge Crew:	14 men, CFC Rate: 6.5%
Monthly Ownership:	12 mo/yr Diesel Fuel: $1/gal
Contingencies:	25% LP site preparation, 24" dia. pipe mob. & demob., & floating platform, mob. & demob. 15% hopper dredging & hopper plant mob. & demob.

Bond: 1% Profit: 10% Overhead: 12%

Following are the M-CACES cost estimates for the selected plan and include: 1) Detailed Summary of the Project First Cost; 2) Detailed Summary of the Federal First Cost; 3) Detailed Summary of the Non-Federal First Cost; and 4) Project Cost Summary.

TABLE 6

NCACES COST ESTIMATE
HUMBOLDT HARBOR -38' DEEPENING
RECOMMENDED PLAN
DETAIL SUMMARY OF FIRST COST

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE $	AMOUNT $	CONTINGENCY	CONTING. %	REASON
	Price Level as of OCT 93							
01------	LANDS & DAMAGES							
	Land Payments	1	JOB	LS	$78,000	$0	0.0	
	Non-Federal Acquisition	1	JOB	LS	$24,300	$12,300	50.6	1/
	Federal Review	1	JOB	LS	$14,200	$7,200	50.7	1/
	LERRD, Site Prep, Land Disp	26,000	CY	$1.18	$30,680	$7,670	25.0	2/
	Subtotal, Lands & Damages Costs:				$147,180			
	Contingencies					$27,170		
01------	LANDS & DAMAGES, TOTAL					$174,350		
12------	NAVIGATION, PORTS & HARBORS							
1202----	HARBORS							
120201--	Mobilization and Demobilization							
	Hopper Dredge and Equipment	1	JOB	LS	$143,095	$21,464	15.0	
	24" Pipeline Transfer and Setup	1	JOB	LS	$162,585	$40,646	25.0	3/
120217--	Hopper Dredging							
	Bar Channel	1,089,000	CY	$1.37	$1,491,930	$223,790	15.0	
	Entrance Channel	461,000	CY	$1.51	$696,110	$104,417	15.0	
	North Bay Channel, Mid. Ground	1,641,335	CY	$1.89	$3,102,123	$465,318	15.0	
	North Bay Channel, Northern	413,555	CY	$2.20	$909,821	$136,473	15.0	
	Samoa Channel	414,000	CY	$2.60	$1,076,400	$161,460	15.0	
	Samoa Turning Basin	324,000	CY	$2.74	$887,760	$133,164	15.0	
	Widen East Samoa Turning Basin	71,000	CY	$2.95	$209,450	$31,418	15.0	
	Widen West Samoa Turning Basin	10,000	CY	$2.53	$25,300	$3,795	15.0	
	Widen West Samoa Turn Basin, land disp	26,000	CY	$4.42	$114,920	$17,238	15.0	
	Widen Entrance Channel	737,000	CY	$1.64	$1,208,680	$181,302	15.0	
	Widen North Bay Channel	409,000	CY	$2.07	$846,630	$126,995	15.0	
120299--	Associated General Items							
	Aids to Navigation	7	EA	$25,000	$175,000	$17,514	10.0	
	Subtotal, Dredging Costs:				$11,049,804			
	Contingencies @ average of	15.1 %				$1,664,993		
12------	NAVIGATION, PORTS & HARBORS, TOTAL					$12,714,797		
30------	PLANNING, ENGINEERING & DESIGN							
	E&D, Dredging	1	JOB	LS	$300,000	$30,000	10.0	
31------	CONSTRUCTION MANAGEMENT (S&I)							
	SIOH, Dredging	1	JOB	LS	$1,000,000	$100,000	10.0	
	Subtotal, Project Costs:				$12,496,984			
	Contingencies @ average of	14.6 %				$1,822,163		
	PROJECT COST, TOTAL					$14,319,147		

TABLE 6 (Continued)

HCACES COST ESTIMATE
HUMBOLDT HARBOR -38' DEEPENING
RECOMMENDED PLAN
DETAIL SUMMARY OF FIRST COST

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE $	AMOUNT $	CONTINGENCY	CONTING. %	REASON
	Price Level as of OCT 93							
	FEDERAL COSTS							
01------	LANDS & DAMAGES							
	Federal Review	1	JOB	LS	$14,200	$7,200	50.7	1/
	Subtotal, Lands & Damages Costs:				$14,200			
	Contingencies					$7,200		
01------	LANDS & DAMAGES, TOTAL					$21,400		
12------	NAVIGATION, PORTS & HARBORS							
1202----	HARBORS							
120201--	Mobilization and Demobilization							
	Hopper Dredge and Equipment	1	JOB	LS	$143,095	$21,464	15.0	
120217--	Hopper Dredging							
	Bar Channel	1,089,000	CY	$1.37	$1,491,930	$223,790	15.0	
	Entrance Channel	461,000	CY	$1.51	$696,110	$104,417	15.0	
	North Bay Channel, Mid. Ground	1,641,335	CY	$1.89	$3,102,123	$465,318	15.0	
	North Bay Channel, Northern	413,555	CY	$2.20	$909,821	$136,473	15.0	
	Samoa Channel	414,000	CY	$2.60	$1,076,400	$161,460	15.0	
	Samoa Turning Basin	324,000	CY	$2.74	$887,760	$133,164	15.0	
	Widen East Samoa Turning Basin	71,000	CY	$2.95	$209,450	$31,418	15.0	
	Widen West Samoa Turning Basin	10,000	CY	$2.53	$25,300	$3,795	15.0	
	Widen West Samoa Turn Basin, land disp	26,000	CY	$4.42	$114,920	$17,238	15.0	
	Widen Entrance Channel	737,000	CY	$1.64	$1,208,680	$181,302	15.0	
	Widen North Bay Channel	409,000	CY	$2.07	$846,630	$126,995	15.0	
120299--	Associated General Items							
	Aids to Navigation	7	EA	$25,000	$175,000	$17,514	10.0	
	Subtotal, Dredging Costs:				$10,887,219			
	Contingencies @ average of	14.9 %				$1,624,346		
12------	NAVIGATION, PORTS & HARBORS, TOTAL					$12,511,565		
30------	PLANNING, ENGINEERING & DESIGN							
	E&D, Dredging	1	JOB	LS	$300,000	$30,000	10.0	
31------	CONSTRUCTION MANAGEMENT (S&I)							
	SIOH, Dredging	1	JOB	LS	$1,000,000	$100,000	10.0	
	Subtotal, Federal Costs:				$12,201,419			
	Contingencies @ average of	14.4 %				$1,761,546		
	FEDERAL COST, TOTAL					$13,962,965		

TABLE 6 (Continued)

MCACES COST ESTIMATE
HUMBOLDT HARBOR -38' DEEPENING
RECOMMENDED PLAN
DETAIL SUMMARY OF FIRST COST

ACCOUNT CODE	ITEM	QUANTITY	UNIT	UNIT PRICE $	AMOUNT $	CONTINGENCY	CONTING. %	REASON
	Price Level as of OCT 93							
	NON-FEDERAL COSTS							
01------	LANDS & DAMAGES							
	Land Payments	1	JOB	LS	$78,000	$0	0.0	
	Non-Federal Acquisition	1	JOB	LS	$24,300	$12,300	50.6	1/
	LERRD, Site Prep, Land Disp	26,000	CY	$1.18	$30,680	$7,670	25.0	2/
	Subtotal, Lands & Damages Costs:				$132,980			
	Contingencies					$19,970		
01------	LANDS & DAMAGES, TOTAL					$152,950		
12------	NAVIGATION, PORTS & HARBORS							
1202----	HARBORS							
120201--	Mobilization and Demobilization							
	24" Pipeline Transfer and Setup	1	JOB	LS	$162,585	$40,646	25.0	3/
12------	NAVIGATION, PORTS & HARBORS, TOTAL					$203,231		
	Subtotal, Non-Federal Costs:				$295,565			
	Contingencies @ average of	20.5 %				$60,616		
	NON-FEDERAL COST, TOTAL					$356,181		

Contingency footnotes:

1/ Real estate costs and contingencies are from the Sacramento District, Real Estate Dvision and are preliminary.

2/ Louisiana Pacific site preparation cost would be affected by the condition of the in-situ material at the site and the last time the site was utilized for dredged material disposal. The material required to be excavated to provide disposal capacity may have consolidated which would affect excavation productivity. The rate of dredge disposal and characteristics of the dredge material may require the Contractor to utilize equipment at the disposal site during pumpout operations to direct the flow of disposed dredged material or to remove mounding of dredged material at the disposal site.

3/ Mobilization and demobilization costs would be affected by the availability of the 24-inch diameter pipe, the supplier cost, delayed delivery to the site, and connection difficulties. For the floating platform construction, the embedded length for the piling is an assumption which may require a design change if a boring investigation is done for verification.

Project Costs - Summary

A summary of the project costs at October 1993 price levels and the fully funded estimate follows.

Project Cost Summary at October 1993 Price Level

Lands and Damages	$ 174,350
Mob and Demob	
Hopper Dredge & Equipment	164,559
24" Pipeline Transfer & Setup	203,231
Hopper Dredging	12,154,494
Aids to Navigation	192,514
Engineering & Design	330,000
Supervision & Administration	1,100,000
Total Project Cost	**$14,319,148**
Interest during Construction (9 months)	554,867
Total Investment Cost	**$14,874,015**

Annual Cost

Amortization & Interest (50 yrs @ 7 3/4%)	$1,180,997
Less Savings in O&M	223,045
Total Annual Cost	**$ 957,952**

Fully Funded Estimate

	Escalation At Midpoint of Construction	Total
Lands & Damages	$ 27,896	$ 202,246
Navigation, Ports & Harbors	2,339,523	15,054,320
Engineering & Design	60,720	390,720
Supervision & Admin	202,400	1,302,400
Total	**$ 2,630,539**	**$16,949,686**

Project Economic Benefits

Appendix B to this Feasibility Report presents the economic analysis used to estimate the benefits resulting from deepening the Humboldt Harbor and Bay channels. The benefits are based on transportation cost savings and derived by comparing the difference in the estimated costs for vessel operations under the "with" and "without" project conditions. The following summarizes the benefit analysis.

There are two primary local industries which the harbor services; the fishing industry, which does not require a deepened harbor, and the forest products industry, which would benefit from the deepened harbor. The harbor is vital to the Humboldt Bay area economy since there are no alternative ports for shipping these commodities.

The benefits are in the form of savings in transportation costs resulting from economic efficiencies to the economy as a whole in the movement of commodities. No claim is made as to who specifically will benefit, whether it be the Port, the shipper, manufacturer, shipping company, the receiver, or the final user. In all likelihood, it will be some combination of the above. The benefits are National Economic Development (NED) benefits.

The benefit analysis is based on the standard "with" versus "without" project analysis. The "without" project condition is considered to be a -35 foot MLLW inner channel. The project was evaluated at the current federal discount rate of 7 3/4 percent with an assumed project economic life of 50 years. Benefits were originally developed in 1991 and have been revised using the latest information, including current vessel operating costs, which are in 1993 price levels. The base year is 1997.

The benefits were computed within the context of a multiport analysis. The existing and projected future "with" and "without" project operations of all the deep draft vessels that use Humboldt Harbor were examined and incorporated into the analysis. The commodities that are shipped out from Humboldt Harbor include lumber, logs, particle board, pulp, chips, petroleum and chemicals; and there appears to be no potential for shifts to other ports since the products are locally produced or consumed. Coos Bay, Oregon was identified as the major "competing" port that shipped similar timber goods to the Far East and Europe. No commodities are expected to be transferred from Humboldt to Coos Bay, or any other competing ports, because of the extra costs accrued in transporting these goods from the Humboldt area for eventual overseas delivery. Although a navigation channel deepening project may attract "new business" to Humboldt Harbor, this induced activity is not viewed as the "most likely alternative" and is not analyzed within the scope of the study. The study focuses on the more efficient use of vessels, including the rerouting of some vessels for given operations.

The following benefit categories were developed for the Humboldt Harbor economic analysis: 1) Reduction of Light-Loading Practices; 2) Economics of Scale; 3) Rerouting; and 4) Change in Operation Mode from truck to ship. Some of the commodities receive more than one type of benefit, with some of the tonnage receiving one type of benefit and a separate portion receiving another type. A summary of the average annual benefits, by benefit category, for the selected plan of a -38 foot MLLW North Bay Channel follows.

HUMBOLDT HARBOR
SUMMARY OF ANNUAL BENEFITS
Average Annual Benefits
North Bay Channel Depth (Ft. MLLW)
(1993 Price Levels)

Benefit Category	North Bay Channel Depth -38
Rerouting, Pulp & Part Brd	$823,300
Light-Loading, Pulp & Part Brd	653,137
Econ of Scale, Woodchips	320,252
Light-Loading, Woodchips	442,993
Change in Mode, Lumber	19,300
Total	**$2,259,000 (rounded)**

B/C Ratio for the Selected and Locally Preferred Plan

The benefit cost ratio for the Selected Plan of a -38 foot MLLW North Bay Channel is 2.36 to one. This B/C ratio is the ratio of the annual benefits, $2,259,000 (rounded), to the annualized cost (including interest during construction) of $958,000 (rounded). Net Annual Benefits are $1,301,000.

Cost Apportionment

Total Project Investment Cost The total project investment cost (October 1993) for the selected plan is estimated to be $14,874,000 (rounded).

Fully-Funded Cost Estimate The current fully funded cost estimate for the selected plan, inflated to mid-point of construction (January 1998) is $16,949,686. This includes an estimate of inflation based on Office of Management and Budget guidelines and the tentative construction schedule.

Non-Federal Cost Sharing For construction of general navigation features (GNF) between 20 feet and 45 feet in authorized project depth, the non-Federal cost share is 25 percent of the construction cost plus 10 percent additional cash with credit for any lands, easements, rights of way, relocations, and disposal areas (LERRD) applied against the additional cash. Based on the guidance provided in EC 1165-2-141, March 15, 1988, this cost share formula also applies to the Bar, Entrance, and Middle Ground of the North Bay Channels which are dredged to depths below 45 feet (to 48 feet, exclusive of overdepth). The increased depth is needed for safe vessel navigation in the Bar, Entrance, and Middle Ground Channels, and therefore, as provided in the EC, the cost sharing should be based on the deepest depths of the protected inner channels.

As provided in Section 101 of the Water Resources Development Act of 1986, the non-Federal cost share consists of 25 percent to be paid during the construction and an additional 10 percent, less any LERRD, to be paid over a period not to exceed 30 years at an interest rate pursuant to Section 106 of the Act. The following table presents the selected and locally preferred project cost sharing.

HUMBOLDT 38/48 FOOT PROJECT
Recommended and Locally Preferred Project
Cost Sharing
(October 1993 Price Level)

Item	Total Cost	% Fed	Federal Cost	% Non-Fed	Non-Fed Cost
Mob and Demob	$ 367,790	75%	$ 275,842	25%	$ 91,948
Dredging	12,154,494	75%	9,115,871	25%	3,038,623
Other GNF	1,430,000	75%	1,072,500	25%	357,500
Total GNF	**$13,952,284**	-	**$10,464,213**	-	**$ 3,488,071**
LERRD	$ 174,350	0	-	100%	$ 174,350
Aids to Navigation	192,514	100%	$ 192,514	-	-
Total First Cost	**$14,319,148**	-	**$10,656,727**		
10% of GNF	-		($1,395,228)	-	$ 1,395,228
Subtotal	**$14,319,148**		**$9,261,499**		**$ 5,057,649**
Credit for LERRD	-		$ 174,350		$ (174,350)
Total Cost Sharing	**$14,319,148**	**66%**	**$9,435,849**	**34%**	**$ 4,883,299**

5.7 REAL ESTATE REQUIREMENTS

The real estate requirement for the Humboldt Deepening Project is a temporary work area easement for an upland dredged material disposal site located on Louisiana Pacific property, just west of the Samoa Turning Basin. The area involved is about 23 acres. This site is approximately 20-25 feet above the surrounding terrain and is a disturbed dune habitat which has previously been used for disposal of asphalt, concrete, and other materials, including dredged material disposed by Louisiana Pacific. The local sponsor is currently working with Louisiana Pacific to reach an agreement on the disposal rights.

There is no federally owned land in the area. Navigation Servitude does not apply to the acquisition of this easement. There are no relocation costs included as part of this project.
The Real Estate Plan for this project is included as Appendix D to this Feasibility report.

5.8 ENVIRONMENTAL IMPACTS

The attached Environmental Impact Statement/Environmental Impact Report presents the project's environmental impacts in detail. The primary impacts deal with short-term affects resulting from the dredging and dredged material disposal operations. The project related impacts have been evaluated in the EIS/EIR. Table 7 shows the selected plan's compliance with environmental requirements.

5.9 MITIGATION PLANS/OTHER COMMITMENTS

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

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

The Coordination Act Report (CAR) prepared by the U.S. Fish and Wildlife Service recommended compensation for subtidal impacts to the benthic habitat in the navigation channels. The Corps position is that compensation for subtidal impacts is not justified for the reasons stated in the EIS/EIR, Section 5.5.4 (page 5-40) and EIS/EIR Appendix B, "Corps Responses to FWS Recommendations" (Response #4) and Appendix J, "Responses to Comments on the Draft EIS/EIR". Briefly, subtidal impacts to benthic habitat are insignificant, short-term and temporary. In addition, impacts to benthic habitat in "new" channel areas represents a very small area (i.e., 9,000 square feet). However, the Corps has investigated some potential restoration/enhancement activities for the Humboldt Bay area, and due to initial cost estimates, believes there is potential to pursue these investigations under Section 1135, environmental restoration, authority. The two potential restoration/enhancement activities are also explained in Appendix B of the EIS/R, "Potential Restoration/Enhancement Sites for Humboldt Harbor and Bay Deepening Navigation Project".

TABLE 7

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Environmental Requirement	*Project Alternative**	*HOODS*	*Louisiana Pacific (LP) Site*
INTERNATIONAL TREATY			
London Convention	FC	FC	NA
FEDERAL			
National Environmental Policy Act (NEPA)	FC	FC	FC
Coastal Zone Management Act	FC	FC	FC
Clean Air Act	FC	FC	FC
Clean Water Act	FC	FC	FC
National Historic Preservation Act	FC	FC	FC
Executive Order 11593, Protection & Enhancement of the Cultural Environment	FC	FC	FC
Abandoned Shipwreck Act	FC	FC	NA
Fish & Wildlife Coordination Act	FC	FC	FC
Endangered Species Act	FC	FC	FC
Executive Order 11990, Protection of Wetlands	NA	NA	NA

TABLE 7 (CONTINUED)

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Environmental Requirement	*Project Alternative**	*HOODS*	*Louisiana Pacific (LP) Site*
FEDERAL			
Estuary Protection Act	FC	NA	NA
Marine Protection, Research, and Sanctuaries Act	NA	FC	NA
STATE			
California Environmental Quality Act	FC	FC	FC
Porter-Cologne Water Quality Control Act	FC	NA	FC
State Lands Commission Policies	FC	NA	NA
California Endangered Species Act	FC	FC	FC
California Coastal Act	FC	FC	FC
California Wetlands Policy	NA	NA	NA
LOCAL			
County of Humboldt General Plan	FC	NA	FC
Humboldt Bay Master Plan	FC	NA	NA

Legend:

FC = Full compliance -All requirements of the law, policy, or related regulations have been met.

PC = Partial compliance -Some requirements of the law, policy, or related regulations have not been met. Refer to sections 3.2 and 3.3 for additional information.

NC = Not in compliance - Use of the site would conflict with the law, policy, or related regulations. Refer to sections 3.2 and 3.3 for additional information.

NA = Not applicable -The law, policy, or related regulations do not apply to the alternative or disposal sites.

* = No difference in compliance with environmental requirements for different depths in navigation channels (i.e., Bar & Entrance to -48 feet MLLW and North Bay Channels to -38 feet MLLW).

5.10 RISK AND UNCERTAINTY

The primary risk and uncertainty for the Humboldt Harbor and Bay Deepening Project is related to the economic viability of the lumber industry in the north coastal section of California.

There is substantial uncertainty about the availability of the timber resource(s) in Northern California and the Pacific Northwest (PNW) and the impact of availability on production and shipments. Several factors are discussed below which address this uncertainty and how it may impact the forecasts for Humboldt Bay.

It is noted that the forecasts used in this analysis are conservative, since they are below the levels of recent production and do not increase during the study time period.

Also, a variety of factors are occurring which are encouraging about resource availability for the mills in the Humboldt Bay vicinity. These include:

The forest products industry has consolidated. Numerous mills have gone out of business. From 1980 to 1994, 56 sawmills representing 2.593 million board feet of production have gone out of business in California (mostly northern California). In addition, 9 plywood, panel, veneer, and other like product plants have also gone out of business in California. Most of these businesses went out of business in the last few years resulting from a loss of timber availability. On the positive side, this consolidation has left more fibre available for more efficient producers.

Throughout the PNW (including northern California), log exports have decreased precipitously which also leaves more resource available for producers.

As harvests from U.S. Forest Service lands declined, relatively more of the fibre was obtained from private lands. In California, private lands increased their share of total harvest from 57.8% in 1985 to 70.0% in 1992. Harvest from private lands in the future are cautiously optimistic with a large volume of planted trees coming on line at or shortly after the turn of the century.

Legislative efforts to limit log exports from private land (the proposed Federal legislation) really would not impact northern California because all of the current shipments overseas are of products and not raw logs.

As resource availability has tightened, logs have been received from greater distances. At the present time, logs are being imported into Humboldt Bay from New Zealand. In addition, there is a plan being implemented to import logs from East Russia. One of the participants in this operation is a Humboldt area producer. Chip imports from Brazil, Chile, New Zealand and elsewhere have also been attempted or discussed. Receipts from more distant U.S. sources are also occurring as logs are transported from Montana, Idaho, Utah, Wyoming and other areas to producing areas.

Finally, more producers are beginning to use recycled wastepaper in pulp and paper production. This also has an effect of stretching raw log resources.

These factors will continue to mitigate the loss of timber availability from USFS lands. As a result, the low forecast provided in the economic analysis for this project is considered reasonable.

5.11 PLAN IMPLEMENTATION

Institutional Requirements

The schedule and details of project implementation are presented in the Project Management Plan, which is incorporated by reference into this Feasibility Report. The schedule is also summarized in Appendix C to this report. The following are key project milestones:

Report Forwarded to the U.S. Congress	Nov.	1995
President Signs Authorizing Legislation	Oct.	1996
Final Permit Received	Feb.	1997
PCA Executed	Feb.	1997
Real Estate Acquisition Completed	Jun.	1997
Construction Contract Awarded	Aug.	1997
Project Construction Completed	Jul.	1998

The project is scheduled to be authorized in the Water Resources Development Act (WRDA) of 1996. Following congressional authorization, the project would be eligible for construction funding. The project will be considered for inclusion in the President's budget based on national priorities, magnitude of the federal commitment, economic and environmental feasibility, level of local support, willingness of the non-federal sponsor to fund its share of the project cost, and budgetary constraints that may exist at the time of funding.

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

The majority of the construction funding would be required in Federal fiscal years 1997 and 1998. The Water Resources Development Act of 1986 requires that the non-Federal sponsor pay 25 percent of the cost of construction of the project.

The non-Federal sponsor is also required to pay an additional ten percent of the total cost of the general navigation features of the project in cash over a period not to exceed 30 years. The value of lands, easements, rights-of-way, relocations, and dredged material disposal areas are credited to this payment. The credit received is limited, however, to the ten percent.

Division of Responsibilities

In addition to the cost sharing responsibilities discussed Section 5.6 (page 70), the following paragraphs outline additional Federal and non-Federal responsibilities in connection with development of general navigation projects, as mandated by WRDA 1986, Public Law 99-662, and other pertinent laws and policy guidance.

Federal Responsibility The Corps of Engineers would be responsible for preparing detailed plans and specifications necessary to award a contract, and constructing and maintaining the project resulting from implementation of the selected plan.

Non-Federal Responsibilities Based on guidance contained in ER 1165-2-131, "Local Cooperation Agreements for New Start Construction Projects", non-Federal interests are subject to cost-sharing, financing, and other applicable requirements of Public Law 99-662, and in addition, are subject to the non-Federal sponsor agreeing to comply with applicable Federal Laws and policies, and the following requirements:

a) Pay during the period of construction 25 percent of the cost of construction of the portion of the general navigation features of the NED plan having a depth in excess of 45 feet, plus 25 percent of the cost of construction of the portion of the general navigation features for the NED plan having a depth in excess of 20 feet but not in excess of 45 feet;

b) Pay with interest over a period not to exceed 30 years following completion of the project, an additional 10 percent of the total cost of construction of the general navigation features of the NED plan, the interest to be determined pursuant to Section 106 of Public Law 99-662. The value of lands, easements, rights-of-way, relocations (other than utility relocations), and borrow and dredged or excavated material disposal areas and costs of utility relocations borne by the sponsor for the NED plan shall be credited toward this required payment:

c) Pay 100 percent of the estimated first costs of construction of the general navigation features of the recommended plan that are in excess of the construction costs of the general navigation features of the NED plan;

d) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

e) Provide or pay the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project;

f) Hold and save the United States free from all damages due to the construction, operation, and maintenance of the project, except for damages due to the fault or negligence of the United States or its contractors;

g) Assume responsibility for construction and installation of all non-Federal project features, concurrent with construction of Federal project general navigation features including appurtenant facilities and services;

h) Provide and maintain adequate public terminal and transfer facilities open to all on equal terms and with such depths from the Federal channel line to and between the wharves of the terminal (berthing areas) as may be required for accommodation of vessels at the terminal, consistent with the Federal project;

i) Prohibit erection of any structures or berthing of any vessels that would encroach on the authorized general navigation features;

j) Perform prior to initiation of construction, and thereafter as determined necessary, environmental investigations to identify the existence and extent of any hazardous substances regulated under the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, in or under all lands, easements and rights-of-way necessary for construction, operation, and maintenance of the project;

k) Assume complete financial responsibility for cleanup and response costs of any CERCLA regulated materials located in, on or under lands, easements, or rights-of-ways necessary for the construction, operation, and maintenance of the project; and be responsible for operating, maintaining, repairing, replacing, and rehabilitating the project in a manner so that liability will not arise under CERCLA;

l) Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, all project features other than those for general navigation;

m) Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project;

n) Keep, and maintain, books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs;

o) Comply with the applicable provisions of the Uniform Relocation Assistance and Real Estate Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulation contained in 49 CFR, Part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act, and

p) Comply with all applicable Federal and State laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964, Public Law 88-352, and the Department of Defense directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, case of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

6. COORDINATION AND PUBLIC INVOLVEMENT

6.1 PUBLIC MEETINGS, WORKSHOPS, AND REPORT CIRCULATION

The San Francisco District of the Corps of Engineers (COE), in conjunction with the local sponsor (HBHRCD), conducted two public workshops/scoping meetings in December 1988, during the initial stages of the Reconnaissance study phase. In July 1989 the Corps and the HBHRCD conducted a public workshop in Eureka for the purpose of presenting the preliminary reconnaissance study alternatives and providing the interested public with an opportunity to express their views on the study alternatives.

On September 12, 1990, the COE and the HBHRCD conducted two public workshops and EIS scoping meetings to initiate the feasibility study phase.

On January 11, 1995, the COE and the HBHRCD conducted a public meeting on the Draft Feasibility Report/Environmental Impact Statement/Report.

6.2 FEASIBILITY STUDY INVOLVEMENT

Coordination with the U.S. Fish and Wildlife Service (FWS) was initiated in the reconnaissance study phase and the Service provided a planning aid letter in May 1989. In May 1991, the FWS provided a Preliminary Draft Fish and Wildlife Coordination Act Report for the feasibility study. Following completion of additional studies, such as eelgrass surveys, hydrodynamic and shoaling studies, and vessel simulation, the Fish and Wildlife Service provided a Draft Coordination Act Report in February 1994 and a Final Coordination Act Report in March 1995.

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

Coordination with other agencies and the general public has also occurred at various points during study execution. These other agencies include the National Marine Fisheries Service, U.S. Coast Guard, California Department of Fish and Game, the California Coastal Commission, California Regional Water Quality Control Board, and the North Coast Unified Air Quality Management District.

As indicated above, a public hearing was held to solicit comments on the Draft Feasibility Report and Environmental Impact Statement/Report included with this report. The Comments and Responses to Comments on the Draft Feasibility report and EIS/EIR are included with this report (Appendix I and J in Final EIS/EIR). The Report is receiving full review by the Corps of Engineers Headquarters and the Office of the Assistant Secretary of the Army for Civil Works.

6.3 CIRCULATION OF THE FEASIBILITY REPORT

This Final Feasibility Report and Final Environmental Impact Statement/Report is being circulated for comments to a wide range of federal, state, and local agencies to include the following:

Federal

Department of the Interior, Office of Environmental Review
Environmental Protection Agency, Region 9
Fish and Wildlife Service
Department of Commerce, National Marine Fisheries Service
Coast Guard

State of California

Department of Fish and Game
California Coastal Commission
Regional Water Quality Control Board
Air Resources Board
State Historic Preservation Officer

Local

Humboldt County
City of Eureka
City of Arcata

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

6.4 VIEWS OF THE LOCAL SPONSOR

The non-Federal sponsor, the Humboldt Bay Harbor, Recreation, and Conservation District, has worked closely with the Corps in preparation of the Feasibility Study. To date, all required local funds have been provided and the sponsor indicates full willingness to cost share in the construction project. Although the NED plan is an inner channel depth of -39 feet MLLW, the local sponsor can only support a project with an inner channel depth of -38 feet MLLW. Therefore, the locally preferred plan and the selected plan is a -48 foot MLLW Bar, Entrance, and Middle Ground of the North Bay Channels and -38 foot MLLW North Bay Channel, Samoa Channel and Samoa Turning Basin.

The local sponsor has given high priority to authorization of the project in the Water Resources Development Act of 1996, targeting construction to begin during Federal fiscal year 1997.

7. CONCLUSIONS AND RECOMMENDATIONS

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

I have also assessed the Humboldt Bay Harbor, Recreation and Conservation District's financial capability and ascertained that it is reasonable to expect that ample funds will be available to satisfy the non-Federal sponsor's financial obligation for the project (reference Appendix E to this Feasibility Report).

For construction of general navigation features (GNF) between 20 feet and 45 feet in depth, the non-Federal cost share is 25 percent of the construction cost plus 10 percent additional cash, with credit for any lands, easements, rights of way, relocations, and disposal areas (LERRD) applied against the additional cash. I have determined this cost share formula also applies to the Bar, Entrance, and Middle Ground of the North Bay Channels, which is dredged to depths below 45 feet (to 48 feet). The increased depth is needed for safe passage through the Bar, Entrance and Middle Ground of the North Bay Channels, and therefore, as provided in the guidance contained in EC 1165-2-141, March 15, 1988, the cost sharing should be based on the deepest depth of the protected inner channel.

I recommend that the existing Federal navigation project at Humboldt Bay, authorized by the River and Harbor Act of 1968, be modified to provide a -48 feet MLLW Bar, Entrance, and Middle Ground of the North Bay Channels with selective widening transitioning to a -38 feet MLLW inner North Bay Channel and continuing at that depth to the Samoa Turning Basin with minor realignment of the entrance to the Turning Basin, and with such further modifications thereto as in the discretion of the Chief of Engineers may be advisable. The total investment cost is estimated to be $14,874,000. It is estimated that no additional annual costs will be incurred for Federal maintenance dredging since shoaling of the project channels is expected to decrease with the project in place. Thus, the estimated total project annual cost is $958,000. With estimated average annual benefits of $2,259,000 in waterborne commerce transportation cost savings, the proposed project is economically feasible with a benefit-to-cost ratio of 2.36 and annual net benefits of $1,301,000, thereby warranting Federal participation.

The fully-funded cost estimate is presently estimated at $16,949,686, based on a scheduled construction completion in FY 1998. Accordingly, the non-Federal cost share is estimated to be $3,488,000 for 25 percent of the general navigation features (GNF), $174,350 for 100 percent of associated improvements, and $1,395,000 plus interest for an additional 10 percent of GNF payable over a period not to exceed 30 years.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of the national Civil Works Construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and/or implementation of funding. However, prior to transmittal to the Congress, the sponsor, the State, interested Federal Agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Date: 16 MAR 95

MICHAEL J. WALSH
Lieutenant Colonel, Corps of Engineers
District Engineer

[First Endorsement]

CESPD-PD-P (April 1995) (1105) 1st End Sloan/tjm/415-705-1474
SUBJECT: Feasibility Report for Navigation Improvements, Humboldt Harbor and Bay (Deepening), Humboldt County, California

DA, South Pacific Division, Corps of Engineers, 630 Sansome St., Room 720, San Francisco, CA 9411-2206 21 April 1995

FOR CDR USACE (CEWRC-WLR), KINGMAN BUILDING, FORT BELVOIR, VA 22060

I concur in the conclusions and recommendations of the District Commander.

BRUCE K. SCOTT
Brigadier General, U.S. Army
Commanding

FINAL ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT

Humboldt Harbor and Bay Deepening Navigation Project

FINAL
ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT

HUMBOLDT HARBOR AND BAY DEEPENING NAVIGATION STUDY

HUMBOLDT BAY HARBOR
HUMBOLDT COUNTY, CALIFORNIA

The responsible Federal Lead Agency is the U.S. Army Corps of Engineers, San Francisco District. The responsible State Lead Agency is the Humboldt Bay Harbor, Recreation, and Conservation District.

Abstract:

Humboldt Harbor is located in Humboldt County on the northern California coast, approximately 225 nautical miles north of San Francisco and 156 nautical miles south of Coos Bay, Oregon. The purpose of this Final EIS/EIR is to investigate the feasibility of Federal assistance in improving commercial deep draft navigation in Humboldt Harbor and Bay channels. The San Francisco District, Corps of Engineers and the Humboldt Bay Harbor Recreation, and Conservation District have investigated several alternative plans for the selective deepening and widening of navigation channels, and various dredged material disposal alternatives for the disposal of the estimated 5.6 million cubic yards of dredged material from the project. This EIS/EIR addresses a no-action alternative and nine alternative plan/options in detail. The recommended plan is Alternative 3, which would include two disposal sites: the proposed Section 102 Humboldt Open Ocean Disposal Site (HOODS) for approximately 5.6 million cys of dredged material, and upland disposal of approximately 26,000 cys of dredged material at the Louisiana Pacific Site. Any potential environmental impacts associated with the recommended plan are addressed in this EIS/EIR and include the following: air quality, noise, hydrology and water resources, geology and sediment quality, biological resources, cultural resources, transportation and socioeconomics. Mitigation measures for these potential impacts are also identified in this EIS/EIR.

The information, displays, and appendices in the attached Feasibility Report are incorporated by reference into this EIS/EIR.

PLEASE REFER TO THE ENCLOSED NOTICE OF AVAILABILITY FOR THE OFFICIAL CLOSING DATE FOR RECEIPT OF PUBLIC COMMENTS. SEND COMMENTS TO EITHER OF THE CONTACTS LISTED BELOW.

For further information on this Final EIS/EIR, please contact either:

Federal Agency Contact

Ms. Tamara Terry
Environmental Branch
U.S. Army Corps of Engineers
211 Main Street, Room 918
San Francisco, CA 94105-1905
Telephone: (415) 744-3341
FAX: (415) 744-3312

State Agency Contact

Mr. Jack Alderson
Chief Executive Officer
Humboldt Bay Harbor, Recreation
and Conservation District
P.O. Box 1030
Eureka, CA 95502-1030
Telephone: (707) 443-0801
FAX: (707) 443-0800

**ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT
HUMBOLDT HARBOR AND BAY DEEPENING
NAVIGATION STUDY
HUMBOLDT BAY HARBOR, CALIFORNIA**

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ACRONYMS

1	APE	Area of Potential Effects
2	ARB	California Air Resources Board
3	BACT	Best Available Control Technology
4	BMP	Best Management Practices
5	B.P.	years before present
6	CAA	Clean Air Act
7	CAAQS	California Ambient Air Quality Standards
8	CalCOFI	California Cooperative Oceanic Fisheries Investigations
9	CAR	Coordination Act Report
10	CCAA	California Clean Air Act
11	CCC	California Coastal Commission
12	CCMP	Comprehensive Conservation and Management Plan
13	CDFG	California Department of Fish and Game
14	CDWR	California Department of Water Resources
15	CEQ	Council on Environmental Quality
16	CEQA	California Environmental Quality Act
17	CESA	California Endangered Species Act
18	CFR	Code of Federal Regulations
19	CNDDB	California Natural Diversity Data Base
20	CNEL	community noise equivalent level
21	CNPS	California Native Plant Society
22	CO	carbon monoxide
23	COE	U.S. Army Corps of Engineers
24	CWA	Clean Water Act
25	cys/cy	cubic yards
26	CZMA	Coastal Zone Management Act
27	CZMP	Coastal Zone Management Plan
28	dB	decibel
29	dBA	A-weighted decibel
30	DDE	diphenyldichloroethylene
31	DEIS/DEIR	Draft Environmental Impact Statement/Report
32	DIFID	Disposal from Instantaneous Dump
33	DO	dissolved oxygen
34	DOHS	California Department of Health Services
35	EHS	Environmental Health Service
36	EIR	Environmental Impact Report
37	EIS	Environmental Impact Statement
38	ERC	Environmental Review Committee
39	ER-L	Effects Range-Low
40	ER-M	Effects Range-Medium

ACRONYMS

1	ESA	Endangered Species Act
2	EPA	Environmental Protection Agency
3	FEIS/FEIR	Final Environmental Impact Statement/Report
4	FEMA	Federal Emergency Management Administration
5	FONSI	Finding of No Significant Impact
6	FWS	U.S. Fish and Wildlife Service
7	gpm	gallons per minute
8	HBHRCD	Humboldt Bay Harbor Recreation, and Conservation District
9	km	kilometer
10	LC	London Convention
11	L_{dn}	day-night equivalent noise level
12	L_{eq}	energy equivalent noise level
13	LOI	letter of intent
14	MCL	maximum contaminant level
15	mcy/mcys	million cubic yards
16	MHHW	mean higher high water
17	MLLW	mean lower low water
18	MOA	Memorandum of Agreement
19	mph	miles per hour
20	msl	mean sea level
21	$\mu g/m^3$	micrograms per cubic meter
22	mg/L	milligrams per liter
23	mgd	million gallons per day
24	MPRSA	Marine Protection, Research, and Sanctuaries Act
25	NAAQS	National Ambient Air Quality Standards
26	NCRWQCB	North Coast Regional Water Quality Control Board
27	NCUAQMD	North Coast Unified Air Quality Management District
28	NDS	Nearshore Disposal Site
29	NED	National Economic Development
30	NEPA	National Environmental Policy Act
31	ng/L	nanograms per liter
32	NGVD	1929 National Geodetic Vertical Datum (mean sea level in 1929)
33	NMFS	National Marine Fisheries Service
34	NO	nitric oxide
35	NO_2	nitrogen dioxide
36	NO_x	nitrogen oxides
37	NOI	Notice of Intent
38	NOP	Notice of Preparation
39	NPDES	National Pollutant Discharge Elimination System
40	NTU	nephelometric turbidity unit
41	ODMDS	ocean dredged material disposal site
42	OMZ	oxygen minimum zone
43	O_3	ozone
44	PAH	polycyclic aromatic hydrocarbon

1	PCB	polychlorinated biphenyl
2	PG&E	Pacific Gas & Electric Company
3	PM_{10}	particulate matter smaller than 10 microns in diameter
4	ppm	parts per million
5	ppt	parts per thousand
6	ROG	reactive organic gas
7	ROI	region of influence
8	RWQCB	Regional Water Quality Control Board
9	SCS	Soil Conservation Service
10	SHPO	State Historic Preservation Officer
11	SIP	State Implementation Plan
12	SLC	State Lands Commission
13	SNOI	Supplemental NOI
14	SNOP	Supplemental NOP
15	SO_2	sulfur dioxide
16	SPP	suspended particulate phase
17	STLC	soluble threshold limit concentration
18	SWRCB	State Water Resources Control Board
19	TBT	tributyltin
20	TCE	trichloroethylene
21	TDS	total dissolved solids
22	TOC	total organic compounds
23	TOG	total organic gases
24	TPH	total petroleum hydrocarbons
25	TSS	total suspended solids
26	TTLC	total threshold limit concentration
27	TVS	total volatile solids
28	USACE	U.S. Army Corps of Engineers
29	USEPA	U.S. Environmental Protection Agency
30	U.S.C.	United States Code
31	VOC	volatile organic compounds
32	VTS	Vessel Traffic Service
33	WES	U.S. Army Engineer Waterways Experiment Station
34	WQC	water quality criteria
35	WQOL	water quality objective limits
36	WRDA	Water Resources Development Act

GLOSSARY

Anchorage area: An area designated by the U.S. Coast Guard for the anchoring of ships in the harbor.

Berth: The water area at the waterfront edge of a wharf, reserved for a vessel. The term is sometimes used to refer to the dock or wharf structure.

Bioassay: The use of living organisms to determine the effect of some substance, factor, or condition.

Breakwater: An engineering structure to afford shelter from wave action.

Channel: The buoyed, dredged, and policed fairway through which ships proceed from the sea to their berth or from one berth to another within the harbor.

Community: As in "plant community" or other type of biological community; a distinctive collection of species occurring together in a particular habitat.

Construction staging areas: An area where construction equipment, supplies, and construction offices are located.

Decibel: A unit of sound measurement.

Dredging: The removal of bottom sediments in order to deepen or widen a waterway.

Filter feeding: Obtaining food by passing water through a filtering mechanism.

Holocene (Recent): The post-Pleistocene geological epoch characterized by fluctuating but generally moderate climates, rising sea levels, and modern animal species; dating to approximately 11,000 years before present, to the present.

Inversion: A condition where a layer of cool air or water is trapped under a layer of warm air or water so that it cannot rise.

Leachate: A solution obtained by leaching, as in the downward percolation of water through soil or solid waste and containing soluble substances, such as at a landfill.

Lead agency: The public agency that has the principal responsibility for carrying out or approving a project.

Mean lower low water : The average height of the lower of the daily low tides.

Nephelometer: A device for measuring the size and concentration of particles in a liquid by an analysis of the light transmitted through or reflected by the liquid.

Nutrient: A substance that promotes growth or provides energy for biological processes; common nutrients are phosphate, nitrate, calcium, and potassium.

Obsidian: Natural volcanic glass. This was the premier material for Native American stone tool manufacture in California, where it was obtained, often by long distance trade, from more than 25 separate sources.

Phytoplankton: Microscopic, usually one-celled plants that drift in the surface waters of the ocean.

Pier: The location in a seaport at which cargo arrives or departs. A dock for loading or unloading ships or vessels.

Pleistocene: A late Cenozoic geologic epoch characterized by fluctuating, generally cool climates -- often accompanied by glaciation -- and distinctive animal species, dating from 3 million years ago until approximately 11,000 years ago.

Pliocene: The late Cenozoic geologic epoch following the Miocene and preceding the Pleistocene; dating from approximately 5 million until 3 million years ago.

Responsible Agency: A public agency other than the lead agency that has responsibility for carrying out or approving a project.

Sediment: Particles and fine matter heavy enough to settle to the bottom of a water column.

Spud: An extendible pile mounted on the side of a dredge or barge which can be driven into bottom sediments under its own weight to anchor the dredge or barge into position.

Suitable material: Dredged material that is suitable for unconfined aquatic disposal.

Turbidity: A cloudy, hazy condition in the water due to the presence of suspended particles, reducing the transmission of light.

Unconsolidated sediments: Those sediments that have not been compressed into a firm consistency; mud.

Unsuitable material: Dredged material that is unsuitable for unconfined aquatic disposal.

GLOSSARY

Upland:	In this document, referring to terrestrial (on land) areas.
Wetlands:	Lands that are periodically or permanently inundated by surface or groundwater and support vegetation adapted for life in saturated soil. Wetlands include marshes, swamps, bogs, and similar areas.

List of Measurements

cm	centimeters
cm/sec	centimeters per second
cy	cubic yards
°C	degrees Celsius
°F	degrees Fahrenheit
ft	feet
km^2	square kilometers
m	meters
m^2	square meters
mcy	million cubic yards
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ng/L	nanograms per liter
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
µg - Atoms/L	micrograms- atoms per liter
µg/L	micrograms per liter
µM/L	micromoles per liter

Unit Conversions

Multiply	*By*	*To Obtain*
milligrams per liter	1	parts per million (fluid)
milligrams per kilogram	1	parts per million (soils, sediments)
micrograms per liter	1	parts per billion (fluid)
nanograms per liter	1	parts per trillion (fluid)
feet	0.3048	meters
miles (nautical)	1.853	kilometers
miles (statute)	1.609	kilometers
inches	2.540	centimeters
cubic yards	0.7646	cubic meters
miles per hour	44.70	centimeters per second
square feet	0.09290	square meters
square miles (nautical)	3.434	square kilometers
µM/L	molecular weight	micrograms per liter
µg - Atoms/L	1/atomic weight	micrograms per liter

Multiples and Submultiples

Prefix	*Symbol*	*Equivalent*	*Factor*
nano-	n	billionth part	$\times 10^{-9}$
micro-	μ	millionth part	$\times 10^{-6}$
milli-	m	thousandth part	$\times 10^{-3}$
centi-	c	hundredth part	$\times 10^{-2}$
kilo-	k	thousandfold	$\times 10^{3}$

SUMMARY

S.1 INTRODUCTION

This Final EIS/EIR analyzes the impacts associated with the proposed deepening of the Humboldt Harbor and Bay navigation channels to accommodate deep-draft ships. In addition, this document also discloses the impacts associated with the disposal of the dredged material. This document fulfills the requirements of the National Environmental Policy Act (NEPA) to support decisionmaking on the Federal civil works projects, and the California Environmental Quality Act (CEQA) requirements for State decisions related to the project. The Humboldt Bay Harbor Recreation, and Conservation District is the non-Federal (local) sponsor of the Federal project.

Existing Federal channel depths in Humboldt Bay navigation do not allow for efficient utilization by deep-draft vessels presently calling at the harbor. Therefore, the objectives of the proposed deepening navigation project are to increase deep-draft navigational safety in the Humboldt Harbor and Bay channels; maximize the efficient use of the Humboldt Harbor and Bay by commercial deep-draft vessels; reducing vessel tidal delays and associated costs; and to improve or restore environmental quality wherever possible without adding undue cost or compromising the primary objectives of the project. Overall, the proposed deepening would alleviate major navigation difficulties presently existing in Humboldt Harbor and Bay due to inadequate, unsafe navigation channels for deep-draft vessels.

S.2 MAJOR CONCLUSIONS AND FINDINGS

S.2.1 Description of Proposed Action

The proposed deepening and selective widening of the Humboldt Harbor and Bay navigation channels would involve the dredging and disposal of approximately 5.6 million cubic yards (mcy) of dredged material in the proposed and soon-to-be-designated Section 102 Humboldt Open Ocean Disposal Site (HOODS), and the dredging and upland disposal of approximately 26,000 cys of dredged material, unsuitable for unconfined aquatic disposal, at the Louisiana Pacific Site. The quality of the sediments to be dredged has been sampled and categorized in terms of its suitability for various disposal options, as explained in Sections 2.8, 4.4.5, 5.4, 5.5.1, and 5.5.2.

The recommended dredging and disposal project (Alternative 3) involves the following: Bar and Entrance channels deepened to -48 feet MLLW, and approximately 1,550, 000 cys of dredged material to be removed; "Middle Ground Area" of North Bay Channel deepened to -48 feet MLLW, and approximately 1,641,335 cys of dredged material to be removed; North Bay and

Samoa channels deepened to -38 feet MLLW, and approximately 1,151,555 cys of dredged material to be removed; Entrance channel widened on the north side of the channel from the jetty heads through the "middle ground" to the turn into the North Bay channel -this widening ranges from a maximum 275 feet in the Entrance channel to 200 feet in the"middle ground" area, and approximately 1,146,000 cys of dredged material to be removed; the Entrance channel edge is moved north and away from the South Jetty by 100 feet; realignment of the existing Samoa channel turning basin to facilitate safer use of the basin, and approximately 107,000 cys of dredged material to be removed; and finally, dredging and disposal of approximately 5.6 million cys of dredged material at HOODS, and the dredging and upland disposal of approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal at the Louisiana Pacific Site.

S.2.2 Comprehensive Summary of Impacts

The potential environmental impacts associated with the recommended plan (Alternative 3) are addressed in this EIS/EIR and include the following: air quality, noise, hydrology and water resources, geology and sediment quality, biological resources, cultural resources, transportation, and socioeconomics. Table S-1 summarizes both insignificant impacts and any potentially significant impacts. Detailed descriptions of these are discussed in Chapters 4 and 5.

S.3 RELATIONSHIP TO ENVIRONMENTAL PROTECTION STATUTES, PLANS, AND OTHER REQUIREMENTS

Table S-2 summarizes the dredged material disposal sites' compliance with environmental requirements. This table also appears in Section 3.0 where the environmental requirements listed in the table are described in detail.

S.4 AREAS OF CONTROVERSY AND CONCERN

Public concerns have been previously identified in an earlier Notice of Intent (NOI) to prepare an EIS published in the Federal Register on August 28, 1990, and in two public workshops and EIS scoping meetings held on September 12, 1990. In addition, a new Supplemental NOI (SNOI) and Notice of Preparation (NOP) to acknowledge the need to do an EIR, which addresses CEQA, and an EIS, which addresses NEPA requirements, respectively, were published in the Federal Register on December 17, 1993. A 45-day public review/comment period on the Draft Feasibility Report and EIS/EIR began on December 16, 1994, the day the document was filed with EPA. A public meeting was held on January 11, 1995 to solicit agency and public comments on the proposed project. The comment period ended on January 30, 1995. Additional details on public concerns and involvement are provided in Chapter 12.0.

TABLE S-1. SUMMARY OF ENVIRONMENTAL IMPACTS

Resource	Insignificant Impact (II) or Potentially Significant Impact (PSI)	Impact Mechanism or Management Measure	Significance after Management
Air Quality	PSI- Exceedence of NCUAQMD emission significance thresholds for NO_x and PM_{10} during dredging and disposal activities at HOODS and LP Site.	Retard injection timing of diesel-powered equipment (self-propelled hopper dredge) by 2 degrees to reduce NO_x emissions by about 15%. Use of reformulated fuel to reduce project emissions of NO_x and PM_{10} by approximately 7% and 15%, respectively. In addition, use of reformulated fuel would reduce SO_2 emissions by approximately 90%. Installation and use of an inter-cooler on the diesel engine of the dredge would reduce the air temperature to the engine and therefore, further reduce the NO_x emissions by 10%.	Implementation of these measures would reduce project emissions of NO_x and PM_{10}, but not to insignificance. SO_2 impacts reduced to insignificance.
	II- Potentially excessive fugitive dust generation from exposed soil during 3-4 day disposal and any necessary reconfiguration at Louisiana Pacific Site.	Apply water to exposed soil, as needed, minimize vehicle speeds in dusty areas, and suspend land-based handling of dry soil or already existing dry dredged material when wind speeds (e.g., instantaneous gusts) exceed 25 mph to minimize dust emissions.	Insignificant.
Noise	II- Noise sources associated with the proposed project would include the self-propelled hopper dredge and a bulldozer used to prepare the LP Site.	Construction activities would result in minor, temporary increases in noise levels due to operation of dredge equipment.	Insignificant.
Hydrology/ Water Quality	II - Short-term and temporary increase in turbidity at the dredge and disposal sites	Dredged material disposed of at HOODS is deemed suitable for unconfined aquatic disposal, and would at a minimum, have to be disposed of in accordance with the testing requirements of the MPRSA and CWA, since these requirements are considered protective of water quality. At the LP Site, monitoring, testing, and reporting of data collected from the effluent and receiving waters will be in full compliance with the NCRWQCB's requirements.	Insignificant.

TABLE S-1. SUMMARY OF ENVIRONMENTAL IMPACTS (CONTINUED)

Resource	Insignificant Impact (II) or Potentially Significant Impact (PSI)	Impact Mechanism or Management Measure	Significance after Management
Sediment Quality	II- At the LP Site, the disposal of approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal due to trace amounts of dioxin is not expected to significantly impact of the dredged material presently at the site.	Monitoring, testing, and reporting of data collected from the effluent and receiving waters at the LP Site will be in compliance with the North Coast RWQCB's requirements. In addition, once dredged material placement has occurred, a layer of clean fill material will be placed over the unsuitable dredged material to reduce any potential impacts the trace amounts of dioxin might have on shorebird species attracted to the site.	Insignificant.
	II- At HOODS, the disposal of approximately 5.6 million cys of dredged material is not expected to cause any significant impacts. Accumulation of dredged material will be unavoidable.	HOODS- Management/Mitigation Measure= Ensure that dredged material disposal takes place in the proper quadrants and cells within HOODS to minimize any thick accumulation of dredged material and confine disposal operations within the disposal site boundaries.	Insignificant.
Seismicity	II - Earthquakes will be a hazard for the life of the project. The main hazard associated with seismic activity is channel instability in the navigation channels. At HOODS, the sands and silts located within HOODS may experience liquefaction and subsequent subaqueous landslides within the different quads and cells of HOODS as a result of earthquakes in the region.	Navigation Channels - The future Humboldt Harbor Deepening Study Design Memorandum will need to determine the liquefaction potential of the underlying sediments and associated slope ratio of the channels to be deepened. Thus, these ratios should supply an adequate safety/stability factor ensuring that any adjacent structures would not be undermined due to seismic-induced mass movement of bottom material. Since this safety factor would be designed in the project, this potential impact is considered insignificant.	Insignificant.
		HOODS- Given the nature of regional oceanic seismicity, this potential impact is considered insignificant.	Insignificant.
	II- LP Site - Potential seismic impacts at the LP Site proper are considered minimal, because the site will remain as an unpopulated historic disposal site.	LP Site - During site preparation activities, any levee preparation needed would be designed using standard geotechnical engineering practices to prevent any potential impacts on adjacent lands due to levee failure.	Insignificant.

TABLE S-1. SUMMARY OF ENVIRONMENTAL IMPACTS (CONTINUED)

Resource	Insignificant Impact (II) or Potentially Significant Impact (PSI)	Impact Mechanism or Management Measure	Significance after Management
Biological Resources	II- HOODS and Navigation Channels- Disposal at HOODS and dredging in the navigation channels would cause short-term, temporary disruption of the benthic community.	HOODS and Navigation Channels - At both sites, dredging and disposal of dredged material would cause short-term, temporary impacts to benthic communities due to smothering at HOODS and disruption within the channels. Dredging of the Samoa Turning Basin could potentially disrupt the nesting activities of an egret and night heron rookery on Indian Island, if dredging were to occur during the nesting season (March to June), and within 1,320 feet of the island. Overall, impacts to this rookery are expected to be insignificant since the annual dredging operations presently conducted have not been reported to cause any nesting disturbances and/or abandonment. Nevertheless, the Corps will schedule the dredging of the Samoa Turning Basin to avoid the nesting season of the egret and night heron rookery at Indian Island.	Insignificant.
	II- LP Site - No significant impacts to biological resources are anticipated.	LP Site - Although no significant impacts to biological resources are anticipated at the LP Site, after disposal of dredged material at LP, a clean layer of fill material will be placed, if deemed necessary by the North Coast RWQCB and other concerned agencies, to isolate trace amounts of dioxin in the dredged material from direct exposure to wildlife. In addition, because the approximately 26,000 cys of dredged material will be disposed of in a "contained" upland dredged material disposal site, disposal of this material is not expected to cause any detrimental impacts to wildlife in the project area.	Insignificant
Transportation	II- HOODS and Navigation Channels - Minor, temporary impacts on navigation may occur during the 10-11 months scheduled to conduct the proposed project.	HOODS and Navigation Channels- Deep-draft vessels may experience temporary maneuvering conflict with the dredges, especially in narrow channels. Commercial deep-draft vessels will report to the local Coast Guard or Marine Safety Office, thus avoiding the infrequent simultaneous approach of two vessels. In addition, although no significant impacts on marine transportation are expected, mitigation measures to be observed during dredging operations are provided in Section 5.7.5.	Insignificant.
	II- LP Site - No impacts anticipated.	II- LP Site - No impacts anticipated.	Insignificant.

TABLE S-1. SUMMARY OF ENVIRONMENTAL IMPACTS (CONTINUED)

Resource	Insignificant Impact (II) or Potentially Significant Impact (PSI)	Impact Mechanism or Management Measure	Significance after Management
Cultural Resources	II- HOODS and Navigation Channels- Potential shipwreck remains and/or discarded objects from a vessel such as an anchor, engine, boiler, and possibly cargo may exist in the western end of the Entrance Channel. At HOODS, there is the potential of impacting potential shipwreck remains in three locations within the disposal site.	Navigation Channel - It has been determined that this feature is located within the area proposed to be widened, in the Bar and Entrance Channel, however, the feature is located at a greater depth (-54 feet) than the proposed design depth.	Insignificant.
		HOODS- Due to the occurrence of potential shipwreck remains at three locations within the HOODS, placement of dredged material will be avoided in the affected cells and quadrants of HOODS. (Note: Avoidance of these locations has been achieved during disposal of dredged sediments from annual spring and fall maintenance dredging).	Insignificant.
	II- LP Site - No impacts to cultural resources are anticipated since no historic properties are recorded at this upland disposal site.	LP Site - None required.	Insignificant.
Socioeconomics	II- HOODS and Navigation Channels - Short-term, localized, and temporary impacts to commercial and recreational fishing may occur with the proposed project. Temporary project-related jobs may provide employment to residents during the construction period of the project.	HOODS and Navigation Channels - Commercial and deep-draft vessels would have to maneuver around dredging equipment, but this impact is temporary and localized and is not expected to result in any significant socioeconomic impacts. Because dredged material disposal at HOODS would be relatively infrequent, and the siting of HOODS is located both outside the nearshore and deep-sea fishing areas, the disposal of dredged material at HOODS is not expected to significantly impact either commercial or recreational fishing activities.	Insignificant.
	II- LP Site - No impacts anticipated.	LP Site - None required.	Insignificant.

TABLE S-2

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Environmental Requirement	*Project Alternative**	*HOODS*	*Louisiana Pacific (LP) Site*
INTERNATIONAL TREATY			
London Convention	FC	FC	NA
FEDERAL			
National Environmental Policy Act (NEPA)	FC	FC	FC
Coastal Zone Management Act	FC	FC	FC
Clean Air Act	FC	FC	FC
Clean Water Act	FC	FC	FC
National Historic Preservation Act	FC	FC	FC
Executive Order 11593, Protection & Enhancement of the Cultural Environment	FC	FC	FC
Abandoned Shipwreck Act	FC	FC	NA
Fish & Wildlife Coordination Act	FC	FC	FC
Endangered Species Act	FC	FC	FC
Executive Order 11990, Protection of Wetlands	NA	NA	NA

TABLE S-2 (CONTINUED)

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Environmental Requirement	*Project Alternative**	*HOODS*	*Louisiana Pacific (LP) Site*
FEDERAL			
Estuary Protection Act	FC	NA	NA
Marine Protection, Research, and Sanctuaries Act	NA	FC	NA
STATE			
California Environmental Quality Act	FC	FC	FC
Porter-Cologne Water Quality Control Act	FC	NA	FC
State Lands Commission Policies	FC	NA	NA
California Endangered Species Act	FC	FC	FC
California Coastal Act	FC	FC	FC
California Wetlands Policy	NA	NA	NA
LOCAL			
County of Humboldt General Plan	FC	NA	FC
Humboldt Bay Master Plan	FC	NA	NA

Legend:

FC = Full compliance -All requirements of the law, policy, or related regulations have been met.

PC = Partial compliance -Some requirements of the law, policy, or related regulations have not been met. Refer to sections 3.2 and 3.3 for additional information.

NC = Not in compliance - Use of the site would conflict with the law, policy, or related regulations. Refer to sections 3.2 and 3.3 for additional information.

NA = Not applicable -The law, policy, or related regulations do not apply to the alternative or disposal sites.

* = No difference in compliance with environmental requirements for different depths in navigation channels (i.e., Bar & Entrance to -48 feet MLLW and North Bay Channels to -38 feet MLLW).

1.0 NEED FOR PROJECT AND OBJECTIVES OF ACTION

1.1 PROJECT AUTHORITY

This study is in response to the Committee on Public Works and Transportation of the U.S. House of Representatives Resolution, dated September 23, 1982, which reads:

> "Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Humboldt Harbor and Bay, California, published as House Document No. 330, 90th Congress, 2nd Session, and other pertinent reports, with a view to determining the advisability of increasing the depth of and making other modifications with respect to the Humboldt Harbor and Bay Project, in the interest of navigation and related purposes".

1.2 PROJECT PURPOSE

The purpose of this study is to investigate the feasibility of Federal assistance in improving commercial deep-draft vessel navigation in the Humboldt Harbor and Bay channels, Humboldt County, California. The study alternatives include structural plans and a no-action plan and their associated benefits, costs and environmental impacts.

1.3 NEED FOR THE PROJECT

Humboldt Harbor is the only deep water port between San Francisco, California and Coos Bay, Oregon. Presently, major navigation difficulties exist in Humboldt Harbor and Bay due to inadequate, unsafe navigation channels for deep-draft vessels, inadequate channel depths, unsafe channel alignments (i.e., sharp turns), and strong currents and waves.

The lack of deep-draft vessel navigation channels in Humboldt Harbor and Bay is the single proble m that has been identified in the study area. Existing channel depths do not allow for the efficient utilization of deep-draft vessel operating drafts. In addition, channel widening and realignment is needed to allow for safe transit of the vessels entering and leaving the Bay. An example relating to the need for a safer (i.e., wider) Entrance Channel follows: During the winter with highly variable weather, sea conditions, and four knot currents in the Entrance Channel, an outbound vessel can not change its required heading from 320^0 to 285^0. Also, the trend in vessel design has been, and continues to be, to decrease the horsepower of the vessel power plant. Generally, over the recent years, the deep-draft vessels calling at Humboldt Bay have gone from 16,000 horsepower to 8,000 horsepower (personal conversation with Messrs. Hoey and Powell, Humboldt Bay Bar Pilots Association, 26 July 1989 in COE (1993a)). The lower powered essels require additional maneuvering room, as compared to higher powered vessels under the same sea conditions.

1.4 OBJECTIVES OF ACTION

Based on the analysis of the identified problems, needs, and opportunities, and the existing physical, human and environmental conditions of the study area, planning objectives were identified to direct formulation and evaluation of alternative plans. The order of the following should not be construed as an indication of urgency or priority:

* Improve deep draft navigation safety in the Humboldt Harbor and Bay channels. This is fundamental to improving safety conditions for vessels entering, leaving, and using the Humboldt Harbor and Bay.

* Maximize the efficient use of Humboldt Harbor and Bay by commercial deep-draft vessels. This objective is fundamental to improving efficiencies of existing and future operations with respect to transportation costs; loading and unloading; and other costs associated with waterborne commerce. This objective is consistent with Federal planning guidelines and the primary goal of contributing to the Nation's Economic Development (NED) consistent with applicable environmental laws, regulations and policies, and acceptability to the project's local sponsor, the Humboldt Bay Harbor, Recreation, and Conservation District.

* Maintain and improve environmental resources to the maximum extent practical. This objective concerns compliance with Federal, State, and local environmental statutes, regulations, laws, and policies, and is characterized by the following four environmental goals: 1) avoid any unacceptable adverse impact on environmental resources; 2) where impacts are not avoidable, they should be minimized to the greatest extent possible, 3) any remaining unavoidable impact must be mitigated to insignificance; and 4) improve or restore environmental quality wherever possible without adding undue cost or compromising the primary objectives.

1.5 INTENDED USES AND AUTHORIZING ACTIONS OF EIS/EIR

This EIS/EIR has been prepared with regard to pertinent Federal and State environmental regulations, policy, and law, and will be provided to the public for review, comment, and participation in the planning process. After public review and comment, this document and the Feasibility Report will provide the basis for decision-making by concerned agencies and officials. Table 1.5-1 provides an overview of the agencies likely to use the document for related actions.

This document addresses the potential effects of the proposed action. The primary Federal portion of the action involves the navigation improvements through selective widening and deepening of navigation channels and subsequent disposal of suitable dredged material in the HOODS. The primary non-Federal portion (HBHRCD) of the proposed action involves the HBHRCD's cost-sharing expenditure and any expenses associated with disposal of dredged

material unsuitable for unconfined aquatic disposal on an upland site. The Final EIS/EIR is intended to be used by the Corps, HBHRCD, and concerned agencies to assist in decision-making regarding the proposed action.

1.5.1 Corps of Engineers Intended Uses

This EIS/EIR supports the proposed Federal Actions described in the accompanying Feasibility Study Report in deciding the level of Federal participation in the proposed action. It has been prepared in accordance with Federal planning guidance, pertinent Army regulations, procedures and policy, and environmental law. The Army's Record of Decision (ROD) from consideration of the Feasibility Study and the Final EIS/EIR will formally document the Army's decision on the proposed action, including any required environmental mitigation commitments. If appropriations are provided, then the Corps would proceed with design refinements, preparation of plans and specifications, and ultimately construction of proposed navigation improvements at Humboldt Bay Harbor.

The Corps has jurisdictional authority pursuant to Section 404 of the Clean Water Act (33 U.S. Code 1344) that governs the discharge of dredged or fill material into the waters of the United States, and Section 10 of the Rivers and Harbors Act (33 U.S. Code 403) that prohibits unauthorized obstruction or alteration of any navigable waters of the United States. While the Corps would be primarily responsible for the navigation dredging related aspects of the proposed action and must comply with Sections 404 and 10 requirements, it does not issue itself permits. Therefore, this EIS/EIR provides the environmental documentation addressing the impacts of future Sections 404 and 10 related actions by the Corps.

Also, the Corps recognizes that it may be requested by HBHRCD to consider this document in any related permit actions of the HBHRCD may undertake pursuant to those aspects of the proposed action for which the HBHRCD may require a 404/10 permit. However, this document is not serving as a public notice for any Department of the Army permits at this time. Rather, such public notice of any permit application will be separate from and subsequent to the public review period for this EIS/EIR.

The Corps submitted the Draft EIS/EIR, which contains the Consistency Determination, to the California Coastal Commission, pursuant and in compliance with the Coastal Zone Management Act and the California Coastal Act (see Section 3.2). Because of the Corps jurisdiction of the waters of the U.S., it must comply with pertinent coastal zone law to the maximum extent practicable but only requires concurrence from the California Coastal Commission (CCC), not approval for the Federal aspects of the proposed action. On February 8, 1995, the California Coastal Commission (CCC) concurred with Consistency Determination (CD-111-94) for the Humboldt Harbor and Bay Deepening Navigation Project.

Table 1.5-1

AGENCIES EXPECTED TO USE THIS EIS/EIR

Agency	Responsibilities
FEDERAL	
Department of Commerce	
National Marine Fisheries Service	Reviews and submits recommendations to the Corps of Engineers related to Federal construction actions and issuance of permits in accordance with the Fish and Wildlife Coordination Act.
Department of Defense	
U.S. Army Corps of Engineers	Lead Federal Agency for navigation improvements and permitting authority for related Harbor construction in navigable water and dredged material disposal.
Department of the Interior	
U.S. Fish and Wildlife Service	Reviews and submits recommendations to the Corps of Engineers related to Federal construction actions and issuance of permits in accordance with the Fish and Wildlife Coordination Act and consultation pursuant to the Endangered Species Act.
Department of Transportation	
U.S. Coast Guard	Has jurisdiction over marine facilities, bridges, and vessel transportation in Harbor waters.
Environmental Protection Agency	
	Has primary responsibility for implementing the Clean Air Act and works with other Federal agencies to implement conformity requirements. Reviews and submits recommendations to the U.S. Army Corps of Engineers related to Federal construction actions and issuance of permits.
STATE	
California Department of Fish and Game	Reviews and submits recommendations in accordance with CEQA. Consultation in accordance with the Fish and Wildlife Coordination Act.

Table 1.5-1

AGENCIES EXPECTED TO USE THIS EIS/EIR

Agency	Responsibilities
STATE	
California Regional Water Quality Control Board, North Coast Region	Permitting authority for Waste Discharge requirements for discharges that may affect groundwater and National Pollutant Discharge Elimination System (NPDES) permit for discharge of wastewater into surfance waters.
California Coastal Commission	Reviews document to assure compliance with the Coastal Zone Management Act and the California Coastal Act in order to assure consistency. Reviews and must approve Humboldt Bay Master Plan Amendment.
California Office of Historic Preservation	Consultation under Section 106 of the National Historic Preservation Act regarding impacts on cultural resources that are either listed, or eligible for listing on the National Register of Historic Places.
State Lands Commission	Dredging and dredge material disposal activities in State tidelands.
LOCAL	
Humboldt Bay Harbor, Recreation, and Conservation District	Lead Agency for EIR and California Coastal Act. Responsible for general regulatory compliance.
Humboldt County Air Pollution Control	Permitting authority for new or modified sources of air emissions.
City of Eureka Public Works	Tidelands trustee of partial acreage of Bay bottom included in project area.

In contrast to the Corps, the HBHRCD does require review and approval of the Humboldt Bay Master Plan Amendments from the CCC for its portion of the proposed action as discussed below.

1.5.2 Humboldt Bay Harbor, Recreation, and Conservation District's Intended Uses

The Humboldt Bay Harbor, Recreation, and Conservation District (HBHRCD) desires Federal participation in the Humboldt Harbor and Bay Deepening Navigation Study for navigation improvements to Humboldt Harbor which will create safe and adequate deep-draft navigation channels for the existing fleet of deep-draft vessels calling on the Harbor. The HBHRCD may use the Final EIS/EIR as a basis for obtaining Department of the Army and other permits necessary to construct the proposed project should the HBHRCD elect to proceed in advance of the Corps in construction of part or all of the proposed project. The Final EIS/EIR will be used by the HBHRCD for obtaining a Humboldt Bay Master Plan Amendment from the California Coastal Commission for the proposed project.

1.6 PRIOR STUDIES AND REPORTS

There have been numerous reports concerning Humboldt Harbor and Bay (detailed in attached Feasibility Report). In addition, the environmental impacts associated with deepening and maintenance dredging of the Humboldt Harbor and Bay and associated navigation channels are analyzed in the following environmental documents listed in chronological order.

1. *Humboldt Harbor and Bay Navigation Improvement, General Design Memorandum No. 1 and Final Environmental Statement, Humboldt Harbor and Bay Navigation Improvement, Humboldt County, California* (COE August 1976a). The Final Environmental Statement project involved the following: deepening the North Bay Channel from -30 feet MLLW to -35 feet MLLW (between Mile 0.75 and Mile 4.29); deepening the Samoa Channel from -30 feet MLLW to -35 feet MLLW and widen from 300 to 400 feet (between Mile 4.29 and Mile 5.0); deepening the Eureka Channel from -30 feet MLLW to -35 feet MLLW; widening the channel bends (up to an additional 200 feet), in the North Bay Channel (at Mile 0.75, Mile 2.0, and Mile 2.60); and construction of a turning basin -35 feet deep and 1,000 feet wide by 1,100 feet long at the end of the Samoa Channel. The total cubic yards (cys) of dredged material, approximately 2,400,000 cys was disposed at two disposal sites located on the North Spit: Site 13-B ("Superbowl Site"; 600,000 cys) and at beach disposal Site #17 (North of "Superbowl Site"; 1,800,000 cys). The project was completed in late 1979.

2. *Final Environmental Statement, Humboldt Bay Harbor Marina Regulatory Permit Application, Eureka, Humboldt County, California* (COE June 1977). The Final Environmental Statement described the proposal by the HBHRCD to develop the southern shore of Woodley Island and the Eureka Inner Channel. This project involved the construction of a 237-berth marina with an access road from Highway 255, parking facilities, support facilities, and limited commercial development. Berthing facilities extend 120 feet into the Federally maintained channel, leaving 260 feet of it navigable.

3. *Environmental Assessment Fiscal Year (FY) 1994 Maintenance Dredging of the Humboldt Harbor, North Bay, Eureka, Samoa, and Field's Landing Channels* (COE March 1994a) This project involved annual Spring maintenance dredging as follows: 1) maintenance dredging an estimated 30,000 cys of silt or clay material, by self propelled hopper dredge, from the Eureka Channel, to a depth of -35 feet MLLW with a 2 foot dredging tolerance; 2) maintenance dredging an estimated 70,000 - 100,000 cys of sand from the North Bay channel to a depth of -35 feet MLLW with a 2 foot dredging tolerance; 3) maintenance dredging an estimated 10,000 - 30,000 of fine sand to silt and clay material from the Field's Landing channel to a depth of -26 feet MLLW with a 2 foot dredging tolerance; 4) maintenance dredging an estimated 15,000 - 30,000 cys of silty sand to sandy clay from the Samoa channel to a depth of -35 feet MLLW with a 2 foot dredging tolerance; 5) disposal of the total estimated quantity of 125,000 - 210,000 cys of mostly sandy material at the HOODS (formerly referred to as the IODS location) location (Final total quantity of dredged material for Spring FY 94 maintenance dredging was only 90,000 cys because only the North Bay and Samoa Channels were dredged; whereas the final total quantity of dredged material for the previous Spring FY 93 maintenance dredging was approximately 150,395 cys).

4. *Environmental Assessment Fiscal Year (FY) 1994 Maintenance Dredging of the Humboldt Harbor Bar and Entrance and North Bay Channels* (COE August 1994b). This project involved annual Fall maintenance dredging as follows: 1) maintenance dredging of an estimated 360,000 cys of sand, by self propelled hopper dredge, from the Bar and Entrance channel to a depth of -42 feet Mean Lower Low Water (MLLW) (includes 2 feet of advanced maintenance dredging) with a 3 foot dredging tolerance; and 2) maintenance dredging of an estimated 65,000 cys of sand, by self propelled hopper dredge, from the North Bay channel to a depth of -35 feet (MLLW) with a 2 foot dredging tolerance; and 3) disposal of the total estimated quantity of 425,000 cys of mostly sandy material from the Humboldt Bar and Entrance and North Bay channels at the HOODS (formerly referred to as the IODS location) location (Final total quantity of dredged material for Fall FY 94 maintenance dredging was approximately 509,200 cys).

1.7 PUBLIC CONCERNS

Public comment on the proposed project was solicited pursuant to Federal and State requirements. This process is described in Chapter 12 of the EIS/EIR. Public comments were solicited so that those issues of concern to the public and all reasonable alternatives could be considered in the environmental analysis. Public concerns raised during this process are summarized in Chapter 12 of the EIS/EIR.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

As required by the National Environmental Policy Act (NEPA) and by Corps Planning guidelines, one of the alternatives considered in detail is the No-Action Alternative. Under the No-Action Alternative, the proposed deepening and widening of Humboldt Bay Harbor navigation channels would not occur, and the channels would continue to be inadequate in providing safe, efficient passage for deep-draft vessels presently calling on the port. This situation would discourage shippers from using Humboldt Bay for commerce since it requires additional vessel trips to accommodate the "light-loaded" vessels, resulting in increased transportation costs and increased vessel safety and maneuvering problems. This in turn would have a long-term adverse impact on the local economy and on national economic development.

With the No-Action Alternative, the existing Federally authorized and maintained navigation channels in Humboldt Bay would include the following: (1) a Bar and Entrance channel, -40 feet MLLW, tapered from a width of 1,600 feet at seaward mile-0.91 to 500 feet at seaward mile-0.18, and then 500 feet wide to mile 0.75; (2) a North Bay channel, -35 feet MLLW, and 400 feet wide between mile 0.75 and mile 4.29; (3) an Outer Eureka channel, -35 feet MLLW, and 400 feet wide between mile 4.29 and mile 5.0; (4) an Inner Eureka channel, -26 feet MLLW, and 400 feet wide between mile 5.0 and mile 6.30; (5) the Samoa channel, -35 feet MLLW, and 400 feet wide between mile 4.29 and mile 5.84; (6) the Samoa Turning Basin, -35 feet MLLW, and 1,000 feet wide by 1,200 feet long, in the upper end beyond mile 5.84; (7) an anchorage area, -35 feet MLLW, and 1,200 feet wide by 1,200 feet long in the North Bay between the Entrance channel and Gunther Island (the anchorage area is not being maintained); and (8) the Fields Landing channel, -26 feet MLLW, and 300 feet wide , and a turning basin at mile 3.16 which is 600 feet wide and 800 feet long. The Arcata channel located in the extreme North Bay (18 feet MLLW and 150 feet wide) is no longer used for commercial navigation and has not been maintained since 1931 (Figure 2.1-1).

The No-Action Alternative is equivalent to existing conditions (described in Section 4.0).

2.2 ACTION ALTERNATIVE PLANS

The Action Alternative Plans include deepening and selectively widening the Humboldt Bar, Entrance, North Bay, and Samoa channels. The deepening of the Humboldt Bar and Entrance channels were included with the deepening of the North Bay channels since deepening the Bar and Entrance channels is necessary to fully utilize deepened North Bay channels.

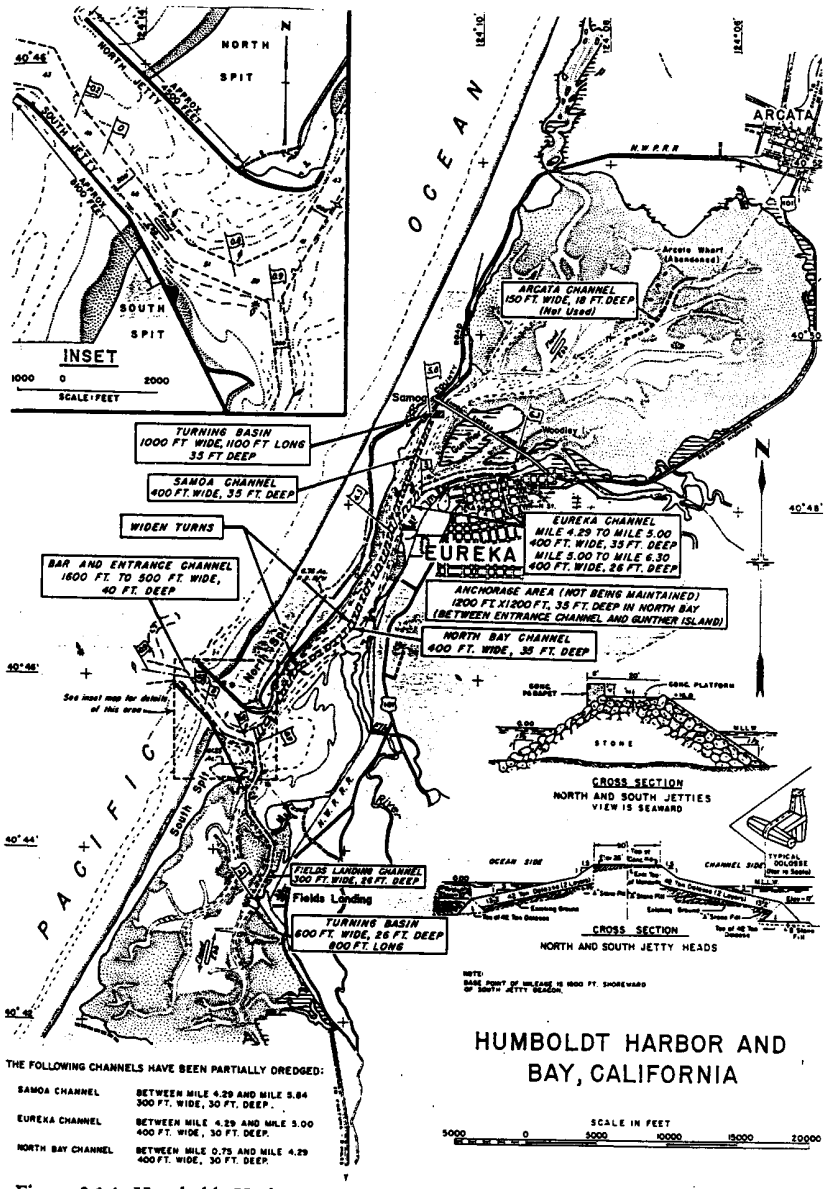


Figure 2.1-1 Humboldt Harbor Navigation Channel Location Map

The following paired channel depths for the Bar and Entrance Channels and North Bay channel plans were investigated:

Bar and Entrance Channels (feet MLLW)	*North Bay Channels (feet MLLW)*
-46	-36
-47	-37
-48	-38
-49	-39
-50	-40
-51	-41
-52	-42

Sea conditions in the Bar and Entrance channels require additional channel depth beyond that required in the interior channels. Because of their unprotected nature, an additional 10 feet of channel depth was assumed. The Bar and Entrance channel 10-foot depth differential allows 5 feet for swell and 5 feet for additional safety clearance. Based on a project benefits economic analysis (detailed in attached Feasibility Report), and further investigation with a "desk-top" navigation simulator, the paired channel depths selected for further study are (1) Bar and Entrance Channels deepened to -48 feet MLLW and (2) North Bay and Samoa Channels deepened to -38 feet. With the selected paired channels depths, there are four "Alternative Plans" as detailed below.

2.2.1 ALTERNATIVE PLAN 1: Bar and Entrance Channels and North Bay Channels Deepened with Selective Widening

Alternative Plan 1 involves deepening and selectively widening the Bar and Entrance, North Bay, and Samoa channels, as detailed below, and includes other details as follows:

- Bar and Entrance channels deepened to -48 feet MLLW
- North Bay and Samoa channels deepened to -38 feet MLLW
- "Middle Ground Area" of North Bay Channel deepened to -48 feet MLLW
- Entrance channel widened on the north side of the channel from the jetty heads through the "middle ground" to the turn into the North Bay channel -this widening ranges from 460 feet in the Entrance channel to 200 feet in the "middle ground" area
- The Entrance channel edge is moved north and away from the South Jetty by 100 feet

- Realignment of the existing Samoa channel turning basin to facilitate safer use of the basin

- Dredging of approximately 5.6 million cys of dredged material with a self-propelled hopper dredge and disposal of suitable material at the soon-to-be designated Section 102 HOODS site.

- Dredging of approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal from the Samoa Channel Turning Basin with a self-propelled hopper dredge equipped with a pipeline to "back-pump" dredged material onto the approved upland site.

2.2.2 ALTERNATIVE PLAN 2: Bar and Entrance Channels and North Bay Channels Deepened without Widening at the Entrance Channel

Alternative Plan 2 is identical to Alternative Plan 1, but without any widening or relocation of the Entrance channel, and includes the following:

- Bar and Entrance channels deepened to -48 feet MLLW

- North Bay and Samoa channels deepened to -38 feet MLLW

- "Middle Ground Area" of North Bay Channel deepened to -48 feet MLLW

- Realignment of the existing Samoa channel turning basin to facilitate safer use of the basin

- Dredging and disposal methods are identical to Plan 1 - including the need to dispose of approximately 26,000 cys of dredged material at the designated upland site

2.2.3 ALTERNATIVE PLAN 3: Bar and Entrance Channels and North Bay Channels Deepened with Reduced Widening at the Entrance Channel

Alternative Plan 3 is identical to Alternative Plan 1, but with a maximum width increase of 275 feet in the Entrance channel rather than the 460 foot increase addressed in Plan 1. Alternative Plan 3 includes the following (Figure 2.2.3-1):

- Bar and Entrance channels deepened to -48 feet MLLW, and approximately 1,550,000 cys of dredged material to be removed.

- North Bay and Samoa channels deepened to -38 feet MLLW, and approximately 1,151,555 cys of dredged material to be removed.

- "Middle Ground Area" of North Bay Channel deepened to -48 feet MLLW, and approximately 1,641,335 cys of dredged material to be removed.

- Entrance channel widened on the north side of the channel from the jetty heads through the "middle ground" to the turn into the North Bay channel -this widening ranges from a maximum 275 feet in the Entrance channel to 200 feet in the "middle ground" area, and approximately 1,146,000 cys of dredged material to be removed.

- The Entrance channel edge is moved north and away from the South Jetty by 100 feet

- Realignment of the existing Samoa channel turning basin to facilitate safer use of the basin, and approximately 107,000 cys of dredged material to be removed.

- A ***grand total*** of approximately 5.6 million cys of dredged material to be removed.

- Dredging and disposal methods are identical to Plan 1 - including the need to dispose of approximately 26,000 cys of dredged material at the designated upland site

2.2.4 ALTERNATIVE PLAN 4: Bar and Entrance Channels and North Bay Channels Deepened with Reduced Widening at the Entrance Channel With Changes to the Samoa Channel Turning Basin and Creation of a New Turning Basin at the Eureka and Samoa Confluence

Alternative Plan 4 is identical to Alternative Plan 1, but with the creation of a new turning basin at the confluence of the Eureka and Samoa Channels. Alternative Plan 4 includes the following:

- Bar and Entrance channels deepened to -48 feet MLLW

- North Bay and Samoa channels deepened to -38 feet MLLW

- "Middle Ground Area" of North Bay Channel deepened to -48 feet MLLW

- Entrance channel widened on the north side of the channel from the jetty heads through the "middle ground" to the turn into the North Bay channel -this widening ranges from a maximum 275 feet in the Entrance channel to 200 feet in the "middle ground" area

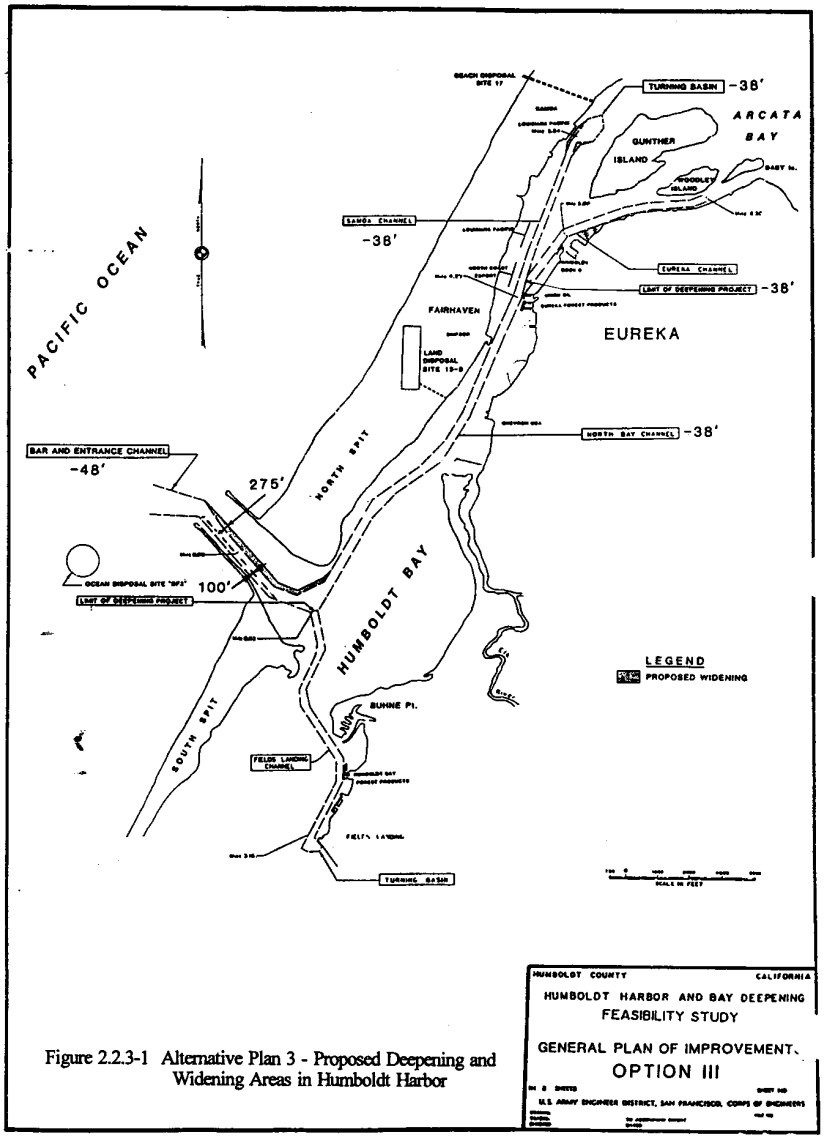


Figure 2.2.3-1 Alternative Plan 3 - Proposed Deepening and Widening Areas in Humboldt Harbor

- The Entrance channel edge is moved north and away from the South Jetty by 100 feet

- Realignment of the existing Samoa channel turning basin to facilitate safer use of the basin

- Creation of a new turning basin at the confluence of the Outer Eureka and Samoa Channels off the North Bay Channel.

- Dredging and disposal methods are identical to Plan 1 - including the need to dispose of approximately 26,000 cys of dredged material at the designated upland site

2.2.5 SOUTH BAY ALTERNATIVE PLANS: Fields Landing Channel Deepening and Selective Widening

The South Bay Alternative Plans include alternative plans with five options briefly detailed below for the deepening and selective widening of the Fields Landing Channel.

- **Alternative Plan 5 - Option 1:** **Fields Landing Channel Deepening from the Middle Ground to Just Beyond the Humboldt Bay Forest Products Terminal**

- **Alternative Plan 6 - Option 2:** **Fields Landing Channel Deepening from the Middle Ground to Just Beyond the Humboldt Bay Forest Products Terminal with Enlargement of the Turning Basin**

- **Alternative Plan 7 - Option 3:** **Fields Landing Deepening from the Middle Ground to Just Beyond the Humboldt Bay Forest Products Terminal with Construction of a New 900 Foot Diameter Turning Basin**

- **Alternative Plan 8 - Option 4:** **Deepen the Entire Fields Landing Channel but with No Vessel Turning Improvements**

- **Alternative Plan 9 - Option 5:** **Deepen the Entire Fields Landing Channel and Enlarge the Existing Fields Landing Turning Basin.**

2.6 ALTERNATIVES ELIMINATED FROM FURTHER STUDY

This section describes the Alternative Plans which were investigated in the reconnaissance and/or feasibility studies, but are not considered in detail in this EIS/EIR. The reasons for eliminating these alternatives from further study are also briefly discussed.

- **ALTERNATIVE PLAN 1:** **Bar and Entrance Channels and North Bay Channels Deepened with Selective Widening**

This Alternative Plan 1 was eliminated from further study because the Corps determined through navigation simulation studies that widening by 460' feet was not necessary.

- **ALTERNATIVE PLAN 2:** **Bar and Entrance Channels and North Bay Channels Deepened without Widening at the Entrance Channel**

This Alternative Plan 2 was eliminated from further study because the Corps determined through navigation simulation studies and discussions with the local bar pilots that not deepening and selective widening of the navigation channels in Humboldt Bay does not resolve the present navigation problems.

- **ALTERNATIVE PLAN 4:** **Bar and Entrance Channels and North Bay Channels Deepened with Reduced Widening at the Entrance Channel With Changes to the Samoa Channel Turning Basin and Creation of a New Turning Basin at the Eureka and Samoa Confluence**

This Alternative Plan 4 was eliminated from further study because the Corps of Engineers best engineering practices strongly recommends against locating a turning basin at the confluence of two navigation channels.

- **SOUTH BAY ALTERNATIVE PLANS:** **Fields Landing Channel Deepening and Selective Widening**

The South Bay Alternative Plans, which included Alternative Plan 5 - Option 1; Alternative Plan 6 - Option 2; Alternative Plan 7 - Option 3; Alternative Plan 8 - Option 4; and Alternative Plan 9 - Option 5 were eliminated from further study because the Corps determined that the proposed improvements to this channel would only benefit one facility - the Humboldt Bay Forest Products Terminal. This terminal is defined as a "Private for Profit Property" as defined by the Corps of Engineers Engineering Regulations (ER 1165-2-123, 31 August 1989 and 30 October 1992) and the Water Resources Development Act (WRDA) of 1990 (Public Law 101-640). Under these regulations, it is the Corps determination that since the single user facility on the Fields

Landing Channel is "....privately owned and operated for profit..", Federal participation in improvement of the Fields Landing reach of Humboldt Bay was not appropriate. The furtherstudy of this reach could be allowed if the local sponsor agreed to pay 100 percent of the total cost. After consultation with the Humboldt Harbor District, the South Bay Alternative Plans were subsequently eliminated based on the single user criteria.

2.7 ALTERNATIVES CONSIDERED FOR FURTHER STUDY

The following Alternative Plans are considered for further study:

- NO-ACTION ALTERNATIVE
- ALTERNATIVE PLAN 3: **Bar and Entrance Channels Deepened with Reduced Widening at the Entrance Channel (as described above in " Action Alternative Plans" section)**

2.7.1 Preferred Plan

Alternative Plan 3 has been identified as the preferred plan. The proposed project would be as described above in the Action Alternative Plan description. The project would be expected to be completed in approximately 11 to 12 months, with upland disposal of dredged material unsuitable for unconfined aquatic disposal completed in approximately 3 to 4 days. The impacts associated with the implementation of Alternative Plan 3 are discussed in Chapter 5.0.

2.8 SEDIMENT SUITABILITY

Up to approximately 5.6 million cys would be dredged from Humboldt Bay Harbor navigation channels to construct the proposed navigation improvement project. This volume includes the following: (1) deepening of the Bar and Entrance channel to -48 feet MLLW; (2) deepening of the North Bay and Samoa channels (Interior channels) to -38 feet MLLW; (3) realignment of the entrance to the Samoa Channel Turning Basin; widening of the Entrance channel to 275 feet; (4) allowance for 3 foot dredging tolerance for the Bar and Entrance channels; and (5) allowance for 2 foot dredging tolerance on the interior North Bay channels.

All of the material to be dredged has been sampled and tested to determine its acceptability for various disposal options and potential uses. This section briefly provides a summary of the evaluation procedures and results. Section 4.4.5 describes the specific sediment testing evaluation for dredged material in more detail.

2.8.1 Determination of Sediment Suitability for Unconfined, Confined, and Non-Aquatic Disposal

The dredged material has been broken down into two main categories:

- sediments suitable for aquatic disposal (i.e., ocean)
- sediments suitable for upland disposal

Sediments Suitable for Ocean Disposal

The suitability of dredged material for ocean disposal is regulated under the MPRSA. Under this Act, suitability is determined by a comparison of the results of bioassays and bioaccumulations tests of the sediments to be dredged to results of the same tests with ocean sediments in accordance with the Implementation Manual ("Green Book") (COE/EPA 1991). The EPA and the Corps are responsible for reviewing the test data and determining suitability for ocean disposal. Those agencies have determined that approximately 5.6 million cys of sediments from this project are acceptable for ocean disposal (sediment samples HB1, HB2, HB3, HB4, HB5, HB7, HB9, HB10, and HB11; sample HB6 was deleted because the area represented by this sample was removed from the deepening study).

Sediments Suitable for Upland Disposal

There are no general suitability criteria for sediments proposed for use as fill or to be dried at a rehandling facility. The RWQCB evaluates upland disposal suitability based on site-specific characteristics and on a case-by-case basis. Informally, the Corps has determined from sediment testing results that the sediments represented by sample HB8 taken in the Samoa Turning Basin, approximately 26,000 cys, are unsuitable for unconfined aquatic disposal and will need to be properly placed in an upland disposal site (Sample HB8 is unsuitable for unconfined aquatic disposal because of minute traces of dioxin detected in the solid phase toxicity tests).

Dredged material would be considered hazardous and require disposal in a Class 1 landfill if the material contained contaminant concentrations greater than those listed in Title 22, California Code of Regulations Section 66261.24. None of the material to be dredged for the construction of this project has been determined to be hazardous under Title 22 criteria.

2.9 DREDGED MATERIAL DISPOSAL OPTIONS

The dredged material disposal options are related to the classification of dredged material into the two categories of suitable for unconfined aquatic disposal and suitable for upland disposal. There are thus two main types of disposal options: sites that can only accept suitable material, and sites that can accept unsuitable material for unconfined aquatic disposal and upon which the material may be managed so that it cannot migrate (upland sites). Within these two main types of disposal options, the aquatic sites that were initially considered (and may have subsequently been eliminated from further consideration), and potential upland sites are briefly discussed below.

Suitable Material

Six sites were originally considered for the disposal of dredged material: the SF3 site, the Nearshore Disposal Site (NDS), HOODS, "Superbowl Site" (Site 13a), LP Site, and a beach disposal site (Site 17).

Unsuitable Material

One upland site is being considered for the placement of approximately 26,000 cys of material unsuitable for unconfined aquatic disposal - the Louisiana Pacific (LP) site.

2.10 DREDGED MATERIAL DISPOSAL SITES ELIMINATED FROM FURTHER STUDY

The Corps and the HBHRCD have considered a number of both aquatic and upland disposal sites during the planning for the Humboldt Bay Harbor Deepening Navigation Project. The following briefly summarizes the problems associated with those disposal sites eliminated from further consideration.

2.10.1 Aquatic Sites

2.10.1.2 SF-3 Disposal Site

SF-3 had been an EPA interim-designated disposal site. Its use for disposal of dredged material dates back to the 1940's. Hydrosurveys conducted in 1984 showed the average depth at the disposal site to be approximately -55 feet Mean Lower Low Water (MLLW). However, between 1984 and 1988, the average depth of the SF-3 disposal site decreased to approximately -40 feet MLLW. The reported situation at the SF-3 disposal site is that waves break over the site and result in navigation hazards to commercial fishing and recreational boats traversing the site. Due to the mounding of dredged material at the SF-3 disposal site, and subsequent concern about navigational safety in the vicinity of the site, use of the site has only occurred once since 1988. The commercial fishing community strongly oppose the continued use of the SF-3 disposal site due to the aforementioned shoaling and navigation concerns.

2.10.1.3 Nearshore Disposal Site (NDS)

In 1988 and 1989, the Corps disposed of sand dredged from the Bar and Entrance Channel and North Bay Channel at the NDS. This site is rectangular in shape with the dimensions 4,500 feet by 1,100 feet, and located between the -50 foot MLLW and -60 foot MLLW contours and having coordinates of 40°44'46"N, 124°15'36"W; 40°44'42"N, 124°15'23"W; 40°44'05"N, 124°15'59"W; 40°44'01"N, 124°15'46"W. The intent of disposing sand at the NDS was to alleviate the navigation problems at SF-3, and to keep the material in the littoral cell.

Concerns have been raised regarding the suitability of the NDS as a disposal site. Strong objection to the use of the site has been voiced by the Humboldt Fisherman's Marketing Association and the Commercial Fishermen's Wives of Humboldt regarding adverse impacts to navigational safety in the vicinity of the southern approach to Humboldt Bay. Based upon their observations, they are skeptical that the disposed sediments are dispersing to the south, instead, it is their belief that the disposed sediment migrates to the north and shoals in the area between the SF-3 disposal site and the end of the south jetty.

Concern has also been expressed by local fishermen, private citizens, and the California Department of Fish and Game regarding adverse impacts on commercial fishery resources that inhabit the nearshore area. Egg brooding Dungeness crab females, Dungeness crab juveniles, and English sole juveniles are found in nearshore areas along the coast of California during the period of the Corps fall dredging and disposal operation at Humboldt Bay (1 September to 1 November).

2.10.2 Upland Sites

2.10.2.1 Beach Disposal (Site 17)

Site 17 is a beach disposal site located on the North Spit of Humboldt Bay (Figure 2.10.2-1). This site was used in the North Bay channel improvement project completed in 1979, and has been used in subsequent maintenance dredging projects. Site 17 was eliminated as a potential disposal site for future consideration due to the following: escalating costs over other alternative sites; ability to use a future EPA-designated Section 102 disposal site (i.e., HOODS); and potential impacts to the endangered Menzie's wallflower (*Erysium menziesii*) from pipeline placement on the Samoa Dunes.

2.10.2.2 "Superbowl Site" (Site 13b)

The "Superbowl Site" (Site 13b) was considered for the disposal of the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal. The "Superbowl Site" is an approximately 60 acre site located on the North Spit adjacent to the Old Eureka Airport/Samoa dragstrip (Figure 2.10.2-1). This site was used as a dredge material disposal site in the North Bay Channel improvement (deepening) project of 1978-1979. The initial permit from the California Coastal Commission required revegetation of the site, but was later rescinded when the site was determined there was an ongoing need for an upland dredged material disposal and a borrow site for future small improvement projects. In addition, after the 1979 use of the "Superbowl Site", a valuable freshwater marsh developed in the lowered Northern end of the site, and supports many waterfowl species during the rainy season. The entire site is surrounded by a raised levee structure, such that the "Superbowl site" is located within a depression in the coastal dune habitat.

Originally, the "Superbowl Site" was designed to contain 1,000,0000 cys of dredged material. After the 1979 use, Site 13b can accommodate approximately 400,000 cys of dredged material. If Site 13b were used for disposal of the unsuitable dredged material, levees would need to be constructed to contain the dredged material in the southern end of the "Superbowl Site", and avoid any impacts to the freshwater marsh. In addition, any populations of the Menzie's wallflower *(Erysimum menziesii)* located on the west and northwest dunes adjacent to the site would need to be protected by fencing the area and containing disposal operations to the southeastern portion of the site. Disposal at the "Superbowl Site" would require a self-propelled hooper dredge equipped with a pipeline to "back pump" dredged material onto the site. Disposal would be completed within approximately 3 days.

The "Superbowl Site" was eliminated as a candidate for an upland disposal site for the proposed project due to the following: escalating costs to reconfigure site to avoid habitat impacts to freshwater marsh and endangered plant species; potential impacts associated with filling near a freshwater marsh; and regulatory permits required to fill on a site with a freshwater marsh present. In addition, a portion of the "Superbowl Site" is located within a coastal barrier protection zone (CA-13A) on the North Spit of Humboldt Bay. If Congress enacts law for the Pacific Coast, and includes this area, Federal agencies developing or providing financial assistance for developing within the barrier would need to comply with any new law that may be enacted. Under the Coastal Barrier Resources Act of 1982, Coastal Barrier Improvement Act of 1990, and USFWS Pacific Region Policy of 1994, excepted activities include "Maintenance or construction of improvements of existing Federal navigation channels, and related structures, including the disposal of dredge material..." (USFWS 1994). If a law is enacted for the Pacific Coast, it is anticipated that an exception would be expected, and any future use of the disposal site would be possible subject to regulation by this new law.

2.11 DREDGED MATERIAL DISPOSAL SITES CONSIDERED FOR FURTHER STUDY

After the elimination of disposal options described above, two disposal sites remained for further consideration, including one aquatic site and one upland site. These sites are shown on on Figures 2.11.1-1 and 2.11.2-1 and described below.

2.11.1 Humboldt Open Ocean Disposal Site (HOODS)

The HOODS (formerly IODS) is one square nautical mile in size; located between the -160 feet MLLW and -180 feet MLLW contours; and positioned within the coordinates 40°48'24"N, 124°16'22"W; 40°49'3"N, 124°17'22"W; 40°47'38"N, 124°17'13"W; 40°48'17"N, 124°18'13"W (approximately 3 to 4 nautical miles from shore). This disposal site has been used nine times, since September, 1990 for both the Fall maintenance dredging of the Bar, Entrance, and North Bay channels; and the Spring maintenance dredging dredging of the Eureka, North Bay, and Field's Landing channels, respectively. The total quantity disposed at HOODS for the past nine maintenance dredging projects (includes Fall 1994 maintenance dredging) is 2,861,289 cys. HOODS has a capacity of approximately 50 million cys; one million cys per year of dredged

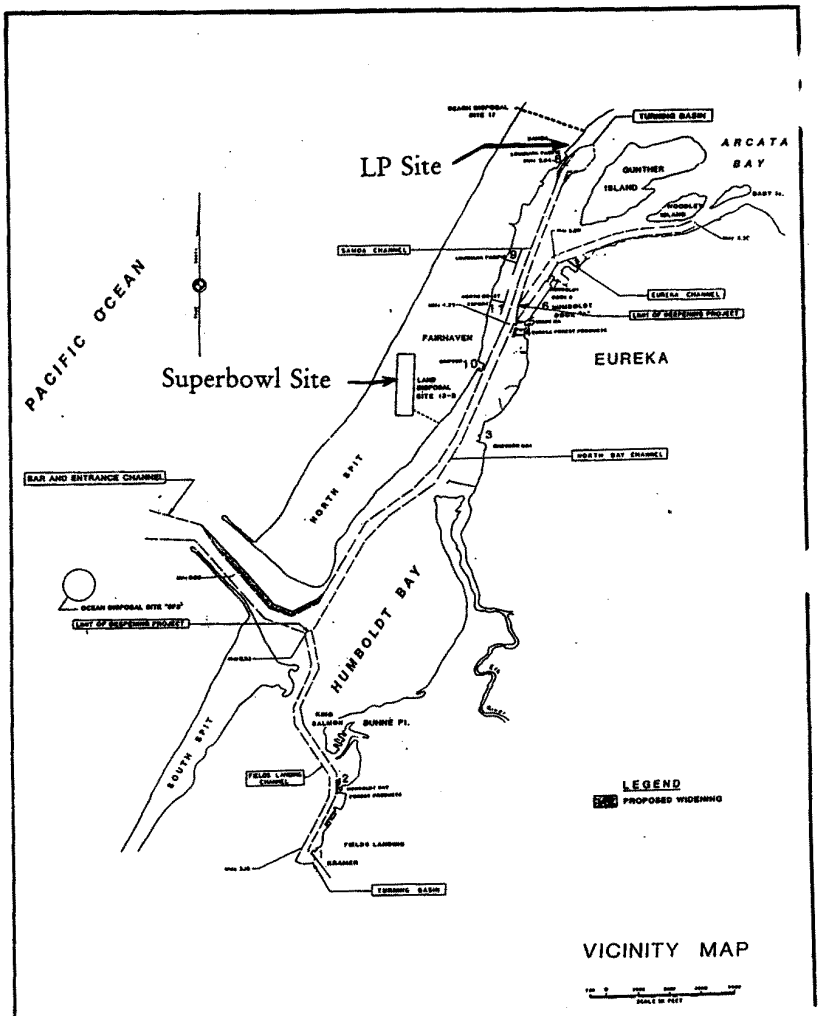


Figure 2.10.2.1 Dredge Material Disposal Sites Initially Considered and Disposal Sites

material disposed over a 50-year period.

All of the approximately 5.6 million cys of dredged material, excluding the approximately 26,000 cys of material unsuitable for unconfined aquatic disposal, would be disposed at this site. Typically, for maintenance dredging projects, sandy material from the Bar and Entrance and North Bay channels would be deposited in Quad 3, cells B4, B5, C4, and C5; and silty clay material from the Eureka and Samoa channels would be deposited in Quad 4, cell C2 (Figure 2.11.1-1). For the Humboldt Harbor and Bay Deepening Navigation Project, the total quantity of dredged material proposed for disposal at HOODS, would be deposited in the above-mentioned cells. Based upon physical characteristics of the sediment, the dredged material is matched with the bottom substrate of each the individual cells and quadrants of HOODS to insure a reduction in adverse impacts to benthic organisms. Over the 50-year use of HOODS, disposal of dredged material would be rotated to utilize other quadrants and cells (Note: cells with potential shipwreck remains [see Section 5.6.3.1] would be avoided). Disposal at this site would require a self-propelled hopper dredge due to the strong currents, breaking seas, and large swells located in the majority of the project area.

Presently, there are currently no EPA approved permanent ocean dredged material disposal sites (ODMDS) for Humboldt Harbor and Bay dredged material, in accordance with Section 102 of the MPRSA. The Corps of Engineers, San Francisco District, requested that EPA designate HOODS as a Section 102 EPA-authorized ODMDS. The Corps has closely coordinated with and provided supporting information to EPA for use in their HOODS EIS. The EPA's final rule on designating the HOODS under Section 102 of the MPRSA is scheduled for August 1995.

2.11.2 Louisiana Pacific Site

The Louisiana Pacific (LP) site would be used to dispose of the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal. The LP disposal site is located on an approximately 23 acre land parcel, with approximately 12 acres of upland habitat historically used as a dredged material disposal site by LP. The site is located near the intersection of Samoa Cookhouse Road and New Navy Base Road, northeast of Samoa, Humboldt County, California (eastern shore of North Spit, south of Samoa Bridge (Highway 255).

The parcel of land where the Louisiana Pacific Site is located appears to have been originally vegetated back-dune habitat covered with shore pine (*Pinus contorta* ssp. *contorta*). Relatively undisturbed areas such as the north corner of the LP Site are still covered with this vegetation type. Located within this relatively undisturbed area, is a triangular-shaped riparian wetland area immediately to the north, between it and the Samoa Bridge. During disposal of berth maintenance dredged materials, LP contract dredgers have been careful to avoid this highly disturbed wetland area when disposing of dredged material. In addition, a site visit conducted on December 30, 1993, revealed the wetland area to be at a much lower elevation than the two settling ponds, thus making it very easy to avoid impacts.

The remainder of the parcel has been bulldozed by LP, and consists of two terraced settling ponds used for dredged material disposal. These two ponds are located behind containment dikes, and are approximately 25-30 feet above the surrounding terrain (located above mean higher high

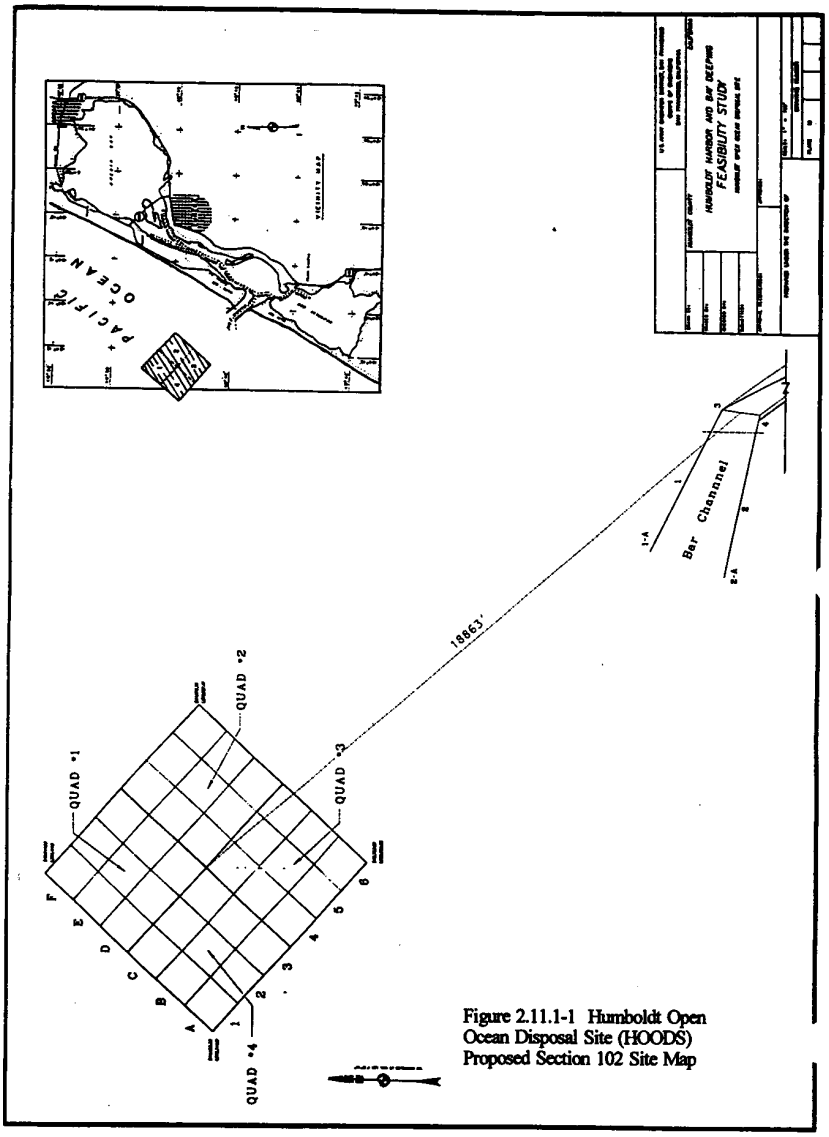


Figure 2.11.1-1 Humboldt Open Ocean Disposal Site (HOODS) Proposed Section 102 Site Map

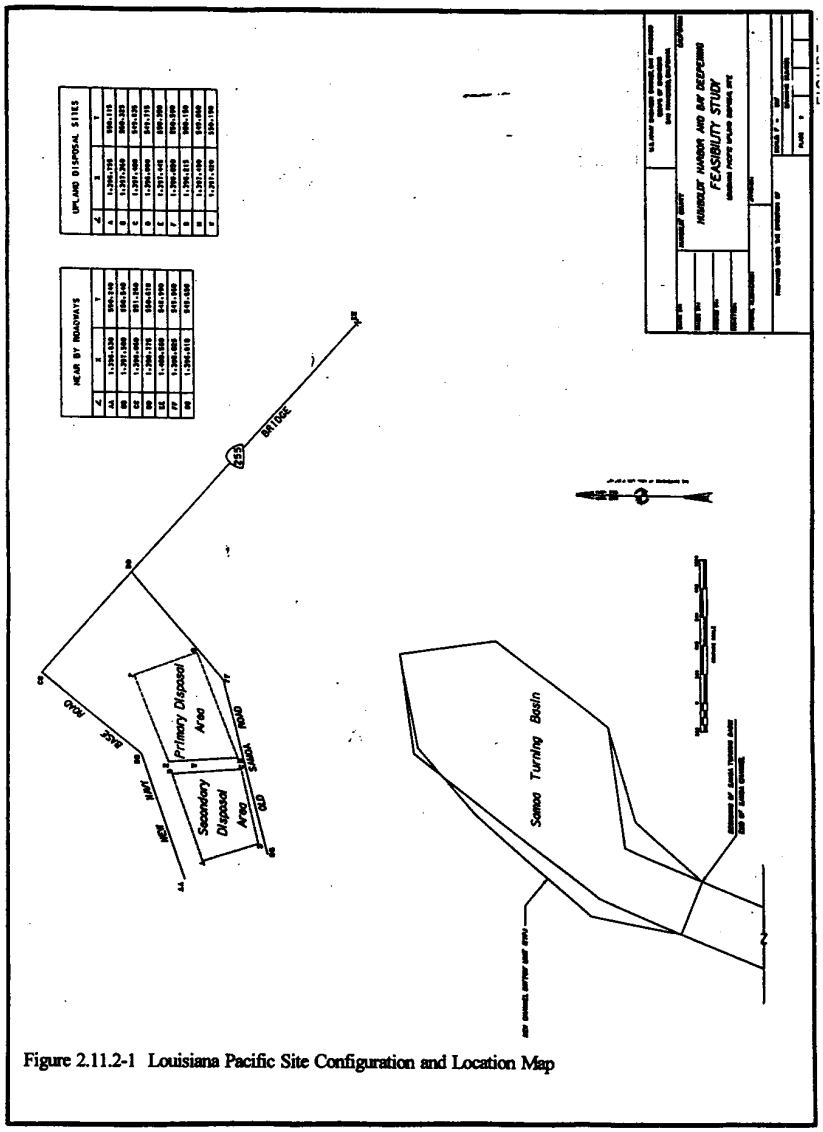


Figure 2.11.2-1 Louisiana Pacific Site Configuration and Location Map

water (MHHW) and the high tide line). The levees of the two ponds and the disturbed areas outside of the levees (i.e., majority of LP Site) are covered with a dense growth of ruderal herbaceous and scrub vegetation. In the past, the LP Site has been used for random dumping of refuse such as asphalt and concrete. Dumping of dredged material by Louisiana Pacific and other entities was permitted about 1982. All dredged material is disposed of behind the containment dikes. LP obtained a 10-year permit from the Corps (dated April 8, 1985; Corps permit #14438N21, expires March 25, 1995) to dispose of approximately 33,000 cys of dredged material. Currently, LP has applied for a permit from the Corps to dispose of up to approximately 110,000 cys of dredged material from the proposed Samoa Terminal Dock Reconstruction Project. The present capacity of the LP Site is 65,000 cys. If the LP Site is used by LP for the disposal of 110,000 cys of dredged material, it would be necessary to raise the existing levees by 4 feet.

The area surrounding the LP site is also owned and operated by the LP Corporation. The LP site is served by the Humboldt Bay Municipal Water Distict (HBMWD), and no groundwater withdrawals are planned. Saline effluent will percolate into the groundwater table and flow into the Bay. Any possible effluent in excess of naturally absorbed water is piped by way of a clarified return line into the Bay. A 100-foot naturally vegetated buffer is provided on the north, west, and south sides of the disposal site, and a 50-foot buffer is provided on the east side, helping to screen the dike profile. Past experience has indicated that dredged material such as silt and sand, revegetate naturally; thus, no active revegetation efforts have occurred.

For the Humboldt Harbor and Bay Deepening Navigation Project, disposal at the Louisiana Pacific site would be accomplished using a self-propelled hopper dredge equipped with a pipeline to "back pump" dredged material onto the upland site, and would be completed within approximately three to four days. The Humboldt Bay Harbor, Recreation, and Conservation District received a Letter of Intent (LOI)(in Real Estate Appenndix of Feasibility Report), dated September 22, 1994, from the Louisiana-Pacific Corporation to allow the use of the LP Site for upland disposal of approximately 26,000 cys of dredged material, and a right of way agreement for the placement of pipeline to the site.

3.0 RELATIONSHIP TO ENVIRONMENTAL PROTECTION STATUTES, PLANS, AND OTHER REQUIREMENTS

This EIS/EIR is a joint document designed to satisfy both CEQA and NEPA. The Humboldt Bay Harbor, Recreation, and Conservation District is acting as the State Lead Agency under CEQA, and the U.S. Army Corps of Engineers , San Francisco District, is acting as the Federal Lead Agency under NEPA. CEQA guidelines contain clear authority for State and local agencies to prepare joint documents with Federal agencies. NEPA regulations issued by the President's Council on Environmental Quality contain similar provisions. The relationship of each project alternative to environmental requirements (an International Treaty, Federal, State, and local), and objectives of land use plans and policies and controls applicable to the study area and the disposal of dredged material are presented below and in Table 3.0-1.

3.1 International Treaty

The principal international agreement governing ocean disposal is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter (26 UST 2403: TIAS 8165), previously known as the London Dumping Convention (LDC), and now referred to as the London Convention (LC). This agreement became effective on August 30, 1975 after ratification by the participating countries, including the United States. Ocean dumping criteria incorporated into the Marine, Protection, Research, and Sanctuaries Act (MPRSA) have been adapted from the provisions of the LC. Thus, material considered acceptable for ocean disposal under MPRSA also, is acceptable for ocean disposal under the LC.

3.2 Federal Laws and Regulations

3.2.1 National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4341 *et seq.*)

This Act requires that environmental consequences and project alternatives be considered before a decision is made to implement a Federal project. NEPA established requirements for preparation of an EIS for projects potentially having significant environmental impacts. This EIS/EIR has been prepared on the proposed project, as discussed in Council on Environmental Quality regulations on implementing NEPA (40 CFR 1500-1508). The document presents sufficient information regarding the generic impacts of the proposed deepening and selected widening of navigation channels in Humboldt Bay to guide future studies. This document will be used in connection with later activities, and with subsequent environmental documents for site-specific projects included within the general framework of this project. All project alternatives presented in the EIS/EIR were developed in accordance with the goals specified in Section 101 of the Act. Distribution of the Notice of Intent (NOI) for the Draft EIS/EIR complied with NEPA requirements. A Notice of Availability (NOA), announcing that the DEIS was available for comment was published in the *Federal Register* on December 16, 1994. After the DEIS

TABLE 3.0-1

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Environmental Requirement	*Project Alternative**	*HOODS*	*Louisiana Pacific (LP) Site*
INTERNATIONAL TREATY			
London Convention	FC	FC	NA
FEDERAL			
National Environmental Policy Act (NEPA)	FC	FC	FC
Coastal Zone Management Act	FC	FC	FC
Clean Air Act	FC	FC	FC
Clean Water Act	FC	FC	FC
National Historic Preservation Act	FC	FC	FC
Executive Order 11593, Protection & Enhancement of the Cultural Environment	FC	FC	FC
Abandoned Shipwreck Act	FC	FC	NA
Fish & Wildlife Coordination Act	FC	FC	FC
Endangered Species Act	FC	FC	FC
Executive Order 11990, Protection of Wetlands	NA	NA	NA

TABLE 3.0-1 (CONTINUED)

COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

Environmental Requirement	*Project Alternative**	*HOODS*	*Louisiana Pacific (LP) Site*
FEDERAL			
Estuary Protection Act	FC	NA	NA
Marine Protection, Research, and Sanctuaries Act	NA	FC	NA
STATE			
California Environmental Quality Act	FC	FC	FC
Porter-Cologne Water Quality Control Act	FC	NA	FC
State Lands Commission Policies	FC	NA	NA
California Endangered Species Act	FC	FC	FC
California Coastal Act	FC	FC	FC
California Wetlands Policy	NA	NA	NA
LOCAL			
County of Humboldt General Plan	FC	NA	FC
Humboldt Bay Master Plan	FC	NA	NA

Legend:

FC = Full compliance -All requirements of the law, policy, or related regulations have been met.

PC = Partial compliance -Some requirements of the law, policy, or related regulations have not been met. Refer to sections 3.2 and 3.3 for additional information.

NC = Not in compliance - Use of the site would conflict with the law, policy, or related regulations. Refer to sections 3.2 and 3.3 for additional information.

NA = Not applicable -The law, policy, or related regulations do not apply to the alternative or disposal sites.

* = No difference in compliance with environmental requirements for different depths in navigation channels (i.e., Bar & Entrance to -48 feet MLLW and North Bay Channels to -38 feet MLLW).

comment period, the comments are addressed, revisions are made to the DEIS, and the document is published as a Final EIS. This document fulfills the NEPA EIS requirements. The requirements of the Act are met by the circulation of both the draft and final EIS/EIR, and by preparation of a Record of Decision.

3.2.2 Coastal Zone Management Act of 1972, as amended, (16 U.S.C.1456 et seq.)

This Act requires that Federal activities affecting land or water resources located in the coastal zone be consistent to the maximum extent practicable with the federally-approved State coastal zone management plans. The State of California's Federally-approved Coastal Zone Management Plan for the waters and shoreline of Humboldt Bay is Humboldt County's "Humboldt Bay Area Plan/Local Coastal Plan (LCP)" (Humboldt County Planning Department 1982), which the California Coastal Commission (CCC) approved on October 14, 1982. CCC has jurisdiction over matters affecting the on and off shore areas within Humboldt Bay Harbor.

The proposed project's consistency with each applicable Coastal Zone Management Act policy/provision from the Humboldt County Local Coastal Plans (LCPs) is analyzed below:

> * *Coastal Provision 30211 - Development shall not interfere with the public's right of access to the sea where acquired through use, or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

The proposed project will not be encroaching upon a public easement area since all operations, except disposal of unsuitable for unconfined aquatic disposal dredged material, will be conducted off-shore. The LP site is privately owned by the Louisiana-Pacific Corporation.

> * *Coastal Provision 30212 - Public access from the nearest public roadway to the shoreline, and along the coast shall be provided in new development projects where (1) it is inconsistent with public safety, military security needs, or the protection of fragile coastal resources, (2) adequate access exists nearby, or (3) agriculture would be adversely affected. Dedicated accessway shall not be required to be opened to public use until a public agency or private association agrees to accept responsibility for maintenance and liability of the accessway.*

The proposed project will be conducted off-shore, except for the disposal of unsuitable dredged material on an upland site. The LP disposal site is in private ownership and public access to the coast and Bay is allowed on property adjacent to the site.

> * *Coastal Act Provision 30230 - Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special or biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term*

commercial, recreational, scientific, and educational purposes.

The proposed project will temporarily impact water quality through an increase in sedimentation and turbidity in the immediate areas of dredging; dredged material disposal; and potential nearby areas depending on the currents and tidal flows. The Corps will obtain a Water Quality Certification from the North Coast Regional Water Quality Control Board for the disposal at HOODS, and proper permits for disposal at any upland site used for material unsuitable for unconfined aquatic disposal. The proposed project will be consistent with all requirements of the RWQCB and EPA. Extensive sediment sampling and testing has been performed to determine which sediments are suitable for unconfined aquatic disposal at HOODS, and which sediments are unsuitable for unconfined aquatic disposal. The proposed project has been designed to have the least impacts to the marine resources, and any species of biological and/or economic significance.

* *Coastal Act Provision 30231 - The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

Please refer to "Coastal Provision 30230" for information related to the temporary impacts to water quality from dredging. The proposed project will not impact human health, and there are no adverse effects expected from the discharges of dredged material disposal, and subsequent decanting of the supernatant from either of the upland disposal sites and/or the HOODS site.

* *Coastal Act Provision 30233 (a) - the diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible, less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:*

(1) New or expanded port, energy, and coastal-dependent industrial facilities, including commercial fishing facilities.

The proposed project has been designed to be the least environmentally damaging alternative, and provides feasible mitigation/compensation measures which minimize any adverse environmental impacts (see Chapter 5.0 and associated sections).

* *Coastal Act Provision 30233 - (b) Dredging and spoils disposal shall be planned and carried out to avoid significant destruction to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment should be*

transported for such purposes to appropriate beaches or into suitable longshore current systems.

The proposed project has been designed to have the least impacts to marine and wildlife resources and habitats, beaches and longshore current systems. The LP upland site has a long history as a disposal site, and the HOODS site is presently being permanently designated as a Section 102 site. Beach replenishment is not feasible due to environmental and economic constraints.

** Coastal Provision 30240 - (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas. (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade such areas and shall be compatible with the continuance of such habitat.*

The proposed project avoids environmentally sensitive habitat areas, since the majority of operations will be conducted off-shore. No significant impacts to any sensitive areas located within or adjacent to the proposed LP upland disposal are expected.

** Coastal Provision 30244 - Where new development would adversely impact archeological or paleontological resources, as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.*

The proposed project may adversely affect archaeological resources (submerged cultural resources at one dredging location and at three locations where ocean disposal of dredged sediments will take place. It is probable that avoidance of these resources can be achieved. If not, consultation with the State Historic Preservation Officer will be completed to determine reasonable mitigation measures for significant archaeological resources.

Based upon the above findings and analyses within this Consistency Determination and the EIS/EIR, the Corps has determined that the proposed project is consistent to the maximum extent practicable with the Federally-approved State's coastal management program, the California Coastal Plan, and the Federally-approved Coastal Zone Management Act, as required by 15 CFR 930 *et seq*. The Corps submitted the draft EIS/EIR which contains the Consistency Determination to the California Coastal Commission pursuant to Section 930.34 of the National Oceanic and Atmospheric Administration Federal Consistency Regulations. On February 8, 1995, the California Coastal Commission (CCC) concurred with Consistency Determination (CD-111-94), by a vote of 10 in favor and 0 opposed.

3.2.3 Clean Air Act of 1977, as amended, (42 U.S.C. 7401 *et seq.*)

The objective of the Clean Air Act is to protect and enhance the quality of the Nation's air resources, and to promote public health and welfare and the productivity of its population. Under

this Act, the administrator of the U.S. Environmental Protection Agency has established a set of Ambient Air Quality Standards, but the primary responsibility for the prevention and control of air pollution is left to the states. For areas where the Ambient Air Quality Standards are not met, the State must include measures in the State Implementation Plan which will achieve the standards as expeditiously as possible.

Section 118 (a) of the Clean Air Act provides that all Federal agencies, including the Corps of Engineers, are subject to all Federal, State, and local requirements regarding the control and abatement of air pollution in the same manner and to the same extent as any non-governmental entity. This provision specifically applies to both substantive and procedural requirements. Section 176 (c) of the Act provides that no Federal agency shall engage in any activity which does not conform to an approved State Implementation Plan. These requirements will be met by obtaining any necessary permits from the State of California prior to construction. Air quality impacts are addressed in detail in Section 5.1 of this EIS/EIR.

In addition the 1990 CAA required Federal actions to complete an analysis of whether the project would conform to the requirements of the most recent Federally-approved State Implementation Plan (SIP). Final guidelines on how to perform the conformity analysis were recently promulgated by the EPA (EPA 1993). However, the final rule does not require a conformity analysis of Federal actions proposed in attainment areas. Therefore, since the project area is in attainment of all NAAQS, a project conformity determination was not performed in the air quality analysis conducted on the Humboldt Harbor and Bay Deepening Navigation Project.

3.2.4 Clean Water Act of 1977, as amended, (33 U.S.C. 1251 *et seq.*)

The objective of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. Specific sections of this Act control the discharge of pollutants and wastes into aquatic and marine environments.

The major section of the CWA that applies to dredging activities is Section 401, which requires certification that the permitted project complies with the State Water Quality Standards for actions within State waters. Under Section 301, states must establish Water Quality Standards for all State Waters, including the territorial sea. HOODS is located outside the boundaries of the State's territorial sea, but as a matter of comity, the Corps will be in full compliance with the water quality standards set forth by the State. Dredging or disposal of dredged material may not cause the concentrations of chemicals in the water column to exceed State standards. To receive State water quality certification, a permit applicant must demonstrate that these standards will not be exceeded.

Section 404(b) of the Clean Water Act, as amended in 1977, requires that the Corps of Engineers evaluate the impact of the discharge of dredged or fill material into waters of the United States in order to make specified determinations and findings. Subpart A, Section 230.1 (c) of the Section 404(b)(1) guidelines states the following: "Fundamental to these guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it is demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and or probable impacts of other activities affecting the ecosystems of concern." Although Section 401 and 404(b) of the CWA apply, by their own terms, only to applications for Federal Permits, the Corps has made a policy decision to apply them to their own projects. This policy is set forth in Corps regulations 33 CFR Part 336. Section 336.1(a) of that regulation states "Although the Corps does not process and issue permits for its own activities, the Corps authorizes its own discharges of dredge or fill material by applying all applicable substantive legal requirements, including public notice, opportunity for public hearing, and application of the Section 404(b)(1) guidelines". An evaluation, as specified in the Section 404(b)(1) guidelines, has been included in this EIS/EIR as Appendix A. When submitted to Congress, this procedure will satisfy Section 404 (r) of the Act in lieu of issuing a public notice, and obtaining a State water quality certification. The findings of the Section 404(b)(1) Evaluation indicated that the proposed placement of approximately 26,000 cubic yards of dredged material unsuitable for unconfined aquatic disposal on the Louisiana Pacific Site will be in full compliance with this Act.

Section 319 of the Clean Water Act requires each State to prepare a management program to control pollution from nonpoint sources. The State of California's Nonpoint Source Management Plan, dated November 1988, uses three general management approaches: voluntary implementation of best management practices; regulatory-based encouragement of best management practices; and effluent limitations. Under the State plan, it is usually up to the Regional Water Quality Control Board to decide which options will be used to address a given nonpoint source problem; however, the State plan encourages the use of the least stringent option that successfully protects or restores water quality. The "Water Quality Control Plan for the Northcoast Region", including the Humboldt Bay Region, dated September 1991, addresses nonpoint source control measures. According to the plan, State and local units of government are given the lead role in controlling land use activities that cause erosion. The nonpoint source impacts of the project alternatives on water quality and habitat are addressed in the appropriate section of this EIS/EIR. The Corps' standard construction contract specifications include management practices to minimize erosion impacts on water quality. Federal development projects are reviewed by the State under Executive Order 12372, "Intergovernmental Review of Federal Programs". Executive Order 12372 requires the Corps to make efforts to accommodate the concerns of the State, or to explain why those concerns cannot be accommodated.

3.2.5 Archeological and Historic Preservation Act of 1974, (16 U.S.C. 469 *et seq.*)

The Archaeological and Historic Preservation Act (AHPA) amended the Reservoir Salvage Act of 1960. The AHPA provides for the preservation of historic and archaeological data that might otherwise be lost or destroyed as a result of any Federal construction project or Federally licensed or assisted undertaking. The AHPA authorizes the lead Federal agency of a project, or the Secretary of the Interior, to undertake recovery or preservation of such data. Federal project funds, up to one percent of the project cost, may be used, or the agency may request the Secretary of the Interior to conduct the desired measures.

The Corps has identified three locations of potential cultural resources during the course of planning studies. These submerged potential sites which may warrant data recovery or protection are situated outside the areas that currently need to be dredged to reach project-channel depth or will be avoided by disposal of dredged materials. Avoidance of impacts to cultural resources, which is supported by the technical information generated thus far, gives the Corps full compliance with the AHPA. In the event that avoidance cannot be achieved due to project changes, and archaeological and historic data would need to be recovered, such data recovery would be implemented to achieve full compliance.

3.2.6 Executive Order 11593, Protection and Enhancement of the Cultural Environment, (36 C.F.R. 8921, May 13, 1971)

This Executive Order requires Federal agencies to (1) inventory the cultural resources on lands under their jurisdiction, (2) outline measures to actively protect and preserve these cultural resources, (3) nominate to the National Register of Historic Places those inventoried cultural resources considered significant, and (4) initiate measures to ensure that their policies contribute to the protection and preservation of non-federally owned cultural resources. No cultural resources have been identified in the study area. The proposed alternatives are therefore in full compliance with this Executive Order.

3.2.7 National Historic Preservation Act of 1966, as amended, (16 U.S.C. 470 *et seq.*)

The National Historic Preservation Act (NHPA) established the National Register of Historic Places, a listing of sites, districts, structures and objects significant in American history, architecture, archaeology, engineering and culture. Archaeological sites, historic buildings and other cultural resources may be determined eligible for inclusion in the National Register on the basis of local, regional, state or national significance. Section 106 of the NHPA requires Federal agencies to "take into account" the effects of a proposed project on such sites and structures which are listed, or which have been determined eligible for listing, on the National Register. The taking into account of effects involves (a) consultation between the Corps and the State Historic Preservation Officer to determine whether identified sites or structures in the Area of Potential Effect (APE) are National Register quality and to analyze possible project-induced impacts and (b) affording the Advisory Council on Historic Preservation an opportunity to

comment on the consultation findings. The Corps must satisfy the Section 106 provisions prior to the expenditure of Federal funds for construction of a proposed project.

The Corps has identified three locations Bay and the offshore ocean-disposal site that may contain submerged cultural resources. These potential sites, although within the APE, are either situated outside the areas that currently need to be dredged to reach the project-channel depth or in designated zones that would be avoided by disposal of dredged materials. This information is the basis for the conclusion that no historic properties will be affected by the proposed undertaking. Presently, the recommended plan is in partial compliance with the NHPA. Full compliance with the NHPA would follow completion of the Section 106 consultation with the SHPO and (if necessary) comments from the Advisory Council on Historic Preservation. December, 1995 is the anticipated date of full compliance.

3.2.8 Abandoned Shipwreck Act of 1987, (43 U.S.C. 2101 *et seq.*)

This Act creates Federal authority to transfer ownership of abandoned shipwrecks to the state on whose submerged lands the wreck is located. The Department of the Interior administers the act through regulations issued by the National Park Service. Exceptions are those shipwrecks on public lands of the United States, which will be kept in Federal ownership, and those on Indian lands, which will be the property of the Indian tribe owning the land rights. The Act provides Federal protection to any shipwreck which meets the criteria for eligibility for inclusion in the National Register for Historic Places. Should any of the submerged cultural resources identified through research and remote sensing be found eligible for inclusion in the National Register, the Corps would achieve full compliance by consultation with the State Historic Preservation Officer and selection of appropriate protection measures.

3.2.9 Fish and Wildlife Coordination Act of 1958 (16 U.S.C. *et seq.*)

The Fish and Wildlife Coordination Act requires that whenever any body of water is proposed or authorized to be impounded, controlled (i.e., diverted), or modified (i.e., deepened), the lead Federal agency must consult with the U.S. Fish and Wildlife Service (FWS); with the State agency exercising administrative authority over wildlife resources (in California, the California Department of Fish and Game); and for projects affecting marine fisheries, the National Marine Fisheries Service (NMFS). Section 662(b) of the Act requires the lead Federal agency to consider FWS and other agencies' recommendations. The recommendations may address wildlife conservation and development, any damage to wildlife attributable to the project, and any measures proposed for mitigating or compensating for these damages. The reports and recommendations of FWS must become an integral part of the reports for engineering surveys when submitted to Congress for authorization. The Act is applicable to the Corps' and EPA's evaluations of consistency with the CWA Section 404, and MPRSA Section 103 requirements. The Corps is coordinating with the FWS, which has prepared a Final Fish and Wildlife Coordination Act Report (CAR) on the proposed project (see Appendix B).

3.2.10 Endangered Species Act of 1973, as amended, (16 U.S.C. 1531 *et seq.*)

The Endangered Species Act protects threatened and endangered species by prohibiting Federal actions that would jeopardize the continued existence of such species or that would result in the destruction or adverse modification of any critical habitat of such species. Section 7 (a) of the Act requires consultation with the Secretary of the Interior (through the U.S. Fish and Wildlife Service) and/or the National Marine Fisheries Service (NMFS), prior to project implementation, to determine if any endangered or threatened species may be present in the area of a proposed Corps action, and to ensure that the action will not jeopardize the continued existence of a species or destroy or adversely modify the designated critical habitat of such species. During the project planning process, the FWS and NMFS evaluate the potential impacts of all aspects of the project on threatened or endangered species. Their findings are contained in letters that provide an opinion on whether a project will jeopardize the continued existence of endangered species or modify critical habitat. Such letters must provide reasonable and prusent alternatives, if any, that will avoid jeopardy. This EIS/EIR is the Biological Assessment required by the Act. Full compliance of the HOODS and upland site with this Act assumes that this EIS/EIR will suffice as a Biological Assessment. Informal consultation with the FWS regarding any endangered species that may be present at the upland site has been initiated in conjuction with the CAR described in the preceding section, and the Corps will initiate formal consultation as appropriate, based on FWS review and comment on upland disposal site alternatives. The Corps Biological Assessment (see Section 4.5 and 5.5) concluded that the proposed project would not impact any threatened, endangered species and there would be no unmitigable impacts associated with the proposed project.

3.2.11 Executive Order 11990, Protection of Wetlands (42 FR 26961, May 25, 1977)

Under this Executive Order, Federal agencies are directed to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial qualities of these lands. Federal agencies are also required to avoid undertaking or providing support for new construction located in wetlands unless (1) no practicable alternative exists and (2) all practical measures have been taken to minimize harm to wetlands. All of the project alternatives are located seaward of the MLLW, therefore are in full compliance with this Executive Order. Each of the upland disposal sites for dredged material unsuitable for unconfined aquatic disposal has been designed to minimize impacts on wetlands to the extent practicable. Any unavoidable wetland losses would be fully mitigated through habitat compensation measures.

3.2.12 Estuary Protection Act, (16 U.S.C. 1221 *et seq.*)

This Act requires all Federal agencies to give consideration to estuaries and their natural resources, and to their importance for commercial and industrial developments, in planning for the use or development of water and land resources. The Act also requires all project reports affecting estuaries that are submitted to Congress to contain a discussion and recommendations by the Secretary of the Interior regarding the project's effects on estuaries and their resources.

Compliance with this Act will be achieved through coordination with the Department of the Interior under the Fish and Wildlife Coordination Act and NEPA.

3.2.13 Marine Protection, Research, and Sanctuaries Act of 1972, as amended, (33 U.S.C. 1401 *et seq.*)

This Act regulates the transportation and ultimate disposal of materials in the ocean, and prohibits ocean disposal of certain wastes entirely. Prohibited materials include those that contain radiological, chemical, or biological warfare agents, high level radiological wastes, and industrial wastes. MPRSA has jurisdiction over all United States ocean waters in and beyond the territorial sea, vessels flying the U.S. flag, and vessels leaving U.S. ports.

Section 102 of the Act authorizes EPA to promulgate environmental criteria for evaluation of all dumping permit actions, to retain authority over Corps MPRSA 103 permits, and to designate ocean disposal sites for dredged material disposal. Presently, the Humboldt Open Ocean Disposal Site (HOODS) is being designated as a Section 102 dredged material disposal site. A Draft EIS for the HOODS designation was completed in March 1995 by EPA. EPA's final designation of the site is scheduled for August 31, 1995. The HOODS has been used for the disposal of dredged material from the navigation channels of Humboldt Harbor Bar, Entrance, and Northern Channels since September 1990, under Section 103 of the MPRSA. EPA's regulations for ocean disposal are published at 40 CFR Parts 220-229. The Corps and EPA would apply the same substantive requirements to Corps dredging projects as to a permitted project. The permitting regulations promulgated by the Corps, under the MPRSA, appear at 33 CFR Parts 320 to 330 and 335 to 338. Based on an evaluation of compliance with the regulatory criteria of 40 CFR Part 227, both EPA and the Corps may prohibit or restrict the disposal of material that does not meet the criteria. The EPA and Corps may also determine that ocean disposal is inappropriate because of ocean dredged material disposal site (ODMDS) management restrictions or because options for beneficial use(s) exist. Site management guidance is provided in 40 CFR 228.7-228.11. The Corps has prepared an evaluation of compliance of the proposed project with the MPRSA ocean dumping criteria identified in Parts 225, 227, and 228 (Appendix C). Pursuant to this Act, the Corps will obtain concurrence from EPA for use of the HOODS.

3.3 State of California Laws and Regulations

3.3.1 California Environmental Quality Act (CEQA) and Implementing Guidelines (June 1986, Public Resources Code Section 21001 *et seq.*)

This Act requires that State and local agencies prepare an Environmental Impact Report (EIR) for any project they propose to carry out or approve which may have a significant effect on the environment. As a Federal agency the Corps of Engineers is subject to the requirements of NEPA. However, the Corps is incorporating the CEQA requirements for the local project sponsor, the Humboldt Harbor, Recreation, and Conservation District, into this joint EIS/EIR. CEQA encourages State and local agencies to use Federal EIS's as State EIR's wherever possible.

Distribution of the Notice of Intent (NOI) and the Notice of Availability (NOA) for the Draft EIS/EIR complied with NEPA/CEQA notification requirements, respectively.

In addition, CEQA establishes requirements similar to those of NEPA for consideration of environmental impacts and alternatives, and for preparation of an EIR prior to implementation of applicable projects. CEQA, however, requires that significant environmental impacts be mitigated to a level of insignificance, or to the maximum extent feasible. If full mitigation is not feasible, the State lead agency must make a finding of overriding considerations before approving the project. The proposed action falls under the purview of CEQA. This document fulfills the CEQA EIR requirement. Responsible agencies (public agencies other than the lead agency that have responsibility for carrying out an approved project) include the California Coastal Commission, North Coast Regional Water Quality Control Board, State Lands Commission, North Coast Air Quality Management District, and the City of Eureka.

3.3.2 Porter-Cologne Water Quality Control Act of 1966 (California Water Code Sec. 13000 *et seq.*; CCR Title 23, Chapter 3, Subchapter 15)

The Porter-Cologne Act is the primary state regulation that addresses water quality. The requirements of the Act are implemented by the State Water Resources Control Board (SWRCB) at the State level and, at the local level, Regional Water Quality Control Board (RWQCBs). Under the direction of the SWRCB, the RWQCBs carry out planning, permitting, and enforcement activities related to water quality in California. The North Coast Regional Water Quality Control Board has jurisdiction over Humboldt Bay. The Act provides for waste discharge requirements and a permitting system for discharges to land or water. The Act also provides plans to identify beneficial uses of water resources and to implement appropriate water quality control measures. As part of protecting the waters of Humboldt Bay, the Act provides for specific water quality objectives addressed in the "Water Quality Control Plan for Enclosed Bays and Estuaries of California" (State Board Resolution No. 91-33; April 1991). Full compliance of the HOODS with this Act assumes that the North Coast RWQCB accepts compliance with the Clean Water Act and the Marine, Protection, Research, and Sanctuaries Act (MPRSA).

3.3.3 State Lands Commission Policies

The State Lands Commission (SLC) is responsible for administration of State public trust lands in coastal waters (within a 3-mile territorial limit) and other tidal and submerged areas. The State's interest in these lands consists of sovereign fee ownership, or a Public Trust easement implicitly retained by the State over sovereign lands sold into private ownership. Use of these lands, including dredging and dredged material disposal activities, requires written authorization from the SLC. The SLC reviews dredging projects for compliance with CEQA. In some cases, the State legislature has granted, by statute, administration of the State's interests in filled and unfilled tidelands and submerged lands to local agencies. In these cases, SLC retains an oversight

role. The proposed dredging will be subject to SLC permit requirements. The SLC is not expected to have any jurisdictional interests in either the Louisiana Pacific upland disposal site or HOODS.

3.3.4 California Endangered Species Act of 1984 (Fish and Game Code Section 2050, *et seq.*)

The California Endangered Species Act provides for the recognition and protection of rare, threatened, and endangered species of plants and animals. The Act requires State agencies to consult with the California Department of Fish and Game (CDFG) to ensure that State-authorized or funded actions do not jeopardize the continued existence of a listed species. The Act prohibits the taking (collection, killing, or injury, whether intentional or accidental) of listed species without authorization from the CDFG. CDFG may authorize the taking of a listed species through a Memorandum of Understanding that establishes the extent of take permitted by CDFG and sets forth the required mitigation.

3.3.5 California Coastal Act of 1976 (Public Resources Code Section 3000 *et seq.*)

This Act recognizes the Port of Humboldt Bay, as well as other California ports, as primary economic and coastal resources, and as essential elements of the national maritime industry. Decisions to undertake specific development projects, where feasible, are to be based on consideration of alternative locations and designs in order to minimize any adverse environmental impacts.

Under the Act, water areas may be diked, filled, or dredged when consistent with a certified port master plan only for specific purposes, including the following:

> *Construction, deepening, widening, lengthening, or maintenance of ship channel approaches, ship channels, turning basins, berthing areas, and facilities that are required for the safety and the accommodation of commerce and vessels to be served by port facilities.*

The water area proposed to be dredged for widening and deepening is the minimum necessary to achieve the purpose of the project, while minimizing harmful effects to coastal resources, such as water quality, fish or wildlife resources, recreational resources, or sand transport systems, and the volume, surface area, or circulation of water.

This Act also encourages the protection and expansion of facilities for the commercial fishing industry, water oriented recreation, and recreational boating interests. Marine resources are to be maintained, enhanced, and where feasible, restored. The biological productivity and the quality of coastal waters appropriate to maintain optimum populations of marine organisms and for the protection of human health are to be maintained. Protection against the spillage of hazardous substances and effective containment and cleanup facilities and procedures are to be provided.

Under the Act, the Humboldt Bay Harbor, Recreation, and Conservation District has had to develop for Coastal Commission certification a "Humboldt Bay Port Master Plan" that addresses environmental, recreational, economic, and cargo-related concerns of the Port of Humboldt Bay and surrounding areas. The proposed action will necessitate amendments of the "Humboldt Bay Port Master Plan" (see CZMA above).

3.36 State of California Wetlands Policy

The State policy recognizes the value of marshlands and other wetlands. The California Resources Agency and its various departments do not authorize or approve projects that fill or otherwise harm or destroy coastal, estuarine, or inland wetlands. Exceptions may be granted if all of the following conditions are met: The project is water-dependent; there is no other feasible alternative available; the public trust is not adversely affected; and adequate compensation is part of the project.

Disposal of dredged material at HOODS would not affect wetlands. Disposal of dredged material unsuitable for unconfined aquatic disposal at the Louisiana Pacific upland site would not affect wetlands.

3.4 Local Laws and Regulations

3.4.1 County of Humboldt General Plan

The General Plan 2020 (Baruth and Yoder 1969) for the Mid-Humboldt County Urban Planning Program addresses various aspects of preservation and development for Humboldt County. Relevant topics include: short-range and long-range land use development (industrial, commercial, and agricultural); recreation; natural environment; transportation; population; and economics. Compatibility with the General Plan is addressed in the corresponding sections of this EIS/EIR.

The General Plan states that "The Entrance Bar is considered to be treacherous and if weather conditions are too bad, the pilots do not bring the ships in or out. With expected growth of the total tonnage of waterborne commerce in Humboldt Harbor, these weather conditions may preclude any other way of handling cargo in the channels. The other ways may have included off-shore loading and unloading of bulk or general cargo. With the expected growth of Humboldt Harbor and increase of general cargo, more use of the development of containerization is expected to be made in the future, which needs loading and unloading facilities". The General Plan also states that "concurrent with construction of a commercial port facility, the Entrance Channel and North Bay Channel should be deepened and widened to insure full utilization by newer-type container vessels". The project alternatives have been designed to be compatible with the General Plan, and with full consideration of the importance of preserving Humboldt Bay's fish and wildlife resources.

3.4.2 Humboldt Bay Master Plan

The Humboldt Bay Master Plan (Koebig and Koebig 1975) (Ordinance No. 7; adopted by the Humboldt Bay Harbor, Recreation, and Conservation District Board of Commissioners (Board) on June 13, 1975) addresses planning objectives for the future of Humboldt Bay. The jurisdictional authority of the Humboldt Bay Harbor, Recreation, and Conservation District for the implementation of this Master Plan for Humboldt Bay is limited to Humboldt Bay up to the mean higher high water (MHHW) except for Indian, Woodley, and Daby Islands where the District jurisdiction is up to the mean high water level. Implementation of the Master Plan on the adjacent upland areas around the Bay will require cooperative efforts with other local jurisdictions.

Water and land use planning objectives (Article II; Section 2) listed in the Master Plan for Humboldt Bay include the following:

(a) Conservation Water - Use of Conservation Water areas shall generally be limited to natural resources habitat, wildlife refuges, mariculture, public access, and scenic vistas.

(b) Development Water - Use of Development Water areas shall generally be limited to access for commercial and industrial users and to improved and maintained channels.

(c) Public Open Space Land - Use of Public Open Space Land areas should generally be limited to natural resources habitat, wildlife refuges, recreation, public access, and scenic vistas.

(d) Agriculture Land - Use of Agriculture Land should generally be limited to crop and livestock production.

(e) Service/Commercial land - Use of Service/Commercial Land should generally be limited to commercial activities that are dependent on proximity to the waterfront, and might include enterprises such as restaurants and specialty shops.

(f) Port-Related Industrial Land - Use of Port-Related Industrial Land areas should generally be limited to waterfront developments requiring direct access to deepwater shipping channels.

(g) Water-Related Industrial Land - Use of Water-Related Industrial Land areas should generally be limited to waterfront developments requiring direct access for shallow draft vessels or requiring industrial cooling water.

(h) Nonwater-related Industrial Land - Use of Nonwater-Related Industrial Land areas should generally be limited to waterfront developments dependent upon not requiring direct access to the waterfront.

Article IV (Operational Policies) addresses "Navigation", in Section 2, and "Dredging, Diking, and Filling", in Section 8, respectively. The Master Plan requires that maintenance and improvement of existing navigational channels be supported and encouraged (through maintenance and construction of facilities), and dredging shall be limited to maintenance and improvement of navigational channels and areas designated for water-related developments. Section 9 (Environmental Quality) in the Master Plan states that maintenance and improvement of environmental quality shall be primary objectives for the use and development of all ares of Humboldt Bay, and not just those areas designated as "Conservation Water" and "Public Open Space Lands". The project alternatives for the proposed project have been designed to be generally compatible with the Humboldt Bay Master Plan.

3.5 Non-Applicable Requirements

The following laws and policies were examined and found not to be applicable to the alternatives discussed in this EIS/EIR:

Land and Water Conservation Fund Act, (16 U.S.C. 4601 *et seq.*) - No Land and Water Conservation Fund Act funds have been used in the study area.

River and Harbor Act of 1899, (33 U.S.C. 401 *et seq.*) - Requirements of this Act are met by Corps planning action.

Watershed Protection and Flood Prevention Act, (16 U.S.C. 1001 *et seq.*) - This Act authorizes certain Soil Conservation Service activities and has no requirements pertaining to Corps projects.

Wild and Scenic Rivers Act, (16 U.S.C. 1271 *et seq.*) - There are no designated rivers near the study area.

Council on Environmental Quality Memorandum on Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act, August 11, 1990 - There are no farmlands in the study area.

3.6 Permits or Approvals Required to Implement the Selected Plan

Permit/Approvals to be Obtained by the Corps of Engineers

- Section 401 (Clean Water Act) Certification from the North Coast RWQCB for dredging.
- EPA concurrence with ocean disposal at the HOODS.

- Consistency Determination concurrence from:
  - The California Coastal Commission for ocean disposal of approximately 5.6 million cys of dredged material at the HOODS, and upland disposal of approximately 26,000 cys of dredged material at the Louisiana Pacific site.
  - California Coastal Commission concurred (10 in favor and 0 opposed) with the Humboldt Harbor and Bay Deepening Navigation Project's Consistency Determination, CD-111-94, on February 8, 1995.

Permits/Approvals to be Obtained by the Humboldt Bay Harbor, Recreation and Conservation District

- State Lands Commission permit for dredging of certain submerged lands in Humboldt Harbor, if necessary.
- From the North Coast RWQCB:
  - Waste discharge permit and any needed NPDES permit for disposal at the Louisiana Pacific upland site.
- Any necessary construction easements and fees associated with upland disposal at the Louisiana Pacific site.

Permits/Approvals to be Obtained by the City of Eureka

- State Lands Commission permit for dredging of certain submerged lands in Humboldt Harbor, if necessary.

4.0 AFFECTED ENVIRONMENT

The term "affected environment" refers to the environmental setting of the study area. The existing environment at Humboldt Harbor and Bay is described in the following sections with respect to air quality; noise; hydrology, groundwater, and water quality; geology, soils, and seismicity; biological resources; cultural resources; transportation; and socioeconomics. The purpose of this section is two-fold: first, it presents the environmental setting and the environmental relationships that presently exist within the study area; and second, it defines the significant resources and other environmental characteristics that would be affected by the alternative plans. For the Humboldt Harbor and Bay Deepening Navigation Project, a detailed discussion of the impacts on each significant resource and environmental characteristic can be found in Section 5.0, while the No-Action Alternative is equivalent to the description of the existing (i.e., "affected") environment in Sections 4.1 to 4.8.

Description of Study Area

Humboldt Bay is a natural land locked harbor located in Humboldt County on the coast of Northern California, approximately 225 nautical miles north of San Francisco and 156 nautical miles south of Coos Bay, Oregon (Figure 4.0). It is the second largest coastal estuary in California, and consists of two large bays connected by a long narrow channel, and separated from the ocean by two rubble mound jetties approximately 2,000 feet apart and extending from the jetty tips. From the entrance, the Bay extends north and south a distance of approximately 14 miles, varying in width from 0.5 to 4 miles, and covering an area of over 17,000 acres. The Bay lies on a narrow coastal plain and is surrounded by rolling terraces, steep mountains, and narrow valleys typical of the coast ranges in the region. Much of the area is covered by dense forests of redwood and Douglas fir. Humboldt Bay is the only harbor between San Francisco, California and Coos Bay, Oregon with channels deep enough to permit passage of large, commercial ocean going vessels.

The tidal range between mean lower low water (MLLW) and mean higher high water (MHHW) is about 6.4 feet at the south jetty and 6.7 feet at Eureka. The Humboldt Bay Entrance channel is exposed to high waves, at times exceeding 30 feet in height during winter months. Deep draft commercial vessels typically do not attempt to navigate the Entrance channel when waves exceed 10 feet in height. The water surface of the Bay covers over 26 square miles at high tide and about 8 miles at low tide.

Adjacent to the Bay are two population centers, Eureka and Arcata, and several smaller communities. Eureka, with a 1992 estimated population of 24,850, is the largest city on the California North Coast and is also the county seat of Humboldt. Arcata, with an estimated 1992 population of 14,700, is the location of Humboldt State University. Smaller communities in the Humboldt Bay area include Bayside, Fairhaven, Fields Landing, King Salmon, Manila, and Samoa.

Humboldt Harbor and Bay is primarily a forest products (lumber, logs, particle board, pulp, wood chips) exporting "port", which recorded 1,729,760 short tons of waterborne commerce in 1990. The harbor is vital to the Humboldt economy since there are no apparent alternative ports for shipping these commodities.

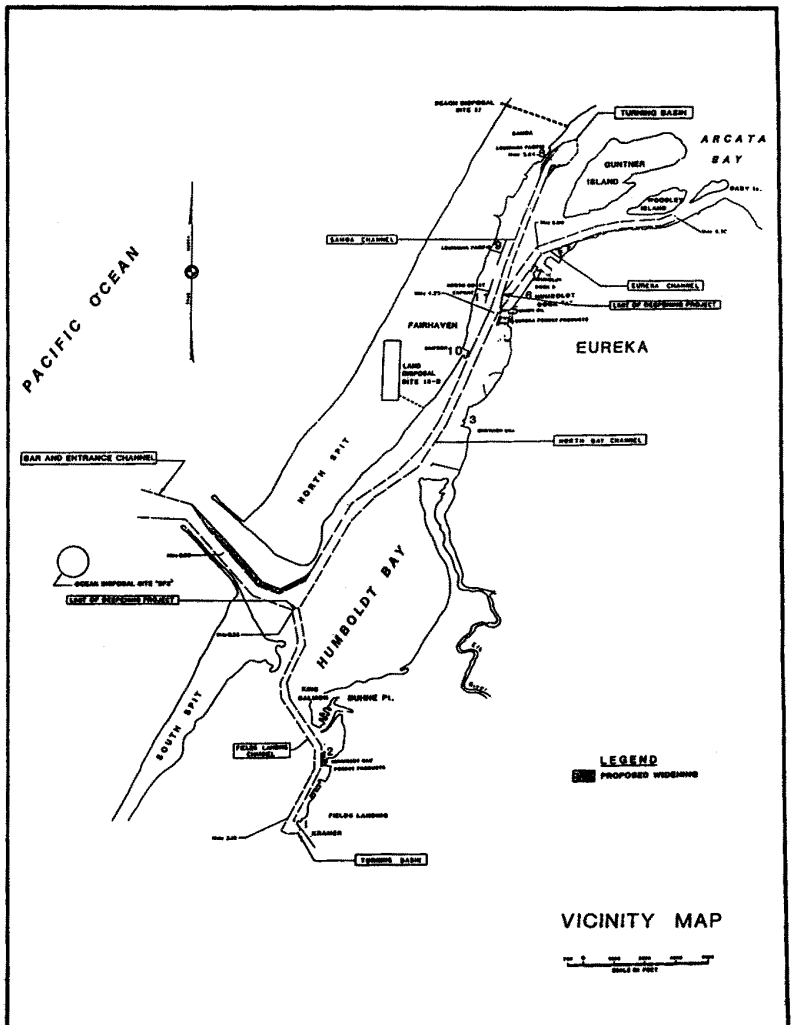


Figure 4.0 Humboldt Harbor Location Map

4.1 AIR QUALITY

Air quality at a given location can be described by the concentrations of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The significance of a pollutant concentration is determined by comparing the concentration to an appropriate Federal and/or State ambient air quality standard. The standards represent the allowable atmospheric concentrations at which the public health and welfare are protected and include a reasonable margin of safety to protect the more sensitive individuals in the population. Federal standards, established by the EPA, are termed the National Ambient Air Quality Standards (NAAQS). The NAAQS are defined as the maximum acceptable concentrations that may not be exceeded more than once per year, except the annual standards, which may never be exceeded. The Clean Air Act allows states to establish air quality standards which are more stringent than the NAAQS. The State standards, established by the California Air Resources Board (ARB), are termed the California Ambient Air Quality Standards (CAAQS). The CAAQS are defined as the maximum acceptable pollutant concentrations that are not to be equaled or exceeded. The NAAQS/CAAQS standards are listed in Table 4.1-1. The pollutants of main concern that are considered in this analysis include ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter smaller than 10 microns in diameter (PM_{10}) (SAIC 1994).

Identifying the Region of Influence (ROI) for air quality requires knowledge of the types of pollutants being emitted; the emission rates; and release parameters of the pollutant source (e.g., release temperature, area of release, release height, etc.); the source proximity to other pollutant sources; and local and meteorological conditions. The ROI for emissions of inert pollutants (all pollutants other than O_3 and its precursors) is generally limited to a few miles downwind from a source (SAIC 1994).

The ROI for ozone can extend much further downwind than for inert pollutants. Ozone is a secondary pollutant formed in the atmosphere by photochemical reactions of previously emitted pollutants, or precursors. Ozone precursors are mainly the reactive organic gas portion (ROG) of volatile organic compounds (VOC) and oxides of nitrogen (NO_x). In the presence of solar radiation, the maximum effect of ROG and NO_x emissions on O_3 levels usually occurs several hours after they are emitted and many miles from the source. Ozone and O_3 precursors transported from other regions can also combine with local emissions to increase local ozone concentrations. Therefore, the ROI for ozone may include much of the North Coast Air Basin (NCAB), and thus, Humboldt County.

4.1.1 Regional Conditions

The project area lies within the North Coast Unified Air Quality Management District (NCUAQMD), which includes Del Norte, Humboldt, and Trinity counties. Onshore air pollution sources in Humboldt County are regulated by the NCUAQMD.

Table 4.1-1. National and California Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a,c]	National Standards[b] Primary[c,d]	National Standards[b] Secondary[c,e]
Ozone (O_3)	1-Hour	0.09 ppm (180 $\mu g/m^3$)	0.12 ppm (235 $\mu g/m^3$)	Same as Primary Standard
Carbon Monoxide (CO)	8-Hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	-
	1-Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	-
Nitrogen Dioxide (NO_2)	Annual	-	0.053 ppm (100 $\mu g/m^3$)	Same as Primary Standard
	1-Hour	0.25 ppm (470 $\mu g/m^3$)	-	-
Sulfur Dioxide (SO_2)	Annual		0.03 ppm (80 $\mu g/m^3$)	-
	24-Hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	-
	3-Hour	-	-	0.5 ppm (1,3000 $\mu g/m^3$)
	1-Hour	0.25 ppm (655 $\mu g/m^3$)	-	-
Particulate Matter (PM_{10})	Annual	30 $\mu g/m^3$[f]	50 $\mu g/m^3$[g]	Same as Primary Standard
	24-Hour	50 $\mu g/m^3$	150 $\mu g/m^3$	
Sulfates	24-Hour	25 $\mu g/m^3$	-	-
Lead	30-Day	25 $\mu g/m^3$	-	-
	Quarterly	-	1.5 $\mu g/m^3$	Same as Primary Standard
Hydrogen Sulfide	1-Hour	0.03 ppm (42 $\mu g/m^3$)	-	-
Vinyl Chloride	24-Hour	0.010 ppm (26 $\mu g/m^3$)	-	-
Visibility[h]	8-Hour (10 a.m. to 6 p.m.)	In sufficient amount to produce an extinction coefficient of 0.23 per km due to particles when the relative humidity is less than 70 percent. ARB Method V.	-	-

Table 4.1-1. National and California Ambient Air Quality Standards

Notes:

a. California standards for ozone, carbon monoxide, sulfur dioxide (1-Hour and 24-Hour), nitrogen dioxide, particulate matter, and visibility reducing particles are values that are not to be exceeded. The sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded.

b. National standards other than ozone and those based on annual averages or arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with a maximum hourly average concentrations above the standard is equal to or less than one.

c. Equivalent units given in parathensis are based on reference temperature of 25 °C and a reference pressure of 760 mm of mercury.

d. National Primary Standards: The levels of air quality necessary with an adequate margin of safety to protect the public health.

e. National Secondary Standards: The levels of air quality necessary protect the public welfare from any known or anticipated adverse effects from a pollutant.

f. Calculated as geometric mean

g. Calculated as arthmetic mean

h. This standrd is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70 percent.

ppm = parts per million
km = kilometer
ARB = Air Resources Board
$\mu g/m^3$ = micrograms per cubic meter

Pollution concentrations in the NCAB are generally low, due to (1) persistent north to northwest winds that blow off the Pacific Ocean and enhance atmospheric mixing, and (2) a low population. A discussion of the existing conditions of climate, baseline air quality, emission inventories, and applicable air quality regulations follows. The discussion focuses on Humboldt County, which contains the entire project area.

4.1.1.1 Climate and Meteorology

The geographic position of California endows it with a climate classified as Mediterranean after the European region of somewhat similar climate. The characteristics of this climate are:

- a concentration of the year's precipitation in the winter season,
- summers which are nearly or completely dry,
- moderate temperatures with a relatively low range in temperature, and
- great variability in precipitation from year to year (Jones and Stokes 1981).

Specifically, the Humboldt Bay area is noted for its high precipitation, and is associated with episodic storms. Eighty-five percent of the precipitation in the area usually occurs during a seven month period from mid-October to mid-May (Pequegnat *et al.*, 1990). The Humboldt Bay area averages 38 inches of rainfall annually.

During the fall and winter, low pressure cyclonic storms are formed in the region south of the Aleutian Islands. These low pressure systems, characterized by cyclonic air circulation

(counterclockwise in the northern hemisphere), result in intense winds from the south and southwest as the storm moves onshore through the area. During the spring and summer, the Aleutian Low is replaced by the North Pacific High with resultant anticyclonic winds (clockwise in the northern hemisphere), from the north and northwest (Pequegnat *et al.*, 1990).

The coastal location of the study area endows the region with moderate temperature conditions. The Pacific Ocean has a moderating effect on temperatures so that the temperatures are generally cool and infrequently cold or hot. Average minimum temperature for Eureka is 41°F in January, and the average maximum temperature is 62° in August. Temperatures of 32°F or lower occur nearly every winter throughout the area and maximum readings for the year seldom exceed 80°F on the coast. Fog is common in the coastal region from late spring until early fall. It usually remains until late morning and returns again in the early evening.

4.1.1.2 Baseline Air Quality

The EPA designates all areas of the United States as having air quality better than (attainment) or worse than (nonattainment) the NAAQS. A nonattainment designation means that a primary NAAQS has been exceeded more than three discontinuous times in three years in a given area. Pollutants in an area are often designated as unclassified when there is a lack of data for the EPA to form a basis of attainment status (SAIC 1994). The NCUAQMD presently is in attainment of all NAAQS (L. Herr, personal communication).

The ARB designates areas of the State as either in attainment or nonattainment of the CAAQS. An area is in nonattainment if the CAAQS has been exceeded more than once in three years (SAIC 1994). The NCUAQMD presently is in attainment of all CAAQS, with the exception of PM_{10}. Presently, all of California, with the exception of Lake County, is in nonattainment of the State PM_{10} standard (L. Herr, personal communication).

Air pollutant levels have historically been monitored within the project area by the NCUAQMD at the following locations: (1) a station on the roof of the Eureka Health Department Site in Eureka, and (2) a station at the Coast Guard Station located on the North Spit. A summary of the most recent air pollution records for Humboldt County is presented in Table 4.1-2 (NCUAQMD 1993, and ARB 1991a, 1992, 1993). None of the ambient air quality standards were exceeded during recent years, except the State 24-hour PM_{10}, which was exceeded several times each year. The following is a discussion of the various pollutants monitored within Humboldt County.

Ozone

Ozone is a colorless gas that is formed in the lower atmosphere as a result of chemical reactions between oxygen, volatile organic compounds (VOCs), and nitrogen oxides (NO_x) in the presence of sunlight, especially during the summer months when maximum insolation occurs. Ozone is a respiratory irritant and can cause damage to lung tissue. Sensitive plant species and synthetic materials can also be damaged by ozone concentrations as low as 0.02 ppm. The data

in Table 4.1-2 shows that the one-hour CAAQS of 0.09 ppm was not exceeded in the project area during the 1990 through 1992 monitoring period.

Nitrogen Dioxide

Nitrogen dioxide is a reddish-brown gas with an irritating odor. It is produced by the combustion of fossil fuels, which allows nitrogen and oxygen to combine and form nitrogen oxide. The gas then reacts with NO_2 to form O_3. Nitrogen dioxide is a respiratory irritant and can cause lung tissue damage. Nitrogen dioxide is also one of the two main components in acid rain. The data in Table 4.1-2 shows that the maximum one-hour NO_2 concentrations did not exceed the State standard during 1988, when this pollutant was last monitored in the project area.

Sulfur Dioxide

Sulfur dioxide is a colorless, nonflammable gas with a pungent odor. Sulfur dioxide is a respiratory irritant and is mainly produced from the combustion of sulfur-containing fossil fuels, as a byproduct in refining fossil fuels from crude oil, and from the production of sulfuric acid. It is a major component of smog and acid rain in many areas of the world. Table 4.1-2 shows that the ambient standards were never exceeded during 1981 and 1991, when this pollutant was last monitored in the project region.

Carbon Monoxide

Carbon monoxide is a clear, odorless gas produced by the incomplete combustion of fossil fuels and organic substances. The natural degradation of plant material can also contribute to the production of CO, but motor vehicles by far are the largest source. As a result, the highest ambient concentrations usually occur near congested transportation arteries and intersections. Carbon monoxide is not a respiratory irritant, but rather interferes with the transfer of oxygen to the blood. Symptoms of exposure include dizziness, headache, and in extreme cases, loss of consciousness. The data in Table 4.1-2 shows that the ambient standards were never exceeded during 1990, when this pollutant was last monitored in the project region.

PM_{10}

Particulate matter less than ten microns in diameter is solid matter from smoke, dust, fly ash, and condensing vapors that can remain suspended in the air for long periods of time. The major sources of this pollutant include industrial processes, automobiles, woodsmoke from open burning, residential wood heating, dust from paved and unpaved roads, construction, and agricultural practices. This size of particulate matter can affect breathing and respiratory symptoms, causing increased respiratory disease and lung damage. In the project region, PM_{10} levels exceeded the 24-hour CAAQS several times each year between 1985 and the present. However, annual ambient standards were not exceeded during those years.

Table 4.1-2 **Maximum Pollutant Concentrations Monitored in Eureka, California (1990-1992)**

Pollutant	*Averaging Time/ Measurement*	Maximum Concentration by Year			Number of Days Federal Standards Exceeded			Number of Days State Standards Exceeded		
		1990	*1991*	*1992*	*1990*	*1991*	*1992*	*1990*	*1991*	*1992*
OZONE	1-hour (ppm)	0.04	0.05	0.04	0	0	0	0	0	0
NITROGEN DIOXIDE	1-hour (ppm)	0.04*	---	---	---	---	---	0	---	---
	Annual (ppm)	0.005*	---	---	0	---	---	---	---	---
CARBON MONOXIDE	1-hour (ppm)	9.0	---	---	0	---	---	0	---	---
	8-hour (ppm)	3.5	---	---	0	---	---	0	---	---
PM_{10}	24-hour (ug/m3)	83	68	88	0	0	0	5	9	7
	Annual (Geo. Ave.)	24.4	29.5	27.1	---	---	---	0	0	0
	Annual (Arith. Ave.)	28.3	32.4	30.8	0	0	0	---	---	---
SULFUR DIOXIDE	1-hour (ppm)	0.02*	0.01	---	---	---	---	0	0	---
	24-hour (ppm)	0.03*	0.03	---	0	0	---	0	0	---
	Annual (ppm)	0.001*	0.001	---	0	0	---	---	---	---

Note: * Monitoring year for NO2 is 1988 and 1981 for SO2.

4.1.1.3 Humboldt County Emissions Inventory

The total air emissions that occurred in Humboldt County during 1989 are shown in Table 4.1-3 (ARB 1991b). This inventory includes emissions from fuel combustion, industrial processes, solid waste disposal, stationary and transportation sources, and miscellaneous processes. These data show that the largest contributors to ROG, CO, and NO_x in Humboldt County are mobile sources.

4.1.1.4 Regulatory Setting

Air quality regulations were first promulgated with the Federal Clean Air Act of 1969. This Act established the NAAQS and delegated the enforcement of air pollution control to the states. In California, the Air Resources Board (ARB) has been designated as the agency responsible for regulating air pollution sources. The ARB, in turn, has delegated the responsibility of regulating stationary emission sources to local air pollution control or management districts. The following is a summary of the Federal, State, and local air quality rules and regulations that apply to project activities.

Federal Statutes and Regulations

Federal Clean Air Act (CAA): (42 U.S.C. 7401 and EPA implementation regulations at 40 Code of Federal Regulations (CFR), Parts 50 and 51). The CAA states that all applicable Federal and State ambient air quality standards must be maintained during the operation of any emission source, and has stablished Prevention of Significant Deterioration (PSD) Standards which include emission thresholds for different ollutants. Primary standards are mandated by the CAA to protect the public health, while secondary standards are intended to protect the public welfare from the adverse effects of a pollutant, such as materials soiling, vegetation damage, and visibility impairment. The CAA also delegates to each State the authority to establish their own air quality rules and regulations. In states where the NAAQS are exceeded, the CAA requires preparation of a State Implementation Plan (SIP) that identifies how the State will meet the standards within the time frames mandated by the Clean Air Act Amendments of 1990.

CAA Amendments of 1990 (1990 CAA): established new nonattainment classifications, new emission control requirements, and new compliance dates for areas presently in nonattainment of the NAAQS, based upon a design day value. The design day value is the fourth highest pollutant concentration recorded in a three-year period. The requirements and compliance dates are based on the nonattainment classification (i.e., marginal, moderate, and serious).

In addition, the 1990 CAA also requires that any Federally funded project must comply with the air quality standards and regulations that have been established by Federal, State, and local regulatory agencies.

Table 4.1-3. **1989 Emission Inventory for Humboldt County (tons/day)**

	TOG	*ROG*	*CO*	*NO_x*	*SO_x*	*PM_{10}*
Stationary Sources						
Fuel combustion	3.0	1.3	17.0	5.0	2.8	3.8
Waste burning	2.4	1.6	35.0	0.1	---	2.1
Solvent use	4.9	4.3	---	---	---	---
Petroleum process, storage, and transfer	4.2	3.6	---	---	---	---
Industrial processes	2.1	1.6	9.5	2.7	3.0	6.7
Miscellaneous processes	20.0	0.6	2.2	---	---	23.0
Subtotal	36.0	13.0	64.0	7.8	5.9	35.0
Mobile Sources						
On-road vehicles	6.8	6.2	55.0	10.0	0.9	1.0
Other mobile sources	5.6	5.4	25.0	17.0	1.7	1.0
Subtotal	12.0	12.0	80.0	28.0	2.6	2.0
TOTAL	48.0	24.0	140.0	35.0	8.5	37.0

Note: TOG = total organic gases.
Source: ARB 1991a. All values reported as rounded in the 1989 Emission Inventory document.

The 1990 CAA requires federal actions to complete an analysis of whether the project would conform to the requirements of the most recent federally-approved SIP. Final guidelines on how to perform the conformity analysis were recently promulgated by the EPA (EPA 1993). However, the final rule does not require a conformity analysis of federal actions proposed in attainment areas. Therefore, since the project area is in attainment of all NAAQS, a project conformity determination was not performed in this analysis.

State Regulations

California Clean Air Act of 1988 (CCAA) (Health and Safety Code 40918-40920): The CCAA requires areas in nonattainment of the ozone and carbon monoxide CAAQS standards to adopt a plan that will lead to the attainment of these standards by the earliest practical date. However, areas in nonattainment for PM_{10} , sulfates, lead, hydrogen sulfide, or visibility are not expressly required to develop an attainment plan under CCAA.

Since, the North Coast Air Basin is in attainment for ozone, nitrogen dioxide, sulfur dioxide, and carbon monoxide, but not PM_{10}, the NCUAQMD is not required to adopt an attainment plan.

Local Regulations

NCUAQMD Rules and Regulations

The CAA gives State and local agencies the authority to establish air quality rules and regulations. Rules adopted by the local air pollution control districts and accepted by the ARB are included in the SIP. When approved by the EPA, these rules become Federally enforceable. The AQMD, having received the necessary approvals, regulates stationary sources of air pollution in the NCAB. The pertinent rules and regulations that apply to project emission sources are summarized below (L. Herr, personal communications, 1994):

- ***Rule 200*** - defines the review process of sources that require air permits. This regulation sets forth preconstruction requirements for stationary sources that may include Best Available Control Technology (BACT).

- ***Rule 400(A) - Public Nuisance.*** This rule states that no person shall discharge from any source air contaminants which cause injury, detriment, nuisance, or annoyance to any considerable number of persons or public, or which endangers the comfort, repose, health, or safety of any such persons or public, or which causes, or has the tendency to cause, injury or damage to business or property. In addition, Rule 400(A) identifies limitations on odorous substances and specific emission limitations on certain odorous compounds.

- ***Rule 410*** - identifies standards for the visibility and opacity of effluent from all sources.

- ***Rule 420*** - identifies standards that limit particulate matter emissions.

- ***Rule 440*** - states that a person shall not discharge into the atmosphere from any single source of emissions whatsoever sulfur oxides, calculated as sulfur dioxide (SO_2) in excess of 1,000 ppm or 2.5 percent by weight; or in excess of the specific source emission limitations of NSPS Rule 490 of the North Coast Air Basin, as applicable. However, this rule exempts fuel used to propel any motor vehicle, boat, or ship. As a result, the sulfur limitation would only apply to project construction machinery and dredges.

For the purpose of evaluating air quality impacts from proposed projects, the following emission thresholds are used by the NCUAQMD to determine the significance of proposed emissions: 15 tons/year PM_{10} (80 pounds/day)*; 40 tons/year ROG (ozone)(220 pounds/day) NO_x, SO_2; 25 tons/year particulate matter (135 pounds/day particulate matter); and 100 tons/year of CO (550 pounds/day) (L. Herr, personal communication and NCUAQMD 1994). [* Note: The significant stationary emission rate for Humboldt County is usually referred to in tons/year. The pounds/day emission rate is actually a more "stringent emission rate" used in Mendocino County, thus any calculations of emission rates in pounds/day would represent the "worst-case scenario" for evaluating air quality impacts].

4.1.1.5 Sensitive Receptors

The impact of emissions to the most sensitive members of the population is of special concern. Sensitive receptor groups include children, elderly, and the acutely and chronically ill. The locations of these groups include residences, schools, day care centers, and hospitals. Therefore, a new project should ensure that its emissions do no cause a nuisance to sensitive receptors in proximity to the project.

4.2 NOISE

4.2.1 Introduction and Regulatory Background

4.2.1.1 Noise Measurement and Terminology

Noise levels are typically measured in decibels (dB), units related to the apparent loudness of sound. An A-weighted decibel (dBA) approximates the response of the human ear to sounds of various frequencies. On this scale, the normal range of human hearing extends from about 3dBA to 140 dBA, with speech normally occurring between 60 and 65 dBA. A 10-dBA increase in the level of a continuous noise is generally perceived as a doubling of loudness, whereas a 3-dBA increase is just noticeable to most people. Noise levels decrease by 6-dBA with each doubling of distance from the source of noise, assuming there are no intervening barriers. Some typical noise levels are listed in Table 4.2.1.1-1 below.

Because environmental noise levels fluctuate over time, a time-averaged noise levl in dBA is often used to characterize the acoustic environment at a given location. The average noise intensity over a given time is the energy equivalent noise level (L_{eq}). The day-night equivalent noise level (L_{dn}) is a 24-hour L_{eq}, which is derived by adding a 10 dBA "penalty" to noise levels measured between 10 P.M. and 7 A.M. The community noise equivalent level (CNEL) incorporates an additional 5 dBA penalty to sound levels measured between 7 P.M. and 10 P.M. These "penalties" account for the greater sensitivity of people to high noise levels at night.

TABLE 4.2.1.1-1
TYPICAL NOISE LEVELS

Noise Source of Environment	*dBA*
Threshold of hearing	0
Quiet suburb	40-55
Interior of residence	50
Conventional Speech	60
Busy urban area	60-75
Street traffic at 100 feet	70
Light truck at 20 feet	80
Gas lawnmower at operator position	80-90
Chain saw at operator position	95-120
Jet airplane on ground at 20 feet	140
(Sources: Canter 1977, Sanks 1989)	

4.2.1.2 Noise Guidelines and Standards

Noise guidelines and standards have been developed by Federal, State, and local agencies. The standards most applicable to the proposed project are the California Office of Noise Control standards and the noise element of each affected county's general plan. The Office of Noise Control guidelines, presented in Table 4.2.1.2-1 below, provide criteria for acceptability of noise levels for various land uses.

TABLE 4.2.1.2-1
California Office of Noise Control Land Use Compatibility Guidelines

Land Use Category	*Clearly Unacceptable (dBA)*	*Normally Unacceptable (dBA)*	*Conditionally Acceptable (dBA)*	*Normally Acceptable (dBA)*
Residential-low density	75	70-75	55-70	50-60
Residential-multi-family	75	70-75	60-70	50-65
Transient lodging	80	70-80	60-70	50-65
Schools, libraries, churches, hospitals	80	70-80	60-70	50-70
Playgrounds, neighborhood parks	72.5	67.5-75	—	50-70
Golf courses, water recreation	80	70-80	—	50-75
Industrial, utilities, agriculture	—	75-85	70-80	50-75

(Source: California Department of Health Services 1976)

4.2.2 Existing Noise Sources

4.2.2.1 Humboldt Harbor and Bay Navigation Channels

The area around Humboldt Bay is primarily devoted to commercial shipping and fishing, lumber related industry, some residential and open space. Ambient noise levels result primarily from commercial and industrial facilities, maritime traffic, and natural sources.

4.2.2.2 HOODS

This site is located in the ocean approximately 3.0 to 4.0 miles from the coast. The existing noise environment is dominated by natural sources, and maritime traffic. HOODS is located a considerable distance from any noise sensitive receptors.

4.2.2.3 Louisiana Pacific Site

This site is located on the North Spit of Humboldt Bay. Ambient noise levels result primarily from natural sources, and highway traffic on Highway 255 and Samoa Boulevard. The LP site is located well away from any noise sensitive receptors.

4.3 HYDROLOGY, GROUNDWATER, AND WATER QUALITY

4.3.1 Regulatory Standards

Regulatory standards for water quality in Humboldt Bay and the North Coast Region are promulgated by a number of agencies under various legislation. The EPA establishes Federal criteria for drinking water quality as mandated by the *Safe Drinking Water Act* (as amended in 1987) and for freshwater and saltwater aquatic life water quality as mandated by the *Clean Water Act*.

Under provisions of the State Porter-Cologne Water Quality Control Act and the Clean Water Act (CWA), the North Coast Regional Water Quality Control Board (NCRWQCB) regulates water quality in the Humboldt Bay Region. The regional board is authorized to monitor surface and groundwater quality and to require permits for the discharge of wastewater to all navigable waters.

In September 1991, the NCRWQCB adopted the "Water Quality Control Plan for the North Coast Region" (NCRWQCB 1991). These plans contain water quality standards for Humboldt Bay that conform to the NC-RWQCB policies for water quality control. Two of these policies are of importance to the proposed project. They include the following:

- State Water Resources Control Board (SWRCB) Resolution Number 68-16, which establishes a Non-Degradation Policy with respect to maintaining the high quality of waters in California. Under this resolution, it is the SWQCB policy that whenever the existing quality of the water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated that any degradation to quality will result in a significant public benefit. In addition, any activity that produces a waste or increases volume or concentration of waste and that discharges or proposes to discharge to existing high quality water will be required to meet waste discharge and water quality requirements.

- In April 1991, the SWRCB adopted the "Water Quality Control Plan for Enclosed Bays and Estuaries" under SWRCB Resolution Number 91-33. The purpose of this plan is to prevent water quality degradation and to protect beneficial uses of bays and estuaries in California by establishing water quality principles, effluent quality requirements, and prohibitions governing the disposal of wastes into these waters. In addition, the plans include guidelines for pollutants for which EPA or the State have developed criteria and that can reasonably be expected to impact beneficial uses. For each pollutant, numerical water quality objectives based on EPA 304 (a) criteria are established for the protection of human health or aquatic life. Acute and chronic toxicity objectives and narrative objectives are also established. These plans supplement the "Water Quality Control Plan for the Northcoast Region" (NCRWQCB September 1991) for the NCRWQCB region.

When considering these regulatory standards, if the proposed project is permitted, the placement of Humboldt Harbor sediment at any upland site would be considered a discharge of waste to land. This would require the project sponsor to obtain, from the NC-RWQCB, a water quality certification (waste discharge order) governing the receiving water and effluent water limitations for the clarified supernatant discharged into the Bay.

4.3.1.1 EPA Ambient Water Quality Standards

Water quality criteria (WQC) were developed by EPA to protect approximately 95 percent of the organisms in the aquatic environment based upon acute, chronic, and bioaccumulative testing of species at different trophic levels (EPA 1986). The criteria were developed from comprehensive species-specific acute, chronic, and bioaccumulation databases. These databases were developed from laboratory studies primarily with estuarine species and single contaminants. WQC do not address multiple contaminant interactions, the form of contaminant, or the potential sensitivity differences between estuarine and oceanic species. Criteria are used as toxicological estimates for aquatic chemical concentrations that are protective of marine life. These criteria are listed in Table 4.3.1.1-1.

EPA water quality criteria are accepted by the State of California and, specifically, the NC-RWQCB for the Humboldt Bay Region for assessing toxic pollutants in surface waters. By complying with these criteria, water quality objectives of the Northcoast Region plan for toxic pollutants will be met.

4.3.1.2 "Northcoast Region Plan" Objectives

The Water Quality Control Plan provides the basis for California water quality control management and consequently, the protection of California's waters. The plan defines (a) beneficial water uses that the State will protect, (b) water quality objectives intended to protect the beneficial uses, and strategies for implementation of the plan. Beneficial uses for surface water range from scenic beauty to the perpetuation of aquatic life. The primary objective of the Northcoast Region Plan is to control concentrations of pollutant constituents in water masses to adequately protect beneficial water uses.

The Northcoast Region Plan defines surface water quality criteria for several parameters, including suspended material, turbidity, pH, dissolved oxygen, bacteria, temperature, salinity. toxicity, ammonia, and sulfides. Dredging and material disposal in California is of considerable concern to the RWQCB because these activities are ongoing, and based on several studies, have demonstrated localized and ephemeral impacts to water quality, and hence, aquatic life. Parameters of concern specific to dredging and material disposal are habitat disruption, total suspended solids loading, reduction of dissolved oxygen, mobilization of toxic pollutants, and the release of nutrients. The RWQCB defers most decisions concerning dredging and dredged material disposal to the Corps, who comply with Section 404 of the Clean Water Act. The board, however, questions the ability of the current dredged material testing criteria to adequately assess

Table 4.3.1.1-1. Federal EPA Water Quality Standards and Criteria
(page 1 of 3)

Parameter	EPA Ambient Water Quality Criteria-Freshwater Chronic (ug/L)	EPA Ambient Water Quality Criteria-Freshwater Acute (ug/L)	EPA Ambient Water Quality Criteria-Marine Chronic (ug/L)	EPA Ambient Water Quality Criteria-Marine Acute (ug/L)
Antimony	1,600[1]	9,000[2]	--	--
Arsenic	190[1]	190[1]	69[1]	36[2]
Barium	--	--	--	--
Beryllium	--	5.3[10]	130[10]	--
Cadmium	1.1[1]	3.9[2]	9.3[1]	43[2]
Chromium (Total)	210[1]	1,700[2]	--	--
Chromium VI	11[1]	16[2]	50[1]	1,100[2]
Copper	12[1]	18[2]	--	2.9[2]
Lead	3.2[1]	82[2]	5.6[1]	140[2]
Mercury	0.012[1]	2.4[2]	0.025[1]	2.1[2]
Nickel	158[3]	1,418[4]	8.3[3]	75[4]
Selenium	--	5[3,8]	20[4,8]	54[3],410[4]
Silver	--	4.1[4]	--	--
Thallium	--	40[10]	1,400[10]	213[10]
Tributyltin	--	26[9]	--	10[9]
Zinc	110[1]	120[2]	86[1]	95[9]
Aluminum	87[1]	750[2]	--	--
Iron	--	1,000[4]	--	--
Manganese	--	--	--	--

Table 4.3.1.1-1. Federal EPA Water Quality Standards and Criteria
(page 2 of 3)

Parameter	EPA Ambient Water Quality Criteria-Freshwater Chronic (ug/L)	EPA Ambient Water Quality Criteria-Frisherwater Acute (ug/L)	EPA Ambient Water Quality Criteria-Marine Chronic (ug/L)	EPA Ambient Water Quality Criteria-Marine Acute (ug/L--)
Ammonia as N	Ratio[5]	Ratio[6]	--	--
Alkalinity as $CaCO_3$	--	20,000[7]	--	--
Cyanide	5.2[1]	22[2]	--	1.0[2]
Sulfide-Hydrogen Sulfide	2.0	--	2.0	--
Total Dissolved Solids	--	--	--	--
Chloride	--	--	--	--
Fluoride	--	--	--	--
Nitrate	--	--	--	--
Nitrite	--	--	--	--
Sulfate	--	--	--	--
Specific Conductivity	--	--	--	--
Polyaromatic Hydrocarbons	--	300[10]	--	--Carbon
Tetrachloride	--	35,000[10]	--	50,000[10]
p-Dichlorobenzene	763[10]	1,120[10]	--	1,970[10]
1,2-Dichloroethane	20,000[10]	118,000[10]	--	113,000[10]
1,1-Dichloroethylene	--	11,600[10]	--	224,000[10]
2,4-D	365[10]	2,020[10]	--	--

Table 4.3.1.1-1. Federal EPA Water Quality Standards and Criteria
(page 3 of 3)

Parameter	EPA Ambient Water Quality Criteria-Freshwater Chronic (ug/L)	EPA Ambient Water Quality Criteria-Frisherwater Acute (ug/L)	EPA Ambient Water Quality Criteria-Marine Chronic (ug/L)	EPA Ambient Water Quality Criteria-Marine Acute (ug/L)
2,4,5-D	—	—	—	—
Endrin	0.0023[10]	0.18[10]	0.0023[10]	0.037[10]
Lindane	--	--	--	--
Methoxychlor	0.03[10]	--	--	0.03[10]
Toxaphene	0.0002[10]	0.73[10]	0.0002[10]	0.21[10]
1,1,1-Trichloroethane	--	--	--	31,200[10]
Trichloroethylene	21,900[10]	45,000[10]	--	2,000[10]
Total, THMs	--	--	--	--
Vinyl Chloride	--	--	--	--

Notes: MCL = Maximum Contaminant Level
1. = 4-day average chronic
2. = 1-hour average acute
3. = 24-hour average
4. = instantaeous maximum
5. = see formula for chronic standards in EPA Quality Criteria for Water, EPA 440/5-86-001
6. = see formula for acute standards in EPA 440/5-86-001
7. = 20 mg/L or more for freshwater aquatic life except where natural concentrations are less
8. = per Marshack (1988)
9. = EPA, 1987 recommended provisional water quality criteria
10. = insufficient data to develop criteria; value persented is the LOEL (Lowest Observed Effect Level)

the effects of pollutants bound in sediments. For that reason, the RWQCB reserves the right to request the dredging proponent to conduct additional tests (i.e., chemical analyses of sediments for certain chemicals of concern in EPAs quality criteria for water, toxicity tests, and disposal alternatives comparisons) on the proposed dredged sediments. The board may also recommend disposal site monitoring to assess potential impacts following material disposal.

4.3.2 Hydrodynamics of Humboldt Bay

The California Current system is a broad (1000 km), sluggish current flowing southward off the Oregon and California coasts. It is the eastern boundary current of the large anticyclonic (clockwise) gyre that occupies most of the North Pacific Ocean (Jones and Stokes, 1981). The California Current is largely wind-driven and the position and intensity of the pressure cells determine the current speed and direction.

The California Current system along central and northern California undergoes fluctuation on an annual cycle. These seasonal fluctuations are in response to changes in the hemispheric atmospheric pressure cells. Winds blow from high pressure areas to areas of low pressure. Changes in the strength and location of these cells cause seasonal changes in the winds along the California coast. Three hydrographic patterns have been described with northern California seasonal wind patterns and include: the upwelling, Davidson Current, and oceanic patterns (Pequegnat *et al.*, 1990). Each of these current patterns have a time of year when they are most prevalent; however, current conditions are influenced by recent winds with the possible occurrence of any of these current systems appearing at any time of the year. Pequegnat *et al.*, 1990) describes the three current seasons or periods as follows:

- **Upwelling Conditions** are most common during the spring and early summer months, and are characterized by strong winds from the north and northwest and a southerly current on the shelf of from one half to more than two knots (>1.0 meters/sec). The water has low oxygen concentrations, low temperatures, and moderately high salinities (at least for the North Pacific Ocean).

- **Davidson Current** conditions are associated with the storms common in the late fall and winter, and are characterized by strong south and southwest winds, large waves, and a northerly current of up to approximately one knot (0.5 meters per second). During these periods nearshore water has low salinities, high concentrations of suspended sediment, moderate nutrient concentrations of suspended sediment, moderate nutrient concentrations, and is saturated with dissolved oxygen.

- **Oceanic Conditions** are common in late summer and early fall, when winds are light and from no predominant direction. During these periods in the California Current, normally offshore with a slow southerly set, moves closer to shore and brings low nutrient concentrations, high temperature, and moderate salinities to the nearshore

environment. The California Current is always present off the coast of California even during the Davidson and upwelling current periods. The direction of the current changes little, but speeds are greatest when north and northwesterly winds are blowing (Jones and Stokes, 1981).

Nearshore circulation current characteristics in the northern California nearshore region are determined by the alignment of the coast, the width of the continental shelf, oceanic currents, topography, bathymetry, winds, tides, density structure, waves and river discharge. At any location or time, one or more of these forces can predominate to influence local currents.

Offshore Circulation - This investigation is fortunate in that offshore current data for several sites near HOODS were available. Long-term current measurements were collected for the U.S. Department of the Interior's Mineral Management Service (MMS) as a component of the Northern California Coastal Circulation Study (MMS 1989). This data was collected for the MMS by EG&G Oceanographic Services and was made available to the Corps for subsequent analysis in this study. The current information obtained from EG&G Oceanographic Services was measured at two mooring sites, station E60 at a depth of 60 meters and station E90 in 90 meters of water. The general trends that this study demonstrated are surface velocities on the order of 25 cm/sec, middepth of 20 cm/sec and bottom velocities of 15 cm/sec. Elevated surface standard deviation values are probably due to the effect of local winds. Surface currents predominate with a southwesterly set, while bottom currents exhibit a northeasterly set.

Waves: Extratropical cyclones (low pressure storms) are the most important source of storm waves reaching the California coast during winter months, November through March. These storms originate near Japan and proceed eastward across the Pacific with the intensity of the waves decreasing southward along the California coast (Jones and Stokes, 1981). The summer months are dominated by the Pacific anticyclone (high pressure cell) with predominant wave action generated by the prevailing west-northwest to north-west winds along the coast.

Borgheld and Pequegnat (1986) utilized wave data from two wave rider buoys offshore of Humboldt Bay and described a seasonal pattern to wave spectra. Winter months (late October through early April) the wave spectra are dominated by longer period swells (periods greater than 12 seconds) generated by distant storms. The rest of the year the spectra demonstrate a greater predominance of locally generated waves (periods less than 12 seconds).

Tides are the periodic rise and fall of the earth's ocean resulting from the forces of the moon and sun acting on the rotating earth. The Humboldt area experiences mixed tides. Mixed tides result in two high and low tides per day (24 hours and 50 minutes). The tides are not equal in amplitude with one high and being the higher of the two high tides, and one low the lower of the two low tides. The tidal range between lower low water and the mean higher high water is 6.4 feet at the south entrance jetty to Humboldt Bay. Tides more than two feet below mean lower low water have been recorded.

4.3.3 Water Quality at Humboldt Bay and HOODS

Ocean water temperatures along the California coast respond to seasonal current changes, wind direction, insulation and upwelling. The temperature of the nearshore waters of northern California normally ranges from 9 to 14°C, with occasional episodes of up to 2°C outside this range. The salinities of the nearshore environment range from less than 25 parts per thousand (ppt) during periods of high runoff to greater than 34.0 ppt when deeper water is advected to the surface during periods of intense upwelling (Pequegnat and Mondeel-Jarvis, 1990).

Pequegnat and Mondeel-Jarvis (1990) describe temperature and salinity changes in nearshore waters adjacent to Humboldt Bay in relation to the hydrographic regimes as follows:

- **Upwelling regimes:** During upwelling periods the nearshore water temperature drops to below 10°C and the salinity rises to over 33.6 ppt. During intense upwelling periods the sea surface temperature may drop to less than 8°C, with salinities greater than 34.1 ppt. The water column is not stratified shoreward of the upwelling front; the distance offshore that the upwelling front is found depends upon both the wind velocity and the wind duration, but is typically more than five miles offshore during periods of moderate upwelling.

- **Davidson Current regimes:** Because the northerly flowing Davidson Current is associated with winter storms, the nearshore surface waters tend to be cool (less than 11°C) and of low salinity (less than 32 ppt) because of high runoff. The nearshore waters also tend to be highly stratified, primarily due to the vertical salinity gradient.

- **Oceanic regimes:** During periods of light and variable winds the warm surface water offshore tends to move onshore. Concurrently, the sea surface temperature typically rises to greater than 13°C and the salinity is usually less than 33.5 ppt. The waters are usually vertically stratified with respect to temperature and to a lesser extent salinity.

Dissolved Oxygen: The surface layers of the ocean are usually saturated with dissolved oxygen (DO), and DO concentration generally decrease with depth. During upwelling conditions the oxygen concentration in the surface waters may be less than 50% of the saturation concentration; this low oxygen concentration is associated with the deeper, low oxygen water which is advected to the surface.

Offshore field surveys conducted in September, 1990 at HOODS at 49 meters MLLW, dissolved oxygen levels ranged from 6.2 mL/l (105% saturation) to 3.5 mL/l (55% saturation); dissolved oxygen values at 55 meters MLLW ranged from 5.9 mL/l (100% saturation) to 2.2 mL/l (35% saturation).

Turbidity: Coastal waters generally have higher turbidities than open ocean waters as coastal waters are more subject to influences from land. Wastewater dischargers, river runoff, and resuspension of small particles on the bottom of shallower waters by waves and currents are the major contributors to nearshore turbidity. Nearshore turbidity values will decrease during the spring runoff season due to increased sediment loading from river waters. This has a direct effect on primary production since the amount of sunlight available to phytoplankton from the surface directly dictates the total amount of energy that may be converted to biomass. Within the first 10 centimeters of seawater, the majority of infrared radiation is absorbed and changed to heat. Within the first meter of seawater approximately 60 percent of the entering radiation is absorbed, and 80 percent is absorbed within the first 10 meters (Gross 1977).

Humboldt Bay is somewhat unique in that it has relatively low freshwater input for its size. Eight five percent of the freshwater input to the Bay comes from river drainage into Arcata Bay and the North Bay channel, twelve percent comes from direct precipitation, and the remainder is from runoff into the South Bay. The extensive movement of water in the channels with the ebb and flow of the tides results in turbulent mixing which rapidly eliminates any vertical stratification in the channels of the Bay, but there is a well-developed, two-layer estuarine system in place. The three major sources of nutrients to the Bay are runoff, the nearshore waters, and municipal wastewater. The State Mussel Watch program found Humboldt Bay to be one of the least polluted bays in the State.

Water quality in the nearshore area off Humboldt County is generally good. Dissolved oxygen levels are near saturation and contaminant levels are quite low. Dissolved oxygen levels are generally higher near the surface and the lowest levels tend to occur during the spring when upwelling brings cold, oxygen-poor water to the nearshore area. Water temperatures range between 7° to 15° C. with the lowest occurring during the upwelling season and the highest associated with the surfacing of the Davison current. Average pH is 7.9 with no clear variation due to season or depth. Salinity increases with water depth and ranges from 27 to 34 parts per thousand where water depth does not exceed 65 feet. Suspended sediment concentrations are somewhat high, a result of sediment suspension by waves and a high seasonal sediment input from land drainage and tidal currents from Humboldt Bay.

Results of field studies conducted at depths of 49 and 55 meters, at the HOODS site, indicated that water became clearer at mid-depths than at the surface but decreased in transmissivity near the bottom. It is suspected that the decrease in transmissivity at depth could be caused by either suspended sediment or by phytoplankton.

4.3.4 Groundwater

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.

The thickness of the alluvial deposits varies from 130 feet to over 375 feet 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.

In the north barrier spit (Samoa Penninsula) 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 is known to have been discovered in the south barrier spit. The total thickness of the dune sand comprising the spits is unknown, but is though to be in excess of 100 feet.

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.

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 alluvium terrace deposits, and Hookton and Carlotta formations, is predominately 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 the 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.

4.3.4.1 LP Site

No groundwater sampling results were available, but groundwater at the LP site is assumed to be of the sodium chloride type characteristic of the north spit. Surface water would be as described above for the Humboldt Bay adjacent to the disposal site. Presently, the LP site consists of two main settling ponds surrounded by dikes with baffles that can be managed to regulate the effluent water, and allow maximum percolation of the supernatant before it is discharged into Humboldt Bay. The LP site is served by the Humboldt Bay Municipal Water District, and no groundwater withdrawals are planned for this site. Monitoring, testing and reporting of data collected from the effluent and receiving waters is the responsibility of the dredging contractor and is required to be in full compliance with their waste discharge requirements.

4.4 GEOLOGY, SOILS, AND SEISMICITY

4.4.1 Regional Geology and Sedimentation

The northern California continental margin has a complex morphology which is developed because of the active tectonism in the area. The study area lies in close proximity to the Gorda-Pacific-North American triple junction, which is usually defined as the juncture of the San Andreas fault and the Mendocino Escarpment (Jones and Stokes 1994). North of the Mendocino Escarpment the coastline can be divided into two major sections based on the coastal morphology and underlying geologic structure.

The coast north of Trinidad Head is generally steep and rugged; offshore islands and seastacks are common. This section of coast is underlain by the Franciscan Formation. The beaches are generally steep, coarse-grained, and limited in lateral extent (the only major exception is Gold Bluffs Beach, just south of the Klamath River).

The study area lies within the other major morphologic area, the area between Cape Mendocino and Trinidad Head. The coast here is underlain by tertiary marine deposits and consists of a coastal plain dissected by meandering rivers and streams. The shore consists of relatively broad, flat beaches. The only major bay along the coast, Humboldt Bay, is found in this area.

The continental shelf north of Cape Mendocino is narrow when compared to the worldwide average, ranging from 10 to 35 kilometers in width (Jones and Stokes 1994). The surface of the shelf shows little relief except in areas near the major headlands where seastacks and underwater promontories are common. The lack of shelf relief, which is surprising considering the active tectonism, is due to the rapid sedimentation in the area. The shelf area has been called the Eel River shelf by Borgheld (1985) because the modern sedimentation is dominated by material supplied by the Eel River. Sedimentation rates vary but apparently range from 0.5 to 2.0 centimeters per year (Borgheld 1985, 1986). This rate is rapid for shelf areas supplied by all but the world's largest rivers. The rate is high because sediment yield from the local rivers is highest of any watershed of comparable size in the United States (Jones and Stokes 1994).

Sedimentation patterns on the Eel River Shelf are produced by a number of processes acting together. Sediments are supplied to the study area in a series of short-term deposition events. The pulsed nature of the sediment supply system is extremely important in the production of the sediment stratification on the shelf.

Numerous rivers and streams empty directly onto the coast in the study area. Of these, two deliver the majority of the sediment to the coast. The major supplier is the Eel River, to the south, which delivers an average of 24,750,000 metric tons of suspended sediment per year to the continental shelf (Borgheld 1985). The Mad River, to the north, supplies an average of 2,517,000

metric tons of suspended sediment per year. The rivers along the northern California coastline have short drainage basins and highly variable stream flows. These rivers characteristically carry the majority of their sediment load during two or three flood-events annually.

Borgheld (1988) has documented a secondary sediment supply system in the study area that is related to the ebb-tidal plume exiting Humboldt Bay. This plume acts like an additional river sediment plume by supplying sediment to the shelf. It delivers less sediment than the Eel River, but delivers the majority of its sediment during spring tides rather than during river flooding.

Each major sediment supply event (i.e., major flood of major spring tide) deposits a layer of sediment on the shelf. The layer is generally thickest near the sediment source and decreases in thickness with distance from the source. Therefore, floods tend to produce layers that are thickest near river mouths and the layers produced by ebb-tidal plume from Humboldt Bay tend to be thickest near the bay mouth.

Once deposited, a layer is mixed physically, by waves and currents, and biologically, by benthic organisms. The amount of physical mixing is primarily controlled by the size of incoming waves and the water depth; wave mixing is more intense in shallower water. Borgheld (1986) collected box cores near the mouth of the Eel River and noted that the flood history of the river has been preserved in the sediments near the river mouth. Thick layers (up to 10 to 12 cm thick) have been laid down during past floods of the river. In shallower water, generally less than 40 meters depth, these layers were subsequently destroyed by sediment remobilization and mixing caused by incoming waves. In water depths greater than 40 meters, many of the sediment layers were preserved, as presumably the water depths were too great for the incoming waves to significantly remix the bottom sediments. Instead, the mixing that occurred was generally limited to bioturbation.

Biological mixing occurs during the day-to-day activities of the organisms that live in, on, or near the bottom. It is unlikely that biologically-produced mixing is uniform on the continental shelf, but no detailed study of this mixing in the study area has been conducted. Borgheld (1985) noted that the biological mixing history of a layer was apparently related to the layer thickness; thick layers had little if any biological mixing while thin layers were commonly intensely mixed.

Wave mixing has an additional effect on the shelf sediment distribution: areas where the bottom sediments are continually resuspended by wave activity tend to have coarser sediments than deeper areas less influenced by waves. Fine-grained sediments (silts and clays) settle slowly compared to larger particles, and their continual resuspension effectively prevents them from accumulating in an area influenced by wave activity.

4.4.2 Sediment Distribution Patterns

Sedimentation produces varying sediment patterns on the Eel River shelf. Depending on the thickness of a deposited layer, the amount of mixing, the length of time before the next deposition event, and the intensity of the next deposition event, a layer may be either preserved (resulting in a variable stratigraphy on the seafloor), partially mixed, or completely mixed (resulting in a seafloor of more homogeneous sediment type).

Bottom sediment data for the study area have been presented by Field *et al.* (1980), Borgheld (1985), and Borgheld and Demirpolat (1986). Because of the variable nature of the bottom sediments with time, some averaging is required in order to produce a sediment distribution map. Of the sediment characteristics that have been used to present sediment data, the mean grain size best demonstrates the general trend of the sediment size distribution (Borgheld and Demirpolat 1986). Three major bottom types are apparent, and appear to be related to water depth:

- Fine to very fine sands cover the nearshore area from the shore to a depth of approximately 50 meters. The average grain diameter decrease with increasing water depth; this zone is commonly mixed by waves.

- The most variable bottom sediments lie in water 50 to 75 meters deep. They have been described as silty sands and sandy silts with variable clay contents. They generally decrease in average grain diameter with increasing water depth, but the trend is less developed than in nearshore sands. Borgheld (1985) describes this area as a demarcation between the nearshore sands and the muds which lie further offshore. These sediments are variable because this mud-sand boundary does not occur at a fixed depth; rather it migrates to shallower or deeper water depending on the wave climate, river flows, and the tide ranges currently in effect. The average sediment size at a location represents an average of the beds that exist at that location.

- In water depths greater than 75 meters, the bottom sediments are poorly sorted silty clays and clayey silts. The sediments are fairly uniform and have a mottled appearance indicative of fairly homogenized sediments. These sediments may be initially supplied as distinct strata, but they are destroyed by benthic organisms which mix the newly deposited material with previously deposited sediments.

4.4.3 Sediment Characteristics

Bottom sediment samples were collected during a study in August of 1989, and again in March of 1990, along transects located offshore of the previous disposal sites - SF-3 and NDS. The bottom sediment samples collected during this study show the same general characteristics that have been noted by previous investigators for samples collected on the Eel River continental shelf

(e.g., Borgheld 1985, Borgheld 1988). The sediments collected at the offshore transects represent three of the four major facies found on the shelf; these facies are discussed below.

Offshore Transects

Inner Nearshore Sands: In water depths shallower than approximately 35 meters, the bottom is covered by well-sorted medium to fine sands. These sediments contain no appreciable silt or clay component. The well-sorted nature of the sediments collected from these water depths is probably a testament to the intense physical mixing that occurs at these water depths. Waves are large enough and sediment mixing occurs frequently enough that these sediments are transported on a regular basis. Any silts, clays, or very fine sands that might settle here are subsequently remobilized and transported further offshore. Sediments in this zone are coarser in shallower water and are probably transported by both suspended and bedload during periods of large waves.

Outer Nearshore Sands: In water depths less than approximately 50 meters, the bottom is sandy in character. Near the outer edge of this zone, in water depths ranging from approximately 35 to 50 meters, the sediments consist of fine to very fine sands and very coarse silts. Medium to fine silts and clays are rarely encountered in this zone. In these water depths, the incoming wave energy is high enough to resuspend and transport fine silts and clays into deeper water, accounting for the lack of fine silt- and clay-sized sediments. Layers deposited in this zone by river flooding and ebb-tidal bay plumes are generally too thin to prevent their subsequent destruction by resuspension. However, the preservation of thicker flood layers in this zone has been documented by Borgheld (1985) near the Eel River mouth.

Wave resuspension and mobilization increase in shallow water, resulting in coarser sediments in shallower water. The nature of the sediment distribution, as well as the distribution of beds and strata on the shelf, suggests that this zone may be primarily influenced by sediment suspension and transport rather than by sediment bedload transport. The very fine sands and coarse silts that characterize the sediments in this zone may be too small to be effectively transported as bedload, being fine enough to be suspended during storms.

Mud-Sand Transition Zone: In water depths between approximately 50 to 75 meters, a transitional facies between the offshore muds and nearshore sands has developed. The water depth in this zone is generally too deep to be directly influenced by surface waves, although very large waves do transport suspended sediment out to these depths. In addition to sediments deposited during major storms by waves, this zone is close enough to the coast to also receive sediment from the major sediment sources. In the study area, the primary coastal sources of sediment are the Eel River and ebb-tidal plume of Humboldt Bay.

The influence of minimal sediment resuspension by surface wave activity and an increased number of sediment layers laid down on the seafloor have produced a sediment deposit that is too thick to be homogenized by benthic organisms. One result is the preservation of sediment beds;

these have been found in sediment cores collected from this zone (Borgheld 1988). Another result is the existence of both temporal and lateral variability of sediment samples collected from this zone.

Offshore Muds: In water depths greater than approximately 75 meters, the bottom is covered by poorly sorted muds; few beds or strata have been observed in cores collected from the deposit.

Disposal Sites: In the area of the HOODS, disposal represents an additional factor that contributes to the sediment distribution pattern. Although temporal and lateral variability exists in the sediments on the shelf, the general trend of decreasing sediment size with increasing water depth in non-depositional areas and the effect of the disposal of dredged material is apparent. Disposal of dredged material in the vicinity of IODS (now HOODS) produce layers that consist of material removed from Humboldt Bay. As with the other areas of the shelf, the ultimate preservation or remobilization of these layers is a function of the initial thickness of the layer, the time until the next layer is deposited, and the physical and biological mixing of the site.

4.4.4 Sediment Transport

Scheffner (1990) performed a sediment dispersion analysis for the HOODS site. The evaluation of the site was separated into two categories, a short-term investigation and a long-term mound stability analysis. The short-term analysis investigates the potential impact of the actual disposal operation on the local environment. This phase represents the initial minutes to hours immediately following the disposal operation during which time the material is entrained and dispersed as it descends through the water column to be deposited on the ocean floor.

The second aspect of the study is a long-term analysis of the stability of the proposed site. Once that a disposal mound has been created as a result of the disposal operation, the question of interest is whether the mound will remain stable over long periods of time or whether the combined action of waves and currents are sufficient to erode the transported material from the mound to be deposited outside the limits of the disposal site. Loss of material from the site would result in a classification of the site as dispersive.

Both short- and long-term analyses are dependent, in part, on the local wave fields and currents at the disposal site. Usually, these data must be either estimated for or collected from the site. This modeling effort of the HOODS was fortunate in that current data were available for several locations near the HOODS. The data were collected by EG&G Oceanographic Services for the U.S. Department of the Interior's Minerals Management Service (MMS) as a component of the Northern California Circulation Study.

Scheffner (1990) concludes that the HOODS site is non-dispersive. The conclusion was based on the two previously mentioned approaches of analysis. Short-term simulations of the disposal operation indicated that sediments are deposited on the bottom rapidly, leaving very little or no sediment in suspension for subsequent transport. A long-term simulation of sediment mound stability shows that, although sediment at HOODS can be moved short distances during peak current periods, the net long-term effect of local waves and currents on the mound is negligible.

4.4.5 Sediment Quality Testing Evaluation for Humboldt Harbor Deepening Project

Chemical and physical sediment analysis evaluations on sediments for the Humboldt Harbor Deepening Project navigation channels were conducted and reported by EVS Consultants in a report titled " Bioassays and Bioaccumulation Testing - Humboldt Harbor Deepening Project", dated February 1993. The results of the sediment chemical and toxicological results will be used to determine the suitability of dredged material from Humboldt Harbor Deepening Project for disposal at the HOODS, in compliance with Section 103 of the Marine Protection Research and Sanctuaries Act (MPRSA). The following is a summary of the sediment chemical and biological tests results.

a. Sediment Collection: Sediment samples were obtained in the Humboldt Harbor Deepening Project navigation channels during December 4-6, and on December 11, 1991. Samples were taken at a total of ten coring locations: samples HB1 and HB2 were taken in the Bar and Entrance Channel (from mudline to project depth of -55 feet MLLW); samples HB3 and HB4 were taken in the North Bay Channel (from mudline to project depth of -44 feet MLLW); sample HB5 was taken in the Outer Eureka Channel (from mudline to project depth of -44 feet MLLW); sample HB7 was taken in the Samoa Channel (from mudline to project depth of -44 feet MLLW); and samples HB8, HB9, HB10, and HB11 were taken in the Samoa Turning Basin (from mudline to project depth of -44 feet MLLW). Sampling at location HB6 was deleted from the study because the area represented by the this sample was removed from the deepening study. (Refer to plates 4.1-4.8, in the Humboldt Harbor and Bay Deepening Feasibility Study, for environmental sample locations)(Figure 4.4.5-1).

b. Sediment Physical Analyses: Grain size analyses was conducted initially on the ten samples to determine which project sediments were predominately sand, and met the exclusionary criteria for further testing as outlined in 40 CFR Section 227.13(b)(1). The EPA/Corps Regional Implementation Agreement (RIA) for the San Francisco District region, defines predominately sand as that material having at least 80 percent with a diameter larger than 0.062 mm (phi #+4) (COE 1993c). Dredged material from the Bar (HB1), Entrance (HB2), and North Bay (HB3, HB4) Channel of Humboldt Harbor were found to be composed predominately of sand, having 98.6, 98.4, 97.1 percent sand respectively. The 1992 and 1993 baseline surveys of these channels for the Corps maintenance dredging program show similar grain size patterns for these channels. Based on the grain size being predominantly sand in these channels, sediments in these areas have been determined to meet the exclusionary critria as defined in 40 CFR 227.13 and environmentally acceptable for ocean disposal without further testing. Samples in the Samoa Turning Basin, HB8 and HB9, did not meet the exclusionary critria. Sediment HB8 consisted of 2.2 percent gravel, 46.5 percent sand, 35.6 percent silt, and 15.7 percent clay, while HB9 sediment had 0.6 percent gravel, 65.1 percent sand, 25.2 percent silt, and 9.1 percent clay.

Due to their finer grain size, further evaluation of HB8 and HB9 sediments consisting of chemical and biological tests was determined necessary. Biological evaluations included the suspended particulate phase toxicity (SPP), 10-day solid phase toxicity, and 28-day bioaccumulation.

c. Bulk Sediment Chemistry Evaluations: The two sediment samples, HB8 and HB9, and the reference sediment from the HOODS, were analyzed for the following parameters: grain size, total organic carbon (TOC), chlorinated pesticides, polychlorinated biphenyls (PCBs), metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc), Organotins, and dioxins.

Total organic carbon was found to be 0.73 and 0.75 and .25 for sediments HB8, HB9, and reference respectively. Total petroleum hydrocarbons and oil and grease were not detected in project sediments or reference sediments (0.75 ppm). Sediments HB8 and HB9 were found to have slightly higher levels of metals compared to that of the reference site (less than 2.5 times for the 10 metals). The contaminants tributyltin and dibutlytin, were not detected (0.2ppb dl) in either project or reference sediments. Butyltin was detected at 0.3 ppb in the HB8 sediment. Of the 16 polyaromatic hydrocarbons analyzed, only Fluorene was detected in HB-8 sediments at 9 parts per billion. Phenanthrene was detected in the reference sediments at 10 parts per billion. Organochloride pesticides were not detected in either project sediment or the reference sediments. Similarly, no PCBs were detected. Results of the 1992 and 1993 baseline surveys are similar to the above. Total organic carbon <0.5 for the Samoa and Eureka channels and no detectable concentrations of oil and grease or organochloride pesticides, with the exception of 44-DDE detected in one Samoa channel sample at 3.3 ppb. Total Organotins for either channel has never exceeded 2 ppb for either survey, while polyaromatic hydrocarbons have been at negligible concentrations <160 ppb.

The ubiquitous Octachlorodibenzodioxin (O_8 CDD) was detected at 79, 2.2, and 11 parts per trillion (pptr) in sediments HB8, HB 9, and the reference sediment. Octachloro dibenzo dioxin (O_8 CDD) was also detected at 1 and 4.5 parts per trillion in the procedural blank and control (Whidbey Island, Washington) respectively. Project sediment HB-8 showed detectable levels of several other chlorinated dibenzodioxin and chlorinated dibenzofuran congeners including the most toxic congeners 2,3,7,8 Tetrachloro dibenzo dioxin (2,3,7,8 TCDD at 0.3 parts per trillion) and dibenzofuran (2,3,7,8 TCDF at 1.6 parts per trillion). HB-9 sediment did not have detectable levels of these more toxic congeners.

The dioxin congener 2378-TCDD has not been detected in sediments from Eureka or Samoa channel sediments during the 1992 and 1993 maintenance dredging baseline surveys. However, the furan congener 2378-TCDF was detected in the 1993 baseline survey at 0.51 parts per trillion in the Samoa Turning Basin.

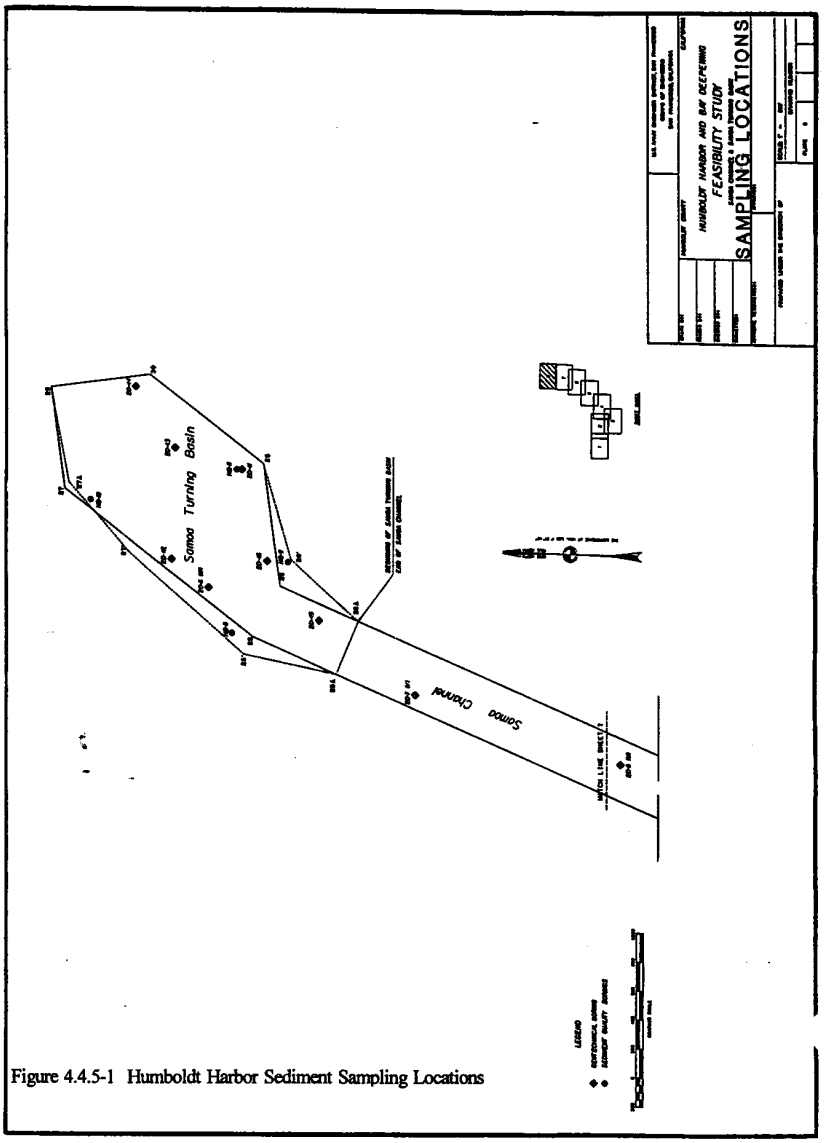


Figure 4.4.5-1 Humboldt Harbor Sediment Sampling Locations

d. Suspended Particulate Phase (SPP) Toxicity Results: Results of SPP toxicity tests are used to determine compliance with water quality criteria during open-water disposal of dredged material. The SPP test results were analyzed to determine the water column effects by comparing survival and normal development in 0%, 10%, 50,% and 100% SPP concentrations. The EC50 is that concentration of the suspended particulate phase (as defined in the joint COE/EPA 1991 "Green Book") which produces a 50 percent reduction of normal development during the test. Similarly the LC50 is that concentration that causes mortality in 50% of the test species.

After LC50 and EC50's are determined, interpretation of the suspended particulate phase test data requires an analysis of mixing and dilution after disposal. The implementing guidance states that dredged material may be considered environmentally acceptable if the bioassay results indicate that the limiting permissible concentration (LPC) will not be exceeded. The LPC of the suspended particulate phase is defined as that concentration which, after initial mixing, will not exceed a toxicity threshold of 0.01 of the acutely toxic concentration (0.01 times the LC50 value).

Suspended particulate phase (SPP) tests on sediments HB8 and HB9 were performed using three aquatic, marine species: juvenile speckled sanddabs (flatfish), mysids, and larvae of the blue mussel. Results of the three SPP tests showed no calculable LC50's for any of the three tests. Therefore, mixing calculations were not required and the Limiting Permissible Concentration (LPC) for water column impacts would not be exceeded during the disposal of HB8 and HB9 sediments.

e. Solid Phase Toxicity Tests: Solid Phase Toxicity Tests were performed on two species: the infaunal amphipod, *Rhepoxynius abronius* and the polychaete worm, *Nephtys caecoides*. In the *Rhepoxynius abronius* test mean survival was 14.0 out of 20 (70%) for HB8, 16.0 out of 20 (80%) for HB9, and 19.4 out of 20(97%) for the reference sediment. Mean percent survival in the control sediment was 19.6 out of 20 (98%). Based on these results, HB8 was determined to have statistically greater mortality ($P<0.05$) when compared to reference.

In the *Nephtys caecoides* test, mean survival was 17.6 out of 25 ((70.4%) for HB8, 20.6 out of 25 (82.4%) for HB9, and 23.2 out of 25 (92.8%) for the reference sediment. Mean percent survival in the control sediment was 24.8 out of 25 (99.2%). Based on these results, HB8 sediment was determined to have statistically greater mortality ($P<0.05$) when compared to the reference sediment.

The "Green Book" defines dredged material not meeting the LPC for benthic toxicity when bioassay organism mortality (1) is statistically greater than in the reference sediment and (2) exceeds mortality in the reference sediment by at least 10% or a value that is in accordance with approved testing methods (e.g., 20% for amphipod bioassays is recommended by EPA and USACE). Based on this criteria, sediment HB8 exceeds the LPC (limiting permissible concentration) for the solid phase test. This sediment caused statistically greater mortality compared to the reference sediment in both solid phase bioassays and the associated mortality was greater then the recommended limit of 10 and 20 percent for the *Nephtys caecoides* and *Rhepoxynius abronius* toxicity tests respectively.

f. Solid Phase Bioaccumulation Tests: Bioaccumulation potential, as well as toxicity, has to be in compliance with the regulations before a dredged material can be considered acceptable for ocean dumping. The Tier III benthic-bioaccumulation tests provide for the determination of bioavailability through 28-day exposure tests.

The initial contaminants of concern analyzed in the sediment chemistry evaluations included 17 organochloride pesticides, 4 polychlorinated biphenyls aroclors (PCB Aroclors 1242, 1248, 1254, 1260), 10 metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc), three Organotins (Tri-, Di-, and Butyltin), and dioxin congeners (polychlorinated dibenzodioxins and dibenzofurans). With the exception of 0.3 ppb butyltin detected in HB8 sediment, no other organic contaminants of concern, other than dioxin, were detected in sediments HB8 and HB. Therefore, it was determined that tissues chemistry in the bioaccumulation study did not require analyses for polychlorinated biphenyls, organochloride pesticides, or Organotins.

HB-8 sediments had detectable levels of several chlorinated dibenzodioxin and chlorinated dibenzofuran congeners including the most toxic congeners 2,3,7,8 Tetrachloro dibenzo dioxin and dibenzo furan (2,3,7,8-TCDD and 2,3,7,8 TCDF), while HB-9 (along with a procedural blank) only showed detectable amounts of Octachloro dibenzo dioxin (O8CDD). The presence of the two toxic congeners 2,3,7,8-TCDD and 2,3,7,8 TCDF in HB-8 at detectable levels of 0.3 and 1.6 parts per trillion (pptr) constituted a "reason-to-believe" that further study was warranted on the HB-8 sediments. Theoretical Bioaccumulation Potential (TBP) calculations were conducted by the Army Corps of Engineers Waterways Experiment Station (WES) using protocols outlined in the Green Book Tier II evaluations, assuming a TOC value of 0.75% and a lipid value of 1.5%. The TBP calculations showed values of 0.6 pptr and 2.4 pptr assuming apparent preference factors of 1 and 4 respectively. Although these values were extremely low, it was concluded that there was sufficient reason to include analyses for the Dioxin congeners in the tissue samples for HB-8.

Solid Phase bioaccumulation tests were performed using two species: the clam *Macoma nasuta*, and the polychaete worm *Nephtys caecoides*. Statistical analyses of tissue chemistry for metals show concentrations of chromium and nickel in the clam tissue to be statistically greater in HB8 and HB9 sediments when compared to reference sediment. The levels of chromium and nickel, however, were less than 2 times that of the reference. Lead levels in HB9 clam tissues were also statistically greater than the reference tissue (1.3 times higher than reference). Copper levels in HB9 worm tissue was statistically greater than the reference tissue (2 times higher than reference).

Certain replicates of the background, control, reference and HB-8 clam and worm tissues contained detectable levels of dioxins and furans. Statistical comparisons could not be performed on the worm tissue data because a shortage of sample necessitated the compositing of the individual replicates for each sample prior to analyses.

Worm Tissues: The ubiquitous dioxin congener O8CDD was detected at levels between 0.7 and 2.1 pptr in all treatments (HB8, background, control, and reference tissues). No other congener was detected.

Clam Tissues: The toxic dioxin and furan congeners 2378-T4CDD and 2378-T4CDF were detected at 0.12 and 0.14 pptr respectively in the control. Statistical analyses of both total T4CDD and 2378-T4CDD indicated there were no significant differences (P,0.05) between the control and the reference. H7CDD was detected in two HB-8 replicates (0.4 pptr), but no significant differences between the test and reference tissues were detected by an analysis of variance and Dunnett's t-test. The most persistent dioxin, O8CDD, was detected in all treatments but the reference. Concentrations in HB8 were significantly higher ($P<0.05$) than the reference sediment.

g. Conclusions for the Bioaccumulation Tests for Humboldt Harbor Deepening Project Sediments:

According to the "Green Book", concentrations of contaminants of concern in tissues of benthic organisms following 28-day exposure to the dredged material are compared initially against applicable Food and Drug Administration (FDA) Action Levels for Poisonous or Deleterious Substances in Fish and Shellfish for Human Food, when such levels have been set for the contaminants. Current FDA action levels have been set for only a handful of contaminants, mostly pesticides. No metals or dioxin limits are currently listed. In the case where no FDA levels exist for the contaminants of concern, the "Green Book" states that information is insufficient to determine compliance with the bioaccumulation aspects of the benthic criteria of 40 CFR paragraph 227.13(c)(3), and the dredged material has to be further evaluated in Tier III. In Tier III one of the following conclusions is reached:

- Tissue concentrations of contaminants of concern in organisms exposed to dredged material do not statistically exceed those of organisms exposed to the reference sediment, and therefore the dredged material meets the LPC for bioaccumulation and complies with the benthic criteria of paragraph 227.13(c)(3).

- Tissue concentrations of contaminants of concern in organisms exposed to dredged material statistically exceed those of organisms exposed to the reference material. The magnitude to determine compliance with paragraph 227.13(c)(3), when bioaccumulation of contaminants in dredged-material tests statistically exceeds that in the reference-material tests, the "Green Book" recommends the following factors that should be assessed to evaluate LPC compliance.

1. Number of species in which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference material.

2. Number of contaminants for which bioaccumulation from the dredged material is statistically greater than bioaccumulation from the reference material.

3. Magnitude by which bioaccumulation from the dredged material exceeds bioaccumulation from the reference material.

4. Toxicological importance of the contaminants whose bioaccumulation from the dredged material statistically exceeds that from the reference material.

5. Phylogenetic diversity of the species in which bioaccumulation from the dredged material statistically exceeds bioaccumulation from the reference material.

6. Propensity for the contaminants with statistically significant bioaccumulation to biomagnify within aquatic food webs.

7. Magnitude of toxicity and number and phylogenetic diversity of species exhibiting greater mortality in the dredged material than in the reference material.

8. Magnitude by which contaminants whose bioaccumulation from the dredged material exceeds that from the reference material also exceed the concentrations found in comparable species living in the vicinity of the proposed disposal site.

HB8 SEDIMENTS: Tissue concentrations of the metals, chromium, and nickel in the clam tissue were statistically greater than the reference. The magnitude by which bioaccumulation from the dredged material exceeds bioaccumulation from the reference material is less than 2X the reference. This magnitude is considered insignificant. Natural bioaccumulation magnitude differences of about 2X of metals are commonly observed within a species in bioaccumulation tests. In addition, because of the low absolute levels of these metals in the sediments to begin with, and because only two metals bioaccumulated at a statistically determinable higher concentration, there is not a significant risk for environmental effects due to metals in the HB8 sediments.

The most persistent dioxin congener, O8CDD, was also shown to be statistically higher ($P<0.05$) than the reference. Because there was no detection of O8CDD in the reference tissue (clam), a determination of the magnitude by which the levels in HB8 tissue exceeds the reference can not be calculated. The presence of O8CDD is not considered toxicologically important by itself, but is a indicator of the potential presence of the planar congener 2378 TCDD, which EPA considers the most potent known animal carcinogen, as likely human carcinogen. Therefore, because is not the planar toxic 2379 TCDD congener, and because of the extremely low O8CDD levels bioaccumulated (1.59 pptr), the presence of the contaminant dioxin and it's associated congeners, is considered to be a trace contaminant that would not pose potential significant undesirable effects due to bioaccumulation in marine organisms.

HB9 SEDIMENTS: Tissue concentrations of the metals chromium, nickel, and lead in the clam tissue were statistically greater than reference. Copper levels in worm tissue was statistically greater than the reference tissue (2 times higher than reference). Because of the lack of tissue,

statistical comparison of HB9 to reference for the detected congener, O8CDD, could not be conducted. However, the pooled tissue analyses showed that a O8CDD concentration of 0.7 pptr, which was equal to the average values detected in the control and reference tissues. Therefore, it is estimated that the HB9 sediments would not have caused bioaccumulation greater then that caused by the reference sediment for this dioxin congener.

h. Conclusions for the Suitability of Humboldt Harbor Deepening Project Sediments for Aquatic Disposal:

1. Sediments HB1, HB2, HB3, HB4, HB5, HB7, HB10, and HB11: These sediments were determined to meet the grain size exclusionary criteria outlined in 40 CFR Section 227.13 (b)(1), and acceptable for ocean disposal without further testing.

2. Sediment HB8: This sediment did not produce any calculable LC50 in the suspended particulate phase tests. However, this sediment showed statistically greater mortality in both the *Nephtys caecoides* and *Rhepoxynius abronius* solid phase tests. Only minor elevated bioaccumulation of a few metals was shown by HB8 sediments. The dioxin congener O8CDD was shown to bioaccumulate statistically higher than the reference sediments, but at levels not considered significant. Based on the results of the 10 day toxicity tests, these sediments are considered unsuitable for unconfined aquatic disposal and will need to be properly placed in an upland disposal area such as the proposed LP Site.

3. Sediment HB9: This sediment did not produce any calculable LC50 in the suspended particulate phase tests, nor did it show any statistically significant toxicity in the solid phase tests. Bioaccumulation of contaminants from this sediment was shown to be insignificant when compared to reference sediments. Based on these results, sediments represented by HB9 do not exceed any LPC requirements and are suitable for unconfined aquatic disposal.

4.4.6 Seismicity and Tsunamis

Humboldt Bay is located near one of the most seismically active regions in California. The local seismic history is relatively active, extremely complex, and not fully understood. 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. A branch of the active San Andreas Fault Zone extends inland 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. Geologically recent earthquakes include: one in 1954 with a richter magnitude 6.5, which centered on the Mad River fault zone about 10 miles from Eureka; a magnitude 7.0 earthquake occurred in November 1980, approximately 26 miles offshore of Patrick's Point, and approximately 33 miles north of Eureka; and a magnitude 7.0 earthquake occurred in April 1992, 27 miles south-southwest of the Humboldt Bay Entrance channel and near the town of Petrolia. This 1992 earthquake was quickly followed by two aftershocks of magnitude 6.0 and 6.5, respectively.

The aftershocks were located approximately 10 miles offshore of Cape Mendocino along the southern end of the subduction zone. These three earthquakes caused extensive damage in the town of Ferndale, located 13 miles south-southeast of the Humboldt Bay Entrance channel. No damage to the jetties along the Entrance channel was detected, and no damage was found to the breakwater and jetty at Buhne Point, located approximately one mile southeast of the Entrance channel. In addition, in late December 1994, a magnitude 5.3 earthquake occurred approximately 11 miles offshore of Eureka.

A tsunami is a sea wave produced by an offshore earthquake. 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. Although, tsunamis have reached Humboldt Bay only infrequently in the past, the possibility exists for future recurrence of tsunamis.

4.4.7 Humboldt Shoreline Monitoring Program

In 1990, when the Corps first proposed the use of HOODS for disposal of dredged material from Spring and Fall maintenance dredging of Humboldt Bay, the California Coastal Commission (CCC) expressed concern about the potential loss of sand from the Eel River littoral cell. In response, the Corps developed a multi-year shoreline monitoring program to monitor erosive and accretionary trends that may result in shoreline changes attributable to removal of material from the littoral cell. The Shoreline Monitoring Program had been scheduled to occur every 3 years from 1990 to 1999, then at 5 year intervals thereafter. However, due to the concerns of the CCC, the monitoring program was stepped up one year, and the first post-baseline data setwas collected in November of 1992. The established program will be re-evaluated after each data set is collected and is collected and analyzed.

The data to be gathered during the monitoring program include: aerial photography pof the coastline from the mouth of the Eel River to the mouth of the Mad River (approximately 37 kilometers (km); scale of 1:12,000); 14 dune and beach profiles spaced evenly 9.6km north and 9.6km south of the Humboldt north and south jetties, respectively; and eight additional profiles up to 3km north of the north jetty in order to monitor dune building.

The data analysis will include zoom-transfer scope work on the aerial photography and profile change analysis on the survey data. Zoom-transfer scope work will be apllied to the Mean High Water Line (MHWL) as depicted by the wetted bound to produce a Fall shoreline. This shoreline will be compared with the trend lines and confidence limits developed for 16 measurement stations discussed in a Moffatt & Nichol Engineers report (August 1991). The vegetation line will be digitized and compared to earlier vegetation lines. Profiles will be analyzed for area

changes from the profiles taken in February of 1991. Additional profiles taken north of the north jetty will serve as a basis for comparison of future surveys in that area.

Any new data points which occur over 37 meters below the corresponding extrapolated trend line will require that some action be taken. The 37-meter allowable shoreline change limit is based on the average 95% confidence limit for all trend lines presented in the Moffatt and Nichols report (20 meters) plus 17 meters allowed for error in wetted bound location. The action to be taken will first describe the extent of the deviation and probable cause of the deviation. If the probable cause of the deviation is not readily available, the monitoring program, if deemed necessary, shall be changed to determine the most probable cause. Finally, if the dredging disposal practices are deemed responsible for any detrimental shoreline effects, alternate sediment management practices will be recommended.

Results of the FY 1992 Shoreline Monitoring Program are detailed in a case study on the "Dependence of Shoreline Change on Channel Dredge Material Disposal Practices, Humboldt Bay, CA" (Appendix D; Madalon and Kendall 1993). Presently, no relation between shoreline change and dredge disposal at HOODS has been determined. Due to the variety of factors affecting shoreline position, effects of dredge disposal at HOODS may not be realized for 10 to 20 years. Continued regular shoreline monitoring of the dynamic Humboldt shoreline will help identify any significant trends (i.e., erosion or accretion) earlier, and would be compared to the historic trends established in the Moffat & Nichol report.

4.4.8 Concern About Jetty Alignment and Maintenance Dredging

One of the concerns raised by an individual during the NOI/NOP comment period was the following:

> "Dredging of the channels is needed because ocean and Bay currents deposit sediment into Humboldt Harbor navigation channels. One of the main problems is that jetties are not positioned according to the "natural" (original) current patterns making Bay flushing more effective. What would be the "natural" flushing of Humboldt Bay without the jetties? How effective would the "natural" flushing action be in maintaining 40-50 feet channel depth? What would be the cost/benefit analysis of realigning the jetties in terms of annual dredging cost savings? What would be the environmental effects upon the fisheries and wildlife values of Humboldt Bay in the longterm?"

After examination of seven bathymetric surveys of the Humboldt Bay entrance before jetty construction, by the Corps, the following was found: The alignment of the entrance to Humboldt Bay varied from "south of west to west to north of west". If there were no jetties, the entrance orientation is dependent, for the most part, on sediment transport up and down the coast, not on hydraulic flushing by the tidal prism. In these "natural channels", the natural depth can shoal to less than 10 feet. It is believed that repositioning the jetties would not benefit in reduced dredging

quantities. Formerly, it was believed that dominant sand transport was from the north, however, with the benefit of better wave data and advances in sediment transport theory, it is now believed that the dominant direction of transport in the Humboldt area is from south to north. Only the largest swells, which are from the west southwest, are capable of transporting sands around the jetty heads and into the channel. Repositioning the jetties to the south could actually allow more sand to enter the Entrance Channel and increase dredging quantities. This increase in shoal material would be minor, however, since the water depths at the ends of the jetties tend to dictate the amount of sand that enters the channel more than changes in jetty orientation. The jetty orientation would have little environmental impact within the Bay itself, and there would be no benefit associated with re-orientation of the jetties.

4.5 BIOLOGICAL RESOURCES

4.5.1 Humboldt Harbor and Bay, Navigation Channels, and HOODS

4.5.1.1 Marine Wildlife

California's coastal waters support an abundance of diverse marine life. This diversity can be attributed to rich food sources, warm and cold currents, seasonal upwellings, a mild climate, and a variety of habitats including: shallow and deep reefs; kelp forests; surf-pounded sandy beaches; deep submarine canyons and trenches; and quiet, soft-bottom habitats away from shore (Ricketts *et al.* 1939, Winzler and Kelly 1977).

Offshore Humboldt Bay, the open coastline is pounded by surf from ocean swells. The ocean bottom consists of sandy to silty clay and there is little cover, protection from waves, or rocky structures to provide habitat. The species in this area are adapted to seasonal changes such as wave height, substrate type, and circulation patterns. Although this habitat seems suboptimal, these sandy bottoms actually support a wide variety of epifaunal and infaunal organisms that support an abundance of fish life (Winzler and Kelly 1977).

Within the affected environment, commercially important biological resources include groundfish (English sole, Dover sole, Pacific sanddab, rockfish), Dungeness crab, and salmon, all of which seasonally inhabit the area proposed for dredged material disposal. A variety of seabirds and marine mammals also occur near the Humboldt Open Ocean Disposal Site (HOODS). Of lesser importance commercially, but of great importance ecologically, are the planktonic and benthic communities that provide food for higher trophic level organisms.

4.5.1.2 Plankton Community

The open waters off Humboldt Bay are part of the California current region, an area where biological components from a variety of marine biotic provinces mix (Jones and Stokes 1981). Few endemic species or distinct neritic (shallow coastal) assemblages are found in this pelagic environment (Jones and Stokes 1981), but warm-water species from the central Pacific province and warmer water cosmopolitan species occasionally occur (Jones and Stokes 1981). Plankton biomass and species composition in this region are influenced by the southerly flowing California current and the Davidson Current that flows sporadically northward in winter. In addition, the upwelling of cold, nutrient-rich deep water during late spring and summer fertilizes surface waters, promoting plant growth.

Phytoplankton

Phytoplankton are chlorophyll-bearing microscopic algae that passively drift or have limited means of locomotion and are, therefore, carried by waves and currents. Phytoplankton forms the

basis of marine food chains by using solar energy to convert inorganic nutrients into organic matter through photosynthesis. The distribution and abundance of phytoplankton depends on light intensity, nutrient concentrations, intensity of grazing, turbulence, turbidity, upwelling, and circulation. The abundance and variety of phytoplankton in surface waters, in turn, influences the subsequent production of zooplankton and benthic organisms.

Phytoplankton concentrates in surface waters where light is available, but vertical distribution is affected by waves and currents. Phytoplankton biomass (as indicated by chlorophyll a concentrations) is usually lower offshore (15-20 mg chlorophyll a/m^2 in the upper 150 m) than nearshore (approximately 300 mg chlorophyll a/m^2 in the upper 150 m) (Owen 1974).

Phytoplankton populations in the coastal waters of northern California are generally composed of diatoms, dinoflagellates, coccolithophores, and flagellates (Hood et al. 1990). Primary production and phytoplankton biomass increase after persistent upwelling periods when cold, nutrient-rich waters induce intense blooms of diatoms. Photosynthetic carbon production rates can be two to ten times higher in areas of pronounced upwelling than in open ocean waters. The rate of primary production in northern California coastal waters is about 150 g C/m^2/year but may reach 300 g C/m^2/year in upwelling regions (Jones and Stokes 1981). Following blooms, phytoplankton biomass declines as nutrients become limiting and phytoplankton is eaten by grazers.

The warmer, nutrient-poor oceanic water of the California Current supports less biomass and relatively smaller species of phytoplankton species than those present during upwelling (Hood et al. 1990). During the stormy fall and winter season, primary production rates are low due to reduced solar radiation, reduced upwelling, increased mixing of surface waters below the euphotic (sunlit) zone, and increased turbidity due to wave action and increased flow of sediment-laden river water. The northerly flowing Davidson Current occasionally influences phytoplankton composition offshore Humboldt Bay during winter months by bringing warm water phytoplankton species from central Pacific waters.

Zooplankton

Zooplankton are aquatic invertebrates that have limited mobility or passively drift with water currents. Zooplankton transfer some of the energy of primary producers to larger invertebrates, fish, birds, and marine mammals. Zooplankton are divided into two main groups: holoplankton, which spend their entire life cycle in the water column; and meroplankton, which consists mostly of the larvae of benthic macroinvertebrates that are temporary members of the zooplankton community. The larvae of polychaetes, bivalves, gastropods, and crustaceans are typical meroplanktonic organisms while holoplanktonic organisms include copepods, mysids (opossum shrimp), euphausiids (krill), and chaetognaths (arrow worms). Microzooplankton, which includes the larval stages of larger zooplankton as well as single-celled organisms, are not discussed here.

Zooplankton populations are regulated by water temperature, food availability, and predation. Zooplankton is most abundant within the top 20-30 m of the water column (Peterson and Miller 1977) and close to shore over the continental shelf (Pearcy 1972, Colebrook 1977, Peterson and Miller 1977).

Zooplankton distribution tends to be extremely patchy, largely as a result of ocean currents (Wickett 1967). The vertical distribution of zooplankton is determined by light, phytoplankton density, food, and the biology of each species. Zooplanktonic species from the Subarctic, Transition, and Central Pacific faunal groups have been identified in the coastal upwelling region offshore Oregon (Peterson and Miller 1977). The oceanic currents that influence the zooplankton composition of the coastal waters offshore Oregon are similar to those that influence the affected area offshore Humboldt Bay (Hickey 1978).

Peak zooplankton abundance in the coastal waters offshore northern California occurs from May through July in response to increased food availability following upwellings. Zooplankton abundance is generally lower during the winter months (Peterson and Miller 1977). Many upper trophic level organisms (i.e. pelagic fishes, marine birds, and mammals) occur seasonally in the area in apparent response to an increased abundance of prey.

The predominant holoplanktonic organisms in the coastal waters off northern California are copepods, such as *Calanus pacificus*, *Acartia spp.*, and *Pseudocalanus sp.*; *mysids*, such as *Neomysis kadiakensis* and *N. rayi*; and *euphausiids*, including *Thysanoessa spinifera* (Peterson and Miller 1977, 1979; Lockheed Center 1979, Pequegnat *et al.* 1990). Zooplankton species with northern affinities dominate in the summer when the California Current flows to the south. The copepod *Pseudocalanus spp.* is an abundant component of the California Current zooplankton restricted to within 5 km of the coast (Peterson *et al.* 1979). Warm water species are transported northward during the winter by the Davidson Current.

The pelagic larval stages of many shallow-shelf benthic invertebrates such as Dungeness crab (*Cancer magister)*, form an important seasonal component of the meroplankton (Jones and Stokes 1981). Following hatching, Dungeness crab zoeae larvae remain in the plankton off central California from mid-December to mid-March (Reilly 1983a). Considerable offshore movement of zoeae occurs, and these larvae can be found in depths greater than 30 m (Reilly 1985). After upwelling begins in April and May, megalopae, the final pelagic stage of Dungeness crabs, appear near shore in large concentrations. The mechanism by which they move inshore is unclear (Pauley *et al.* 1989). Megalopae occur off Humboldt Bay from April to June, concentrating at the surface, especially at dawn and dusk. They are frequently associated with floating materials, slicks, and upwelling fronts (Toole 1989). Dungeness crab larvae feed on zooplankton and are preyed upon by plankton-feeding fish such as salmon (Reilly 1983b) and rockfish (Prince and Gotshall 1976).

The zooplankton species identified offshore Humboldt Bay are an essential link in the food web of the affected area but are not of direct economical or commercial importance.

4.5.1.3 Benthic Community

Algae Community

Attached plants are uncommon in open coastal waters with sandy bottoms because of a lack of nutrients, few attachment sites, and inhibition by waves and longshore currents. Some seaweeds, mostly *Fucus distichus* and *Ulva sp.*, are found along the intertidal and subtidal portions of the north and south jetties. The lack of suitable substrate and the intensity of wave action prohibits the development of large kelp beds in the subtidal area off Humboldt Bay.

Invertebrate Community

Benthic macrofaunal invertebrates are those organisms (generally > 1 mm) that inhabit bottom sediments. Only a few detailed studies of the benthic invertebrate communities offshore Humboldt Bay have been performed (ERC 1976, Lockheed Center 1979, IEC 1981, Winzler and Kelley 1984, Pequegnat and Mondeel-Jarvis 1990, Pequegnat *et al.* 1990), and only one study sampled the benthic macrofauna in water deeper than 30 m (Pequegnat et al. 1990). The preferred unconfined aquatic disposal site, HOODS, ranges in depth from 49-55 m.

Benthic Infauna

The distribution and abundance of benthic infauna nearshore continental shelf sediments is related to sediment grain sizes (Gray 1974), organic content of sediments, interactions among organisms, and environmental disturbances (such as storm waves and high sediment loads associated with episodic floods and drag fishing). These factors determine the species composition of an area (Pequegnat *et al.* 1990).

Polychaetes, crustaceans, and mollusks are the dominant forms of infauna inhabiting the subtidal benthic environment offshore Humboldt Bay. Infaunal biomass is dominated by polychaetes, bivalves, and gastropods (Pequegnat *et al.* 1990). Patchiness in the distribution and abundance of dominant species has been reported for the benthic infauna offshore Humboldt Bay (IEC 1981, Pequegnat *et al.* 1990). Total infaunal abundances reported have ranged from 2400 organisms/m^2 in March to 3450 organisms/m^2 in August (Pequegnat *et al.* 1990).

In general, the number of species and the abundance of the benthic infauna increases with increasing depth in the affected environment (Pequegnat et al. 1990). Deeper water environments are free from wave action and sediments are finer and contain more organic debris.

Three zones of benthic infauna have been identified (Pequegnat *et al.* 1990): the nearshore zone (<35 m); the mid-depth zone (35 - 55 m); and the offshore zone (>55 m). The break between the mid-depth and offshore zones does not occur at a fixed depth, but is believed to be highly mobile between the depths of approximately -55 to -75 meters. The migrating nature of this boundary is in response to the wave energy and sediment supply to the shelf. At water depths greater than 55 m, silts, and organic material increase incrementally in bottom sediments with increasing bottom depth. This transitions area between the mid-depth and offshore zones is called the "Mud-Sand Transition Zone".

The nearshore benthic zone has clean sand with little organic debris and is swept by waves. The infaunal diversity in the nearshore is low, and there are more suspension feeders and fewer burrowing deposit feeders than found further offshore. Small polychaetes, amphipods, cumaceans, and mollusks are the principal infauna in the nearshore zone (Lockheed Center 1979, IEC 1981, Winzler and Kelley 1984, Pequegnat *et al.* 1990). The abundance and diversity of infauna in the nearshore zone varies seasonally (Pequegnat *et al.* 1990, Winzler and Kelley 1984) probably because of seasonal wave action in the relatively shallow depths. Deposit feeders, however, are generally non-mobile and feed from burrows within the sediments. Sediments with higher organic content provide better habitat for non-motile deposit-feeders.

As previously stated, the break between the mid-depth and the offshore zones does not occur at a fixed depth but ranges from 55-75 m in depth in response to wave energy and sediment supply. The HOODS is located within this transition zone.

The Mud-Sand Transition Zone (>55 m but <75 m) contains fine sands with silty clays and terrestrial organic debris. More infaunal species and individuals as well as more burrowing, deposit feeding polychaetes and mollusks are found in this zone than closer to shore. The sediments in this zone are finer and contain more organic material and so provide a more suitable habitat for burrowing infaunal organisms than the sand substrates of the nearshore and mid-depth zones. For example, the bivalve (*Axinopsida serricata)*, has only been found in water >49 m deep, probably because the finer-grained sediments found in deeper water are better for burrowing (Pequegnat *et al.* 1990). The stability of this environment is partly responsible for its relatively higher diversity and the increase in sedentary burrowing and tube-dwelling infauna (Oliver *et al.* 1980).

Amphipods, cumaceans, isopods, polychaetes, and clams have been identified in the stomach contents of demersal fish and Dungeness crab taken in the affected environment (ERC 1976). Demersal fish and Dungeness crab probably feed on benthic infauna from a range of depths but specific feeding grounds have not been positively identified.

Benthic Epifauna

Epifauna refers to animals that are associated with the surface of the sea floor rather than those that burrow into sediments. Most of the epibenthic species captured in trawls offshore Humboldt Bay are carnivorous or omnivorous. These species affect the distribution and abundance of infaunal prey (Woodin 1974, Virnstein 1977).

Decapods, particularly *C. magister* and three species of shrimp, Bay Shrimp *(Crangon franciscorum)*, Sand Shrimp *(C. nigricauda)*, and Coon-stripe Shrimp (*Pandalus danae*), are numerically dominant organisms in the region. Pequegant *et al.* (1990) report that these species are generally more abundant and found at greater depths in March than in August. Common echinoderms include the Short-spined Star *(Pisaster brevispinus)*, Brown Mud Star (*Luidia foliolata*), and the Pacific Sand Dollar (*Dendraster excentricus)*. Large numbers of sand dollars are found in the nearshore and mid-depth zones.

The most important epifaunal invertebrate reported in this region is the Dungeness crab, which is fished commercially all along the northern California coast. Most of these crabs are taken from water less than 55 m deep; however, this may be partly due to the depths to which fisherman are willing to lower their crabpots (Pequegnat *et al.* 1990). Adult crabs are found living over several substrate types, but they prefer sandy-mud bottoms (Karpov 1983; Lawton and Elner 1985). Dungeness crab are highly mobile and change depths in response to local conditions such as storm turbulence.

Adult male and female Dungeness crabs move into shallow sandy areas to mate between March and July; between September and November egg-brooding females partially bury themselves in the sand in shallow subtidal and intertidal areas until their eggs hatch. The distribution of the planktonic life stages are discussed in the section on zooplankton. Juvenile Dungeness crab remain at the bottom of estuaries or shallow nearshore areas for 11 to 15 months before moving offshore. Researchers are currently debating if juvenile crabs need specific areas such as estuaries as nursery grounds (Toole 1989, Pauley *et al.* 1989; Pequegnat *et al.* 1990).

Dungeness crabs occupy successive trophic levels as they develop. Larvae eat zooplankton and are, in turn, preyed upon by fish. Adult Dungeness crabs are opportunistic feeders that eat mollusks, crustaceans, and fish as well as serving as prey to numerous predators. According to Stevens *et al.* (1982), crabs eat bivalves during their first year, shrimp *(Crangon spp.)* their second year, and juvenile fish in the third year. Cannibalism is common among these crabs and probably influences juvenile and adult abundance. Crabs move into shallower water at night and deeper water in the day; this response has been correlated with food availability (Stevens *et al.* 1984).

Caridean shrimp (*C. franciscorum, C. nigricauda*) found offshore Humboldt Bay are important food items for demersal fish and crabs. The commercially fished Pink Shrimp

(Pandalus jordani) was not found in any of the trawl samples collected by Pequegnat *et al.* (1990). Pink shrimp are reportedly commercially fished in depths over 70 m from Patrick's Point north.

Sand dollars are found in extensive, densely-packed beds at depths of 0 to 100 m (Pearse 1975). Depending on sea conditions, sand dollars migrate into shallow water when it is calm and offshore during storms. Sand dollars are found in narrow bands along shore off Humboldt Bay throughout the year and are common at 12 m in September (Pequegnat and Mondeel-Jarvis 1990).

Pelagic Macroinvertebrates

A few squid (*Loligo sp.*) were captured in trawls made by Pequegnat *et al.* (1990) offshore Humboldt Bay in 31 to 55 m of water in August and March. However, none have been reported in previous trawl samples from this vicinity (Lockheed Center 1979, IEC 1981, Winzler and Kelley 1984). The distribution of Market Squid (*Loligo opalescens)*, is unclear, and environmental influences are largely unknown (Kashiwada and Recksiek, 1978). Squid egg sacks are occasionally found on crab pots off the Humboldt County coast and are an incidental catch by trawling shrimp fishermen in water 72-182 m deep (R. Warner, pers. comm.). However, market squid apparently do not occur in adequate numbers to support a commercial fishery in this area.

4.5.1.4 Fish Community

A total of 562 species of fish have been identified in California's coastal waters. In discussing the ecology of fishes, species are commonly grouped into assemblages based on broad similarities in biology or where they are found (Miller and Lee 1972). Nearshore bottom fish, deep water benthic fish, schooling marine fish, and anadromous fish are major fish assemblages. Nearshore bottomfish and deep-water benthic fish are called demersal because they are associated with the sea floor, whereas schooling and anadramous fish are called pelagic because they live in open water. The following sections discuss the demersal and pelagic fish found within the affected environment, as well as the occurrence of these fish at Humboldt Open Ocean Disposal Site (HOODS).

Demersal Fishes

Bottomfish are characterized as either nearshore species living at depths of 11-100 m (6-50 fathoms) or deep-water species inhabiting shelf habitats at depths of 100-550 m (50-300 fathoms). Common demersal fish found near shore in the waters off Humboldt Bay are English sole, Pacific sanddab, starry flounder, butter sole, Pacific sand sole, speckled sanddab, curlfin turbot, pricklebreast poacher, tubenose poacher, warty poacher, plain midshipman, staghorn sculpin and showy snailfish (Winzler and Kelly 1984, Pequegnat *et al.* 1990). In addition, lingcod may occur near rocks off the

harbor entrance jetties, and California halibut may inhabit nearshore waters outside the bay (Monroe 1973). Of these species, the commercially important fish are English sole, Pacific sanddabs, starry flounder, California halibut and lingcod.

The most abundant demersal fish living in the deeper shelf environments are chimaeras, sharks and skates, flatfishes and rockfishes (Winzler and Kelly 1977). Common fish species in deep water benthic areas include ratfish, roughscale rattail, giant rattail, blacktail snailfish, twoline eelpout, longnose skate, and spiny dogfish. The commercially important fish species in the deeper shelf areas are Dover sole, petrale sole, rex sole, black rattail (sold as "grenadier,"), sablefish, widow rockfish, canary rockfish, boccaccio rockfish, darkblotched rockfish, and chilipepper rockfish.

Many deepwater flatfishes and rockfishes move between deep and shallow water during their development (Pequegnat *et al.* 1990). Adult bottomfishes tend to move from deep to shallow water to aggregate and spawn; their eggs and larvae are pelagic and move with the currents. Juveniles settle to the bottom and move into nursery grounds in estuaries or shallow coastal areas. The juvenile stages of deepwater fish, in particular, are sensitive to conditions in nearshore habitats. The juvenile stages of many commercial deep water bottomfish, including Dover sole, petrale sole, widow rockfish, canary rockfish, boccacio rockfish, darkblotched rockfish, and chilipepper rockfish, occur in nearshore areas (Toole 1989).

Pelagic Fish

Pelagic fish are found in the epipelagic zone, which roughly encompasses the upper 200 m (110 fathoms) of the water column. The epipelagic zone extends over the continental shelf where upwellings occur. The abundant phytoplankton and zooplankton in this area support vast schools of fish.

Pelagic fish offshore Humboldt Bay include anadromous fish and schooling marine species. Anadromous adult fish migrate through Humboldt Bay on their way to freshwater spawning grounds, and juveniles pass through the affected environment during their seaward migration. Anadromous fish species in Humboldt Bay include chinook salmon, coho salmon, steelhead trout and coastal cutthroat trout (Monroe 1973).

Schooling marine species known to commonly occur in this open coastal area are blue rockfish, black rockfish, and Pacific tomcod, Pacific herring, northern anchovy, night smelt, whitebait smelt, eulachon, shiner surfperch, spotfin surfperch, silver surfperch, walleye surfperch, white seaperch, and bay pipefish (Toole 1989, Pequegnat *et al.* 1990). Pacific cod, a year-round commercial and sport species, may also be found in this area (Dames and Moore 1981). The brown smoothhound, a requiem shark, is also known to occur in this area.

Occurrence of Pelagic and Demersal Fish at the HOODS Site

HOODS: Trawl surveys were conducted in August 1989 and March 1990 during the Humboldt State University survey in the area of the HOODS at depths of 49 and 55 m and at similar depths just south of the HOODS (Pequegnat *et al.* 1990). In August 1989, the trawl catch was composed primarily of whitebait smelt and, in order of decreasing abundance, Pacific sanddab, rex sole, dover sole, Pacific tomcod and juvenile sanddab. More species were found during the March 1990 surveys; in order of decreasing abundance these were: night smelt, whitebait smelt, Pacific tomcod, Pacific sanddab, shiner surfperch, black rockfish, English sole, speckled sanddab, Pacific sand sole, showy snailfish, curlfin turbot, eulachon, Pacific herring, juvenile sanddab and larval smelt. Black rockfish, night smelt, English sole, Pacific sanddab and Pacific tomcod made up most of the catch by weight.

Commercially important nearshore bottomfish species occurring within the HOODS are English sole, Pacific sanddab, lingcod, and California halibut. The life histories of these species are summarized in Appendix E. English sole use the HOODS primarily as adults and older juveniles. Adults live at depths of 20-70 m in the summer and 40-130 m in the winter; larger juveniles move from nearshore to deeper waters and may be found within the HOODS. Adult Pacific sanddab spawn at depths of 35-90 m from July to September, with most spawning activity in August. Juvenile lingcod could potentially use the HOODS since they are found in sandy bottoms from the intertidal zone to depths of 200 m. Adult and juvenile California halibut may also use the HOODS area. Adult California halibut are found in waters as shallow as 55 m, and older juvenile California halibut move from shallow bays to deeper offshore water.

Of the deep water bottomfish, Dover sole, Petrale sole, and juvenile stages of widow rockfish, canary rockfish, boccacio rockfish, and chilipepper rockfish are likely to inhabit the HOODS. Appendix E summarizes the life stages of these bottomfish in relation to the importance of nearshore habitats. Juvenile Dover sole and petrale sole are likely to occur within the IODS during the summer; adults may also occur in this area during the non-spawning period (April to October). Juvenile rockfish are commonly found in shallow waters (less than 37 m) in late spring and summer; presumably older juveniles gradually move offshore as they increase in size and occur within the HOODS.

Many commercially important pelagic fish including anadromous and schooling marine species may use the HOODS. Adult anadromous fish use the HOODS as they migrate towards Humboldt Bay to spawn and juveniles pass through in their seaward migration. Of the schooling marine species, juvenile black rockfish, adult yellowtail rockfish and juvenile and adult stages of whitebait smelt and night smelt may all inhabit the HOODS (Pequegnat *et al.* 1990).

4.5.1.5 Bird Community

Terrestrial, Coastal and Sea Birds

The most spectacular wildlife forms of Humboldt Bay are its birds, and over two hundred species have been recorded in the general area. Each fall and winter millions of migrating birds pass along the California coast on their southern trek, and most pause to rest and feed on or near the Bay for varying periods of time. Others may spend the entire winter locally without moving further south. It is during this season that the area becomes a popular attraction for both hunters and nature enthusiasts. The region also supports a large variety of year-round residential birds.

A monthly aerial census conducted by the California Department of Fish and Game from 1967 to 1970 revealed an average annual bird-days of use at a total of 13,500,000 (Monroe *et. al.*, 1973). There is a general interchange of birds between the Bay, the Eel River Delta, and the lagoons as they adapt to changing climatic and tidal conditions and maximize usage of available food sources. For the purposes of this report they are divided into two broad categories: the land birds (i.e., raptors), and water-associated birds, the last of which is again divided into several sections. There are over eighty species of land birds known to occur within the Bay's drainage area but they are generally found in agricultural areas and uplands and therefore not dependent on the Bay to any great extent. These include both resident and migratory species. Upland game birds provide many days of hunting. Since these birds are not directly relative to this study no further detail will be given for this category.

Terrestrial (Raptors)

The raptor group is composed of eagles, hawks, falcons, ospreys, kites, vultures and owls, and these birds represent the top of the food chain. Some twenty-three species of these birds have been seen in the vicinity of Humboldt Bay, including the Peregrine falcon which is on the

Federal and State lists of endangered species and the Southern bald eagle which is listed as rare by the State and endangered by the Federal. Of all of these, the osprey is most dependent upon the Bay, and several pairs nest within the Bay area. They fish the South Bay principally, taking several species of fish; surfperch seem to be the most important. The red-tailed hawk, Northern harrier, and American kestrel also range over the Bay marshes in search of various vertebrates and invertebrates. The eagles are the largest of the local raptors and, of these, the bald eagle is most closely associated with aquatic or marine habitats. The remaining species of raptors feed mostly on insects, small birds, and small mammals.

Water-Associated Birds

The water associated birds have developed very specialized morphological characteristics which enable them to utilize an aquatic, freshwater or marine environment. These birds are very efficient at utilizing the various micro-habitats within these types of environments. This specialization makes them very efficient biologically, but also renders them extremely vulnerable to habitat change. Man's activities in altering these habitats have seriously affected many populations of water birds and have caused some to be near extinction, while others are threatened and/or greatly reduced in number. Humboldt Bay as an ecological unit is, therefore, very important to water birds in terms of survival. Greater emphasis will be placed on these birds in this report. Among water birds, there is a great deal of diversity in size, form, and habits; they include nine orders of birds and over one hundred species utilize the Humboldt Bay area. They are hereby grouped according to their relationship with the habitats they occupy.

Waterfowl

Humboldt Bay is ecologically most important to the water associated birds (Monroe 1973). All species of waterfowl belong to the order Anseriformes. They are all migratory birds and the vast majority are fall and winter visitors which nest as far north as the Arctic Circle. Humboldt Bay lies along the Pacific flyway which extends from Alaska to South America. There are three basic routes of travel that comprise this flyway and the coastal route is second in importance in terms of total numbers of bird use. It is mostly used by pintails, widgeon, brant, and the diving ducks. Most of the birds using this flyway are produced in Alaska or western Canada and winter in the United States, Central America and South America. The importance of California's wetlands to waterfowl in this flyway is demonstrated by the fact that approximately 68% of the entire Pacific flyway population of ducks and 83% of its geese winter in California.

Due to the efforts of the Canadian government and conservation organizations, the breeding grounds of the Pacific flyway waterfowl in Alaska and Canada have suffered less from man's interference than those of other major flyways. As a result of their successes, the breeding territory for these birds is far greater than the area available to them as wintering grounds. In California these wintering grounds are estimated to have been originally about five million acres in size and, today, less than five hundred thousand acres remain. The future of waterfowl populations in the Pacific flyway therefore depends to a great extent on how man affects the remaining habitat. Humboldt Bay currently offers approximately 48,850 acres of suitable nesting habitat.

There are twenty-two species of ducks which commonly use Humboldt Bay. Arcata Bay supports over 70% of the duck use and the South Bay receives less than the remaining 30%. About 2% occurs in the channel between the two bays. In general they can be classified as puddle ducks, diving ducks and fish ducks or mergansers. The more common puddle ducks include the pintail, widgeon, mallard, gadwall, green-winged teal, cinnamon teal, and northern shoveller. Widgeon, or baldpates, are the most abundant species visiting the Bay area and comprise about 50% of the

total waterfowl numbers during winter months. Pintails are also abundant and are early migrants, appearing as early as August. Mallard, gadwall, and cinnamon teal are all known to nest in the area.

Puddle ducks feed predominantly on aquatic vegetation or agricultural crops. When feeding on submerged vegetation they utilize only areas of shallow water and do not dive below the surface as do other ducks. They are often observed in large numbers on the open waters of the Bay but are not usually feeding in these areas. The one exception to this is the widgeon which feed extensively on eelgrass. Other important puddle duck foods are barley, prairie bulrush, creeping spikerush, widgeon grass, pondweed, buttercup, saltgrass, and clover. Organisms such as small clams, molluscs, arthropods, gastropods and insects are also eaten to some extent according to species. Green-winged teal and pintails tend to consume more of these foods than others.

The common diving ducks of Humboldt Bay are scoters, scaup, canvasbacks, redheads, buffleheads, ring-necked ducks, golden-eyes and ruddy ducks. Of these, the three species of scoters occur in the greatest numbers, followed by the two species of scaup which are probably the most important local diving duck in terms of hunting. Like the puddle ducks, most diving ducks are winter migrants that spend the summer in more northern latitudes and none are known to nest locally.

Diving ducks obtain food by diving beneath the water surface with some capable of diving to depths of 20 to 30 feet or more, although most feed in more shallow water. Food habits vary considerably between species and dietary preferences may vary according to location and food availability. In general, diving ducks tend to consume more animal matter than puddle ducks. Shallow water areas and mud flats of the Bay are main feeding grounds for these ducks. Here the many small marine organisms located in the substrate provide over 70%, by volume, of the food items consumed. The many small freshwater marshes adjacent to the bay are also important feeding grounds for vegetation.

Humboldt Bay is host to all three species of fish ducks, or mergansers, the American, red-breasted, and hooded. Of these, the first two are common and the American nests locally. The hooded merganser is not often seen. These species feed almost entirely on animal matter, with small fish comprising the bulk of their diet. Various molluscs, crustaceans, and insects serve to complete the meal. Mergansers pursue and capture their prey underwater and they are at home in the Bay, on the ocean, or in tributary streams, so long as sufficient food is available.

The types of geese reported in the Humboldt area include Canada geese, snow geese, Ross' geese, white-fronted geese, emperor geese, and Pacific black brant. The appearance of all of these species, other than brant, is rare, and apparently geese were more common in years past when more cereal grains were grown locally. Given their preference for this food, it is conceivable that geese

would become more common if grain acreages were increased.

The Pacific black brant is a unique species among waterfowl. It is smaller than most geese and is strictly maritime in its habits. The brant nests in arctic coastal regions of western Canada, Alaska, and Siberia. A portion of this population moves down the Asian coast to winter, and the remainder flies south along the west coast of North America. Coastal bays and estuaries of California and Mexico constitute the principal wintering grounds for these birds. Humboldt Bay historically contained the largest wintering populations of brant on the west coast of the United States and still provides habitat critical to the west coast black brant population. At one time wintering brant numbered as high as 10,000 (Moffitt 1934) but now number less than 100 birds (Springer 1982). Henry (1980) concluded that human disturbance, especially hunting, has been the major cause for this decline.

Most brant pass through the Humboldt area in the fall, pausing only for a short time to rest and feed before moving on south. In late December, they begin to return again in large numbers and Humboldt Bay is their first major "refueling stop". Many will stay in the Bay until late April to May before continuing their northern journey to ancestral breeding grounds. The South Bay is by far the most important brant area and 90% of the brant use is recorded there, the remainder being in Arcata Bay. Recently the peak fall and spring migrant brant numbers in the Bay have been only 900 and 11,000, respectively, and brant-use days were about 350,000 in 1981-82 (Springer 1982). Local populations may exceed 100,000 birds at the peak.

The feeding habits of brant are much more restricted than those of most other waterfowl as they feed almost exclusively on eelgrass. Eelgrass is a maritime plant which grows in shallow water areas of coastal bays from Mexico to Alaska and has suffered greatly from dredging, siltation, and pollution. The winter habitat available to brant has been drastically reduced and they have disappeared from many areas where they were formerly very common. When eelgrass is not available, brant will subsist on grasses from agricultural lands adjacent to bay areas, but only for short periods of time. Sandy beach habitats are also important for brant as they utilize these areas to preen and to ingest sand for gizzard grit.

In September 1971, the establishment of the 8,936 acre Humboldt Bay National Wildlife Refuge was approved by the Migratory Bird Conservation Commission and the Director of the Bureau of Sport Fisheries and Wildlife (now the U.S. Fish and Wildlife Service). The refuge (Figure 4.5.1.5-1) was established primarily to preserve and enhance values associated with migratory waterbirds, particularly the brant. As authorized, it will protect key wildlife habitat along the east side of Arcata Bay, Sand Island, Indian Island, and South Bay south and directly west of the Fields Landing Channel. Of the approximately 1,000 ducks produced in the vicinity of the Bay each year, production within the approved refuge is estimated to be 400 ducks (USFWS 1988a).

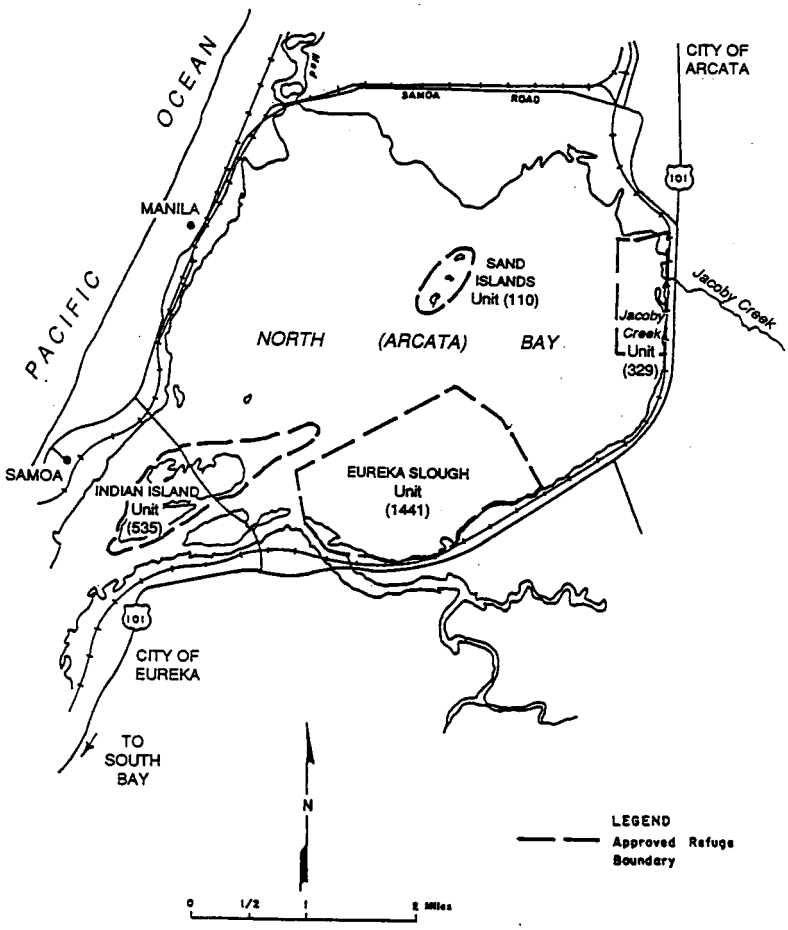


Figure 4.5.1.5-2 Humboldt Bay National Wildlife Refuge Boundary Map

The swan is the largest and one of the most beautiful members of the waterfowl family. The only species utilizing the Humboldt Bay area is the Tundra swan which nests in the remote arctic regions of western Canada and Alaska and visits the Bay area each winter. They migrate south to spend the fall and winter months along the west coast, principally in California. Their arrival is usually in late November or December and they remain until March before returning to breeding grounds. Between 500 and 1,500 swans winter in the Humboldt Bay-Eel River area where they feed on vegetation from pasture lands and freshwater marshes. They are very rarely in the Bay itself, preferring the Beatrice Flats area adjacent to the South Bay.

Shorebirds

Humboldt Bay has historically been known as one of the most important shorebird concentration areas in California. They belong to the order Charadriiformes, of which there are five families and at least thirty-one species represented locally. Some twenty of these are considered to be common to the Humboldt Bay area and manly others are less abundant, but seen on the Bay regularly. A few are occasional or rare visitors. All of these birds share certain similar characteristics but individual species exhibit considerable variations in size, color and external features. Most tend to be drab in color but a few, such as the avocet, exhibit striking color contrasts, and size can vary from very small to very large. The most common to Humboldt Bay include the dunlin, western sandpiper, least sandpiper, black-bellied plover, short-billed dowitcher, sanderling, willet, marbled godwit, black turnstone, killdeer, red-necked phalarope, and the common snipe, a popular gamebird.

Like the waterfowl, shorebirds follow well established flyways between breeding and wintering grounds. The majority nest in Canada and Alaska and travel along the coastal zone in their migration. The primary wintering grounds are coastal bays and estuaries from California to Central America. During the summer months small numbers of non-breeding shorebirds are present in Humboldt Bay. Migrant birds from northern breeding grounds begin to arrive as early as late July and local populations reach their highest numbers from September to April when the daily average shorebird count is in excess of 26,000. Arcata Bay consistently harbors the greatest number of shorebirds due to its large expanses of intertidal mud flats and substrate composition. South Bay is also important, but not nearly to the same extent.

Shorebirds feed almost exclusively on animal organisms and the bulk of their diet consists of small clams, arthropods, insects, worms, and gastropods and other mollusks. The intertidal mud flats provide a wealth of such food items, which explains the heavy use of these areas by shorebirds. Acre for acre, no other habitat type comes close to the food production of these organisms.

Most shorebirds have developed characteristically long legs and bills in proportion to their body size. These features enable them to move freely about in the shallow water and soft mud, and probe into the substrate to find food items. A few species, including phalaropes, avocets, and stilts, swim readily and skim the water surface for small insects or other floating organisms.

There are five general habitat types which shorebirds frequent. The most important type, in terms of food production and total use, is the intertidal mud flat. Shorebirds move to these areas as soon as the tide begins to recede, following the waterline. At low tide, when the flats are completely exposed, thousands of birds can be seen moving about and probing the soft mud for food organisms. When the tide rises again, they move shoreward, staying just ahead of the waterline. When the water is high, the birds move to adjacent agricultural lands and freshwater marshes. The greatest utilization of these areas for feeding occurs when pastures are wet from rains and flooding. Ocean beaches also provide feeding grounds for some species. Salt marshes are ideal for resting and roosting habitat, and are also used to some extent for feeding.

One listed shorebird species, the western snowy plover (*Charadrius alexandrinus*) nests on both the north and south spit of the Bay. Due to disturbance of its nesting habitat (open, flat, sandy areas) from recreational activities such as off-road vehicles, and human disturbance, numbers of snowy plovers have recently declined.

Wading Birds

Wading Birds all belong to the order Ciconiformes, which includes herons, ibises and related species. Some of North America's most beautiful birds are included in this category. In Humboldt Bay, they are represented only by the heron family and common species are the blue heron, black-crowned night heron, green heron, common egret and American bittern. Two other species, the snowy egret and cattle egret, are seen on occasion but not commonly. Most of these wading birds are year-round residents of the North Coast although some migrate to a certain extent.

The primary visible differences between wading bird species are in size, color and habits. Most have extremely long legs and wide toes adapted for moving in shallow water and mud and long necks and sharp bills for grasping prey. Food habits are similar for all species and basically consist of small fish, crustaceans, amphibians and other water associated organisms. The blue heron and common egret also feed on small mammals and reptiles.

The most important feeding areas for the blue heron, common egret, and night heron are the large shallow water areas of Arcata and South Bay, the salt marshes, freshwater marshes, and agricultural lands. The green heron prefers the salt and freshwater marshes, and tributary streams. The bittern is found only in the dense cover of salt marshes, freshwater marshes, and along the edges of streams and sloughs.

Humboldt Bay is the most important area of northwestern California for wading bird populations and is second only to San Francisco Bay in the state. Many birds utilize the area for nesting, including birds from outlying areas which move to the Bay to take advantage of established rookeries. The Monterey Cypress grove on Indian Island supports an egret and heron rookery and is one of the largest and most productive in the State in terms of nesting birds, and the best known in Northern California. It is the northernmost egret breeding colony on the Pacific coastline.

Smaller rookeries used by the black-crowned night heron are found near Mad River Slough and on the Samoa Spit.

The nesting period usually begins in March and extends through June. This is a critical time in the life cycle of wading birds. While feeding, they are able to tolerate a certain amount of disturbance by humans and can even be seen feeding within a few feet of major highways. During nesting there is a complete change in their behavior and the birds become sensitive to even very minor disturbances. If these disturbances continue over extended periods of time, the birds are apt to abandon all nesting activity. Nest abandonment is a well documented event and it is essential that major breeding colonies be protected from unnecessary human interference. The number of great blue herons has declined from 72 to 16 pairs in the years 1976 to 1980, a reduction of over 80%.

Several of the wading birds were almost exterminated during the early part of this century because their plumage was in great demand for use in women's hats. One of the nation's earliest conservation movements was begun in response to this use, and national legislation provided the necessary protection that eventually brought their numbers back up. Today they are still protected by law, but are faced with new threats, namely the use of pesticides, effects of pollution, and loss of habitat. The protection of rookeries as well as minimization of these other threats will ultimately determine the future for the various wading bird species.

Miscellaneous Water Associated Birds

There are several species of birds that are dependent on marshes and the aquatic environment, but are very diversified in all other aspects, namely the coots, rails, grebes and loons. There is a great deal of diversification between them in size, form, coloration, and habits, which make each one efficient in utilizing its particular niche within a community.

The American coot, or mud hen, is a member of the rail family and is quite common throughout North America. It can be found in almost any aquatic habitat type, although it usually prefers an area with grass on which to graze. The coot will also feed on aquatic vegetation, alfalfa, and other agricultural crops. In the Humboldt Bay area the coot is seen most often in freshwater marshes and sloughs within agricultural lands. They are migratory by nature and populations are highest during the winter months in the Bay.

There are three other members of the rail family known to the Humboldt Bay area. The Virginia rail and sora rail are the most common of the three, but are seldom seen. They inhabit marshy areas with dense vegetation and may be found in the salt marshes of the Bay, but prefer freshwater areas. The third type, the California clapper rail, is extremely rare and is on the Federal and State list of endangered species. This secretive bird depends almost exclusively on salt marshes and the loss of these areas over most of its range is the probable reason for its decline. The preservation of what salt marsh areas remain will be essential to the salvation of this rare bird.

The grebes occupy all open water habitat types in and around the Bay. They usually remain in relatively deep water and often commute between the Bay and the ocean. They are swimming birds and are almost helpless on land, having feet that are lobed instead of webbed as do most other swimming and diving birds. They dive beneath the water surface to gather food or escape their enemies. Five species are found in the Humboldt Bay area. The western grebe is the largest of these and also the most common. The red-necked grebe is similar in size and appearance and both are usually seen in the deeper water areas of the Bay and on the ocean offshore. The horned grebe, eared grebe and pied-billed grebe are much smaller and are most often seen in sloughs, ditches and freshwater marshes adjacent to the Bay, rarely venturing into the ocean. As with other migratory species grebe populations are highest during winter months. Some nesting may occur locally, particularly by the pied-billed grebe.

Three species of loons are found in the Bay and offshore areas during winter months, the Arctic, common, and red-throated. Although they are often seen, they cannot be considered as being numerous. Within the Bay they prefer the deeper water areas of the North and South Bay and the connecting channel. Like the grebe, they trade back and forth between the Bay and the ocean and swim underwater to feed and avoid enemies.

Pelagic and Coastal Birds

The open seas and coastal areas are home to these types of birds and at least thirty-four species from three orders have been recorded locally. Of these, the petrels, fulmars, shearwaters, albatrosses, and jaegers are predominantly pelagic and tend to remain well offshore. Murres, guillemots, puffins, and auklets are found closer inshore along the ocean beaches and rocky headlands. A few are seen inside of the Bay, particularly the murres. Gulls and terns are common residents or migrants and are more closely associated with the Bay than the other pelagic birds. Gulls are opportunists that scavenge for their food in many habitat types but are found most frequently around the Bay and ocean shore. Several species of gulls are especially abundant and the Caspian tern nests on Sand Island in Arcata Bay. This rookery and a large cormorant rookery (approximately 200+ birds) located on the remains of the old Arcata Wharf near Sand Island are the only ones of their kind in the area of Humboldt Bay.

One Federally endangered species in the affected environment is the Marbled Murrelet (*Brachyramphus marmoratus*). Marbled murrelet populations have been reduced by logging of old-growth forests where these birds nest. In California, the marbled murrelet is found from the Oregon border south to Eureka and between Half Moon Bay and Santa Cruz (Carter *et al.* 1990). In recent surveys in the northern region, most birds were observed between the Oregon border and Redwood Creek; 26 of 175 marbled murrelets were observed between Trinidad and the mouth of Humboldt Bay (Carter *et al.* 1990). During the summer breeding season, murrelets concentrate nearshore closer to their nests. Marbled murrelets feed on fish they catch by surface diving (Ehrlich *et al.* 1988) within 2 km of shore in depths of 30 m.

The State and Federally listed endangered California brown pelican is a common coastal visitor that uses the Bay extensively during late summer and fall but is absent or rare at any other time of the year. The pelican feeds both in the Bay and offshore and more than 400 have been seen in the Bay at one time (U.S. Fish and Wildlife Service, 1988). Three species of cormorants are common residents, namely the Brandts, pelagic and double-crested. They fish in the channels and shallow water bays for the most part. A large nesting colony is located on the remains of the old Arcata wharf in Arcata Bay and is thought to be the largest in California and the second largest on the Pacific Coast.

4.5.1.6 Marine Mammals

Pinnipeds

Five species of pinnipeds occur in the Humboldt area. The Steller's Sea Lion (*Eumetopias jubatus*) and the Harbor Seal (*Phoca vitulina richardsii*) breed in the area. The California Sea Lion (*Zalophus californianus*), Northern elephant Seal (*Mirounga angustirostris*), and Northern Fur Seal (*Callorhinus usinus*) use the area for feeding and during migration (ECI 1988).

The harbor seal is by far the most common marine mammal of Humboldt Bay and large numbers of these animals can be seen at low tide on hauling out areas located in the North and South Bays. Humboldt Bay is one of California's most important pupping grounds for harbor seals. Peak numbers (on land) occur in May during the spring breeding season and in June when adults are on land to molt (ECI 1988). Harbor seals are usually found within 20 km from shore in waters less than 200 m deep (Bonnell *et al.* 1983), and feed on flatfish, surfperch, tomcod, and greenling (Shapiro and Assoc., 1980); other research would add anchovies, herring, small crabs, and occasionally octopus to this list. Each seal consumes about 11 pounds of prey per day .

The California sea lion and Federally threatened Stellar sea lion are commonly seen in the ocean and sometimes in the Bay , and its tributary streams and sloughs. Sea lions are the most frequently sighted pinniped in the area. Sea lions migrate to and from breeding grounds in southern California and the Baja Peninsula. The number of sea lions peaks in September and October during the northward migration and again in May during their southward migration (ECI 1988). Northern elephant seals occur regularly off Humboldt County in spring and summer after the winter breeding season (December-March) as pelagic, widely dispersed, solitary feeders (ECI 1988). Northern fur seals occur seasonally in the region from December to June; they are found mostly offshore along the continental shelf and shelf break (ECI 1988).

Cetaceans

At least 20 species of cetaceans have been recorded from Humboldt County waters and about half of these can be considered relatively common. The most common continental shelf species in the area are the Pacific Harbor Porpoise (*Phocoena phocoena*) and the Gray Whale (*Eschrichtius*

robustus). Harbor porpoises are present throughout the year but are seen more frequently during fall. They are usually sighted within 1 km of shore (ECI 1988) in deep water channels (30 to 80m deep).

Humpback Whales (*Megaptera novaeangliae*), a Federally listed endangered species, are found in nearshore waters during their annual migrations between the southern winter breeding grounds and feeding areas in Alaska. Minke Whales (*Balaenoptera acutorostrata*) also occur in nearshore waters. Other less common Federally listed endangered large migrant cetaceans in the area include the Blue Whale (*Balaenoptera musculus*), the Finback Whale (*B. physalus*), and the Sperm Whale (*Physeter macrocephalus*). These species generally occur in deeper waters, offshore from the HOODS.

The recently delisted gray whale is the most common cetacean in the nearshore coastal waters. Gray whales migrate south in December and January and north from March through May, usually passing within 1.5 - 8 km offshore. Gray whales pass closest to shore during spring migration when cows with calves stay close to the shoreline. Gray whales may feed during migration, particularly during the northward migration when females are with young. Their diet consists of soft-bottom benthic invertebrates found at depths of 9-40 m and dense swarms of shrimp and spawning squid (COE 1988). Dohl *et al.* (1983) noted that gray whales avoid very turbid water and change direction when approaching large river plumes such as off the Klamath and Eel rivers and San Francisco Bay during periods of heavy runoff.

Other common smaller cetaceans seen in Humboldt waters outside the Bay are the Pacific Whitesided Dolphin (*Lagenorhynchus obliquidens*), the Northern Right Whale Dolphin (*Lissodelphis borealis*), Dall's Porpoise (*Phocoenoides dalli*), and the Risso's Dolphin (*Grampus griseus*). These species also occur primarily in deeper waters offshore from the HOODS. All but the northern right whale dolphin, however, also occurs in smaller numbers in shelf waters (ECI 1988).

Mammals

At least fifty species of mammals are found in the Humboldt Bay area and can be divided into terrestrial and marine species discussed above. Most of the terrestrial mammals are not directly associated with the Bay, but utilize the adjacent upland areas. One exception is the river otter which is generally more at home in the fresh waters of tributary streams but is sometimes seen in the Bay and sloughs. Beaver occur in the Mad River drainage area and as transients in other freshwater streams flowing into the Bay. Other species found in the general area that may use the Bay on occasion include the gray fox, coyote, bobcat, ringtail cat, raccoon, striped skunk, spotted skunk, mink, weasel, badger, blacktail deer, elk, black bear, rabbits, squirrels, bats, and many other rodents and small mammals. All of these creatures are an integral part of the complex food chain which enables the Bay to function as such.

4.5.1.7 Threatened, Endangered, and Sensitive Species

Determination of Status

For purposes of this analysis, sensitive species are species listed, proposed, or candidates for listing as rare, threatened, or endangered by the U.S. Fish and Wildlife Service (USFWS); marine fish and wildlife species listed or proposed for listing as rare, threatened, or endangered by the National Marine Fisheries Service (NMFS); and species listed or proposed for listing as rare, threatened, or endangered, by the California Department of Fish and Game (CDFG).

Wildlife and plant species listed or proposed for listing as Federally threatened or endangered are protected under the Federal Endangered Species Act (ESA) (16 USC 1531 et seq.). In California, State-listed rare, threatened, or endangered wildlife and plant species are protected under the California Endangered Species Act (CESA) (California Fish and Game Code, Section 2050 et seq.) (Appendix F).

Several threatened or endangered species are known to occur or have a potential to occur either occasionally or periodically within the Humboldt Bay area, and are discussed below. This discussion of threatened and endangered species that may occur in the study area, and as discussed in the existing and impact Biological Resources sections of this EIS/EIR will serve as the Corps' Biological Assessment for the Humboldt Harbor and Bay Deepening Navigation Project.

FISH

Winter-run Chinook Salmon *(Onchorhynchus tshawytscha)*. The winter-run chinook salmon is listed by the State of California and the Federal government as an endangered species. Winter-run chinook salmon are an anadromous species that pass through the Sacramento River drainage to the California coastline. The winter-run chinook salmon is fished commercially in North America from Kotzebue Sound, Alaska, to Santa Barbara, California. Juveniles of the species are ocean-dwelling and occur primarily over continental shelf waters (SAIC 1994). Adult chinook salmon spend most of the marine portion of their life cycle off the California coast. During this time the winter-run chinook salmon may be found off the coastline near Humboldt Bay (USFWS 1994).

Chinook salmon tend to be an opportunistic feeder. Fry feed mainly on zooplankton in estuaries, characteristically in schools in the littoral of shallow sublittoral habitats such as saltmarshes, mudflats, and other intertidal areas. Smolts feed on gammarid amphipods and larval fish in brackish waters. Larger smolts select larger crustaceans (*Corophium* and *Neomysis*) and fish as food. Food consumed by marine dwelling juveniles consists primarily of fish, crustaceans, and insects. Marine prey of adult chinook salmon are pelagic crustaceans such as krill, larval crabs, and fish (USFWS 1994).

Tidewater Goby *(Euclyclogobius newberryi)*. The tidewater goby is listed as endangered by the Federal government. The tidewater goby has been found at the northeastern shore of Arcata Bay, at the mouth of the Jacoby Slough, and at the mouth and in ponds near Mad River Slough. It is generally found in fresh or low salinity water (less than ten parts per trillion), but they can also live in saltwater. It does not inhabit the channels, as it is not a deep water species, and thus is not found in the project direct-impact area.

Green Sturgeon *(Acipenser medirostris)*. The green sturgeon is a Federal candidate species, and is a primitive fish that is a benthic feeder that feeds on small fish. It is found in estuaries, lower reaches of large rivers, and salt or brackish waters off river mouths. It is a demersal species that prefers saline waters; during high freshwater inflow, it may move out of the project area (Skinner 1962 *in* Shapiro and Associates, Inc. 1980). Eggs are broadcast-spawned and externally fertilized in relatively fast water flows in depths greater than 3 inches and silt is known to prevent the eggs from adhering to each other . Female green sturgeon produce 60,000 -140,000 eggs. The green sturgeon is a long-lived fish that can reach lengths of up to 7 feet. From the Eel River northward, green sturgeon predominate and it is likely that records of sturgeon caught between San Francisco Bay and the Klamath River refer to green sturgeon. In 1974, nine green sturgeon were collected in Arcata Bay over a two-month period with total length ranging from 73-112 centimeters (USFWS 1994).

CETACEANS/MAMMALS- OPEN OCEAN

Humpback Whale *(Megaptera novaeangliae)*. The humpback whale is listed by the Federal government as an endangered species. The humpback whale has a worldwide range. Distribution over the summer feeding grounds ranges from the coasts of Japan and southern California north to the Chukchi Sea. Humpback whales typically can be found off the California coastline from approximately March through January with greatest concentrations occurring from mid-August through October (SAIC 1994). According to recent NMFS surveys conducted in 1991 and 1993, approximately 600 humpbacks were counted off the California coast (Shoulak 1994).

Summer feeding occurs from the Aleutian Islands to the Farallon Islands off central California. Humpback whales feed on baitfish, eupausids, pelagic crabs, and a variety of other prey in the summer and early fall. Humpback whales feed at the surface down to about 150m (SAIC 1994).

Blue Whale *(Balaenoptera musculus)*. Blue whales are listed by the Federal government as an endangered species. Similar to humpback whales, blue whales are pelagic and may occur offshore from Humboldt Bay in summer and early fall. Usually blue whales are found in continental slope and deeper waters. Their primary food are euphausiids which ensures that they occur within 200 nautical miles of the continental shelf. Off northern and central California Dohl *et al.* (1983) noted

blue whales in waters from 80 to 3,600 m deep (SAIC 1994), and recent NMFS surveys have counted approximately 2,200 blue whales off the California coast (Shoulak 1994).

Finback Whale *(Balaenoptera physalus)*. The finback whale is listed by the Federal government as an endangered species. The finback whale ranges in the Pacific from the Bering Sea to Cabo San Lucas, Baja California. They are most abundant off northern and central California during summer and autumn (approximately 985 in recent NMFS surveys). The finback whale feeds on small fishes, pelagic crustaceans, and squids (SAIC 1994).

Sperm Whale *(Physeter macrocephalus)*. The sperm whale is listed by the Federal government as an endangered species. The sperm whale occurs in deep oceanic waters and is rarely reported over the shelf. The sperm whale ranges in the Pacific from the Bering Sea to the equator. They are deep divers and prey mostly upon large squid, skate, and bottom fish (SAIC 1994).

Stellar's Sea Lion *(Eumetopias jubatus)*. The Stellar's sea lion is listed by the Federal government as a threatened species. In California, the cause for decline is unclear; several factors may be acting synergestically including infertility due to pollutants and disease, interspecific competition with California sea lions, and a depleted food source. The Stellar's sea lion ranges from California to the Bering Sea. The Steller's sea lion is commonly seen in the ocean and sometimes in the Bay, and its tributary streams and sloughs. Stellar's sea lion breeds at Sugarloaf Rock near Point St. George. The Sugarloaf rookery is one of only two major rookeries south of Alaska and in 1981, accounted for roughly 30% of Stellar's sea lion births in California (Bonnell *et al.* 1983). At least 1000 animals were counted in the Sugarloaf rookery during the 1981 breeding season (ECI 1988); however, Steller's sea lion populations have been declining throughout their range over the past two decades and numbers at Sugarloaf are currently much lower. The other major haulout site in the Humboldt region is to the north of Humboldt at Castle Rock. Steller's sea lions breed in the late spring and summer, and the onset of the breeding season, beginning in mid-May, is uniform throughout its range. Steller's sea lions feed primarily on squid, octopus, and fish such as smelt, flatfishes, and rockfishes (SAIC 1994).

BIRDS

American Peregrine Falcon *(Falco peregrinus anatum)*. The peregrine falcon is listed by both the Federal and State as an endangered species. The peregrine falcon is a very uncommon breeding resident and an uncommon migrant to California. Important yearlong habitats include riparian areas and coastal and inland wetlands. Protected cliffs and ledges are needed for cover. It breeds in woodlands, forests, and coastal habitats and the breeding period is from early March to late August. Peregrine falcons eat a variety of birds, mammals, insects, and fish (Zeiner *et al.* 1990a). They frequently hunt in the North Bay area, but do not nest near the Bay. (USFWS 1994). Approximately 100 pairs were counted in recent USFWS surveys in mainly Humboldt and Del Norte counties (Shoulak 1994).

Marbled murrelet *(Brachyramphus marmoratus)*. The marbled murrelet is listed by the Federal government as an endangered species. The eastern Pacific subspecies of the marbled murrelet is found from the Aleutian Islands to central California. Loss and modification of nesting habitat from commercial timber harvesting is cited as the primary cause of the bird's decline. Murrelets are usually observed offshore of an area that has trees of adequate size and minimal contiguous acreage. Successful nesting requires at least a 60 acre stand of old growth trees or a stand of mature trees with an old growth component. This bird has been observed many miles inland, perhaps in search of suitable nest trees.

Essentially a coastal species, murrelets spend most of their time resting on the water close to shore, making them vulnerable to oil spills. Because murrelets feed on fish and invertebrates near shore, gill net mortality from commercial fishing has also contributed to their decline. Adult birds mature early at two years, but mated pairs only produce one chick per year resulting in low and irregular reproductive rates. In Humboldt, the marbled murrelet generally feeds in deeper water at the entrance to the Bay. It also uses the Entrance Bay near the PG&E plant at King Salmon and is known to occur toward the mouth of the Elk River. They concentrate in the Bay area in large numbers during the breeding season and in June through August. Breeding occurs in old-growth timber inland from Humboldt Bay (USFWS 1994).

Western Snowy Plover *(Charadrius alexandrinus nivosus)*. The coastal population of the western snowy plover is listed by the Federal government as an endangered species. The Pacific coast population breeds primarily on coastal beaches from southern Washington to southern Baja California, Mexico. Other nesting habitats exist in the form of salt pans, dredge disposal sites, dry salt ponds, and salt pond levees. Historically, there were at least 80 nesting sites on the west coast; 28 remain today. The plover's numbers have declined due to human activity on the beaches during nesting season. Jogging, off-road vehicles, pets, and horseback riding either destroy the nests outright, or cause adults to leave incubating eggs. European beach grass is considered a secondary threat because it has been planted to stabilize dunes and grows so thickly that it reduces available nesting habitat.

Locally, the coastal population of the western snowy plover breeds and winters in Humboldt Bay area, using intertidal beaches and foredunes. Historically, snowy plovers nested on both the North and South spits of Humboldt Bay. In recent years, however, nesting has occurred primarily at the mouth of the Mad River, where human interference is reduced. Preferred nesting sites include sand spits and dune-backed beaches (USFWS 1994).

The USFWS has prepared a proposal (February 24, 1995; 95-14) to designate critical habitat for the coastal population of western snowy plover throughout its range on the Pacific coast of the United States. Both the North and South spit and portions of the eliminated upland disposal site referred to as the"Superbowl Site", lie within critical habitat areas included in their draft proposal.

Bald Eagle *(Haliaeetus leucocephalus)*. The bald eagle is listed as endangered by both the Federal and State. The bald eagle is a permanent resident in California. It requires large bodies of water, or free-flowing rivers with abundant fish, and adjacent snags or other perches for feeding. Nesting occurs in large, old-growth, or dominant live trees with open branchwork, especially ponderosa pine. In recent years, bald eagles have established a breeding site on private land a few miles inland from Humboldt Bay. The bald eagle is believed to forage in both the Mad River and in the Bay year-round (USFWS 1994).

California Brown Pelican *(Pelecanus occidentalis californicus)*. The California brown pelican is listed as endangered by both the Federal and State. The brown pelican is typically found in estuarine, marine subtidal, and pelagic waters along the California coast. In Humboldt Bay, they are common from June through November, rare to uncommon from December to May, and rare and irregular from March to April. In California, they breed from March to July on the Channel Islands at Anacapa Island (approximately 3,600 nesting pairs in 1993), and near Santa Barbara Island. Breeding also occurs on islands off the Pacific Baja California coast of Mexico, and in the Gulf of California. Pelicans feed mostly on small schooling fish and forage during daylight hours. Its food occasionally consists of crustaceans, carrion, and young brown pelicans (USFWS 1994). They are plunge divers and prefer clear waters for easy prey detection. Because their feathers are wettable, pelicans usually forage within 15 km from shore and return to specific coastal roosts for the evening, usually arriving by late afternoon. In Humboldt Bay, it feeds both offshore and in the Bay. More than 400 pelicans have been seen in Humboldt Bay at one time (USFWS 1988). Favored roost sites include sand spits at the mouth of the Elk River, and the breakwater near the Coast Guard Station on the North spit (USFWS 1994).

Aleutian Canada Goose *(Branta canandensis leucopareia)*. The Aleutian canada goose is listed as endangered by both the Federal and State. It is a subspecies of the Canada goose and prefers lacustrine, fresh emergent wetlands, moist grasslands, croplands, pastures, and meadow habitats. It feeds on green shoots, seeds, wild grasses, forbs, and aquatic plants. In northeastern California, it nests mainly from March to June and prefers to nest near water on a dry, slightly elevated site, with good visibility from the nest. It will also use man-made structures such as platforms, baskets, and artificial rock islands.

Approximately 12,000 geese were counted in a 1993 USFWS survey in Crescent City (Shoulak 1994). Historically, Humboldt County has been used as an important staging area during spring and fall migration, however, since their population levels are low, use of the project area by the Aleutian Canada goose is unpredictable (USFWS 1994).

Short-Tailed Albatross *(Diomedea albatrus)*. The short-tailed albatross is listed as endangered by the Federal and State. It was once abundant in the northwest Pacific and off northern California, but was thought extinct by late 1940's; however, by 1954, a few had returned to nest on Torishima, an island south of Japan. The present world-wide population is estimated at 200. North American sightings in recent years are mainly from Alaska, although three have been recorded in California.

Prior to their population decline, short-tailed albatrosses flew in large flocks offshore. Their diet consists of fish, shrimp, and squid (COE 1991).

AMPHIBIANS

Northern Red-Legged Frog *(Rana aurora aurora)*. The Northern red-legged frog is Federally-listed as a candidate species. This frog commonly inhabits freshwater ponds and other more or less permanent bodies of water from sea level to 8,000 feet. This amphibian also frequents moist forests, grasslands, and riparian areas where emergent aquatic vegetation or forest understory provide adequate cover. During the rainy season, frogs may be found some distance from permanent water. In the Humboldt Bay area, open freshwater ponds within the project area are potential breeding sites for this species.

REPTILES

Northwestern Pond Turtle *(Clemmys marmorata marmorata)*. The northwestern pond turtle is Federally-listed as a candidate species, and is a subspecies of the western pond turtle. Throughout California, the western pond turtle is uncommon to common west of the Sierra-Cascade crest. It basks on partially submerged logs, rocks, floating vegetation, and open mud banks, and is normally associated with permanent ponds, lakes, streams, and irrigation ditches. The western pond turtle is the only abundant native turtle in California. Young are preyed on by garter snakes, bullfrogs, fishes, wading birds, and certain mammals. Its food source includes aquatic plant material, aquatic invertebrates, fishes, frogs, and carrion. Nests have been found in soil types ranging from sandy to very hard. Usually 3 to 11 eggs are laid from March to August, which hatch in approximately 73 to 80 days (USFWS 1994).

MAMMALS

Pacific Western Big-Eared Bat *(Plecotus townsendii townsendii)*. The Pacific western big-eared bat is Federally-listed as a candidate species, and is found throughout most of California. Although considered a true cave dweller, it will use man-made structures in the Humboldt Bay and Harbor area for roosts. Caves, mine tunnels, and buildings may be used for roosts. The bat hangs in tight clusters and moves from cave to cave, even during the winter (USFWS 1994).

PLANTS

Menzie's Wallflower *(Erysium menziesii ssp. eurekense)*. Menzie's wallflower is listed as endangered by the Federal and State. Menzie's wallflower is found on coastal dune habitats of the North and South spits of Humboldt Bay. Price (1993) suggested this population be considered a separate subspecies of the Menzie's wallflower and named it *Erysium menziesii spp. eurekense* in his Jepson Manual treatment. This subspecies is found nowhere else in the world, and its habitat is extremely fragmented (USFWS 1994).

On the North Spit, Menzie's wallflower typically occurs in the northern dune mat community. Within this habitat, the Menzie's wallflower is not randomly dispersed, but clustered in patches of a few to hundreds of individuals. Menzie's wallflower is also sometimes found bordering lupine scrub, herbaceous dune hollows, and open sand areas (USFWS 1994). The distribution of Menzie's wallflower can vary significantly over a period of several years (COE 1994c).

Menzie's wallflower populations have declined due to habitat loss and habitat disturbance. Coastal development, invasion by aggressive exotics such as European beachgrass (*Ammophila arenaria*), and overuse of dune habitat by off-road vehicle traffic have all contributed to the species' endangered species status (USFWS 1994 and COE 1994c).

Beach Layia *(Layia carnosa)*. Beach layia is listed as endangered by both the Federal and State. Beach layia occurs with Menzie's wallflower on the North Spit, and on the South Spit. The Humboldt County population consists of the largest known remaining population. Habitat loss and disturbance from coastal development, invasion of non-native plant species, and overuse of dune habitat by off-road vehicle traffic have all contributed to the decline of this species.

Beach layia is most often found in open, sparsely vegetated areas within dune mat habitat. Beach layia is also found in lower densities along margins of lupine scrub, herbaceous hollows, trails, and open areas with moving sand. It typically blooms from April to May or June (USFWS 1994).

Western Lily *(Lilium occidentale)*. The western lily is listed as endangered by both the Federal and State. The western lily is a hydrophytic species found in sphagnum bogs, forests, and around the margins of ephemeral ponds. It is also found in coastal prairies and scrub near the coast where fog is common. In the Humboldt Harbor and Bay area, it is restricted to slightly raised promontories of old well-drained beach wash and in areas overlain with alluvium and organic topsoil. It is also found on swamp edges or wet ground in azalea patches and on dry slopes of gullies having clay soils. In Humboldt, the western lily does not occur on the North Spit due to the absence of suitable habitat. In California, it blooms from mid-June to mid-July. Western lily has been found on Table Bluff (USFWS 1994).

Northcoast Sand Verbena *(Abronia umbrellata ssp. breviflora)*. The northcoast sand verbena is listed as a candidate species by the Federal. The northcoast sand verbena is found on beaches. low sandy hummocks, open sandy bay edges, and river mouths. Dune mat and beach strand are the preferred habitats, however, it can also occur along borders of trails, and in open sand. It is found only in fine sand or silty sand beaches with little organic soil. This species does not form stable populations, but instead shifts in location from year to year.

In Humboldt, the northcoast sand verbena is found in larger numbers on the North Spit than the South Spit. Reasons for species decline include stabilization of sand-dune systems by non-native species; loss of habitat from coastal construction and industrial development; and disturbance from

heavy recreational use. The northcoast sand verbena blooms from May through September (USFWS 1994).

Humboldt Bay Owl's Clover *(Castilleia ambigua ssp. humboldtiensis)*. The Humboldt Bay owl's clover is another plant species listed as a candidate species by the Federal. The Humboldt Bay owl's clover is found exclusively in the salt marshes of Humboldt Bay. Tidal elevations range from 7.7 to 8.4 feet MLLW in North Humboldt Bay. On the North Spit it is found mainly on island marshes of the slough. On the South Spit, it is found mainly in the southern portion.
It blooms from May to August (USFWS 1994).

Northcoast Bird's Beak *(Cordylanthus maritimus ssp. palustris)*. The northcoast bird's beak is Federally-listed as a candidate species. The northcoast bird's beak is found in the mixed marsh subtype of salt marsh. On the North Spit, it is found on the island marshes of the slough. It is also found on the South Spit, mainly in the southern portion. Northcoast bird's beak is found at the same and slightly higher elevation as the Humboldt Bay owl's clover; these two species coexist in many areas (USFWS 1994).

Humboldt Bay Gumplant *(Grindelia stricta ssp. stricta)*. The Humboldt Bay gumplant is also Federally-listed as a candidate species. The Humboldt Bay gumplant is usually found in salt marshes bordering Humboldt Bay, and occurs most frequently at elevations above 7.4 feet MLLW. The gumplant may have wide habitat requirements; on the South Spit it occurs within the mixed marsh salt marsh type. It blooms from July to November (USFWS 1994).

4.5.2 Louisiana Pacific Site

4.5.2.1 *HABITAT*

A site visit was conducted on December 30, 1993, by USFWS, CDFG, Harbor District, and Corps staff. The site visit confirmed the parcel of land where the LP Site is located appears to have been originally vegetated back-dune habitat consisting of shore pine (*Pinus contorta* ssp. *contorta*). Relatively undisturbed areas such as the north corner of the LP Site are still covered with this vegetation type. Located within this relatively undisturbed area, is an approximately 2.6 acre triangular-shaped riparian wetland area (i.e., scrub-shrub wetland) immediately to the north, between it and the Samoa Bridge. During disposal of berth maintenance dredged materials, LP contract dredgers have been careful to avoid this highly disturbed wetland area when disposing of dredged material. In addition, the site visit revealed the wetland area to be at a much lower elevation than the two settling ponds described below, thus making it very easy to avoid impacts.

The remainder of the parcel has been bulldozed by LP, and consists of two terraced settling ponds used for dredged material disposal. These two ponds are located behind containment dikes, and are approximately 25-30 feet above the surrounding terrain (located above mean higher high water (MHHW) and the high tide line). The levees of the two ponds and the disturbed areas outside

of the levees (i.e., majority of LP Site) are covered with a dense growth of ruderal herbaceous and scrub vegetation. Plant species found in these areas are mainly ruderal, along with a mixture of a few dune species such as beach sagewort (*Artemisia pycnocephala*) that are capable of competing with the dense growth of ruderal plants. In the past, the LP Site has been used for random dumping of refuse such as asphalt and concrete. Dredged material (i.e., from LP's maintenance dredging of the Bay) is periodically dumped on the site; the desiccation process occasionally results in water "ponding" on the site. The extent and duration of any ponding on this site varies from year-to-year, depending on amount of dredged material dumping, and rainfall. These ponded areas do not function as wetlands, however, due to their continually disturbed condition, and lack of true hydric soils and wetlands vegetation (USFWS 1994).

4.5.2.2 *WILDLIFE*

Birds

The Louisiana Pacific upland disposal site has a triangular-shaped riparian scrub-shrub wetland immediately north of the site, between it and the Samoa Bridge. During the site visit, snowy egrets (*Egretta thula)* were observed using another wetland marsh area to the southeast of this site, between the Samoa Bridge and Vance Avenue. When the Louisiana Pacific site contains water, egrets may use this area. Waterfowl may also use this site, and hawks such as the northern harrier (*Circus cyaneus)* may use the area to forage for rodents. Birds such as gulls and rock doves may use the area for loafing. However, according to a local bird expert, avian use of the site is very low, due to its degraded condition (USFWS 1994).

Mammals

Various small mammals such as ground squirrels, rats, mice, shrews, raccoons, skunks, and muskrat (*Ondantra zibethicus)* may use the site at different times of the year for forage and cover, depending on the quality of habitat available (USFWS 1994).

Invertebrates

Any significant populations of invertebrates of value to feeding birds or other wildlife are highly unlikely, however, due to the site's continually disturbed condition (USFWS 1994).

4.5.2.3 Threatened and Endangered Species

No known threatened or endangered species are known to occur on the LP Site. A site visit, conducted on January 25 - 27, 1994, by a Corps botanist revealed no rare plant species onsite. No rare plant species have previously been noted anywhere in the vicinity of this site, and colonization of this site is unlikely due to its degraded condition. The northcoast sand verbena could colonize the area near the northern outflow pipe into the Bay. This area has typical ruderal and coastal plants, and cordgrass was present in the intertidal zone. No sign of northcoast sand verbena was noted at

this time (DeJager 1994). Although the shoreline area by the LP Site is not very good habitat for rare salt marsh plants, a resurvey was conducted in June 1994, by Botanica Northwest Associates, during the time when any rare salt marsh and shoreline plants would be blooming. In June 1993, an earlier biological survey of the LP Site was conducted by Karen Theiss and Associates for the Louisiana-Pacific Corporation Samoa Terminal Reconstruction Project (Louisiana-Pacific 1994). These two surveys and the 1994 site visits concluded that no rare or endangered salt marsh and/or shoreline plants were present in this area, and thus would not be impacted by the proposed project.

4.5.3 Estuarine and Wetland Habitat

There are many definitions of the term "wetland", but generally it refers to an area that is inundated by water with a frequency such that it can support a prevalence of vegetation and organisms which require saturated soil conditions for growth and reproduction. These types of areas include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural ponds.

Executive Order 11990 requires the protection of wetlands by Federal agencies engaged in carrying out their responsibilities for Federal lands, Federal construction, and Federal activities and programs. It is the policy of the Corps that wetlands are a vital public resource, the unnecessary alteration or destruction of which should be discouraged as contrary to the public interest. To this end, the Corps has prepared a detailed description of the wetlands, by type, for the Humboldt Bay area and has identified areas of importance and/or environmental concern. Also, evaluated are the major types of Corps activities in terms of their impacts on wetlands and potential approaches to mitigation. This information will be utilized in evaluating the alternatives for this project.

Of the 215 million acres of wetlands estimated to exist in the United States at the time of colonial settlement, less than 95 million acres remain today. The annual loss of wetlands in the U.S. today exceeds 450,000 acres. California has suffered a 91 percent reduction of wetland habitats and thus has the dubious distinction of being the nation's leader in this category. Originally Humboldt Bay and its adjacent wetlands covered more than 27,000 acres. It has since been reduced to approximately 17,000 acres.

4.5.3.1 *Freshwater Marsh*

The flat pasture lands surrounding the Bay are interspersed with shallow drainage ditches, borrow pits, and various streams which create a myriad of freshwater marsh habitats. During the relatively dry summer months this habitat type is confined to the limits of the stream banks and comprises some 40 acres, but winter rains cause the waters to expand out over the lowlands, creating new areas of freshwater marsh. Depending on the amount of rainfall, this may increase the total area of freshwater marsh up to tenfold, or 400 acres, during the winter months.

Permanent freshwater marshes are found at the southeast end of the Bay in the Salmon Creek and Elk River drainages extending into the area known as Beatrice Flat; between the cities of Eureka and Arcata in the flats east of the Bay; and in the bottomlands to the north of the Bay extending northward nearly to the Mad River and along the Mad River Slough. There are small ponds near the north end of the South Spit, at the south end of the Samoa Spit, and near Buhne Point on the east edge of the Bay. These ponds are each about one acre when full.

There are ponds throughout the agricultural lands which are flooded seasonally at the discretion of the landowners. The location of these ponds varies according to the location of check dams constructed by the landowners and the dams are frequently washed out by flood conditions in midwinter.

Plants common in the freshwater marshes of Humboldt Bay include creeping spikerush, bulrush, sago pondweed, widgeon grass, water naiad, arrow grass, European beach grass, beach lupine, and saltgrass. Humboldt Bay marshes are generally highly productive areas that offer a wide variety of plant species and other wildlife foods. The seasonal areas are primarily flooded pasture lands that support plant species typical of most low lying pastures in the county.

4.5.3.2 *Salt Marsh*

The salt marsh habitat occurs only in remnant stands along the perimeter of the Bay, in tidal tributaries, and on islands within the Bay. The original estimated 7,000 acres included most of the lands in Arcata Bottoms, Jacoby Creek, Eureka Slough, Elk River, and Beatrice Flats which have since been reclaimed as agricultural lands. The total salt marsh remaining is estimated at 970 acres (Shapiro and Assoc., 1980), only 10-15% of the original acreage. The remaining wetland communities around the Bay include approximately 250 acres of brackish marsh, 274 acres of freshwater marsh, and 170 acres of riparian freshwater swamp (USFWS 1994).

The largest single tract of salt marsh is on Indian Island, which lies north and west of the city of Eureka and contains 200 acres of salt marsh habitat. A smaller area of about 10 acres lies between Indian Island and Eureka Slough and is known as Daby Island. From the mouth of the Eureka Slough, north to the Arcata Redwood Mill along the east side of Arcata Bay lies a 70 acre stretch of marsh, and another 25 acre area lies along the same shore to the north. The Mad River Slough contains a number of small salt marsh islands ranging from less than 1 acre to 50 acres, totalling an area of approximately 100 acres, and the same pattern and acreage is found along the perimeter of Arcata Bay. In the South Bay, salt marsh habitats are confined to small islets or narrow edge cover along the shoreline and tributary sloughs totalling another approximate 100 acres.

In terms of basic nutrients, the salt marsh is more productive than the richest agricultural lands. The peat soils are rich in organic material, including plants and the remains of small animal life that are washed away with rains and tides to fertilize the Bay and sea. The marsh acts as a filter for

incoming sediments and some forms of pollutants, and also provides habitat for many kinds of wildlife including one of California's rarest birds, namely the clapper rail.

The dominant plant cover is comprised primarily of cordgrass *(Spartina densiflora)*, pickleweed *(Salicornia virginica)*, and saltgrass *(Distichilis spicata)*. Humboldt Bay Cordgrass is an exotic species introduced from Chile during the mid-1800's, most likely arriving as ballast on a lumber ship Marin County is the only other area in North America where this plant can be found and it was introduced as part of a revegetation experiment in 1976. Other plants include marsh rosemary, gum plant arrow grass, salt rush, and jaumea. Two species of plants that are candidates for the Federal threatened and endangered species list occur around the Bay and are saltmarsh dependent. They are the northcoast bird's beak and Humboldt Bay owl's-clover. The latter species is endemic to Humboldt Bay.

4.5.3.3 *Intertidal Mud Flats*

Intertidal mud flats are areas which are fully exposed at low tide and entirely inundated by water at high tide. They range from about -3 or -4 feet MLLW to 5 or 6 feet MLLW. Given their fluctuating nature, the exact acreage is difficult to quantify, but the average is about 7,200 acres. The largest areas of intertidal mud flats occur in the Arcata Bay (4,600 acres) and South Bay (2,600 acres).

Two distinct types of this habitat exist and can be described as high and low mud flats. The high mud flat is found from MLLW to mean high water (MHW) and is typically extremely smooth and muddy (i.e., devoid of vegetation), gently contoured, and transected at wide intervals with tidal channels. The only plant life to be found is the green algal species typical to the low mud flats. Low mud flats are found just below MLLW and have a relatively flat surface configuration with irregularities formed by small hummocks separated by shallow water depressions. These water-filled depressions and the borders along the Bay's shallow water provide growing conditions for small clumps and larger beds of eelgrass and widgeon grass. Both low mud flats and eelgrass are most common in the South Bay. Other plant life is limited to several species of algae, of which blooms may cover the mud and eelgrass in dense layers during the summer months.

The mud flats are rich in the invertebrate life upon which most of the avian wildlife of the Bay is dependant. It is here that the bulk of the food organisms consumed by the Bay's fish and wildlife is produced and many of the vital life processes upon which the Bay's productivity depends take place. Most invertebrates occur in the top 6 inches of the strata with approximately 97% being found in the upper 2 inches. The species and numbers of invertebrates found are determined by the sediment composition and location in relation to tidal submergence time. As a wildlife habitat, the mud flat is probably the most important area in the Bay. The total bird use days recorded here surpass that of all other habitat types. During low tide, the exposed mud flats are feeding grounds for thousands of shorebirds which move across the mud in search of small invertebrates with their long, probing bills.

4.5.3.4 *Shallow Water Bays (Subtidal)*

Approximately 6,000 acres in the Bay can be classified as shallow water (subtidal), with this habitat type most common in the Arcata and South Bays. The bottom of these areas are rarely, if ever, exposed completely at low tide and it is this characteristic that separates them from the neighboring mud flats. The subtidal benthic substrates are dominated by several species of marine algae, including green algae *(Ulva* sp.), red algae *(Endocladia* sp.), nori *(Porphyra* sp.), kelp *(Alaria* sp.), and rockweed *(Fucus* sp.)(USFWS 1994).

The vast majority of eelgrass *(Zostera marina)* growth is in these areas and is normally of sufficient density to prevent boat passage except where oyster culture has disturbed it. The production of eelgrass was significantly reduced following the establishment of oyster cultivation in the North Bay in the 1950's. There are marked seasonal differences in growth rates of eelgrass with summer rates approximately twice as great as growth in winter, apparently due to increased solar insulation.

Eelgrass often forms dense stands on the mudflats below the +1 foot MLLW contour, while maximum biomass production generally occurs at -1 foot MLLW. The lower limit of eelgrass growth has not been clearly defined, but it has been identified as being somewhere below -1.5 feet MLLW. A recent survey, in 1990, by WESCO found that the greatest densities of eelgrass in South Humboldt Bay typically occurred at depths of less than -12 feet MLLW. Most of the Bay's mudflats are covered by eelgrass. Although eelgrass forms a monotypic community, it also supports a wide variety of epiphytic algae, thus its community structure may be more complex. The eelgrass community is one of the most productive in Humboldt Bay (USFWS 1994).

About 1,942 acres of eelgrass beds occur in the South Bay, and 1,075 acres occur in the North Bay. Eelgrass accounts for about 20 percent of the total aerial extent of the intertidal habitat of the Bay. Humboldt Bay is recognized as having one of the three largest stands of eelgrass in the Pacific northwest region. Eelgrass exerts an important influence on sedimentary regime, distribution of infaunal organisms, and the occurrence and density of fish and birds (USFWS 1994).

Arcata Bay eelgrass beds contribute significantly to the overall primary productivity of the Bay. Eelgrass beds in Arcata Bay are not as dense as those of the South Bay; the scattered growth of eelgrass along the Entrance Bay and Arcata Bay channels suggest that it is less significant in the energy budgets of those portions of the Bay. Eelgrass also grows along many of the channels that are routinely dredged (USFWS 1994).

Detritus from eelgrass beds supports a food web which may be even more diverse than that supported by the standing crop. Detritus remains in the eelgrass beds, or is transported by tidal action to other nearby habitats, thereby becoming a major food source for a wide variety of benthic invertebrates including molluscs and crustaceans. Detritavores are in turn fed upon by shorebirds, waterfowl and fish. Many molluscs, crustaceans, and fish of sport and commercial importance utilize eelgrass as nursery grounds (USFWS 1994).

Eelgrass is the major food of black brant and other waterfowl species, including American widgeon, scaups, Canada geese, and pintail (Phillips 1984). Without eelgrass, the black brant could not survive. Invertebrate herbivores are unable to feed directly on eelgrass so most of the production must enter a pathway to microbial decomposers to be included in the food chain. Eelgrass produces nutrients and oxygen required for the Bay's fauna. Eelgrass is rooted in sediments, and takes up nutrients through root hairs. The anaerobic sediments surrounding the roots are composed of micro-organisms that can fix atmospheric nitrogen, thereby creating a ready nitrogen supply for the eelgrass, and a fairly stable source of nitrogen compounds for herbivores (USFWS 1994). Fish lay their eggs in the dense foliage and small crustaceans and other organisms use it to hide from their enemies.

4.5.3.5 *Tidal Channels*

Tidal channels are naturally occurring trenches which are the deepest areas in the Bay and are situated almost always below MLLW. They form a complex network in their locations within the mudflats and relatively shallow waters of the Arcata and South Bays. Location and depth is determined by tidewater action, tributary flows, water velocity, and siltation. Beginning in the Entrance Bay, navigation channels proceed north to the Samoa and Eureka channels and south to Field's Landing. These channels are dredged annually in the spring and fall to maintain their authorized depths, which can be expected to exert some influence over the marine resources therein. The tidal channels tend to shoal in an up-bay direction from as deep as 30 feet near the entrance of the Bay to 6-12 feet deep in the upper reaches of the Arcata and South Bays. Eelgrass grows in dense stands in and along the edges of many of these channels, particularly in the South Bay area, and waterfowl tend to congregate in these areas during low tides. There are approximately 1,000 acres of this habitat type.

4.6 CULTURAL RESOURCES

4.6.1 Identification and Evaluation

Cultural resources may be defined as the remains of previous human activity that are archeological (e.g., artifacts found on or within the ground) or historical (e.g., standing architectural features, structures, buildings, shipwrecks or natural landscapes of important events). The term also includes traditional cultural properties, a site or location associated with historically rooted cultural practices or beliefs of a living community. The Humboldt Harbor deepening and widening project, because of its emphasis on the aquatic environment, will be primarily concerned with archaeological and historical resources.

Identification and significance evaluation of cultural resources are mandated under Federal statutes, including the National Historic Preservation Act (NHPA) and Executive Order 11593, the most relevant for the proposed undertaking. Section 106 of the NHPA requires a Federal agency to consider the effects of their undertaking on "historic properties," a term for cultural resources that are, or determined to be, eligible for listing in the National Register of Historic Places (National Register). The Advisory Council on Historic Preservation published the regulations implementing the Section 106 process (36 CFR Part 800). In addition, the California Environmental Quality Act (CEQA), Appendix K, establishes the criteria of significance for cultural resources which are subject to State of California regulatory review.

One of the initial steps in the Section 106 process is delineation of the project's Area of Potential Effects (APE). Typically, an APE includes the areas where project activities could affect the historic properties located on terrestrial ground surfaces or the seafloor, including areas adjacent to any construction site where "indirect" impacts can occur. It is clear that the Humboldt Harbor project's APE would therefore include the dredging locations and site(s) where disposal of dredged materials will occur (i.e., ocean disposal site and upland disposal site), as well as any new construction roads, pipelines and other utility corridors, and construction staging areas. The APE for the dredging portion of the project was reduced in scope to include only the areas proposed for widening: the Samoa Turning Basin and the Bar and Entrance Channel. It was determined, in consultation with State Historic Preservation Officer, that the channel sections to be only deepened would less likely contain maritime cultural resources than areas of widening and, thus they were excluded from the APE.

Federal and State criteria are used for evaluating the significance of cultural resources. The Federal criteria for defining cultural resources significance (i.e., determining whether a cultural resource meets the National Register requirements for eligibility) are codified in 36 CFR 60.4. According to the National Register criteria, a significant cultural resource must have "integrity" and contain one or more of the following qualities:

A. Is associated with events that have made a significant contribution to the broad patterns of history; or

B. Is associated with the lives of persons significant in the past; or

C. Embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Have yielded, or may be likely to yield, information important in prehistory or history.

Appendix K (Archeological Resources) of the CEQA states that an important, or significant archeological resource is one that:

A. Is associated with an event or person of:

1. Recognized significance in California or American History; or

2. Recognized scientific importance in prehistory.

B. Can provide information which is both of demonstrable public interest and useful in addressing scientifically consequential and reasonable or archeological research questions;

C. Has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind;

D. Is at least 100 years old and possesses substantial stratigraphic integrity; or

E. Involves important research questions that historical research has shown can be answered only with archeological methods.

4.6.2 Regional Historical Overview

Significant cultural resources indicative of human adaptation to the geographic region of Humboldt Bay are recorded in a variety of environmental settings surrounding the proposed dredging and disposal areas. Cultural resources include shellmiddens and artifacts reflecting prehistoric settlement by Native Americans; historic shipwrecks indicating early maritime trade and commerce; and the historically constructed environment (i.e., roads, railroad tracks, piers and buildings). In addition, these cultural resources demonstrate historic period settlement, economic fluctuations, and adaptations to natural and social conditions.

Humboldt Bay was the approximate center of the territory occupied by a Native American group who are referred to as the Wiyot. The Wiyot spoke an Algonquian language, and thus they were linguistically related to Algonquian speakers in the eastern and central portion of the United States. The Wiyot language is now extinct. The population estimates of the Wiyot at pre-Contact time range from 1,000 to 3,300.

The Wiyot were adapted to an environment characterized by heavy rainfall and redwood forests. They relied on the waters of the area to provide them with the bulk of their diet, namely mollusks, fish, and sea mammals, of which salmon was the most significant. The Wiyot located their villages along the shores of the Bay and near the mouth of the Eel and Mad rivers. The accumulation of refuse from everyday activities, i.e., processing of foodstuffs and tool-making, is called a "midden." Middens in the Wiyot territory generally contain fish and shellfish remains, and mammal bone fragments, indicative of their diet, as well as their tools made from stone, bone, and wood. These archaeological sites of the Wiyot contain the information to chronicle more than 1,000 years of social interaction, cultural change, cultural process, and final disruption of a Native American society. Many of the sites have been looted for artifacts or destroyed by development. Protection of the remaining sites, or intact portions of such sites, is essential for a complete understanding of the prehistory and history of Humboldt Bay.

The Spanish exploration of the coast of California began in the 16th century. Humboldt County was claimed for the King of Spain in 1775. It was not until 1806, however, that it was truly discovered by Jonathan Winship, an employee of the Russian-American Fur Company, on a sea otter hunting expedition. As the only sizeable harbor between San Francisco and the Columbia River in Oregon, it became a major port of trade for the Trinity mine supply ships and the lumber industry.

Although Humboldt Bay was suitable for commercial purposes, the shifting sandbar across its entrance seriously impaired the movement of ships into the Bay. At times, the entrance was completely closed by the sand and ships could neither enter nor leave the harbor entrance. A preliminary review of the literature indicates that at least eight-four ships were wrecked in the vicinity of Humboldt Bay. Most wrecks occurred as the ships tried to cross the sandbar and enter the Bay. Shipwrecks, or submerged maritime resources, have the potential to provide information not available in the written record on historic ship construction, trade, commerce, industry, military history, and maritime lifeways.

4.6.3 Disposal Site Options

4.6.3.1 Humboldt Open Ocean Disposal Site (HOODS)

It has been approximately 6,000 - 8,000 years since sea levels were low enough to have exposed the seafloor location of the ocean disposal site. Remote sensing data indicate that HOODS has a flat topography, and is evidently devoid of any indications of old fresh water courses or terraces. During this period, the (terrestrial) disposal site and environs may have been suitable for human

occupation. The possibility that archaeological remains from prehistoric occupation exist at HOODS is considered remote. If such remains were present at some time, it appears likely that sediments would have covered the original ground surfaces. The probability of finding such archaeological sites is therefore low.

The ocean waters in the vicinity of Humboldt Bay have been the site of numerous vessel accidents and sinkings. Coordination with the California Office of Historic Preservation and the State Lands Commission, has indicated that several ships have been reported as sinking in the vicinity of HOODS. No shipwrecks are recorded as situated within the disposal site.

To assist in identifying the possible presence of maritime archaeological sites at the HOODS, a "survey" using a magnetometer and side-scan sonar equipment was completed in 1990 under contract to the Corps of Engineers. A report by Land and Sea Surveys/BioSystems, Inc. (1991) provides the survey methods and results. This survey was coordinated with State Historic Preservation Officer and the National Park Service, including submittal of review copies of the scope of work and report. Numerous magnetic and sonar anomalies were identified within the HOODS. Three of the identified seafloor features were interpreted to be *"potential shipwreck locations."* The three locations were not investigated further to confirm or refute the suspected archaeological nature of the features because disposal activities were planned to avoid the locations. Any future project proposal to dispose dredged materials in or near these areas would require additional scientific study to evaluate the features. (Note: The proposed avoidance of the three locations has been successfully implemented for the disposal of dredged materials from maintenance dredging projects.)

4.6.3.2 Louisiana-Pacific Site

The Louisiana-Pacific Site is a private parcel historically used for upland disposal of dredged materials. The site preparation and repeated use have created a basin-like topography with dune environments surrounding it. No archaeological sites or other cultural resources are recorded for the L-P Site. In addition, no properties eligible for listing in the National Register of Historic Places, or recorded with the State of California as important historical sites, are known for the disposal site and its immediate vicinity. The Corps conducted a terrestrial archaeological reconnaissance of the L-P Site in 1993 to inspect areas believed to be relatively undisturbed, i.e., the dunes on the perimeter of the disposal area. No evidence of cultural resources was observed. In addition, the parcels adjacent to the L-P Site were visited to confirm that none of the nearby archaeological sites recorded along the Samoa Peninsula were in the disposal site APE.

In the region, Indian Island (aka Gunther Island) is classified as extremely sensitive for archaeological and cultural properties. Two large prehistoric sites located on the Island (CA-HUM-67 and HUM-68) are believed to have been occupied during the Wiyot tenure. Site CA-HUM-67 is listed on the National Register of Historic Places. The Island is located roughly 500 feet away from the L-P Site.

4.6.4 Navigation Channels

4.6.4.1 Humboldt Bar, Entrance, North Bay, Samoa, and Outer Eureka Channels

The entire Humboldt Bay has been designated as a California State Landmark (No. 882, the Humboldt Harbor Historical District). The North Jetty and South Jetty appear to meet the criteria for listing in the National Register of Historic Places and would warrant documentation in the Historic American Engineering Record. The jetties were found eligible for inclusion as a California Historic Civil Engineering Landmark (Pursell 1981). The jetties are not within the project's Area of Potential Effects.

The area to be widened at the Bar and Entrance Channel was considered highly sensitive for the presence of submerged maritime resources due to the quantity of vessel accidents and sinkings reported in the literature. The area to be widened in the vicinity of Samoa is considered less sensitive as the number of shipwrecks reported within the Bay is considerably lower than that listed for the sandbar outside the Bay.

Shipwrecks are not likely to occur in the channel areas to be deepened as the channels are regularly maintained and burial of maritime resources below the existing bottom would not be possible. These already channelized areas are therefore considered least sensitive for shipwrecks.

To identify shipwrecks or other maritime cultural resources that might exist in the channels to be widened, the Corps retained a professional marine archaeologist to conduct a magnetometer and side-scan sonar survey in 1994. The SHPO was consulted regarding the rationale to focus the survey on the areas of new dredging (i.e., channel and turning basin widening) and was given a review copy of the scope of work. The Corps independently researched archival records and available publications at local libraries and maritime organizations in Eureka and Arcata to better assess the likelihood of reported shipwrecks being present in the targeted portions of the APE. One magnetic anomaly of consequence was identified near the western end of the Bar and Entrance Channel. This anomaly was tentatively interpreted as the location of a potential shipwreck. It is situated on the seafloor at a depth of approximately -54 feet, which is below the depth of the proposed dredging.

4.7 TRANSPORTATION

4.7.1 Regional Transportation

The Humboldt Bay area is served not only by waterborne transportation, but also by highways, rail, and air.

U.S. Highway 101 is the major highway serving the Humboldt Bay area. It traverses the area from south to north, connecting the Oregon border to the north with Santa Rosa and the San Francisco Bay area to the south. Highway 101 is the primary route for both tourist access to the Humboldt Bay area, and for access by commercial transporters. Highway 299 which runs west from Highway 101 to Highway 5 in the east. Improvements to both highways are steadily being made, but Highway 299 from east of Buckhorn Summit to Whiskeytown Reservoir is a serious impediment (i.e., landslides) to the movement of cargo by truck east into Redding and linking to the existing rail system in the Central Valley (Groby 1994).

Railroad service connects Arcata and Eureka with cities to the south for freight services only. There is a railroad spur which serves all the docks and industries on the North Spit. Historically, this spur has been used primarily by the logging industry. There are no railroad lines located north or east of the City of Arcata. Presently, the condition of the southbound rail linkage to class-one rail lines is also in need of attention (Groby 1994). The provision of a rail service over the mountains toward Redding would make Humboldt Bay more viable as an export port for the Central Valley, but presently the hinterland of Humboldt Bay is the access to coastal areas by waterborne transportation.

The major airport serving commercial airline passengers and handling freight is the Eureka-Arcata Airport, located about sixteen miles north of Eureka, near the community of McKinleyville.

4.7.1.1 *Marine Cargo Transportation*

<u>Humboldt Harbor and Bay Navigation Channels</u>

Commodity traffic at Humboldt Harbor is composed of deep-draft shipping, barge traffic, and commercial fishing boats. Both the barges and commercial fishing vessels traffic have much shallower drafts than the deep-draft vessels using Humboldt Harbor, thus do not require a deepened harbor. Deep-draft vessels, mainly the forest products industry, would benefit from deepened navigation channels since the presently maintained channels are inadequate for existing deep-draft vessels entering and leaving the Bay.

Currently, the commodities that are being exported from Humboldt Harbor include: lumber; logs; particle board; pulp; chips; petroleum; and chemicals. Table 4.7.1.1-1 below displays the

various docks in Humboldt Harbor and their associated commodities. Figure 4.7.1.1 shows the dock location along the various navigation channels. Only the shipment of the following products use deep-draft vessels in the Bay: lumber; particle board; pulp; and woodchips. Logs are shipped out of the South Bay which is located outside the proposed project; petroleum is either barged or shipped in at operating drafts less than 30 feet; and chemicals are barged into Humboldt Bay.

TABLE 4.7.1.1-1
HUMBOLDT HARBOR DOCKS AND COMMODITIES

Dock No.	Company	Commodity
1	Kramer	Inactive
2	Humboldt Bay Forest Products	Logs
3	Standard Oil	Petroleum
4	Eureka Forest Products	Lumber/Logs
5	Union Oil	Petroleum
6	Humboldt Dock "A"	Inactive
7	Humboldt Dock "B"	Inactive
8 & 9	Louisiana-Pacific	Lumber, pulp, particle board, chemicals
10	Simpson Paper	Pulp, petroleum, chemicals
11	North Coast Export Co.	Chips

Humboldt Harbor's tonnage had increased from 1,383,927 short tons in 1975 to 1,729,760 short tons in 1990, an increase of nearly 25 percent. In 1991, there was an increase of 100,000 short tons, but in 1993 there was only 1,125,544 short tons (a decrease of approximately 604,000 short tons from 1991). According to Vessel Traffic Records, approximately 154 deep-draft vessels called on Humboldt Bay in 1993 (Westfall Stevedore Company, 1993), and changes in tonnage exported exhibited cyclical rather than secular trends.

Humboldt Harbor currently uses a higher percentage of deep-draft vessels in the 40,000-50,000 dead weight ton (dwt)(51%). A gradual growth in the utilization of larger vessels in Humboldt

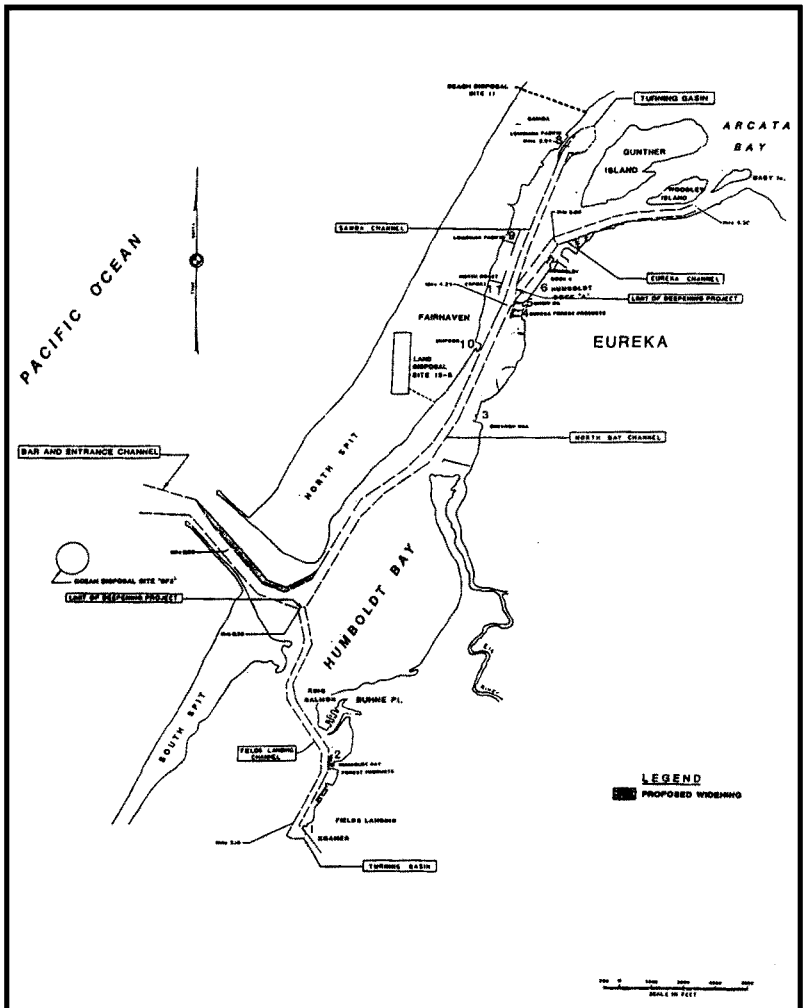


Figure 4.7.1.1 Dock Locations along Navigation Channels in Humboldt Bay

Humboldt Harbor has been noticed in the past decade. Smaller vessels from 15-30,000 dwt are gradually being phased out by shipping companies, and use of larger vessels (40,000 dwt plus) is commonplace.

Presently, deep-draft vessels calling on the Bay with an operating draft of 30 feet or more have had to practice the following to accommodate the Harbor's depth restraint (explained in more detail in the "Economic Appendix" attached to the Feasibility Report):

- Tidal Delays: All deep-draft vessels with an operating draft of 30 feet or more must wait for a high tide to maintain a five foot underkeel clearance. With the proposed project the additional depth will have the same effect as a high tide and reduce transportation costs associated with using Humboldt Harbor in its present condition.

- Light-loading: Large deep-draft vessels are unable to enter or depart from Humboldt Harbor fully loaded. The depth of the existing channels limit the operating draft of the vessel which in turn limits the vessel's load. A deeper channel would reduce the need for vessels to top-off at other harbors, allowing the vessel to load fully before sailing to an overseas destination.

- Rerouting: Certain deep-draft vessels, particularly those that transport pulp and particle board, travel extra distances just to accommodate Humboldt Harbor's depth constraint.

- Change in Operational Mode: During 1989, shippers discontinued shipping lumber by deep-draft vessel from Humboldt due to the channel depth constraints. Recently, shipment of lumber has been changed from deep-draft vessels to trucks due to the inadequate depths of the navigation channels.

- Economies of Scale: Large vessels are unable to load to maximum capacity and depart from Humboldt Harbor. The large carrying capacity allows more cargo to be transported and reduces the number of trips made. In Humboldt Harbor, many trips must be made by smaller deep-draft vessels for cargo that would fit in a vessel with an operating draft over 30 feet.

Transportation problems associated with the export of the following commodities in deep-draft vessels presently calling on Humboldt Bay are briefly described in the following:

- Lumber: Terminals in Humboldt Bay receive lumber both finished and rough cut for coastal shipping and overseas shipping. Lumber used to be shipped from Humboldt

Harbor, but the shipping line ceased calling on the Harbor in 1988 after their ship was completely loaded, and had to wait inside the Harbor for three days because the Bar was completely unpassable due to shallow draft over the Bar. Thus, lumber is currently barged from Eureka to Long Beach and San Diego.

- Pulp and particle board: Pulp is exported to pulp mills in the Far East and Europe from Humboldt. Approximately, 60 vessels carry forest products from Humboldt on an annual basis. Generally, 60% load for the Far East, 20% load for the Mediterranean, and 20% load for Northern Europe. Presently, the operating schedule for the pulp and particle board deep-draft vessel is structured to adjust to the depth constraints of Humboldt Harbor, and thus, increases the transportation costs associated with using the Harbor.

- Woodchips: Woodchips are purchased from approximately 20 sawmills located in Humboldt County and Southern Oregon. Generally, woodchips are transported directly to Japan from the North Bay channel. The woodchip carrier fleet consists of 12 vessels of which 50% are 45,000 dwt, 33% are 40,000 dwt, and 17% are 35,000 dwt. Shippers utilizing the Humboldt Harbor point out that their deep-draft vessels oftentimes are light-loaded because of the lack of adequate deep-draft navigation channels for the present-day ships calling on Humboldt Harbor.

The deepening and selective widening of Humboldt Bay Harbor navigation channels is proposed for the following purposes: eliminate navigation problems associated with maneuvering the present-day deep-draft vessels in inadequate channel depths and widths; provide safe efficient passage within channels for deep-draft vessels entering and leaving the Bay; reducing the risk of accidents involving deep-draft vessels, which could cause serious environmental damage to the Bays fish and wildlife resources; and alleviate the transportation problems described above for commercial deep-draft vessels presently calling on the Harbor.

HOODS

This disposal site is located approximately 3 to 4 nautical miles offshore from Humboldt Bay. It has been used regularly since September, 1990 for both the Fall maintenance dredging of the Bar, Entrance, and North Bay channels; and the Spring maintenance dredging of the Eureka, North Bay, and Field's Landing channels, respectively. The general discussion under the existing marine transportation in the navigation channels, applies to this disposal site, as well.

LP Site

No existing marine transportation is associated with this site except for the disposal of dredged material by LP contract dredgers.

4.7.1.2 *Land Transportation*

Humboldt Bay Harbor Navigation Channels

Access to the navigation channels is by marine transportation only, and land-associated transportation on roads into and out of the Harbor area are not associated with the proposed project.

HOODS

Access to HOODS is by marine transportation only, and land-associated transportation is not associated with the disposal site.

LP Site

The access to the LP Site is mainly by dredges situated adjacent to the site in Humboldt Bay. Samoa Boulevard is a two-lane road that provides access to the north spit and Highway 255 to Eureka. Adjacent land uses include mainly low density residential areas in the small towns of Manila and Samoa, agricultural land to the east toward Arcata, and access to beach dunes on the north spit just west of the disposal site.

4.8 SOCIOECONOMIC ENVIRONMENT

4.8.1 Population

There are two major population centers adjacent to the Bay and several smaller communities. Eureka, with a population of 24,850 (1992) is the largest city on the North Coast and the county seat and commercial center of Humboldt County. Arcata has a population of 14,700 (1992) and is the home of Humboldt State University. Small communities in the area include Bayside, Fairhaven, Fields Landing, King Salmon, Manila, and Samoa. The total population of Humboldt County was estimated at 123,600 in 1992 (Groby 1994).

4.8.2 General Employment and Income Sources

The Humboldt County economy has grown slowly but fairly steady over time in spite of the seasonal and cyclical shocks to which it has been subjected. Although, the forest products industry has been the economic mainstay of the County economy for many years, other employment fields provide employment opportunities as well. The 1990 total annual income and associated employment field are as follows: agricultural, forestry, and fishery employment = $17,465,000; construction and mining employment = $53,085,000; manufacturing employment = $ 17,381,700; transportation and public utilities employment = $67,362,000; retail and wholesale employment = $162,557,000; financial, insurance and real estate employment = $28,987,000; personal and business services employment = $157,782,000; and Federal, State, and local government employment = $233,196,000, respectively (total annual income = $894,231,000) (Groby 1994). In 1990, these employment fields accounted for the following percentages of income: agricultural, forestry, and fishery employment = 2.0 %; mining and construction employment = 5.9%; manufacturing employment = 19.4%; transportation and public utilities employment = 7.5%; retail and wholesale trade employment = 18.2%; finance, insurance, and real estate employment = 3.2%; personal and business services = 17.6%; and Federal, State, and local government employment = 26.1%, respectively (Groby 1994). Growth in these various employment fields is expected to remain fairly stable, with the exception of the seasonal changes in income (i.e., forest products, manufacturing and tourism related fields), often associated with the depressed economy in Humboldt County.

4.8.3 Humboldt Harbor and Bay and Navigation Channels

4.8.3.1 Commercial Fishing

Humboldt County has a long history of commercial fishing and ranks as one of the most productive areas on the west coast. Commercial fishing is the third largest industry in the Humboldt area. A 1987 study estimated the total landings of commercial fisheries to have an approximate value of $20.3 million. In 1988, fish landings had increased and totalled approximately 104.5

million pounds (Groby 1994). The industry was estimated to provide 1,105 full-time jobs with 488 of these representing actual harvesting and processing and the remainder a mixture of support services. About 500 vessels fish primarily out of Eureka, Fields Landing, Trinidad, King Salmon and Shelter Cove, landing seafood with a dockside value of $10-20 million annually. The majority of these are salmon/crab vessels. There are eight receiving stations, five processing plants, an animal food plant and a cannery which provide a major source of employment for the area, as well as various indirect supporting facilities which supply items such as ice, fuel, hardware, supplies, services and repairs. The commercial fish landings exceed those of all other ports north of Los Angeles and is comprised of different species than those of the larger ports south of Los Angeles. Processors in Eureka and Fields Landing fillet and pack seafood, shipping Humboldt County products throughout the United States and overseas.

A variety of fish and shellfish are caught year round in waters adjacent to the County. There are 45 different species which contribute to the commercial fishing effort. Of these, oyster culture is the largest commercial fishing activity within Humboldt Bay itself and is limited to the North Bay, where a small amount of sea perches and clams are also taken. There are presently 25 to 50 million of the introduced Pacific oyster being raised in Arcata Bay and Mad River Slough. Oyster culture in Arcata Bay is carried out primarily on raised beds that are harvested by dredging. The Mad River Slough operation is a small tray culture and suspended lantern net method and is of minor economic significance compared to Arcata Bay. Harvesting of these oysters yields 875,000 pounds a year with a market value of $1.7 million (Shapiro and Assoc., 1980). A basic problem with shellfish culture in the Bay is pollution from human sewage and non-point sources. Presently, if more than one-half inch of rain falls within 24 hours, the Bay is closed to shellfish harvesting for the next 5 days. During wet winters this can result in significant closure periods.

The primary fish groups caught commercially are groundfishes (flatfish and rockfish), albacore tuna, Dungeness crab, and salmon. Flatfishes averaged 31-42% of the total annual landings for Humboldt Bay from 1981-1985 (Barnhart *et al.*, 1989), with the Dover sole and English sole being the most important. Rockfish are caught by commerical fishermen outside the Bay and comprised 25-31% of the commercial landings from 1981-1985. Salmon is the most valuable fin fish on a per-pound basis and has historically sustained a large portion of the commercial fishery. From 1971-75 fishermen averaged 276,000 salmon annually but landings in recent years have been greatly reduced due to declines in salmon runs and a restricted commercial season. During the 1981-85 period, commercial fishermen annually landed an average of nearly 1.6 million pounds of Dungeness crab worth over $1.4 million at Eureka. The Bay supports a minor commercial fishery for the sevengill and leopard sharks which are caught by hook and line and drift gill nets. There is a commercial gill net fishery each winter in Arcata Bay for adult herring, primarily to obtain herring roe which is exported to Japan (Barnhart 1986) and a live anchovy bait fishery by albacore fishermen in the fall. A minor commercial fishery for surfperch exists, primarily for the redtail,

which are captured by beach seine and hook-and-line.

The most significant obstacle to economic development of the Humboldt Bay region is its remote location; the fishing industry appears to be one sector with significant expansion potential (Humboldt County Planning Department 1982). Given a total earned income estimate for the county of $640 million, the commercial fishing industry was calculated to represent 3.2% of the economy (Radtke 1977). The importance of tourism and recreation is difficult to estimate because secondary indicators must be used.

4.8.3.2 Commercial Shipping

Humboldt Bay is the only harbor between San Francisco, California and Coos Bay, Oregon with channels deep enough to permit passage of large, commercial ocean going vessels. The Bay also provides the necessary port facilities for shipping and fishing activities, and the Humboldt area economy is dominated by the following resource based sectors in descending order of magnitude: timber and wood products, agriculture, fisheries, and tourism. Shipping facilities in Humboldt Bay serve primarily the forest products and petroleum industries. In 1993, 154 deep- draft vessel trips accounted for 1,125,544 tons of commerce, consisting of woodchips, pulp, logs, lumber, petroleum, and particle and fiber board. Historically, annual deep-draft tonnage accounts for approximately 70% of the total annual tonnage passing through the Harbor, with all but petroleum representing exports.

4.8.3.3 Agriculture

Agriculture has historically been one of the major economic resources of Humboldt County, but has shown a downward trend. Agricultural related employment was estimated at 1,900 jobs in 1977 as compared to 2,500 in the early 1960's and with incorporation of new technology, the numbers are expected to continue to decrease. Of the 18,265 acres in agricultural use, 94% was in pasture.

4.8.3.4 Land Use

The land use pattern around the Bay is quite diversified Residential, commercial and industrial zones are located in or near the cities of Arcata and Eureka, along the Samoa Spit and at several other locations along the Bay shore. The Humboldt Bay National Wildlife Refuge was approved in 1971 and is managed by the U.S. Fish and Wildlife Service in the North and South Bays. It was established primarily to preserve and enhance those values associated with migratory birds but recognizes the many other uses of the Bay system as well. The refuge is authorized to encompass approximately 8,900 acres but not all of this has been approved yet. The remainder of the land is devoted to agriculture or remains undeveloped. There is a general trend towards urban, commercial, or industrial development of these areas, however.

4.8.3.5 Recreational Activities

Humboldt Bay provides a multitude of outdoor recreational opportunities which are associated with its biological resources. The unique combination of redwood forests, rocky headlands, sandy beaches and estuaries make the Humboldt County coastline particularly attractive. The number of visitors to the area is ever-increasing and their importance to the local economy is high. Cold air and water temperatures limit the use of the area for swimming, water skiing, and other such water contact sports. The greatest use is, therefore, closely tied to fish, wildlife, and aesthetic values. Use of these resources can be divided into two types: appropriative and non-appropriative uses. Appropriative uses involve the actual removal of individual units such as fish or game. Non-appropriative uses involve the same resources but without any removal, activities such as nature study, photography, or wildlife observations. Both of these are important and each has its place in the overall recreational picture.

4.8.3.6 Hunting

The most significant appropriative use in the immediate area of the Bay is waterfowl hunting and is estimated to supply over 25,000 man-days of recreation annually (Monroe, 1973). Most hunting is done from temporary or permanent blinds along the shorelines of the Bay, marshes, sloughs, and agricultural lands. Another popular waterfowl hunting style, which is rarely seen in other parts of the state, is known as sculling. This is accomplished by approaching rafted birds on open water in a uniquely designed low profile boat. These vessels are highly efficient when in the hands of a skilled operator.

The regular waterfowl season usually opens in October and extends into January. The black brant season opens in November and ends in late February. Humboldt Bay is the most important brant hunting area in California, contributing up to 75% of the total state kill. Wilson's snipe is a bird found in salt marshes, freshwater marshes, and wet pasture lands adjacent to the Bay, and are also hunted on a limited scale over a season which coincides with the waterfowl season. There are many private hunting clubs in operation and many private landowners permit hunting on their farmlands. Upland game hunting species include pheasant, quail, doves, bandtailed pigeon, grouse, squirrels, and rabbits. Deer hunting is the major appropriative use of big game.

4.8.3.7 Sportfishing

Humboldt Bay is one of the primary sport fishing areas in California. Anglers fishing in the Bay catch at least 41 species of fish, oysters, ten species of clams, and three species of crabs. Animals such as shore crabs and ghost shrimp are collected by fishermen for bait, thereby indirectly contributing to sport fishing activities. Seven of California's twelve shellfish reserves are in Humboldt Bay. These areas are State lands which have been set aside for public clamming and oystering.

Sport clam diggers operate mostly in the South Bay due to the easier access and greater abundance of the more desirable clams. The most popular areas are the northern end of Clam Island and Buhne Point. The clamming which takes place in Arcata Bay is focused on Indian Island, Bird Island, San Island, and along the Mad River Channel. Of the 25 species of clam found, only ten are harvested to any extent. These include two species of gaper clams, two species of Washington clams, the littleneck clam, basket cockle, softshell clam, bentnose clam, geoduck and rough piddock. Mussels are also taken and native oysters are found in Arcata Bay, being of the greatest abundance north of Woodley Island and in the Arcata Channel. Sport crabbers usually operate in the winter months and catch market, red, and rock crabs.

The fishing effort can be separated into shore, pier, skiff, and skindiving categories. Shore fishing is the most popular type of sport fishing effort and takes the form of surf-casting, surf-netting, and rocky shore fishing. Shore fishermen operate predominatly on the South Jetty and Buhne Point Jetty and catch the widest variety of species, some twenty-seven different kinds. These include surfperches, night and surf smelt, blennies, greenlings, rockfish, flatfish, and salmon. Of these, surfperch have been found to account for up to 50% of the total recreational catch. Salmonids are caught during the summer in the Entrance Bay, particularly from the jetties or in a boat between the jetties, but most are caught in the nearshore waters outside the Bay.

Some 10,000-15,000 anglers operate from 500 boats out of Humboldt Bay annually. The Pacific Fishery Management Council reported that for 1971-75, recreational salmon anglers fished an average of 40,000 angler days out of the Bay and averaged about 10,000 chinook salmon. Salmon anglers took 26,000 chinook in 1985 from ports on the Bay. Three licensed party boats operate from Humboldt Bay, predominantly from June through September. Salmon and crabs are the target species, with salmon being the majority. One operator estimated that he charters 1,000 to 1,500 fishermen each season (Walters, 1982).

Pier fishermen catch the most fish in terms of tonnage. Given the general area in which these structures are located, this type of fishing is limited to surf frequenting species, bottom dwellers, and surface feeders. Smelt dipping is popular and makes up a large portion of the angling catch taken from piers. Colorful greenling and lingcod are usually taken from the jetties and other rocky areas but also occur in waters of mud flats and channels. Rockfish and surfperch are commonly caught by anglers fishing from the jetties.

Humboldt Bay supports a very active marine skiff fishing center and is the most important area in Northern California for this effort. Most skiff fishing occurs during the summer and fall and the fishery is showing a growing trend. Skindiving is increasing in popularity and target species include lingcod, seaperch, rockfish, kelp greenling, and cabezon. Divers are also in search of abalone, sea urchins, shells, coral, and clams.

4.8.3.8 Nature Study

Non-appropriative uses of the Bay constitute by far the heaviest recreational use. These include nature study, wildlife observation, and photography, and are enjoyed by residents and visitors in excess of 135,000 user days annually. The Humboldt Bay National Wildlife Refuge is a location for many of these uses and the numbers of people engaging in these types of activity is ever-increasing. The Audubon Society and Sierra Club are among the environmental organizations with local chapters in the Humboldt area.

4.8.3.9 Scientific and Educational Use

Humboldt Bay, with its wealth of natural resources and physical features, is highly attractive for educational and scientific purposes. It offers almost unlimited possibilities for the study of natural history, ecology, and marine sciences. The College of the Redwoods and Humboldt State University enjoy easy access to these studies that are not available to many other institutions, and provide research results on the many facets of the Bay environment. Presently, Humboldt State University is the largest single employer in the County, and has an enrollment of approximately 7,200 full-time students. High school and grammar school classes also use the Bay and its resources for field types and classroom work that have become a regular part of many school conservation programs. Scientific use of the Bay is also made by many governmental agencies, independent foundations and private industry as is evidenced by the many hundreds of publications on record concerning the bay and its resources. These uses are always expected to be on the increase.

4.8.4 HOODS

Socioeconomic resources in the vicinity of this site include commercial fishing, recreational sportfishing, and shipping, as described above for the Humboldt Harbor and Bay area. In 1989, the Corps conducted a study entitled "The Humboldt Harbor Fishermen Outreach Survey" to inform the public and various user groups of the Corps' intent to investigate using HOODS as a permanent dredged material disposal site for Humboldt Bay dredging projects, and to involve the public in the decision- making process. The objective of this study was to locate those portions of the Pacific Ocean offshore of Humboldt Harbor, California which are, have been, and will be of value to commercial and recreational fisherman. The study attempted to determine which areas were not being utilized, which areas had been utilized historically, and which areas were potentially valuable for future usage by fishermen. The information gathered with this study was helpful in the location of areas of offshore waters which would be suitable for receiving dredged material with a minimal risk of impact to fisheries (WESCO 1989b).

Information regarding the use of the offshore areas of Humboldt Bay by fishermen was obtained by developing and mailing a questionnaire to over 197 of the commercial and recreational fishermen of Humboldt Harbor. In addition, a bathymetric base map of the Pacific Ocean and coastline approximately one day's travel north and south by fishing boat from Humboldt Harbor accompanied

the questionnaire. Of the 197 questionnaires mailed to the fishermen of Humboldt Harbor, only nine responses were received. Most of the base maps returned with the questionnaires had the entire area from the coastline to 1,189 meters delineated as the area fished. All responses received addressed the fishermen's present fishing locations and methods - none addressed the questions of past or future fishing locations or the routes taken to their present fishing grounds. Results of the questionnaires determined the following: sport fisherman seeking salmon generally stay within three miles from shore, with a few traveling five or six miles from shore; party boats venture up to ten miles offshore; from Humboldt Bay, sport fishermen range from south of the Eel River and north to Redding Rock above Trinidad; sport fishing for rockfish occurs over rock outcroppings near shore; and that most recreational fishermen stay within two miles of Humboldt Bay with a few going out beyond four miles (WESCO 1989b).

The survey determined that Northern California's offshore ocean is a highly productive fishing ground, and the location of a dredged material disposal site within three miles offshore of Humboldt Bay is likely to impact the Dungeness crab fishery; and if located within 10 to 20 miles offshore of Humboldt Bay, the recreational deep-sea fishery would be impacted. Locating a dredged material disposal site outside of the 3-mile line would potentially impact the commercial rockfish, sablefish, and sole fisheries. The draggers that fish these species out to the 1,190 meter depth are also very concerned that the mounding of disposed sediments will make trawl navigation difficult. Using the steep underwater valleys and canyons that lie relatively close to shore for dredged material disposal was not recommended by the California Department of Fish and Game because there is little information available pertaining to the productivity of these formations, and the role they play in the biological food web as they transport nutrient rich waters into the photic zones. In addition, the underwater canyons would be difficult to monitor for impacts from dredged material disposal (WESCO 1989b).

The fishery least likely to be impacted by the offshore disposal of dredged material is the salmon fishery. This species is fished throughout the offshore area at depths ranging from 4 to 1,200 meters. The large quantity of oceanic mid-water column habitat available to adult salmon, and the fact that salmon reproduction in fresh water is not subject to dredged material disposal, makes this species significantly less vulnerable to this type of impact than the other commercial fisheries of California's north coast (WESCO 1989b).

From the fishermen surveys conducted it was concluded that the preferred siting of the HOODS is between 3 to 4 nautical miles from shore, due northwest of the jetty entrance. Although, the siting of HOODS within this 3 to 4 nautical mile zone, and the subsequent disposal of dredged material at HOODS, would have a temporary, localized, and immediate adverse affect upon benthic infauna and epifauna within the disposal area, this impact is not considered significant to the fishing industry.

4.8.5 Louisiana Pacific Site

Socioeconomic resources on the LP Site are minimal to nonexistent, since it is a highly degraded historical dredged material site. Socioeconomic and recreational resources located nearby offsite might include recreational fishing, clam digging, and bird watching.

The LP Site is privately owned and operated by the Louisiana Pacific Corporation, which manages and maintains the disposal of dredged material onsite. The project sponsor, Humboldt Bay Harbor, Recreation, and Conservation District would be responsible for the costs and obtaining permission to place dredged material unsuitable for unconfined aquatic disposal onsite. Presently, it is not known how much LP charges to place dredged material on their disposal site, and if they receive any revenue from other entities buying dried dredged material for other uses (e.g., building a baseball field, building levees up, etc.).

5.0 ENVIRONMENTAL EFFECTS AND MITIGATION MEASURES

Introduction

The purpose of this section is to provide a detailed discussion of the potential environmental effects of the proposed alternative plans upon significant environmental resources and other environmental characteristics. This section is organized by resource, and includes air quality; noise, hydrology, groundwater, and water quality; geology, soils, and seismicity, biological resources; cultural resources; transportation, and socioeconomics.

The EIR/EIS has been prepared in accordance with both the California Environmental Quality Act (CEQA) and the National Environmental Quality Act (NEPA) guidelines. Each of these guidelines provides criteria for determining the significance of environmental impacts on various resources that could occur from a proposed project. A general discussion of significance, as defined in the CEQA and NEPA guidelines, is provided below.

CEQA

The following summarizes definitions of significance provided in CEQA guidelines Sections 15064 and 15065, and Appendix F (California Office of Planning and Research 1992).

Section 15064, "Determining Significant Effect", states that the determination of the significance of a project impact requires careful judgement by the agency responsible for environmental review under CEQA (lead agency). The decision must, to the extent possible, be based on scientific and factual data and must be determined in context with the environmental setting. As stated in Section 15065, a project may have a significant environmental effect if:

(a) The project has the potential to degrade the quality or range of the environment, or achieve short-term environmental goals to the disadvantage of long-term environmental goals;

(b) The environmental effects of a project are individually limited, but cumulatively considerable when viewed in relation to other past, current, or future projects; or

(c) The environmental impacts from a project would cause substantial direct or indirect adverse effects on human beings.

The Lead Agency must consider both primary (direct) and secondary (indirect) impacts in evaluation of the significance of environmental effects from a proposed project. Primary or direct impacts are those immediately related to project actions (e.g., construction impacts), whereas

secondary or indirect impacts can be removed in time or space from the direct impacts; however, they are caused in some ways by actions associated with the proposed project.

Appendix F of the Guidelines provides an outline of potential project effects that would typically be considered significant. Examples of project effects that would be viewed as significant include: substantial effects on a rare or endangered species or its habitat; substantial interference with the movement of any resident or migratory fish or wildlife species or substantial reduction of fish, wildlife, or plant habitat; substantial degradation of water quality or degradation/depletion of groundwater resources; substantial increases in flooding, erosion, or siltation, and conflict with adopted environmental plans and goals of the project area.

NEPA

The definition of the term "significantly" under the NEPA guidelines at 40 CFR 1508.27, requires consideration of both the context and intensity of the project impact. The definitions of context and intensity as provided in the NEPA guidelines, are presented below.

(a) CONTEXT. This means that the significance of an action must be analyzed in several contexts, such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, on the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short-term and long-term effects are relevant.

(b) INTENSITY. This refers to the severity of the impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that overall the effect will be beneficial.

(2) The degree to which the proposed action affects public health or safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about future considerations.

(7) Whether the action is related to other actions with individually insignificant and cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulative significant impact on the environment. Significance cannot be avoided by terming an action temporary or breaking it down into small component parts.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural. or historic resources.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

As can be seen from the above overview of "significance" definitions, CEQA and NEPA use similar definitions concerning the evaluation of project impacts (SAIC 1994). Based on these broad definitions, significance criteria were developed and applied to the environmental impact assessment for each of the resource areas evaluated by this document. The specific significance criteria are presented at the beginning of each resource section.

NO-ACTION ALTERNATIVE

Impacts under the No-Action Alternative, for each of the resource categories listed in Chapter 5.0 (Sections 5.1 to Section 5.8), are the same as those described in Chapter 4.0 (Sections 4.1 to Section 4.8) under existing conditions; since by definition, the No-Action Alternative is equivalent to the description of the existing environment.

5.1 AIR QUALITY

The proposed action involves deepening and selective widening of Humboldt Harbor navigation channels, and the transportation of approximately 5.6 million cys of dredged material to HOODS, and approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal to an upland site. The following sections discuss potential regional and site-specific air quality impacts that may occur with the proposed action. Feasible mitigation measures that would reduce or eliminate significant impacts are also identified.

Information on dredging and disposal emission sources was obtained from Corps staff (E. Hong, personal communications). Emission inventories were estimated for each project activity and were based on reasonable worst-case assumptions. Emission factors used to calculate equipment emissions were obtained from Compilation of Air Pollution Emission Factors, AP-42, Vols. I and II (EPA 1985) and special studies conducted for the California Air Resources Board (ARB)(1984). Detailed emission and equipment usage data associated with each project activity are contained in Appendix G.

5.1.1 Impact Significance Criteria

Criteria to determine the significance of air quality impacts are based on Federal, State, and local air pollution standards and regulations. Impacts are considered to be significant if project emissions (1) increase ambient pollutant levels from below to above the National Ambient Air Quality Standards (NAAQS) or California Ambient Air Quality Standards (CAAQS), (2) substantially contribute to an existing or projected air quality standard violation, or (3) exceed the following daily AQMD thresholds (a) Best Available Control Technology (BACT) trigger levels of 15 tons/year PM_{10} (80 pounds/day)*; 40 tons/year ROG (ozone) NO_x, SO_2 (220 pounds/day); 25 tons/year particulate matter (135 pounds/day); and 100 tons/year of CO (550 pounds/day) (L. Herr, personal communication and NCUAQMD 1994). [* Note: The significant stationary source emission rate for Humboldt County is usually referred to in tons/year. The pounds/day emission rate is actually a more "stringent emission rate" such as used in the adjacent County of Mendocino. Thus, any calculations of emission rates in pounds/day would represent the "worst-case scenario" for evaluating air quality impacts].

5.1.2 *Project Impacts*

The proposed dredging and disposal activities would occur for approximately 11 to 12 months. Disposal of dredged material unsuitable for unconfined aquatic disposal would last for approximately 3 to 4 days at the LP site. The main combustive emission sources from the proposed action would be a diesel-fired self-propelled hopper dredge and a survey boat that transports workers and supports the dredge. Disposal activities at the LP site would also include the use of one bulldozer.

5.1.2.1 Humboldt Harbor and Bay Navigation Channels and HOODS

Summaries of daily and total emissions that would occur from dredging and disposal activities related to dredging the Humboldt Harbor and Bay navigation channels and disposal at HOODS are provided in Tables 5.1-1 and 5.1-2, respectively. Total emissions are based on the dredging and disposal of approximately 5.6 million cys (minus the 26,000 cys associated with the LP site). Since daily project emissions differ marginally between dredging locations within the Harbor, peak emissions are provided in Table 5.1-1 as a representation of a worst-case project scenario. As shown in Tables 5.1-1 and 5.1-2, daily and total project emissions of NO_x and PM_{10} would exceed the NCUAQMD thresholds for these pollutants. These emissions would, therefore, be significant.

Project emissions would be spread over a large area between the Humboldt Harbor navigation channels and HOODS. Additionally, since project emission sources would be mobile, pollutant impacts would not be large enough in a localized area to exceed any ambient air quality standard.

The Humboldt Harbor is surrounded by predominately industrial and commercial businesses. The Samoa Elementary School located on the North Spit is the nearest sensitive receptor to any proposed dredging area, approximately 2000 feet away. Any air emissions from dredging equipment and the survey boat would be well dispersed before reaching this location. Therefore, project emissions would not be expected to adversely affect this or any other sensitive receptor.

Mitigation Measures

Since dredging and disposal activities would exceed NCUAQMD emission significance thresholds for NO_x and PM_{10}, mitigation measures were evaluated to determine if they would reduce project emissions to insignificance. The most feasible measure to reduce significant NO_x emissions would be to retard injection timing of diesel-powered equipment (one self-propelled hopper dredge). Retarding injection timing by two degrees would reduce NO_x emissions by about 15 percent from diesel-powered equipment. Although retarding injection timing by more than 2 degrees would further reduce NO_X emissions, it was not considered fesible due to fuel economy penalties. Although electrification of diesel-powered dredges would eliminate a substantial amount of project emissions, this measure was also deemed infeasible. Additionally, phasing of dredging activities, which would spread project emissions over a longer period and decrease daily emissions was also deemed infeasible. The use of reformulated fuel would reduce significant project emissions of NO_X and PM_{10} by approximately 7 and 15 percent, respectively (K. Cleary, personal communication, 1994). In addition, use of reformulated fuel would also provide the added benefit of reducing SO_2 emissions by about 90 percent (S. Ziemer, personal communication).

Tables 5.1-1 and 5.1-2 show the reduction in project emissions due to the implementation of 2 degree injection timing retard, and use of reformulated fuel. Implementation of these measures would reduce project emissions of NO_x, SO_2, and PM_{10}. However, project NO_x and PM_{10} emissions would remain significant.

Additional mitigation measures that would minimize project emissions and reduce potential nuisance problems include the following:

- Avoid unnecessary idling of construction equipment.
- Keep all trucks and other construction equipment properly tuned and maintained.
- Reduce NO_X emissions further through the use of an inter-cooler on a turbo-charged, diesel-engined hopper dredge. An inter-cooler could be installed to reduce the air temperature to the engine and therefore, reduce the NO_X emissions by approximately 10%
- Obtain and comply with all required NCUAQMD permits and applicable rules and regulations.

5.1.2.2 LP Site

Summaries of daily and total emissions that would occur from dredging the West Samoa Turning Basin and disposal activities at the LP site are provided in Tables 5.1-3 and 5.1-4, respectively. Total emissions are based on the dredging and disposal of approximately 26,000 cys of dredged material. As shown in Table 5.1-3, daily project emissions of NO_x and PM_{10} would exceed the NCUAQMD thresholds for these pollutants*. These emissions would therefore be significant. [*Note: NO_x and PM_{10} emissions would be considered significant in Mendocino County, but not in Humboldt County. PM_{10} emission significance in Humboldt County is based on tons/year thresholds only].

Project emissions would be spread over a large area, between the West Samoa Turning Basin in Humboldt Harbor and the LP site. Additionally, since project emission sources would be mobile, pollutant impacts would not be large enough in a localized area to exceed any ambient air quality standard.

The Humboldt Harbor is surrounded by predominately industrial and commercial businesses. The Samoa Elementary School located on the North Spit is the nearest sensitive receptor to any proposed dredging area, approximately 2000 feet away. Any air emissions from dredging

TABLE 5.1-1. PEAK DAILY EMISSIONS FROM DREDGING HUMBOLDT HARBOR AND DISPOSAL AT HOODS (Pounds/Day)						
Activity/ Equipment Type	ROG	CO	NO_x*	SO_2**	PM	PM_{10}***
Self-propelled Hopper Dredge	123.0	348.6	1,602.9	106.6	114.5	109.9
Survey Boat	3.9	6.3	36.5	2.6	3.0	2.8
Total Pounds/Day	126.9	354.9	1,639.4	109.2	117.4	112.7
Mitigated Emissions	126.9	354.9	1,295.9	10.9	99.8	95.8

TABLE 5.1-2. TOTAL EMISSIONS FROM DREDGING AT HUMBOLDT HARBOR AND DISPOSAL AT HOODS (Total Tons)						
Activity/ Equipment Type	ROG	CO	NO_x*	SO_2**	PM	PM_{10}***
Self-propelled Hopper Dredge	19.4	54.9	252.1	16.8	18.0	17.2
Survey Boat	0.5	1.4	6.6	0.4	0.5	0.5
Total Tons	19.9	56.3	258.7	17.2	18.5	17.7
Total Mitigated Emissions	19.9	56.3	204.5	1.6	15.7	15.1

NOTE:

* = Decrease in NO_x by approximately 15% (retarding injection timing by 2 degrees) and approximately 7% (reformulated fuel use) with mitigation measures.

** = Decrease in SO_2 by approximately 90% (reformulated fuel use) with mitigation measures.

*** = Decrease in PM_{10} by approximately 15 % (reformulated feul use) with mitigation measures.

equipment and the survey boat would be well dispersed before reaching this location. Therefore, there project emissions would not be expected to adversely affect this or any other sensitive receptor.

Dust and Odors from Dredged Sediments Placed Upland

Fugitive dust emissions in the form of PM_{10} would be generated during any site preparation and levee reconstruction at the LP Site if soil conditions are dry. Handling, transportation, and disposal of the approximately 26,000 cys of dredged material would generally not produce any fugitive dust, since dredged material would be wet. Mitigation measures identified in the following sections would minimize emissions of fugitive dust during project disposal activities.

Odors could be emitted from dredged spoils exposed to the atmosphere due to decomposition of organic matter. However, sediments dredged from Humboldt Harbor in the past have not produced any odor complaints from the public. Therefore, it is not expected that project dredging or disposal activities would generate any significant odor impacts.

Mitigation Measures

Since dredging and disposal activities would exceed NCUAQMD emission significance thresholds for NO_x and PM_{10}, the same mitigation measures identified in Section 5.1.2.1 were evaluated to determine if they would reduce project emissions to insignificance. Tables 5.1-3 and 5.1-4 show the reduction in project NO_x, SO_2, and PM_{10} emissions due to the implementation of 2 degree injection timing retard, and the use of reformulated fuel. Implementation of these measures would reduce project emissions of NO_X, and PM_{10}, but not to insignificance. Project NO_X emissions would remain significant.

Potential sources of fugitive dust include movement of already existing dried dredged material during levee reconfiguration and site preparation, and possibly the layer of fill material placed over the newly placed dredged material.

Because large amounts of soil will be moved to reconfigure the levees, a large amount of soil may be exposed at one time, a potential for fugitive dust generation is high. Incorporation of appropriate mitigation measures, such as regularly applying a soil binding agent (e.g., water) when large areas of bare and dry soil are exposed, will reduce this potential impact to insignificant.

Potential for airborne particles to be blown from levees and from sediment placed on the site would be possible, but would not result in any new impacts to air quality beyond what presently exists.

TABLE 5.1-3. DAILY EMISSIONS FROM DREDGING THE WEST SAMOA TURNING BASIN AND DISPOSAL AT THE LP SITE (Pounds/Day)

Activity/ Equipment Type	ROG	CO	NO_x*	SO_2**	PM	PM_{10}***
Self-propelled Hopper Dredge	86.8	246.0	1,131.2	75.3	80.8	77.6
Survey Boat	3.9	6.3	36.5	2.6	3.0	2.8
Bulldozer	3.1	9.1	33.0	3.6	2.9	2.8
Total Pounds/Day	93.8	261.4	1,200.8	81.4	86.7	83.2
Mitigated Emissions	93.8	261.4	949.2	8.1	73.7	70.7

TABLE 5.1-4. TOTAL EMISSIONS FROM DREDGING THE WEST SAMOA TURNING BASIN AND DISPOSAL AT THE LP SITE (Total Tons)

Activity/ Equipment Type	ROG	CO	NO_x*	SO_2**	PM	PM_{10}***
Self-propelled Hopper Dredge	0.18	0.53	2.43	0.16	0.17	0.16
Survey Boat	0.01	0.02	0.09	0.01	0.01	0.01
Bulldozer	0.01	0.02	0.07	0.01	0.01	0.01
Total Tons	0.20	0.57	2.59	0.18	0.19	0.18
Total Mitigated Emissions	0.20	0.57	2.05	0.02	0.16	0.15

NOTE:

* = Decrease in NO_x by approximately 15% (retarding injection timing by 2 degrees) and approximately 7% (reformulated fuel use) with mitigation measures.

** = Decrease in SO_2 by approximately 90% (reformulated fuel use) with mitigation measures.

*** = Decrease in PM_{10} by approximately 15 % (reformulated fuel use) with mitigation measures.

To minimize the impact of fugitive dust emissions during site preparation and levee reconstruction, the following dust control measures are recommended:

- Apply a soil binding agent such as water, as needed, during any reconfiguration of levees and when there are large areas of bare, exposed soil.
- Apply water at least twice daily to dirt roads leading in and out of the site, and dirt stockpiles to prevent excessive dust emissions.
- Minimize vehicle speeds in dusty areas.
- Suspend land-based handling of dry soil or already existing dry dredged material when wind speeds (e.g., instantaneous gusts) exceed 25 mph.

5.1.2.3 *Long-Term Air Quality Impacts from Project Implementation*

As a result of the proposed navigation channel deepening, the existing deep-draft vessels (40,000-50,000 dwt) calling on Humboldt Harbor would be able to navigate and maneuver safely and efficiently in the newly deepened channels. Fewer ships would be required to transport the same amount of cargo presently exported by Humboldt Harbor. Although, these larger ships would generate more emissions per ship visit than the smaller 15,000-30,000 dwt deep-draft vessels, fewer emissions would be produced over the long-term for a given amount of cargo. The main reason for this is that a decreased number of ship visits would eliminate a substantial amount of cargo ship emissions due to cruising and maneuvering activities. The proposed channel deepening and selective widening would therefore decrease the amount of emissions produced per unit of cargo throughput. This would produce a long-term beneficial impact to air quality in the region, due to increasing the safety and efficiency of navigation in the Humboldt Harbor navigation channels. In addition, practices such as light-loading, tidal delays, rerouting, etc... would be eliminated and would allow the full utilization of the existing deep-draft vessel's cargo-loading capacity. This beneficial long-term impact to air quality is expected to continue overtime, since the deepening of the navigation channels is not expected to be growth-inducing; deepening is to accommodate existing deep-draft vessels exporting goods from Humboldt Harbor.

5.2 NOISE

5.2.1 Impact Significance Criteria

Appendix F of the State CEQA guidelines indicates that a project will normally result in a significant adverse impact if it causes "a substantial increase in the ambient noise level in areas sensitive to noise adjacent to the project site". Noise impacts from the proposed project were considered significant if one of the following three criteria were met:

- Noise levels at sensitive receptors would exceed a single nighttime 1-hour L_{eq} of 55 dBA. This significance threshold is based on preventing sleep disturbance. Dwellings are typically capable of approximately 20 dBA of noise attenuation; therefore, the resulting interior noise level would be 35 dBA, a level sufficient to prevent sleep disturbance (EPA 1981).

- Noise levels at sensitive receptors would exceed a single daytime hourly L_{eq} of 70 dBA for 10 or more days. Exceedence of noise levels for less than 10 days is considered a short-term impact; however an exceedence of 10 or more days)a total of 10 days and not necessarily 10 days in a row) is persistent enough to cause severe annoyance. Disruption of communication in a normal voice will occur with noise levels of 66 dBA, and a disruption of communication in a raised voice will occur with noise levels of 72 dBA, based on a standard communication criteria of a distance of 1 meter (EPA 1981). The 70 dBA significance threshold was chosen to represent an average noise level at which speech interference occurs.

- Noise levels at receptors would be in the unacceptable ranges determined by the Office of Noise Control, Department of Health Services, indicated on Table 4.2.1.2-1 in Section 4.2.

5.2.2 Noise Sources

Noise sources associated with the proposed project include dredge equipment, and construction equipment used to prepare the upland disposal site.

5.2.3 Humboldt Harbor and Bay Navigation Channels

5.2.3.1 *Project Impacts*

Construction activities would result in minor, temporary increases in noise levels due to the operation of dredge equipment. Work in the outer reaches of the Inner Harbor and Bar and

Entrance channels would be less noticeable, since this area is some distance from any residential development. No significant noise impacts are expected.

5.2.3.2 *Mitigation Measures*

No significant noise impacts are identified; therefore, no mitigation measures are required.

5.2.4 HOODS

5.2.4.1 *Project Impacts*

Noise associated with this alternative would result primarily from the self-propelled hopper dredge moving to and from the HOODS. Due to the existing ship noise in the area, and since the dredged material disposal site is well removed (approximately 3.5 miles from shore) from any sensitive noise receptors, no significant noise impacts are expected.

5.2.4.2 *Mitigation Measures*

No mitigation measures are required.

5.2.5 Louisiana-Pacific Site

5.2.5.1 *Project Impacts*

Sources of noise associated with this alternative include a self-propelled hopper dredge equipped with a pipeline to "back pump" dredged material onto the designated upland disposal site, and any on-site construction equipment associated with site and levee preparation. No significant noise impacts are expected, as discussed below.

NOISE FROM CONSTRUCTION EQUIPMENT: Equipment used for minimal site and levee preparation has the potential to produce high levels of noise. Peak noise levels associated with equipment that would be used on the site would range from 75 to 88 dBA at 50 feet from the source (EPA 1971). Noise from localized sources typically falls off by about 6 dBA with each doubling of distance from source to receptor. This attenuation rate does not account for natural or artificial barriers, such as structures, trees, shrubs, or topographic relief, all of which would increase the attenuation rate (resulting in lower noise levels). Assuming a peak noise level of 88 dBA and the 6 dBA attenuation rate, a noise level of about 66 dBA would occur at the nearest sensitive receptor, approximately 600 feet away. This peak noise level of 88 dBA would occur only for a very limited period of time, when the equipment is in operation. Noise impacts from construction activities would be insignificant since there are no sensitive receptors within approximately 2,000 feet of the site.

5.2.5.2 *Mitigation Measures*

No mitigation measures are required.

5.3 HYDROLOGY, GROUNDWATER, AND WATER QUALITY

5.3.1 Conceptual Model of Water Quality Impacts

5.3.1.1 Aquatic Disposal

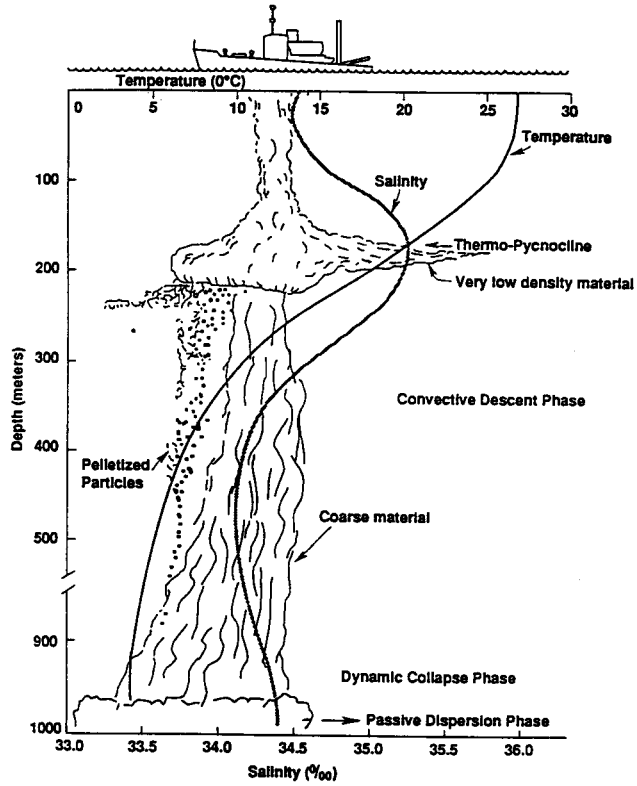
The disposal of dredged material in the marine environment occurs through three major phases which affect the behavior of the material in the water column and the nature of the deposit on the bottom (Figure 5.3.1.1-1). These are:

- *The Convective Descent Phase* during which the majority of the dredged material is transported to the bottom under the influence of gravity as a concentrated cloud of material;
- *The Dynamic Collapse Phase* following impact of the bottom where the vertical momentum present during the Convective Descent Phase is transferred to horizontal spreading of the material;
- *The Passive Dispersion Phase* following loss of momentum from the disposal operation, when ambient currents and turbulence determine the transport and spread of material.

During convective descent of the disposal process, water is entrained with the disposal cloud, resulting in a gradual decrease in the concentration and density of the discharged material. This entrainment of water and the residual dispersal of sediment washing out of the disposal vessel will result in some portion of the dredged material remaining in suspension throughout the water column after disposal. Since these suspended sediments are not transported as part of the dredged material plume, the ultimate fate of this material depends primarily on its settling rate and the ambient currents in the area (SAIC 1987). In deep ocean sites, where salinity gradients are well-defined (i.e., the pynocline), the descent of fine materials will be slowed by the abrupt change in water density and will likely experience dynamic collapse and horizontal spreading well before contact with the bottom (see Figure 5.3.1.1-1) (Pequenat *et al.* 1978).

The second phase of transport occurs when the cloud begins a dynamic vertical collapse, characterized by horizontal spreading upon contact with the bottom (Clarke *et al.* 1971). The material flattens out and is similar to the base surge cloud in a detonation-type event as the dredged material plume assumes a horizontal circular shape with a small vertical dimension (COE 1976b).

During the last phase, passive dispersion, particles settle and can be advected and dispersed by bottom currents and turbulence caused by disposal. The concerns of dredged material disposal are that disposed materials will impact the disposal environment, including the water column, bottom sediment, and biological resources (Pequenat *et al.* 1978). Potential impacts to the disposal environment are discussed in the following sections.



NOTE: This figure of dredged material disposal is adapted to a two-layered deepwater system (1000m) with a strong thermo-pycnocline.

Source: Pequegnat et al., 1978.

Figure 5.3.1.1-1 Transport Processes During Open Water Disposal

5.3.2 Testing Requirements

5.3.2.1 Sediment Quality

Chemical and physical sediment analysis evaluations and results of testing on sediments for the Humboldt Harbor Deepening Project navigation channels are discussed in Section 4.4.5. In summary, the tests concluded that dredged material represented by samples HB1, HB2, HB3, HB4, HB5, HB7, HB10 and HB11, approximately 5.6 million cys are acceptable for ocean disposal without further testing. Dredged material represented by sample HB8 is considered unsuitable for unconfined aquatic disposal and needs to be placed in an appropriate upland site such as the LP site.

5.3.3 Impact Significance Criteria

Surface water and groundwater quality impacts were considered significant if project activities would result in:

- Alteration of existing regional scale hydraulic conditions (i.e., groundwater flow direction or gradient and surface water flow direction or velocity). Within this context, a significant regional impact is defined as one of similar size, concentration, or duration as currently exists. For example, if the volume of water released as effluent from hydraulic upland disposal were of the same magnitude as existing regional freshwater surface water flows, this impact would be considered significant.

- Exceedence of the State or Federal water quality standards or objectives (e.g., NCRWQCB Northcoast Region Plan objectives, State and Federal maximum contaminant levels, and Federal Ambient Water Quality Criteria) wherever applicable, based on specific site conditions.

- Long-term sedimentation and/or erosion above existing rates that would affect the operation of water control structures, gates, or valves.

- Increased flooding that would cause impacts to the integrity of the site design or surrounding areas.

In addition to consideration of the above criteria, an implicit criterion for the aquatic disposal is that, in order for impacts to be considered not significant, the dredged material would, at a minimum, have to be disposed of in accordance with the testing requirements of the MPRSA and CWA, since these requirements are considered protective of water quality. Since only the material deemed suitable for unconfined aquatic disposal according to the testing requirements of the MPRSA and CWA would be disposed at HOODS, disposal at this site is considered automatically to not have significant water quality impacts according to this criterion. In addition, disposal of the approximately 5.6 million cys at HOODS has been shown to meet the

requirements for dredged material disposal.

5.3.4 Hydrodynamics

5.3.4.1 *Project Impacts*

Humboldt Harbor and Bay Navigation Channels

The hydrodynamics of Humboldt Bay are discussed in Section 4.3.2 The removal of dredged material from Humboldt Harbor navigation channels will leave depressions that do not change the local hydrodynamics substantially. A "Humboldt Bay Numerical Hydrodynamics and Sedimentation Study" conducted by the Corps' Waterway Experiment Station (COE/WES 1994d), concluded that with the implementation of the proposed project the channel velocities will decrease due to an increase in the cross-sectional area. The tide range will not be significantly changed. The results of the sedimentation study also indicate that the proposed project will have a significantly lower inflow of sediment (decreased shoaling), when compared to the existing condition. Waters moving over the channels will deposit their suspended sediment load into the dredged channels; however, current velocities will not change markedly. No significant impact to channel hydrodynamics is expected during or after dredging.

HOODS

No significant impacts to hydrological conditions at the HOODS are anticipated as a result of the disposal of dredged materials from the channel deepening project. Disposal of dredged material at the HOODS will result in an accumulation of dredged material over the seafloor, changes in the immediate bathymetry of the site, and slight changes in sediment characteristics within the site. HOODS has a projected 50-year life span, and an approximate site capacity of 50 million cys.

As described later in Section 5.4.2.2, numerical modeling of sediment dispersion at the HOODS indicated that, due to relatively weak bottom currents, the HOODS is a non-dispersive site (Scheffner 1990). The accumulation of dredged material from the disposal of channel deepening project materials at the HOODS is unavoidable. Due to the HOODS deeper water depth (-165 to -185 feet MLLW), accumulation of dredged material at the HOODS is not expected to cause any adverse surface wave conditions at the site. Presently, annual bathymetric surveys of Quad 2, Cell E5, which was used on one occasion in 1990, have been conducted yearly to verify any potential dispersive nature of the site. As part of the final designation of the HOODS, EPA will develop a detailed long-term Site Management and Monitoring Plan (SMMP) for the HOODS. The Corps' monitoring of HOODS will be in accordance with the SMMP that EPA will include with the site designation rule.

5.3.5 Water Quality

5.3.5.1 *Project Impacts*

Humboldt Harbor and Bay Navigation Channels

Water quality variables that could be temporarily affected by dredging operations include: total suspended solids, dissolved oxygen, nutrients, pH, salinity, and temperature. Potential impacts to these parameters can be predicted by reviewing actual field measurements collected during several water quality monitoring studies at dredge sites. As part of the "Dredge Disposal Study For San Francisco Bay And Estuary " (COE, April 1976), conducted by the Corps, the effects on the water column by operation of a hopper, hydraulic cutterhead and clamshell dredge were determined. For the Humboldt Harbor Deepening Navigation study, a self-propelled hopper dredge is expected to be used for the disposal of dredged material at both HOODS and the LP Site.

The Corps study revealed that dredging operations did not typically cause significant fluctuations in salinity, temperature, or pH over the short-term or long term.

Nutrient enrichment caused by potential elevated concentrations of phosphorus and nitrogen in the dredged material may increase water turbidity by enhancing primary production. Impacts would be short-term and temporary, with nutrients flushed out into the Bay. No significant impacts are expected.

The two water quality parameters experiencing the greatest fluctuations during the Corps studies were dissolved oxygen and total suspended solids. Dissolved oxygen concentrations tend to decline in the vicinity of the dredging operations when the suspension of anoxic sediment creates high biological and chemical oxygen demand. During the Corps study, dissolved oxygen concentrations declined in only four of 12 measurements, and were greatest in the lower 2 meters of the water column. The greatest fluctuation in dissolved oxygen (3.5 parts per million) occurred at a near bottom sampling location within 50 meters from the dredge. In all cases, background levels in dissolved oxygen were regained within 10 minutes of the sampling event (COE 1976). Dissolved oxygen concentrations during the dredging of Humboldt Harbor navigation channels sediments will decline for very short periods of time. Because exact ambient dissolved oxygen concentrations are not available for the dredging sites, a prediction as to whether or not dissolved oxygen levels will dip below the 5mg/L minimum requirement for dissolved oxygen set by the RWQCB is not possible. Dissolved oxygen levels in the immediate vicinity of the dredging operation may become depressed below the minimum RWQCB requirement for a short time (less than 10 minutes). Due to the short duration of the effect, impacts to dissolved oxygen in the water column are expected to be insignificant.

Concentrations of total suspended solids (turbidity) vary with the material being dredged and the type of dredge employed. Gravel and sands settle out quickly, whereas silts may remain in suspension for up to several hours. The amount of sediments suspended by hydraulic-cutterhead are vastly reduced compared to a clamshell dredge; however, not all sediments being suspended

by the cutterhead will be drawn into the suction tube. In comparison to the clamshell dredge, this percentage of suspended material is very small. Pipelines that extend from the seafloor to the upland site all but eliminate mid-water and surface plumes. Suspended materials are restricted to the immediate vicinity of the cutter itself. Elevated suspended sediment concentrations are on the order of a few tens of grams per liter within 3 m of a cutterhead dredge; and a few hundred milligrams per liter within 200 m of the cutter (Barnard 1978). Thus, suspended sediment concentrations decrease with increasing distance from the dredging operation.

With the exception of sediment samples HB8 and HB9, all of the remaining Humboldt Harbor Deepening dredged material sediments tested were at least 80 percent sand with a diameter of greater than 0.062 mm, thus eliminating them from further testing based on the grain size exclusionary criteria (see section 4.4.5). Finer grain size sediments, such as samples HB8 and HB9, are typically associated with the uptake of concentrations of heavy metals, nutrients, petroleum, and chlorinated hydrocarbons. Based on the suspended particulate phase tests conducted on sediment HB8 and HB9, the Limiting Permissable Concentration (LPC) for water column impacts would not be exceeded due to the disposal of these sediments. Based on the solid phase toxicity tests conducted on sediment samples HB8 and HB9, the sediments represented by HB8 exceeded the LPC established in the solid phase, and was determined to be unsuitable for unconfined aquatic disposal.

A slight potential for the release of a trace amount of dioxin (0.3 picograms/gram), from sediment sample HB8 proposed to be dredged from the Samoa Channel Turning Basin, exists during the widening and deepening of this portion of the Samoa Turning Basin. Chemical reactions between the suspended sediments and the water column are possible during the dredging operation, but dioxin is characteristically extremely hydrophobic and strongly binds to sediment. In addition, the use of the self-propelled hopper-dredge on this dredged material unsuitable for unconfined aquatic disposal will cut down significantly on the concentration of any suspended sediment plume resulting from this dredging.

Overall, no significant impacts to water quality due to lowered dissolved oxygen concentrations; elevated concentrations of total suspended solids (turbidity); changes in pH, temperature, and nutrient levels; and release of contaminants are expected with the proposed deepening project.

HOODS

No significant, long-term water quality impacts are anticipated to occur as a result of the disposal of approximately 5.6 million cys of dredged material from the Deepening Project. Dredged material disposal typically has a short-term (several hours to days) impact on the water column; however, these short-term impacts are not considered significant. Water quality variables which could be temporarily affected by disposal of dredged material from Humboldt bay at HOODS would include: total suspended solids, dissolved oxygen, light transmittance through the water column, and nutrients. As described in Section 5.3.2, any dredged material deemed suitable for unconfined aquatic disposal at HOODS would, at a minimum, have to be disposed of in

accordance with the testing requirements of the MPRSA and CWA, since these requirements are considered to be protective of water quality.

As described earlier in Section 5.3, the disposal of dredged material in the marine environment occurs through three major phases - convective descent, dynamic collapse, and passive dispersion. These phases affect the behavior of the dredged material in the water column, and the nature of the deposit on the bottom.

Dredged materials to be disposed of at HOODS during maintenance dredging activities are primarily coarse sand, with a smaller volume of sediment characterized as sand/silt. As described previously in Section 5.3.5.1, coarser materials fall relatively rapidly to the bottom, while finer materials can remain in the water column for longer periods of time. As stated previously, the Corps' monitoring of HOODS will be in accordance with the SMMP that EPA includes with their site designation rule.

LP Site

No significant impacts to water quality are expected at this site by the placement of the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal. Sediments to be discharged at the surface of the LP site will comply with the requirements of the North Coast RWQCB's receiving water and effluent water limitations for the clarified supernatant which is discharged into Humboldt Bay. As stated previously, the trace amounts of dioxin within the dredged material is characteristically hydrophobic and strongly adheres to sediment, thus no significant impact to water quality is anticipated from the dioxin. Monitoring, testing, and reporting of data collected from the effluent and receiving waters shall be the responsibility of the local sponsor, and will be in full compliance with their future waste discharge order requirements. Therefore, with monitoring and full compliance with the requirements set by the NCRWQCB, no significant impacts to water quality are expected.

5.3.6 Groundwater

5.3.6.1 Project Impacts

HOODS

No potential groundwater impacts are associated with ocean disposal of dredged sediments.

LP Site

No significant impacts to groundwater are expected with the disposal of dredged material at this site since dioxin is hydrophobic and is not expected to leach out of dredged sediments. Nevertheless, if groundwater sampling and monitoring is deemed necessary it will be the responsibility of the local sponsor.

5.4 GEOLOGY, SOILS, AND SEISMICITY

5.4.1 Impact Significance Criteria

Impacts from geologic hazards were considered significant if the dredging or sediment disposal activities would potentially result in damage to or elimination of geologic resources with either a present or potential future value, or if project activities generated or exposed people or structures to geologic hazards.

The following geologic conditions were considered significant if they resulted in migration of contaminants from a disposal site or increased sedimentation of a local waterway:

- Active (Holocene) or potentially active (Quaternary) surface faults in close proximity or on the project site. (The California State geologist considers Quaternary faults potentially active unless determined from direct evidence that they have become inactive before the Holocene Epoch)

- Subsurface materials prone to liquefaction as a result of seismic activity.

- Subsurface materials prone to settlement as a result of seismic activity or native material compaction.

Significant impacts on soils were identified if any of the following conditions were met:

- Agricultural productivity of the soil would be reduced by disruption, displacement, compaction, or overcovering.

- Erosion rates would be increased to such a level that siltation would cause significant impacts on water quality or aquatic habitats.

- Sediments being discharged at the surface of the upland site would contain materials that would inhibit revegetation.

Aquatic dredged material disposed at HOODS is required to be disposed according to the testing requirements of the MPRSA and CWA. As for impacts to water quality, sediment impacts at HOODS would be considered not significant by this criteria, since only material deemed suitable for unconfined aquatic disposal, according to MPRSA and CWA testing requirements would disposed of at HOODS. Dredged material unsuitable for unconfined aquatic disposal is proposed to be placed at the LP site, followed by covering with "clean fill material". For the LP site, it is appropriate to apply the "disposal according to testing results" to the suitable material in the "fill material", not the underlying unsuitable material, since the "fill material" will be exposed to the water column and biological resources over the long term. The ability of the "fill material" to provide long-term isolation of the dioxin-contaminated sediments may need to be monitored through post-project dioxin monitoring. The dioxin-monitoring would be conducted

if deemed necessary by the NCRWQCB. Overall, no adverse impacts to sediment quality at this site are expected as a result of disposal at the LP site, because dioxin occurs in very trace amounts.

5.4.2 Sediment Quality

Project Impacts

5.4.2.1 Humboldt Harbor and Bay Navigation Channels

The potential impacts to bottom sediments in the Humboldt Harbor and Bay navigation channel dredging sites include changes in bottom topography and potential slight changes in sediment transport processes. The proposed project calls for dredging the Bar and Entrance channels to -48 feet MLLW, and dredging the North Bay, and Samoa channels to -38 feet MLLW. The deeper depths to which the navigation channels will be dredged will result in an unavoidable change in bottom topography. Fine-grained sediments present in the water column will flocculate and ultimately settle in the bottom of the dredged channel. The sediments will form a "fluff" layer which forms within the first few weeks after dredging, and will cause temporary short-term impacts to benthic organisms. This layer will be flushed from the affected navigation channels because currents exiting the channels have surface, middepth, and bottom velocities strong enough to flush fine-grained sediments. Another immediate effect of sediment removal includes the slumping of materials located on the channel slopes into the channel. This process will persist until side slopes equilibrate. These processes are common in maintenance dredging projects and are not considered significant.

Prevailing hydrodynamic conditions in the Humboldt Harbor and Bay navigation channels will not change after dredging has taken place. Sediment transport processes, as a result, will not substantially change. These channels will be depositional in nature and will continue to be the sites of future spring and fall maintenance dredging projects.

The last change that will occur due to the removal of dredged material unsuitable for unconfined aquatic disposal in the Samoa Turning Basin is the potential for improved sediment quality conditions in terms of removal of dioxin-contaminated sediment (minute traces of dioxin). This approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal will not be disposed in-water; rather, it will be disposed on the proposed upland site and carefully controlled. These sediments (sample HB8) failed the "Green Book" criteria for solid-phase toxicity testing. The remaining dredged material has been tested and determined acceptable for ocean disposal. Overall, significant impacts to sediment quality are not expected.

5.4.2.2 HOODS

The potential impact of disposal operations on the physical environment of HOODS are based on the a study conducted by Scheffer (1990).

Potential sediment impacts at the HOODS include the following:

- accumulation of dredged material over the seafloor of the one square nautical mile disposal site
- changes in bottom topography
- slight changes in sediment transport processes

Changes in bottom topography or sediment transport processes are not expected to be substantial at HOODS. HOODS has a capacity of approximately 50 million cys; one million cys per year of dredged material disposed over a 50-year period. All of the approximately 5.6 million cys of dredged material, excluding the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal, would be disposed at HOODS.

The selection of HOODS was based, in part, upon the recognition that the bottom substrate within the site varies from very fine sand to sandy silt along its eastern boundary (-160 feet) to silty sands and some clay along its western boundary (-180 feet). Generally, physical impacts are minimized when sand is placed on a sandy bottom and are maximized when mud is placed over a sandy bottom. When disposed sediments are dissimilar to bottom sediments at the site, recolonization at the disposal site will probably be slowed and carried out by organisms whose life habits are adapted to the new sediment. The variability in bottom substrate within the HOODS permits the option of disposing dredged material at a location where the bottom substrate is most similar to the type of material dredged from Humboldt Bay, thereby, minimizing the adverse impact from dissimilar bottom substrate and dredged material. Typically, sandy material from the Bar and Entrance and North Bay channels would be deposited in Quad 3, cells B4, B5, C4, and C5; and silty clay material from the Eureka and Samoa channels would be deposited in Quad 4, cell C2 .

The first bulletized impact is unavoidable physically but its significance can only be assessed in terms of biological impacts (see Section 5.5). Rapid accumulations of dredged material exceeding 10 cm in thickness have been shown to smother native benthic communities, but recolonization has been found to occur at a dredged material disposal site such as HOODS. Numerical modeling performed by the Corps and a sediment dispersion analysis performed by Scheffner (1990) for the HOODS site (see Section 4.4) conclude that the HOODS is a non-dispersive site. Nevertheless, further analysis of post disposal bathymetric surveys is being conducted to monitor any significant loss of material from the centroid of the dredged material mound at HOODS, which could result in a classification of the site as dispersive.

Presently, surveillance and site management of HOODS are conducted by the United States Coast Guard (USCG), EPA and the Corps. Under Section 107(c) of the MPRSA, the USCG conducts surveillance to discourage unauthorized disposal (33 USC 1417). Additional surveillance, site management and enforcement responsibilities are delegated to EPA (40 CFR 22.36) and the Corps (33 CFR 226). The Corps utilizes the Dredge Data Logging System (DDLS) as a monitoring and surveillance tool on contract hopper dredges at Humboldt Bay. The DDLS is installed on the hopper dredge and provides full time, hard disc records of all pertinent dredge performance data (position, draft, date and time, work and disposal area, etc.). Overall, significant impacts to sediment quality at HOODS are not expected.

Although, significant impacts to sediment quality are not expected, accumulation of dredged material at HOODS will be unavoidable, and its significance can be reduced by the implementation of the following mitigation measures.

Mitigation Measures

- Ensure that dredged material disposal takes place in the proper quadrants and cells within HOODS to minimize any thick accumulation of dredged material which may potentially impact benthic organisms, and to confine disposal operations within the disposal site boundaries.

  a. Accurate positioning shall be required to attain this goal. Global positioning system (GPS) and LORAN-C receivers, used routinely in off-shore vessel positioning/navigation, will be used during disposal for this project, providing the repeatable accuracy needed for disposal operations.

  b. Disposal logs shall be maintained and spot inspections should be performed during disposal operations.

  c. Self-propelled hopper dredges should not be overloaded to minimize accidental spillage enroute to the HOODS, and should be accomplished under weather conditions that minimize accidental spillage.

- Ensure that the Corps' monitoring of HOODS is in accordance with EPA's long-term Site Management and Monitoring Plan (SMMP) to-be-developed and included with the final site designation rule.

5.4.2.3 Louisiana Pacific Site

The disposal of approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal on the LP site is not expected to significantly impact the sediment quality of dredged material presently at the site. Sediments to be discharged at the surface of the LP site will comply with the requirements of the North Coast RWQCB's receiving water and effluent water limitations for the clarified supernatant which is discharged into Humboldt Bay. The site presently contains two large settling basins specially designed and managed to allow maximum

percolation of the supernatant in the ground, and minimize discharge to the Bay. The trace amounts of dioxin in the dredged material to be disposed is hydrophobic and therefore, binds to the sediment. Monitoring, testing and reporting of data collected from the effluent and receiving waters shall be the responsibility of the local sponsor, and will be in full compliance with their future waste discharge order requirements. In addition, once dredged material placement has occurred a layer of clean fill material will be placed over the unsuitable dredged material to reduce any potential impacts the trace amounts of dioxin might have on shorebird species attracted to the site. Therefore, with monitoring and full compliance with the requirements set by the RWQCB, no significant impacts to sediment quality are expected.

5.4.3 Seismicity

Regional

The geological impacts for the navigation channels and disposal sites are very similar. The project area is located near one of the most seismically active regions in California. The whole project area would be susceptible to violent ground motion in the event of an earthquake on a nearby fault. The potential impact from severe ground motion varies with the use of the dredged material. All of the sites may be susceptible to liquefaction and large amounts of settling during a seismic event. The impact on soils varies from site to site.

Project Impacts

5.4.3.1 Humboldt Harbor and Bay Navigation Channels

In view of the known seismic activity in the Humboldt Bay area, earthquakes will be a hazard for the life of the project. The main hazard associated with seismic activity is channel instability. The future Corps Humboldt Harbor Deepening Navigation Study Design Memorandum will need to determine the liquefaction potential of the underlying sediments and associated slope ratio of the channels to be deepened. These ratios should supply an adequate safety/stability factor ensuring that adjacent structures would not be undermined due to small amounts of expected slumping or a seismic-induced mass movement of bottom material. Because this safety factor will be designed into the project, this potential impact is considered insignificant.

5.4.3.2 HOODS

Liquefaction potential is generally associated with cohesionless unconsolidated, saturated fine grained sandy sediments. The logs of borings show the Bay bottom sediments within the project area consist predominately of fine grained sands with some areas of silt and clay. The sands and silts located within the HOODS may experience liquefaction as a result of ground motions originating from earthquakes in the region. Liquefaction of these sediments could result in subaqueous landslides within the different quads and cells of the HOODS, and/or cause varying degrees of differential settlement in adjacent Bay bottom areas. Given the nature of regional oceanic seismicity, this potential impact is considered insignificant.

5.4.3.3 Louisiana Pacific Site

No potentially seismic impacts are expected to occur at the LP site. The geological and seismic hazards identified in the regional section are applicable to the LP site. If a large magnitude earthquake occurs on a nearby fault, severe ground motion and liquefaction could occur at the site. However, potential seismic impacts at the site are considered minimal, because the site will remain as an unpopulated historic disposal site. Although potential geologic impacts are considered insignificant, during site preparation levees should be designed using standard geotechnical engineering practices to prevent any potential impacts on adjacent facilities in the event of levee failure (i.e., protect the triangular-shaped scrub-shrub wetland on the northeastern corner of the LP disposal site).

5.5 BIOLOGICAL RESOURCES

5.5.1 Biological Testing Requirements for Dredged Material

5.5.1.1 Ocean Disposal Testing Requirements

Section 103 of the MPRSA specifies that material dredged and transported to a designated ocean disposal site must be evaluated to determine its potential impact to the site and its environs. The evaluation is performed in accordance with criteria contained in 40 CFR 227.27, and implementation of the evaluation is described in the *Evaluation of Dredged Material Proposed for Ocean Disposal Testing manual* ("Green Book") developed jointly by the EPA and the COE (COE/EPA 1977, revised in 1991). The objective of the testing program is to determine whether disposal in designated ocean disposal sites can occur (i.e., whether or not materials are found suitable for disposal) without causing unreasonable degradation or endangerment of the environment. The regulations and criteria, however, are based on the premise that a certain amount of environmental degradation or change is acceptable within the boundaries of the disposal site. The degree of change is linked to water quality criteria and limiting permissible concentrations (LPCs) of the dredged material or toxic constituents, below which impacts are believed to be insignificant.

The protocol for determining the suitability of dredged material for ocean disposal (40 CFR 227.13) is shown in Figure 5.5.1.1-1 (flow chart). There are obvious cases where dredged material is not considered chemically contaminated and would, therefore, cause negligible pollution-causing impacts when discharged at an appropriate disposal site. Thus, material that meets the requirements of paragraph 40 CFR 227.13(b) may be excluded from the technical evaluations required by Section 40 CFR 227.13, and need be evaluated in terms of its compatibility with the disposal site and the considerations of 40 CFR Subparts C, D, and E, and the appropriate sections of 40 CFR 228.

Dredged material that does not meet the conditions for exclusion of 40 CFR 227.13(b) must receive a full technical evaluation of its potential for environmental impact. The evaluative procedures emphasize biological effects, rather than simple chemical presence, of possible contaminants. Dredged material is separated for evaluation into three phases, as defined in 40 CFR 227.32(b)(1). The liquid phase and the suspended particulate phase are considered to have the greatest potential for impact on the water column and are evaluated with this in mind. The solid phase has the greatest potential for impact on benthic organisms, and evaluative emphasis is placed here. All three phases must be evaluated and, when complete, satisfy the general criteria for evaluating environmental impact from constituents prohibited from dumping except as trace elements.

The testing manual (EPA/COE 1991) describes a tiered testing approach to implement the MPRSA (Section 103) regulations. The tiered approach involves four tiers, any of which may allow determination of suitability. The tiered tests and evaluation guidelines are summarized in Table 5.5.1.1-1. Tier I uses existing information, and Tier II uses relatively quick and simple

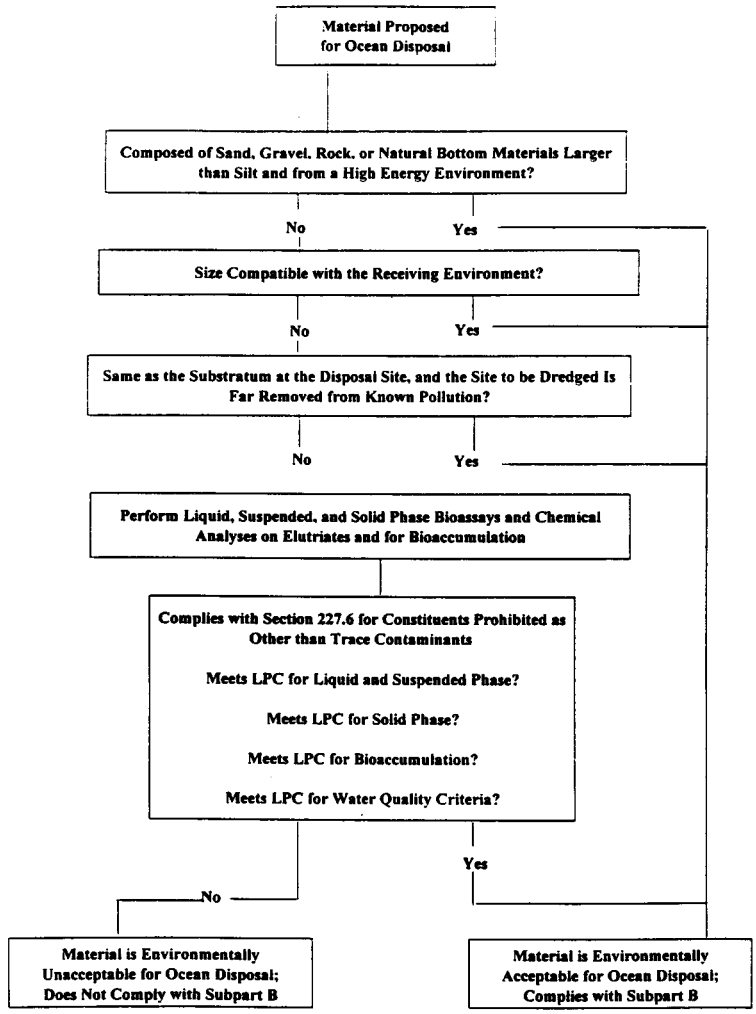


Figure 5.5.1.1-1 Protocol for Determining Suitability of Dredged Material of Ocean Disposal

Table 5.5.1.1-1. Implementation Manual's Tiered Testing Approach
(page 1 of 2)

Tier	Objective	Test	Interpretive Guideline	Action Item (when exceedances noted)
Tier I	Evaluate existing information	Review Data	Compare data to 3 exclusionary	If exclusionary criteria are not met and information cannot determine compliance with LPCs, enter Tiers II, III, or IV
	Identify contaminants of concern	Review Data	Tiers II, III, or IV-type prior data are reviewed to determine compliance with LPCs	If exclusionary criteria are not met and infomation cannot determine compliance with LPCs, enter Tiers II, III, or IV
Tier II Water Column	Evaluate marine water-quality criteria (WQC) compliance using numerical mixing model	Model	> WQC, bulk analysis screen, or elutriate do not exceed criteria	If WQC are exceeded, LPC is not met.
Tier II Benthos	Evaluate potential benthic impact using calculations of theoretical bioaccumulation potential (TBP) of nonpolar organic	Model	TBP > TBP of reference	Determine compliance with bioaccumulation aspects of benthic criteria
Tier III Water Column	Evaluate toxicity of suspended and dissolved portions of contaminants and dredged material (after initial mixing)	Elutriate Bioassays (one species each representative of phytoplankton or zooplankton, crustacean or mollusc, and fish)	Model: Concentration of dissolved plus suspended contaminants > 0.01 of the LC50 beyond the boundaries of the disposal site at any time, or anywhere after the 4-h initial mixing period	Exceeds LPC for water column toxicity
Tier III Benthos	Evaluate acute and chronic toxicity for benthos using bioassays	Whole - Sediment Bioassays (filter-feeding, deposit-feeding and burrowing species)	Mortality is statistically greater than in the reference sediment and exceeds mortality in the reference by at least 10% (20% for amphipod bioassays and for other bioassays).	Exceeds LPC for benthic bioassay criteria (in rare cases, Tier IV)

Table 5.5.1.1-1. Implementation Manual's Tiered Testing Approach (page 2 of 2)

Tier	Objective	Test	Interpretive Guideline	Action Item (When exceedances noted)
Tier III Benthos (cont.)	Evaluate the benthic bioaccumulation of chemicals of concern	Bioaccumulation tests (filter-feeding, deposit-feeding and burrowing species)	Compare tissue chemistry results to FDA Action Levels (a) If one or more contaminants of concern are statistically greater than FDA Action Levels, LPC is exceeded. (b) If all contaminants of concern are not statistically greater than FDA Action Levels or there are no FDA levels for all contaminants, determine if tissue concentrations statistically exceed those of organisms exposed to the reference sediment.	(a) Exceeds LPC for bioaccumulation (b) Further Evaluation is required in Tier III. Case specific evaluative criteria determined by EPA/COE (see interpretive guideline)
Tier IV Benthos	Evaluate long-term effects of exposure to dredged material Evaluate benthic bioaccumulation	Bioassays using infaunal organisms Steady-state biooaccumulation tests Use results of Tier IV bioaccumulation tests Collect field benthic organisms	Case-specific Compare tissue chemistry results to FDA Action Levels (a) If one or more contaminants of concern are statistically greater than FDA Action Levels or there are no FDA levels for all contaminants, determine if tissue concentration statistically exceed those of organisms exposed to the reference sediment. Tissue concentration statistically exceed those of field-collected organisms.	Case specific evaluative criteria determined by EPA/COE (a) Exceeds LPC fo bioaccumulation (b) Further Evaluation is required in Tier IV. Case specific evaluative criteria determined by EPA/COE Determine LPC compliance.

procedures for assessing impacts. For dredged materials with either readily apparent potential for environmental impact or no impact, Tier I may provide adequate information for a suitability decision. Tiers III and IV involve more extensive evaluation for dredged materials having less clear potential for impact or for which historical data are unavailable. More intensive evaluation procedures are prescribed with successive tiers. It is important to note that testing at each tier is not required for every situation. If there is a reason to believe that contamination is a strong possibility and historical data are not available to support a decision, testing can begin at Tier II or Tier III. Tiers may be conducted simultaneously when time constraints are an issue. The program is intended to be as flexible as possible and consider dredging projects on a case-by-case basis (SAIC 1994).

5.5.2 Testing of Humboldt Harbor Sediments

Sediment samples were collected in the Humboldt Harbor Deepening Project navigation channels during December 4-6, 1991, and December 11, 1991. A total of ten samples were initially taken and tested according to Green Book procedures at the following locations: samples HB1 and HB2 were taken in the Bar and Entrance Channel; samples HB3 and HB4 were taken in the North Bay Channel; sample HB5 was taken in the Outer Eureka Channel; sample HB7 was taken in the Samoa Channel; and samples HB8, HB9, HB10, and HB11 were taken in the Samoa Turning Basin. Since the Field's Landing Channel was removed from the study, sample HB6 was dropped from analysis. With the exception of samples HB8 and HB9, the remaining eight sediment samples were predominately sand, and met the exclusionary criteria outlined in Section 227.13(b)(1). Biological and chemical tests conducted on samples HB8 and HB9 included the following:

- Solid phase acute toxicity test with polychaete worms and amphipods.
- Suspended particulate phase bioassays with larval bivalves (mussels), mysid shrimp, and fish.
- Bioaccumulation testing using 28-day procedures with clams and polychaete worms.
- Sediment chemistry test for conventional parameters and contaminants.

The results of the sediment chemical and biological tests conducted on the above sediments are discussed in Section 4.4.5. Table 5.5.2-2 below summarizes the Green Book tests conducted on samples HB8 and HB9.

Table 5.5.2-2. Tier III, Sediment Testing Conducted for the Humboldt Harbor and Bay Deepening Navigation Study

	Solid Phase		Suspended Particulate Phase			Bioaccumulation			
Humboldt Harbor Study	10-day Polychaete	10-day Amphipod	48-hour Larval	96-hour Mysid	96-hour Fish	28-day Bivalve	28-day Polychaete	Sediment Chemistry	Comment
Sample HB-8	X	X	X	X	X	X	X	X	Samoa Turning Basin
Sample HB-9	X	X	X	X	X	X	X	X	Samoa Turning Basin

Bivalve – *Macoma nasuta* (28-day bioaccumulation), *Mytilus edulis (48-hour* suspended particulate phase)

Polychaete – *Nephtys caecoides* (28-day bioaccumulation)

Amphipod – *Rhephoxynius abronius* (10-day solid phase toxicity)

Fish – *Citharichthys stigmaeus* (96-hour suspended particulate phase toxicity)

Larval – *Mytilus edulis* (96-hour suspended particulate phase toxicity)

Mysid – *Holmesimysis costata* (96-hour suspended particulate phase toxicity)

5.5.3 Impact Significance Criteria

A biological impact is considered significant if it:

- Is expected to affect the population status of a State or Federally listed, proposed, or candidate species or is expected to affect the breeding or foraging habitat of such a species so as to result in increased mortality or reduced reproductive success.
- Causes the loss or long-term degradation of any environmentally sensitive habitat.
- Interferes substantially with the movement of any resident or migratory fish or wildlife species.
- Causes a measurable change in species composition or abundance of a sensitive community or causes a substantial change to marine habitat within the harbor or disposal sites for a period of five years or longer.
- Adversely affects a plant species that is considered rare, threatened, or endangered.

ALTERNATIVE PLAN 3: Potential impacts associated with the construction of Alternative Plan 3 are discussed in the following order: impacts associated with deepening of Humboldt Harbor and Bar navigation channels; dredged material disposal at HOODS; and dredged material disposal at the proposed LP site.

5.5.4 Humboldt Harbor and Bay Navigation Channels Deepening

5.5.4.1 *Project Impacts*

Plankton Community

An increase in suspended solids in Humboldt Harbor and Bay navigation channels would result from dredging operation activities associated with the proposed dredging project. The temporary, localized impacts would be characterized by increased suspended particulates, attenuation of light penetration, and reduced dissolved oxygen concentrations. As a result, potential impacts to the planktonic community associated with the increased turbidity may include a reduction in primary feeding productivity of phytoplankton due to the reduced light in the water column, and clogging of gills and feeding appendages of zooplankton. Impaired feeding activities associated with clogged gills and feeding appendages could reduce the survival, growth, and biomass of zooplankton (SAIC 1994). However, the increased turbidity conditions are expected to be localized and temporary, lasting only while dredging activities persist. In addition, any

impacts associated with the suspension of the sediment from sample HB-8 (Samoa Turning Basin), with trace amounts of dioxin, would be minimal. Dioxin is hydrophobic and binds to sediment, thus suspended sediment particles would sink to the bottom and become not chemically bioavailable. Therefore, overall reduced productivity and physical impacts resulting from the suspended sediments are not expected to be significant compared to the natural fluctuations in primary production of plankton at Humboldt Bay. Impacts to the plankton community are not expected to be significant.

Benthic Community

Impacts to the existing benthic community of Humboldt Harbor corresponding to the proposed navigation improvements (deepening and widening selected parts of the Harbor) would initially be removal of the benthic community in the areas to be dredged. As a result, productivity would be temporarily reduced in the dredged regions. Recolonization of the dredged areas would occur by larval recruitment or immigration of organisms from adjacent unaffected areas. Species first recolonizing the benthos would be small, shallow burrowing opportunistic species. The Humboldt Harbor navigation channels have been and continue to be maintenance dredged both in the spring and fall, resulting in a benthic community adapted to frequent disturbance. Predominately sandy sediments such as those found in the Bar and Entrance Channel and North Bay Channel, support the lowest invertebrate species diversity. Species-diversity tends to increase in finer-grained sediments such as in the Samoa Channel, and Eureka Channel (USFWS 1994). Other disturbances to the benthos occurring with in the Humboldt Harbor are prop-wash effects, commercial and human activities (e.g., oyster mariculture activities), and shoaling of the channel bottoms. Thus, the existing community is likely to be unstable, less developed, and less productive than nondredged regions. A similar community is expected to reestablish itself following navigation improvements. Greater impacts would be to benthic communities existing in areas where channel widening would occur. The community that eventually develops would be less productive and more similar to those benthic communities presently existing within the maintenance dredged navigation channels. Recovery of the current benthic community in these nondredged areas would not be as complete as present because they would be subjected to similar disturbances already occurring in dredged channels. Because the existing benthic community in Humboldt Harbor is unstable and consists of species tolerant of disturbance, impacts of dredging in much of the project area is expected to be temporary and minimal.

Based on the results of the chemical and biological tests conducted on Samoa Turning Basin sediment samples HB-8 and HB-9, toxic effects on benthic suspension and filter feeding infauna in areas adjacent to the dredge site, due to temporary suspension of channel sediments with trace amounts of dioxin (HB-8), are expected to be insignificant. Any impacts to benthic organisms from trace amounts of dioxin remaining in areas adjacent to the Samoa Turning Basin dredge area are expected to be insignificant compared to existing conditions. Impacts to any benthic organisms that recolonize the Turning Basin channel site are expected to be insignificant.

Dredging would remove the upper layer of sediment with trace amounts of dioxin and expose clean sediment that have not been affected by human activity. For a period, until more shoaling occurs, sediment conditions at the site may actually improve.

Impacts to the benthic community existing in Humboldt Harbor would be direct and consist primarily of removal of the community. However, because the community present at the various dredged navigation channels consist of opportunistic species or those tolerant of disturbance, recolonization and reestablishment of a similar community is relatively rapid; original biomass is sometimes reached in 2 weeks to 4 months (USFWS 1994). In areas that had not previously been dredged (widening regions), the benthic community would change to a less developed community similar to the existing channel assemblage. Therefore, the overall benthic community found within the harbor is not expected to be significantly changed by the navigation improvements.

Fish Community

Fish occurring in the dredging areas would be disturbed temporarily by the increase in suspended solids that could affect the levels of dissolved oxygen in the water column, decrease visibility for foraging activities, and impaired oxygen exchange due to clogged or lacerated gills. Impacts would be greatest on fish eggs, larvae and juveniles. However, the turbid conditions are temporary and most fish will be able to avoid the area during dredging operations. Additionally, some fish (e.g., striped bass) are able to detect prey in highly turbid waters (SAIC 1994). Displacement from spawning and rearing areas would also be detrimental to fish species. Pacific herring are known to spawn in intertidal areas (not included in dredging area) in Humboldt Bay, and herring eggs could be negatively impacted by increase turbidity if dredging occurs during spawning season (December through February), or the fish may not spawn in the harbor as a result of the disturbance (SAIC 1994). Impacts to fish are mainly related to habitat disturbance since they are able to avoid areas during dredging activities. The spawning area for herring in the harbor is small relative to other spawning areas within Humboldt Bay. If dredging does not occur during spawning periods or of efforts are made to contain the suspended sediments, potentially significant effects on fish due to an increase in turbidity would be temporary and insignificant. Alternatively, dredging could be monitored by qualified fish biologists during the spawning season, and dredging could be redirected to another area if spawning is observed in the vicinity of the dredging operations.

Another impact of concern would be the loss of prey species and altered benthic habitat as the sediments are removed. However, this impact is expected to be temporary, persisting until recolonization of the benthic community occurs. Due to frequent disturbances from the spring and fall maintenance dredging and other harbor activities, this habitat for fish is already disturbed so that additional dredging should not have a significant impact on the fish or their habitat.

An eelgrass survey of the South Bay was performed in August 1989 along the limits of Fields Landing channel (WESCO 1989) and indicated that the lower reaches of the channel are bordered by eelgrass areas of mostly high density. This eelgrass had the potential to be impacted by channel improvements, however, the deepening of the Fields Landing channel has been dropped out of the project alternatives.

In addition, another eelgrass survey was conducted by the Corps in mid-September 1991, in the Samoa Channel Turning Basin (Miner 1993). Presence of eelgrass beds was determined using a hydrographic survey positioning system on uniformly spaced fathometer transects through two survey areas. In order to verify the interpretation of the fathometer recordings, scuba divers visually inspected all areas (with "bounce dives") in which the fathometer recordings indicated anomalies in the benthic profile. Scuba divers also made "bounce dives" and visually inspected several transects in the shallowest portions of the two survey areas in the Samoa Turning Basin to verify the accuracy of the fathometer recordings in detecting the presence of eelgrass. Shoot (turion) density was sampled near one of the two survey areas. Results of this field survey, found eelgrass in dense beds with well-defined edges in the shallow areas on both sides of the Samoa Turning Basin. Eelgrass growth was limited to depths of 5 feet MLLW or less in the surveyed areas (Miner 1993). Originally, based on the results of the field survey, the enlargement and deepening of the Samoa Turning Basin being considered at that time indicated the proposed channel would be 50 feet from the nearest eelgrass beds. Presently, the channel line of the Samoa Turning Basin has been relocated to provide a 100 foot buffer between the channel edge and the nearest surveyed eelgrass beds.

Any adverse impact on eelgrass beds would adversely affect Pacific herring and any other fishes, which depend on these areas for spawning substrate, feeding, and/or cover. No direct impacts to eelgrass are anticipated from the proposed project, since the project has been redesigned to avoid eelgrass beds in the Samoa Turning Basin, and eelgrass is not known to grow in dredged navigation channels. Eelgrass surveys conducted previously and described above have supported this finding. Overall, impacts to eelgrass and thus, fish habitat in eelgrass beds are not expected to be significant, and will be avoided.

The potential impacts from any toxic effects resulting from the trace amounts of dioxin in sample HB-8, are minimal. The presence of these sediments suspended in the water column will be limited to the immediate dredging area. Dioxin, as stated previously, is hydrophobic and will stay bound to the sediment, and not be chemically bioavailable to water column biota. The elevated turbid conditions are expected to be temporary, and should not have a significant impact on fish species. Dredging would remove the upper layer of sediment with trace amounts of dioxin and expose clean sediment that have not been affected by human activity. For a period, until more shoaling occurs, sediment conditions at the site may actually improve. Therefore, toxic effects associated with dredging in the Samoa Turning Basin are not expected to be significant for the fish community.

In conclusion, impacts to fish present at the dredging site initially would include reduced prey availability, avoidance of the area due to increased turbid conditions, and possible effects on herring spawning activities or development. These conditions are expected to be temporary and minimal, particularly if dredging occurs during periods when herring do not spawn. Toxic effects associated with the Samoa Turning Basin sediments are not expected to be significant. Thus, overall impacts on the fish community occurring in Humboldt Harbor are expected to be insignificant.

Marine Mammals and Birds

Impacts to marine mammals and birds at Humboldt Harbor would result primarily from turbidity caused by the dredging operation, disturbance from operation of the dredging equipment, and effects on food resources such as fish and invertebrates. The effects of turbidity and disturbance by the dredging operation will be localized and temporary. Both turbidity and operations disturbance will cause birds and mammals to avoid, based on their mobility, the immediate dredging site during dredging operations. This should have a minor effect on foraging and other behavior of these animals, as the area to be avoided will be a very small part of the normal foraging, resting, or transit habitat for these species. There should be no significant reduction in short-term food availability for these species due to this temporary avoidance of the immediate dredging site. Once dredging in a specific navigation channel is complete, interference with bird and mammal activity in the area will end (SAIC 1994).

In the Samoa Turning Basin Channel, the resuspension of dredged material that is both suitable and unsuitable for unconfined aquatic disposal will occur at the immediate dredging site (sample HB-8) during dredging operations. In the Samoa Turning Basin, sediments with trace amounts of dioxin from sample HB-8, would be temporarily exposed during dredging operations to benthic invertebrates, plankton, and fish, and any any birds or mammals that may feed upon these organisms. However, the exposure of these food species to the trace amount of dioxin will be temporary and will be extremely limited in areal extent. In addition, most fish, the principal food of marine birds and mammals, will also avoid the immediate dredging site, thus further reducing their exposure to contaminants. The expectation that birds and mammals will largely avoid the immediate dredging site, also reduces their exposure to potentially contaminated prey from the turning basin area. Overall, toxic effects or bioaccumulation resulting from exposure to trace amounts of dioxin-contaminated suspended sediment and prey will be negligible for marine birds and mammals.

As mentioned above for fish, no impacts to eelgrass beds are anticipated with the proposed dredging and measures will be taken to avoid any potential impacts to eelgrass communities located within close proximity of the proposed dredging areas. In addition, impacts to bird species dependent upon eelgrass for forage are not expected to be significant since eelgrass beds will be avoided with the proposed design.

A slight potential for disturbances to a night heron and egret rookery on Indian Island exists if construction is located within one quarter mile (1320 feet) of areas of such activity, and occurs during nesting season (March to June). Annual maintenance dredging operations occur here presently, and any impacts are not expected to be significant. An estimated 45 days of dredging will be needed to dredge the Samoa Turning Basin. The dredging operations would occur approximately 875 feet away from the edge of Indian Island, thus dredging operations will be scheduled to avoid the March through June nesting season of the heron and egrets inhabiting the Indian Island rookery. In conclusion, impacts to this rookery are not expected to be significant since the annual dredging operations presently conducted have not been reported to cause nesting disturbances and abandonment, and the dredging for the deepening project will be scheduled to avoid the nesting season.

In the long term, food for marine birds and mammals in dredged areas may be reduced until the benthic community in these areas becomes re-established. Food for bottom-feeding fish, which compose part of the food resource for birds and mammals, may also be temporarily reduced. These effects will be minor because they will be limited to the dredged areas, which make up a small part of the total foraging range of any birds or mammals. These effects will also be limited by the fact that much of the food-chain that incudes marine birds and mammals is water-column based, and the water column environment is expected to return to normal soon after dredging ends.

Overall, impacts on marine birds and mammals at the Humboldt Harbor dredging areas are expected to be insignificant. Temporary avoidance of the dredging sites during dredging operations will have an insignificant effect on feeding and other aspects of the ecology of birds and mammals. Exposure of birds and mammals to suspended sediments in the Samoa Turning Basin will be small and temporary, so that exposure to any trace contaminants associated with the sediments will be negligible.

Subtidal Habitat

For the Humboldt Harbor and Bay Deepening Navigation Project, the Service in their Coordination Act Report requests compensation for impacts associated with deepening already deepened and annually maintenance dredged channels. Compensation for this is not justified. There is no portion of the channel widening project, including channel side slopes, that includes "first time" dredging disturbance of shallow (defined as less than -20 feet MLLW) subtidal channel areas. There is a small portion of the eastern edge of the Samoa Turning Basin that would involve "first time" dredging of shallow (defined as less than -20 feet MLLW) subtidal channel areas. This small area represents an area of approximately 9,000 square feet, and would be temporarily impacted. Compensation for this small area is not justified and is considered to be an insignificant impact considering the extent of subtidal channel areas available in the Humboldt Harbor navigation channels (see Appendix B for further explanation).

5.5.4.2 Threatened, Endangered, and Sensitive Species

Threatened, endangered, and sensitive wildlife and plant species which occur in the general vicinity of the Humboldt Harbor and Bay navigation channels include the following: winter-run chinook salmon, tidewater goby, green sturgeon, Stellar's sea lion, peregrine falcon, marbled murrelet, western snowy plover, bald eagle, brown pelican, Aleutian canada goose, short-tailed albatross, northern red-legged frog, northwestern pond turtle, Pacific western big-eared bat, Menzie's wallflower, beach layia, western lily, northcoast sand verbena, Humboldt Bay owl's clover, northcoast bird's beak, and Humboldt Bay gumplant.

Potential impacts to marine mammals and birds such as impaired visibility for foraging and reduced food availability within the dredging areas, which would alter normal feeding and passage activities, would be temporary and localized in each navigation channel.

The winter-run chinook salmon occurs occasionally in Humboldt Harbor during migration season (November to May). Because Humboldt Harbor is not located within the species' main migration route, few individuals are expected to occur in the Harbor during dredging, and these would be likely to avoid the immediate dredging site where effects could occur. Therefore, potential effects (as described for fish in general) on salmon such as turbidity effects, reduction in food resources, toxicity, or bioaccumulation (e.g., in Samoa Turning Basin) would be very limited in magnitude and duration. The resultant impacts on winter-run chinook salmon would be negligible. The benthic community is expected to recover quickly enough following dredging that there should be no long-term effect on potential food sources in the Bay. The potential for impacts is further reduced because migrating adult chinook salmon have ceased to feed or almost ceased to feed by the time they enter the Bay on their upstream migration. In addition, the migration success of both adult and juvenile chinook salmon should not be affected significantly because both have the ability to detect and avoid dredging activities, and re-establish their migration course after any deviation. Passage of juvenile salmon out of the Bay is usually rapid (approximately one week), so that they are expected to take the most direct route to the ocean. Therefore, no adverse effects on this species are expected to occur.

The tidewater goby occurs at the northeastern shore of Arcata Bay and at the mouth of both the Jacoby Slough and Mad River Slough. The goby does not inhabit the deepwater navigation channels and thus, is no effects to this species are expected to occur.

The green sturgeon occurs in estuaries, lower reaches of large rivers, and salt or brackish waters off river mouths. It prefers saline waters and may inhabit the areas adjacent to and within the navigation channel project areas. As with other fish species, the green sturgeon is highly mobile and would likely avoid areas being dredged. Therefore, no effects to this species are expected to occur.

The Stellar's sea lion is most often seen in the ocean, and sometimes in the Bay. Sea lions are highly mobile and capable of avoiding the immediate dredging area. Any impacts upon this species is expected to be minimal and insignificant.

Peregrine falcons could potentially forage within the Bay, however like many marine mammals and bird and fish species, the area to be deepened accounts for only a small portion of their foraging area, and they are likely to avoid the dredging area. If variations in normal feeding patterns or passage activities associated with ship-following behavior patterns (as observed in other bird species) occur, these behavior changes would be temporary, generally ceasing after dredging operations are completed.

The snowy plover occurs mainly on intertidal beaches and foredunes, and recently, nesting has occurred at the mouth of the Mad River. The dredging of the navigation channels is not expected to cause any effects to this species since they generally nest on land. Therefore, no effects to this species are expected to occur with the dredging of the navigation channels.

The marbled murrelet, bald eagle, and brown pelican all forage in the Bay, within the project area. Avoidance and limited use of the dredging site by such species during dredging operations will render negligible any short-term effects, such as those of turbidity or food reduction. Long-term effects such as reduction in benthic- or pelagic-based food resources, are also expected to be negligible due to the fairly rapid recovery expected in these communities. In addition, bird species are highly mobile and can avoid dredging activities, and thus, any impacts upon these species would be expected to be minimal and insignificant.

The endangered Aleutian canada goose occurs primarily in lacustrine habitats, fresh emergent wetlands, moist grasslands, croplands, pastures and meadows. Humboldt County has been used historically as an important staging area, but these staging areas are located mainly near croplands well away from the channels. Therefore, no adverse effects are expected to occur to this species with the dredging of the navigation channels, because the canada goose does not forage nor nest near the navigation channels.

The short-tailed albatross mainly forage offshore for fish, shrimp, and squid. As with other marine bird species, they are highly mobile and would likely avoid dredging activities in the navigation channels. However, since the occurrence of this species is rare, no adverse effects on this species are expected to occur.

The northern red-legged frog and the northwestern pond turtle occur in open freshwater ponds, and permanent ponds, lakes, streams, and irrigation ditches, respectively. No adverse effects on these species are expected to occur, since dredging is to occur in deep water navigation channels.

The Pacific western big-eared bat is considered a cave dweller, but will use man-made structures for roosts. No adverse effects are expected to occur to this species, since dredging is to occur in navigation channels.

The Menzie's wallflower, beach layia, western lily, northcoast sand verbena, Humboldt Bay owl's clover, northcoast bird's beak, and Humboldt Bay gumplant all occur on either sandy upland areas such as in dune mat habitat, sandy beaches, or in salt marshes of Humboldt Bay. No adverse effects are expected to occur to these species, since the dredging is to occur in deep water navigation channels.

In conclusion, impacts on endangered, threatened, and sensitive species in Humboldt Bay and Harbor are expected to be minimal and insignificant. Avoidance and limited use of the dredging areas by such species during dredging operations will render negligible any short-term effects associated with turbidity, food reduction, or toxicity from the trace amounts of dioxin contained in Samoa Turning Basin sediments (sample HB-8). Long-term effects such as reduction in benthic- or pelagic- based food resources, are also expected to be negligible due to the fairly rapid recovery expected in these communities.

5.5.4.3 *Mitigation Measures - Humboldt Harbor and Bay Navigation Channels*

In order to reduce any potential impacts to the biological community in the Humboldt Harbor navigation channels from dredging operations, the following mitigation measures are proposed for implementation:

- The Corps will provide a qualified marine biologist observer, if necessary, on board the hopper dredge during those periods when dredging might have a greater effect on fish or wildlife, such as during herring spawning season from November through March to redirect the dredging operation away from and thus avoid effects on fish.

- The Corps will schedule the dredging of the Samoa Turning Basin to avoid the nesting season (March through June) of the egret and night herons residing in the Indian Island rookery.

5.5.5 HOODS

The effects of the disposal of dredged material in open water are temporary and usually restricted to the immediate vicinity of a disposal area (Burks and Engler 1978). The majority of the dredged material to be disposed of from Humboldt Bay navigation channels consists of sand (approximately 85 to 90%) with some silts and clays originating in the Eureka and Samoa channels. The sediment plumes produced from the disposal of dredged material offshore of Humboldt Bay are expected to be negligible.

5.5.5.2 *Project Impacts*

Plankton Community

Phytoplankton

The disposal of dredged material at the preferred site may cause mortality to phytoplankton through entrainment in the sediment plume and may temporarily reduce production by increasing turbidity and reducing light penetration. However, the increased turbidity produced during disposal of dredge spoils is typically localized and temporary, and the impacts would be insignificant compared to natural fluctuations in primary production (Copeland and Dickens 1974, Hirsch *et al.* 1978). The pelagic environment offshore of Humboldt Bay is seasonally subjected to large amounts of suspended sediments discharging from the Eel River and Humboldt Bay. The limited impacts from projected amounts of dredged material disposal at HOODS are not expected to have any significant long-term adverse effects on the phytoplankton offshore of Humboldt Bay.

Zooplankton

Impacts on zooplankton as a result of dredged material disposal may include mortality through entrainment in the sediment plume and interference with filter feeding caused by increased suspended sediments. These impacts would be short-term and localized and would not significantly affect planktonic conditions over the widespread nearshore waters.

Benthic Community

Benthic Algae

The only benthic algae communities in the affected environment are along the intertidal and subtidal portions of the jetties. Benthic algal communities probably do not occur within HOODS. Disposal operations should not affect the limited algal communities along the jetties because they are about three nautical miles from the preferred site. Disposal of dredged material at HOODS would not have any significant short-term or long-term effects on the benthic algal communities in the area.

Benthic Infauna

These organisms are buried when dredged material is deposited, usually resulting in a reduction in the number of species and abundance at the disposal site. Survival of organisms varies with species and the depth of disposed materials (Hirsch et al. 1978). Direct mortality due to burial of organisms will be restricted to the immediate disposal area (Hirsch 1978). Immediately following dredged material disposal, the number of species and the abundances of infaunal organisms is reduced (Oliver and Slattery 1976, Scott *et al.* 1987). Recolonization by

opportunistic, early colonizers occurs within 3-6 months (Bingham 1977, Scott *et al.* 1987). The sequence and rate of colonization and the end state of recolonization can be predicted only if the reproductive patterns of the local benthic fauna are known (Oliver and Slattery 1976).

The most permanent impact of dredged-material disposal is a change in substrate (Tatem 1984). Although the grain size of the substrate at the preferred alternative site ranges from approximately 50% sand in the easterly cells to approximately 10% sand in the westerly cells (Pequegnat *et al.* 1990), the sediments dredged from Humboldt Bay are predominantly sand (approximately 85 to 90%). Many benthic invertebrates will be unable to move through the dredged material, and the lateral migration of adults from the adjacent benthic community will be hindered because they are adapted to finer-grained sediments (Hirsch *et al.* 1978). In addition, the planktonic larvae of many benthic invertebrates respond to specific cues for settlement and metamorphosis, including grain size of the substrate (Meadows and Campbell 1972). Disposal of sandier sediments (Bar, Entrance, and North Bay channel sediments) in easterly cells of the preferred site and of finer-grained sediments (Fields Landing, Eureka, and Samoa channel sediments) in the westerly cells of the preferred site may promote recolonization of the dredged material. Dexter *et al.* (1984) found that although the sediments at a dredged-material disposal site in Elliott Bay, Washington, were sandier than ambient sediments, there was a greater abundance and biomass of benthic invertebrates in the dredged materials mound than in the surrounding area three years after disposal. However, this may have been an artifact of organisms introduced by currents around the mound (Tatem 1984).

From previous observations of macrobenthic recolonization at dredged material disposal sites, it is expected that after the dredged material is deposited, the initial recolonization will be by motile, short lived, shallow burrowing opportunistic species, probably small crustaceans (e.g., amphipods and cumaceans) and polychaetes (Oliver and Slattery 1976, Winzler and Kelley 1984). Deposit feeding fauna will have a more difficult time recolonizing because the low organic content and coarseness of the dredged material is not conducive to burrowing infauna. The rate at which the benthic community at the HOODS recovers will depend on the duration between disposal operations. Recolonization of a diverse and stable benthic assemblage at the preferred site would probably take one to three years after disposal operations end (Dillon 1984, Scott *et al.* 1987). As a result of the past continuous disposal of dredged material at HOODS, the benthic community that has developed is variable in composition and abundance, and is characterized by opportunistic species that are tolerant of disturbance. Because the benthic community existing at the site is unstable and characteristic of a frequently disturbed community, impacts associated with burial and smothering of the benthos are expected to be minimal, localized, temporary, and insignificant.

Benthic Epifauna

Of particular concern is the impact of disposal operations on Dungeness crabs. The impacts on planktonic larval stages of zooplankton were discussed above. Dredge disposal operations

offshore of Humboldt Bay generally occur during April and May when Dungeness crabs are mating in shallow sandy areas and in September and October when egg-brooding females are found partially buried in the sand in the shallow subtidal areas. Juvenile Dungeness crabs settle in shallow offshore areas from April to July. During these critical life stages, Dungeness crabs caught beneath the disposal plume would be smothered. However, Dungeness crabs are found in association with a range of substrates, so the alteration in sediment type following disposal should not have a detrimental effect on these crabs.

Because the HOODS is located in deeper water than found at either of the previous ocean disposal sites (SF-3 and NDS), few individuals of the critical life stages of Dungeness crab are expected to be affected. Based on the available field data, the HOODS has not been identified as a critical habitat for any life stages of Dungeness crabs or any other epifaunal species reported in this area. Since the impacts will be short-term and restricted to the area within the disposal site boundaries, significant long-term impact on Dungeness crabs and other epifauna populations in the affected environment is not expected.

Pelagic Invertebrates

HOODS is not known to provide critical spawning habitat for the Market Squid *Loligo opalescens*. This species is highly mobile and would be able to avoid the disposal plume. Although this species has been reported to be a component of the biological community offshore of Humboldt Bay, there is no evidence that this species would be adversely impacted by dredged material disposal at HOODS.

Fish Community

Demersal Fishes

Disposal of dredged material at HOODS is likely to adversely affect the demersal fish population at HOODS. The immediate local effect of dredged material disposal would be the burial of adult and juvenile bottomfish as well as their epifaunal and infaunal food resources. After dredged material is dumped, much of the fine-grained sediment with high water content remains suspended near the ocean floor (Hirsch *et al.* 1978). This can stress fish by physically clogging their gills and reducing the availability of dissolved oxygen. Adults can avoid suspended material by moving out of an area, but juvenile fish are more vulnerable and susceptible to stress (SAIC 1986). Sediments can remain suspended for weeks or more, and areas outside a designated area may be affected if bottom currents transport suspended sediments. The HOODS, however, is far enough offshore (3-3.5 mi) that except during storms, bottom currents are low, and suspended sediments should not move much beyond the disposal area (Scheffner 1990).

The cumulative effect of dredged material disposal at HOODS may be to decrease species diversity and abundance. Previous studies at the NDS and SF-3 indicate that past disposal actions have adversely affected fish fauna (ERC 1976, Lockheed Center 1979, Winzler and Kelly 1984, Pequegnat *et al.* 1990). Similar reductions in number of species and biomass have been reported at other coastal dredged material sites. These reductions are partially caused by reduced food availability. Benthic infauna and epifauna populations, which are the main food source for fish, decline when disposal occurs frequently because the original benthic fauna is unable to re-establish itself (SAIC 1986). Some recovery of the benthic community occurs within months, but complete recovery of the original benthic communities requires about one year (SAIC 1986). When dumping occurs more than once a year, it is likely that the benthic community will be reduced and so support a more limited fish community. However, dredged material disposed at HOODS may have a smaller effect on fish populations than at nearshore areas (SF-3 and NDS) since in general, fish abundance and biomass decrease toward offshore areas.

The effects of disposal could be minimized by scheduling activities during seasons that would least affect fish reproduction. Recovery from physical impacts is most rapid when disposal operations are completed shortly before seasonal peaks in spawning or larval abundance (Hirsch 1978). Peak spawning activity of many benthic fish occurs from December to February and usually eggs and larvae are pelagic by spring. Dredging in November, just before the peak in spawning activity, may contribute to a rapid recovery. Preservation of nursery areas is also critical. Juveniles of many species inhabit the shallow, sandy bottoms at the preferred site, usually May through August. Older juvenile English sole may use the area from August to November as they move from protected areas to deeper waters off the open coast (Lassuy and Moran 1989).

To reduce the effects of suspended sediments on fish, very fine-grained sediments should be deposited in the smallest area possible so that the least amount of benthic habitat is affected (Hirsch et al. 1978). However, sandy sediment deposited in an area with similar indigenous sediments should be dispersed over a large area. The similar grained sediment should minimally modify the disposal area, and a thin layer of sediment would allow bottomfish a better chance of surviving burial (Hirsch et al. 1978).

Pelagic Fishes

Disposal activities at HOODS should minimally affect the pelagic marine and anadromous species. Pelagic fish passing through the area may be forced to divert during discharge operations. Adult fish within and immediately adjacent to the disposal area would probably experience short-term clogging of their gills by suspended materials and a slight decrease in available oxygen due to the biological oxygen demand of the dredged material. Adult fish may also experience stress from avoidance reactions. However, these impacts should be short-term and localized, and the effects on pelagic adults in the water column should not be significant.

Juveniles may be more susceptible to the effects of released dredge material. Juveniles passing through a turbidity plume would be subject to gill clogging, interference with oxygen exchange, and slightly lowered oxygen availability due to the biological oxygen demand of suspended sediments. Juvenile anadromous fish generally move seaward between March and October, and juvenile black rockfish usually move to benthic habitats at this site in June. Release of dredge material would least likely affect juvenile anadromous and marine fish during the late fall and winter.

Marine Mammals and Birds

Coastal and Sea Birds

Disposing of dredged material at HOODS would have little direct effect on seabird breeding colonies in the area because the site is located offshore away from known colonies. Indirect impacts on seabirds from use of HOODS could result from temporary turbidity that would displace and obscure prey items in the water column. This would affect surface diving seabirds such as alcids and lunge divers such as brown pelicans that feed in clear water. Turbidity from disposal would be both localized and temporary; consequently, birds that feed in clear water and in the mid-water column will likely avoid plumes and feed elsewhere. Benthic fish and invertebrates at HOODS are not generally used as food by seabirds. Only a few deep-diving species (common murres, cormorants, and loons) dive over 35 m, and studies indicate that bottom fish comprise only a small portion of their diet (Ainley and Boekelheide 1990). Disposed dredged material may provide a brief supply of food for surface feeding seabirds such as shearwaters, storm petrels, fulmars, and gulls, depending on the abundance of marine organisms present. This food source, however, would be temporary and incidental to the total diet of these birds.

Use of HOODS would have no direct effect on the marbled murrelet, snowy plover, or double-crested cormorant breeding populations because these species usually occur closer to the coastline.

Marine Mammals

Use of the HOODS site will have no direct impact on most populations of marine mammals in the Humboldt Bay area. Many occur in offshore waters deeper than found at HOODS. It is possible that the plume or disposal ship traffic would cause gray and humpback whales to alter migratory routes. Studies have shown that gray whales offshore to avoid ship traffic and turbid water (Dohl *et al.* 1983). Gray whales tend to forage in waters shallower than those found at HOODS. Therefore, impacts to gray whales would not be significant. Disposal at this site would probably have little direct effect on marine mammal foraging since most other marine mammals in the area forage on mobile organisms that would likely evade the disposal area. In addition, our coordination with the National Marine Fisheries Service (NMFS) on the spring and fall O&M

dredging in Humboldt Bay, and the Humboldt Harbor and Bay Deepening project has not indicated any concerns regarding disposal at the HOODS (see letter dated December 27, 1993 in Appendix F).

Use of HOODS will have no direct effect on pinniped breeding or haul-out sites because the site is located offshore of known breeding colonies and haul-out sites.

Cumulative Impacts as a Result of Disposal at HOODS

Cumulative impacts to the biological community at HOODS would include a decrease in benthic infaunal and epifaunal populations and lowered fish diversity. Benthic infaunal communities at HOODS will be the most impacted as long as disposal is taking place. Benthic infauna will be buried during disposal and, depending on length of time between disposal operations, may not have sufficient time to recolonize. Benthic epifauna, including Dungeness crabs, may also be affected to some extent; however, few, if any, of the critical life stages of this species are found at HOODS.

The cumulative effect of dredged material disposal on demersal fish at HOODS may be to decrease species diversity and abundance. This effect has been documented offshore of Humboldt Bay at NDS and at SF-3 (ERC 1976, Lockheed Center 1979, Winzler and Kelly 1984, Pequegnat *et al.* 1990) and at other coastal disposal sites. These reductions are partially caused by reduced populations of benthic infauna and epifauna populations, a main food source for fish.

Because the dredged material is not toxic, however, these communities could re-establish once disposal operations ceased. In addition, because the abundance and biomass of most marine species tend to decrease toward offshore areas, HOODS is the best site in terms of its location. In summary, the following features of HOODS have served to reduce potential impacts to the biological communities found offshore of Humboldt Bay:

- ☼ its distance from nearshore communities,
- ☼ depth,
- ☼ location away from biologically sensitive areas and areas utilized by humans for fishing, shipping, and recreation, and
- ☼ timing and design of dredge disposal.

Because of these features, the disposal of dredged material at HOODS is not expected to significantly affect the biological resources.

5.5.5.2 Threatened, Endangered, and Sensitive Species

Threatened, endangered, or sensitive species which occur in the general vicinity of HOODS include humpback, blue, finback, and sperm whales, Stellar sea lions, winter-run chinook salmon, peregrine falcon, marbled murrelet, brown pelican, and short-tailed albatross. Potential impacts such as impaired visibility for foraging and reduced food availability within the HOODS disposal area, which would alter normal feeding and passage activities, would be temporary and localized at the HOODS site. The listed whales and pinnipeds forage throughout the region off the California coast, so that any reduction in food supply in the disposal area would be insignificant. Many of the whales, such as the humpback and formerly-listed gray whale, and the Stellar sea-lion generally occur over the continental shelf area, so that few would be affected by disposal at HOODS. In addition, both whales and pinnipeds are highly mobile and capable of avoiding the dredge plume. Any impacts upon endangered or threatened whale or pinniped species are expected to be minimal and insignificant.

California brown pelicans roost on the South spit of Humboldt Bay, and during calm weather, may forage in clear upper slope waters. However, the majority of brown pelicans forage over shallower shelf waters. Similarly, winter-run chinook is found primarily over the continental shelf. Because both species primarily forage in shallower waters away from the HOODS, these species are not expected to be affected by the disposal activities.

The peregrine falcon is a very uncommon breeding resident and an uncommon migrant to California. Peregrine falcons feed on small birds (e.g., storm petrals and auklets), mammals, insects and fish. Peregrine falcons could potentially forage at HOODS; however, this species occurs throughout the offshore central California coast area and is not expected to be significantly affected by disposal operations. If variations in normal feeding patterns or passage activities associated with ship-following behavior patterns (as observed in other bird species) occur, these behavioral changes would be temporary, generally continuing only during disposal operations (SAIC 1994).

The endangered short-tailed albatross is rarely sighted in California (Stallcup 1990), but may occur over slope waters off the Humboldt coastline. However, since the occurrence of this species is rare, and the albatross has not been sighted in the vicinity of HOODS, no adverse effects on this species are expected to occur.

The endangered marbled murrelet can usually be observed offshore of an area that has trees of adequate size and minimal contiguous acreage. Usually, murrelets feed on fish and invertebrates in deeper water closer to the Bay entrance, and not as far offshore as HOODS. As described above for marine birds and mammals in general, marbled murrelets are highly mobile and would avoid HOODS during the disposal operations. Because the murrelet is generally found closer to the Bay entrance, this species is not expected to be affected by disposal operations .

Only sediment suitable for unconfined aquatic disposal will be disposed of at HOODS, so that ingestion of contaminated prey is highly unlikely. Most of the endangered or threatened whale and pinniped species feed on pelagic species such as fish, which are only temporarily exposed to dredged material. The disposal site is likely to be only a small part of the foraging range of the endangered species, so that only a small portion of the bird's or mammal's diets will be made up of organisms that have been exposed to dredged material. Since no significant contaminant levels were detected in the dredged material to be disposed of at HOODS, there is not expected to be negative impacts on any threatened, endangered, or sensitive species.

Impacts to threatened, endangered, or sensitive species caused by disposal activities are considered insignificant. Potential impacts are considered minimal, restricted primarily to the disposal site, and are temporary in nature. Therefore, no loss of foraging habitat, mortality, or reduced reproductive success is expected to occur for these species.

5.5.5.3 *Mitigation Measures - HOODS*

In order to reduce potential temporary impacts to the biological community at HOODS from dredged material disposal activities, the following mitigation measures are proposed for implementation:

- Ensure that dredged material disposal takes place in the proper quandrants and cells within HOODS to minimize any thick accumulation of dredged material which may impact benthic organisms by smothering and burial, and to confine disposal operations within disposal site boundaries. Thus, minimization of thick accumulations of sediment would potentially reduce biological impacts to benthic communities associated with HOODS.

  a. Accurate positioning shall be required to attain this goal. Global positioning (GPS) and LORAN-C receivers, used routinely in off-shore vessel positioning/navigation, will be used during disposal for this project, providing the repeatable accuracy needed for disposal operations.

  b. Disposal logs shall be maintained and spot inspections should be performed during disposal operations.

  c. Self-propelled hopper dredges should not be overloaded to minimize accidental spillage enroute to the HOODS, and should be accomplished under weather conditions that minimize accidental spillage.

- Ensure that the Corps' monitoring of HOODS is in accordance with EPA's long-term SMMP to-be-developed and included with the final site designation rule. The SMMP would include monitoring of both long and short-term (project-specific) impacts of dredged material disposal, and other provisions. The proposed project-specific monitoring program for HOODS would include disposal monitoring and surveillance and would include some of the following:

  a. Daily records of dredging operations. transportation sohedules, hopper-dredge load volumes transported and disposed, and exact location (i.e., quadrant and cell), and time of disposal.

  b. Inspection of dredging operations by a qualified inspector who will submit a report describing operations.

  c. If a violation occurs, it must be reported to the EPA within 24 hours, and all modifications required to bring disposal operations into compliance must be made prior to continuation of disposal activities at HOODS.

  d. Onboard inspection by EPA Region IX, the Corp's San Francisco District staff, or a certified inspector to ensure that transportation and disposal of dredged material occur within the designated discharge zone, and that compliance with all permit terms and conditions is met.

  e. Continued monitoring of dredged material transport following disposal at HOODS to assess whether the material remains within the disposal zone (non-dispersive) or is transported out of HOODS (dispersive) and deposited elsewhere.

5.5.6 Louisiana-Pacific Upland Site

At the Louisiana Pacific site, approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal (Sample HB-8: Figure 2.11.1-1) would be "back pumped" via an approximately 2000-foot pipeline. The pipeline would be connected to a self-propelled hopper dredge at an offloading platform anchored in the Samoa Channel Turning Basin. Mitigation to control noise generated from the off-loading platform would not be necessary since no booster pump will be required. Once dredged material is placed at the LP Site, a clean layer of fill material will be placed on dredged material to isolate the minute trace amounts of dioxin in the dredged material from the surrounding environs. Monitoring, testing, and reporting of effluent and receiving waters will be conducted by the local sponsor. In addition, a dioxin-monitoring plan may be implemented if deemed necessary by the North Coast RWQCB.

5.5.6.1 *Project Impacts*

Habitats

The approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal would be disposed of on the existing dredged material disposal site. No vegetation would be expected to grow on the site during the drying process. Disposal of dredged material would not cause significant impacts to the habitat at the LP Site since presently the dredged material disposal areas are continually disturbed dune habitat with graded, barren soil.

Dioxin in Sample HB-8

Sediment sample site HB-8 is located on the west side of the Samoa channel turning basin that is proposed to be widened. This sediment sample contains approximately 26,000 cys of dredged material proposed for disposal at the LP Site. A specific type of tetra-chlorodibenzodioxin (T4CDD) called 2,3,7,8 T4CDD was found in these sediments.

The 2,3,7,8 T4CDD was found in concentrations of 0.3 picograms per gram (pg/g) in sample HB-8 site's sediment; the detection limit is 0.2. According to the EPA (1993), low-risk sediment concentrations for T4CDD in general are as follows: fish - 60.0 pg/g; piscivorous mammals - 2.5 pg/g; and piscivorous birds - 6.0 pg/g. High-risk sediment concentrations are: fish - 100.0 pg/g; piscivorous mammals - 25.0 pg/g; and piscivorous birds - 210.0 pg/g. Completely piscivorous wildlife are at the greatest potential risk to dioxin exposure in aquatic ecosystems (EPA 1993). However, since 2,3,7,8 T4CDD is found at concentrations in the HB-8 sediments at approximately ten-fold below the level that presents low-risk to most sensitive species of wildlife, its risks to fish and wildlife are expected to be relatively low (USFWS 1994).

In addition, because of the following: (1) the contaminated dredged material will be disposed of on a contained upland dredged material disposal site; (2) it will disposed of in a relatively small quantity (26,000 cys); and (3) there are no known piscivorous mammal or bird species of special concern at the LP Site, disposal of this dredged material is not expected to cause any detrimental impacts to wildlife in the project area (USFWS 1994). Nevertheless, if deemed necessary by the RWQCB and other concerned agencies, a layer of clean fill material may be placed over the dredged material to isolate any trace amounts of dioxin from direct exposure to wildlife.

Invertebrates

No impacts to invertebrates are expected with the disposal of dredged material since the presence of invertebrates is highly unlikely under without project conditions.

Birds

A slight increase in bird activity would be expected, perhaps due to bird species such as gulls being attracted to the dredged materials to feed on benthic organisms and organic residues newly released on site.

Mammals

Mammals would be temporarily impacted through indirect impacts from disturbance, therefore, any mammal use would be temporarily diminished. Because of the disturbed nature of the site and relatively low habitat value it provides, this impact is considered not significant.

5.5.6.2 Threatened, Endangered, and Sensitive Species

No threatened, endangered, nor sensitive wildlife species are known to inhabit the existing dredged material disposal site called the Louisiana Pacific site. If an endangered bird species was attracted to the dredged material to feed on benthic organisms and organic residues, any impacts upon this species are expected to be very minimal and insignificant; considering the low level of trace amounts of dioxin contained in the dredged material.

5.5.6.3 *Mitigation Measures - Louisiana Pacific Site*

Significant impacts to any biological community which may be inhabiting the dredged material disposal site are expected to be minimal and insignificant, since the disposal site is highly degraded and has low habitat value. Nevertheless, in order to reduce any potential impact upon any unknown wildlife species attracted to the site before and after dredged material disposal, and the drying period, the following measures will be implemented:

- After completion of the disposal of dredged material unsuitable for unconfined aquatic disposal (approximately 3 to 4 days) at the LP site, place a layer of "clean fill" material to avoid direct long-term exposure to wildlife. The thickness of the cap should be such that exposure of the contaminated sediments due to runoff and erosion is prevented. Note: Significant impacts to wildlife species exposed to this low level of dioxin are expected to be minimal and insignificant since trace amounts of dioxin occur frequently in terrestrial sediments. Therefore, the need for a layer of "clean fill" will be determined through consultation with the North Coast RWQCB and other concerned agencies.

- Two endangered plant surveys and several site visits were conducted on the Louisiana-Pacific Site by Karen Theiss and Associates, Botanica Northwest Associates (Appendix H), and a Corps botanist (See Section 4.5.2.3). These two surveys and the 1994 site visits concluded that no rare or endangered salt marsh and/or shoreline plants were present or expected to be present at the LP Site, and thus would not be impacted by the proposed project. Before disposal of dredged material at LP, and during the blooming season of the endangered plant species, another plant survey will be conducted on the LP Site.

5.5.7 Habitat Evaluation Procedures (HEP) Analysis

The impact analysis (HEP) is a methodology developed and conducted by the U.S. Fish and Wildlife Service, and other resource and water development agencies for documenting the quality and quantity of available habitat for selected fish and wildlife species.

The fish and wildlife impact evaluations for the Humboldt Deepening Project were conducted using a combination of HEP (on areas where existing Habitat Suitability Index (HSI) models were applicable), and a "HEP-like" habitat-based assessment using word models initially developed for the Oakland Harbor Navigation Project, and modified for the Humboldt Harbor and Bay Deepening Navigation Project. This HEP analysis was mainly developed and conducted in-house by the Service due to time constraints on the project, and is detailed in their Fish and Wildlife Coordination Act Report (Appendix B). In addition, the Services' recommendations, along with the Corps responses, are located in the same appendix.

5.6 CULTURAL RESOURCES

5.6.1 Impact Significance Criteria

The implementing regulations of Section 106 of the National Historic Preservation Act (36 CFR Part 800) outline the requirements of Federal agencies in order to consider the project's effects to cultural resources listed or eligible for listing in the National Register of Historic Places. Impacts to such cultural resources are considered significant if the characteristics defining the National Register eligibility would be:

- Physically damaged or altered;
- Isolated from its historic context; or
- If project elements were introduced that are out of character with the significant property or its setting.

The American Indian Religious Freedom Act in effect requires Federal agencies to allow access to Federal lands and objects used in the practice of traditional Native American religious ceremonies. Title 36 CFR Part 900 addresses the consideration of Native American and other interested parties in the process of evaluating impacts on cultural resources. Any action that could directly or indirectly affect properties including archaeological sites, biological habitats, or topographic features associated with Native American religious practices would be considered significant under these statutes.

The California Environmental Quality Act (Appendix G) lists the "Significant Effects" criteria which are also applicable to the proposed project. A significant effect on cultural resources was defined if the project would:

- Disrupt or adversely affect a prehistoric or historic archaeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as a part of a scientific study; or
- Conflict with established recreational, educational, religious, or scientific uses of the area.

5.6.2 Humboldt Harbor and Bay Navigation Channels

5.6.2.1 *Project Impacts*

The currently available information from the marine archaeological survey of channel-widening areas indicates that the western end of the Bar and Entrance Channel contains a magnetic anomaly. This anomaly may represent (a) the remains of a shipwreck, (b) discarded

objects from a vessel such as an anchor, engine, boiler, and possibly cargo or (c) possibly debris or lost equipment from construction of the North Jetty. The initial objective of the survey was to determine the precise location of the magnetic feature relative to the proposed channel widening. The feature is situated within the area currently designated to be widened. However, the approximate depth of the feature is -54 feet, which is below the proposed design channel depth of -48 feet. Its likely that dredging of this location will not be necessary as sufficient depth is already in place. This existing depth suggests that scouring of sediments occurs in the westerly area of the Entrance Channel. If avoidance by dredging cannot be incorporated into the project design, the Corps, in consultation with the SHPO, will develop a plan of action to study the potential shipwreck remains. Additional study could include subsurface probing and sampling, supplemental magnetometer and side-scan sonar analyses, or a remotely operated video.

5.6.2.2 *Mitigation Measures*

Based upon the depth of the area in question dredging may not be necessary in the vicinity of the feature. Avoidance is therefore achieved and no impact would occur. Hence, no mitigation measures would be required.

5.6.3 Disposal Site Options

5.6.3.1 HOODS

Project Impacts

Due to the occurrence of potential shipwreck remains at three locations within the disposal site, placement of dredged sediments could cause adverse impacts to cultural resources. Restricting the placement of sediments in cells without evidence of potential shipwreck remains would avoid project impacts. (Note: Avoidance of these locations has been achieved during placement of dredged sediments from periodic maintenance dredging.) This avoidance alternative will be studied for the new sediments from the proposed deepening and widening. If avoidance cannot be achieved, additional investigations will be needed to determine the precise nature and extent of the resources, which will ultimately provide information to evaluate the National Register eligibility of the resources. A determination of National Register eligibility would require a detailed assessment of the effects of dredged-materials disposal. If adverse effects are determined for any one of the three features, a treatment plan would be developed and implemented in consultation with the SHPO. Conversely, if a determination of non-eligibility for the National Register is found, the Corps is not required to take further steps to comply with Section 106 of the National Historic Preservation Act.

Mitigation Measures

There is no need at this time to develop mitigation measures (i.e., a treatment plan). A plan would be required if it is concluded that dredged materials would be placed at one or more of the three locations of concern. If placement of dredged materials at the locations is ultimately recommended, the Corps will take the necessary actions as outlined above.

5.6.3.2 Louisiana-Pacific Site (LP)

Project Impacts

It has been determined that no cultural resources or historic properties are recorded at or adjacent to the Louisiana-Pacific Site. The likelihood of unrecorded archaeological or historical resources being present at the site is very low. Thus, the possibility that use of the disposal site would cause impacts to significant cultural resources is remote.

Mitigation Measures

Because recorded cultural resources are not present at the L-P Site, development of mitigation measures (i.e., a treatment plan) is not appropriate at this time. Of course, there is always the possibility (considered remote) that upland disposal of dredged sediments may encounter previously unknown cultural resources. Therefore, the following precautionary measures are relevant to the proposed work:

If unrecorded cultural resources are encountered during any dredged-material placement activity at the L-P Site, all construction shall be temporarily stopped at the discovery location and a qualified cultural resources specialist retained to evaluate the find. This evaluation would follow Federal standards and guidelines. More project-specific procedures will be included in the construction plans and specifications.

5.7 TRANSPORTATION

5.7.1 Impact Significance Criteria

The threshold of significance used for land transportation impacts is generally the level of additional traffic that would be perceptible by the motoring public. While there is no absolute standard for this level, a change (increase) in the ratio of traffic volume to highway capacity (V/C) greater than 3 percent (0.03) was used to define a significant impact. The 0.03 threshold probably represents the change in traffic that is noticeable to most of the driving population. For example, if a signalized 4-lane street has a capacity of 1,600 vehicles per hour in each direction, an impact of 48 or more vehicles in one direction would be considered "significant" (1,600 X 0.03). Each truck would be considered equivalent to two passenger cars for the purpose of this analysis, so in the above example, 24 or more trucks would be considered "significant" (SAIC 1994).

Waterborne transportation impacts would be considered significant if they would cause a substantial increase in: (1) unsafe vessel operations incidents; (2) the risk of toxic or polluting material entering the water; or (3) unreasonable delays to commercial vessels plying their trade. All of these potential significant impacts are a function of the combined effects of increases in waterborne traffic and other navigation hazards. Some navigation hazards are caused by natural phenomenon such as shoals and islands, fog, inclement weather, and tides and currents. Other man-made hazards include bridge abutments, jettys, piles, and moored vessels.

5.7.2 Regional

No significant regional transportation and circulation impacts are expected. The only potential regional transportation impacts would be to marine transportation because the majority (if not all) of the associated transportation is on water (self-propelled hopper dredges and hydraulic-pipeline dredges). The only potential land transportation impact might be with very localized impacts associated with upland disposal on the LP site, as discussed below.

The Coast Guard in Humboldt Bay does not maintain a Vessel Traffic Service (VTS) Center in Humboldt Bay. Commercial deep-draft vessels and Navy vessels entering the Bay contact a local Coast Guard Station located on the north spit of Humboldt Bay, and a Marine Safety Office in Alameda, California to coordinate their movements. Small and private vessels are not required to coordinate their movements by contacting the Coast Guard. No Coast Guard records were available to indicate the increase in ship traffic density from year to year.

Hazards to navigation for any coastal area include: (1) shoals and islands; (2) bridges and other structures; (3) fog and inclement weather; (4) vessel traffic; and (5) tides and currents. Shoaling generally occurs in the Entrance Channel and in other navigation channels in Humboldt

Bay and is a potential navigation hazard for any vessels entering Humboldt Bay. The Entrance channel contains a shoal near the old SF-3 disposal site, which causes sneaker waves that cause severe navigation problems and have resulted in several boating incidents with local commercial fisherman. Major navigation problems for deep-draft vessels occur at the Entrance channel between the two jetties (i.e., turning from the Bar channel into the Entrance channel), and negotiating the middle ground areas (i.e, turning from the Entrance channel into the North Bay channels and vice versa).

Meteorological conditions which make navigation in the Humboldt Bay difficult are primarily fog during the warmer part of the year and storms in the winter. Fog occurs much of the time during the summer months, forming in late afternoon and burning off by the late morning the following day. Some types of commercial vessels have been restricted from entering Humboldt Bay during periods of intense fog. Fog by itself does not pose a serious problem if ship navigation radar is in good condition, but coupled with other vessel traffic; the strong currents and waves in the Bay; the inadequate, unsafe navigation channels for deep-draft vessels; and the possibility of other ships straying from their traffic lane, navigation can become extremely dangerous. In the past, serious collisions have occurred due to a combination of many circumstances, including bad weather.

Because of its unpredictability, traffic from other vessels can pose perhaps one of the greatest hazards to navigation. Large commercial and naval vessels are required by Coast Guard regulations to travel in their designated traffic lanes when moving within inland waterways. Smaller commercial vessels, such as tug boats, fishing boats, and private vessels often do not navigate within specific traffic lanes, but rather travel in the most expeditious route possible. These vessels can pose serious hazards to navigation, particularly if other circumstances such as fog are present.

Tidal action causes extremely strong currents throughout the Humboldt Bay area during periods of maximum ebb and maximum flood tides. Currents above 2 knots are considered to be strong and potentially hazardous if not properly corrected for during slow speed maneuvering in Humboldt Bay navigation channels. In the North Bay channel, the velocity of tidal currents is less than 2 knots, and does not exceed 3 knots. Between the north and south jetties, the velocity is about 2 knots, with a maximum of 4 knots. Strong currents along with strong winds make maneuvering large vessels at slow speed hazardous without the aid of tug assistance.

The Coast Guard, Port Safety Officer, collects detailed reports of vessel incidents occurring in the Bay. The categories of incidents include the following: collisions; near-misses, vessel groundings; noncompliance (not listening to instructions); non-participation (turning the vessel radio off); hindering navigation (e.g., a sail boat passing in front of a commercial vessel); and loose barges (the tow line snaps and the barge is set adrift). With approximately 2,233 and 14 self-propelled hopper dredge trips to and from the HOODS site and LP site envisioned, respectively, it is very unlikely that any incidents will occur that are serious enough to be

considered significant.

Although a low probability, the most likely incident would be a dredge having a collision with a smaller private vessel. This outcome is considered extremely unlikely since annual spring and fall maintenance dredging occurs in Humboldt Bay navigation channels, and no record of such an incident has been found. Therefore, no significant impacts on vessel safety are considered likely as a result of the proposed dredging and disposal operation.

The LP site would require dredged sediments to be "back pumped" from a temporary pipeline connected to a temporarily hydraulically-equipped self-propelled hooper dredge. The temporary transfer pipeline and associated connection platform could be a hazard to navigation if not properly marked and lighted.

5.7.3 Humboldt Harbor and Bay Navigation Channels

Project Impacts

Marine Transportation

Minor, temporary impacts on navigation may occur during the approximately ten to eleven months scheduled to conduct the proposed project. Deep-draft vessels may experience temporary maneuvering conflict with the dredges, especially in narrow channels. Commercial fishing boats conduct business mostly year round and there could be some temporary impediment of vessel traffic due to construction activities. With the commercial deep-draft vessels reporting to the local Coast Guard or Marine Safety Office, the infrequent simultaneous approach of two vessels can be avoided. Therefore, the potential impact of delay and economic cost to existing commercial vessels is not expected to be significant. The actual dredging operation is a potential hazard as it restricts portions of the channel. However, these operations can and have been routinely conducted without incident in the spring and fall maintenance dredging of the Humboldt Bay navigation channels, and would not create a significant impact.

The proposed deepening and selective widening of Humboldt Bay Harbor navigation channels project is designed to eliminate the navigation problems associated with exisiting deep-draft vessels calling on the Harbor, and not to increase the vessel traffic beyond what is presently calling on Humboldt Harbor.

Land Transportation

No significant land transportation impacts are expected to occur with the proposed dredging operations in the Humboldt Harbor navigation channels. Truck traffic is not associated with the proposed project.

5.7.4 HOODS

Marine Transportation

No significant transportation impacts are expected to occur if this disposal site is used. The HOODS has been used for several years, so dredge disposal activities are known and expected.

Land Transportation

No land-associated transportation is proposed for the use of this ocean disposal site.

5.7.5 LP Site

Marine Transportation

No significant marine transportation impacts are expected due to the use of the Louisiana Pacific upland site. Trucking dredged material to LP would increase the risk of accidents and congestion, Therefore, the approximately 26,000 cys of dredged material will be pumped with a temporarily hydraulically-equipped self-propelled hopper dredge, and a 2000 foot temporary pipeline from the Samoa Turning Basin to the LP site. The usage of the self-propelled hopper dredge with a temporary pipeline and associated connection platform will require special coordination with the local Coast Guard for required navigation warning lights and published warnings in the Local Notice to Mariners. The pipeline may be able to be submerged to allow the passage of small boat traffic and will be located to avoid interference with boat traffic.

Land Transportation

No significant roadway impacts are anticipated with the use of the LP Site. As discussed in the "Marine Transportation" section above, a temporarily hydraulically-equipped self-propelled hopper dredge will be used to dredge the Samoa Turning Basin. The exact placement of the 2000 foot temporary pipeline is not known at this time, but it is not anticipated to cause significant roadway impacts because there is an existing underground pipe under the roadway. The pipeline will be properly marked to minimize any conflicts or hazards its temporary placement may cause. In addition, it is not known at this time if the approximately 26,000 cys of dredged material would be moved offsite by LP after drying has occurred. Moving dried material would cause no significant impacts to roadways in the project area.

Mitigation Measures

Although no significant impacts on marine transportation are expected, the U.S. Coast Guard has recommended the following measures be observed during dredging operations:

- All dredging vessels associated with the deepening project and operating in or near a navigation channel should contact the local Coast Guard station.

- In the event project dredging vessels are likely to restrict or affect navigation of other vessels, dredge operators should transmit and confirm their intentions and any other necessary information (including temporary pipeline placement to LP Site) to the local Coast Guard to promote safe navigation of all vessels in the project vicinity.

- The local Coast Guard Station or Marine Safety Office should be contacted each time: (1) when the dredge vessel commences dredging operations; (2) a dredge vessel moves between the dredging location and the HOODS site; and (3) when the dredge operators change dredge locations. Upon notification, the Coast Guard can advise affected shipping traffic.

- Once the dredge vessel is positioned, the local Coast Guard should be informed of the extent of any channel obstruction that may occur from dredging operations. Because the number of dredging vessels and equipment associated with the proposed project are not anticipated to block the navigation channels, other shipping traffic is not expected to be blocked from normal vessel movements. In any event, the Coast Guard should be informed of positions of dredging equipment at all times.

5.8 SOCIOECONOMIC ENVIRONMENT

5.8.1 Impact Significance Criteria

This brief analysis considers the socioeconomic impacts of the project. Socioecomonic impacts in themselves, however are not considered effects on the environment, and thus no significance criteria are established.

5.8.2 Regional

The purpose of the Humboldt Harbor and Bay Navigation Deepening project is to eliminate navigation and safety problems associated with maneuvering the present-day deep-draft vessels in inadequate and unsafe navigation channels. It is not expected to be growth-inducing, and thus, a considerable change in the operations and economic climate of Humboldt Harbor is not expected.

5.8.3 Humboldt Harbor and Bay

The proposed project is expected to allow for more efficient use of deep-draft vessels presently calling on the Harbor, and eliminate the following practices presently used by deep-draft to accommodate the Harbor's depth restraint: tidal delays, light-loading, rerouting, change in operational mode, and economies of scale (e.g., large vessels are unable to load to maximum capacity and thus more trips are needed). The project will help stimulate the local economy slightly by allowing more efficient use of the deep-draft vessels calling on the Harbor, thus eliminating excessive expenses presently accrued by commercial deep-draft vessels utilizing the inadequate navigation channels. With improvements in deep-draft navigation channels, a reduction in trips by light-loaded deep-draft vessels are expected since they will be allowed operate fully loaded. Nevertheless, shipping activity and cargo levels are expected to remain fairly constant with those levels reported in Section 4.7.

Since the proposed project is not growth-inducing, there is not expected to be significant increases in the following: shipping activity; annual business revenue to the Harbor; or the generation of new jobs, and increases in personal income from direct and induced jobs as a result of deep-draft navigation improvements. Temporary project-related jobs may provide employment to residents during the construction period of the project.

Project Impacts

In general, any physical impacts related to commercial and recreational fishing would be short term, localized, and insignificant. Commercial and recreational fishing boats and deep-draft vessels would have to maneuver around dredging equipment, but this impact is temporary and localized and is not expected to result in any significant socioeconomic impacts.

5.8.4 HOODS

Project Impacts

Use of this site for the disposal of dredged materials is not anticipated to have impacts related to commercial or recreational fishing, as explained previously in Section 4.8.4. Impacts to the fish community at HOODS are expected to be short term and insignificant. The dredge disposal plume would dissipate rapidly, so that turbidity and physical obstructions caused by the turbidity would be temporary. Any fish migrating through the HOODS would be able to avoid the disposal plume. Such avoidance would not impact the fish catch success associated with any sport fish in the area, since fish may disperse in response to dredged material disposal events, but usually return within an hour or so (SAIC 1994). Because dredged material disposal at HOODS would be relatively infrequent, disposal of dredged material at HOODS is not expected to significantly impact commercial or recreational fishing activities since the siting of HOODS is located both outside the nearshore and deep-sea fishing areas. Therefore, socioeconomic impacts are expected to be negligible. In addition, no significant impacts to commercial shipping would result from the use of HOODS.

5.8.5 Louisiana Pacific Site

Project Impacts

No adverse socioeconomic impacts would result from the use of this historical dredged material disposal site. Use of this disposal site may generate revenue for the landowner, the Louisiana Pacific Corporation. The project sponsor would be responsible for obtaining any necessary permits for upland disposal, which should be obtained after the completion of the EIS/EIR process.

6.0 RECOMMENDATIONS

6.1 THE ENVIRONMENTALLY PREFERRED ALTERNATIVE (CEQA)

The identification of the environmentally preferred alternative in this section and the following section builds upon the discussion and analysis presented in Chapter 2 and in particular the Feasibility Report. The environmentally preferred alternative is Alternative Plan 3. The reasoning for this determination is explained below.

The environmentally preferred alternative is the structural alternative that has the fewest impact mechanisms that would generate a change in existing environmental conditions. For a dredging project, the environmentally preferred alternative is usually the project that involves the least amount of dredging. Of course, there is the possibility of a project restoring or enhancing existing environmental conditions through the use of project-by-products to restore or enhance lost or diminished resources. This should not be confused with mitigation which is the planned minimization of adverse impacts. However, projects with restoration features built-in can only take advantage of the opportunity to return resources that have been lost, and are not viewed as creating something new. Therefore, while projects with restoration features are considered more desirable from an environmental viewpoint, they are not always available in project development. For example in dredging projects, disposal of dredged material can sometimes serve as a beneficial use by using material as fill in an effort to achieve a desired substrate elevation conducive to the development of a wetland habitat type or a dry land feature of human benefit. However, when a dredging project is short of an opportunity to "reuse" its dredged material, the environmentally preferred dredging project is generally the "least dredging alternative". The "least dredging alternative" would result in the least amount of bottom area disturbance at the dredge site, and water column and bottom impacts at the disposal site.

The alternatives section of this EIS/EIR (Section 2.2) originally considered nine action alternative plans. Of these nine alternative plans, all of the "larger" projects were screened out of further consideration based upon cost effectiveness. This screening process and local sponsor preferences resulted in Alternative Plan 3, the "smallest" project being proposed for construction. Since Alternative Plan 3 would involve the least amount of dredging and disposal, it is viewed as the environmentally preferred alternative for the Humboldt Harbor and Bay Deepening Navigation Project. Alternative Plan 3 would place an estimated 5.6 million cys of suitable dredged material (sand) at a soon-to-be-designated ocean disposal site (HOODS), and an estimated 26,000 cys of finer-grained dredged material unsuitable for unconfined aquatic disposal at an approved confined upland disposal site (Louisiana Pacific). Use of both disposal sites is considered environmentally acceptable, and within the general and specific criteria governing dredged material disposal. Presently, there is no known restoration opportunity available in the

project area. Generally, sandy material is considered undesirable for wetland creation and there has not been an identified need for dredged material as construction material in the project area. In addition, there is some concern that the ocean disposal of dredged material would decrease the sand supply of the nearshore littoral cell. The sedimentation studies and the Humboldt Bay Shoreline Monitoring Program (see Section 4.4) conducted to date, have indicated that Humboldt Bay is not the major sand source for the littoral cell, and the beaches to the north and south of the Humboldt Harbor Entrance Channel are relatively stable. One other environmental concern voiced during the preparation of the EIS/EIR was the potential impact of the proposed project on eelgrass beds in the Bay. Eelgrass was found within the project area, on the northwest edge of the Samoa Channel Turning Basin. The proposed turning basin design considered the location of these eelgrass beds and now the project design avoids impacting the eelgrass beds altogether.

In conclusion, Alternative Plan 3 is the minimum structural project of the nine alternative plans considered in the EIS/EIR. None of the nine alternative plans considered, including Alternative Plan 3, would avoid significant impacts, since the air quality impacts associated with the dredging and disposal of dredged material cannot be mitigated to insignificance by feasible measures. Nevertheless, considering that the project has been designed to minimize impacts on known resources, and no known restoration opportunities are available, Alternative Plan 3 is the environmentally preferred alternative.

6.2 THE ENVIRONMENTALLY PREFERABLE, FEASIBLE ALTERNATIVE (NEPA)

For the Humboldt Harbor and Bay Deepening Navigation Project, the environmentally preferable, feasible alternative is the same as the environmentally preferred alternative which is Alternative Plan 3 discussed in Section 6.1 above.

6.2.1 Selection of the Least-Cost Plan that Can Be Implemented

The Least-Cost Plan that can be implemented is the same Alternative Plan 3 discussed in Section 6.1 and 6.2 above.

6.3 THE SELECTED PLAN

All nine alternative plans considered in this EIS/EIR produce national and regional navigation benefits with relatively few differences in the nature of the environmental impact. All alternatives involve dredging and disposal of various quantities of the same type of dredged materials (primarily clean sand with disposal at the same disposal sites). The differences between each alternative plan address the Humboldt Bay user's needs and preferences such as increased maneuvering safety (widths); costs (depths); and user equality (i.e., Samoa Turning Basin location and the elimination of any South Bay Channel dredging). These differences effect a change in the magnitude of the impacts, but not necessarily the moment of the impact since the resource

base within the project area is essentially homogeneous. Although the volume of dredging and disposal of dredged material varies with each alternative plan originally considered, all alternative plans were considered feasible until costs were analyzed. Cost analysis and associated cost/benefit ratios of each alternative plan showed the major differences between the alternative plans in the final array. Alternative Plan 3, the "least dredging quantity project", was found to be the most cost effective project supported by the local sponsor, and since it involves the least amount of dredging it is considered the least environmentally impacting project. Therefore, Alternative Plan 3 is the selected plan for the Humboldt Harbor and Bay Deepening Navigation Project.

7.0 UNAVOIDABLE SIGNIFICANT IMPACTS

Dredging operations at Humboldt Harbor would result in unavoidable significant adverse air quality impacts, since NO_x and PM_{10} emissions would not be feasibly mitigated to below the NCUAQMD Best Available Control Technology (BACT) emission significance thresholds during the project duration. The main source of emissions would be the diesel-powered self-propelled hopper dredge and one bulldozer used for approximately 3 to 4 days at the upland disposal site. However, these emissions would be temporary and cease at the end of the 10 to 11 month construction period.

The preferred alternative plan is Alternative Plan 3, which involves disposal of approximately 5.6 million cys of dredged material at HOODS, and approximtately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal at the approved Louisiana Pacific site. The only unavoidable significant impact with this alternative would be on air quality. Disposal activities from this alternative plan would exceed NCUAQMD emission significance thresholds for both NO_x and PM_{10} pollutants. Feasible mitigation measures would reduce project emissions, but not to insignificance (see Sections 5.1. and 5.1.2.3). However, these emissions would be temporary and cease at the end of disposal activities.

8.0 GROWTH-INDUCING IMPACTS

The primary purpose of the proposed Humboldt Bay Harbor Deepening Navigation Project is to improve navigation safety in the Bay and channels for the existing deep-draft vessels entering, leaving, and utilizing the navigation channels associated with the project area. Over the past two decades trade vessels in the worldwide fleet have grown larger as older vessels are phased out by "lower cost per unit" vessels. These larger vessels can not enter or depart from Humboldt harbor fully loaded. Instead the forest product shippers operating in Humboldt Bay must practice multi-port loading and discharge, which results in inefficiencies such as tidal delays, light-loading, rerouting, and multi-mode transportation links. In short, the trade fleet calling at Humboldt Harbor has "out grown" the existing channels so that while more efficient vessels are available to Humboldt shippers they can not be utilized in the existing Humboldt Harbor channels. The proposed channel improvements address the navigation channel inefficiencies associated with the existing fleet of vessels calling on the Harbor, and not greater cargo volume movement which is linked to growth.

Grobey (1994) reports that the successful growth and development of the Port (Humboldt Harbor) is dependent on the creation of a "transhipment port". The variables involved in this type of port are marketing, land-based transportation, and harbor facilities. However, in Grobey's opinion, harbor-based economic activity cannot progress until land-based transportation systems (roads and railroads) are improved. A sub-variable of harbor economic activity is the health of the forest product market. The Economic Appendix of the Humboldt Harbor and Bay Feasibility Study reports that in general, forest product volumes such as lumber, wood chips, pulp, etc. are depressed at this time in the North Coast region, but could recover and increase slightly by the year 2000. All of these variables indicate that navigation improvements are not directly-linked to growth in Humboldt County but rather there are only a small part of the economics of the Humboldt /North Coast region. This finding is also reflected in the economic analyses of the proposed improvements where the project is justified on the basis of existing deep-draft waterborne commerce flows and not forecasted flows of commerce.

Therefore, the proposed Humboldt Harbor and bay Deepening Navigation Project is not expected to result in any reasonably forseeable population, housing growth increases, or growths in waterborne commerce/maritime trade in the project area due to implementation of Alternative Plan 3.

Should the improvements provided by the proposed project result in an unexpected growth in maritime trade that necessitates expansion or construction of improvements beyond the currently proposed project, additional environmental review would be required.

9.0 CUMULATIVE IMPACTS

9.1 LOCAL CONSIDERATIONS

9.1.1 Humboldt Harbor

Potential cumulative impacts of the proposed Humboldt Harbor and Bay Deepening Navigation Project involve only local considerations. Within the local context, the proposed project would be conducted in concert with the annual spring and fall maintenance dredging and disposal activities required to provide adequate and safe navigation channels for the existing deep-draft vessels calling on the Harbor. Additionally, the local context would include any other known projects planned by other entities in the Humboldt Harbor project area.

With the implementation of Alternative Plan 3, sedimentation studies have shown a decrease in shoaling and thus, a decrease in the annual maintenance dredging from the existing dredging of an estimated 686,000 cys of dredged material to an estimated 618,000 cys of dredged material (a decrease of 68,000 cys).

The only unavoidable significant impact with this alternative would be on air quality. Disposal activities from this alternative plan would exceed NCUAQMD emission significance thresholds for both NO_x and PM_{10} pollutants. Feasible mitigation measures would reduce project emissions, but not to insignificance (see Sections 5.1. and 5.1.2.3). However, these emissions would be temporary and cease at the end of disposal activities. No potential cumulative noise quality impacts have been identified for the proposed project.

Water quality impacts associated with future maintenance dredging of the Humboldt Harbor will be localized and short-term, dissipating rapidly once dredging is completed. Maintenance dredging will affect water quality by temporarily increasing the suspended sediment load and decreasing dissolved oxygen levels; however, the magnitude of short-term impacts associated with maintenance dredging will be less than those expected to occur at the dredging site for the proposed project. Impacts are not expected to be additive due to the temporary nature of the adverse but insignificant impacts. Total suspended solids concentrations will be low in the vicinity of the dredging operation, and dilution at the dredging site will occur quickly. As such, dissolved oxygen concentrations will rebound, and consequently, significant impacts to the water column are not expected.

Future annual maintenance dredging projects will remove those sediments that have accumulated in the navigation channels associated with the proposed project. Potential impacts to sediment quality are the same as those described in section 5.4.2 for the proposed dredging

site. Impacts are not expected to be additive because maintenance dredging would either maintain present sediment quality conditions at the dredging site or improves sediment quality if recently deposited sediments have any potential contaminants, therefore, adverse impacts to sediment quality at the dredging site are not expected.

Impacts to the biological community associated with future annual maintenance dredging projects within Humboldt Harbor are expected to be localized and short-term. Impacts would be of a similar nature to those described for the proposed project, although are expected to be of a lesser magnitude. Although the benthic organisms will be removed in areas where dredging occurs, the community present is unstable and consists of species tolerant of disturbance. Therefore, recovery of the current benthic community following completion of dredging activities is expected to be complete. Because suspension of sediments during dredging is expected to be short-term, physical and toxic effects of increased suspended particulates on plankton, benthic invertebrates, and fish are not expected to be significant, provided dredging is avoided in areas where spawning is occurring. The dredging activities may temporarily affect the use of the area as a foraging site for fish, marine mammals, and birds, which would likely avoid the area and forage in other areas. Toxicity effects associated with the trace amounts of dioxin associated with the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal are expected to be insignificant since this material will not be disposed in-water; rather it will be disposed of on the proposed LP upland site (sections 5.4.2, section 5.5.1 and 5.5.2).

No cultural resources are expected to be affected with the proposed project or any future maintenance dredging of the Humboldt Harbor and Bay Deepening navigation channels. Due to the occurrence of potential shipwreck remains at three locations within the HOODS (Section 4.6.3.1), avoidance of these locations has been achieved during placement of dredged material from annual maintenance dredging. Although no shipwrecks are recorded as situated within HOODS, placement of dredged material from the proposed project will be avoided in these locations. Therefore, the proposed project would not contribute to any cumulative impacts on cultural resources.

The proposed project would result in negligible impacts on recreational or commercial fishing, and thus cumulative impacts to marine transportation are not expected to occur (section 5.7). Since no ground transportation is expected for dredged material moved from the Samoa Turning Basin to the LP Site, ground transportation would not be impacted. The proposed project is not expected to be growth-inducing, and is expected to result in no more cumulative impacts than the continuance of maintenance dredging and disposal activities.

In addition to the Humboldt Harbor and Bay Deepening Navigation project, the following project is being proposed within the Humboldt Bay boundaries:

- *Louisiana-Pacific Corporation Samoa Terminal Dock Reconstruction.* The purpose of this proposed project by the Louisiana-Pacific Corporation is to provide a safer, more effective facility for the existing Samoa Terminal Dock (Redwood Dock). This dock is used by marine vessels for the continued export of wood products from the Samoa Mill site. The project includes the following: construction of bulkhead (sheet pile wall) around existing 75-year old dock; demolition of existing 6-acre dock; dredging of approximately 110,000 cys of subtidal sediments; placement of suitable dredged material as fill behind the bulkhead and disposal of any "unsuitable for unconfined aquatic disposal" dredged material at the "LP Disposal Site (upland)"; construction of concrete dock extensions extending north and south of bulkhead; berth deepening; and creation of a 6 acre intertidal mitigation area with: 0.68 acres of eelgrass bed restoration, 0.28 acres of salt marsh restoration and creation of 0.9 acres of woody vegetation for removal of like habitat during mitigation site excavation, and the loss of approximately 6 acres of intertidal mudflat and 0.72 acres of shallow subtidal habitat filled for the dock; and loss of approximately 0.34 acres of eelgrass beds shaded by the pier extension and gangway. The EIR for this project was completed in October 1994. Project construction was to begin in late 1995, pending permit approvals.

The above project is not expected to result in significant cumulative impacts in conjunction with the Humboldt Harbor and Bay Deepening Navigation Project.

10.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Implementation of the proposed dredging would result in both short- and long-term impacts. Dredging would temporarily increase air pollution emissions and noise in the immediate vicinity of the deepening and widening; air quality impacts would be significant and would last for up to two years. The transport of the dredged material and disposal of the material at the approved disposal site(s) would increase maritime traffic for the duration of the dredging period. Depending on the selected disposal site, there would be approximately 2,800 self-propelled hopper dredge trips in transit to HOODS, and approximately 14 trips to the LP upland disposal site during this period (assuming the self-propelled hopper dredge could hold 2,000 cys of sediment and has a 3,800 capacity load). The dredge would be anchored in Humboldt Harbor for the duration of the dredging. The project duration is expected to be approximately 11 to 12 months. Approximately 9 dredge loads per day would be in transit to HOODS. This level of additional traffic would have only minimal impacts on ship passage into and out of Humboldt Bay (depending on dredging location), and any impacts would be short term.

Aquatic or upland disposal of the dredged materials would also result in short- and long-term environmental impacts. Disposal at an aquatic site would temporarily increase turbidity and dissolved constituents, scare away nektonic marine organisms, and to some degree modify the bottom topography. Upland placement of those sediments unsuitable for unconfined aquatic disposal would limit the holding capacity of the upland disposal site, and eliminate the potential for use of these sediments for such beneficial uses as fill or cover material. Creation of wetland habitat or other beneficial uses of dredged sediments would be considered a beneficial project impact, but is not under consideration with the approximately 26,000 cys of dredged material planned for upland disposal due to a minute trace of dioxin in the sediments. Upland disposal is not expected to result in a release of the trace amounts of dioxin contained within the dredged sediments to groundwater and surface water resources, but precautions will be taken to prevent any contamination. Upland disposal may be accompanied by short-term monitoring of water resources beneath and adjacent to the placement site, allowing for early detection of resource contamination. Contingency measures would be triggered at specific concentration levels should significant contamination of surface or groundwater resources occur. Contingency measures and the specific concentration levels triggering those mechanisms would be established by the facility's operating permits.

The tradeoff for the potential environmental impacts that are not offset by environmental gains is the socioeconomic gain of maintaining Humboldt Harbor as a safe and navigable port on the West Coast. Past and future maintenance and new dredging projects in the Humboldt Bay area are predicated on the current needs for safe navigation of the present deep-draft vessels calling at the Bay, and for maintenance of the economic and social advantages of present-day

waterborne commerce. The improvement and maintenance of dredging practices of the past have resulted in limited, largely short-term environmental consequences. The long-term implications of the proposed project are significant in terms of maintaining the present-day economic viability. The long-term environmental consequences of the project are considered minimal on a regional level.

11.0 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES THAT WOULD OCCUR IF THE PROPOSED ACTION IS IMPLEMENTED

Resources which are committed irreversibly or irretrievably are those which will be used by a project on a long-term or permanent basis. The proposed project would involve two types of resources. (1) general industrial resources including capital, labor, fuels, and construction materials; and (2) project-specific resources such as biotic resources, water resources, and land uses at the disposal site(s). The industrial resources would not be retrievable if the project is constructed.

Irreversible environmental changes would occur at the proposed deepening and widening areas of the Humboldt Bay navigation channels and the approved disposal site(s). Benthic organisms living in the sediment dredged in Humboldt Harbor would be destroyed by dredging activities. Although evidence indicates that benthic recolonization does take place at sites that are dredged regularly, constant disturbance tends to result in colonization by more opportunistic species, thus changing the nature of the distribution and diversity of species. Since the project area already is dredged annually, for both spring and fall maintenance dredging episodes, respectively, the bottom materials are already occupied by hardy species.

Similar disturbance of benthic communities would occur at the aquatic disposal site, HOODS. Continued disposal of dredged materials at the HOODS aquatic site would modify or preclude recolonization of the site to its previously undisturbed state. However, since the HOODS site is currently being used for dredged material disposal, so benthic community changes are already occurring there.

Any placement of sediments unsuitable for unconfined aquatic disposal at an upland site such as the LP site, would temporarily eliminate the holding capacity for future disposal of dredged material. The LP site is already in use as a dredged material disposal site by LP. The use of this site for the Humboldt Harbor and Bay Deepening Navigation Project would temporarily decrease the holding capacity of the site until further excavation to increase its size had occurred, and/or dredged material placed previously is moved elsewhere. The approximately 26,000 cys of dredged material to be placed at the LP site is expected to remain there permanently.

12.0 PUBLIC INVOLVEMENT AND INTERAGENCY COORDINATION

12.1 PUBLIC INVOLVEMENT

Public comment on the proposed project was solicited pursuant to Federal and State requirements. An earlier Notice of Intent (NOI) to prepare an EIS was published in the Federal Register on August 28, 1990, and two public workshops and EIS scoping meetings were held on September 12, 1990 to solicit agency and public comment on the proposed project. A new Supplemental NOI (SNOI) and Notice of Preparation (NOP) to acknowledge the need to do an EIR, which addresses CEQA, and an EIS, which addresses NEPA requirements, respectively, was published in the Federal Register on December 17, 1993 (COE 1993b). The SNOI and NOP consider using the Humboldt Open Ocean Disposal Site (HOODS) for dredged material disposal and in addition, the potential use of two upland disposal sites located on the North Spit of Humboldt Bay.

Together, the NOI, NOP, and SNOI address all components and alternatives in the current project description and considered in this EIS/EIR. Briefly, a summary of the public concerns identified in the NOI, NOP, and SNOI processes include the following.

Dredging Activity:

- Determination of type of dredged materials and any toxics associated with this material
- Types of dredging equipment (e.g., self-propelled hopper dredge, clamshell, or hydraulic dredge)
- Impacts to rare, threatened, or endangered species
- Discuss any impacts to eelgrass beds in Humboldt Bay

Aquatic and Upland Dredged Material Disposal:

- Analysis of any and all dredged material disposal sites being considered for proposed project
- Provide a complete proposal to fully compensate for any losses, together with monitoring and contigency provisions, if necessary (e.g., habitat replacement, restoration, or improvement)
- Impacts to rare, threatened, or endangered species

Aquatic Dredged Material Disposal:

- Impacts of ocean disposal
- Impacts of aquatic disposal on shoreline morphology (e.g., erosion/accretion trends)

Upland Dredged Material Disposal:

- Impacts of upland disposal on wildlife habitat (e.g., wetland habitat)
- Water quality impacts (e.g., impacts to surface waters from dewatering and groundwater from percolation)

A 45-day public review/comment period on the Draft EIS/EIR began on December 16, 1994, the day the document was filed with the EPA. A public meeting was held on January 11, 1995 to solicit public comments. The comment period ended on January 30, 1995. Approximately 210 Notices of Availability of the Draft EIS/EIR and 210 copies of the draft document were mailed to Federal, State, and local agencies, as well as other organizations, businesses, and individuals.

Appendix I both summarizes and provides detailed information on the Draft EIS/EIR comment activity. Appendix J responds to the comments on the Draft EIS/EIR.

Approximately 210 Notices of Availability of the Final EIS/EIR and 210 copies of final document are expected to be mailed to Federal, State, and local agencies, other organizations, businesses, and individuals.

12.2 INTERAGENCY COORDINATION

The Corps and Humboldt Bay Harbor, Recreation, and Conservation District have made effort to coordinate the development of this project with other agencies, including the Environmental Protection Agency, U.S. Fish and Wildlife Service (USFWS), National marine Fisheries service (NMFS), the State Resources Agency, The California Department of Fish and Game (CDFG), the North Coast Regional Water Quality Control Board (NCRWQCB), the California Coastal Commission (CCC), the State Lands Commission, the North Coast Unified Air Quality Management District (NCUAQMD), and other agencies. These coordination efforts have involved discussions, meetings, and correspondence on primarily the following issues: air quality, biological resources, hydrology, sediment testing, water quality, biological resources, and cultural resources.

Development of the air quality information in this document has been coordinated with staff of the North Coast Unified Air Quality Management District (NCUAQMD). Although, the proposed project is located in an attainment area, the air quality emissions of NO_x and PM_{10} for the project would temporarily exceed the NCUAQMD's emission significance thresholds. The air quality impacts are however, temporary, short-term, and construction-related. Nevertheless, the State will be required to submit a "Statement of Overriding Consideration" to satisfy CEQA requirements for temporary air quality impacts.

The USFWS's Coordination Act Report for the project was received in March 1995. Appendix B contains the full text of the CAR. Appendix B also contains the Service's recommendations related to the project, as contained in the Final CAR, as well as the Corps' response to those recommendations.

The USFWS's updated list of proposed and listed, threatened, and engangered species that may occur in the project area is provided in Appendix F in its entirety. The USFWS, by letter dated February 10, 1995, concurred with the Corps' Biological Assessment, except for the plant species at the Louisiana Pacific upland disposal site, that the Humboldt Harbor and Bay Deepening Navigation Project proposed plan is not likely to affect federally listed, threatened, and endangered species. In June 1993, a biological survey was conducted on the Louisiana Pacific disposal site by Karen Theiss and Associates for the Louisiana-Pacific Corporation's proposed Samoa Terminal Reconstruction Project. Additionally, in June 1994, another biological plant survey was conducted for the Corps by Botanica Northwest Associates, at the proposed pipeline right-of-way on the LP disposal site. Both surveys conducted during the respective blooming season for each of the three endangered plant species; Menzie's wallflower, beach layia, and western lily, found that the dredged materials at the LP site are not suitable habitat for these dune species, and the only plants found on these materials are a dense growth of ruderal/scrub vegetation, and salt marsh species. The Corps, by letter dated February 7, 1995, reaffirmed their previous conclusion that the proposed action will not affect any of these three species due to their absence at the LP disposal site, and in addition, explained to the Service that although both Menzie's wallflower and beach layia species occur on the "Superbowl Site", the dredged materials at the LP site is very different in composition (i.e., poor drainage and salt leaching capability). In a letter dated March 14, 1995, the Corps received the Service's final concurrence on the three plant species in the Corps' Biological Assessment, based on the recently submitted information.

The Corps coordinated with the State Historic Preservation Officer (SHPO) in 1993 and 1994 to delineate the APE for the currently proposed project as well as to discuss the scope of the marine archaeological survey and potential for submerged shipwrecks to exist in the APE. The report of the marine archaeological survey has been provided to the SHPO requesting the agency's opinion regarding the Corps' conclusion that no historic properties exist in the APE. The Corps anticipates concurrence with this finding from the SHPO in June, 1995, which would

satisfy the Corps' responsibilities pursuant to Section 106 of the National Historic Preservation Act. Any special conditions that may be required for implementation of avoidance measures for the HOODS and Entrance Channel locations will be developed in consultation with the SHPO. In addition, previous coordination with the SHPO between 1990 and 1992 regarding the designation and use of the HOODS, and maintenance dredging of Humboldt Harbor, is relevant to the current undertaking. The agencies agreed that historic properties were not present within either project area, thus fulfilling the Corps' archaeological and historic preservation responsibilities.

The Corps and Humboldt Bay Harbor, Recreation, and Conservation District have coordinated and consulted with agencies that commented on the Draft EIS/EIR.

13.0 DOCUMENT RECIPIENTS OF DRAFT ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

FEDERAL GOVERNMENT

Bureau of Indian Affairs
Honorable Barbara Boxer, U.S. Senator
Honorable Dianne Feinstein, U.S. Senator
Honorable Frank Riggs, U.S. Representative
National Marine Fisheries Service, Santa Rosa
National Park Service
U.S. Army Corps of Engineers, Woodley Island Marina
U.S. Coast Guard, Long Beach
U.S. Department of the Interior
U.S. Department of Transportation
U.S. Environmental Protection Agency, Region IX, San Francisco
U.S. Environmental Protection Agency, Washington, D.C.
U.S. Federal Emergency Management Agency
U.S. Federal Highway Administration
U.S. Fish and Wildlife Service, Sacramento
U.S. Fish and Wildlife Service, Humboldt Bay NWR, Loleta
U.S. Forest Service, Region 5, San Francisco
U.S. Geological Survey, Menlo Park
U.S. Maritime Administration
U.S. National Oceanic and Atmospheric Administration, Washington, D.C.
U.S. Navy

STATE GOVERNMENT

Air Resources Board
California Coastal Commission
California Department of Boating and Waterways
California Department of Fish and Game, Eureka
California Department of Fish and Game; Marine Resources Region, Long Beach
California Department of Health
California Department of Parks and Recreation; State Historic Preservation Officer
California Department of Transportation (Caltrans), Eureka
California Department of Water Resources
California Environmental Protection Agency
California Native American Heritage Commission
California Office of Historic Preservation
California Resources Agency
California State Clearinghouse
California State Lands Commission
California State Water Resources Control Board

Document Recipients of EIS/EIR

STATE GOVERNMENT (continued)

Honorable Dan Hauser, California State Assembly
Honorable Mike Thompson, California State Senator
Honorable Pete Wilson, Governor
Northcoast Unified Air Quality Management District
Northcoast Regional Water Quality Control Board
State Lands Commission

LOCAL GOVERNMENT

City of Eureka, City Manager
City of Eureka, Chamber of Commerce
City of Eureka, Mayor and Council
City of Eureka, Planning Director
City of Eureka, Public Works Director
Department of Transportation
Humboldt Bay Harbor, Recreation and Conservation District; Board of Commissioners
Humboldt County Association of Governments
Humboldt County Board of Supervisors
Humboldt County Department of Health Services
Humboldt County Department of Public Works
Humboldt County Planning Department
Humboldt/Del Norte County Director of Environmental

ORGANIZATIONS/GROUPS/COMPANIES/OTHERS

California State Auto Asssociation
Citizens for Port Development
Commercial Fishermen's Wives of Humboldt
Eureka Forest Products
Greater Eureka Chamber of Commerce
Humboldt Bay Forest Products, Inc.
Humboldt Bay Municipal Water District
Humboldt Bar Pilots Association
Humboldt Dock & Shipping Co.
Humboldt Fisherman's Marketing Association, Inc.
Humboldt State University; College of Natural Resources
Humboldt State University; Cooperative Fisheries Research Unit
Humboldt State University; Department of Biology
Humboldt State University; Department of Oceanography
Humboldt State University; Wildlife Research Field Station
ILWU - Longshore Division
Krumnow Charter, Inx.

ORGANIZATIONS/GROUPS/COMPANIES/OTHERS (continued)

Louisiana- Pacific Corporation
Northcoast Environmental Center
Pacific Affiliates
Pacific Bell Telephone
Pacific Coast Federation of Fishermen's Association
Pacific Gas and Electric
Pacific Lumber Company
Redwood Region Audubon Society
Redwoods United Inc.
Sea Grant Marine Advisor
Simpson Paper Co.
Star Shipping (USWC) Inc.
The Surfrider Foundation
Times Standard
Unocal Refining & Marketing Division
Western Surfing Association Environmental Branch
Westfall Stevedore Co.
Winzler & Kelly Engineers

INDIVIDUALS

Ms. Patricia Banducci
Mr. and Mrs. William Galloway
Ms. Marilee Grazis
Ms. Crystal Greenwell
Mr. Hopkins
Mr. Bruce Taylor
Mr. John Warren

14.0 REFERENCES

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15.0 PERSONS AND AGENCIES CONTACTED

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Ziemer, S. Air Quality Specialist. SAIC, Santa Barbara, CA. 1994.

16.0 LIST OF PREPARERS

Name	*Discipline/Expertise*	*Experience*	*Role in Preparing DEIS/DEIR*
Corps of Engineers Staff			
Roderick A. Chisholm	Chief, Environmental Branch	24 years, Water Resources Management	Quality Assurance
Roger Golden	Environmental Resources Planner/Agency Coordination	24 years, Environmental Resources Planner	Technical Manager
Tamara Terry	Wildlife Management	6 years, Wildlife Biologist	EIR/EIS Manager
Kerry Guy	Environmental Engineering	5 years, Sediment/Water Quality Studies	Sediment/ Water Quality Testing
Richard Stradford	Archeologist	16 years, Cultural Resources Management	Cultural Resources Coordination
Peter La Civita	Marine Biologist	21 years, Marine Biology	HOODS EIS (editor); Marine Biology
Bill DeJager	Terrestrial Ecologist/Botanist	3 years, Ecologist	Botany, upland disposal sites
Other Corps of Engineers Offices and Contractors			
EVS Environmental Consultants	Dredged Material Sampling/Testing		
Humboldt Bay Harbor, Recreation, and Conservation District Staff			
Jack Alderson	California Waterfront Experience since 1949; (Nautical Scientist & Oceanographer)	20+ years C.E.O., Humboldt Harbor District	Quality Assurance; EIR Manager

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Humboldt Harbor and Bay Deepening Navigation Project

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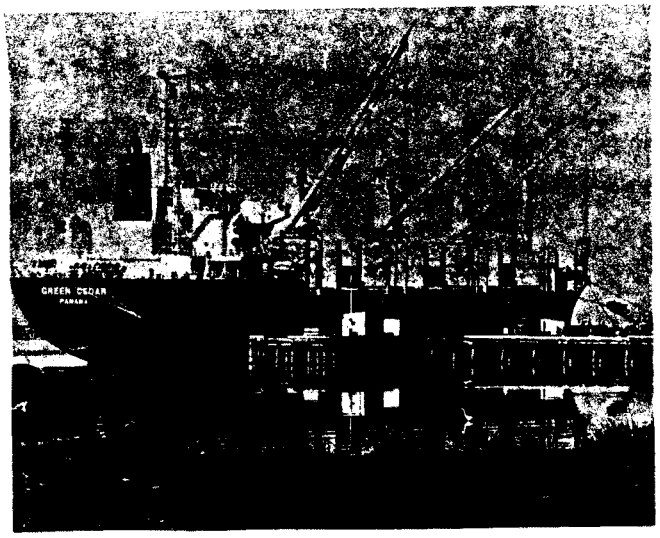

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APPENDIX A

COMPLIANCE OF THE SELECTED PLAN WITH SECTION 404(b)(1) OF THE CLEAN WATER ACT (LOUISIANA PACIFIC SITE)

SECTION 404(b)(1) EVALUATION FOR THE PROPOSED HUMBOLDT HARBOR AND BAY DEEPENING NAVIGATION PROJECT IN HUMBOLDT HARBOR, CALIFORNIA

1.0 PROJECT LOCATION & DESCRIPTION

Humboldt Harbor is located in Humboldt County on the Northern California coast, approximately 225 nautical miles north of San Francisco and 156 nautical miles south of Coos Bay, Oregon. The San Francisco District, Corps of Engineers and the Humboldt Bay Harbor Recreation, and Conservation District have investigated several alternative plans for the selective deepening and widening of navigation channels, and various dredged material disposal alternatives for the disposal of the estimated 5.6 million cubic yards of dredged material from the project. The recommended plan is Alternative 3, which includes the following: (1) Bar and Entrance Channels deepened to -48 feet MLLW; (2) "Middle Ground Area" of North Bay Channel deepened to -48 feet MLLW; (3) North Bay, Samoa Channel, and Samoa Turning Basin deepened to -38 feet MLLW; (4) Entrance channel widened on the north side of the channel from the jetty heads through the "middle ground" to the turn into the North Bay channel (this widening ranges from a maximum 275 feet in the Entrance channel to 200 feet in the "middle ground" area); (5) Entrance channel edge is moved north and away from the South Jetty by 100 feet; (6) Widening and realignment of the existing Samoa channel turning basin to facilitate safer use of the basin; (7) removal of approximately 5.6 million cys of dredged material, and disposal in the soon-to-be designated Section 102 Humboldt Open Ocean Disposal Site (HOODS); and (7) upland disposal of approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal at the Louisiana Pacific Site by "back-pumping" with self-propelled hopper dredge.

1.1 Study Authority & Purpose

This study is in response to the Committee on Public Works and Transportation of the U.S. House of Representatives Resolution, dated September 23, 1982, which reads:

> "Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on Humboldt Harbor and Bay, California, published as House Document No. 330, 90th Congress, 2nd Session, and other pertinent reports, with a view to determining the advisability of increasing the depth of and making other modifications with respect to the Humboldt Harbor and Bay Project, in the interest of navigation and related purposes".

The purpose of the proposed study is to investigate the feasibility of Federal assistance in improving commercial deep-draft vessel navigation in the Humboldt Harbor and Bay channels, Humboldt County, California.

1.2 General Description of Dredged or Fill Material

1.2.1 General Characteristics: Fine-grained silt and clay dredged material

1.2.2 Quantity: Approximately 26,000 cys of dredged material.

1.2.3 Source: Samoa Channel Turning Basin - Sediment Sample HB-8.

1.3 Description of Proposed Discharge Site

1.3.1 Location & Size: The Louisiana-Pacific (LP) upland disposal site is located on an approximately 23 acre land parcel- with approximately 12 acres of upland habitat historically used as a dredged material disposal site by LP. The site is located near the intersection of Samoa Cookhouse Road and New Navy Base Road, northeast of Samoa, Humboldt County, California (eastern shore of North Spit, south of Samoa Bridge). The LP site presently has a capacity for approximately 65,000 cys of dredged material.

1.3.2 Confined-unconfined-open water: The dredged material will be placed in a confined upland disposal site.

1.3.3 Habitat: The site is a disturbed dune habitat consisting of graded, barren soil, except for about 2.6 acres (non-contiguous) containing various grasses, plants, and trees. The site has previously been used for random dumping of asphalt, concrete, etc..., and then, ultimately dumping of dredged material by LP. The site has a triangular shaped riparian wetland immediately north of the site, between it and the Samoa Bridge. LP contract dredgers have always been careful to prevent any dredged material from encroaching on the riparian wetland area.

1.3.4 Timing and Duration of Discharge: Approximately thirteen to fourteen loads of dredged material will be disposed of over an approximately 3 to 4 day period.

1.3.5 Disposal Method: A self-propelled hopper dredge will be used to dredge the approximately 26,000 cys of sediment from the Samoa Channel Turning Basin, and then dredged material will be "back-pumped" from the hopper dredge (hooked up at a connection platform) onto the upland site.

2.0 FACTUAL DETERMINATIONS

This section addresses the proposed discharge alternative, Alternative 3, which includes ocean disposal of approximately 5.6 million cubic yards (mcy) of dredged material at the soon-to-be designated Section 102 HOODS, and approximately 26,000 cubic yards (cys) of dredged material unsuitable for unconfined aquatic disposal at the historical upland dredged material disposal site called the Louisiana Pacific Site. This section only discusses the potential effects of the return flow into the aquatic environment of Humboldt Bay. Disposal at the ocean site is not discussed in this 404(b)(1) evaluation because disposal at this site is not regulated by the Clean Water Act, but by the Marine Protection, Research, and Sanctuaries Act (MPRSA). Disposal at the ocean site is evaluated according to the relevant requirements of the MPRSA in Appendix C.

3.0 PHYSICAL SUBSTRATE DETERMINATIONS

3.1 **Sediment Type:** The LP Site consists mainly of sand and assorted dredged material from past disposals by LP (probably a mixture of sand, silty sand, sandy silt and clay materials).

3.2 **Dredged/Fill Material Movement:** Slurried dredged material will be "back-pumped" to a confined disposal area at the Louisiana Pacific disposal site. Dredged material "back-pumped" from the Bay, moves in through an encased inflow pipe which crosses under a roadway (Samoa Road), and is contained in a primary disposal basin. The primary disposal basin is separated from the secondary disposal basin by an overflow weir. An overflow pipe from the secondary disposal basin provides additional discharge control. To aid the settlement of dredged material, baffles or floating filters may be incorporated to control scum and floatables.

4.0 WATER CIRCULATION, FLUCTUATION, AND SALINITY DETERMINATIONS

4.1 **Water:** At the Louisiana Pacific site, water levels are maintained through a series of overflow weirs to maximize percolation of the supernatant into the ground, and minimize discharge into the Bay. Any discharges during the drying of dredged material will be controlled until the effluent water meets the North Coast RWQCB's discharge requirements. Effluent (return) water will leave the site and be discharged into the Bay via a shallow, open drainage ditch. This drainage ditch travels northerly along the toe of the two disposal basins and Samoa Road, and ends in the same area where the encased inflow pipe exists. The existing overflow pipe located in the southeast corner of the secondary disposal basin connects directly to the return drainage ditch. Given the approximately 13 to 14 hopper loads of dredged material to be disposed of at the LP Site, and the sandy nature of the sediments underlying the disposal site, it is anticipated that a very minimum of secondary overflow will occur.

4.2 Salinity: Salinity measurements are not available from the Louisiana Pacific Site. Salinity in Humboldt Bay will not be impacted from dredged sediment disposal and the subsequent release of minimal amounts of effluent water off the upland disposal site.

4.3 Current Patterns & Circulation: There is no circulation of water on the Louisiana Pacific Site since it is an upland dredged material disposal site. The circulation of water in Humboldt Bay will not be impacted by the release of effluent discharge off the disposal site.

4.4 Actions that will be taken to Minimize Impacts: No potential significant impacts at the Louisiana Pacific Site are anticipated, however actions will be taken to minimize any potential impacts to Humboldt Bay. Actions would include the upgrading of existing perimeter levees and discharge controls at the Louisiana Pacific Site, if deemed necessary.

5.0 SUSPENDED PARTICULATE/TURBIDITY DETERMINATIONS

5.1 Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Upland Disposal Site: After the placement of dredged material on the Louisiana Pacific Site, on-site effluent discharges would be controlled by site operations. Sediments to be discharged at the surface of the LP site will comply with the requirements of the North Coast RWQCB's receiving water limitations, and discharges during the drying of dredged material will be meet the limitations established for the clarified supernatant which is discharged into Humboldt Bay. Monitoring, testing, and reporting of data collected from the effluent and receiving waters shall be the responsibility of the local sponsor. Elevated levels of suspended particles and increased turbidity are expected during dredging, and will return to normal once dredging is completed. No increase in suspended particles and turbidity levels are expected from the Louisiana Pacific site.

5.2 Dissolved Oxygen: No data was available for Humboldt Bay in the vicinity of the LP Site. All discharges onto the site and into the Bay will comply with the RWQCB's discharge requirements.

5.3 Effects (degree and duration) of discharge on chemical and physical properties of the water column

5.3.1 Toxic Metals and Organics: No potential significant impacts to Humboldt Bay are anticipated from disposal and subsequent effluent water discharge from the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal (because of trace amounts of dioxin) from the Louisiana Pacific Site. Dioxin is characteristically extremely hydrophobic and strongly binds to sediment, and is not expected to cause any significant impacts to Humboldt Bay.

5.3.2 Aesthetics: No potential significant impacts are anticipated at the Louisiana Pacific site.

5.3.3 Effects on Biota: Historically, the Louisiana Pacific site has been used as a dredged material disposal site. Since the site is highly disturbed and has very minimal habitat value to plant and wildlife species, no potential significant impacts are expected from the disposal of dredged material at the LP site. A layer of clean fill material will be placed over the dredged material, once disposal is completed, to isolate and avoid direct exposure of any feeding shorebirds to the trace amounts of dioxin in the sediment (Note: The dioxin level in sediment sample HB8 is considered to be a trace amount since it was detected at 0.3 picograms/gram and the detection limit is 0.2).

6.0 CONTAMINANT DETERMINATION

No significant contaminant impacts are expected from the disposal of the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal at the LP site. Perimeter levees already exist at the site and the trace amounts of dioxin in the dredged material are characteristically extremely hydrophobic and will bind to sediment. Levels of dioxin are considered minimal and will not cause significant contaminant impacts to the dredged material disposal site.

7.0 AQUATIC ECOSYSTEMS AND ORGANISM DETERMINATIONS

No impacts to the ecosystem at the upland disposal site are expected since the site is highly degraded and supports no aquatic habitat, or endangered species onsite.

8.0 PROPOSED DISPOSAL SITE DETERMINATIONS

8.1 Mixing Zone Determination: Not applicable to upland disposal site.

8.2 Determination of Compliance with Applicable Water Quality Standards: The applicable North Coast RWQCB's water quality standards for receiving waters and effluent water limitations will be met at the Louisiana Pacific upland site.

8.3 Potential Effects on Human Use Characteristics: The disposal of dredged material on the Louisiana Pacific site will have no impact on municipal and private water supplies, wilderness areas, research sites, or similar preserves, parks, national and historical monuments, national seashores, or water related recreation. Recreational and commercial fisheries will not be impacted because disposal is on an upland disposal site.

9.0 DETERMINATION OF CUMULATIVE EFFECTS ON THE AQUATIC ECOSYSTEM

Based on the above discussion, no cumulative effects on the aquatic ecosystem are anticipated from the disposal of dredged material and subsequent release of effluent water into Humboldt Bay from the Louisiana Pacific site.

10.0 DETERMINATION OF SECONDARY EFFECTS ON THE AQUATIC ECOSYSTEM

No secondary effects on the aquatic ecosystem are anticipated for the Louisiana Pacific site.

FINDING OF COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE
For

HUMBOLDT HARBOR AND BAY DEEPENING NAVIGATION STUDY
HUMBOLDT HARBOR, CALIFORNIA

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

Alternative site analysis was completed for this project and is discussed in detail in Section 2.9 on Dredged Material Disposal Options in the EIS/EIR. The proposed disposal of the approximately 26,000 cys of dredged material at the Louisiana Pacific site was selected because it is an upland site, and has no adverse impact on the aquatic ecosystem.

The planned disposal of dredged material at the Louisiana Pacific site would not violate any applicable water quality standards.

This disposal operation would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

The use of the disposal site will not harm any proposed or listed threatened or endangered species or their designated critical habitat. The use of the disposal site will not violate the protective measures of any refuge, sanctuary, or special ecological site.

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

Appropriate steps to minimize any potential adverse effects of the discharge on aquatic ecosystems would include the cessation of upland disposal activities during extreme tidal currents associated with spring tides.

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

UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE COORDINATION ACT REPORT

FOR THE

HUMBOLDT HARBOR AND BAY DEEPENING PROJECT

APPENDIX B

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

March 21, 1995

Lt. Colonel Michael J. Walsh
District Engineer
U.S. Army Corps of Engineers
211 Main Street
San Francisco, California 94105-1905

Subject: CESF - Humboldt Harbor and Bay Deepening Project

Dear Colonel Walsh:

Enclosed are three copies of the Fish and Wildlife Service's (Service) detailed report of the effects on fish and wildlife resources of the Corps of Engineers' (Corps) Humboldt Harbor and Bay Deepening Project. This report has been prepared under authority of, and in accordance with, the provisions specified in Section 2(b) of the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661 et seq.).

Our analysis is based on 1) project plans and related information provided by the Corps prior to March 6, 1995, 2) a literature review, 3) personal communications with recognized experts, 4) field investigations, 5) HEP (Habitat Evaluation Procedures) analyses, and 6) best professional judgement.

The report includes several applications of HEP to quantify forecasted project impacts and mitigation needs for aquatic and terrestrial resources in the project area. Our resource protection and mitigation planning goals are based on the Service's Mitigation Policy (*Federal Register* 46:15, January 23, 1981) which is discussed in the report. The HEP and Mitigation Policy do not apply to assessments of impacts or mitigation planning for threatened or endangered species.

Appendix E contains a letter from the California Department of Fish and Game (Department), dated March 28, 1994, that provides comments on the Service's draft FWCA report. According to the letter, the Department concurs with "the vast majority of the [Service's] general and specific recommendations...with the singular exception of the suggested mitigation requirements". The Service has noted this comment; however, we have retained these recommendations in the report. We believe mitigation is warranted and, at this time, have no other means with which to quantify losses of fish and wildlife and their habitats.

Appendix F contains a letter from the National Marine Fisheries Service (NMFS), dated January 30, 1995, that provides comments on the Corps' December 1994 Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) for the Humboldt Harbor and Bay Deepening Project. The second

page of this letter (paragraph 2) states "The U.S. Fish and Wildlife Service's Draft [FWCA Report], contained in Appendix B, expressed concern over secondary, indirect impacts of dredging that may cause eelgrass losses and other impacts by altering patterns of water circulation, sediment flushing, nutrient cycling, and Bay productivity. Possibly the best way to address these concerns, which I share with the [Service] would be to implement General recommendation #4 in the [FWCA Report] [page 68], which calls for development of a long-term mitigation, monitoring, and remedial-action plan designed to ensure success of any mitigation actions".

Appendix H contains a letter from the Service to the Corps, dated March 14, in which the Service concurs with the determination that the Humboldt Harbor and Bay Deepening Project is not likely to adversely affect plant species, and that formal consultation will not be necessary. Therefore, we have eliminated discussions of federally listed, proposed, and candidate species in the final FWCA Report.

Thank you and your staff for the opportunity to provide our input to your planning process. Should you have any questions, please call Caroline Wilkinson of my staff at (916) 979-2107.

Sincerely,

Joel A. Medlin

Joel A. Medlin
Field Supervisor

Enclosure

cc: (w/enclosure)
ARD-ES, Portland, OR
NMFS, Santa Rosa, CA
CDFG, Director, Sacramento
CDFG, Menlo Park (Attn: Bob Tasto)
CDFG, Eureka (Attn: Herb Pierce, Ron Warner)
EPA, Region IX, San Francisco (Attn: Brian Ross)
RWQCB, Oakland
California Coastal Conservancy, Oakland (Attn: Laurel Marcus)
California Coastal Commission, San Francisco (Attn: Jim Raves)
HBHRCD, Eureka (Attn: Jack Alderson)
Humboldt Bay NWR, Loleta (Attn: Kevin Foerster)

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ACKNOWLEDGMENTS

This report was prepared by Caroline W. Wilkinson, Douglas C. Weinrich, Michael B. Fris, Dr. Steven A. Schoenberg, and Richard W. DeHaven, Fish and Wildlife Biologists, U.S. Fish and Wildlife Service, Sacramento, California. The preparators thank Herb Pierce, Ron Warner, and Bob Tasto, California Department of Fish and Game; Kevin Foerster, Humboldt Bay National Wildlife Refuge; Roger Golden, U.S. Army Corps of Engineers; Chris Mobley, National Marine Fisheries Service; and Jack Alderson, Humboldt Bay Harbor Recreation and Conservation District for their many useful review comments made on an earlier draft of the report. We also thank the many people listed in our "Personal Communications" section and cited throughout the text.

PREFACE

This is our detailed Fish and Wildlife Coordination Act Report (FWCA Report) on the effects that proposed channel deepening, selective channel widening, and turning basin improvements at Humboldt Harbor, California would have on fish and wildlife resources. The report has been prepared under authority of, and in accordance with, the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; U.S.C. et seq.). The report has been reviewed by the California Department of Fish and Game (CDFG) and the National Marine Fisheries Service (NMFS). As discussed in the attached transmittal memorandum, their comments on the draft FWCA Report are found in Appendices F and G.

The purposes of this report are to (1) evaluate the impacts of each alternative on fish and wildlife and their habitats, (2) identify and evaluate the least environmentally damaging alternative, and (3) recommend methods for preserving, compensating or enhancing fish and wildlife resources.

Mitigation recommendations in this report are based on the Fish And Wildlife Service's (Service's) Mitigation Policy (*Federal Register* 46:15; January 23, 1981) which provides internal guidance to us for developing appropriate mitigation for projects under our purview. Under the policy, each distinct, mappable fish and wildlife habitat resource is assigned to one of four Resource Categories to ensure that recommended mitigation is consistent with the fish and wildlife habitat values which are involved. The Resource Categories cover a range of habitat values from those considered to be of high value, unique, and irreplaceable to those believed to be of relatively low value to fish and wildlife. Each of the four Resource Categories also have specific mitigation goals.

Specifically, the four Resource Categories are: (1) those habitat areas of high value to the evaluation species which are unique and irreplaceable, (2) those habitat areas of high value for evaluation species which are either scarce or becoming scarce; (3) those habitat areas of high to medium value for the evaluation species which are relatively abundant; and (4) those habitat areas of medium to low value for the evaluation species. The Service's respective mitigation planning goals for these four Resource Categories are: (1) no loss of existing habitat value; (2) no net loss of in-kind habitat value; (3) no net loss of habitat value, while minimizing loss of in-kind habitat value; and (4) minimize loss of habitat value. The Mitigation Policy is not used to evaluate project impacts on federally-listed endangered or threatened species. Listed species needs are separately considered, as provided for in the Endangered Species Act of 1973, as amended.

INTRODUCTION

The purpose of the proposed Humboldt Harbor and Bay Deepening Project is to examine channel deepening, selective channel widening, and turning basin improvement alternatives for the Harbor and Bay near the city of Eureka, Humboldt County, California. Current channel depths do not allow for the efficient operation of deep draft vessels, and channel widening and realignment are needed to allow for safe passage of the vessels entering and leaving the Bay (USACE 1989). This report describes fish and wildlife resources found within the project area and the impacts that proposed harbor improvements presently being investigated by the U.S. Army Corps of Engineers (Corps) may have on these resources. A concurrent study of the disposal site is being done by the Environmental Protection Agency (EPA) pursuant to Section 102 of the Marine Protection, Research, and Sanctuaries Act. The EPA expects to issue the draft Environmental Impact Statement (EIS) for public review by March 31, 1995. The EPA anticipates a site designation date of August 31, 1995. Appendix A gives the Service's responses to the Corps' responses to the Service's recommendations in the draft FWCA Report.

DESCRIPTION OF THE PROJECT

The proposed Humboldt Harbor and Bay Deepening Project involves proposed deep draft navigation channel improvements to the existing Humboldt Harbor and Bay. These improvements would consist of channel deepening, selective channel widening, and turning basin improvements. The dredged material would be excavated and disposed of at the Humboldt Open Ocean Disposal Site (HOODS). A relatively small amount (about 26,000 cubic yards) (cys), unsuitable for unconfined aquatic disposal at the HOODS because of contaminants, would be disposed of at the Louisiana Pacific upland disposal site (USACE 1993a). The "Superbowl" site analyzed in the draft FWCA report was eliminated as a potential disposal site, mainly due to the fact that it contains federally-listed plant species (*i.e.* Menzie's wallflower).

The Corps has primary responsibility for maintaining navigable waters of the United States under Section 10 of the Rivers and Harbors Act of 1899. The Corps also grants permits for dredged material disposal activities. Section 404 of the Clean Water Act (amended 1972) gives the Corps authority to issue permits for discharge of dredged or fill material into waters of the U.S. Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) gives the Corps permitting authority for the transportation of dredged material for disposal at ocean sites. Comments on all permit applications are solicited from other government agencies and interested parties through a Public Notice process. For federally-authorized Corps contruction projects, such as the proposed Humboldt Harbor and Bay Deepening Project, the Corps does not formally issue a permit to itself.

The EPA also has regulatory roles under both the MPRSA and the Clean Water Act. The EPA, in cooperation with the Corps, develops criteria for evaluating the impacts of dredged material discharges into ocean and inland waters. The joint EPA-Corps "Green Book" and "Gold Book", respectively, contain these criteria. Section 102 of the MPRSA gives the EPA authority to designate and manage ocean disposal sites such as the site being considered for the proposed Humboldt Harbor and Bay Deepening Project. Section 404 of the Clean Water Act also authorizes the EPA to prohibit or restrict the use of particular disposal sites, if it is determined that site disposal would have adverse environmental impacts.

The San Francisco Bay Regional Water Quality Control Board (RWQCB), under guidance of the State Water Resource Control Board, regulates activities which could potentially affect water quality in the coastal bay areas. The RWQCB sets target volumes for the amounts of dredged material which can be disposed of at in-bay disposal sites. Their policies also regulate major new dredging operations (including channel deepening) and encourage upland and ocean disposal options. Under Section 401 of the Clean Water Act, the RWQCB issues water quality certification, which verifies that dredged material discharges will not violate in-bay water quality standards. To determine the potential effects on water quality by various disposal alternatives, the RWQCB may require testing of dredged sediments. The RWQCB is developing criteria for

dredged sediment suitability for both in-bay and upland (including beneficial uses) disposal.

The California State Lands Commission (SLC) has jurisdiction over State public trust coastal waters and tidal areas. A permit must be obtained from SLC before dredging or dredge disposal on lands or waters of their jurisdiction. SLC also reviews dredging projects for compliance with the California Environmental Quality Act (CEQA) before issuing its permit.

The Service, NMFS, and CDFG, under auspices of the Fish and Wildlife Coordination Act, review federally-sponsored or permitted water-related projects to determine their effects on fish and wildlife resources and identify means and measures for mitigating those effects. Also, under the Endangered Species Act, these agencies have authority to regulate activities which may affect populations or habitats of federally-listed threatened and endangered species. Generally, the Service has jurisdiction over terrestrial wildlife and freshwater fish species that are federally-listed, whereas NMFS has jurisdiction over listed marine wildlife and fishes, including anadromous fish.

Before a proposed project is implemented, the action agency (i.e., the entity proposing a project) must consult with the appropriate Federal and State resource agencies on the potential impacts the project would have on fish and wildlife, including special-status species. On the State level, the CDFG has responsibility for threatened and endangered species listed under the California Endangered Species Act. The CDFG also has, under the CEQA, an equivalent review role as the Federal resource agencies.

More detailed discussion of the various regulatory and natural resource agencies involved in the existing management structure of dredging operations in the Estuary are given in a recent report funded by the EPA (San Francisco Estuary Project 1990).

DESCRIPTION OF THE AREAS

A. HUMBOLDT HARBOR AND BAY AREAS TO BE DEEPENED AND WIDENED

Humboldt Bay, which is the only major shipping port between San Francisco (233 miles south) and Coos Bay, Oregon (209 miles north), is also one of California's largest estuaries (Figure 1). It consists of three sub-bays: the wide, shallow South Bay; a deeper, narrower central Entrance Bay; and the largest sub-bay, the wide, relatively shallow North Bay (Arcata Bay). The width of the Bay varies from one-half mile to about 4 miles and is about 14 miles in length. The total water surface area is 7.8-square-miles at low tide and 24.5-square-miles at high tide. Over half of the surface of the North and South Bays is exposed at low tide. Both South Bay and Arcata Bay consist of extensive intertidal mudflats and channels (Barnhart *et al.* 1991). Entrance Bay has one deep connecting channel (Samoa Channel) which joins North Bay and South Bay and also leads to the ocean through the Bar and Entrance Channels. Samoa Channel is maintained by two concrete and rock jetties exceeding 1 mile in length. A narrow sand spit from one-eighth to 1 mile in width separates the Bay from the ocean on both sides of the entrance (Figure 2).

Humboldt Bay has a drainage basin of 288-square-miles and is immediately surrounded by lowlands which were converted from salt and brackish water marshes to agricultural uses in the 1880's (Barnhart *et al.* 1991). The lowlands are intersected by foothills of the Coast Range which extend nearly to the Bay shore at several locations (Monroe *et al.* 1973). Sources of freshwater to the Bay include Jacoby Creek and Freshwater Creek in Arcata Bay, Elk River in Entrance Bay, and Salmon Creek in South Bay. These streams and their corresponding sloughs are generally under tidal influence, however, tide gates are present on Salmon Creek.

About 77 percent of the total reach of Humboldt Bay is composed of tidal flats, 19 percent is channels, and 4 percent is salt marshes (Shapiro and Associates, Inc. 1980)

The cities of Eureka and Arcata, along with several smaller communities, are located on or near the Bay; they have a total population of about 70,000 people. The bulk of shoreline facilities for shipping, commercial fishing and associated services are centered around Entrance Bay, with other industrial and commercial sites situated at various locations on Humboldt Bay. The remaining shoreline is in agriculture or remains undeveloped. Arcata Bay is utilized by the City of Arcata, City of Eureka, and the Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD) for mariculture and open space. The South Bay includes mainly open space and the Humboldt Bay National Wildlife Refuge. As of May 1994, the Refuge encompassed 2,108 acres within an approved boundary of 8,936 acres. Diked seasonal wetlands constitute the majority of the existing Refuge in south Humboldt Bay. Less than 300 acres of tidal mudflats are currently managed as part of the Refuge (K. Foerster, pers. comm.).

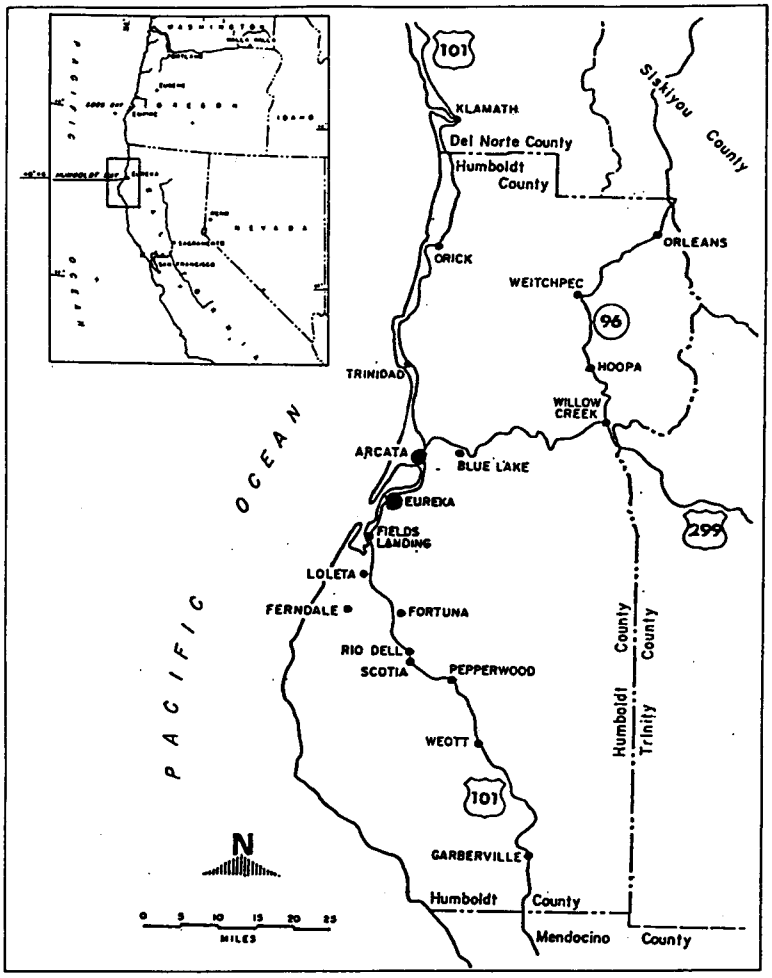

Figure 1. Location map of the Humboldt Harbor and Bay area (Source: Shapiro and Associates, Inc. 1980).

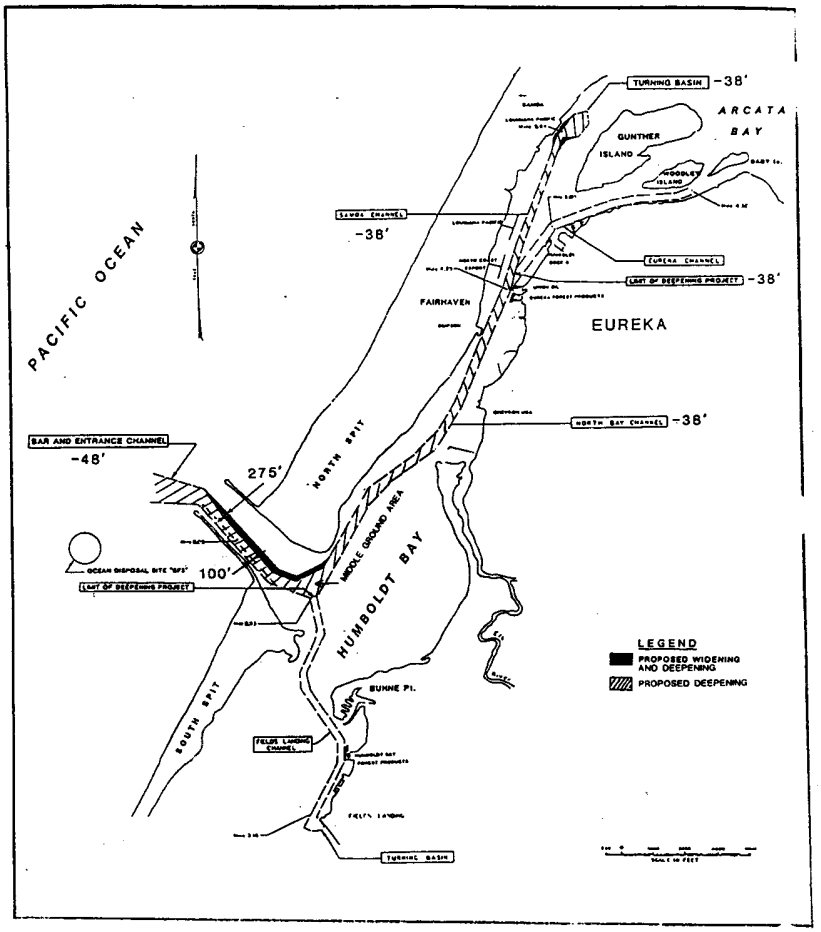

Figure 2. Proposed Corps deepening and widening within Humboldt Harbor and Bay (Source: USACE 1994).

B. DISPOSAL SITES

1. Humboldt Open Ocean Disposal Site (HOODS)

The HOODS is 1-square-nautical-mile in size (848 acres), located between the -160 and -180 feet Mean Lower Low Water (MLLW) contours, and about 3 to 3.5 miles from the Pacific coastal entrance to Humboldt Harbor (Figure 3). Numerical modeling by the Corps suggests that the site is nondispersive. The site is characterized as a transition area between the "mid-depth" and "offshore" zones (USACE 1993b). This transition area, termed the inner edge of migrating sand-silt front, is believed to be variable in substrate and is typified by a reduced abundance of species. Including the 1994 fall maintenance dredging, the HOODS has been used for disposal 10 times previously, receiving a total of about 2,861,289 cys of dredged material.

The proposed HOODS is not an EPA-approved designated disposal site, therefore, it is currently being considered for use on an interim basis until designated by the EPA (USACE 1993b). All ocean disposal activity is being conducted in accordance with Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (USACE 1993c). The transportation of dredged material for disposal is being evaluated to confirm that it would not unreasonably degrade or endanger human health, welfare, or amenities or the marine environment, ecological systems, or economic potentialities (USACE 1993c).

The HOODS is subdivided into four quadrants with each quadrant subdivided into nine cells. This way, the site can be better managed in terms of 1) directing accurate placement of dredged material; 2) facilitating accurate monitoring within the HOODS; 3) reducing the area requiring monitoring; and 4) if appropriate, rotating disposal between quadrants or cells (USACE 1993b). This is the scenario for maintenace dredging, however, we assume this would be done for disposal from the deepening project as well.

2. Louisiana Pacific Upland Disposal Site

The Louisiana Pacific upland disposal site is located on about 23 acres, with about 12 acres of upland habitat historically used as a dredged material disposal site by Louisiana Pacific and other private industries (Figure 4). The site is located near the intersection of Samoa Cookhouse Road and the New Navy Base Road, and is northeast of Samoa (eastern shore of the North Spit, south of the Samoa Bridge). The Louisiana Pacific site was originally able to contain 66,000 cys of dredged material, and presently has the capacity to contain about 45,000 cys (USACE 1993d).

The Louisiana Pacific site is composed of disturbed dune habitat, about 20-25 feet above the surrounding terrain (located above MHHW and the high tide line). In the past, it has been used for random dumping of refuse such as asphalt and concrete. Dumping of dredged material by Louisiana Pacific and other entities was permitted by about 1982. All dredged materials are disposed of behind containment dikes. The Louisiana Pacific industry obtained a 10-year permit from the Corps (dated April 8, 1985; Corps Permit #14438N21, expires March 25, 1995) to dispose of about 33,000 cys of dredged material (USACE 1993d).

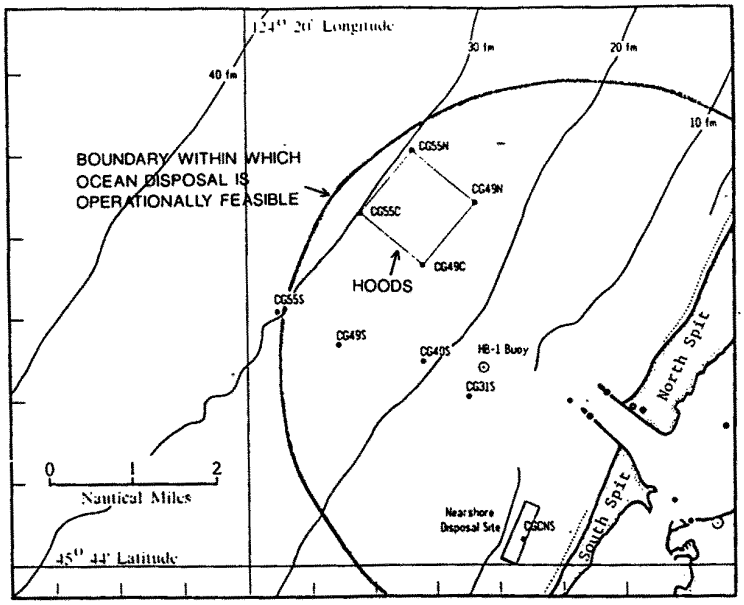

Figure 3. Location of the Humboldt Open Ocean Disposal Site (HOODS) (Source: USACE 1993c).

The Louisiana Pacific upland disposal site has a triangular-shaped riparian wetland immediately to the north, between it and the Samoa Bridge. Louisiana Pacific contract dredgers have always been careful to avoid this site when disposing of any dredged material (USACE 1993d). A site visit on December 30, 1993, revealed the wetland site to be at a much lower elevation than the disposal site, making it very easy to avoid.

The area surrounding the Louisiana Pacific site is also owned and controlled by Louisiana Pacific. The Louisiana Pacific site is served by the Humboldt Bay Municipal Water District (HBMWD), and no groundwater withdrawals are planned. Saline effluent would percolate to the groundwater table and flow to the Bay. Any possible effluent in excess of naturally absorbed water is piped by way of a clarified return line to the Bay. The dredging contractor is, of course, responsible for obtaining and complying with permits needed for dredging and disposal on the Louisiana Pacific site (USACE 1993d).

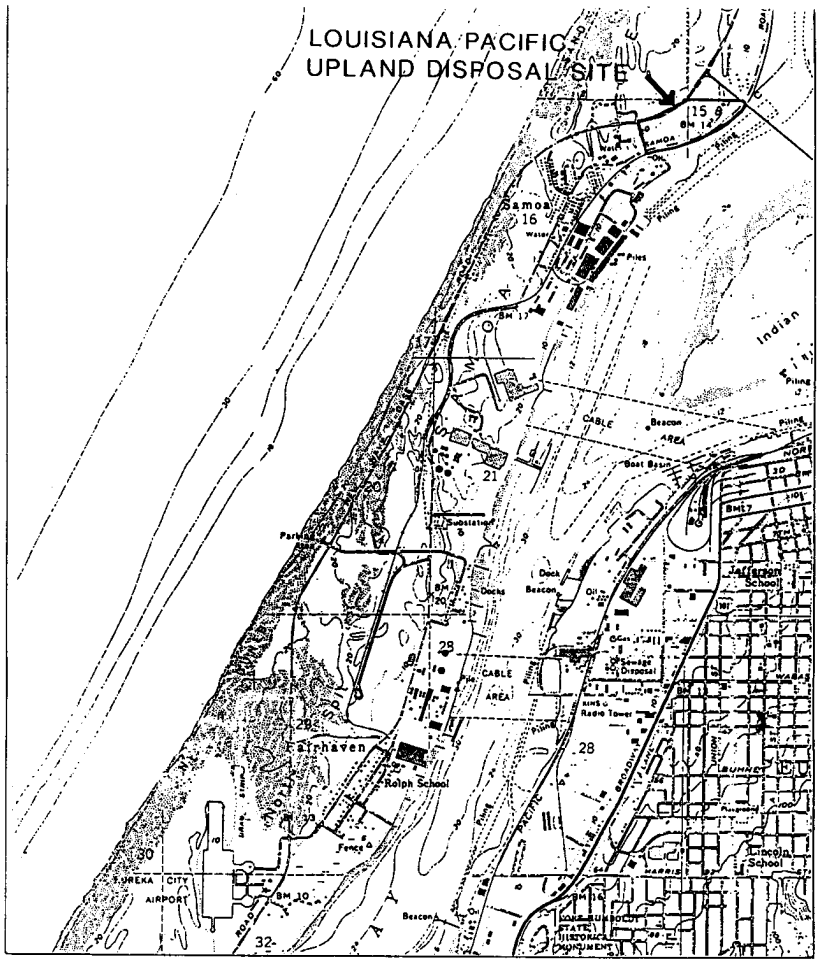

Figure 4. Location of the Louisiana Pacific upland disposal site (Source: USACE 1993d).

A 100-foot naturally vegetated buffer is provided on the north, west, and south sides of the disposal site, and a 50-foot buffer is provided on the east side, helping to screen the dike profile. Past experience indicates that dredged materials, such as silt and sands, revegetate naturally. No specific active revegetation efforts have thus occurred (USACE 1993d).

DESCRIPTION OF ALTERNATIVES

A. Humboldt Harbor and Bay Deepening and Widening

Since the Service submitted the Draft FWCA Report in February 1994, two aspects of the alternatives have been changed or eliminated: 1) the Outer Eureka Channel is no longer in the recommended plan; and 2) the project footprint will not be altered, but the cubic yards of dredged material would increase by an estimated 1.5 million cys from a total project estimated at 4.1 million cys to 5.6 million cys, to include the Middle Ground Area. Recently, at a January 11, 1995 Public Meeting, the Humboldt Bar Pilots expressed the need to modify the "Middle Ground Area" of the North Bay Channel (Figure 2) to allow safer navigation of deep-draft vessels as they move from the deeper Bar and Entrance Channel through the Middle Ground Area, to the shallower North Bay Channel. The Bar Pilots stated that as deep-draft vessels move from the deeper Bar and Entrance Channel, through the Middle Ground Area, and turn into the shallower North Bay Channel, the vessels are perpendicular to the Entrance Channel wave action. This Entrance Channel wave action causes severe "rolling" of the deep-draft vessels as they make this turn. To alleviate this safety problem, the Bar Pilots stated that it is necessary for the Middle Ground Area to be -48 feet MLLW with the deepening project and not -38 feet MLLW as originally planned.

The proposed Humboldt Harbor Deepening Project now includes two alternatives instead of four: the No Action Alternative and one Structural Alternative. The Structural Alternative consists of one option which addresses deepening and selective widening alternatives (Figure 2). (Please note that the FWCA Report refers to the structural alternative as "Alternative 1." In the Corps' Draft Feasibility Report and Environmental Impact Statement/Report for the project, it is called "Alternative Plan 3".) The vessels currently using Humboldt Harbor are deep draft vessels, barges, and shallow draft recreational and commercial fishing vessels. The size of the vessels which use North Bay terminals differ from those using the South Bay terminal. Therefore, various sized vessels were used to aid in the design of the North Bay and South Bay channel increments (USACE 1989). A description of the various options and alternatives follows.

No-action alternative. Under the no-action alternative, all vessels currently using Humboldt Bay would continue to utilize channels and turning basins with current dimensions. Except for impacts associated with maintenance dredging, current conditions and ecosystem trends in the project area are expected to continue.

Structural alternative. Only one option will be considered (Table 1). The **Bar and Entrance Channels** would be **deepened** from -40 feet to -48 feet MLLW. The amount of material to be removed would be about 1,550,000 cys. The Entrance channel would be **widened** on the north side of the channel from the jetty heads through the middle ground to the turn into the North Bay Channel. The proposed widening would range from 275 feet in the Entrance Channel to 200 feet in the Middle Ground Area. The amount of material to be removed would be

Table 1. Structural alternative for the Humboldt Harbor and Bay Deepening Project, including depths, volume to be dredged, and impact acreage.

BAR AND ENTRANCE CHANNEL				
DEEPENING		WIDENING		
New Depth (ft MLLW)	Volume of Material to be Removed (cys)	Area to be Widened (ft)	Volume of Material to be Removed (cys)	New Acres Impacted
-48	0 1,550,000	200-275	1,146,000	38.72

NORTH BAY AND SAMOA CHANNELS			
DEEPENING			
New Depth (ft MLLW)	Volume of Material to be Removed (cys)	(Middle Ground Area of North Bay)	
		New Depth (ft MLLW)	Volume of Material to be Removed (cys)
-38	1,151,555	-48	1,641,335

SAMOA CHANNEL TURNING BASIN				
WIDENING				
West Side (ft)	West Side Impacted (acres)	East Side (ft)	East Side Impacted (acres)	Volume of Material to be Removed (cys)
170.0	4.22	200.0	2.38	107,000

TOTAL VOLUME TO BE DREDGED: 5,600,000 cys
TOTAL ACRES THAT MAY BE IMPACTED: 45.32

about 1,146,000 cys. The **North Bay and Samoa Channels** would be deepened from -35 feet to -38 feet MLLW. The volume of material to be removed would be about 1,151,555 cys. The **Middle Ground Area** of the North Bay Channel would be **deepened** to -48 feet. The volume of material to be removed would be about 1,641,335 cys. The entrance to the existing **Samoa Channel turning basin** would be **widened** to facilitate safer use of the turning basin. The maximum additional width on the west side of the turning basin would be 170 feet; the east side would be 200 feet.

Existing channel bottom areas that would be affected:
- **Bar and Entrance Channels**: 216.4 acres
- **North Bay and Samoa Channels**: 364.9 acres

New channel bottom areas that would be affected:
- **Bar and Entrance Channels**: 38.72 acres

Samoa Channel Turning Basin: 6.60 acres (east side, 2.38; west side, 3.78)

Total acreage impacted: 45.32[1]

Overdepth: 3 feet for the Bar and Entrance Channel –
2 feet for North Bay and Samoa Channels

B. Humboldt Open Ocean Disposal Site (HOODS)

The HOODS would be used for all dredged material suitable for unconfined aquatic disposal. About 5,600,000 cys of dredged material would be disposed of at the HOODS.

C. Louisiana Pacific Upland Disposal Site

Only one site for dredged material drying and disposal is being considered for the project: the Louisiana Pacific upland disposal site. The site was selected for its capacity, costs associated with transport and disposal, and environmental considerations, including the degree of contamination of dredged sediments. About 26,000 cys of material unsuitable for unconfined aquatic disposal is proposed to be disposed of on this site, which would be used as a temporary drying facility for dredged sediments until eventual disposal at an approved upland site.

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[1]Maps dated November 1993, of the areas to be widened (Bar and Entrance, North Bay, and Samoa Channels) were provided to the Service by the Corps. Square footage had already been determined; acreage was calculated from the square footage. Mr. Roger Golden (USACE, pers. comm.) stated that the acres to be widened (45.32 acres) are all "new" channel dredging areas. According to studies by the Corps, only 9,000 ft^2 (0.20) acre of the 45.32 acres are between 0 and 20 feet deep (shallow unvegetated or vegetated subtidal); the remaining 45.12 acres to be impacted are all at depths greater than 20 feet (deep unvegetated or vegetated subtidal). In their draft EIS/EIR the Corps' response to the Service's fourth specific recommendation in our draft FWCA Report, states that only the 9,000 ft^2 involves first time dredging. This is contradictory to phone conversations as discussed above. Also, the Service maintains that since the areas to be widened would be "new" impacts, they would require mitigation. As discussed in Appendix D, deep unvegetated or vegetated subtidal habitat is of high to medium value for the evaluation species (Dungeness crab and marine fishes). The mitigation planning goal for this habitat is Resource Category 3--no net loss of habitat value while minimizing loss of in-kind habitat value.

EXISTING BIOLOGICAL RESOURCES

A. Humboldt Harbor and Bay

1. Habitats

The most extensive habitat types in Humboldt Bay are subtidal and intertidal areas. Subtidal areas are not exposed even during the lowest low tide of the year. The subtidal benthic substrates of Humboldt Bay are dominated by several species of marine algae, including green algae (*Ulva* spp.), red algae (*Endocladia* spp.), nori (*Porphyra* spp.), kelp (*Alaria* spp.), and rockweed (*Fucus* spp.). Some subtidal areas may also be occupied by eelgrass (*Zostera marina*) beds (Barnhart *et al.* 1991, Shapiro and Associates, Inc. 1980).

Much of the Bay area also includes intertidal mudflats (Figure 5). The largest intertidal mudflats are located in Arcata Bay (4,600 acres) and South Bay (2,600 acres), although the totals vary according to the extent of tidal inundation. Intertidal mudflats are composed of both high- and low-elevation areas. Low mudflats are characterized by an irregular surface configuration superimposed on a gradual contour and formed by small hummocks separated by shallow water depressions and small channels. Eelgrass and widgeon grass (*Ruppia maritima*) may grow in the water-filled depressions and along the transition zones between the mudflats and shallow water bays (Monroe *et al.* 1973). Low mudflats are in areas at or slightly below MLLW.

High mudflats extend from MLLW to an elevation of about +4 to +5 feet MLLW. Except for a seasonal mat of green algae (*Chaetomorpha aerea* and *Enteromorpha* spp. (Shapiro and Associates, Inc. 1980), the high mudflats are generally muddy and devoid of vegetation. Substrate textures range from silty clays to sands. Overall, intertidal mudflats are very productive in terms of the abundance and diversity of species that they support (USFWS 1989a). A complete list of marine plant species and habitat preference for Humboldt Bay was included in an earlier report (USFWS 1989b, Appendix B).

Eelgrass often forms dense stands on the mudflats below the +1 foot MLLW contour, while maximum biomass production generally occurs at -1 foot MLLW. The lower limit of eelgrass growth has not been clearly defined, but it has been identified as being somewhere below -1.5 feet MLLW (Shapiro and Associates, Inc. 1980). A recent survey (WESCO 1990) found that the greatest densities of eelgrass in South Humboldt Bay typically occurred at depths of less than -12 feet MLLW. Most of the Bay's mudflats are covered by eelgrass. Although eelgrass forms a monotypic community, it also supports a wide variety of epiphytic algae (Shapiro and Associates, Inc. 1980), thus its community structure may be more complex. This plant community is one of the most productive in Humboldt Bay.

About 1,942 acres of eelgrass beds occur in South Bay and 1,075 acres occur in North Bay (Harding and Butler 1979). Eelgrass accounts for about 20 percent of the total areal extent of the intertidal habitat of the Bay. Phillips (1984) recognized Humboldt Bay as having one of the three largest stands of

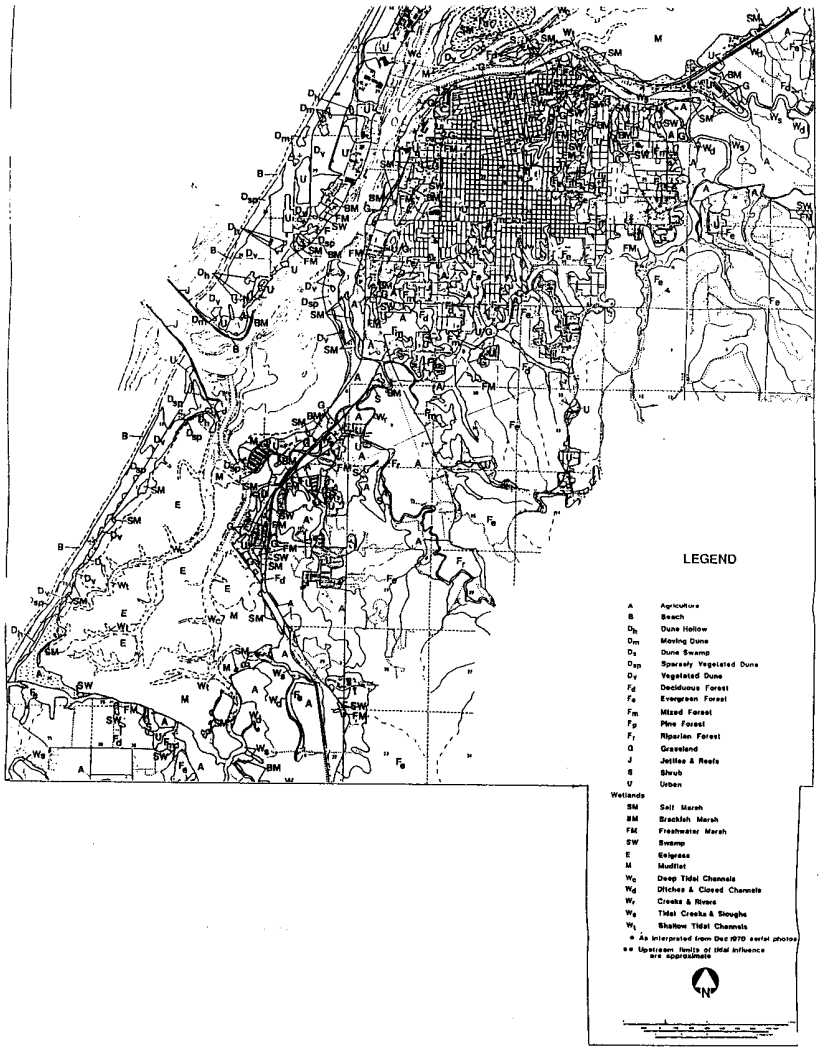

Figure 5. Habitat types within Humboldt Harbor and Bay (Source: Shapiro and Associates, Inc. 1980).

eelgrass in the Pacific northwest region. Eelgrass exerts an important influence on the sedimentary regime, distribution of infaunal organisms, and occurrence and density of fish and birds.

Arcata Bay eelgrass beds contribute significantly to the overall primary productivity of the Bay. Eelgrass beds in Arcata Bay are not as dense as those of South Bay; the scattered growth of eelgrass along the Entrance Bay and Arcata Bay Channels suggests that it is less significant in the energy budgets of those portions of the Bay (Barnhart *et al.* 1991). Eelgrass also grows along many of the channels that are routinely dredged.

Eelgrass habitat supports an extremely diverse and complex food web based on primary production by eelgrass, numerous epiphytic organisms associated with eelgrass, and the detritus generated by eelgrass and its epiphytes. Eelgrass is grazed upon by waterfowl including black brant (*Branta bernicla nigricans*), widgeon (*Anas americana*), scaup (*Athya* spp.), and mallard (*Anas platyrhynchos*). Small crustaceans such as amphipods, isopods and other invertebrates also utilize eelgrass as a food source. Eelgrass also provides a substrate for many types of diatoms and epiphytic macroalgae which are consumed by zooplankton, small crustaceans, and small gastropods. Larger crustaceans, such as shrimp, feed on the smaller organisms, and all are preyed upon by waterbirds, crabs and small fish, including juvenile salmon and herring.

Detritus from eelgrass beds supports a food web which may be even more diverse than that supported by the standing crop. Detritus remains in the eelgrass beds, or is transported by tidal action to other nearby habitats, thereby becoming a major food source for a wide variety of benthic invertebrates including molluscs and crustaceans. Detritavores are in turn fed upon by shorebirds, waterfowl, and fish. Many molluscs, crustaceans, and fish of sport and commercial importance utilize eelgrass beds as nursery grounds (Shapiro and Associates, Inc. 1980).

Eelgrass also produces nutrients and oxygen required for the Bay's fauna. Eelgrass is rooted in sediments, and takes up nutrients through root hairs. The anaerobic sediments surrounding the roots are composed of micro-organisms that can fix atmospheric nitrogen, thereby creating a ready nitrogen supply for the eelgrass, and a fairly stable source of nitrogen compounds for herbivores (Shapiro and Associates, Inc. 1980).

Salt marsh habitats are also found around Humboldt Bay, and are generally dominated by one of three plant species: pickleweed (*Salicornia virginica*), cordgrass (*Spartina alterniflora*), and salt grass (*Distichlis spicata*). However, nearly 90 percent of the original salt marsh in the Humboldt Bay area has been either diked or filled, leaving a current total of 971 acres. The remaining wetland plant communities around the Bay include 250 acres of brackish marsh, 274 acres of freshwater marsh, and 170 acres of riparian freshwater swamp (Barnhart *et al.* 1991). The Indian Island marsh in the vicinity of the proposed project supports the largest remaining tract of salt marsh in the Bay.

Deep subtidal dredged channels are generally characterized by a lack of plant cover due to depth, light attenuation, and higher turbidities associated with runoff and maintenance dredging activities. However, there are a few species of algae which may become established in the channels in periods between dredging activities (Shapiro and Associates, Inc. 1980). Eelgrass may also be present on the edges or upper slopes of dredged channels.

The water surface and water column areas throughout the Bay, throughout both the subtidal and intertidal areas, are important to a wide array of waterfowl, seabirds, macroinvertebrates, plankton, and fish. Please note, however, that of about 15,470 acres of tidelands and channels in Humboldt Bay, only about 500 acres are managed specifically for fish and wildlife purposes (K. Foerster, pers. comm.).

2. Invertebrates

A diverse assemblage of invertebrate species inhabits the different marine environments of Humboldt Bay. Boyd *et al.* (1975) enumerated 141 species from 65 stations in Entrance Bay, North Bay, Samoa, and Eureka Channels. Excluding the Entrance Bay, Bott and Diebal (1982) collected 188 species at stations in the same area. Three major invertebrate groups dominate the Humboldt Bay invertebrate fauna: polychaete worms, bivalve molluscs, and crustaceans. These three groups account for 90 percent of the species present (Bott and Diebal 1982; Boyd *et al.* 1975). Polychaetes (*Glycinde* sp., *Ophelia* sp.) were found to be most numerous, accounting for 50 percent of species collected, with molluscs (*Tellina* spp.) and crustaceans (*Crangon* sp., *Diastylis* sp.) comprising another 20 percent each of species collected (Barnhart *et al.* 1991). The remaining groups of invertebrates are of lower relative importance because of their scarcity, extremely small size, or their infrequent occurrence in Humboldt Bay. A complete list of invertebrate species and habitat preference for Humboldt Bay was included in an earlier report (USFWS 1989b, Appendix D).

Copepods and other small crustaceans represent the largest biomass in marine food webs, and comprise the bulk of the zooplankton that commercially and recreationally important fish species of Humboldt Bay utilize for food (Shapiro and Associates, Inc. 1980).

Several invertebrate groups in Humboldt Bay are particularly significant because of their importance to the local economy. Dungeness crab (*Cancer magister*) juveniles, egg-brooding females, and mating pairs occur within the nearshore zone of ocean waters adjacent to Humboldt Bay (Toole 1989) (Figure 6). The Bay itself is a nursery ground for at least three commercially or recreationally important crab species: Dungeness crab, red crab (*Cancer productus*), and rock crab (*Cancer antennarius*) (Monroe *et al.* 1973) (Figure 7). The rock crab and red crab are the basis of a small commercial fishery, and the Dungeness crab is the basis of a large fishery in nearshore waters (Barnhart *et al.* 1991).

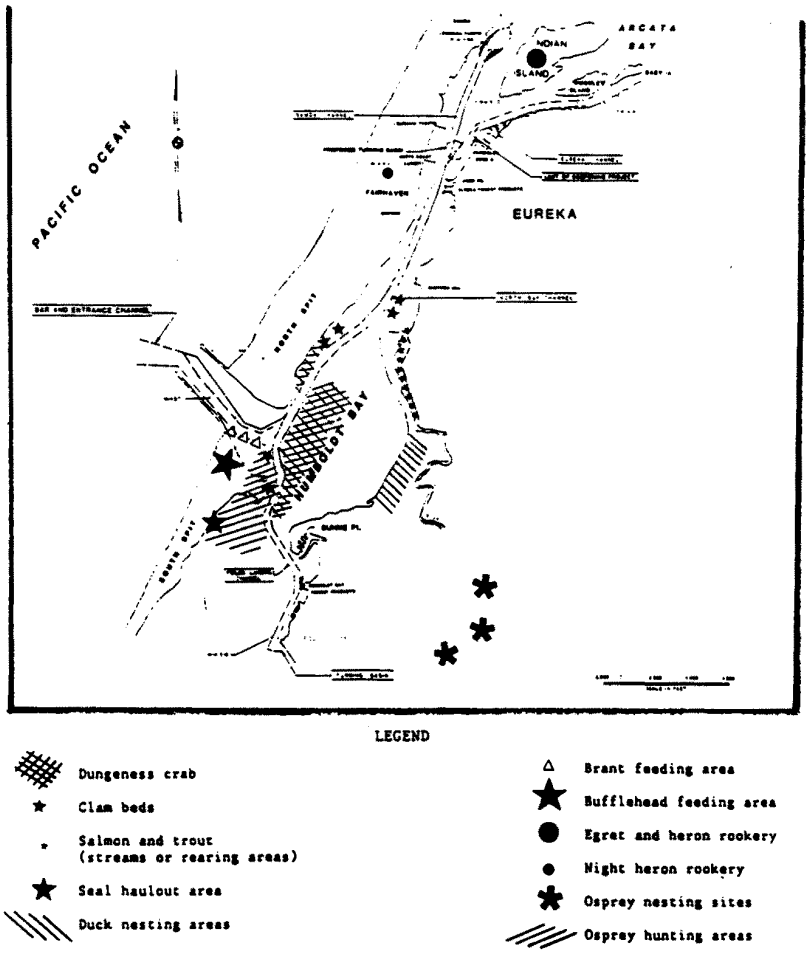

Figure 6. Species of special concern within Humboldt Harbor and Bay (Sources: R. Walder, pers. comm.; H. Pierce, pers. comm.; R. Warner, pers. comm.; Shapiro and Associates, Inc. 1980).

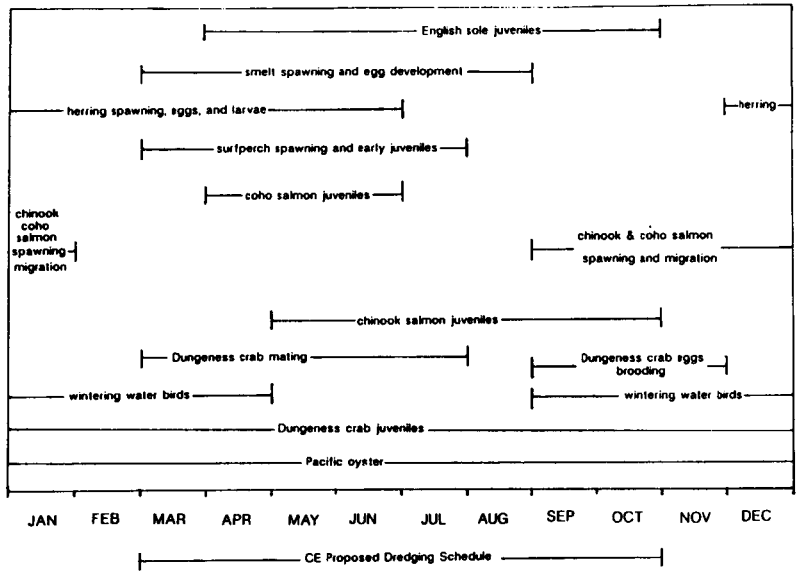

Figure 7. Summary of critical life stages of important fish and wildlife species using the Humboldt Bay estuary (Source: Toole 1989).

Intertidal eelgrass beds provide cover and feeding areas for juvenile crabs. As they mature, the young move to the deeper waters of the channels and eventually to the ocean. Many young red and rock crabs remain and mature on the tidal flats where they prey upon oysters and other organisms of the Bay. Several species of Bay shrimp (*Crangon* spp.) are also commonly found in Humboldt Bay (Monroe *et al.* 1973).

Extensive clam beds, which are harvested recreationally, exist throughout most of the intertidal mudflat and subtidal zones in the Bay (Shapiro and Associates, Inc. 1980) (Figure 6). The most commonly taken species of clams are gapers (*Tresus* spp.), Washingtons (*Saxidomus* spp.), littlenecks (*Protothaca* spp.), and cockles (*Clinocardium nuttalli*).

Native oysters (*Ostrea lurida*) are also taken in Arcata Bay; they are most abundant in the Arcata Channel, north of Woodley Island, however, they are too small to be of commercial importance (Shapiro and Associates, Inc. 1980). The introduced Pacific oyster (*Crassostrea gigas*) is also cultured in Arcata Bay. (Barnhart *et al.* 1991)

Boyd *et al.* (1975 *in* Shapiro and Associates, Inc. 1980) found that the Eureka-Samoa assemblage was characterized by several species of polychaetes, bivalve molluscs, and a cumacean. These species occurred in shallow water associated with relatively high silt and clay sediments. The Arcata Bay channel assemblage contained polychaetes, molluscs, and a caprellid amphipod. These species were found in deeper waters and were associated with sediments containing more than 50 percent sand. The largest number of organisms per sample was found within the Arcata Bay Channel areas, while the Entrance Bay assemblage had relatively few invertebrate species and low numbers of organisms per sample. Several polychaete and mollusc species characterized the fauna in the Entrance Bay area.

Boyd *et al.* (1975 *in* Shapiro and Associates, Inc. 1980) also determined that there was a relationship between the location and number of benthic invertebrates and the main channels. Samples on the west side of the channels showed the greatest diversity; samples in the main channels had the next highest diversity; and samples collected along the east side of the channels had the lowest diversity. This pattern was believed to be related to sediment transport mechanisms functioning along the channels. Areas to the west of the channels were slowly aggrading while areas next to the channels on the east sides were gradually eroding. The channel bottom stations were not much different from those in the western channel flank. Less diversity in the eastern channel flanks indicate that erosional processes have been instrumental in restricting the establishment of diverse communities along these eastern flanks. The coarse sediments indicated that a dynamic bottom environment can be colonized by only a few species (Shapiro and Associates, Inc. 1980).

Most invertebrates occur in the top 6 inches of bottom sediments; about 97 percent are found in the upper 2 inches (Humboldt Bay Working Group 1984). Higher invertebrate densities and diversity are found in finer grained sediments of the deeper channels. In many locations, however, even benthic

infauna are sparse, due to high velocity tidal currents and coarser sediments (Shapiro and Associates, Inc. 1980).

3. **Fish**

Numerous fish species occur in and around the project area. Some spend their whole lives within the confines of the Bay estuary, others migrate out of the Bay as juveniles or after they develop into adults, and others only visit the Bay to feed (USACE 1989). At high tide, numerous fish range across the extensive shallow waters to forage, retreating to deeper channels and pools, or the ocean, at low tide. Of the 110 species (Barnhart *et al.* 1991) of fish found in Humboldt Bay, about 50 have been consistently reported in sample collections. Among the most abundant species taken or observed are redtail surfperch (*Amphisticus rhodoterus*), shiner surfperch (*Cymatogaster aggregata*), English sole (*Parophrys yetulus*), Pacific herring (*Clupea harengus*), northern anchovy (*Engraulus mordax*), smelt (*Spirinchus* sp.), and sculpin (*Cottus* sp.) (Shapiro and Associates, Inc. 1980). Rockfish (*Sebastes* spp.), tomcod (*Microgadus proximus*), greenling (*Hexagrammos* sp.), and leopard shark (*Triakis semifasciata*), are also common. A list of fish abundance, life history, habitat use, and season of occurrence in Humboldt Bay has been provided in our earlier report (USFWS 1989b, Appendix B).

Many important commercial and sport fish species use the Humboldt Bay estuary as a spawning and/or nursery area (Shapiro and Associates, Inc. 1980; Barnhart *et al.* 1991), or use the Bay during some part of their life cycle (Figure 7). The anadromous fish of Humboldt Bay include chinook salmon (*Oncorhyncus tshawytscha*), coho salmon (*Oncorhynchus kisutch*), steelhead trout (*Oncorhynchus mykiss*), and coastal cutthroat trout (*Oncorhynchus clarki*). Humboldt Bay provides nursery areas for all of these species, with the possible exception of cutthroat trout, before they enter the open ocean. Jacoby and Freshwater Creeks in Arcata Bay, Elk River in Entrance Bay, and Salmon Creek in South Bay are the most important tributary streams. Probably the most significant salmon and steelhead spawning tributary of Humboldt Bay is Elk River (Figure 6) (Monroe *et al.* 1973). During 1971-75, recreational salmon anglers fished an average of 40,000 days annually out of Humboldt Bay with a catch averaging 10,000 chinook salmon per year. In 1985 anglers took 26,000 chinook salmon. For the 1981-85 period, Eureka commercial fishermen landed an annual average of 441,000 pounds of salmon worth nearly $1 million (Barnhart *et al.* 1991).

Pacific herring, which spawn in Humboldt Bay, dominate commercial landings in the Bay. Adult herring enter the Bay and spawn from December to March. Herring juveniles have been collected in the Bay during spring, summer and fall, and herring constitute an important forage species for birds and larger fish.

Schools of sub-adult and adult northern anchovy migrate into Humboldt Bay in spring and summer to feed. These fish are important food for other fish and birds and, during some years, attract salmon into the Bay.

The English sole, a commercially important flatfish, uses Humboldt Bay extensively as a rearing area. It spawns offshore and the pelagic larvae are washed into the Bay by currents.

Other fish species known to spawn in Humboldt Bay or its tributaries include longfin smelt (*Spirinchus thaleichthyes*), night smelt (*Spirinchus starksi*), surf smelt (*Hypomesus pretiosus*), jacksmelt (*Atherinopsis californiensis*), bay goby (*Lepidogobius lepidus*), greenling, and redtail surfperch.

4. **Birds**

Humboldt Bay is a major wintering area for well over 100 species of migratory water birds (Harris 1966), in addition to a variety of resident birds. A total of 251 bird species have been reported for the Humboldt Bay region (Barnhart *et al.* 1991). Bird species associated with habitats most likely to be affected by the proposed project are listed in Appendix B. Counts of 124,000 ducks have been recorded for Humboldt Bay (Barnhart *et al.* 1991); however, mid-winter counts usually range from 20,000 to 60,000 (Springer 1982). Twenty-two species of ducks commonly use the Bay. The American wigeon is the most abundant duck during the fall with scaup, scoter (*Melanitta* spp.), pintail (*Anas acuta*), canvasback (*Aythya valisineria*), redhead (*Aythya americana*), mallard, teal (*Anas* sp.), and bufflehead (*Bucephala albeola*) also present during this period (Shapiro and Associates, Inc. 1980). Ducks utilize open water areas of the Bay, and mudflat and eelgrass areas when covered by water. Arcata Bay supports over 70 percent of the duck use while South Bay receives less than 30 percent. Only about 2 percent of the duck use occurs in the channel between the two Bays (Monroe *et al.* 1973).

Humboldt Bay is not considered a major waterfowl breeding ground, however, a substantial number of birds are produced. Nesting activity occurs mainly on the agricultural lands and associated freshwater marshes and sloughs adjacent to the Bay (Humboldt Bay Working Group 1984). Mallard, gadwall (*Anas strepera*), and cinnamon teal (*Anas cyanoptera*) nest in the grassland and upland areas around the Bay where about 48,850 acres of suitable nesting habitat is available (Monroe *et al.* 1973). An estimated 1,000 ducks are produced in the vicinity of the Bay each year (USFWS 1988a).

A species of special concern to the Service in Humboldt Bay is the black brant, a marine goose. A major share of the entire Pacific Flyway brant population utilizes the Bay during fall migration (Monroe *et al.* 1973), where they pause to rest and feed. In late December, they return in large numbers and remain in the Bay until late April before flying north to breed. The preferred food of brant is eelgrass (80+ percent of the diet); their feeding areas roughly correspond with eelgrass beds in the Bay (Barnhart *et al.* 1991). Humboldt Bay eelgrass beds are the first major "refueling stop" for brant on their northward migration from Mexico. South Bay is the most important brant area, with over 90 percent of the use occurring there (Monroe 1973).

In September 1971, establishment of the Humboldt Bay National Wildlife Refuge was approved by the Migratory Bird Conservation Commission and the Director of the Bureau of Sport Fisheries and Wildlife (now the U.S. Fish and Wildlife

Service). The refuge was established primarily to preserve and enhance values associated with migratory waterbirds, particularly the brant. As authorized, it protects key wildlife habitat along the east side of Arcata Bay, Sand Island, Indian Island, and South Bay south and directly west of the Fields Landing Channel. As of June 1991, the Refuge encompassed about 2,108 acres within an approved boundary of 8,936 acres. Diked seasonal wetlands constitute the majority of the existing refuge in South Humboldt Bay. Less than 300 acres of tidal mudflats are currently managed as part of the Refuge (K. Foerster, pers. comm.).

At least 31 species of shorebirds use Humboldt Bay (Humboldt Bay Working Group 1984) and they are among the most numerous and visible group of bird species present. They feed extensively on invertebrates taken from beaches, sandflats, mudflats, pastures and occasionally in open water. None of the species in this group are known to breed in the project area (Shapiro and Associates, Inc. 1980). Common shorebird species using the Bay include the black-bellied plover (*Pluvialis squatarola*), American avocet (*Recurvirostra americana*), greater yellowlegs (*Tringa melanoleuca*), willet (*Catoptrophorus semipalmatus*), marbled godwit (*Limosa fedoa*), western sandpiper (*Calidris maure*), dunlin (*Calidris alpina*) and red-necked phalarope (*Phalaropus lobatus*). Bay mudflats are the most important shorebird habitat. Use of mudflats was evaluated by Gersterberg (1972 *in* Shapiro and Associates, Inc. 1980) and 29 of the 31 species he observed used this habitat type. Black-bellied plovers, western sandpipers, marbled godwits and willets were the most commonly observed species.

Wading birds common to the Humboldt Bay area include the great blue heron (*Ardea herodias*), great egret (*Casmerodius albus*), snowy egret (*Egretta thula*), and black-crowned night heron (*Nycticorax nycticorax*). Species utilizing the Bar and Entrance Channels and pelagic areas in the vicinity of the jetty include gulls (*Larus* spp.), common murre (*Uria aalge*), and pigeon guillemot (*Cepphus columba*). Many primarily terrestrial bird species use the upland and marsh habitats surrounding the Bay to feed and nest.

The Indian Island marsh is utilized by a variety of birds such as herons, egrets, willets, raptors, song sparrows (*Melospiza* spp.) and others. On the island's 50 acres of uplands, the diverse habitat attracts a large variety of birds. Over 45 species of land birds have been recorded on the island. One large and several small salt ponds are used regularly by such species as pied-billed grebes, mallards, greater scaup, and buffleheads. Mudflats around the island are used extensively by feeding and roosting shorebirds. A small grove of Monterey cypress and eucalyptus trees supports an egret and black-crowned night heron rookery which is the northernmost egret breeding colony along the Pacific coastline (USFWS 1988a) (Figure 6). This rookery is one of the largest and most productive in the state in terms of nesting birds, and the best known in northern California (USACE 1989).

Ospreys (*Pandion haliaetus*) are commonly seen in the King Salmon area near the Bay entrance (H. Pierce, pers. comm.). They are abundant in the Humboldt Bay area and nest along the Bay margin near Eureka, where three to four nest sites may be found. They feed close to the Bay and are also seen near fresh water along the Elk River, up to 4 miles inland.

5. **Terrestrial Mammals**

Of the terrestrial mammals known to inhabit the project area, those that are water-oriented include the river otter (*Lutra canadensis*), raccoon (*Procyon lotor*), weasel (*Mustela frenata*), and mink (*Mustela vison*) (Shapiro and Associates, Inc. 1980). The river otter is generally more at home in the fresh waters of tributary streams but is sometimes seen in the Bay and sloughs (USACE 1989). River otters are often seen on the east side of Woodley Island (J. Alderson, pers. comm.). Black-tailed deer (*Odocoileus hemionus*), raccoon, striped skunk (*Mephitis mephitus occidentalis*), and weasel may visit salt and brackish marshes, and the western harvest mouse (*Reithrodontomys megalotis longicaudus*) may live in brackish marsh areas. Deer forage in these areas (Shapiro and Associates, Inc. 1980) and have been seen swimming from Woodley Island to Indian Island to browse (J. Alderson, pers. comm.). A list of mammal species' status and habitats for Humboldt Bay has been provided in our earlier report (USFWS 1989b, Appendix G).

6. **Marine Mammals**

Marine species utilizing the open water areas of Humboldt Bay include the harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga angustirostris*), Steller sea lion (*Eumetopias jubatus*), Pacific harbor porpoise (*Phocoena phocoena*), and the gray whale (*Eschrichtius robustus*). The NMFS has responsibility for protection of these species. The harbor seal is the most common marine mammal of Humboldt Bay. Over 500 seals have been counted on a single day (Monroe *et al.* 1973). Peak numbers occur from February to August (USACE 1989). They haulout on mudflats exposed at low tide (Figure 6) to rest throughout the year, and give birth to young on these sites between March to June (R. Walder, pers. comm.). Harbor seals in Humboldt Bay feed on flatfish, surfperch, tomcod and greenling (Shapiro and Associates, Inc. 1980).

The California sea lion is commonly seen in the ocean and occasionally in the Bay or its tributary streams and sloughs (USACE 1989). Sea lions have been known to give birth on the north jetty near the Bar and Entrance Channel. Elephant seals are common in the channels of the Bay and have been seen near the Louisiana Pacific pulp mills. Steller sea lions prefer the pelagic environment, and are therefore not common in the bay (R. Walder, pers. comm.).

The harbor porpoise is the only porpoise which commonly utilizes the Bay, and is usually seen in deep water channels (USACE 1989). It is a regular visitor and the most common cetacean in the Bay (Monroe *et al.* 1973). Harbor porpoises have been seen at the mouth of the Bar and Entrance channel and just outside the channel, but not inside the Bay itself (R. Walder, pers. comm.). Several whale species have traditionally used waters offshore. During migration (December to February and March to April), small groups of migrating gray whales may be seen within a few hundred yards of shore in the vicinity of the Bay entrance. The gray whale has been recently de-listed as an endangered species.

7. **Endangered Species**

The Corps' Biological Assessment (BA) for the deepening project is found in their draft EIR/EIS (USACE 1994). Through the review of this BA and other correspondence from the Corps, the Service concurs with the Corps' determination that Section 7 consultation is not required for the project. Therefore, all threatened and endangered species discussions have been deleted from this final FWCA report.

B. Humboldt Open Ocean Disposal Site

1. **Habitats**

Phytoplankton common in the water column includes species of diatoms, silicoflagellates, coccolithophores, and dinoflagellates, all of which are fairly common within the California Current system. Predominant phytoplankton show seasonality in productivity and species composition. During spring/summer upwelling events, planktonic blooms occur, dominated by the diatom genera *Chaetoceros* and *Peridinium* are predominant (USFWS 1994).

2. **Invertebrates**

In studies done by Humboldt State University in August 1989 and March 1990, 55 species of macroinvertebrates were collected. Species identified include crustaceans (decapods, amphipods, isopods, mysids, euphausids), cnidarians, echinoderms, and polychaetes. Decapods, mainly the Dungeness crab, and three species of shrimp (*Crangon nigricauda*, *Crangon franciscorum*, and *Pandalus danae*) made up 47 percent of the species and 45 percent of the macroinvertebrates biomass in August 1989 (USACE 1993b).

3. **Fish**

Humboldt State University personnel trawled the offshore waters of Humboldt Harbor and Bay in August 1989 and March 1990. Species identified included English sole, Pacific sand sole (*Psettichthys melanostictus*), starry flounder (*Platichthys stellatus*), night smelt, and larval smelt. These were collected in trawls up to 131-feet-deep. White bait smelt were collected in trawls up to 160-feet-deep and Pacific sanddab (*Citharichthys sordidus*), rex sole (*Glyptocephalus zachirus*), slender sole, and dover sole (*Microstomus pacificus*) were collected in 130+ feet of water. Other fish found included speckled sanddab, Pacific tomcod (*Microgadus proximus*), butter sole (*Isopsetta isolepis*), petrale sole (*Eopsetta jordani*), surfperch, chinook salmon, coho salmon, and the warty poacher. There is a seasonal fluctuation in the diversity and numbers of fish due to the interplay of the current regimes, mostly occurring during the summer (USACE 1993b).

4. **Birds**

As mentioned earlier, the Pacific Flyway extends from Alaska to South America, and includes the Humboldt Bay area. Migrating waterfowl such as pintails, widgeon, brant, and diving ducks stop in the project area during fall and

winter. The western grebe (*Aechmophorus occidentalis*) and red-necked grebes (*Podiceps grisegena*), are associated with deeper water found offshore. At least 34 species of birds are know to frequent the ocean near Humboldt Bay: these include petrels (*Pterodroma* spp.), northern fulmar (*Fulmarus glacialis*), shearwaters (*Puffinus griseus* spp.), albatrosses (*Diomedea nigripes*), and jaegers (*Stercorarius* spp.), which tend to remain well offshore. Murres, guillemots, tufted puffins (*Fratercula cirrhata*), and rhinoceros auklets (*Cerorhinca monocerata*) are found closer inshore, such as along the ocean beaches and rocky headlands. Several species of gulls are also abundant (USACE 1993b).

5. **Mammals**

Marine mammals found in the Humboldt Harbor and Bay area include sea lions, seals, dolphins, porpoises, and whales. All are migratory, and local populations vary. The harbor seal and the Pacific harbor porpoise are common to the Bay, although their populations are small. The common dolphin (*Delphinus delphis*), Pacific bottlenose dolphin (*Tursiops gillii*), and gray whale are also found along the Humboldt coast (USACE 1993b).

C. Louisiana Pacific Upland Disposal Site

To our knowledge, no surveys have been conducted on resources specific to this site, therefore, the following discussions on habitats, invertebrates, birds, mammals and endangered species are based on assumptions made by the Service using 1) best professional biological judgement, and 2) various published documents pertaining specifically to the North Spit.

1. **Habitats**

A site visit on December 30, 1993, revealed the area is disturbed dune habitat consisting of graded, barren soil, except for about 2.6 acres (non-contiguous) containing various grasses, plants, and trees, which can be considered a scrub-shrub wetland area. Dredged material (i.e., from maintenance dredging of the Bay) is periodically dumped on the site; the dessication process occasionally results in water "ponding" on the site. The extent and duration of any ponding on this site varies from year-to-year, depending on amount of dredged material dumping, and rainfall. These ponded areas do not function as wetlands, however, due to their continually disturbed condition, and lack of true hydric soils and wetlands vegetation.

2. **Invertebrates**

The Service can only assume that various insects occur at the site. Any significant populations of invertebrates of value to feeding birds or other wildlife are highly unlikely, however, due to the site's continually disturbed condition.

3. **Birds**

The Louisiana Pacific upland disposal site has a triangular-shaped riparian wetland immediately north of the site, between it and the Samoa Bridge. During the December 30 site visit, snowy egrets (*Egretta thula*) were observed using another wetland marsh area to the southeast of this site, between the Samoa Bridge and Vance Avenue. When the Louisiana Pacific site contains water, egrets may use this area. Also, waterfowl may use the site, and hawks such as the northern harrier (*Circus cyaneus*), may use the area to forage for rodents. Birds such as gulls and rock doves may use the area for loafing. However, a local bird expert indicates that avian use of the site is very low, due to its degraded condition (C. Roberts, pers. comm.).

4. **Mammals**

Various small mammals such as ground squirrels, rats, mice, shrews, raccoons, skunks, and muskrat (*Ondatra zibethicus*) may use the site at different times of the year for forage and cover, depending on the quality of habitat available.

FUTURE CONDITIONS WITHOUT THE PROJECT

A. Humboldt Harbor and Bay

1. Habitats

Little or no change in vegetation is expected to occur in the project area, although suspended sediments from continued maintenance dredging of existing channels would cause temporary increases in turbidity, and reduce water column productivity (USACE 1973), as now.

2. Invertebrates

Invertebrates would continue to be affected by maintenance dredging. During each dredging episode, 75 percent or more of the benthic organisms are removed from the site (Allen *et al.* 1980). Sediments suspended by dredging would periodically smother some benthic communities and, if dredging takes place during a period of high water column, concentrations of invertebrate larvae, recruitment by some polychaete, amphipod, and shrimp species could be reduced. Dredging would also temporarily reduce oxygenation of the water column. The cumulative impacts of maintenance dredging over the long term would alter the distribution and abundance of benthic species and species assemblages (USACE 1972), as now.

3. Fish

The distribution and abundance of many fish species would also continue to be affected by maintenance dredging. Marine and anadromous species would tend to avoid areas of high turbidity or be periodically subjected to reduced water quality and prey abundance (USACE 1972), as now.

4. Birds

Bird use of the Humboldt Bay area would continue as now. Species utilizing terrestrial and adjacent wetland habitats would not be affected beyond present effects of maintenance dredging. Species using open water areas of the Bay in the vicinity of the existing navigation channels would be periodically affected by maintenance work, which would disrupt nesting and feeding by various diving and surface-feeding wildlife. Bird, fish, and invertebrate prey would continue to be held at lowered densities within the dredged channels.

5. Mammals

The present overall abundance and distribution of Bay area land mammals would continue to be unaffected by in-water activities. However, Harbor seals' movements, feeding, and haulouts may be temporarily altered by maintenance dredging work through noise and work activities, temporarily reduced water quality, and reduced prey abundance, as now. Other marine mammals are likely to be similarly affected by continued maintenance dredging, with overall abundances and distributions remaining as now.

B. Humboldt Open Ocean Disposal Site

The Corps and EPA are currently collecting data, selecting sites, and evaluating a permanent ocean dredged material disposal site. It is anticipated that the proposed HOODS will be considered as a candidate for permanent designation as an ocean dredged material disposal site for maintenance dredging (USACE 1993b) (and disposal from the deepening and widening project). Therefore, disposal would occur at the site even without the proposed deepening and widening project. A more detailed analysis on impacts from dredged material disposal at the site is given below in the "Future Conditions with the Project" section of this report.

1. **Habitats**

Phytoplankton in the water column would be subject to temporary losses of productivity due to turbidity caused by ocean disposal plumes (USFWS 1994).

2. **Invertebrates**

Temporary turbidity in the water column would continue to cause suspension-feeding zooplankton to expend resources processing fine sediments, resulting in lower growth and survival rates. Coarse and coagulated dredged material would fall quickly to the ocean floor, smothering benthic infauna and altering the substrate beneath the point of disposal, as now. Mobile organisms may be able to move from, or burrow through the new sediments. Recolonization of the new substrate would be expected, although species composition may be different. Finer sediments would continue settling in broader areas with less impact (USFWS 1994).

3. **Fish**

Benthic and pelagic fishes would continue moving from the area during dredged material disposal periods. The free-floating eggs and larvae of fish and other marine species may suffer decreased hatching success, and impaired larval development and feeding (USFWS 1994), as now.

4. **Birds**

Birds would likely be attracted to the area to feed on any floating residue from the dredged material dumping operations. The increased turbidity of the area may continue to decrease feeding opportunities for birds, as now, if overall productivity of the area is decreased (USFWS 1994).

5. **Mammals**

As now, marine mammals would likely avoid use of the area when the site is actually receiving dredged material (USFWS 1994).

C. Louisiana Pacific Upland Disposal Site

Soil from maintenance dredging is placed on the site (usually every 3-4 years) and soil is regularly removed as well, i.e., the area is continually "worked"

(J. Alderson, pers. comm.). Therefore, even without the deepening and widening project, dredged material disposal, and thus regular site disturbance, would still occur at this site. A more detailed analysis on impacts from dredged material disposal on the site is given below in the "Future Conditions with the Project" section of this report.

1. **Habitats**

Future disposal would regularly and temporarily impact the upland habitat as now, although a specific acreage number cannot be determined. No significant vegetation (beyond existing) is expected to develop on the dredged material site in the future.

2. **Invertebrates**

No impacts to invertebrates from the dredged material disposal are expected.

3. **Birds**

Avian species use of the area would likely continue to be very low to non-existent, as now.

4. **Mammals**

Whatever mammals exist on the site would continue to be temporarily impacted through indirect impacts from disturbance as now.

FUTURE CONDITIONS WITH THE PROJECT

This section presents the overall results of the Service's projections of with-the-project conditions for each potential impact area. The detailed results of our impact analysis for each site is given in the "Discussion" section under the "Evaluation of Project Impacts" and "Evaluation of Mitigation Needs" sub-headings.

A. Humboldt Harbor and Bay

1. Habitats

About 6.60 acres of subtidal habitat would be directly affected under this alternative through widening of the existing Samoa Turning Basin. About 38.78 acres in the Bar and Entrance Channel would also be affected by widening. About 581.30 acres of deep, subtidal habitat would be disturbed by deepening of the existing Bar and Entrance, North Bay, and Samoa Channels.

The Corps has reduced the aeral extent of the proposed dredging to avoid direct impacts to known areas of eelgrass beds. Nevertheless, secondary impacts related to the dredging may cause eelgrass losses.

Eelgrass vegetated areas are generally found in association with gradual sloping sand or sand/mud habitats. The depth distribution of the plant is dependent on several physical factors, including: (1) current velocity, (2) tidal range, (3) availability of substrate, (4) turbidity, and (5) light penetration. Widening the channels would affect each of these variables, and may cause some reduction in plant cover or growth. Of various possible impacts, dredging has been found to have the greatest impact on eelgrass communities (Phillips 1984). The plants are removed and the entire physical, biological, and chemical structure of the ecosystem changes.

Eelgrass grows in sediments varying from firm sand with moderate wave action to soft mud in quiet bays. Evidence suggests that higher current speeds enhance plant growth by breaking down diffusion gradients across the leaf surface and making more CO_2 and nutrients available to the plants, thus influencing biomass and production (Phillips 1984).

Loss of eelgrass habitat and associated fauna may occur in subtidal areas to be widened by dredging. Channel widening could result in a loss of eelgrass due to wave shock from larger vessels that tear leaves from the plant or erode the substrate. Also, eelgrass will not grow in areas where wave shock is regular (Ostenfeld 1908, Phillips 1974). Indirect loss of eelgrass could also result from a greater desiccation of the plants as a result of increased drainage of intertidal mudflats due to the presence of a larger turning basin. Survival of eelgrass relates directly to the degree of desiccation it undergoes (Phillips 1984).

The sediments found in the navigation channels appear to originate primarily from direct input from upland water runoff, biological activity, and inflow through the tidal inlet (Shapiro and Associates, Inc. 1980). These factors control sediment distribution, the growth of marine vegetation, and

invertebrate distribution. Silt and clay do not generally accumulate in the lower reaches of the tidal channels due to high current velocities. Finer material predominates near the upper reaches of the tidal channels since velocities are slow enough to allow finer material to settle out. In the transition zone, mixtures of fine and coarse sediments collect due to alternating tidal conditions. Waning tidal currents allow the silt and sand remaining in suspension to be deposited along channel borders. Currents follow the major channels; they are strongest in the channels and decrease the further they are from the Bay mouth.

Deepening the channels would change the low-tide holding capacity of the Bay, which would in turn influence circulation patterns and flushing characteristics. The velocity of the tidal wave moving up and down the channels would change at less than 20 percent of existing velocity (USACE 1992); however, these changes would have an impact on the biology and chemistry of the Bay. However, a complete understanding of circulation and flushing, the nutrient budget, and Bay productivity is needed in order to assess changes caused by channel deepening (Barnhart *et al.* 1991). Deepening of the channels may increase the water holding capacity and decrease flushing velocity (J. Pequegnat, pers. comm.). Deepening and widening of the channels may change the tidal patterns, (i.e., the timing of the high and low tides) (J. Gast, pers. comm.).

Dredging would suspend and redistribute bottom sediments, and much of this material would eventually resettle in the dredged channel. Redistribution of these sediments is a function of their settling rates and the transport mechanisms, such as coastal currents and reversing tidal currents, within the dredged channels (USFWS 1977). In addition, the deeper a channel is dredged, the faster it will accrue sediment (J. Gast, pers. comm.), thus requiring more frequent maintenance dredging. Sedimentation studies for Humboldt Harbor and Bay, however, have shown a decrease in shoaling and thus, a decrease in the annual maintenance dredging from the existing dredging of an estimated 686,000 cys of dredged material to an estimated 618,000 cys of dredged material (a decrease of 68,000 cys) (USACE 1994).

The angle of repose or slope of the channel side is a function of the combined effects of gravity flow of fluid sediments, slumping of compacted sediments, and later erosion and transport by waves and tidal currents. The bottom topography of a Bay or estuary changes when a dredge creates or deepens a channel at the dredge site. Such physical modifications can disrupt the existing hydrological regime. Tidal currents may be channeled into the dredged trenches, altering the usual transport patterns. The redistribution of sediments that may result from changing circulation patterns is not always predictable (USFWS 1977). Widening would at least initially change the slopes of the channels, and could thus affect adjacent benthic habitats (J. Pequegnat, pers. comm.).

Studies indicate that certain areas within Humboldt Bay are presently undergoing active erosion and accretion, some of which can be directly attributed to human modifications. For instance, the need for construction of jetties and dredging of the Bar and Entrance Channels have been ascribed to concentrated tidal currents that have resulted in the erosion of Buhne Point,

the accretion of Elk River Spit, and the erosion of Red Bluff next to the power plant in the King Salmon area (Barnhart *et al.* 1991). Deepening and widening the Entrance Channel may allow more wave energy to reach Entrance Bay, thus promoting additional erosion problems in the King Salmon area (Barnhart *et al.* 1991). Other areas undergoing active erosion are the salt marshes along the Bay margins and on Indian Island (Shapiro and Associates, Inc. 1980). Enlarging the Entrance Channel could cause excessive wave energy to erode the shores, which would be a chronic, rather than an episodic, impact (J. Gast, pers. comm.).

The proposed channel dredging would increase turbidity and siltation. The effects of increased turbidity and siltation include the smothering of benthic flora, a reduction in light penetration, and a corresponding reduction in biological productivity of an area (USFWS 1989b). Sediments resuspended by dredging can eventually bury plant and invertebrate communities away from the site, as well as drastically reduce plant density by affecting light penetration and plant growth. The reduction in seagrass density could result in an increased silt load, caused by a reduction in sediment trapping, and increased erosion of bottom sediments. In turbid waters, eelgrass populations are generally limited to depths of less than about 3 meters (10 feet). However, eelgrass has been observed down to 30 meters (98 feet) where the water is clear (Phillips 1984).

A study done in an Oregon estuary determined that the most important water quality parameter related to eelgrass is turbidity (Phillips 1984). Evidently, turbidity caused by dredging, sewage, oil, and plankton blooms can have major effects on eelgrass. If eelgrass declines enough, it is possible that increased erosion of bottom sediments could occur which would affect eelgrass recovery (Phillips 1984). Although the larger, heavier particles such as sand and clumps of mud settle rapidly out of suspension, the fine silts and clays remain suspended for longer periods and are transported from the dredge site by local currents (USFWS 1977). Unconsolidated fine sediments are also returned to the water with the overflow from hopper dredges. Increased sedimentation and turbidity depend upon the type of materials, since gravel and sands settle out quickly whereas silts may remain in suspension for up to several hours (USACE 1989). It is known that suspended sediments can reduce photosynthetic production (USACE 1973). The reduction of light may significantly affect the depth to which eelgrass and algae can exist, as well as reduce primary productivity throughout the water column (EPA and USFWS 1980).

In conclusion, while the Corps has reduced the scope of the project to avoid direct impacts to eelgrass, losses of this valuable habitat may nevertheless occur secondarily. Such losses cannot be specifically quantified at this time, although overall benthic/water column losses are qualified later herein.

2. <u>Invertebrates</u>

The expected adverse impacts to invertebrates in the Bay from proposed deepening and widening include: (1) destruction of benthic organisms of the channel bottom; (2) direct burial; (3) destruction of substrate; (4) increased

wave activity; (5) direct mortality or chronic toxicity due to resuspension of contaminants and (6) turbidity.

Destruction of benthic organisms when they are physically drawn up by dredging equipment is one of the most direct impacts of any dredging operation. During the initial channel construction and at each maintenance dredging, 75 percent or more of the benthic organisms may be removed from the site. Unfortunately, recolonization is usually by the more opportunistic and disturbance-tolerant species, which may be less important to fish and bird predators, and the pre-project diversity is seldom reached. This usually results in a long-term reduction in overall biological productivity.

"Community resilience may actually decrease with increasing diversity, especially after a relatively severe disturbance like dredging or disposal (Watt 1964, Dayton 1972, May 1973, Holling 1973, Goodman 1975). In fact...a positive correlation [was found] between community resilience, environmental stress, and decreasing community complexity (a qualitative measure of species-species interactions based upon many components of community structure). Hence, communities living in a highly stressed and variable physical environment (*e.g.*, shallow water offshore and the back harbor) were less complex and recovered more quickly from experimental disturbance than those in more benign and less variable areas (*e.g.*, deeper water and outer harbor)" (Oliver *et al.* 1977).

"That dredging disrupts the benthic habitat at the [dredging] site is obvious.... The long-term environmental concern is the repopulation of bottom areas where dredging or disposal has occured. In dredging areas, natural or established bottom communities are taken away, leaving a new substrate for colonization which may or may not resemble the original bottom sediments. In disposal, established bottom communities at the site will be blanketed with dredged material which may or may not resemble bottom sediments at the disposal site. Thus, there is a need for information on both benthic recovery and recolonization, and on the vertical migration abilities of benthic organisms in newly deposited sediments" (Hirsch *et. al.* 1978).

Hirsch *et al.* (1978) also noted that: 1) "All epifaunal (surface-dwelling) forms are generally killed if trapped under dredged material overburdens, while infauna (subsurface dwellers) migrated to varying degrees"; 2) "Generally, physical impacts are minimized when sand is placed on a sandy bottom and are maximized when mud is deposited over a sandy bottom"; and 3) "Smaller animals...are more susceptible to the effects of burial than are larger organisms."

"Dredging and disposal operations have immediate localized effects on the bottom life. The recovery of the affected sites occurs over periods of weeks, months, or years depending on the type of environment and the biology of the animals and plants affected. The more naturally variable the environment, the less effect dredging and disposal will have, because animals and plants common to the unstable areas are adapted to stressful conditions and have life cycles which allow them to withstand the stresses imposed by dredging and disposal." (Hirsch *et al.* 1978).

In addition, loss of suitable habitat and invertebrate diversity may also result due to changes in current speeds and configurations resulting from channel deepening and widening. Barnhart *et al.* (1991) noted that "species-rich" invertebrate assemblages in Humboldt Bay were found in areas of silt, gravel and biogenous material (80 percent or less sand) and "species-poor" assemblages were found in areas of clean sand (greater than 90 percent) associated with greater current speed. Benthic invertebrates are probably not able to recolonize channel bottoms in North Bay deeper than -38 feet MLLW, if fine bottom material gives way to underlying gravel and coarse sand; new material that becomes deposited in these channels could also be fine-grained. It is uncertain if this would also be the case in other parts of the Bay and its entrance. Predominantly sandy sediments, such as those found in the North Bay Channel, Bar and Entrance Channel, and Eureka Channel to some extent, support the lowest invertebrate species diversity. Diversity increases as sediments become more mixed as in the Samoa Channel, and the Eureka Channel to some extent.

A species-poor assemblage of invertebrates was found in 1974 and 1980 off the southwestern tip of Indian Island at the confluence of the Samoa and Eureka Channels. A similar area was found between the North Spit and the Elk River Spit where North Bay Channel is narrowly confined as it joins Entrance Bay. Both areas were identified as species-poor in 1974, and dredging activities in 1977-78 appear to have resulted in the expansion of this condition. The species-poor area between North Spit and Elk River Spit was significantly larger in 1980 than in 1974, and a similar area to the southwest of Indian Island had also increased in size following dredging (Barnhart *et al.* 1991).

The hydrology of the dredging sites is also important. A high degree of flushing rapidly dilutes and carries away the suspended solids, minimizing the physical and chemical effects on the benthic community. If, on the other hand, stagnant bottom conditions are created by dredging, greater changes in the benthic community can be expected. Oxygen depletion and release of growth stimulants or contaminants may have detrimental effects on the biota living in the immediate vicinity of the dredging site (USFWS 1977).

Construction-related activities would impact the water quality temporarily through the increase of sedimentation and turbidity in the immediate areas of dredging. Increased sedimentation and turbidity would be dependant upon the type of materials, since gravel and sands settle out relatively quickly, whereas silts may remain in suspension for up to several hours (USACE 1989). Siltation of adjacent habitats may interfere with the attachment by sessile invertebrates, or create soft bottom layers which are uninhabitable for many burrowing species (USACE 1973).

Certain life stages of several important commercial invertebrate species which utilize the Bay are particularly susceptible to bottom and water column impacts. Foremost among these are larval and juvenile Dungeness crab. Molting takes place from April-May. Mating of Dungeness crabs occurs from March-May. Fertilization of eggs occurs during October-November. Hatching takes place from late December- mid-January (CDFG 1983). Peddicord and McFarland (1976) found the Dungeness crab to be most vulnerable to increased turbidity during molting. Crab foraging patterns may also be altered or

curtailed by substrate changes and accompanying reductions in food availability. Displacement from spawning and rearing areas would also be detrimental and movement or migration along established routes by species such as the Dungeness crab may be interrupted by project activities.

Adverse impacts to invertebrates due to dredging-induced turbidity and increased sediment loads may also extend to clam reserves opposite the Bar and Entrance Channel found on the east shore of the Bay (USACE 1989). Depending upon currents and siltation patterns, clam density and distribution may be affected by smothering and substrate alterations.

In conclusion, some additional, incremental impacts to benthic and water column areas are inevitable if the project is implemented. We quantify such impacts and resultant mitigation needs later herein.

3. **Fish**

Adverse impacts to fish of the Bay could occur through (1) removing them from the channel during dredging operations; (2) direct losses of habitat; (3) creating high levels of suspended solids in the water column during deepening; and (4) increased contaminant loads.

Fish would be indirectly displaced from foraging areas in and around the dredge site during construction and maintenance dredging. The adverse impacts could be significant if work were to take place during those periods when aquatic organisms are in the process of building up fat reserves. Displacement from spawning and rearing areas would also be detrimental to fish and wildlife. Movement or migration along established routes by species such as the Pacific herring could be interrupted by project activities (USFWS 1989b). However, impacts to fish are mainly related to habitat disturbance since they are believed capable of avoiding construction activities. Fish eggs and larvae may be covered with silt and die, whereas the mobile species can leave the area (USACE 1989).

The destruction of benthic habitat and its benthos in the dredged area would reduce use of the channel by game and nongame fishes until habitat restoration and natural repopulation of organisms has taken place. The dredging site would probably be repopulated with some of the same fish species lost during project construction, however, this could take weeks, months, or years depending in the species of fish affected (Hirsch *et al.* 1978).

Any adverse impact on the eelgrass beds would adversely affect Pacific herring and other fishes, which depend on these areas for spawning substrate, feeding, and/or cover. In addition, fish not directly dependent on eelgrass would also be affected adversely by any decrease in nutrient inflow to the Bay system from these areas. The reduction in nutrient inflow would adversely affect the complex food web of the Bay (USFWS 1989b).

In addition to physical disturbance of the channel bottom, the proposed channel deepening and widening would temporarily increase turbidity and siltation. The direct effects of increased turbidity on fish include (1) inhibition of respiratory exchange through clogging of gills and abrasive

action on gill filaments; (2) elimination of spawning areas; (3) reduction of fish feeding ability; and (4) establishment of anaerobic conditions (USFWS 1989b). Suspended sediments can clog and damage the gills of many species of fish. Certain life stages of several important anadromous fish species which utilize the Bay are particularly susceptible to these conditions. Pacific herring eggs are also susceptible to increased turbidity through adherence and smothering by suspended material. Any long-term changes could reduce commercial fish landings, perhaps thereby adversely affecting the local economy. Also, because periodic maintenance will be required, the channel would be disturbed at regular intervals, preventing extensive use by fish.

In conclusion, the Service believes that the project would have an incremental detrimental impact on fishery resources. This impact is accounted for later herein via our benthic/water column analysis of impacts and mitigation needs.

4. **Birds**

Possible impacts to birds could occur through (1) indirect loss of habitat; (2) loss of eelgrass due to wave shock from larger vessels; (3) indirect loss of eelgrass resulting from greater desiccation of the plants as a result of increased drainage of intertidal mudflats due to the presence of a larger turning basin; (4) increased disturbance from greater noise, human disturbance, and wave action; (USFWS 1989b) and (5) possible detriments from contaminants.

Adverse impacts to birds from this alternative could include, as discussed above, the indirect changes in values of mudflats available for foraging shorebirds and wading birds. Also, any indirect adverse impacts on eelgrass beds would affect migratory waterfowl, especially the brant. However, many bird species besides the brant are intimately associated with the eelgrass community. For example, upon deposition of herring eggs and the hatching of fry, enormous swarms of birds including gulls, coots and scoters are attracted to eelgrass to feed on eggs and juvenile herring. Also, Canada geese, widgeon, scoters, canvasbacks and coots eat eelgrass vegetation. And pintails, mallards and green-winged teal (*Anas crecca*) feed on eelgrass seeds and invertebrates. Eelgrass does not grow in areas where wave shock is regular (Ostenfeld 1908, Phillips 1974). Impacts from wave shock may not be a problem, however, since tugboats turn the large deep draft vessels at low speed in the turning basins (C. Huval, pers. comm.). Birds not directly dependent on eelgrass could also be affected due to a reduction in nutrient inflow that would adversely affect the complex food web of the Bay.

Brant numbers and use-days have declined greatly for Humboldt Bay (Springer 1982). Early in this century, populations in the Bay likely exceeded 100,000 birds (Monroe *et al.* 1973). More recently, average spring brant use in the Bay has declined from 35,000-40,000 birds in 1960 to about 10,000-12,000 in 1987 (USFWS 1988a); for California as a whole, the decline has been even more precipitous--almost 99 percent since the 1940's (Phillips 1984). These declines may be attributable to disturbance from a variety of human activities, including industrial and commercial development. Maintaining the integrity of intertidal habitats and the eelgrass community, and reduction of human disturbances, is critical to sustaining present and future brant

populations. However, conditions have changed in recent years. The Refuge's survey data show peak brant populations at 24,710 (March 1992), 23,755 (March 1993), and 31,870 (March 1994). The localized increase in brant use is likely due to several factors including the elimination of a springtime brant hunt in the mid-1980's, a voluntary elimination of low-level flights by the U.S. Coast Guard helicopters during critical periods and an increased presence by Service Law Enforcement officers (K. Foerster, pers. comm.).

Potential disturbances to a black-crowned night heron and common egret rookery located west of, and in close proximity to, Samoa channel could occur due to the reduction of value of the subtidal and intertidal benthic communities located in the channels (USACE 1989). A small grove of Monterey cypress and eucalyptus on Indian Island is the site of this egret and heron rookery. Herons and egrets are easily disturbed by human activity during nesting (March to June), and nest abandonment due to such disturbances is well-documented. Breeding colonial waterbirds, including common egrets and black-crowned night herons, are especially susceptible to human disturbance due to their high-density nesting habits. Detrimental impacts may include egg and nesting mortality (Teal 1965, Schreiber 1979, Jeffrey 1987), premature fledging or nest evacuation (Veen 1977), and reduced body mass or slower nestling growth (Kurry and Gochfeld 1975, Pierce and Simons 1986). Human disturbance may also alter foraging patterns of adults (Skagen *et al.* 1991) and effect reproduction (Gillet *et al.* 1975, Tremblay and Ellison 1979, Cairns 1980, Safina and Burger 1983). Effects on reproduction may include disruption of occupation of colony sites (Conover and Miller 1978), subcolony prelaying abandonment (Safina and Burger 1983), or other adverse effects on pair-bond establishment and nest-site selection behavior (Rodgers and Smith 1994).

A study done by Rogers and Smith (1994), on set-back distances to protect nesting bird colonies from human disturbance in Florida, revealed the black-crowned night heron flushed from nests in response to a walking approach directly toward the nest, at a mean distance of 20-40 meters, indicating that it is sensitive to this type of disturbance. Although the common egret was not studied, the great egret was, and was found to be one of the more sensitive species when approached on foot or in a boat (Rodgers and Smith 1994). Since human disturbance can adversely affect wildlife, with colonial breeding birds being particularly susceptible, it is important to provide a buffer. Rodgers and Smith (1994) recommended a set-back distance of about 100 meters for wading birds. This distance may be reduced or increased per surveying and monitoring of the area. Responses and disturbance may vary with factors including habitat type, food supply, and bird species (Manuwal 1978, Ollason and Darnet 1980, Erwin 1989).

Larger boats and increased traffic may produce an expansion of land-based services and facilities resulting in increased disturbance to birds, greater pollution, and increased occurrence of oil and chemical spills into the harbor. A deeper, wider channel may also result in a change in current velocities, the creation of a "dead water" zone, and decreased circulation of waters, nutrients and oxygen (USFWS 1989b).

In conclusion, the Service finds that bird life of the Bay area would be incrementally and detrimentally impacted. We have considered this point in

our evaluation of benthic/water column impacts and mitigation needs, which follows later herein.

5. **Terrestrial Mammals**

Impacts to terrestrial mammals would be caused mainly by human noise and disturbance from construction activities.

6. **Marine Mammals**

This alternative could indirectly displace marine mammals from foraging in areas in and around the dredge site, due to the presence of project-related equipment and turbidity. The adverse impacts could be significant if work were to take place during those periods when organisms are in the process of building up fat reserves. Also, there is a remote possibility that movement or migration along established routes by species such as the gray whale may be interrupted by project activities (USFWS 1989b).

The widened channels and turning basins of Humboldt Bay would also induce human growth in the harbor area resulting in additional long-term adverse effects on marine dependent organisms. Increased traffic may produce an expansion of land-based services and facilities resulting in increased disturbances to marine wildlife such as the California sea lion, steller sea lion, harbor seal and harbor porpoise; these species could also be detrimentally affected by increased pollutants and toxicants, and increased occurrence of oil and chemical spills into the harbor. A deeper, wider channel may also result in a change in current velocities, the creation of a "dead water" zone, and decreased circulation of waters, nutrients and oxygen (USFWS 1989b).

These potential incremental impacts to marine mammals were a consideration in the development of our evaluation of benthic/water column impacts and mitigation needs which appear later herein.

B. Humboldt Open Ocean Disposal Site

1. **Habitats**

Under with-the-project conditions, phytoplankton in the water column would be subject to temporary losses of productivity due to turbidity caused by ocean disposal plumes (USFWS 1994). These impacts would be incrementally larger in magnitude than the future without-the project conditions.

"[H]abitat disruptions due to disposal are minimized at disposal sites which have a naturally unstable or shifting substrate due to wave or current action. At such sites the dredged material is rather quickly disposed, instead of covering the area to substantial depths. This natural dispersion, which usually occurs most rapidly and affectively during the stormy winter season, can be assisted by conducting the disposal operation so as to maximize the spread of dredged material, producing the thinnest possible layer of overburden. A general case in point is ocean disposal in offshore deep water areas. Such disposal operations deposit dredged material on quiet bottom

areas not subject to turbulent water movement, resulting in bottom coverage by dredged material which can be expected to remain in place for long periods of time. The thinner the layer of overburden, the easier it is for motile organisms to survive burial by vertical migration through dredged material" (Hirsch *et al.* 1978).

"Habitat disruption can be further minimized by matching the physical characteristics of the dredged material to the substrate found at the disposal site. The ability of fauna to migrate is heavily dependent on the physical nature of the dredged material overburden" (Hirsch *et al.* 1978).

2. Invertebrates

Temporary turbidity increases in the water column would cause suspension-feeding zooplankton to expend more resources processing fine sediments, resulting in lower growth and survival rates, which would be increased in magnitude compared to the without-the-project conditions. Also, more coarse and coagulated dredged material would fall quickly to the ocean floor, smothering more benthic infauna and altering the substrate beneath the point of disposal. Mobile organisms may be able to move from, or burrow through the increased new sediments. Recolonization of the new substrate would be expected, although species composition may be different. Fine sediments would settle in a broader area with less increase of incremental impacts (USFWS 1994).

"Since larval recruitment and lateral migration of adults are primary mechanisms of recolonization, recovery of physical impacts will generally be most rapid if disposal operations are completed shortly before the seasonal increase in biological activity or larval abundance in the area. Both this consideration and the desire to maximize dispersion by wave and current action would argue in many cases for winter or spring scheduling of dredging and disposal operations" (Hirsch *et al.* 1978).

3. Fish

Benthic and pelagic fishes would likely move from the area during disposal periods. The free-floating eggs and larvae of fish and other marine species may suffer decreased hatching success, and more impaired larval development and feeding (USFWS 1994). Some additional burial of bottom fish may occur during the disposal activity, but the passage of migrating pelagic fish through the HOODS would not be affected. Adult fish are mobile enough to avoid direct burial and smothering (USACE 1993b).

4. Birds

More birds would be attracted to the area to feed on any surface residues from the dredged sediment. However, the increased turbidity would incrementally decrease overall feeding opportunities for most birds. If overall biological productivity is also decreased, cumulative impacts would be even larger (USFWS 1994).

5. **Mammals**

Since marine mammals tend to avoid human activities, the potential for collisions between marine mammals and self-propelled hopper dredge vessels, and the direct disposal of material upon marine mammals at the HOODS would not be appreciably increased over existing conditions (USACE 1993b). Also, since marine mammals are so mobile, impacts on their feeding, due to turbidity increases, should not increase significantly.

C. Louisiana Pacific Upland Disposal Site

For future with-the-project conditions, there will be dock development. It is unknown if other private entities plan to dispose of dredged material here in the future. If so, this would reduce the design capacity of the site. This in turn would prohibit its use as an upland dredged material disposal site for the deepening and widening project is 26,000 cys of unsuitable-for-unconfined-aquatic-disposal material (USACE 1993d). Dredged material would be dried on-site, and return flow would go into the Bay via an outflow pump.

1. **Habitats**

The 26,000 cys would be disposed of on the site. No vegetation would be expected to grow on the site during the drying process.

2. **Invertebrates**

No impacts would be expected to invertebrates from the dredged material disposal are expected.

3. **Birds**

Only a slight, if any, increase in bird activity would be expected, perhaps due to species such as gulls being attracted to the dredged materials to feed on benthic organisms and organic residues.

4. **Mammals**

Mammals would be temporarily impacted through indirect impacts from disturbance, therefore, any mammal use would be temporarily diminished. However, this would not be a significant increase over the future without-the-project conditions.

CONTAMINANTS DISCUSSION

Bioassays and bioaccumulation testing for the Humboldt Harbor and Bay Deepening Project was done for the Corps by Environment Consultants (EVS); a final report was submitted to the Corps in February 1993. "The purpose of the study was to perform chemical characterization, suspended particulate phase, and solid phase bioassays and bioaccumulation tests of sediments to be dredged from Humboldt Harbor" (EVS 1993). Specifically, results from sites HB-8 and HB-9 (those sites containing contaminants), indicated that: 1) the sites had relatively uncontaminated chemical concentrations; 2) copper concentrations were more than twice as high at the HB-8 site than at the reference site; and 3) detectable quantities of dioxins and furans were found. It appears from the sampling that was done, however, that dioxins are of the most concern at the sample sites, therefore, this is what the Service focused on in their analysis of the EVS report.

In particular, sample site HB-8 (Figure 8) is located at the west side of the Samoa channel turning basin that is proposed to be widened. At this site, a specific type of tetrachlorodibenzodioxin (TCDD) called 2,3,7,8 TCDD was found in the sediments. Although several different types of dioxins were tested for, this dioxin is the one the Service is most concerned about as it is the most toxic.

The 2,3,7,8 TCDD was found in concentrations of 0.3 picograms per gram (pg/g) in the HB-8 site's sediments; the detection limit is 0.2. According to the EPA (1993), low-risk sediment concentrations for TCDD in general are: 1) fish: 60.0 pg/g; 2) piscivorous mammals: 2.5 pg/g; and 3) piscivorous birds: 6.0 pg/g. High-risk sediment concentrations are: 1) fish: 100.0 pg/g; 2) piscivorous mammals: 25.0 pg/g; and 3) piscivorous birds: 210.0 pg/g. Completely piscivorous wildlife are at the greatest potential risk to dioxin exposure in aquatic ecosystems (EPA 1993). However, since 2,3,7,8 TCDD was found at concentrations at the HB-8 site that were approximately ten-fold below the level that presents low-risk to the most sensitive species of wildlife, its risks to fish and wildlife are expected to be relatively low.

Because 1) the contaminated dredged material would be disposed of on a very limited area, 2) it would be disposed of in a relatively small quantity (26,000 cys), and 3) there are no known piscivorous mammal or bird species of special concern at either proposed upland disposal site, it does not appear the material would have any detrimental impacts to wildlife in the project area. The material, however, should be capped with "clean" (non-contaminated) fill material to avoid direct exposure to wildlife as discussed in our recommendations.

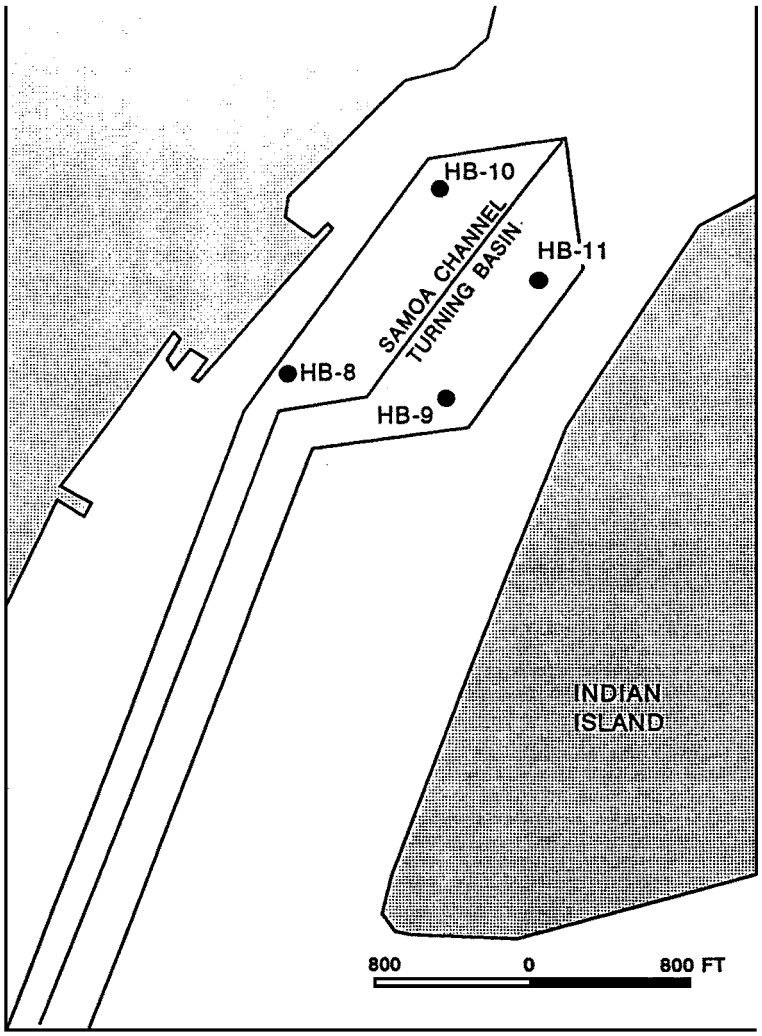

Figure 8. Somoa Channel Turning Basin sediment sampling locations (Source: EVS 1993).

RESULTS AND DISCUSSION

A. Habitat Evaluation Procedures (HEP)

Habitat Evaluation Procedure (HEP) is a methodology developed by the Service and other resource and water development agencies for documenting the quality and quantity of available habitat for selected fish and wildlife species. HEP and its uses are described in detail in the attached Appendix C.

The fish and wildlife impact evaluations for the project were conducted using a combination of HEP (on areas for which existing Habitat Suitability Index (HSI) models were applicable), and a HEP-like habitat-based assessment using word models initially developed for the Oakland Harbor Navigation Project (USFWS 1994), and modified for the Humboldt Harbor and Bay Deepening Project. Hereinafter, however, all such impact evaluations for this project are referred to as "HEPs".

B. Description of the Fish and Wildlife Service's Mitigation Policy

The recommendations herein for mitigation and the protection of fish and wildlife resources conform with the Service's Mitigation Policy as published in the Federal Register (46:15 January 23, 1981). The Mitigation Policy provides Service personnel with guidance in making recommendations to protect, conserve, and enhance fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of valuable fish and wildlife resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife habitat values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife.

In applying the Mitigation Policy during an impact assessment, each specific habitat or cover-type which may be impacted by the project is identified. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category determination. Selection of evaluation species can be based on several rationales, including: (1) species known to be sensitive to specific land and water use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with important resource problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Service. Evaluation species used for Resource Category determinations may or may not be the same evaluation elements used in an application of the Service's Habitat Evaluation Procedures (HEP), if one is conducted. Finally, based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's

relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation goals range from "no loss of existing habitat value" (Resource Category 1) to "minimize loss of habitat value" (Resource Category 4). The goal for Resource Category 2 is "no net loss of in-kind habitat value"; to achieve this goal, any unavoidable losses of habitat value would need to be replaced in-kind. As defined in the Mitigation Policy, "in-kind replacement" means providing or managing substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost.

Under Pacific Region Fish and Wildlife Service guidance, we are also pursuing a goal of no net loss of wetland acreage, while seeking a net overall gain in the quality and quantity of wetlands through restoration, development and enhancement. Furthermore, the Service believes that wetlands compensation, which is the restoration or creation of wetlands to offset losses, should only be deemed acceptable when losses are determined to be unavoidable and compensation is known or believed to be technically feasible. Restoration of former or degraded wetlands is the preferred form of compensatory mitigation, followed by wetlands creation. These general goals regarding wetlands are used in the Service's analyses and recommendations relative to all proposed projects.

In recommending mitigation for adverse impacts to any of these habitats, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimizing, rectification measures, measures to reduce or eliminate impacts over time, and compensation measures.

C. General Methodology

The acreages of each cover-type present on the upland impact site were planimetered from 1:2,400 color aerial photographs. Acreages for the HOODS and proposed dredged areas were obtained from the Corps and by planimetering from a 1:24,000 navigation map.

Copies of the various HSI models for the upland disposal site HEPs are included in Appendix C-1. These models were chosen because they were readily available, their variables included characteristics of the cover-types that would change with the project, and their relative simplicity facilitated completing the HEPs in the short time available. These models were designed as planning tools, however, and as such are not exhaustive syntheses of everything that can possibly affect each species.

The HSI models did meet certain usability constraints as follows:

1) They were based on habitat variables that can be determined for existing conditions and reasonably predicted for future conditions, both with- and without-the-project; such criteria are needed both for impact assessment and the development of mitigation recommendations.

2) They were simple enough to allow adequate time for users to implement them in the HEP, and make appropriate conclusions and recommendations.

3) They could be applied at any time of the year (i.e., existing data should be available to assess the model variables if field sampling is not possible).

D. Evaluation of Project Impacts and Mitigation Needs

This section contains the following discussions: 1) habitats, evaluation species, and mitigation goals; 2) evaluation of project impacts; 3) evaluation of mitigation needs; and 4) potential mitigation sites, options, and costs for the Humboldt Harbor and Bay area, Humboldt Open Ocean Disposal Site, and Louisiana Pacific Upland Disposal Site. In each of the HEP analyses, estimates of acreages needed for mitigation are given. These are based on the designs of the project, including the various dredged material disposal alternatives, as presently stated by the Corps. In some instances, these designs may not have yet incorporated all of the more desirable forms of mitigation (i.e., *avoidance, minimization, reduction, and/or rectifying impacts*), before *replacement mitigation* was considered. Therefore, the Service's statement of certain *replacement mitigation* needs should not be construed as our acknowledgement that all other more desirable forms of mitigation have been fully exhausted by the Corps.

a. Humboldt Harbor and Bay

1. <u>Habitats, Evaluation Species, and Mitigation Goals</u>

In the Service's preliminary draft FWCA Report for the project (USFWS 1991) three basic cover-types were recognized: 1) deep unvegetated or vegetated subtidal (> 20 feet MLLW); 2) shallow unvegetated or vegetated subtidal (0 to 20 feet MLLW); and 3) unvegetated or vegetated intertidal (< 0 feet MLLW). Most of the vegetation present is eelgrass. Eelgrass may occur in both the intertidal and shallow subtidal zone, however, greatest abundance is expected in the shallow subtidal areas due to dredging of the deeper areas. The exact distribution of eelgrass is not known, thus, we opted to define the cover-types using the above depth criteria.

The deep unvegetated or vegetated subtidal habitat of Humboldt Bay is of high to medium value for the evaluation species and is relatively abundant in the region. The evaluation species selected to determine the value of this habitat type are the Dungeness crab and marine fishes (principally bottomfish). These species have been selected because of their high values to commercial and sport fishing interests.

Shallow unvegetated or vegetated subtidal habitats in Humboldt Bay are of high value for the evaluation species. Eelgrass beds are scarce or becoming scarce thoughout the Pacific Northwest and California. Humboldt Bay supports one of three significant beds of eelgrass in California. Much of their historic decline can be attributed to navigation and harbor projects, and pollution. The evaluation species selected to determine the value of the eelgrass beds

are the black brant, and marine fishes that depend on these areas to complete their life cycle, such as the Pacific herring. The black brant was selected because it is a species of special concern to the Service. Marine fishes were selected because of their importance to the commercial and sport fisheries.

The unvegetated or vegetated intertidal mudflats in Humboldt Bay are also of high value for the evaluation species. The evaluation species selected to determine the value of the intertidal mudflats are the numerous migratory shorebirds that use the area. Migratory shorebirds were selected to determine the value of this habitat because of their protection under the Migratory Bird Treaty Act, importance for non-consumptive human uses (e.g., photography and birdwatching), and value as general biological indicator species.

Based on the preceding considerations, our mitigation planning goals for the three cover-types are: (1) deep unvegetated or vegetated subtidal habitat--no net loss of habitat value, while minimizing loss of in-kind habitat value (Resource Category 3); (2) shallow unvegetated or vegetated subtidal--no net loss of in-kind habitat value (Resource Category 2); and (3) unvegetated or vegetated intertidal--no net loss of in-kind habitat value (Resource Category 2).

For the HEP analysis, however, a somewhat simpler cover-type designation scheme was needed. Thus, the three cover-types were lumped into two broad categories to which project impacts would be expected: water column, and subtidal benthic areas (see Appendix D).

2. <u>Evaluation of Project Impacts</u>

Selection of Alternative 1 presently being proposed by the Corps would result in 1) a temporary direct impact on about 581.4 acres of deep subtidal benthic habitat due to deepening of the existing channels; 2) a temporary direct impact on an additional 45.32 acres of deep subtidal benthic habitat in new areas to be widened (Bar and Entrance, Middle Ground; east and west side of Samoa Turning Basin); 3) indirect loss of about 474.3 acres of shallow subtidal habitat in adjacent areas (harbor and bay), which includes waters up to 600 feet from the edge of the dredging project; and 4) an indirect impact on about 44.0 acres of intertidal habitat in adjacent areas (Appendix D).

As mentioned above, these habitat acres were categorized into two broad cover-types for the HEP (Appendix D): 1) water column, and 2) subtidal benthic. For these two cover-types combined, the HEP showed impacts (*i.e.*, losses of habitat value) to 43.46 AAHUs for Alternative 1. This assumes a 50-year project life, and numerous assumptions contained in the HEP for the site (see Appendix D).

Thus, the selection of any of the dredging alternatives would result in direct habitat losses that would not be avoided or minimized. Most of the direct habitat loss (581 acres for either option) would be deep channel bottoms and slopes already subjected to regular disturbance from maintenance dredging. However, an additional 45.1 acres of deep subtidal area (generally greater than -25 feet MLLW) would be converted to deeper water habitat having more

dynamic (due to future maintenance dredging) and texturally altered substrate characteristics.

Harbor areas, in general, are characterized by high industrial activity and low current velocities. This results in settling out of fine particulates, which are often contaminated, in the channels. Several reviews and specific studies conclude that the dredging action and hydrodynamics of the channels themselves adversely impact benthic and water column habitat, yet it is difficult to accurately predict the magnitude of impacts.

Surveys cited by DiSalvo (1977) and the Service (USFWS 1970, Morton 1977) suggest that benthic invertebrate abundance and diversity is diminished 50 percent or more in ship channels compared to adjacent, undredged areas. These reduced values are presumed to reflect both the direct losses due to maintenance dredging, and any indirect reduction resulting from diminished water and sediment quality. Notably, the recovery of benthic communities after dredging has ceased varies considerably, from 2 weeks to 11 months or more. In summary, although the resource quality of the benthic and open water habitats in the project area may be considered less than pristine due to prior dredging and harbor activities, they would nevertheless be significantly and adversely impacted by this project and its maintenance dredging.

This initial HEP analysis of impacts of the proposed project on water column and subtidal benthic cover-types within Humboldt Harbor may still require further adjustments and refinements. However, the SIs (Suitability Indices) upon which the results are based were selected based on our best professional judgement and our understanding of the mechanisms and severity of disturbance which occurs in many similar dredging projects. To the extent that our assumptions are later confirmed as reasonable, the results support the conclusion that harbor dredging impacts, though individually small and difficult to quantify, constitute a significant cumulative impact when considered in combination with all other dredging conducted in the Bay. Furthermore, there is a strong inference that mitigation is needed and justified for these cumulative impacts.

3. **Evaluation of Mitigation Needs**

As discussed in the HEP for the Humboldt Harbor and Bay (Appendix D), each acre of mitigation habitat would provide up to 1 AAHU of replacement habitat value. Thus, the Service recommends that the Corps provide not less than 43.46 acres of new "optimum" habitat area (one cover-type estimate) as mitigation for Alternative 1 for water column and subtidal benthic habitat impacts. As discussed later, this value could potentially be reduced by one-half, if two "optimum" cover-types are created as compensation.

Additional cumulative impacts from maintenance dredging two times a year (fall and spring), totalling about 700,000 cys, is estimated to occur over the life of the project. Separate mitigation would be needed to be done commensurate with this volume. We estimate at this time that about 9 acres/million cys would be needed for mitigation; therefore, we recommend that the Corps work in cooperation with all involved agencies to develop a mitigation scenario to offset overall, cumulative impacts to the Humboldt Harbor and Bay from

dredging, both maintenance dredging and presently proposed deepening and widening.

Several mitigation alternatives discussed by MEC Analytical Systems (1993), notably upland cut, in-bay terrace, and sediment remediation options, could be applied to offset in-Bay dredging impacts. These alternatives are discussed in detail in the following section on the HOODS impacts within the "Potential Mitigation Sites, Options, and Costs" section.

One point the Service would like to make is that although eelgrass surveys were done in certain areas, the entire Humboldt Harbor and Bay area was not surveyed for eelgrass. Even if eelgrass is not found in the areas to be deepened, eelgrass nearby may be indirectly impacted due to changes in turbidity, currents, and current velocities.

If it becomes necessary to mitigate potential losses of eelgrass habitat, replacement mitigation may not be a truly realistic option. Although transplantation and establishment of eelgrass has been accomplished with some degree of success elsewhere in North America (Phillips 1984), many attempts on the West Coast have failed for reasons not readily understood (*e.g.*, see Fredette *et al.* 1988 on San Francisco Bay). Furthermore, selection of candidate sites for eelgrass habitat creation for the present project would be difficult at best, since the plant is likely to already be growing wherever suitable site conditions exist, and the cost of creating suitable new conditions may be prohibitively high. Given these limitations, the best way to mitigate any impacts on eelgrass is to avoid them altogether.

Many of the indirect impacts on fish, wildlife, and their habitats, which have been discussed above, could be reduced or eliminated by careful timing of project construction. Figure 7 summarizes the more sensitive periods in the life histories of key Humboldt Bay species. Construction and maintenance dredging should be timed to avoid the periods of peak use, particularly by fish and invertebrates. Impacts to these species can best be minimized by restricting work to the late summer and early fall months (late August to early November).

4. **Potential Mitigation Sites, Options, and Costs**

The potential mitigation sites, options, and costs for the impacts to the Humboldt Harbor and Bay are discussed in detail in the following section on the HOODS because the same types of mitigation are recommended for impacts due to both the dredging of the Bay and disposal at the HOODS.

b. Humboldt Open Ocean Disposal Site

1. **Habitats, Evaluation Species, and Mitigation Goals**

We have also identified two cover-types that may be directly or indirectly affected by the proposed HOODS: 1) open surface waters; and 2) deep water benthos. The open surface water of the HOODS is of high to medium value for the evaluation species and is abundant in the region. The evaluation species selected to determine the value of this habitat type are waterbirds and

anadramous salmonids. Waterbirds were selected because of Service responsibilties under the Migratory Bird Treaty Act, and their relatively high value for non-consumptive use such as bird-watching. Anadramous salmonids were chosen because of their high commercial and sportfishing values.

Deep water benthos is of medium to low value for the evaluation species and is also abundant in the region. The evaluation species selected to determine the value of this cover-type are flatfishes, such as halibut and Dover sole, due to their commercial significance.

Based on the preceding considerations, our mitigation planning goals for these two habitats which would potentially be impacted by the project are: 1) open surface waters--no net loss of habitat value while minimizing the loss of in-kind habitat value (Resource Category 3); and 2) deep water benthos--minimize the loss of habitat value (Resource Category 4).

2. **Evaluation of Project Impacts**

The Corps has not provided an analysis of the fate of the disposed material. The "footprint" of benthic area would depend on the depth of the water, the composition of the material, and the predominant current conditions and energies. If the maximum extent of impact was 0.5-mile beyond the border of the HOODS, about 4-square-miles would be affected (2,560 acres).

The HEP application to the impacts of disposal of Humboldt Harbor dredged material at the HOODS showed these overall estimates of impacts (*i.e.*, losses of habitat value) to open surface waters and deepwater benthos are 2.24 AAHUs for Alternative 1 (Appendix E).

3. **Evaluation of Mitigation Needs**

As discussed in detail in the HEP (Appendix E), each acre of mitigation habitat could provide up to 1 AAHU of "compensation" habitat value. Thus, the Service recommends that the Corps provide not less than 2.24 acres of new "optimum" habitat area as mitigation for Alternative 1 for open surface and deepwater benthos impacts. As discussed within the HEP, this value could potentially be reduced by one-half, if two "optimum" cover-types were created for compensation.

Although some further refinement and adjustments to the SIs may be warranted, the results also show that the HOODS would incur impacts to fish and wildlife habitat as a consequence of the overall, cumulative impact of all dumping events. The HEP (Appendix E) shows that no less than 14 acres (potentially reduced to 7 acres, if two-cover-type compensation is created) of new "optimum" aquatic habitat area would need to be created as mitigation for the combined loss of open surface water and deep water benthos habitat value. The Service recommends that the Corps work in cooperation with all involved agencies to develop a mitigation scenario to offset these overall, cumulative impacts.

Such "optimization" of SIs through enhancement in deep, open oceanic areas would likely be infeasible. However, such optimization may be both

technically and economically feasible at more nearshore coastal areas, or within the Bay.

In order to achieve "optimum" status as applied to the HSI formula above, such replacement habitat would be of a type which is considered of the greatest regional scarcity. Also, some additional "credit" could be achieved where the mitigation option creates more than one additional cover type, as in the creation of both water column and subtidal benthic habitat in an upland cut (discussed in the following section). This could potentially reduce recommended mitigation acreages by one-half. However, should maintenance dredging be shown to increase beyond present projections, impacts would increase and the mitigation ratio would thus increase.

4. **Potential Mitigation Sites, Options, and Costs**

a. Potential Mitigations Sites

The following discussion is intended to provide general information on the character and availability of potential mitigation sites for habitat creation in the project area. These compensation areas were first discussed and evaluated in 1991, and some may not now be available for mitigation. Due to lack of time, the Service has not been able to re-evaluate their present availability. These sites, however, can be used as a basis for identifying and comparing various mitigation options.

Selection of potential mitigation sites (Table 2 and Figure 9) was based on the following requirements: 1) compensatory mitigation would take the form of creation of intertidal and/or shallow subtidal habitats, 2) the mitigation site(s) should contain uplands with low existing habitat values for fish and wildlife, and 3) the completed mitigation site(s) should be contiguous with the Bay. Six potential mitigation sites have been selected, and all sites are located on the Humboldt Bay waterfront. All sites are owned by the city of Eureka, except for site F, which is owned by Humboldt Bay and Harbor Recreation and Conservation District.

Site A is a filled site adjacent to the Eureka Channel along Waterfront Drive, between 14th Street and the Eureka small boat basin. This area consists of some city land and some land to be redeveloped (T. Curl, pers. comm.). It is currently commercially marketed following its filling (D. Norman, pers. comm.). Site B includes various filled former saltmarsh and mudflat locations adjacent to the North Bay Channel between the west end of Hilfiker Lane and the Palco Marsh. This area contains fill, cement foundations, and metal sheds in poor condition. Old pilings are found along the shore (M. Long, pers. comm.). This area is commercially viable (D. Norman, pers. comm.). Site C is located on the North Spit, just south of Fairhaven and adjacent to the east side of the New Navy Base Road. There are possible wetlands here. Site D is located between Vio and Del Norte Streets. Some buildings are located on the site. Site E is located on the North Spit, north of the Samoa boat ramp. Site F contains uplands and is located adjacent to the Samoa Channel at the west end of the Samoa Bridge. This site goes to uplands very quickly (+20 feet to +30 feet). Mudflats are found here and some areas are filled but

Table 2. Ownership, total acreage, value/acre, costs and constraints of potential mitigation sites in Humboldt Harbor and Bay.

[a]SITE	OWNERSHIP	TOTAL ACREAGE	[b]VALUE/ ACRE	[c]GRADING COST/ ACRE	MIN. TOTAL COST/ACRE	[d]OTHER COSTS	CONSTRAINTS
A	City of Eureka	29.5	$261,360-$348,480	$67,758-$112,930	$329,118-$461,410	Shoreline protection	Buildings, currently commercially marketed; possible wetlands
B	City of Eureka	24.1	"	"	"	Shoreline protection, removal of structures	Buildings; possible wetlands
C	City of Eureka	23.4	"	"	"	Shoreline protection, removal of structures	Buildings; possible wetlands
D	City of Eureka	22.9	"	"	"	Shoreline protection	Buildings
E	City of Eureka	~5.0	"	"	"	Shoreline protection	Possible size limitation; possible wetlands
F	[e]HBHRCD	~4.0	[f]~$20,000	"	"	Shoreline protection	Possible size limitation;

[a]See Figure 9.
[b]Estimated cost for uplands to be converted to wetlands is ~$6-8/ft^2.
[c]Includes excavation and levee construction costs at ~$3-5/cys. Land elevations are ~+10' and need to be excavated to ~-4' MLLW. Therefore, ~22,586 yd.^{3} per acre of mitigation would need to be removed.
[d]Site conditions requiring additional costs; includes shoreline protection, structure removal, and removal of vegetation.
[e]Humboldt Bay and Harbor Recreation and Conservation District.
[f]Estimated value in 1987.

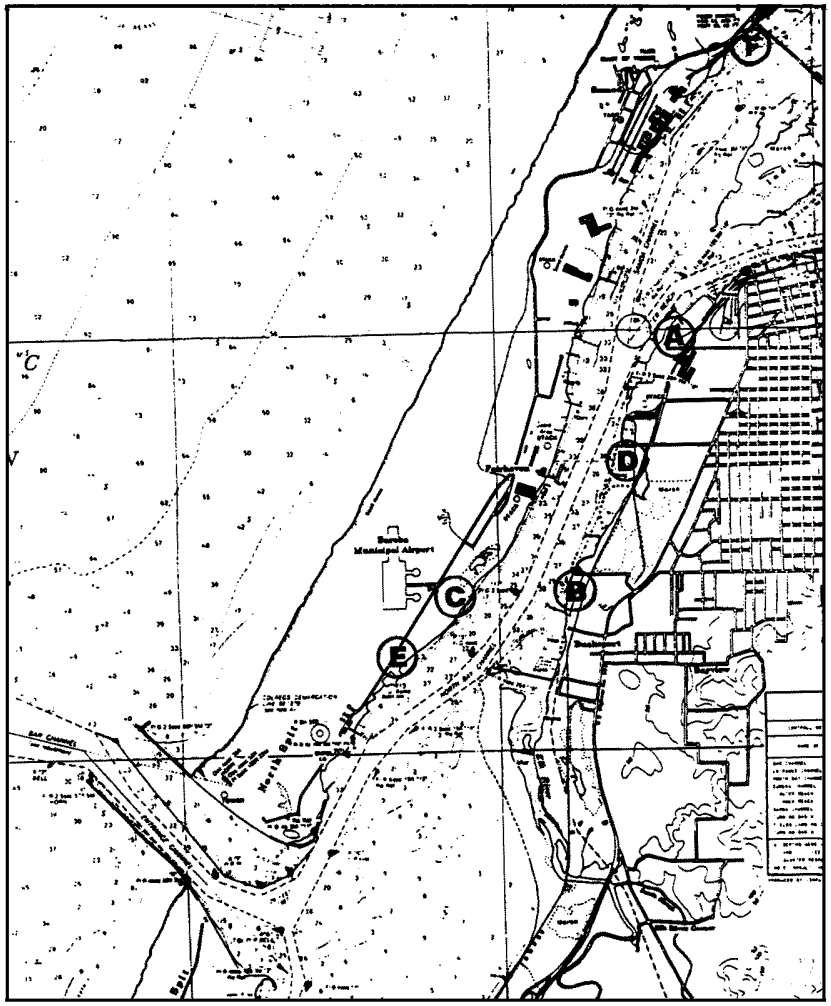

Figure 9. Locations of potential mitigation sites within Humboldt Harbor and Bay.

could be reclaimed to intertidal. This area is leased by the Louisiana-Pacific Lumber Mill (J. Alderson, pers. comm.).

These areas could be used to form an upland cut to create two habitat types: 1) water column, and 2) benthic habitat. This is discussed below in the following "Potential Mitigation Options" section.

b. Potential Mitigation Options

Pursuant to a State Senate Bill (SB-1677), MEC Analytical Systems, Inc. of Carlsbad, California (MEC 1993) analyzed six potential mitigation alternatives for port development projects such as the proposed Humboldt Harbor project:

(a) Rock reef: This concept involves placement of one or more 3- to 10-foot-high "modules" of quarry rock at moderate depth (20 to 100 feet). The structure adds value by providing fish shelter and forage area.

(b) Upland cut: New subtidal and/or tidal habitat is created by removal ("cutting") of upland areas contiguous to existing estuary areas. Various aquatic cover-types are created within the cut to optimize habitat value to fish and wildlife.

(c) In-bay terrace: A subtidal area is recontoured so that it is shallower than the one it replaces, enhancing benthic productivity and subtidal vegetation.

(d) Hi-relief (vertical) substrates: Precast structures with high surface area are attached to bulkheads or other harbor structures, providing attachment area for fouling organisms.

(e) Sediment remediation: Contaminated sediments are isolated by placement of "clean" sediment caps over them, often in association with subsurface containment structures, or "dikes," thus isolating contaminants from fish and wildlife resources.

(f) Kelp restoration: Transplants are anchored into previously denuded, or sand bottom areas. Established kelp beds have high values as forage and shelter for aquatic resources.

Among potential mitigation methods, rock reef construction was considered the most flexible in terms of siting, and also scored highest on technical feasibility due to ease of construction, lowest cost, and proven results. Upland cuts, in-bay terraces, and kelp restoration could potentially result in greater resource enhancement, but are either unproven or have resulted in mixed successes to date. Sediment remediation and vertical substrates scored relatively low in terms of cost and effectiveness. Due to the lack of any other known suitable mitigation options for the Humboldt Harbor and Bay Project area, we are recommending upland cuts and rock reef construction as two possible mitigation options.

Upland cuts, which would increase shallow tidal or intertidal water area, would require the acquisition of significant low-relief lands, and would

create a large amount of spoil material during construction of the cut. Rock reefs could be constructed using proven methods at various bay and nearshore, open ocean sites. Within Humboldt Harbor and Bay, construction sites for such reefs would have to be carefully screened so as to avoid any conflicts with vessel traffic, or existing high-value shallow water habitats. The current lack of such structures, and appropriate depth (35 to 90 feet), suggest that such a reef might significantly enhance sportfishing opportunities in the area as well as habitat values for a wide range of fish and wildlife species. It is likely that opportunities for this type of enhancement are sufficient to provide the maximum mitigation acreage. Like the analysis of Oakland Harbor dredging impacts (USFWS 1994), this analysis represents a first attempt at using HEP for quantifying fish and wildlife impacts and mitigation needs related to dredging and disposal of dredged materials in a deep ocean area.

c. Potential Mitigation Costs

The size of the parcels potentially available for an upland cut scenario ranges from about 4.0 to 29.5 acres. Estimated costs for land purchases in fee title (an alternative may be the purchase, possibly at much less cost, of conservation easements) range from $6.00 to $8.00/ft^2 (D. Norman, pers. comm.), or between $261,360 and $348,480/acre (as of 1991). However, Site F was valued at about $20,000/acre 6 or 7 years ago (J. Alderson, pers. comm.). The candidate sites are all at elevations of +10 feet or less. To excavate to an intertidal depth of -4 feet MLLW, about 22,586 cys would need to be moved for every acre of mitigation (i.e., tidal restoration) required. Excavation, grading, and embankment construction are estimated to cost about $3.00 to $5.00/cyd (R. Varozza, pers. comm.), which amounts to between $67,758 and $112,930/acre. Therefore, minimum total costs per acre would range from $329,118 to $461,410, but may be considerably less. Additional costs that cannot be estimated at this time would include any necessary removal of structures and vegetation.

Table 3 summarizes potential mitigation sites, options, and costs for Alternative 1.

The upland cut mitigation option would be essentially as described in MEC (1991). Since two habitats would be created (new water column and subtidal benthic), this could potentially reduce the necessary mitigation acreage by up to about one-half. We estimate a 22.66-acre (Alternative 1) upland cut unit would cost, at a *minimum*, about $7.8-10.9 million (minimum total cost per acre of land is $329,118-$461,410) (Table 3). The Service also recommends a grassland buffer around the intertidal and subtidal wetted area. Assuming the mitigation site is square in shape, the three sides with embankments should extend out 200 feet. This would be an additional 15.6 acres. Minimum costs with the buffer would be $13.0-18.3 million. To achieve full mitigation for the minimum size site, existing habitat value would need to be zero, so that an increase in value from 0.0 to 1.0 could be achieved for each new cover-type. While theoretically possible, this would, in practice, be extremely difficult to achieve. Also, any upland cut areas used should be devoid of any existing freshwater wetlands; if not, in-kind mitigation for their losses would be needed.

Table 3. Potential mitigation sites, options, and costs for Alternative 1 for the Humboldt Harbor and Bay Deepening Project.

Acres[1] Impacted	Mitigation Option	Mitigation Acres Needed	Mitigation Sites	Value of Land/Acre	Grading Cost/ Acre	Minimum Total Cost/ Acre of Land	Minimum Cost/Acre for an Upland Cut	Cost/ Acre for a Rock Reef
45.32 total	a) Upland cut	a) 22.66[2]	a) "Site A" (29.5 acres)[3] "Site D" (22.9 acres)[4]	a)$261,360-$348,480	a)$67,758-$112,930	a)$329,118-$461,410	a)$7.8-$10.9 million (without 15.8-acre buffer)	
	b) Rock reef	b) 45.32	b) Various Bay and nearshore open ocean sites				$13.0-$18.3 million (with 15.8-acre buffer)	b) $122,500
	c) Other potential methods as described in MEC 1993	c) 45.32 maximum	c) unknown					

[1] See Appendices D and E.

[2] Credit is achieved where the mitigation option creates more than one additional cover type, as in the creation of both water column and subtidal benthic habitat in an upland cut. This reduces the mitigation acreage by one-half.

[3] 19.45 acres of water column and subtidal habitat would be created.

[4] About 3.21 acres of water column and subtidal habitat would be created.

The second mitigation option is the construction of an artificial reef(s), as described in MEC (1991). The reef would be sited in an area of the Pacific Ocean, or perhaps within the Bay, at existing depths less than 100 feet. A 45.32-acre (Alternative 1) rock reef complex, built of quarry rock, would cost about $5.57 million ($122,500 per acre), assuming 3,500 tons of rock per acre at a cost of $35 per ton. The cost could be decreased about 40 percent through the use of broken and/or discarded (i.e., rejected) concrete pipe, which is relatively inexpensive, instead of quarry rock.

c. Louisiana Pacific Upland Disposal Site

1. Habitats, Evaluation Species, and Mitigation Goals

We have identified the following habitats that may be directly impacted by the proposed dredged material disposal at the Louisiana Pacific upland disposal site: 1) scrub-shrub wetlands, and 2) dune. The scrub-shrub wetlands are of high value to the evaluation species and have been significantly reduced in acreage in the Humboldt Bay region. The evaluation species selected to determine the value of this habitat type is the yellow warbler (*Dendroica petechia*), which represents a wide array of avian species for which the Service has management responsibility. Dune habitat is of high to medium value for the evaluation species and is relatively abundant in the Humboldt Bay region. The evaluation species selected to determine the value of this habitat type (selected for the same reason that the yellow warbler was selected for scrub-shrub wetlands) is the savannah sparrow (*Passerculus sandwichensis*).

Based on the preceding considerations, our mitigation planning goals for these two habitats are: 1) scrub-shrub wetlands--no net loss of in-kind habitat value or acreage (Resource Category 2), and 2) dune habitat--no net loss of habitat value while minimizing the loss of in-kind habitat value (Resource Category 3).

2. Evaluation of Project Impacts

Results of the impact analysis (Appendix C) show that no change in AAHUs would occur in the scrub-shrub or dune habitats of the Louisiana Pacific disposal site over the 50-year life of the project. The primary reason for this is that the site is currently a permitted, active, dredged material disposal site. Therefore, no mitigation would be needed.

RECOMMENDATIONS

The Council on Environmental Quality and the Service's Mitigation Policy define mitigation as including the following elements: avoid impacts, minimize impacts, rectify impacts, reduce impacts over time, and compensate for impacts. The Service considers these elements to represent the most desirable sequence of steps in the mitigation planning process. In determining when to move from any one element to the next in the sequence, success or failure of particular techniques or approaches in the past under similar circumstances (as reflected in the results of previous mitigation evaluation studies) are taken into account.

The recommendations for mitigation contained within this section constitute what the Service believes, from a fish and wildlife resource perspective and consistent with our Mitigation Policy, to be the best present recommendations for the project. The outcomes of any new or renewed consultations, as required under Section 7 of the Endangered Species Act, could also affect the recommendations given herein. Rationale for many of the recommendations were discussed earlier within this report.

The Service is required to abide by internal guidelines (Federal Register 40(231):55818) when reviewing proposals for work and activities in or affecting navigable waters that are sanctioned, permitted, assisted, or conducted by the Federal Government. With respect to dredging and disposal of dredged materials, the existing guidelines state that "in-bay, open water, and deep-water disposal generally will be considered acceptable to the Service only after all upland and other alternative disposal sites have been explored and rejected for good cause." Also, the Service's preferred dredged material disposal methods are contingent upon two other factors: 1) the degree and type of contamination of the dredged sediments; and 2) the need for all disposal of sediments to meet established agency criteria to ensure full protection of fish and wildlife resources.

Based on analyses provided herein, we believe the proposed Humboldt Harbor and Bay Deepening Project would have significant direct and indirect impacts on certain fish, wildlife, and their habitats. Therefore, we have the following recommendations for the Corps to take to avoid, minimize, or compensate for these impacts:

I. General Recommendations

1) Reevaluate the need for, and benefits of, the project with a view towards selection of the no-project alternative in lieu of the structural alternative (Alternative 1), to avoid altogether the potential adverse impacts. The benefits re-analysis should include likely reductions of logging activity in the area.

2) If the structural alternative is implemented, and upland disposal is proved infeasible, dispose of the dredged material, which is suitable for deep ocean disposal, at the Humboldt Open Ocean Disposal Site; other sediments not deemed suitable for ocean disposal should be disposed of at the Louisiana Pacific upland disposal site.

3) Ensure appropriate sediment screening criteria which have been developed, including the EPA-COE "Green Book" and the RWQCB's appropriate criteria are used to regulate the dredged material disposal. Any sediments for which suitabilities are not agreed to based on agency criteria should be disposed of in the manner which would best minimize detrimental impacts to fish and wildlife resources, as determined by the Service.

4) Develop long-term mitigation monitoring and remedial-action plans designed to ensure success of any mitigation actions implemented to offset impacts to (a) benthic and water column impacts due to the in-bay dredging, (b) ocean disposal actions, and (c) upland disposal actions. Monitoring and reporting on all such mitigation should occur annually for the first 10 years and at least each 5 years thereafter. If mitigation criteria are not met, specific corrective actions should be required until mitigation is successful. Reports of all monitoring and remedial activities should be provided to the Service, CDFG, constructing agencies, and other involved entities.

5) Further explore possible reductions of construction and maintenance dredging volumes to reduce both dredging and dredge disposal impacts to the extent feasible.

II. Specific Recommendations

A. Humboldt Harbor and Bay

1) Dredge the suspected contaminated areas first, followed by dredging of uncontaminated areas. This should help limit the spread of unsuitable sediments to the new channel area due to dredging actions.

2) Restrict the dredging for the project to only the late-August-to-early-November period to the extent feasible, to best minimize impacts on critical life stages of important fish and wildlife species which use the Humboldt Bay estuary. Restrict future maintenance dredging to this same "window" as well. Also, avoid all dredging during the Pacific herring spawning season (December 1 through March 1) in harbor waters.

3) Cooperate in developing a program to monitor, regulate, and effectively prevent the influx of additional contaminants into Humboldt Harbor and Bay so as to decrease impacts of future dredging to fish and wildlife, and to allow use of Humboldt Harbor and Bay sediments for more beneficial uses.

4) Provide, as compensation for the Humboldt Harbor and Bay dredging project impacts (i.e., to benthic areas and the water column) either 45.32 acres of "optimum" one cover-type, replacement habitat such as a "rockreef" (or similar) option, or 21.73 acres of "optimum," two cover-type, replacement habitat using an "upland cut" option, as detailed in the mitigation section, herein, and in MEC (1991) for Alternative 1. In addition, "buffer" areas should be provided around any such compensation areas, as described in the text and Table 3.

5) Conduct (and include in the EIS) further, better refined underwater surveys of the channels to determine the presence or absence of eelgrass during the period of maximum eelgrass growth in late summer. Since site-specific data on subtidal benthic habitats are not available for the entire area where the Corps' deepening and widening could occur, additional data are needed. A contingency plan for offsetting long-term losses of eelgrass should also be developed. A report of findings should be provided to the Service as soon as practicable. In addition, the Corps should undertake a comprehensive, bay-wide eelgrass mapping and monitoring program, possibly as part of the Corps/NMFS habitat restoration agreement or as a Coastal America project.

6) Provide a plan for monitoring of possible impacts to the egret and heron rookery located on Indian Island. Remedial actions, with specific "trigger" mechanisms, should be specified.

7) Provide at least a 100-foot buffer to protect eelgrass beds from dredging impacts. Silt curtains could also be provided to minimize the impact of dredging in eelgrass beds.

B. **Humboldt Open Ocean Disposal Site**

1) If used as a disposal site for Alternative 1, provide as compensation for the dredged material disposal impacts (i.e., benthic areas and the water column) due to the project's disposal, either 2.24 acres of "optimum," one cover- type, replacement habitat such as a "rockreef" (or similar) option, or 1.12 acre of "optimum," two cover-type, replacement habitat using an "upland cut" option, as detailed in the mitigation section herein, and in MEC (1991). This mitigation should be provided in concert with mitigation stated in II. A. 4. above; the "buffer" should also be included.

2) Work cooperatively with all involved agencies to provide, as compensation for all cumulative impacts of disposal at the HOODS, either 14.08 acres of "optimum" rockreef (or similar) habitat, or 7.04 acres of "optimum" upland cut replacement habitat, as in II. B. 1. above.

3) Develop, fund, and implement a detailed mitigation and monitoring plan for the HOODS. Specific remedial and additional mitigation actions and/or curtailment of dredged material disposal should be included as aspects of this plan.

C. **Louisiana Pacific Upland Disposal Site**

1) Develop and implement a dioxin monitoring plan for the sediments and the decanted water that would a) return to the Bay via an outflow pipe if the material is disposed of on the Louisiana Pacific Upland Disposal Site.

2) Take all feasible measures to ensure that sediments are fully contained on the site, and effluents meet standards for re-entry into the Bay.

3) Avoid adverse impacts to the scrub-shrub wetlands on the site, and dune habitats along the site's boundaries, by using the central, highly disturbed portion of the disposal site for the dredged material disposal to the maximum extent feasible.

4) Avoid the salt marsh habitat at the northeast corner of the site near Somoa Bridge and Vance Avenue. (These wetlands were not analyzed in the impact analysis because the Corps verbally agreed they would be avoided due to physical barriers that would prevent their being disposed upon.)

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APPENDIX A

RESPONSES TO THE CORPS' COMMENTS ON THE SERVICE'S DRAFT FISH AND WILDLIFE COORDINATION ACT REPORT FOR THE HUMBOLDT HARBOR AND BAY DEEPENING PROJECT

DEPARTMENT OF THE ARMY
SAN FRANCISCO DISTRICT, CORPS OF ENGINEERS
211 MAIN STREET
SAN FRANCISCO, CALIFORNIA 94105-1905

February 7, 1995

Environmental Planning Section

Mr. Joel Medlin
Field Supervisor
U.S. Fish and Wildlife Service
Sacramento Ecological Services Field Office
ATTN: Caroline Wilkinson
2800 Cottage Way, Room E-1803
Sacramento, California 95825

Subject: Draft Coordination Act Report - Humboldt Harbor and Bay Deepening Project

Dear Mr. Medlin:

The Corps of Engineers, San Francisco District, has reviewed the Draft Coordination Act Report (DCAR) (dated February 1994) provided by the U.S. Fish and Wildlife Service (FWS). The following below are the Corps' and the Humboldt Bay Harbor, Recreation, and Conservation District's (Harbor District - the local non-federal sponsor) comments on the DCAR. Also, attached as enclosures are the "Scope of Work" (Enclosure 1); "Middle Ground Area" information (Enclosure 2); and "Schedule of Events for Processing Humboldt Harbor and Bay Deepening Navigation Project Feasibility Report and EIS/EIR."

(Note: Enclosures not included in this appendix - only comments on the DCAR)

GENERAL COMMENTS:

1. The project description has been revised slightly since the DCAR was written. Please refer to the enclosed project description on the "Scope of Work"(i.e. Outer Eureka Channel is no longer in project; "Middle Ground Area" deepened from old project description of -38 feet MLLW to -48 feet MLLW [please see page 2 of Scope of Work]; and disposal of approximately **5.6 million cys** of dredged sediments at the HOODS [project went up **1.5 million cys** with deepening of "Middle Ground Area"].

2. The DCAR should reference the following important documents and regulations: (1) The Environmental Statement, Humboldt Harbor and Bay, Navigation Improvement Project,

U.S. Army Corps of Engineers, 1976; (2) Humboldt Bay Master Plan (by Koebig and Koebig, 1975); (3) "Ordinance No. 7 of the Humboldt Bay Harbor, Recreation, and Conservation District"; (4) "City of Eureka's Local Coastal Plan (LCP); (5) County of Humboldt's LCP; (5) new federal regulations; and (6) other controls placed by the California Coastal Commission (CCC), etc...

3. Extensive use of the Shapiro report is found throughout the DCAR. The Harbor District doesn't acknowledge the validity of this report and would like a disclaimer noted in the final CAR.

SPECIFIC COMMENTS

1. (Page 14, paragraph 3) - The Shapiro report is not an acceptable reference for the Humboldt Bay Harbor, Recreation and Conservation District. Please note the disclaimer in the report. A great deal of information is incorrect and undocumented.

2. (Page 16, paragraph 1) - Please update last sentence of paragraph 1 to: "including the **Fall 1994 maintenance**, the HOODS has been used for disposal ten times previously, receiving a total of approximately **2,861,289** cys of dredged material."

3. (Page 20-24, all alternatives) - Description of alternatives will need to be revised to reflect project alternatives discussed in attached "Scope of Work", and the Draft EIS/EIR, dated December 1994, sent to the Service.

4. (Page 32, paragraph 3) - Historically correct, but a far cry from other historical levels. No where near those landings will occur in the next few years as the PFMC regulations preclude a normal fishing season due to the impact on the Klamath salmon resource.

5. (Page 36, endangered species) - Please update endangered species section, if necessary.

6. (Page 48, paragraph 1) - Proposed activity is confined to deep channels. Please explain how harbor seal haulouts will be temporarily changed by maintenance work?

7. (Page 49, paragraph 7) - The "Superbowl" Site is no longer under consideration in Draft EIS/EIR, please put in "disposal sites initially considered" or some other section.

8. (Page 51, paragraph 5) - The sentence in the DCAR beginning with "Evidence suggests that higher current speeds enhance plant growth by ....., thus influencing biomass and production" is not applicable to the Humboldt Harbor Deepening Project. The Deepening Project will create reduced or more moderate current water speeds (Please see"Humboldt Harbor Hydrodynamics and Sedimentation Study"; Appendix 1 - Attachment 3 in Draft Feasibility Report). In addition, no impacts are anticipated to eelgrass beds since eelgrass does not grow in already maintenanced dredged deep-water navigation channels (Please refer to #30 for additional eelgrass information).

9. (Page 51, paragraph 6) - The widening of the entrance to the existing Samoa Turning Basin has been redesigned to avoid impacts to eelgrass beds located nearby the project area.

10. (Page 52, paragraph 3) - The "Humboldt Bay Numerical Hydrodynamics and Sedimentation Study" concluded that with the implementation of the selected alternative (referred to as Plan 2 in above report), less shoaling will occur. The sentence beginning with "In addition, the deeper a channel is dredged, the faster it will accrue sediment...." is contradictory to the results of the sedimentation study. In addition, with the

implementation of "Alternative 3" in the Draft EIS/EIR (same as Plan 2 in sedimentation report), "sedimentation studies have shown a decrease in shoaling and thus, a decrease in the annual maintenance dredging from the existing dredging of an estimated 686,000 cys of dredged material to an estimated 618,000 cys of dredged material (a decrease of 68,000 cys)(Please see "Section 9-1 in Draft EIS/EIR.")

11. (Page 52, paragraph 5) - Erosion and accretion of the shoreline areas within the Humboldt Bay have been investigated. Shoreline areas located outside Humboldt Bay are currently being investigated with the Humboldt Shoreline Monitoring Program. Actual erosion and accretion trends in these areas outside the Bay may not be able to be detected for ten years. Results of the substantive analysis of the "Humboldt Bay Numerical Hydrodynamics and Sedimentation Study" ("Appendix 1 - Attachment 3" in Feasibility Report)," show no noticeable changes are anticipated in erosion and accretion patterns of the shoreline areas within Humboldt Bay as a result of the project's effects on tidal currents and water surface elevations."

    In regards to additional wave energy entering the Bay and reaching the east coast of the Bay, this additional energy is expected to be small, and to be directed at stable, reveted shorelines. The PG&E revetment design conditions were checked and found to be built for a depth-limited wave; which is the largest wave possible to break on the structure due to the water depths at the structure, thus the PG&E revetment will also be stable, and deepening of the navigation channels would have no effect on the PG&E seawall. Any additional refracted and diffracted wave energy is expected to be small, and have little to no effect on the unrevetted shoreline.

12. (Page 52, paragraph 5) - Please see #11 regarding erosion within the Bay, PG&E revetment, increased wave energy, etc... The results of the hydrodynamics and sedimentation study show what is stated in #11 above.

13. (Page 54, paragraph 4) - "Increased channel capacity through project implementation will not result in **increased current speeds** and corresponding decreases in invertebrate species diversity."

14. (Page 55, paragraph 4) - Please relate dungeness crab life cycle to deep navigation channels.

15. (Page 61, paragraph 1) - Please delete "Superbowl Site" from discussion or put info in another section of "originally considered upland sites."

16. (Page 56, paragraph 2) - Please explain why original species diversity or population density could never be reestablished in the deep navigation channels?

17. (Page 56, paragraph 4) - The high turbidity in Humboldt Bay during a normal winter has certainly caused existing organisms to adjust. This winter time turbidity is longer in duration than might ever be caused by dredging. In addition, the channel is already maintenance dredged twice a year; how will new conditions reduce its "subsequent extensive use by fish"?

18. (Page 56, paragraph 6) - Wave shock is mentioned here and in other places. Deep draft, sea going vessels that would use the turning basin will be traveling so slowly that there is little danger of wave shock.

19. (Page 56, paragraph 6) - Please explain how deep water navigation channel work would result in direct loss of bird habitat?

20. (Page 56, paragraph 6) - Please explain what exactly the increased disturbance from greater noise, human disturbance, and wave action entails?

21. (Page 57, paragraph 3) - Is it documented or alleged that herons and egrets on Indian Island currently abandon their nests during Spring and Fall maintenance dredging activities in the Humboldt Harbor and Bay?

22. (Page 57, paragraph 4) - Widening of the entrance into Samoa Turning Basin **would not induce growth** in the harbor area. Samoa Turning Basin widening addresses the safety issue only, and is not related to growth -inducement. The Humboldt Deepening Navigation project **is designed to benefit the navigational safety of existing deep-draft vessels** (Please see Section 4.7; Section 5.7, etc... in Draft EIS/EIR).

23. (Page 58, paragraph 3) - Please explain how noise from waterside activities will impact terrestrial mammals?

24. (Page 58, paragraph 5) - The NMFS director has written the Corps and stated that maintenance dredging and deepening the Humboldt Bay Navigation Channels would not impact the movement or migration of any species of concern for NMFS.

25. (Page 58, paragraph 6) - The purpose of widening and deepening the existing channels in Humboldt Bay is strictly for the safety of the existing ships calling on Humboldt Bay. Safety does not involve growth inducement, and thus, it is not expected that larger boats and increased traffic will occur.

26. (Page 64, paragraph 2) - The Corps, along with the California Department of Fish & Game, EPA, and CCC, feel that HEP was inappropriately applied in Humboldt Harbor Navigation Projects.

27. (Page 66, paragraph 4) - Which has the biggest impact on the decline of eelgrass beds - navigation, harbor projects or pollution (i.e., please define in order of magnitude of impacts)?

28. (Page 67, paragraph 5) - Please clarify what is meant by the "indirect loss" of 474.3 acres of shallow subtidal habitat. Is this habitat truly lost or is it just adversely affected in some unexplained way? (i.e., In the HEP "shallow subtidal habitat" is defined as 0 to -20 MLLW. This definition is not applicable to any of the proposed-to-be-deepened navigation channels, since the already maintenance dredged channels are presently at at least -35 feet MLLW and -40 feet MLLW.

29. (Page 68, paragraph 3) - The comment here regarding the "low resource quality" (i.e., "In summary, the resource quality of the benthic and open water habitats in the project area may be considered initially low, but would still be significantly impacted by the project"), of the benthic and open-water habitat contradicts previous evaluations made in the DCAR and HEP.

30. (Page 69, paragraph 3) - Eelgrass does not grow in deep-water navigation channels in Humboldt Bay. Eelgrass surveys were conducted, and impacts to eelgrass beds are not anticipated since the Corps has redesigned the Samoa Turning Basin to avoid eelgrass beds. In addition, please read hydrodynamic report (Appendix A in Feasibility Report) and information in Draft EIS/EIR regarding hydrodynamics (i.e., currents and current velocities), and turbidity to determine "indirect impacts" to eelgrass. With the deepening project, the **velocity of the currents are less, and turbidity conditions are not changed from existing conditions.**

31. (Page 69, paragraph 3) - The FWS's speculation that "eelgrass nearby maybe indirectly impacted" does not support a mitigation requirement for this activity. This type of subjective inference, without scientific support, is an example of why the Corps believes that HEP is not an appropriate tool to be used in the estuarine or marine environment.

32. (Page 71, paragraph 6) - Compensatory mitigation might be the intertidal areas created in the South Bay by the U.S.Fish and Wildlife Service. These intertidal areas were created by blowing holes in the dike without obtaining proper permits.

33. (Page 75, paragraph 1) - The Corps, along with other agencies (i.e. CDFG and CCC), do not concur with the FWS's recommendation regarding rock reef construction. Northern and Southern California coastal areas are substantially different in the quantity and need of rocky substrate available for use by fish and invertebrates. In addition, the Corps does not concur with the recommendation for the siting and construction of costly artificial reefs along the California coast.

34. (Page 79, paragraph 2 & elsewhere) - Explain the derivation of the 45.46-acres of mitigation for Alternative 1. According to the Service's HEP, "shallow subtidal channel areas are defined as less than -20 feet MLLW. See Comment #27 above. The only area of "new" channel dredging is a small portion of the Samoa Turning Basin (i.e. eastern edge of the Samoa Turning Basin) that would involve the "first time" dredging disturbance of shallow subtidal channel areas. This small area represents approximately 9,000 square feet, <u>not</u> 45.1 acres. In addition, the Corps believes that compensation for subtidal impacts associated with deepening already deepened and annually maintenance dredged channels is not justified.

35. (Page 80, "Superbowl Site") - "Superbowl Site" is no longer under consideration. Please remove discussion and place in another section for sites "originally considered" or remove altogether.

36. (Pages 83-87, "recommendations") - Please see Corps responses to Services' recommendations in "Appendix B" of <u>Draft Humboldt Harbor & Bay Deepening Navigation Project EIS/EIR</u>.

37. (Page 86, "Superbowl Site") - See Comment #35 above.

38. (Page 84, recommendation #3) - Please see Draft Humboldt Harbor & Bay Deepening Navigation Project EIS/EIR & Feasibility Report regarding sediment testing conducted (i.e., Section 2-9; Section 4.4.5; Section 5.4.2; Section 5.5.1 & 5.5.2, etc.).

SPECIFIC COMMENTS - HEP

1. **Appendix E - Calculation of the impacted area for the "Deep Water Benthos"**: The DCAR's calculation of a 4 square mile impacted area for the deep water benthic habitat assumes that dredged material impacts would extend 0.5 miles beyond each border of the 1 square mile HOODS site, effectively quadrupling the impacted area. The HOODS site is non-dispersive for sandy disposed material, and modeling results confirm that no impacts are expected outside the immediate disposal site. Thus, the impact area used for the HEP calculations leads to a substantial overestimation of the habitat loss associated with the use of the HOODS site. In addition, HEP was not designed to be used in aquatic marine environments - thus, the Corps questions the validity and accuracy of applying a HEP model for quantifying potential impacts due to ocean disposal. We strongly disagree that any compensatory mitigation for the use of the HOODS is necessary or reasonable because the areas surrounding the HOODS disposal site have not been known to be adversely impacted by earlier disposal of dredged material from Humboldt Harbor; deposited sediments will not alter the basic habitat type of the disposal site itself; and only suitable non-toxic sediments may be disposed at HOODS.

2. **Appendix D - HEP-Deep-Water Navigation Channels**: See Comment #33 above. The mitigation requirements identified by the Service for selective widening and deepening of navigation channels was based upon the application of a traditionally land-based Habitat Evaluation Procedures to dredging at the estuarine project site and adjacent subtidal areas, as well as disposal at the HOODS and upland LP Site. Thus, the Corps questions the validity and accuracy of applying a HEP model for quantifying potential impacts due to ocean disposal.

If you have any questions or need any further information, please contact Tamara Terry of our Environmental Planning Section, at (415) 744-3341.

Sincerely,

Roderick A Chisholm, II
Chief, Planning Branch
Planning/Engineering Division

Enclosures

APPENDIX A

The following is the Service's responses to the Corps' comments on the draft FWCA report.

GENERAL COMMENTS - FWCA REPORT:

1. Comment incorporated.
2. Comment noted.
3. Comment noted.

SPECIFIC COMMENTS - FWCA REPORT:

1. Comment noted.
2. Comment incorporated.
3. Comment incorporated.
4. Comment noted.
5. Comment incorporated.
6. Comment incorporated.
7. Comment incorporated.
8. Comment noted.
9. Comment incorporated.
10. Comment incorporated.
11. Comment noted. Recommendation #7 (FWCA Report, specific recommendations, Humboldt Harbor and Bay) has been deleted.
12. Comment noted.
13. Comment incorporated.
14. Comment incorporated.
15. Comment incorporated.
16. Comment noted, sentence reworded.
17. Comment noted, sentence reworded.
18. Comment noted.
19. Comment noted, sentence reworded.
20. Comment incorporated.
21. Comment incorporated.
22. Comment incorporated.

23. Comment noted.

24. Comment noted.

25. Comment noted.

26. Comment noted.

27. Comment noted.

28. Comment noted - This question is explained in Appendix D.

29. Comment noted, sentence reworded.

30. Comment noted.

31. Comment noted.

32. Comment noted.

33. Comment noted.

34. Comment incorporated on page 22, in the footnote.

35. Comment incorporated.

36. Comment noted.

37. Comment incorporated.

38. Comment noted.

SPECIFIC COMMENTS - HEP REPORT

1. Comment noted.

2. Comment noted.

APPENDIX B

BIRD SPECIES ASSOCIATED WITH HABITATS MOST LIKELY TO BE AFFECTED BY THE HUMBOLDT HARBOR AND BAY DEEPENING PROJECT

Bird species associated with habitats most likely to be affected by Humboldt Harbor and Deepening Project, and the relative importance of these habitats to the species (Source: Barnhart *et al.* 1991).

	ENTRANCE BAY	DEEP CHANNELS	OPEN WATERS	JETTIES, PIERS, RUINS
Red-throated loon	P	P	S	
Pacific loon	P	P	S	
Common loon	P	P	S	
Yellow-billed loon	P	P	S	
Pied-billed grebe			S	
Horned grebe	S	P	P	
Red-necked grebe	P	S		
Eared grebe		S	S	
Western grebe	P	P	S	
Clark's grebe	P	P	S	
Northern fulmar	S		S	
Fork-tailed storm petrel	S	S		
Leach's storm petrel		S		
White pelican			S	
Brown pelican	P	P	S	S
Double-cr. cormorant	S	P	S	P
Brandt's cormorant	P	P		S
Pelagic cormorant	P	P		P
Magnificent frigatebird	S	S		
Great blue heron		S	P	S
Great egret			P	S
Snowy egret			S	S
Cattle egret				S
Green-backed heron				S
B.c. night heron			S	S

Appendix B (continued)

	ENTRANCE BAY	DEEP CHANNELS	OPEN WATERS	JETTIES, PIERS, RUINS
Tundra swan			S	
Greater w.f. goose			S	
Lesser snow goose			S	
Ross' goose			S	
Emperor goose			S	
Brant goose	S	S	P	
Canada goose			S	
Wood duck			S	
Green-winged teal			S	
Mallard	S	S	S	
Northern pintail	S	S	P	
Cinnamon teal			S	
Northern shoveler			S	
Gadwall			S	
Eurasian wigeon			P	
American wigeon			P	
Canvasback			P	
Redhead	P	S	P	
Ring-necked duck			S	
Tufted duck			S	
Greated scaup	P	S	P	
Lesser scaup	S	S	P	
King eider		S		

Appendix B (continued)

	ENTRANCE BAY	DEEP CHANNELS	OPEN WATERS	JETTIES, PIERS, RUINS
Steller's eider		S		
Harlequin duck	S	S		S
Oldsquaw	P	P	S	
Black scoter	P	S		
Surf scoter	P	P	S	
White-winged scoter	P	P	S	
Common goldeneye	S	P	S	
Bufflehead	S	S	P	
Common merganser		S		
Red-breasted merganser	P	P	P	
Ruddy duck	S	S	P	
Osprey	S	P	P	S
Virginia rail			P	
Sora			P	
American coot			P	
Black-bellied plover				P
Am. bl. oyster catcher				P
American avocet			P	
Greater yellowlegs			S	
Willet			S	S
Wandering tattler				P
Spotted sandpiper				P
Whimbrel				S
Long-billed curlew				S
Marbled godwit			P	S

Appendix B (continued)

	ENTRANCE BAY	DEEP CHANNELS	OPEN WATERS	JETTIES, PIERS, RUINS
Ruddy turnstone				S
Black turnstone				P
Surfbird				P
Sanderling				S
Western sandpiper				S
Least sandpiper				S
Rock sandpiper				P
Dunlin				S
Red-necked phalarope	S		S	
Red phalarope	S		S	
Pomarine jaeger	P	P	S	
Parasitic Jaeger	P	P	S	
Franklin's gull			S	
Little gull			S	
Common bl.-headed gull			S	
Bonaparte's gull		S	P	S
Heerman's gull	P	P	P	S
Mew gull	S	S	S	
Ring-billed gull	S	S	S	
California gull	S	S	S	S
Herring gull	S	S	S	S
Thayer's gull	S	S	S	S
Western gull	S	S	P	P

Appendix B (continued)

	ENTRANCE BAY	DEEP CHANNELS	OPEN WATERS	JETTIES, PIERS, RUINS
Glaucous-winged gull	S	S	P	P
Glaucous gull	S	S	S	S
Black-legged kittiwake	S	S	S	P
Caspian tern	P	P	P	S
Elegant tern	S	P	P	
Common tern	S	P	P	S
Forster's tern	S	S	P	S
Least tern			S	
Black tern			S	
Common murre	P	P	S	
Pigeon guill		S		
Marbled murrelet	P	S		
Belted kingfisher		S	S	P
Black phoebe				S
Common raven				S

P = Primary use

S = Secondary use

Appendix C

HUMBOLDT HARBOR AND BAY DEEPENING PROJECT UPLAND DISPOSAL SITES HABITAT EVALUATION PROCEDURES

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INTRODUCTION AND BACKGROUND

These applications of the Fish and Wildlife Service's (Service) Habitat Evaluation Procedures (HEP) are intended to quantify the impacts to fish and wildlife resources that would occur with the temporary disposal of about 26,000 cubic yards (cys) of dredged materials found unsuitable for unconfined aquatic disposal at an upland site with construction of the Humboldt Harbor and Bay Deepening Project. Eventually, the dried material would be permanently disposed at an approved upland site. The project is fully described in the Project Description section of the accompanying Fish and Wildlife Coordination Act (FWCA) report.

DESCRIPTION OF HEP

HEP is a methodology, developed by the Service and the State and Federal resource and water development agencies, which can be used to document the quality and quantity of available habitat for selected fish and wildlife species. HEP provides information for two general types of habitat comparisons: (1) the relative value of different areas at the same point in time; and (2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed or anticipated land-use and water-use changes on habitat can be quantified. In a similar manner, any compensation needs (in terms of acreage) for the project can also be quantified, provided a mitigation plan has been developed for specific alternative mitigation sites.

A HEP application is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HUs and Average Annual Habitat Units (AAHUs) over the life of the project are then used in the comparisons described above.

The reliability of a HEP application and the significance of HUs are directly dependent on the ability of the user to assign a well-defined and accurate HSI to the selected evaluation elements or communities. Also, a user must be able to identify and measure the area of each distinct cover-type being utilized by fish and wildlife within the project area. Both the HSIs and the habitat acreages must also be reasonably estimable at various future points in time. The Service has determined that these HEP criteria can be met, or at least reasonably approximated, for the Humboldt Harbor and Bay Deepening Project upland dredged material disposal alternative; thus HEP is an appropriate analytical tool.

A fundamental and critical step in designing any HEP application is the setting of overall goals and objectives. In this HEP application such goals and objectives were developed based on the overall, long-term resource management goals of the Fish and Wildlife Service. The mitigation policies of the Service (see description within the body of the FWCA report) were also carefully considered.

The primary goal was to evaluate, as required by the FWCA, the impacts on fish and wildlife from placement and drying of the spoil material on one disposal site. The following basic criteria were established to assist in ranking the acceptability of the alternative disposal sites from a fish and wildlife perspective:

- Mitigation recommendations for avoiding, minimizing, rectifying, and reducing or eliminating adverse impacts are preferred before compensation recommendations;

- Existing wetland habitat values and acreages should not be diminished, especially for migratory, and other water-oriented birds; and

- Development of a compensation area(s) should emphasize establishment of native species.

METHODOLOGY

The Service's 1980 version of HEP was used in this application which was conducted in January 1994. Due to the short time period to complete the impact analyses, separate HEP teams[2] were formed to evaluate the impacts of (a) dredging of the harbor area and (b) aquatic and upland disposal sites. The following pertains to the upland disposal site only.

Two general habitat types were identified (existing or that would be created) in the potential impact zones by reviewing existing literature, discussions with representatives from the Service, Corps of Engineers (Corps), and the local sponsor. The existing habitats at the upland disposal site affected by the proposed project are summarized in Table 1.

The acreages of each habitat on the impact site were planimetered from aerial photographs provided by the California Department of Water Resources, which were enlarged to a scale of 1:2,400. Figure 1 shows the habitat mapped at the disposal site.

Table 2 summarizes the habitats and HSI models that were used for quantifying impacts to fish and wildlife at the site.

The yellow warbler HSI model is a published model developed by the Fish and Wildlife Service. The yellow warbler was selected to evaluate the habitat values provided by the small acreage of scrub-shrub wetlands on the project's proposed upland disposal site because (1) it predominately uses deciduous shrubland and deciduous scrub-shrub wetland habitats, (2) optimal nesting habitat is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs, and (3) it has a minimum territory size of at least 0.37 acres of suitable habitat.

Table 1. Summary of the habitats existing at the upland disposal site being evaluated in the Humboldt Harbor and Bay Deepening Project.

SITE	HABITAT-TYPE[3]	AREA (acres)
Louisiana Pacific Disposal Site	scrub/shrub wetland	2.6
	dune	22.1
	total	24.7

[2]Due to the short time period to complete the analysis, the "HEP Team" consisted of Fish and Wildlife Service staff only. Corps of Engineers, California Department of Fish and Game, and Humboldt Bay Harbor Recreation and Conservation District staff attended the December 30, 1993 site review or provided valuable information needed to complete the HEP analysis.

[3]Dune habitat is this HEP report refers to the combination of dune mat, beach grass, and bush lupine vegetation types mapped in Duebendorfer (1992). (See FWCA report for complete citation).

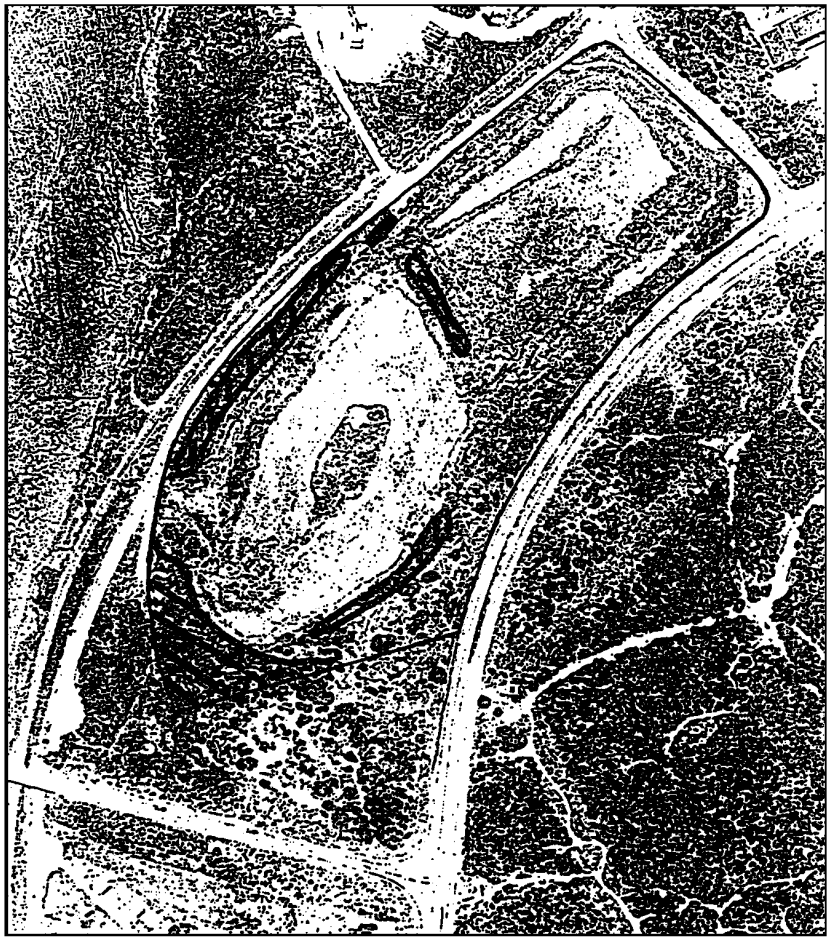

Figure 1. Habitat map of the Louisiana Pacific dredged material disposal site. Striped polygons indicate areas of scrub-shrub wetlands. Areas not within polygons are dune habitats.

Table 2. Habitats and HSI models used for evaluating fish and wildlife impacts associated with the Humboldt Harbor and Bay Deepening Project.

HABITAT	HSI MODEL
scrub/shrub wetland	yellow warbler
dune	savannah sparrow

The savannah sparrow HSI model was developed by the Service's Sacramento Ecological Services Field Office; this model has been used in other HEP applications, and has been reviewed by species experts and the National Biological Survey's (formerly the Service's) National Ecology Research Center in Fort Collins, Colorado.

The savannah sparrow was selected to evaluate habitat values provided by the dune habitat of the project's proposed upland disposal site because this species inhabits dune areas. Copies of these HSI models are included in Appendix C-1.

In addition to their applicability to the sites, these models were chosen because (1) they were readily available, (2) their variables included characteristics of the habitat that would affected with the project, (3) the suitability indices could be determined given the data at hand, and (4) their relative simplicity facilitated completing the HEPs in the short time available. The models used are designed as planning tools, and are not exhaustive syntheses of everything that can possibly affect each species.

HSI models generally measure the value of certain attributes of a given habitat or community. Examples of such attributes include percent woody or herbaceous cover, presence of ponded water or saturated soil, and water depth. HSI model outputs reflect the carrying capacity of the particular habitat type for the evaluation elements. The HSI value thus calculated represents the degree to which the study area contains the structural and functional components necessary to support the life requisites of these species.

Lastly, model validation realistically must be viewed as model improvement. As new data becomes available on cause-and-effect relationships and individual model use is increased, the models may be modified so that future HSI values are better predictors of animal performance.

The capacity of each sample site to meet the needs of these evaluation species within the project impact and compensation areas was determined by the HEP Team through measurement of specific habitat variables. Values for the SIs of each species HSI were determined by information gathered in a site review, aerial photography and video tape interpretation, or review of existing records. Table 3 lists the variables contained in each model and indicates how the data for each variable was obtained.

At the completion of data collection, the HSIs were calculated by hand or using a calculator, as appropriate, for each evaluation species. The equations used to calculate the HSIs are contained in each model (Appendix C-1).

Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing specific baseline values for each evaluation species, based on probable future conditions and the HEP team's best professional

Table 3. Variables used in the Humboldt Harbor and Bay Deepening Project, upland disposal site alternatives.

VARIABLE	HOW OBTAINED
YELLOW WARBLER	
V1 - % deciduous shrub crown cover	field notes, aerial photography interpretation
V2 - Average height of deciduous shrub canopy	field notes, video tape estimate
V3 - % of deciduous shrub canopy comprised of hydrophytic shrubs	field notes, aerial photography interpretation
SAVANNAH SPARROW	
V1 - % cover of grass and grass-like plants	aerial photograph interpretation, estimate
V2 - % forb cover	aerial photograph interpretation, estimate
V3 - % litter cover	field notes, estimate
V4 - Average height of grass and grass-like plants	video tape estimate
V5 - Average height of forbs	video tape estimate
V6 - Modal distance among shrubs and/or trees	aerial photograph measurements

judgement. The assumptions used to derive future HSI and acreage values with- and without-the project on the impact area are contained in Appendix C-2 and summarized in Table 4.

RESULTS AND DISCUSSION

Our results are based on project designs as presently provided by the Corps. There may be further changes or refinements to the project prior to preparation of the required environmental documents.

The Service's mitigation objective for the upland disposal alternative is to ensure that compensation, if needed, is consistent with the fish and wildlife habitat values involved. Scrub-shrub wetlands are of high value to fish and wildlife and have been significantly reduced in acreage in the Humboldt Bay region; therefore, our goal as described in the attached FWCA report is for no net loss of in-kind habitat value, or acreage (i.e., Resource Category 2). Dune habitats, although degraded in these sites, are also of high to medium value to wildlife, but are still relatively abundant; therefore our goal is no net loss of habitat value while minimizing loss of in-kind habitat value (i.e., Resource Category 3). The HEP results for the upland disposal site follow.

Results of the impact analysis show that no change in AAHUs would occur in the scrub-shrub or dune habitats of the Louisiana Pacific disposal site over the life of the Humboldt Harbor and Bay Deepening Project. The primary reason for this is that the site is currently a permitted, active, dredged material disposal site. As such, it is continually disturbed, to varying degrees, as dredged material is dried on the site and moved to other upland disposal sites before new disposal events occur. Existing baseline habitat values for the scrub/shrub and dune habitats were 2.03 and 13.04 AAHUs, respectively. These relatively low values are further indicators of the regular disturbances occurring to these habitats on the site.

An important assumption in this impact analysis was that a new permit to use the Louisiana Pacific disposal site will be obtained (existing permit expires in 1995). The HEP Team believed this assumption was both necessary for the analysis, and desirable, so that some other site with more valuable habitats would not be impacted in the future. Time constraints did not permit validation of this assumption. Even so, the use of the site for this project would likely be completed under the existing permit.

Table 4. Predicted habitat changes for future Target Years (summary of Appendix C-2) at the Louisiana Pacific disposal site.

TARGET YEAR	ASSUMPTION
Future Without Project (PA 1, Impact Area)	
Target Year 0	Baseline habitat conditions - characterized by highly disturbed dune and scrub/shrub wetland areas. Current dredged disposal activities continue (disposal every 3-4 years) with dried dredged material removed to upland sites. This cycle is continual for the life of the project. This assumes a new permit is obtained to dispose of material on the site when the existing permit expires in 1995.
Target Year 1	Site is characterized by an average HSI value for each habitat. The average is determined by estimating the high and low values expected during each disposal cycle.
Target Year 51	Same as TY 1
Future With Project (PA 2, Impact Area)	
Target Year 0	Baseline habitat conditions - characterized by highly disturbed dune and scrub/shrub wetland areas. Current dredged disposal activities continue (disposal every 3-4 years) with dried dredged material removed to upland sites. This cycle is continual for the life of the project. This assumes a new permit is obtained to dispose of material on the site when the existing permit expires in 1995.
Target Year 1	Site is graded with all vegetation removed, and filled evenly over the entire site with about 26,000 cys of aqueous dredged material for drying. Dredged material disposal is completed in about 3 days. No vegetation would develop on the site during drying period. Dredged material drying is completed and the dried material is transported to an approved landfill site.
Target Year 51	Habitat values same as TY 0, 1.
Future Without Project (MP 1, Compensation Area)	
Target Year 0	Baseline habitat conditions - Hypothetical 10 acre site characterized by upland vegetation (grasses, scattered shrubs) located adjacent dune habitat.
Target Year 1	Same as baseline
Target Year 10	Same as baseline
Target Year 51	Same as baseline
Future With Project (MP 2, Compensation Area)	
Target Year 0	Baseline habitat conditions - characterized by upland vegetation.
Target Year 1	Compensation site acquired, developed, and managed to provide scrub/shrub wetland, and dunes. Dune habitat would be managed to promote native species.
Target Year 10	Compensation area habitats continue to develop.
Target Year 51	Same as TY 10

Our analysis also assumed that future dredged material disposal events on this site would not impact the entire site at any given time. We also assume impacts to the scrub/shrub wetland would be avoided due to its juxtaposition within the northerly border of the site and around the outer margins of the site, by confining dredged material disposal to the more central, highly-disturbed area of the site, which is currently in use as a dredged material drying site. Impacts to the dune habitat are assumed to be avoided completely by avoidance of the narrow band of disturbed dune habitat existing on the outer boundary the site. Both of these actions could be accomplished by

increasing the depth of the disposed material so that the minimum possible acreage is affected by disposal events.

CONCLUSIONS AND RECOMMENDATIONS

From the Service's perspective, the Louisiana Pacific disposal site is an acceptable upland disposal site for this project if, as we assumed, dredged material is deposited only within the site areas which are currently being actively used. However, this preliminary conclusion is based on a habitat-value perspective only, regarding direct impacts of using the site.

Should this disposal alternative be selected for use in the Humboldt Harbor and Bay Deepening Project, we recommend the Corps:

a. Take all feasible measures to ensure that sediments are fully contained on the site, and that all effluents meet standards for re-entry into the Bay.

b. Avoid adverse impacts to the scrub/shrub wetlands on the site by using the central, highly disturbed portion of the disposal site for the project's dredged material.

c. Minimize adverse impacts to the dune habitats located along the site boundaries, by placing the dredged material to the interior of the site to the maximum extent feasible.

d. Avoid the salt marsh habitat at the northeast corner of the site near Somoa Bridge and Vance Avenue. (These wetlands were not analyzed in the impact analysis because (a) the Corps verbally agreed they would be avoided, and (b) physical barriers on the site would restrict dredged material from being deposited there).

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Appendix C-1

HSI MODELS

PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information includes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

Habitat Evaluation Procedures Group
Western Energy and Land Use Team
U.S. Fish and Wildlife Service
2625 Redwing Road
Ft. Collins, CO 80526

ACKNOWLEDGEMENTS

We gratefully acknowledge Douglas H. Morse for his review of this habitat model. The cover of this document was illustrated by Jennifer Shoemaker. Word processing was provided by Carolyn Gulzow and Dora Ibarra.

YELLOW WARBLER (*Dendroica petechia*)

HABITAT USE INFORMATION

General

The yellow warbler (*Dendroica petechia*) is a breeding bird throughout the entire United States, with the exception of parts of the Southeast (Robbins *et al.* 1966). Preferred habitats are wet areas with abundant shrubs or small trees (Bent 1953). Yellow warblers inhabit hedgerows, thickets, marshes, swamp edges (Starling 1978), aspen (*Populus* spp.) groves, and willow (*Salix* spp.) swamps (Salt 1957), as well as residential areas (Morse 1966).

Food

More than 90% of the food of yellow warblers is insects (Bent 1953), taken in proportion to their availability (Busby and Sealy 1979). Foraging in Maine occurred primarily on small limbs in deciduous foliage (Morse 1973).

Water

Dietary water requirements were not mentioned in the literature. Yellow warblers prefer wet habitats (Bent 1953; Morse 1966; Stauffer and Best 1980).

Cover

Cover needs of the yellow warbler are assumed to be the same as reproduction habitat needs are discussed in the following section.

Reproduction

Preferred foraging and nesting habitats in the Northeast are wet areas, partially covered by willows and alders (*Alnus* spp.), ranging in height from 1.5 to 4 m (5 to 13.3 ft) (Morse 1966). It is unusual to find yellow warblers in extensive forests (Hebard 1961) with closed canopies (Morse 1966). Yellow warblers in small islands of mixed coniferous-deciduous growth in Maine utilizated deciduous foliage far more frequently than would be expected by chance alone (Morse 1973). Coniferous areas were mostly avoided and areas of low deciduous growth preferred.

Nests are generally placed 0.9 to 2.4 m (3 to 8 ft) above the ground, and nest heights rarely exceed 9.1 to 12.2 m (30 to 40 ft) (Bent 1953). Plants used for nesting include willows, alders, and other hydrophytic shrubs and trees (Bent 1953), including box-elders (*Acer negundo*) and cottonwoods (*Populus* spp.) (Schrantz 1943). In Iowa, dense thickets were frequently occupied by yellow warblers while open thickets with widely spaced shrubs rarely contained nests (Kendeigh 1941).

Males frequently sing from exposed song perches (Kendeigh 1941; Ficken and Ficken 1965), although yellow warblers will nest in areas without elevated perches (Morse 1966).

A number of Breeding Bird Census reports (Van Velzen 1981) were summarized to determine nesting habitat needs of the yellow warbler, and a clear pattern of habitat preferences emerged. Yellow warblers nested in less than 5% of census areas comprised of extensive upland forested cover types (deciduous or coniferous) across the entire country. Approximately two-thirds of all census areas with deciduous shrub-dominated cover types were utilized, while shrub wetlands types received 100% use. Wetlands dominated by shrubs had the highest average breeding densities of all cover types [2.04 males per ha (2.5 acre)]. Approximately two-thirds of the census areas comprised of forested draws and riparian forests of the western United States were used, but average densities were low [0.5 males per ha (2.5 acre)].

Interspersion

Yellow warblers in Iowa have been reported to prefer edge habitats (Kendeigh 1941); Stauffer and Best 1980). Territory size has been reported as 0.16 ha (0.4 acre) (Kendeigh 1941) and 0.15 ha (0.37 acre) (Kammeraad 1964).

Special Considerations

The yellow warbler has been on the Audubon Society's Blue List of declining birds for 9 of the last 10 years (Tate 1981).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model has been developed for application within the breeding range of the yellow warbler.

Season. This model was developed to evaluate the breeding season habitat needs of the yellow warbler.

Cover types. This model was developed to evaluate habitat in the dominant cover types used by the yellow warbler. Deciduous Shrubland (DS) and Deciduous Scrub/Shrub Wetland (DSW) (terminology follows that of U.S. Fish and Wildlife Service 1981). Yellow warblers only occasionally utilize forested habitats and reported populated densities in forests are low. The habitat requirements in forested habitats are not well documented in the literature. For these reasons, this model does not consider forested cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous that is required before an area will be occupied by a species. Information on the minimum habitat area for the yellow warbler was not located in the literature. Based on reported territory sizes, it is assumed that at least 0.15 ha (0.37 acre) of suitable habitat must be available for the yellow warbler to occupy an area. If less than this amount is present, the HSI is assumed to be 0.0.

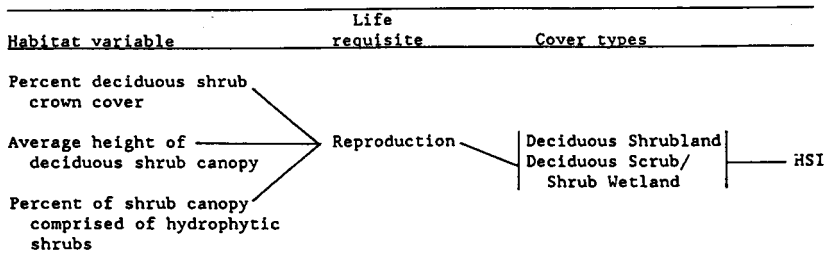
Verification level. Previous drafts of the yellow warbler habitat model were reviewed by Douglass H. Morse and specific comments were incorporated into the current model (Morse, pers. comm.).

Model Description

Overview. This model considers the quality of the reproduction (nesting) habitat needs of the yellow warbler to determine overall habitat suitability. Food, cover, and water requirements are assumed to be met by nesting needs.

The relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler is illustrated in Figure 1.

Figure 1. Relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler.



The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for the yellow warbler and to explain and justify and variable and equations that are used in the HSI model. Specifically, these sections cover the following: (1) identification of variables that will be used in the model; (2) definition and justification of the suitability levels of each variable; and (3) description of the assumed relationship between variables.

Reproduction component. Optimal nesting habitat for the yellow warbler is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs. Upland shrub habitats on dry sites will provide only marginal suitability.

It is assumed that optimal habitats contain 100% hydrophytic deciduous shrubs and that habitats with no hydrophytic shrubs will provide marginal suitability. Shrub densities between 60 and 80% crown cover are assumed to be optimal. As shrub densities approach zero cover, suitability also approaches zero. Totally closed shrub canopies are assumed to be of only moderate suitability, due to the probable restrictions on movement of the warblers in

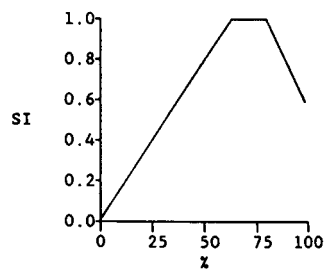
suitability, due to the probable restrictions on movement of the warblers in those conditions. Shrub heights of 2 m (6.6 ft) or greater are assumed to be optimal, and suitability will decrease as heights decrease to zero.

Each of these habitat variables exert a major influence in determining overall habitat quality for the yellow warbler. A habitat must contain optimal levels of all variables to have maximum suitability. Low values of any one variable may be partially offset by higher values of the remaining variables. Habitats with low values for two or more variables will provide low overall suitability levels.

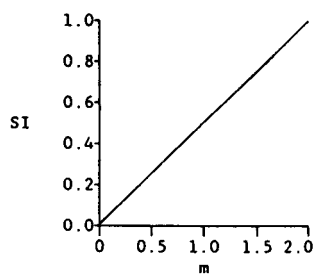
Model Relationships

Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

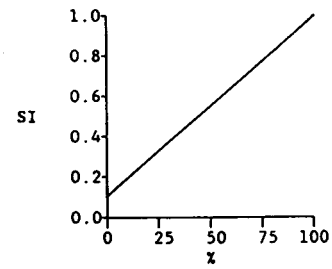
Cover type	Variable	
DS,DSW	V_1	**Percent deciduous shrub crown cover.**



DS,DSW	V_2	**Average height of deciduous shrub canopy.**



DS, DSW V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs.



Equations. In order to obtain life requisite values for the yellow warbler, the SI values for appropriate variables must be combined ith the use of equations. A discussion and explanation of the assumed relationship between variables was included under Model Description, and the specific equation in this model was chosen to mimic these perceived biological relationships as closely as possible. The suggested equation for obtaining a reproduction value is presented below.

Life requisite	Cover type	Equation
Reproduction	DS,DSW	$(V_1 \times V_2 \times V_3)^{1/2}$

HSI determination. The HSI value for the yellow warbler is equal to the reproduction value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays *et al.* 1981) are provided in Figure 2.

Figure 2. Definitions of variables and suggested measurement techniques.

Variable (definition)	Cover types	Suggested techniques
V_1 Percent deciduous shrub crown cover (the percent of the ground that is shaded by a vertical projection of the canopies of woody deciduous vegetation	DS,DSW	Line intercept

	which are less than 5 m (16.5 ft) in height).		
V_2	Average height of deciduous shrub canopy (the average height from the ground surface to the top of those shrubs which comprise the uppermost shrub canopy).	DW,DSW	Graduated rod
V_3	Percent of deciduous shrub canopy comprised of hydrophytic shrubs (the relative percent of the amount of hydrophytic shrubs compared to all shrubs, based on canopy cover).	DW.DSW	Line Intercept

SOURCES OF OTHER MODELS

No other habitat models for the yellow warbler were located.

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SAVANNAH SPARROW

General

The savannah sparrow (*Passerculus sandwichensis*) is a common breeding bird in low-elevation grasslands of the Pacific Northwest. It is found east and west of the Cascade Mountains in open fields, meadows, grain fields, and tidal marshes of pickleweed (*Salicornia virginica*) (Jewett *et al.* 1953; Larrison and Sonnenberg 1968). Birds have also been observed breeding in wet mountain meadows of the Cascades at 1890 m (6200 ft.) elevation (Banks 1960). Large numbers of savannah sparrows migrate through Washington and Oregon (Swarth 1936); migrants commonly range into mountainous areas seldom used for breeding (Larrison and Sonnenberg 1968; Wahl and Paulson 1971). Wintering birds are found west of the Cascades and favor grassy dunes and tidal marshes (Larrison and Sonnenberg 1968).

Food Requirements

Plant seeds and insects are the principle foods of the savannah sparrow. The percent plant food in the diet of sparrows collected throughout the geographic range was high in fall (84 percent) and winter (92 percent), moderate in spring (63 percent), and low in summer (26 percent) (Martin *et al.* 1961). Important food plants in California during spring and summer were bluegrass (*Poa* spp.), miner's lettuce (*Montia* sp.), pigweed (*Amaranthus* sp.), and chickweed (*Stellaria* sp.) (Martin *et al.* 1961). A wider diversity of plant seeds were consumed in fall and winter; species included knotweed (*Polygonum* sp.), turkey mullein (*Eremocarpos setigerus*), pigweed, wild oats (*Avena* spp.), canarygrass (*Phalaris* sp.), bluegrass, rabbitfoot polypogon (*Polypogon monspeliensis*), miner's lettuce, chickweed, and bromegrass (*Bromus* spp.). Crabgrass (*Digitaria* sp.) was the staple item in the diet of wintering savannah sparrows in South Carolina (Norris 1960). The major animal foods of this sparrow include beetles (Coleoptera), caterpillars (Lepidoptera), grasshoppers (Orthoptera), ants (Hymenoptera), bugs (Hemiptera), and flies (Diptera) (Martin *et al.* 1956). Spiders (Arachnida) and snails (Gastropoda) are taken locally. Insect prey taken by sparrows in Utah included leafhoppers (Cicadellidae), aphids (Aphididae), lygus bugs (Lygaeidae), damsel bugs (Nabidae), leaf beetles (Chrysomelidae), weevils (Curculionidae), midges (Chironomidae), and caterpillars (Knowlton 1950; Taber 1968). Dragonflies (Odonata), butterflies (Lepidoptera), aphids, spiders, and worms (Oligochaeta) were eaten by savannah sparrows in Wisconsin (Weins 1969). Larval and adult butterflies and moths were the main diet of savannah nestlings in Nova Scotia (Welsh 1975).

The savannah sparrow forages in the same grass-dominated cover types used for nesting. Individuals move slowly through the vegetation at about 0.3 m (1 ft.) per minute while foraging (Cody 1968). Sparrows on a Minnesota grassland spent 100% of their foraging time feeding on the ground and on vegetation within 7.6 cm (3 in.) of the surface (Cody 1968). Dense grass or grass clumps appear to be important components of foraging habitat for this species (Taber 1968). Wisconsin savannah sparrows restricted their foraging to areas of low grass cover having an average height of less than 10.2 cm (4 in.) (Wiens 19973. Concentrated feeding occurred around the perimeters of grass clumps.

Savannah sparrows on Destruction Island off the Washington coast spent 80% of their foraging time on a rockweed (*Fucus distichus*) substrate and the remaining 20% divided among substrates of barnacles (Cirripeda), gravel, sea lettuce (*Ulva* sp.), encrusting algae, mussels (*Mytilus* sp.), and sand (Nysewander 1977). Breeding savannah sparrows on a dune system in Nova Scotia foraged for nesting food within a dense cover of drifted eelgrass (*Zostera marina*) along a lagoon shore (Welsh 1975).

Foraging habitat for wintering birds is characterized by abundant small seeds available on the ground and by bare ground on which birds can move and forage (Quay 1957). Savannah sparrows will congregate around concentrated seed sources (Baird 1968). The density of wintering sparrows on a South Carolina field was correlated with the frequency of crabgrass on sample quadrats (Norris 1960). Sparrow density was 32.6 to 71.7 birds per ha (13.2 to 29.0 per acre) on areas with a crabgrass frequency of 77%, but was only 3.0 to 12.4 birds per ha (1.2 to 5.0 per acre) where crabgrass frequency was 9%.

Water Requirements

The savannah sparrow inhabits dry uplands and other areas such as sand dunes and salt marshes that lack sources of fresh water (Baird 1968(. The species is able to subsist on moisture derived from dew and succulent food items (Cade and Bartholomew 1959). Fresh water is used for bathing and drinking when available (Norris 1960). Resident races of this species in salt marshes can utilize saline water to meet water requirements (Cade and Bartholomew 1959); Poulson and Bartholomew 1962). Other races, such as Brook's savannah sparrow (*P.s. Brooksi*) in the Pacific Northwest, use salt marshes mainly as wintering areas; these races have a low tolerance for salt water but can survive on brackish water.

Cover Requirements

Savannah sparrows roost on the ground among short grass (Baird 1968). Cover requirements during the breeding season are satisfied by moist open grassy fields with scattered forbs and a dense ground layer of grass and accumulated litter (Tester and Marshall 1961; Wiens 1973). Specific physical and vegetative characteristics of breeding habitat are described below under "Reproduction Requirements."

Wintering populations of savannah sparrows require an overhead cover of low to moderately tall grass (Quay 1957). Most wintering individuals on an Arizona grassland foraged between 4 and 16 m (13.1 and 52.5 ft.) from tree or shrub cover (Pulliam and Mills 1977). Relative density of savannah sparrows within this area was more than 3 times that of areas closer to or further from woody cover. Individuals usually flew to an exposed perch in herbaceous vegetation when first disturbed, but flew to cover if flushed a second time.

Reproduction Requirements

The savannah sparrow will nest in a variety of ecological situations, including prairie, freshwater marsh, sedge bog, cultivated field, coastal salt marsh, grassy sand dune, and subalpine meadow (Baird 1968). This species was

associated with the fescue-snowberry (*Festuca-Symphoricarpos*) plant community in the shrub-steppe region of eastern Washington (Johnsgard and Rickard 1957).

This species is a ground nester. Nests are usually placed in a shallow hollow among grass tussocks and low rank vegetation (Baird 1968; Taber 1968). Of 27 nests found on old fields in Wisconsin, 19 were either partially domed or well concealed beneath overhanging litter (Weins 1969). Nests on Nova Scotia coastal dunes were placed beneath grass tufts, under heavy crowberry (*Empetrum nigrum*) growth, and under clumps of reindeer moss (*Cladonia* sp.) (Welsh 1975).

Savannah sparrows generally require dense grass or grass clumps and a well-developed litter layer on nesting habitat (Taber 1968). A pasture in Michigan used for nesting was characterized by grass hummocks 30 cm (11.8 in.) high and other grasses up to 45 cm (17.7 in.) tall (Potter 1972). The average height of vegetation on nesting territories in Minnesota was 0.6 m (2.0 ft.) (Cody 1968). The average vertical density (number of contacts of vegetation on a thin metal bar held upright perpendicular to the ground) on these territories was 14.3, while the horizontal density of vegetation (number of contacts on a thin 0.9 m bar held parallel to the ground 5 cm above the surface) averaged 13.3. Other grasslands within the geographic range of the savannah sparrow but without breeding populations had vegetation less than 0.4 m (1.4 ft.) tall. The average vertical and horizontal densities were less than 8.0 and 8.7 respectively on these unoccupied grasslands. Portions of a Wisconsin pasture that were colonized in the early and middle stages of territory establishment had significantly more grass cover, deeper and patchier litter, and lower forb density and cover at the peak of the breeding season than areas of the pasture colonized during the late spring (Weins 1973). Grass cover ranged between 71 and 100% among all territories and averaged 96, 95, and 88% respectively on early-, middle-, and late-occupied territories. The corresponding average litter depths were 2.8, 2.4, and 1.8 cm (1.1, 0.9, and 0.7 in.). Forb cover on territories ranged between 15 and 42%; the averages on early-, middle-, and late-occupied territories were 18, 23, and 34% respectively. Average forb heights on these territory groups were 12, 16, and 18 cm (4.7, 6.3, and 7.1 in.). The density of forbs was low on the first territories established and high on later territories. Nest sites were located in areas with a litter cover of 100% (Weins 1969). The litter cover over entire nesting territories averaged 64%. The mean litter depth at nest sites was 7.8 cm (3.1 in.); most nests were located in litter more than 1 cm (0.4 in.) deep.

Special Habitat Requirements

Savannah sparrows require song and display perches within breeding territories. Weed stalks and fence posts were used for perching in the Pacific Northwest (Gabrielson and Jewett 1940) and Wisconsin (Weins 1973). Perch sites in Michigan included thistle (*Cirsium* sp.), goldenrod (*Solidago* sp.), willow (*Salix* sp.) clumps 0.5 to 2.0 m (1.6 to 6.6 ft.) high, barbed wire fencing, and the ground (Potter 1972). Small woody plants were used on sites where tall forbs were absent in southeastern Washington (Johnsgard and Rickard 1957) and Nova Scotia (Welsh 1975).

Interspersion Requirements

The savannah sparrow is an "herb sparrow" (Odum and Hight 1957). All its habitat requirements are satisfied by the herbaceous vegetation of grass-dominated cover types. No interspersion of woody vegetation is necessary.

Breeding territories in Michigan averaged 0.11 ha (0.27 acres) in area (Potter 1972). Territories with nests were larger (0.12 ha, 0.30 acres) than those without nests (0.08 ha, 0.20 acres). Territories ranged in size from 0.01 to 0.29 ha (0.02 to 0.72 acres), but 58% were between 0.06 and 0.12 ha (0.15 to 0.30 acres) in area. Breeding territories in a Wisconsin pasture ranged in area from 0.16 to 1.09 ha (0.40 to 2.69 acres) (Weins 1973). The mean size of territories on the center of the pasture was 0.45 ha (1.11 acres), while territories on the periphery averaged 0.65 ha (1.61 acres). Territories formed early in the breeding period were smaller (0.49 ha, 1.21 acres) than those established during the middle (0.53 ha, 1.31 acres) and late (0.57 ha, 1.41 acres) periods of territory formation. The size of individual territories on Nova Scotia sand dunes varied within the breeding season (Welsh 1975). The maximum mean territory size of 0.21 ha (0.53 acres) was reached immediately after clutch completion. After hatching a brood, sparrows defended a smaller feeding area averaging 0.15 ha (0.37 acres) in size. The territory size over the entire breeding period averaged 0.17 ha (0.42 acres) and ranged from 0.07 to 0.40 ha (0.17 to 0.99 acres).

The density of breeding birds on an old field in New Brunswick was 8.7 pairs per ha (3.5 per acre) (Dixon 1978). Nesting habitat on Nova Scotia coastal dunes supported 5.4 pairs per ha (2.2 per acre) (Welsh 1975). The density of savannah pairs was 3.7 per ha (1.5 per acre) on old fields in Michigan (Potter 1972). A density of only 2.5 territories per 10 ha (1 per 10 acres) was observed in southeaster Washington (Johnsgard and Rickard 1957).

Savannah sparrows move over a wide area during winter foraging activity. Short-term winter home ranges in South Carolina averaged 3.2 ha (8 acres) in area and ranged from 0.8 to 5.7 ha (2 to 14 acres) (Norris 1960). Individuals changed foraging areas frequently and the total area utilized during a winter season was larger than these home range sizes. Winter density on old fields averaged 9.9 to 12.3 birds per ha (4 to 5 per acre), while spring and fall densities were less than 4.9 birds per ha (2 per acre). Congregations of more than 74.1 birds per ha (30 per acre) occurred around concentrated food sources.

Special Considerations

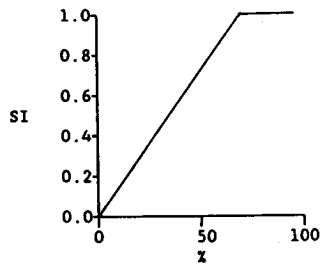
The savannah sparrow will readily utilize cultivated and hay fields in place of natural grasslands as breeding and wintering habitat. Heavy grazing eliminates nesting and cover habitat by reducing the height and density of herbaceous vegetation. The loss of natural salt marsh and dune communities to development reduces the area of suitable breeding and wintering habitat for coastal populations of this species. Relatively high pesticide levels have been found in savannah sparrows due to their insectivorous diet during the summer (Johnson 1975).

SAVANNAH SPARROW

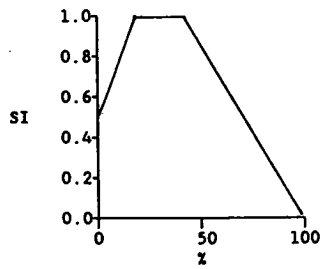
Herbland
Herb-dominated wetland

Habitat Requirement	Field Measurement
Food	Percent cover of grass and grass-like plants
Cover	Average height of grass and grass-like plants
	Percent forb cover
	Average height of forbs
	Percent litter cover
	Modal distance among shrubs and trees
Reproduction	Percent cover of grass and grass-like plants
	Percent forb cover
	Percent litter cover
	Average height of grass and grass-like plants
	Average height of forbs

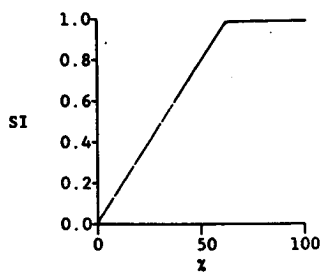
Variable 1: Percent cover of grass and grass-like plants



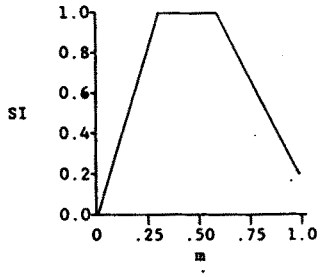
Variable 2: Percent forb cover



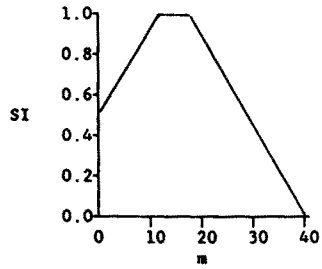
Variable 3: Percent litter cover



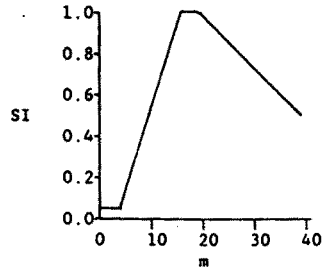
Variable 4: Average height of grass and grass-like plants



Variable 5: Average height of forbs



Variable 6: Modal distance among shrubs and/or trees



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Appendix C-2

HEP ASSUMPTIONS

ASSUMPTIONS

GENERAL

1. HEP is the preferred method to quantify project impacts and the HSI models selected to evaluate the habitat are acceptable given the time constraints imposed.

2. The HEP period of analysis is 50 years; the dredging would be completed within 1 year, disposal would be completed in 3-4 days.

3. About 26,000 cys of dredged material may require upland disposal; only the Louisiana Pacific site would be used.

4. Aerial photography interpretation and literature review are acceptable means to map habitat at the two upland disposal sites.

5. The maximum acreage that would be directly impacted at either disposal site is 16 acres, assuming the material is at least 1 foot deep throughout the site.

LOUISIANA PACIFIC SITE

6. The dredged material, if disposed on the Louisiana Pacific site, would be dried for about one year and then transported to an approved landfill site.

7. The Louisiana Pacific site exhibits degraded habitats as it is used for maintenance dredged material disposal drying annually.

8. The salt marsh located in the northeast corner of the Louisiana Pacific disposal site (near Somoa Bridge and Vance Avenue) would be avoided. Therefore, wetland acreages in the HEP report do not include this wetland.

9. The permit to dispose of dredged material at the Louisiana Pacific site expires in 1995. For this analysis, it is assumed a new permit will be obtained.

10. Two feet of topsoil would be spread over the site the first winter following termination of deposition. Spoils would be contoured to a configuration of adjacent dunes creating mounds vary in height from 5 to 30 feet (conditions of California Coastal Commission permit NCR-76-C-345, filed 9/10/76).

DATA ANALYSIS ASSUMPTIONS

LOUISIANA PACIFIC SITE

FUTURE WITHOUT PROJECT (PA1

Yellow Warbler (Scrub-Shrub Wetland)

V1 % deciduous crown cover
V2 Average height of deciduous shrub canopy
V3 % of deciduous shrub canopy comprised of hydrophytic

TY0 (Baseline) Site continually disturbed in between disposal events.

V1 60% SI = 1.0
V2 1.5m SI = 0.75 HSI = $(V1 \times V2 \times V3)^{1/2} = (1.0 \times 0.75 \times 0.82)^{1/2} = .78$
V3 80% SI = 0.82

TY1 Harbor material disposed and site continually disturbed in between dredged material disposal events, spaced 3-4 years apart. Therefore, no change from baseline conditions for the life of the project.
TY2 No change from TY1
TY3 No change from TY2
TY51 No change from TY3. This assumes a new permit is granted to continue to use this site for dredged material disposal.

Savannah Sparrow (Dune)

V1 % cover of grass and grass-like plants
V2 % forb cover
V3 % litter cover
V4 Average height of grass and grass-like plants
V5 Average height of forbs
V6 Model distance among shrubs and/or trees

TYO (Baseline) Site continually disturbed in between disposal events.

V1 30% SI = .42
V2 12% SI = .90
V3 10% SI = 0.16
V4 .15m SI = 0.50
V5 10cm SI = 0.83
V6 33m SI = 0.73

$$HSI = \frac{V1 + V2 + V3 + V4 + V5 + V6}{4} = .59$$

TY1 Site continually disturbed in between dredged material disposal events, spaced 3-4 years apart. Therefore, no change from baseline.
TY51 No change from TY1. This assumes a new permit is granted to continue to use this site for dredged material disposal.

FUTURE WITH PROJECT (PA2)

Yellow Warbler (Scrub-Shrub Wetland)

TY0 (Baseline)
TY1 Assume site is graded, all vegetation cleared, and dredged material is spread evenly over entire site.

V1 % deciduous crown cover = 0. SI = 0
V2 Average height of deciduous shrub canopy = 0 SI = 0
V3 % of deciduous shrub canopy comprised of deciduous shrubs = 0 SI = 0.10

V1 = 0 SI = 0
V2 = 0 SI = 0 $HSI = (V1 \times V2 \times V3)^{1/2} = 0.0$
V3 = 0 SI = 0.10

TY51 No change from TY1. This assumes a new permit is granted to continue to use this site for dredged material disposal.

Savannah Sparrow (Dune)

TY0 (Baseline)
TY1 Assume site is graded, all vegetation cleared, and dredged material is spread evenly over entire site.

V1 = 30% SI = 0.42
V2 = 12% SI = 0.90
V3 = 10% SI = 0.16
V4 = .15m SI = 0.50
V5 = 10cm SI = 0.83 $HSI = \frac{0.42 + 0.90 + 0.16 + 0.50 + 0.83 + 0.73}{6} = .59$
V6 = 33m SI = 0.73

TY51 No change from TY1. This assumes a new permit is granted to continue to use this site for dredged material disposal.

Appendix C-3

HEP OUTPUT REPORT

Form D: Net Change in AAHUs Date: 01/27/1994

Study Name: UPLAND DISPOSAL SITE OPTIONS - LOUISIANA PACIFIC

Action: PA 2 (with project) FUTURE WITH PROJECT
Compared To: PA 1 (without project) FUTURE W/O PROJECT
Period of analysis: 51

Evaluation Species		AAHUs With Action	AAHUs Without Action	Net Change
ID#	Name			
2	YELLOW WARBLER	2.03	2.03	0.00
3	SAVANNAH SPARROW	13.04	13.04	0.00

Appendix D

DRAFT HABITAT EVALUATION PROCEDURES FOR THE HUMBOLDT HARBOR AND BAY AREAS TO BE DEEPENED AND WIDENED

A. Site Description

Humboldt Bay, which is the only major shipping port between San Francisco (233 miles south) and Coos Bay, Oregon (209 miles north), is also one of California's largest estuaries. It consists of three sub-bays: the wide, shallow South Bay; a deeper, narrower central Entrance Bay; and the largest sub-bay, the wide, relatively shallow North Bay (Arcata Bay). The width of the Bay varies from one-half mile to about 4 miles and is about 14 miles in length. The total water surface area is 7.8-square-miles at low tide and 24.5-square-miles at high tide. Over half of the surface of the North and South Bays is exposed at low tide. Both South Bay and Arcata Bay consist of extensive intertidal mudflats and channels (Barnhart *et al.* 1991). Entrance Bay has one deep connecting channel (Samoa Channel) which joins North Bay and South Bay and also leads to the ocean through the Bar and Entrance Channels. Samoa Channel is maintained by two concrete and rock jetties exceeding 1 mile in length. A narrow sand spit from one-eighth to 1 mile in width separates the Bay from the ocean on both sides of the entrance.

Humboldt Bay has a drainage basin of 288-square-miles and is immediately surrounded by lowlands which were converted from salt and brackish water marshes to agricultural uses in the 1880s (Barnhart *et al.* 1991). The lowlands are intersected by foothills of the Coast Range which extend nearly to the Bay shore at several locations (Monroe *et al.* 1973). Sources of freshwater to the Bay include Jacoby Creek and Freshwater Creek in Arcata Bay, Elk River in Entrance Bay, and Salmon Creek in South Bay. These streams and their corresponding sloughs are generally under tidal influence, however, tide gates are present on Salmon Creek.

About 77 percent of the total reach of Humboldt Bay is composed of tidal flats, 19 percent is channels, and 4 percent is salt marshes (Shapiro and Associates, Inc. 1980)

B. Model Description

For the area proposed to be dredged, we adapted a recently developed model from our analysis of the proposed Oakland Harbor Navigation Project (USFWS 1994). This model uses an aggregate HSI, which represents our best professional opinion about the value of the habitat under existing and alternative (i.e., with-versus without-dredging) future conditions. As in traditional HEP procedures, this aggregate HSI may vary from 0.0 to 1.0, where 1.0 would represent the highest value of that cover-type within the local region (Humboldt Bay). The general factors and mechanisms by which dredging can reduce habitat value are discussed in the proposed Oakland Harbor Navigation Project (USFWS 1994).

In the Service's preliminary draft FWCA Report for the Humboldt project (USFWS 1991) three basic cover-types were recognized: 1) deep unvegetated or vegetated subtidal (> 20 feet MLLW); 2) shallow unvegetated or vegetated subtidal (0 to 20 feet MLLW); and 3) unvegetated or vegetated intertidal (< 0 feet MLLW). Most of the vegetation present is eelgrass. Eelgrass may occur in both the intertidal and shallow subtidal zone, however, greatest abundance is expected in the shallow subtidal areas due to dredging of the deeper areas. The exact distribution of eelgrass is not known, thus, we opted to define the cover-types using the above depth criteria.

The deep unvegetated or vegetated subtidal habitat of Humboldt Bay is of high to medium value for the evaluation species and is relatively abundant in the region. The evaluation species selected to determine the value of this habitat type are the Dungeness crab and marine fishes (principally bottomfish). These species have been selected because of their high values to commercial and sport fishing interests.

Shallow unvegetated or vegetated subtidal habitats in Humboldt Bay are of high value for the evaluation species. Eelgrass beds are scarce or becoming scarce thoughout the Pacific Northwest and California. Humboldt Bay supports the only significant beds of eelgrass in California and Oregon. Much of their historic decline can be attributed to navigation and harbor projects, and pollution. The evaluation species selected to determine the value of the eelgrass beds are the black brant, and marine fishes that depend on these areas to complete their life cycle, such as the Pacific herring. The black brant was selected because it is a species of special concern to the Service. Marine fishes were selected because of their importance to the commercial and sport fisheries.

The unvegetated or vegetated intertidal mudflats in Humboldt Bay are also of high value for the evaluation species. The evaluation species selected to determine the value of the intertidal mudflats are the numerous migratory shorebirds that use the area. Migratory shorebirds were selected to determine the value of this habitat because of their protection under the Migratory Bird Treaty Act, importance for non-consumptive human uses (e.g., photography and birdwatching), and value as general biological indicator species.

Based on the preceding considerations, our mitigation planning goals for the three cover-types are: (1) deep unvegetated or vegetated subtidal habitat--no net loss of habitat value, while minimizing loss of in-kind habitat value (Resource Category 3); (2) shallow unvegetated or vegetated subtidal--no net loss of in-kind habitat value (Resource Category 2); and (3) unvegetated or vegetated intertidal--no net loss of in-kind habitat value (Resource Category 2).

For the HEP analysis, however, a somewhat simpler cover-type designation scheme was needed. Thus, the three cover-types were simply lumped into two broad categories to which project impacts would be expected: water column (includes existing channel, new channel, and adjacent bay/harbor), and subtidal benthic areas (includes existing channel and new channel).

C. Impact Analysis

The area of new channel, existing channel, area between the channel and land (or hard structure), and perimeter border of channel not adjacent to land were measured by planimetry of a 1:24,000 navigation chart. The following assumptions are made in this analysis: 1) previously dredged area is equal to the existing channel bottom as indicated in the plans, 2) impacts on the subtidal benthic cover-type would not extend beyond the dredging boundaries, and 3) the impacted open water cover-type consists of a) an area of open water within the inner and outer harbors equivalent to the impacted subtidal benthic area, b) adjacent open water areas between the channel edge and land (termed "adjacent harbor") and c) for any perimeter of the channel which is not adjacent to land, an additional open water area equal to the length of the perimeter multiplied by 600 feet (termed "adjacent bay").

A low level of impact is anticipated in these adjacent areas, due to exposure to sediment plumes during construction and maintenance of the project, even though these areas are themselves not dredged. Deep subtidal areas impacted by the project are about 581 acres of existing channel, 45 acres of new channel, and 608 acres of adjacent area (Table 1). In addition, about 44 acres of intertidal and 474 acres of shallow subtidal cover-types, also adjacent to the project, would be impacted (total of 1,126 acres of adjacent bay and harbor area; see Table 1). HSIs are assumed to remain constant without the project. We also assume a 1-year construction period for the project, followed by a 50-year project life, during which annual maintenance dredging would be conducted.

The general factors which determine habitat suitability in the Oakland Harbor Navigation Project (USFWS 1994), apply equally to the Humboldt Harbor Deepening project. These are: (a) temporary physical disturbances due to to the dredging, (b) changes in rate or area of deposition, (c) subsequent disturbance due to increased maintenance dredging, and (d) indirect impacts associated with any increase in shipping activity associated with the project.

However, there are several differences to note between this model and the preliminary HEP model described for ocean disposal impacts (Appendix E). First, because less comprehensive site-specific information is available for the dredging site, we do not calculate a formula-based HSI from individual SIs. Rather, an aggregate HSI is estimated which represents our best professional opinion as to the likely change in habitat value for the three impact categories. Second, because impacts would be greatest during the 1-year construction period, the HSIs are not constant over time. In the following selection scheme, a HSI value of 1.0 represents the optimum value of that cover-type within Humboldt Bay. Third, it is assumed that dispersion of sediments and any associated contaminants would impact only the water column of adjacent areas, and that no significant accumulation of such sediments would occur in the shallow or deep subtidal benthic cover-types.

Impacts were first calculated using the preliminary HEP for Alternative 1. Impacts for the larger project Alternatives 2 and 3 were then estimated by

Table 1. Aggregate Habitat Suitability Indices (HSIs) by Target Year (TY) period and estimated Average Annualized Habitat Units (AAHUs) for subtidal benthic and water column cover types affected at the proposed dredging site by the Humboldt Harbor Deepening Project.

COVER TYPE		HSIs			AAHUs		
Impact Area	Acres	TY0	TY1	TY2-TY53	Without Project	With Project	Net Loss
WATER COLUMN							
existing channel	581	0.7	0.5	0.7	406.70	404.47	2.23
new channel	45	0.7	0.5	0.7	31.50	31.33	0.17
adj. bay/harbor	1126	0.8	0.7	0.8	900.80	898.63	2.17
				total water column loss =			4.57
SUBTIDAL BENTHIC							
existing channel	581	0.4	0.3	0.36	232.40	208.71	23.69
new channel	45	0.7	0.3	0.36	31.50	16.30	15.20
			total subtidal benthic loss =				38.89

assuming that overall impacts would increase in proportion to the larger dredging volumes associated with these alternatives.

1. Water Column

In general, the deeper waters of the existing channel would have a somewhat reduced existing habitat value compared to either unchannelized deep waters or adjacent shallow areas. This results in part from higher loads of fuel, oil, and other contaminants associated with shipping, and urban centers such as the city of Eureka. Contaminant levels in the water column may be partially ameliorated at some times of the year by flows from the Mad River. We assume existing HSIs of 0.7, 0.7, and 0.8 for water column within the existing channel, new channel, and adjacent subtidal areas, respectively, which would be reduced during the construction period to 0.5, 0.5, and 0.7, and return to existing values after construction. These are intended to be average values for the entire area, as it is clear that impacts would vary considerably over space as the project (i.e., dredging) proceeds.

2. Deep subtidal benthic

Impacts of channel construction on sediment-associated benthic fauna, is considered to be substantially greater than the impacts on the water column, which is a dispersive environment. New, deepened, or widened channel areas are expected to accumulate fine sediments with higher organic content than existing conditions. Also, the local contaminant load and/or disturbance due to increased or new maintenance dredging would reduce the benthic abundance in such environments.

Unlike Oakland Harbor, benthic surveys in the existing channel and reference areas are not available for Humboldt Harbor. However, considering the somewhat less urbanized nature of the Humboldt County area, and the greater potential presence of high-value eelgrass beds in undredged areas, we have assumed a somewhat higher baseline (existing) benthic value of 0.4 for the existing channel, and 0.7 for the new channel areas.

Lowest HSIs would likely be experienced during the 3-year construction period. Clearly, the value would vary between locations as the project is constructed; areas which had been most recently dredged would show the lowest benthic quality, whereas areas which had not yet been dredged would exhibit higher quality, and dredged areas which had recovered would display intermediate quality. For simplicity, we assume the HSI would decline to 0.3, and would recover to 90 percent of the baseline condition (HSI = 0.36). The incomplete recovery is assumed to be a consequence of the greater deposition anticipated with a larger and deeper channel, as well as the overall negative influence of increased vessel traffic such as higher frequency of contaminant spills and increased propwash.

D. Discussion

For alternative 1, HEP analyses showed losses of 4.57 and 38.89 AAHUs of water column and subtidal benthic habitat value, respectively. For Alternative 1, mitigation of this loss could be theoretically done by providing at least 43.46 acres of "optimum" habitat (refer to the Service's Oakland Harbor draft FWCA Report (USFWS 1994) for further discussion). If the ratio of 43.46 acres per 5 million cys is applied to alternatives 2 and 3, about 59.97 and 77.36 acres, respectively, of such new "optimum" habitat would be needed to offset those impacts (Table 2).

The main uncertainty in this analysis is that mitigation would undoubtedly be less than optimal, which may necessitate additional mitigation area. As previously mentioned (and in USFWS 1994), some mitigation concepts which provide more than one cover-type could potentially reduce acreage requirements. For example, an upland cut creates both benthic and water column cover-types; optimization of both of these cover-types (i.e., increasing values from zero to 1.0, for each) could potentially, and under ideal conditions, reduce mitigation requirements to one-half the values in Table 2.

Table 2. Individual impacts and mitigation requirements for habitat value losses at the dredge site for the three alternatives of the Humboldt Harbor Project.

ALTERNATIVE	DREDGED VOLUME (million cys)	INDIVIDUAL IMPACT (AAHUs) OR MITIGATION AREA (acres)
1	5.0	43.46
2	6.9	59.97
3	8.9	77.36

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Appendix E

DRAFT HABITAT EVALUATION PROCEDURES FOR DISPOSAL AT THE HUMBOLDT OPEN OCEAN DISPOSAL SITE (HOODS)

A. Site Description

The HOODS is a square nautical mile in size (848 acres), located between the 160 and 180 Mean Lower Low Water (MLLW) contours, about 3 to 3.5 miles from the Pacific coastal entrance to Humboldt Harbor. Numerical modeling by the Corps suggests that the site is nondispersive. The site is characterized as a transition area between the "mid-depth" and "offshore" zones (Corps 1993). This transition area, termed the inner edge of migrating sand-silt front, is believed to be variable in substrate and is typified by a reduced abundance of species. Including 1994 spring and fall maintenance dredging, the HOODS has been used for disposal 10 times previously, receiving a total of about 2,861,289 cys of dredged material.

B. Model Description

The model used for impact analysis is adapted from a model developed for another ocean disposal site, the Ocean Dredged Material Disposal Site (ODMDS) (USFWS 1994), which is being considered for the disposal of sediments from dredging of Oakland Harbor. Briefly, the model calculates a Habitat Suitability Index (HSI) from four community-based suitability indices (SIs) for each of the three cover-types. The four community-based indices are: (a) X1 - use of the habitat by the evaluation species, where the extent of use is ranked relative to the observation of such species within the impact area compared to other habitats within the species' population range; (b) X2 - overall community diversity; (c) X3 - the evaluation species' commercial and/or recreational value; and (d) X4 - relative scarcity of the habitat type on a regional or national basis. These SIs reflect, on a scale of 0.0 to 1.0, our best professional judgement as to the existing or future value of the affected area for each of the three cover-types.

The overall HSI equals the average of X1, X2, and X3 which is then scaled by multiplying the result by X4. The formula applied may be expressed as:

$$HSI = ((X1 + X2 + X3)/3) * X4$$

If SIs are assumed to be constant over the project life, then the Average Annual Habitat Units (AAHUs) equal the product of the HSI and cover-type acreage. The difference between without- and with-disposal alternatives is then summed across cover-types to obtain the loss due to the project. Mitigation through the provision of "optimum habitat" (i.e., an increase of HSI from zero to 1.0; see USFWS 1994 for further explanation) would thus require an acreage not less than the AAHUs lost.

Designated sites such as the HOODS and ODMDS may receive dredged material from a variety of sources, resulting in relatively constant impacts over the life of the site. In our analysis, we therefore also calculate cumulative impacts from all disposal activities, and assign a fraction of that impact for an

individual project, such as Humboldt Harbor deepening, based on the dredge volume it contributes to the capacity of the site.

C. Assumptions

1. The HOODS has a project life of 50 years, and would receive an average of about 698,000 cubic yards (cys) of dredged material per year, or about 35 million cys over the life of the project. This is based on the 1982 to 1991 record of fall-season maintenance dredging for the Bay Bar and Entrance, and North Bay Channels (Corps 1993).

2. About 230 disposal events (at about 3,000 cys per dredge load) would occur annually. These would be rotated regularly among the 36 grid sections of the HOODS.

3. The dredged material would be dominated by sand (greater than 95 percent), and substantially free of all contaminants.

4. There would be no increase in maintenance dredging (i.e., maintenance dredging would be the same with- and without- the project).

D. Impact Analysis

The basis for selection of cover-types is general descriptive information provided by the Corps (1993). We have identified two basic cover-types of concern at the HOODS: (1) open surface waters; and (2) deep water benthos. At this time, we have not defined a deep water column as in the Service's draft FWCA Report for Oakland Harbor (USFWS 1994), because of the more moderate depth of the HOODS. Below, we describe the important fish and wildlife resources associated with the two basic habitats at the HOODS.

1. Open Surface Waters

The impact area affected by the site would be about 1 square mile (640 acres). This area provides suitable habitat for about 34 species of waterbirds, including petrels, fulmers, shearwaters, albatrosses, and jaegers. Of those species of concern in the area, the short-tailed albatross is endangered, feeding on fish, shrimp, or squid in the open waters similar to that of the HOODS. Common and Pacific bottlenose dolphins also occur along this area of the Humboldt coast.

Due to the relatively close proximity of the HOODS to the coast, anadromous fishes associated with surface waters likely include chinook and coho salmon, sea-run cutthroat trout, and steelhead trout. A variety of other fish and shellfish are also commercially harvested in the area, such as dover and petrale sole, pink shrimp, rockfish, lingcod, sablefish, lingcod, halibut, and others.

Appropriate evaluation species would be (i) waterbirds because of the Service's responsibilities for their management under the Migratory Bird Treaty Act, and their relatively high value for non-consumptive uses such as

bird-watching, and (ii) anadromous salmonids, because of their high commercial and sportfishing values. This area is thus given the mitigation planning goal of "no net loss of habitat value while minimizing the loss of in-kind habitat value" (Resource Category 3).

General impacts to these biotic communities would include increased disturbance due to vessel traffic itself, and exposure of aquatic species to high concentrations of relatively clean, sandy, dredged material. Typically, the rapid deposition of sand-dominated dredged material results in a reduced disposal plume.

X1: In consideration of the distance of the HOODS from the coast and its position within the Pacific Flyway, we tentatively assign a no-disposal SI of 0.9. The expected frequency of disturbance is sufficent to result in a reduction in habitat use of about 20 percent overall for the area, or a with-disposal SI of 0.7 (Table 1).

X2: Diversity of surface-associated fish and wildlife in these waters is considered relatively high (no-disposal SI = 0.9). Disturbance of the waters will result in a local reduction of species diversity, due to avoidance of the dump site by some species (with-disposal SI = 0.7).

X3: Coastal areas within and around the HOODS are considered prime fishing grounds for numerous species and are frequented by surface trollers, though less so than some areas nearer to the coast. Regular visitation by dredge barges will likely have a moderate negative impact on commercial/recreational value (no-disposal SI = 0.8, with-disposal SI = 0.6)

X4: Habitat such as the HOODS is of high value, however, it has thus far been relatively unimpacted by human activities in this region. Still, it is considered of greater scarcity than surface waters farther offshore. Therefore, both disposal and no-disposal conditions would have an SI = 0.03.

2. Deep Water Benthos

The Corps has not provided an analysis of the fate of the disposed material. The "footprint" of benthic impact area would depend on the depth of the water, the composition of the material, and the predominant current conditions and energies. Assuming that the maximum extent of impact extends 0.5 mile beyond the border of the HOODS, about 4 square miles would be affected (2,560 acres).

Infauna near the HOODS is typified by polychates, crustaceans and molluscs, similar in biomass to nearshore values (Corps 1993). The sand dollar, which is common in the harbor, is not typically found offshore. Now, however, it occasionally dominates the biomass near the disposal site, apparently due to the translocation of animals with the dredged material. The area is considered in a hydraulic transition boundary between the mid-depth and offshore zones, where silts and organics increase with bottom depth.

Demersal fishes include several species of sole and smelt. The most abundant macroinvertebrates are several species of shrimp, mysids, and starfish. Deep water areas such as the HOODS are also a significant habitat for adult

Dungeness crab. An appropriate evaluation species for the deep water benthos of the HOODS would be the commercially significant flatfishes such as Dover sole. This area is thus given a mitigation planning goal of "minimize the loss of habitat value" (Resource Category 4).

Table 1. Preliminary alternative Habitat Evaluation Procedures (HEP) analysis of impacts at two ocean habitats affected by disposal at the Humboldt Open Ocean Disposal Site. The project life is 50 years, and all Habitat Suitability Indices (HSIs) are assumed to be constant over the project life.

COVER TYPE action	SUITABILITY INDICES x1	x2	x3	x4	HSI	ACRES	AAHUs
OPEN SURFACE WATERS							
no disposal	0.9	0.9	0.8	0.03	0.026	640	16.64
with disposal	0.7	0.7	0.6	0.03	0.020	640	12.80
						loss =	3.84
DEEPWATER BENTHOS							
no disposal	0.8	0.6	0.8	0.03	0.022	2,560	56.32
with disposal	0.7	0.5	0.6	0.03	0.018	2,560	46.08
						loss =	10.24

X1: The HOODS is considered an ideal habitat for the evaluation species, and provides excellent forage for demersal fishes. Discharge of sand would result in some smothering of benthic organisms and a reduced use of the area by these fishes. However, under the assumptions that disposals are rotated among cells within the HOODS and limited to 230 events, the impact on habitat use would be considered relatively low (i.e., no-disposal SI = 0.8; with disposal SI = 0.7).

X2: Diversity in the HOODS is reputed to be moderate because it is within a transition zone. Nonetheless, placement of sands over the natural silt-clays of the area would result in some reduction in species abundance not suited to this grain size, and possible impacts due to introduction of species from the dredged material. A moderate impact is therefore assumed (i.e., no-disposal SI = 0.6, with disposal SI = 0.5).

X3: Similar to the surface waters, there is relatively high use and value of the commercial catch within and around the HOODS. Disposal at the site is assumed to result in a modest reduction in the commercial value of the site (i.e., no-disposal SI = 0.8, with disposal SI = 0.6).

X4: As with the open surface waters, the deepwater benthos is of high value but largely unimpacted by human activities in this region. Still, it is considered of greater scarcity than surface waters farther offshore. (i.e., both conditions SI = 0.03).

E. Discussion

The HEP analyses (Table 1) show losses of about 3.84 and 10.24 AAHUs for the open surface water and deepwater benthos cover-types, respectively. For a mitigation area which created and maximized values for one cover-type each acre of "optimum habitat" could potentially provide 1 AAHU of habitat value. In this manner, about 14 acres of "optimum habitat" would be needed to mitigate the 14 AAHUs lost due to all disposal at the HOODS.

The individual impact of the Humboldt Harbor Project, and the needed mitigation area, would vary with the alternative selected (Table 2). For alternatives 1, 2, and 3, a minimum of about 2.0, 2.8 and 3.6 acres (of one "optimum" cover-type), respectively, would need to be provided to mitigate losses attributed to the HOODS. In order to achieve "optimum" status as applied to the HSI formula above, such replacement habitat would be of a type which is considered of the greatest regional scarcity. Several conceptual alternatives which may meet

this goal, and associated costs, are discussed in the accompanying draft FWCA Report and in USFWS 1994. Additional mitigation credit could be achieved where the mitigation option creates two cover-types, as in the creation of both water column and subtidal benthic habitat in an upland cut. This could potentially reduce the mitigation acreage by one-half, although certain assumptions integral to this scenario are highly improbable.

Table 2. Individual impacts and mitigation requirements for disposal of dredged material at the HOODS site for the three alternatives of the Humboldt Harbor Project.

ALTERNATIVE	DREDGED VOLUME (million cys)	FRACTION OF HOODS CAPACITY	INDIVIDUAL IMPACT (AAHUs) OR MITIGATION AREA (acres)
1	5.6	0.14	2.24

LITERATURE CITED

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Appendix F

Letter of Comments from the California Department of Fish and Game

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
P.O. BOX 944209
SACRAMENTO, CA 94244-2090

March 28, 1994

Mr. Dale A. Pierce
Acting Field Supervisor
U.S. Fish and Wildlife Service
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

Dear Mr. Pierce:

The Department of Fish and Game (DFG) has reviewed the U.S. Fish and Wildlife Service's (USFWS) draft Fish and Wildlife Coordination Act Report (CAR) for the U.S. Army Corps of Engineers Humboldt Harbor and Bay deepening project. The proposed Corps' project would remove approximately 3.3 to 4.7 million cubic yards of sediment with disposal at the Humboldt Open Ocean Disposal Site (HOODS). Approximately 26,000 cubic yards have been determined to be chemically unsuitable for open water disposal and are targeted for upland disposal at either the "superbowl" or Louisiana Pacific (LP) sites on the Samoa Peninsula. Navigational improvements proposed by the Corps would consist of channel deepening, selective widening, and turning basin changes.

The DFG compliments the USFWS for providing a thorough and exhaustive treatment of the many possible types of direct and indirect adverse impacts that could result from this or other coastal dredging and disposal projects. In addition, we concur with the vast majority of the USFWS's general and specific recommendations made to the Corps (pages 83 through 87) for this proposal, including the preference for the LP upland site for unsuitable materials, with the singular exception of the suggested mitigation requirements. These requirements are based upon the application of traditional land-based Habitat Evaluation Procedures (HEP) to dredging at the estuarine project site and adjacent subtidal areas as well as disposal at the HOODS and upland sites. The DFG recently provided the USFWS with detailed comments on the use of HEP in estuarine and marine environments in our response to the Oakland Harbor CAR, and our views regarding its application to this proposal remain essentially the same.

The DFG believes that one of the principal problems with HEP application in this proposal relates to the inability of the USFWS to identify and describe specific, significant impacts to resources or their habitats from project activities, thereby rendering attempts at precise quantification of changes in Habitat Suitability Indices or Average Annual Habitat Units needed for mitigation meaningless. We would strongly support requiring mitigation from the Corps in the form of compensation for any intertidal or vegetated subtidal areas that are proposed to be dredged or otherwise demonstrably modified and, additionally, any shallow unvegetated subtidal areas that would be reduced to deep subtidal areas (i.e., greater than -20 feet mean lower low water. The CAR does not indicate if, or to what extent, any of these types of habitat modifications will actually take place from carrying out this proposal. On the other hand, statements are made in the CAR to the effect that the Corps has revised the initial proposal in an effort to avoid direct impacts to established eelgrass areas.

In our review of this and other coastal development projects, the DFG will continue to insist that, where significant unavoidable adverse impacts due to dredging and disposal can be identified and reasonably quantified, mitigation in the form of habitat replacement, restoration, and/or enhancement is not only appropriate, but required. However, we do not believe that HEP analysis, as it is applied in the CAR to this particular proposal, clearly demonstrates that need. We will, nevertheless, reserve our full judgement on this issue until we have had the opportunity to review the project's Draft Environmental Impact Statement.

As always, DFG personnel are available to discuss our comments and concerns in greater detail. To arrange for discussion, please contact Mr. Robert N. Tasto, Environmental Specialist, California Department of Fish and Game, Marine Resources Laboratory, 411 Burgess Drive, Menlo Park, California 94025, telephone (415) 688-6360.

Sincerely,

John L. Turner, Chief
Environmental Services Division

Attachment

cc: Colonel Leonard E. Cardoza
U.S. Army Corps of Engineers
San Francisco, California

The Honorable Douglas P. Wheeler
Resources Agency
Sacramento, California

Mr. Robert N. Tasto
Department of Fish and Game
Menlo Park, California

ATTACHMENT

Pg. 12, Para. 4. The discussion of Regional Water Quality Control Board regulatory activity is actually referring to several actions taken by the San Francisco Bay RWQCB and not the North Coast RWQCB, which will be involved with this proposal.

Pg. 13, Para. 2, Ln. 1. The DFG also reviews and comments upon federally-sponsored or permitted water-related projects under the Fish and Wildlife Coordination Act.

Pg. 14, Para. 1, Lns. 10-15. The information herein should be referenced to Figure 4.

Pg. 22, Table 1. Note the correction of 200 feet to 200 feet in footnote 2.

Pg. 54, Para. 5, Lns. 9-11. The mere fact that one species becomes numerically dominant does not, by itself, mean that biological diversity is reduced.

Pg. 54, Para. 5, Lns. 11-14. New material that becomes deposited in these channels could also be fine-grained.

Pg. 56, Para. 2, Lns. 5-6. If species diversity is not to be reestablished in the deepened and widened channel areas as indicated, the USFWS should attempt to predict which species may be lost.

Pg. 56, Para. 4, Lns. 13-15. The channel is already maintenance dredged twice a year; how will new conditions reduce its "extensive use by fish"?

Pg. 57, Para. 3, Lns. 8-10. Is it documented or alleged that herons and egrets currently abandon their nests during maintenance dredging activities in Humboldt Harbor and Bay? This appears to us as an opportunity for the USFWS to acquire some quantitative scientific data for application of HEP. This is an example of unsupported inferences which serve to undermine the HEP's credibility.

Pg. 62, Para. 2, Lns. 6-7. The meaning of "relatively uncontaminated chemical concentrations:" needs clarification in this context. The discussion of copper concentrations and the presence of dioxins and furans that immediately follows appears to conflict with this statement.

Pg. 62, Para. 3. The CAR should state somewhere, if our assumptions are correct, that the contaminants discussed here are those which have made the 26,000 cubic yards unsuitable for open-water disposal.

Pg. 64, Para. 2, Lns. 4-5. The DFG feels that HEP was inappropriately applied in the Oakland Harbor Navigation Project.

Pg. 66, Para. 5, Lns. 3-4. Significant eelgrass beds also occur in Tomales and Morro Bays in California.

Pg. 67, Para. 4. In other words, the USFWS is not drawing a distinction between extremely different habitats such as deep subtidal and vegetated intertidal for this HEP analysis.

Pg. 67, Para. 5, Ln. 6. Please clarify what you mean by the indirect "loss" of 474.3 acres of shallow subtidal habitat. Is the habitat truly lost or is it just adversely affected in some unexplained way?

Pg. 68, Para. 3, Lns. 8-10. The comment here regarding the low resource quality of the benthic and open-water habitat contradicts previous evaluations in the CAR.

Pg. 69, Para. 3, Lns. 3-5. The speculation that "eelgrass nearby may be indirectly impacted" does not necessarily support a mitigation requirement for this activity. This type of subjective inference, without scientific support, is an example of why we feel that HEP is not an appropriate tool in the estuarine or marine environment.

Pg. 75, Para. 1, Lns. 6-7. We do not concur with the USFWS's recommendation regarding rock reef construction. Northern and southern California coastal areas are substantially different in the quantity and need of rocky substrate available for utilization by fish and invertebrates. Siting and construction of costly artificial reefs along the California coast should be well thought out and done only in consultation with other resource and regulatory agencies.

Appendix G

Letter of Concurrence from the National Marine Fisheries Service

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

January 30, 1995 F/SW02

Lt. Colonel Michael J. Walsh
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Walsh:

The following comments relate to the December 1994 Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) titled the Humboldt Harbor and Bay Deepening Navigation Project. The DEIS/DEIR analyzes the impacts associated with the proposed: deepening and widening of the Humboldt Harbor and Bay navigation channels to accommodate deep-draft ships, the disposal of approximately 4.1 million cubic yards of dredged material in the Humboldt Open Ocean Disposal Site (HOODS), and the dredging and disposal of approximately 26,000 cubic yards of dredged materials at the Louisiana Pacific upland site.

The National Marine Fisheries Service is responsible for preserving and enhancing marine, estuarine, and anadromous fish resources and the habitats that support them. Anadromous fish species in Humboldt Bay include chinook salmon, coho salmon, steelhead trout, and coastal cutthroat trout . Important marine species include herring and Dungeness crab.

The potential impacts associated with the construction of Alternative Plan 3 are discussed in Section 5.5. According to the DEIS/DEIR, the impacts for the planktonic, benthic, and fish communities are not expected to be significant when compared to the existing conditions. Proposed mitigation measures to minimize dredging impacts include: avoiding eelgrass beds by at least 50 feet, and redirecting or postponing dredging if spawning is observed by a "qualified fishery biologist".

I am concerned that a 50 ft. buffer may not be adequate to protect eelgrass beds from dredging impacts. Any unintended eelgrass losses may be irreversible since past attempts to artificially create eelgrass habitat have generally failed. Given this fact, and the importance of this habitat for a number of sensitive species, including herring, I recommend that a larger buffer zone of at least 100 ft. be fully considered. Additionally, silt curtains could be used to minimize the impact of dredging on eelgrass beds.

The proposed avoidance of impacts to spawning activities through the use of a "qualified fishery biologist" is unrealistic. Given the natural turbidity and size of Humboldt Bay, it is unlikely that even a "qualified fishery biologist" could reliably detect spawning activities of numerous and diverse species such as herring and Dungeness crab that spawn in the Bay. A more appropriate approach would be to develop seasonal dredging windows that would be expected to eliminate or minimize impacts to spawning activities, based on the known life history patterns of the various species that spawn in the Bay. I believe that a team of biologists from the Corps of Engineers, U.S. Fish and Wildlife Service, NMFS, and California Department of Fish and Game should be able to develop appropriate dredging windows in just a few interagency meetings.

The U.S. Fish and Wildlife Service's Draft Fish and Wildlife Coordination Act Report, contained in Appendix B, expressed concern over secondary, indirect impacts of dredging that may cause eelgrass losses and other impacts by altering patterns of water circulation, sediment flushing, nutrient cycling, and Bay productivity. Possibly the best way to address these concerns, which I share with the U.S. Fish and Wildlife Service, would be to implement General recommendation #4 in the Coordination Act Report (page 84), which calls for development of a long-term mitigation, monitoring, and remedial-action plan designed to ensure success of any mitigation actions.

I generally believe that the information contained in the DEIS/DEIR is adequate to select a project alternative, even though the proposed mitigation needs improvement and clarification. However, it should be mentioned in the DEIS/DEIR that there is a potential for future listings of coho salmon and steelhead trout under the Endangered Species Act. After a listing, new and maintenance dredging projects in Humboldt Bay would require Section 7 consultation and/or conferences.

If you have questions concerning these comments or wish to discuss the project further, please contact Mr. David Mattens at: National Marine Fisheries Service, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404; telephone (707) 578-7513.

Sincerely,

Christopher T. Whitley for

James R. Bybee
Environmental Coordinator
Northern California

cc: C. Morris, EPA
J. Medlin, FWS
J. Turner, CDFG

Appendix H

Service's Letter of Concurrence to the Corps of Engineers on Section 7 Consultation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-95-I- 597

March 14, 1995

Roderick A. Chisolm, II
Chief, Planning Branch
Department of the Army
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105-1905

Subject: Response to Request for Concurrence With the Determination that the Humboldt Harbor and Bay Deepening Navigation Project is Not Likely to Adversely Affect Listed Plant Species

Dear Mr. Chisolm:

Thank you for your letter dated February 7, 1995, which provided further information on additional plant surveys and vegetation communities regarding the proposed Humboldt Bay Harbor and Bay deepening navigation project. With this additional information, the Service can now concur that the proposed action is not likely to adversely affect listed plant species and that formal consultation will not be necessary prior to undertaking the proposed federal action pursuant to 50 CFR §402.13. If you have any questions, please contact Kirsten Tarp at (916) 979-2120.

Sincerely,

Joel A. Medlin
Field Supervisor

cc: ARD-ES, Portland, OR
C. Wilkinson, FWS, SFO
M. Littlefield, FWS, SFO

Corps of Engineers Responses To The
U.S. Fish and Wildlife Service
Final Coordination Act Report (CAR)
For The
Humboldt Harbor And Bay Deepening Project
Dated March 1995

The Service's CAR includes recommendations that apply to the Corps' selected plan for dredging the Humboldt Harbor and Bay channels with disposal of the dredged material at the following sites: the proposed soon-to-be-designated Section 102 Humboldt Open Ocean Disposal Site (HOODS) located approximately 3 to 3.5 miles from the Pacific coastal entrance to Humboldt Bay and; the Louisiana Pacific upland site located near the intersection of Samoa Cookhouse Road and the New Navy Base Road on the eastern shore of the North Spit, south of the Samoa Bridge. The following details the Service's general and specific recommendations and the Corps' responses to those recommendations.

I. General Recommendations

1) Reevaluate the need for and benefits of the project with a view towards selection of the no-project alternative in lieu of the structural alternatives (Alternative 1), to avoid altogether the potential adverse impacts. The benefits re-analysis should include likely reductions of logging activity in the area.

Corps Response: The need for and benefits of the project are periodically reviewed/re-evaluated on the basis of current information throughout the planning study.

2) If the structural alternative is implemented, and upland disposal is proved infeasible, dispose of the dredged material, which is suitable for deep ocean disposal, at HOODS; other sediments not deemed suitable for ocean disposal should be disposed of at the Louisiana Pacific upland disposal site.

Corps Response: The selected plan is to dispose of the dredged material, which is suitable for ocean disposal, at the proposed Humboldt Open Ocean Disposal Site and dispose those sediments not deemed suitable for ocean disposal at the Louisiana Pacific site.

3) Ensure appropriate sediment screening criteria which have been developed, including the EPA-COE "Green Book" and the RWQCB's appropriate criteria are used to regulate the dredged material disposal. Any sediments for which suitabilities are not agreed to based on agency criteria should be disposed of in a manner which would best minimize detrimental impacts to fish and wildlife resources, as determined by the Service.

Corps Response: The appropriate sediment criteria, such as the "Green Book" and the RWQCB's criteria for uplands have been and will continue to be used in selecting sediments suitable for unconfined aquatic disposal and upland disposal.

4) Develop long-term mitigation monitoring and remedial-action plans designed to ensure success of any mitigation actions implemented to offset impacts to (a) benthic and water column impacts due to in-Bay dredging, (b) ocean disposal actions, and (c) upland disposal actions. Monitoring and reporting on all such mitigation should occur annually for the first 10 years and at least each 5 years thereafter. If mitigation criteria are not met, specific corrective actions should be required until mitigation is successful. Reports of all monitoring and remedial activities should be provided to the Service, CDFG, constructing agencies, and other involved entities.

Corps Response: Draft monitoring plans are in preparation by the Corps and the Humboldt Bay Harbor Recreation and Conservation District. A final monitoring plan will be developed in coordination with the Service and California Department of Fish and Game, as well as other concerned agencies such as EPA and RWQCB, prior to the placement of dredged material on the selected disposal sites. The scope, frequency, duration, and reporting requirements will be defined by the monitoring plan.

5) Further explore possible reductions of construction and maintenance dredging volumes to reduce both dredging and dredge disposal impacts to the extent feasible.

Corps Response: The Corps has an ongoing value engineering program, the purpose of which is to reduce project construction costs and related operation and maintenance costs. The Humboldt Harbor deepening project will be value engineered under this program. It is noted that the "with" project condition of the selected plan results in an estimated lesser volume of annual maintenance dredged material (based upon hydrodynamic modeling) than the volume of maintenance dredged material under the existing project condition.

II. Specific Recommendations

A. Humboldt Harbor and Bay

1) Dredge the suspected contaminated areas first, followed by dredging of the uncontaminated areas. This should help limit the spread of unsuitable sediments to the new channel area due to the dredging actions.

Corps Response: The Corps will dredge the material unsuitable for unconfined aquatic disposal (i.e. located on the west side of the Samoa Turning Basin) before dredging the remainder of the Samoa Turning Basin material suitable for unconfined aquatic disposal.

2) Restrict the dredging for the project to only the late-August-to-early-November period to the extent feasible, to best minimize impacts on critical life stages of important fish and wildlife species which use the Humboldt Bay estuary. Restrict future maintenance dredging to this same "window" as well. Also, avoid all dredging during the Pacific herring spawning season (December 1 through March 1) in harbor waters.

Corps Response: Restricting the project dredging to the late August to early November time period is not economically feasible. The estimated project construction time period is 11 to 12 months. Restricting the dredging to the late

August to early November time period allows for at most 3 months of dredging. To achieve project construction completion would then require 3 to 4 separate dredge plant mobilizations/demobilizations (mob/demob). The 2 to 3 additional dredge plant mob/demobs would add an estimated $300,000 to $450,000 to the cost of construction.

Maintenance dredging occurs in response to the continual shoaling of the navigable channels which renders the channels unsafe for navigating by vessels. Restricting future maintenance dredging to the late August to early November time period is partially feasible. Currently the annual maintenance dredging of the Harbor channels occurs in two phases: late August through October (fall) and; late March through April (spring). The volume of annual maintenance dredged material from the fall dredging phase is three to four times the volume dredged in the spring phase. The spring phase maintenance dredging is required in order to provide safe navigable channels until the fall time period when the "bulk" of the maintenance dredging occurs.

The Corps will monitor, as needed, dredging activities in harbor waters during the herring spawning season (December 1 through March 1). However, monitoring of dredging activities in the harbor waters does not mean curtailing the dredging activities in harbor waters during the December 1 through March 1 time period. The Corps will require a qualified marine biologist to be on board the dredging plant during the December 1 through March 1 dredging time period. The marine biologist will be required to observe for herring spawning in close proximity to the dredging activity to ensure that the dredge plant maintains an acceptable (i.e. doesn't significantly disturb) distance from any current herring spawning activity, as well as, any previous (i.e., within the last two weeks) spawning site, since herring eggs are susceptible to smothering until they hatch. The marine biologist will submit daily reports to the Corps' construction field superintendent to indicate time, location, whether any herring activity was noticed, and if noticed how close to the dredge, as well as actions taken to minimize adverse impacts on spawning herring.

3) Cooperate in developing a program to monitor, regulate, and effectively prevent the influx of additional contaminants into Humboldt Harbor and Bay so as to decrease impacts of future dredging to fish and wildlife, and to allow use of Humboldt Harbor and Bay sediments for more beneficial uses.

Corps Response: The Corps is always open to cooperating with all appropriate interested parties to address the prevention of any additional contamination into Humboldt Harbor. It is noted that out of an estimated total project volume of 5,600,000 cys of material to be dredged, only an estimated 26,000 cy is unsuitable for unconfined open water disposal. The "unsuitable" material apparently reflects use of preservatives in historical (not current) sawmill operations.

4) Provide, as compensation for the Humboldt Harbor and Bay dredging project impacts (i.e., to benthic areas and the water column) either 45.32 acres of "optimum" one cover-type, replacement habitat such as a "rockreef" (or similar) option, or 21.73 acres of "optimum," two cover-type, replacement habitat using an "upland cut" option, as detailed in the mitigation section, herein, and in MEC (1991) for

Alternative 1. In addition, "buffer" areas should be provided around any such compensation areas, as described in the text and Table 3.

Corps Response: Compensation for subtidal impacts associated with deepening already deepened and annually maintenance dredged channels is not justified. There is no portion of the channel widening project, including channel side slopes, that includes "first time" dredging disturbance of shallow (defined as less than -20 feet MLLW) subtidal channel areas. Appendix D of the CAR (page 124) provides the USFWS assumptions used in the HEP analysis. There are no verified Habitat Suitability Indices for either water column habitat or benthic subtidal habitat. The HSIs assigned are apparently subjective and the resultant calculations invalid. The use of unverified models and the reference to HEP and HSI's is inappropriate and use of this terminology is misleading. Further refinement of SIs would not be needed if the SIs were from peer reviewed and verified HSIs. Conservative, instead of realistic, estimates result in unnecessary pertubations of the environment to provide compensation for overestimated impacts. Adverse factors that the Service applies to the dredging include changes in area or rate of sediment deposition, subsequent disturbance due to increased maintenance dredging, and indirect impacts associated with increased shipping activity. (Note, page 126 of the CAR uses a three year construction period when in fact the Humboldt Deepening project construction period is estimated at approximately 11-12 months.) Also, the discussion presented on page 126 of the CAR assumes an incorrect three year construction period, yet the discussion of mitigation on page 68 of the CAR recommends restricting the dredging to at most three months per year (i.e., late August to early November). As a result of these assumptions, the Service estimates a net subtidal benthic loss of 23.69 AAHUs. In response to the Service's use of the above adverse assumptions for dredging, the Corps notes that the opposite is actually the case, i.e., under the "with project" condition there would be reduced shoaling in the navigation channels (this net reduction in annual sedimentation in the navigation channels is estimated at 118,000 cubic yards) and a moderate reduction in the number of deep draft vessel trips due to efficiencies in vessel transportation.

Compensation for subtidal impacts associated with the deepening or widening of "new" channel areas that are less than -20 feet MLLW is not justified. Appendix D of the CAR (page 125) also shows a subtidal benthic loss of 15.20 AAHUs associated with 45 acres of "new" channel dredging (this acreage includes both deep and shallow (defined as less than -20 feet MLLW) subtidal channel areas (reference page 123 of the CAR). In fact, there is a small portion of the proposed project which realigns the entrance to the Samoa Turning Basin (i.e., the eastern edge of the Samoa Turning Basin) that would involve the "first time" dredging disturbance of shallow subtidal channel areas. This small area represents approximately 9,000 square feet. The Service recognizes shallow subtidal areas (0 to 20 feet MLLW) and intertidal areas (greater than 0 feet MLLW) (reference page 123 of CAR). "Eelgrass may occur in both the intertidal and shallow subtidal zone, however, greatest abundance is expected in the shallow subtidal areas...". In response to the Service's desire to "know" the location of eelgrass in the project area before the CAR could be completed, the Corps in coordination with the Service conducted surveys for eelgrass along the east and west boundary of the Samoa Turning Basin. The results of these surveys indicated that the proposed Turning Basin channel improvement to the eastern boundary would

not impact any eelgrass. Eelgrass was located in a part of the western boundary of the Turning Basin and the proposed channel improvement was modified to avoid impacting this eelgrass area.

It is also noted that California Department of Fish and Game (letter dated March 28, 1994) and the U.S. Environmental Protection Agency (letter dated May 6, 1994) have problems with the Service's CAR and the HEP application to marine and estuarine habitats. Their concerns are that "...the HEP does not identify and describe specific, significant impacts to resources or their habitats from project activities, thereby rendering attempts at precise quantification of changes in Habitat Suitability Indices or Average Annual Habitat Units needed for mitigation meaningless."

The Service has suggested some compensation measures but has not provided enough specifics for the Corps to evaluate and justify this recommendation. However, the Corps has investigated some potential restoration/enhancement sites in the Humboldt Bay area (reference Appendix B "Potential Restoration/Enhancement Sites For Humboldt Harbor & Bay Deepening Navigation Project").

5) Conduct (and include in the EIS) further, better refined underwater surveys of the channels to determine the presence or absence of eelgrass during the period of maximum eelgrass growth in late summer. Since site- specific data on subtidal benthic habitats are not available for the entire area where the Corps' deepening and widening will occur, additional data is needed. A contingency plan for offsetting long-term losses of eelgrass should also be developed. A report of findings should be provided to the Service as soon as practicable. In addition, the Corps should undertake a comprehensive, bay-wide eelgrass mapping and monitoring program, possibly as part of the Corps/NMFS habitat restoration agreement or as a Coastal America project.

Corps Response: The Corps, during the reconnaissance study phase, conducted an eelgrass survey of the Fields Landing channel in accordance with the Service's Planing Aid Letter survey location and design recommendations. Then, during this study feasibility phase, the Corps conducted an eelgrass survey (during the period of maximum eelgrass growth in late summer) in the Samoa Turning Basin (the results of this survey are included in the Draft EIR/S) in accordance with the Service's survey location and design recommendations. Both site specific eelgrass surveys the Corps has conducted have been based upon the Service's knowledge of eelgrass locations in the Harbor. The "footprint" of the proposed navigation channel deepening and selective channel widening project has not changed between the reconnaissance and feasibility study phases except for the deletion of the Fields Landing and Outer Eureka Channels from the study. Since the existence of eelgrass is unlikely in the remaining unsurveyed deep water channels of the project area, additional eelgrass surveys are not justified. The Corps views the Service's request for "additional data" as for information only and not based upon project likely potential impacts to biological resources. The recommendation that the Corps undertake a comprehensive, bay-wide eelgrass mapping and monitoring program, possibly as part of the Corps/NMFS habitat restoration agreement or as a Coastal America project has been referred to the appropriate Corps internal elements for consideration.

6) Provide a plan for monitoring of possible impacts to the egret and heron rookery located on Indian Island. Remedial actions, with specific "trigger" mechanisms, should be specified.

Corps Response: A draft plan, including remedial actions, to monitor project impacts on the egret and heron rookery located on Indian Island will be developed in coordination with the non-Federal sponsor and the Fish and Wildlife Service.

7) Provide at least a 100-foot buffer to protect eelgrass beds from dredging impacts. Silt curtains could also be provided to minimize the impact of dredging in eelgrass beds.

Corps Response: A "buffer zone" of a minimum 100 feet between the northwest channel boundary of the Samoa Turning Basin and the nearest surveyed eelgrass beds has been incorporated into the recommended plan (reference Section 5.5.4.1 of the Final EIS/EIR). During the preparation of construction plans and specifications, the Corps will investigate the feasibility of using siltation curtains in and near the north west section of the Samoa Turning Basin to further minimize dredging turbidity potential impacts on eelgrass beds located at least 100 feet distant form the dredge plant.

B. Humboldt Open Ocean Disposal Site

1) If used as a disposal site, for Alternative 1, provide as compensation for the dredged material disposal impacts, (i.e., benthic areas and the water column) due to the project's disposal, either 2.24 acres of "optimum," one cover-type, replacement habitat such as a "rockreef" (or similar) option, or 1.12 acre of "optimum," two cover-type, replacement habitat using an "upland cut" option, as detailed in the mitigation section herein, and in MEC (1991). This mitigation should be provided in concert with mitigation stated in II. A. 4. above; the "buffer" should also be included.

Corps Response: Authority to include compensation in the Humboldt project for impacts related to all ocean disposal activities is believed to be a U.S. Environmental Protection Agency (EPA) decision. The Service's recommendation will be forwarded to EPA for consideration in their rulemaking.

2) Work cooperatively with all involved agencies to provide, as compensation for all cumulative impacts of disposal at the HOODS, either 14.08 acres of "optimum" rockreef (or similar) habitat, or 7.04 acres of "optimum" upland cut replacement habitat, as in II. B. 1. above.

Corps Response: Authority to include compensation in the Humboldt project for cumulative impacts related to all ocean disposal activities is believed to be a U.S.

Environmental Protection Agency (EPA) decision. The Service's recommendation will be forwarded to EPA for consideration in their rulemaking.

3) Develop, fund, and implement a detailed mitigation and monitoring plan for the HOODS. Specific remedial and additional mitigation actions and/or curtailment of dredged material disposal should be included as aspects of this plan.

Corps Response: Authority to include compensation in the Humboldt project for impacts related to all ocean disposal activities is believed to be a U.S. Environmental Protection Agency (EPA) decision. The Service's recommendation will be forwarded to EPA for consideration in their rulemaking. The EPA is developing a site management and monitoring plan for their "to be" designated ocean disposal site. The Corps will comply with the HOODS management/monitoring plan as specified by EPA.

C. **Louisiana Pacific Upland Disposal Site**

1) Develop and implement a dioxin monitoring plan for the sediments and the decanted water that would a) return to the Bay via an outflow pipe if the material is disposed of on the Louisiana Pacific Upland Disposal Site.

Corps Response: The Corps will comply with the standards and requirements as determined by the North Coast Regional Water Quality Control Board for upland disposal of dredged material.

2) Take all feasible measures to ensure that sediments are fully contained on the site, and effluents meet standards for re-entry into the Bay.

Corps Response: The Corps' upland disposal site design includes all feasible measures to ensure that sediments are fully contained on the site, and effluents meet North Coast Regional Water Quality Control Board standards for re-entry into the Bay.

3) Avoid adverse impacts to the scrub-shrub wetlands on the site, and dune habitats along the site's boundaries, by using the central, highly disturbed portion of the disposal site for the dredged material disposal to the maximum extent feasible.

Corps Response: The Corps' upland disposal site design includes using the central, highly disturbed portion of the site for disposal of the dredged material to the maximum extent feasible.

4) Avoid the salt marsh habitat at the northeast corner of the site near Samoa Bridge and Vance Avenue. (These wetlands were not analyzed in the impact analysis because the Corps verbally agreed they would be avoided due to physical barriers that would prevent their being disposed upon.)

Corps Response: The Corps will avoid the salt marsh habitat at the northeast corner of the site near Samoa Bridge and Vance Avenue.

Potential Restoration/Enhancement Sites for Humboldt Harbor & Bay Deepening Navigation Project

At the Feasibility Review Conference (FRC), on August 8-9, 1994, with representatives from the ASA's office, Headquarters, Washington Level Review Center, the project sponsor, and other concerned agencies, it was agreed that the Corps would investigate potential environmental restoration/enhancement activities that could be associated with the Humboldt Deepening Project with a minimum of increased cost.

Following the FRC, coordination with the Harbor District and USFWS resulted in the field investigation of two potential restoration/enhancement sites in Humboldt Bay. The two sites, one located on the North Spit of Humboldt Harbor, and the other located in the South Bay, on the Humboldt Bay National Wildlife Refuge, are described below.

Site # 1 - Humboldt North Spit Breakwater

This site is located (Figure 1) on the North Spit of Humboldt Bay immediately off of New Navy Base Road and north of the Samoa Boat Ramp/County Park. During the past 40 years, erosion of the shoreline in this area has progressed as much as 400 feet. During a storm on December 11-12, 1993, a portion of the shoreline retreated approximately 10 feet. In an emergency effort to temporarily halt this retreat, the Humboldt County Public Works Department placed gabions in a 400 foot-long trench immediately inland of the face of the eroded shoreline. The road immediately adjacent to this eroded area is the access road to the Coast Guard Station's Search and Rescue facility located on the North Spit.

As background, the Samoa Boat Ramp and parking lot originally were placed in this spot in 1943 by the Navy during World War II for a sea plane base. The shoreline was even with the east edge of the parking lot in 1943, and has retreated approximately 10 feet per year (400 feet total) inland since that time. In an analysis the County of Humboldt prepared in 1983 related to a proposed Exxon jacket construction project, it was noted that wave energy coming in through the jetties, struck the rock rip-rap east of the Humboldt Bay entrance , which was placed by the railroad and PG&E, and reflected northerly over to this stretch of the North Spit. Thus, in addition to locally generated wind waves and refracted open ocean waves, reflected waves contributed to erosion all along the area from the Coast Guard Station north to approximately the mouth of Elk River. Over time, the Coast Guard has taken remedial measures in the form of constructing some groins to slow down the erosion, but this is a temporary measure. If the erosion is not halted, the only access road to the Coast Guard's Search and Rescue facility would eventually be rendered inaccessible, and any necessary rescue efforts for deep-draft and recreational vessels would either be severely limited or completely halted until road repairs are completed. These road repairs would most likely require the relocation of the road inland over sparsely vegetated dune habitat.

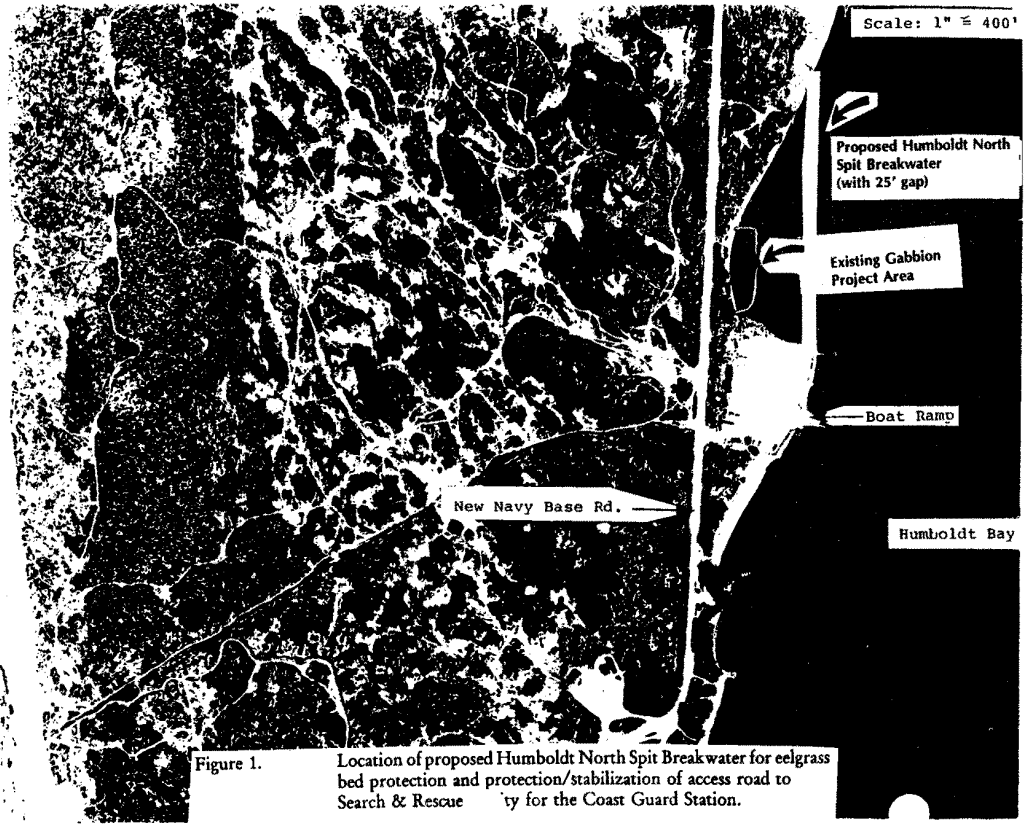


Figure 1. Location of proposed Humboldt North Spit Breakwater for eelgrass bed protection and protection/stabilization of access road to Search & Rescue ty for the Coast Guard Station.

However, gabions have been placed along the most critical reach of the eroded shoreline. This is only an interim measure to save this important access road and cannot be expected to last long; the gabions will eventually be either outflanked, and/or undermined as the elevation at the base of the gabions is only +8 feet MLLW.

A breakwater could be constructed which runs roughly due north from the northeastern terminus of the County's erosion protection area, for a distance of approximately 1,200 feet until it would join land again. This breakwater would halt erosion with minimal impact to the eelgrass beds that are located closer to shore in the intertidal zone. A gap of approximately 25 feet would be placed near the midpoint of the breakwater to allow for tidal circulation.

Eventually, some accretion in the lee of the breakwater can be expected but the areas should remain intertidal (albeit shallower), and the additional shelter afforded by the breakwater is expected to facilitate eelgrass growth in the presently more exposed areas where no eelgrass was observed on a 3-foot tide.

The proposed breakwater crest should be visible at most higher tides (i.e., approximately +8 feet MLLW). The average bottom depth is assumed to be approximately -3 feet MLLW (strictly a visual estimate from a site visit on September 29, 1994). Therefore, with 2H:1V side slopes, and a minimal crest width of 5 feet, a typical cross-section might be as pictured in Figure 2. The breakwater would need the following:

- ☼ Total Stone Volume: approximately 300 ft^2 X 1175 feet = 350,000 ft^3
- ☼ Porosity: 37 percent
- ☼ **Actual Tonnage**: (1.0 - .37) 350,000 ft^3 = 220,000 ft^3 with 165 lbs/ft^3 = **18,000 tons**

☼ To be stable under a 4-foot wave, stone sizes would need to be roughly = 1/2 ton.

Assuming the stone costs approximately $40/ton (in-place), the estimated cost equals **$720,000** (18,000 tons X $40/ton) . The estimate of $40/ton may be too low, but the stone size is small, and larger stone could be accepted if any local quarry has some extra available to unload. In addition, if the Corps still has stockpiled stone on the South Spit of Humboldt Bay, this stone may be used to accomplish the construction with further reduced costs. Further cost reductions are also possible if the breakwater side slopes are steepened to 1.5H:1V.

Because the cost of a stone breakwater may be too great to be incorporated into the

proposed deepening project, alternative breakwater designs were considered. One such design was a timber piling and tire breakwater. This type of structure is less costly but has only been used successfully in wave climates where the design wave height was 2 feet or less, and wave periods were under 4 seconds. This is not the case at the proposed site. While wave heights are typically less than 2 feet, open ocean swell can reach the site with wave periods in excess of 15 seconds. This type of breakwater would be very transmissive to these longer period swells. Concern was also expressed by the local public works office regarding the aesthetic acceptability of such a structure by the local environmental and regulatory agencies. Therefore, this type of breakwater construction was eliminated from further consideration at this site.

Advantages of this Proposed Breakwater: Access is maintained to the local Coast Guard's Search & Rescue Facility without the relocation of the existing road inland over any sensitive or proposed listed plant species and/or habit, and eelgrass growth could be facilitated in the lee of the breakwater . Presently, eelgrass grows in the calmer areas in the immediate lee of the boat ramp parking lot. This growth zone would be expected to expand with the expanded area of calm water produced by the breakwater.

This potential breakwater should be constructed of stone and considered under a separate study authority, such as Section 1135, as the preliminary cost estimate appears prohibitive for consideration under the Humboldt Deepening Project.

Site #2 - "White Slough Unit" Potential Wetland Restoration Site - Field #2

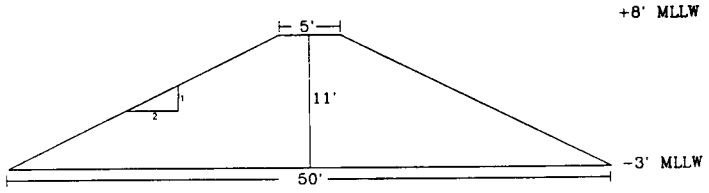
The following information was provided by Kevin Foerster, Humboldt Bay National Wildlife Refuge, in a personal communication on October 11, 1994:

The proposed salt marsh restoration site is located within the Humboldt Bay National Wildlife Refuge (Figure 3). This "White Slough Unit/Field #2" is located on the eastern shore of South Humboldt Bay , and west of Highway 101 near the Tompkins Hill Road exit. The intent of the Service's proposed project is to restore a salt marsh in Humboldt Bay.

Historically, the area was a tidally-influenced salt marsh and mudflat before being "reclaimed" for agricultural uses in the early 1900's. The U.S. Fish and Wildlife Service (Service) purchased the area in the mid-1980's. Cattle grazing, on a seasonal basis, has continued under Service management.

The overall size of Field #2 is approximately 50 acres. A 4,800 foot-long perimeter levee with two water control structures prevent salt water from flooding the area. The levee has approximately 2,000 feet of minor erosion, 1,400 feet of moderate erosion, and 1,400 feet of serious erosion. The levee currently provides some flood protection to Highway 101 along the southern edge of the property.

FIGURE 2: CROSS-SECTION OF POTENTIAL HUMBOLDT BAY NORTH SPIT BREAKWATER



The Service's proposed salt marsh restoration project would involve breeching the levee in strategic locations to allow the tidal waters to inundate the area on a regular basis. An engineering analysis and cost would need to be completed to develop a site plan. In addition, a small levee may be needed in the southern portion of the tract to provide protection for Highway 101.

The site visit on September 29, 1994 only enabled viewing of the "White Slough Unit" from afar on the Tompkins Hill Road exit due to time constraints, and lack of access to the property. This potential restoration activity should probably be considered under a seperate study authority, such as Section 1135.

The Corps will continue to work with the local entities and other agencies on these potential restoration/enhancement activities.

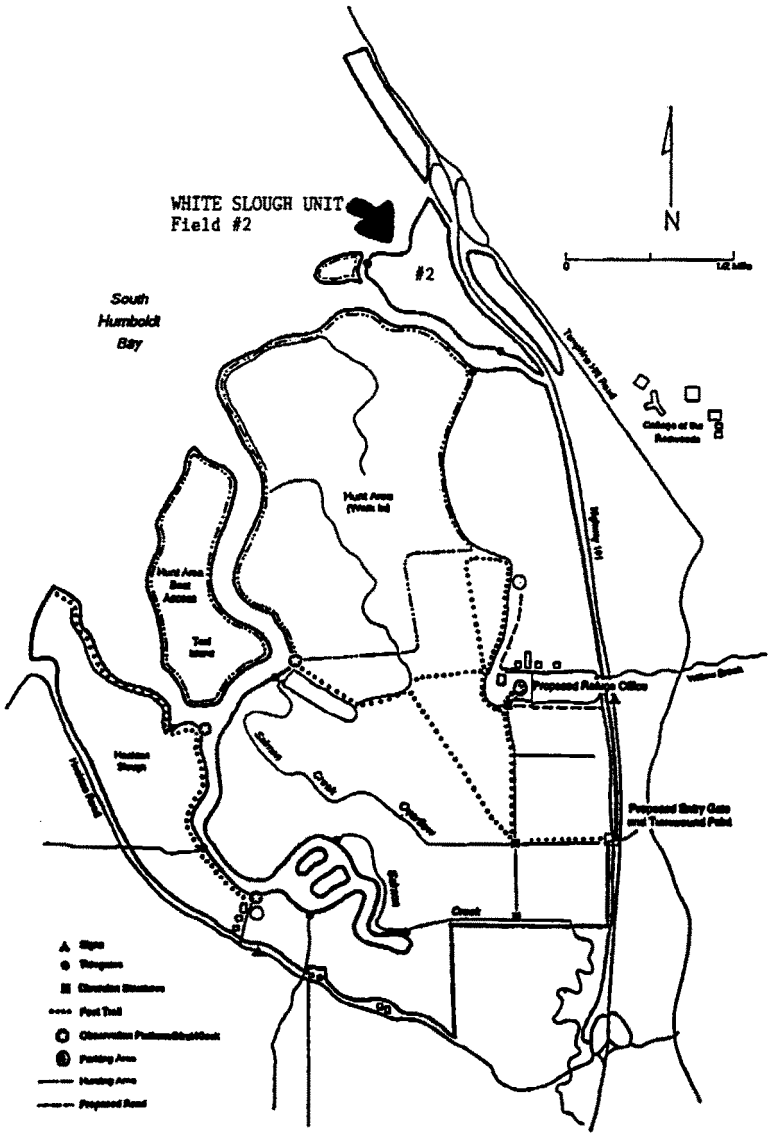


Figure 3. Location of "White Slough Unit" - Field #2 - a potential salt marsh restoration site.

APPENDIX C

COMPLIANCE OF THE SELECTED PLAN WITH RELEVANT GUIDELINES OF THE MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

COMPLIANCE OF THE PROPOSED ACTION WITH OCEAN DUMPING REGULATIONS

Title 40 of the Code of Federal Regulations (CFR), Subchapter H, Parts 220 through 229 establishes procedures and criteria to be applied by the Corps for the issuance of permits to transport dredged material for the purpose of dumping it in ocean waters pursuant to Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA). These criteria are based on those established for the issuance of permits by EPA under Section 102 of the MPRSA. This appendix evaluates the compliance of the proposed action with the criteria identified specifically in Parts 225, 227, and 228.

1.0 Compliance with Part 225 - U.S. Army Corps of Engineers Dredged Material Permits

The proposed project involves the proposed deepening and selective widening of navigation channels in Humboldt Harbor to accommodate existing deep-draft vessels calling on the Harbor. Approximately 5.6 million cys of dredged material will be removed. The approximately 5.6 million cys of dredged material proposed for disposal at the soon-to-be designated Section 102 HOODS site has been tested according to EPA and Corps guidelines (EPA/COE 1991), and is deemed suitable for ocean disposal. In addition, approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal (trace amounts of dioxin) will be disposed of at the Louisiana Pacific upland disposal site. HOODS is currently being designated for use by the EPA under Section 102 of the MPRSA and no other feasible site has been designated for ocean disposal. Previously, a SF-3 disposal site and a Nearshore Disposal Site (NDS) were used as interim disposal sites for dredged material, but were discontinued due to concerns regarding disposal site mounding and navigation safety, and impacts to commercial fisheries, respectively. The Corps has used HOODS since September 1991 for the disposal of dredged material from Spring and Fall maintenance dredging projects.

2.0 Compliance with Part 227 - Criteria for the Evaluation of Permit Applications for Ocean Dumping of Materials

Criteria used to evaluate ocean disposal of dredged material permit applications are provided in 40 CFR 227, Subparts B, C, D, and E. The disposal permit applications must demonstrate compliance with Subpart B Sections 227.4, 227.5, 227.6, 227.9, 227.10, and 227.13. Subparts C, D, E, and G must be complied with for Corps approval of disposal at HOODS.

2.1 Subpart B - Environmental Impact

Based on the site characterization studies and characterization of dredged material, disposal of the Humboldt Harbor dredged material tested and deemed suitable for disposal at the ocean site would not be expected to have unacceptable adverse effects on human health or the ocean (40 CFR 227.4). The disposal would not have unacceptable effects on the marine ecosystem of the ocean site and vicinity.

Dredged material from Humboldt Harbor does not contain materials prohibited for ocean disposal (40 CFR 227.5) at HOODS. Prohibited materials for disposal include high-level radioactive wastes; materials produced or used for radiological, chemical, or biological warfare; or persistent inert synthetic or natural material that may float or remain in suspension.

Only dredged material that has been tested according to the "Green Book" (EPA/COE 1991) and approved protocols (Section 4.0), and deemed suitable for ocean disposal will be disposed of at HOODS. Grain size analyses were conducted on ten sediment samples to determine which samples were predominately sand and met the exclusionary criteria outlined in 40 CFR Section 227.13(b)(1), and were acceptable for ocean disposal without further testing. Due to their finer grain size, only sediment samples HB8 and HB9 were determined to require further evaluation with chemical and biological tests (See Section 4.4.5 - "Sediment Existing Section" for results).

The total quantity of dredged material proposed for disposal at HOODS, approximately 5.6 million cys, would be disposed of over a 11 to 12 month period. Sediment footprint modeling estimated that a maximum thickness of the dredged material footprint for 5.6 million cys would be approximately 55 inches. A sediment dispersion analysis for HOODS was performed by Scheffner (1990). Scheffner concluded that the HOODS site is non-dispersive. The conclusion was based on two previously mentioned approaches of analysis. Short-term simulations of the disposal operation indicated that sediments are deposited on the bottom rapidly, leaving very little sediment in suspension for subsequent transport. A long-term simulation of sediment mound stability shows that, although sediment at HOODS can be moved short distances during peak current periods, the net long-term effect of local waves and currents on the mound is negligible. Thus, dredged material is expected to be contained within the disposal site boundaries. The disposal of dredged material at HOODS would result in the burial of benthic organisms in the immediate disposal area, but overall, would have little impact on mobile and burrowing organisms. Because the benthic community existing at HOODS is unstable and characteristic of a frequently disturbed community, impacts associated with burial and smothering of the benthos are expected to be minimal, localized, temporary, and insignificant.

Disposal of dredged material at HOODS would not pose a hazard to fishing, navigation, shorelines or beaches (40 CFR 227.10). Significant commercial and recreational fisheries are contained within the ocean surrounding HOODS, but no critical fisheries habitats have been

identified in the area. Sportfishing and marine recreation activities occur nearby HOODS, but no significant impact is expected with the disposal of dredged material at HOODS. Dredged material disposal at HOODS would not pose a hazard to navigation since the site is between -165 to -185 feet deep. The use of HOODS for dredged material disposal would not affect shipping since deep-draft vessels can easily avoid the 1-square mile site if it is in use. Disposal of dredged material is not expected to impact shorelines or beaches. The Humboldt Shoreline Monitoring Program is monitoring any trends of accretion and/or erosion occurring on the shorelines along Humboldt Bay. Presently, no relation between shoreline change and dredged material disposal at HOODS has been determined. Sediment dispersion modeling results indicate that the concentration of suspended sediments will be reduced to ambient concentrations rapidly after disposal.

2.2 Subpart C - Need for Ocean Dumping

Ocean disposal of dredged material was determined to be the most economical and environmentally feasible alternative. The Humboldt Bay Harbor, Recreation and Conservation District (HBHRCD) and the Corps evaluated several alternatives for disposal of dredged material including upland disposal ("Superbowl Site"), beach disposal (Site 17), and ocean disposal. The need for ocean disposal for the sediments suitable for unconfined aquatic disposal and upland disposal for the approximately 26,000 cys of dredged material unsuitable for unconfined aquatic disposal was established in the EIS/EIR, and the preferred disposal alternative was identified in Section 2.11.

Dredged material is produced by natural sedimentological processes but anthropogenic activities contribute to concentrations of toxic substances in sediments. The material to be dredged from Humboldt Harbor was tested in accordance with Parts 227.6 and 227.32 to determine its suitability for ocean disposal. A regional regulatory decision and approval for ocean disposal of dredged material is required. A dredged material volume of approximately 5.6 million cys is too large to be stored (227.15).

2.3 Subpart D - Impact of the Proposed Dumping on Aesthetic, Recreational, and Economic Values

The Corps/HBHRCD evaluated the impact of the Humboldt Harbor and Bay Deepening Navigation Project through an EIS/EIR. This EIS/EIR specifically evaluates the impacts of the proposed disposal of dredged material at HOODS. Recreational and commercial fishing would not be impacted by the disposal at HOODS. Dredged material disposal will not exceed applicable marine water quality criteria (MWQC) standards. Because of the distance of the ocean site from the shore, no impacts are expected from disposal at HOODS on aesthetic, recreational, or economic values.

2.4 Subpart E - Impact of the Proposed Dumping on Other Uses of the Ocean

HOODS is located approximately 3.8 nautical miles from the coast. HOODS is located far from estuarine and coastal areas, shorelines and beaches employed for recreational activities. The principal uses of the ocean in the vicinity of HOODS are transportation and to a limited extent fishing. Commercial and recreational fishing are found nearby HOODS, but due to the limited size of HOODS in comparison with the surrounding ocean waters, disposal operations are not expected to affect this activity. Therefore, disposal of dredged material at HOODS is not expected to affect either transportation or fishing activity in the area. No other potential uses of the ocean in the vicinity if HOODS have been identified.

APPENDIX D

CASE STUDY OF "DEPENDENCE OF SHORELINE CHANGE ON CHANNEL DREDGE MATERIAL DISPOSAL PRACTICES"

Reprinted from COASTAL ENGINEERING CONSIDERATIONS IN COSATAL ZONE MANAGEMENT
Proceedings, 8th Symposium on Coastal and Ocean Management
Sponsored by the American Shore and Beach Preservation Association/ASCE
Held July 19-23, 1993, New Orleans, Louisiana

DEPENDENCE OF SHORELINE CHANGE ON CHANNEL DREDGE MATERIAL DISPOSAL PRACTICES, HUMBOLDT BAY, CA, A CASE STUDY

Leonard J. Madalon, Jr. A.M. ASCE[1]
Thomas R. Kendall M. ASCE[2]

Abstract

This paper addresses the evaluation of dredge material disposal sites for Humboldt Harbor with emphasis on the Humboldt Open Ocean Disposal Site (HOODS) and the potential impact of its use on the adjacent shoreline. The dispersive characteristics of three disposal sites are evaluated based on wave induced near-bed velocity and through use of Hallermeier limits. The applicable littoral cell is defined, including the influence on regional sediment transport of the jetties which stabilize the entrance to Humboldt Bay. The high water line on eleven sets of aerial photos spanning 42 years are analyzed to determine historic shoreline-change trends for 19.3 kilometers of coastline, establishing a baseline data set to aid in isolating any contribution of the HOODS use on subsequent shoreline changes. Implications of HOODS use are described. A shoreline change monitoring program is recommended. Data collected two years after the baseline data set was established are presented and analyzed. The recommendation is made to continue use of the HOODS with a provision for continued long-term monitoring.

Introduction

Commerce, as well as recreation and defense, demand that existing waterways remain navigable. The natural processes of erosion and deposition continue to place sediment in navigation channels, frequently filling them to depths insufficient for modern-day-vessel drafts. Dredging of the deposited sediments remains the most common method of maintaining navigable waterways. Heightened environmental awareness, however, has led to concerns about the damaging effects of dredging and dredge disposal practices on the biota, both benthic and pelagic, and water quality. In order to reduce the total area affected by dredge disposal, specific disposal sites have been designated. However, prolonged and increased use of these disposal sites has, in some instances, led to mounding of dredge disposal material. This mounding can create navigation hazards both by decreasing nominal bottom depth and by causing waves to shoal and break. Therefore, new disposal sites are continually being sought. One means of minimizing navigation hazards and the effect on biological resources is to use deep ocean disposal sites containing minimal biota. This, however, can add significantly to transportation costs and have serious consequences for the littoral environment and coastal erosion.

Humboldt Bay contains California's largest shipping port north of San Francisco (see Figure 1). In order to support deep draft ocean-going vessels so necessary to the region's lumber and wood chip industry, navigation channels must be dredged to below the natural depths found in the entrance and bay.

To date there have been three documented sites for disposal of Humboldt Bay dredge material (see Figure 2). Use of SF-3 and the Nearshore Disposal Site has been discontinued and the Humboldt Open Ocean Disposal Site is under investigation.

SF-3 had been used since the 1940's. It is south of the harbor entrance near the seaward limit of the littoral zone. The original depths ranged from -18 meters (m) to -27m Mean Lower Low Water (MLLW) and stabilized with disposal of dredge material to a depth of -17m MLLW in the 1940's. Heavy use of SF-3 in the 1980's shoaled the area to a depth of -12m MLLW by 1988. These shallower depths resulted in breaking waves which were deemed hazardous for small crafts. As a result, the nearshore disposal site was activated.

The Nearshore Disposal Site (NDS) is located 2 kilometers (km) southeast of SF-3 in -15m to -18m MLLW. It was used for two dredging episodes in 1988/89. A total of 1,189,700m^3 of dredge material was disposed of at the site. Use was discontinued due to adverse biological effects on gravid female Dungeness crab, juvenile Dungeness crab, and juvenile English sole.

The Humboldt Open Ocean Disposal Site (HOODS) is 5km northwest of Humboldt Bay in depths ranging from -49m to -55m MLLW. It is being considered pursuant to Sect 102 of the Marine Protection, Research and Sanctuaries Act of 1972. In the fall of 1990, 316,700m^3 of dredge material were disposed of at HOODS. In the spring and fall of 1991, a total of 544,500m^3 of dredge material

[1]Civil/Coastal Engineer, U.S. Army Corps of Engineers, San Francisco District, 211 Main Street, San Francisco, CA 94105-1905, USA
[2]Civil/Coastal Engineer, U.S. Army Corps of Engineers, San Francisco District, 211 Main Street, San Francisco, CA 94105-1905, USA

was disposed of at HODDS. In the spring and fall of 1992, HODDS received dredge material totalling 227,800m^3. Further use of HODDS is dependent on the effects of removing in excess of 380,000 m^3 of sand out of the littoral cell on an annual basis.

Eureka Littoral Cell

The coastline off which these disposal sites lie is located within the Eureka Littoral Cell. Two important features to note about the Eureka Littoral Cell are the sediment sources and the seasonal variation of wave direction and energy entering the region.

Major sediment contributions come from the Eel River to the south and the Mad River to the north. The Eel River dominates the input volume with an average of 4.08 billion kilograms of sand per year (Bodin, 1982). This is approximately ten times the input of the Mad River.

Net longshore transport within the cell is a small fraction of the gross longshore transport with sediment transport varying significantly from winter to summer. Winter longshore transport is influenced strongly by high energy swells out of the southwest to west. These swells average 3m in height (Bodin, 1982) and can reach heights greater than 11m (Kendall and Cole, 1990). Summer longshore drift is influenced strongly by seas generated from NNW winds. These seas average 1m to 2m in height and can reach heights greater than 5m (Bodin, 1982). Thus, the surf zone is wider in winter than in summer.

The wider surf zone of winter allows sediments to bypass the jetties and yields a predominately northward transport. After passing to the lee of the ebb tidal bar to the north (Figure 2), some sediments fall out (through wave sheltering) and are transported to the north spit when accretionary conditions persist. This ebb tidal bar sheltering is believed to contribute to the seaward offset of the north spit relative to the south spit, after the scenario for down coast offsets suggested by Douglass, 1991. Note that prior to mound formation at SP-3, wave sheltering had been primarily to the north of the jettied entrance, now however, sheltering may occur equally on the north and south spits. The historic seaward offset of the north spit near the jettied entrance has also resulted from impoundment of southward transport during typical summer conditions which cannot carry sand back past the north jetty. Traditionally, the growth of the north spit had been attributed simply to what was assumed to be a predominantly southward transport without consideration of the seasonal variation in the surf zone width and wave directions or location of the ebb tidal bar.

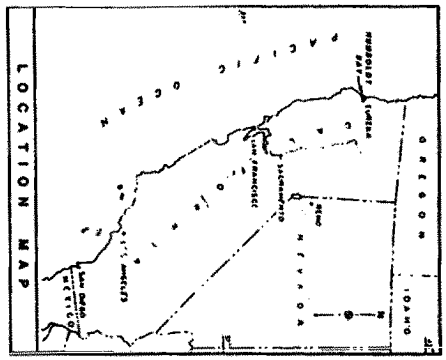


FIGURE 1. Humboldt Bay

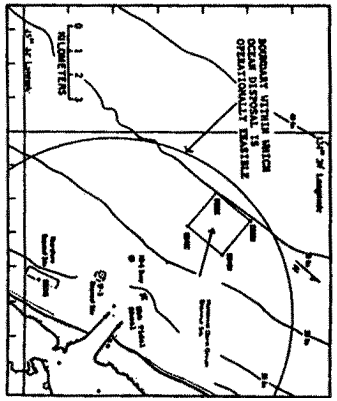


FIGURE 2. Humboldt Dredge Material Disposal Sites

Dispersive Characteristics of Disposal Sites

SF-3 (Figure 2) was determined to be an actively dispersive site (Hands and Allison, 1991) when described by the wave induced near-bed velocity. Hands and Allison (1991) also found SF-3 to fall in the buffer zone between the Hallermeier outer and inner limits. The Hallermeier limits describe a buffer zone, based on wave height, wave period, and sediment size, that is outside the very active littoral zone and yet shoreward of the zone of insignificant sediment motion. Because of the large Hallermeier buffer zone in the Humboldt area, seasonal exchanges of onshore transport in the summer and offshore transport in the winter were deemed likely. Site retention of dredge material was favored when annual disposal rates doubled in the 1980's. After disposal at SF-3 ceased, the mound elevation of -12m MLLW of 1988 was reduced to -14m MLLW in January of 1990. One seabed drifter release at SF-3 in November of 1988 found all but one drifter indicating northward transport. This is believed to be characteristic of westerly swells which are more common and more energetic in winter; transport to the south may be more characteristic of summer conditions.

NDS (Figure 2) was also determined to be an actively dispersive site (Hands and Allison, 1991) when described by the wave induced near-bed velocity. Hands and Allison (1991) also found NDS to fall in the Hallermeier buffer zone. As with the SF-3 dredge material disposal site, seasonal exchanges between onshore and offshore transport were deemed likely. Dartnell (1990) determined the NDS site to be 99% dispersive and, by use of the Flow Intensity Parameter, that most of the sediment would move offshore rather than onshore. Kendall et al (1991) found bathymetry records suggested that some of the disposal mound remained and that some of the disposal mound moved shoreward.

HOODS at depths of -49m to -55m MLLW (Figure 2), was determined to be nondispersive both in the short term (at the time of disposal) and long term (a period of years) by Scheffner (1990). Using the Hallermeier limits described by Hands and Allison (1991) for the Humboldt area, HOODS was found to be located within the outer limit of -57m MLLW, that is, within the zone where some sediment movement is still expected. In further contrast to the findings of Scheffner (1990), are those of Battelle: "the candidate area... appears to be very dispersive and a large portion of fine-grained material can be expected to be transported away from the disposal site located there" (California Coastal Commission, 1990). The suggestion that this site is dispersive does not imply that the sediment will return to the beach.

History of Nearby Shoreline and Duneline Changes

In a recent study, Moffatt & Nichol Engineers (1991) investigated 11 sets of aerial photographs of the open coast near Humboldt Bay in order to determine shoreline (wetted bound) trends from 1948 to 1990. In general, shoreline accretion was observed up to 9.6km south of the south jetty from 1948 to 1990 and up to 9.6km north of the north jetty from 1948 to 1974. However, a strong pattern of shoreline retreat was observed up to 3km north of the north jetty from 1974 to 1990.

The vegetation line, assumed to represent the dune line, was mapped from aerial surveys of 1962 and 1990. These vegetation lines showed a similar movement along the south spit but contrary movement along the north spit when compared to movement of the Mean High Water Line (MHWL). Movement of the south spit vegetation line showed seaward movement for the 9.6km investigated south of the jetties. Some or all of this movement may be attributed to vegetation densification. Movement of the north spit vegetation line showed seaward movement for 3km north of the north jetty and landward movement from 3km to 9.6km north of the north jetty. Analysis by Davis (1991) of 1990 aerial photos shows a divergence of the back of beach line (as indicated by the slope break) from the vegetation line. This indicates a change of the beach profile near the jetties, probably as a result of significant sand accumulation (that is, dune building). Therefore, the more recent erosive trend in the MHWL north of the north jetty appears to be offset somewhat by the probable dune building, that is, the 'lost' sands may in fact be conserved onshore in the form of dunes.

The change of trends from accretionary to erosive of the north spit in 1974, as shown by the MHWL, may have been influenced by the 1972 rehabilitation of the jetty tips. During the rehabilitation, 4,800 dolosse were added to the tips of the north and south jetties. The added dolosse created a greater barrier to sediment traveling through and around the base of the south jetty tip as the bottom depth changed from -6m MLLW to -17m. The effects of this barrier may be seen in the reduced volumes dredged in the mid to late 1970's and in the erosive trend on the north spit from 1974 onward. This barrier would be effective until enough sand is trapped to raise the bottom contour and allow bypassing to resume. The time lag to fill in the trap is unknown.

Implications of HOODS Use

Historically the Eureka Cell has been accretionary. The large sand sources in the cell make this possible. The Eel River to the South provides approximately 2.3 million cubic meters annually, and the Mad River to the North provides approximately 230,000 cubic meters annually. While not all of this sand reaches the north and south spits, enough does reach the area to provide an excess as shown in the accretionary trends.

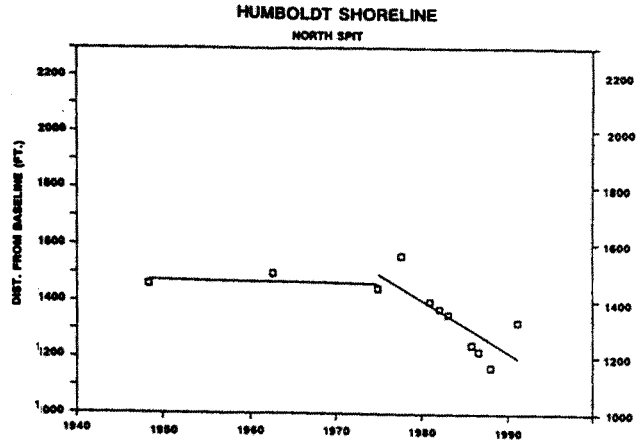


FIGURE 3. Sample Time History Trend Line for Station 1C (use conversion factor of 0.3048 to convert feet to meters)

Dredging quantities from 1982 through 1989 averaged 528,000 cubic meters per year for the bar and entrance channel. Comparison of this quantity with the total amount entering the cell from the two rivers shows that the sand that will be taken to the HOODS represents less than 20% of the material entering the cell. This 20% will, more than likely, be significant to the local region from which it is taken. However, it is uncertain how significant HOODS use will be, i.e. whether accretionary trends will be slowed or actually reversed to erosive trends.

Additionally, it is now believed, as stated above, that net longshore transport is south to north. This would imply that the former practice of placing dredge material to the south may have allowed some of that sand to enter the bar and entrance channel. Repercussions of HOODS use may reduce dredging needs in the bar and entrance channel, since less sand is being recycled. Therefore, the amount of material removed from the littoral zone may be less than that projected based on the quantities dredged when SF-3 was used.

Monitoring Program

A monitoring program had been scheduled to occur every 3 years from 1990 to 1999 and then at 5 year intervals thereafter. However, due to the pressing concerns of the California Coastal Commission, the monitoring program was stepped up one year and the first post-baseline data set was taken in November of 1992. The established program will be re-evaluated after each data set is collected and analyzed.

The data to be gathered during the monitoring program include: aerial photography of the coastline from the south of the Eel River to the mouth of the Mad River (approximately 37km) at a scale of 1:12,000; 14 dune and beach profiles spaced evenly 9.6km north and 9.6km south of the Humboldt north and south jetties, respectively; and up to eight additional profiles up to 3km north of the north jetty in order to monitor dune building.

The data analysis will include zoom-transfer scope work on the aerial photography and profile change analysis on the survey data. Zoom-transfer scope work will be applied to the Mean High Water Line as depicted by the wetted bound to produce a fall shoreline. This shoreline will be compared with the trend lines and confidence limits developed for 16 measurement stations in the Moffatt and Nichol 1991 report (see Figure 3 for a sample trend line). The vegetation line will be digitized as well and compared to earlier vegetation lines. Profiles will be analyzed for area changes from those profiles taken in February of 1991. Additional profiles taken north of the north jetty will serve as a basis for comparison of future surveys in that area.

Any new data points which occur over 37 meters below the corresponding extrapolated trend line will require that some action be taken. The 37-meter allowable shoreline change limit is based on the average 95% confidence limit for all trend lines presented in the Moffatt and Nichol 1991 report (20 meters) plus 17 meters allowed for error in wetted bound location. The action to be taken will first describe the extent of the deviation and the probable cause of the deviation. If the probable cause of the deviation is not readily available, the monitoring program, if deemed necessary, shall be altered to determine the most probable cause. Finally, if the dredging disposal practices are deemed responsible for detrimental shoreline effects, alternate sediment management practices will be recommended.

Results of 1992 Monitoring Program

The shoreline mapping study found an average accretion of 13 meters on the south shoreline and 2 meters on the north shoreline. Of the seven measurement stations south of the south jetty five showed accretion ranging from 7 meters to over 50 meters while two showed erosion of 17 meters and 25 meters. Both erosive measurement stations were within the allowable erosion limit (see Table 1). Of the nine measurement stations north of the north jetty four showed accretion ranging from 1 meter to 25 meters while five showed erosion ranging from 1 meter to 22 meters. All of the erosive measurement stations were within the allowable erosion limit (see Table 2).

TABLE 1. South Shoreline Changes and Allowable Erosion Limit (October 1990 to November 1992)

Measurement Station	Shoreline Change meters (m)	Allowable Erosion Limit meters (m)
1S	- 17 m	- 36 m
2S	+ 27 m	- 34 m
3S	+ 18 m	- 36 m
4S	+ 33 m	- 37 m
5S	+ 7 m	- 36 m
6S	- 25 m	- 36 m
7S	+ 50 m	- 37 m

Measurement station 1S is located approximately 370 meters south of the south jetty. Subsequent stations are at 1600 meter intervals in a southerly direction. (-) represents erosion, (+) represents accretion.

TABLE 2. North Shoreline Changes and Allowable Erosion Limit (October 1990 to November 1992)

Measurement Station	Shoreline Change meters (m)	Allowable Erosion Limit meters (m)
1N	+ 1 m	- 48 m
1B	- 4 m	- 45 m
1C	- 22 m	- 48 m
2N	+ 25 m	- 50 m
3N	+ 19 m	- 47 m
4N	- 1 m	- 38 m
5N	- 1 m	- 36 m
6N	- 4 m	- 35 m
7N	+ 1 m	- 36 m

Measurement station 1N is located approximately 90 meters north of the north jetty. Measurement stations 1N, 1B, 1C and 2N are at 550 meter intervals in a northerly direction. Subsequent stations are at 1600 meter intervals in a northerly direction. (-) represents erosion, (+) represents accretion.

An attempt was made using aerial photography to discern dune movement by mapping the October 1990 vegetation line and comparing it with the November 1992 vegetation line. It was determined, however, that the vegetation line was subject to too much interpretation and that reliable data could not be obtained from the Humboldt vegetation line. Problems occurred due to differential vegetation density along the dune profile and the inability to draw a line along vegetation of the same density two years later, resulting in large scale errors.

In addition, beach berm and dune profiles taken in March 1991 were compared with beach berm and dune profiles taken in November 1992. Three comparisons were made. Beach berms were compared from the +2 meter MLLW contour to the toe of dune. Dunes were compared from the toe of dune to the top of dune. And, the whole profile, from the 2 meter contour to the top of dune, was compared. As the March profile represents a winter profile and the November profile represents a fall profile, very little, if any, erosion and even some accretion was expected. Due to seasonal noise, no attempt was made to establish a limiting criteria on this data set for precipitating any action.

Of the fourteen profiles analyzed, four showed loss of sand on the beach berm and four different profiles showed loss of sand on the dune. The whole profile showed a net loss of sand on only two profiles, one coincident with beach berm sand loss and one coincident with sand loss on the dune.

Only eight of the fourteen March 1991 monuments were found. This was credited to vandalism. The lost six positions were relocated with a global positioning system. These positions have been marked with 2.5-meter-long steel fence posts.

Conclusions

According to recent studies (Battelle, 1989; Scheffner, 1990; and Hands and Allison, 1991) the dispersive nature of HOODS is debatable. Even if HOODS is dispersive, HOODS sediments will have little chance of returning to the nearshore.

Most of the shoreline near the jettied entrance has been accreting except for the relatively recent retreat observed just north of the entrance. If jetty repair and improvements of 1972 played an important role in the north spit erosion, and the south jetty fillet has now become sufficiently wide such that the south jetty is once again retaining significantly less northward moving sand, then the pre-1970 accretionary trend would be expected to resume for the north spit, were nearshore disposal to continue. However, with disposal at HOODS, accretionary trends in the region may be slowed or even reversed.

Results of the 1992 monitoring program compared favorably with the trend lines developed in Moffat and Nichol Engineers (1991). No relation between shoreline change and dredge disposal at HOODS was determined.

Due to the variety of factors affecting shoreline position, effects of dredge disposal at HOODS will only be realized over the long term (10 to 20 years). Continued regular monitoring may help identify any significant negative trends earlier.

Recommendations

In light of the fall 1992 monitoring program results, continued dredge material disposal at the HOODS should be allowed to continue with shoreline monitoring at 3 year intervals for the first 9 years and every 5 years thereafter. Shoreline trends would be mapped and compared with the historic trends documented in Moffat & Nichol, Engineers (1991). Significantly different trends would quantify shoreline effects of HOODS use.

As erosion is still being realized on the near north spit, the extensive dune profiling should continue in order to determine whether beach sand has been lost to the offshore environment or if it is actually being conserved onshore in the form of dunes. Due to the inaccuracies in mapping the vegetation line, its continued monitoring is not recommended.

Further monitoring of the SF-3 site for continued deepening and shoreward transport is recommended. A study of SF-3, the NDS and 3 miles of shoreline south of the south jetty is being conducted by the Dredging Research Program of the U. S. Army Corps of Engineers. Field data were collected in 1991. Analysis is forth-coming and will determine effects of nearshore disposal and lag times involved in sediment dispersion. Continued monitoring may be required.

Monitoring of south spit build up is recommended to estimate sand bypassing of the south jetty.

Low level use of SF-3 may be advisable in the future. Other nearshore sites north of the entrance may also be worth considering.

Dredge disposal practices will need to be reevaluated if the monitoring program results suggest that use of the HOODS site is significantly impacting the shoreline.

Acknowledgments

The authors would like to recognize Roger Golden and Ted Bruch for their assistance in gathering dredging data, Cynthia Chan for her help in data reduction, Richard B. Davis Company for the aerial and land surveys, and Moffat and Nichol Engineers for their efforts in data reduction.

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Table 3-4. Summary of critical stages of commercially-important nearshore demersal fish found near Humboldt Bay.

SPECIES	SPAWNING HABITAT/SEASON	EGG HABITAT	LARVAL HABITAT	JUVENILE HABITAT/SEASON FEEDING	ADULT SEASONAL DISTRIBUTION/HABITAT, RANGE, FEEDING
English sole[1,2,3,4,5] *Parophrys vetulus*	Spawn in sand and sand/mud bottoms at depths of 60-110 m; most abundant from December-February, but occurs year-round.	Pelagic, November-March	Pelagic. Most larvae within 2 km of shore. December-May	Larval juveniles settle to bottom from November-May into open coastal areas, mainly <16 m deep; nursery areas are mainly estuaries but also open coastline, April-October; juveniles emigrate to deeper waters, August-November; Diet: amphipods, cumaceans, polychaetes, benthic invertebrates.	Summer depths of 20-70 m, Winter depths of 40-130 m. Offshore sand, sand-mud substrate; Baja California-Bering Sea; Diet: epifaunal, infaunal prey, including polychaetes, bivalves, small crustaceans, brittle stars.
Pacific sanddab[2,7] *Citharichthys sordidus*	Spawn in 35-90 m, sandy bottoms; July-September, with peak activity in August	Pelagic	Pelagic, inshore-724 km offshore, July-August peak abundance in October-November.	Most occur in 66-92 m, spring-fall. Diet: amphipods, copepods, cumaceans, mysids.	Commonly occur at depths of 35-95 m; Deep sand to sand/mud areas; Baja California-Bering Sea; Diet: euphausid and mysid crustaceans
Starry flounder[4] *Platichthys stellus*	Spawn in shallow, coastal and bay areas, December-January	Pelagic	Pelagic	Juveniles settle to bottom, probably in shallow waters.	Most abundant over soft sand, mainly in shallow water; Santa Barbara, California-Arctic Alaska Diet: Crabs, shrimp, worms, clams
Lingcod[1,2,3,6] *Ophiocon elongatus*	Spawn in rocky bottoms, from intertidal to 19 m. November-April with peak activity in late December to early February.	Demersal, rocks in tidepools from lower intertidal to 19 m depth.	Demersal, January-July, rocks and vegetation in lower intertidal, but older larvae are pelagic, near surface	Pelagic, January-July; 1-yr juveniles may recruit to sandy, shallow bottoms, down to 60 m but usually in bays, estuaries.	Rocky habitat, mainly in waters less than 100 m deep. Baja California-Shumagin Islands, AK
California halibut[1,4,8] *Paralichthys californicus*	Spawn at depths of 6-20 m over sandy bottoms. February-August, peak in May	Pelagic, concentrated in areas with depths of 6-20 m	Pelagic, usually found between 12 and 45 m isobaths	March - May move to deeper, offshore waters with growth. Juveniles recruit to sand and mud bottoms off coastal embayments/estuaries in June. Diet: copepods, mysids, cumaceans, amphipods	Adults most common from surf (55 m) zone to 60 m. Baja California - Quillayute River, WA Diet: anchovies, croakers, flatfish and squid

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Table 3-5. Summary of critical stages of commercially-important deep-water demersal fish found near Humboldt Bay.

SPECIES	SPAWNING HABITAT/SEASON	EGG HABITAT	LARVAL HABITAT	JUVENILE HABITAT/SEASON FEEDING	ADULT SEASONAL DISTRIBUTION/HABITAT, RANGE, FEEDING
Dover sole[1,2,4,5] *Microstomus pacificus*	Spawning aggregations in 80-732 m, November-March	Pelagic eggs primarily in upper 50 m, from November-March	Pelagic, primarily in upper 50 m	Mud bottom, on shelf. February 130-183 m depth, may move into shallows (10-183 m) in summer. Diet: same as adults	Mud bottoms, 18m - 915 m; Baja California - Bering Sea; Diet: polychaetes, bivalves, benthic crustaceans, brittle stars
Petrale sole[1,2,3] *Eopsetta jordani*	Major spawning aggregations in 274-450 m, November - March. Move offshore in winter and inshore in summer.	Pelagic eggs, float with current, sink before reaching nearshore areas.	Pelagic, in shallow waters	Benthic in fall of 1st year (64-82 m depths), May-August found 18-90 m. Diet: mysids, sculpins, juvenile flatfishes	Sandy bottom; 18-547 m; Baja California - Gulf of Alaska; Diet: euphausiids, shrimp, pelagic fish, juvenile flatfish.
Rex sole[5] *Glyptocephalus zachirus*	Spawn at 100-300 m.	Pelagic	Pelagic	Become benthic in winter, 150-200 m, use this depth as nursery.	Sand or mud bottom; 18-614 m depth, but mainly below 61 m; San Diego - Bering Sea
Sablefish[1,2,3] *Anoplopoma fimbria*	Deep water, January/February	Pelagic	Pelagic, upper 1 m, 5.6-370 km from shore, March-July	Shallow waters. Occur at depths of 100-200 m, occasionally 30 m deep. Diet: euphausiids, copepods, amphipods, larvaceans.	Mud/clay bottoms; bottom at 305-1829 m; Baja California - Bering Sea Diet: squid, octopus, euphausiids, shrimp
Rockfish spp.	mid-November to mid-March	Ovoviviparous	Pelagic, found year-round, commonly at depths >100 m		
Widow rockfish[1,2,3] *Sebastes entomelas*	Little known. Spawning may be confined to restricted areas, January - March	Ovoviviparous.	Pelagic, March	Become benthic, small juveniles occur from surface to depths of 20 m; older juveniles at depths of 9-37 m, mainly June - August. Diet: euphausiids, salps.	Rocky banks; 34-366 m; Baja California - Kodiak, Alaska; Diet: amphipods, euphausiids, shrimp, salps
Canary rockfish[2,3] *Sebastes pinniger*	Spawning may be confined to specific areas, mid-winter	Ovoviviparous	Not in epipelagic, or shallow waters	Become benthic, occur at depths less than 22 m; mainly May - August.	Rocky bottom; 91-274 m; Baja California - SE Alaska

Table 3-5. Summary of critical stages of commercially-important deep-water demersal fish found near Humboldt Bay (cont.).

SPECIES	SPAWNING HABITAT/SEASON	EGG HABITAT	LARVAL HABITAT	JUVENILE HABITAT/SEASON FEEDING	ADULT SEASONAL DISTRIBUTION/HABITAT, RANGE, FEEDING
Boccaccio rockfish[1,2,3] *Sebastes paucispinis*	Two broods: spawning in mid-November and March.	Ovoviviparous.	Occur often far offshore in the upper 100 m, mid-December and April.	Some benthic juveniles occur in less than 22 m, but not common. Diet: perches, jack mackerel, juvenile rockfishes.	Rocky reefs and open bottom; 27-320 m. Baja California - Gulf of Alaska; Diet: rockfish, Pacific hake, northern anchovy. Soft bottom, usually below 91 m.
Thornyhead rockfish[2,3] (Shortspine & longspine) *Sebastolobus alascanus* & *Sebastolobus altivelis*	Little known.	Pelagic, Eggs float at surface in gelatinous masses, January - May.	Pelagic.	Not restricted to shallow, nursery areas.	
Darkblotched rockfish[2,3] *Sebastes crameri*	Little known; spawning may be confined to restricted areas, February.	Ovoviviparous.	Pelagic, March.	not restricted to shallow, nursery areas. 0-year old found at 73 - 130 m.	Soft bottom, 29-549 m. Southern California to Bering Sea.
Chilipepper rockfish[1,3] *Sebastes goodei*	Spawn in mid-November to mid-March.	Ovoviviparous.	pelagic, occur near surface. December - April.	Age-0 found at surface to 8 m, around rocky reefs during summer. Subadults and adults occur at depths of 50-350 m. Diet: planktonic crustaceans.	Sand and mud bottom; 61 - 329 m; Baja California - British Columbia. Diet: euphausiids, anchovies, lanternfish.

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[5]Muller and Lee 1972

Table 3-6. Summary of critical stages of commercially-important pelagic fish found near Humboldt Bay in relation to dredge disposal.

SPECIES	SPAWNING HABITAT/SEASON	EGG HABITAT	LARVAL HABITAT	JUVENILE HABITAT/SEASON FEEDING	ADULT SEASONAL DISTRIBUTION/HABITAT, RANGE, FEEDING
ANADROMOUS FISH					
Chinook salmon[1,2] *Oncorhynchus tshawytscha*	Fish return to Humboldt County rivers and must hold in estuaries and nearshore areas until rains provide sufficient flows to move upstream, September - February	Freshwater.	Freshwater.	Juveniles in nearshore waters, but little information on nearshore distribution in ocean. Concentrate near canyon heads. May - October in some locations.	Ocean San Diego - Bering Sea
Coho salmon[1,2] *Oncorhynchus kisutch*	Fish return to Humboldt Counth rivers and must hold in estuaries and nearshore areas until rains provide sufficient flows to move upstream, September - February.	Freshwater.	Freshwater.	Juveniles in nearshore waters, in ocean off Oregon, most juveniles found within 4 m of surface. Concentrate near canyon heads. March - June.	Ocean Baja California - Arctic Alaska
Steelhead trout[2,5,6] *Oncorhynchus mykiss* Summer run	Return to Middle Fork Eel River, May - October	Freshwater.	Freshwater.	Juveniles (1-4 yr olds) move through nearshore waters, March - April.	Ocean Baja California - Bering Sea
Winter run	Return to Humboldt County rivers, November - April			Juveniles (1-4 yr olds) move through nearshore waters, March - April.	Ocean Baja California - Bering Sea
Coastal cutthroat trout *Oncorhynchus clarki clarki*	Spends summer in ocean and estuaries, spawns in January, February			Seaward smolt migration peaks in May, fish remain close inshore.	Ocean Eel River - SE Alaska
ROCKFISH					
Blue rockfish[2] *Sebastes mystinus*	Spawns in mid-November to mid-April	Pelagic.	Pelagic.	Become benthic in <25 m, late May - June.	Schooling rockfish, off bottom over reefs and pinnacles; surface - 550 m; Baja California - Bering Sea

Table 3-6. Summary of critical stages of commercially-important pelagic fish found near Humboldt Bay in relation to dredge disposal (cont.).

SPECIES	SPAWNING HABITAT/SEASON	EGG HABITAT	LARVAL HABITAT	JUVENILE HABITAT/SEASON FEEDING	ADULT SEASONAL DISTRIBUTION/HABITAT, RANGE, FEEDING
ROCKFISH (cont.)					
Black rockfish[3] *Sebastes melanops*	Spawning area unknown, maybe offshore, January - April	Pelagic.	Pelagic, April - June.	Restricted to benthic, 40 - 50 m depth, mainly in June; range is from April - October.	Primarily found in areas with depths of 54 m or less; mainly found in mid-waters; Southern California - Aleutian Islands.
Yellowtail rockfish[2] *Sebastes flavidus*	Spawn in mid-November to mid-March	N/A.	Pelagic.	Juveniles have been found in bay, nursery areas.	Mostly pelagic, 24 - 46 m; San Diego - Kodiak Island.
BEACH AND BAY FISH					
Herring[1,4] *Clupea harengus pallasi*	Spawns in protected embayments, esp. Humboldt bay; December - March	Eggs restricted to embayments, esp. Humboldt Bay, December - March.	Restricted to bays and shallow coastal areas nearshore. Spring and early summer.	Not restricted to shallow water nursery areas.	When not spawning, typically offshore. Baja California - Arctic Alaska.
Surf, Night Smelt Whitebait smelt[1,2] *Hypomesus pretiosus, Spirinchus starksi Allosmerus elongatus*	Restricted to spawning in surf zone of sandy beaches, March - August. Surf smelt spawns at day, night smelt spawns at night.	Eggs attached to sand grains in surf zone of sandy beaches, March - August.	Little known.	Little known.	Little known. Generally, Southern California - British Columbia or Alaska.
Surfperches[1,2] *Cymatogaster aggregata Amphisus rhodoterus Hyperprosopon ellipticum H. argenteum Phanerodon furcatus*	Spawn in protected embayments and shallow coastal waters. Spring and early summer.	Viviparous.	Viviparous.	Restricted to bays and shallow areas, esp. Humboldt Bay. Summer and fall.	Shallow surf, sheltered bays; generally, Southern California - British Columbia or Alaska.

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APPENDIX F

SPECIES LISTS FOR PROPOSED AND LISTED ENDANGERED AND THREATENED SPECIES THAT MAY BE PRESENT IN HUMBOLDT HARBOR AND BAY DEEPENING NAVIGATION PROJECT AREA

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-94-SP-1614

September 20, 1994

Mr. Roderick A. Chisholm, II
Chief, Planning Branch
Planning/Engineering Division
Corps of Engineers-San Francisco District
211 Main Street
San Francisco, California 94105-1905

Subject: Updated Species List for Proposed Humboldt Harbor and Bay Deepening Project, Humboldt County, California

Dear Mr. Chisholm:

The enclosed updated list replies to your letter of August 18, requesting information on listed and proposed endangered and threatened species that may be present in the subject project area (see Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service (Service) to provide a species list pursuant to Section 7(c) of the Endangered Species Act, as amended. (Act).

Some pertinent information concerning the distribution, life history, habitat requirements, and a discussion of the responsibilities of federal agencies under Section 7(c) of the Act were provided for those species addressed in response to your initial request for a species list. Attached is information concerning those listed and proposed species not previously addressed.

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. If you determine that a proposed species may be adversely affected, you should consider requesting a conference with our office pursuant to 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

Also, for your consideration, we have included a list of the candidate species that may be present in the project area (see Enclosure A). These species are currently being reviewed by the Service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is completed. Should the

biological assessment reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

If the proposed project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by the U.S. Army Corps of Engineers (Corps), a Corps permit shall be required, pursuant to section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act. Impacts to wetland habitats require site specific mitigation and monitoring. You may request a copy of the Service's General Mitigation and Monitoring Guidelines or submit a detailed description of the proposed impacts for specific comments and recommendations.

Please contact Laurie Stuart Simons of this office at (916) 978-5408 extension 330 if you have any questions regarding the enclosed list or your responsibilities under the Endangered Species Act. If you have any questions regarding wetlands, contact Mike Aceituno at (916) 978-5801.

Sincerely,

Gary C. Stone

for Joel A. Medlin
Field Supervisor

Enclosures

cc: FWS-SFO, (Corps Projects)

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OR MAY BE AFFECTED BY THE PROPOSED HUMBOLDT HARBOR AND BAY DEEPENING PROJECT, HUMBOLDT COUNTY, CALIFORNIA (1-1-94-SP-1614, SEPTEMBER 20, 1994)

Listed Species

Fish

winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)
tidewater goby, *Euclyclogobius newberryi* (E)

Birds

Aleutian Canada goose, *Branta canadensis leucopareia* (T)
California brown pelican, *Pelecanus occidentalis californicus* (E)
western snowy plover, coastal population, *Charadrius alexandrinus nivosus* (T)

Proposed Species

None

Candidate Species

Fish

green sturgeon, *Acipenser medirostris* (2R)

Birds

western snowy plover, interior population, *Charadrius alexandrinus nivosus* (2■)

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)

(E)--Endangered (T)--Threatened (P)--Proposed (CH)--Critical Habitat
(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
(1R)-Recommended for Category 1 status.
(2R)-Recommended for Category 2 status.
(■)--Listing petitioned.
(*)--Possibly extinct.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-94-SP-500

February 2, 1994

Mr. Roderick A. Chisholm, II
Chief, Environmental Branch
Planning/Engineering Division
Army Corps of Engineers-San Francisco
211 Main Street
San Francisco, California 94105-1905

Subject: Updated Species List for the Proposed Humboldt Harbor and Bay Deepening Project, Humboldt County, California

Dear Mr. Chisholm:

This response updates our list for the Proposed Humboldt Harbor and Bay Deepening Project sent to you with our letter dated December 21, 1993, File Number 1-1-94-SP-276, of the proposed and listed endangered and threatened species that may be present in the subject project area (see Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service (Service) to provide a species list pursuant to Section 7(c) of the Endangered Species Act, as amended, (Act).

Pertinent information concerning the listed species life history and distribution, and a discussion of the responsibilities of federal agencies under Section 7(c) of the Act were provided for those species addressed in response to your initial request for a species list. Attached is information concerning those listed species not previously addressed.

Formal consultation, pursuant to 50 CFR § 402.14, should be initiated if you determine that a listed species may be affected by the proposed project. If you determine that a proposed species may be adversely affected, you should consider requesting a conference with our office pursuant to 50 CFR § 402.10. Informal consultation may be utilized prior to a written request for formal consultation to exchange information and resolve conflicts with respect to a listed species. If a biological assessment is required, and it is not initiated within 90 days of your receipt of this letter, you should informally verify the accuracy of this list with our office.

Also, for your consideration, we have included a list of the candidate species that may be present in the project area (see Enclosure A). These species are currently being reviewed by the Service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are included for your consideration as it is possible that one or more of these candidates could be

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED HUMBOLDT HARBOR AND BAY DEEPENING PROJECT, HUMBOLDT COUNTY, CALIFORNIA (1-1-94-SP-276, DECEMBER 21, 1993)

Listed Species

Birds

American peregrine falcon, *Falco peregrinus anatum* (E)
marbled murrelet, *Brachyramphus marmoratus* (T)
western snowy plover, coastal population, *Charadrius alexandrinus nivosus* (T)

Plants

Menzies' wallflower, Erysimum menziesii (E)
beach layia, Layia carnosa (E)

Proposed Species

Fish

tidewater goby, *Euclyclogobius newberryi* (PE)

Plants

western lily, Lilium occidentale (PE)

Candidate Species

Fish

green sturgeon, *Acipenser medirostris* (2R)

Amphibians

northern red-legged frog, *Rana aurora aurora* (2)

Reptiles

northwestern pond turtle, *Clemmys marmorata marmorata* (2)

Mammals

Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)

Plants

northcoast sand-verbena, Abronia umbellata ssp. breviflora (2)
Humboldt Bay owl's-clover, Castilleja ambigua ssp. humboldtiensis (2)
northcoast bird's-beak, Cordylanthus maritimus ssp. palustris (2)
Humboldt Bay gumplant, Grindelia stricta ssp. blakei (2)

proposed and listed before the subject project is completed. Should the biological assessment reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

Please contact Laurie Stuart Simons of this office at (916) 978-5408 extension 330 if you have any questions regarding the enclosed list or your responsibilities under the Endangered Species Act. For questions concerning the threatened winter-run chinook salmon, please contact Jim Lecky, Endangered Species Coordinator, at the National Marine Fisheries Service, Southwest Region, 501 West Ocean Boulevard, Suite 4200, Long Beach California 90802-4213, or call him at (310) 980-4015.

Sincerely,

Cay C. Goude

for Dale A. Pierce
Acting Field Supervisor

Enclosures

cc: FWS-SFO (Wetlands), Sacramento, CA
FWS-SFO (Corps Projects), Sacramento, CA
NMFS (Jim Lecky), Long Beach, CA

Plants

northcoast sand-verbena, Abronia umbellata ssp. breviflora (2)
Humboldt Bay owl's-clover, Castilleja ambigua ssp. humboldtiensis (2)
northcoast bird's-beak, Cordylanthus maritimus ssp. palustris (2)
Humboldt Bay gumplant, Grindelia stricta ssp. blakei (2)

(E)--Endangered (T)--Threatened (P)--Proposed (CH)--Critical Habitat
(1)--Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2)--Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
(1R)-Recommended for Category 1 status.
(2R)-Recommended for Category 2 status.
(a)--Listing petitioned.
(*)--Possibly extinct.
(#)--Published 1 year petition finding indicates that taxon warrants listing.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

F/SW031:RCW

DEC 27 1993

Mr. Roderick A. Chisholm, II
Chief, Environmental Branch
Corps of Engineers
San Francisco District
211 Main Street
San Francisco, California 94105-1905

Dear Mr. Chisholm:

Thank you for requesting information regarding the presence of any Federally listed threatened or endangered species, or critical habitat, that may be affected by the proposed Humboldt Harbor and Bay Deepening Project in Humboldt County, California.

Available information indicates that the Sacramento River winter-run chinook salmon species, which the National Marine Fisheries Service recently determined should be reclassified from a threatened to an endangered species, may occur at the proposed project site. However, there is no designated critical habitat for this species at the proposed project site. The U.S. Fish and Wildlife Service should be contacted regarding the presence of listed species that may be under its jurisdiction.

If you have questions concerning these comments, please contact Mr. Gary Stern at (707) 578-7513.

Sincerely,

for JJ Slater

Gary Matlock, Ph.D.
Acting Regional Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825

In Reply Refer To:
1-1-95-I-330

January 10, 1995

Roderick A. Chisholm, II
Chief, Planning Branch
Department of the Army
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105-1905

Subject: Response to Request for Concurrence With Determination that Section 7 Consultation is Not Required Regarding the Humboldt Harbor and Bay Deepening Navigation Project, Humboldt County, California.

Dear Mr. Chisholm:

In response to the December 7, 1994, letter requesting concurrence with the determination that section 7 consultation is not required regarding the Humboldt Harbor and Bay deepening navigation project, the Service provides the following species by species determination:

FISH

Tidewater goby (*Eucyclogobius newberryii*)

Based on the Biological Assessment and a December 13, 1994, conversation with Tamara Terry, the Service concurs that the project is "not likely to adversely affect" the tidewater goby, and formal consultation is not required.

BIRDS

Aleutian canada goose (*Branta canadensis leucopareia*)
California brown pelican (*Pelecanus occidentalis californicus*)
western snowy plover, coastal population (*Charadrius alexandrinus nivosus*)
bald eagle (*Haliaeetus leucocephalus*)
marbled murrelet (*Brachyramphus marmoratus*)
American peregrine falcon (*Falco peregrinus anatum*)
short-tailed albatross (*Diomedea albatrus*)

The Service concurs that the project is "not likely to adversely affect" above bird species, and formal consultation is not required.

PLANTS

Menzie's wallflower (*Erysium menziessii*)
beach layia (*Layia carnosa*)
western lily (*Lilium occidentale*)

The Service does not concur that the project is "not likely to adversely affect" the above plant species. The plant survey conducted at the Louisiana Pacific disposal site was inadequate. Only a small portion of the project, near the carrier pipe, was surveyed. Because most of the proposed project area in the preferred alternative was not surveyed, the Service believes that the project may affect these plants. The Service recommends an adequate survey of the entire area affected by the project be conducted during the flowering time for these plants.

Additionally, some of the other project alternatives, if chosen, including the "Superbowl" disposal site may also adversely affect listed plant species.

If sufficient information is provided indicating that this action is not likely to adversely affect the plants listed above, then formal consultation may not be necessary prior to undertaking the proposed federal action pursuant to 50 CFR §402.13.

If you have any questions, please call Robert Pine at (916) 979-2752 for goby concerns, Ken Sanchez at (916) 979-2749 for bird concerns, or Kirsten Tarp at (916) 979-2120 for plant concerns.

Sincerely,

for Joel A. Medlin
Field Supervisor

cc: ARD-ES, Portland, OR
Dale Sweetnam, DFG, Stockton, CA
K. Sanchez, FWS, SFO
K. Tarp, FWS, SFO
M. Littlefield, FWS, SFO

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-95-I- 597

March 14, 1995

Roderick A. Chisolm, II
Chief, Planning Branch
Department of the Army
San Francisco District, Corps of Engineers
211 Main Street
San Francisco, California 94105-1905

Subject: Response to Request for Concurrence With the Determination that the Humboldt Harbor and Bay Deepening Navigation Project is Not Likely to Adversely Affect Listed Plant Species

Dear Mr. Chisolm:

Thank you for your letter dated February 7, 1995, which provided further information on additional plant surveys and vegetation communities regarding the proposed Humboldt Bay Harbor and Bay deepening navigation project. With this additional information, the Service can now concur that the proposed action is not likely to adversely affect listed plant species and that formal consultation will not be necessary prior to undertaking the proposed federal action pursuant to 50 CFR §402.13. If you have any questions, please contact Kirsten Tarp at (916) 979-2120.

Sincerely,

Joel A. Medlin
Field Supervisor

cc: ARD-ES, Portland, OR
C. Wilkinson, FWS, SFO
M. Littlefield, FWS, SFO

APPENDIX G

AIR QUALITY EMISSION TABLES

Table 1. Emission Source Data for Humboldt Harbor and Bay Deepening Project

Activity/ Equipment Type	*HorsePower* (Hp)	*Fuel* Conversion *Factor*	*Number Active*	*Fuel Use Gal/Hr*	*Hours Per Day*	*Work Days*	*Total Fuel Usage*
Mobilize/Demobilize							
Hopper Dredge	8000	0.02	1	172.7	24	6	24,869
Bar Channel							
Hopper Dredge	8000	0.02	1	142.4	24	51.7	176,690
Survey Boat	340	0.05	1	16.0	6	51.7	4,632
Entrance Channel							
Hopper Dredge	8000	0.02	1	141.7	24	43.2	146,915
Survey Boat	340	0.05	1	16.0	6	43.2	3,871
North Bay (Middle)							
Hopper Dredge	8000	0.02	1	141.2	24	13.4	45,410
Survey Boat	340	0.05	1	16.0	6	13.4	1,201
North Bay (North)							
Hopper Dredge	8000	0.02	1	140.7	24	28	94,550
Survey Boat	340	0.05	1	16.0	6	28	2,509
Outer Eureka Channel							
Hopper Dredge	8000	0.02	1	140.7	24	8.2	27,690
Survey Boat	340	0.05	1	16.0	6	8.2	735
Samoa Channel							
Hopper Dredge	8000	0.02	1	140.8	24	38.3	129,423
Survey Boat	340	0.05	1	16.0	6	38.3	3,432
Samoa Turning Basin							
Hopper Dredge	8000	0.02	1	140.6	24	31.6	106,631
Survey Boat	340	0.05	1	16.0	6	31.6	2,831
East Samoa TB							
Hopper Dredge	8000	0.02	1	133.4	24	7.6	24,332
Survey Boat	340	0.05	1	16.0	6	7.6	681
W Samoa TB (Land Disp)							
Hopper Dredge	8000	0.01	1	100.5	24	4.3	10,372
Survey Boat	340	0.05	1	16.0	6	4.3	385
Bulldozer	335	0.04	1	14.5	8	4.0	464
W Samoa TB (Ocean Disp)							
Hopper Dredge	8000	0.02	1	133.4	24	0.9	2,881
Survey Boat	340	0.05	1	16.0	6	0.9	81
Entrance Widening							
Hopper Dredge	8000	0.02	1	135.1	24	43.2	140,072
Survey Boat	340	0.05	1	16.0	6	43.2	3,871
North Bay Widening							
Hopper Dredge	8000	0.02	1	134.0	24	30.4	97,766
Survey Boat	340	0.05	1	16.0	6	30.4	2,724
Bar Adv. Maintenance							
Hopper Dredge	8000	0.02	1	142.4	24	10	34,176
Survey Boat	340	0.05	1	16.0	6	10	896
Ent. Adv. Maintenance							
Hopper Dredge	8000	0.02	1	141.7	24	7	23,806
Survey Boat	340	0.05	1	16.0	6	7	627
Total Fuel Usage							1,114,522

Table 2. Emission Factors for the Humboldt Harbor and Bay Deepening Project.

	Fuel	*Emission Factors (Pounds/1000 Gallons)*							
Equipment Type	*Type*	*TOG*	*ROG*	*CO*	*NOx*	*SO2*	*PM*	*PM10*	*Source*
Hopper Dredge	D	37.50	36.00	102.00	469.00	31.20	33.50	32.16	(a)
Survey Boat	D	45.70	43.87	70.20	407.50	28.50	33.00	31.68	(b)
Bulldozer	D	27.6	26.50	78.5	284.9	31.1	25.3	24.29	(c)

Notes: (a) AP-42, Table 3.3-1, Vol. I (EPA, 1985).

(b) ARB (1984), except SO2/PM from Scott Environmental Technology (1981).

(c) AP-42, Table II-7.1, Vol. II (EPA, 1985).

(d) Pollutant abbreviations: total organic compounds (TOG), reactive organic compounds (ROG), carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), particulate matter (PM), particulate matter less than 10 microns in diameter (PM10)

Table 3. Daily Emissions for Dredging and Disposal at Humboldt Harbor and Bay.

Activity/	*Pounds Per Day*						
Equipment Type	*TOG*	*ROG*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Mobilize/Demobilize							
Hopper Dredge	155.4	149.2	422.8	1,943.9	129.3	138.9	133.3
Bar Channel							
Hopper Dredge	128.2	123.0	348.6	1,602.9	106.6	114.5	109.9
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	132.3	127.0	354.9	1,639.4	109.2	117.4	112.7
Entrance Channel							
Hopper Dredge	127.5	122.4	346.9	1,595.0	106.1	113.9	109.4
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	131.6	126.4	353.2	1,631.5	108.7	116.9	112.2
North Bay (Middle)							
Hopper Dredge	127.1	122.0	345.7	1,589.3	105.7	113.5	109.0
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	131.2	125.9	351.9	1,625.9	108.3	116.5	111.8
North Bay (North)							
Hopper Dredge	126.6	121.6	344.4	1,583.7	105.4	113.1	108.6
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	130.7	125.5	350.7	1,620.2	107.9	116.1	111.4
Outer Eureka Channel							
Hopper Dredge	126.6	121.6	344.4	1,583.7	105.4	113.1	108.6
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	130.7	125.5	350.7	1,620.2	107.9	116.1	111.4
Samoa Channel							
Hopper Dredge	126.7	121.7	344.7	1,584.8	105.4	113.2	108.7
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	130.8	125.6	351.0	1,621.4	108.0	116.2	111.5
Samoa Turning Basin							
Hopper Dredge	126.5	121.5	344.2	1,582.6	105.3	113.0	108.5
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	130.6	125.4	350.5	1,619.1	107.8	116.0	111.4
East Samoa TB							
Hopper Dredge	120.1	115.3	326.6	1,501.6	99.9	107.3	103.0
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	124.2	119.2	332.9	1,538.1	102.4	110.2	105.8
W Samoa TB (Land Disp)							
Hopper Dredge	90.5	86.8	246.0	1,131.2	75.3	80.8	77.6
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Bulldozer	3.2	3.1	9.1	33.0	3.6	2.9	2.8
Total	97.7	93.8	261.4	1,200.8	81.4	86.7	83.2
W Samoa TB (Ocean Disp)							
Hopper Dredge	120.1	115.3	326.6	1,501.6	99.9	107.3	103.0
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	124.2	119.2	332.9	1,538.1	102.4	110.2	105.8
Entrance Widening							
Hopper Dredge	121.6	116.7	330.7	1,520.7	101.2	108.6	104.3
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	125.7	120.7	337.0	1,557.2	103.7	111.6	107.1
North Bay Widening							
Hopper Dredge	120.6	115.8	328.0	1,508.3	100.3	107.7	103.4
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	124.7	119.7	334.3	1,544.8	102.9	110.7	106.3
Bar Adv. Maintenance							
Hopper Dredge	128.2	123.0	348.6	1,602.9	106.6	114.5	109.9
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	132.3	127.0	354.9	1,639.4	109.2	117.4	112.7
Ent. Adv. Maintenance							
Hopper Dredge	127.5	122.4	346.9	1,595.0	106.1	113.9	109.4
Survey Boat	4.1	3.9	6.3	36.5	2.6	3.0	2.8
Total	131.6	126.4	353.2	1,631.5	108.7	116.9	112.2
Total Peak Daily Emissions	132.3	127.0	354.9	1,639.4	109.2	117.4	112.7
Total Peak Mitigated Emissions	132.3	127.0	354.9	1,393.5	109.2	117.4	112.7

Table 4. Total Emissions for Dredging and Disposal at Humboldt Harbor and Bay.

Activity/ Equipment Type	*Tons Per Year*						
	TOG	*ROG*	*CO*	*NOx*	*SO2*	*PM*	*PM10*
Mobilize/Demobilize							
Hopper Dredge	0.5	0.4	1.3	5.8	0.4	0.4	0.4
Bar Channel							
Hopper Dredge	3.3	3.2	9.0	41.4	2.8	3.0	2.8
Survey Boat	0.1	0.1	0.2	1.1	0.1	0.1	0.1
Entrance Channel							
Hopper Dredge	2.8	2.6	7.5	34.5	2.3	2.5	2.4
Survey Boat	0.1	0.1	0.2	0.9	0.1	0.1	0.1
North Bay (Middle)							
Hopper Dredge	0.9	0.8	2.3	10.6	0.7	0.8	0.7
Survey Boat	0.0	0.0	0.1	0.3	0.0	0.0	0.0
North Bay (North)							
Hopper Dredge	1.8	1.7	4.8	22.2	1.5	1.6	1.5
Survey Boat	0.0	0.0	0.1	0.6	0.0	0.0	0.0
Outer Eureka Channel							
Hopper Dredge	0.5	0.5	1.4	6.5	0.4	0.5	0.4
Survey Boat	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Samoa Channel							
Hopper Dredge	2.4	2.3	6.6	30.3	2.0	2.2	2.1
Survey Boat	0.1	0.1	0.2	0.8	0.1	0.1	0.1
Samoa Turning Basin							
Hopper Dredge	2.0	1.9	5.4	25.0	1.7	1.8	1.7
Survey Boat	0.1	0.1	0.1	0.7	0.0	0.0	0.0
East Samoa TB							
Hopper Dredge	0.5	0.4	1.2	5.7	0.4	0.4	0.4
Survey Boat	0.0	0.0	0.0	0.2	0.0	0.0	0.0
W Samoa TB (Land Disp)							
Hopper Dredge	0.2	0.2	0.5	2.4	0.2	0.2	0.2
Survey Boat	0.01	0.01	0.02	0.09	0.01	0.01	0.01
Bulldozer	0.01	0.01	0.02	0.07	0.01	0.01	0.01
Total Land Disposal	0.21	0.20	0.57	2.59	0.18	0.19	0.18
W Samoa TB (Ocean Disp)							
Hopper Dredge	0.1	0.1	0.1	0.7	0.0	0.0	0.0
Survey Boat	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Entrance Widening							
Hopper Dredge	2.6	2.5	7.1	32.8	2.2	2.3	2.3
Survey Boat	0.1	0.1	0.2	0.9	0.1	0.1	0.1
North Bay Widening							
Hopper Dredge	1.8	1.8	5.0	22.9	1.5	1.6	1.6
Survey Boat	0.1	0.0	0.1	0.6	0.0	0.0	0.0
Bar Adv. Maintenance							
Hopper Dredge	0.6	0.6	1.7	8.0	0.5	0.6	0.5
Survey Boat	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Ent. Adv. Maintenance							
Hopper Dredge	0.4	0.4	1.2	5.6	0.4	0.4	0.4
Survey Boat	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Emissions	20.9	20.1	56.8	261.3	17.4	18.7	17.9
Mitigated Emissions	20.9	20.1	56.8	222.1	17.4	18.7	17.9
Total HOODS Emissions	20.7	19.9	56.3	258.7	17.2	18.5	17.7
Mitigated HOODS Emissions	20.7	19.9	56.3	219.5	17.2	18.5	17.7
Total HOODS Hopper Dredge	20.2	19.4	54.8	252.1	16.8	18.0	17.3
Total HOODS Survey Boat	0.5	0.5	1.4	6.6	0.4	0.5	0.5

APPENDIX H

RARE PLANT SURVEY FOR THE LOUISIANA PACIFIC SITE

SUMMARY

On June 2, 1994, a rare plant survey was conducted at a site on the Samoa Peninsula of Humboldt Bay, California. The proposed transfer of dredged materials from Humboldt Bay to an existing disposal site would impact areas which have some potential for the occurrence of rare plant species. These areas were surveyed for two sensitive salt marsh species and three sensitive sand dune plant species, all of which are known to occur on the Samoa Peninsula. None of these target species, nor any other sensitive plant species, were encountered or are expected to occur along the proposed pipeline route.

PROJECT BACKGROUND

A feasibility study for the deepening of Humboldt Bay Harbor, Humboldt County, is currently in preparation by the U.S. Army Corps of Engineers, San Francisco District. As proposed, dioxin-contaminated dredge spoils would be transferred from an offshore barge to an existing disposal site which is currently owned and used by Louisiana-Pacific, located just south of the Eureka-Samoa Bridge. The spoils would be transferred through a temporary pipeline. The proposed route of transfer would cross salt marsh habitat and disturbed dune habitat, as well as weedy, roadside areas.

SENSITIVE PLANT SPECIES

Two sensitive plant species occur in Humboldt Bay salt marshes. These are Humboldt Bay owl's clover *(Castilleja ambigua* ssp. *humboldtiensis,* formerly *Orthocarpus castillejoides* var. *humboldtiensis))* and Point Reyes bird's-beak *(Cordylanthus maritimus* ssp. *palustris).* A third plant that grows in Humboldt Bay salt marshes was until recently listed as rare by the California Native Plant Society. Humboldt Bay gumplant, formerly known as *Grindelia stricta* ssp. *blakei,* was believed to be endemic to the Humboldt Bay area. Now, the plant is considered the same as *Grindelia stricta* var. *stricta,* a common plant in northern coastal salt marshes. Three sensitive plant species occur in local sand dunes. These are beach layia *(Layia carnosa),* Humboldt Bay wallflower *(Erysimum menziesii* ssp. *eurekense),* and pink sand verbena *(Abronia umbellata* ssp. *breviflora).*

The main threat facing these rare plants is habitat loss due primarily to coastal development, all-terrain vehicle (ATV) use, and the spread of non-native plant species. All rare plants found in California are protected under the California Environmental Quality Act (CEQA), California Endangered Species Act (CESA) and NPPA (Native Plant Protection Act). Under NPPA and CESA, state-listed rare, threatened, endangered or candidate species cannot be taken or possessed except for scientific, educational, or management purposes without the permission of the California Department of Fish and Game (Howald 1990). The CEQA review process is designed to provide a method of disclosure of potential impacts resulting from proposed development.

Humboldt Bay owl's clover

Humboldt Bay owl's clover is on List 1B of the California Native Plant Society as endangered in a portion of its range. It currently has no state listing and is a candidate for Federal listing (Skinner and Pavlik 1994). Humboldt Bay is the only location where Humboldt Bay owl's clover is known to occur.

Humboldt Bay owl's clover is an annual hemiparasitic member of the Figwort Family (Scrophulariaceae). It typically germinates in January-February, blooms in May-June, and quickly withers after blooming. It is a small plant, but showy in bloom, with bright pink bracts. Humboldt Bay owl's clover is restricted to high elevation salt marshes.

Point Reyes bird's beak

Point Reyes bird's beak is on List 1B of the California Native Plant Society as endangered in a portion of its range. It currently has no state listing and is a candidate for Federal listing (Skinner and Pavlik 1994). Point Reyes bird's beak ranges from Coos Bay, Oregon, to Morro Bay, California.

Point Reyes bird's beak is an annual hemiparasitic member of the Figwort Family (Scrophulariaceae). It typically germinates in January-February, blooms in June-July, and withers by August. It is a small, somewhat inconspicuous plant. Like Humboldt Bay owl's clover, Point Reyes bird's beak is restricted to high elevation salt marshes, and the two rare plants commonly co-occur.

Beach layia

Beach layia is on List 1B of the California Native Plant Society (CNPS) as endemic to California, endangered throughout its range, and with occurrences limited to a few highly restricted populations (Skinner and Pavlik 1994). It is listed as endangered by the state

(Calif. Dept. Fish Game 1991) and it received Federal endangerment status in June, 1992 (Federal Register 57:120, 6-22-92). The largest known remaining population of beach layia occurs in Humboldt County, on the North Spit of Humboldt Bay (Morey 1989), where it has a widespread but patchy distribution (Duebendorfer 1992).

Beach layia is a small, somewhat succulent, winter annual belonging to the sunflower family (Asteraceae). The plant is small and inconspicuous. It typically germinates in mid-winter, blooms in April-May, and withers by mid-summer. The preferred habitat of beach layia is open, sparsely vegetated areas within the northern foredune community, a vegetation type characterized by low-growing native herbaceous and suffrutescent perennials. In addition, beach layia also occurs in open areas with moving sand, and in disturbed sandy areas (Duebendorfer 1992).

Humboldt Bay Wallflower

Humboldt Bay wallflower is on List 1B of the California Native Plant Society (CNPS) as endemic to California, endangered throughout its range, and with occurrences limited to a few highly restricted populations (Skinner and Pavlik 1994). Humboldt Bay wallflower is listed as endangered by the state (Calif. Dept. Fish Game 1991) and it received Federal endangerment status in June, 1992 (Federal Register 57:120, 6-22-92). Humboldt Bay wallflower is endemic to coastal dune habitats on the North and South Spits of Humboldt Bay.

Humboldt Bay wallflower is a member of the mustard family (Brassicaceae). It is a monocarpic perennial: the first year, the plant forms a basal rosette of leaves; it may persist in this vegetative state up to several years before flowering; and it dies after fruiting. In Humboldt County, Humboldt Bay wallflower typically blooms in late February-early April. On the North Spit of Humboldt Bay, Humboldt Bay wallflower typically occurs in the northern foredune community. Within this vegetation type, the wallflowers are clustered in patches of a few to hundreds of individuals (Sawyer and André 1990). In addition to its preferred habitat, Humboldt Bay wallflower is also found occasionally on the borders of lupine scrub, herbaceous dune hollows, and open sand areas (Duebendorfer 1992).

Pink Sand Verbena

Pink sand verbena is on List 1B of the California Native Plant Society (CNPS) as endangered in a portion of its range, rare in and outside California, and with occurrences confined to several populations. It is a candidate for Federal listing, with threat and/or distribution data

considered insufficient to support listing at this time (Skinner and Pavlik 1994). Currently, pink sand verbena has no state endangerment status in California (Calif. Dept. Fish Game 1991), but it is listed as endangered by the state of Washington (Skinner and Pavlik 1994). This subspecies of pink sand verbena *(A. u.* ssp. *breviflora)* ranges from southern Oregon to Marin County, California (Hickman 1993). The largest concentration of plants occurs at Gold Bluffs Beach, in northern Humboldt County (Vrilakas 1988).

Pink sand verbena is a member of the four-o'clock family (Nyctaginaceae). Little is known about its life history. There is some confusion as to whether the plant is an annual or a perennial which exhibits an annual die-back of leaves. It could be that it exhibits different growth strategies under different environmental conditions. Pink sand verbena blooms June through September (Munz and Keck 1973). Pink sand verbena is restricted to coastal sandy habitats. It occurs on beaches; low, sandy hummocks; open, sandy bay edges; and river mouths. Pink sand verbena is also found along borders of trails and in open sand (Duebendorfer 1992).

RESULTS OF SURVEY

The areas surveyed on June 2 are highlighted in Figure 1. These are areas that would be impacted by the placement of a temporary pipeline, which would connect to an underground carrier pipe already in place.

The intertidal area between the mudflats and the carrier pipe is vegetated by salt marsh. The substrate is bay mud mixed with a high percentage of gravel. The dominant species growing here are Chilean cordgrass *(Spartina densiflora)*, perennial pickleweed *(Salicornia virginica)*; and saltgrass *(Distichlis spicata)*. Occasional species are orache *(Atriplex patula* ssp. *hastata)*, jaumea *(Jaumea carnosa)*, sea lavender *(Limonium californicum)*, and sea plantain *(Plantago maritima* ssp. *juncoides)*. The cordgrass is a non-native invasive species that has risen to a position of dominance in the area's salt marshes. Orache is also non-native and is a common species. The other species listed above are all native members of the Humboldt Bay salt marsh community.

No Humboldt Bay owl's clover or Point Reyes bird's-beak were found in or near this area of salt marsh. Typically, these rare species occur in higher elevation marshes in more protected locations, and they are generally not associated with dense stands of Chilean cordgrass, as found in the project area.

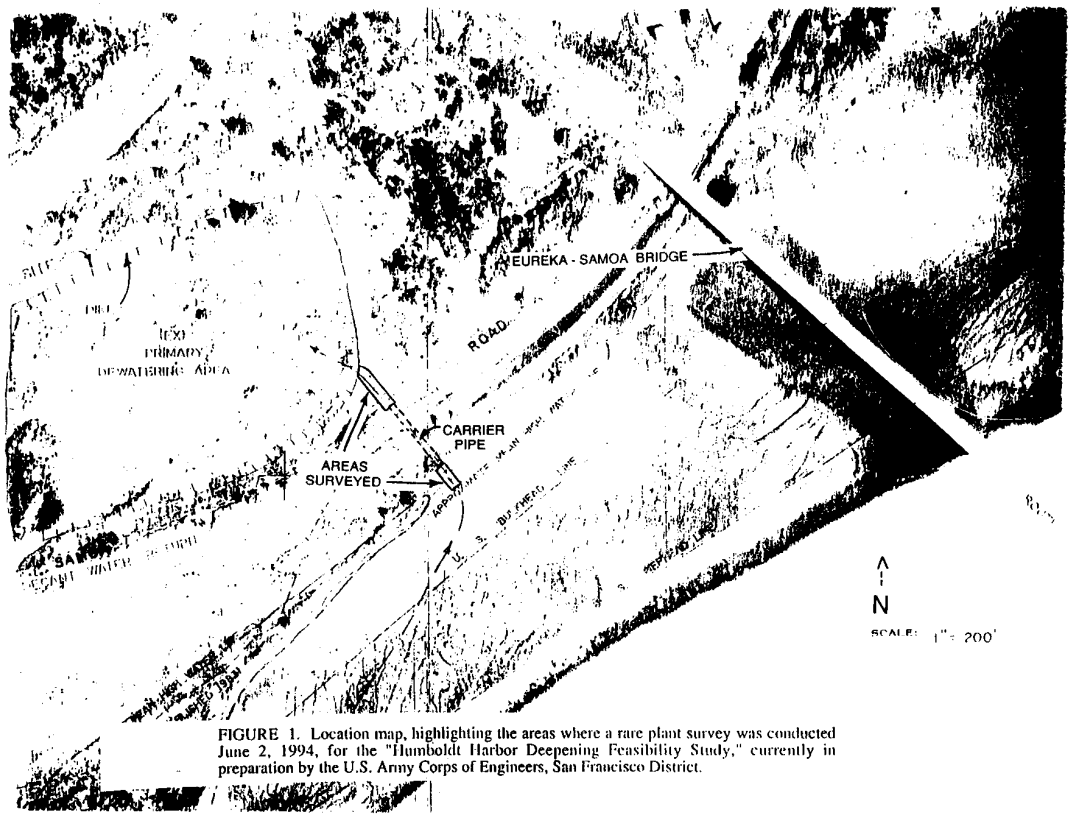

FIGURE 1. Location map, highlighting the areas where a rare plant survey was conducted June 2, 1994, for the "Humboldt Harbor Deepening Feasibility Study," currently in preparation by the U.S. Army Corps of Engineers, San Francisco District.

The area overlying the carrier pipe is vegetated by ruderal herbs and grasses. The pipe also crosses under the railroad tracks and Samoa Road.

At the other end of the underground carrier pipe, the proposed temporary pipeline would run up a sandy slope to the disposal site. The slope is vegetated by weedy plant species including California blackberry *(Rubus ursinus)*, ripgut brome *(Bromus diandrus)*, soft chess *(Bromus hordeaceus)*, annual fescue *(Vulpia myuros* var. *myuros)*, sheep sorrel *(Rumex acetosella)*, yarrow *(Achillea millefolium)*, hairgrass *(Aira caryophyllea)*, European beachgrass *(Ammophila arenaria)*, lotus *(Lotus purshianus)*, vetch *(Vicia americana* var. *americana* and *V. sativa* ssp. *nigra)*, hairy cat's ear *(Hypochaeris radicata)*, English plantain *(Plantago lanceolata)*, mustard *(Brassica* sp.*)*, bracken fern *(Pteridium aquilinum)*, sow thistle *(Sonchus oleraceus)*, parentucellia *(Parentucellia viscosa)*, and groundsel *(Senecio sylvaticus)*. Occasional native sand dune species occurring in this area are dunegrass *(Leymus mollis)*, beach evening primrose *(Camissonia cheiranthifolia)*, coast brome *(Bromus carinatus* var. *maritimus)*, and beach strawberry *(Fragaria chiloensis)*.

Bordering the pipeline route, there is dense growth of yellow bush lupine *(Lupinus arboreus)*, European beachgrass, wild blackberry, dunegrass, coyote brush *(Baccharis pilularis)*, and bee plant *(Scrophularia californica)*.

No beach layia, Humboldt Bay wallflower, or pink sand verbena were found in or near the pipeline route. This sandy area is quite disturbed, and it is not considered optimal habitat for any of these rare plant species.

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APPENDIX I

COMMENTS ON THE DRAFT EIS/EIR

Introduction

Appendix I includes copies of the comments submitted on the Draft EIS/EIR. It includes comment letters from Federal and State agencies, regional and local agencies, groups and organizations, and businesses.

Appendix J includes responses to all the comments contained in Appendix I. The responses in Appendix J are organized in the same order in which the comment letters are presented in Appendix I.

The following summarizes the comment activity on the Draft EIS/EIR. Twenty-four (24) people attended the public meeting on the Draft EIS/EIR held at 3:30 P.M. on January 11, 1995, at the Humboldt Bay Harbor, Recreation and Conservation District office in Eureka, California. Following the Corps presentation on the results of the Humboldt Harbor and Bay (Deepening) Navigation Feasibility Report and EIS/EIR, the public was invited to speak and/or present written presentations. Several members of the public spoke in favor of the project's recommended plan, and no one opposed the recommended plan. One person read and submitted a comment letter into the record. This letter, in Appendix I, is from the Humboldt Bay Forest Products, Inc., and concerns the possibility of including the Fields Landing Channels in the proposed project. Written comments on the Draft EIS/EIR include 13 letters from agencies, groups and organizations, and businesses. The 13 letters received were from Federal agencies (6 letters); State agencies (1 combined letter for 9 agencies); regional and local agencies (1 letter); groups and organizations (3 letters); and businesses (2 letters). These letters represented 79 seperate comments; a number of these comments were essentially the same.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

January 30, 1995 F/SW02

Lt. Colonel Michael J. Walsh
District Engineer
San Francisco District
Corps of Engineers
211 Main Street
San Francisco, California 94105

Dear Colonel Walsh:

The following comments relate to the December 1994 Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) titled the Humboldt Harbor and Bay Deepening Navigation Project. The DEIS/DEIR analyzes the impacts associated with the proposed: deepening and widening of the Humboldt Harbor and Bay navigation channels to accommodate deep-draft ships, the disposal of approximately 4.1 million cubic yards of dredged material in the Humboldt Open Ocean Disposal Site (HOODS), and the dredging and disposal of approximately 26,000 cubic yards of dredged materials at the Louisiana Pacific upland site.

The National Marine Fisheries Service is responsible for preserving and enhancing marine, estuarine, and anadromous fish resources and the habitats that support them. Anadromous fish species in Humboldt Bay include chinook salmon, coho salmon, steelhead trout, and coastal cutthroat trout . Important marine species include herring and Dungeness crab.

The potential impacts associated with the construction of Alternative Plan 3 are discussed in Section 5.5. According to the DEIS/DEIR, the impacts for the planktonic, benthic, and fish communities are not expected to be significant when compared to the existing conditions. Proposed mitigation measures to minimize dredging impacts include: avoiding eelgrass beds by at least 50 feet, and redirecting or postponing dredging if spawning is observed by a "qualified fishery biologist".

I am concerned that a 50 ft. buffer may not be adequate to protect eelgrass beds from dredging impacts. Any unintended eelgrass losses may be irreversible since past attempts to artificially create eelgrass habitat have generally failed. Given this fact, and the importance of this habitat for a number of sensitive species, including herring, I recommend that a larger buffer zone of at least 100 ft. be fully considered. Additionally, silt curtains could be used to minimize the impact of dredging on eelgrass beds.

2 The proposed avoidance of impacts to spawning activities through the use of a "qualified fishery biologist" is unrealistic. Given the natural turbidity and size of Humboldt Bay, it is unlikely that even a "qualified fishery biologist" could reliably detect spawning activities of numerous and diverse species such as herring and Dungeness crab that spawn in the Bay. A more appropriate approach would be to develop seasonal dredging windows that would be expected to eliminate or minimize impacts to spawning activities, based on the known life history patterns of the various species that spawn in the Bay. I believe that a team of biologists from the Corps of Engineers, U.S. Fish and Wildlife Service, NMFS, and California Department of Fish and Game should be able to develop appropriate dredging windows in just a few interagency meetings.

3 The U.S. Fish and Wildlife Service's Draft Fish and Wildlife Coordination Act Report, contained in Appendix B, expressed concern over secondary, indirect impacts of dredging that may cause eelgrass losses and other impacts by altering patterns of water circulation, sediment flushing, nutrient cycling, and Bay productivity. Possibly the best way to address these concerns, which I share with the U.S. Fish and Wildlife Service, would be to implement General recommendation #4 in the Coordination Act Report (page 84), which calls for development of a long-term mitigation, monitoring, and remedial-action plan designed to ensure success of any mitigation actions.

I generally believe that the information contained in the DEIS/DEIR is adequate to select a project alternative, even though the proposed mitigation needs improvement and
4 clarification. However, it should be mentioned in the DEIS/DEIR that there is a potential for future listings of coho salmon and steelhead trout under the Endangered Species Act. After a listing, new and maintenance dredging projects in Humboldt Bay would require Section 7 consultation and/or conferences.

If you have questions concerning these comments or wish to discuss the project further, please contact Mr. David Mattens at: National Marine Fisheries Service, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404; telephone (707) 578-7513.

Sincerely,

Christopher T. Mobley for

James R. Bybee
Environmental Coordinator
Northern California

cc: C. Morris, EPA
J. Medlin, FWS
J. Turner, CDFG

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213
TEL (310) 980-4000; FAX (310) 980-4018

F/SWO31:IVL

JAN 25 1995

Mr. Roderick A. Chisholm, II
Chief, Planning Branch
Planning/Engineering Division
Corps of Engineers
San Francisco District
211 Main Street
San Francisco, California 94105-1905

Dear Mr. Chisholm:

Thank you for providing me with the opportunity to comment on the Draft Feasibility Report and Environmental Impact Statement/Report for Navigation Improvements in Humboldt Harbor and Bay, California. I apologize for the delay in responding to your request.

1 Available information indicates that the proposed Humboldt Harbor and Bay Deepening Project is not likely to affect the endangered Sacramento River winter-run chinook salmon. In addition, the proposed project is not likely to affect marine mammals under the jurisdiction of the National Marine Fisheries Service. For these reasons, I concur that formal section 7 consultation under the Endangered Species Act is not required.

If you have questions regarding these comments, please contact Ms. Irma Lagomarsino at (310) 980-4016.

Sincerely,

Hilda Diaz-Soltero
Regional Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
PPN 1038

January 25, 1995

District Engineer
Corps of Engineers, San Francisco District
ATTN: Environmental Planning Section (T. Terry)
211 Main Street
San Francisco, California 94105-1905

Subject: Review of Draft Feasibility Report and Environmental Impact Report for Humboldt Harbor and Bay Deepening Project, Humboldt Bay Harbor, Recreation and Conservation District, Humboldt Bay, Eureka, Humboldt County, California

Dear Ms. Terry:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Feasibility Report, Draft Environmental Impact Report (DEIR) and the Draft Environmental Impact Statement (DEIS) for navigational improvements in Humboldt Bay Entrance and Channel and the Samoa Turning Basin. The following comments are provided to supplement the Service's Draft Fish and Wildlife Coordination Act Report for the Humboldt Harbor and Bay Deepening Project (DCAR), dated February 1994.

As stated in the DEIR/EIS and Draft Feasibility Report, the Humboldt Harbor and Bay Deepening Project consists of deepening the Bar, the North Bay, and the Samoa Channel and deepening and widening the Entrance Channel and the Turning Basin. Dredged materials will be disposed of at two sites: 4.1 million cubic yards of "clean" dredge material would be disposed of at the Humboldt Open Ocean Disposal Site (HOODS); the remaining 26,000 cubic yards of sediment contaminated with dioxin and copper would be disposed at the Louisiana Pacific Disposal Site. The purpose of the project is to improve navigation within the Channel for larger deep-draft vessels using the harbor. The Service prepared the DCAR for the Humboldt Harbor and Bay Deepening Project in February 1994 for the Corps of Engineers (Corps). The following comments address both the Draft EIR/EIS and the Corps responses to the recommendations in the DCAR and the Habitat Evaluation Procedure (HEP) models.

General Comments

1 The Service is concerned that the Corps and the Humboldt Harbor, Bay and Recreation District have not fully evaluated the cumulative impacts of additional dredging in Humboldt Harbor and Bay. Long-term mitigation monitoring and remedial action plans must be designed to offset the impacts to the benthic community, eelgrass beds, and the ocean disposal site. While the Corps believes this deepening project does not require mitigation because the impacts are "short-term, localized and temporary," the secondary impacts caused by this project to the wildlife in this area have not been fully evaluated. Although maintenance dredging occurs twice annually, the Humboldt Harbor and Bay Deepening Project is of significantly larger proportion. Impacts from dredging are cumulative. Not only will this project significantly affect already stressed areas, it will impact areas (through channel widening) that previously are not affected by the maintenance dredging.

2 The Service is aware of the concerns expressed by the Corps, California Department of Fish and Game, and the U.S. Environmental Protection Agency (EPA) regarding the use of the HEP and word models developed and utilized in the DCAR to assess impacts resulting from this project. While we agree that the word models used in impact assessments perhaps do not provide enough "specifics" (Corps Response to Service's Recommendations, p. 6) for the Corps to evaluate the mitigation plans to their satisfaction, these issues do not mean mitigation is not required. As the DEIR/EIS points out, "[i]rreversible environmental changes would occur at the proposed deepening and widening area of the Humboldt Bay navigation channels and the approved disposal site" (p. 11-1). This is the basis of our request for mitigation. At present, there are no other proposed methods for evaluating the impacts to Humboldt Harbor and Bay from this project. If the Corps does not agree with the methods used by the Service to quantify losses, the Service is open to discuss methods the Corps does recommend to evaluate impacts from this dredging project. The Corps may also wish to develop their own plan for mutually beneficial mitigation.

Specific Comments

3 The DEIR/EIS states that the total area of previously undredged harbor bottom is 9,000 square feet. At the August 9, 1994, Feasibility Review Conference in Eureka and in personal communications with and written correspondence from the Corps' San Francisco office, the Service was told that the total previously undredged area to be dredged by this project is approximately 45 acres. Please make this correction in the EIR/EIS.

4 Restricting the project dredging to only the late-August to early November period would reduce disruption and minimize impacts to the critical lifestages of important fish and wildlife species. Additional dredging in late March through April could disrupt critical breeding times for migratory birds (increased activity and noise could lead to the abandonment of nesting areas, additional stress on breeding pairs and nestlings) and cause a decrease in food (benthic communities). This may impact the local wildlife populations for several breeding seasons.

5 The Corps has determined through chemical analysis of sediment samples collected throughout the Bay that all but 26,000 cubic yards of the substrate to be dredged is clean material (p. 32). The Service is concerned that the number of sites sampled (10) may not be sufficient to accurately represent the over 4.1 million cubic yards of material to be dredged. This represents an average of one sample per every 410,000 cubic yards to be dredged.

6 The increased traffic from international vessels may result in an increase in ballast dumping. This may introduce a variety of exotic species, both plant and animal, into the Bay environment. History has shown that, over time, these exotics can displace native flora and fauna through competition. The Baltic clam (*Macoma balthica*), one of more than 90 species introduced into San Francisco Bay, is a strong competitor for the resources that would otherwise be utilized by native species. This should be addressed as a potential effect to the sensitive species in the Bay, including the vital eelgrass beds and to the local fishing industry. The Service recommends that the EIR/EIS be modified to include possible treatment of ballast water at local water treatment facilities or the prohibition of ballast water discharge within the Bay and Harbor. (California State Lands Commission, p. 128).

Benthic Community

The DEIR/EIS states that mitigation for benthic community impacts are not necessary because the effects are "short term, insignificant and temporary" (p. 72). According to the DEIR/EIS, "recolonization by early colonizers

occurs within 3-6 months" (p. 5-45). Early colonizers are not the diverse, highly favored members of the benthic community that support the diverse and abundant life found in the Bay and Harbor. This is not true recovery of a *community*. The DEIR/EIS quotes, "original biomass is *sometimes* reached in 2 weeks to 4 months" (USFWS 1994). If dredging occurs in the spring months of March and April, these could be a biologically critical 4 months. Without further study, it would be impossible to determine when the original biomass of the benthic community specific to Humboldt Bay and the conditions therein could be reached. If it is not determined that the benthic community will indeed recover within two weeks and that further impacts to the food chain can be avoided, mitigation for not only the direct loss of the benthic community but also the loss of the species dependant on the benthic community is necessary.

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9 The capacity of the HOODS is 50 million cubic yards: 1 million/year for 50 years (pp. 2-13 through 2-15). This project would generate 4.1 million in 11 months, an extremely large amount of dredged material for disposal, even for a site with the capacity of the HOODS. This would significantly change the calculated effects to the benthic communities and the indigenous species. The Service is concerned that the effects at the HOODS have not been calculated for this large of a disposal. The HOODS has previously been used for disposal for only 740,000 cubic yards of dredged material. This is significantly less than the 4.1 million expected to be generated by this project. The Service maintains that without further calculation on the part the Corps and EPA, the assumed effects of 4.1 million cubic yards of dredged material on this site cannot be compared to and based on the effects of 740,000 cubic yards. Please recalculate the effects of using this site to reflect a disposal of this magnitude and include the results in the EIR/EIS.

10 The DEIR/EIS states that the material deposited at the HOODS will be mixed both by wave action and by biological mixing by benthic organisms (p. 4-30). Biological mixing may not occur to the extent assumed here because of the possibility of smothering or otherwise disturbing the benthic community at the HOODS and Humboldt Harbor and Bay. This could seriously extend the time

10 necessary for the dredge material disposed at the HOODS to be fully mixed. The DEIR/EIS should be amended reflect this when determining the rapidity of deposited dredged material mixing at the HOODS.

11 "Presently, no relation between shoreline change and dredge disposal at the HOODS has been determined...[E]ffects of dredge disposal at the HOODS may not be realized for 10-20 years" (p. 4-43). The HOODS has not even begun to be used as a large disposal site. As stated above, it is difficult to justify comparing the effects of 4.1 million cubic yards of material to the effects of 740,000 cubic yards. The Service is concerned that the use of the HOODS as a major disposal site could result in changes of the entrance channel of Humboldt Bay or the mouth of the Eel River. More thought should be given before dumping 4 years worth of sediment at the HOODS in 11 months.

12 Dredge material would be dumped at the HOODS without further testing (p. 5-24). The Service strongly advises against this policy. Humboldt Bay has long been an industrial shipping port and there is a significant probability of contaminants in areas throughout the bay. The Service recommends that the Corps follow the standards for sample testing outlined in the EPA Gold Book for off-shore dredge material disposal. This will help ensure that contaminants are not spread into the open ocean disposal site.

13 Sediments deposited at the HOODS can remain suspended for a relatively long time ("weeks or more") and can be transported to areas outside the designated area by bottom currents (p. 5-46). The Service is concerned that the Corps may not have allowed for this effect when deciding the method for dumping material at the HOODS. If the Corps cannot adhere to the grid plan as outlined, or if there is any uncertainty in the ability to follow this outline, mitigation should be provided for the additional loss of bottom dwelling fish and bottom habitat.

Eelgrass Beds

14 The DEIR/EIS states that eelgrass beds are "being avoided" (Table 5). Please include a map of the locations of all the eelgrass beds and their proximity to the dredging project. This will help determine the extent of not only primary impacts but also secondary impacts to the eelgrass beds. It does not seem that secondary impacts to the eelgrass beds have been considered. This is important as mitigation should be provided to amend for any impacts to this vital resource.

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15 The Service is concerned that there is a possibility for ingestion of the suspended, dioxin-contaminated sediment while the Samoa Turning Basin is dredged. Diving birds and the "fish...able to detect prey in highly turbid waters" (p. 5-37) may be at risk during this time. The Service recommends that the EIR/EIS address these possible impacts.

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17 Although the Service agrees that marbled murrelets would likely avoid the HOODS during disposal operations (p. 5-50), sediments are suspended for up to several weeks and can be pushed out of the disposal site by wave action (p. 5-46). This may make avoidance of the dredged material impossible. The EIR/EIS should detail how avoidance of the suspended sediments will be obtained.

18 Please include the details of the Egret/Heron Rookery Avoidance Plan (p. S-5) in the EIR/EIS. The Service recommends that any avoidance plan consider the secondary effects on the rookery by the increase in usage of the Turning Basin by larger and more vessels. It is recommended that the EIR/EIS address any effects on the health of the rookery as a result of the Turning Basin widening project and plans to avoid these effects.

Cumulative Impacts

19 The Service is aware of other projects being proposed in the Bay, such as the Louisiana Pacific ship terminal expansion that, if permitted, will dredge another 200,000 cubic yards from the Bay. Impacts from dredging are cumulative. Not only will the Deepening project significantly affect the environment of the Bay, it will add to the cumulative impacts from the various dredging projects in Humboldt Harbor and Bay. We are concerned that these reasonably foreseeable project impacts have not been addressed in the DEIR/EIS.

Summary Comments

20 The Service recommends that the EIR/EIS address the potential secondary impacts of this project. This should include information on the potential of impacts from heavier vessel traffic, the use of the HOODS for receiving such a large amount of dredge material within such a short period, whether the benthic communities in the previously undredged portions of the Bay will recover fully and how long it will take.

21 The Service is concerned that if the Humboldt Bay and Harbor Deepening Project proceeds as outlined, the adverse impacts resulting from this dredging will not be adequately mitigated. The following impacts must be mitigated for: loss of 45 acres of previously undredged harbor bottom including benthic habitat, flatfish habitat, dungeness crab; and secondary impacts caused by increased disturbance and traffic from larger vessels that would use Humboldt Harbor and Bay. These are outlined in more detail in the DCAR prepared by our office. If the Corps has any other suggestions or would like to implement other means of assessing the impacts, the Service is open to discuss these.

22 Until the impacts of the dredging project on the Bay and the HOODS are more fully examined and plans are developed to mitigate for these impacts, the Service will continue to oppose the Humboldt Harbor and Bay Deepening Project.

23 Please send us copies of any revisions to the mitigation plan implemented or monitoring reports prepared regarding this project, so that we may follow the progress of the proposed mitigation.

If you have any questions regarding these comments, please contact Louise Lampara at (916)979-2113.

Sincerely,

Joel A. Medlin
Field Supervisor

cc: Reg. Dir., (AFWE), FWS, Portland, OR
Dir., CDFG, Sacramento, CA
NMFS, Santa Rosa, CA
Humboldt Bay NWR, Loleta (Attn: K. Foerser)
EPA, Region IX, San Francisco (Attn: Brian Ross)
HBHRCD, Eureka (Attn: Jack Alderson)

Reference:

California State Lands Commission. California Comprehensive Offshore Resource Study. Volume 1. 1994. p. 128.

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, CA 94107-1376

WPW
PE

January 31, 1995

ER 94/0956

Lt. Colonel Michael J. Walsh
District Engineer
U.S. Army Corps of Engineers
San Francisco District
211 Main Street, Room 918
San Francisco, California 94105-1905

Dear Lt. Colonel Walsh:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement/Environmental Impact Report for Humboldt Harbor and Bay Deepening Navigation Study, Humboldt
1 Harbor, Humboldt County, California. The Department has no comments to offer.

We have appreciated the opportunity to comment on this project.

Sincerely yours,

Patricia S Port

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPC
Regional Director, USFWS, Portland

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, CA 94107-1376

February 2, 1995

ER 94/956

District Engineer
Corps of Engineers, San Francisco District
ATTN: Environmental Planning Section (T. Terry)
211 Main Street
San Francisco, California 94105-1905

Subject: Review of Draft Feasibility Report and Environmental Impact Report for Humboldt Harbor and Bay Deepening Project, Humboldt Bay Harbor, Recreation and Conservation District, Humboldt Bay, Eureka, Humboldt County, California

Dear Ms. Terry:

The U.S. Department of the Interior, Office of Environmental Policy and Compliance, has reviewed the Draft Feasibility Report, Draft Environmental Impact Report (DEIR) and the Draft Environmental Impact Statement (DEIS) for navigational improvements in Humboldt Bay Entrance and Channel and the Samoa Turning Basin.

The following comments are provided to supplement the U.S. Fish and Wildlife Service's (the Service) Draft Fish and Wildlife Coordination Act Report for the Humboldt Harbor and Bay Deepening Project (DCAR), dated February 1994.

As stated in the DEIR/EIS and Draft Feasibility Report, the Humboldt Harbor and Bay Deepening Project consists of deepening the Bar, the North Bay, and the Samoa Channel and deepening and widening the Entrance Channel and the Turning Basin.

Dredged materials will be disposed of at two sites: 4.1 million cubic yards of "clean" dredge material would be disposed of at the Humboldt Open Ocean Disposal Site (HOODS); the remaining
1 26,000 cubic yards of sediment contaminated with dioxin and copper would be disposed at the Louisiana Pacific Disposal Site.

The purpose of the project is to improve navigation within the Channel for larger deep-draft vessels using the harbor. The

Service prepared the DCAR for the Humboldt Harbor and Bay Deepening Project in February 1994 for the Corps of Engineers (Corps). The following comments address both the Draft EIR/EIS and the Corps responses to the recommendations in the DCAR and the Habitat Evaluation Procedure (HEP) models.

General Comments

2 The Service is concerned that the Corps and the Humboldt Harbor, Bay and Recreation District have not fully evaluated the cumulative impacts of additional dredging in Humboldt Harbor and Bay. Long-term mitigation monitoring and remedial action plans must be designed to offset the impacts to the benthic community, eelgrass beds, and the ocean disposal site.

While the Corps believes this deepening project does not require mitigation because the impacts are "short-term, localized and temporary," the secondary impacts caused by this project to the wildlife in this area have not been fully evaluated.

Although maintenance dredging occurs twice annually, the Humboldt Harbor and Bay Deepening Project is of significantly larger proportion.

Impacts from dredging are cumulative. Not only will this project significantly affect already stressed areas, it will impact areas (through channel widening) that previously are not affected by the maintenance dredging.

The Service is aware of the concerns expressed by the Corps, California Department of Fish and Game, and the U.S. Environmental Protection Agency (EPA) regarding the use of the HEP and word models developed and utilized in the DCAR to assess impacts resulting from this project.

While we agree that the word models used in impact assessments perhaps do not provide enough "specifics" (Corps Response to Service's Recommendations, p. 6) for the Corps to evaluate the mitigation plans to their satisfaction, these issues do not mean mitigation is not required.

As the DEIR/EIS points out, "[i]rreversible environmental changes would occur at the proposed deepening and widening area of the Humboldt Bay navigation channels and the approved disposal site" (p. 11-1). This is the basis of our request for mitigation.

At present, there are no other proposed methods for evaluating the impacts to Humboldt Harbor and Bay from this project. If the Corps does not agree with the methods used by the Service to quantify losses, the Service is open to discuss methods the Corps does recommend to evaluate impacts from this dredging project. The Corps may also wish to develop their own plan for mutually beneficial mitigation.

Specific Comments

3 The DEIR/EIS states that the total area of previously undredged harbor bottom is 9,000 square feet. At the August 9, 1994, Feasibility Review Conference in Eureka and in personal communications with and written correspondence from the Corps' San Francisco office, the Service was told that the total previously undredged area to be dredged by this project is approximately 45 acres. Please make this correction in the EIR/EIS.

4 Restricting the project dredging to only the late-August to early November period would reduce disruption and minimize impacts to the critical lifestages of important fish and wildlife species. Additional dredging in late March through April could disrupt critical breeding times for migratory birds (increased activity and noise could lead to the abandonment of nesting areas, additional stress on breeding pairs and nestlings) and cause a decrease in food (benthic communities). This may impact the local wildlife populations for several breeding seasons.

5 The Corps has determined through chemical analysis of sediment samples collected throughout the Bay that all but 26,000 cubic yards of the substrate to be dredged is clean material (p. 32). The Service is concerned that the number of sites sampled (10) may not be sufficient to accurately represent the over 4.1 million cubic yards of material to be dredged.

This represents an average of one sample per every 410,000 cubic yards to be dredged.

6 The increased traffic from international vessels may result in an increase in ballast dumping. This may introduce a variety of exotic species, both plant and animal, into the Bay environment.

History has shown that, over time, these exotics can displace native flora and fauna through competition. The Baltic clam (*Macoma balthica*), one of more than 90 species introduced into San Francisco Bay, is a strong competitor for the resources that would otherwise be utilized by native species.

This should be addressed as a potential effect to the sensitive species in the Bay, including the vital eelgrass beds and to the local fishing industry.

The Service recommends that the EIR/EIS be modified to include possible treatment of ballast water at local water treatment facilities or the prohibition of ballast water discharge within the Bay and Harbor. (California State Lands Commission, p. 128).

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"recolonization by early colonizers occurs within 3-6 months" (p. 5-45). Early colonizers are not the diverse, highly favored members of the benthic community that support the diverse and abundant life found in the Bay and Harbor.

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23 Please send us copies of any revisions to the mitigation plan implemented or monitoring reports prepared regarding this project, so that we may follow the progress of the proposed mitigation.

Thank you for the opportunity to comment.

Sincerely yours,

Patricia Sanderson Port
Regional Environmental Officer

cc: Director OEPC w/ Original Incoming
Reg. Dir., (AFWE), FWS, Portland, OR
Dir., CDFG, Sacramento, CA
NMFS, Santa Rosa, CA
Humboldt Bay NWR, Loleta (Attn: K. Foerser)
EPA, Region IX, San Francisco (Attn: Brian Ross)
HBHRCD, Eureka (Attn: Jack Alderson)

Reference:

California State Lands Commission. California Comprehensive Offshore Resource Study. Volume 1. 1994. p. 128.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

January 30, 1995

Ms. Tamara Terry
Environmental Branch
U.S. Army Corps of Engineers
211 Main St., Rm. 918
San Francisco, CA 94105-1905

Dear Ms. Terry:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the project entitled **Humboldt Harbor and Bay Deepening Navigation Study**, Humboldt County, California. Our review is provided pursuant to the National Environmental Policy Act (NEPA) [42 USC 4231 et seq.], Council on Environmental Quality (CEQ) regulations [40 CFR Parts 1500-1508] and Section 309 of the Clean Air Act.

The Corps of Engineers (COE) is considering whether to provide assistance in improving commercial deep draft navigation in Humboldt Harbor and Bay channels. The COE and the Humboldt Bay Harbor Recreation and Conservation District have assessed alternative plans for the selective deepening and widening of navigation channels and various dredged material disposal alternatives for the disposal of the estimated 4.1 million cubic yards of the dredged material from the project.

Based on our review, we have assigned the DEIS a rating of **EC-2 (Environmental Concerns-Insufficient Information)**. This EC-2 Rating is further defined in the attached "Summary of the EPA
1 Rating System." EPA commends the COE for selecting an alternative that is the environmentally preferred alternative and for its extensive efforts to incorporate EPA suggestions into the EIS. We have assigned the EC-2 rating because of the failure to include the no action alternative and the lack of specificity in the DEIS concerning both management of the "unsuitable" dredged material to be disposed at the Louisiana Pacific site and details regarding monitoring of the HOODS disposal site. Our specific comments are below.

Alternatives EPA appreciates the COE's efforts in developing a proposed action in the DEIS that is the "smallest" of all the action alternatives evaluated, in terms of both area affected and amount of dredging and disposal required. The proposed action also avoids any direct impact to eelgrass beds, and minimizes effects to other sensitive environmental resources in the area to the greatest extent. We concur with the DEIS identification of the proposed

action as the environmentally preferred alternative among the action alternatives assessed. However, aside from mentioning the no action alternative (current management) in the introduction, the DEIS does not include the alternative of no action as required by
2 NEPA (40 C.F.R. 1502.14. We recommend that the Final EIS include a full analysis of the impacts of the no action alternative and use this analysis to compare the current management alternative with the other alternatives included in the DEIS.

Suitability of dredged materials The dredged material that would be generated by the proposed project has been tested for its suitability for aquatic disposal in accordance with EPA and Corps of Engineers guidelines. Based on the sediment testing results
3 summarized in the DEIS, we concur that the material proposed for disposal at HOODS is suitable for such disposal. Furthermore, we agree that approximately 26,000 cubic yards of sediment from the Samoa Turning Basin, represented by sediment sample "HB-8", is unsuitable for disposal at HOODS due to elevated levels of dioxin, and acute toxicity in the solid phase bioassays. Upland disposal of this material is proposed for the "Louisiana Pacific" site. We believe it will be necessary to cover this material with a thin (~1-foot) layer of "clean" sediment to minimize its exposure to wildlife that may be attracted to this site (the DEIS states that this *may* occur).

Monitoring The DEIS includes little detail regarding HOODS site
4 monitoring during or following disposal operations. The DEIS presumes that EPA will publish the final site designation EIS and Rule prior to the deepening project construction. In this regard, details of the Corps' site monitoring will have to be in accordance with the Site Management and Monitoring Plan (SMMP) that EPA will include with the site designation rule. The Humboldt project final EIS should either acknowledge this directly, or should reference the specific SMMP provisions if they are available at that time.

We appreciate the opportunity to review and provide comments on the DEIS. Please send two copies of the Final EIS to this office at the same time it is officially filed with our Washington, D.C. office. If you have any questions, please feel free to contact me at (415) 744-1584, or have your staff contact Brian Ross regarding dredging/wetlands issues at 744-1987, or Edward Yates regarding NEPA issues at (415) 744-1571.

Sincerely,

David Farrel, Acting Chief
Office of Federal Activities

enclosures (2)
MI# 0559. HUMBOLDT.DEI

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

The Resources Agency

Pete Wilson
Governor

Douglas P. Wheeler
Secretary

of California

California Conservation Corps • Department of Boating & Waterways • Department of Conservation
Department of Fish & Game • Department of Forestry & Fire Protection • Department of Parks & Recreation • Department of Water Resources

January 30, 1995

U. S. Army Corps of Engineers
San Francisco District
Environmental Branch
ATTN: Ms. Tamara Terry
211 Main Street
San Francisco, CA 94105-1905

Dear Ms. Terry:

1 The State has reviewed the Draft Feasibility Report and Environmental Impact Statement/Report for Navigation Improvements, Humboldt Harbor and Bay (Deepening), Humboldt County, submitted through the Office of Planning and Research.

We coordinated review of this document with the State Lands and California Coastal Commissions; the Air Resources, Integrated Waste Management, and North Coast Regional Water Quality Control Boards; and the Departments of Fish and Game, Parks and Recreation, Toxic Substances Control, and Transportation.

2 The California Coastal Commission states that this project is on the agenda for the Wednesday, February 8, 1995, federal consistency determination meeting.

Thank you for providing an opportunity to review this project.

Sincerely,

for James T. Burroughs
Deputy Secretary and General Counsel

cc: Office of Planning and Research
1400 Tenth Street
Sacramento, CA 95814
(SCH 94124021)

The Resources Building Sacramento, CA 95814 (916) 653-5656 FAX (916) 653-8102

California Coastal Commission • California Tahoe Conservancy • Colorado River Board of California
Energy Resources, Conservation & Development Commission • San Francisco Bay Conservation & Development Commission
State Coastal Conservancy • State Lands Commission • State Reclamation Board

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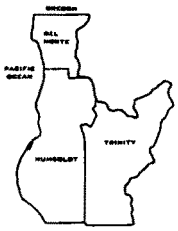
NORTH COAST UNIFIED AIR QUALITY MANAGEMENT DISTRICT

2389 MYRTLE AVENUE
EUREKA, CALIFORNIA 95501

PHONE (707) 443-3083
FAX (707) 443-3099



January 23, 1995

Ms. Tamara Terry
Environmental Branch
U.S. Army Corps of Engineers
211 Main Street, Room 219
San Francisco, CA 94105-1905

Subject: Draft Feasibility Report and EIS from Navigation Improvements in Humboldt Harbor and Bay (Deepening)

Dear Ms. Terry:

I would like to convey some information that hopefully will become part of your final environmental documents.

1 In my discussions with individuals of the California Air Resources Board who are knowledgeable about inter-cooled internal combustion engines (diesel) and their emissions, I obtained certain pertinent information regarding mitigation of NOx emissions.

It is expected that the diesel engine(s) that will be used on the harbor dredging operation will be of the most energy efficient type and therefore, will be Turbo-charged. If so, an inter-cooler could be installed to reduce the air temperature to the diesel engine and therefore, reduce the No_x by about 10%. If ocean water is used for the inter-cooler to cool the air, the No_x emission reductions could be 20-30%.

These mitigation measures coupled with the engine retarding measures offers some significant No_x reductions. It is my understanding that if those private businesses that may be bidding on this project have a diesel dredge that is not equipped with an inter-cooler that the cost to install one is $5,000 to $10,000 and requires dry docking.

You or the Harbor Commission may wish to insert certain conditions or criteria into the bidding process, for example:

1. The diesel dredge used must be turbo-charged.
2. The diesel dredge engine must be equipped with an inter-cooler.
3. Ocean/Bay water will be used in the inter-cooler to cool the combustion air and reduce No_x emissions.

2 Perhaps there should also have been a brief discussion in the draft EIR, even though very expensive to install ($100,000), about using Selective Catalytic Reduction (SCR) as a No_x reduction methodology or mitigation measure.

3 We do not want to convey or infer a negative attitude toward this project because we believe that it will have a tremendous amount of long-term benefit for the North Coast, both in safety and economics. We believe these comments offer a more complete air quality evaluation of the potential air impacts and No_x mitigation measures that should be considered in the environmental information document. Perhaps the comments will also allow you to take advantage of additional No_x emission reductions that were otherwise unknown or overlooked.

Thank you for the opportunity to comment and work with you on this project. Please call me if any clarification is needed.

Sincerely,

Wayne Morgan

Wayne Morgan
Air Pollution Control Officer

WM:dwmltrs5.ltrs

CITIZENS FOR PORT DEVELOPMENT
3125 Lowell Street
Eureka CA 95503

January 25, 1995

Corps of Engineers,
Environmental Planning Section
211 Main Street, Rm. 918
San Francisco, CA 94105

Attn: Tamara Terry:

Re: Draft Feasibility Study and EIR for Humboldt Bay Navigation Improvements (CD-111-94)

1 This is to notify the Harbor District and the Corps of Engineers that the Citizens for Port Development is in support of the Harbor and Bay Deepening Navigation Project (CD-111-94).

Our goal is to optimize opportunities for economic diversification through the construction of modern port facilities on Humboldt Bay. We see this project as an essential component, along with the new modern wharf facilities, and railroad and highway improvements in the planning stages.

The increased safety of the bar crossing for all commercial and recreational shipping and fishery on this bay is also important. Our efforts from the beginning have been to increase the potential for good, long-term, good paying jobs.

We thank the Corps for your efforts to keep this project on track, and hope to see it continue and be brought to fruition at the earliest possible date.

Sincerely,

Kaye Strickland

Kaye Strickland, Chairperson
Citizens for Port Development

cc: Jack Alderson, CEO
Humboldt Bay Harbor, Recreation and
Conservation District

Humboldt Bar Pilots Association

Member of the American Pilots Association

Phone 443-3559
Area Code 707

P. O. Box 3555
Eureka, California 95501

January 12, 1995

Col. Michael J. Walsh, District Engineer
U.S. Army Corps of Engineers
San Francisco District
211 Main Street
San Francisco, CA 94105

Dear Col. Walsh,

On 11 January Captains Bessellieu, Powell and I met with Roger Golden at the Humboldt Bay
1 Harbor, Recreation and Conservation District's office. We discussed the deepening of the North Bay Channel Middle Ground Area and the turning basin adjacent to the Louisiana Pacific Samoa wharf prior to the public hearing concerning the navigation improvements to Humboldt Bay and Bar. Our meeting brought out uses of the turning basin of which Roger was unaware and he advised me to bring them to your attention.

The present length of the L.P. Samoa wharf is 1,064 feet and not suitable to berth two 600+ LOA type vessels at one time. To expedite the use of the wharf we often bring a 600+ LOA type vessel into the turning basin and anchor it for a short period of time awaiting the departure of a 600+ LOA type vessel berthed at the L.P. Samoa wharf. As soon as one vessel leaves the wharf the anchored vessel is put alongside. The usable width of the basin is decreased by the presence of the vessel alongside. Most of the 600+ LOA vessels have a beam of 100-105 feet. Some vessels using the turning basin arrive loaded to maximum draft. By loading cargo in their forward holds they actually leave the harbor with less draft than their arrival draft.

Louisiana Pacific intends to modernize their Samoa wharf to accommodate two 600+ LOA type vessels. Future vessels using Humboldt Bay after the new dredging will probably be longer and
2 wider than the present vessels. This increase in length and width coupled with the wharf's future ability to berth two vessels will decrease the usable size of the turning basin even more. With the advent of larger and deeper vessels our ability to turn vessels at other locations will decrease and the use of the turning basin will increase as it is the only turning basin in the North Bay.

Please let me know if I can be of any further assistance. My home phone number is (707) 443-6595.

Sincerely,

Capt. Paul F Hoey

REDWOOD REGION AUDUBON SOCIETY
P.O. BOX 1054, EUREKA, CALIFORNIA 95502

30 January 1995

Ms. Tamara Terry
Environmental Planning Section
Corps of Engineers, San Francisco District
211 Main Street, Room 918
San Francisco CA 94105-1905

Subject: Environmental Effects, Humboldt Bay Deepening Project

Dear Ms. Terry:

The District is currently reviewing the environmental consequences of a proposed deepening project for Humboldt Bay (hereafter, the "project"). An Environmental Impact Statement (EIS) was prepared for the project, and
1 was placed in a few locations in the Humboldt Bay area. Our members were not able to obtain a copy of the project plan and EIS for review purposes until nearly the end of the public review period. Having obtained the EIS, we find that there are a number of concerns about the project which are not addressed in the EIS, particularly concerns of a cumulative or indirect nature. We believe that the District is obligated to conduct further investigations about these effects, and to include additional information about those effects in the project review record, prior to deciding to proceed with the project.

We wish to indicate clearly for the project record that our organization is not inherantly opposed to the proposed project. Indeed, we believe
2 (and have said so on the record) that development of harbor-related improvements in Humboldt Bay could be a substantial benefit to the entire northcoast region, particularly if enacted in combination with environmental enhancements, such as the completion of the Humboldt Bay National Wildlife Refuge, the full protection of the sensitive duneland communities on the sand spits west of the bay, the protection of riparian forests along coastal rivers and streams, and permanent protection for the remnant old-growth redwood forests in the "Headwaters Forest" area. We believe that discussions about these mitigating enhancements must accompany any discussion about the deepening project.

The EIS correctly identifies Humboldt Bay as one of the most important natural estuarine areas on the Pacific coast, second in importance in California only to the San Francisco Bay estuary. Humboldt Bay is, however, substantially less modified from natural estuarine conditions than is San Francisco Bay at the present time. The highly productive estuarine invertebrate communities support higher-level trophic communities as complex, or more complex, than occur anywhere else on the Pacific coast (see, for example, the Humboldt Bay estuarine profile published by the U.S. Fish & Wildlife Service: Biological Report 1, January 1992). The Pacific Coast Joint Venture, in its Strategic Plan (copy enclosed), identifies Humboldt Bay's natural communities as essential for sustaining the high numbers and biological diversity of shorebirds and waterfowl that have been observed here.

3 We have identified for local agencies, including the Humboldt Bay Harbor District, a concern about the effect of harbor-development projects on the long-term stability of the benthic biological communities which occur in the bay. No local environmental review or planning documents have been prepared which address those benthic communities in anything more than cursory fashion. We do not know (nor does anyone else, apparently)

3 what the effects of harbor development projects will be on the long-term sustainability of those communities. In the past, it has always been argued that such an analysis is beyond the scope of local agencies and localized project reviews. Well, the proposed deepening project is not just a project of a local agency with limited funding and localized political concerns; this is an Army Corps project, and we believe that the Corps must be aware of and protective of the internationally significant biological resources which have been documented in Humboldt Bay.

There are two basic concerns which we feel must be addressed by the Corps
4 prior to any approvals for the proposed deepening project. The first concern deals with sediment dynamics in Humboldt Bay, which will undoubtedly be altered by the dredging included in the deepening project. We have been told (Milt Boyd, pers. comm.) that past dredging has already modified sediment sizes and sorting in the central part of Humboldt Bay (i.e., "Entrance Bay," which is the primary focus of the proposed project). The prediction has been advanced that the sediment-type and sediment-size changes in Entrance Bay are likely to lead to correlated sediment-type and sediment-size changes in North (Arcata) Bay and South Bay. No reliable data exist about the relationship between the sediment dynamics in Entrance Bay and the dynamics of North Bay and South Bay under current conditions. We are not aware that any model has been developed to link the Entrance Bay conditions to North and South bays so as to allow prediction of the possible sediment dynamics under current conditions. Therefore, we do not understand how the Corps can evaluate the potential changes in North Bay and South Bay sediment changes under the conditions which would exist if the proposed project were carried out. Nor can we envision what kinds of mitigation measures would be required to avoid or offset any effects which might result. We believe that the Army Corps is obligated to address these unknown but vitally important questions before the proposed project is approved.

The concern about sediment types and sizes, and about their dynamics under the changed conditions resulting from the proposed project, exists because the aquatic communities in Arcata Bay and South Bay are functionally dependent on substrate conditions. If the substrate is altered significantly, our members have a real concern about the induced effects which could occur on the invertebrate and plant communities, which in turn sustain the mammals, birds, and fish which mean so much to our members.

5 The biological analyses of the project's potential effects in the EIS are limited to considerations of the aquatic communities in the areas to be impacted directly by dredging and by spoil deposition. The best that the EIS can do in addressing these ecological relationships outside of the areas to be impacted by dredging or spoil disposal is to note that providing answers about potential project effects will require additional, more-specific studies. We agree. We think that it's about time that somebody accepted the responsibility for conducting those studies, and got about doing them.

In recent years, a related indirect imact has made itself known in
6 coastal waters throughout the world. This is the introduction of exotic invertebrate organisms to coastal estuaries in ballast water discharged

6 from international commercial vessels (see the paper by Carlton and Geller, enclosed). We are told that the San Francisco Bay estuary no longer has a single intact native aquatic-organism community, because of the wholesale introduction of exotic species. The introduction of exotics to Humboldt Bay may or may not lead to immediate, significant disruptions in the fabric of native aquatic communities in Humboldt Bay. Such disruptions might or might not result in significant differences in the abilities of those communities to sustain higher trophic levels in Humboldt Bay. We believe that this effect is potentially very significant, and certainly must be addressed by the Corps prior to approving <u>any</u> project which is likely to lead to significant disruptions. The responsibility for addressing this concern is the Corps', not the Harbor District's or some other local agency, especially since it is unlikely that any local agency will ever get to the position of accepting the responsibility.

Thank you very much for your attention to these concerns of our ±700 local members. If Corps staff would like to discuss these concerns, we would be happy to meet.

Sincerely,

Chad Roberts

Chad Roberts

copies: Humboldt Bay Harbor, Recreation and Conservation District
Congressman Frank Riggs
Northcoast Environmental Center
Western Region, National Audubon Society

P. O. BOX 266
FIELDS LANDING, CA 95537

HUMBOLDT BAY FOREST PRODUCTS INC.

(707) 443-5631
FAX (707) 443-3553

Export/Logging/Trucking/Construction

January 12, 1995

San Francisco District Corp of Engineers
211 Main Street
San Francisco, CA 94105-1905

Attention: Roger Golden CESPN-PE

Dear Mr. Golden:

1 First, it has been stated in the Feasibility Report that the Humboldt Bay Forest Products Terminal is "privately owned and operated for profit". There is nothing wrong with this idea, our country is based on private enterprize and the capitalist system. Due to this, federal participation in improvement of Fields Landing reach (Hookton Channel) of Humboldt Bay is not appropriate. I have a sincere problem with this. Second, HBFP is not the only deep water facility on the
2 Hookton Channel. The Humboldt Bay Harbor Conservation and Recreation District owns what used to be called Kramer Dock which historically handled ocean going lumber vessels that were deep water vessels. The fact that the Humboldt Bay Harbor Conservation and Recreation District has not used the dock does not mean it does not exist. The Humboldt Bay Harbor Conservation and Recreation District also owns the property where Humboldt Marine Services is located which is the east side of the turning basin and this portion of the Kramer Dock is dredged for deep water vessels and they periodically tie up there.

Third, one of the biggest expenses and concerns is the disposal
3 of the dredging spoils. If the Corp would look back into their records they would find that the Humboldt Bay Forest Products yard was created by the dredge spoils from the original dredging of the Hookton Channel. When people like myself appear in front of you, they always want something. In my case that is also true, but I also have a solution. If the Corp would like, I will offer my property in Fields Landing as a disposal site for whatever dredge spoils it can handle. I am serious about this offer.

I purchased the yard and dock in Fields Landing with the idea of building a thriving business handling cargo for ocean going vessels (deep draft). It was my belief that the Hookton Channel was part of the Humboldt Bay. In a discussion with Jack McKeller I was told that the Hookton Channel was part of the maintenance dredging program in Humboldt Bay. I also assumed that when major improvements were made on the Bay, that the Hookton Channel would be included, I was wrong. I really believe in my heart that it is a misunderstanding.

Humboldt Bay Forest Products Terminal is a handling facility for everyone and anyone who wished to ship through us. Since 1987, over 20 companies have shipped cargo through HBFP Terminal. We are a service company. Since 1987 HBFP Terminal has handled over 560,000 tons and 53 vessels.

4 The future of Humboldt Bay I feel is in the south bay, principally Fields Landing. I think the major port facility for Humboldt Bay should be built in Fields Landing. It is not an urban area as is Eureka. We have rail service, a highway interchange, and last but not least two deep water docks.

Sincerely,

Stanwood A. Murphy, Jr.
President

Michael J. Scalici
6220 Lanphere Road
Arcata, CA. 95521
707-826-1521
Natural resources consulting services

Dredged materials management, historic investigations of river & coastal processes, mapping.

Planning/Engineering

Lieutenant Colonel Michael Walsh
Army Corps of Engineers, San Fransisco District
211 Main Street
San Fransisco, CA. 94105

RE: *Humboldt Harbor and Bay* Deepening Draft Feasibility Report and Environmental Impact Statement/ Report for Navigation Improvements

Dear Lieutenant Colonel Walsh,

I have reviewed the *Humboldt Harbor and Bay* Deepening Draft Feasibility Report and Environmental Impact Statement/ Report for Navigation Improvements, December, 1994 and have some comments. The first set of comments are in reference to *Project Impacts on Hydrodynamics* (Section 5.3.4.1). The second set combines reflections of late 19th and early 20th century Humboldt Bay history, various data sets and 3 years of living and working on Humboldt Bay to predict hydrodynamic and morphologic changes from channel enlargement.

1 Section 5.3.4.1, the hydrodynamic model is based on questionable assumptions. The conclusions stated that channel enlargement will reduce velocities *and* reduce shoaling rates. These phenomena generally are inversely related. If velocities are reduced in a channel, more particles can fall out of transport. The weakened velocities will then pick up a smaller fraction of sediment, initiating shoaling.

I gathered data from US Coast and Geodetic Survey and Army Corps regarding tidal prism estimates, channel bathymetry, shoreline profiles, dredge volume, sites of dredge disposal, ad nauseam, in an attempt to get a handle on factors affecting morphodynamics in Humboldt Bay.

Post-It™ brand fax transmittal memo 7671	# of pages ▸ 8
To LT. COL WALSH	From MIKE SCALICI
Co. USACE	Co. HEAD TO TIDE RES. CONS.
Dept.	Phone # 707-826-1521
Fax # 415-744-3310	Fax # 707-826-3682

There are several questions I want to ask with these data:

What was the variability of the Humboldt Bay inlet channel dimensions and position prior to jetty construction?

What contributed to that variability?

What are the channel dimensions and tidal prism today as compared to those found prior to jetty construction?

What have been the impacts of jetty construction and channel dredging on channel dimensions and shoaling rates?

What have been the impacts of diking of the sloughs along the margin of the bay on tidal prism?

What role would re-opening some of the slough channels to tidal circulation play in increasing tidal prism and enhancing the flushing capacity of Humboldt Bay's channels?

What was the relative contribution of the sediments dumped at SF-3 to shoaling in Entrance Channel?

INLET CHANNEL DIMENSIONS, TIDAL PRISM

Five estimates of inlet channel dimensions prior to jetty construction were given by Mendell. It ranged from a maximum of 6,230 m^2 in 1858 to a minimum of 3,560 m^2 in 1889. The channel dimensions were largely a factor of the position and direction of flow of the inlet channel and how much fresh water was passing through the inlet at any given time. It enlarged during floods that brought large amounts of water and drift into the Bay. In those days, Mad River was still discharging significant portions of its flood flows into Arcata Bay. This large volume of water and drift then exited through the Bay's inlet mouth and tended to readjust its position to a more southerly one and shift its direction of flow from a northwesterly to a westerly one. It reduced its dimensions during interannual drought cycles and upwelling conditions. Shoaling occurred, reducing its dimensions and re-alligning the inlet channel to its modal northwesterly direction.

SHOALING RATES IN HUMBOLDT BAY'S NAVIGATION CHANNELS

In a tidal channel that undergoes annual maintenance dredging, in order to maintain constant channel dimensions, the decade-averaged volume of sediment dredged from that channel is equivalent to the annual shoaling rate in it. The table below summarizes the dredging history of Humboldt Bay channels. The time-averaged dredge volume data, rounded to the nearest ten cubic yards, is shown for 6 relatively constant channel dimension time periods.

Table 1: The average annual volume of sediment dredged from Humboldt Bay's navigation channels for six time periods.

PERIOD	Bar & Entrance	North Bay	Samoa	Eureka	Fields Landing	Total
1927-40	10,350	22,950	6,940	160,090	36,940	236,800
1941-52	0	0	1,050	57,630	81,430	140,110
1953-59	369,660	95,710	29,850	37,410	62,250	613,030
1960-71	591,630	16,440	620	78,800	65,930	753,420
1972-79	324,740	89,020	0	450	52,150	466,350
1980-92	401,420	218,760	6,590	122,430	42,380	735,040

If we look at the most recent period (1980-1992), an average of 401,420 yds^3 of sediment was dredged from the Bar and Entrance Channels. The deepening project calls for over 3,000,000 yds^3 to be dredged- that's 7.5 times more than the average annual dredging rate. The average annual volume dredged from the entire bay was 735,040 yds^3, with the project calling for about 4.1 million yds^3 to be dredged. That means that about 5.6 times more sediment will be removed from Humboldt Bay than the average annual dredging rate.

DREDGE DISPOSAL HISTORY

With the dredge volumes from Table 1 in mind, let us briefly recount the disposal history of those sediments. Much of the early dredge spoils were dumped on salt marsh or upland sites, such as Woodley Island, around Eureka, and on the margin of Arcata Bay.

From the 1950's until 1988, most of the dredged materials were disposed of at SF-3, near South Jetty (See Figure 1). Since SF-3 is an active dispersal site, some of that material may have been transported into Entrance Channel and contributed to shoaling. Using data from Borgeld and Pequegnat (1986), the average volume reduction of SF-3 was 14% between 1977-1982, or 2.8% per year. That equates to an average annual volume of sand advected from SF-3 of 114,100 yds^3.

Figure 1 shows sediment dispersal options from SF-3. Apparently none accreted on South Spit. Moffatt and Nichols (1991) found that between 1987-1990, an average of 28 meters of shoreline erosion occurred on South Spit. Some may have been transferred to the outer bar while some may have gotten sucked directly into Entrance Channel during flood tides and contributed to shoaling there. That which reached the outer bar may have *a)* Remained there, *b)* Returned to the Entrance Channel, or *c)* Bypassed the inlet during the moderate storms of the late 1980's and helped build North Spit. Moffatt and Nichols (1991) showed an average accretion of about 12 meters on North Spit near the jetty between 1987-1990. This accretion, however, followed two decades of net erosion.

My best estimate is that 5-10% of the sand that shoaled in Entrance Bay between 1977-1982 came from SF-3.

Since autumn, 1990, dredged materials have been dumped at the deep, offshore site (HOODS). With the cost of upland disposal mushrooming due to environmental restrictions, offshore disposal has apparently become the default option across the country. The total volume of material dumped at HOODS through fall 1992 (the last period I have data for), was 1.42 million yds^3 or 500,000 yds^3 per year.

With respect to historical progression of events affecting Humboldt Bay and above statements, I would like to suggest the following:

2 1) Maintenance dredging has kept inlet dimensions at levels that exceed those that would form without dredging. By increasing the dimensions of the channels, shoaling rates will increase, *not* decrease.

3 2) Now that sediments are disposed offshore, another source of sediment may be needed to compensate for that amount once supplied by SP-3. This may be accomplished by beach nourishment projects or by climatic events that will erode unarmored and exposed sand dunes.

4 3) Since Elk River spit is a sensitive indicator of wave power entering the Bay, it needs to be monitored carefully. Enlargement of Entrance Channel may increase total wave power reaching Elk River spit. Once Entrance Channel is enlarged, waves won't break as readily through the channel and should theoretically deliver more wave power to the spit. This may initiate accelerated rates of erosion. Although the spit, since the 1940's, has been in a general accretionary phase, the project changes to Entrance Channel geometry might reverse that trend and begin a cycle of erosion. Field reconnaissance last week indicated that Elk River spit eroded scarps, 1 to 1.2 meters high over a distance of about 300 to 500 meters during the "El Nino onset" storms in early January.

5 4) If diked tidal sloughs are re-opened to tidal circulation, the tidal prism volume of the Bay will be increased. Additional benefits of re-opening some of these slough channels would include the restoration of estuarine habitat (particularly eel grass beds), improved stormwater conveyance and improved storm surge buffering capacity.

The city is considering ways to reduce stormwater flooding and re-opening (Mc)Daniels Slough to tidal circulation. As a member of the city's Creeks and Wetlands Advisory Committee, I see an important link between the proposed deepening and Arcata's intentions. With inefficient tide gates at the mouth of this late Holocene Mad River distributary, the channel is choked with vegetation and is useless for flood control, storm water conveyance and fisheries/ wildlife habitat.

6 While I feel the deepening project is vital to keep Humboldt Bay as a competitive shipping port, it would be foolish to deepen the channels without consideration to the concerns I have. I look forward to speaking with you soon.

Sincerely yours,

μ Scalici

μ Scalici

P.S. I would like to dispel the myth that Mad River Slough is a former Mad River channel. Figure 4 shows the morphology of the Mad River delta as it appeared in the mid-1800's. Stratigraphic sequences in Mad River Slough show in the last 2,000 years, 4 or 5 sequences of intertidal mud accretion followed by peat development during interseismic periods. This was puncuated by sudden submergence (Vick, 1988). Historic, geomorphic and stratigraphic evidence suggests that (Mc)Daniels Slough was Mad River's most recent distributary whose delta front was building in the mid-1800's. Liscom Slough was an earlier Mad River distributary whose delta front eroding, and Mad River Slough was a tidal estuary.

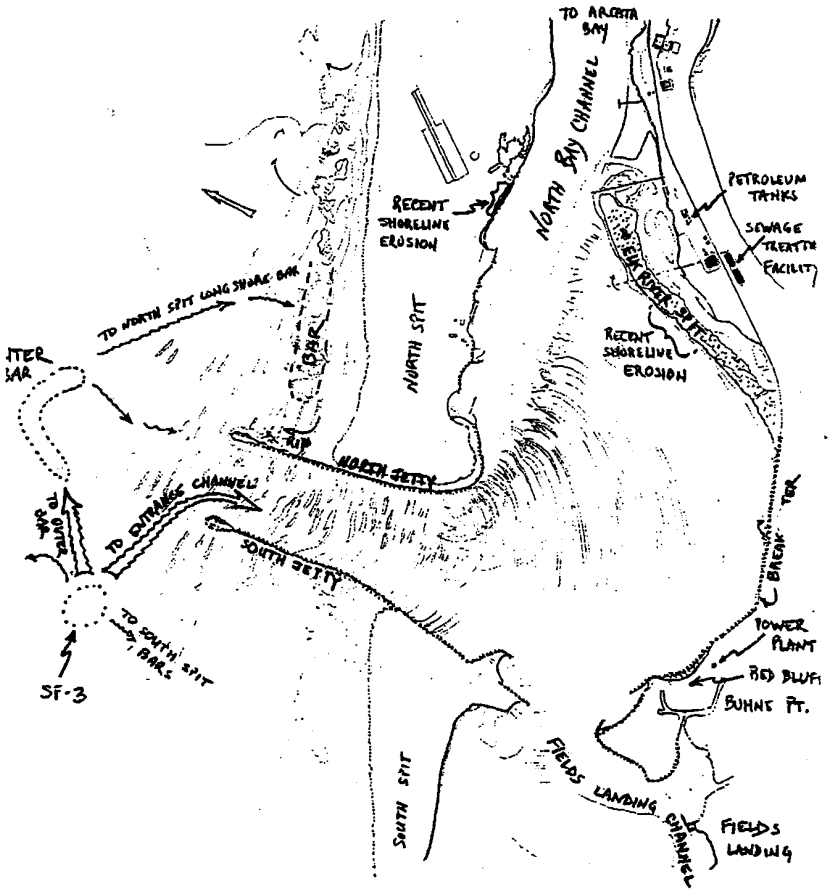


FIGURE 1: ENTRANCE BAY - MAPPED FROM PHOTO TAKEN OCT. 10, 1990
SHOWING GENERAL FEATURES AND SIBLE PATHWAYS OF SAND FROM SF-3

ARCATA
DELTA
ACTIVELY
SUBSIDING
DELTA ACTIVELY
BUILDING
ARCATA BAY 1890
USCGS

FIGURE 2

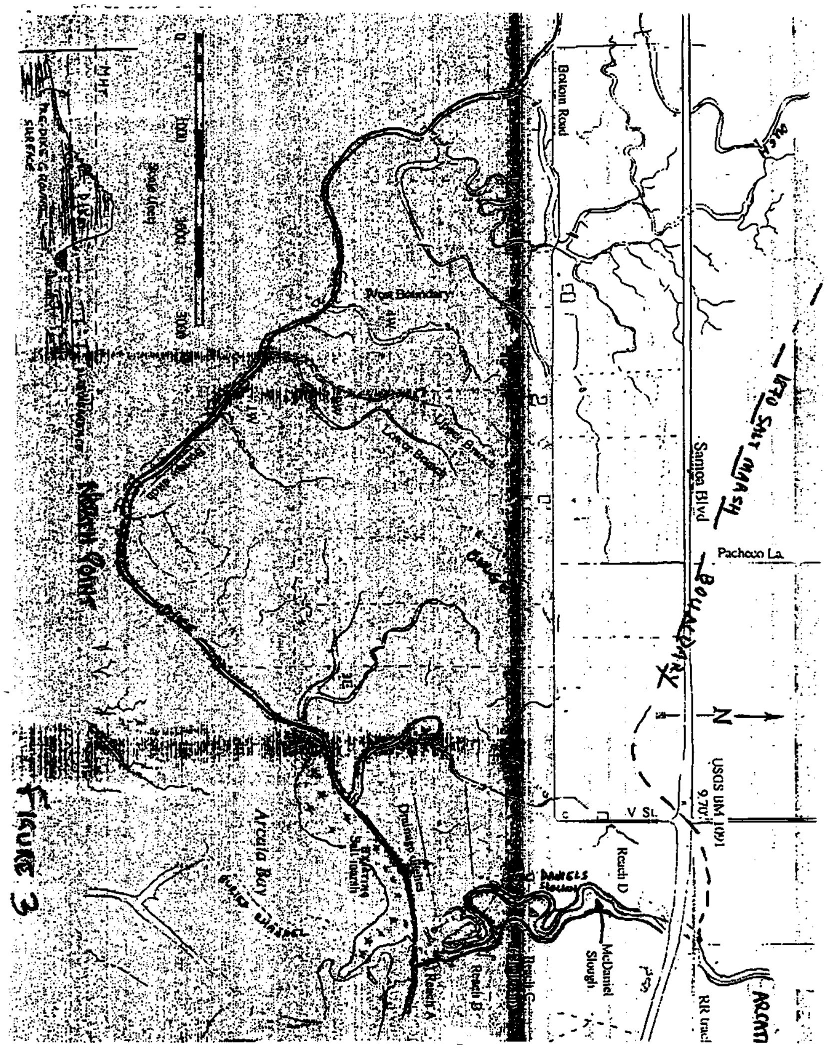
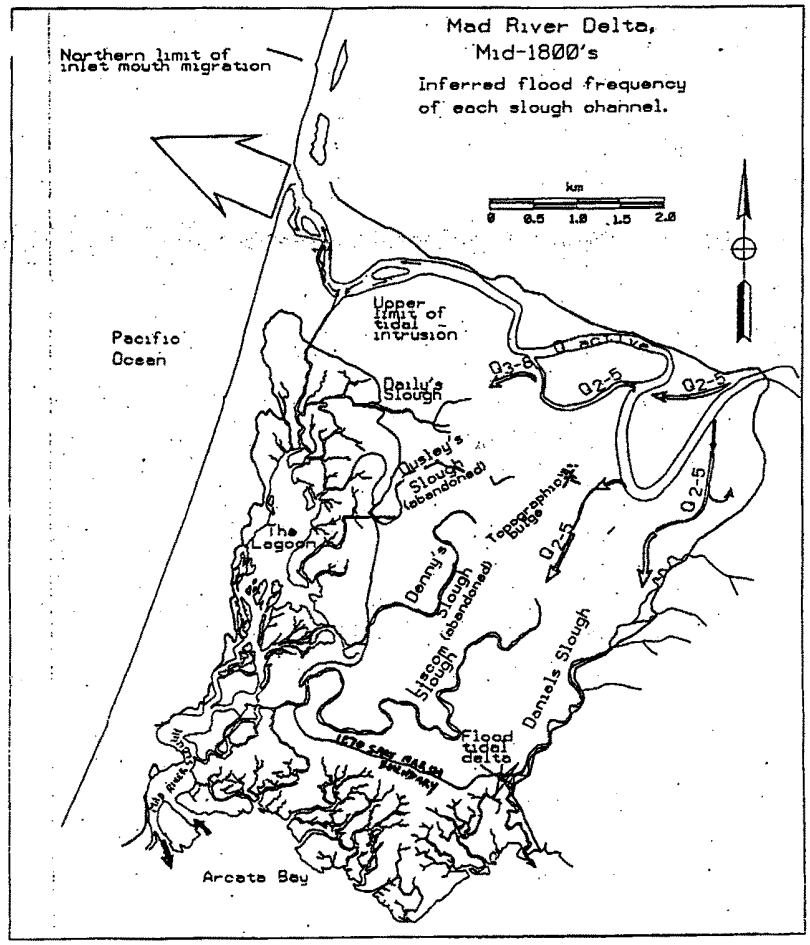


FIGURE 3
Samoa Blvd
Pacheco La.
N
V St.
Reach D
McDaniel Slough
Reach A
Reach B
RR track
Arcata Bay
BOUNDARY


Mad River Delta,
Mid-1800's
Inferred flood frequency
of each slough channel.
Northern limit of
inlet mouth migration
km
0 0.5 1.0 1.5 2.0
Pacific
Ocean
Upper
limit of
tidal
intrusion
Daily's
Slough
Q3-8
Q2-5
Q2-5
Q2-5
Q2-5
Dusley's
Slough
(abandoned)
Topographic
Bulge
The
Lagoon
Denny's
Slough
(abandoned)
Liscom
Slough
Daniels Slough
Flood
tidal
delta
Arcata Bay

APPENDIX J

RESPONSES TO COMMENTS ON THE DRAFT EIS/EIR

Table of Contents for Responses to Comments on Draft EIS/EIR

Responses to Comments from Federal Agencies

JAMES R. BYBEE, U.S. Department of Commerce, NOAA, National Marine Fisheries Service 595

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RESPONSES TO COMMENTS ON THE DRAFT EIS/EIR

Responses to Comments from Federal Agencies

JAMES R. BYBEE, U.S. Department of Commerce, NOAA, National Marine Fisheries Service, letter dated January 30, 1995.

1. A "buffer zone" of a minimum 100 feet between the northwest channel boundary of the Samoa Turning Basin and the nearest surveyed eelgrass beds has been incorporated into the recommended plan (reference Section 5.5.4.1 of the Final EIS/EIR). During the preparation of construction plans and specifications, the Corps will investigate the feasibility of using siltation curtains in and near the northwest section of the Samoa Turning Basin to further minimize dredging turbidity potential impacts on eelgrass beds located at least 100 feet distant from the dredge plant.

2. The Corps is perplexed by NMFS's statement that it is "unrealistic" to consider use of a qualified fishery biologist on the dredge to detect (and thus redirect dredging away from) spawning activities due to natural turbidity and size of Humboldt Bay. Use of qualified fishery biologists on dredges to detect herring spawning activities is a resource agency accepted and effective practice in San Francisco Bay - a Bay that has greater natural turbidity and is much larger than Humboldt Bay. Biologists on board the dredges use indicators such as avian fauna activity to locate herring spawning. The spawning activities of numerous and diverse species such as herring and Dungeness crab occur in the shallow water depths of Humboldt Bay and Arcata Bay. The proposed channel deepening project involves dredging in open water at depths greater than 18 feet and in areas at least 100 feet from surveyed eelgrass beds in the Samoa Turning Basin. The proposed project anticipated dredging method is hydraulic cutter head - a method which minimizes and localizes turbidity to the bottom water column. Also, the sand characteristics of the sediment proposed to be dredged further reduce the degree of turbidity during dredging.

   Based on the above information, the Corps believes use of qualified fishery biologists on the dredge to detect (and thus redirect dredging away from) spawning activities is a realistic approach to mitigating potential impacts to spawning activities. Since the proposed project is estimated to require 11 to 12 months for construction, development of "seasonal dredging windows" is not considered economically feasible due to the significant dredge equipment mobilization/demobilization cost increase associated with "multiple" construction starts for the same job. Also, please refer to the Corps response to the FWS Coordination Act Report (CAR), Specific Recommendations, A. Humboldt Harbor and Bay 2. The Corps is very receptive to an interagency meeting with marine biologists from the National Marine Fisheries Service (NMFS), Fish and Wildlife Service (FWS), and California Department of Fish and Game to developing additional feasible mitigation measures regarding herring and Dungeness spawning activities.

3. The Corps and the Humboldt Bay Harbor Recreation and Conservation District are continuing to develop mitigation monitoring plans and remedial action plans regarding dredging in the Samoa Turning Basin and use of the ocean and upland dredged material sites. Dredged material disposal site monitoring requirements are determined by the Environmental Protection Agency (EPA) and the Regional Water Quality Control Board (RWQCB). These agencies will provide their dredged material disposal site monitoring requirements following completion of the Final EIS/EIR. Subsequent to the actions by these agencies, the Corps and the Humboldt Bay Harbor Recreation and Conservation District will finalize and coordinate the monitoring plans with the EPA, RWQCB, NMFS, FWS, California Department of Fish and Game, as well as, other concerned agencies, prior to the dredging and placement of dredged material on the selected disposal sites. The scope, frequency, duration, and reporting requirements will be defined by the monitoring plan.

4. Comment noted. The following statements are incorporated by reference into the Final EIS/EIR: "There is a potential for future listings of coho salmon and steelhead trout under the Endangered Species Act. After a listing, new and maintenance dredging projects in Humboldt Bay would require Section 7 consultation and/or conferences."

HILDA-DIAZ SOLTERO, U.S. Department of Commerce, NOAA, National Marine Fisheries Service, letter dated January 25, 1995.

1. Comment noted. Regarding the proposed project, the Sacramento River winter-run chinook salmon, and marine mammals, the National Marine Fisheries Service concurs that formal Section 7 consultation under the Endangered Species Act is not required.

JOEL MEDLIN, U.S. Department of the Interior, Fish and Wildlife Service, letter dated January 25, 1995.

1. Cumulative and secondary impacts have been evaluated in the FEIS/EIR (reference Section 9). The Corps and the Humboldt Bay Harbor Recreation and Conservation District are continuing to develop mitigation monitoring plans and remedial action plans regarding dredging in the Samoa Turning Basin and use of the ocean and upland dredged material sites. Dredged material disposal site monitoring requirements are determined by the Environmental Protection Agency (EPA) and the Regional Water Quality Control Board (RWQCB). These agencies will provide their dredged material disposal site monitoring requirements following completion of the Final EIS/EIR. Subsequent to the actions by these agencies, the Corps and the Humboldt Bay Harbor Recreation and Conservation District will finalize and coordinate the monitoring plans with the EPA, RWQCB, NMFS, FWS, California Department of Fish and Game, as well as, other concerned agencies, prior to the dredging and placement of dredged material on the selected disposal sites.

2. Mitigation has been incorporated into the recommended project by: reducing the size (i.e., the channel "footprint") of the project, through hydrodynamic and vessel simulation modeling, to the minimum necessary in order to provide safe, efficient deep draft navigation channels; and redesigning the channel improvements to avoid direct and indirect impacts to eelgrass beds (reference Corps response #1 to the January 30, 1995 letter submitted by Mr. James Bybee of the U.S. Department of Commerce, NOAA, National Marine Fisheries Service) (the eelgrass survey areas were recommended by the Fish and Wildlife Service (FWS), the eelgrass survey designs were fully coordinated with FWS, and the eelgrass survey results were submitted to the FWS).

   Compensation for subtidal impacts associated with deepening already deepened and annually maintenance dredged channels is not justified. There is no portion of the channel widening project, including channel side slopes, that includes "first time" dredging disturbance of shallow (defined as less than -20 feet MLLW) subtidal channel areas. Appendix D of the CAR (page 157) provides the USFWS assumptions used in the HEP analysis. Adverse factors that the Service applies to the dredging include changes in area or rate of sediment deposition, subsequent disturbance due to increased maintenance dredging, and indirect impacts associated with increased shipping activity. (Note, page 159 of the CAR uses a three year construction period when in fact the Humboldt Deepening project construction period is estimated at 11 to 12 months.) As a result of these assumptions, the Service estimates a net subtidal benthic loss of 23.69 AAHUs. In response to the Service's use of the above adverse assumptions for dredging, the Corps notes that the opposite is actually the case, i.e.,

under the "with project" condition there would be reduced shoaling in the navigation channels (this net reduction in annual sedimentation in the navigation channels is estimated at 118,000 cubic yards) and a moderate reduction in the number of deep draft vessel trips due to efficiencies in vessel transportation.

Compensation for subtidal impacts associated with the deepening or widening of "new" channel areas that are less than -20 feet MLLW is not justified. Appendix D of the CAR (page 157) also shows a subtidal benthic loss of 15.20 AAHUs associated with 45 acres of "new" channel dredging (this acreage includes both deep and shallow (defined as less than -20 feet MLLW) subtidal channel areas. In fact, there is a small portion of the proposed project which realigns the entrance to the Samoa Turning Basin (i.e., the eastern edge of the Samoa Turning Basin) that would involve the "first time" dredging disturbance of shallow subtidal channel areas. This small area represents approximately 9,000 square feet. The Service recognizes shallow subtidal areas (0 to 20 feet MLLW) and intertidal areas (greater than 0 feet MLLW). "Eelgrass may occur in both the intertidal and shallow subtidal zone, however, greatest abundance is expected in the shallow subtidal areas...". In response to the Service's desire to "know" the location of eelgrass in the project area before the CAR could be completed, the Corps in coordination with the Service conducted surveys for eelgrass along the east and west boundary of the Samoa Turning Basin. The results of these surveys indicated that the proposed Turning Basin channel improvement to the eastern boundary would not impact any eelgrass. Eelgrass was located in a part of the western boundary of the Turning Basin and the proposed channel improvement was modified to avoid impacting this eelgrass area (also, reference Corps response #1 to the January 30, 1995 letter submitted by Mr. James Bybee of the U.S. Department of Commerce, NOAA, National Marine Fisheries Service).

The Corps, along with the U.S. Environmental Protection Agency (EPA) (letter dated May 6, 1994) and the California Department of Fish and Game (F&G) (letter dated March 28, 1994), is very concerned with the FWS's "...use of the HEP and word models developed and utilized in the DCAR to assess impacts resulting from this project." Specifically the concern is with the FWS CAR and the HEP application to marine and estuarine habitats and that "...the HEP does not identify and describe specific, significant impacts to resources or their habitats from project activities, thereby rendering attempts at precise quantification of changes in Habitat Suitability Indices or Average Annual Habitat Units needed for mitigation recommendation meaningless." The Corps contracted with the FWS to provide a CAR and a HEP. Implied in the contract is that the FWS would provide a meaningful HEP, since they agreed to the HEP Scope of Work and accepted money to provide a HEP. It is incumbent upon the FWS to provide an accepted product. The Corps has evaluated the impacts of the proposed project and provided appropriate and acceptable mitigation according to NMFS, EPA, and F&G.

The Service has suggested some compensation measures but has not provided enough specifics for the Corps to evaluate and justify this recommendation. However, the Corps has investigated some potential restoration/enhancement sites in the Humboldt Bay area (reference Appendix B "Potential Restoration/Enhancement Sites For Humboldt Harbor & Bay Deepening Navigation Project").

3. The EIS/EIR does not require correction. The FWS comment, which reads "The DEIR/EIS states that the total area of previously undredged harbor bottom is 9,000 square feet.", is incorrect. Section 5.5.4.1 (page 5-40, lines 34 through 38) of the Draft EIR/EIS correctly reads "There is no portion of the channel widening project, including channel side slopes, that includes "first time" dredging disturbance of shallow (defined as less that -20 feet MLLW) subtidal channel areas. There is a small portion of the eastern edge of the Samoa Turning Basin that would involve "first time" dredging of shallow (defined as less that -20 feet MLLW) subtidal channel areas. This small area represents an area of approximately 9,000 square feet." The EIS/EIR also, correctly states that the "45 acres of "new" channel dredging ... includes both deep and shallow (defined as less that -20 feet MLLW) subtidal channel areas.".

4. The Corps currently conducts maintenance dredging of the Federal channels in late March through April each year with no known impact on the critical life stages of migratory birds. Construction of the proposed project would also involve dredging, to a greater depth, of the existing Federal channels during late March through April. There is no difference in the dredging period (i.e., late March through April) between the "without" and "with" project condition. Therefore, there is no "... additional dredging in late March through April ..." which "... could disrupt critical breeding times for migratory birds ...".

5. Refer to Section 5.5.1.1 of the EIS/EIR. The number of sites sampled is sufficient to accurately represent the material to be dredged. The Corps has conducted sediment sampling and testing in accordance with the Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual (1991), referred to as the "Green Book", developed jointly by the EPA and the Corps. The sediment sampling plan for the Humboldt Harbor and Bay (Deepening) study was fully coordinated with and approved by the EPA. By letter dated January 30, 1995, the EPA concurs "... that the material proposed for disposal at HOODS is suitable for such disposal.".

6. The FWS is incorrect in their statement that there would be "... increased traffic ..." under the "with" project condition. The proposed project (i.e., the "with" project condition) economic analysis indicates that there would be a moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay due to the efficiencies provided to vessel transportation. Therefore, since there is no increase in deep draft vessel traffic under the "with" project condition, there would not be an increase in ballast dumping. In fact, given the moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay

with the proposed project and associated reduced ballast dumping, the proposed project mitigates the existing potential to introduce a variety of exotic species, both plant and animal, into the Bay environment.

Regarding those deep draft vessels involved in international trade, the Corps does not have the authority to require treatment of ballast water at local water treatment facilities or prohibit ballast water discharge within the Bay and Harbor. Such authority is the sole purview of the U.S. Department of Commerce. Presently, the U.S. Coast Guard and EPA are addressing that situation, along with the International Maritime Organization, and a regulation is expected to be written in the near future.

7. The sources for these two statements are contained in numerous benthic studies done by Humboldt State University, and references such as the following (see Section 14.0 References for full citation): COE 1976a; Bott and Diebel 1982; and Pequegnat, J.E., D. Mondeel-Jarvis, and Borgeld 1990.

8. The proposed project now includes placement of an approximate one foot thick layer (as recommended by the EPA) of clean sediment on the material to be disposed at the Louisiana Pacific site. The source for the top layer material is the dredged material from other areas of the project which have been determined to be suitable for disposal in the ocean. Project specifics regarding placement of this top layer of clean sediment will be developed during preparation of the construction plans and specifications.

9. The effects of using the HOODS for disposal of dredged material from the proposed Humboldt Harbor and Bay navigation improvement project are addressed in this EIS/EIR (Section 5. and Appendix C) and the EPA's Draft Environmental Impact Statement for Designation of an Ocean Dredged Material Disposal Site off Humboldt Bay, California, dated March 1995. The HOODS was "sized" to accomodate the proposed Humboldt Harbor and Bay navigation Improvement project.

10. The FWS statement, which reads "The DEIR/EIS states that the material deposited at the HOODS will be mixed both by wave action and by biological mixing by benthic organisms (p. 4-30).", is incorrect. Page 4-30 of the EIS/EIR addresses the existing regional geology and sedimentation. There is no statement in this section of the EIS/EIR that specifically addresses the HOODS. This section of the EIS/EIR does, however, state that "In water depths greater than 40 meters, many of the sediment layers were preserved, as presumably the water depths were too great for the incoming waves to significantly remix the bottom sediments. Instead, the mixing that occurred was generally limited to bioturbation." The HOODS is located in water depths greater than 40 meters. The implication is that bioturbation in and near the HOODS would occur under both the "without" and "with" project conditions.

11. The Service has confused maintenance dredging of navigation channels with new work (deepening and widening) dredging of navigation channels and effects on the coastal shoreline

given disposal of dredged material at the HOODS. The FWS comment quotes the EIS/EIR statement on page 4-43 which addresses the potential for changes in the coastal shoreline due to annual disposal of maintenance dredged material at the HOODS. Annual maintenance dredging of the Humboldt Harbor and Bay Federal channels is necessary due to shoaling of the channels primarily from sediment littoral transport along the coast. The Corps is conducting a long term Shoreline Monitoring Program to assess whether there is a relationship between shoreline change and disposal of maintenance dredged material at the HOODS. The proposed project to deepen and selectively widen the existing Federal channels would be new work dredging of the existing substrate (i.e., sediment that is not currently in, nor would it be placed in the littoral system with disposal at the HOODS) and, therefore, would have no impact on the coastal shoreline. Also, under the "with" project condition, shoaling, and thus maintenance dredging, of the navigation channels is expected to decrease an estimated 118,000 cubic yards (cys) annually compared to the "without" project condition. This is a decrease of an estimated 118,000 cys annually that would be disposed at the HOODS.

12. The FWS comment "... recommends that the Corps follow the standards for sample testing outlined in the EPA Gold Book for off-shore dredge material disposal." The FWS is significantly in error with such a recommendation for two reasons: 1) the EPA Gold Book has not been implemented and; 2) more importantly the as yet to be implemented EPA Gold Book addresses sediment sampling and testing of material for disposal in waters of the U.S. pursuant to the Clean Water Act. Disposal of material at the HOODS is pursuant to the Marine Protection, Research and Sanctuaries Act (MPRSA). In other words, the FWS recommends that the Corps not comply with the law regarding sediment sampling and testing of material for disposal at the HOODS.

    In fact for the project material proposed to be disposed at the HOODS, the Corps has conducted sediment sampling and testing in accordance with the Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual (1991), referred to as the "Green Book", developed jointly by the EPA and the Corps. By letter dated January 30, 1995, the EPA concurs "... that the material proposed for disposal at HOODS is suitable for such disposal.". For additional information refer to Section 5.5.1.1 and Appendix C of the EIS/EIR.

13. Included in the EPA designation of the HOODS under Section 102, of the MPRSA, is a site management and monitoring plan. The Corps will comply with the requirements of the EPA management and monitoring plan for the HOODS.

14. The proposed project has been designed to avoid both direct and indirect impacts to surveyed eelgrass beds. A "buffer zone" of a minimum 100 feet between the northwest channel boundary of the Samoa Turning Basin and the nearest surveyed eelgrass beds has been incorporated into the recommended plan (reference Section 5.5.4.1 of the Final EIS/EIR).

During the preparation of construction plans and specifications, the Corps will investigate the feasibility of using siltation curtains in and near the northwest section of the Samoa Turning Basin to further minimize dredging turbidity potential impacts on eelgrass beds located at least 100 feet distant from the dredge plant.

The FWS stated in their Preliminary Draft Coordination Act Report (DCAR) for this project, that they could not complete a DCAR until the Corps conducted eelgrass surveys of the Samoa Turning Basin. In response to this request and in full coordination with the Service, the Corps conducted an eelgrass survey of the Samoa Turning Basin, prepared a report (complete with full size maps), and submitted the report to the Service (reference "Samoa Turning Basin Eelgrass Survey - North Humboldt Bay, California", November 1993, prepared by Scott P. Miner, Ecologist, San Francisco District, Corps of Engineers). Upon request, the Corps will provide the Service with additional full size maps of the eelgrass surveys.

15. The possibility for ingestion of the suspended sediment while the Samoa Turning Basin is dredged is considered to be very remote. The proposed project anticipated dredging method is hydraulic cutter head - a method which minimizes and localizes turbidity to the bottom water column. Also, the sand characteristics of the sediment proposed to be dredged further reduce the degree of turbidity during dredging.

16. The Corps is very receptive to meeting with marine biologists from the National Marine Fisheries Service, Fish and Wildlife Service, and California Department of Fish and Game to develop additional feasible mitigation measures regarding "onboard" observation for sensitive species.

17. The EIS/EIR (page 5-50, Line 37) states "Usually, murrelets feed on fish and invertebrates in deeper water closer to the Bay entrance, and not as far offshore as HOODS." Also, (pege 5-50, Lines 39 through 41) "... marbled murrelets are highly mobile and would avoid HOODS during the disposal operations. Because the murrelet is generally found closer to the Bay entrance, this species is not expected to be affected by disposal operations."

The EIS/EIR (page 5-46, Lines 36 through 40) states "Sediments can remain suspended for weeks or more, and areas outside a designated area may be affected if bottom currents transport suspended sediments. The HOODS, however, is far enough offshore (3-3.5 mi) that except during storms, bottom currents are low, and suspended sediments should not move much beyond the disposal area (Scheffner 1990)." Also, during storms at or near the HOODS, it is likely the Corps would not conduct dredged material disposal operations at the HOODS in order to not place human life and dredge plant equipment at risk.

The above information (i.e., the feeding range of the murrelet, the murrelets mobility, the location of the HOODS, and conduct of safe dredged material disposal operations at the HOODS) details how murrelets would avoid suspended sediments at the HOODS.

18. The "... details of the Egret/Heron Rookery Avoidance Plan ..." are as stated in the EIS/EIR (S-5) - the Corps will schedule project construction to avoid dredging of the Samoa Turning Basin during the egret/heron nesting period.

    The "with" project condition economic analysis indicates that there would be a moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay due to the efficiencies provided to vessel transportation. Therefore, since there is no increase in deep draft vessel traffic under the "with" project condition, there would not be any secondary impacts on the rookery. In fact, given the moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay expected with the proposed project, the proposed project would mitigate for any potential existing "without" project impacts on the rookery.

19. Cumulative impacts related to "... reasonably foreseeable project impacts ..." have been addressed in the EIS/EIR (see Section 9.0).

20. There is no potential for secondary impacts from heavier vessel traffic, since the "with" project condition economic analysis indicates that there would be a moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay due to the efficiencies provided to vessel transportation.

    The potential of secondary impacts from placing the proposed project dredged material at th HOODS is addressed in the EIS/EIR (reference Sections 5.0 and 9.0, and Appendices C and J).

    The benthic communities in the "... previously undredged portions of the Bay ..." are expected to recover as referenced in Section 5.5.4.1 of the EIS/EIR.

21. Compensation for subtidal impacts associated with deepening already deepened and annually maintenance dredged channels is not justified. There is no portion of the channel widening project, including channel side slopes, that includes "first time" dredging disturbance of shallow (defined as less than -20 feet MLLW) subtidal channel areas. Appendix D of the CAR (page 157) provides the USFWS assumptions used in the HEP analysis. Adverse factors that the Service applies to the dredging include changes in area or rate of sediment deposition, subsequent disturbance due to increased maintenance dredging, and indirect impacts associated with increased shipping activity. (Note, page 159 of the CAR uses a three year construction period when in fact the Humboldt Deepening project construction period is estimated at 11 to 12 months.) As a result of these assumptions, the Service estimates a net subtidal benthic loss of 23.69 AAHUs. In response to the Service's use of the above adverse assumptions for dredging, the Corps notes that the opposite is actually the case, i.e., under the "with project" condition there would be reduced shoaling in the navigation channels is estimated at 118,000 cubic yards) and a moderate reduction in the number of deep draft vessel trips due to efficiencies in vessel transportation.

channels (this net reduction in annual sedimentation in the navigation Compensation for subtidal impacts associated with the deepening or widening of "new" channel areas that are less than -20 feet MLLW is not justified. Appendix D of the CAR (page 157) also shows a subtidal benthic loss of 15.20 AAHUs associated with 45 acres of "new" channel dredging (this acreage includes both deep and shallow (defined as less than -20 feet MLLW) subtidal channel areas. In fact, there is a small portion of the proposed project which realigns the entrance to the Samoa Turning Basin (i.e., the eastern edge of the Samoa Turning Basin) that would involve the "first time" dredging disturbance of shallow subtidal channel areas. This small area represents approximately 9,000 square feet. The Service recognizes shallow subtidal areas (0 to 20 feet MLLW) and intertidal areas (greater than 0 feet MLLW). "Eelgrass may occur in both the intertidal and shallow subtidal zone, however, greatest abundance is expected in the shallow subtidal areas...". In response to the Service's desire to "know" the location of eelgrass in the project area before the CAR could be completed, the Corps in coordination with the Service conducted surveys for eelgrass along the east and west boundary of the Samoa Turning Basin. The results of these surveys indicated that the proposed Turning Basin channel improvement to the eastern boundary would not impact any eelgrass. Eelgrass was located in a part of the western boundary of the Turning Basin and the proposed channel improvement was modified to avoid impacting this eelgrass area.

It is also noted that the California Department of Fish and Game (letter dated March 28, 1994) and the U.S. Environmental Protection Agency (letter dated May 6, 1994) have serious concerns with the Service's CAR and the HEP application to marine and estuarine habitats. Their concerns are that "...the HEP does not identify and describe specific, significant impacts to resources or their habitats from project activities, thereby rendering attempts at precise quantification of changes in Habitat Suitability Indices or Average Annual Habitat Units needed for mitigation meaningless." The Corps contracted with the FWS to provide a CAR and a HEP. Implied in the contract is that the FWS would provide a meaningful HEP, since they agreed to the HEP Scope of Work and accepted money to provide a HEP. It is incumbent upon the FWS to provide an accepted product and the Corps accepts the FWS "open" invitation to discuss the Corps' suggestions. The Corps has evaluated the impacts of the proposed project and provided appropriate and acceptable mitigation according to NMFS, EPA, and F&G.

The Service has suggested some compensation measures but has not provided enough specifics for the Corps to evaluate and justify this recommendation. However, the Corps has investigated some potential restoration/enhancement sites in the Humboldt Bay area (reference Appendix B "Potential Restoration/Enhancement Sites For Humboldt Harbor & Bay Deepening Navigation Project").

22. Comment noted.

23. The Corps will continue to provide the FWS with copies of any revisions to implemented mitigation plans, as well as monitoring reports prepared as part of the project.

PATRICIA SANDERSON PORT, U.S. Department of the Interior, Office of Environmental Policy and Compliance, letter dated January 31, 1995.

NOTE: This comment letter is dated and was submitted to the Corps following the close of the 45 day Draft EIS/EIR public comment period.

1. Comment noted. See U.S. Department of the Interior Office of the Secretary, Office of Environmental Policy and Compliance Letter, dated February 2, 1995.

PATRICIA SANDERSON PORT, U.S. Department of the Interior, Office of Environmental Policy and Compliance, letter dated February 2, 1995.

NOTE: This comment letter is dated and was submitted to the Corps following the close of the 45 day Draft EIS/EIR public comment period. Also, the substance and text of this letter is, to an overwhelming degree, an exact copy of the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995. Accordingly, the following Corps responses (except for response number 1) refer the reader to the Corps responses to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

1. The statement which reads "... the remaining 26,000 cubic yards of sediment contaminated with dioxin and copper would be disposed at the Louisiana Pacific Disposal Site." is incorrect. The material proposed for disposal at the Louisiana Pacific disposal site is not contaminated with copper. Please refer to Section 4.4.5 of the EIS/EIR.

2. See Corps responses number 1 and 2 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

3. See Corps response number 3 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

4. See Corps response number 4 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

5. See Corps response number 5 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

6. See Corps response number 6 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

7. See Corps response number 7 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

8. See Corps response number 8 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

9. See Corps response number 9 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

10. See Corps response number 10 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

11. See Corps response number 11 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

12. See Corps response number 12 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

13. See Corps response number 13 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

14. See Corps response number 14 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

15. See Corps response number 15 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

16. See Corps response number 16 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

17. See Corps response number 17 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

18. See Corps response number 18 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

19. See Corps response number 19 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

20. See Corps response number 20 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

21. See Corps response number 21 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

22. See Corps response number 22 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

23. See Corps response number 23 to the U.S. Department of the Interior Fish and Wildlife Service Letter, dated January 25, 1995.

DAVID FARREL, U.S. Environmental Protection Agency, letter dated January 30, 1995.

1. Comment noted. This comment concerns the "lack of specificity in DEIS concerning both management of the unsuitable dredged material to be disposed at the Louisiana Pacific Site and details regarding the monitoring of the HOODS disposal site." Please note that in Appendix A - "Compliance of the Selected Plan with Section 404(b)(1) of the Clean Water Act (Louisiana Pacific Site" - both management and monitoring of dredged material at the LP Site are briefly discussed. In regard to HOODS monitoring, the text has been revised as stated in #4 below.

2, Comment noted. The Final EIS/EIR contains an analysis of the impacts of the no action alternative compared with other EIS/EIR alternatives. Note that the no action alternative is equivalent to the description of the existing (i.e., affected) environment in Sections 4.1 to 4.8.

3. Comment noted. The Corps will provide a layer, approximately 1 foot thick, of clean sediment on the estimated 26,000 cubic yards of dredged material to be placed at the Louisiana Pacific upland site.

4. Comment noted. The Corp's monitoring of HOODS will be in accordance with the Site Management and Monitoring Plan (SMMP) that the EPA will include in the site designation rule.

Responses to Comments from State Agencies

JAMES T. BURROUGHS, The Resources Agency of California, letter dated January 30, 1995.

1. Comment noted. The review of the Draft EIS/EIR was coordinated with: the State Lands and California Coastal Commissions; the Air Resources, Integrated Waste Management, and North Coast Regional Water Quality Control Boards; and the Departments of Fish and Game, Parks and Recreation, Toxic Substances Control, and Transportation.

2. On February 8, 1995, the California Coastal Commission, in a unanimous vote, concurred with the Corps' Consistency Determination pursuant to the Coastal Zone Management Act.

Responses to Comments from Regional and Local Agencies

WAYNE MORGAN, North Coast Unified Air Quality Management District, letter dated January 23, 1995.

1. Comment noted. The EIS/EIR text has been revised to incorporate additional mitigation measures for reduced NO_x emissions by installation of an inter-cooler on diesel engine of dredge (see Section 5.1.2.1).

2. Comment noted. An initial informal survey of the dredging industry indicates that it is economically infeasible to equip self propelled dredges with Selective Catalytic Reduction. It is noted that the proposed project is anticipated to be dredged by mobile (i.e., self propelled) ocean going hopper dredges, not stationary dredge plants which generally result in greater engine emission concentrations in a localized area.

3. Comment noted.

Responses to Comments from Groups & Organizations

KAYE STRICKLAND, Citizens for Port Development, letter dated January 25, 1995.

1. Comment noted. This letter indicates support for the proposed project.

1 **PAUL F. HOEY, Humboldt Bar Pilots Association, letter dated January 12, 1995.**
2
3 1. Comment noted.

CHAD ROBERTS, Redwood Regional Audubon Society, letter dated January 30, 1995.

1. Copies of the Draft EIS/EIR, locally available for public review, were placed at the following locations: the Humboldt Bay Harbor, Recreation and Conservation District on Woodley Island in Eureka, the Humboldt County Library in Eureka, Arcata City Library in Arcata, the Humboldt State University Library in Arcata, and one was mailed to a Redwood Regional Audubon Society member's address in Mc Kinleyville. In addition. Mr. Roberts has now been placed on the EIS/EIR mailing list.

2. The Congressional resolution authorizing the Corps to study the feasibility of navigation improvements to Humboldt Harbor and Bay, as well as Department of the Army regulations, do not allow for the environmental enhancement of completing the Humboldt Bay National Wildlife Refuge, protecting sensitive "duneland" communities on the sand spits west of the Bay, protecting riparian forests along coastal rivers and streams, and permanently protecting the remnant old-growth redwood forests in the "Headwaters Forest" area.

3. The Humboldt Harbor and Bay (Deepening) EIS/EIR does address navigation impacts on benthic communities (reference Section 5.5.4, Sections 9.0, 10.0, and Section 11.0).

4. The sediment dynamics under both the existing (i.e., "without" project condition) and proposed project alternative (i.e., "with" project condition) have been modeled, evaluated (includin impacts), and reported. The report is titled "Humboldt Bay Numerical Hydrodynamics ano Sedimentation Study", dated July 1994, prepared by the U.S. Army Corps of Engineers Waterways Experiment Station. This study is contained in Appendix A - Engineering Analysis to the Feasibility Report and Environmental Impact Statement/Report For Navigation Improvements Humboldt Harbor and Bay (Deepening), Humboldt County, California.

   The U.S. Army Engineer Waterways Experiment Station (WES) report did not address the magnitude of sediment size/sorting change due to dredging. Nor is there any measure of correlation between project size and sediment size sorting changes. This is not to say that no change will occur due to the deepening of the channel. However, there are other factors which should be examined. The main sources of sediment entering the Humboldt Bay system are the Eel and Mad Rivers. If there are any changes in the sizes and types of sediment from these rivers, then this could significantly affect the sedimentation within Humboldt Bay.

   Since the primary movement of sediment into Humboldt Bay is via the "Entrance Bay", the sizes and types of sediment in the Entrance Bay does determine the sizes and types of sediment in the North and South Bays. However, the magnitude of the effect may be small. The numerical study performed at WES (Humboldt Bay Numerical Hydrodynamics and Sedimentation Study) indicates that sediment concentrations in the North and South Bays tend to be 1 to 2 orders of magnitude less than in the Entrance Bay. The study also indicated that widening and/or deepening of the channels would result in very small, perhaps insignificant, changes in

sedimentation patterns. WES interprets these results to indicate that no significant changes in North or South Bay sediment sizes or sorting will occur due to the Humboldt Harbor and Bay Deepening Project.

The WES study provides reliable data concerning the relationship between sediment dynamics in the Entrance Bay and the dynamics of North and South Bay under current conditions. The models contained in the Corps' TABS-MD surface water modeling system have been used for many studies and have been proven both reliable and accurate. Both the hydrodynamics and sedimentation of the entire system were modeled and no significant changes in the North Bay or South Bay were seen in the results.

5. The Corps is unable to find "words" to the effect that "providing answers about potential project effects will require additional more-specific studies". The Corps believes that appropriate biological studies have been conducted and the proposed project impacts (both direct and indirect) are addressed in the EIS/EIR.

6. The proposed project economic analysis indicates that there would be a moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay due to the efficiencies provided to vessel transportation. Since there is no increase in deep draft vessel traffic under the "with" project condition, there would not be an increase in ballast dumping. In fact, given the moderate reduction in the number of deep draft vessel trips in and out of Humboldt Bay with the proposed project and associated reduced ballast dumping, the proposed project mitigates the existing potential to introduce a variety of exotic species, both plant and animal, into the Bay environment.

Regarding deep draft vessels involved in international trade, the Corps does not have the authority to require treatment of ballast water at local water treatment facilities or prohibit ballast water discharge within the Bay and Harbor. Such authority is the sole purview of the U.S. Department of Commerce. Presently, the U.S. Coast Guard and EPA are addressing that situation, along with the International Maritime Organization, and a regulation is expected to be written in the near future.

Responses to Comments from Businesses

STANWOOD MURPHY, JR., Humboldt Bay Forest Products, Inc., letter dated January 12, 1995.

1. The Fields Landing Channel, including the Humboldt Bay Forest Products Terminal, was included in the Humboldt study during the reconnaissance study phase. The Humboldt Bay Forest Products Terminal was, and continues to be, the only ACTIVE dock servicing deep draft vessels in the Fields Landing Channel. During the reconnaissance study phase, Corps Headquarters issued a new Engineering Regulation (ER 1165-2-123, dated 8/31/89) which excluded privately owned and operated for profit facilities from Federal participation. Deletion of the Fields Landing Channel from further consideration in the feasibility study phase was fully documented as part of the Reconnaissance Study Report certification. The non-Federal study sponsor (i.e., the Humboldt Harbor, Bay, Recreation, and Conservation District) by letter dated 5/2/90, informed the Corps of their unanimous decision to proceed with the Feasibility Study phase, recognized that there was no Federal interest in improving Fields Landing Channel, and requested reconsideration of the Fields Landing Channel if "eligibility does exist in the future". The non-Federal sponsor and Humboldt Bay Forest Products were informed that consideration of the Fields Landing Channel in the Feasibility Study phase would require 100% non-Federal funding.

2. Although there are two separately owned (i.e., the Humboldt Bay Forest Product dock and tl Humboldt Harbor, Bay, Recreation, and Conservation District dock) "deep water" vessel servicing docks in Fields Landing Channel, only the Humboldt Bay Forest Product dock is active in servicing deep draft vessels. It is noted that the Corps, by letter dated 1/10/95, received a request from the Humboldt Harbor, Bay, Recreation, and Conservation District to conduct a navigation study of Fields Landing Channel pursuant to Section 107 of the River and Harbor Act of 1960 (PL 86-645), as amended.

3. Comment noted.

4. Comment noted.

MICHAEL SCALICI, Humboldt State University Marine Laboratory, letter dated January 31, 1995.

NOTE: This comment letter is dated and was submitted to the Corps following the close of the 45 day Draft EIS/EIR public comment period.

1. The TABS-MD model used in the work, like all models, is based on a number of assumptions, such as the Boussinesque Approximation, but the assumptions used in this model are the same ones that virtually all modelers employ. The flow model itself has been applied to scores of sites by the Corps and others with excellent results, and the Corps considers it to be a valid tool. In addition, the model for the Humboldt Bay study was verified by comparison with field observations as described in the report titled "Humboldt Bay Numerical Hydrodynamics and Sedimentation Study", dated July 1994, prepared by the U.S. Army Corps of Engineers Waterways Experiment Station. This study is contained in Appendix A - Engineering Analysis to the Feasibility Report and Environmental Impact Statement/Report For Navigation Improvements Humboldt Harbor and Bay (Deepening), Humboldt County, California.

   Regarding the reasonableness of the shoaling rate results, it should be noted that neither sedimentation analysis nor modeling is a perfect science. In many studies, order of magnitude agreement between measured and predicted shoaling rates has been considered acceptable. In the case of the Humboldt Bay study, the Corps regards the verification as exceptional, well within an order of magnitude (reference Figure 43 of the report). For the Bar and Entrance Channel, the agreement is within 100 cubic meters per day or within 8% of the historical rate.

   The variation in predicted shoaling rates for the modeled plan conditions ranges between 12% and 21% of the Base (i.e., existing) condition rate. The shoaling rates for the various plans are indicators of the general trend that can be expected. The differences between the base and plan conditions shoaling rates were small, so the conclusion is that channel shoaling rates will not change dramatically.

   The "Humboldt Bay Numerical Hydrodynamics and Sedimentation Study" concluded that Plans 1 and 3 increase shoaling rates and only Plan 2 decreases (albeit a very small change) shoaling rates. Conventional wisdom does "say" when a channel is enlarged, shoaling will increase. While this is usually, but not always true, conventional wisdom does not "tell" where the increased shoaling will occur. A simple example illustrates what is possible. Assume that a flume of variable cross-sectional area $A(x)$ (x is measured away from the inflow and sediment source) has a constant inflow Q with a constant sediment concentration C. Assume that $A(x)$ is such that $A(x)$ increases as x increases. Sediment will tend to settle out as A increases and velocity decreases. Now, assume that the flume channel is changed so the new cross-sectional area $A' = 2A(x)$. In this case, velocities will decrease faster with increasing x, and sediment will settle out closer to the source. However, if $A' = A(x)/2$, the velocities will increase faster with increasing x, and sediment will be carried further away from the source. In the case of the Humboldt Bay study, dimensions could cause sediment to settle out closer or further away from the ocean, depending on the configuration.

Of course, the Bar and Entrance Channels of Humboldt Bay are not simple flumes, but the shape of the three plan geometries plays a significant role in the shoaling rates and locations. Plan 1 has the largest change with both deepening and channel realignment. Plan 3 has no channel realignment, only deepening. Plan 2 has a slight realignment and deepening. Plan 3 would fit more closely to the "rule of thumb" mentioned above and, indeed, does show more shoaling than the Base. Plan 1 is significantly wider between the jetties than Plan 2 and has a funnel shape. The Corps believes that this funnel shape causes the unusual shoaling differences. The larger cross-section at the ocean end of the Plan 1 channel allows more sediment to flow inland. The narrowing of the channel inland increases the velocities, thus allowing the sediment to be transported further inland, where it tends to settle out when the channel turns north. The width of the Plan 2 channel between the jetties is less than Plan 1, and the channel width is fairly constant. The lack of a funneling effect, as in Plan 1, allows the sediment to settle further seaward where more would tend to be swept back into the ocean on the ebb tide than for Plan 1.

2. See Corps response to comment number 1, above.

3. The Corps is conducting a long term shoreline monitoring study (see Appendix D-"Dependence of Shoreline Change on Channel Dredge Material Practices, Humboldt Bay, CA - A Case Study") as part of the operations and maintenance of the Humboldt Harbor and Bay Federal channels.

4. Comment noted.

5. Comment noted.

6. Representatives from the Corps are available to speak and/or meet with you, at your convenience, regarding your concerns.

APPENDIX B
HUMBOLDT HARBOR & BAY (DEEPENING) FEASIBILITY STUDY
ECONOMIC ANALYSIS
MARCH 1995

INTRODUCTION

This report presents the economic benefits in the form of transportation savings resulting from the proposed navigation improvements to the Humboldt Harbor; specifically, in the Harbor Entrance and North Bay Channels. The project benefits are derived from comparing the difference in the estimated costs for vessel operations under "with" and "without project" conditions. These resulting benefits are summarized in the following table.

Table 1
HUMBOLDT HARBOR
SUMMARY OF ANNUAL BENEFITS
MARCH 1995
Average Annual Benefits
North Bay Channel Depth (Ft. MLLW)

Benefit Category	-36	-38	-39	-40	-42
Re-Routing: P & PB	$101,500	$823,300	$823,300	$823,300	$823,300
Light-Loading: P&PB	$248,126	$653,137	$784,257	$784,257	$784,257
Econ. of Scale: Woodchips	$151,028	$320,252	$358,412	$396,573	$396,573
Light-Loading: Woodchips	$147,363	$442,993	$523,836	$523,836	$523,836
Change in Mode: Lumber	$19,300	$19,300	$19,300	$19,300	$19,300
Total*	$667,000	$2,259,000	$2,509,000	$2,547,000	$2,547,000

*Rounded to the nearest thousand.

The project was evaluated at the current federal rate of 7-3/4 percent with a project economic life of 50 years. Benefit analyses were originally developed in 1991. They have been revised at this time using the latest information, including current vessel operating costs and are presented in Table 1. The base year is 1997, the anticipated date of project completion, however, the analyses are presented at mid decade points (1995, 2005, etc). For optimization purposes the benefits were determined at one foot intervals from -36 feet MLLW to -42 feet MLLW.

SCOPE AND PURPOSE

The purpose of this economic analysis is to develop an estimate of the benefits for the proposed Humboldt Harbor project alternatives and to present the methodology for determining these benefits. The project consists of deepening and also provides other channel improvements (e.g. widening and "rounding" of turns, additional deepening of the entrance area) consistent with the deepening. These design changes are based on the requirements of the "design ship" and are discussed in the Engineering Analysis. The project's justification with respect to depth is based on economic criteria: maximum net benefits and a benefit to cost ratio greater than one.

The benefits were computed within the context of a multiport analysis. The existing and projected future "with" and "without" project operations of all the vessels that use Humboldt Harbor were examined and incorporated into the analysis. The commodities that are being shipped through Humboldt Harbor include lumber, logs, particle board, pulp, chips, petroleum and chemicals. There appears to be no potential for shifts to other ports since the products are locally produced or consumed. Coos Bay, Oregon was identified as the major "competing" port that shipped similar timber goods to the Far East and Europe. No commodities are expected to be transferred from Humboldt to Coos Bay, or any other competing ports, because of the extra costs accrued in transporting these goods from the Humboldt area for eventual overseas delivery. For example, the alternative to large scale trucking of the timber goods to Coos Bay is clearly uneconomical and will be discussed in more detail in the latter part of this analysis. Although a navigation channel deepening project may attract "new business" to Humboldt Harbor, this induced activity is not viewed as the "most likely alternative" and is not analyzed within the scope of the study. The study focuses on the more efficient use of vessels, including the rerouting of some vessels for given operations.

The benefits are in the form of transportation savings resulting from economic efficiencies to the economy as a whole. No claim is made as to who specifically will benefit, whether it be the Port, the shipper, manufacturer, shipping company, the receiver or the final user. In all likelihood, it will be some combination of the above. The benefits being evaluated are National Economic Development (NED) Benefits. This analysis also provides some insight into the underlying economics of waterborne forest products operations in Humboldt Bay.

STUDY AREA

The area affected by the Humboldt Harbor deepening project is primarily the area adjacent to the Harbor, which is an integral part of the local Humboldt County economy. There are two primary local industries which the harbor services, the fishing industry and the forest products industries, the latter requiring large deep draft vessels, would substantially benefit from the navigation channel deepening project. The Harbor is vital to the Humboldt County economy since there are no apparent alternative ports for shipping these commodities. Products that are shipped from or to the Docks located in the South Bay were excluded from this analysis because

they are privately-owned and are considered single-user for the purposes of Federal interest. Table 2 lists the various docks and their operations. Figure 1 show the docks' location along the channels.

Table 2
HUMBOLDT HARBOR DOCKS

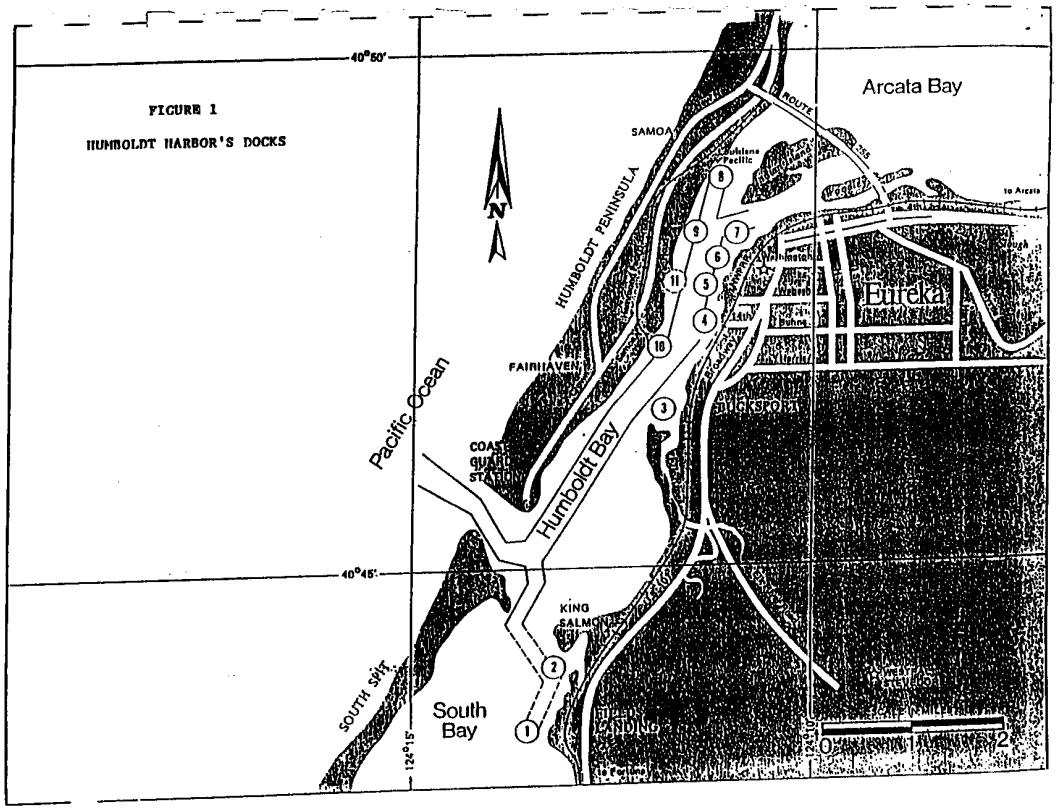
Dock No.	Occupant	Commodity
1	Kramer	Inactive
2	Olson Terminals	Logs
3	Standard Oil Company	Petroleum
4	Eureka Forest Product	Lumber/Logs
5	Union Oil Company	Petroleum
6	Humboldt Dock "A"	Inactive
7	Humboldt Dock "B"	Inactive
8 & 9	Louisiana-Pacific	Lumber, Particle Board, Pulp, Chemicals
10	Simpson Paper	Pulp, Petroleum, Chemicals
11	North Coast Export Co.	Chips

THE BENEFIT ANALYSIS

The benefit analysis is based on the standard "with" versus "without" project analysis. The "without" project condition is considered to be the currently authorized -35 foot MLLW interior North Bay channel with a -40 foot MLLW Entrance channel. The "with" project conditions were evaluated for incremental alternative channel depths of between -36 and -42 feet MLLW for the North Bay channel, and corresponding channel depths of between -46 and -52 feet MLLW at the entrance and bar as described in the Feasibility Report main volume. The reasons underlying the 10 foot channel depth differential between the Bar and Entrance Channel and the North Bay Channel are discussed in the engineering analysis Appendix A to this report. The economic analysis was developed after a thorough search, collection, and analysis of available data. These data, together with the assumptions and calculations, are presented below. The economic analysis is based on a thorough understanding of these shipping practices.

FIGURE 1

HUMBOLDT HARBOR'S DOCKS



DATA SOURCES

Information sources relied upon for estimating benefits include the following:

a. Interviews with the personnel of local shippers, shipping companies, stevedore company, and U.S. Forest Service; most importantly were the various shipping companies at Humboldt Harbor, which provided information regarding the ship movements and operations future plans and the Bar Pilots which identified problems with existing depths and shipping practices. All of this information was analyzed and put into an analytical framework.

b. Vessel Activity Reports compiled by a local stevedore company. This was a valuable source of detailed tonnages by year.

c. Lloyd's Shipping Register, 1990-1992;

d. Distances Between Ports, 5th Edition, 1985, (the Defense Mapping Agency);

e. Vessel operating costs (the Corps of Engineers for FY 1991 and 1993)

The various shippers/shipping companies at Humboldt Harbor not only provided information regarding their shipping movements, but also described their problems with the existing channel depths and how they would change their operations in response to improved channel dimensions. This information allowed the economic analysis to be able to separate the tonnages into appropriate benefit categories resulting from the "with" project condition.

DISTANCES

From the Distances Between Port, the primary route round trip distances from Humboldt were computed and are presented in Table 3.

Table 3
ROUND TRIP DISTANCES

WOODCHIPS - EXPORTS TO JAPAN	NAUTICAL MILES
Muroran	9,086
Nagoya	10,618
Shimizu	11,108
Toyamashinko	10,000
PULP & PARTICLE BOARD - EXPORTS TO FAR EAST	
Inchon, Korea	11,568
Iyomishima, Japan	10,332
Yokohama, Japan	9,536
EXPORTS TO EUROPE	
Antwerp, Belgium	12,876
Naples, Italy	18,114

TONNAGE

Existing Conditions

Table 4 presents the major commodities shipped over the Humboldt Harbor Docks for the last decade. Viewed together, the tonnage indicates an overall upward movement; however the past few years, influenced by environmental concerns at Forest Product sources, indicates a recent counter-trend.

Table 4
HUMBOLDT HARBOR TONNAGE
1982-1992
(Short Tons)

Year	Lumber	Logs	Particle Board	Pulp	Chips	Petroleum	Chemicals	Total
1992	94,201	4,488	88,634	363,055	415,737	301,586	35,791	1,303,492
1991	156,848	104,244	109,056	366,876	634,992	332,755	43,810	1,747,951
1990	165,841	103,447	106,634	357,380	606,597	321,980	67,881	1,729,760
1989	72,339	150,731	62,408	351,898	436,292	348,621	69,187	1,491,476
1988	192,808	188,710	43,446	355,231	453,637	396,117	71,102	1,701,051
1987	225,047	144,336	40,235	353,942	322,402	421,045	79,419	1,586,426
1986	171,485	49,330	9,211	362,116	399,134	336,718	84,336	1,412,330
1985	58,374	241,571	N/A	276,756	351,502	295,501	56,106	1,279,810
1984	56,640	115,121	N/A	297,116	421,464	342,118	93,799	1,326,258
1983	27,860	97,470	N/A	258,413	331,702	321,188	59,008	1,095,641
1982	6,155	78,035	N/A	314,301	73,259	256,110	70,520	798,380

Source: Vessel Activity Report for Humboldt Bay
Stevedore Company, Annual Publications - Years 1982 - 1992.

Future Conditions

Under typical economic considerations, economic growth is normally assumed. However, Northern California's forest product industry may be an exception because of the increasing environmental concerns regarding endangered species in the forest product source timber areas. Thus, based on interviews with the U.S. Forest Service and representatives of the industry, no tonnage increases were projected from the base year and in some instances downward forecasts of the various commodities were assumed. Given the uncertain future regarding the forest products industry, the tonnage totals are projected downward until 1995, or 2005, and then held constant thereafter. These rates are considered "most likely" based on current information and is consistent with viewpoint of the Forest Service which assisted in developing these projections. The projected future tonnages for the affected commodities are presented in Table 5. Excluded are tonnages for commodities not impacted by the project.

Table 5
HUMBOLDT HARBOR TONNAGE
Projected Project-Related Cargo*
1990(actual)-2045

Year	Pulp & P. Board	Woodchips	Lumber	Total
1990	464,014	606,597	165,000	1,170,611
1995	450,000	525,300	100,000	1,075,000
2005	450,000	454,900	63,000	968,000
2015	450,000	454,900	63,000	968,000
2025	450,000	454,900	63,000	968,000
2035	450,000	454,900	63,000	968,000
2045	450,000	454,900	63,000	968,000

*Excludes Docks Located in the South Bay

UNDERKEEL CLEARANCE

The current channel bottom at Humboldt Harbor is -35 feet MLLW. Vessels are typically loaded to 35 feet of sailing draft under current conditions which is documented by the representative sampling in the attached spreadsheet derived from the Humboldt Harbor pilot's

logs. A careful scrutiny of the stevedore logs also indicates that the maximum sailing draft at midship under current conditions is 35 feet. An examination of tidal patterns indicates a maximum usable tide of five feet.[1] A daily tidal curve derived for Humboldt Harbor is illustrated in Figure 2. Allowing for the use of five feet of tide, the underkeel minimum clearance at Humboldt is also five feet. This five foot underkeel clearance consists of one foot of trim, two feet of squat, and two feet for tidal maneuverability (includes one foot for safety).

PORT CHANNEL DEPTHS

The existing channel depths of all principle ports was determined using Lloyd's Ports of the World. The depths given are typically at the fairway. Table 6 shows the various depths of origin, intermediate and destination ports. The depth at the port of origin has no impact on the benefits calculations. All of the intermediate port depths exceed 38 feet except Coos Bay which can allow ships with drafts of up to 36' to enter the harbor. The impact to the benefits is primarily affected by the constraints at the ports of destination. Table 6 indicates only 2 overseas ports with draft limitations. Both of these ports comprise a small proportion of the woodchip and pulp trade and their impact on the benefit analysis is considered insignificant.

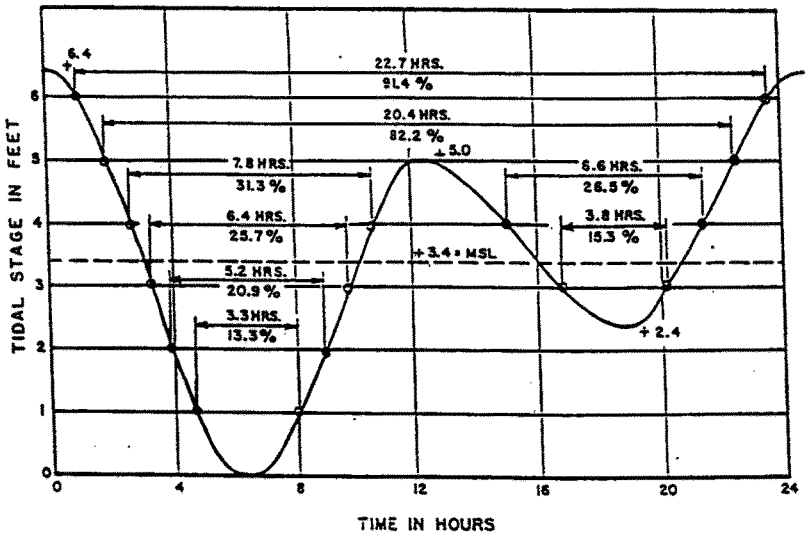
FLEET MIX

The changing world vessel fleet revolves around the needs of the particular industry it serves. In the case of the forest products industry, the high value and the sensitive nature of many forest products cargoes are the major influences that shape the vessel design and purpose-built port handling and storage facilities, integration of shipping, storage and inland distribution functions. Due to the shipping practice of multi-port loading and discharge, a lumber vessel may load 9-10,000 tons at a specific port while the vessel involved might be 35-40,000 DWT. This multi-port practice, primarily carried out by the Pulp and Particle Board operations at Humboldt, can be seen in Figures 3 through 5 where ships pick up locally produced loads from several ports before departing overseas.

[1]Typical high tide at Humboldt is six feet, but for a short duration. The terminals are located approximately six miles distant from the Entrance channel. It takes approximately one hour to go from a terminal to the Entrance channel. The variation in tide is approximately one foot between leaving the terminal and high tide at the Entrance channel.

FIGURE 2

HUMBOLDT HARBOR
MEAN TIDE CURVE



NOTE: BASED UPON LUNAR DAY OF 24.84 HOURS

Table 6
Depth Chart For Forest products Ports Associated With Humboldt Bay
1978-1993

Port of Origin	Depths (ft- MLLW)	Commodity
Hachinoche	42.64	
Hakodate	39.36	
Incheon	42.64	
Iwakuni	37.72	
Kawasaki	39.36	
Kure	55.76	
Kushiro	39.36	
Murroran	54.12	
Niigata	41	
Osaka	39.36	
Sendai	39.36	
Shanghai	na	
Shimizu	82	
Tomakomai	45.92	
Yokohama	39.36	
Intermediate Ports		
Coos Bay	35.1	Lbr, Pulp, P.B.
Longview	40.0	Pulp, P.B.
Los Angeles	50.8	Lbr, Pulp, P.B.
Port Angeles	100.0	Pulp, P.B.
Vancouver	42.0	Lbr, Pulp, P.B
Ports of Destination		
Incheon	42.6	Lbr, Pulp
Kagoshima	45.9	Chips
Kure	55.8	Chips
Murroran	54.1	Chips
Nagoya	45.9	Chips
Savona	32.0	Pulp
Sendai	39.4	Pulp, Chips
Shimizu	82.0	Chips
Tagonoura	35.0	Chips
Tomakomai	45.9	Chips
Toyamashinko	37.7	Chips
Yokahama	39.4	P.B

Sources
Port depths: LLoyd's Ports Of The World
Commodities:Westfall Stevedore Company

Interviews with shipping companies reveal that vessels used in the shipment of wood products are getting larger because of the economic efficiencies and the lower cost per unit these vessels yield utilizing deeper channels. Some of these larger vessels are currently calling at Humboldt and further growth in ship size is expected. Many shippers state that the deepening project at Humboldt Harbor will allow them to more fully take advantage of the larger vessels and reduce the unit costs for their cargo. Presently some shippers, specifically the woodchip carriers, have had to turn away larger vessels coming from British Columbia because of the vessel operating draft constraint at Humboldt Harbor. The existing fleet mix at Humboldt Harbor compared to the world fleet mix is shown below.

Fleet Mix

Size Range ('000 DWT)	% in Humboldt Harbor	% of World Fleet
10 - 20	1	14
20 - 30	26	34
30 - 40	21	38
40 - 50	51	13
50+	1	1

Humboldt Harbor uses a higher percentage of vessels in the 40-50,000 DWT category. An examination of the shipping records of Humboldt Harbor for the last decade shows a gradual growth of utilization of larger vessels. It is reasonable to believe that the smaller vessels from 15-30,000 DWT will be phased out and replaced by larger vessels, in the range of 40,000's DWT. For the purpose of this analysis, the "with" project Wood Chip carrier fleet is made up entirely of ships in the 40-50,000 DWT class. In the "without" project case the fleet mix distribution is expected to contain ships between 30,000 and 45,000 DWT. For Pulp and Particle Board operations which travel to many ports the ship distribution is expected to be the same with and without the project and also some increase to larger ships overtime. Table 7 presents a ship log containing statistical information on selected vessels from the Humboldt Bar Pilots Association for the period of 1992-1993.

Table 7

HUMBOLDT BAR PILOTS ASSOCIATION SHIP LOG: Selected Vessels (1992 - 1993)

DATE	VESSEL	DOCK	COMMODITY[1]	BENEFIT	TIME SAIL	TIDE	DWT[2]	DESIGN LENGTH[2]	DESIGN DRAFT[2]	SAILING DRAFT
01/09/92	Anangel Might	Simpson Paper	Pulp & P.B.	**	0800	1352 HW	23130	539.10	32.29	30.06
02/03/92	Star Merchant	Simpson Paper	Pulp	*	1230	1303 HW	44895	659.51	37.82	31.00
02/13/92	Star Langanger	Simpson Paper	Pulp	*	1400	1359 HW	41425	641.17	36.15	25.50
02/20/92	Oji Universe	North Coast Export	Chips	**	1200	1314 HW	46899	631.69	36.18	34.25
02/27/92	Star Magnate	Simpson Paper	Pulp & P.B.	*	1935	2119 HW	43051	600.09	39.48	33.67
03/04/92	Keisho Maru	North Coast Export	Chips	***	1030	1141 HW	38891	639.85	34.52	30.50
03/09/92	Star Dieppe	Louisiana Pacific	Pulp	*	1810	1759 HW	43082	600.09	39.47	25.42
04/03/92	Finnwood	Simpson Paper	Pulp	*	1735	1749 LW	29094	605.34	33.95	24.75
04/04/92	Star Musketeer	Louisiana Pacific	Pulp & P.B.	*	1155	1256 HW	44895	659.51	33.01	32.42
04/18/92	Prince of Tokyo	North Coast Export	Chips	**	1305	1410 HW	41515	638.84	36.17	34.75
04/28/92	Star Djervanger	Louisiana Pacific	Pulp	*	1830	2213 HW	43051	600.09	39.48	28.17
05/12/92	Great Pearl	Simpson Paper	Pulp	*	2130	2139 HW	37415	623.78	37.09	24.67
05/18/92	Star Merchant	Simpson Paper	Pulp & P.B.	*	0815	0800 LW	44895	659.51	37.82	25.25
05/21/92	Keisho Maru	North Coast Export	Chips	***	1540	1709 HW	38891	639.85	34.52	31.33
05/24/92	Star Hong Kong	Louisiana Pacific	Pulp	*	1800	1921 LW	43052	600.09	39.48	28.42
05/30/92	Oji Pioneer	North Coast Export	Chips	**	1100	1217 HW	42730	656.13	33.85	34.42
05/30/92	Star Evanger	Louisiana Pacific	Pulp	*	1930	2301 HW	44959	692.94	37.80	32.08
06/10/92	Star Magnate	Simpson Paper	Pulp	*	1800	2102 HW	43051	600.09	39.48	24.42
07/03/92	Star Merchant	Simpson Paper	Pulp	*	1405	1539 HW	44895	659.51	37.82	24.67
07/12/92	Star Drivanger	Louisiana Pacific	Pulp & P.B.	*	1030	1219 HW	43052	600.09	39.48	24.92
07/17/92	Star Europa	Louisiana Pacific	Pulp & P.B.	*	1411	1505 HW	45063	657.83	37.91	33.50
07/17/92	San Mateo Victory	Simpson Paper	Pulp	*	1810	2033 LW	10852	455.26	26.56	16.83
07/26/92	Star Derby	Louisiana Pacific	Pulp	*	1800	2124 HW	43700	600.42	39.37	22.08
08/08/92	Pacbaron	Simpson Paper	Pulp	*	0345	1019 HW	26861	562.43	32.53	21.33
08/14/92	Star Djervanger	Simpson Paper	Pulp & P.B.	*	1835	1922 HW	43051	600.09	39.48	23.92
08/16/92	Shiraoi Maru	North Coast Export	Chips	***	1120	1437 HW	40007	639.76	35.16	29.33
09/23/92	Star Dover	Simpson Paper	Pulp & P.B.	*	0955	1028 HW	43082	600.09	39.47	30.25
10/06/92	Star Derby	Simpson Paper	Pulp	*	1435	1520 HW	43700	600.42	39.37	28.83
10/15/92	Star Tuva	Simpson Paper	Pulp	*	2140	2123 LW	28861	554.52	35.48	24.92
10/17/92	Shin Sendai	North Coast Export	Chips	**	0940	0946 LW	42304	634.28	33.88	21.50
10/22/92	Crane Arrow	Simpson Paper	Pulp	*	0615	0946 HW	41646	615.16	39.59	28.17
10/30/92	Star Europa	Simpson Paper	Pulp	*	1242	1403 HW	45063	657.83	37.91	33.42
11/12/92	Star Davanger	Louisiana Paper	Pulp	*	2120	1921 LW	43793	600.42	39.50	25.08
11/17/92	Carissa Star	North Coast Export	Chips	***	1605	1655 HW	30967	599.11	32.69	32.42
11/20/92	Star Derby	Simpson Paper	Pulp & P.B.	*	1530	1449 LW	43700	600.42	39.37	28.17
11/28/92	Star Dover	Simpson Paper	Pulp & P.B.	*	0945	1331 HW	43082	600.09	39.47	28.17
12/10/92	Star Djervanger	Simpson Paper	Pulp	*	1005	1105 HW	43051	600.09	39.47	23.00
01/04/93	Star Langanger	Simpson Paper	Pulp	*	0640	0748 HW	41425	641.17	36.15	33.75
02/10/93	Rana M	Simpson Paper	Pulp	*	1240	1420 HW	50300	700.02	39.90	33.50
03/02/93	Star Merchant	Simpson Paper	Pulp	*	1745	1959 HW	44895	659.51	37.82	33.17
03/19/93	Star Drivanger	Simpson Paper	Pulp	*	1600	2225 HW	43052	600.09	39.48	28.87
03/31/93	Star Dover	Louisiana Pacific	Pulp	*	0315	0445 HW	43082	600.09	39.47	33.58
04/17/93	Chuetsu Maru	Louisiana Pacific	Chips	**	0905	1001 HW	42791	656.09	35.49	33.42
07/10/93	Forest Prince	Louisiana Pacific	Chips	**	1557	1729 HW	41901	639.85	36.09	34.08

P.B. = Particle Board

* During the period of 1992 -1993, nearly all Pulp & Particle Board vessels were being re-routed due to economic factors. However, the economic analysis, based on 1989 - 1990 data indicates that 56% of the vessels will reap re-routing benefits, while 44% will reap light loading benefits under long run future conditions.

** Light Loading

*** Economies of Scale

Sources:

Humboldt Bar Pilots Association, 1992-1993.

[1] Westfall Stevedore Company, Vessel Activity for Humboldt Bay, 1992-1993.

[2] Lloyd's Register of Shipping, 1994.

TYPES OF BENEFITS

The following types of benefit categories were determined for the Humboldt Harbor economic analysis: 1) Reduction of Light-Loading Practices 2) Economies of Scale 3) Rerouting and 4) Change in Operation Mode from truck to ship. Some of the commodities receive more than one type of benefit, with some of the tonnage receiving one type of benefit and a separate portion receiving another type. The tonnages for 1990 and future project years, by type of benefit, for the impacted commodities at Humboldt Harbor are desegregated in Table 5.

Tidal delay benefits were excluded from this economic analysis because they were determined to be offset by rerouting induced tidal delays associated with more efficient with project loading of vessels. The benefits associated with tidal delays were determined to be marginal with no impact on the economic justification or optimization. The dis-benefits associated with rerouting induced tidal delays would be difficult to quantify, and offset by tidal delay benefits. Due to the marginal and offsetting qualities involved, tidal delay benefits and rerouting induced tidal delay dis-benefits will not be included in this economic analysis.

Reduction of Light-Loading Practices

Large vessels cannot enter or depart from Humboldt Harbor fully loaded. The depth of the channel limits the operating draft of the vessel which in turn limits the vessel's load.

With a deeper channel, vessels can load more fully. A larger load distributes the fixed operating costs over a larger volume to reduce the cargo's cost per ton. A deeper channel also reduces the need for vessels to top-off at other harbors, allowing the vessel to load fully before sailing to an overseas destination.

Economies of Scale

Large vessels cannot load to maximum capacity and depart from Humboldt Harbor. This is especially true for the wood chip ships which typically fully-load at Humboldt for direct overseas delivery. Larger vessels can carry more cargo which would reduce the unit cost per ton. The large carrying capacity allows more cargo to be transported and reduces the total number of trips made. Transportation savings result from reduction of vessel trips required to transport the same amount of cargo.

Rerouting

Certain vessels, particularly those that transport pulp and particle board, travel extra distances just to accommodate Humboldt Harbor's depth constraint. The savings in transportation
costs are derived from reduced sailing distances and times spent at port from the expected changes in vessel sailing routes.

It should be noted that those vessel trips considered part of the rerouting category are not included in the vessel light-loading benefit category. Light-loading benefits are claimed only when vessels depart from Humboldt and are light-loaded for the voyage overseas. Therefore, tonnages claimed under the rerouting benefit are not to be counted also for light-loading benefits in order to avoid double-counting. Under project conditions these vessels can sail on a most efficient course and pick up cargoes along the West Coast, then proceed to Humboldt and load to at or near maximum design draft before sailing overseas. Rerouting benefits are discussed in more detail under the category Pulp and Particle Board.

Change in Operational Mode

This benefit category pertains to the shipment of lumber from Humboldt to the Far East and Europe incorporating the recent change in the mode of shipment from deep draft to truck. During 1989, shippers discontinued shipping lumber by deep draft vessel from Humboldt due to channel depth constraints. The channel depth constraint is related to the operational mode which dictates that lumber be loaded last on vessels moving south from Northern Pacific ports toward the Panama Canal.

BENEFIT CALCULATIONS

The benefits are based on transportation costs savings for various size vessels. Operating costs for the various vessels were obtained from Corps of Engineer Planning guidance for Deep Draft Vessels. The operating costs of vessels actually using Humboldt Harbor were based on vessels similar in type draft and DWT to the OCE fleet. These costs consist of the amortized investment costs, crew wages, subsistence, stores, supplies, equipment and miscellaneous expenses. From these data, hourly operating costs, at sea and in port, were derived. The following table displays the hourly costs for foreign bulk carriers.

HOURLY OPERATING COSTS
FOREIGN FLAG DRY BULK CARRIERS
(1993 PRICE LEVEL)

Vessel DWT	Draft	Speed	At Sea	In Port
25,000	32.4	14	$559	451
35,000	36.0	14	607	486
40,000	37.5	14	635	509
45,000	39.0	14	658	527
50,000	40.2	14	681	544

Source: Vessel Operating Costs, Planning Guidance for Deep Draft Vessel, 1993.

BENEFITS BY TYPE OF COMMODITY

Vessel Activity Reports identified seven types of commodities transported through Humboldt Harbor: Lumber, Logs, Particle Board, Pulp, Chips, Petroleum, and Chemicals.

Logs, petroleum products and chemicals, are excluded from the benefit analysis because (a) logs are shipped out of South Bay which is not included in the deepening project, (b) petroleum products are either barged or shipped at operating drafts less than 30 feet, and (c) chemicals are barged into Humboldt Bay. Companies that transport petroleum and chemicals by barge indicated that the deepening project would not induce them to change from their current barge operations. The shipment of the remaining four products, utilizing deep draft vessels, -- lumber, particle board, pulp and woodchips -- would derive benefits from transportation savings with a channel deepening project.

Lumber

Terminals receive lumber both finished and rough cut for coastal and overseas shipments. Lumber used to be shipped from Humboldt Harbor. The shipping line ceased calling for lumber shipments at Humboldt Bay in 1988 after experiencing significant vessel delays. Their ship, after completing loading, had to wait inside the harbor for three days because the bar was not passable due to insufficient water depths in the Bar Channel. Thus, lumber is currently barged from Eureka to Long Beach and San Diego. This incident did not in itself cause the termination

of lumber shipments but does demonstrate the need for deeper harbors overtime. Until 1988, lumber
shipments were on a 60 day schedule. The ships travelling enroute would generally be approximately 70% loaded, drawing 30 to 31 feet of draft before loading at the terminal in the North Bay Channel.

Since lumber ships are too large to fully load at Humboldt, and if the existing depths are not increased to accommodate these heavier ships, very few lumber ships will be able to call at Humboldt Bay. Shippers indicated that if the channels were improved, they would consider contract shipping of lumber overseas once again.

Interviews with the shipping line confirm that they ceased calling at Humboldt Harbor because of the increasing problems they had with shallow waters. However, if the harbor is deepened, there is a potential for vessels to resume calling at Humboldt. One terminal used one barge to transport 103,387 short tons of lumber to Southern California and Mexico in 1990. Fourteen barge trips were made carrying an average load of 7,385 short tons. Since it is uncertain whether there would be a switch from barges to ships in transporting lumber from Humboldt, no benefit is claimed in this economic analysis.

While most of the lumber is currently transported in barges to Mexico, several thousand tons of the lumber formerly transported by deep draft vessels to overseas ports is currently being trucked to Coos Bay. With deeper channels at Humboldt, the cost of picking up this cargo is nominal. This traffic is expected to revert to deep draft shipping with a deepening project. Approximately 100,000 board feet of lumber a month are being trucked to Coos Bay at a cost of $330 per truckload. A truckload carries an average of 13,500 board feet. With channel deepening at Humboldt, an estimated 89 truck trips will be eliminated, resulting in an annual cost savings of $29,300 per year as shown in following computations:

$330 per truckload x 100,000/13,500 board feet x 12 months = $29,300

Based on the recent decline in lumber harvests and sales, company officials forecast a decline for the next decade to approximately 70% of current loads. Adjusting for the projected decline in the lumber trade, yields an average annual benefit of $19,300.

Pulp and Particle Board

Pulp is the interim raw material between timber and paper. Pulp is reprocessed into paper to make brown paper bags, milk cartons and cardboard. Pulp is exported to the paper mills in the Far East and Europe. Particle board is used as wall board in construction of homes, furniture, and kitchen cabinets.

Information from the shipping line shows that approximately 60 vessels carry forest products from Humboldt Harbor on an annual basis. Depending on market conditions, vessel

shipments can fluctuate from 48 to 66 a year. Ideally, the shipping lines would prefer to proceed from North to South at times making Humboldt the last port of call. However, the data indicates that this is rarely the case: 3 distinct re-routing practices have been adopted to accommodate the current channel constraint at Humboldt.

The ships are re-routed from Humboldt back to a more northern Port to pick up cargo that couldn't be accommodated due to existing channel restrictions at Humboldt. The remaining vessels shipping pulp and particle board are currently light-loading using various sized vessels. These vessels then proceed directly to overseas ports after loading at Humboldt Harbor. These differing practices (light-loading and re-routing) reflect differing responses from shipping companies to the current restricted channel conditions at Humboldt. Under improved channel conditions represented by any of the channel deepening alternatives, these practices are predicted to change and reflect greater transportation efficiencies. This evaluation of the "with" project condition reflects the judgement of the shippers.

Rerouting (Pulp & Particle) - A 36 foot maximum current operating draft used in the Humboldt Harbor Draft Economic Appendix for Coos Bay is taken from the Economic Appendix to the Coos Bay Report (p. C-33). Further it is supported by the ship log obtained from the Coos Bay Bar Pilots Association for the time period of 1990-1993. Also, the economic analysis now indicates that while both Humboldt Bay and Coos Bay have the same channel depth of 35 feet, 36 foot draft ships actually do operate out of Coos Bay because of higher tides there. At Humboldt Bay, the maximum operating draft possible under with out project conditions is 35 feet. For this economic analysis, the with out project conditions regarding Coos Bay's channel depth is that it is based on the current -35 feet MLLW. This analysis does not take into account the proposed deepening of Coos Bay. This impact is considered to be extremely minor. The additional foot of draft at Coos Bay causes ships, with ultimate destinations to the south of Humboldt Bay, to call first at Humboldt Bay, then backtrack to top off at Coos Bay and finally resuming the original southward route. This practice of backtracking results in unnecessary transportation costs.

With regard to the other ports involved in the backtracking, Squamish, British Columbia, et al., the backtracking is based on the current depths of over 35 feet and the shipping logs indicate that backtracking is taking place. Also, the shipping companies have indicated that increasing the depth at Humboldt Harbor will affect the routing of three basic shipping routes: the Mediterranean Route, the Mediterranean/North European Route and the Pacific Route. Letters have also been received from the shipping companies indicating that on a regular basis the larger ships are rerouted from the more northerly ports due to channel constraints at Humboldt Harbor.

Approximately 56% of the pulp and particle board vessel trips will benefit by a change of route. The pulp and particle board vessels' operating schedule is structured to accommodate the channel depth constraints of Humboldt Harbor. An analysis of the vessel routes show economic

efficiencies that indicate the deepening project will alter the existing routes and therefore reduce the overall vessel trip distances.

The evaluation of the with and without project conditions focuses on the distance savings. Issues such as tidal delays, added time in port, etc., are minor derivative costs which are offset by tidal delay benefits from with project conditions.

Approximately 36 vessel trips are affected on an annual basis on three basic routes. A breakdown of the operations for a typical year, 1989, was used as the basis for distributing benefits between the routes.

a. Mediterranean Route

The six ships travelling on the existing Mediterranean route start from the Far East, sail to British Columbia ports in Canada, and make the following intermediate stops along the United States West Coast: Port Angeles, Longview, Eureka, then backtracking to Coos Bay before crossing the Panama Canal to the Mediterranean. Although Coos Bay has a 35-foot depth, the same as Humboldt Harbor, vessels backtrack to Coos Bay because of higher tides at Coos Bay allows ships to operate up to 36 feet. With deepening the channels at Humboldt, the transportation costs associated with backtracking to Coos Bay would be eliminated. Figure 3 illustrates the current Mediterranean route. The annual rerouting benefits for these vessels are computed below and rounded to the nearest hundred.

360 nautical miles/14 knots = 25.7 hours spent at sea
25.7 hrs x $658/hr x 6 vessels = $101,500

b. Mediterranean/North Europe Route

Eighteen vessels on the North European route start from the Far East and call first at Humboldt, then sail north to British Columbia ports. The vessels then sail south and make intermediate stops at ports along the United States West Coast before proceeding to the Panama Canal and finally to European countries. With the Humboldt deepening project, vessels don't have to make Humboldt the first U.S. port of call. Instead, they can sail directly to British Columbia ports, then sail south along the ports of the United States West Coast to Humboldt and Los Angeles before traveling through the Panama Canal to Europe. Figure 4 illustrates the existing Mediterranean and North European route. The annual rerouting benefits for these vessels are computed below and rounded to the nearest hundred.

580 nautical miles/14 knots = 41.4 hours spent at sea
41.4 hrs x $658 x 18 vessels = $490,300

Figure 3

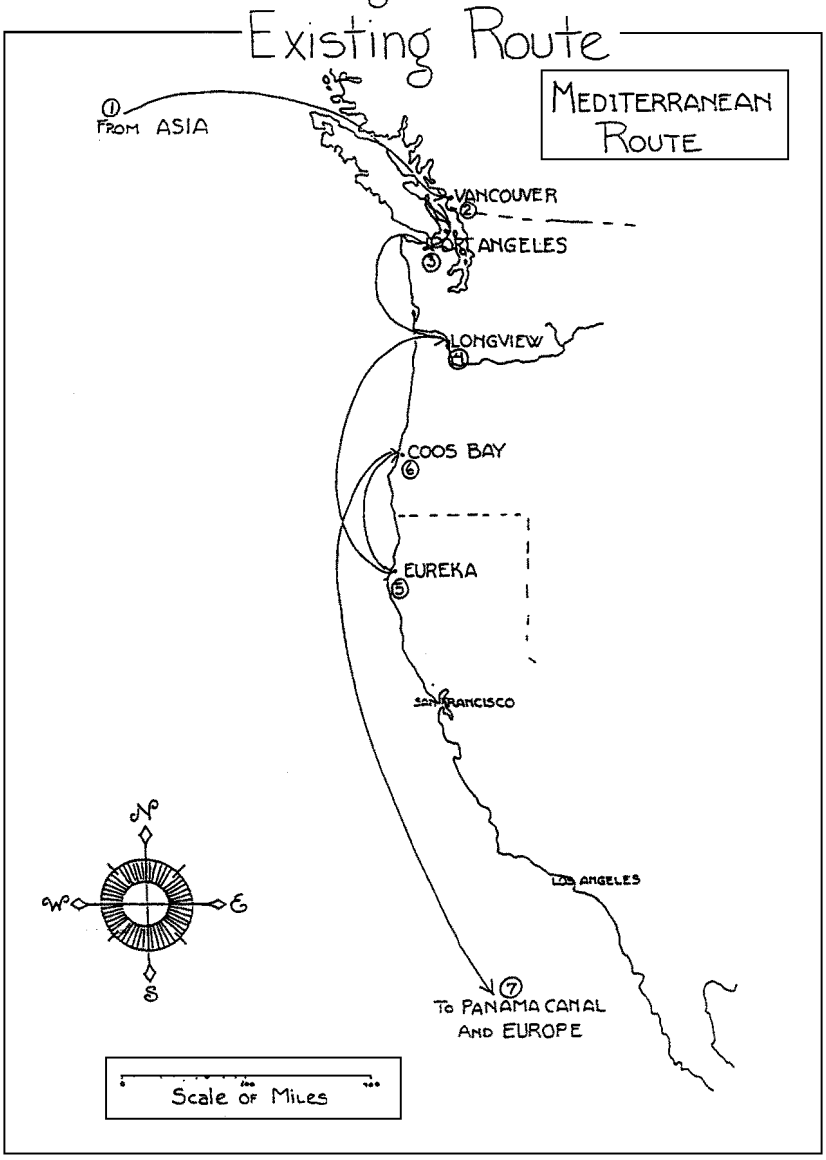
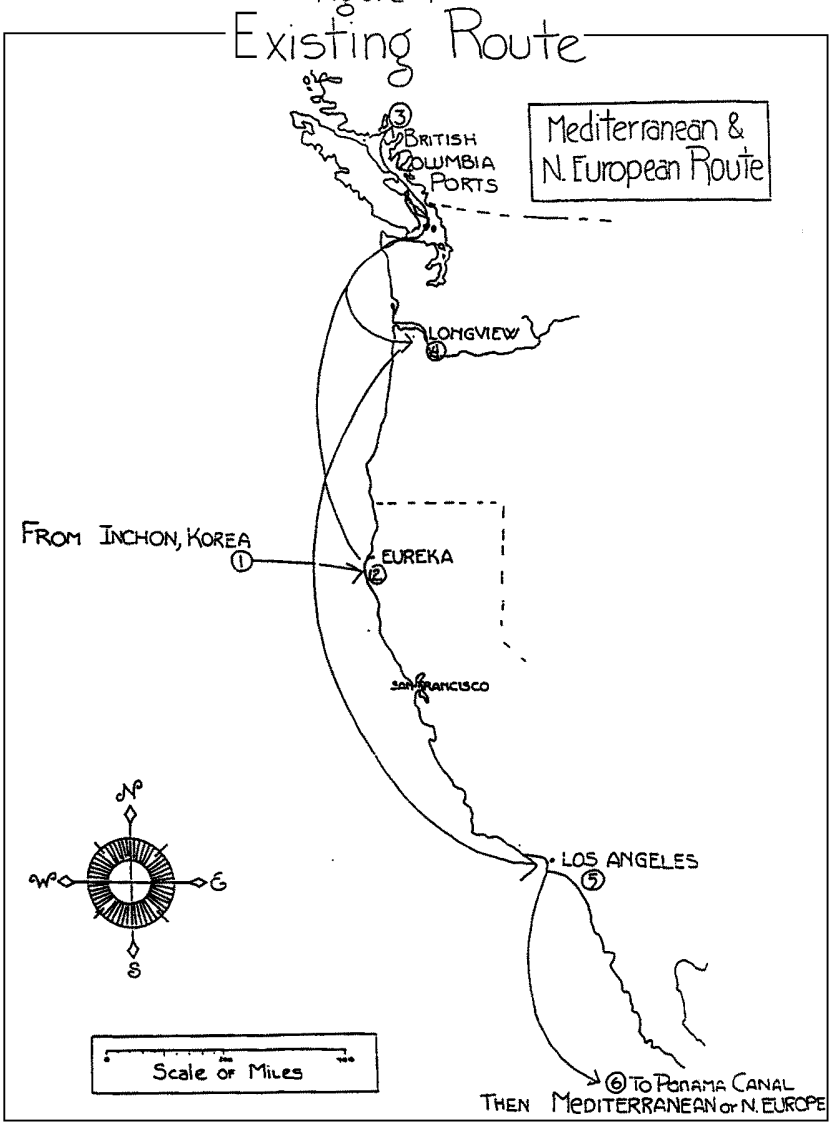

Existing Route
MEDITERRANEAN ROUTE
① FROM ASIA
② VANCOUVER
③ PORT ANGELES
④ LONGVIEW
⑥ COOS BAY
⑤ EUREKA
SAN FRANCISCO
LOS ANGELES
⑦ TO PANAMA CANAL AND EUROPE
N
W
E
S
Scale of Miles

Figure 4


Existing Route
Mediterranean & N. European Route
3
British Columbia Ports
Longview
4
From Inchon, Korea
1
Eureka
2
San Francisco
N
W
E
S
Los Angeles
5
Scale of Miles
6 To Panama Canal
Then Mediterranean or N. Europe

c. Pacific Route

The twelve vessels travelling on the Pacific route start from the Far East and sail to Squeamish, British Columbia before heading south to Humboldt. The vessels then sail north again to Portland, Oregon and return to Squeamish to "top off" before proceeding to the Far East. The vessels would prefer to discharge and pickup cargo at Squeamish, pick up additional cargo at Portland and proceed to Humboldt to complete loading to near maximum vessel design capacity before proceeding to an overseas destination in the Far East. The extra distance in the U.S. (580 miles) is partially offset by a savings of 170 miles for the shorter overseas leg from British Columbia vis a vis Humboldt. Figure 5 illustrates the existing Pacific route. The annual rerouting benefits for these vessels are computed below and rounded to the nearest hundred.

410 nautical miles/14 knots = 29.3 hours spent at sea
29.3 hrs x $658 x 12 vessels = $231,500

Light Loading (Pulp and Particle Board) - Vessels departing Humboldt Harbor for overseas destinations have to light load under with-out project conditions due to channel depth constraints. Table 8 shows the cost calculations to compute total vessel operating costs for various ships carrying Pulp and Particle Board from Humboldt Harbor. The unit costs are derived from these data under various conditions of light-loading. The shippers have also indicated that once the mills adjacent to Humboldt Harbor return to full production, which is expected, ships will depart with increased loads and utilize the deepened channel at Humboldt Harbor in order to decrease per unit transportation costs.

However, only a portion of the total tonnage is used in this benefit analysis given the historical loading patterns. Using the tonnage projections of the Coos Bay Harbor Feasibility Report as a guide, 75 percent of the tonnage for light-loading is used in the Humboldt calculations. Vessels that are involved in rerouting have been excluded from the calculations. Table 9 shows the tonnage distribution for cargo departing Humboldt Harbor. Table 10 shows the costs and benefits associated with these shipments, with an "Exchange Factor" of 4 used for Humboldt. The Exchange Factor is based on the facts that on average approximately 7,500 tons are carried from Humboldt of a typical overseas light loaded haul of 30,000 DWT.

Future Shipment Levels (Pulp & Particle Board) - With the potential decline of acres available for harvesting, local interests have indicated the forest products companies are engaged in long-term planning. For the past 10 to 15 years, they have been cloning redwood, Douglas fir and western hemlock trees. In the summertime, the company hires college students to spot the best trees and mark them. In the fall, foresters check the marked trees to verify premium selection. The tree limbs are cut and trucked to a nursery for grafting. In a genetic laboratory, seeds are extracted and cross pollinated.

Figure 5

Existing Route

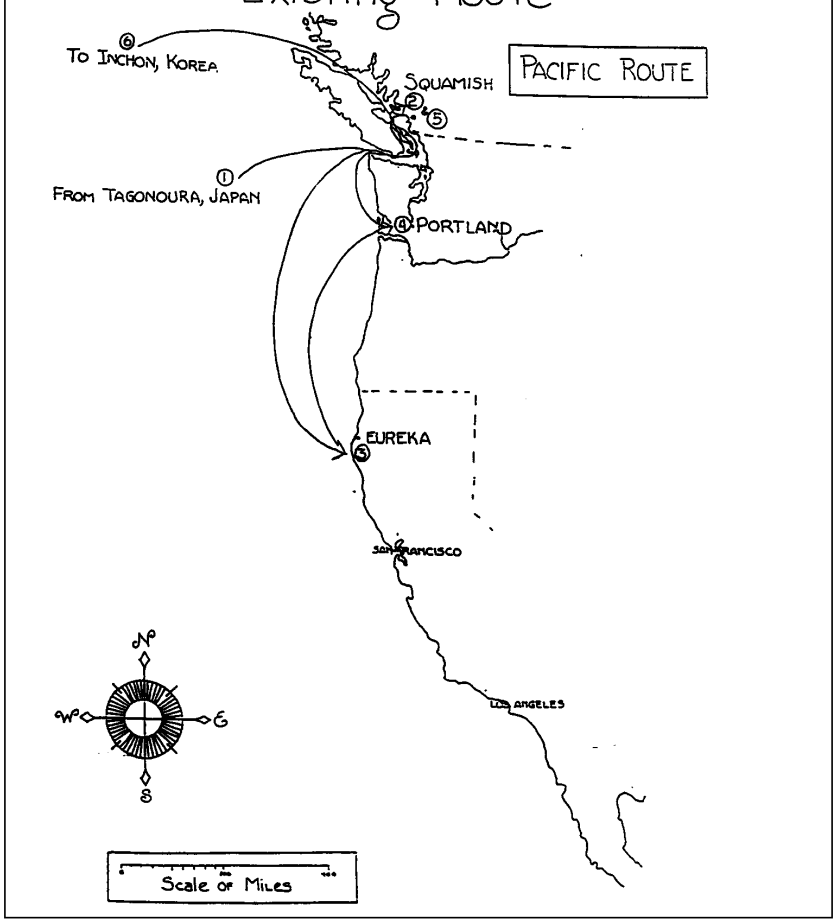


Table 8
PULP & PARTICLE BOARD

DESTINATION: JAPAN

39	45000	637	35	658	527	419146	18445	437591
38	40000	637	35	635	509	404495	17815	422310
37	37500	637	35	621	498	395577	17413	412990
36	35000	637	35	607	486	386659	17010	403669
35	32500	637	35	595	478	379015	16713	395728
34	30000	637	35	583	469	371371	16415	387786

DESTINATION: EUROPE

39	45000	920	36	658	527	605360	18972	624332
38	40000	920	36	635	509	584200	18324	602524
37	37500	920	36	621	498	571320	17910	589230
36	35000	920	36	607	486	558440	17496	575936
35	32500	920	36	595	478	547400	17190	564590
34	30000	920	36	583	469	536360	16884	553244

Table 8a
Cost per Ton
PULP & PARTICLE BOARD
Destination: Combined(Eur.&F.E.)
$/ton(Weighted Average)
Feet Lightloaded

39	126.2	45000	9.84	10.21	10.62	11.05	11.53
38	117.1	40000	10.68	11.11	11.57	12.07	12.61
37	112.3	37500	11.14	11.60	12.09	12.62	13.21
36	107.5	35000	11.67	12.16	12.69	13.27	13.90
35	102.3	32500	12.32	12.85	13.42	14.05	14.74
34	97.1	30000	13.08	13.66	14.29	14.98	15.74

Table 9
LIGHT LOADING
PULP & PARTICLE BOARD
AFFECTED TONNAGE, HUMBOLDT
BY VESSEL

DESIGN DRAFT	DWT	1995	2005	2015	2025	2035	2045
39	45000	83,865	86,406	88,948	91,489	94,030	96,572
38	40000	27,955	30,496	33,038	35,579	35,579	35,579
36	35000	13,723	10,165	7,624	6,099	5,083	5,083
34	30000	27,955	24,397	22,872	20,331	17,790	16,773
Total Tonnage:		153,498	151,465	152,482	153,498	152,482	154,007
Exchange Factor : 4							

Table 10
HUMBOLDT HARBOR
Pulp & Particle Board
VESSEL COSTS & LIGHT-LOADING BENEFITS

DESIGN DRAFT		COSTS					
		-- EXISTING 35 FOOT CHANNEL					
39	45000	$3,866,729	$3,983,903	$4,101,076	$4,218,250	$4,335,423	$4,452,597
38	40000	$1,349,184	$1,471,837	$1,594,490	$1,717,143	$1,717,143	$1,717,143
36	35000	$667,387	$494,361	$370,771	$296,617	$247,180	$247,180
34	30000	$1,462,615	$1,276,464	$1,196,685	$1,063,720	$930,755	$877,569
		$7,345,915	$7,226,565	$7,263,022	$7,295,730	$7,230,502	$7,294,490
		-- 36 FOOT CHANNEL					
39	45000	$3,707,850	$3,820,209	$3,932,568	$4,044,927	$4,157,286	$4,269,645
38	40000	$1,293,406	$1,410,988	$1,528,571	$1,646,153	$1,646,153	$1,646,153
36	35000	$640,650	$474,556	$355,917	$284,733	$237,278	$237,278
34	30000	$1,462,615	$1,276,464	$1,196,685	$1,063,720	$930,755	$877,569
		$7,104,521	$6,982,217	$7,013,741	$7,039,534	$6,971,472	$7,030,645
		-- 37 FOOT CHANNEL					
39	45000	$3,561,512	$3,669,436	$3,777,361	$3,885,286	$3,993,210	$4,101,135
38	40000	$1,242,057	$1,354,971	$1,467,885	$1,580,800	$1,580,800	$1,580,800
36	35000	$640,650	$474,556	$355,917	$284,733	$237,278	$237,278
34	30000	$1,462,615	$1,276,464	$1,196,685	$1,063,720	$930,755	$877,569
		$6,906,834	$6,775,427	$6,797,848	$6,814,539	$6,742,043	$6,796,781
		-- 38 FOOT CHANNEL					
39	45000	$3,426,286	$3,530,113	$3,633,940	$3,737,767	$3,841,594	$3,945,421
38	40000	$1,194,629	$1,303,232	$1,411,834	$1,520,437	$1,520,437	$1,520,437
36	35000	$640,650	$474,556	$355,917	$284,733	$237,278	$237,278
34	30000	$1,462,615	$1,276,464	$1,196,685	$1,063,720	$930,755	$877,569
		$6,724,181	$6,584,365	$6,598,376	$6,606,658	$6,530,064	$6,580,705
		-- 39 TO 42 FOOT CHANNEL					
39	45000	$3,300,954	$3,400,983	$3,501,012	$3,601,040	$3,701,069	$3,801,098
38	40000	$1,194,629	$1,303,232	$1,411,834	$1,520,437	$1,520,437	$1,520,437
36	35000	$640,650	$474,556	$355,917	$284,733	$237,278	$237,278
34	30000	$1,462,615	$1,276,464	$1,196,685	$1,063,720	$930,755	$877,569
		$6,598,848	$6,455,234	$6,465,448	$6,469,931	$6,389,539	$6,436,382

LIGHT LOADING BENEFITS

Decadal	Factors	1996	2006	2016	2026	2036	2046	
		0.26942	0.39714	0.18827	0.08925	0.04231	0.02006	
	DiscRate		0.07750					Ave. Ann. Benefits
	36 FOOT CHANNEL		PROJECT					
TRANSPORT SAVINGS		$241,394	$244,348	$249,281	$256,196	$259,030	$263,844	
ANNUALIZED SAVING		$65,037	$97,041	$46,932	$22,865	$10,959	$5,292	$248,126
	37 FOOT CHANNEL		PROJECT					
TRANSPORT SAVINGS		$439,081	$451,137	$465,174	$481,191	$488,460	$497,709	
ANNUALIZED SAVING		$118,299	$179,167	$87,577	$42,946	$20,666	$9,982	$458,637
	38 FOOT CHANNEL		PROJECT					
TRANSPORT SAVINGS		$621,735	$642,200	$664,646	$689,072	$700,439	$713,785	
ANNUALIZED SAVING		$167,510	$255,046	$125,131	$61,499	$29,635	$14,316	$653,137
	39 TO 42 FOOT CHANNEL			PROJECTS				
TRANSPORT SAVINGS		$747,067	$771,330	$797,574	$825,799	$840,963	$858,108	
ANNUALIZED SAVING		$201,277	$306,330	$150,158	$73,702	$35,580	$17,211	$784,257

Note:" Annualized Savings" represents a calculation, not the benefits per se for that year or decade.

As a result, these trees will grow faster and are disease-resistant since they are cross-pollinated with the healthiest male and female species. By 2020, supplies of trees are expected to produce twice as much fiber for the pulp mills. Pulp and particle board producers plant 1,000 trees annually and harvest them on a 60-year cycle. The total acreage devoted to pulp production are between eight hundred thousand and a million in California. Over 90% of the pulp and particle board source is derived from softwood trees.

Representatives of major pulp and particle board producers indicate that 200,000 short tons of pulp needs to be generated in order to cover the costs of operating the mills. Over 75% of the pulp is exported with the remainder transported to Central and Southern California paper mills. With the demands of pulp expected to increase sharply over the next few decades, the companies anticipate that their tonnage will remain relatively the same as the current volume. For the purpose of this analysis the combined pulp and particle board shipments were based on a modest decline from 1990 levels.

Woodchips

Woodchips are a by-product of sawmill operation which can be used for the production of particle board and paper. Woodchips are purchased from approximately 20 sawmills located in Humboldt County and Southern Oregon. Pacific Lumber, Eel River Sawmill, Fair Pacific, Boise Cascade, Miller Redwood, Louisiana-Pacific, and Simpson are some of the main suppliers for the North Coast. Wood chips in Humboldt Bay have typically been loaded to the design limits of vessels. In one case, loading was slightly greater than design draft. The reason for this occurrence includes loading practices (compacting process at Humboldt Bay) and the relative weight of the chips in Humboldt Bay relative to other sources. First, in Humboldt Bay chips are compacted into the vessel holds using specialized equipment to increase the load per vessel. Second, Redwood chips have a higher relative weight per cubic foot than Douglas fir.

Generally, woodchips are transported directly to Japan from the Humboldt North Bay Channel. Occasionally, woodchip carriers have made an additional stop at Coos Bay to pick up more cargo before sailing to Japan. However, the analysis assumes all cargo will proceed directly from Humboldt to overseas' ports. Surveys collected from shippers for 1990 operations show 19 vessel trips were made to transport 606,597 short tons of woodchips.

Economies of Scale (Woodchips) - A deeper channel offers a shipper an opportunity to utilize larger, deeper draft ships, thereby lowering unit costs. This is especially true where a ship is fully loaded at one port for shipment. This tendency to shift to larger vessels to take advantage of the increased opportunities for lowering unit costs is called Economies of Scale and shippers indicate they would be able to and would shift to larger, deeper draft vessels with at project. For 1990 operations, 21% of woodchip carriers consisting of 35% of the cargo have been identified to benefit from using larger vessels. This proportion is expected by the ship operators to hold in the future "without" project condition. Economies of scale benefits have been estimated for the tonnage currently shipped in these vessels. Computations have been performed based on

replacing the 30,000, 35,000 and 40,000 DWT vessels with 45,000 DWT vessels, which is only expected to occur under the "with" project condition. For the purposes of determining unit costs, only the 35,000 and 40,000 vessels are used. Since OCE's planning guidance does not furnish specific costs for woodchip carriers, costs for bulk carriers were used because woodchip carriers are part of the bulk fleet.

Light-Loading (Woodchips) - Vessels that are already 45,000 DWT, sailing directly to Japan and carrying less than a full load will be able to be more fully loaded with the channel deepening. Data from 1990 shipping operations show 26% of the vessels light-loaded. "Without" a deepening project this proportion is expected to remain constant. Interviews with the woodchip exporter representative indicate the existing channel depths impose restrictions as to the types of commodities loaded. Shippers point out that their vessels can not fully load hardwood chips which causes deep draft problems. A woodchip carrier would like to carry 4 hatches of hardwood chips but in actual practice, can only transport 3 hatches of hardwood chips. Hardwood chips can not be mixed within hatches with other commodities. With the channel deepening project, light-loading practices will either decrease or be eliminated. Vessels that are currently light-loading 3 feet or less can fully load with the channel deepening project.

Woodchip tonnages are projected to decrease approximately 25% over the next decade according to the woodchip exporter and U.S. Forest representatives. With this decline, tonnage is expected to drop to 525,328 by 1995 and 454,948 by 2005. No further decreases are anticipated beyond 2000. The year 2000's tonnage will be sustained through the remaining life for this 50 year project life.

The cost per trip calculations are based on average operating costs of a representative sample of vessels trips to Far East ports. Table 11 shows the calculations for hours spent at sea and at port, which are used to compute the total costs from which the per ton costs are computed for fully loaded vessels and for various vessel draft of light loading. Table 13 also shows the cost per ton for the various alternate light loading situations using the same trips.

Table 12 presents the transportation costs and benefits (savings) in light loading for Woodchips. Table 13 presents the benefits for Economies of Scale for the Woodchip operations. In these calculations the costs for existing smaller vessels of 16,000 and 30,000 DWT, ships not expected to be part of the without project fleet in the future, were deleted from the analysis to prevent a distortion of the benefits.

Table 11
HUMBOLDT HARBOR
Light-Loading Benefits
WOODCHIPS
DESTINATION: Various Ports, Far East
Total Cost of Voyage

39	45000	637	66	658	527	419146	34782	453928
38	40000	637	66	635	509	404495	33594	438089
37	37500	637	66	621	498	395577	32835	428412
36	35000	637	66	607	486	386659	32076	418735
35	32500	637	66	595	478	379015	31515	410530
34	30000	637	66	583	469	371371	30954	402325

Table 11A
Humboldt Harbor
WOODCHIPS
$/ton
Feet Lightloaded

32	86.7	25000	14.98	15.69	16.47	17.33	18.29
33	91.9	27500	13.91	14.54	15.24	16.00	16.84
34	97.1	30000	13.02	13.59	14.22	14.90	15.66
35	102.3	32500	12.26	12.78	13.36	13.98	14.67
36	107.5	35000	11.61	12.10	12.62	13.20	13.83
37	112.3	37500	11.09	11.54	12.03	12.56	13.14
38	117.1	40000	10.63	11.05	11.51	12.00	12.55
39	126.2	45000	9.79	10.16	10.56	11.00	11.47

Table 12
Woodchips
Light-Loading Benefits
& Transportation Costs

		35 foot Channel		Existing Conditions			
		1995	2005	2015	2025	2035	2045
	Tonnage(st)	330,158	285,926	285,926	285,926	285,926	285,926
Design Draft	DWT						
39	45000	$2,391,236	$2,368,086	$2,550,248	$2,732,407	$2,914,567	$3,096,727
38	40000	$1,307,973	$996,393	$797,114	$597,836	$398,557	$199,279
36	35000	$240,261					
34	30000						
		$3,939,470	$3,364,478	$3,347,360	$3,330,242	$3,313,124	$3,296,006

		1995	2005	2015	2025	2035	2045
	Tonnage(st)	330,158	285,926	285,926	285,926	285,926	285,926
Design Draft	DWT	With Project	Depths				
		36	foot Channel				
39	45000	$2,292,983	$2,270,784	$2,445,460	$2,620,135	$2,794,811	$2,969,487
38	40000	$1,251,567	$953,423	$762,739	$572,054	$381,369	$190,685
36	35000	$229,321					
34	30000						
		$3,773,870	$3,224,207	$3,208,198	$3,192,189	$3,176,180	$3,160,171
		37	foot Channel				
39	45000	$2,202,485	$2,181,163	$2,348,944	$2,516,726	$2,684,508	$2,852,290
38	40000	$1,199,825	$914,007	$731,205	$548,404	$365,603	$182,801
36	35000	$219,333	$0	$0	$0	$0	$0
34	30000	$0	$0	$0	$0	$0	$0
		$3,621,643	$3,095,169	$3,080,150	$3,065,130	$3,050,111	$3,035,091
		38	foot channel				
39	45000	$2,118,860	$2,096,347	$2,259,758	$2,421,170	$2,582,581	$2,743,992
38	40000	$1,108,194	$844,204	$675,364	$506,523	$337,682	$168,841
36	35000	$201,759	$0	$0	$0	$0	$0
34	30000	$0	$0	$0	$0	$0	$0
		$3,428,814	$2,942,552	$2,935,122	$2,927,692	$2,920,263	$2,912,833
		39 Thru 42	foot channel				
39	45000	$2,041,353	$2,021,590	$2,177,097	$2,332,604	$2,488,111	$2,643,618
38	40000	$1,108,194	$844,204	$675,364	$506,523	$337,682	$168,841
36	35000	$201,759	$0	$0	$0	$0	$0
34	30000						
		$3,351,307	$2,865,795	$2,852,461	$2,839,127	$2,825,793	$2,812,459

	Average Annual Benefits
Project Depth	Savings on Transportation Cost for Light-Loading
36	$147,363
37	$282,913
38	$442,993
39	$523,836
40	$523,836
41	$523,836
42	$523,836

Table13
HUMBOLDT HARBOR
Economy-of-Scale Benefits
WOODCHIPS
DESTINATION: Various Ports, Far East

Without Project Conditions

DWT	Destination	Oper. Draft	Short Tons	Hours At Sea	Hours At Port	Cost At Sea	Cost At Port	Total Cost '	Cost Per Ton	
40000	Toyamashink	35	37000.4	714	49	453,571	24,941	478,512	12.93	
30000	Shimizu	34	30912	793	59	481,611	29,353	510,964	16.53	
40000	Nagoya	35	37000.4	758	66	453,571	32,076	485,647	13.13	
35000	Shimizu	35	34774	793	49	481,611	23,398	505,009	14.52	
Average Cost Per Ton:		34.75	139687	765	56			495033	13.53	(EXCLUDES 30000 DWT)

With Project Conditions

DWT	Cost At Sea	Cost At Port	total cost	42 feet cost per ton	savings	40 feet cost per ton	savings	38 feet cost per ton	savings	36 cost per ton	savings
45000	470,000	29,512	499,512	10.77	1.99	10.77	1.95	11.14	1.92	11.94	1.92
45000	522,076	31,093	553,169	11.93	3.12	11.93	3.07	12.33	3.04	13.23	3.04
45000	499,046	34,782	533,828	11.51	0.87	11.51	0.82	11.90	0.79	12.76	0.79
45000	522,076	25,823	547,899	11.82	1.89	11.82	1.85	12.22	1.82	13.10	1.82
	Average Cost			11.51		11.51		11.90		12.76	
	Average Savings				2.02		2.02		1.83		0.77

Benefits -- Savings on Transportation Cost for Economy of Scale

Alternative Channel Depths	1995	2005	2015	1994 dollars 2025	2035	2045	Average Annual Benefits
36	40,430	59,595	28,251	13,393	6,349	3,010	$151,028
37	63,080	92,983	44,079	20,896	9,906	4,696	$235,640
38	85,730	126,371	59,907	28,399	13,463	6,382	$320,252
39	95,946	141,429	67,045	31,783	15,067	7,142	$358,412
40	106,161	156,488	74,183	35,167	16,671	7,903	$396,573
41	106,161	156,488	74,183	35,167	16,671	7,903	$396,573
42	106,161	156,488	74,183	35,167	16,671	7,903	$396,573

Petroleum Products

Oil companies transport petroleum products to Humboldt. Standard Oil used one barge to transport 193,141 short tons of petroleum in 1990. The barge travelled 47 times from the San Francisco Bay to Humboldt and carried an average load of 4,100 short tons of petroleum.

Union Oil uses two tankers to carry gasoline and diesel fuel oil. Both tankers were built in 1981 with the same dimensions of 40,631 DWT and a 35 foot design draft. Operating drafts range from 22 to 28 feet. These vessel operating depths are operations driven, not a function of the existing channel depths. Both tankers have been used since 1981 to transport petroleum from Southern California to Humboldt. Since both tankers are company owned, Union Oil does not anticipate having to use other tankers until these vessels exceed their economic life. No benefits have been claimed in this analysis since the current operating drafts are less than 30 feet.

DESIGN VESSEL

In order to facilitate the project design, the "Design Vessel" was determined. The design vessel is defined as the largest vessel or vessels anticipated to use the project on a predictable and economic basis over the life of the project. In order to determine this vessel a series of investigations were performed.

First of all, the existing shipping operations utilizing Humboldt Harbor were determined and the largest vessels for each operation were identified. These vessels are displayed in Table 14. All the shippers and ship operators involved with Humboldt Harbor were contacted for their assessment as to the largest vessels they anticipate using in the future, assuming an improved channel. The Pulp and Particle Board operators indicated that the largest of current vessels would be of adequate size. A log ship operator indicated that they would use larger vessels with an increased channel depth but did not specify the size. The chip carriers using specialized ships said they would make some shifts to deeper draft vessels although the overall capacity was adequate. The study also investigated the largest vessels currently used in comparable trades at the deeper draft ports on the west coast. The largest vessels at Humboldt Harbor are presented in Table 14. Another factor considered in developing the Design Vessel is the largest existing vessels used for handling the commodities transported in and out of Humboldt Harbor, i.e. bulk carriers used for transporting forest products. According to published sources, there are some 50,000 DWT ships used in the forest product trade, however, they operate out of Canadian ports and are not used by the Humboldt Harbor shippers operating out of any U.S. West Coast Port, including Seattle and Tacoma.

All of these factors taken together point to a similar Design Vessel of the following dimensions with respect to length and beam. This vessel is a composite of vessels currently operating in the forest trade. The DWT for this vessel is approximately 45,000.

Length 650 feet
Beam 106 feet

If the largest available forest product vessels, 50,000 DWT, were to be used at Humboldt Harbor, its average dimensions are 700 foot in length, 100 foot beam width, and 40 foot design draft. However, given the shipping practices for Pulp and Particle Board, and other constraints (Panama Canal and other Ports) the 50,000 DWT vessel is not likely to be employed on a regular basis on the U.S. West Coast.

Table 14
HUMBOLDT HARBOR
DESIGN VESSEL

Commodity	DWT	Length (ft)	Max. Draft	Beam
Woodchips	46,595	675	37	100
	45,752	639	36.5	106
Particle Board	45,252	656	38.8	100
Pulp	43,700	600	39.3	102
Logs	36,138	622	36	91
	25,357	524	34	83
Petroleum	40,631	658	35	100
	40,631	658	35	102

OPTIMIZATION

In order to determine the optimum size channel the benefits and costs are compared at one foot channel depth increments. The project alternative with maximum Net Benefits indicates the NED alternative. Table 15 below displays the estimated annualized costs and benefits by one foot increments and indicates 39 feet is the depth with the greatest average annual net benefits. However, the 38 and 40 foot projects have very similar Net Annual Benefits.

Net Benefit Determination for Optimization (1993 price levels)

Table 15
Net Benefits

Channel Depth	Annual Benefits*	Annual Cost* Minus O&M Savings	Net Annual Benefits*
35	$0	$0	$0
36	$667,000	$618,000	$49,000
37	$1,095,000	$793,000	$302,000
38	$2,259,000	$912,000	$1,347,000
39	$2,509,000	$1,139,000	$1,370,000
40	$2,574,000	$1,390,000	$1,184,000
41	$2,574,000	$1,586,000	$988,000
42	$2,574,000	$1,798,000	$776,000

*Rounded to the nearest thousand.

SENSITIVITY ANALYSIS

There is substantial uncertainty about the availability of the timber resource(s) in Northern California and the Pacific Northwest (PNW) and the impact of availability on production and shipments. Several factors are discussed below which address this uncertainty and how it may impact the forecasts for Humboldt Bay.

First, this discussion should emphasize that the forecasts used in this Economic Analysis are conservative since they are below the levels of recent production and do not increase during the study time period. Second, a variety of factors indicate that there may be an increase in the resources available to the mills in the Humboldt Bay vicinity. These include:

- The forest products industry has consolidated. Numerous mills have gone out of business. From 1980 to 1994, 56 sawmills representing 2.593 million board feet of production have gone out of business in California (mostly northern California). In addition, 9 plywood, panel, veneer, and other like product plants have also gone out of business in California. Most of these businesses went out of business in the last few years resulting from a loss of

timber availability. On the positive side, this consolidation has left more fibre available for more efficient producers.

- Throughout the PNW (including northern California), log exports have decreased precipitously which also leaves more resource available for producers.

- As harvests from US Forest Service lands declined, relatively more of the fibre was obtained from private lands. In California, private lands increased their share of total harvest from 57.8% in 1985 to 70.0% in 1992. Harvest from private lands in the future are cautiously optimistic with a large volume of planted trees coming on line at or shortly after the turn of the century.

- Legislative efforts to limit log exports from private land (the proposed Federal legislation) really would not impact northern California because all of the current shipments overseas are of products and not raw logs.

- As resource availability has tightened, logs have been received from greater distances. At the present time, logs are being imported into Humboldt Bay from New Zealand. In addition, there is a plan being implemented to import logs from Far East Russia. One of the participants in this operation is a Humboldt area producer. Chip imports from Brazil, Chile, New Zealand and elsewhere have also been attempted or discussed. Receipts from more distant US sources is also occurring as logs are transported from Montana, Idaho, Utah, Wyoming and other areas to producing areas.

- Finally, more producers are beginning to use recycled wastepaper in pulp and paper production. This also has an effect of stretching raw log resources.

These factors will continue to mitigate the loss of timber availability from USFS lands. As a result, the low forecast provided in this economic analysis is considered reasonable.

APPENDIX C

PROJECT SCHEDULE

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List 16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
START	HUMBOLDT HARBOR (DEEPENING) STUDY	1-Nov-1988		1-Nov-1988
REAL ESTATE	REAL ESTATE REVIEW FY 89 CARRYOVER	1-Nov-1988	0.00 Dys E	1-Nov-1988
UDO 6 FY93	UDO 6 FOR FY93 (EE,FWL,E86913003)	1-Nov-1988	0.00 Dys E	1-Nov-1988
EELGRASS SUR	EELGRASS SURVEY FY 89 CARRYOVER	1-Nov-1988	0.00 Dys E	1-Nov-1988
UDO 1 FY93	UDO 1 FOR FY93 (R E STUDY,E86893072,890928)	1-Nov-1988	0.00 Dys E	1-Nov-1988
UDO 2 FY93	UDO 2 FOR FY93 (WES, EF, E86903070)	1-Nov-1988	0.00 Dys E	1-Nov-1988
UDO 3 FY93	UDO 3 FOR FY93 (WES,EF, E86903071)	1-Nov-1988	0.00 Dys E	1-Nov-1988
RPT PROC SPD	RECON REPORT PROCESSING THRU CESPD	1-Nov-1988	0.00 Dys E	1-Nov-1988
ADJ ENTRY1FW	FY-92 ADJUSTING ENTRY NO. 1 FOR LOCAL MONEY	1-Nov-1988	0.00 Dys E	1-Nov-1988
EEL GRSS END	COMPLETE EEL GRASS EVAL/COORD WITH F&WS	1-Nov-1988	0.00 Dys E	1-Nov-1988
CONTINGENCY	CONTINGENCY	1-Nov-1988	0.00 Dys E	1-Nov-1988

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
CONTINGENCY	FY-93 EARLY YEAR ONLY CONTINGENCY	1-Nov-1988	0.00 Dys E	1-Nov-1988
ADJ ENTRY192	ADJUSTING ENTRY NO. 1 FOR FY-92	1-Nov-1988	0.00 Dys E	1-Nov-1988
UDO 5 FY93	UDO 5 FOR FY93 (PREP PUBLICATION,E86923040)	1-Nov-1988	0.00 Dys E	1-Nov-1988
RECON PHASE	HUMBOLDT (DEEPENING) - RECON STUDY PHASE	1-Nov-1988	398.00 Dys E	4-Dec-1989
UDO 4 FY93	UDO 4 FOR FY93 (SED TEST,EE,E82880008)	1-Nov-1988	0.00 Dys E	1-Nov-1988
ADJ ENTRY194	ADJUSTING ENTRY NO. 1 FOR FY-94	1-Nov-1988	0.00 Dys E	1-Nov-1988
ADJ ENTRY1AA	FY-92 ADJUSTING ENTRY NO. 1 FOR FED MONEY	1-Nov-1988	0.00 Dys E	1-Nov-1988
SPD RPT PRCS	CESPD REVIEW OF FINAL RECON REPORT	4-Dec-1989	58.00 Dys E	31-Jan-1990
RECON >SPD	006 FINAL RECON REPORT TO CESPD (R5)	4-Dec-1989		4-Dec-1989
WLRC REVIEW	WASH. LEVEL REVIEW CENTER (WLRC) REVIEWS RECON RPT	31-Jan-1990	14.00 Dys E	14-Feb-1990
NPR ON RRC	CESPD PREPARE/TRANSMIT NPR ON	14-Feb-1990	14.00 Dys E	28-Feb

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
	RRC TO WLRC			
REVIEW MTG	007 RECON REVIEW CONFER (RRC) W/ WLRC (R6)	14-Feb-1990		14-Feb-1990
PREP IPMP	CESPN PREPARES INITIAL PROJECT MGMT PLAN (IPMP)	14-Feb-1990	35.00 Dys E	21-Mar-1990
MFR IN WLRC	MFR RECEIVED IN WLRC	28-Feb-1990	0.00 Dys E	28-Feb-1990
REVIEW	LOCAL SPONSOR REVIEW OF DRAFT FCSA/IPMP	21-Mar-1990	6.00 Dys E	27-Mar-1990
IPMP OK PRB	050 PRB APPROVES IPMP	21-Mar-1990		21-Mar-1990
D FCSA/IPMP	DRAFT FCSA/IPMP SENT TO LOCAL SPONSOR	21-Mar-1990	0.00 Dys E	21-Mar-1990
IPMP REVIEW	CESPD REVIEW OF IPMP	21-Mar-1990	13.00 Dys E	3-Apr-1990
PUBLIC WKSP	LOCAL SPONSOR PUBLIC WKSHOP ON RECON	27-Mar-1990	0.00 Dys E	27-Mar-1990
REVISE FCSA	CESPN REVISES DRAFT FCSA/IPMP	27-Mar-1990	36.00 Dys E	2-May-1990
RECON OK SPD	051 CESPD APPROVES FINAL RECON REPORT (R7)	3-Apr-1990		3-Apr-1990
IPMP APPROVD	IPMP APPROVED BY SPD	3-Apr-1990	0.00 Dys E	3-Apr-1990
MFR ENDORSED	WLRC APPROVES CESPD MFR ON RRC SUBJECT TO	3-Apr-1990	21.00 Dys E	24-Apr-1990
SUBJECT TO	CESPN RESPONSE TO MFR SUBJECT TO COMMENT	24-Apr-1990	14.00 Dys E	8-May-1990

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
PUBL HEARING	LOCAL SPON PUBLIC HEARING ON DFCSA&IPMP	2-May-1990	0.00 Dys E	2-May-1990
LOCAL SPONSR	LOCAL SPONSOR COORDINATES W/ CITY ON FCSA	4-May-1990	15.00 Dys E	19-May-1990
RPT CERTIF.	NOUSACE CERTIFIES RECON REPORT	8-May-1990	17.00 Dys E	25-May-1990
DFCSA OK LOC	LOCAL SPON APPROVAL OF DFCSA	19-May-1990	0.00 Dys E	19-May-1990
CORPS SIGNS	CESPN SIGNS FCSA	25-May-1990	45.00 Dys E	9-Jul-1990
RECON CERT	052 NOUSACE CERTIFIES RECON REPORT	25-May-1990		25-May-1990
REPRT RELESD	CESPD RELEASES RECON REPORT TO PUBLIC	25-May-1990	0.00 Dys E	25-May-1990
L.S. SIGNS	LOCAL SPONSOR SIGNS FCSA	9-Jul-1990	4.00 Dys E	13-Jul-1990
RQST FND	CESPD REQUESTS FEASIBILITY STUDY FUNDS	13-Jul-1990	10.00 Dys E	23-Jul-1990
FCSA SIGNED	060 FCSA SIGNED	13-Jul-1990		13-Jul-1990
RELSE FUNDS	NOUSACE RELEASES FEASIBILITY STUDY FUNDS	23-Jul-1990	28.00 Dys E	20-Aug-1990
DOE-PM	DOE FOR PROJ MANAGEMENT THRU 999	20-Aug-1990	0.00 Dys E	20-Aug-1990
PREPARE FWS	CORPS PROVIDES DESIGN ALTERNATIVES TO FWS	20-Aug-1990	102.00 Dys E	30-Nov-1990
PROJ MANAGER	PROJECT MANAGEMENT THRU 999	20-Aug-1990	0.00 Dys E	20-Aug-1990
COORD W/ WES	CESPN-PE-W COORDINATION W/ WES	20-Aug-1990	179.00 Dys E	15-Feb-1991

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List 16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
	ON SEDIMENT STUDY			
PUB NOT/NOI	PREPARE FEAS STDY PUBLIC NOTICE & NOI ON EIS	20-Aug-1990	14.00 Dys E	3-Sep-1990
VESSEL SIM 1	VESSEL SIMULATION 1 W/ WES ($40.0-$2.5)	20-Aug-1990	180.00 Dys E	16-Feb-1991
FEAS START	100 START FEASIBILITY STUDY & EIS	20-Aug-1990		20-Aug-1990
SED CORD EPA	COE COORDINATES SEDIMENT TESTING PLAN WITH EPA	20-Aug-1990	90.00 Dys E	18-Nov-1990
REV WES SED	REVIEW SPRING 92 WES SHOALING STUDY/NAV SIM	20-Aug-1990	0.00 Dys E	20-Aug-1990
TECH COORDIN	TECHNICAL MANAGER COORDINATION	20-Aug-1990	0.00 Dys E	20-Aug-1990
REAL EST GEN	REAL ESTATE FUNDING>$PK FOR PRS'S, ETC.	20-Aug-1990	0.00 Dys E	20-Aug-1990
PROGRAMS	PROGRAMS FUNDING THRU 999	20-Aug-1990	0.00 Dys E	20-Aug-1990
PM SUPPORT	PM BRANCH SUPPORT THRU 999	20-Aug-1990	0.00 Dys E	20-Aug-1990
BEGIN DEIS	BEGIN PREPARATION OF DEIS ($70,000)	20-Aug-1990	90.00 Dys E	18-Nov-1990
PE CHIEFS	PE DIVISION CHIEFS REVIEW AND INPUT	20-Aug-1990	0.00 Dys E	20-Aug-1990
HYDROSURVEY	PREPARE & MANAGE HYDROSURVEY CONTRACT	20-Aug-1990	30.00 Dys E	19-Sep-1990

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
SED TRANS 1	SEDIMENT TRANSPORT STUDY W/ WES ($55.0-$12.0)	20-Aug-1990	180.00 Dys E	16-Feb-1991
SPD WES COOR	SPD FIELD COORDINATION W/WES (FY90:$125)	20-Aug-1990	41.00 Dys E	30-Sep-1990
SEND NOI	SUBMIT EIS NOTICE OF INTENT TO FEDRL REGISTER	3-Sep-1990	1.00 Dys E	4-Sep-1990
PLAN MEETING	PLANNING FOR PUBLIC SCOPING MEETING	4-Sep-1990	3.00 Dys E	7-Sep-1990
PUBLISH NOI	PUBLISH NOI ON EIS IN FR, ANNOUNCE WORKSHOP	4-Sep-1990	14.00 Dys E	18-Sep-1990
CNDCT WKSHP	CONDUCT PUBLIC WORKSHOP & EIS SCOPING MEETING	18-Sep-1990	1.00 Dys E	19-Sep-1990
HYDROSVY CNT	HYDROSURVEY CONTRACT (FY90 $7,500)	19-Sep-1990	60.00 Dys E	18-Nov-1990
SURVEYMAPPING	CHANNEL WIDTH BATHEMETRY FOR A GEOTECH. SLOPE STAB EVAL.	19-Sep-1990	0.00 Dys E	19-Sep-1990
TEAM MTG 91	STUDY TEAM MEETING FY 1991 ($4000)	20-Aug-1990	364.00 Dys E	19-Aug-1991
WATER RESRCS	WATER RESOURCES - WAVE HEIGHT ANALYSIS	18-Nov-1990	45.00 Dys E	2-Jan-1991
SCOPE OF WRK	SCOPE OF WORK & MGMT. OF	18-Nov-1990	50.00 Dys E	7-Jan-1991

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
	SEDIMENT TESTING CONTRACT			
PRELIM DCAR	FWS PROVIDES DRAFT CAR	30-Nov-1990	84.00 Dys E	22-Feb-1991
FWS COORD	F&WS - DCAR/NEP	30-Nov-1990	0.00 Dys E	30-Nov-1990
BID PREP	A/E CONTRACTOR PREPARES & SUBMITS BID	7-Jan-1991	30.00 Dys E	6-Feb-1991
AWARD CNTRCT	AWARD CONTRACT FOR SEDIMENT TESTING	6-Feb-1991	14.00 Dys E	20-Feb-1991
VESSEL SIM 2	VESSEL SIMULATION 2 - CONTINUED DESK TOP	17-Feb-1991	200.00 Dys E	5-Sep-1991
COE REVIEW	CORPS REVIEW & COMMENT ON PRELIMINARY DCAR	22-Feb-1991	14.00 Dys E	8-Mar-1991
DRAFT CAR	FWS SUBMITS DRAFT CAR	8-Mar-1991	14.00 Dys E	22-Mar-1991
EEL GRASS 92	EEL GRASS SURVEY IN FALL OF 1991 (FY-92)	22-Mar-1991	0.00 Dys E	22-Mar-1991
TAKE SAMPLES	COLLECT SEDIMENT SAMPLES	20-Feb-1991	100.00 Dys E	31-May-1991
END T/MTG 91	END STUDY TEAM MEETING - FY 1991	30-Sep-1991	0.00 Dys E	30-Sep-1991
ECON ANALYS	ECONOMIC ANALYSIS	20-Aug-1990	75.00 Dys E	3-Nov-1990
SED IN-HOUSE	SED TESTING IN-HOUSE MONITORING	23-Oct-1991	0.00 Dys E	23-Oct-1991
TEST SAMPLES	SEDIMENT TESTING & ANALYSIS(COST INCL SAMPLING)	23-Oct-1991	60.00 Dys E	22-Dec-1991

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
SED TRANS 2	SEDIMENT TRANSPORT STUDY NO. 2	17-Feb-1991	242.00 Dys E	17-Oct-1991
GEOTECH EVAL	GEOTECHNICAL INVESTIGATION	22-Dec-1991	30.00 Dys E	21-Jan-1992
CNTINUE DEIS	INCORPORATE SEDIMENT TEST RESULTS INTO DEIS	22-Dec-1991	120.00 Dys E	20-Apr-1992
END SED TEST	COMPLETE SEDIMENT TESTING CONTRACT	22-Dec-1991	0.00 Dys E	22-Dec-1991
GEOTEC INVES	GEOTECH REVIEW & GEOTECH SECT FOR ENG APPEND	21-Jan-1992	21.00 Dys E	11-Feb-1992
DESIGN	DESIGN ENGINEERING	30-Jun-1992	75.00 Dys E	13-Sep-1992
FEA PUB WKSP	101 FEASIBILITY STUDY PUBLIC WORKSHOP (F2)	19-Sep-1990		19-Sep-1990
COST ESTIMTE	COST ENGINEERING	13-Sep-1992	60.00 Dys E	12-Nov-1992
DESIGN ENGR2	FEAS LEVEL DESIGNS/PREP ENG PORTIONS OF ENG APPEND	13-Sep-1992	90.00 Dys E	12-Dec-1992
INSTI. STUDY	INSTITUTIONAL STUDY - ABILITY TO PAY ($4,500)	12-Nov-1992	40.00 Dys E	22-Dec-1992
PREPARE PMP	CESPN PREPARES DRAFT PMP	12-Nov-1992	14.00 Dys E	26-Nov-1992
PLAN FORMULN	PLAN FORMULATION OF STUDY ALTERNATIVES	12-Nov-1992	60.00 Dys E	11-Jan-1993
PREL FEAS/EN	PREPARE PRELIM. FEAS. RPT/ENGINEERING APPENDIX	11-Jan-1993	110.00 Dys E	1-May-1993
REAL ES REV	REAL ESTATE REV BY SPK, INCLUD PMP, FEAS REPORT	11-Jan-1993	0.00 Dys E	11-Jan-1993

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
DEIS/FEAS	COMBINE ADMIN DEIS W/ PRELIM D FEAS RPT/ENG APPEN	1-May-1993	30.00 Dys E	31-May-1993
PRELM TO SPD	SUBMIT PRELIM. DEIS/FEAS PACKAGE TO CESPD	31-May-1993	45.00 Dys E	15-Jul-1993
CESPD REVW	CESPD REVIEW OF MATERIAL FOR CONFERENCE #1	15-Jul-1993	41.00 Dys E	25-Aug-1993
PED REC INIT	201 RECOMMEND INITIATION OF PED (MAY B.Y. MINUS 2)	1-May-1993		1-May-1993
ADD LAND SIT	SPONSOR REQUEST TO CONSID LP LAND DISP SITE	25-Aug-1993	30.00 Dys E	24-Sep-1993
SCOPE STUDYS	SCOPE ADDIT CULT RES, F&WS, & RE STUDIES	24-Sep-1993	40.00 Dys E	3-Nov-1993
FEA STU CON1	102 FEASIBILITY STUDY CONFERENCE #1 (F3)	25-Aug-1993		25-Aug-1993
TEAM MTGS	STUDY TEAM MEETINGS	3-Nov-1993	0.00 Dys E	3-Nov-1993
ABIL TO PAY	ABILITY TO PAY ANALYSIS	3-Nov-1993	30.00 Dys E	3-Dec-1993
N-CACES PREP	N-CACES PREPARATION	3-Nov-1993	21.00 Dys E	24-Nov-1993
RE REPORT	REAL ESTATE REP FOR D FEAS STUDY	3-Nov-1993	45.00 Dys E	18-Dec-1993
F&WS, NEP+	F&WS NEP & OTHER WORK LEAD TO CAR	3-Nov-1993	45.00 Dys E	18-Dec-1993
CULTURAL RES	CULTURAL RESOURCES EVAL OF	3-Nov-1993	45.00 Dys E	18-Dec-1993

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
	CHANNEL BOTTOMS			
CMPLTDEIS/FE	COMPLETE ADMIN DEIS & PRELIM FEAS REPORT/ENG APPEND	3-Nov-1993	60.00 Dys E	2-Jan-1994
DRAFT CAR		18-Dec-1993	30.00 Dys E	17-Jan-1994
FWS: FRC,CAR	F&WS FUNDS FOR FRC, CAR	17-Jan-1994	0.00 Dys E	17-Jan-1994
INCORP REPTS	INCORP CAR, CULT RES, RE INTO DFEAS/EIR/EIS	17-Jan-1994	10.00 Dys E	27-Jan-1994
CESPN REVIEW	CESPN REVIEW OF ADMIN DEIS/PRELIM FEAS REPORT	27-Jan-1994	7.00 Dys E	3-Feb-1994
REVISE RPT	REVISE ADMIN DEIS/PRELIM FEAS REPORT	3-Feb-1994	81.00 Dys E	25-Apr-1994
DRAFT TO SPD	SUBMIT DEIS & PRELIM FEAS PKG TO CESPD	25-Apr-1994	7.00 Dys E	2-May-1994
CESPD REVIEW	SPD REV OF DEIS/FEAS REPORT/DLCA/M-CACES	2-May-1994	9.00 Dys E	11-May-1994
F4 MFR PREP	SPD PREPARES MFR ON F4 CONF	11-May-1994	7.00 Dys E	18-May-1994
WTR RES REV	WATER RESOURCES BRANCH REVIEW	18-May-1994	10.00 Dys E	28-May-1994
REVSD RPT	CESPN PREPARES REVISED REPORT/SUBMITS TO CESPD	18-May-1994	21.00 Dys E	8-Jun-1994
RPT TO WLRC	CESPD SUBMITS DRAFT EIS/FEAS REPORT TO WLRC	8-Jun-1994	6.00 Dys E	14-Jun-1994
PRINT REPRTS	PRINT FEAS/EIS - VARIOUS	8-Jun-1994	0.00 Dys E	8-Jun-1994

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
	PRINTINGS			
WLRC REVIEW	WLRC REVIEWS DRAFT EIS/FEAS REPORT FOR FRC	14-Jun-1994	56.00 Dys E	9-Aug-1994
PMP OK PRS	160 CESPN APPROVES PMP & SUBMITS TO CESPD	3-Nov-1993		3-Nov-1993
FEAS CONF 2	103 FEAS STUDY CONF NO. 2 (F4)	11-May-1994		11-May-1994
F-5/REP>SPD	104 DRAFT FEAS REPORT/DEIS TO CESPD	8-Jun-1994		8-Jun-1994
FRC CONTINUD		9-Aug-1994	1.00 Dys E	10-Aug-1994
PREP NFR	CESPD PREPARES NFR ON FRC/SUBMITS TO HQUSACE	10-Aug-1994	14.00 Dys E	24-Aug-1994
NFR RECEIVED	HQUSACE RECEIVES NFR ON FRC	24-Aug-1994	1.00 Dys E	25-Aug-1994
HQUSACE MEMO	HQUSACE PROVIDES MEMO TO CESPN & COORD. W/ ASA	25-Aug-1994	16.00 Dys E	10-Sep-1994
MEMO RECEIVD	CESPN RECEIVES MEMO FROM HQUSACE	10-Sep-1994	1.00 Dys E	11-Sep-1994
SPN REVISION	CESPN REVISES DEIS/FEAS REPORT PER HQ COMMENTS	11-Sep-1994	21.00 Dys E	2-Oct-1994
POLCA COOR	PRELIM DRAFT LCA COORD WITH LOCAL SPONSOR (ER 1165-2-131,P43)	11-Sep-1994	30.00 Dys E	11-Oct-1994

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List 16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
CONTRACTS LA	CONTRACTS BRANCH LABOR	2-Oct-1994	0.00 Dys E	2-Oct-1994
SPD APPROVAL	CESPD CLEARS DEIS/FEAS RPT FOR PUBLIC RELEASE	2-Oct-1994	7.00 Dys E	9-Oct-1994
ECON DATA CO	ECON DATA COLLECTION CONTRACT	2-Oct-1994	0.00 Dys E	2-Oct-1994
ECON LABOR	ECONOMICS REVISIONS	2-Oct-1994	0.00 Dys E	2-Oct-1994
T R C	120 TECHNICAL REVIEW CONFERENCE	9-Aug-1994		9-Aug-1994
FEAS FRC	140 FEASIBILITY REBOLUTION CONFERENCE (FRC)	9-Aug-1994		9-Aug-1994
N-CAC OK SPD	150 N-CACES COST EST APPROVED BY SPD	18-May-1994		18-May-1994
PRINT DRPT	CESPN PRINTS DRAFT EIS/FEAS REPORT	9-Oct-1994	7.00 Dys E	16-Oct-1994
SUBMIT DRPT	SUBMIT DRAFT EIS/FEAS REPORT TO HQUSACE	16-Oct-1994	5.00 Dys E	21-Oct-1994
WES TESTING	MIPR - WEST MODEL TESTING	21-Oct-1994	90.00 Dys E	19-Jan-1995
NCACES EST.	PREPARE NCACES COST ESTIMATE	21-Oct-1994	60.00 Dys E	20-Dec-1994
NCACES EST.	PREPARE NCACES COST ESTIMATE	21-Oct-1994	60.00 Dys E	20-Dec-1994
REAL ESTATE	CESPK-RE - GROSS APPRAISAL/REP & SUPPORT	21-Oct-1994	60.00 Dys E	20-Dec-1994
FILE DEIS	FILE DEIS WITH EPA	21-Oct-1994	17.00 Dys E	7-Nov-1994
SAIC	A/E CONTRACT - SAIC	21-Oct-1994	90.00 Dys E	19-Jan-1995
NCACES EST.	PREPARE NCACES COST ESTIMATE	21-Oct-1994	60.00 Dys E	20-Dec-1994
NCACES EST.	PREPARE NCACES COST ESTIMATE	21-Oct-1994	60.00 Dys E	20-Dec-1994

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List 16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
PUBL REVIEW	BEGIN PUBLIC REVIEW OF DEIS/FEAS REPORT	16-Dec-1994	25.00 Dys E	10-Jan-1995
PREP C.C.C.	PREPARE DETERMINATION FOR COASTAL COMMISSION	16-Dec-1994	14.00 Dys E	30-Dec-1994
PREP RWQCB	CESPN PREPARES RWQCB CERTIFICATION REQUEST	16-Dec-1994	14.00 Dys E	30-Dec-1994
DFEA/EIS PUB	161 FIELD LEVEL COORD (PUB REV DFEAS/DEIS)(F6) PUBLIC (F6)	16-Dec-1994		16-Dec-1994
PUBLIC MTG.	FINAL PUBLIC MEETING ON FEASIBILITY STUDY	10-Jan-1995	1.00 Dys E	11-Jan-1995
REVIEW CONT.	CONTINUE PUBLIC REVIEW DRAFT EIS/FEAS REPORT	11-Jan-1995	15.00 Dys E	26-Jan-1995
FEAS PUB MTG	162 FEASIBILTY STUDY FINAL PUBLIC MEETING (F7)	11-Jan-1995		11-Jan-1995
PREP FNL RPT	CESPN PREP ADMIN F EIS/FEAS REP/ENGR APPEN	26-Jan-1995	30.00 Dys E	25-Feb-1995
SPN REVISION	CESPN PREPARES REVISED FEIS/FEAS RPT	25-Feb-1995	21.00 Dys E	18-Mar-1995
PRINT FINAL	PRINT FINAL FEASIBILITY REPORT & EIS	18-Mar-1995	2.00 Dys E	20-Mar-1995

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
RPT TO SPD	SUBM FINAL EIS/FEAS REPORT>SPD	20-Mar-1995	1.00 Dys E	21-Mar-1995
CESPD REVIEW	CESPD REVIEW & PREP. OF DIV. ENGR. PN	21-Mar-1995	21.00 Dys E	11-Apr-1995
FFEA/EIS>SPD	163 FINAL FEAS REPORT/EIS>SPD (FS)	21-Mar-1995		21-Mar-1995
WLRC SUB PRE	PREP FOR WLRC SUBMISSION	11-Apr-1995	7.00 Dys E	18-Apr-1995
C.C.C. REVW	COASTAL COMMIS. CONSIST. DETRM. PROCESS	11-Apr-1995	60.00 Dys E	10-Jun-1995
PED FUNDS	PED FUNDS ALLOCATED TO CESPN	11-Apr-1995	21.00 Dys E	2-May-1995
RWQ CERT PRO	RWQCB CERTIFICATION PROCESS TO ISSUANCE	11-Apr-1995	60.00 Dys E	10-Jun-1995
FEA COMPLETE	170 FEAS RPT COMPLTD & CESPD ISSUES DIV. ENGR. PN	11-Apr-1995		11-Apr-1995
ST.&FED REVW	STATE & FED AGEN REVIEW COORD BY WLRC	18-Apr-1995	90.00 Dys E	17-Jul-1995
OK>FILE FEIS	WLRC ADVISES SPD TO FILE & DISTRIB. FEIS	18-Apr-1995	0.00 Dys E	18-Apr-1995
FEA DC REVW	WASH LEVEL REVIEW OF FEAS REP	18-Apr-1995	30.00 Dys E	18-May-1995
PUB REV FEIS	PUBLIC REVIEW OF FINAL EIS/FEASIBILITY REPORT	18-Apr-1995	30.00 Dys E	18-May-1995
WLRC SUBMISS	180 WLRC SUBMISSION; ST. WLRC/HQ/ASA REVIEWS	18-Apr-1995		18-Apr-1995

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List 16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
FEIS FILED	310 CESPD FILES FINAL EIS W/ EPA FOR PUBLIC REVIEW	18-Apr-1995		18-Apr-1995
DESIGN BASIS	CESPN PREPARES DRAFT BASIS FOR DESIGN	2-May-1995	30.00 Dys E	1-Jun-1995
CONTINUE PED	PED CONTINUES BEYOND FEAS AUTHORIZATION	2-May-1995	0.00 Dys E	2-May-1995
DPCA START	BEGIN FIRST DRAFT PCA (ER1165-2-131,PAGE 3)	2-May-1995	21.00 Dys E	23-May-1995
PREPARE ROD	CESPN REVIEWS FEIS/FEAS COMMENTS & DRAFTS ROD	18-May-1995	20.00 Dys E	7-Jun-1995
DR ASSESSMT	WLRC PREPS DRAFT ASSESSMENT	18-May-1995	14.00 Dys E	1-Jun-1995
DPCA COORD	COORD DPCA WITH LOCAL SPONSOR	23-May-1995	30.00 Dys E	22-Jun-1995
CESPN REVIEW	CESPN REVIEW OF DRAFT BASIS FOR DESIGN	1-Jun-1995	14.00 Dys E	15-Jun-1995
WLRC MEMO	WLRC MEMO TO HQ ON DR ASSESSMT	1-Jun-1995	7.00 Dys E	8-Jun-1995
PED START	200 INITIATE PED	2-May-1995		2-May-1995
SPD CMPT ROD	CESPD FINALIZES ROD & SUBMITS TO WLRC	7-Jun-1995	14.00 Dys E	21-Jun-1995
HQ&ASA COMMT	ASA & HQ COMMENTS TO WLRC	8-Jun-1995	7.00 Dys E	15-Jun-1995
REVISE B/D	CESPN REVISES DRAFT BASIS FOR DESIGN	15-Jun-1995	7.00 Dys E	22-Jun-1995
WLRC CON ASS	WLRC COMPLETES ASSESSMENT	15-Jun-1995	7.00 Dys E	22-Jun-1995
DC DOCUMMT	WLRC COORD & RESOLV COMMTS	21-Jun-1995	21.00 Dys E	12-Jul-1995

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
SUBMIT D B/D	SUBMIT DRAFT BASIS FOR DESIGN TO CESPD	22-Jun-1995	7.00 Dys E	29-Jun-1995
CESPD REVIEW	CESPD REVIEW OF DRAFT BASIS FOR DESIGN	29-Jun-1995	30.00 Dys E	29-Jul-1995
CHIEF REP PR	PREP FOR CHIEF'S REPORT SIGNING	17-Jul-1995	10.00 Dys E	27-Jul-1995
SEN REP BRF	190 SEN REPS BRIEF; SPN VISIT TO DC	17-Jul-1995		17-Jul-1995
ASA REVIEW	ASA FINAL REVIEW REPORT AND DLCA	27-Jul-1995	14.00 Dys E	10-Aug-1995
PERMITS END	940 FINAL PERMIT - RWRCB & C.C.C. APPROVALS	10-Jun-1995		10-Jun-1995
REVISE B/D	CESPN PREPARES FINAL BASIS FOR DESIGN	29-Jul-1995	14.00 Dys E	12-Aug-1995
HQ FIN COORD	HQ FIN COORD PRIOR TO CHIEFS REPORT	10-Aug-1995	7.00 Dys E	17-Aug-1995
SUBMIT F B/D	CESPN SUBMITS FINAL BASIS FOR DESIGN TO CESPD	12-Aug-1995	7.00 Dys E	19-Aug-1995
CHIEF REPORT	330 CHIEF'S REPORT SIGNED & SENT TO ASA(CW)	18-Aug-1995		18-Aug-1995
FORW REP ASA	HQ FORWARDS REPORT TO ASA	18-Aug-1995	63.00 Dys E	20-Oct-1995

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
APPROVE B/D	CESPD APPROVES FINAL BASIS FOR DESIGN	19-Aug-1995	7.00 Dys E	26-Aug-1995
HYDRO SURVEY	CONDUCT HYDROGRAPHIC SURVEYS	26-Aug-1995	45.00 Dys E	10-Oct-1995
DRAFT P & S	CESPN PREPARES DRAFT PLANS & SPECIFICATIONS	10-Oct-1995	50.00 Dys E	29-Nov-1995
FORW TO CONG	ASA FORWARDING OF REPORT TO CONGRESS	20-Oct-1995	22.00 Dys E	11-Nov-1995
ROD SIGNED	320 ASA(CW) SIGNS RECORD OF DECISION (ROD)	20-Oct-1995		20-Oct-1995
RPT>CONGRESS	340 ASA(CW) SUBMITS REPORT TO CONGRESS	11-Nov-1995		11-Nov-1995
SLACK>WRDA96		11-Nov-1995	325.00 Dys E	1-Oct-1996
REVIEW P & S	CESPN REVIEW OF DRAFT PLANS & SPECIFICATIONS	29-Nov-1995	21.00 Dys E	20-Dec-1995
REVISE P & S	CESPN REVISES DRAFT PLANS & SPECIFICATIONS	20-Dec-1995	14.00 Dys E	3-Jan-1996
SUBMIT P & S	CESPN SUBMITS DRAFT PLANS & SPECS TO CESPD	3-Jan-1996	7.00 Dys E	10-Jan-1996
CESPD REVIEW	CESPD REVIEW OF DRAFT PLANS & SPECIFICATIONS	10-Jan-1996	30.00 Dys E	9-Feb-1996
REVISE P & S	CESPN PREPARES FINAL PLANS & SPECIFICATIONS	9-Feb-1996	21.00 Dys E	1-Mar-1996

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
SUBMIT F P&S	CESPN SUBMITS FINAL PLANS & SPECS TO CESPD	1-Mar-1996	7.00 Dys E	8-Mar-1996
P&S REPRO	REPRODUCTION OF PLANS & SPECIFICATIONS	8-Mar-1996	15.00 Dys E	23-Mar-1996
PRES SIGNS	350 PRESIDENT SIGNS AUTHORIZING LEGISLATION	1-Oct-1996		1-Oct-1996
DPCA NEGOTIA	PCA FINAL NEGOTIATIONS WITH LOCAL SPONSOR	1-Oct-1996	30.00 Dys E	31-Oct-1996
DPCA>HQ	DRAFT PCA PACKAGE TO HQ FOR REVIEW	31-Oct-1996	9.00 Dys E	9-Nov-1996
DPCA HQ REV	DPCA PACKAGE REV BY HQ & FORWARDED TO ASA	9-Nov-1996	30.00 Dys E	9-Dec-1996
P&S START	500 START PLANS & SPECIFICATIONS	26-Aug-1995		26-Aug-1995
PCA ASA REV	ASA REVIEW OF PCA	9-Dec-1996	21.00 Dys E	30-Dec-1996
PCA>SPONSOR	PCA>SPONSOR FOR LOCAL SIGNATURE PROCESS	30-Dec-1996	40.00 Dys E	8-Feb-1997
PCA OK OASA	650 LCA APPROVED BY OASA (PRIOR TO EXECUTION)	30-Dec-1996		30-Dec-1996
R.E. ACQU	REAL ESTATE ACQUISITION PROCESS	8-Feb-1997	140.00 Dys E	28-Jun-1997

HUMBOLDT DEEPENING PROJECT SCHEDULE

Task & Milestone List

16-Mar-1995

Task name	Description	Earliest start	Planned duration	Earliest finish
PCA EXECUTED	690 PCA EXECUTED BY AGA (FOLLOWS LOCAL SPON SIGNING)	8-Feb-1997		8-Feb-1997
R.E. INIT	760 INITIATE REAL ESTATE ACQUISITION	8-Feb-1997		8-Feb-1997
PREP TO ADV	PREPARE TO ADVERTISE	8-Feb-1997	14.00 Dys E	22-Feb-1997
P&S APPROVED	590 CESPD APPROVES PLANS & SPECIFICATIONS	8-Mar-1996		8-Mar-1996
PED COMPLETE	290 P E D COMPLETE	8-Mar-1996		8-Mar-1996
REAL ES END	780 REAL ESTATE ACQUISITION COMPLETE	28-Jun-1997		28-Jun-1997
CONTRACT AD	CONSTRUCTION CONTRACT ADVERTISED	5-Jul-1997	30.00 Dys E	4-Aug-1997
ADVERTISE	950 START CONSTRUCTION BID ADVERTISEMENT	5-Jul-1997		5-Jul-1997
AWARD CNTRCT	CESPN AWARDS CONSTRUCTION CONTRACT	4-Aug-1997	1.00 Dys E	5-Aug-1997
CONST MANAGE	CONSTRUCTION MANAGEMENT	5-Aug-1997	0.00 Dys E	5-Aug-1997
AWARD CONST	960 CONSTRUCTION CONTRACT AWARDED	5-Aug-1997		5-Aug-1997
CONSTRUCTION	PROJECT CONSTRUCTION	5-Aug-1997	357.00 Dys E	28-Jul-1998
PHYSICAL END	990 PROJECT PHYSICALLY COMPLETE	28-Jul-1998		28-Jul-1998
CLOSEOUT	PROJECT CLOSEOUT	28-Jul-1998	90.00 Dys E	26-Oct-1998
AUDITS END	996 SPONSOR AUDITS COMPLETE	26-Oct-1998		26-Oct-1998
ACCEPT PROJ	999 FINAL ACCEPTANCE & TRANSF TO LOCAL SPONSOR	26-Oct-1998		26-Oct-1998