AD-A150 454 LUMMI BAY MARINA WHATCOM COUNTY WASHINGTON DRAFT DETAILED PROJECT REPORT A.. (U) CORPS OF ENGINEERS SEATTLE WA SEATTLE DISTRICT DEC 83 1/4

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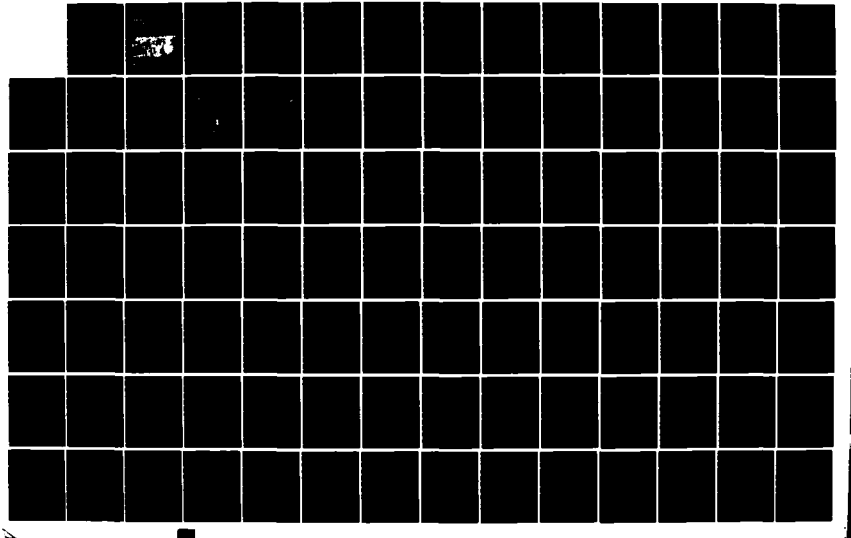

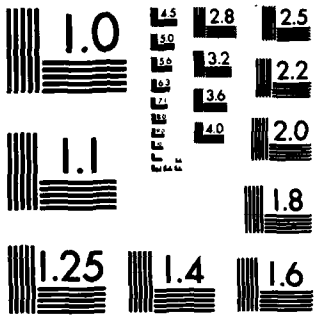

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DRAFT DETAILED PROJECT REPORT AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

LUMMI BAY MARINA
WHATCOM COUNTY, WASHINGTON

US Army Corps of Engineers
Seattle District

DECEMBER 1983

THIS DOCUMENT CONTAINS:

DRAFT DETAILED PROJECT REPORT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

PLATES

APPENDIXES

APPENDIX A - PRELIMINARY SECTION 404 EVALUATION FOR CONSTRUCTION OF LUMMI BAY MARINA WITH PUBLIC NOTICE, PUBLIC AND AGENCY REVIEW COMMENTS ON THE PUBLIC NOTICE, AND CORPS RESPONSES TO THESE COMMENTS

APPENDIX B - STUDY COORDINATION AND PUBLIC INVOLVEMENT (INCLUDES U.S. FISH AND WILDLIFE SERVICE REPORT, PUBLIC AND AGENCY COMMENTS ON THE DRAFT DETAILED PROJECT REPORT/ENVIRONMENTAL IMPACT STATEMENT, AND ON THE LUMMI BAY MARINA PROJECT, IN GENERAL, AND CORPS RESPONSES TO THESE COMMENTS)

APPENDIX C - ENGINEERING DESIGN AND COST ESTIMATES

APPENDIX D - ECONOMIC AND SOCIAL INVOLVEMENT

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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18. SUPPLEMENTARY NOTES

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Lummi Bay, Strait of Georgia, Lummi Indian Reservation, Federal navigation project, commercial fishing, small boat harbor, navigation improvements

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)
Conducted under Section 107 of the 1960 River and Harbor Act, as amended, the Corps of Engineers study determined the feasibility of federal involvement in constructing a navigation access channel and other improvements to service a proposed public commercial fishing boat marina at Lummi Bay in northwestern Washington. Principal features of the tentatively recommended plan are 1) a moorage basin for 438 commercial fishing boats with floats, docks, etc., and a public boat launching ramp for small boats to be built by the Lummi Indian Tribe behind a diked portion of their existing aquaculture pond project;

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2) federal navigation channel, 7300 feet long by 100 feet wide by 12 feet deep at mean lower low water with timber pile breakwater protection at the moorage basin entrance and a turning basin and local access channel; 3)disposal of approximately 1,470,000 cubic yards of material from channel and moorage basin dredging behind containment dikes to provide 65 acres of fill for marina support buildings and other water-related development by the Lummi Tribe; 4) mitigation for project-related impacts to shallow-water habitat by reintroducing 65 acres of the existing sea pond project not now in use for aquaculture to tidal action and preserving the portion as an undeveloped tidal area with establishment of wetland marshes and planting of eelgrass in selected areas; and 5) maintenance dredging of channels and moorage basin with disposal of about 2 to 3 acres of dredged fill every five years at a 25-acre site within the unused sea pond.

First cost of the project is estimated at $6,291,000 (October 1983 price level) with $1,820,000 allocated to the federal government and $4,471,000 allocated to local interests. Local sponsor is the Lummi Indian Tribe.

LUMMI BAY MARINA

WHATCOM COUNTY, WASHINGTON

DRAFT

DETAILED PROJECT REPORT

AND

ENVIRONMENTAL IMPACT STATEMENT

DECEMBER 1983

DEPARTMENT OF THE ARMY

SEATTLE DISTRICT, CORPS OF ENGINEERS

DRAFT DETAILED PROJECT REPORT
AND
DRAFT ENVIRONMENTAL IMPACT STATEMENT

LUMMI BAY MARINA, WHATCOM COUNTY, WASHINGTON

ABSTRACT: The responsible lead agency is the U.S. Army Corps of Engineers, Seattle District. Lummi Bay is located on the Lummi Indian Reservation in western Whatcom County, and adjacent to the Strait of Georgia and regional fishing grounds. Commercial salmon fishing is a principal means of economic livelihood and provides food subsistence for many Whatcom County fishermen, including the Lummi and Nooksack Indian Tribes as well. At the request of the Lummi Indian Tribe, and under the authority of Section 107 of the 1960 River and Harbor Act, as amended, the Seattle District investigated the feasibility of Federal participation in development of navigation improvements for a new public commercial fishing boat marina located on the Lummi Indian Reservation, and within a portion of the existing aquaculture pond (sea pond) in Lummi Bay. Squalicum Harbor provides the closest available public moorage facility for area fishermen, however, there is a shortage of available commercial fishing boat moorage space at that harbor, and throughout Whatcom County. While commercial fishing boat moorage shortages exist, economic justification for developing a new marina focuses upon moorage problems at Squalicum Harbor, due to the harbor's proximity to the Lummi Reservation, plus the large number of Lummi Indian fishing boats mooring at this facility. During the summer fishing season, when fishing is most intensive, the lack of additional moorage at Squalicum Harbor poses severe overcrowded harbor conditions, ranging from boat damages due to rafted boats bumping into each other, to delays incurred to fishermen in leaving the Harbor. In the absence of additional wet moorages, moorage overcrowding will continue at Squalicum in spite of the harbor's current expansion program. Alternatives to wet moorage were considered in addition to various wet moorage sites within the county, during the Corps of Engineers Detailed Project Report feasibility study (and evaluated during the preparation of an accompanying environmental impact statement). The study indicated that a Federal interest exists in cost-sharing construction of navigation channel and breakwater improvements to service the Lummi Bay Marina. The proposed marina will provide moorages for 438 Indian and non-Indian commercial fishing boats, thus increasing the available regional supply of wet moorages, while significantly reducing current and projected future overcrowding within Squalicum Harbor. In addition to nonfederally provided moorage slips and aforementioned Federal navigation improvements, the marina project will also include miscellaneous nonfederally provided water dependent marina and marina-related features (constructed upon dredged fill material) and various environmental design and mitigation items. The plan was selected based on its fulfillment of the planning objective and planning criteria. If you would like further information please contact:

Environmental Impact Statement

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Detailed Project Report

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PLEASE SEND YOUR REVIEW COMMENTS ON THE DRAFT REPORT TO THE DISTRICT ENGINEER BY 9 MARCH 1984.

NOTE: Information, displays, maps, etc., discussed in the Detailed Project Report are incorporated by reference in the Environmental Impact Statement.

EXECUTIVE SUMMARY

The study for a new public commercial fishing boat marina in Lummi Bay, Whatcom County, was conducted at the request of the Lummi Indian Tribe, and under the authority of Section 107 of the 1960 River and Harbor Act, as amended. Section 107 authorizes the Secretary of the Army to allocate funds for planning, design, construction, and maintenance of small navigation projects when, in the opinion of the Chief of Engineers, such work is advisable. The purpose of this Detailed Project Report (DPR) study was to document the need for and feasibility of providing a new public commercial fishing boat marina in Lummi Bay and to determine if a Federal interest exists in project development.

There is a shortage of commercial fishing boat wet moorages in Whatcom County. The DPR study indicated that area marinas are operating at above capacity and cannot accommodate the existing and projected surplus of commercial fishing boats requiring moorage. For both Indian and non-Indian commercial fishermen, overcrowded wet moorage conditions at Squalicum Harbor, the closest available moorage facility, have resulted in the need to raft commercial fishing boats. This situation is particularly severe during the intensive summer fishing season, and poses navigation safety problems for both the boater and Squalicum Harbor operations. The Lummi Indian fishing fleet is the largest Indian fleet in Washington State. The majority of the Lummi fleet and some boats of the nearby Nooksack Tribe moor at Squalicum Harbor, due to the lack of protected harbors on either reservation. For the commercial fisherman, marina development at a Lummi Reservation site offers advantages over Squalicum Harbor, including a reduced sailing time to the fishing grounds and elimination of vessel damages caused by overcrowded conditions and, for Lummi Indian fishermen residing on the reservation, a reduced travel time from residence to the marina. Other economic benefits are discussed in this report.

During the early stage of the DPR study, a number of alternative concepts were considered to address the demand for permanent wet moorage for commercial fishing boats. These included no action, dry storage and wet moorage. Dry storage was dropped from further consideration because it failed to satisfy the planning objective and criteria. No-action and wet moorage concepts were evaluated in detail. Alternate wet moorage sites within the county were evaluated on the basis of the planning objective and criteria. In screening the wet moorage sites, legal, financial, policy, social, economic, environmental, and design criteria were considered, as well as public and agency concerns. Based upon the evaluation, only the recommended Lummi Bay site was found to satisfy the planning objective and criteria. Detailed planning focussed on a new public commercial fishing boat marina at the northwest corner of the existing Lummi Indian sea pond aquaculture project in Lummi Bay.

Technical studies and agency and public input indicate that the public interest would best be served by a navigation improvement plan for a new public commercial fishing boat marina in Lummi Bay involving the following major provisions:

o Construction of a 7,300-foot-long by 100-foot-wide by 12-foot-deep (at mean lower low water - MLLW) navigation entrance channel in Lummi Bay to a new small boat basin located in the northwest corner of the existing sea pond.

o Construction of a 200-foot-long by 200-foot-wide by 12-foot-deep (MLLW) turning basin and a 1,400-foot-long by 100-foot-wide by 12-foot-deep (MLLW) moorage basin access channel.

o Reinforcement of portions of the existing sea pond dike and construction of timber-pile breakwaters as protection for the moorage basin.

o U.S. Coast Guard navigation aids to mark the entrance channel.

o Construction of a 438-berth commercial fishing boat moorage basin (with variable depths of -10 to -12 feet MLLW). The basin will include various marina features, such as a public boat launch ramp, access docks, fuel float, work floats, wharves, and marine way to facilitate large boat haulout (for shipyard repairs).

o Development of upland, water-dependent and marina-related features situated on 65 acres, to be constructed on approximately 1,470,000 cubic yards of material dredged from the channel and basin improvements. Upland development includes (but is not limited to) a fish processing plant, a shipyard, web houses, net repair areas, marina administration office, and necessary access roads, utilities and parking areas. Construction of approximately 4,850 lineal feet of dikes will be required to contain the dredged material.

o Mitigation measures for project-induced losses associated with shallow-water habitat, includes reintroduction of portions of the sea pond near the proposed marina to Lummi Bay tidal action; establishment of tidal marshes, and planting of eelgrass on and adjacent to the navigation entrance channel side slopes and in the marina basin periphery area.

The recommended plan would:

o Alleviate the regional shortage of commercial fishing boat wet moorages.

o Reduce fishing boat operating costs.

o Reduce boat rafting damages.

o Enhance land values at the marina.

o Provide employment opportunities for unemployed or underemployed persons on the Reservation and within Whatcom County.

o Mitigate for adverse environmental impacts.

o Enhance Lummi Indian opportunities for economic self-reliance, in light of the President's 1983 Indian Policy.

Federal responsibilities include initial and maintenance dredging of the navigation channel and turning basin improvements, construction and maintenance of breakwater improvements, including breaching the northwest portion of the existing sea pond dike to create the moorage basin entrance; and installation and maintenance of navigation aids. The responsibility for and cost of monitoring of water quality associated with construction dredging and disposal would be shared with the local sponsor, and coordinated with environmental agencies. To mitigate for removal of productive herring spawning eelgrass resulting from construction of the entrance channel, approximately 7 acres of eelgrass will be replanted (adjacent to and on portions of both the channel and the moorage basin) immediately following project construction. For the first 5 years following project construction, the Corps and local sponsor would monitor the status of eelgrass rejuvenation and marsh productivity, and replanting would occur, if required. The local sponsor would construct and maintain all remaining project features to include interior sea pond dikes, moorage basin dredging, breaching of the southwestern portion of the sea pond dike to provide an opening of approximately 300 lineal feet to promote tidal action to the mitigation area adjacent to the basin, various moorage basin features (e.g., marina floats, ramps, docks, utilities), construction of all mitigation features, (including planting of eelgrass and marsh establishment), and all upland development features.

Total first cost of the recommended plan required to claim project economic benefits would be $6,291,000, reflecting October 1982 price levels. The following apportionment of project first cost reflects Federal cost sharing limitations under Section 107 of the 1960 River and Harbor Act, as amended: The first cost to the Federal Government would be $1,820,000, which includes the $78,000 aids to navigation by the U.S. Coast Guard. The remaining revised project first cost of $4,471,000 assigned to the Lummi Tribe, as local sponsor, includes $422,000 for the remaining Federal share of the first costs of general navigation facility improvements; $1,218,000 for the non-Federal share of construction first costs of the general navigation facility improvements; and $2,831,000 for construction of self-liquidating associated marina facilities necessary to claim economic benefits related to construction of a Federal project. Cost details are discussed in the Detailed Project Report. The Lummi Tribe would also invest approximately an additional $18,000,000 to construct all remaining nonproject associated upland water-dependent and marina-related features.

Average annual costs over the project life, including average annual increased maintenance costs and interest during construction, would be $596,000 and the average annual benefits would be $732,000 resulting in a benefit-to-cost ratio of 1.2 to 1.0.

TABLE OF CONTENTS

TABLE OF CONTENTS (con.)

TABLE OF CONTENTS (con.)

TABLES

TABLE OF CONTENTS (con.)

DETAILED PROJECT REPORT

SECTION 1. BACKGROUND

1.01 Study Authority. This detailed project report (DPR) is submitted in accordance with provisions of Section 107 of the 1960 River and Harbor Act, as amended. Section 107 authorizes the Secretary of the Army to allocate funds for planning, design, construction, and maintenance of small navigation projects when, in the opinion of the Chief of Engineers, such work is advisable. Not more than $2 million of Federal funds can be allocated under this authority for planning, design, and construction of any one project.

1.02 Type of Study. This DPR presents the results of a feasibility study for construction of a new public commercial fishing boat marina complex within a portion of the existing tribal aquaculture project (sea pond) in Lummi Bay. The study was conducted by the Seattle District, U.S. Army Corps of Engineers, under the above authority in response to a 27 June 1980 written request from and in subsequent coordination with the Lummi Indian Tribe.[1/] The Tribe acted as local sponsor for the DPR study.

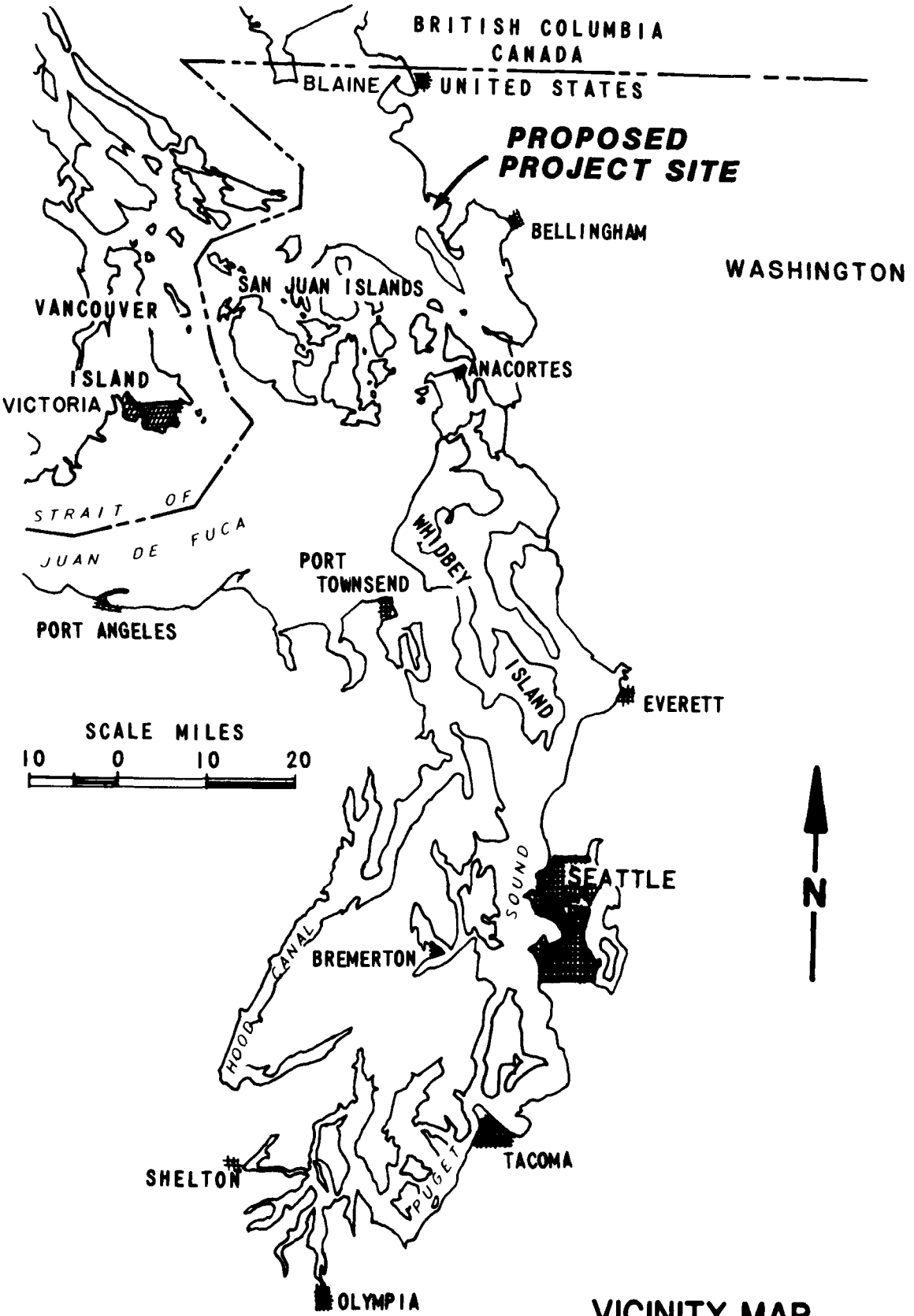
1.03 Location of Study Area. Lummi Bay is situated adjacent to the Strait of Georgia on the Lummi Indian Reservation, in western Whatcom County, Washington. It is also located approximately 100 nautical miles northwest of Seattle; 7 nautical miles northwest of Bellingham and 40 miles south of Vancouver, British Columbia, Canada (figure 1-1). Lummi Bay is bordered on the north, south, and east by Reservation uplands, including Sandy Point to the northwest, and Gooseberry Point to the southeast; and Strait of Georgia on the west (figure 1-2).

1.04 Needs. By letters dated 19 October 1981 and 23 June 1982 (appendix B), the Lummi Tribe requested Federal assistance in construction of a new public commercial fishing boat marina on the Reservation, to help alleviate the shortage of American Indian and non-Indian commercial fishing boat moorage space in Whatcom County.

1.05 The Lummi fishing fleet and other Indian and non-Indian commercial fishermen lack adequate berthing facilities in Whatcom County. The Lummi fleet is one of the largest in the state and the majority of tribal members depend upon open-water fishing for their economic livelihood and subsistence. The commercial fishing industry is the largest single employer on the Lummi Reservation. Squalicum Harbor at Bellingham, Washington, offers the closest available public moorage facility to the Lummi Indian Reservation in southern Whatcom County. Commercial fishing boat moorage is at a premium. Blaine Harbor, operated by the Port of Bellingham and situated approximately 25 miles north of Bellingham, offers the closest available public moorage in northern Whatcom County. However, the Blaine marina is also at capacity.

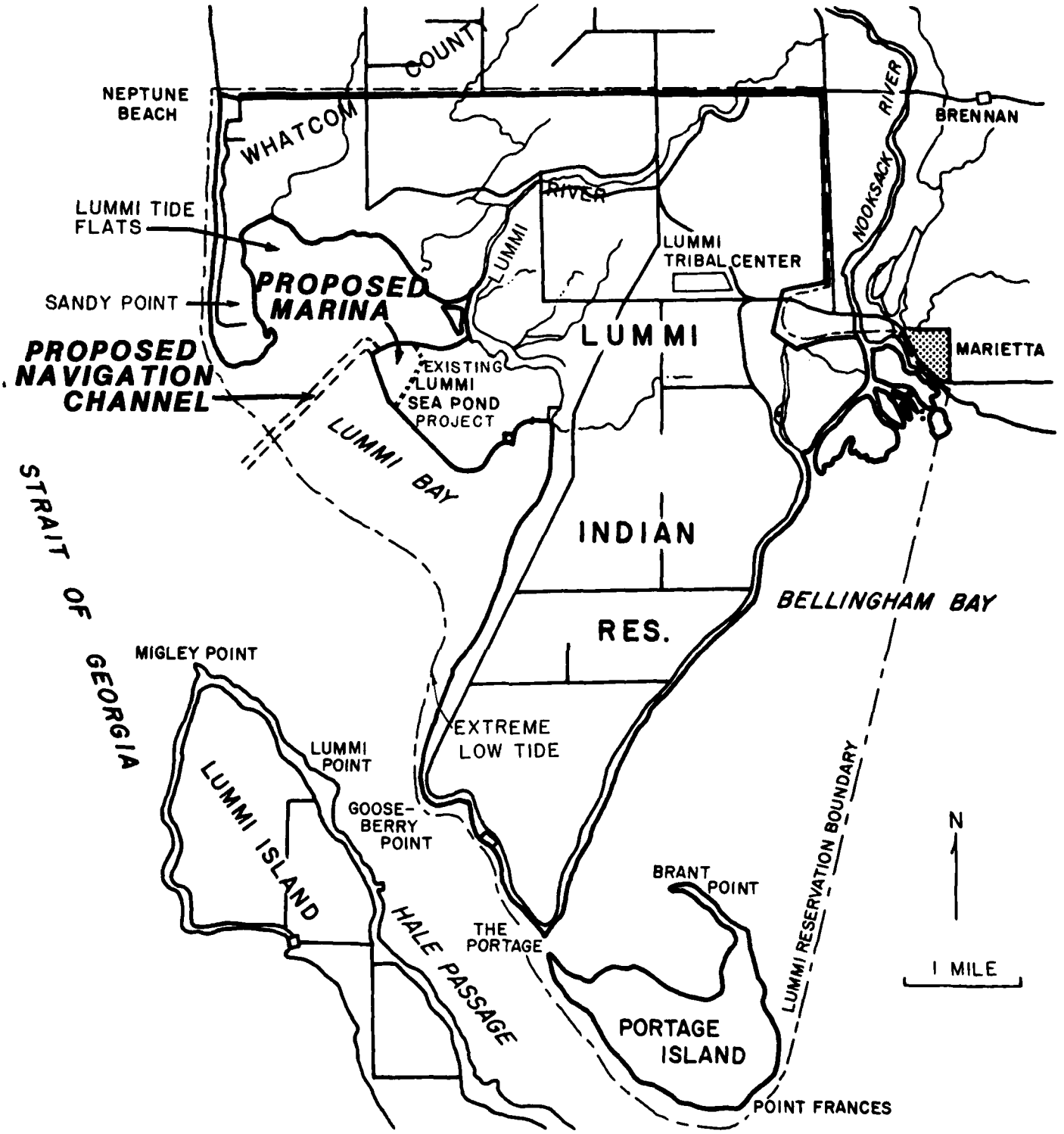
1.06 A regional shortage of berthing facilities for commercial fishing boats exists and will continue to occur, even with expansion of moorages at Squalicum Harbor, where Federal navigation improvements were completed by the Seattle District in 1980, under the Section 107 authority. Squalicum Harbor overcrowding, which currently poses navigation safety and boat damage problems, will

1/Pertinent correspondence is reproduced in appendix B.



VICINITY MAP
LUMMI BAY MARINA

FIGURE 1-1



PROJECT LOCATION MAP
LUMMI BAY MARINA

FIGURE 1-2

continue in the future. In 1982, Squalicum Harbor contained 204 commercial fishing slips; when expansion is completed by 1984, the supply of slips will increase to 444. During the fishing season, the number of fishing boats increases to between 650-700. A large portion of the Indian and non-Indian fleet, particularly gillnet and seiner boats, must be lashed together, several vessels abreast, to moor in the protected harbor at Squalicum. This condition, known as "rafting," has resulted in structural boat damage and, on occasion, fisherman inconvenience due to delays incurred in leaving Squalicum Harbor for the fishing grounds. The proposed Lummi Bay Marina project has been designed to accommodate the projected surplus of commercial fishing boats without permanent moorage which would raft at Squalicum Harbor. Appendix D discusses economic assumptions relating to moorage problems and used to derive project benefits.

1.07 For purposes of the DPR study, development of commercial fishing boat benefits (e.g., operating cost savings, opportunity costs and reduction of rafting damage) associated with a new marina at Lummi Bay, took into account the Squalicum Harbor facility as part of the "future without-project" condition. Squalicum Harbor officials indicate that transfer of the surplus commercial fishing fleets out of Squalicum Harbor to the proposed Lummi Bay Marina is desirable and will not adversely impact Squalicum's financial condition because income from moorage fees for rafted boats is minimal and is preferable to the potential for safety, boater inconvenience, and navigation hazards created by the current overcrowding situation. The Port of Bellingham, which owns and operates Squalicum Harbor, has endorsed the proposed project (see Port correspondence dated 22 September 1982 and 15 August 1983 - appendix B).

1.08 The Lummi Tribe has invested over $50,000 in studies to evaluate the feasibility of developing a new small boat harbor (marina) on the Reservation to alleviate moorage overcrowding for both the Lummi fleet, and other commercial fishing boats; to reduce vehicular travel time from residence to marina, and to increase employment opportunities and income for the Tribe. These studies were evaluated during the Corps DPR study.

1.09 Pertinent References. Pertinent references applicable to the socioeconomic, engineering and design, and environmental aspects of the study are listed in appropriate appendixes.

SECTION 2. PLANNING OBJECTIVE AND CRITERIA

2.01 Planning Objective. The planning objective for this study is to satisfy a portion of the need for additional public commercial fishing boat wet moorage in Whatcom County, specifically on the Lummi Indian Reservation, and to provide appropriate wave protection for these new moorages.

2.02 Planning Criteria.

a. General. In formulating plans to meet the planning objective, a wide range of planning criteria was considered. These criteria were used to screen and evaluate alternative plans and to measure each plan's contribution to the evaluation parameters or criteria of: National Economic Development (NED), Environmental Quality (EQ), Regional Development (RD), and Other Social Effects (OSE), of the Water Resources Council's Principles and Guidelines. The comparative evaluation of alternative plans developed during initial plan formulation is presented in section 3. The criteria considered include identified outputs, factors such as conditions which impose constraints and limitations on the planning process, and rules and guidelines for evaluation of the plans. The criteria also include other needs, opportunities, and concerns in addition to the primary planning objective. Not all the criteria are compatible, and no plan could fully satisfy all of them. Applicable planning criteria for the study are presented in the following paragraphs under the account to which they are primarily related.

b. National Economic Development (NED) Criteria. The NED criteria are used to guide the formulation of alternative plans to meet the objective of developing maximum net benefits to the nation. The pertinent NED criteria are as follows:

- o Alleviate a regional shortage of commercial fishing boat moorages.
- o Provide adequately sized moorage facilities to accommodate existing and future surplus commercial fishing boats at area harbors (but principally at Squalicum Harbor).
- o Reduce commercial fishing boat damage, fisherman injury, and additional boater and Port of Bellingham operating costs due to overcrowded moorage conditions at Squalicum Harbor.
- o Reduce commercial fishing boat running time from home port to fishing grounds.
- o Increase employment opportunities for unemployed or underemployed individuals.
- o Provide appropriate wave protection within the project to insure safe moorage of commercial fishing boats.
- o Provide annual plan benefits which exceed annual costs, considering environmental effects.

o Use the current Federal discount rate of 7-7/8 percent in determining annual costs and in discounting future benefits.

o Use a 50-year project economic life in plan economic analysis.

o Include in average annual cost estimates interest and amortization of construction costs and provision for annual maintenance, operation, and major component replacement.

o Insure that plans are implementable within a range of likely future economic conditions.

o Insure that plans developed reflect the Administration's policy of promoting Indian Tribe economic self-reliance.

c. Environmental Quality (EQ) Criteria. The EQ criteria which follow consist of specific environmental resource related concerns, constraints, and opportunities. These include criteria imposed by Federal, state, and local regulations and those uniquely related to the Lummi Bay project area. The environmental resources of this are described in the environmental impact assessment. EQ criteria include the following:

o Preserve the natural and beneficial values of the developed and underdeveloped portions of the saltwater flood plain in the study area in conformance with Executive Order (EO) 11988. The requirements of EO 11988 are presented in more detail in section 4.02f of the accompanying Environmental Impact Statement (EIS).

o Preserve the wetlands in the study area in conformance with EO 11990. The requirements of EO 11990 are presented in more detail in section 4.02f of the EIS.

o Preserve the shore zone habitat critical to fish and wildlife, including shallow water areas.

o Preserve or salvage any significant (as determined by National Register of Historic Places criteria) historic and prehistoric cultural resource sites affected by potential project construction or effects in accordance with the authorities contained in existing legislation and executive orders, including the National Historic Preservation Act of 1966; the Reservoir Salvage Act of 1960, as amended by Public Law 93-291; and EO 11593.

o Compliance with the Federal Coastal Zone Management Act is not required since lands held in Federal trust are exempt. However, the Lummi Indian Tribe has adopted an ordinance implementing a Lummi Tribe Coastal Zone Management Plan which delineates allowable uses in specified areas.

o Comply with the land use plans of the Lummi Indian Reservation.

o Protect any threatened or endangered species in the study area and their critical habitat.

o Protect Indian and non-Indian fishery operations in the study area.

o Preserve or enhance water quality in the study area in conformance with Section 404 of the Clean Water Act of 1977 (Public Law 92-500), as amended.

o Avoid decreasing existing air quality in the study area.

d. Regional Development (RD) Criteria. The RD criteria consist of opportunities related to increased economic efficiency within the Lummi Bay study area that do not necessarily provide increases in NED. This list also includes areas of concern listed in Section 122 of Public Law 91-611. Regional development criteria include the following:

o Increase employment in Whatcom County and on the Lummi Indian Reservation during plan implementation.

o Contribute to county and Reservation development and growth by reducing constraints to boating-related economic activity.

o Increase net income to county and Reservation businesses during plan implementation.

o Encourage local expenditures for improvement of community facilities (e.g., schools and utilities).

o Increase property values within the study area.

o Increase tax revenues within the study area.

e. Other Social Effects (OSE) Criteria. The OSE criteria listed below include those engineering policy standards that were applied to all alternatives to assure the maintenance of public health and safety and those opportunities and constraints related to the social well-being of people. This list also includes area of concern listed in Section 122 of Public Law 91-611. OSE criteria include the following:

o Increase community cohesion within Whatcom County and the Lummi Indian Reservation.

o Avoid the relocation of residential properties.

o Avoid the relocation of public facilities and properties and the resulting inconvenience to residents during construction.

- Avoid increased noise levels in the study area.
- Preserve the aesthetic values along the Lummi Bay shoreline.
- Provide vehicular access to the marina public boat launch ramp.

SECTION 3. FORMULATION AND EVALUATION OF ALTERNATIVES

3.01 Plan Formulation Approach. The plan formulation process begins with the identification of the planning objective and the planning criteria. A range of structural and nonstructural alternatives concept is then identified to address the planning objective. Concepts which meet the planning objective emerge from the preliminary screening and are further evaluated and refined. Refinements are based on the results of additional technical studies and an extensive program of interagency and local sponsor coordination to formulate realistic alternatives. Final alternatives are evaluated against the planning criteria, and a detailed system of accounts is developed to measure their contribution to the NED, EQ, RD, and the OSE accounts of the Water Resources Council's Principles and Guidelines.1/ Based on the results of this analysis, the alternative that results in maximum net economic return, consistent with protecting environmental quality, is designated.

3.02 Preliminary Analysis and Screening of Concepts. Alternative concepts formulated in response to the moorage and wave protection needs were:

- o No action
- o Dryland Storage
- o Wet Moorage

3.03 The no-action alternative concept was carried into the final analysis as the nonstructural alternative in accordance with the Water Resources Council's Principles and Guidelines (see paragraph 3.06 for additional discussion). The dryland storage concept was dismissed from further consideration early in the initial screening as being unresponsive to the planning objective of providing needed additional wet commercial fishing boat moorages in Whatcom County, in general, and on the Lummi Reservation, in particular. Dry storage is discussed in paragraph 3.07 of this report.

3.04 The alternative concept of wet moorage was identified to satisfy the planning objective. Various Whatcom County and Lummi Reservation sites were considered either for marina expansion or new marina development. These sites are discussed later in this section. Principal evaluation factors involving marina expansion include availability of adequate water and back-up land area; and desires of local interests. Based upon preliminary evaluation, expansion of existing marina sites in Whatcom County was not feasible.

3.05 Several new marina sites (figure 3-1) on the Lummi Reservation were subsequently analyzed in response to the planning objective and planning criteria. Principal considerations for new sites include desires and financial capability of the local sponsor; project economic feasibility, environmental constraints, engineering limitations; and public and agency acceptance. Based upon preliminary evaluation of the alternative wet moorage sites, only a marina at the northwest portion of the existing aquaculture pond (sea pond) in Lummi Bay satisfied applicable evaluation criteria. Therefore, other alternative sites

1/See table 3-1 of the DPR.

were dismissed from further consideration. Table 3-1 presents a summary comparison of the final alternatives. Each of the concepts and final alternatives are discussed in the following paragraphs.

3.06 Alternative 1 - No Action (Nonstructural Plan).

a. Description. The concept of no action reflects the "without" plan condition and provides the basis for comparison of the tentatively recommended final plan. This alternative would not satisfy the objective of providing additional wet moorages within the study area. Commercial fishing boat overcrowding would continue at Squalicum Harbor, posing boat damage, and boater navigation safety.

b. Evaluation with Key Criteria.

(1) National Economic Development (NED) Criteria.

- Additional moorages would not be provided, therefore foregoing an increase in national benefits.

- Overcrowded moorage conditions at Squalicum Harbor would continue, resulting in continued boat damage, boat operating costs, and boater concerns over navigation safety.

- There would be net increases in employment opportunities.

(2) Environmental Quality (EQ) Criteria.

- Wetlands in the study area would be preserved.

- Threatened or endangered species and their habitat would be preserved.

- Shoreline habitat critical to fish and wildlife would be preserved.

- The Lummi Indian Tribe Coastal Zone Management Programs would be complied with.

- Existing air quality in the study area would be preserved.

(3) Regional Development (RD) Criteria.

- This alternative would not result in increased regional employment.

- This alternative would not result in net income to region businesses.

- This alternative would not result in increased per capita income.

TABLE 3-1

SUMMARY COMPARISON OF FINAL ALTERNATIVES

Item	Alternative 1 No Action (Nonstructural Plan)	Alternative 2 Lummi Bay Marina Sea Pond Site (NED/Recommended Plan)
a. Plan Description		
1. Structural Measures	None	Navigation entrance and access channels and turning basin. Breakwater protection. Moorage basin to accommodate 438 commercial fishing boats. Marina support development located on upland fill. Disposal of maintenance dredging material within upland containment dikes.
2. Nonstructural Measures	None	Interagency water quality monitoring during construction.
3. Fish and Wildlife Mitigation	None	Establishment of tidal areas reintroduced to tidal action. Establishment of wetland vegetation areas. Postconstruction inspection and planting eelgrass.
b. Construction Investment Costs		
Federal Costs	None	$1,820,000 1/
Non-Federal Costs	None	4,471,000
Total Construction Cost	None	$6,291,000
Interest During Construction	None	329,000
Total Investment Cost	None	$6,620,000

1/Engineering and design, supervision and administration, and contingencies costs. Allocation of costs reflect Federal and non-Federal responsibilities and funding constraints imposed by Section 107 authority and include U.S. Coast Guard navigation aids costs. There are no costs required for lands, easements, and rights-of-way associated with project construction.

TABLE 3-1 (con.)

Item	Alternative 1 No Action (Nonstructural Plan)	Alternative 2 Lummi Bay Marina Sea Pond Site (NED/Recommended Plan)
c. Response to Planning Criteria		
1. National Economic Development		
(a) Transportation savings due to reduced boat running time to fishing grounds and reduced vehicular driving time from home to new marina.	No Change	Cost Savings
(b) Transportation savings due to reduction in boat damages caused by rafting.	No Change	Cost Savings
(c) Reduced fisherman injury caused by rafting.	No Change	Cost Savings
(d) Total annual benefits.	None	$732,000
(e) Total annual costs.	None	$596,000
(f) Benefit-to-Cost Ratio.	N/A	1.02 to 1
(g) Planning Objective. Provide additional fishing boat wet moorage in Whatcom County and on the Lummi Reservation.	No Change	Yes
2. Environmental Quality		
(a) Water Quality	No Change	Temporary and Permanent Decrease
(b) Commercial Fishery	No Change	Increased Moorage
(c) Air Quality	No Change	Temporary Decrease
(d) Relation to Coastal Zone Management Plan	Yes	Variance from Designated Uses Required

TABLE 3-1 (con.)

Item	Alternative 1 No Action (Nonstructural Plan)	Alternative 2 Lummi Bay Marina Sea Pond Site (NED/Recommended Plan)
(e) Compliance with land use upland.	Yes	Yes
(f) Wildlife		
Endangered Species	No Change	Under Investigation 2/
Aquatic Fauna	No Change	Major Change
(g) Avian Fauna	No Change	Moderate Change
(h) Wetlands	No Change	Major Change
3. Regional Development		
(a) Long-term Employment	No Change	Yes
(b) Construction Employment	No Change	Temporary Increase
(c) Property Values	No Change	Increased Value
(d) Net Business Income	No Change	Increased Value
(e) Tax Revenues	No Change	Temporary Increase
4. Other Social Effects		
(a) Life, Health, and Safety	Long-term Adverse	Long-term Beneficial
(b) Community Cohesion	Long-term Adverse	Long-term Beneficial
(c) Relocation of Public and Residential Properties.	None Required	None Required
(d) Aesthetics	No Change	Long-term Beneficial and negative changes (depending upon individual values)
(e) Noise Levels	No Change	Temporary Increase

2/Potential impacts to the Peregrine Falcon are unknown at this time and so are under investigation (see EIS, sections 3.02b(8) and 4.02b(z)).

(4) Other Social Effects.

- No increase and possibly a decrease in community cohesion within Whatcom County and the Lummi Reservation may result.

- Relocation of residential properties and public facilities would be avoided.

- Noise levels in the study area would probably not increase.

- Existing aesthetic values along the Lummi Bay shoreline would be preserved.

3.07 Dryland Storage. This alternative concept, which included development of dryland storage facilities within the Lummi Reservation-Squalicum Harbor vicinity to accommodate fishing boats requiring moorage, was dismissed after initial screening as being unresponsive to the planning objective. This plan would also be a local option and could not include participation by the Corps of Engineers under Section 107 of the 1960 River and Harbor Act, as amended, because Federal involvement under this program is restricted to improvements in navigable waters. It would require a launching ramp with a secured upland area for storage of trailered boats, generally limited to those under 27 feet in length, or a tiered structure with provisions for removing the boats from the water and subsequently stacking them in tiers in the structure. Facilities of this type are typically limited to smaller boats. Sufficient back-up land would be required to store the surplus commercial fishing boats - particularly the larger gillnet and seine craft.

3.08 This concept would not meet the planning objective. No adequate upland areas are available for this plan in the vicinity of Squalicum Harbor or the Lummi Reservation. Another principal reason for eliminating storage as a practical alternative involves the intensity of in-port boat traffic during the commercial fishing season. Individually assigned wet moorages for commercial fishing boats are preferable over a rafting condition for several reasons, including: (1) the ability to quickly take on provisions or crew members, (2) the convenience of a safe area to make minor repairs without the inconvenience and obstructions caused by rafting boats, (3) the convenience of having an assigned moorage space rather than being subjected to boat rafting, and (4) the advantages of paying for utility services on a user basis rather than on a community-wide basis.

3.09 Wet Moorages.

a. General. Wet moorages would more completely satisfy the planning objective of providing needed commercial fishing boat moorages in Whatcom County and specifically on the Lummi Reservation. This conceptual alternative would also be eligible for Federal participation by the Corps of Engineers in planning and construction.

b. Site Selection. Various potential marina sites within Whatcom County and on the Lummi Reservation were evaluated for their ability to provide suitable wet moorages according to the planning objective and general criteria outlined in section 2. Expansion of existing sites within the county was considered, focussing upon development of new marina sites on the Lummi Reservation. This section discusses the plan formulation process, leading to location of the proposed Lummi Bay Marina at the northwest corner of the diked (aquaculture) sea pond project as the recommended plan.

c. Expansion of Existing Marinas. Expansion of moorages at existing marinas was considered, but discarded after initial evaluation. Outside of the Lummi Reservation, expansion of the two existing Port of Bellingham operated public marinas in Whatcom County was evaluated. During the fishing season, rafting of fishing boats at both marinas is not uncommon, due to a shortage of wet moorages. However, the Port of Bellingham has no future plans to expand Blaine Harbor, (currently at moorage capacity, and located within the city of Blaine (see figure 1-1) and approximately 25 nautical miles north of Squalicum Harbor) because the Port does not foresee a demand for expansion of the present Blaine facility to accommodate permanent moorage for the estimated 438-boat surplus commercial fishing fleet projected to moor at the Lummi Bay Marina. According to Port officials, transient non-Indian fishing boaters are willing to undergo the inconvenience of rafting at Blaine due to the short non-Indian fishing season. The larger Indian commercial fleet traditionally bypasses rafting moorage at Blaine altogether due to the longer Indian season. With less of a time restriction, any incentives for the moorage of the Indian fleet at a Blaine facility might therefore be less appealing than permanent moorage closer to home port. In principal, the majority of commercial fishermen in Whatcom County moor in and around the Bellingham area close to their residence. The inconvenience, increased travel time and travel cost associated with permanent moorage away from home port outweigh any possible advantage to a Blaine expansion - even were the Port of Bellingham to consider such a proposal. Accordingly, this site was dismissed from further consideration and at the request of the Port. The Port of Bellingham also operates Squalicum Harbor in Bellingham (see figure 3-1 for location). Squalicum Harbor serves the Lummi and Nooksack Tribal Fishing Fleet as well as non-Indian commercial fishing boats. The marina currently contains 284 wet moorage slips. By 1984, the Port will expand the commercial fishing boat moorage capacity to a maximum of 444 slips due to a recently completed Corps of Engineers navigation project, constructed under authority of Section 107 of the 1960 River and Harbor Act. During the typical fishing season, it is not uncommon for 650 to 700 commercial fishing boats to desire wet moorage. Severe overcrowding exists and will continue in spite of the planned marina expansion. The Port is constrained from further marina expansion because of existing development which precludes adjacent marina development. Squalicum Harbor is bordered on the east by the Columbia Cement Plant and to the west by the Georgia Pacific pulp and paper mill and waste water treatment plant complex. Accordingly, this site was dismissed from further consideration at the request of the Port of Bellingham and because it failed to satisfy the planning objective. Other marinas in Whatcom County are privately operated and operating at or above capacity during the commercial fishing season. These sites are addressed in appendix D. Furthermore, since the Federal Government may not participate in private

navigation improvements, private marina expansion was discarded after initial evaluation. The analysis of wet moorage sites subsequently shifted to potential wet moorage sites within the Lummi Reservation.

d. Lummi Indian Reservation Marina Sites. Developing moorages at sites other than the northwest corner of the sea pond in Lummi Bay was considered, but discarded after initial evaluation. The saltwater shoreline of the Reservation was analyzed for possible marina development. The following five marina sites (figure 3-1) on the Lummi Reservation were identified and subsequently evaluated during this DPR study for their ability to satisfy the planning objective and criteria:

(1) East Sandy Point Site. This is one of three marina sites previously evaluated for environmental feasibility by the Oceanographic Institute of Washington (OIW), under contract to the Lummi Tribe.[1/] Sites also evaluated as part of this consultant study included Onion Bay and Gooseberry Point. According to the OIW study, marina development including navigation channel access at East Sandy Point would have required extensive dredging and shoreline fill. Potential environmental problems associated with marina development at this site include adverse impacts to marine fauna and their habitat associated with dredging and construction of marina support areas on a tidal wetland, lack of suitable access roads, noncompliance with current zoning (the Lummi Indian Coastal Zone Management Plan precludes commercial development within this residential area of Sandy Point. During DPR study plan formulation, this site was rejected from further analysis at the request of the Lummi Tribe (local sponsor), due principally to attendent environmental problems (see section 2 for criteria).

(2) Onion Bay Site. Marina development at this site posed engineering and environmental problems similar to East Sandy Point. This site was also discarded from further analysis due to its inability to satisfy the planning criteria, and at the request of the local sponsor.

(3) Gooseberry Point Site. In 1981, the Seattle District completed a reconnaissance study for a combination recreation and commercial fishing boat marina at Gooseberry Point. The study was undertaken at the request of the Lummi Tribe, under Section 107 authority (see appendix B for correspondence). Reflecting its own independent evaluation of alternative sites including East Sandy Point, Onion Bay, and Gooseberry Point, the Tribe requested the reconnaissance study focus upon Gooseberry Point for a new marina site. No other sites were therefore considered during the Corps study. The Corps reconnaissance study subsequently demonstrated a Federal interest in navigation project development, and the current DPR study was recommended. The proposed Federal project is identified in the reconnaissance report.[2/]

1/Oceanographic Institute of Washington, Seattle, Washington, Environmental Assessment of Three Marina Sites on the Lummi Indian Reservation, 1977.
2/On file in the Seattle District office of the Corps of Engineers.

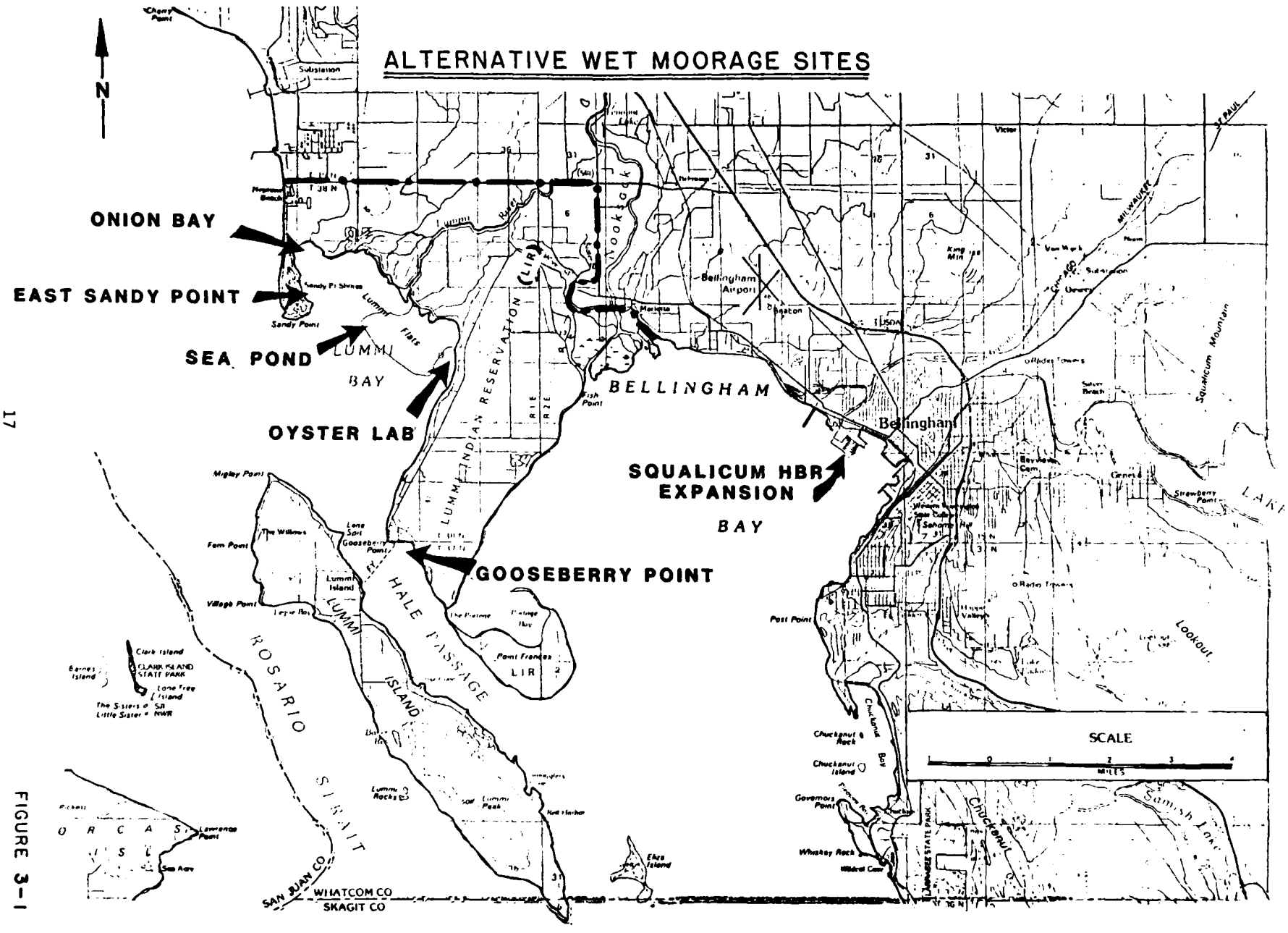

ALTERNATIVE WET MOORAGE SITES
N
ONION BAY
EAST SANDY POINT
SEA POND
OYSTER LAB
SQUALICUM HBR EXPANSION
GOOSEBERRY POINT
LUMMI BAY
BELLINGHAM BAY
LUMMI INDIAN RESERVATION (LIR)
HALE PASSAGE
LUMMI ISLAND
ROSARIO STRAIT
ORCAS ISLAND
SAN JUAN CO
WHATCOM CO
SKAGIT CO
Bellingham
Bellingham Airport
Sandy Point
Fish Point
Point Frances LIR 2
Post Point
Lookout
Chuckanut Bay
Governors Point
Whiskey Rock
Eliza Island
Lummi Rocks
Lummi Peak
Lawrence Point
Clark Island
CLARK ISLAND STATE PARK
Lone Tree Island
Barnes Island
Village Point
Farm Point
Migley Point
Goosebery Point
The Willows
Lummi Island
Strawberry Point
Squalicum Mountain
SCALE
MILES

FIGURE 3-1

included: a rubblemound breakwater with navigation access channel dredging, upland disposal of dredged material, and associated non-Federal dredging and construction of marina floats and shoreline features. In April 1982, the Seattle District initiated a DPR study for marina construction at a site approximately 1,000 feet immediately south of Gooseberry Point. This site was selected because the Tribe owns approximately 70 acres of upland for potential marina support features, and current land use zoning permits marina development. During May 1982, an interagency field trip was held at this site south of Gooseberry Point. Because of agency environmental concerns (e.g., loss of extensive amounts of eelgrass used for spawning by Pacific herring), an alternative to this site south of Gooseberry Point was pursued. During this field trip the agencies and Lummi Tribe also visited the northwest corner of the sea pond project in Lummi Bay, to assess that area as a possible alternative to the Gooseberry Point site. The agencies indicated that the Lummi Bay site be pursued instead of the Gooseberry Point site as the Lummi site appeared to offer less adverse environmental concerns. By letter dated 23 June 1982 (appendix B), and reflecting its own independent evaluation of all practical marina sites on the Reservation, the Lummi Tribe requested that the Gooseberry Point site be dismissed from further DPR study and that attention be focused at a marina site at the northwest corner of the sea pond in Lummi Bay. In response to this local sponsor request, the Seattle District subsequently focused upon the Lummi Bay site for the DPR study. The Tribe is of the opinion that the shift in project site locations (from the site south of Gooseberry Point to Lummi Bay) should be considered as a mitigation concession in evaluating environmental impacts associated with the Lummi Bay Marina.

(4) Oyster Lab Site. The local sponsor briefly evaluated marina construction adjacent to the Oyster Lab at the southeast corner of the sea pond. Due to extensive dredging and potential environmental problems of interfacing a navigation channel with an established salmon migration route, potential adverse impacts to the existing oyster hatchery, and higher project construction costs (when compared to the a marina located at the northwest corner of the sea pond dike) this site was dismissed from further consideration.

(5) Lummi Bay Sea Pond Site. In response to the 23 June 1982 local sponsor request letter (see appendix B), detailed planning and studies were directed to marina development at the northwest corner of the existing sea pond dike[1/] in Lummi Bay. Three marina design variations were formulated at this location, reflecting different planning criteria emphasis. Federal and associated non-Federal project features were basically identical, except for mitigation features and the location of dredged material disposal. The three plan variations are conceptually displayed in figure 3-2. Variation 1, the plan which maximized net tangible benefits, contained no mitigation features. However, agencies indicated that mitigation was required for filling a productive wetland for marina support development (see U.S. Fish and Wildlife

1/The Lummi Tribe constructed the sea pond dike (to contain approximately 760 acres) in the early 1970's and to enhance subsequent development of the aquaculture facilities to raise pan-sized salmon and oysters.

LUMMI BAY MARINA – SEA POND SITE VARIATIONS

PRINCIPAL ENVIRONMENTAL DESIGN DIFFERENCES

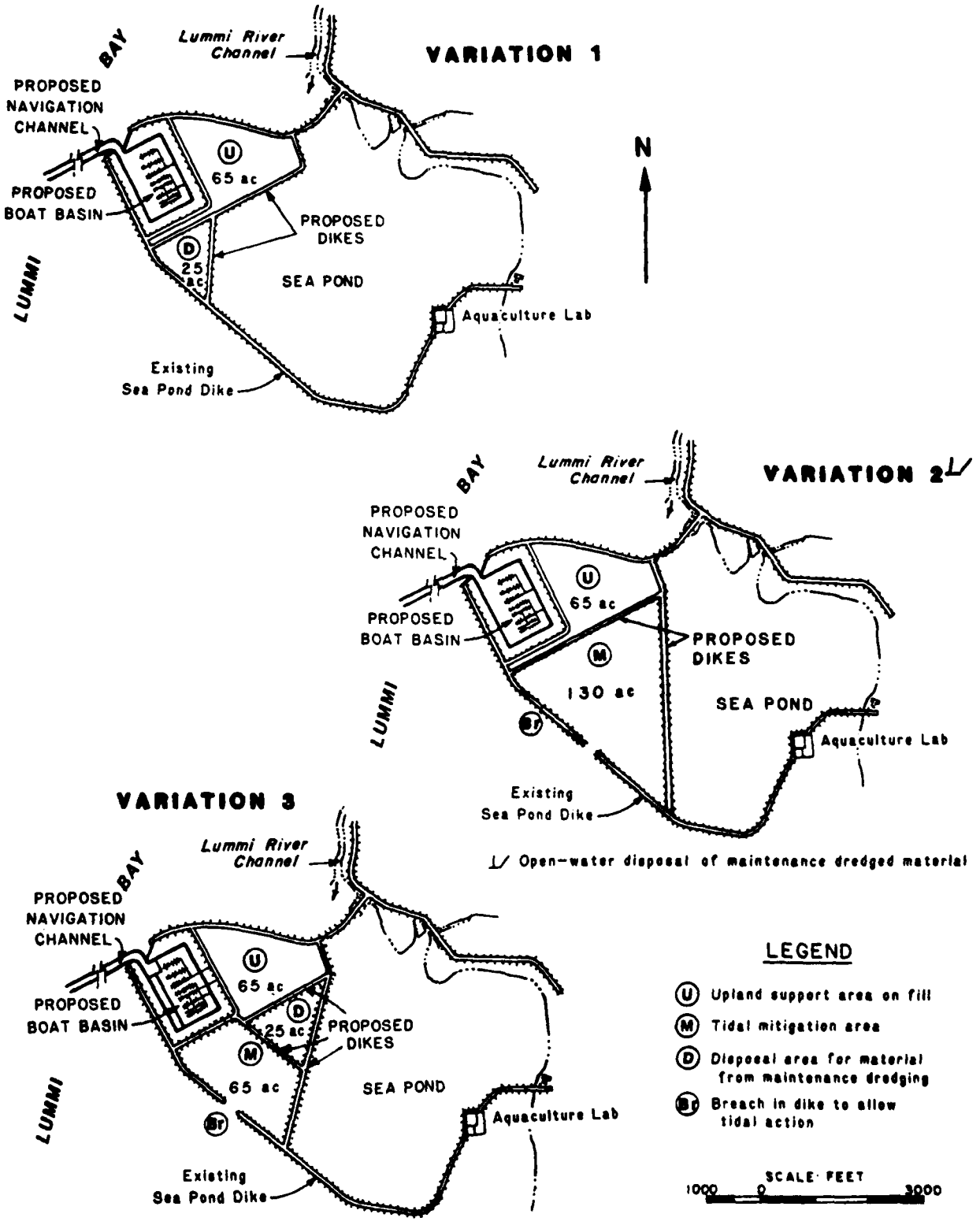


FIGURE 3-2

Service draft Fish and Wildlife Coordination Act Report for project mitigation recommendations). Therefore, Variation 1 would have been environmentally unacceptable. Variation 2, while contributing most to environmental concerns, was not economically justified. This variation was formulated in response to environmental agency requests for 2 sea pond acres to be reintroduced to tidal action for every 1 acre filled as a result of project construction. However, Variations 1 and 2 were dropped from further consideration. Variation 1 which contained no tidal mitigation areas would have been environmentally unacceptable, while Variation 3 would have been unacceptable to the local sponsor as too costly, and potentially jeopardizing the economic feasibility of project construction. Variation 3 reflects a compromise between the two above plans. It is the plan which comes closest to satisfying the planning objective and planning criteria. It has therefore been designated as alternative 2, and is identified as the recommended plan.1/

3.10 Alternative 2 - Lummi Bay Marina, Sea Pond Site (NED and Recommended Plan).

a. Description. The recommended plan is described in detail in section 4 of this DPR and shown on plates 1 and 2. It satisfies the planning objective and planning criteria. The plan is economically efficient, providing the maximum net benefits within the financial capability of the local sponsor and is environmentally acceptable. The plan would provide 438 additional permanent wet moorage spaces in a new public commercial fishing boat marina.2/ The moorage area would be located within a portion of the northwestern corner of the sea pond in Lummi Bay. Principal Federal navigation improvements include: (1) an entrance channel connecting the marina with deep water in the Strait of Georgia; (2) a marina access channel and turning basin; (3) breakwater protection (reinforcement of portions of the existing sea pond dike and construction of timber pile breakwaters at the marina entrance); and (4) U.S. Coast Guard navigation aids marking the entrance channel. Material dredged from the Federal channels and turning basin would be deposited behind local sponsor constructed containment dikes, located adjacent to the marina within the sea pond. The local sponsor would be required to furnish all remaining project features, including all marina and upland features and appropriate project-related environmental mitigation items. Local sponsor responsibilities are discussed in sections 4 and 6 of this DPR.

The total project first cost (Federal and associated non-Federal) of this alternative is estimated at $6,291,000, including contingencies, engineering and design, supervision, and administration. By including some environmental features (e.g., wetland plantings and introduction of portions of the existing sea pond to intertidal action), potential adverse environmental impacts associated with permanent loss of some aquatic habitat are reduced.

1/Section 4.08i of the DPR discusses additional reasons for locating the upland shoreside marina uses adjacent to the proposed marina moorage basin in the recommended plan.

2/The distribution of moored boats is shown on page D-14 of appendix D.

b. Evaluation With Key Criteria.

(1) National Economic Development (NED) Criteria. Additional public commercial fishing boat wet moorages would be provided on the Lummi Reservation, Whatcom County, to accommodate permanent moorage of commercial fishing boats.

- Based on a 50-year project life and an interest rate of 7-7/8 percent, the average annual benefits of $732,000 exceed the average annual costs of $596,000, including first cost of construction, annual maintenance, operation, and major replacement. The benefit-to-cost ratio for this alternative is 1.2 to 1.

- Each separable unit or purpose of the plan provides benefits which exceed its cost.

- This plan would realize its economic benefits under a range of reasonable future economic conditions.

(2) Environmental Quality (EQ) Criteria.

- Some wetlands and fish and wildlife habitat in the study area would be lost while some would be improved. Existing historic and prehistoric cultural resources would be preserved.

- Variances would be required from the Coastal Zone Management Plan adopted by the Lummi Tribe.

- The land use plans of the Lummi Tribe would be complied with.

- It is believed that the status quo regarding threatened and endangered species in the study area and their critical habitat would be maintained. However, a Peregrine Falcon study is being conducted to verify this assumption. Study results and a discussion of project-related impacts will be determined by January 1984, and published in the final DPR.

- Temporary decrease in existing water quality would occur during construction. Long-term impacts on water quality are expected to be minor.

- Permanent adverse environmental impacts would be mitigated by project structural and nonstructural environmental and mitigation features.

(3) Regional Development (RD) Criteria.

- Employment in Whatcom County and on the Lummi Reservation (both economically depressed) will be increased.

- o Whatcom County and Lummi Reservation businesses will experience an increase in net income.

- o Property values within the study area would be increased.

(4) Other Social Effects (OSE).

- o Relocation of residential properties and public facilities would be avoided.

- o Based upon individual preferences, aesthetic values in the study area would either be preserved or lost.

- o The project will increase community cohesion within the Lummi Reservation and in Whatcom County.

SECTION 4. RECOMMENDED PLAN

4.01 Plan Description. The recommended project plan layout is shown on plates 1 and 2. Based upon Federal and non-Federal responsibilities reflecting the distribution of project benefits and the Federal cost-sharing limitations under the Section 107 program, principal Federal features (general navigation facilities) of the plan include: (1) construction and maintenance dredging of a navigation entrance channel (connecting the marina with deep water in the Strait of Georgia) and the marina turning basin and access channel; (2) construction and maintenance of timber-pile breakwaters at the marina entrance, rehabilitation and maintenance of a portion of the existing rock face of the sea pond dike (the marina portion of the dike functions as a protective breakwater); (3) postconstruction tidal marsh and eelgrass monitoring with the local sponsor; and (4) U.S. Coast Guard installation and maintenance of navigation aids. The Federal entrance and access channels will be marked by the U.S. Coast Guard to prevent encroachment of moored or anchored craft, and to allow unobstructed entrance to and exit from the marina. Remaining project features would be non-Federal, and the responsibility of the local sponsor. Non-Federal features include: (1) construction and maintenance dredging of the marina moorage area; (2) construction and maintenance of containment dikes, miscellaneous marina, and all upland support facilities; (3) reintroduction of part of the sea pond to tidal action as mitigation for diking and filling portions of the sea pond; and (4) planting of wetland vegetation (e.g., eelgrass and marshes). The Corps and Lummi Tribe will jointly monitor wetland construction for the first 5 years following project construction (replanting will occur if necessary).

4.02 Navigation Conditions. The marina was situated at the northwest corner of the sea pond in Lummi Bay to take advantage of breakwater protection afforded by the existing sea pond dikes and to optimize use of the existing natural channel (Lummi River) for marina access, and to minimize eelgrass impacts. Other siting parameters are identified in appendix C.

4.03 Tides and Currents. Tides of Puget Sound are of the mixed type and have the diurnal inequality typical of the Pacific Coast of North America. Extreme tidal elevations in Lummi Bay range from -4.5 feet to +12.0 feet MLLW. Inside the diked aquaculture pond (sea pond) the proposed marina location water surface elevation is presently maintained at a relatively constant level (i.e., at about +6 feet MLLW) through use of tidal gates for tribal fish rearing operations.

4.04 Winds. Prevailing summer winds in the Bellingham area are light and predominantly from the south and southeastern directions. Winter storms frequently produce winds in excess of 50 miles per hour from the north and south. Estimated maximum wind velocity-duration curves are shown on figure C-1 in appendix C.

4.05 Waves. The proposed marina site is exposed to wind waves generated from the south through west and north directions, with fetch lengths ranging from 1.2 to 7.2 miles. The maximum wave characteristics for the principal fetch length are listed in appendix C.

4.06 Geotechnical. Exploratory drill borings were made along the proposed channel alinement and in the boat moorage area at the locations shown on plates 5 and 6. Detailed boring logs are given on plate 7. Laboratory tests were made on representative soil samples to determine the properties of the materials to be dredged from the channel and moorage area and the foundation of the disposal fill. Gradation curves are on plate 8. Cut slopes of 4 horizontal to 1 vertical are appropriate for both the channel and moorage basin excavations. Because of the thickness (+100 feet) of weak foundation material underlying the project site, a 175-foot offset from the sea pond dike toe to the top of the moorage basin cut slope is required to maintain the stability of the dike. A more detailed discussion of project related geotechnical design is presented in appendix C.

4.07 Design Criteria. Primary project design considerations included minimizing environmental impact, minimizing impacts on the existing aquaculture operation, maximizing wave protection, and attaining an acceptable benefit-cost evaluation. Specifically, disruption, displacement, or destruction of shoreline, wetland, and marine habitat should be avoided wherever possible and minimized where unavoidable; vessels should be protected from extreme wave conditions; and benefits derived by constructing and operating the facility should exceed costs. Basic design parameters and criteria as well as other factors affecting features and dimensions of the navigation project are presented in appendix C.

4.08 Structural Features. The structural features of the navigation improvement plan are shown on the plates and are described in detail in appendix C. Apportionment of project costs is shown in table 4-1 of this DPR. The project encompasses approximately 252 acres as shown on table C-1 of appendix C. The entrance and access channels, turning basin, breakwater improvements, and certain mitigation features are considered Federal general navigation facilities under the Section 107 program. Remaining marina project features are self-liquidating non-Federal items and not eligible for Federal cost-sharing, under the Section 107 program. The U.S. Coast Guard has a separate Federal program for installation and maintenance of navigation aids.

a. Entrance Channel. A 7,300-foot-long by 100-foot-wide by 12-foot-deep (at MLLW) entrance channel would be constructed along the natural tideflat channel of the Lummi River to provide boater access to the marina from the Strait of Georgia. The entrance channel would encompass about 35 acres, and entail hydraulic dredging of approximately 645,000 cubic yards of material, with subsequent pipeline disposal within the nonfederally constructed containment area, which will be developed as part of the marina project. The moorage basin entrance would be situated at the northwest corner of the sea pond, with the opening to the north to minimize wave attack and to take advantage of the adjacent Lummi River channel within Lummi Bay. By following

the existing channel, dredge volumes are reduced and disruption of existing environmental habitat (e.g., eelgrass) is reduced. Breaching of the sea pond dike and removal of an existing tidegate would be required to provide the basin entrance.

b. Turning Basin and Access Channel. A 200-foot-wide by 200-foot-long turning basin with a depth of -12 feet MLLW would be provided at the basin entrance. The connecting access channel would be 1,400 feet long by 100 feet wide with a depth of -12 feet MLLW. These features would encompass about 6 acres and entail hydraulic dredging of approximately 180,000 cubic yards of material. Dredged material will be hydraulically pumped to the same non-Federal marina construction disposal area.

c. Breakwaters. The existing sea pond dike would provide breakwater protection to the north and west sides of the marina. Two timber pile breakwaters, each 280 lineal feet long with riprap reinforcement, will be constructed adjacent to the marina entrance to provide wave protection from northerly wind-generated waves. Details of the timber-pile breakwater are shown on plate 3. The timber-pile breakwater has been designed to accommodate fish passage. In addition, approximately 2,300 lineal feet of the existing western sea pond dike would be reinforced with quarry spalls to 1,500-pound rock, to provide additional breakwater protection to the boat basin.

d. Moorage Basin. Approximately 645,000 cubic yards would be hydraulically dredged from the 25-acre moorage basin, with subsequent pipeline disposal in the adjacent confined non-Federal disposal site. Moorage basin depths will range from -12 feet MLLW to -10 feet MLLW. Such a bottom profile would require gillnet and skiff boats to moor at the southern end of the marina, while seiners would moor at the northern end. The basin shape and bottom profile have been designed to assure proper flushing and circulation, and minimize poor dissolved oxygen and low temperature. A 25-acre buffer strip of undisturbed tidelands will be maintained around the moorage basin periphery to assure proper slope stability. Typical moorage basin cross sections are shown on plate 4.

e. Moorage Facilities. Moorage features include necessary floats, access docks, ramps, and wharves to accommodate 438 commercial fishing boats. Specific marina moorage area features are contained in the local sponsor construction permit application - the public notice in appendix A.

f. Boat Launching Ramp. The moorage basin will include a public boat launch ramp to facilitate launching of trailerable pleasure boats and commercial fishing boats.

g. Disposal of Construction Dredged Material. The 825,000 cubic yards of material dredged to create the entrance channel, access channel, and turning basin, and the approximately 645,000 cubic yards dredged for the moorage basin would subsequently be deposited within the 65-acre upland disposal area adjacent to the eastern border of the moorage basin. Containment dikes approximately 4,850 lineal feet long on the east and south sides of the marina would

accommodate the construction dredged material. These dikes would consist of a core of pit-run granular fill, trucked from the closest available upland source, with an outer layer of sand received from the dredge disposal. The disposal area would be filled to elevations ranging from +15 to +25 feet MLLW, and would provide approximately 65 acres for the local sponsor's upland marina support features. Disposal of construction dredged material within the marina containment dikes is less costly than open-water disposal. Disposal of maintenance dredged material relating to project mitigation is discussed in the following paragraph. Maintenance is also addressed in paragraph 4.17 of this DPR.

h. Mitigation Features. As mitigation for filling aquatic lands within the sea pond (for subsequent upland development), the local sponsor would initially construct approximately 4,850 lineal feet of containment in dikes in the sea pond adjacent to the southern boundary of the moorage basin to establish the 65-acre fill area. Only the outer dike face will be visible once development of the 65-acre area has been completed. The local sponsor would also construct a 1,300-foot-long dike to separate the basin from the 65-acre mitigation area. Approximately 300 feet of the southwestern portion of the sea pond dike, located about 3,300 linear feet south of the extreme northwest tip of the existing sea pond dike would be breached and adjacent dike side slopes reinforced. Breaching would subject approximately 90 acres within the sea pond to tidal action. Under the tentatively selected maintenance plan[1/] about 25 of the 90 acres will be reserved for periodic disposal of maintenance dredged material. Maintenance dredging will be conducted on 5-year cycles, and require disposal of 40,000 cubic yards of dredged material within the 25-acre reserved disposal site at a rate of approximately 2 to 3 acres every 5 years.[2/] However, until maintenance dredging occurs, the adjacent wetland area will remain subject to tidal action. At year 5, the first year of maintenance dredging, the local sponsor would construct approximately 1,200 lineal feet of dike (with overflow weir) at the western end of the 25-acre maintenance disposal area to contain dredged material. Under the current plan, and once the 25-acre disposal site was filled with dredged material, (at the end of the 50-year project economic life), the local sponsor would construct water-dependent and/or marina-related uses. Details and environmental aspects of these proposed uses would be addressed and provided by the local sponsor prior to fill development, and as part of a sponsor permit action. About 65 of the 90 acres would be permanently reserved as an undeveloped tidal area. Upland features are discussed in the following paragraph. Maintenance dredging is discussed in paragraph 4.16. Project environmental measures (e.g., eelgrass planting, marsh establishment and water quality monitoring) are addressed in paragraph 4.11.

1/The maintenance program will be confirmed prior to the first year of maintenance dredging and disposal. Various dredging and disposal alternatives will be considered at that time and a recommended plan identified. The current maintenance plan incorporates hydraulic dredging with subsequent confined disposal within the designated 25-acre site adjacent to the marina uplands. An alternative plan to be evaluated will consist of clamshell dredging and open-water disposal.

2/Reflects about 38,000 cubic yards of maintenance dredging from entrance channel and about 2,000 cubic yards from turning basin and access channel.

i. Upland Support Facilities. As shown on the public notice in appendix A, miscellaneous local sponsor water-dependent and water-related support features are proposed for development on the proposed 65-acre upland diked disposal area. The list includes parking areas; access roads; utilities; a seafood processing plant including cold storage; retail stores for fishery supplies, groceries, and boat equipment; weblockers and lockers for storage of nets and gear; harbormaster office; restrooms; small restaurant; and a barge building area. Existing Reservation waste water treatment, power and water systems would service the complex. Marina upland area stormwater runoff would be controlled through catch basins and oil-grease separators. The local sponsor would place only water-dependent and/or marina-related facilities on filled uplands. Concerning phasing of upland facility development, essential structures, such as web lockers, would be constructed first, followed by a fish processing plant a barge building plant, and service businesses. Although the ultimate composition of the completed development has not yet been planned, it is expected that it will include both Indian and non-Indian owned businesses and will be restricted to providing marina-related goods and services. Full development of the marina complex would occur over 5 to 7 years following completion of the boat basin. Economic self-sufficiency and development of tribal resources are primary goals of the Tribe and are also being stressed by the Federal Government. Fishing is, by tradition, the primary economic activity of the Lummi Indians; therefore, development of the proposed commercial marina complex is essential to the Tribe's economic development and ultimate self-sufficiency.

j. On 24 January 1983, President Reagan announced, as part of his Indian Policy, the Administration's intent to implement a series of actions designed to enhance and foster Tribal self-sufficiency, and restore reservation economies.1/ In this light, the proposed 65-acre upland development package, and the various marina-related uses proposed for development on dredged fill material, are considered by the Lummi Tribe as an integral component of the Reservation, comprehensive development program towards economic self-reliance, with additional positive spin-off effects designed to attract private sector revenue, while enhancing a depressed Whatcom County economy. Details of the local sponsor portion of the project, including the upland fill development, will be refined concurrently with the Corps of Engineers preparation of plans and specifications.

k. A marina serving commercial fishing boats needs certain support areas and services nearby whose location is essential for efficient and economical commercial fishing operations. Early in the planning process, two different alternatives to the recommended upland filling of 65 acres within the sea pond containment dikes were identified, as discussed below, but discarded in favor of the recommended plan.

1/The President's Indian Policy is reproduced in its entirety in appendix B under pertinent correspondence.

Alternate No. 1: Relocate the marina to shore, placing a portion of the dredge fill on shore for the service facilities, with the remainder to deep-water disposal.

The entrance channel would be doubled in length from that proposed in the recommended plan, by an additional 20 acres of tidelands requiring approximately 300,000 c.y. of additional material. Dredge costs would increase to $2.50 per c.y. for hydraulic dredging fill because of the long distance the material would be piped. Deep-water disposal would cost approximately $5.00 per c.y. The dredging cost for this alternative would be approximately $4.4 million greater than dredging cost for the recommended plan. This alternate is not economically nor logistically feasible and is unacceptable to the local sponsor.

Alternate No. 2. Relocate the service facilities to shore, using a portion of the dredged material to provide the necessary shoreside lands, with the remaining dredged material taken to deep-water disposal. Approximately 400,000 c.y. of dredge material would be placed on land at an estimated cost of $2.50 per c.y. and about 1,100,000 c.y. would be disposed in deep water at a cost of $5.00 per c.y. Dredging costs would be $3.6 million above the dredging cost for the recommended plan.

This alternative would also eliminate the adjacent shipyard requiring boaters to travel to Bellingham, with increased travel time, associated travel costs, and inconvenience. This alternative would require a shuttle bus to move people and equipment to the boats and, as a result, incurs both added inconvenience and introduces the potential for added user costs. Fish received at the wharf would need to be trucked to the processing plant, increasing the risk of spoilage and raising the cost because of double-handling.

This concept would be inefficient and expensive in both the initial cost and operating expense.

This alternate is not considered economically feasible and is unacceptable to the local sponsor.

Alternate No. 3 - The Recommended Plan for Upland Development: The local sponsor has evaluated the above mentioned two alternatives for shoreside development and has identified a plan which entails construction of marina-related and water-dependent features situated within a 65-acre confined dredged disposal site adjacent to the proposed marina moorage basin in the sea pond. Appendix D contains a discussion of the rationale for obtaining fill material from project dredging in comparison to delivery by another method. The public notice in appendix A contains a layout of the location of upland features. In identifying fill for 65 acres, the local sponsor has provided the following rationale for principle marina-related and water-dependent features.

(1) Shipyard.

(a) Purpose. The approximately 6-acre shipyard will provide facilities and space for the repair and maintenance of boats moored at the proposed Lummi Bay Marina, as well as visiting boats. Fishing boats are normally taken out of the water annually for maintenance and repair work. The nearest full service at shipyard shipyards would be Blaine, Bellingham, and in Anacortes, Washington. Accordingly, an on-site shipyard offers locational advantages to the boater.

(b) Rationale for Size. The shipyard must provide sufficient space to accommodate the anticipated number of boats from the Lummi Bay Marina requiring service. The yard has been sized to service 20 boats at any one time and will contain the following features: (1) a marina repair shop which would contain repair bays, machine shops, welding shop, stockroom, and offices; (2) the loading and unloading area for the boat haul-out facility (marine ways); and (3) parking for cars and trailers transporting smaller, trailerable boats to and from the yard.

(c) Rationale for Location. The shipyard must be located adjacent to the basin to permit ease of haul out and re-entry and should be adjacent to marine commercial sales for purchase of necessary boat gear and equipment. This is especially true during the intensive summer fishing season when downtime is critical. Larger commercial fishing boats (e.g., seiners and tenders) are too large to transport more than a few hundred feet from the moorage basin. There are no feasible alternative upland locations outside of the sea pond for development of a shipyard, which would not result in increased transportation costs for boat repair and maintenance. Further, vacant, undeveloped, tribally-owned upland adjacent to the marina has been zoned farmland. Any other upland reservation locations, should they exist, would be too far from the marina basin and support services to be economically feasible.

(2) Parking.

(a) Purpose. Parking areas for cars, trucks, and trailers will provide uncongested pedestrian access to fishing boats within the boat basin. The parking areas will be used on a 24-hour per day basis to accommodate intensive fishing activities.

(b) Rationale for Size. The parking areas must provide sufficient space for boat crews while fishing and for persons visiting boats for inwater maintenance or loading and unloading supplies and equipment. The approximately 8-acre parking area has been designed to accommodate 1.5 stalls per berth, reflecting the distribution and size of moored fishing boats within the basin.

(c) Rationale for Location. Parking areas servicing the boat basin must be provided within 200 to 300 feet of moored boats to minimize fishermen travel time to and from boats and avoid pedestrian/vehicular congestion and

circulation problems. Upland parking areas are not feasible for two principle reasons: (1) land surrounding the sea pond dike is either residential or agricultural and is not available for other uses; and (2) development of parking areas at upland locations away from the immediate Lummi Bay Marina, even if land was available, would require a 24 hours a day shuttle to ferry passengers and gear to and from the boat basin. The added expense of facility, a shuttle operation, plus fishermen inconvenience, makes upland parking an unacceptable and impracticable alternative to the recommended project.

(3) Seafood Processing Plant and Cold Storage.

(a) Purpose. The approximately 7-acre complex receives, processes, and stores fish delivered by both home and visiting commercial boats and by buyers. The processed fish are subsequently trucked to regional markets or sold at the marine commercial sales complex at the marina. The complex will serve workers, salesmen, and buyers.

(b) Rationale for Size. The plant and cold storage area must be of sufficient size to accommodate receiving, processing, and storage operations, including necessary utilities (wastewater, water, power, etc.), parking, (for 50 cars), and loading and unloading facilities.

(c) Rationale for Location. There is a regional need for another fish processing plant. The complex must be situated adjacent to the receiving wharf and docks to eliminate the anticipated high cost of transporting and double handling of perishable fish associated with development at some upland site. In the proposed plant location, fish can be transported to the plant by conveyor belt or by forklifts. The receiving wharf must be adjacent to deep water to facilitate unloading from boats. Development of the processing plant and adjacent storage complex at the new marina on the Reservation will reduce boat travel time and operating costs to deliver fish to similar existing facilities in Bellingham, Blaine, and Anacortes.

(4) Webhouses and Net Repair.

(a) Purpose. Webhouses consist of lockers for storage of nets and other fishing and boat gear. Adjacent net repair areas accommodate outdoor repair work and parking for employee and visitor vehicles.

(b) Rationale for Size. The approximately 16-acre complex has been designed to accommodate repair and storage of nets from home port and visiting boats. There is a direct ratio for the number of lockers or sheds and the number of skiff, gillnet, seine, crab, and other boats. Parking areas and net repair areas must accommodate vehicles, trailers, and other transportation equipment.

(c) Rationale for Location. Webhouses and net repair areas must be situated as close as possible to boat unloading areas, since carts and other transportation equipment is not suited to traveling on roadways for other than very short distances. There is no available upland adjacent to the sea pond for this use. The only feasible location for this use is at the project site.

(5) Marine Commercial Sales Complex.

(a) Purpose. The proposed 2-acre complex will provide various commercial fishing boat marine equipment (e.g., hardware, nets, electronics, canvas, and upholstery), sales outlets and repair services, a small grocery store and small restaurant, and adequate fishermen and employee parking areas.

(b) Rationale for Size. The complex must be large enough to accommodate the above-noted uses, in comparison to the number of boats in home port and the various adjacent support uses.

(c) Rationale for Location. The marine commercial sales complex must be situated close to the boat basin, boat repair, and storage areas and parking areas for the convenience of the user. As stated, current land development adjacent to the sea pond precludes other uses. In order for the complex to service the commercial fishermen, many of the services, e.g., grocery and restaurant, would need to operate on a 24-hour per day operation. There are no other facilities on the Reservation offering full-time service. The Bellingham area offers the closest available services. Transient boaters often need quick and convenient service without having to drive into Bellingham or Blaine. There are no alternative practical locations for this use.

(6) Barge Fabrication Area.

(a) Purpose. The approximately 8-acre barge fabrication area is needed for construction, assembly, storage, and manueverability of general bulk-cargo barges by an independent construction company.

(b) Rationale for Size. Sufficient space to fabricate five to six 125-foot-long to 250-foot-long barges is required.

(c) Rationale for Location. Convenient water access for launching barges is critical. The proposed fabrication area is close enough to the Lummi River to allow for launching at high tide. Barges would be skidded down the north sea pond dike for launch at high tide. Barges are currently under upland construction on the Reservation, several miles away from the sea pond, need to be trucked on house-moving equipment down a heavily used public road to Gooseberry Point (a travel distance of approximately 4 miles), for subsequent launching. The proposed 8-acre barge complex would attract additional barge business to the economically depressed Reservation, due to the economic advantages associated with the site location.

(7) Boat Storage Yard.

(a) Purpose. The approximately 7-acre paved boat storage area provides necessary storage of commercial fishing boats.

(b) Rationale for Size. The boat storage area has been sized to accommodate 100 home port and transient boats.

(c) Rationale for Location. The storage area must be located within close proximity to the boat basin launch ramp, marine ways, and the shipyard. Feasible upland locations do not exist for this development. Under the current proposal, boats may be launched or retrieved without delays incurred by long distance travel time to and from an upland site.

4.09 Aids to Navigation. By letter dated 16 November 1982 (appendix B), the U.S. Coast Guard would install and maintain navigation aids consisting of three timber-pile dolphin fixed light beacons and three timber-pile fixed day beacons. The location of these aids is shown on plate 1 and the estimated cost is contained in appendix C.

4.10 Real Estate. In Lummi Bay, the State of Washington owns submerged lands from tideland elevation -4.5 feet MLLW to deep water in Puget Sound. The Lummi Tribe (local sponsor) owns Reservation lands above tideland elevation -4.5 feet MLLW. The United States claims navigational servitude jurisdiction from mean high water (+7.8 feet in Lummi Bay) to coastal deep waters. Project areas designated for Federal entrance and access channels and turning basins would require no Washington State lease since Federal navigation projects may be constructed in navigable waters without compensation to the owner. Although the non-Federal moorage basin will be dredged to depths below elevation -4.5 feet MLLW, the Lummi Tribe would not have to secure a Washington State lease for project construction, since the Tribe owns the moorage basin land. Accordingly, there are no project-related costs for lands, easements, and rights-of-way.

4.11 Environmental and Mitigation Features. The recommended plan of improvement is responsive to environmental concerns, including those expressed by agencies, through design modifications within the economic constraints imposed by the planning objective and the financial capability of the local sponsor. Because the marina portion of the project will also result in loss of aquatic habitat within the existing sea pond (due to filling for marina support facilities on upland development), a number of environmental and mitigation measures have been included. The following environmental design and mitigation features would be included in the project; they are also addressed in section 4 of the EIS and in appendix C of the DPR. Mitigation features are shown on plate 2.

o The alinement of the entrance channel along an existing channel in Lummi Bay is designed to impacts to the algae and eelgrass community. A net loss of approximately 29 acres of herring spawning eelgrass may occur with dredging of the entrance channel. Mitigation for removal of eelgrass would entail replanting of approximately 7 acres[1/] of eelgrass during May and June following channel dredging, adjacent to and along the channel slopes, as well as along the moorage basin periphery. The shallow slopes of the channel and adjacent areas are expected to promote eelgrass rejuvenation. Verification of the success of eelgrass rejuvenation will be evaluated for the initial 5 years following project construction. Eelgrass replanting may occur during this time, if deemed necessary by appropriate experts and agencies.

1/Seven acres is the maximum replanting that can practically be accomplished in Lummi Bay.

o The configuration of the turning basin, access channel, and moorage basin are designed to maximize tidal flushing and circulation and minimize adverse water quality. A Section 404(b)(1) evaluation report is contained within appendix A.

o The basin entrance breakwaters have been designed to accommodate fish passage.

o The marina and upland support areas would be designed to control pollutants.

o The 25-acre moorage basin setback would be introduced to tidal action through the marina entrance.

o An existing marsh, located within the 25-acre moorage basin periphery area, would be preserved.

o Construction and maintenance dredging would be scheduled, designed, conducted, and monitored to avoid or minimize adverse impacts on water quality; Lummi Bay biota and associated habitat including aquaculture operations, area crab, herring, and salmon populations and habitat, and commercial fishing activities.

o Approximately 7 acres of eelgrass will be planted along and adjacent to the navigation channel slopes and moorage basin periphery. Planted areas will be evaluated for the first 5 years following project construction to verify eelgrass repopulation where planting was conducted. Replanting of eelgrass will be undertaken, if required.

o Monitoring of water quality will be conducted.

o The project-related loss of 65 acres of shallow water habitat within the sea pond to be filled for upland development, including containment dikes, would be mitigated by initially introducing approximately 90 acres of the sea pond to tidal action following project construction (25-acre moorage basin setback, plus a 65-acre tidal mitigation area at the southern end of the project). Approximately 4,000 lineal feet of sand and gravel dikes will eventually surround the 65-acre mitigation area, and about 2,900 lineal feet of containment dikes will surround 25 of the 90 acres reserved for potential periodic disposal of maintenance dredged material. The 65-acre tidal area will be introduced to tidal action by breaching a 300-foot-wide portion of the existing sea pond dike. The breach would include rock slope protection against wave action and tidal current scour. Table C-1 of appendix C identifies project acreage.

o A 200-foot-long by 200-foot-wide area adjacent to the dike between the marina moorage area and northwest portion tidal mitigation area would be gently sloped and planted with wetland vegetation.

o The 25-acre maintenance disposal area would have an existing ground surface elevation to facilitate intertidal action and avoid fish entrapment. Project maintenance is discussed in paragraph 4.18.

o Wetland vegetation would be planted in part of the southwestern portion of the maintenance disposal area, and on part of the southern edge of the tidal mitigation area dike on the sea pond side.

4.12 Cultural Resources. The proposed project would not impact any known cultural or historic sites (see responses from the Washington State Office of Archeology and Historic Preservation (SHPO), appendix B). In the event that previously unrecognized sites are encountered during construction, an evaluation of the resource will be made in cooperation with the SHPO and the Lummi Indians. Further action will be coordinated with the Advisory Council on Historic Preservation.

4.13 Recreation. As one standard requirement of sponsoring a Federal small boat harbor navigation project, the local sponsor must provide certain non-Federal features, including recreation and access amenities. For the Lummi Bay Marina project, the local sponsor would provide a public boat launch ramp, shoreside parking for car and boat trailer combinations, and a road providing ramp access from the nearest public road. The ramp would be designed to permit use during both low and high tides and would permit launching of trailerable recreational pleasure boats and commercial fishing boats (principally small gillnetters and skiffs).

4.14 Project Costs. Estimated project construction and maintenance costs (including mitigation costs) are summarized in table 4-1 with detailed cost estimates presented in appendix C (tables C-2 through C-7). In addition to the costs shown in table 4-1, the local sponsor would invest approximately $18 million to construct all remaining non-Federal project features. See table C-7 in appendix C for a listing of this investment.

4.15 Design and Construction Schedule. The planning, design, and construction schedule for the Federal or general navigation project features, assuming funding availability, is summarized below and shown in plate 9. The marina moorage basin would begin operation by early 1988.

Submit Final DPR to NPD	May 1984
Initiate plans and specifications	June 1984
Advertise construction	February 1985
Award construction contract	April 1985
Complete construction of Federal (General) Navigation Facilities	May 1986

TABLE 4-1

APPORTIONMENT OF ESTIMATED FIRST COSTS[1/][2/]
(October 1982 Price Levels)

First Costs	Total Cost[2/]	Federal Cost	Non-Federal Cost	Responsibility
Federal Costs (General Navigation Facilities)				
1. Dredging (Entrance and Access Channels and Turning Basin) and Disposal (Sea Pond)	$2,589,000	$1,657,000[3/]	$932,000[4/]	Corps
2. Breach Sea Pond Dike for Boat Basin Entrance	32,000	20,000[3/]	12,000[4/]	Corps
3. Reinforce Sea Pond Dike at Basin Entrance for Breakwater Protection	192,000	123,000[3/]	69,000[4/]	Corps
4. Timber Pile Breakwater at Basin Entrance	486,000	311,000[3/]	175,000[4/]	Corps
5. Mitigation Features	83,000[5/]	53,000[3/]	30,000[4/]	Corps and Local Sponsor
6. Lands, Easements, and Rights-of-Way	0	0	0	N/A
7. U.S. Coast Guard Navigation Aids	78,000	78,000	0	U.S. Coast Guard
Subtotal First Costs General Navigation Facilities	$3,460,000	$2,242,000	$1,218,000	
Non-Federal Costs (Associated Marina Facilities)[6/]				
1. Dredging (Moorage Basin) and Disposal (Sea Pond)	$1,548,000	$ 0	$1,548,000	Local Sponsor
2. Containment Dike (Excludes Mitigation Area Dike)	467,000	0	467,000	Local Sponsor
3. Moorage Facilities[7/]	769,000	0	769,000	Local Sponsor
4. Mitigation Features[8/]	47,000	0	47,000	Local Sponsor
5. Lands, Easements, and Rights-of-Way	0	0	0	N/A
Subtotal, First Costs Marina Associated Facilities	$2,831,000	$ 0	$2,831,000	
Total Project First Costs	$6,291,000	$2,242,000	$4,049,000	
Revised First Cost Apportionment	$6,291,000	$1,820,000[9/]	$4,471,000	

Footnotes: see next page

TABLE 4-1 (con).

1/Numbers rounded and include contingencies, engineering and design, supervision and administration, but exclude interest during construction (an economic cost required for derivation of the project benefit-to-cost ratio).

2/The apportionment of estimated Federal and non-Federal project contributions is based upon (1) traditional cost-sharing requirements associated with Section 107 authority and (2) the distribution of National Economic Development (NED) project benefits.

3/Based upon NED project benefit distribution, Federal share of general navigation facilities first cost would be 64 percent of total first cost. See table 4-3 of the DPR for benefit distribution.

4/Remaining non-Federal share of general navigation facilities first cost would be 36 percent of project benefits.

5/Reflects Federal portion of mitigation features cost (see tables C-3 and C-6 of appendix C for details).

6/Includes those non-Federal, self-liquidating items required to be constructed to achieve project NED benefits. See table C-4 of appendix C for details. In addition to these costs, the local sponsor will invest approximately $18 million to construct the remaining miscellaneous project features. See table C-7 of appendix C for details.

7/Includes moorage floats and support piling and dock, wharf, and access ramp. See table C-4 of appendix C for details.

8/Reflects non-Federal portion of mitigation features cost (see tables C-4 and C-6 of appendix C for details). Mitigation features include mitigation area containment dikes, breaching of sea pond dike to introduce tidal action, and marsh establishment.

9/Excludes $258,000 for preauthorization planning (i.e., DPR study) costs. The maximum allowable Federal (i.e., Corps of Engineers) contribution for planning and construction of the Lummi Bay Marina project under Section 107 authority would be $2 million minus the $258,000 or $1,742,000. The U.S. Coast Guard would provide 100 percent of the costs of navigation aids, or $78,000. The revised total Federal contribution to project first costs would be $1,742,000 (Corps) plus $78,000 (U.S. Coast Guard), or $1,820,000.

4.16 Operation, Maintenance, and Replacement. A summary of estimated Federal and non-Federal project operation and maintenance costs is shown in table 4-2 and detailed in appendix C.

a. Dredging and Disposal. Disposal of maintenance dredged material has been tentatively proposed. Final selection of the most appropriate maintenance alternative will occur prior to the first year of scheduled maintenance dredging operations - year 5 following initial project construction dredging. Alternative dredging and disposal methods will be evaluated at that time, and a final selection will be based on evaluation in accordance with the National Environmental Policy Act, the Clean Water Act, other applicable laws, and regulations and in coordination with appropriate agencies. Based upon a preliminary evaluation, the following dredging and disposal method has been selected. Federal maintenance dredging of the entrance channel, access channel, and turning basin is estimated at 40,000 cubic yards every 5 years during the project life. Dredging will be conducted during a 3-month period. Dredging would be accomplished by hydraulic pumps with pipeline disposal within the 25-acre nonfederally constructed maintenance dredging disposal area. At year 5, the initial year of maintenance dredging, the local sponsor will construct about 1,200 lineal feet of permanent dike to contain subsequent maintenance dredge material. The dike will include a weir. Every 5 years, placement of dredged material in an east to west direction will add about 2 to 3 acres of fill to the disposal area. After year 50, the 25-acre fill area could be developed for upland marina-related activities. Details of non-Federal development after year 50 on the 25-acre fill area would be the responsibility of the local sponsor and are not addressed in this DPR. The local sponsor will be expected to comply with applicable agency criteria in formulating permit applications for upland development. Moorage area dredging (a non-Federal responsibility) is considered negligible due to the advantageous marina location and adequate marina flushing.

b. Breakwater. At year 25, the Federal Government would reinforce the moorage basin portion of the sea pond dike and replace the timber breakwater with a similar unit.

c. Navigation Aids. The U.S. Coast Guard would replace light beacon batteries annually and replace the wood pile dolphins at year 25 (see U.S. Coast Guard letter, appendix B.).

d. Environmental Measures. Water quality will be monitored as a Federal (Corps) responsibility during maintenance dredging and disposal.

e. Mitigation Measures. Monitoring of the tidal eelgrass and marsh areas will be conducted during the initial 5 years following project construction will be a shared Federal (Corps) and non-Federal (Lummi Tribe) responsibility. Thereafter, the marshes and repopulated eelgrass areas are expected to be self-sustaining. Mitigation area dikes should not require maintenance.

TABLE 4-2

ESTIMATED PROJECT MAINTENANCE COSTS

Federal Costs (General Navigation Facilities)	First Costs[1/]	Average Annual Costs[2/]
1. Corps of Engineers.		
a. Maintenance Dredging (every 5 years @ 40,000 yards)	$265,000[3/]	$44,800
b. Dike Breakwater and Entrance Rock Repair (at year 25)	177,000	2,100
c. Timber Pile Breakwater Repair (at year 25)	482,000	5,900
d. Monitor Mitigation Features (annually for first 5 years)	3,200[4/]	1,000
Total: Corps of Engineers Annual O&M Costs		$53,000
2. U.S. Coast Guard Nav. Aids		
a. Replace Light Beacon Batteries (annual)	800	800
b. Structure Replacement (at year 25)	78,000	900
Total: U.S. Coast Guard Annual O&M Costs		$1,700
Subtotal Federal Annual O&M Costs		$55,500
Non-Federal Costs (Associated Marina Facilities)		
a. Repair and Replace Ramps, Floats, Docks (Annual)	$2,900	$2,900
b. Construct Maintenance Dredging/Tidal Mitigation Separation Dike (year 5)	72,000	4,000
c. Monitor Mitigation Features (annually for first 5 years)	1,800[5/]	600
Subtotal Non-Federal Annual O&M Costs		$7,500
Total Federal and Non-Federal Annual Maintenance Cost		$63,000

1/Numbers rounded; October 1982 price levels. Estimate includes E&D, S&A, and contingencies. See tables C-3 and C-5 of appendix C for details of Federal and non-Federal maintenance responsibilities.

2/50-year project life, 7-7/8 percent interest rate.

3/Estimate includes costs associated with maintenance dredging mob and demob and dike weir construction, monitoring for eelgrass rejuvenation in entrance channel and monitoring of water quality monitoring during project maintenance dredging.

4/Reflects Federal share of estimated monitoring cost, or $3,200 based upon distribution of project benefits for general navigation facilities (see table 4-3 of DPR).

5/Reflects non-Federal share of cost at 36 percent of $5,000, or $1,800.

f. Miscellaneous Features. As project local sponsor, the Lummi Tribe would be responsible for maintenance of all remaining project features, including such items as floats, ramps, piers, docks, and all shoreside features. Estimated non-Federal maintenance costs for those associated marina facilities required to be constructed and maintained to achieve project NED benefits, are noted in table C-6 of appendix C and were developed in consultation with the local sponsor.

4.17 Economics of the Recommended Plan.

a. Methodology. The economic justification of the recommended plan is determined by comparing the average annual costs with average annual NED benefits which would be realized from the plan. A 50-year period of economic analysis was selected in analyzing the recommended project. Benefits and costs were based on October 1982 price levels. The first year of project operation was assumed to be 1988. Project moorage is expected to be fully utilized during first year of marina operation in early 1988. Costs of the plan would accrue at different periods of time. They were made comparable by conversion to an average annual equivalent time basis using the current 7-7/8 percent interest rate for water resource projects. Additional information on the economic analysis for project benefits is presented in appendix D. The following project benefit categories were identified for this project:

(1) Transportation Savings. The basis for commercial fishing benefits was the savings in operating costs to various types of fishing boats due to reduced running time between home port and the fishing grounds and a reduced running time from home to the proposed marina (in comparison to current practice).

(2) Damage Reduction. The basis for damage reduction was the elimination of annual fishing boat damages attributable to current rafting conditions at Squalicum Harbor.

(3) Land Enhancement. Land enhancement benefits were estimated in accordance with ER 1165-2-317. Benefits were based on the assumption that non-Federal, marina-related upland development could occur on the dredged fill disposal areas, resulting in an enhanced land value.

(4) Employment. In this category, benefits are estimated for those unemployed or underemployed individuals who would be employed with Federal and associated non-Federal project construction activities. The Lummi Indian Reservation satisfies the criteria for the benefit category.

(5) Reduced Opportunity Costs. In this category, benefits were estimated for the value of time lost as a result of increased travel time and operating costs due to a lack of adequate moorage facilities.

b. Average Annual Benefits. Project benefits, derived as discussed in the following paragraphs and in appendix D, are summarized in table 4-3.

TABLE 4-3

AVERAGE ANNUAL BENEFITS

Category	Distribution of Average Annual Benefits 1/ Total	General	Local
Transportation Savings	$391,000	$391,000	$0
Damage Reduction	27,000	27,000	$0
Land Enhancement	237,000	0	237,000
Employment	77,000	N/A 2/	N/A 2/
Total Average Annual Benefits	$732,000	$418,000	$237,000
Total Average Annual Benefits for Cost Apportionment	$655,000 3/	$418,000	$237,000
Percent	100	64	36

1/Used in calculating apportionment of Federal or general facilities project cost (minus U.S. Coast Guard aids to navigation cost).
2/Not included in cost apportionment per Corps regulations.
3/$732,000 minus employment benefits of $77,000.

c. Average Annual Costs. Average annual costs include interest and amortization of $533,000 on the project investment of $6,620,000 and annual operation and maintenance costs of $63,000, for a total annual cost of $596,000.1/ Annual costs shown in table 4-4 were determined using an interest rate of 7-7/8 percent and a project life of 50 years. All costs were based on October 1982 price levels.

TABLE 4-4

AVERAGE ANNUAL COSTS 2/

	Amount
Interest and Amortization	$533,000 3/
Operation, Maintenance, and Replacement	63,000
Total Average Annual Costs	$596,000

1/Includes interest during construction of $329,000.
2/October 1982 price level and 7-7/8 percent interest rate.
3/Reflects project investment cost of $6,620,000.

d. Economic Justification. A benefit-to-cost ratio of 1.2 to 1.0 was calculated based upon average annual benefits of $732,000 and average annual costs of $596,000.

4.18 Environmental Effects of the Recommended Plan.

a. General. Project construction would have the following environmental effects. The EIS contains additional information and evaluation. For example, table 1-1 of the EIS addresses the relationship of the recommended plan to environmental protection statutes and other environmental requirements.

o Construction of the entrance channel would remove approximately 13 acres of eelgrass. Approximately 7 acres of eelgrass will be planted on the channel side slopes and adjacent areas immediately following project construction. Replanting will be considered if required during the first 5 years of monitoring following project construction.

o Deep water resulting from channel construction may increase crab habitat in Lummi Bay.

o Filling within the sea pond for upland construction will permanently remove productive biota; temporary destruction and long-term modifications of biota will occur with dredging of the moorage basin area.

o Removal of about 65 acres of shallow water habitat associated with construction of marina upland (65 acres) fill areas will be mitigated through construction of separation dikes and by breaching an outer dike to reintroduce a 65-acre area within the sea pond, to tidal action. About 4,000 lineal feet of dike would be required to contain the 65-acre tidal mitigation area. About 25 acres would be reserved for potential disposal of maintenance dredged material, and initially subject to tidal action. Other project areas which would be introduced to tidal action include the 25-acre moorage basin and adjacent periphery area.

o Construction of fish passage provisions at the marina entrance would allow juvenile salmon passage and minimize exposure to predation in open water.

o Short-term localized construction impacts include noise, impacts to air and water quality, and visual aesthetics.

o Physical alteration of the areas would decrease the value of avian habitat.

o Moorage basin construction will result in conversion of poorly flushed diked habitat to subtidal well flushed habitat.

o Contaminants resulting from marina operation would decrease the survival of biota and avian fauna.

o Water quality would be monitored during construction and maintenance dredging and disposal operations.

o Dredging timing will be scheduled to minimize adverse impacts on Pacific herring, crab, salmon, aquaculture and populations, and commercial fishing operations.

b. Endangered Species. Both bald eagles and peregrine falcon are on the Federal endangered species list, and have been observed in Lummi Bay. A biological assessment for the bald eagle has been prepared, and concluded that project construction and operation would not significantly impact the bald eagle. A study is being conducted from the fall of 1983 through the winter of 1984 in order to address potential project impacts to the peregrine falcon. Results will be presented in a biological assessment, and described in the final EIS.

4.19 Cost-Sharing Responsibilities.

a. Apportionment of Federal and Non-Federal Costs. Cost apportionment is shown in table 4-1.

b. Federal Responsibilities. Total first cost of the recommended plan would be $6,291,000 (October 1982 price level). This includes $3,299,000[1/] for construction of general navigation facility improvements; $130,000[2/] for mitigation features; $2,784,000[3/] for local sponsor self-liquidating or associated marina features necessary to achieve project benefits; and $78,000 for U.S. Coast Guard navigation aids. Section 107 of the 1960 River and Harbor Act, as amended, limits Federal (i.e., Corps of Engineers) participation in the first cost of the general navigation facilities to $2 million. Accordingly, non-Federal interests will assume full responsibility for the Federal portion of the first cost of the general navigation facilities in excess of the $2 million Federal limitation. This $2 million limit includes preauthorization (i.e., DPR) study costs of $258,000.

c. Federal participation under Section 107 authority in planning, design, construction, and maintenance of small boat marinas is limited to the general navigation facilities, defined as breakwater protection for the moorage area, entrance and access channels, and turning basins. The amount of Federal participation depends on the extent benefits are either local or general in nature. The U.S. Coast Guard has a program, separate from the Section 107 program, to provide 100 percent of the first cost of navigation aids.

1/From table 4-1, $3,460,000 minus $83,000 in mitigation costs minus $78,000 in U.S. Coast Guard navigation aids costs.
2/From table 4-1, $83,000 general navigation facilities mitigation cost plus non-Federal associated marina facilities costs of $47,000.
3/From table 4-1, $2,831,000 in non-Federal associated marina facilities costs minus $47,000 in mitigation costs.

As shown in table 4-1, the Federal share of the project first cost (including DPR study costs) would be $1,820,000. The Federal authority to cost share in project improvements under the Section 107 program depends upon higher authority approval of the findings of this report and subsequent availability of congressional funding. After authorization and funding, detailed plans and specifications would be prepared, followed by construction of the general navigation facility improvements.

d. Non-Federal Responsibilities.

(1) General. The non-Federal share of the project first cost of $6,291,000 is estimated at $4,471,000, and includes $452,000 for the remaining first costs of general navigation facility improvements (including mitigation features costs) in excess of the $2 million Federal cost-sharing limitation under Section 107 authority, $1,188,000 for non-Federal share of general navigation and $2,831,000 for construction of self-liquidating associated marina facilities, including mitigation features' costs. See table 4-1 of the DPR for cost apportionment. The Lummi Tribe will invest approximately an additional $18,000,000 to construct all remaining non-project associated upland water-dependent and marina-related features.

(2) For Navigation Improvements. The Lummi Tribe, as local sponsor, would be responsible for providing necessary lands, easements, and rights-of-way for construction; providing moorage area and upland support features, including confinement and containment dikes for initial and subsequent maintenance dredging disposal; and holding and saving the United States free from damages due to construction works. Additional local sponsor requirements are addressed in section 6 of this DPR.

(3) For the Mitigation Measure. By Federal policy and regulation, mitigation of adverse impacts of the navigation improvement project is a legitimate part of project implementation and is cost shared in the same proportion as the general navigation facilities. Accordingly, the non-Federal share of project mitigation first costs would have been $47,000 or 36 percent of total mitigation costs. However, Federal cost limitations associated with the Section 107 program, result in a revised non-Federal share of 100 percent of mitigation first costs, or $130,000. The local sponsor (Lummi Tribe) requested that the Federal Government allocate 100 percent of available funds to construction of general navigation facilities.

(4) Local sponsor legal requirements are addressed in section 6 of this DPR. Table 4-1 identifies the Federal and non-Federal cost-sharing responsibilities associated with project construction.

4.20 Environmental Monitoring. The cost of water quality monitoring during project construction and maintenance dredging has been included in the Federal general navigation facilities cost (under supervision and administration). The cost of inspecting entrance channel side slopes and adjacent areas to verify eelgrass rejuvenation following project construction has also been

included in Federal maintenance dredging supervision and administration costs. The cost of monitoring mitigation marshes is included as a separate item under operation and maintenance (see table 4-2).

4.21 Local Sponsor Assurances. Required local sponsor assurances are listed in section 6 (Recommendations) of this DPR. The Lummi Tribe, as local sponsor of the proposed project, has furnished informal assurance that they possess the legal and financial authority and capability, under applicable Federal authority and other laws, to assume the non-Federal responsibilities for the proposed Lummi Bay Marina project. Formal assurance will be provided by the local sponsor prior to completion and processing of the final report. Legal agreements for the project construction and maintenance entered into between the United States and the Lummi Tribe (as local sponsor) will be set up so as to be enforceable in United States courts. The local sponsor would also be willing to enter into a legal agreement to place only water-dependent and/or marina-related facilities on fill material.

4.22 The local sponsor will retain fee ownership of the disposal areas for the economic life of the project,1/ and provide the United States Government perpetual easements for disposal areas required for future Federal operation and maintenance work. By letter dated 11 April 1983 (appendix B), the Lummi Tribe has indicated its intent to satisfy the local sponsor requirements.

1/See paragraph 6a of ER 1165-2-317.

SECTION 5. COORDINATION

5.01 Coordination Framework. Interagency coordination has occurred throughout the course of the study. In May 1982, the Lummi Tribe and the Seattle District jointly conducted an environmental interagency field trip to the Gooseberry Point and sea pond project sites. The purpose of the site visit and subsequent meeting was to identify environmental concerns associated with marina projects at these locations. In June 1982 (see letter dated 23 June 1982, appendix A), the Lummi Tribe requested the Corps DPR study focus upon the sea pond site for a possible project. A tentative project design was developed by May 1983, reflecting interagency input. A final public meeting was conducted by the local sponsor in January 1984 during the public review of the draft DPR/EIS. The draft DPR/EIS was distributed for agency and public review on 9 January 1984. The District Engineer's tentative conclusions and recommendations were presented by the Corps of Engineers at the final public meeting, on the Lummi Indian Reservation on 31 January 1984 attended by approximately ____ persons, with the public given an opportunity for questions and comments. Coordination was accomplished throughout the study with Federal, state, and local agencies through meetings and correspondence. This coordination was effective in resolving issues which surfaced during the planning process.

5.02 Coordination With Key Agencies.

a. General. During interagency coordination, some environmental agencies expressed concerns regarding the water-dependent nature of certain non-Federal features proposed for construction on the disposal fill (i.e., barge building). These agencies have requested project mitigation in the form of 1 acre of the sea pond to be reintroduced to tidal action for each sea pond acre to be filled for upland development purposes. Project mitigation features, as discussed in this report, are considered to adequately compensate for project induced environmental degredation, and include 1 acre of tidal reintroduction for 1 acre of upland fill in addition to such measures as eelgrass planting and marsh establishment. In addition to the Lummi Tribe, key DPR study participants included the U.S. Fish and Wildlife Service (FWS), Environmental Protection Agency (EPA), U.S. Coast Guard (USCG), and the Washington State Departments of Ecology, Fisheries, and Game. Formal agency comments on the draft DPR/EIS and other pertinent coordination correspondence are contained in appendix B.

b. Local Sponsor - Lummi Indian Tribe. The Lummi Tribe was an active participant throughout the study. The Tribe arranged for and conducted coordination meetings and the final public meeting, as well as assembled economic, environmental, and engineering data on both Federal and non-Federal project features for use and evaluation by the Seattle District and other agencies. By letter dated 11 April 1983, the Lummi Tribe agreed to furnish the items of local cooperation listed in section 6 of this report. A copy of the letter and other pertinent local sponsor correspondence are contained in appendix B. (The Lummi Tribe will provide an updated sponsorship letter following public and agency review of the draft DPR/EIS.)

c. U.S. Fish and Wildlife Service (FWS). The Olympia office of the FWS was helpful in inventorying the biota of the site, assessing potential project impacts, and offering timely environmental input to the project planning process. In accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958 (Public Law 82-624), as amended, a final FWCA report on the Section 107 project was prepared by the Olympia office of the FWS (to be prepared following public and agency review comments on draft DPR/EIS). A draft FWCA report was included with the December 1983 draft DPR/EIS (see appendix B, part 3) for public and agency review. Draft FWCA report recommendations and Seattle District, Corps of Engineers responses are reproduced, as follows:

FWS Recommendation: We recommend that maintenance dredging spoils be disposed of at an open-water disposal site. A Department of Natural Resources approved site currently exists in Bellingham Bay. Eliminating the contained disposal site within the sea pond will reduce the total amount of fill required for the project by 25 to 30 acres and will reduce adverse impacts to fish and wildlife resources.

Response: Only a tentative decision has been made regarding the disposal site for maintenance dredged material. Alternatives include disposal in the previously designated 25-acre area within the sea pond, in open water, and on uplands. Compliance with Section 404(b)(1) of the Clean Water Act will be evaluated at a later date (prior to maintenance dredging). Compliance and costs will be included in evaluations used in selection of a site.

FWS Recommendation: We recommend that the uplands which will be created be limited in size to that which is necessary for marina support facilities. Restaurants and other nonwater-dependent facilities should be eliminated from the filled area. We have not seen evidence of a commitment to construct the barge-building facility, so filling for such an activity must be considered speculative. In addition, alternative locations likely exist which are suitable for such an operation. Eliminating the barge-building facility could reduce the amount of fill required by about 25 acres and would greatly reduce impacts to fish and wildlife resources.

Response: The Lummi Tribe, in conducting an economic analysis, has determined that 65 acres of upland are necessary to substantiate an economically viable tribal operation. An expanded discussion and justification regarding the proposed upland structures have been included in the draft detailed project report to be distributed for public review. Only water-dependent and/or marina-related structures needed for direct support of marine operations would be placed on the fill area. There are no practicable alternative locations for any of the proposed structures. The local sponsor has stated that there is a strong need for constructing an 8-acre (revised from 25) barge building facility and no other alternative location has been found available or is feasible.

FWS Recommendation: We recommend that the Corps of Engineers attempt to satisfy the HEP analysis mitigation goal and enlarge the presently proposed mitigation area. To fully compensate for project-induced losses, approximately 2 acres of the sea pond should be returned to estuarine flushing for every acre filled. As was stated earlier, the mitigation goal for resource category 4 habitat is to minimize losses and reduce them over time, where possible. Therefore, this service has some flexibility in mitigation recommendations. We recommend that the Corps provide a mitigation area of at least the same number of acres as the number to be filled, and continue to develop other techniques to reduce adverse project impacts.

Response: The proposed project design has been revised to provide a mitigation area of 65 acres for filling 65 acres. To increase biological values, wetland species will be planted in the mitigation and other areas. An additional 25 acres of a possible maintenance disposal area will be subject to tidal action as a result of initial project construction. Disposal site evaluations and selection will occur just prior to maintenance dredging and in accordance with pertinent regulations.

FWS Recommendation: We recommend that the navigation channel be evaluated 2 years after construction to see if eelgrass is revegetating the side slopes. If revegetation has not occurred, we recommend that eelgrass be planted on the side slopes to replace habitat lost during dredging. The state and Federal resource agencies should be consulted to determine whether planting is necessary.

Response: If natural regrowth is determined not to adequately compensate for removal of eelgrass due to project construction, planting of eelgrass will be conducted along the navigation channel and adjacent areas. The appropriate agencies will be consulted. The Seattle District is currently gathering information on eelgrass planting and is coordinating this effort with resource agencies.

FWS Recommendation: We recommend that the mitigation area be planted to eelgrass immediately after construction. The full value of this area will only be realized if good eelgrass growth is established. This area is removed from the lush Lummi Bay eelgrass beds and if it is not planted, vegetation may proceed slowly.

Response: It would be useful to clarify the intended meaning of the terms "full value" of an area and "good" eelgrass growth in your final FWCA report. We agree that successional vegetative growth may be slow and that vegetation can increase an area's biological value. As such, wetland planting has been incorporated into the project design and includes a portion of the mitigation area. Specific species that will be planted have not yet been determined but may include eelgrass. Species selection will be coordinated with the appropriate agencies and will be dependent on characteristics of available habitats. Eelgrass or other plantings will occur as soon as reasonable after construction and will be limited to those areas where potential survival is favorable and where adequate natural regrowth is not predicted to occur.

FWS Recommendation: We recommend that the mitigation area be sloped at least a 10-degree angle towards the outlet to prevent stranding of juvenile salmonids, and the outlet should be as large as possible.

Response: The existing ground surface within the proposed mitigation area is of sufficient slope to prevent fish stranding. The outlet to the tidal mitigation area at the western portion of the sea pond dike will be designed in coordination with the Washington Department of Fisheries. The design will include an opening that will insure adequate tidal action, minimize scouring of the substrate and thus avoid fish stranding, and still provide acceptable wave protection to interior features.

FWS Recommendation: We recommend that the dike between the marina and the mitigation area be gently sloped and planted to marsh vegetation. This will provide cover for nesting and escape and will provide diversity to the mitigation area. State and Federal agency biologists should be consulted to determine the proper plant species. We also recommend that the small marsh near the northwest tide gate be preserved and enhanced.

Response: All proposed slopes have been designed as shallow as possible without threatening the structural integrity of the slope or the project economic feasibility. The slope proposed for the northwestern portion of the mitigation area has been designed to facilitate wetland plantings. Proposed planting locations and selection of wetland species will be coordinated with appropriate resource agencies during the public review period and during preparation of plans and specifications. Proposed project designs include preservation of the small marsh currently existing near the northwest tide gate.

FWS Recommendation: We recommend that every effort be made to control stormwater, garbage, oil and gas, paint, and other pollutants through proper design of the marina and upland support areas.

Response: The local sponsor concurs with this recommendation and has incorporated it into the non-Federal portion of the project by including storm drainage systems as well as oil/gas spill containment and cleanup booms.

FWS Recommendation: We recommend that construction timing be limited as follows:

(1) No construction outside the sea pond from 15 March to 30 November. This will protect outmigrating juvenile salmonids, herring spawning, oyster spat, Dungeness crabs, and juvenile salmon in the net pens, and will avoid conflict with the flounder trawl fishery.

(2) Construction inside the sea pond can take place year round provided sedimentation and turbidity are minimized.

Response: We have incorporated this recommendation into the proposed project designs. However, construction outside the sea pond during the period from 1 December through 15 March poses difficulties to the dredging contractor because of weather conditions. Also, the project construction contract award is tentatively scheduled for April 1985, which essentially means that the contractor will have about 8 months of inactivity before beginning work. Additional project costs will be incurred as a result of the December to 15 March dredging restriction. We believe the December to 15 March restriction is unreasonable and should be reconsidered to allow increased working time. We ask you to reconsider the appropriate dredging window to determine if dredging outside the sea pond could begin in July. This would reduce the highly constrained conditions now imposed on project construction and enable dredging of the boat basin during the Washington Department of Fisheries preferred window. Dredging within the sea pond is scheduled to be conducted anytime of the year provided adverse impacts to aquaculture operations are avoided. Turbidity will be controlled to minimize adverse effects.

FWS Recommendation: If contained disposal in the sea pond is selected, we recommend that the maintenance dredging pond and the mitigation area not be separated by a dike. Disposal material should be piled along the sides of the pond to preserve the middle of the pond as wetlands/mudflat.

Response: The mitigation and tentative maintenance dredging disposal areas will not be separated by a dike for a number of years following project construction. A dike between the two areas may be constructed by the local sponsor just prior to the first year of project maintenance dredging (estimated at year 5), but this will be evaluated under separate action and at a later date. A Section 404(b)(1) evaluation for maintenance dredging disposal will be prepared at that time. If constructed for disposal, the dike would include a weir that remains open during the following 45 years of the project life, except during dredging disposal operations (every 5 years). Accordingly, the site would be subject to decreasing tidal action during the 50-year project life should this site be utilized for maintenance dredging. As such, the maintenance disposal area may be completely filled by project year 50.

d. Department of Transportation, U.S. Coast Guard (USCG). The USCG has the responsibility for installing and maintaining aids to navigation for the Lummi Bay Marina project (see letter dated 16 November 1982, appendix B).

e. (To be completed following receipt of public and agency comments on the draft DPR/EIS.)

5.03 Final Public Meeting. To be completed.

5.04 Coordination of Draft DPR/EIS. At this writing, it is expected that the draft DPR/EIS will be distributed during the week of 16 January 1984 for the required 45-day review by appropriate Federal, state, and local agencies, and interested groups and individuals.

5.05 Coordination of Public Notice. The public notice is attached as appendix A, part 2.

SECTION 6. RECOMMENDATIONS

6.01 I recommend construction of a small boat harbor at Lummi Bay, Washington, consisting of a navigation entrance and access channels and a turning basin and miscellaneous additional features in accordance with the recommended plan in section 4 of this detailed project report. Estimated total first cost of project features under the Section 107 study authority, exclusive of aids to navigation, is $6,203,000 for construction and $63,000 annually for maintenance, provided that prior to construction local interests agree to:

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

b. accomplish without cost to the United States all alterations and relocations as required of buildings, roads, utilities, and other structures and improvements;

c. hold and save the United States free from 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;

d. provide and maintain without cost to the United States adequate berthing areas and local access channels with depths commensurate with those in the Federal improvements, and necessary mooring facilities, utilities, a public landing with suitable water supply and essential sanitary facilities, parking area, and access roads open to all on equal terms;

e. provide a cash contribution of 100 percent of costs allocated to land enhancement, and provide the remaining non-Federal items discussed in section 4 of this detailed project report necessary to achieve project benefits;

f. pay all project costs in excess of the Federal cost limitation of $2 million as provided in Public Law 86-645, as amended; and

g. agree to place only water-dependent and/or marina-related facilities on upland fill.

The Lummi Tribe further agrees to:

a. comply with Section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352), that no person shall be excluded from participation in, denied the benefits of, or be subjected to discrimination in connection with the project on the grounds of race, color, or national origin.

b. comply with Sections 210 and 305 of Public Law 91-646, approved 2 January 1971, and entitled the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970."

The net cost to the Federal Government for the recommended improvement, exclusive of aids to navigation, is estimated at $1,742,000 for construction and $55,000 annually for maintenance.

(TO BE SIGNED FOR FINAL DPR/EIS)

Date:_____

NORMAN C. HINTZ
Colonel, Corps of Engineers
District Engineer

ENVIRONMENTAL IMPACT STATEMENT

SUMMARY

ENVIRONMENTAL IMPACT STATEMENT (EIS)[1/]

1. Major Conclusions and Findings. Under Section 107 of the 1960 River and Harbor Act, the Lummi Indian Tribe requested assistance from the Corps of Engineers to construct a marina on the Lummi Indian Reservation, Whatcom County, Washington. The purpose of the proposed marina is to meet the public and Indian need for moorage and berthing for commercial fishing boats. All initial site alternatives considered were not included in final analysis due to engineering, land usage/ownership, and environmental constraints. Final alternatives consist of no action and construction of a marina in the diked sea pond and a navigation entrance channel in the natural Lummi (Red) River channel just north and west of the diked sea pond. No changes are predicted for Lummi Bay under the no-action alternative. The construction alternative consists of a navigation channel 7,300 feet long, 100 feet wide at the base, and deepened to -12 feet mean lower low water (MLLW) by hydraulic dredge. In addition, a turning basin, access channel, and marina would be hydraulically dredged to a depth ranging from -10 to -12 feet MLLW. The initial construction dredged material would be placed in the sea pond to construct containment dikes and a 65-acre upland for marina support facilities. Maintenance dredging of the channel is predicted to be conducted at 5-year intervals. The tentative alternative proposed for maintenance dredging consists of placement of the dredged material in a 25-acre area of the sea pond. However, disposal at a designated open-water site will also be considered. Final selection of the most appropriate maintenance alternative will be based on evaluation in accordance with the National Environmental Policy Act, the Clean Water Act, and other applicable legislation and regulations. Environmental features of initial construction consist of reintroducing the 65-acre mitigation area of the diked sea pond to tidal action; reintroducing the 25-acre marina to tidal action; reintroducing the 25-acre potential maintenance dredged disposal area to tidal action; maintaining a tidally reintroduced 25-acre, shallow water perimeter around the marina; preservation of an existing marsh at the northwest corner of the diked sea pond; and minimizing the net loss of eelgrass that is used by Pacific herring for spawning.

2. Areas of Controversy. Areas of controversy consist of adequacy of mitigation, adequate alternative analysis for the site selection, size of the fill, water dependency of structures proposed for the fill, and likely net loss of eelgrass that is used by Pacific herring as spawning substrate. Coordination with resource agency representatives has resulted in proposed mitigation consisting of 1 acre of the sea pond reintroduced to tidal action for every acre filled. The Lummi Indian Tribe has indicated that the marina must be on tribal land and no other practicable or feasible site is known to exist. The Lummi Indian Tribe has stated that in order to construct the needed structures, all of the proposed fill is needed. Only water-dependent

1/Information, displays, etc., referenced in the main report or appendixes are incorporated by reference in the EIS.

or necessary marina-related facilities (with no practicable alternatives) are proposed for the 65-acre fill. Investigations and evaluations were conducted to estimate acres of eelgrass that would be lost as a result of navigation channel construction and acreage of eelgrass that could successfully be planted (or would naturally repopulate). It is likely that the proposed project would result in a net loss of eelgrass, including that used by Pacific herring for spawning.

3. Issues to be Resolved.

a. The Washington Department of Fisheries (WDF) has requested a crab study to assess short- and long-term impacts of the proposed project on Dungeness crab. Coordination in early stages of project planning had resulted in agreement that a crab study was not necessary if dredging occurred between December 1 and March 15. The proposed project was designed to minimize adverse impacts to crabs, particularly through dredging timing, and projected impacts are not considered to be potentially significant enough to warrant detailed crab study. Further coordination will be conducted during review of this draft to attempt to resolve this issue.

b. In order to minimize potential impacts to Dungeness crab, the WDF has recently requested that only clamshell dredges be used. However, the use of clamshell dredges is not economically feasible.

c. The WDF has concurred with tentatively proposed timing of dredging outside of the sea pond (December 1 to March 15) but has recommended that dredging within the diked sea pond not be allowed from March 15 to June 15 in order to avoid potential impacts to juvenile outmigrating salmonids. Resource personnel, including WDF representatives, previously assisted in developing the tentatively proposed dredging schedules consisting of December 1 to March 15 outside of the sea pond and any time of the year inside of the sea pond, provided there are no significant impacts to aquaculture operations. The WDF suggested additional dredging time constraints could adversely impact the economic feasibility of the dredging project. Further coordination during review of this draft will be accomplished before finalizing construction schedule.

d. Potential impacts to peregrine falcons resulting from project construction have not been determined due to lack of available information on their presence or use of Lummi Bay. A study is being conducted during the winter of 1983-1984 to address potential impacts. Results will be incorporated into the final report and EIS.

e. The specific acreage of eelgrass that would be removed through navigation channel construction are not precisely known, but is estimated at 29 acres, part of which is used by Pacific herring as a spawning substrate. Eelgrass transplanting and natural revegetation would likely be possible for about 7 acres. Thus it appears that project implementation would result in a net loss of about 22 acres of eelgrass, which represents about 1 percent of the existing eelgrass habitat in Lummi Bay. A portion of the eelgrass removed is used by Pacific herring as a spawning substrate. While a loss of Pacific herring spawning substrate is inconsistent with the policy of the WDF, it is not practicable to fully replace the lost eelgrass.

TABLE EIS i-1

RELATIONSHIP OF LUMMI BAY MARINA
STUDY TO ENVIRONMENTAL REQUIREMENTS

FEDERAL STATUTES	COMPLIANCE
Archeological and Historic Preservation Act, as amended 16 USC 469 et seq.	Partial[1/]
Clean Air Act, as amended 42 USC 1857h-7 et seq.	Full
Clean Water Act	Partial[1/2/]
Coastal Zone Management Act, as amended, 16 USC 1451 et seq.	N/A[3/]
Endangered Species Act, as amended, 16 USC 1531 et seq.	Partial[1/]
Estuary Protection Act 16 USC 1221 et seq.	Full
Federal Water Project Recreation Act, as amended, 16 USC 460-1(12) et seq.	N/A
Fish and Wildlife Coordination Act, as amended, USC 661 et seq.	Partial[1/]
Land and Water Conservation Fund Act, as amended, 16 USC 4601-4601-11 et seq.	Partial[1/]
Marine Protection Research and Sanctuary Act, 33 USC 1401 et seq.	Full
National Environmental Policy Act, as amended, 42 USC 4321 et seq.	Partial[1/]
Rivers and Harbors Act, 33 USC 401 et seq.	Full
Watershed Protection and Flood Prevention Act, 16 USC 1001, et seq.	Partial[1/]
National Historic Preservation Act, 16 USC 407a et seq.	Full
Wild and Scenic Rivers Act, as amended, 16 USC 1271 et seq.	N/A
Executive Orders, Memoranda:	
Flood Plain Management 11988	Full
Protection of Wetlands 11990	Partial[1/]
Environmental Effects Abroad of Major Federal Actions 12114	Full
Executive Memorandum Analysis of Impacts on Prime and Unique Farmlands in EIS, CEQ Memorandum, 30 August 1976	N/A

STATE AND LOCAL POLICIES	COMPLIANCE
Washington State Constitution	
Article XV. Harbors and Tide Waters	N/A
Article XVII. Tidelands	N/A
Multiple Use Concept in Management and Administration of State Owned Lands (RCW 79.68.060)	N/A
State Environmental Policy Act of 1971 (RCW 43.21)	Partial[1/]
Water Resources Act of 1971 (RCW 90.54)	N/A
Shoreline Management Act of 1971 (RCW 90.58)	Full
Water Pollution Control Act (RCW 90.48)	Partial[1/]
Permits Required:	
Shoreline Substantial Development Permit	No
Shoreline Conditional Use Permit	No
Washington Department of Natural Resources Lease of Tidelands	No
Washington Department of Ecology Water Quality Certification	Certification will be obtained following WDE review of draft EIS

1/Full compliance with final approval of this document.

2/State water quality certification will be obtained following review of the draft EIS by WDE.

3/Under this Act, lands held in trust by the Federal Government, its officers or agents are excluded from the coastal zone.

NOTES: The compliance categories used in this table were assigned based on the following definitions:

a. Full Compliance - All the requirements of the statute, executive order, and related regulations have been met.

b. Partial Compliance - Some requirements of the statute, executive order, or other policy and related regulations remain to be met.

c. Noncompliance - None of the requirements of the statute, executive order, or other policy and related regulations have been met.

d. Not applicable (N/A) - Statute, executive order, or other policy not applicable.

LUMMI BAY MARINA EIS

TABLE OF CONTENTS

TABLE OF CONTENTS (con.)

TABLE OF CONTENTS (con.)

TABLES

TABLE OF CONTENTS (con.)

FIGURES

SECTION 1. NEED FOR AND OBJECTIVES OF ACTION

1.01 Study Authority. Section 1 of the detailed project report (DPR) provides detailed discussion of the study authority. This environmental impact statement (EIS) is prepared as required by Section 102(2)(C) of the National Environmental Policy Act of 1969 and the Council on Environmental Quality Regulations on Implementing National Environmental Policy Act Procedures (43 FR 55990). The requirements of Section 404(b)(1) of the Clean Water Act of 1977 (Public Law 95-215); Executive Order (EO) 11990, Protection of Wetlands; EO 11988, Flood Plain Management, Coastal Zone Management Act, and other applicable statutes were considered during the planning of this project and are discussed in appropriate sections of this document (see table EIS i-1 and EIS section 4.02f).

1.02 Statement of Problem, Needs, and Objectives. The study area is located in Lummi Bay, on the Lummi Indian Reservation, near Bellingham, in Whatcom County, Washington (see DPR figure 1-1). The Lummi and Nooksack Indian (hereafter referred to as Treaty) fishing fleets and non-Indian commercial fishermen lack adequate berthing facilities in Whatcom County. The Lummi fleet is one of the largest in the state and the majority of tribal members depend upon open-water fishing for their economic livelihood and subsistence. Squalicum Harbor, which is situated at Bellingham, approximately 7 nautical miles southeast of the sea pond in Lummi Bay, offers the closest available moorage facility to the Lummi Reservation. Several tribal fishing boats moor in the Sandy Point area, located approximately 0.5 nautical miles northwest of the sea pond. Nooksack Indians and nontreaty fishermen also moor their fishing boats at Squalicum Harbor. Traveltime from Squalicum Harbor to regional open-water fishing areas is a major concern of fishermen as it substantially increases operating expenses and decreases time available for fishing. In addition, traveltime from their homes to the marina where they moor their boats is a concern (see appendix D for detailed discussion of economic and social involvement).

A regional shortage of berthing facilities for commercial fishing boats and harbor overcrowding, which currently poses navigation safety and boat damage problems, will continue to exist even with expansion of moorages at Squalicum Harbor. Mooring additional Lummi commercial fishing boats in the Sandy Point area under present conditions is not considered possible. There are very few berthing spaces, space for additional berths is limited, and much of the area is privately owned.

In undertaking the proposed project, the Lummi Tribe has three objectives: to provide safer and less crowded moorage for commercial fishermen, to reduce traveltime to and from fishing grounds from the marina as well as between their home and the marina, and to provide income to the Lummi Tribe through operation of a tribally owned and operated marina. This last objective also reflects the Administration's policy of promoting Indian economic self-sufficiency on reservations.

Squalicum Harbor officials indicate that transfer of Indian and other commercial fishing fleets is desirable and will not adversely impact Squalicum's financial condition because income from moorage fees for rafted boats is minimal and is far outweighed by the potential for fire, safety, and navigation hazards created by the current overcrowding.

SECTION 2. ALTERNATIVES

2.01 Alternatives Eliminated from Further Study. The concept of wet moorage satisfied the planning objective more closely than dry land storage and no action. Alternative wet moorage sites eliminated during early study planning because of engineering and/or economic reasons were expansion of existing public boat harbors outside the Lummi Reservation (see DPR section 3.09c), construction of marina support facilities on existing uplands (see section 4.08j of DPR for details), and construction of marinas on the Lummi Reservation at sites other than the northwestern portion of the existing sea pond (see DPR sections 3.09d to h). Four of five alternative sites were investigated by the Lummi Indian Tribe for marina development and then eliminated from further consideration. Those eliminated from further study are Gooseberry Point south, east Sandy Point, Onion Bay, and the oyster lab (a site adjacent to the southwestern portion of Lummi Bay) (see DPR figure 3-1 for site locations). Site environmental, economic, and land use concerns are discussed below.

a. Gooseberry Point South. This site is located south of Gooseberry Point between the tribe's Stommish (ceremonial) grounds and Gooseberry Point. Significant marine resources exist at Gooseberry Point. The extensive beds of eelgrass located at the site are an important aquatic resource. They are important for herring spawning and would be heavily impacted by marina construction and operation. There appears to be also populations of Dungeness crabs and clams in the area that would be eliminated by construction of a marina, especially through filling for upland facilities. Much of the upland immediately north at the Gooseberry Point marina site has been built up for housing, and so construction or future expansion of a marina at Gooseberry Point could conflict with adjacent landowners and existing land uses. This site was primarily eliminated from further consideration due to the anticipated severity of environmental impacts. Refer to the DPR, section 3.09g, for further discussion of the Gooseberry Point south site.

b. East Sandy Point. Although the area just east of Sandy Point is located within the boundaries of the Lummi Reservation, most of the property proposed for the marina is owned and has been developed for residential use by non-Indians. Upland space for development of marina related facilities is limited. Environmental concerns include the area and amount of dredging, as well as the volume of fill within a tidal wetland, that would be required for a commercial fishing marina. Significant associated environmental impacts would occur as a result of filling the tidal wetland.

c. Onion Bay. Development of a marina in Onion Bay would require dredging a considerable volume of material to accommodate marina development and could lead to significant affects on water flushing, circulation, and quality. Due to the extensive dredging and design modifications that would be required, the Onion Bay site is not considered economically feasible. Major environmental concerns include potential impacts on eelgrass and herring spawning.

2.02 Final Alternatives. (See DPR table 3-1 for summary comparison of final alternatives).

a. Alternative 1: No Action. Under the no-action alternative there would be no Federal involvement in the proposed project. The current needs for additional moorage by the Lummi and Nooksack Indians and the surplus nontreaty commercial fishing fleet would continue to exist. Lummi fishing boats would continue to moor in Squalicum, Blaine, Point Roberts, and other harbors. The majority of Lummi and Nooksack fishermen would still have to travel long distances to fishing grounds. Problems associated with overcrowding of boats at Squalicum Harbor would still exist. Environmental impacts associated with the construction and operation of a marina at Lummi Bay would not occur. Local entities would probably not pursue marina construction without Federal assistance.

b. Alternative 2: Lummi Bay Marina, Sea Pond Site (Recommended Plan).

(1) Engineering Features. The boat basin is proposed to be located in the northwest corner of the diked sea pond (see plate 2). An existing shallow channel running along the north dike of the sea pond and out to the deeper water by Hale Passage would be deepened by hydraulic dredge to -12 feet mean lower low water (MLLW) to establish a navigation entrance channel (plate 1). Sediment in the marina access channel turning basin and marina basin would be removed by hydraulic dredge to variable depths of -10 to -12 feet MLLW. Approximately 825,000 cubic yards (c.y.) of sediment would be removed to construct the 7,300-foot navigation channel, as well as a turning basin at the marina entrance and an access channel within the marina. Entrance to the boat basin would be from the north, the direction of minimum wave attack. The existing sea pond dike and a new timber pile wall at the marina entrance would provide breakwater protection to the marina. Construction of the boat basin would require removal of an additional 645,000 c.y. of sediment. Side slopes of the proposed project features are described in section 4 of the DPR and shown in plate 7. The entrance channel and boat basin have been designed to maximize circulation and flushing and provide maximum wave protection to boats inside the basin by location, design, and use of a timber pile breakwater at the entrance. The timber pile breakwater has been designed to allow for fish passage. Dredged material would be placed in the sea pond to provide uplands for marina support facilities. Proposed fill consists of 65 acres for the upland facilities and its containment dikes[1/]. Fill of 2.9 acres would be placed to construct a dike between the marina and mitigation area. Fill of 1.1 acres would be required for the construction of the mitigation area dike. Fill of 1.3 acres would be placed to construct a dike for an area reserved as the tentatively selected site for disposal of maintenance dredged material. Initial dike construction will provide for 146 acres of the sea pond to be reintroduced to tidal action: 65 acres for mitigation, 25 acres for potential placement of

1/All dike acreage estimates refer to the cross section area of the dikes at mean higher high water (+8.6 feet at project site).

maintenance dredged material, 25 acres at the moorage basin periphery, 25 acres for the moorage basin itself, and 6 acres for the turning basin and access channel. At 5-year intervals, maintenance dredged material is proposed to be placed in a reserved 25-acre section of the sea pond which had been initially reintroduced to tidal action. Alternatively, maintenance dredged material may be placed at a designated open-water disposal site, in which case the 25 acres would remain as intertidal lands. Final selection of a maintenance dredging alternative is scheduled to be made approximately 5 years after project construction and in accordance with the National Environmental Policy Act, the Clean Water Act, and other appropriate legislation and regulations. If maintenance dredged material is placed within the sea pond, fill of 1.0 acre for containment dike construction in the sea pond between the mitigation and maintenance areas may be conducted just prior to maintenance dredging.

Water quality impacts of dredging and disposal are detailed in sections 4.02a.(2) and (3) and section 4.03c.

Local sponsor (non-Federal) marina features are described in detail in the DPR but generally include a fuel dock, fishing boat moorages, and transient moorages. Upland facilities include parking lots, access docks, a boat launching ramp, fish buying and processing freezers, an egg house, cold storage areas, web houses, an unloading pier, boat haulout areas, repair yards for boats, restrooms, a harbor master building, engine repair facilities, a fish supply store, a restaurant, a small grocery store, and a fish market. See the DPR report for details of proposed features. (Plate 1 identifies the location of some of the upland features.)

Potable freshwater would be supplied from existing wells located on the reservation. Restrooms would include showers and be located at the harbor master building. A sewage pumpout facility for boats would be located at the fuel dock. Sewage would be pumped out of the area and given secondary treatment at an existing sewage treatment plant located on tribal land near Portage Island. The treatment plant is presently operating below capacity and thus will be able to accept additional waters. A complete storm drainage system would be constructed for all marina upland areas and would include catch basins with oil separation devices. Two containment and cleanup booms would be located at the marina for use in accidental fuel or oil spills. A fire hydrant standpipe, fire hose, cabinet, fire extinguisher, and foam would be placed at the marina in case of fires.

(2) Environmental Features. Location of the navigation channel has been proposed along an existing natural channel in Lummi Bay to minimize impacts to the eelgrass/algae community. Eelgrass planting is proposed for the navigation channel and adjacent areas but nevertheless a net loss of about 22 acres of eelgrass is predicted to occur, which may represent about 1 percent of eelgrass found in Lummi Bay. The access channel and boat basin have been designed to maximize flushing and circulation in order to maintain water quality within the proposed boat basin and the modified sea pond. The timber pile breakwater at the marina entrance has been designed for fish passage. The marina has been designed to maximize tidal flushing and thus minimize adverse water quality, poor dissolved oxygen (DO), and high temperatures (see EIS section 3.02b.(1) and 4.02a. for water quality details). About 25 acres within the marina harbor would be maintained at the

existing shallow water/intertidal elevation. A marsh that exists at the northwest corner of the diked sea pond would be preserved. A 65-acre section of the sea pond would be reintroduced to tidal action and would include a containment dike. The western part of the dike located on the sea pond side between the sea pond and the mitigation area would be constructed with shallow slopes and planted with wetland vegetation. Wetland vegetation would also be planted in portions of the designated maintenance disposal and 65-acre mitigation areas, where portions of the dikes would be constructed to have shallow slopes. Wetland vegetation may be planted within parts of the marina.

(3) Fish and Wildlife Mitigation. Fish and wildlife mitigation is summarized above and detailed in section 4.03b.

2.03 Comparative Impacts of Major Alternatives. See DPR table 3-1 for summary comparison of final alterntives.

a. No-Action Alternative. Under the no-action alternative, none of the environmental impacts associated with marina construction and operation would occur. Crowded conditions and attendant problems at regional moorage areas would continue (see appendix D for economic and social details).

b. Construction Alternatives. Short-term, localized construction impacts would be similar for all sites and designs and would include increased noise, impacts to water quality, air quality, and visual esthetics. Aquatic vegetation would be removed, thus reducing or eliminating faunal habitat. Macroinvertebrate and fish communities would be eliminated from the area proposed for fill. A different macroinvertebrate community would inhabit the proposed marina. Pilings, floats, and other in-water structures would provide additional habitat for marine flora and fauna, creating a different aquatic community. Fish, such as salmon, may increase their use of the proposed marina area. Birds would be disturbed by increased human activity at the proposed marina and channel with the result that birds more tolerant of human activity would increase and those less tolerant would decrease.

Impacts due to marina operation include minimal short-term impacts to aquatic biota, air quality, and water quality, as well as minimal long-term decreases in water quality due to increased runoff carrying soil, oil, grease, boat maintenance products, and direct input by boats of petroleum hydrocarbons, sewage, and other toxic substances. Marine flora and fauna would be impacted by the decrease in water quality and physical disturbances resulting from maintenance dredging and scouring due to powerboat operation.

Marina facilities and general design are similar for all alternatives discussed below. As discussed in section 2.01, alternatives (1) through (3) below have been eliminated from further study.

(1) Gooseberry Point South. Resources at Gooseberry Point that would be impacted by marina construction include eelgrass, shellfish beds, and juvenile coho, chum, and chinook salmon from the Nooksack River. The

alternative was eliminated from detailed study primarily due to environmental concerns. This site was formally eliminated from detailed study by request of the local sponsor (see appendix B for correspondence from Lummi Tribe).

(2) East Sandy Point. The east Sandy Point site is composed of some intertidal wetlands and mudflats. The area is not zoned for commercial development and access roads to the area are narrow. The few salmon that may use the Lummi River (also known as the Red River) would pass near Sandy Point. Juvenile herring, sand lance, and anchovy are known to be in the general area. In Lummi Bay near Sandy Point, populations of Dungeness crab, clams, and oysters are found. The area supports resident and migratory waterfowl populations such as Western grebe, mallard, pintail, black brant, and American wigeon. Extensive dredging and filling of tidal areas, although not as much as that for the Onion Bay site, would be required to construct and operate a marina at this site. Eelgrass and associated fauna would be temporarily and/or permanently removed. These impacts would be similar to those at the Lummi Bay site. The proposed east Sandy Point site was eliminated from further study because the area is not zoned for commercial development, access roads are inadequate, and there are major environmental impacts resulting from filling a tidal wetland for marina support facilities.

(3) Onion Bay. Onion Bay is very close to east Sandy Point and thus has many similar resources to that site. The Onion Bay site and most surrounding uplands are owned by the Lummi Tribe. Extensive dredging for a boat basin and access channel would be required. Eelgrass would be removed during project construction. Species that use the eelgrass areas for rearing and feeding may move to other areas as a result of project construction and thus may decrease their survival and numbers. This may include Dungeness crab, juvenile salmon, and Pacific herring. Some fish usage would probably increase at the proposed marina. Herring spawning would be eliminated from the area. Crab usage of the proposed navigation channel should increase. Avian fauna appear to use the tidal flats in this area and their usage of the area would probably be decreased as a result of project construction. This site was eliminated from detailed consideration because of the extensive construction and maintenance dredging that would be required, potential impacts on a nearby wetlands, and disruption of predator bird populations.

(4) Lummi Bay Sea Pond. In general, portions of the Lummi Indian sea pond are used for rearing salmon and oysters. Construction of a marina within the sea pond would reduce its aquatic biota and total volume of water. As a result of the combination of both a decrease in water volume and closure of the northwest tide gate, water temperature and DO within the sea pond are expected to remain about the same. Impacts as a result of navigation channel construction will be similar to those of construction of a marina in Onion Bay, with the exception that impacts to eelgrass and known herring spawning areas may not be as great. Waterfowl that now use the sea pond may decrease their activities at the sea pond due to increased marina activities. Even though extensive dredging would be required, the dredging would be in a diked area of very little tidal action and in a natural river channel with apparent

lesser amounts of aquatic biota than other areas of Lummi Bay. As such, impacts to aquatic biota may, at the same elevation, be less than at the other sites. Water quality and proper flushing can be attained with the proposed design (see DPR report). The primary reason for local sponsor selection of the site was because it is on Lummi Tribal land.

SECTION 3. AFFECTED ENVIRONMENT

3.01 Study Area. The study area is located on the Lummi Indian Reservation, within Lummi Bay, near Bellingham in northwestern Washington (see DPR figures 1-1 and 1-2). Lummi Bay covers a surface area of about 6 square miles of shallow, tribally owned tidelands. The river that flows into Lummi Bay is now a branch of the Nooksack River called the Lummi (or Red) River and is 5.25 miles in length. The head of Lummi River is at the Nooksack River (river mile 4.5) where a culvert allows water to flow from the Nooksack River into the Lummi River only at high flows such as at flood conditions. Portions of the Lummi River banks have been diked. Prevailing currents direct waterflows from Bellingham Bay through Hale Passage (located between Lummi Island and Lummi Peninsula), past Lummi Bay, and then into the Strait of Georgia.

Construction of a Lummi Indian Tribal aquaculture facility occurred between 1969 and 1977. The facility consists of a hatchery and oyster complex and a 760-acre diked sea pond. Operation commenced in the summer of 1972 with the first large fish and oyster crop occurring in 1973. Tide gates were constructed along the dikes at several locations (see plate 2) with openings that permit partial drainage of the enclosed diked area. Freshwater is obtained for the hatchery and oyster complex via a piping system extending from Kwina Slough, off of the Nooksack River, to the sea pond. Currently, only portions of the sea pond are used for acquaculture, partially due to high temperatures occurring during the summer. Primary aquaculture operations consist of spawning and rearing salmon at the hatchery located along the southern portion of the sea pond. Some species are placed in nets near the southwest tide gate within the sea pond for final rearing prior to release. Although oysters are not currently grown in the sea pond itself, water from the southwest portion of the sea pond is used for their initial rearing at the building located at the southwest edge of the pond.

3.02 Environmental Conditions.

a. Physical Environment. The Lummi Reservation is located 8 land miles northwest of Bellingham and is within a narrow peninsula consisting of 5,000 acres of tidelands, 12,000 acres of upland-interior, and 1,000 acres on Portage Island (Lummi Planning Office, 1980).

(1) Geology and Sediments. The geology of the Lummi Reservation is the result of three basic processes: (a) Vashon recessional outwash (northern uplands), (b) Vashon advance outwash, and (c) Nooksack alluvium. The Nooksack River used to flow directly into Lummi Bay but now flows only into Bellingham Bay. It appears that the natural alluvial delta process is the prime cause of sediment distribution and arrangement in Lummi Bay. In deep soil survey borings it was found that there was some clay at considerable depths, but the primary materials are very loose sands and soft silts. Top sediments consisted of primarily medium to very fine sands with smaller percentages of silt and clay. See appendix C for distribution and descriptions of Lummi Bay and sea pond sediments.

(2) Climate and Weather. The climate in the general area is a temperate marine type with relatively mild, wet winters and cool, dry summers. Recorded observations in Bellingham over a period of 43 years indicate a maximum temperature of 97° F, a minimum of -4° F, and a mean of 49° F. The mean annual rainfall on the reservation and associated coastal zone is 32 inches. Prevailing surface winds at Lummi Bay are from the southeast, southwest, west-northwest, and northeast. Frontal systems advancing from the south are common year around and contribute to the southeast and southwest winds. Winds from the southeast are most frequent and tend to funnel through Hale Passage. Strong southwest winds can be accompanied by considerable wave development from the southernly fetch beyond Point Migley on Lummi Island. These waves combined with extreme high tides in the winter of 1983 to cause extensive damage to the western-most section of the existing aquaculture dike.

From late fall to early spring, west, northwest, and northeast winds are common. These westerly winds, while less frequent than northeastern winds, are significant because of the extreme fetch (up to 100 nautical miles) up the Strait of Georgia. Wind under these conditions can form 3- to 6-foot waves that enter Lummi Bay by bending around Sandy Point. This infrequent but powerful force is responsible for the net southward littoral drift forming Sandy Point and the shoal to the south. Northeast winds are cold, dry, inland winds from the Fraser River Valley. At times these can be steady 15-20 knot winds that may last for several days. During extreme cold conditions, ice forms in the aquaculture pond and adjacent tide flats. Fog may occur at any time of the year, but is most frequent in the spring or autumn.

(3) Air Quality. The Federal Clean Air Act of 1970 required the Environmental Protection Agency (EPA) to promulgate national primary and secondary ambient air quality standards. These standards were published in 1971 and were either adopted or made more stringent by the Northwest Air Pollution Authority (NWAPA). Air quality in Whatcom County is monitored by NWAPA, which has several suspended particulate and sulfur dioxide monitoring stations in Bellingham. Air in the Lummi Bay area appears to have good circulation and few local sources of pollutants.

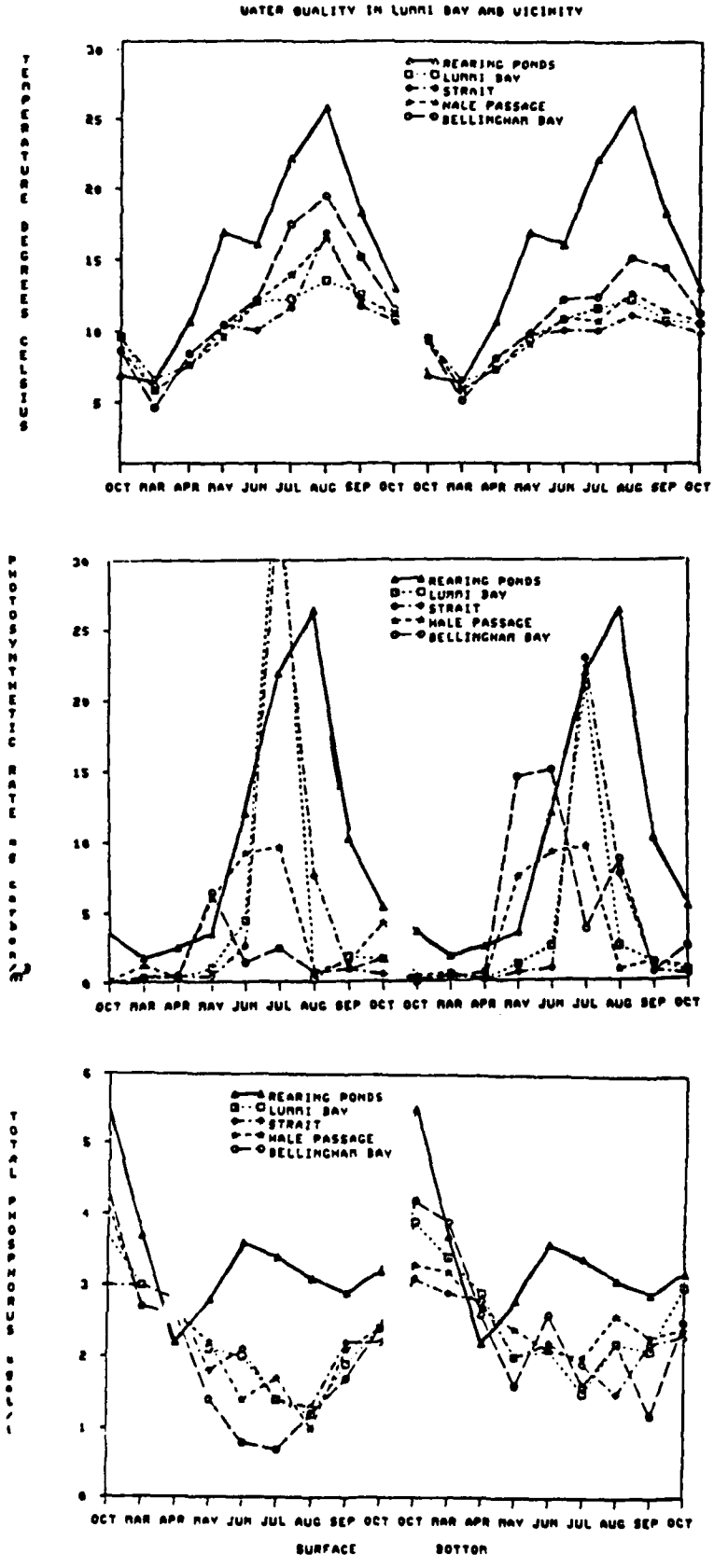
b. Ecological Environment.

(1) Water Related Conditions. Lummi Bay is a shallow water habitat with extensive tidal flats. The bay depth varies from 16 feet to 0 feet above MLLW. Due to the lack of confining topography, the water in the bay freely exchanges with the water from Hale Passage and the Georgia Straits. The major freshwater source to the bay is the Lummi River. During spring thaws, when riverine discharges are at their peak, the Fraser River introduces an additional source of freshwater to the Straits, which is in turn carried into the bay. The freshwater sources carry nutrients, bacteria, and organic compounds into the bay. Nutrients, pesticides, bacteria, and other material carried by the Lummi River usually deposit in the river or over its delta. Those elements which are not deposited on the delta are dispersed over the flats and carried out into the deeper marine waters on the ebbtide.

With the construction of the aquaculture facility, 760 acres of tidal flat were confined within dikes. Diking of the water restricted the flow, reducing the original 100 percent tidal flushing in the diked area to about 10 to 15 percent per tidal cycle. Reduction in flushing caused changes to the water quality. The temperature of the water in the bay is closely related to the air temperature due to the shallowness of the water and the large surface area. With the increased retention time of the water behind the dike, the temperature is increased or decreased to some degree over that of the open bay. In addition, nutrients which would normally be diluted or flushed out of the bay are retained within the ponds. The additional nutrients and increased residence time results in an increase in productivity. Due to the shallowness of the bay, the water is fairly well mixed so there is no measurable difference in DO from the surface to the bottom of the water column. Data on nutrients and productivity obtained by the Lummi aquaculture project and Washington Department of Fisheries (WDF) is presented in figure EIS 3-1. The salinity in the bay varies with the freshwater input, reaching minimal levels in the surface waters during spring thaw. The salinity of the ponds also undergoes a reduction during spring and is generally higher than the lowest values experienced in the bay.

(a) Pesticides. Pesticides are primarily carried into the bay with water and sediment during periods of high runoff (storms, winter-spring thaw). The pesticides pass through the Nooksack River system into the Lummi River and into Kwina Slough. Deposition of sediments and any attached pesticides would occur in the slough, at the mouth of the river, and in the river delta. The pesticides measured in Kwina Slough by the U.S. Geological Survey were the highest concentrations observed (Parker, 1974, table EIS 3-1). In general, the concentrations observed throughout the area were very low, particularly in the sea pond, the vicinity of the proposed marina. The quantity and variety of pesticides has diminished in the county with restrictions imposed on most of the compounds previously measured by the Soil Conservation Service (SCS) (personal communication). It is expected that the levels of these elements in the sediments would, therefore, have decreased since the 1974 study. Recent information from the SCS has added additional compounds to the original list. The compounds now in use are not on the EPA priority pollutant list and are not considered high risk compounds for human health. The most frequently used compounds are atrazine, dinoseb, and vernolate.

(b) Fecal Coliforms. The sanitary quality of the Nooksack and Lummi Rivers declines as the water moves toward the mouths of the rivers (Parker, 1974). This is due to the increased agricultural and urban activities in the lower watershed. As most of the Nooksack water flows into Bellingham Bay, few, if any, contaminants reach Lummi Bay. Small volumes of water from the Lummi River are discharged into the bay. The concentrations of fecal coliforms found in the bay were fewer than in the river or nearby Kwina Slough (Parker, 1974). The levels found in the sea pond were lower than any other site (Parker, 1974). The decrease of bacteria in the water of Lummi Bay may have been due to several factors, including: sunlight inhibition, marine microbial competition or predation, dilution and/or flushing, and settling



EIS-12

FIGURE EIS 3-1

TABLE EIS 3-1

SUMMARY OF PESTICIDE ANALYSES
OF BOTTOM SEDIMENTS IN KWINA SLOUGH

		Maximum		Minimum	
Pesticide	No. of Samples	PPB ug/kg	Date or Number of Occurrences	ug/kg	Number of Occurrences
Aldrin	16	0.2	16	0.2	16
DDD	16	0.8	9/7/71	0.2	12
DDE	16	0.9	10/11/72 11/5/72	0.2	8
DDT	16	1.2	9/21/72	0.2	13
Dieldrin	16	0.2	16	0.2	16
Endrin	16	1.6	7/26/72	0.2	15
Heptachlor	16	0.2	16	0.2	16
Heptachlor epoxide	16	0.2	16	0.2	16
Lindane	16	0.2	16	0.2	16
Chlordane	16	1.0	16	1.0	16
Parathion	10	0.2	10	0.2	10
Methyl parathion	10	0.2	10	0.2	10
Diazinon	1	0.2	7/19/71	0.2	1
2,4-D	11	1/	--	1/	--
Silvex	11	1/	--	1/	--
2,4,5-T	11	1/	--	1/	--

1/Absent or less than a variable lower limit of detection. Sampling period 19 July 1971 to 30 September 1971.

Source: USGC Open File Report, Parker, 1974.

either at the mouth or over the river delta. It is unlikely that large concentrations of bacteria would be found in Lummi Bay, except during periodic winter storms when Lummi River discharge may be at its peak. At this time, due to low temperatures (which promotes survival) and high runoff, the bacterial load of the system may be increased (Parker, 1974; preliminary Corps of Engineers studies in Grays Harbor). Even at this time, the fecal coliforms observed in the harbor would most likely only prevail for short periods.

(c) Trace Metals. Of the metals that were examined, mercury, cadmium, and zinc were the only ones detected in any significant concentration (table EIS-2). They can be considered below EPA, 1976-1980, criteria for saltwater.

(2) Terrestrial Flora. Terrestrial vegetation in the project vicinity consists of diked areas that were once partly wetlands but have now been diked and converted to agricultural lands. Some forested lands exist both east and northeast of Lummi Bay.

(3) Aquatic Flora. Eelgrass exists throughout Lummi Bay, especially in the lower areas. Using an infrared aerial photograph, it was estimated that there may be up to 2,000 or more acres of eelgrass in the tidal areas of Lummi Bay. Eelgrass distribution is regulated by factors such as substrate type, light, turbidity, temperature, and currents. Eelgrass communities have been known to stabilize bottom sediments, absorb wave and current energy, and decrease erosion. Eelgrass is important to the aquatic fauna by providing food, shelter, and an attachment surface for some species. Eelgrass areas are vital to some migrating fauna such as herring, Dungeness crab, and waterfowl.

Eelgrass presence generally increases biological productivity and diversity of the estuary. Species closely associated with eelgrass are (1) those avian fauna whose diet is largely composed of leaves (i.e., black brant, wigeon, scoter, canvasback, and coot); (2) those fish that use the area for spawning and/or rearing (i.e., herring, smelt, and salmonids); and (3) Dungeness crab that use the area for mating and rearing (Proctor et al., 1980).

In April 1973, shortly after initiation of sea pond aquacultural operations, a study was conducted within and immediately outside of the sea pond. The study purpose was to determine existence of aquatic vegetation and benthic biota. Extensive eelgrass (Zostera spp.) beds were seen at the lower southern portion of the pond (stations A-1, A-2, A-3, and B-1) and at the northwest corner area (stations A-6 and A-7) (see figure EIS 3-2 for station locations). These are immediately adjacent to the two main tide gates and receive greater tidal exchange than other sea pond areas. In areas void of eelgrass growth, according to a 1973 study (Heath, 1975), a filamentous diatom grows abundantly. This type of diatom commonly blooms in the springtime.

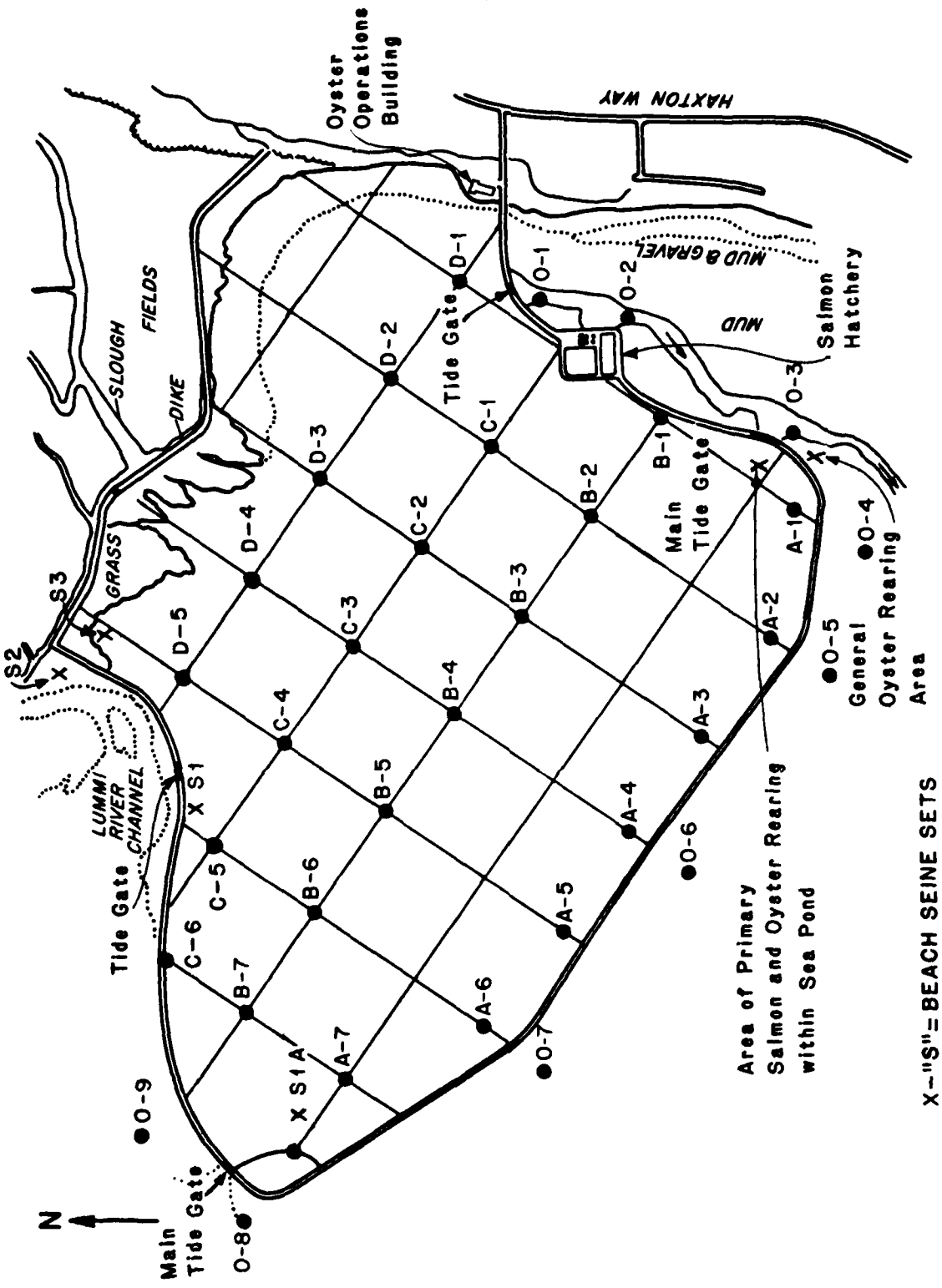
TABLE EIS 3-2

SUMMARY OF TRACE-METAL ANALYSES OF KWINA SLOUGH AT THE FISH PENS, SHOWING SAMPLING PERIODS, MAXIMUMS, AND MINIMUMS WITH DATES OF OCCURRENCE OR NUMBER OF OCCURRENCES, AND MEAN AND MEDIAN CONCENTRATIONS

Constituent	Sampling Period	Number of Samples	Maximum		Minimum		Mean	Median
			Micrograms Per Liter	Date of occurrence	Micrograms per Liter	Number of occurrences	Micrograms Per Liter	
Chromium, dissolved	8/10/79 to 2/2/72	39	0	--	0	--	0	0
Lead, dissolved	do	47	7	12/30/71	0	19	1	1
Zinc, dissolved	do	47	40	9/1/71	0	12	10	10
Selenium, dissolved	do	12	7	9/27/71	0	3	2	2
Copper, dissolved	do	46	7	9/3/71	0	3	2	2
Cadium, dissolved	do	44	1	[a]3	0	41	0	0
Mercury, total	do	47	1.2	8/19/71	0	10	0.2	0.2
Arsenic, dissolved	9/29/71 to 2/2/72	8	8	2/2/72	0	4	2	0
Fluoride, dissolved	11/3/71 to 2/2/72	6	[b]0.2	12/30/71	[b]0	2	[b]0.1	[b]0.1

[a]Number of occurrences.
[b]In milligrams per liter.

Source: Parker, 1974.



SOURCE: HEATH et al., 1975

SEA POND AND LUMMI BAY SAMPLING STATIONS

FIGURE EIS 3-2

Beach seining was conducted in the sea pond on July 15, 1982 (see DPR plate 4) at four locations: just inside the northwest tide gate, just east of the tide gate along the northern dike, and at two sites along the western dike just south of the tide gate. Seining results indicated the presence of eelgrass and sea lettuce. On January 12, 1983, studies were conducted in the sea pond and consisted of trawl and grab samples as well as a scuba survey. A series of trawl runs were conducted near the northwest tide gate and in areas east of this tide gate. Bottom trawling, conducted from the west to east, brought up large quantities of sea lettuce and some detritus. Detritus consisted mostly of dead eelgrass and was primarily located near the northwest tide gate. Results of the easterly trawling demonstrated lesser amounts of vegetation present on the bottom substrate. Grab sampling was conducted with a Peterson dredge at transect locations C-5, B-7, and A-7 (figure EIS 3-2). Small amounts of eelgrass were found at sites C-5 and B-7. Live and decayed eelgrass fragments, sea lettuce fragments, and a total of five eelgrass seeds were found in trawl samples taken at site A-7. Scuba survey divers noted a thick, loose layer of eelgrass occurring near the northwest tide gate. Increasingly smaller amounts of eelgrass were seen as the divers swam east. Sea lettuce was seen in small scattered patches during the scuba survey. During a site inspection on October 18, 1983, racks of eelgrass were noted inside the sea pond along the western dike.

A scuba survey was conducted on July 15, 1982 outside of the diked sea pond in the vicinity of the western section of the proposed navigation channel (see DPR plate 3). Eelgrass was seen growing in dense patches along the edges of the natural channel, but only in limited areas in the natural Lummi River and small tidal channels. Small amounts of sea lettuce were found outside of the existing natural drainage channels. On August 3, 1982, benthic sampling conducted in Lummi Bay along the natural channel from the northwest tide gate revealed presence of eelgrass at sampling sites 2 and 3 while none were found in samples at sites 1, 4, and 5 (see DPR plates 3 and 4 for site locations).

A vegetative survey of the general project area was conducted on May 12, 1983. A species list with referenced figure EIS 3-3 is given in table EIS 3-3. Pickleweed (Salicornia virginica) and salt grass (Distichlis spicata) appear to be the dominate marsh species located in intertidal areas along the northeast portions of the diked sea pond. Eelgrass (Zostera spp.) was seen in small patches in the area north of the diked sea pond and in dense groups in Lummi Bay at the lower elevations west of the diked sea pond. At the time of the survey, eelgrass appeared to be absent from some areas, particularly along portions of the Lummi River channel. Narrow bladed eelgrass (Zostera japonica) is documented as growing at elevations above 3 feet MLLW and wide bladed eelgrass (Zostera marina) at lower elevations (Proctor et al., 1980). A small marsh is located at the northwest corner of the sea pond. It has been reported that an "uncommon plant," Puccinellia nutkaensis (alkali grass), may exist in the general project area.

TABLE EIS 3-3

LUMMI BAY VEGETATIVE SURVEY SPECIES LIST

Conducted May 12, 1983 (1100 to 1400 Hours)
by Fred Weinmann and Gail Arnold
Corps of Engineers, Environmental Resources Section

Numbered Items Below are Keyed to Overlay (figure EIS 3-3):

(1) (a) Dominant species:
- Distichlis spicata (salt grass)
- Salicornia virginica (pickleweed)
- Triglochin maritima
- Atriplex patula
- Glaux maritima
- Plantago maritima
- Grindelia integrifolia
- Cotula coronopifolia
- Deschampsia cespitosa

(b) At circle in center:
- Grindelia integrifolia (inside)
- Salicornia virginica and Distchlis spicata (at outer circle)
- Sambucus spp. (elderberry) (at southwest circle edge)

(c) At southwest portion of delta:
- Elymus mollis (wild rye) (a small stand)

(2) Salicornia virginica

(3) Low marsh consisting of primarily Salicornia virginica

(4) High marsh intermixed with some upland species:
- Potentilla pacifica
- Distichlis spicata
- Elymus mollis
- Grindelia integrifolia
- Solanum dulcamara (nightshade)
- Achillea millefolium (Yarrow)

(5) Upland species:
- Elymus mollis (dominant species)
- Achillea millefolium (dominant species)
- Vicia spp. (Vetch; beach pea)
- Cirsium spp. (thistle)
- Rumex spp.
- Rubus spp. (blackberry)
- Sambucus spp. (elderberry)
- Heracleum lanatum (cow parsnip)

(6) Salicornia
Elymus mollis (small patch)

TABLE EIS 3-3 (con.)

Numbered Items Below are Keyed to Overlay (figure EIS 3-3):

(7) Cirsium spp. (dominant, some old flower stocks)
Sambucus spp. (some present)

(8) (a) Trees upland of area marked as number 8 on overlay

(b) Upper margin:
- Typha latifolia (cattail)
- Potentilla pacifica
- Juncus spp.
- Carex lyngbei

(c) Narrow margin near sea pond:
- Salicornia virginica
- Distichlis spicata

(9) Salicornia virginica
Cladophora spp. (green algae)

(10) Zostera marina (broad leaved eelgrass)

(11) Zostera japonica (narrow leaved eelgrass) (patchy distribution)

(12) Small pond in center with with surrounding vegetation:
- Vicia spp.
- Elymus mollis
- Sargassum muticum (dead on shore, not growing at site)
- Distichlis spicata
- Salicornia virginica (abundant near small pond)
- Typha latifolia (few)
- Scirpus maritimus (bulrush)
- Atriplex patula
- Scirpus americanus (three-square bulrush)
- Tanacetum spp. (tansey)

(13) Approximately 30- by 30-foot round area comprised of primarily sand and containing rounded mounds throughout area; many red threadworms, polychaete, cumacea.

(14) Area had fragments of bivalves: horse clam (Tresus capax), bent-nosed clam (Macoma nasuta), cockle (Clinocardium nuttalli).

(15) Observed about 60 Great Blue Heron and many seagulls.

(16) Broad leaved eelgrass in deeper areas along channel (about -2 to -4 MLLW). Broad and narrow-leaved eelgrass mixed along upper channel edges. Some Entermorpha spp. (green alga), lesser amounts Ulva spp. (sea lettuce).

TABLE EIS 3-3 (con.)

Numbered Items Below are Keyed to Overlay (figure EIS 3-3):

(17) Broad and narrow leaved Zostera in some areas along channel, but not in channel.

(18) Near tidegate:	Enteromorpha linza (some attached to substrate) Enteromorpha intestinalis (minute amounts) Zostera (broad and narrow leaved) Ulva spp.
(19) Field area:	Clover and forage grasses

NOTES:

(a) About one-half way out to deeper water (Hale Passage): Laminaria spp. (growing in small quantities), scattered Enteromorpha linza.

(b) Near tide gate:	Many large flatfish Many small sculpins (darting) Mussels and barnacles on riprap
(c) Along channel:	Flatfish Small sculpins One crab (Hemigrapsus nudus) Gravid caprellid amphipod on eelgrass Filamentous diatoms on eelgrass Red algae, including Gigartina papillata (infrequent)

(d) Some blue areas on map are dead plant species (i.e., Grindelia integrifolia, Cirsium spp., Achi a millefolium).

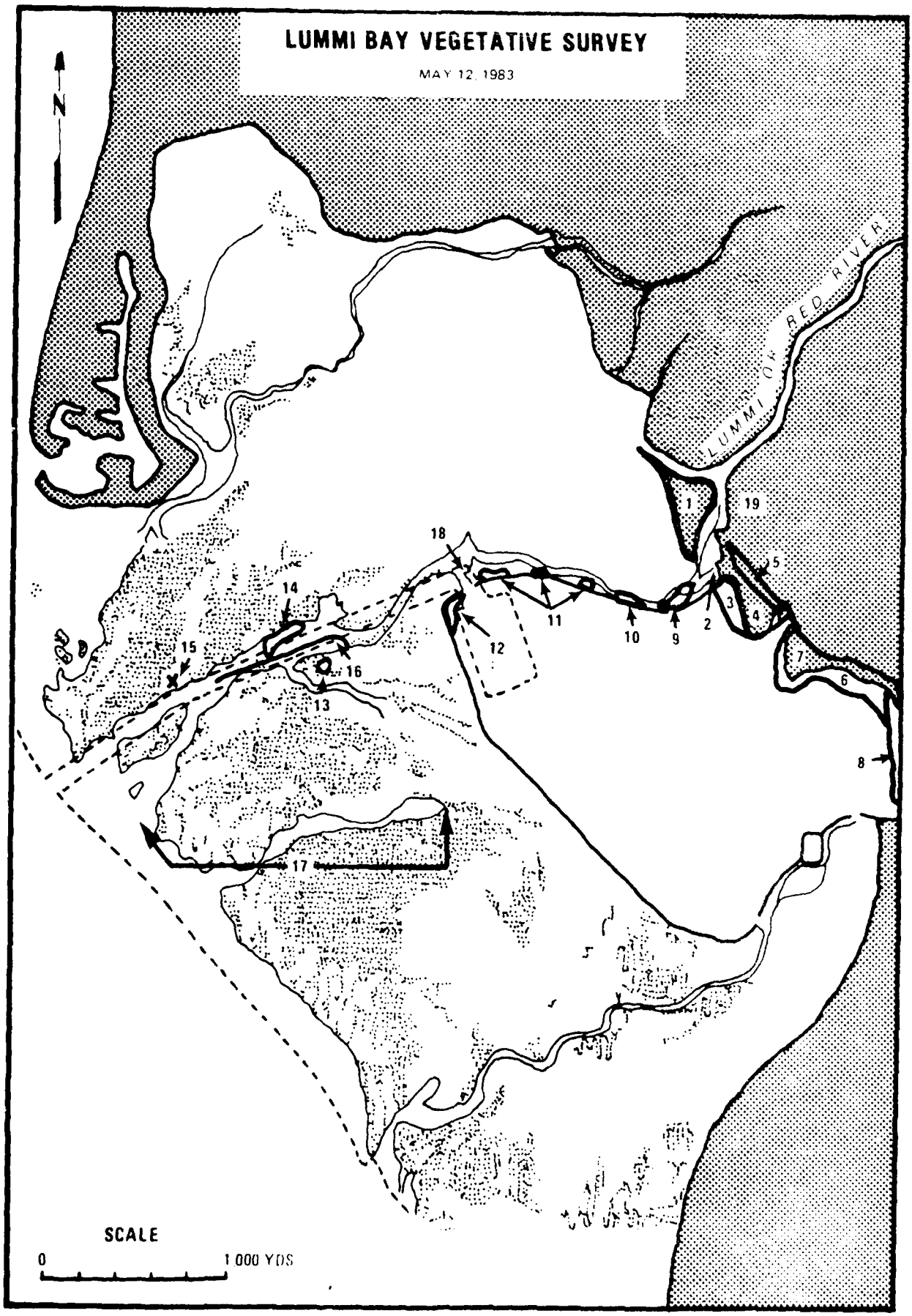


FIGURE EIS 3-3

According to Corps of Engineers regulations, wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. According to this definition, the vegetated tidelands in Lummi Bay and the eelgrass growing in the sea pond are considered wetlands.

(4) Aquatic Macroinvertebrates. Species and density of aquatic macroinvertebrates appeared to differ in three habitats sampled: the diked sea pond; Lummi Bay areas on either side of this natural channel (excluding the diked sea pond); and the natural channel outflow of the Lummi River located north of the diked sea pond. Due to these differences, species descriptions have been separated into the following three subsections. A predator-prey relationship which may exist in all three areas includes predation on Corophium by birds, Pacific staghorn sculpin, juvenile salmonids, threespine stickleback, starry flounder, Dungeness crab, Dunlin, nemertean worms, and other amphipods. In regards to possible productivity, data from an April 1973 study indicated that biomass values were higher outside of the diked sea pond than inside (Heath, et al., 1975). Species lists are given in a 1975 report by Heath, et al. (see bibliography). Much of the following information is from that report.

(a) Diked Sea Pond. Within the sea pond, biomass values fluctuate greatly from one area to another, with the largest standing crops of macroinvertebrates located at the northwest and southwest tide gates (Heath, et al., 1975). Heath and others postulated that this is because the deepest and best flushed areas are adjacent to the two westerly tide gates. Abundance of invertebrates, as well as vegetation, decreased along transect lines from the west to the east.

The most abundant species present in the sea pond is the tube dwelling polychaete (Spio filicornis). The polychaete is a suspended and detrital feeder common to many littoral areas on the west coast. The second most abundant is the auger snail (Cerithium moerchi). It is usually found in quiet water and was absent outside of the sea pond. The snail is particularly concentrated along transect B (see figure EIS 3-2). The hermit crab (Pagurus spp.) has been seen within the sea pond inhabiting these shells. The bubble shell (Haminoea vesicula) is the most ubiquitous of all invertebrates within the sea pond. It is usually found in warm, shallow estuaries and is not adversely affected by brackish water. A few to moderate numbers were found at each sampling station during 1973 (Heath, et al.; 1975). The following species were also found during the 1973 sampling: bubble shell (Acteocina culcitella); Japanese little-neck clam (Venerupis japonica); native little-neck clam (Protothaca staminea), Macoma spp., rough-skinned lug worm (Arenicola spp.); and gammaridean amphipods. Corophium spp. (a gammaridean amphipod) were found in great numbers at each station. Many snails (Cerithium moerchi) inhabitated the mid-depth of the sea pond. Very few numbers of the probosis worm, Glycera spp., were found in the sea pond.

Beach seining was conducted in the sea pond on July 15, 1982 (see DPR plate 4 for location). Sculpins were collected and stomach contents of some included kelp crab (Pugettia producta), shore crab (Hemigrapsus spp.), and hermit crab (Paguridea). Benthic grab sampling, beach seining, and a scuba survey were conducted in the northwest corner of the sea pond on January 12, 1983. The polychaete (Spio filicornis) was the most abundant organism found in the sea pond from the grab samples. Biota found near the northwest tide gate consisted of live eelgrass and sea lettuce fragments with many polychaetes and gammarid amphipods. The most abundant polychaete was S. filicornis. Fewer numbers of Glycinde spp. were collected. Gammarid amphipods included the species Caprella equilibra. Other species present near the tide gate included butter clams (Saxidomus giganteus), oyster drills (Nucella (formerly Thais) lamellosa), clam and oyster (Ostreidae) fragments, sand dollars (Echinoidea), worm tubes, and a few crab appendages. The numbers of organisms found decreased in an easterly direction. Beach seining captured some crab, shrimp, drill shells, and clam shells (see figure EIS 3-2 for beach seining station locations). In particular, a crab (about 3-1/2 inches across the carapace) was found at station S1 and ghost shrimp were collected from station S1A. The scuba survey was conducted in the northern sea pond from the tide gate to the east. The survey revealed a deep area adjacent to the northwest tide gate where shrimp and gammarid amphipods were seen in a detritus-eelgrass community. As the divers moved east, they observed some crabs, clam (Macoma spp.), cockle siphons, a few hermit crabs, one live oyster, and a few empty clam shells. Fish traps were set out in several areas in the sea pond on January 12, 1983 and retrieved the next day. A few shrimp and Dungeness crab (Cancer magister) were collected. Otter trawling conducted on January 13, 1983 resulted in collection of several Dungeness crabs. Large numbers of several gammarid amphipod species were present in the algae community; species such as Corophium were numerous.

The only current invertebrate culture at the aquaculture facility is the partial rearing of oysters. Oyster larvae are initially cultivated in the oyster hatchery located near the southeast corner of the sea pond. Water for the hatchery is taken from the southeast portion of the sea pond at the first tide gate from the east. In late winter, when the oysters reach the spat stage, they are placed just inside and outside of the sea pond southwest tide gate. Final rearing occurs outside of Lummi Bay after oysters reach the seed stage in late spring.

(b) Lummi Bay (excluding the natural Lummi River River channel and the diked sea pond). Invertebrate types collected during 1973 sampling included Clycera spp. (polychaete), Arenicola spp. (polychaete), Spio filicornis (polychaete), nemertean worms, gammaridean amphipods (including Corophium spp.), Cerithium moerchi (auger shell), Haminoea vesicula (bubble shell), Venerupis japonica (Japanese little-neck clam), bent-nosed clam (Macoma spp.), Mya arenaria, oysters, and geoducks. Species found during another study at areas near the mouth of the Lummi River, northeast of the sea pond and at the southwest edge of Lummi Bay, included polychaetes (particularly Spiophanes cirrata), Corophium acherusicum, Macoma irus, Tigriopus californicus, Tanais spp., Mya arenaria, and Battalaria cumming

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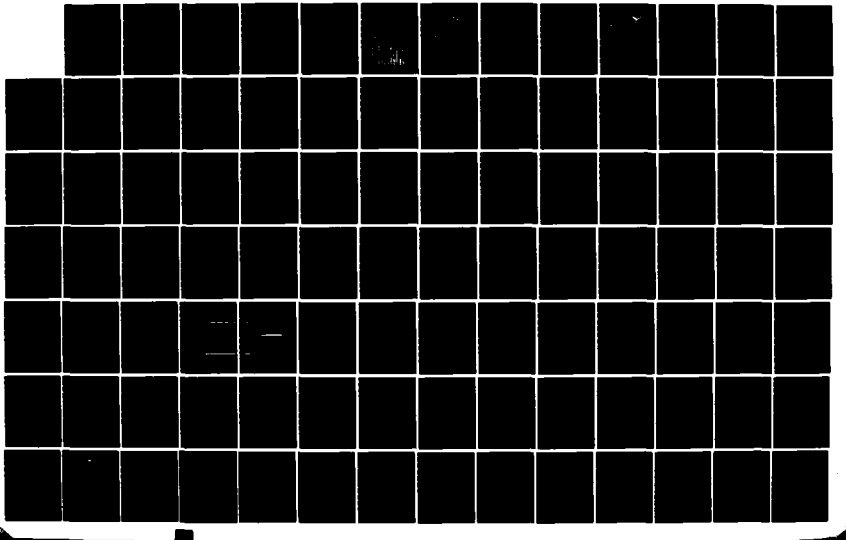
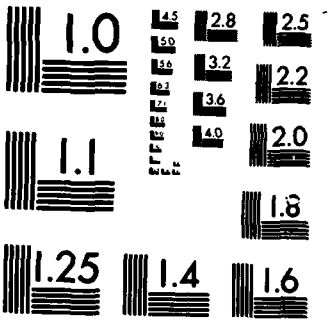




(Martin, 1973). Hard and soft shell clams are commercially harvested near Lummi and Portage Islands. Geoducks are commercially harvested at Sandy Point. Juvenile and adult oysters are located just east of Sandy Point.

A scuba survey was conducted along the outer and deeper Lummi River channel on July 15, 1982. Many Dungeness crab were observed in the eelgrass along the margins of the channel. Most were 4.0 to 4.5 centimeters (cm) across, which indicated they were 1-year old. There were equal numbers of males and females. One dungeness crab was 7.5 cm (2 years old) and another 17 cm. Some flounder, kelp crab, and hermit crabs were seen along the channel edges. Benthic sampling along the natural channel on August 3, 1982 revealed presence of Venerupis japonica, Tresus capox (horseneck or gaper clam), Macoma nasuta (bent-nosed clam), Clinocardium nuttalli (basket cockle), Cancer productus (red rock crab), sand shrimp, flat worms, sand flea, and brittle star.

The value of these species to the productivity of Lummi Bay is evidenced in a report describing a Corophium species in Grays Harbor (Albright, 1982). Corophium salmonis is a dominant benthic organism in Grays Harbor. Its habitat is on gently sloping beaches of muddy sand or mud and in the upper and mid-intertidal ranges. It is an important food resource. Its known production and turnover rates provides substantial food for its predators. Predators include other amphipods, nemertean worms, Pacific staghorn sculpin, juvenile salmonids, threespine stickleback, starry flounder, Dungeness crab, and Dunlin. See section 4 of EIS for examples interactions between species at differing food chain levels.

The proposed project area is within the heart of Dungeness crab nursery areas in Puget Sound; 80 percent of Puget Sound catch occurs between Hale Passage and Birch Bay (Bumgarner, 1982 and 1983). An eelgrass area with a sand or mud-sand bottom is the habitat type preferred by Dungeness crab (Williams, 1975). The habitat provides shelter and food. Dungeness crab larvae are semifilter feeders, whereas larger crabs feed on clams, crustaceans (i.e., amphipods and infaunal species), and fish. Some adult Dungeness crab feed on juveniles of the same species (Armstrong, 1981, and Meyer, 1973). In Grays Harbor, the juveniles are known to move offshore at sexual maturity, which is reached in about 1 year (Armstrong, 1981). However, in Similk Bay, an area near the proposed marina, most Dungeness crab have been documented to be permanent residents of the bay with annual cyclic migrations around the bay perimeter (Meyer, 1973). Thus, if Lummi Bay crab populations are similar to those in Similk Bay, it may be that Dungeness crab spend the majority, if not all, of their life stage in Lummi Bay. Site specific data is not available and it is possible that crabs found in Lummi Bay do not utilize the bay during their entire life cycle. Predators of Dungness crab include filter feeding organisms, nemertean worms, large zooplankton, coho and chinook salmon, flounder, sculpin, and man (Armstrong, 1981). Current crab sport fishing in the area is from mid-May to mid-April. Commercial fishing in the general area is from October to mid-April. The crab fishing seasons are scheduled to avoid major mating, molting, and rearing seasons. Molting appears to occur in late spring and early summer. Mating occurs primarily during the summer, and rearing of new young occurs mainly during spring, summer, and early fall (Bumgarner, 1982 and 1983).

The aquaculture utilization of Lummi Bay outside of the existing sea pond is limited to a small commercial oyster bed located in the eastern portion of the bay. Intermediate rearing takes place here, with initial rearing upland and final rearing outside of Lummi Bay. At present these mudflats are certifiable by the Department of Social and Health Services, allowing commercial shellfish harvesting in the bay. A public shellfish bed exists southeast of the entrance to Sandy Point.

(c) Lummi River Channel. During a July 15, 1982 scuba survey of the outer channel, several empty horseneck shells lying on the channel bottom had small Dungeness crabs underneath them. Empty cockle shells were also found in the channel. At the outermost part of the channel, cockle and horseneck clam siphons were seen indicating existence of living bivalves. Kelp crabs, hermit crabs, and polychaetes were also observed at the outer channel.

(5) Fish. Many fish feed on detritivorus invertebrates found in saline littoral habitats. Invertebrates, such as amphipods and harpaticoids, constitute major prey of juvenile pink, chum, and chinook salmon as well as other fish. The invertebrates are dependent on a detritus based food web for their survival.

Lummi Bay is situated between two major river systems that are important producers of salmon. The Fraser River to the north and the Nooksack River to the east release many hundred thousand hatchery and native juvenile salmon to the adjacent marine waters. The initial transition to saltwater is a gradual process that takes place in the estuaries and intertidal areas at these river mouths. Some species, such as pink and chum salmon, spend several months in these habitats prior to their movement into deep water. These shallow water habitats are critical to the success of these populations and to the fisheries that depend on the adults returning 2 to 5 years later. Estuaries and eelgrass habitats provide these outmigrating juveniles with abundant food, warm water for growth, and protection from larger predators.

(a) Salmonids. The Nooksack River is utilized by coho, chum, and chinook salmon. These species are not known to migrate upstream or downstream between the Lummi and Nooksack Rivers. In addition to Lummi sea pond aquaculture releases, steelhead, coho, chum, pink, and chinook salmon fry from nearby river systems may rear and migrate through Lummi Bay. From limited beach seine surveys conducted by the Lummi Fisheries Office, it is known that several salmonid species utilize the intertidal portions of Lummi Bay. It is not known whether the Lummi River flowing into Lummi Bay is used to any extent by outmigrants. There is nothing to prevent their usage at normal spring flows other than perhaps an avoidance behavior caused by such things as extensive agricultural practices along most of the Lummi River. Although the Lummi River has received coho plants and may be used by chum, use of the river by salmonids is considered limited and not significant for purposes of this proposed project (U.S. Fish and Wildlife Service (FWS), September 1982).

Natural salmonid use of the sea pond is uncertain. Near shore areas are typically known to be important nurseries for young pink and chum salmon fry during the initial seawater life phase. Specific data is not available to verify or quantify this use in Lummi Bay or the diked sea pond near the marina site. Hatchery produced salmonids, reared at the Lummi Indian Tribe aquaculture facility (hatchery and rearing pens located along the southern edge of the diked sea pond), reside in the pond for various times following liberation at the hatchery or within the sea pond, depending on the species. These species include coho yearlings, fall chinook, and chum young-of-the-year. Typical species from the Lummi Indian aquaculture facility include 1-2 million yearling coho reared in the net pens just inside of the southeast tide gate; 1-2 million fall chinook (90 per pound, 5 to 6 months old); and 2-4 million (450 per pound) chum salmon. Both the chinook and chum are reared at the sea pond hatchery. The tribe also has a hatchery on Skookum Creek which hatches and rears coho and chinook prior to transfering them to the sea pond for further rearing.

Migration times of both natural and hatchery juvenile salmon stocks through Lummi Bay are expected to occur between April and late June. The bulk of adult salmon which would be returning to the hatchery on the south side of the sea pond are present in Lummi Bay from late August through December. Trapping activity at the sea pond is approximately as follows:

Fall Chinook	Late August to October 15
Coho	Late August to December
Chum	November 15 to January 1

The tribe has initiated a steelhead rearing program and some yearling fish will be released from Lummi Bay. Return timing of adult fish is expected to be between December 15 to March 1. Tribal biologists believe that the high water temperature in Lummi Bay during August probably acts as a barrier to adult fish migration, inhibiting earlier returns of all chinook to the hatchery.

Typically, juvenile salmon are transported to the saltwater net pens in the sea pond during the spring. Tribal biologists begin hauling coho smolts to the pond during mid-April and complete the operation by mid-May. Fish are fed for 30 to 45 days and released during early June. Fall chinook are transported to the Lummi Bay hatchery during May, and released by late June. Chum salmon are reared totally at the Lummi Bay hatchery. They are typically ponded during mid-March, reared to approximately one gram, and released between April 15 and May 1.

Past experience indicates quite variable patterns of outmigration from the sea pond following release from the Lummi Bay facilities. Juvenile coho, if released during late May and June, leave the pond vicinity rapidly and with little indication of any prolonged residency in the pond. Early released coho (April) tend to inhabit both the pond and just outside of the tide gates for a considerable time following release. During these times, heavy predation from sea gulls and diving ducks is common. Current coho releases are programmed

for late May and June. Fall chinook seem to show some prolonged residency in the pond after release, although water temperatures in the pond during late June are very high and no doubt inhibit its extended use by chinook juveniles. Juvenile chum salmon fry are generally quite reluctant to leave the Lummi Bay rearing ponds after release (screens pulled). Tribal biologists have not seen much evidence that these hatchery chum move into the sea pond after release, but with the rich copepod life in the pond, these chum may feed in the pond for some time. Lummi sea pond releases would probably be dependent on the adjacent eelgrass habitats during their initial exposure to the marine environment. The high return rates experienced by the tribal saltwater releases may in part be due to the abundant natural food that is available when they must make the transition from their hatchery diet.

There is not a clear picture of the overall use of Lummi Bay by nonhatchery salmonids. Springtime use may be high since the bay supports large eelgrass beds and associated benthic communities. By summer though, tribal biologists expect use to decline as bay water temperatures exceed levels consistent to good salmonid production. The Lummi River flowing from the Nooksack River to Lummi Bay has historically received coho plants to make use of available rearing habitat; however, the river has been extensively channelized and degraded by buildup of debris. The Lummi River is not considered a natural production area for salmonids. Chum may use the river to a very limited extent. Juvenile salmonids have been known to migrate along the Lummi River and the shoreline just east of Sandy Point.

(b) Herring. Pacific herring range from the Beufort Sea to the Gulf of Georgia. Pacific herring that use Lummi Bay are part of what is known as the Gulf of Georgia stock (see figure EIS 3-4). This stock is the largest herring stock in Washington and supports a sac-roe fishery. Spawning usually takes place on algae or eelgrass growing from high tidal levels to depths of 11 meters. Lummi Bay spawning is known to occur from April to June. Survival of herring eggs depends on depth, temperature, and salinity of the water, as well as predation. Birds, such as gulls and diving ducks, are the major predators on the eggs. Other predators include crabs, sculpins, starry flounder, dogfish, rockfish, and sea cucumbers. Adult herring are also preyed upon by species such as chinook and coho salmon, dogfish, lingcod, sea lions, whales, and waterfowl. Herring will spawn after 2 to 3 years of growth. They spawn annually until death which ranges from 7 to 12 years of age.

Herring spawning surveys were started in 1973. Between 1973 and 1978, no herring spawning activity was observed in Lummi Bay during the yearly surveys. Figure EIS 3-5 shows the use of Lummi Bay by spawning herring since 1978. Several symbols are used to identify individual spawnings. Also shown are the approximate boundaries of the spawn based on sample stations where no spawn was found and on aerial photographs showing eelgrass distribution. Most spawning occurs southeast of Sandy Point on the west side of Lummi Bay. Egg deposition is typically found in the intertidal areas between 0.0 and -3.0 MLLW. Spawn intensities are usually "very light" or "light" (up to 100 eggs per lineal inch of eelgrass). See figure EIS 3-6 for comparisons of numbers of herring spawns between 1978 and 1983.

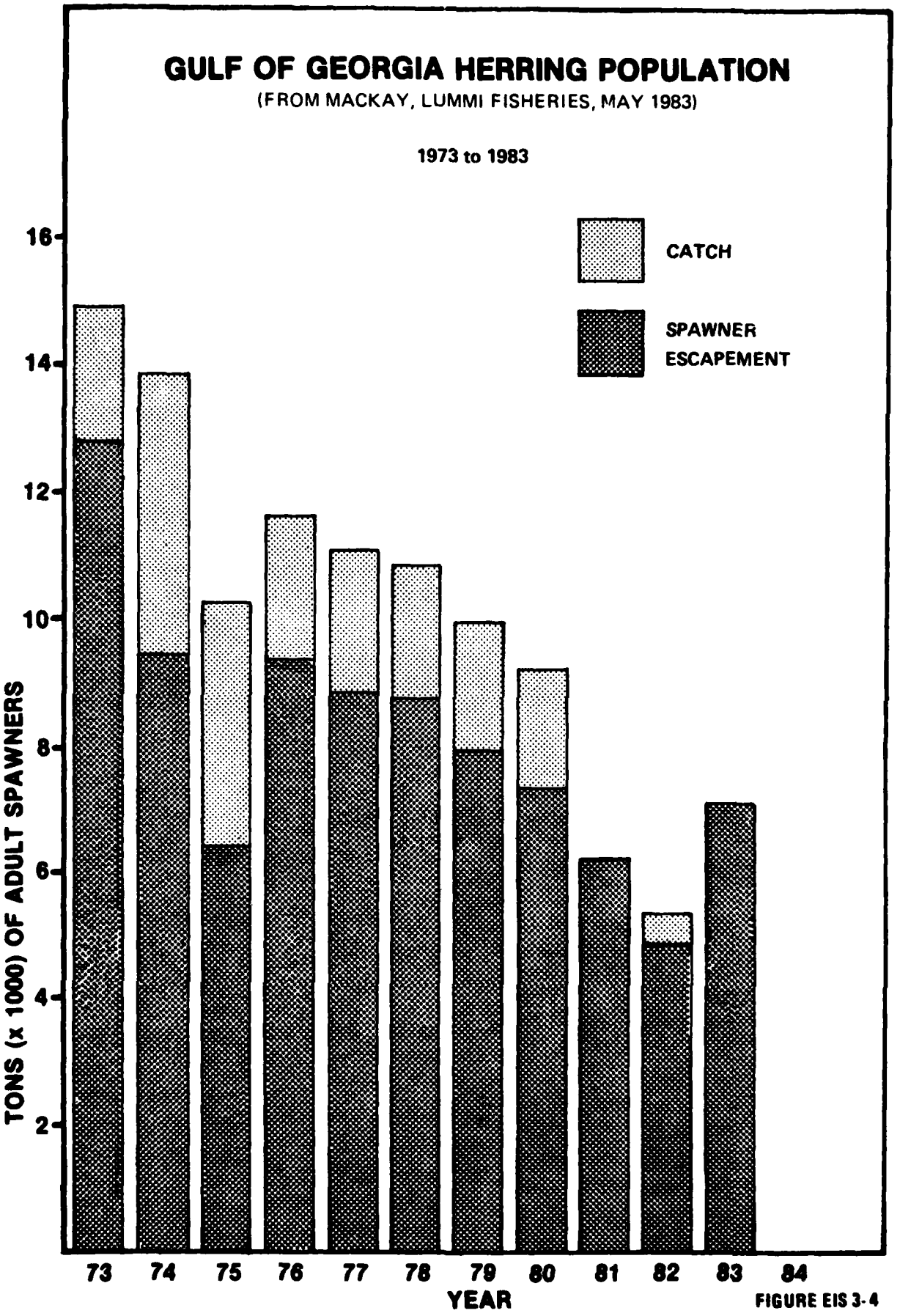


FIGURE EIS 3-4

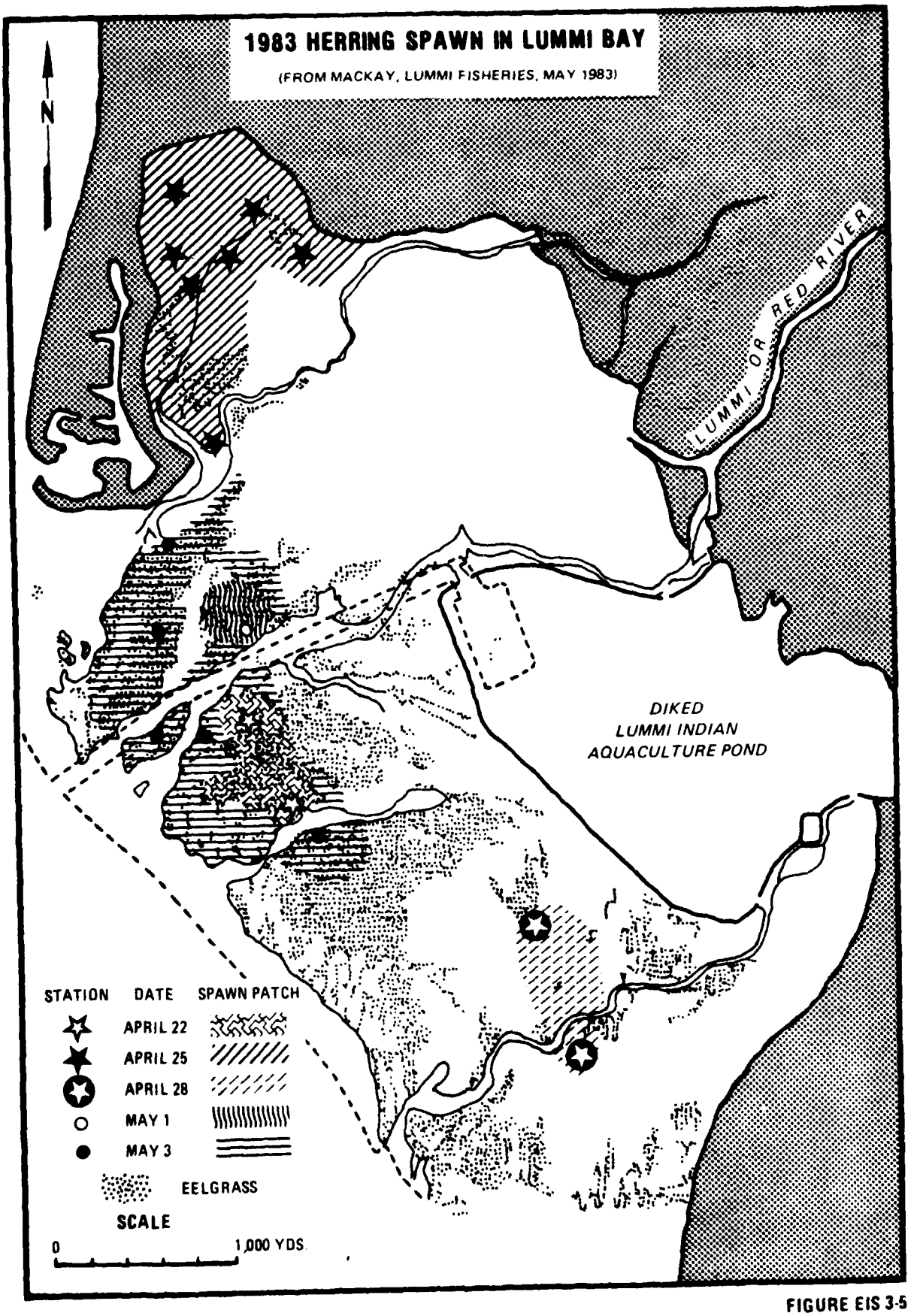


FIGURE EIS 3-5

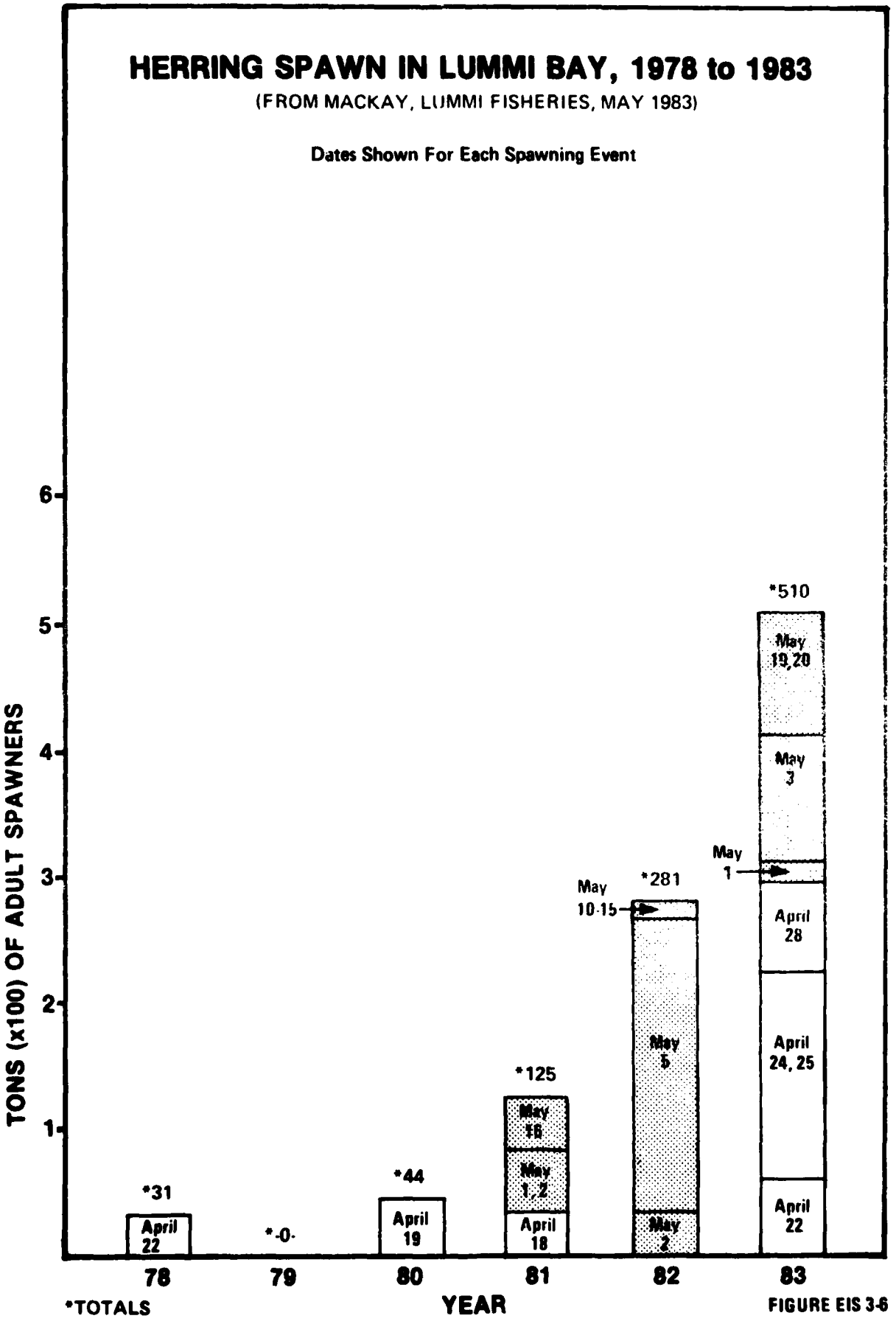


FIGURE EIS 3-6

Lummi Bay received a larger than normal amount of herring spawning in 1983 (see figure EIS 3-7). Surveys by Lummi fisheries and WDF personnel documented six spawn events in 1983 occurring between Sandy Point and Gooseberry Point. Spawn was recorded for the first time this year in the shallow, northwestern part of the bay (known as Onion Bay). Preliminary estimates indicate approximately 9.8 percent of the Gulf of Georgia spawning occurred in Lummi Bay in 1983.

Increased usage of Lummi Bay by spawning herring is occurring during a period of reduced stock size. According to Murphy (1977), a reduction in spawning range is common as populations decline. This year no spawn was found at Point Roberts; the first such occurrence in 11 years of surveying. The spawning population may be shifting closer to or slightly south of the historical center of spawning activity near Cherry Point.

The future of the Gulf of Georgia population and sac-roe fishery depends to a large extent on the success of spawning events that occur when the stock is depressed. The contribution of Lummi Bay spawns to the overall population is not known. The habitat found here is unlike other shorelines that receive spawn in the Strait of Georgia. Several factors at first inspection would tend to limit production in this intertidal environment. Overall population decline may be from natural causes, as herring are noted for wide fluctuations in stock sizes and are subject to high rates of natural mortality (Murphy, 1977). Fishing pressure has been responsible for the collapse of many clupeoid fisheries worldwide. Hopefully this has been prevented by the restricted harvest on this stock in recent years and by intensive sampling and management efforts. Bird predation has been observed to be more intensive in shallow areas where both diving ducks such as scoters and surface feeding gulls can feed on the eggs. This year fewer birds were observed than in the past, but a large percentage of these were seen feeding on Lummi Bay spawn for several days after the spawning event. High-water temperatures are known to occur in the bay that may exceed the lethal limit for herring eggs during certain tide cycles (Seymour, 1983). In 1983, initial sampling of spawn in Onion Bay showed no obvious mortalities when sampled 14 days later.

(c) Other Fish Species. Fish have been observed throughout the sea pond during sampling with beach seines, otter trawls, fish traps, and fyke nets, as well as during a scuba diving survey. These include numerous starry flounder (up to 41 cm in length), staghorn sculpin (up to 35 cm in length), and other sculpin. Perch, cod, tubesnout, gunnel, Pacific herring, threespine stickleback, smelt, and blenny were also present but in smaller numbers. During several field studies in Lummi Bay along the Lummi River channel, large flatfish were frequently observed as were many very small sculpins.

Stomach content analysis of several species indicate their feeding on estuary biota. A Pacific tomcod stomach contained amphipod parts, algae, crab pieces, shell fragments, and small shrimp. Pacific staghorn sculpin stomachs contained shrimp, crab, eelgrass, and sea lettuce. A hybrid sole had amphipods, worms, and shrimp in its stomach. A kelp perch stomach contained amphipods, crab, and barnacle larvae.

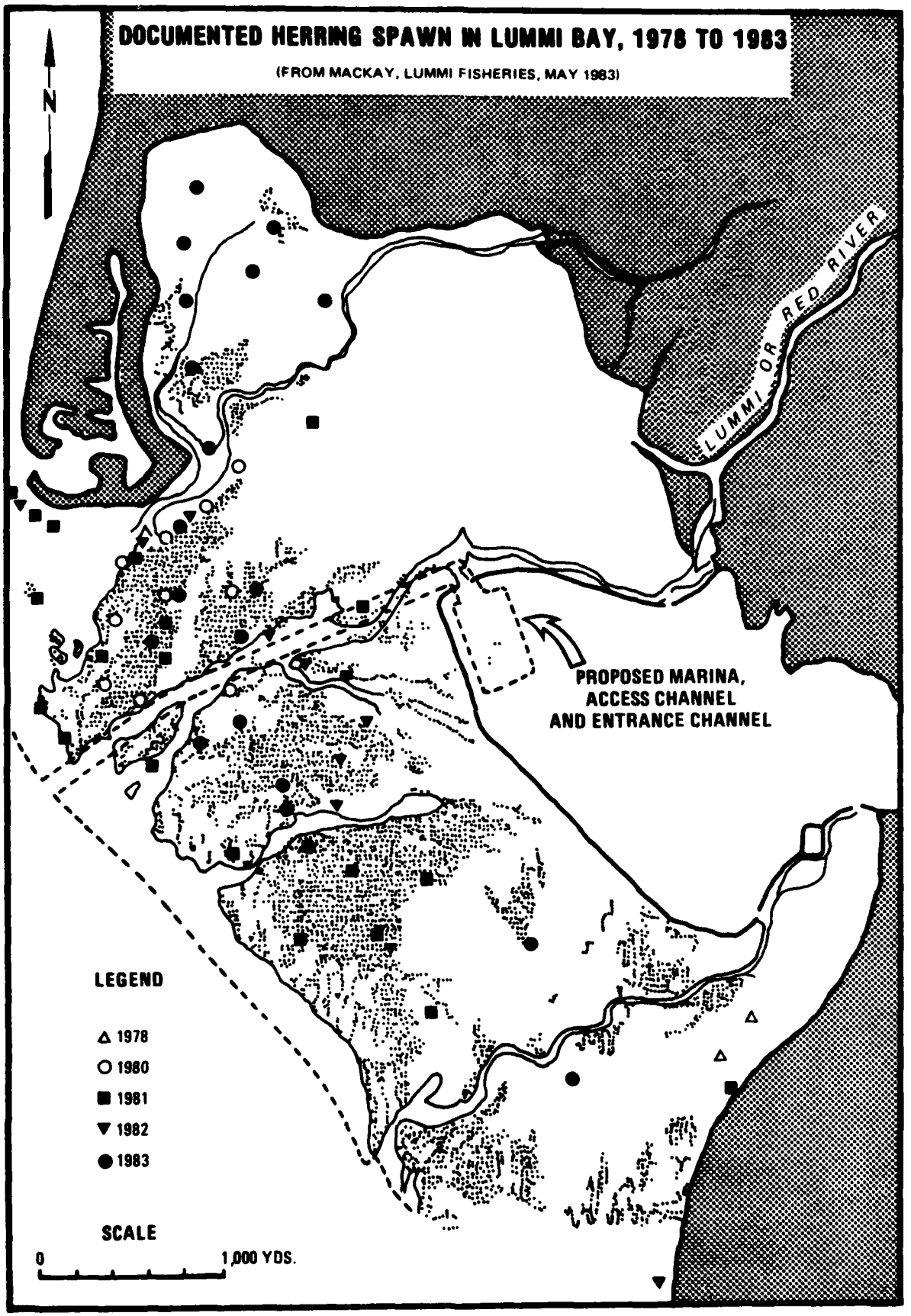


FIGURE EIS 3-7

(6) Birds. Birds extensively utilize Lummi Bay for feeding and shelter throughout the year. The bay is particularly valuable to those species that use the area during migration for resting and feeding. Shorebirds that use the bay include sandpipers, Dunlin, Forster's tern, gulls, and great blue heron. Large numbers of Dunlin have been observed in the bay during the spring, fall, and winter, but especially in spring and summer during migration. Diving birds observed in the bay include the common loon, western grebe, double-crested cormorant, and alcids such as the marbled murrelet. Diving birds are known to be highly vulnerable to oil pollution since they submerse themselves in the water and thus can get covered with oil present on the water surface when they resurface. Double-crested cormorants are easily disturbed both directly by nearby human activities and indirectly by adverse changes in their food web. Marbled murrelets are widely distributed throughout the area. Predatory birds observed in and around Lummi Bay include bald eagles, peregrine falcons, hawks, and owls. These species use adjacent farmlands and marine habitats for feeding. Bald eagles and peregrine falcons winter in the study area. Although bald eagles are an endangered species throughout most of the United States, they are listed as threatened in Washington, primarily because they are relatively common and nest in the Pacific Northwest. The Pacific Northwest is one of the most important wintering areas in the United States for Peregrine falcons. Peregrine falcons feed on small ducks, shorebirds, and alcids; species which have been observed to use Lummi Bay. The bay is an important habitat for relatively large numbers of adult waterfowl for overwintering and migration during fall, winter, and spring. Species that have been observed in Lummi Bay include black, white-winged, and surf scoters; swans; geese; red-breasted and common mergansers; American wigeon; pintail; green-winged teal; lesser scaup; common goldeneye; bufflehead; and mallard. Lummi Bay is a sport hunting area for American wigeon, pintail, and mallard. Large numbers of scoters forage during April and May on spawned Pacific herring eggs at Cherry Point and Discovery Bay. The diet of white-winged scoters also includes little neck and soft shell clams. Scoters normally congregate in flocks and spend their entire nonbreeding lives in marine waters. Black scoters have been seen in Lummi Bay and are the largest group of scoters seen in the bay outside of herring spawning season (4,000 have been seen in one flock). Lummi Bay species such as scoters are vulnerable to oil spills because of their activities on water surfaces. Geese seen in Lummi Bay include black brant, which overwinter in the bay area. Large numbers of brant use the bay as a staging/foraging area in April and May during migration (6,400 have been seen in one day). Black brant feed on aquatic plants, primarily eelgrass. They are easily disturbed by small vessels and low flying aircraft. Other birds observed in Lummi Bay include kingfisher, crow, and American coot.

(7) Mammals. Muskrat, river otter, and mink are known to use aquatic habitats near Lummi Bay. Other mammals found near the bay, particularly at agricultural fields, include black-tailed deer, bobcat, bats, shrews, moles, skunks, weasels, and mice. Pods of killer whales, as well as harbor seals and porpoises, swim through Puget Sound adjacent to Lummi Bay, but are not known to use the bay. Harbor seals were seen in Hales Passage adjacent to Lummi Bay on October 18, 1983.

(8) Threatened and Endangered Species. Both bald eagles and peregrine falcons are on the Federal endangered species list and have been observed in Lummi Bay. Sea pond use by bald eagles has been evaluated in a biological assessment (BA) which is available at Seattle District, Corps of Engineers. Peregrine falcon use of Lummi Bay will be examined in a study scheduled to be conducted during the winter of 1983-84. Based on this study, a BA would be prepared. At least four species of endangered marine mammals (gray whale, fin whale, humpback whale, and blue whale) may swim by Lummi Bay on rare occasions. No other threatened or endangered species are known to use Lummi Bay.

c. Historic and Prehistoric Resources. The project is situated in the traditional Lummi Indian territory. The Lummi, like many other Salish speaking Indians of Puget Sound, relied heavily upon the resources of the marine, estuary, and riverine environments. Typically, large winter villages would be found along the shoreline near the confluence of a major stream or river with Puget Sound or along major rivers where smaller rivers or creeks intersected the larger river. The gathering of marine and terrestrial resources required that they travel to those areas containing the specific needed resource. Fishing, one of the most important economic aspects of these peoples, occurred at preferred locations along the shorelines of Puget Sound and the rivers. One preferred area was at the mouths of streams or rivers entering Puget Sound. Here tidal fish weirs were erected. Similar fishing devices were used upstream on the main channels. In the former case, the weir entrapped fish as they came in on the tide and left them stranded behind the weir as the tide receded. In the later case, the fish upstream movement was stopped, blocked, and the fish taken as they pooled in front of the weir or as they moved through special openings in the weir. The tidal trap described above is one type of site that might be expected within the vicinity of the project. In addition, shellfish gathering locations might be anticipated on the adjoining uplands.

There are no known cultural resource sites within the project area. A single ethnographically reported village site is located immediately adjacent, but outside, the project area. Suttles (1951) locates the site on Lummi Bay below the mouth of Smugglers Slough. No additional information is available for this site. The National Register of Historic Places lists no sites within or immediately adjacent to the proposed project.

d. Socioeconomic Environment. The proposed project would be located on Lummi Indian Tribal land. See socioeconomic appendix for details of Lummi Indian Tribe economy (appendix D).

SECTION 4. ENVIRONMENTAL EFFECTS OF THE FINAL ALTERNATIVES

4.01 Alternative 1: No Action. Without proposed project construction, the sea pond could be modified and used for increased aquaculture operations or part of the sea pond could be converted to uses other than those currently in existence. Presently, only part of the sea pond is utilized for aquaculture operations with the remaining areas not currently in use due primarily to high summer temperatures. The remaining areas could be reintroduced to tidal action, filled, or, with increased flushing, utilized for aquaculture. Given the fact that the sea pond is on the Lummi Indian Reservation and Lummi Indians value the pond, it is unlikely that it will be reintroduced to tidal action. It is also unlikely that the pond would be filled without marina construction, since the filled area would have limited value. It is possible that, in the distant future, culverts or tide gates could be added to the sea pond dike in order to increase flushing within the sea pond and thus decrease pond water temperature critical to salmonid survival. This would be very costly and probably would not occur in the near future.

Modifications of the sea pond described above have a low probability of occurring due to Lummi Indian interests and high modification costs. In conclusion, it can be assumed that the no-action alternative will result in minimal change and thus no significant impacts would be expected.

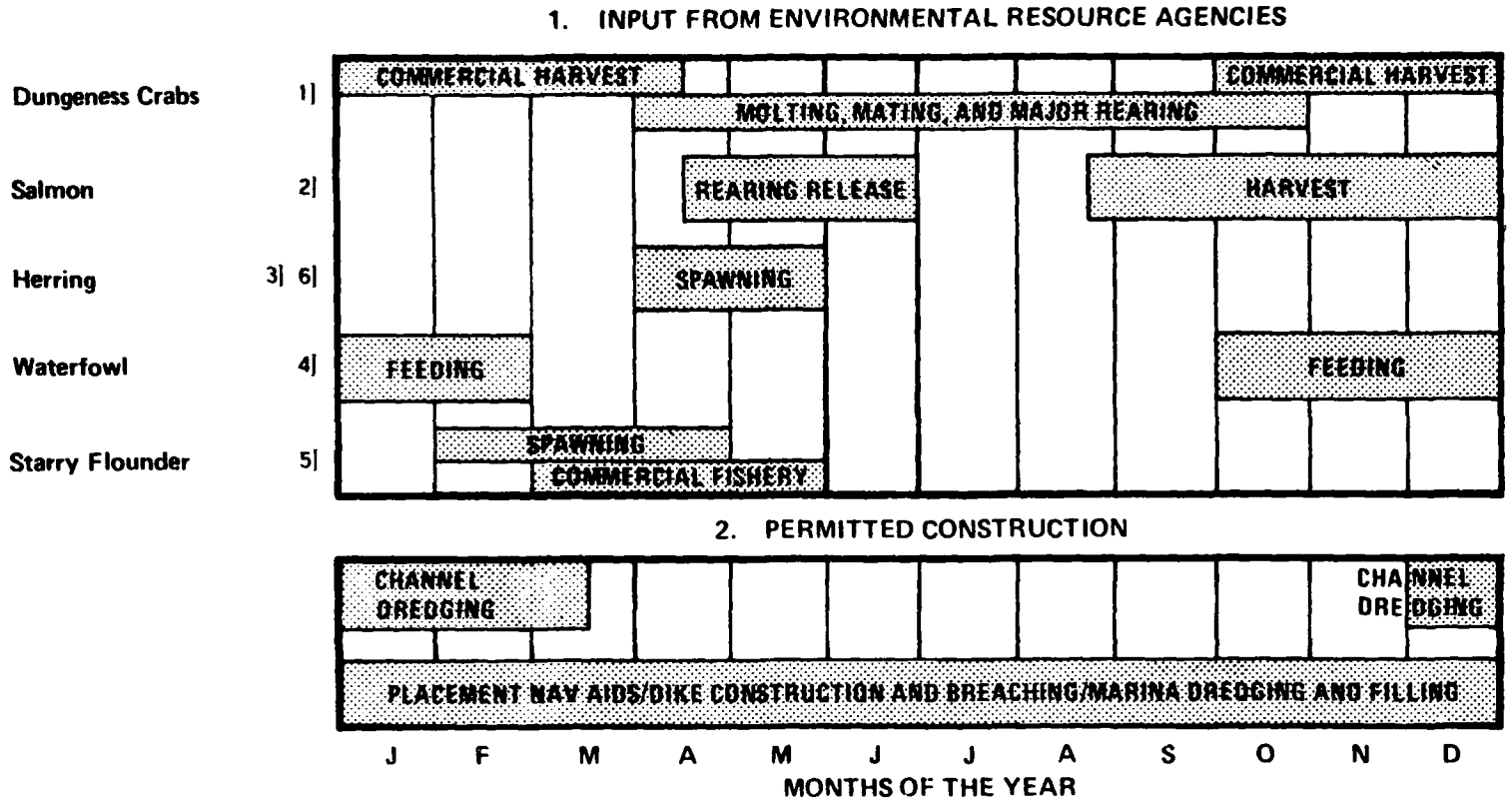
4.02 Alternative 2: Lummi Bay Marina Sea Pond Site (Recommended Plan).

a. Physical Impacts and Their Significance.

(1) Geology and Sediment. No significant impacts to geology or sediments are expected.

(2) Dredging. Under the recommended plan both the marina and navigation channel would be dredged. Approximately 645,000 c.y. of sands and fine silts would be removed by hydraulic dredge to construct a boat basin to a depth varying from -10 to -12 feet MLLW. Approximately 825,000 c.y. of sands and fine silts would be removed by hydraulic dredge to construct a 7,300-foot navigation channel, turning basin (at marina entrance), and access channel (within marina) to a depth of -12 feet MLLW. Details of dredging methods are in DPR report, section 4, and in appendix C. Soil characteristics are described in appendix C. Dredging of the navigation channel and turning basin is tentatively scheduled to be conducted during a 3-1/2-month period from December through March 15 in order to avoid major Dungeness crab rearing and harvesting, juvenile salmon rearing and release, and herring spawning and rearing. Although dredging would be conducted to minimize impacts to eelgrass, a net loss is expected to occur which may be about 1 percent of the eelgrass habitat found in Lummi Bay. Dredging to construct the access channel, turning basin, and moorage basin is tentatively scheduled to be conducted any time of year. However, dredging and disposal activities in the sea pond would be allowed only during those times when significant adverse impacts to aquaculture would not be expected (see figure EIS 4-1 for relationship of proposed dredging to significant commercial resources). Mitigation is described in section 4.03 of the EIS, section 4 of the DPR, and appendix C.

LUMMI BAY MARINA CONSTRUCTION SCHEDULE



SOURCES OF INFORMATION:

1| Dahlgren - Washington Department of Fisheries (May 18, 1983)
Stout - Fish and Wildlife Service (May 17, 1983)
Bumgarner - Washington Department of Fisheries (1982 and 1983)
2| Dahlgren - Washington Department of Fisheries (May 18, 1983)
Stout - Fish and Wildlife Service (May 5, 1983)
Seymour - Lummi Indian Fisheries Office (May 18, 1983)
3| Mackay - Lummi Indian Fisheries Office (June 3, 1983)
4| Stout - Fish and Wildlife Service (May 17, 1983)
Brunner - Corps of Engineers (May 17, 1983)
5| Draft Fish and Wildlife Coordination Act Report (June 1983)
6| Timing Based on Data Specific to Lummi Bay

FIGURE EIS 4-1

Maintenance dredged material will either be placed in a reserved and confined area of the sea pond (recommended plan) or disposed at a designated open-water site. Final selection of the most appropriate maintenance alternative will be based on feasibility and economic evaluations and in accordance with the National Environmental Policy Act, the Clean Water Act and other applicable legislation and regulations.

(3) Disposal. The recommended plan consists of placing construction dredged material within a diked area in the sea pond to construct 65 acres of uplands for water dependant facilities. Initial dredged material would also be used for partial construction of needed containment dikes within the sea pond. Dredging would be by hydraulic dredge with the pipeline discharge located as far as possible from the disposal area weir. The weir would be located along the northern dike near the existing uplands to the east (see DPR plate 2). The hydraulic pipe discharge would be initially located along the western edge of the proposed fill. The pipe would be moved, as needed, up and down this edge and also east into the fill area. Factors that would be considered to control water quality during dredging and disposal would include the distance between the dredge pipe discharge and the weir, ponding depth, length of weir, depth of water over the weir, DO, temperature, pH, and turbidity. Although the waters of Lummi Bay are currently classified by the state as class AA, the sea pond may not meet applicable state criteria (chapters 173-201 WAC, June 6, 1982). The classification would be considered in developing project water quality criteria for the proposed project. Criteria will be determined (prior to receipt of Washington State water quality certification) through coordination with the Washington Department of Ecology (WDE), WDF, and the Lummi Indian Tribe. Disposal effluent would contain suspended sediments consisting primarily of fine silts and some sands. The exact material would vary with area and depth being dredged. At ebbtide, the suspended sediments would probably flow out of Lummi Bay along the natural Lummi River channel. At floodtide, the fine sediments may settle out onto that part of Lummi Bay located near the weir. Depending on factors such as sediment type, the settled sediments may wash out into deeper water at high tide or much later. It is possible that floculated material would not wash out. The effluent would be more turbid, lower in DO, and higher in organics than the receiving water. During construction and operation of the proposed project, salinity within the sea pond and in Lummi Bay should not change significantly except that there may be a slight increase in salinity just outside of the weir at low tides. The natural condition consists of salinity changes due to varying Lummi River flows and tides.

Maintenance dredged material will either be placed in a diked area of the sea pond (recommended alternative) or disposed at a designated open-water site. Final selection of the most appropriate maintenance alternative will be based on evaluation in accordance with the National Environmental Policy Act, the Clean Water Act and other applicable legislation and regulations. Water quality impacts would be similar to those described above but would depend on existing disposal techniques, existing state guidelines, and coordination with the appropriate agencies.

Mitigation for initial construction is discussed in section 4.03 of the EIS, section 4 of the DPR, and appendix C.

(4) Water Quality.

(a) Construction Related Impacts. Dredging causes changes in water conditions associated with suspension of sediments. The suspended material would cause temporary physical and chemical changes to the aquatic ecosystem. Suspended particles interfere with light penetration resulting in turbid conditions. Turbidity from suspended sediments at the site of the dredging and the water discharge point would affect the function and behavior of biota. This is likely to cause avoidance to some degree by the more mobile species that frequent Lummi Bay. The extent of this displacement is not known but would be expected to be greater for salmonids than the less mobile and less sensitive forms such as flounder and crab. Suspended sediments could conceivably affect the sensitive olfactory functions of returning adult salmon, interferring with their normal migration patterns. The settling of silt on nearby eelgrass vegetation could be significant under certain weather/tide conditions. Macroinvertebrate numbers may decrease and so food items for biota such as crabs, Pacific herring, and salmon may decrease. Adhesion of egg masses from herring and other species may occur. Chemical changes which may be induced by redisturbing sediments include a decrease in DO and an increase in particulate and dissolved contaminants.

o Pesticides and Trace Metals. In the aquaculture pond, which would be partially dredged for marina construction, the deposition rates of river materials from freshwater sources was found to be very low (.001 foot per year) (Parker, 1974, and Heath, King, and Patten, 1974). Pesticides and trace metals would be carried in with riverine sediments. Since the sedimentation rate is so low, the accumulation of pesticides and metals deposited over time would be low (e.g., tables EIS 3-1 and 2). In the case of Lummi Bay, the dominant material is fine sands. The coarser riverborne material appears to cover the fine silts and clay in the bay (Shannon and Wilson, 1970). Pesticides do not adhere to sand particles; therefore, they would not be expected to accumulate in the sandy substrate.

o Fecal Coliforms. Another concern for dredging related impacts is the settling of bacteria into the sediments. Two factors will affect the bacterial distribution in the sediments. These are (1) the physical and chemical characteristics of the sediment and (2) the prevailing currents. The sediment in the old river channel, which would be dredged to provide an access channel, is primarily fine sand (Shannon and Wilson, 1970; Corps of Engineers, 1982). Fine sand is very low in organic content, the major nutrient for bacterial growth and survival. Thus, the potential for bacterial survival is low. The quantity of bacteria found in the sea pond was quite low relative to other sites (see table EIS 3-2). Therefore, it is not expected that any measurable amount of bacteria would be released into the water column during dredging.

(b) Operational Controls to Minimize Potential Dredging and Disposal Impacts. Dredging methods used during marina construction would be conducted in a manner to minimize any contamination of the water column by release of sediment bound materials. The marina and channel would be dredged with a

hydraulic dredge. Dredged material would be placed in a diked area of the sea pond by pipeline disposal. An overflow weir would be located along the northern dike near the eastern end. Effluent would be discharged to the natural Lummi River channel in Lummi Bay. In this confined dredging mode, contaminants which may be present in the dredged material would first be subjected to settling in the diked area of the sea pond and any remaining contaminant suspended in the water would be diluted as the overflow water is returned to the receiving water. During ebbtide dredging, the water from the pond would be carried away from the site and mixed with Hale Passage water. Dredging on a floodtide could cause some settling out of sediments into the bay.

(c) Operation and Maintenance of the Marina. During the operation and maintenance of the marina, water quality in the marina will undergo direct changes. These changes include:

- o increase in nutrients,
- o increase in bacteria, and
- o increase in petroleum hydrocarbons and trace metals.

The increases should be short term, although some material will be taken up by the sediment and the biota. Secondary impacts due to the increase in nutrients would result in some increase in productivity. Potential bacterial loads from waste disposal may render the shellfish in Lummi Bay unsuitable for human consumption. The sandy areas around the marina would experience an increase in nutrients and organic material which may provide habitat for the development of eelgrass beds.

Construction of the marina will increase flushing efficiency in the sea pond from the present 10-15 percent to 30 percent with the project. Due to the increased flushing, the present degradation in water quality conditions (high temperature, nutrients, and primary productivity; see figure EIS 3-1) associated with physical confinement should be reduced. Thus, the temperature is not expected to increase over that of the existing levels. In fact, there should be a decrease in the temperature extremes experienced in the past. While the increased flushing would alleviate the physical changes, the chemical and biological changes associated with a build up of nutrients will not be totally eliminated since there is potential for an additional source of these elements due to untreated sewage discharge from boats in the marina.

Flushing efficiency at the mitigation and fill sites would increase from an existing 10 to 15 percent to approximately 100 percent. Thus the present water quality conditions should improve with the increased flushing.

The reduction in area in the remainder of the sea pond would increase flushing over the existing condition. However, the loss of one of the tide gate entrances would reduce the quantity of water passing through the pond. Due to the resultant decrease in water volume, the quality of the water in the pond may undergo some degradation. While the extent of degradation is not expected to be major, absolute changes are not predictable with existing information.

The bay outside of the marina would experience some change in water conditions. Effluents from boats passing through the entrance channel may increase sanitary and bilge waste loads, but these materials should generally be flushed out into the Strait and diluted on ebbtides before reaching any sensitive areas such as the shellfish harvesting beds at Sandy Point.

Floodtides and winds would carry the finer sized particles (sediment, bacteria, and viruses) into the bay along Sandy Point. However, only small quantities of fine grained particles should reach the shellfish harvesting areas due to dispersion and dilution.

(d) Waste Management. Two booms will be maintained at the facility in case of oil or gas spills. A plastic floating boom would be used for containment. An interior boom of absorbent material would be used for cleanup. Storm drainage systems, water supply, and sewage disposal are included in the tentatively selected plan and are described in DPR section 4 and EIS section 2.02b(1).

(5) Air Quality. Short-term degredation is expected during construction. Long-term degredation to air quality is expected to be minor because of vessel emmissions relative to open air circulation in Lummi Bay.

(6) Noise. Noise levels would increase during project construction and marina operation. Due to distance from the proposed marina and navigation channel, local residents shoud not be impacted by the increase in noise. Avian fauna may be impacted by noise increases and so may use other areas. Aquatic organisms would not be significantly affected.

b. Ecological Resources Not Expected to be Impacted.

(1) Mammals. No significant impacts to mammals, either terrestrial or marine, are expected. Based on information regarding available area and species habits, marine mammals (such as seals and porpoises) probably would not be displaced due to an increase in mans' activities at Lummi Bay.

(2) Threatened and Endangered Species. See section 3.02b(8) regarding threatened and endangered species known to occur in the project area. Based on the BA that has been prepared on the bald eagle (available at Seattle District, Corps of Engineers), there would be no adverse impacts on the bald eagle as a result of proposed project construction. The FWS has not yet responded to this BA. Existing information on the peregrine falcon is not currently adequate to prepare a BA. A study is scheduled to be conducted during the winter of 1983-1984 to gather information for preparation of a BA and to determine potential for project related impacts. Results will be presented in the final EIS. A BA regarding gray, fin, humpback, and blue whales is currently under preparation. Impacts to these species are not expected to be significant.

c. Ecological Impacts and Their Significance. Initial dike construction will include the provision of 90 acres of the sea pond reintroduced to tidal action for a 65-acre mitigation area and a 25-acre area for potential placement of maintenance dredged material (tentative preferred alternative). At 5-year intervals maintenance dredged material may be placed in 25 acres of the sea pond which has been reintroduced to tidal action. Alternatively, maintenance dredged material may be placed at a designated open-water disposal site, in which case the 25 acres will remain as intertidal lands. Final selection of a maintenance dredging alternative will be made at approximately 5-year intervals in accordance with the National Environmental Policy Act, the Clean Water Act, and other appropriate legislation and regulations. Both alternatives are economically feasible.

(1) Diked Sea Pond. The most significant and severe impact of the project is the eventual loss of about 100 acres of aquatic habitat in the sea pond. Aquatic flora and fauna in the sea pond would be eliminated from areas proposed for placement of fill material. This is expected to be significant since many important organisms used by fish and birds for food, such as Corophium, utilize this habitat. Several species of fish and birds that have been seen in the sea pond would be displaced. Extensive flora located at the proposed marina site would be modified. The deeper marina areas that would be dredged may support less vegetation due to a decreased potential for photosynthesis and a potential for pollutants; the shallow shelf area around the deeper marina would support vegetation and may have greater densities than that which exists because of increased flushing within the marina due to the deeper navigation channel and wide marina entrance. Wetlands occurring along the eastern edge of the sea pond and within the unaltered portions of the sea pond would not be impacted other than as a result of possible oil/fuel spills or altered sea pond water levels due to closure of one tide gate. Construction activities would be regulated so as not to impact the marsh existing at the northwest corner of the sea pond.

Aquatic macroinvertebrates located in the sea pond where the fill is proposed would be eliminated. It appears that numbers and types are less than in areas of greater tidal flushing. Macroinvertebrate species currently inhabiting the area of the proposed marina are expected to change in numbers and types due to increased tidal flushing. Utilization by larger macroinvertebrates, such as crabs, should increase, and utilization by smaller species, such as Corophium, would probably decrease (Cardwell, 1978).

Fish diversity and standing crop in the area of the proposed marina is expected to change. Fish passage has been included into designs of the timber pile breakwater (see DPR plate 2 and appendix C). Similar sculpin and flatfish usage of the area is expected to remain the same or increase. Use by species of chum and chinook salmon, surf smelt, Pacific sandlance, and Pacific herring is expected to increase (see Cardwell, 1978, discussion of Birch Bay Village Marina). Herring numbers may eventually decrease in the proposed marina due to predation: spiny dogfish and chinook and chum salmon are known to feed on larval and juvenile herring. Survival of herring larvae is expected to decrease due to potential pollutants resulting from marina

operation, but this is not expected to be significant (MacKay, 1981). Use of the marina by salmon is expected to increase and may benefit those species. Salmon and bait fish use of the marina area may increase relative to contiguous, natural, nearshore habitats (Cardwell, 1978). It has been demonstrated that Pacific herring, surf smelt, Pacific sandlance, and juvenile chinook salmon prefer protected habitats (Cardwell, 1980). As such, these species may utilize the proposed marina to a great extent. Coho, chum, and pink salmon have not shown a preference for protected habitats (Cardwell, 1980). Since fish may use the mitigation and maintenance areas, there is a possibility of fish stranding at low tides, especially near the dike opening if a scour hole developes there. The dike breach would be made as wide as possible without threatening side dikes with increased wave action. The dike breach at the mitigation area would be designed to minimize the development of such a scour hole and thus reduce the possibility of fish stranding.

Waterfowl use the sea pond extensively. Use of the sea pond by some species of birds would probably decrease due to increased human activity, while use of the area by other species may increase with the presence of the marina. Waterfowl usage of the sea pond would likely decrease. Some species may migrate elsewhere if other habitats are available due to increased human activity at the proposed marina.

Based on a simplified Habitat Evaluation Procedure conducted by the FWS, impacts as a result of filling the sea pond were estimated to be significant. Biota would decrease and a resultant decrease in productivity would cause decreased survival to important biota such as Pacific herring, juvenile salmon, smelt, Dungeness crab, and starry flounder. To compensate for these impacts, mitigation has been proposed as described in section 4.30

(2) Lummi Bay. Terrestrial flora growing around the borders of Lummi Bay would not be impacted by the project. Marshes located along Lummi Bay shorelines should not be impacted by the project unless there is a large pollution source, such as an oil spill, from the marina or navigation channel that reaches the shorelines. Aquatic flora consists of sand/mudflat and eelgrass/algae communities. Those communities located in Lummi Bay at some distance from the navigation channel should not be impacted unless there is a pollution source as mentioned above. The eelgrass/algae community located adjacent to the proposed navigation channel would be impacted during project construction and operation. An estimate on the amount of eelgrass to be removed as a result of channel construction is approximately 29 acres. The degree of impact and significance is not precisely known because of lack of specific data on acreage of eelgrass impacted and on types and numbers of those animal species using the eelgrass/algae or sand/mudflat areas. However, it is believed (at this time) that even with planting of eelgrass, the project would result in a net loss of eelgrass. Using the estimate of up to 2,000 acres or more of eelgrass existing in Lummi Bay and calculating a net loss of about 22 acres of eelgrass due to navigation channel construction, the net loss of eelgrass in Lummi Bay would be about 1 percent. If no further future loss of eelgrass were to occur in Lummi Bay, the impact of the proposed Lummi Bay Marina would not be judged significant. However, since land use plans and policies, economics of development, and other factors are all subject to change, there is no assurance that future actions, other than that proposed here, would result in additional losses of eelgrass.

The value of mudflats is known for its contribution to productivity in the aquatic food chain and to avian fauna. A very small percentage of the sand/mudflat community in Lummi Bay is located near the proposed navigation channel. As such, proposed project impacts would affect a very small percentage of this type of habitat available in Lummi Bay.

The value of eelgrass/algae communities has been well documented (Proctor, 1980). Eelgrass helps stabilize bottom substrate; provides for food, shelter, and attachment surface for marine organisms; increases biological productivity and diversity of an estuary; and provides food, spawning, and/or rearing habitat for fish, shellfish, and waterfowl. Slowly decaying particles of eelgrass can be found through all parts of an estuary, in intertidal marshes, along coastal beaches, and across the continental shelf bottom. The decaying eelgrass is converted to detritus, thus providing a rich food source for detritivores in many habitats, particularly during unproductive winter months. Aquatic macroinvertebrates such as amphipods and crabs have been seen to inhabit the eelgrass/algae community along the proposed navigation channel. Amphipods play a major role in mechanical breakdown of dead eelgrass, thus aiding in detritus production. Dungeness crabs of various life stages inhabit the proposed channel margins and may be scattered throughout the eelgrass/algae community in Lummi Bay. The vegetative community is known to provide shelter to the crab larvae, juveniles, and adults. Lummi Bay is probably one of the most productive rearing and nursing areas for Dungeness crab in the Strait of Georgia area. Zoea larvae of the Dungeness crab are generally known to feed on phytoplankton and zooplankton. Generally, crabs in the megalops stage have been known to feed on small crustaceans, crab eggs, and plankton. Adults in other areas have been known to feed primarily on clams, fish, isopods, amphipods, polychaetes, shrimp, small crabs, and barnacles. It is known that clams, fish, amphipods, polychaetes, and small crabs are prevalent in the Lummi Bay eelgrass/algae community. Other aquatic biota valuable to crabs may also be present. It is known that salmon, herring, sculpin, flounders, and other fish that may be present in the Lummi Bay have feed on Dungeness crabs. Birds and fish feed on small fish present in Lummi Bay such as herring. Diets of birds such as black brant, wigeon, and scoter (all three seen in Lummi Bay) are largely comprised of eelgrass leaves and marine invertebrates attached to the leaves. Scoters also feed on spawned herring eggs.

The above brief discussion of the eelgrass/algae biotic community demonstrates the intricate relationships of organisms that use the area and its important value to invertebrates, fish, birds, and man. Dredging of the proposed navigation channel would remove the eelgrass/algae community existing along the natural channel margins. If construction of the proposed channel would change currents in areas devoid of eelgrass that are adjacent to the proposed channel, eelgrass could eventually recolonize or be successfully planted. However, this appears unlikely. If the amount of the eelgrass proposed for removal from Lummi Bay would equal that which will rapidly revegetate or be planted, impacts to macroinvertebrates, fish, and birds would be minimal. However, it is believed that even with planting of 7 acres, a net loss of eelgrass would result. As a result, eelgrass documented as used by Pacific

herring as spawning substrate would be permanently decreased and impacts to herring populations could result. With the decrease in eelgrass habitat and deepening of the Lummi River channel, potential impacts could occur to macroinvertebrates used as food by crab, herring, and salmon, as well as directly to crab and fish species. Specific effects of fuel and oil on herring eggs and larva as a result of marina construction are not known (for more information see MacKay, 1981). There is also a potential for release of pollutants from boats using the channel which would hinder biotic development adjacent to the channel or, if the pollutant spreads out into other areas of Lummi Bay, result in decreased survival of biota in the bay. Increased human activity may cause fauna, such as waterfowl and other birds, to move to other areas which could result in their decreased survival.

Dungeness crab distribution, abundance, and life stage usage are not specifically known for Lummi Bay. Dungeness crab could be present throughout the year and/or migrate to other areas. Depending on existing distribution and use of Lummi Bay by Dungeness crabs during their various life stages, dredging of the channel could adversely impact crabs. It is probable that dredging the new channel may add a deeper water habitat for crabs to move into at low tide. It has been shown that dredging can have significant impacts on Dungeness crab and that the impact depends in part on existing water temperature, diel timing and season of the dredging, and type of dredge used. Relatively high crab mortalities have been documented to occur during hydraulic dredging. Mortalities have been shown to be lowest with clamshell dredging (Armstrong, 1981), but clamshell dredging is not feasible for the proposed project. In order to minimize impacts, dredging timing has been scheduled during probable low crab abundance.

It should be noted that marine vessel traffic is known to interrupt feeding and resting activities of birds (Manuwal, et al., 1979). Marina construction could be detrimental to birds dependent on Lummi Bay for nesting, feeding, rearing, and resting. For example, shallow draft recreational vessels utilizing protected bays appear responsible for extirpation of wintering black brant populations from much of the California coast (Manuwal, et al., 1979). Loons, grebes, cormorants, scoters, and alcids are paricularly vulnerable to oil pollution from marina and other sources due to their diving habits (Manuwal, et al., 1979). Major impacts are known to occur during migration and wintering when large numbers of diving birds are present.

(3) Lummi River Channel. Aquatic flora is almost nonexistent within the Lummi River channel itself. The navigation channel has been proposed to be constructed in the natural Lummi River channel to minimize dredging requirements and impacts to eelgrass. Some eelgrass will be removed. Channel slopes would be planted to minimize the loss of eelgrass. The navigation channel bottom would be altered periodically in locations where maintenance dredging is required.

Macroinvertebrates would be impacted during proposed channel construction and maintenance. Bivalves and some crabs would be destroyed. Larger crabs may move out of the area during dredging but some would be taken up and destroyed by hydraulic dredging. The eelgrass/microinvertebrate community would be decreased. The deeper channel would slowly repopulate sometime after construction. Maintenance dredging would temporarily impact biota in the channel and could have long-term impacts if species such as crabs are harmed during the dredging operation. Numbers and sizes of crabs that could be present are not known. The overall impact on macroinvertebrates would be minimized by dredging at times which avoid major crab mating and rearing times. Marina traffic may interfere with some commercial and sport crabbing operations just outside of Lummi Bay, but this should be minimal.

Flatfish and sculpins are known to use the natural channel. Many large flatfish utilize habitats near the sea pond northwest tide gate. Flatfish of various sizes have been observed at the outer channel. Small sculpins have been observed all along the channel. It is known that juvenile salmon use the channel (EIS Section 3). Juvenile salmon use of shallow water embayments is well documented. Some adult salmon may attempt to return to the sea pond aquaculture facility via the proposed entrance channel instead of the channel from which they were released, located just south of the sea pond. Attempts that may be made to net any adult salmon in the entrance channel could cause interferences with boating traffic. Whether other fish are present in the channel is not known, but some assumptions regarding the channel usage can be made. Threespine stickleback, perch, and cod have been found in the sea pond and may use the channel on their way to and from the sea pond. It is not known whether smelt or herring use the channel. Based on known habits of those species in the observed channel, it can be assumed that, unless properly timed, significant mortalities to herring and juvenile salmon could occur. Possible impacts resulting from navigation channel operation could consist of decreased herring egg survival at navigation channel edges due to pollutants and boat activity as well as creating adult salmonid attraction to the channel. Herring spawning and egg survival impacts could be significant due to a net loss of herring spawning substrate (eelgrass).

Use of the channel by birds is not extensive. Due to increased human activity in the channel, those birds that do use the channel edges may be disturbed and so move to other areas. Thus some habitat would be eliminated, but significant adverse impacts should not occur.

d. Historical and Prehistoric Impacts and Their Significance. Since no historic or prehistoric sites are known to exist within the project area, no significant impacts are anticipated. In their letter dated September 27, 1982, the State of Washington Office of Archaeology and Historic Preservation determined that the proposed project in Lummi Bay would have no effect on known cultural resources and recommended reconsideration if landward features are proposed. If a site or sites are found during construction, work would stop until specialists complete an adequate investigation to determine significance of potential project impacts. Any such efforts would be conducted with the Lummi Tribe and the State of Washington Office of Archeology and Historic Preservation.

e. Socioeconomic Impacts and Their Significance. Construction of the marina and navigation channel would provide some temporary employment. Operation of the marina and related upland facilities would provide employment and enhance the Lummi Indian economy. The Lummi and Nooksack Indian Tribes would benefit economically by placement of their commercial fishing boats in a marina closer to their home and closer to their traditional fishing grounds. Indian treaty rights would not be adversely impacted. Project construction dredging would interfere to a limited extent with the sport and commercial Dungeness crab fishery at the mouth of Lummi Bay. Construction dredging should not interfere to a great extent with the starry flounder trawl fishery conducted in Lummi Bay. It is uncertain if commercial catches of Pacific herring would decrease due to a net loss of herring spawning substrate. Operation of the marina would interfere with commercial and sport Dungeness crab and starry flounder trawl fisheries in Lummi Bay, but economic changes should be minimal.

f. Relationship of Plans to Existing Plans, Policies, and Controls. In Lummi Bay, the State of Washington owns submerged lands from tideland elevation -4.5 feet MLLW to deep water in Puget Sound. The Lummi Tribe (local sponsor) owns reservation lands above tideland elevation -4.5 feet MLLW. The United States claims navigational servitude jurisdication from MHHW (+7.8 feet in Lummi Bay) to coastal deep waters. Project areas designated for Federal entrance and access channels and turning basins would require no Washington State lease since Federal navigation projects may be constructed in navigable waters without compensation to the owner. Although the non-Federal moorage basin will be dredged to depths below elevation -4.5 feet MLLW, the Lummi Tribe would not have to secure a Washington State lease for project construction since the tribe owns the moorage basin land above this elevation.

Use of Lummi Bay lands is projected to change as a result of project construction. The change would be consistent with the Lummi Indian Tribal interests but a variance would be required under their coastal zone plan. The proposed project is in compliance with all applicable Federal, state, and local plans, policies, and controls except the Lummi coastal zone plan. Pertinent plans, policies, and controls are discussed below. A list of environmental requirements is provided in the EIS summary table (table EIS 1-1).

(1) Coastal Zone Management Act. The National Coastal Zone Management Act (NCZMA) (Public Law 91-583; 86 Stat. 1280) was passed by the United States Congress in 1972 and in June 1976 the state Coastal Zone Management Program (CZMP) was approved to receive funding. The State Management Act (SMA) of 1971, as passed by the State Legislature, provides "for the management of Washington's shorelines by planning and fostering all reasonable and appropriate uses." The SMA is implemented through detailed planning efforts that culminated in the State Management Program (SMP) for municipalities and counties. A SMP is not required for the proposed action, because actions on lands held in trust by the Federal government (i.e., Indian Reservations) are excluded from requirements of the NCZMA. However, an Indian tribe may submit a reservation coastal zone plan to the state, receive state

approval, and then have the state send the plan to the Office of Coastal Resources Management for Federal approval though inclusion in the state plan. The Lummi Indian Tribe has developed and implemented a coastal zone plan, but has not applied for or received state or Federal approval of the plan. Since the proposed project is on the Lummi Indian Reservation and no direct effects are expected on state lands, the Lummi Indian plan is the applicable plan. Policies of the Lummi Indian plan are considered advisory under the NCZMA.

(2) Local Shoreline Master Programs. The coastal zone plan prepared by the Lummi Indian Tribe (GPA Consulting Services, December 1979) is known as the Lummi Coastal Zone Management Plan (LCZMP). The final plan was approved by the tribe in February 1982 and defines acceptable coastal uses for the Lummi Indian Reservation. Proposed marina construction is not consistent with LCZMP designated aquaculture use of the diked sea pond and so a variance would be required under the LCZMP. Proposed navigation channel construction is not consistent with the designated conservancy element used in Lummi Bay and so a variance would be required.

The general marina element policy given in the LCZMP is given below and provides for the protection of ecological processes during the development and operation of a marina facility.

(a) Marina design and location shall provide for minimum adverse effects on natural shoreline processes and fish and wildlife habitats.

(b) Marinas shall be located in areas where a minimal amount of dredging will be necessary to maintain the facilities.

(c) Existing adjacent land uses shall be considered in the location procedure for a marina, and suitable buffers shall be provided if necessary.

(d) Suitable marina sites shall be preserved until such time as a marina may be developed.

(e) Marinas shall not be located in an area where the disruption of littoral transport and accretion may occur.

(f) Accessory marine uses shall be limited to water dependent uses or those which provide sufficient public access to the area.

(g) Nonwater dependent uses shall be located inland to preserve as much of the coastline as possible.

(h) Fuel docks and fuel storage shall be carefully regulated to minimize potential spill and fire hazards.

(i) Basins shall be designed so as to provide for adequate flushing rates to maintain acceptable levels of water quality.

In accordance to the above, potential impacts to fish and wildlife habitats have been minimized and are presented in EIS section 4. Dredging has been minimized, littoral transport and accretion should not be significantly altered, fuel and spill hazards have been minimized, and flushing is determined adequate. The proposed project incorporates the above provisions of the marine element policy except categories f and g (above). Categories f and g require only water dependent uses. Needed marina related, as well as water dependent, uses are proposed for the marina support fill area. Use of the proposed fill areas must be carefully evaluated regarding water dependent usage (see appendix A (Section 404(b)(1) Evaluation) for analysis of water dependent uses). Marina related uses must be carefully evaluated and a LCZMP variance would be required. The Lummi Indian Tribe has proposed only water dependent or marine related facilities that have no practicable alternatives for the 65-acre fill. Any changes to the specific proposal described in the DPR/EIS and the Section 10/404 permit application will require a new Section 10/404 permit.

(3) Washington Department of Natural Resources (DNR) Policy on Open-Water Disposal of Dredged Material into Puget Sound. Currently, the project proposal is to place initial and maintenance project dredged material within the sea pond. As such this DNR policy is not applicable. If the alternative of open-water disposal for maintenance dredged material is selected at a later date, this DNR policy will be addressed.

(4) Clean Water Act of 1977 (Public Law 95-217), Section 404(b) Guidelines. The effects of discharge of dredged or fill material into waters of the United States must be evaluated pursuant to guidelines promulgated by the EPA. This document has considered all the factors pertinent to this action and analyses are detailed in appropriate sections of this document. The 404(b)(1) evaluation for initial construction is provided in appendix A. Pursuant to Public Law 95-217 and implementing Corps of Engineers regulation, application will be made to the WDE for appropriate certification of water quality. Application will be made to the Corps of Engineers, by the local sponsor, for a Federal permit to place fill material in Lummi Bay. This permit, if issued, will be conditioned to allow only water dependent and/or marina related structures on all fill.

Maintenance dredged material will either be placed in a diked area of the sea pond or disposed at a designated open-water site. Final selection of the most appropriate maintenance alternative will be based on evaluation in accordance with the National Environmental Policy Act, the Clean Water Act, and other applicable legislation and regulations.

(5) Water Resources Development Act (Public Law 94-587). Section 150(b) required that whenever the Secretary of the Army, acting through the Chief of Engineers, submits a report on a water resource development project to Congress, such report shall include, where appropriate, consideration of the establishment of wetlands. Although proposed Section 107 (River and Harbor Act) projects, such as the proposed Lummi Bay Marina, are not submitted to Congress for authorization, they qualify for Section 150 funding. Due to the estimated costs and benefits of project disposal alternatives, it was determined that obtaining funding under Section 150 would not be beneficial for proposed project features.

(6) Executive Order 11988, Flood Plain Management. Analyses have been done regarding effects of the NED/tentatively selected plan on the flood plain. EO 11988 defines the base flood elevation for this purpose as the elevation of the 100-year recurrence interval. EO 11988 defines acceptable management of areas located within flood plains. The proposed project lies entirely within the area of tidal influence. Proposed project features would not influence the base flood elevation of Lummi Bay or adjacent areas. During the planning process for the proposed project, Federal, state, and local entities and individuals have been and will continue to be kept informed of the proposed action, including the dredge and disposal plans. The proposed project would not be located in a flood plain. This evaluation conforms to requirements of the decisionmaking process of EO 11988.

(7) Executive Order 11990, Protection of Wetlands. Under the tentatively selected plan, eelgrass would be removed through dredging and filling. Fill would be for construction of marina dependent upland facilities, associated dikes, and maintenance disposal and mitigation area dikes. Purpose of the fill is for marina related upland facilities. No known alternative sites exist for placement of the marina structures. It is known that dredged material disposal would cause removal of some eelgrass and Ulva within the sea pond. This would be mitigated by reintroducing part of the sea pond to tidal action and by constructing several small wetlands. Dredging of the proposed navigation channel would remove about 29 acres of eelgrass. Considering the slow rate of natural revegetation, planting of eelgrass is scheduled to be conducted. Even with plantings, a net loss of eelgrass will probably occur but may be about 1 percent of that found in Lummi Bay. Further information on evaluation of project alternatives and avoidance of mitigation of impacts to wetlands are provided in EIS sections 2.02, 2.03, 4.02c, and 4.03 and in the appendix A Section 404(b)(1) evaluation.

No practicable alternatives to the proposed action exist (see section 2.03) and the tentatively selected plan includes all practicable measures to minimize losses to wetlands as a result of project construction.

g. Adverse Environmental Impacts Which Cannot Be Avoided. Adverse environmental impacts which cannot be avoided consist of (1) permanent destruction of all biota within the sea pond area proposed to be filled for dike and upland construction; (2) temporary destruction and long-term modifications of the biota existing in the areas of proposed harbor basin and navigation channel construction; and (3) a loss of eelgrass. It is not certain whether survival of aquatic biota and avian fauna may decrease due to a potential for contaminants entering the water (i.e., potential oil spills, marina operation activities) or whether significant avian fauna habitat would be removed.

h. Irreversible and Irretrievable Commitments of Resources. Biota within the proposed navigation channel will be permanently altered. Eelgrass acreages would probably decrease. Biota in the area of the sea pond proposed for initial fill would be permanently eliminated from the aquatic environment. The marina area would remain aquatic but types and amounts of biota present would permanently change.

The capitol and labor necessary to construct and maintain the proposed marina would be committed irreversibly and irretrievably. This includes the capitol and labor associated with dredging and filling activities, administration, personnel, operations, maintenance, and petroleum products used. In addition, the land being filled and the materials used for fill and for constructing the marina would be irreversibly committed. Restoration of the land and reuse of materials may be possible but is very unlikely.

In addition to the initial economic commitment, further commitment of socioeconomic and environmental resources could be expected in the future as a direct result of the marina. Economic growth, population, and land development patterns would be affected and directed by local land use planning.

Commitments of nonrenewable energy products due directly or indirectly to construction and maintenance of this project are diverse, considerable, and not easily quantifiable. Construction activities, such as dredge and fill activities and building the breakwater, boat slips, parking, and auxiliary support facilities, would require a nonrenewable expenditure of energy for implementation of the project. Additional fuel and manpower would be expended for maintenance activities which include mowing and gardening of landscaped areas and inspection and repairs of marina facilities. Traffic disturbance or increased congestion (anticipated from commuters to and from the marina) on local arterial would result in an increase in energy consumption. Fuel consumption by small boats that would use the marina also represent energy commitments, but cannot be reasonably calculated due to the variety of craft and unknown frequency of use. The effect of increasing fuel prices has already been observed to spur conservation efforts. This would likely continue as prices rise, but may not necessarily reduce total consumption as numbers of persons engaged in boating would increase.

In summary, it is safe to presume that marina construction, directly and indirectly, involves a potantially large energy commitment.

i. Relationship Between Local Short-Term Use of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity. It is expected that as a result of proposed construction, aquatic productivity in Lummi Bay as a whole (including the diked sea pond) would not change significantly since productivity and habitat lost by filling would be mitigated by reintroduction of part of the sea pond to tidal action (dredge maintenance, mitigation, and marina areas) and marsh and eelgrass wetland plantings. However, some loss of eelgrass and its associated fauna would result. In general, there would be a long-term change in the project area from an area with minimal daily human activity to an area of intense human activity. The long-term result will be a reduction in the amount of relatively "natural" environment.

j. Operation and Maintenance. Initial dike construction will provide for 90 acres of the sea pond to be reintroduced to tidal action: 65 acres for mitigation and 25 acres for potential placement of maintenance dredged material (tentative preferred alternative). At 5-year intervals maintenance dredged material may be placed in 25 acres of the sea pond which has been

reintroduced to tidal action. Alternatively, maintenance dredged material may be placed at a designated open-water disposal site, in which case the 25 acres will remain as intertidal lands. Final selection of a maintenance dredging alternative will be made at approximately 5-year intervals in accordance with the National Environmental Policy Act, the Clean Water Act, and other appropriate legislation and regulations. Both alternatives are economically feasible.

4.03 Environmental Features, Mitigation, and Monitoring of Adverse Effects.

a. Environmental Features. The following are environmental features of the proposed project:

(1) Change in project location from Gooseberry Point south to Lummi Bay to reduce project impacts.

(2) Incorporation of fish passage features within the proposed moorage basin entrance breakwater.

(3) Scheduling of construction to avoid impacts to crabs and other fauna.

(4) Introduction of tidal action to turning basin and access channel and moorage basin.

(5) Routing of navigation channel to minimize impacts to eelgrass in Lummi Bay.

b. Mitigation. The following are mitigation features of the proposed project:

(1) Sixty-five acres of the sea pond reintroduced to tidal action to compensate for 65 acres of fill for marina support facilities.

(2) Twenty-five acres of peripheral tidal area preserved in the boat basin.

(3) Eelgrass planting or regrowth in the vicinity of navigation channel to minimize losses of eelgrass.

(4) Establishment of wetlands within mitigation, potential maintenance, and moorage basin areas.

(5) Twenty-five acres of potential maintenance dredging disposal area (tentatively selected disposal area) reintroduced to tidal action for a minimum of 5 years and possibly for the life of the project.

c. Monitoring. The following monitoring is part of the proposed project:

(1) Water quality monitoring during dredging and disposal.

(2) Monitoring of constructed wetland areas.

(3) Monitoring of eelgrass establishment on slopes and adjacent to the navigation channel.

d. Evaluation Criteria Used In Mitigation Planning. The following is based on Corps of Engineers regulation:

(1) Scientific literature documents the contribution of eelgrass to carbon fixation, detrital production, faunal recruitment, current velocity reduction, and sediment stabilization. The proposed mitigation is a result of consideration of the scientific literature and coordination with state and Federal agencies, local interests, the Lummi Indian Tribe, and Northwest experts. The coordination reflects a consensus for the need and justification of the mitigation feature.

(2) The recommended plan (excluding maintenance dredging) was formulated under, and is responsive to, the requirements of all applicable environmental statutes, executive orders, and state and local regulations (see table EIS 1-1 and EIS section 4.02(f)). Primary Federal requirements include the National Environmental Policy Act, Fish and Wildife Coordination Act, EO 11990, Coastal Zone Management Act, and the Clean Water Act.

(3) Monetary and nonmonetary benefits of the proposed mitigation exceed monetary and nonmonetary costs. This conclusion is based upon the known values of biota known to inhabit the sea pond (see list in table EIS 4-1) and on potential impacts to these resources as a result of project construction. Specific monetary benefits of the proposed mitigation to significant biota have not been calculated because data does not exist on numbers, distribution, seasonal presence, and economic value of significant biota occurring in Lummi Bay and in the diked sea pond. Significant biota are listed in table EIS 4-1. Existing data are not sufficient to determine and document the specific use of the proposed project area by significant fish and wildlife. Neither is there any acceptable methodology for determining monetary values for crab nursery areas, herring spawning habitat, salmon nursery habitat, and habitat primarily valued for its food chain production. Proposed mitigation is based on an analysis of the existing data, consultation of resource agency representatives, identification of practicable alternatives, professsional evaluations, and benefits to the significant resources that would probably be affected by project construction, as well as economic and engineering considerations. Utilizing the existing data, it was determined that mitigation should be based upon the concept of like-for-like. That is, the biomass and productivity which would be decreased with project construction should be increased through wetland plantings and by increasing tidal action in the diked sea pond.

TABLE EIS 4-1

SIGNIFICANT BIOTA KNOWN TO INHABIT THE SEA POND[1/]

Eelgrass
Amphipods (including *Corophium*)
Ghost shrimp
Dungeness crab
Salmon
Pacific herring
Starry flounder
Staghorn sculpin
Pacific tomcod
Smelt
Kelp perch
Waterfowl
Great Blue Heron

1/Numbers, distribution, seasonal presence, and life stages usage are unknown.

(4) The overall monetary and nonmonetary plan benefits were maximized by considerations of practicable alternative measures, costs relative to benefits of mitigation measures, availability of mitigation lands, habitat development potential, economic value of project lands, existence of local public lands or private lands contiguous to the project, and more remote public or private lands. Additional mitigation development was not considered economically feasible.

(5) Factors contributing to the justification of expenditures recommended was based on the qualitative assessment of resources likely to be lost as a result of project construction and the best practicable method of replacing those resources or the habitat upon which they depend (see 3 above for a listing of factors).

(6) Mitigation of unavoidable losses has been provided to the maximum extent justifiable and practicable on project lands by reintroducing the marina and maintenance disposal area to tidal action and by planting of wetland species.

(7) The proposed mitigation site is contiguous with project lands and is the closest site practicable to the habitats adversely impacted by the project. The mitigation site is located adjacent to the proposed marina and maintenance disposal area. Federal funds are not required for purchase of mitigation lands.

(8) There is no proposed recommendation for acquisition of noncontiguous project lands or for purchase by the Federal Government of any lands for mitigation purposes.

(9) No known fish and wildlife management measures, other than aquaculture and herring surveys, are conducted in Lummi Bay or the diked sea pond. That portion of the sea pond that has been proposed for mitigation is not used for aquaculture operations or included in herring surveys. As such, no recommendations exist for acquisition of non-Federal public lands which are presently being managed for environmental purposes.

(10) Plans do not include recommended intensified management of locally available public lands because no such lands exist in the vicinity of the study area.

(11) The proposed mitigation has been assessed for beneficial fish and wildlife actions associated with the project which could offset the adverse impacts. Since available data is limited regarding resources existing in the study area, impacts as a result of project construction can only be subjectively evaluated and estimated. Adverse impacts would be lessened by placement of the marina and fill area in the diked sea pond, which has very limited tidal action; by preservation of the marsh existing at the northwest corner of the diked sea pond; and by placement of the navigation channel in the natural Lummi (Red) River channel. Reduction of the fill area to that which is determined necessary would reduce adverse impacts to aquatic biota.

Reintroduction of the enclosed sea pond to tidal action would benefit fish and wildlife. Disposal of maintenance dredge material on an upland site or on open water would reduce adverse project impacts to aquatic biota, but this has been determined not to be economically practicable.

(12) Separable mitigation measures are considered justified and appropriate based on documentation that overall environmental losses would exceed gains as a result of project construction. In addition, potential adverse effects on salmon, Pacific herring, Dungeness crab, and their associated food chains constitute impacts to values of such significance that separable mitigation measures are considered justified.

SECTION 5. PUBLIC INVOLVEMENT

5.01 Study Coordination and Public Involvement. The study coordination and public involvement framework for this study is presented in section 5 of the DPR and in appendix B. Federal agencies most involved with the study include the EPA, FWS, U.S. Coast Guard, Bureau of Indian Affairs, and National Marine Fisheries Service. In accordance wih the Fish and Wildlife Coordination Act (FWCA) of 1958 (Public Law 85-624), as amended, a draft FWCA report on this project, dated June 3, 1983, was prepared by the Olympia office of the FWS and provided to the Corps of Engineers. The FWCA report is in appendix B. State and local agencies or groups involved with the study include the WDE, WDF, Washington Department of Game (WDG), Office of Archaeology and Historic Preservation, DNR, city of Bellingham, Whatcom County, Port of Bellingham, Lummi Indian Tribe, and environmental groups. Engineering and environmental data were furnished to interested agencies and individuals upon request and as the information became available. Agency coordination has consisted of several meetings and field trips.

5.02 Remaining Coordination. Coordination, particularly regarding those issues included in the summary, will be ongoing with the interested public and Lummi Indian Tribe, as well as with the Federal, state, and local agencies. Further coordination with resource agencies and the interested public will take place during the draft review period. A public meeting is scheduled to be held during the review period. Coordination with appropriate Federal, state, and local agency representatives will take place during preparation of plans and specifications as well as during construction.

5.03 Statement Recipients. The draft DPR and EIS will be distributed to the public for a 45-day review period. Comments on the drafts will be responded to in the final DPR and EIS. Revisions will be incorporated into the final DPR and EIS where appropriate. A list of persons, groups, and agencies who received the draft report will be presented in appendix B of the final report.

5.04 Public Views and Responses. Throughout the study, representatives of various Federal, state, and local agencies and groups have expressed interest and concerns regarding the proposed marina and navigation channel. Responses to recommendations presented in the draft FWCA report are given in DPR section 5.02c. Several resource agency concerns are included in the report summary. Several entities have expressed need for and support of the project. Most Federal and state resource agency representatives have expressed concerns regarding structures considered as water dependent and the need for adequate mitigation. Water dependent structures are discussed in appendix A. Federal and state agencies have requested mitigation of 1 acre of the sea pond reintroduced to tidal action for every sea pond acre that is filled. The proposal currently consists of initial construction filling of approximately 70.3 acres (including containment dikes) and reintroducing 146 acres of sea pond to tidal action.

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Ken Brunner B.S.	Wildlife Biologist	Wildlife Biologist, Corps of Engineers, 6 years; Biological Technician, Corps of Engineers, 1 year.	Description of and Effects on Wildlife; Threatened and Endangered Species Biological Assessment.
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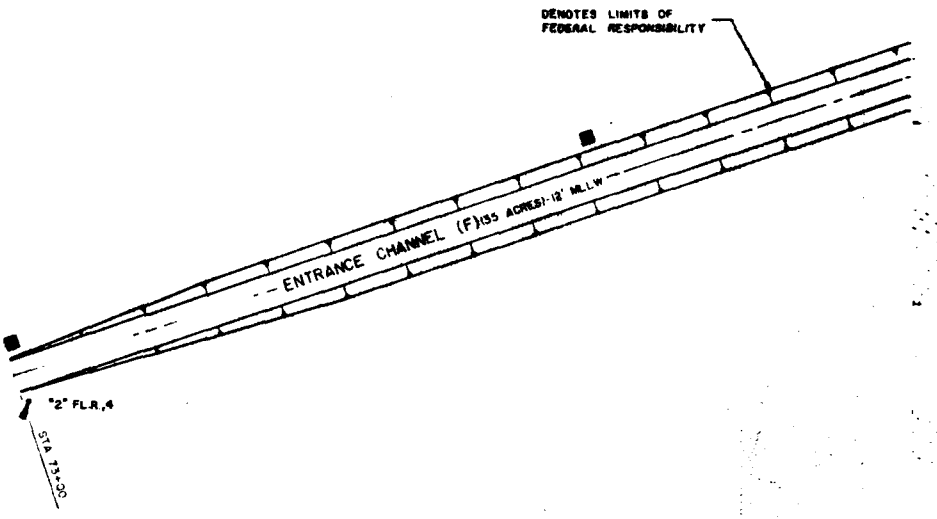
Andy Maser B.S., M.S.	Water Project Planner/ Architect	Corps of Engineers Study Manager for Flood Control, Wastewater Management, Navigation Project Studies 3 years - Detroit District 5 years - St. Louis District 4 years - Seattle District	Study Manager; Formulation of Alternatives; Needs Assessment; Economic Evaluation; Public and Agency Coordination.

PLATES

STRAIT OF GEORGIA



3

REVISIONS

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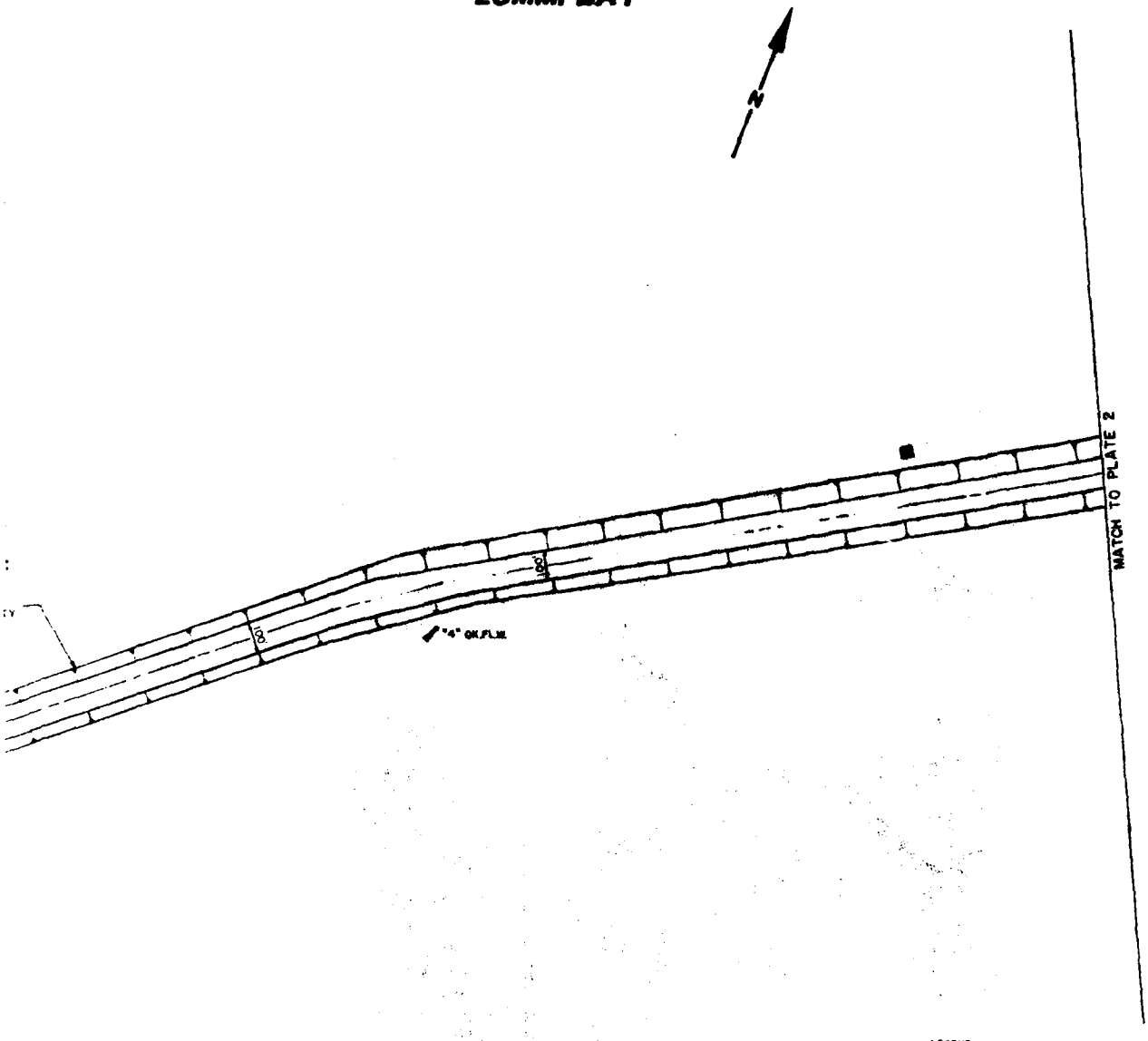
LUMMI BAY



LEGEND

■ USCG WOOD DOLPHIN DB

"2" FL R .4 USCG WOOD DOLPHIN LIGHT

BASED ON AERIAL PHOTOGRAPHY
TAKEN 21 JUNE 1982

0 200' 400'

VERTICAL DATUM BASED ON M.L.L.W.

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE WASHINGTON

LUMMI BAY MARINA

PLAN

WHATCOM COUNTY WASHINGTON

SCALE	DRAWING NO.	FILE NO.	DATE	PLATE
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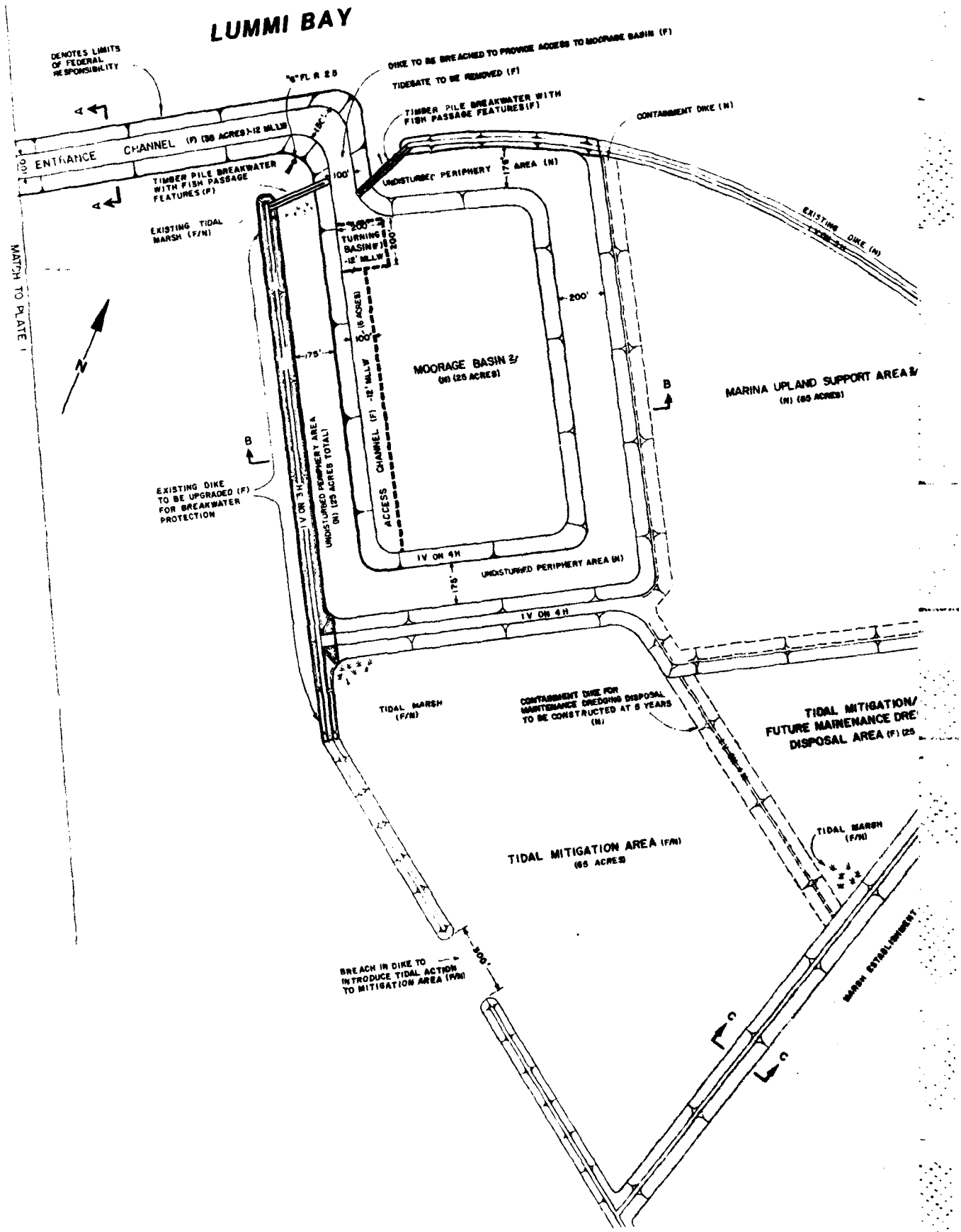
2



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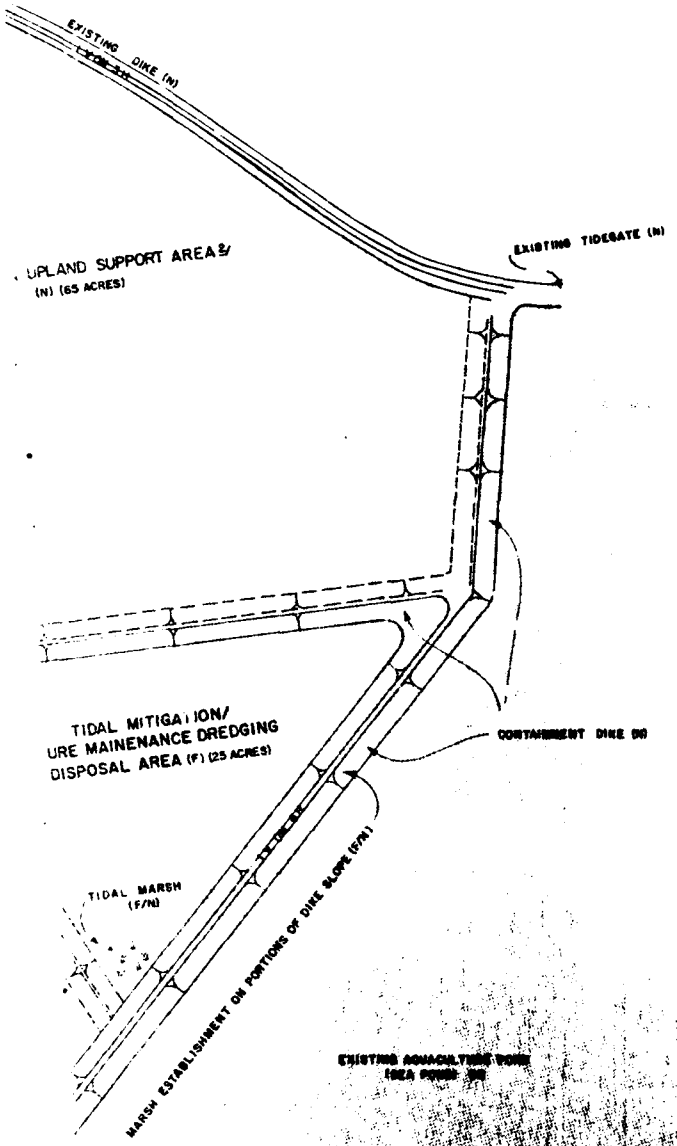

NOTES

1. SEE PLATES 3 AND 4 FOR SECTIONS AND DETAILS
2. SEE PUBLIC NOTICE IN APPENDIX A, PART 2, FOR DETAILS OF THESE NON-FEDERAL PROJECT FEATURES.

LEGEND

"6" FL R .2.5 — USCG WOOD DOLPHIN LIGHT

BASED ON AERIAL PHOTOGRAPHY TAKEN 21 JUNE, 1982

0 200' 400'

VERTICAL DATUM BASED ON M L L R

F—FEDERAL PROJECT FEATURES
N—NON-FEDERAL PROJECT FEATURES

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

LUMMI BAY MARINA

PLAN

WHATCOM COUNTY WASHINGTON

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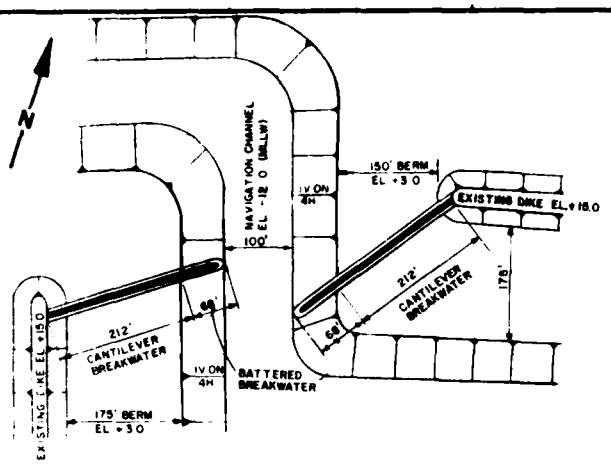

LUMMI BAY MARINA ENTRANCE PLAN

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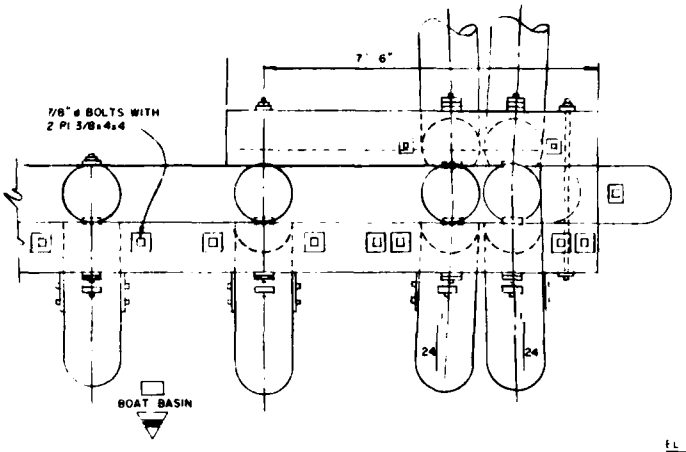

PLAN

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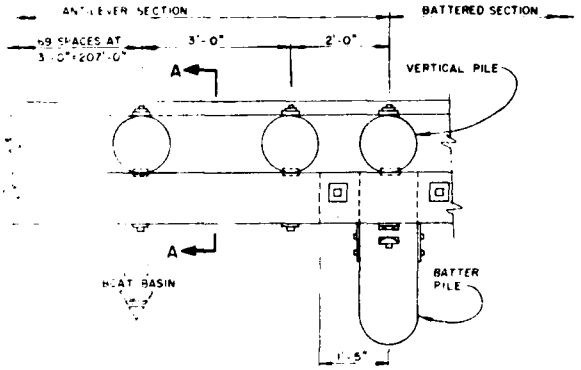

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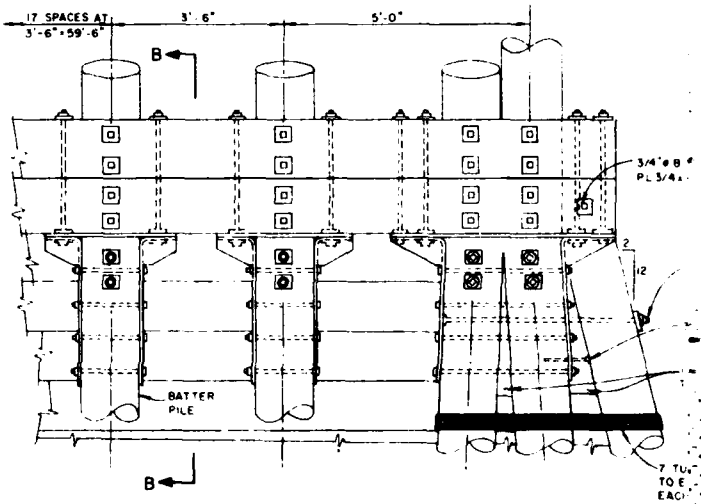

FRONT ELEVATION

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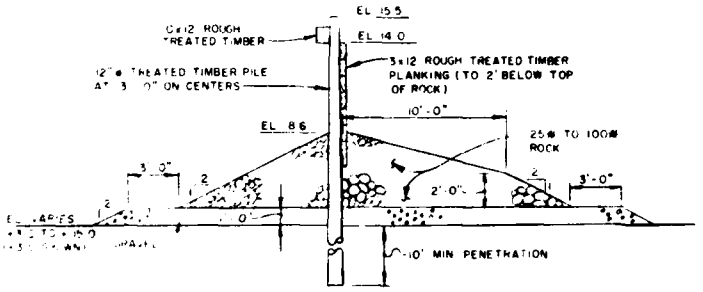

SECTION A - A

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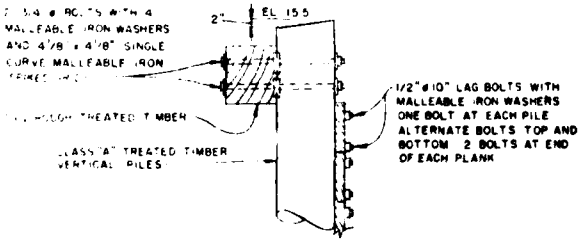

CONNECTION DETAIL

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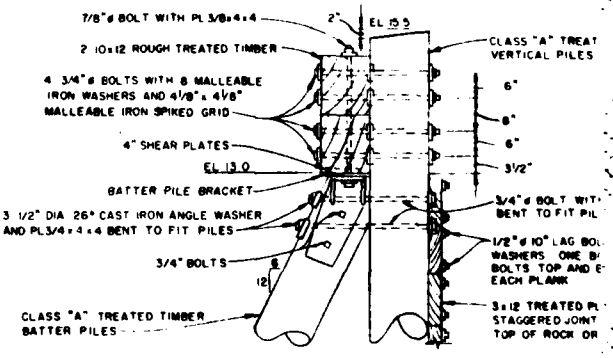
CANTILEVER SECTION



CONNECTION DETAIL

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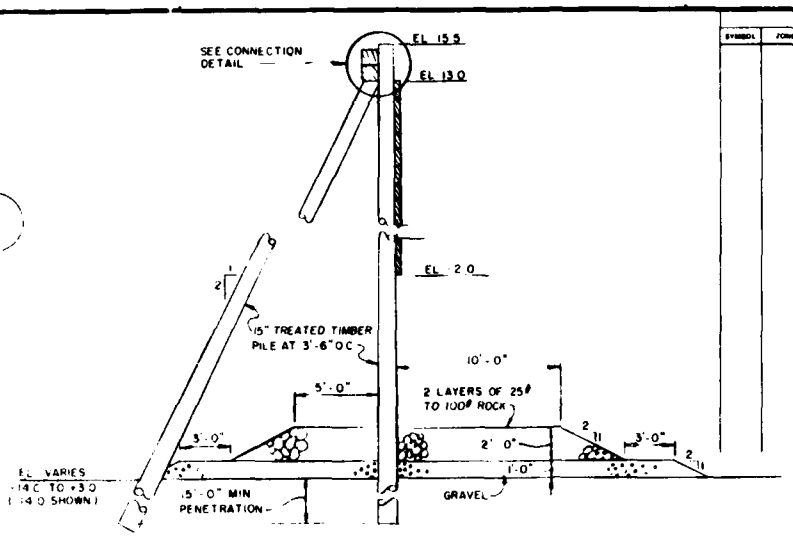

SECTION B - B
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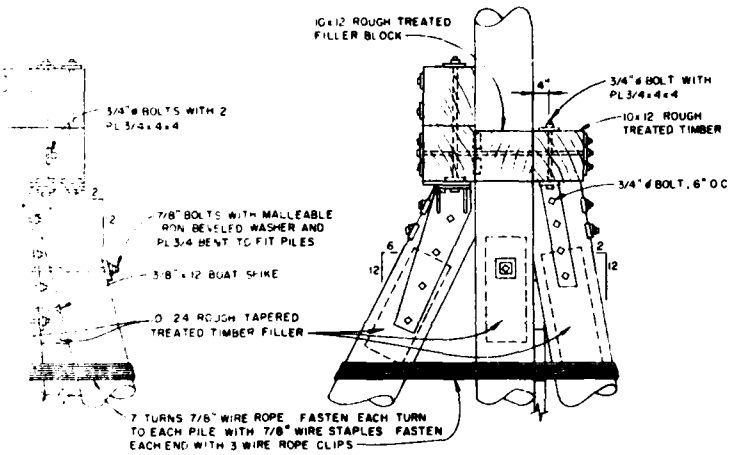

SIDE ELEVATION
SCALE 3/4" = 1'-0"

NOTES

1. ALL METAL SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION
2. ALL BOLTS, NUTS, AND WASHERS SHALL BE GALVANIZED
3. ALL BOLTS USED AGAINST WOOD SHALL HAVE MALLEABLE IRON WASHERS AT EACH END

CLASS 'A' TREATED TIMBER VERTICAL PILES

6"
6"
3/2"

3/4"ø BOLT WITH PL 3/4x4x4 BENT TO FIT PILES

1/2"ø 10" LAG BOLTS WITH MALLEABLE IRON WASHERS, ONE BOLT AT EACH PILE, ALTERNATE BOLTS TOP AND BOTTOM, 2 BOLTS AT END OF EACH PLANK

3x12 TREATED PLANKING, RANDOM LENGTH, 12" MIN STAGGERED JOINTS, (PLANKING TO RUN 2'-0" BELOW TOP OF ROCK OR EL +2.0, WHICHEVER IS HIGHER)

TERED SECTION

1" = 10' 10' 5' 0 10' 20'

1/4" = 1'-0" 1' 0 1'

3/4" = 1'-0" 12" 6" 0 1' 2 3'

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

LUMMI BAY MARINA

TIMBER-PILE BREAKWATER
SECTION AND DETAILS

WHATCOM COUNTY WASHINGTON

PREPARED					
CHIEF	SECTION				
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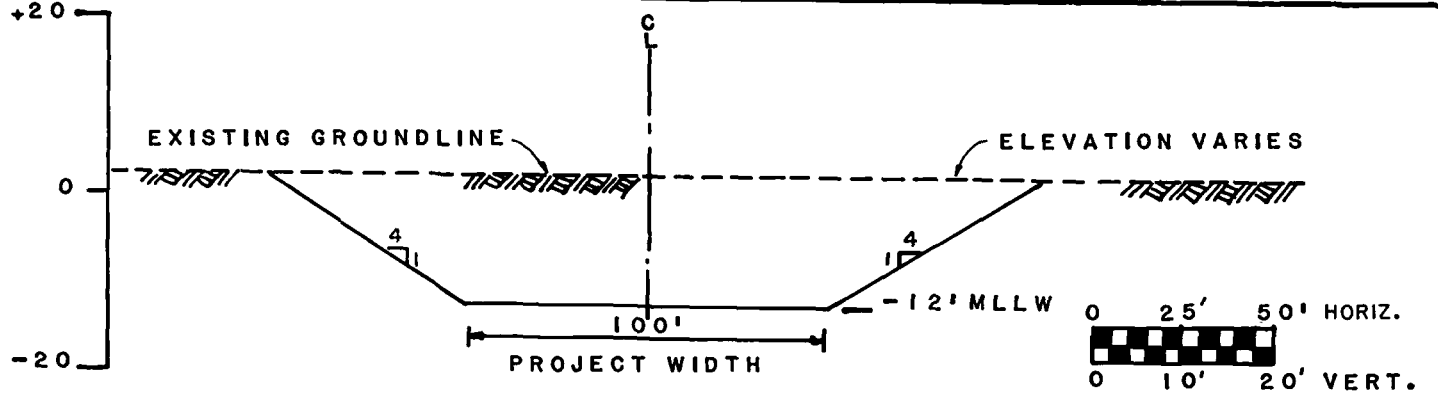
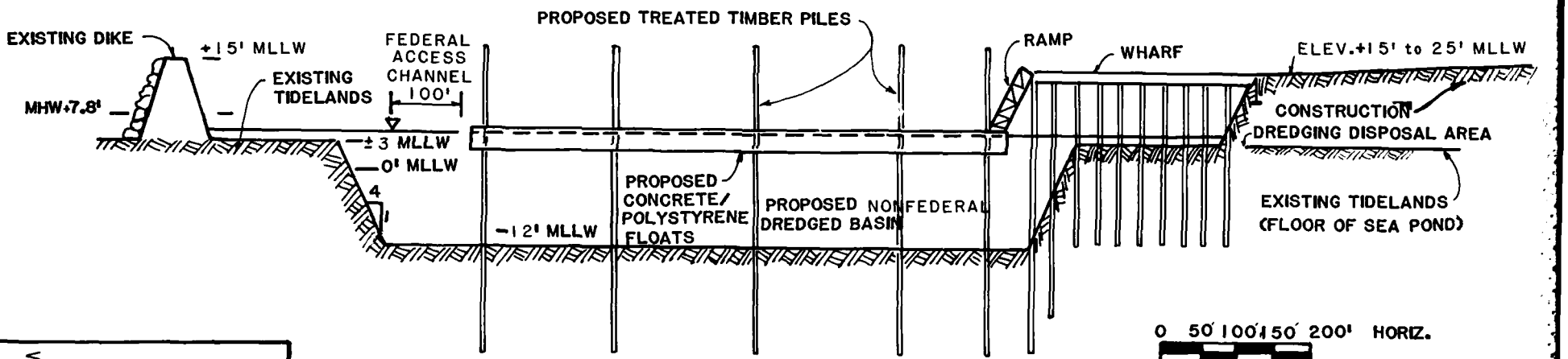
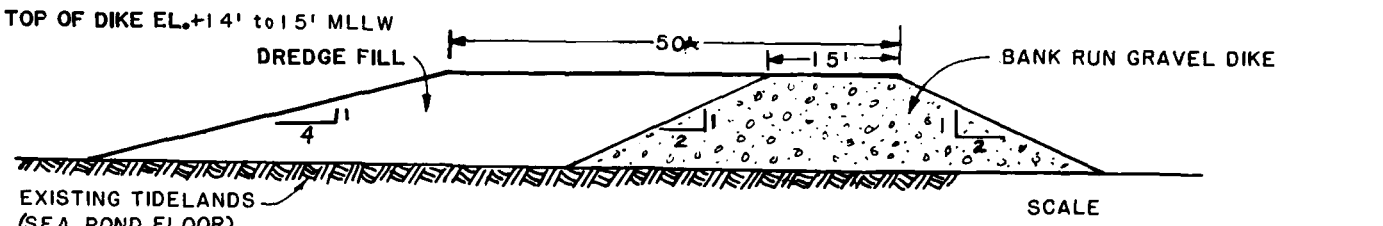


NAVIGATION ENTRANCE CHANNEL
TYPICAL SECTION A-A



MARINA
TYPICAL SECTION B-B



DIKE
TYPICAL SECTION C-C

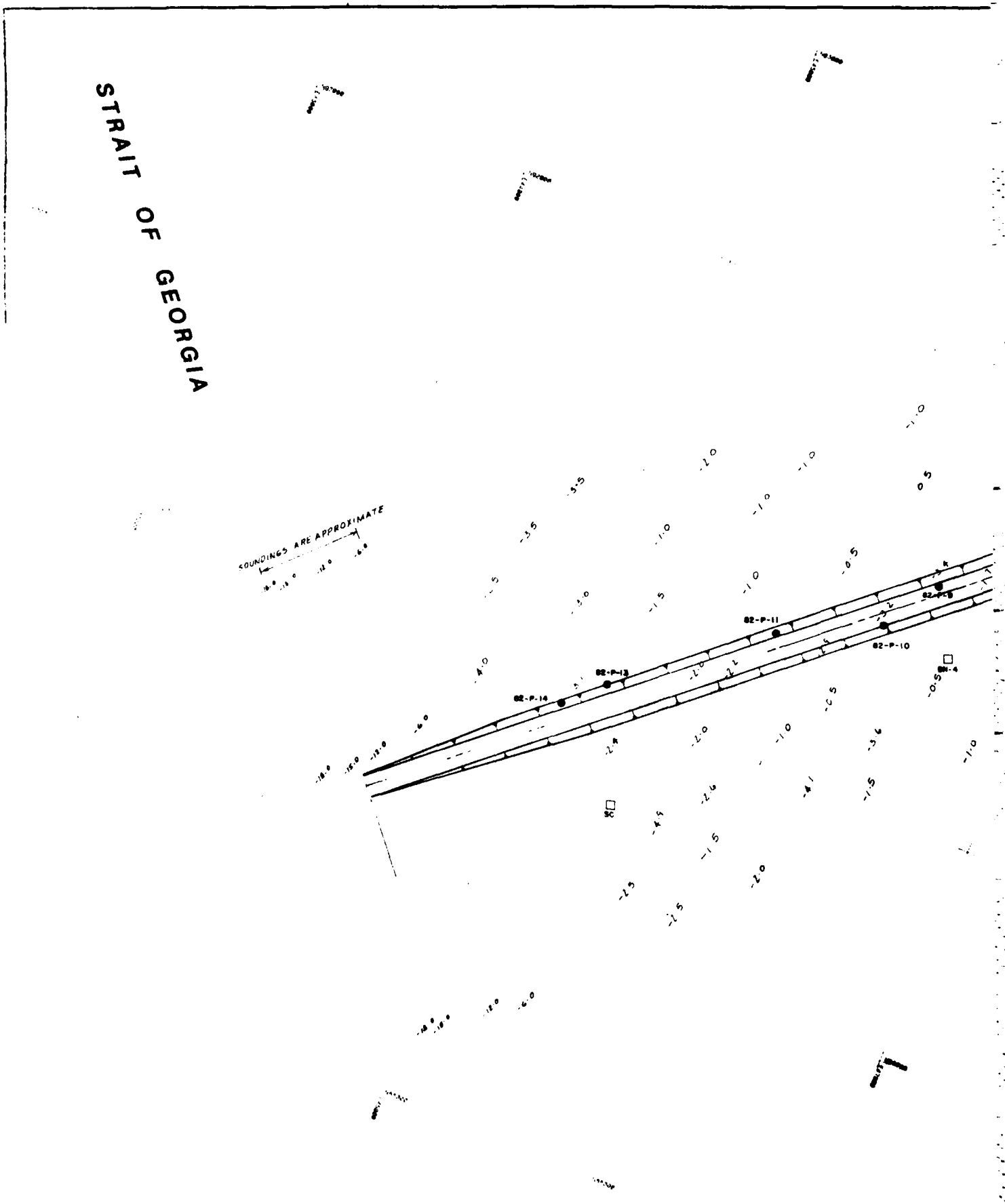
LUMMI BAY MARINA

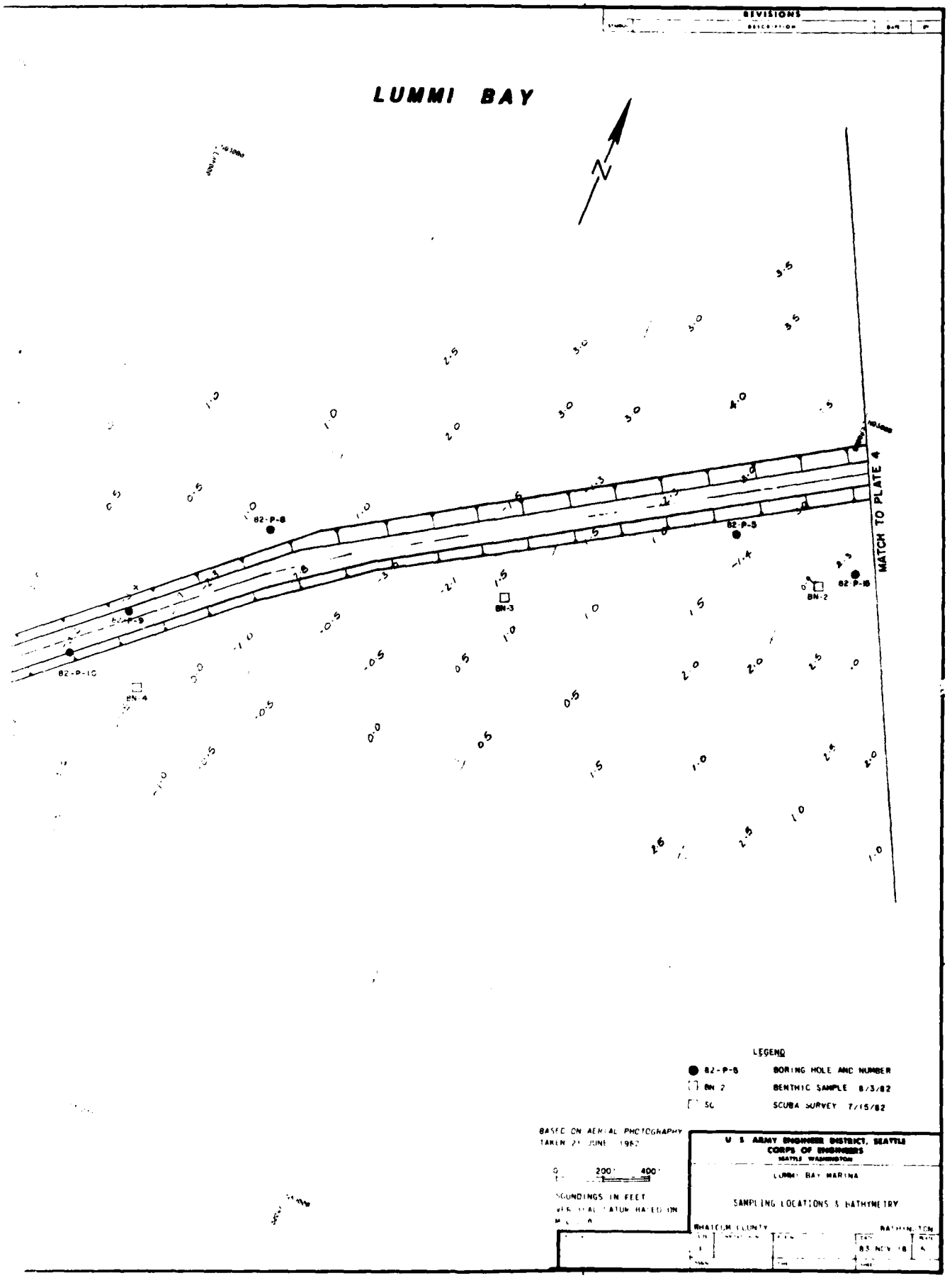
TYPICAL SECTIONS

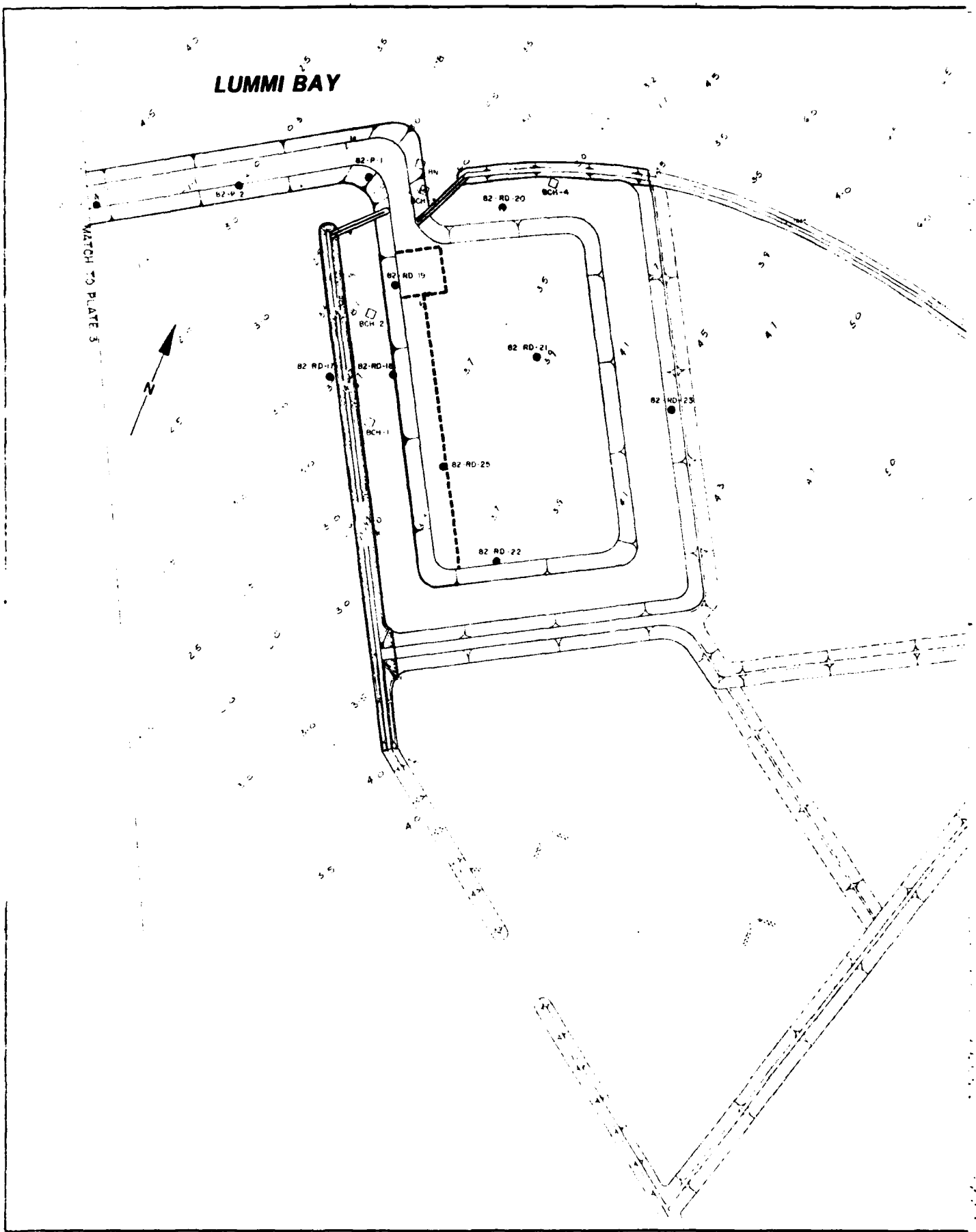
NAVIGATION CHANNEL,
MOORAGE BASIN AND DIKES

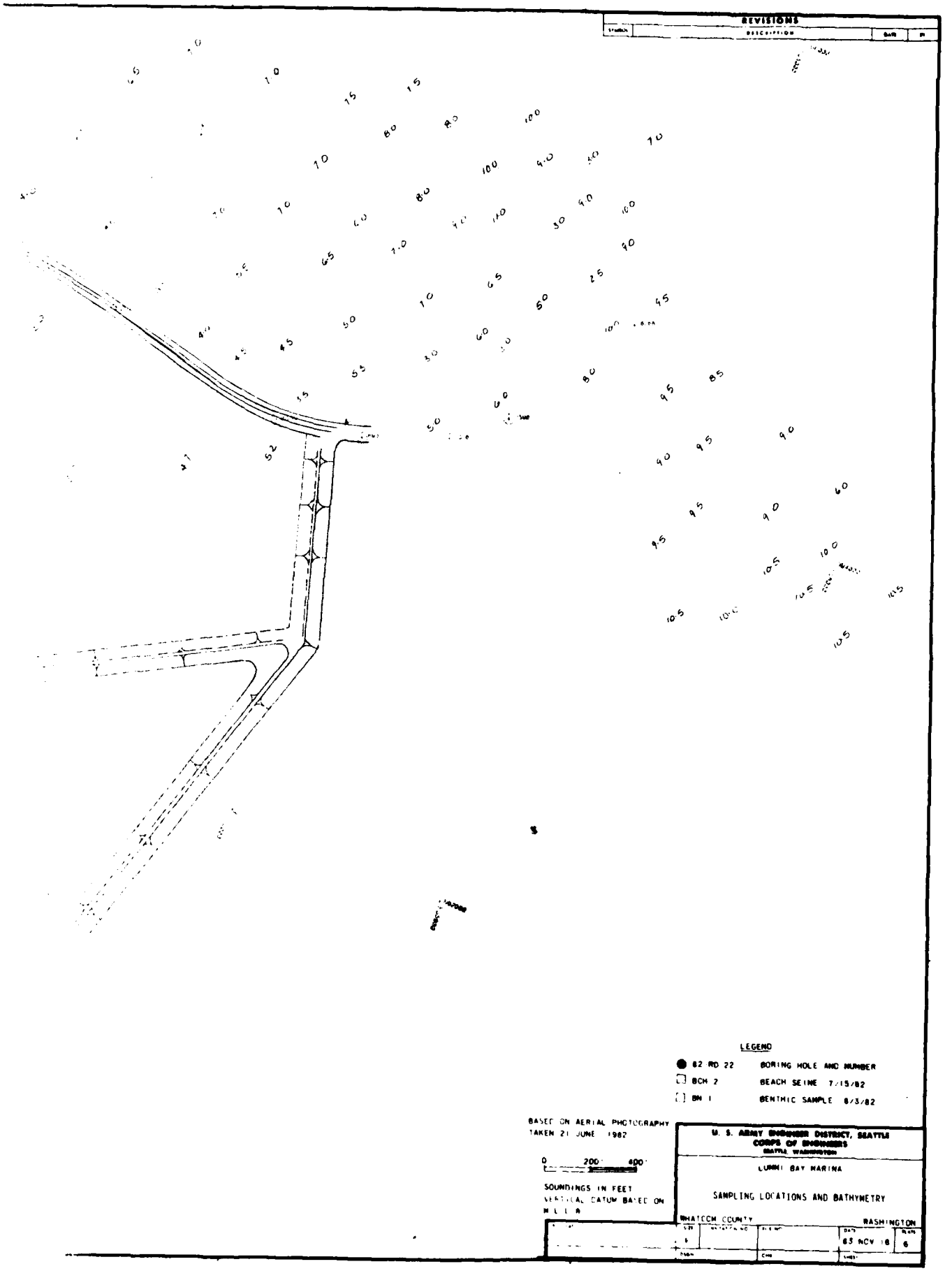
WHATCOM COUNTY WASHINGTON

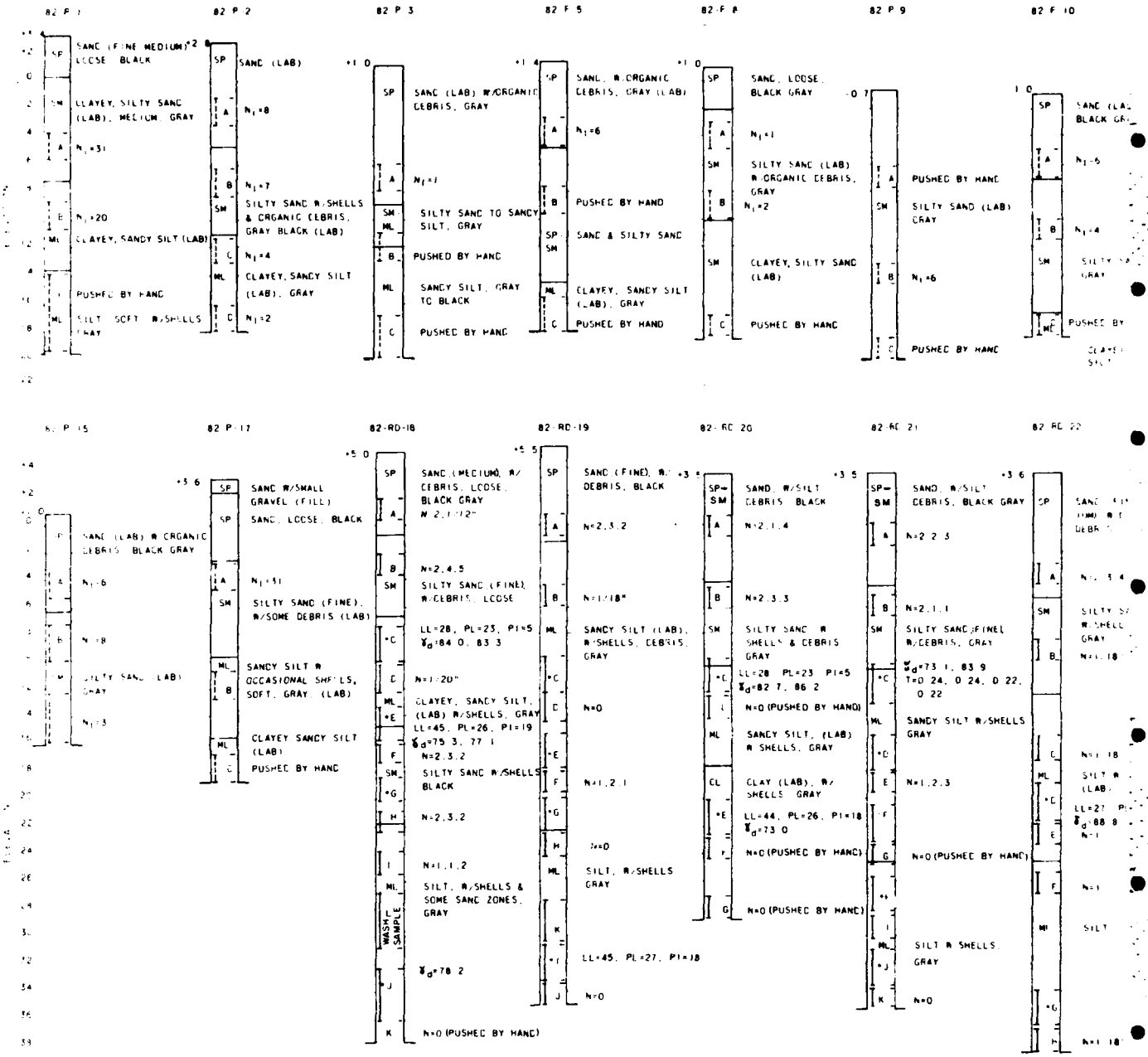
PLATE 4











LEGEND

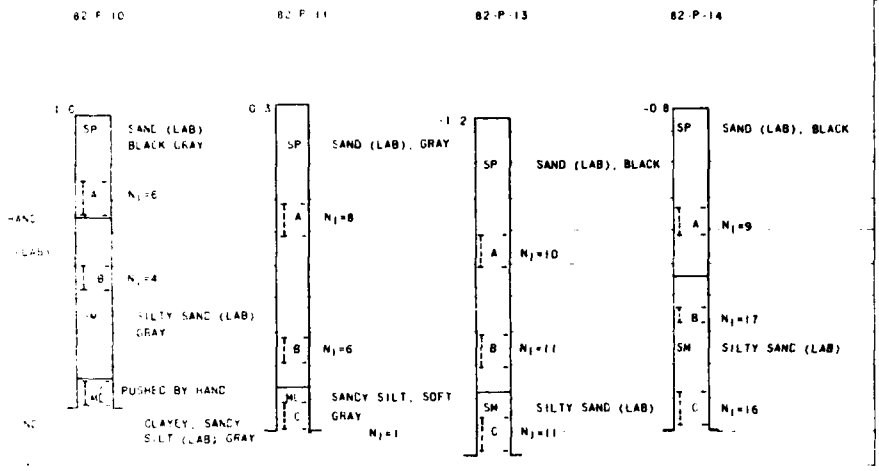
- W — SILT, LOW PLASTICITY
- M — SILT
- SP — SAND, POORLY GRADED
- SM — SAND W/SILT, W/ PLY GRADED
- CL — CLAY, LOW PLASTICITY
- ▼ — LOCATION OF SAMPLE TAKEN W/ 1 1/2" I.D. PORTER SAMPLER
- ▼ — NUMBER OF BLOWS W/ 30 LB HAMMER TO DRIVE PORTER SAMPLER
- I — LOCATION OF SAMPLE TAKEN W/ 2" O.D. SPLIT SPOON SAMPLER
- N = 4,5 — NUMBER OF BLOWS TO DRIVE 2" O.D. SPLIT SPOON SAMPLER 18" (IN 6" INCREMENTS UNLESS OTHERWISE NOTED) WITH 140 LB HAMMER DROPPED 30" (STANDARD PENETRATION TEST)
- I* — LOCATION OF SAMPLE TAKEN W/ 3" O.D. OSTERBERG PISTON TYPE TUBE SAMPLER

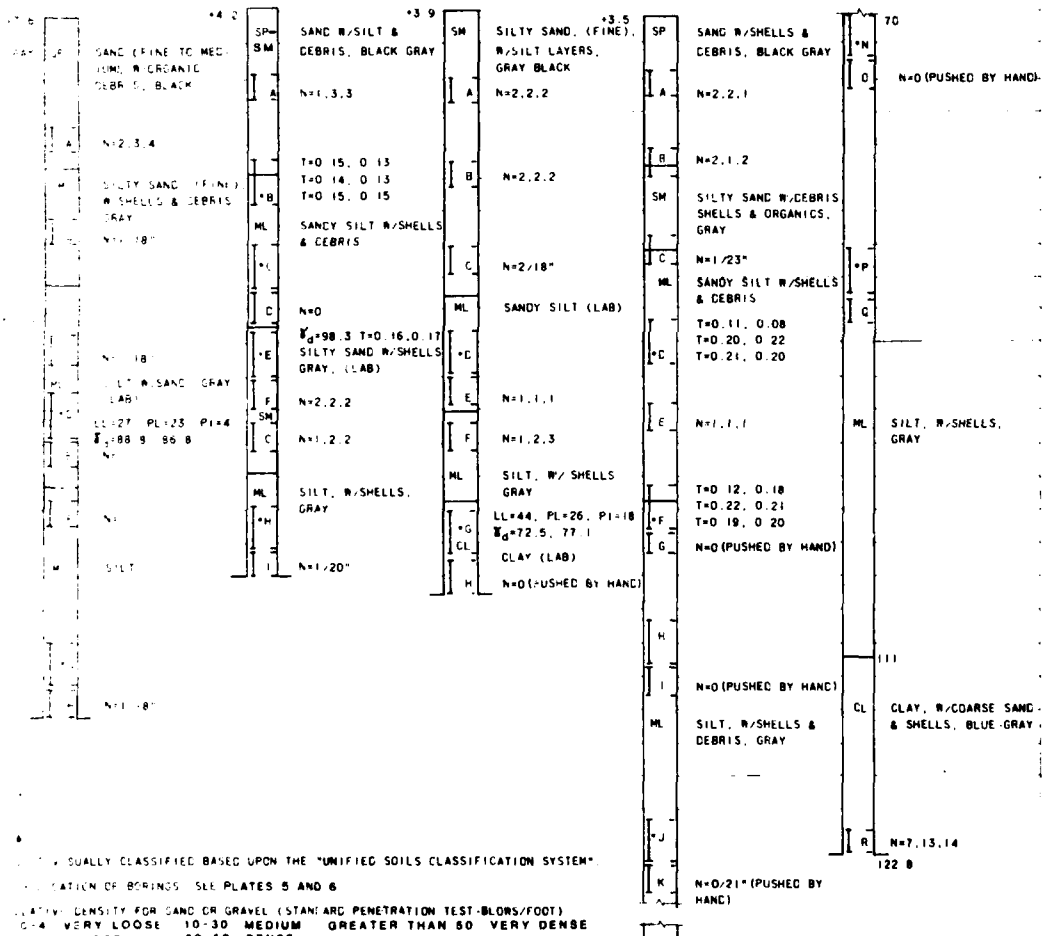
(LAB) LABORATORY CLASSIFICATION
LL LIQUID LIMIT
PL PLASTIC LIMIT
PI PLASTICITY INDEX
T.V. TORVANE SHEAR TEST (TONS/FT2)
γ_d DRY DENSITY (#/FT3)
82 P 1 PORTER SAMPLER BORING NUMBER
82 RD 18 ROTARY DRILL BORING NUMBER

NOTES

1 SOILS VISUALLY CLASS
2 FOR LOCATION OF BORIN
3 RELATIVE DENSITY FOR
0-4 VERY LOOSE
4-10 LOOSE
RELATIONSHIP OF CONS
0-2 VE
2-4 SO
4-8 MED
4 SEE SHEET FOR LABOR

REVISIONS				
SYMBOL	ZONE	DESCRIPTION	DATE	BY





* USUALLY CLASSIFIED BASED UPON THE "UNIFIED SOILS CLASSIFICATION SYSTEM"

LOCATION OF BORINGS: SEE PLATES 5 AND 6

RELATIVE DENSITY FOR SAND OR GRAVEL (STANDARD PENETRATION TEST-BLOWS/FOOT)

0-4	VERY LOOSE	10-30	MEDIUM
4-10	LOOSE	30-50	DENSE
GREATER THAN 50	VERY DENSE		

RELATIONSHIP OF CONSISTENCY FOR FINES (STANDARD PENETRATION TEST-BLOWS/FOOT)

0-2 VERY SOFT	8-15 STIFF
2-4 SOFT	15-30 VERY STIFF
4-8 MEDIUM	GREATER THAN 30 HARD

SEE NOTE FOR LABORATORY GRADATION CURVES

BORING LOG CONTINUED NEXT COLUMN

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

LUMMI SMALL BOAT BASIN

EXPLORATION BORING LOGS

WHATCOM COUNTY WASHINGTON

DESIGN	DRAWN	TRACED	SUBMITTED	APPROVED
CHIEF, SOILS SECTION				
CHIEF, ENGINEERING DIVISION				
CHIEF, ENGINEERING BRANCH				

SCALE	INVITATION NO.	FILE NO.	DATE	SHEET
F		E-88-1-01	83 SEP 01	7

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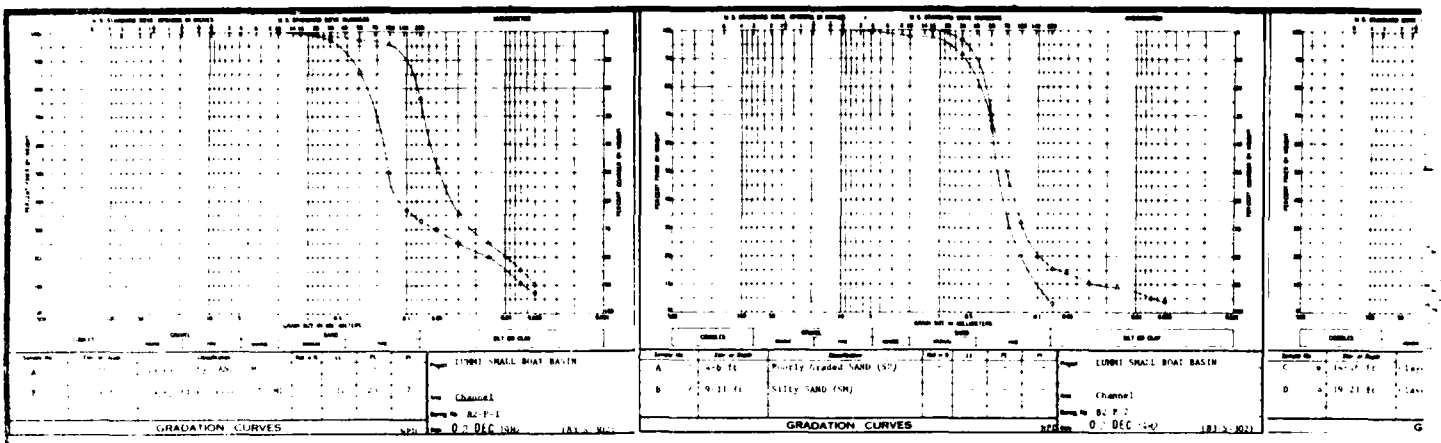

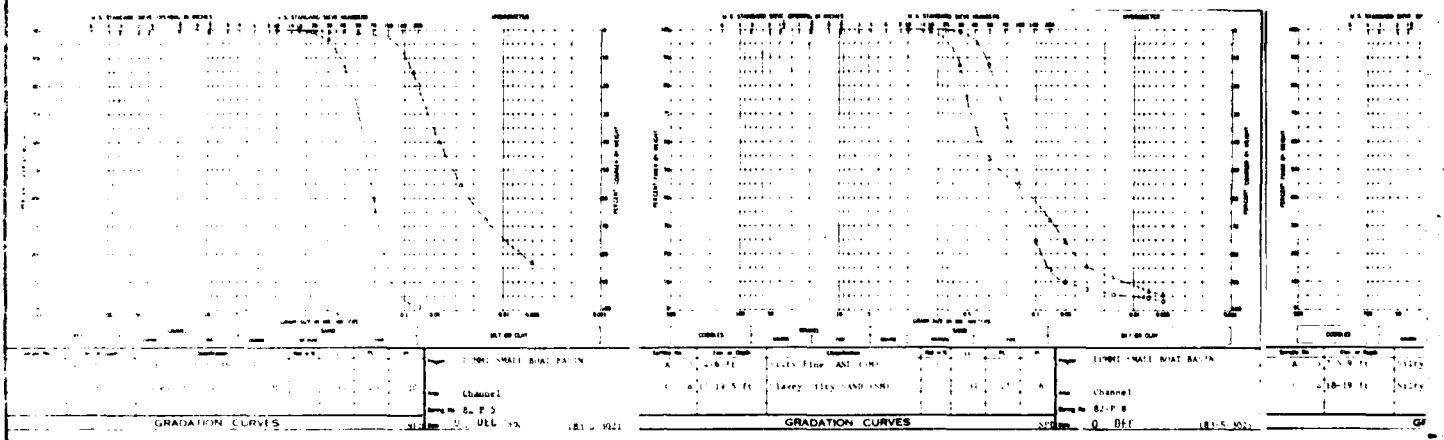

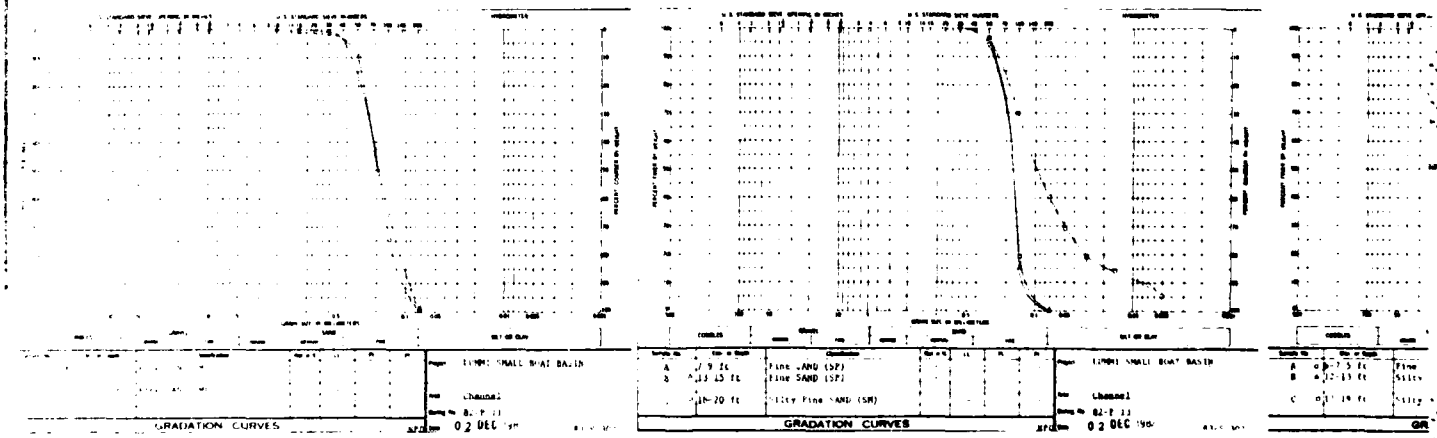

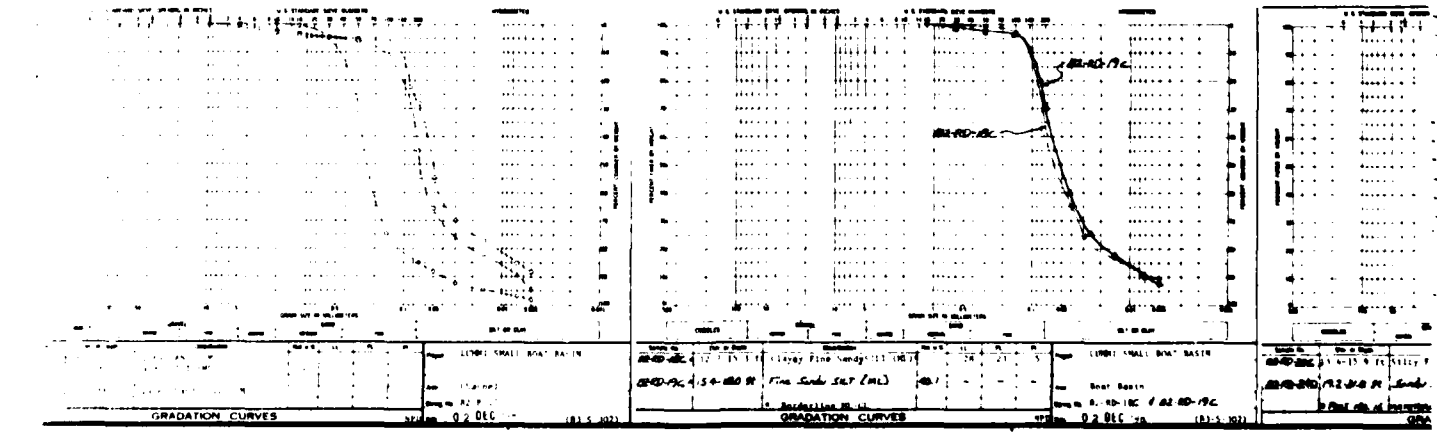

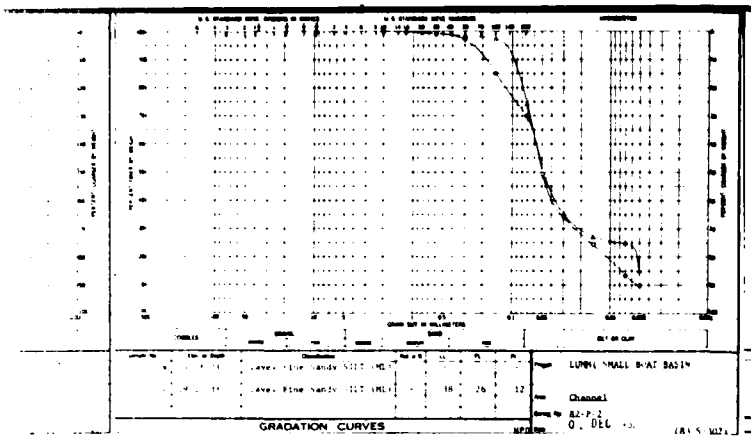

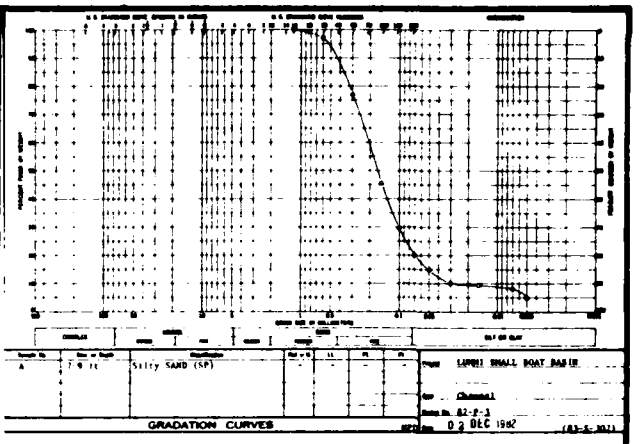

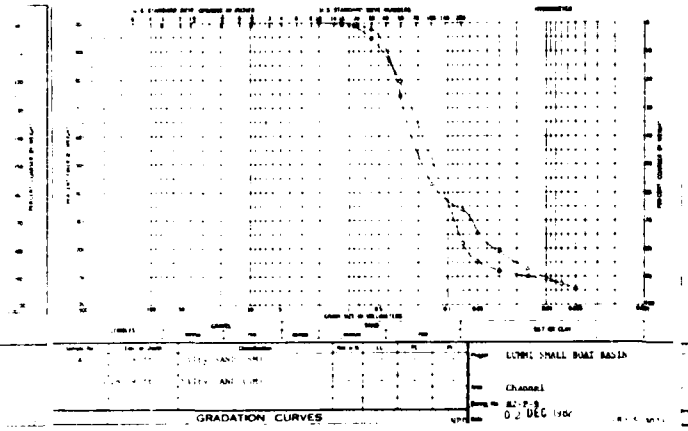

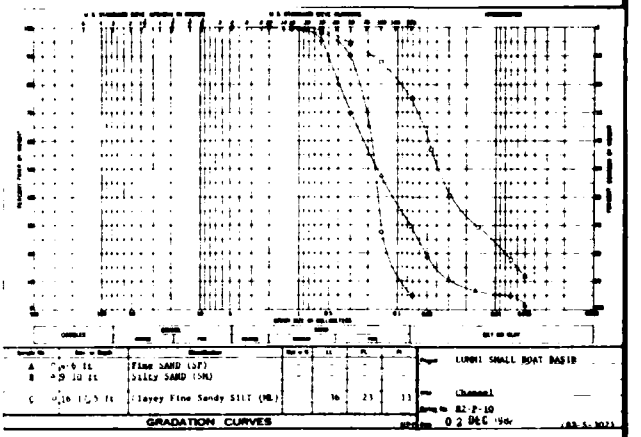

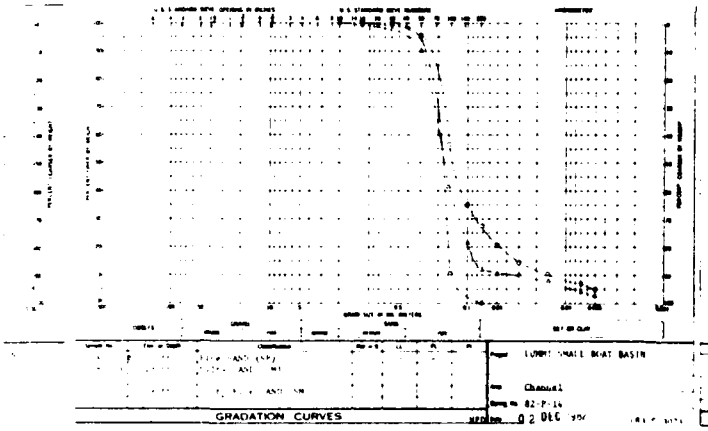

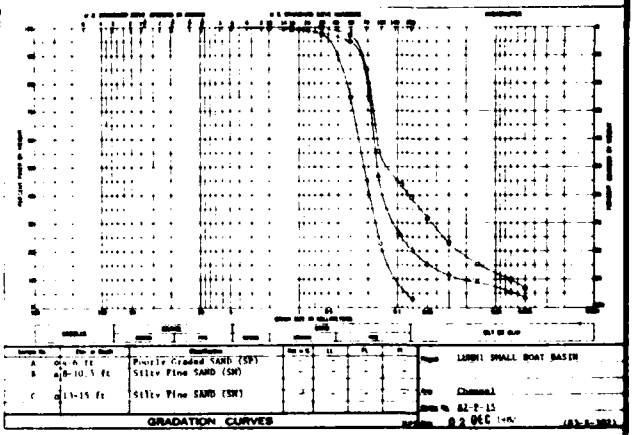

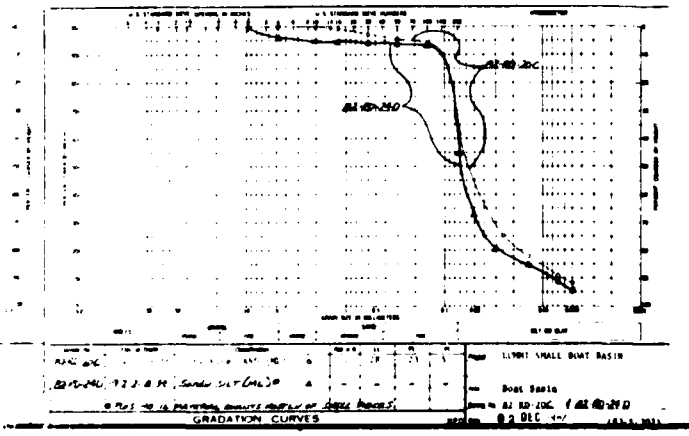

NOTES

1. FOR ADDITIONAL NOTES SEE PLATE 7.
2. FOR BORING LOCATIONS SEE PLATES 5 AND 6.

REVISIONS

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS

LUMMI BAY MARINA

GRADATION CURVES

WHATCOM COUNTY WASHINGTON

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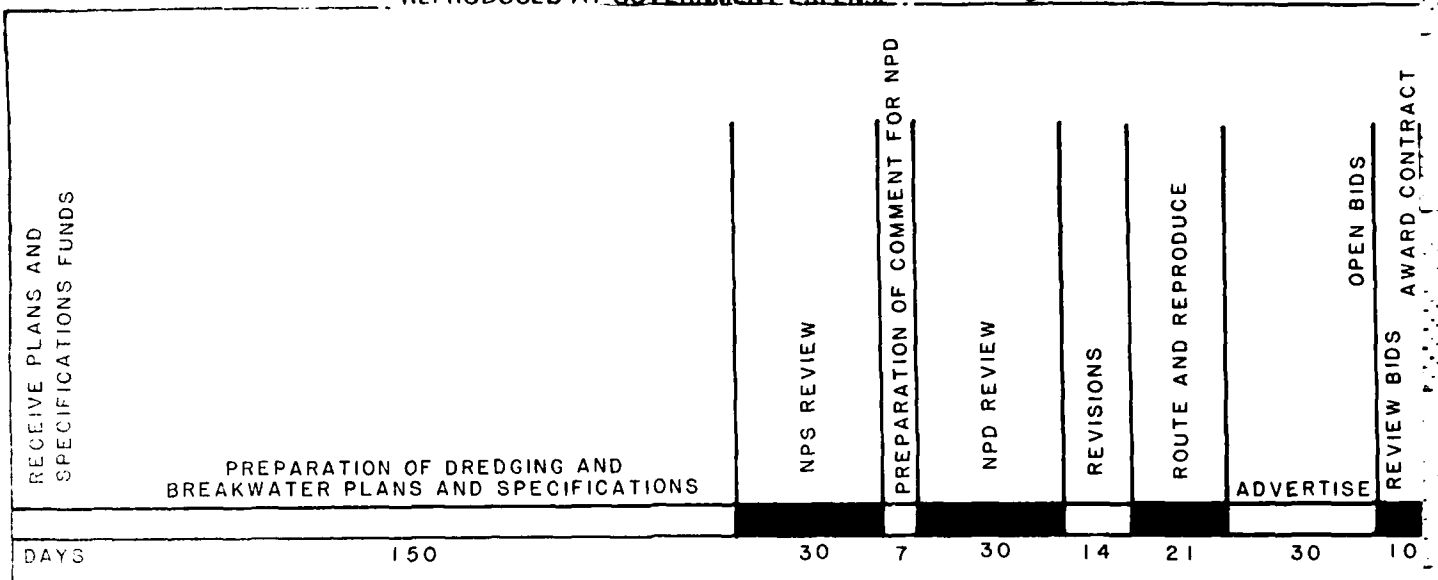

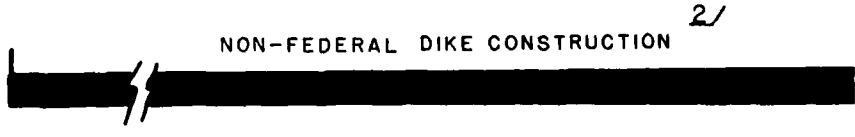

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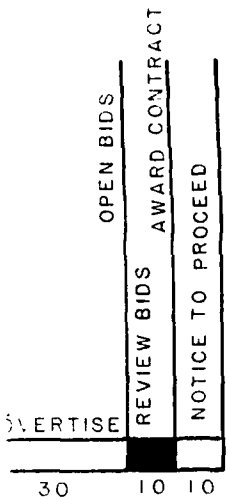


CORPS ADMINISTERED DREDGING AND BREAKWATER CONT

ENTRANCE CHANNEL MOBILIZATION AND DREDGING (645,000 c.y.). DREDGING RESTRICTED TO DEC. – MARCH (120 DAYS).

ACCESS CHANNEL, TURNI (825,000 c.y.), BREAKW AREA WORK, ETC. (210

ATER CONTRACT (330 DAYS) 1/

NNEL, TURNING BASIN AND MOORAGE BASIN DREDGING
.), BREAKWATER CONSTRUCTION, MITIGATION
ETC. (210 DAYS)

NOTES:

1/ LOCAL SPONSOR MOOR
(645,000 CY) TO BE I
ADMINISTERED CONTRA

2/ CONSTRUCTION PERIOD
AND MAINTENCE DISPO
TO END OF PROJECT C

U. S. ARMY ENG
CORPS
SEATTL

LUMM

DESIGN AND CO

WHATCOM COUNTY

SIZE	INVITATION NO	FILE NO
DSGN		CHK

	7	8	9	10	11	12	13	14	

NOTES:

1/ LOCAL SPONSOR MOORAGE AREA DREDGING (645,000 CY) TO BE INCLUDED IN CORPS ADMINISTERED CONTRACT.

2/ CONSTRUCTION PERIOD OF SOUTHERLY MITIGATION AND MAINTENCE DISPOSAL AREA DIKES CAN EXTEND TO END OF PROJECT COMPLETION TIME.

U. S. ARMY ENGINEER DISTRICT, SEATTLE
CORPS OF ENGINEERS
SEATTLE, WASHINGTON

LUMMI BAY MARINA

DESIGN AND CONSTRUCTION SCHEDULE

WHATCOM COUNTY WASHINGTON

SIZE	INVITATION NO	FILE NO	DATE	PLATE
				9
DSGN		CHK		SHEET

12 | 13 | 14

APPENDICES

APPENDIX A

PART 1 - PRELIMINARY SECTION 404(b)(1) EVALUATION

PART 2 - PUBLIC NOTICE

PART 3 - PUBLIC AND AGENCY COMMENTS ON
PUBLIC NOTICE AND CORPS RESPONSES

APPENDIX A, PART 1

PRELIMINARY SECTION 404(b)(1) EVALUATION

APPENDIX A, PART 1

404(b)(1) EVALUATION FOR CONSTRUCTION OF
LUMMI BAY MARINA

The proposed project is construction of 438 commercial fishing boat moorages in Whatcom County at Lummi Bay, Washington. This appendix displays the evaluation of the effects of the placement of dredged material into waters of the United States using guidelines promulgated pursuant to Section 404 of the Clean Water Act (40 CFR 230).

The factors, considerations, and analysis contained in Section 404 guidelines are evaluated following and in referenced paragraphs of the environmental impact statement (EIS) and detailed project report (DPR) for the Lummi Bay Marina project.

Full compliance with the provisions of the Clean Water Act will be met by obtaining water quality certification from the State of Washington pursuant to Section 401 of the Clean Water Act.

NPSEN-PL-ER

APPENDIX A, PART 1
LUMMI BAY MARINA STUDY
PRELIMINARY SECTION 404(b)(1) EVALUATION

1. Introduction. Pursuant to Section 404(b)(1) of the Clean Water Act, the U.S. Environmental Protection Agency (EPA) promulgated guidelines that must be applied to all activities involving the discharge of dredged or fill material in navigable waters (EPA, 1980). The following sections evaluate the proposed discharge of dredged and fill material based on evaluation factors derived from the EPA guidelines. To avoid repetition, references are made to discussions in the draft DPR and EIS.

The Lummi Bay Marina plan consists of dredging an entrance and access channel in Lummi Bay, dredging a marina in part of the diked aquaculture pond, and filling 65 acres of the aquaculture pond with dredged material to support upland marina facilities. The support facilities include parking, access docks, boat launch, fish buying and processing freezers, an egg house, cold storage areas, web houses, an unloading pier, boat haul out areas, boat repair yards, restrooms, harbor master building, engine repair facility, fish supply store, restaurant, grocery store, and a fish market. As the final marina design has not been completed, the proportion of the fill devoted to the water dependent support activities and water related support facilities has not been determined. Construction activities which will be evaluated in this report are as follows:

o Placement of rock riprap from an upland source as reinforcement for 560 linear feet of timber breakwater and 2,300 linear feet of existing dike.

o Placement of granular fill from an upland source to form the core of about 8,000 linear feet of containment dike.

o Pipeline discharge of coarse dredged material from Lummi Bay into the confined disposal site in Lummi sea pond to form the shell of about 8,000 linear feet of containment dike.

o Pipeline discharge of finer dredged material from Lummi Bay into the confined disposal site in Lummi sea pond to form 65 acres of upland base for marina facilities.

2. Description of Proposed Discharge.

a. General Characteristics of Material. Boring and test excavations (see DPR plates 3 through 6) indicate that tideland sediments in the dredge area consist mostly of sand overlying fine silts. Nearly 100 percent of the material to be dredged from the entrance channel will be fine to medium sands. The access channel and moorage basin consist of approximately 75 percent fine

to medium sand and approximately 25 percent silt. See section 1 of appendix C for details. Section 3.02(a)(1) of the EIS and section 1.09 of appendix C discuss the general characteristics of the upland and tideland material to be dredged and used as fill.

b. Quantity of Material. Approximately 1,470,000 cubic yards (c.y.) of Lummi Bay sediments obtained during dredging of the proposed Federal entrance and access channel, turning basin, and moorage basin (see appendix C, sections 2.14 to 2.23 for details) will be placed by pipeline discharge in the fill area. About 9,000 tons of rock riprap and about 700 c.y. of gravel will be imported from an established quarry to protect the breakwater and entrance area sideslopes form the core of the containment dikes.

c. Source of Material. Fill material will be obtained from Lummi Bay and a nearby upland site.

d. Need for Proposed Activity. Section 1.02 of the EIS and section 1.04 of the DPR discuss the need for the proposed project. The marina is needed because of a regional shortage of berthing facilities for commercial fishing boats. Rock and gravel fill are needed for structural integrity of breakwater and dikes. Placement of dredged material is needed to provide fill for upland marina support facilities and as an alternative to open-water disposal. Proposed project details are described in section 2 of appendix C.

e. Location. Figures 1-1 and 1-2 of the DPR present the location of the proposed action in Lummi Bay, on the Lummi Indian Reservation, near Bellingham, Washington.

f. Description of Proposed Disposal and Discharge Sites. The containment dikes will be placed on an unconfined disposal site at the northwest corner of the existing Lummi sea pond project (see plate 2). The dikes will serve as confinement for the discharge of dredged material.

g. Method of Discharge. Containment dikes, with a top elevation of about 15.0 mean lower low water (MLLW), will be constructed by trucks hauling imported gravel to the site and pipeline discharge of coarser dredged material. Material used for the confined disposal will be placed by hydraulic pipeline dredge. The discharge pipe would be initially located along the western edge of the proposed fill area. The pipe would be moved as needed. During construction, an overflow weir will be built at the northeast corner of the disposal site. Effluent will pass over the weir into the existing flood and ebb channel of the Lummi River adjacent to the northern extension of the sea pond dike. Rock riprap for side slopes will be placed by clamshell.

h. Timing of Discharge. Due to potential impacts to juvenile salmon, Pacific herring, and Dungeness crab, dredging in Lummi Bay will be accomplished during December through March 15. Dredging in the sea pond will be conducted any time of the year as long as aquaculture operations and biota outside of the sea pond are not significantly affected. This restriction will affect the timing for discharge of dredged material. No other specific time restrictions have been placed on placement of rock and gravel.

i. Projected Life of Disposal Site. Dredged material, rock, and gravel will fill the proposed disposal site within 1 year.

3. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem.

a. Substrate. Discharge of construction material will convert aquatic habitat to uplands.

b. Suspended Particulates/Turbidity. Suspended particulates and turbidity will increase slightly during project construction. Exact concentrations and differences from natural conditions will vary depending on type of material being discharged and on tidal cycle. With proper controls, impacts are considered to be minimal.

c. Water Quality. No significant concentrations of pollutants are known or expected in the sediments. Therefore, no toxic reactions or harmful releases are expected (see section 3.02(b)(1) and 4.02(a)(4) of the EIS). Short-term, localized changes in dissolved oxygen, turbidity, and suspended sediments will occur during disposal. Impacts are expected to be minimal.

d. Current Patterns in Water Circulation. Current patterns in Lummi Bay will not be altered by the proposed discharge. Current velocities in the proposed channel should be concentrated toward the center and will be less along the sides than conditions in the existing tidal channel. Filling of the sea pond will eliminate tidal flushing over 70 acres. Circulation in the unaltered section of the sea pond will not be affected by the proposed discharge.

e. Normal Water Fluctuations. Tidal fluctuations will be eliminated in the filled area of the sea pond. Lummi Bay tidal fluctuations will not be affected by placement of dredged material or rock and gravel reinforcement.

f. Salinity Gradients. No effect is expected.

4. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem.

a. Threatened and Endangered Species. Bald eagles and peregrine falcons have been identified in the proposed marina site. Impacts to the bald eagle are not expected. A study of habitat utilization by the peregrine falcon in Lummi Bay area is being conducted. Based on the results of the study, a determination of the effects of the proposed plan on the peregrine falcon will be made. Significant impacts are not anticipated. See EIS sections 3.02(b)(8) and 4.02(b)(2).

b. Aquatic Food Web. Discharge of construction dredge material will eliminate aquatic habitat and thus, food organisms from the aquatic food web. See section 4.02(c) of the EIS for details.

c. Wildlife. Impacts to peregrine falcons and waterfowl, such as black brant, may occur but are expected to be minor. No other affect is expected. See section 4.02(c) of EIS for details.

5. Potential Impacts on Special Aquatic Sites.

a. Wetlands. The proposed project will alter the wetland community in and along the existing Lummi River channel and eliminate aquatic habitat in part of the sea pond. The mitigation measure of reintroducing part of the sea pond to tidal flushing will increase its habitat value.

b. Sanctuaries and Refuges. No scientific study areas, sanctuaries, or refuges will be affected by the proposed disposal. Overall impacts are expected to be minimal. Some eelgrass loss will occur.

c. Mudflats. Not applicable.

d. Vegetated Shallows. Eelgrass areas are found in the sea pond. Eelgrass beds constitute one of the most valuable aquatic habitats in the State of Washington. Their value derives from their provision of habitat for a large variety of commercially and recreationally important aquatic species and from primary production as a base of the tidal food webs. Fill will be placed in that portion of the sea pond where concentration of eelgrass is expected to be low. Impacts are expected to be minimal in light of proposed mitigation.

6. Potential Effects on Human Use Characteristics.

a. Municipal and Private Water Supplies. Not applicable.

b. Recreational and Commercial Fisheries. Potential discharge effects on recreational and commercial fisheries are expected to be minimal (see EIS, section 4.02(a)(4)). No oyster beds will be impacted. Recreational clamming may be affected by the discharge, but this should be minimal. Temporary interference with the starry flounder fishery may occur. Juvenile salmon and Pacific herring should not be significantly impacted due to timing restrictions and eelgrass regrowth or plantings. Disposal activities will be scheduled to avoid interfering with commercial and recreational crab collecting.

c. Water Related Recreation. No impacts are expected.

d. Esthetics. The natural view of part of Lummi Bay will be changed. Considering the total esthetics as the combination of attributes and amentities, rather than just visual impact, the proposed marina is considered a major intrusion that will significantly alter the esthetic character of the area which cannot be mitigated. To some observers, the marina will represent a positive esthetic impact; it will be considered picturesque and compatible with the water oriented Northwest.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. No impacts are expected.

7. Evaluation and Testing of Discharge Material.

a. General Evaluation of Dredged or Fill Material. Potential contaminants associated with sediments are addressed in section 3.02(b)(1) of the EIS. Some pesticides and fecal coliforms are expected from farm and pasturelands in the upper watershed. Available information indicates that any contaminants in the dredged material are minimal and would not result in measurable contaminant effects or changes in Lummi Bay. Imported rock gravels will be clean. Impacts are discussed in EIS section 4.02(a)(4).

b. Evaluation of Chemical-Biological Interactive Effects.

(1) Exclusion of Material from Testing. Available information on the area to be dredged and filled indicates that toxic constituents are found in minimal concentrations throughout Lummi Bay, including the diked sea pond. The concentrations are not high enough to cause harmful effects (per EPA, 1980 and 1976 criteria). The dredged material meets the exclusion criteria because material to be dredged is similar to that of the fill area and the concentration of any toxic constituents is low. Rock and gravel are excluded by their large particle size and upland source.

(2) Water Column Effects. No significant chemical affects on water column organisms would be expected based on available information (see EIS, section 3.02(b)(1)). Consequently, chemical and bioassay testing of the sediments was not performed.

(3) Effects on Benthos. No significant chemical affects on benthic organisms would be expected, based on available information (see EIS, section 3.02(b)(1)). Consequently, bioassay testing of the sediments was not considered necessary.

c. Comparison of Excavation and Discharge Sites.

(1) Total Sediment Chemical Analysis. An inventory of the total concentration of contaminants would not be of value in comparing the discharge material to the sediment at the disposal area because, based on available information, material at the two areas are similar.

(2) Biological Community Structure Analysis. The proposed project discharge site and the dredged material source site are different since the discharge site has been diked and removed from tidal action. The biological communities at the sites are discussed in EIS, section 3.02(b)(3) through (5). Although the two areas are different, the dredged sediments and associated biological community are similar to the discharge sediments. Therefore, a community structural analysis was not completed. Placement of clean gravel and rock does not require a community structural analysis. The aquatic biological community at the disposal site will be eliminated (see EIS, section 4.02(c)).

d. Physical Tests and Evaluation. No physical substrate tests were performed or considered necessary.

8. Factual Determinations.

a. Physical Substrate Determinations. Aquatic habitat will be converted to upland habitat.

b. Water Circulation, Fluctuation, and Salinity Determinations. The proposed discharge during construction dredging is not expected to significantly impact Lummi River downstream flows, normal Lummi Bay water level fluctuations, base salinity distributions, or current patterns. Sea pond circulation will be partially eliminated by placement of fill and partially improved by breaching the existing dike. Reference section 3 of this evaluation for supportive information.

c. Suspended Particulate/Turbidity Determinations. Short-term impacts would be localized to areas along the Lummi River channel, particularly the section near the overflow weir. Some aquatic habitat will probably be covered but, with proper controls, this should be minimal.

d. Contaminants Determinations. Based on available information, contaminants are not known or expected to occur in harmful concentrations in the material proposed for discharge. In addition, due to the similarity of dredged material to the material at the disposal site, construction/fill materials should not introduce, relocate, or increase concentrated contaminants to any known extent.

e. Aquatic Ecosystem and Organism Determinations. The placement of dredged and upland fill materials on aquatic habitats at Lummi Bay will have the following effects on the bay and sea pond aquatic ecosystem and communities.

(1) Elimination of the aquatic community in the sea pond and thus loss of food web functions from about 70.3 acres of aquatic habitat due to filling during construction.

(2) Areal ecosystem reduction of sea pond productivity will result in a corresponding loss of total productivity in Lummi Bay.

(3) Destruction of a small number of phytoplankton, zooplankton, and benthos in the project vicinity due to siltation and temporary reduced dissolved oxygen levels.

f. Proposed Disposal Site Mixing Zone Determinations. The construction discharge mixing zone will be confined to the smallest practicable area, which will produce the lowest potential for adverse environmental effects. Washington Department of Ecology (WDE) effluent limitations for the return flow from the disposal area in Lummi Bay includes the provisions that the dilution zone shall meet WDE effluent dilution zone guidelines for estuaries. A monitoring program will be developed through coordination with water quality agencies to ensure that water quality outside the specified mixing zone at the Lummi Bay disposal overflow weir is in compliance with applicable water quality criteria and standards.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. Based on the impact analyses contained in section 4 of the EIS, it is considered that the proposed discharges will contribute to cumulative impacts on the sea pond aquatic ecosystem. It is known that areas of fill will be permanently removed from the aquatic habitat.

h. Determination of Secondary Effects on the Aquatic Ecosystem. The major secondary impact resulting from placement of fill and discharge of dredged material is increased boating in the bay and vicinity. Impacts to aquatic ecosystem as a result of increased boating are:

(1) disturbance to crab, fish, bird, and associated prey populations in Lummi Bay;

(2) reduction in the use of the sea pond by fish such as staghorn sculpin and starry flounder;

(3) reduction in the use of Lummi Bay by marine birds and the bald eagle;

(4) localized increases in fecal coliform bacteria, petroleum hydrocarbons, and floating trash; and

(5) potential for accumulation of fecal coliform bacteria in shellfish tissues in inner tidal beds located in Lummi Bay.

9. Proposed and Alternative Actions to Minimize Adverse Effects.

a. Actions Concerning the Location of the Discharge. The area of discharge during construction is an integral and necessary part of the proposed project. The proposed discharge point will minimize discharge effects to the greatest extent possible. No practicable alternative action exists. Impacts are minimized by placing dredged material on similar substrate at the disposal site. The discharge pipe would be moved, as needed, along the fill area. A factor which would be considered in determining its location is distance from the overflow weir.

b. Actions Concerning the Material to be Discharged. There are no plans to treat or rehandle the materials to be discharged as the materials do not contain toxicants in any significant concentration. Design of the containment dikes will minimize turbidity to the greatest extent practicable as described in EIS section 4.02(a)(3).

c. Actions Controlling the Material After Discharge. The conditions for placement of initial unconfined fill and reinforcement material will be coordinated with the Lummi Indian Tribe, WDE, and the Washington Department of Fisheries (WDF) to develop timing and location of dredging/disposal in order to minimize adverse environmental impacts. During the discharge of dredged material, a weir overflow system will be used to minimize turbidity (see appendix C). Effluent returning to Lummi Bay will need to meet guidelines developed in coordination with those agencies mentioned above.

d. Actions Affecting the Method of Dispersion. A hydraulic pipeline dredge will dispose material into a confined area with an overflow weir located as far away as practicable from the pipeline outlet. There is no other known practicable method of pipeline discharge that would result in any less impact on water quality due to the manner in which the material is dispersed. The dredged material effluent will have a retention time before flowing over the top of the weir into Lummi Bay. Conditions for retention time, amount of water allowed over the weir, amount of water covering the confined disposal area, and length of weir will be coordinated with those agencies mentioned above. No other practicable dispersion alternative is known that would significantly reduce adverse construction discharge effects.

e. Actions Related to Technology. No other technology is known that could be both practicable and would have less discharge effects than the selected construction technique.

f. Actions Affecting Plant and Animal Populations. There are no known practicable alternative actions that would minimize adverse construction discharge effects on plant and animal populations in the sea pond or the bay ecosystem in general. Reintroduction of tidal flushing in the marina, along with wetland vegetation plantings, should minimize adverse effects. Wetland plantings, including eelgrass, are proposed for the project in the sea pond and also in Lummi Bay to minimize a net loss of eelgrass. Impacts will be mitigated by reintroduction of part of the dike sea pond to tidal action and by wetland plantings (see EIS section 4.03).

g. Actions Affecting Human Use. The proposed discharges will not have major impacts on the human use potential of Lummi Bay with two exceptions: the elimination of about 70 acres of diked aquatic habitat and possible secondary contamination of existing shellfish in parts of Lummi Bay. Disposal operations will be scheduled to avoid interfering with commercial and recreational activities.

10. Analysis of Practicable Alternatives.

a. Identification and Evaluation of Practicable Alternatives. With the proposed project, the placement of dredged and fill material will occur to allow development of marina support facilities, to protect the moorage basin from damaging wave action, and to provide an economically feasible site for placement of dredged material.

b. Evaluation of Alternatives to Discharge in Special Aquatic Sites. Alternatives to discharge of construction dredged/fill material in the diked sea pond are discussed in section 2 of the EIS. In considering the proposed design, the containment dike for the moorage basin is clearly a water dependent activity. The web storage sheds, small restaurant, parking, and other marina facilities are considered to be water related as well as intimately related to the overall marina project. This is because of the overall project objective to construct a marina for commercial fishermen with related parking and other

support facilities. Without the marina support facilities, the project objective could not be fulfilled as cost and logistic constraints preclude locating support facilities inland of Lummi Bay. All proposed structures are necessary for functioning of the marina, and no practicable alternatives exist.

11. Review of Conditions for Compliance.

a. Availability of Practicable Alternatives. No practicable alternatives to the proposed action exist.

b. Compliance with Pertinent Legislation. The proposed discharges are considered in compliance with requirements of both Section 307 of the Clean Water Act and the Marine Protection, Research, and Sanctuaries Act of 1972. Compliance with requirements of the Endangered Species Act of 1973 will be determined after analyzing results of the peregrine falcon study scheduled for the winter of 1983-1984.

c. Potential for Significant Degradation of Water as a Result of the Discharge of Polluted Material. Based on information presented previously, it is concluded that the proposed discharge will not result in release of pollutants that will have significant adverse effects on human health or welfare, the aquatic ecosystem and wildlife dependent on this ecosystem, and recreational, esthetic, and economic values.

d. Steps to Minimize Potential Adverse Impacts on the Aquatic Ecosystem. All appropriate and practicable measures to minimize potential adverse discharge effects have been included in the proposed project. Mitigation includes reintroduction of part of sea pond to tidal action and planting wetland species.

12. Findings. Based on information available at this time, it is concluded that the proposed action complies with the evaluation critera set forth in the 404(b)(1) guidelines. A peregrine falcon study is currently being conducted in order to gather information necessary for an impact evaluation. Should additional information become available which could affect this conclusion, a reevaluation will be made.

APPENDIX A, PART 2

PUBLIC NOTICE

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX C-3755
SEATTLE, WASHINGTON 98124

PUBLIC NOTICE

Public Notice Date: 5 January 1984
Expiration Date: 6 February 1984
Reference: NPSEN-PL-NC-84-1
Name: Seattle District, Corps of Engineers

The Seattle District, Corps of Engineers, proposes to undertake a Federal navigational project, which is a commercial navigation channel and breakwaters, in Lummi Bay, Bellingham Bay near Bellingham, Whatcom County, Washington. The Federal portion of the project consists of dredging, placing fill, and constructing breakwaters.

As part of this project, Lummi Indian Business Council, 2616 Kwina Road, Bellingham, Washington 98226, ATTN: David Oreiro, Tribal Planner, telephone (206) 734-8180, proposes to perform related non-Federal work consisting of dredging, placing fill, and constructing a marina and support buildings.

The proposed work described below and shown on the inclosed drawings will be performed in accordance with provisions of Section 10 of the River and Harbor Act of March 3, 1899, Section 404 of the Clean Water Act, 33 CFR 209.145, and Section 107 of the 1960 River and Harbor Act, as amended.

LOCATION - In Lummi Bay, Bellingham Bay near Bellingham, Whatcom County, Washington.

WORK - Federal: Remove tidegate and dispose as fill; excavate 2,600 tons of rock and 14,000 cubic yards of gravel for entrance to marina, and relocate gravel and rock onto existing berms; dredge entrance channel, turning basin, and access channel of 825,000 cubic yards of sand and silt, and dispose behind berms in Lummi Seapond; place 9,000 tons of rock from uplands as entrance slope protection; and construct two timber-pile breakwaters.

Non-Federal: Excavate 7,000 cubic yards of gravel and 1,200 tons of rock from existing berm for opening to mitigation area and place on existing berm slopes. Place 57,200 cubic yards of bank-run gravel from uplands for containment berms and boat ramp; dredge mooring basin of 645,000 cubic yards of sand and silt and dispose behind berms in Lummi Seapond; place 62,000 cubic yards of fill on mitigation area berms by end dump and dozer; install piling, floats, and ramps in mooring basin; construct 2 wharves, a precast concrete boat launch ramp, 14 marina support buildings, and 2 parking lots.

PURPOSE - Federal: Provide access to marina and protect marina entrance.

Non-Federal: Provide commercial boat moorage, sales and related support activities, repair and maintenance, seafood processing, and mitigation.

ENDANGERED SPECIES - The proposed work may affect the bald eagle, American peregrine falcon, and certain marine mammals. A biological assessment has been prepared for the bald eagle which leads to a no-effect determination. Biological assessments are currently being prepared for the peregrine falcon and marine mammals.

CULTURAL RESOURCES - A reconnaissance for cultural resources has been conducted. None were found and preliminary determination indicates the proposed work will not adversely affect important cultural resources. The work is not located on a property registered in the National Register of Historic Places. Presently unknown archeological, scientific, prehistorical or historical data may be lost or destroyed by work to be accomplished under the requested permit.

PUBLIC HEARING - Any person may request, in writing, within the comment period specified in this notice, that a public hearing be held to consider this application. Requests for public hearings shall state, with particularity, the reasons for holding a public hearing.

ENVIRONMENTAL DOCUMENTS - A draft detailed project report (DDPR) and a draft Environmental Impact Statement (DEIS) covering the proposed work, titled "Lummi Bay Marina, Whatcom County," has been prepared by the Seattle District, Corps of Engineers, and is being distributed for public and agency review. A copy may be obtained free of charge by calling Andy Maser, DDPR Study Manager, telephone (206) 764-3651. The DEIS contains a Preliminary Section 401(b)(1) Evaluation as Appendix A. A public meeting to discuss the findings of the DDPR and DEIS will be held 31 January 1984 at 7 p.m. at the Lummi Neighborhood Facility Building, Kwina Road, Lummi Indian Reservation.

ADDITIONAL INFORMATION - The evaluation of the impact of the activity on the public interest will include application of the guidelines promulgated by the Administrator, EPA, under authority of Section 404(b) of the Clean Water Act.

EVALUATION - The decision whether to perform this work will be based on an evaluation of the probable impact, including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof; among those are conservation, economics, aesthetics, general environmental concerns, wetlands, cultural values, fish and wildlife values, flood hazards, flood plain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food production and, in general, the needs and welfare of the people.

NPSEN-PL-NC-84-1

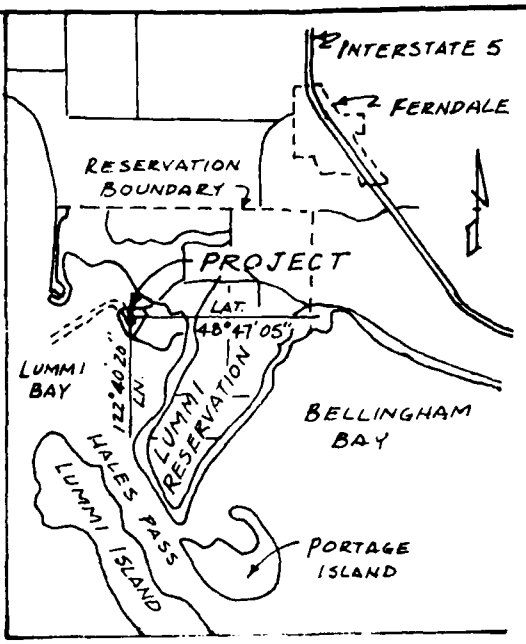
COMMENT AND REVIEW PERIOD - Comments on these factors will be accepted and made part of the record and will be considered in determining whether it would be in the best public interest to perform the work. Comments should refer to the reference number shown above and reach this office, ATTN: Andy Maser, NPSEN-PL-NC, telephone (206) 764-3651, not later than the expiration date of this public notice to insure consideration.

1 Incl
Prints (5)

ADJACENT OWNERSHIPS:

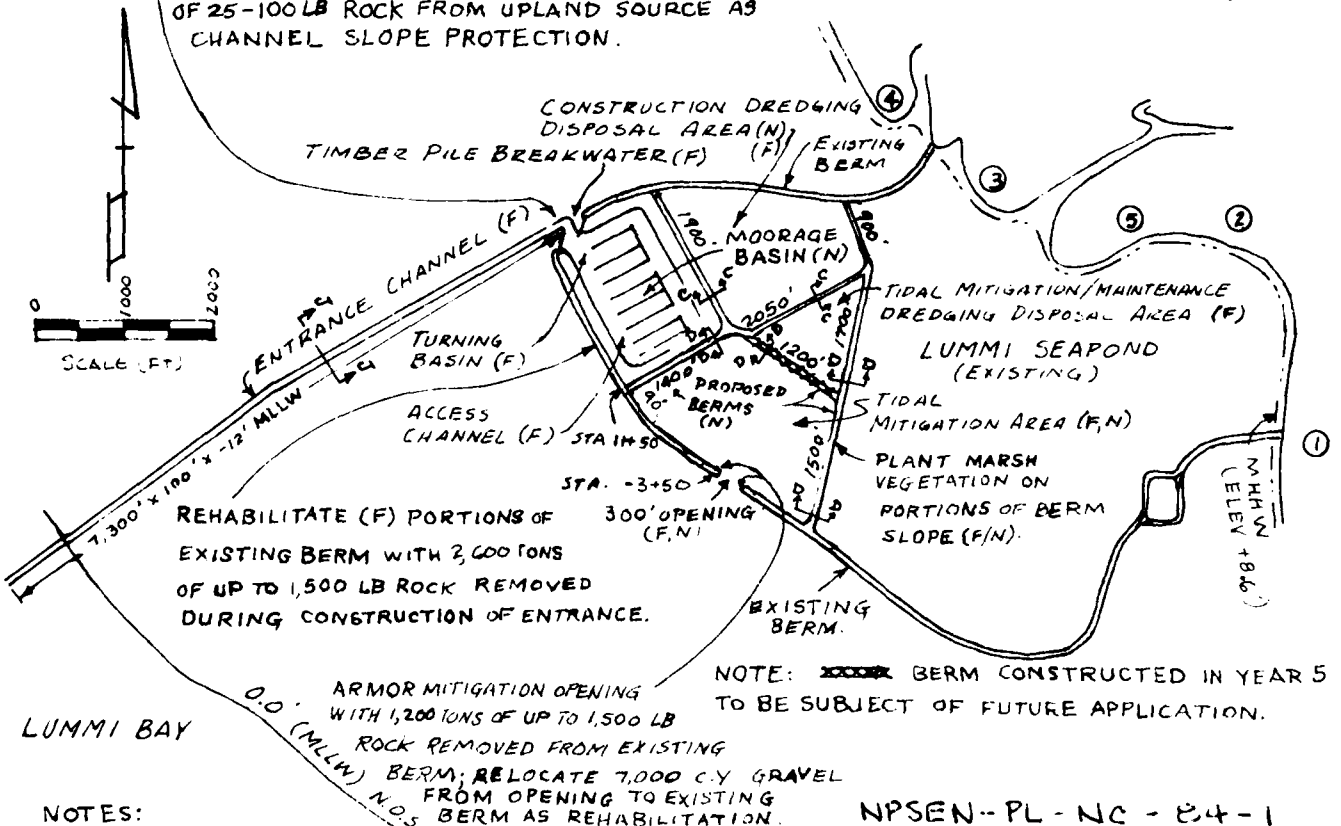
① LUMMI TRIBAL ALLOTMENT NO. 39
② LUMMI TRIBAL ALLOTMENT No 78
③ LUMMI TRIBAL ALLOTMENT No. 118
④ LUMMI TRIBAL ALLOTMENT No. 11
} BUREAU OF INDIAN AFFAIRS, TRUSTEE.
⑤ E. J. NICHOLS, ET. AL.

DREDGING AND FILL: BY HYDRAULIC PIPELINE DREDGE, REMOVE APPROX. 1,470,000 C.Y. OF SAND AND SILT FROM EXISTING WETLANDS AT PROPOSED ENTRANCE CHANNEL (F), TURNING BASIN (F), ACCESS CHANNEL (F), AND MOORAGE BASIN (N); PLACE BEHIND BERM ON ADJACENT 65 AC. WETLAND CONSTRUCTION DREDGING DISPOSAL AREA AS FILL FOR MARINA SUPPORT BUILDINGS (N).



VICINITY MAP

ENTRANCE (F) - REMOVE TIDE GATE AND 600 FT OF EXISTING BERM FOR MOORAGE ACCESS; RELOCATE 14,000 C.Y. GRAVEL TO REINFORCE EXISTING BERM; PLACE 9,000 TONS OF 25-100 LB ROCK FROM UPLAND SOURCE AS CHANNEL SLOPE PROTECTION.



REHABILITATE (F) PORTIONS OF EXISTING BERM WITH 2,600 TONS OF UP TO 1,500 LB ROCK REMOVED DURING CONSTRUCTION OF ENTRANCE.

EXISTING BERM.

NOTE: XXXXX BERM CONSTRUCTED IN YEAR 5 TO BE SUBJECT OF FUTURE APPLICATION.

LUMMI BAY

0.0' (MLLW)

ARMOR MITIGATION OPENING WITH 1,200 TONS OF UP TO 1,500 LB ROCK REMOVED FROM EXISTING BERM; RELOCATE 7,000 C.Y. GRAVEL FROM OPENING TO EXISTING BERM AS REHABILITATION. (F,N)

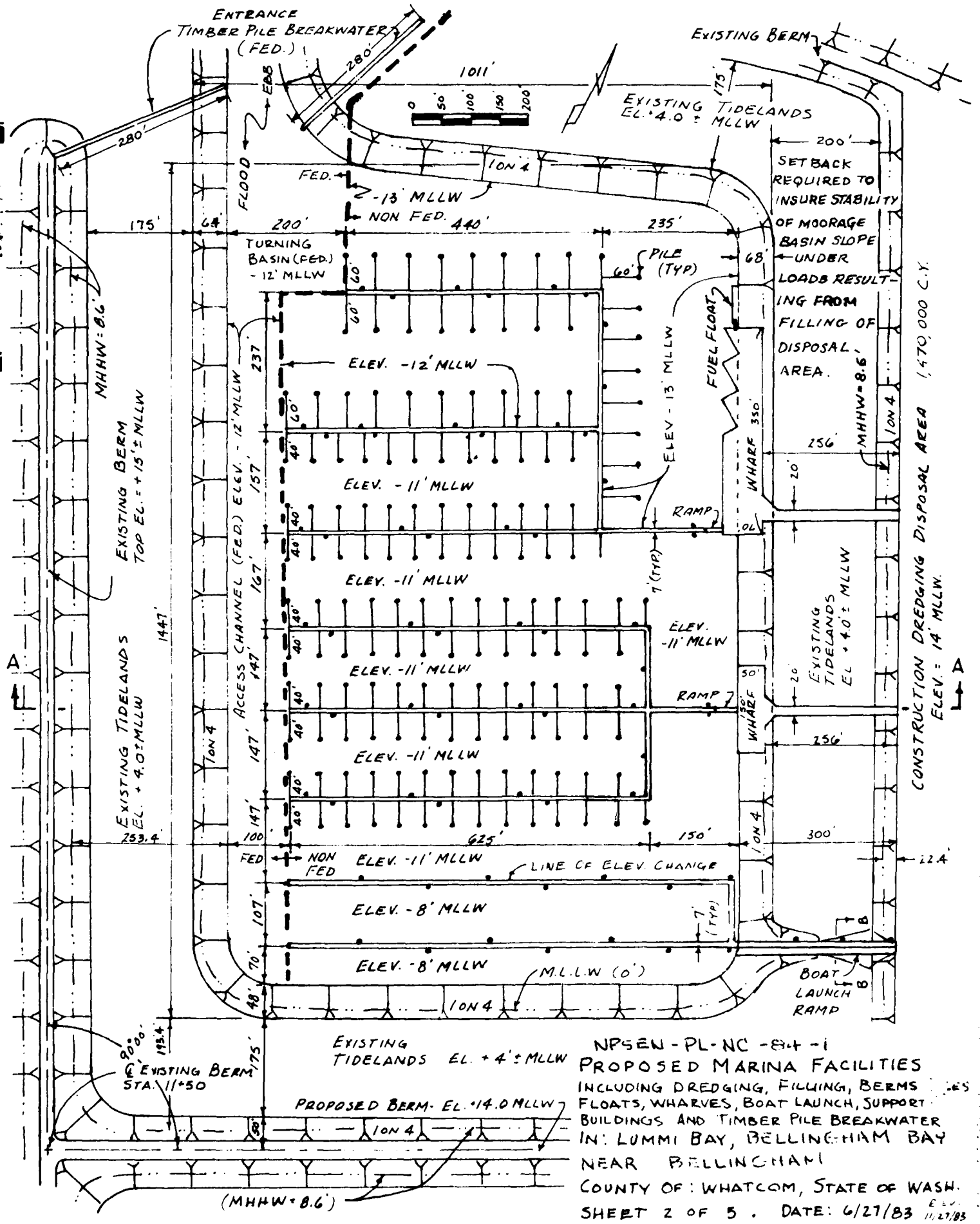
NOTES:

(N) = NON FEDERAL PORTIONS OF PROJECT.
(F) = FEDERAL PORTION OF PROJECT

PURPOSE: PROVIDE ACCESS TO MARINA, COMMERCIAL BOAT MOORAGE, SALES AND RELATED SUPPORT ACTIVITIES, REPAIR AND MAINTENANCE, SEAFOOD PROCESSING, MITIGATION

NPSEN-PL-NC-84-1

PROPOSED MARINA FACILITIES
INCLUDING DREDGING, FILLING, BERMS, PILES, FLOATS, WHARVES, BOAT LAUNCH, SUPPORT BUILDINGS AND TIMBER PILE BREAKWATER.
IN: LUMMI BAY, BELLINGHAM BAY
NEAR BELLINGHAM
COUNTY OF: WHATCOM
SHEET 1 OF 5. DATE: 6/27/83
REV 11/28/83
REV 12/2013



NPSEN - PL - NC - 84 - 1

PROPOSED MARINA FACILITIES

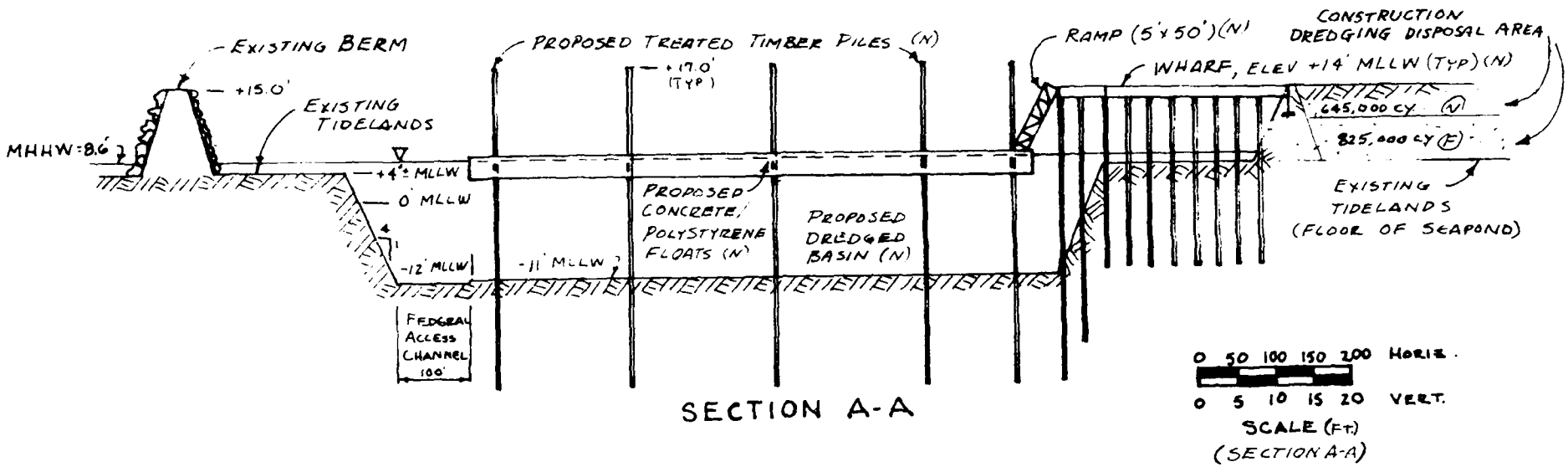
INCLUDING DREDGING, FILLING, BERMS FLOATS, WHARVES, BOAT LAUNCH, SUPPORT BUILDINGS AND TIMBER PILE BREAKWATER

IN: LUMMI BAY, BELLINGHAM BAY

NEAR BELLINGHAM

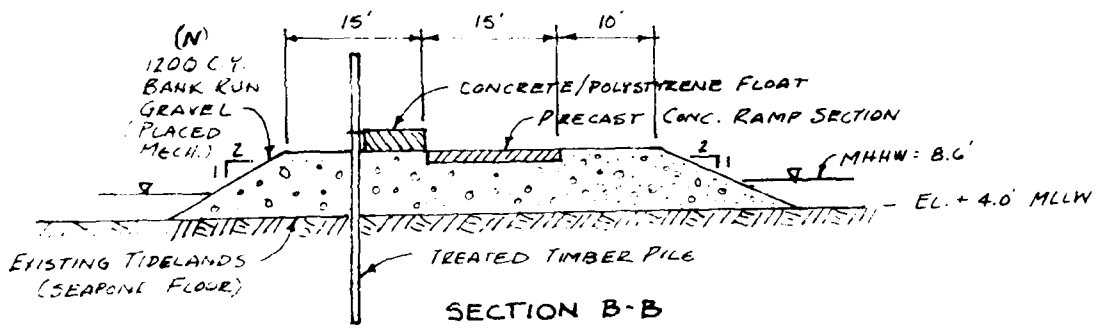
COUNTY OF: WHATCOM, STATE OF WASH.

SHEET 2 OF 5 . DATE: 6/27/83 E.L.V. 11.27.83



SECTION A-A

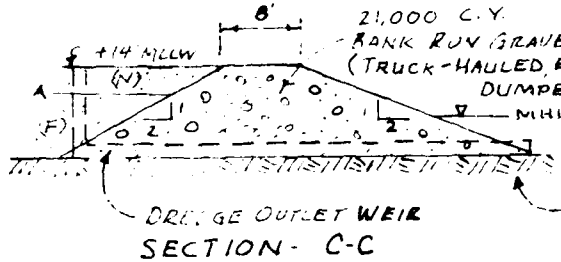
0 50 100 150 200 HORIZ.
0 5 10 15 20 VERT.
SCALE (FT.)
(SECTION A-A)



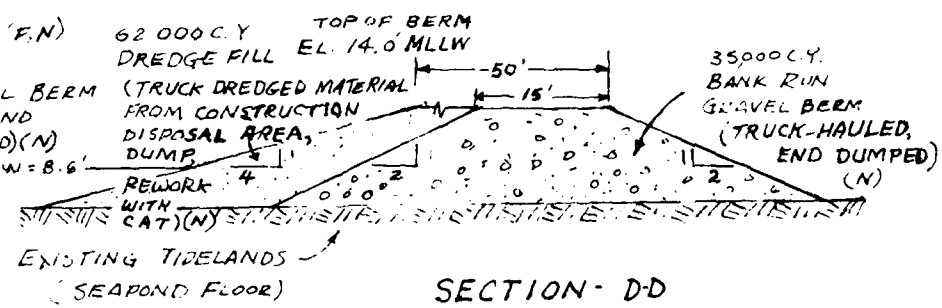
SECTION B-B

0 5 10 15 20
SCALE (FT.) H&V
(SECTIONS BB, CC, DD)

1,470,000 C.Y.
DREDGE FILL (PLACED HYDRAULICALLY) (F,N)



SECTION - C-C



SECTION - D-D

NPSEN-PL-NC-84-1

PROPOSED MARINA FACILITIES

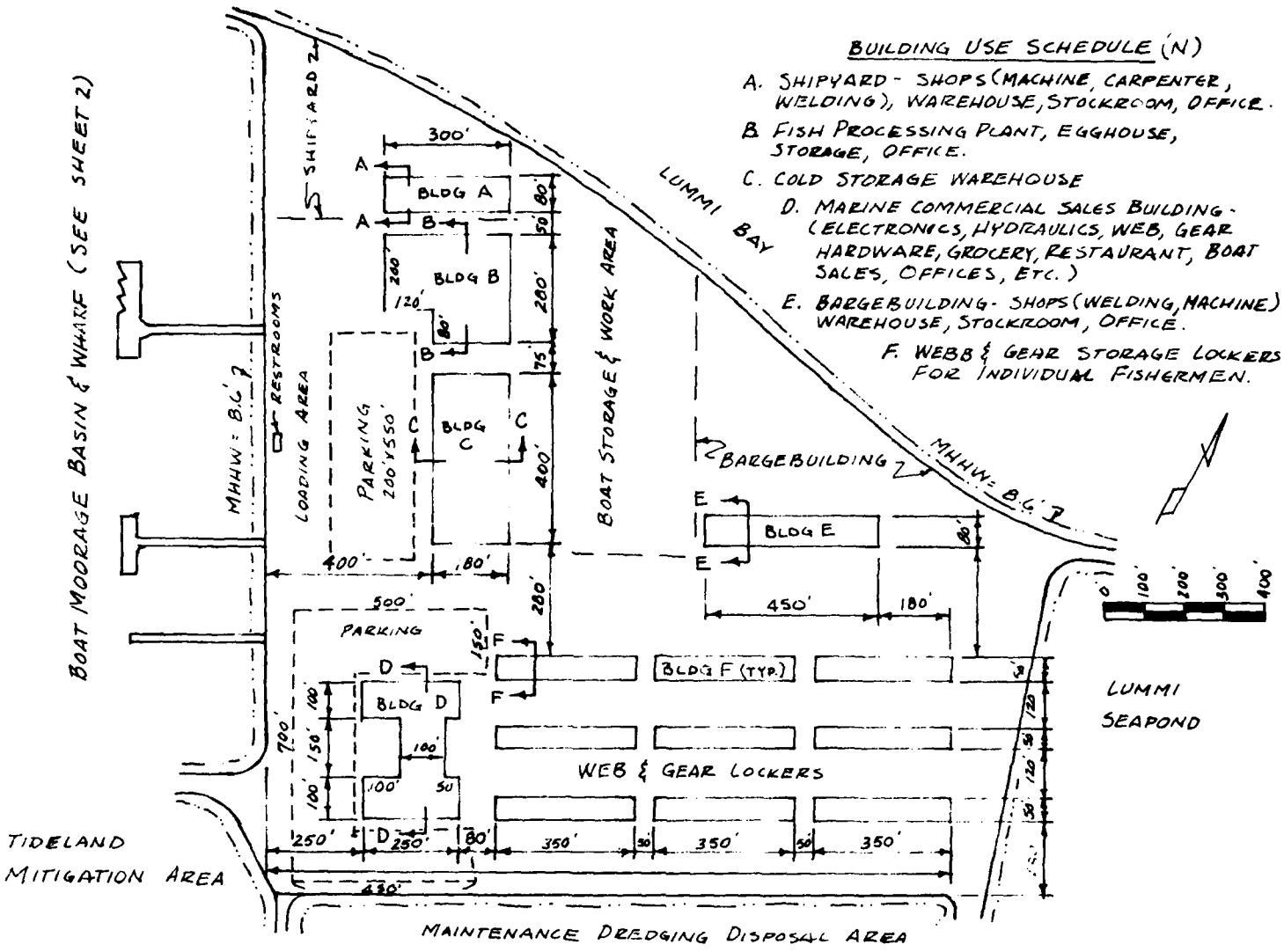
INCLUDING DREDGING, FILLING, BERMS, PILES, FLOATS, WHARVES, BOAT LAUNCH, SUPPORT BUILDINGS AND TIMBER PILE BREAKWATER

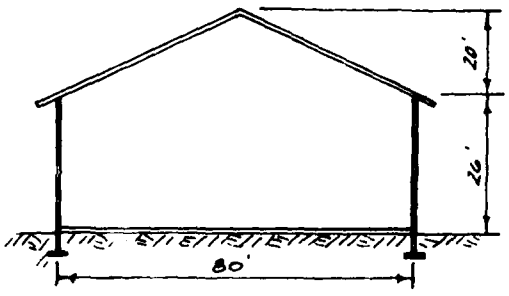
IN: LUMMI BAY, BELLINGHAM BAY

NEAR BELLINGHAM

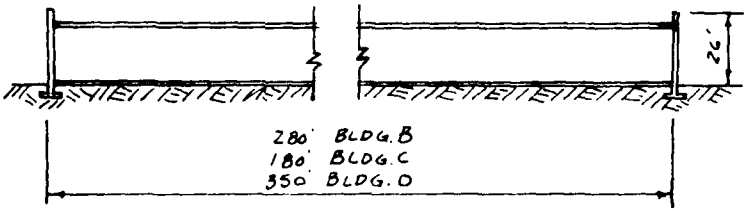
COUNTY OF: WHATCOM

SHEET 3 OF 5. DATE: 6/27/83

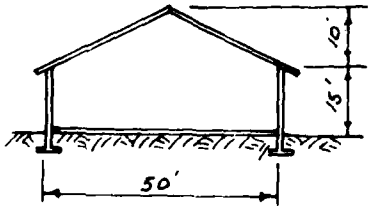




SECTIONS A-A, E, E



SECTIONS B-B, C-C, D-D



SECTION F-F

NPSEN-PL-NC-84-1

PROPOSED MARINA FACILITIES

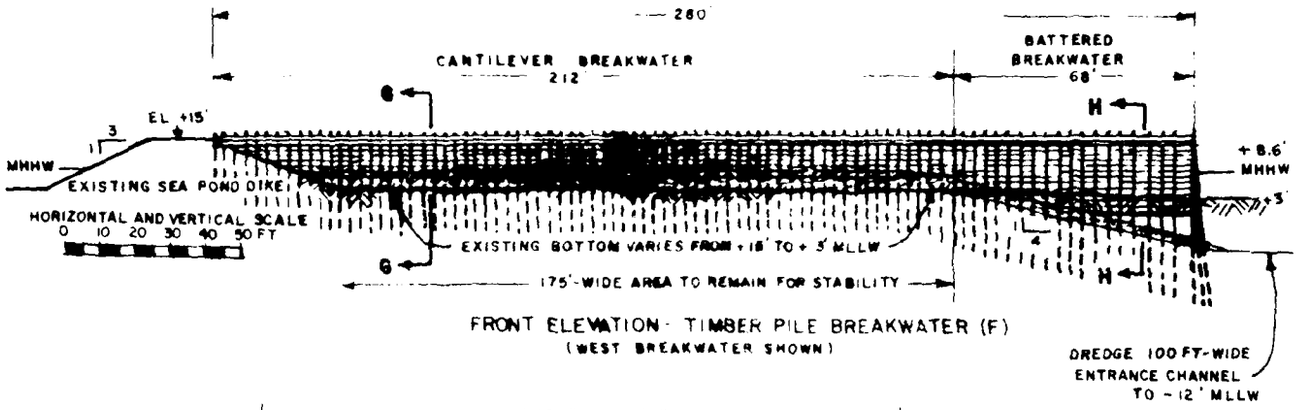
INCLUDING DREDGING, FILLING, BERMS, PILES, FLOATS, WHARVES, BOAT LAUNCH, SUPPORT BUILDINGS, AND TIMBER PILE BREAKWATER

IN: LUMMI BAY, BELLINGHAM BAY

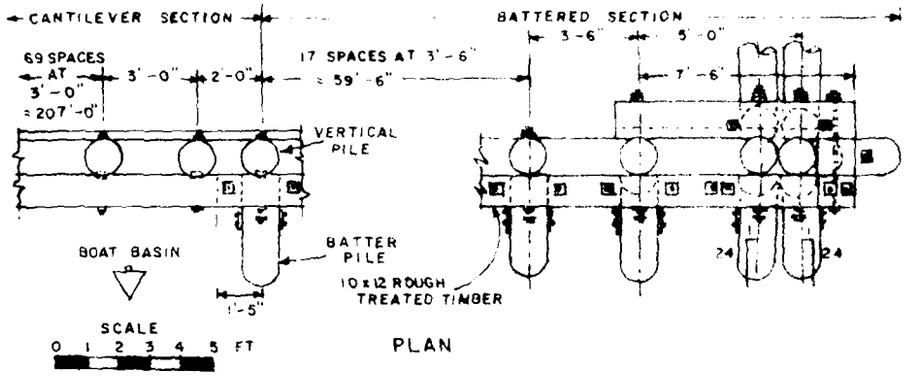
NEAR BELLINGHAM

COUNTY OF: WHATCOM

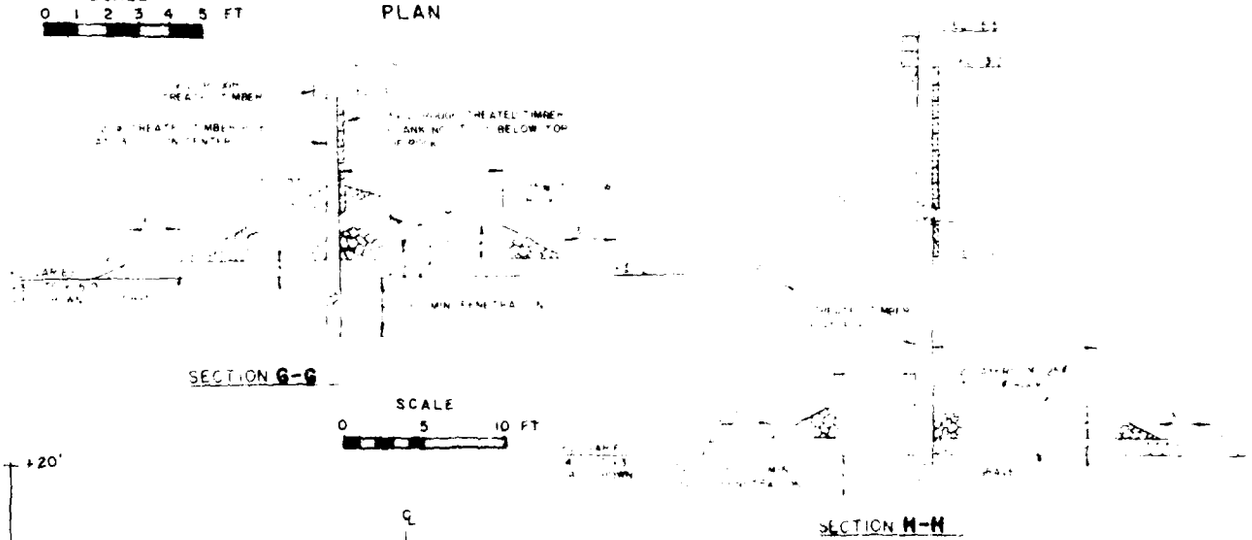
SHEET 4 OF 5 DATE: 11/28/83



FRONT ELEVATION - TIMBER PILE BREAKWATER (F)
(WEST BREAKWATER SHOWN)

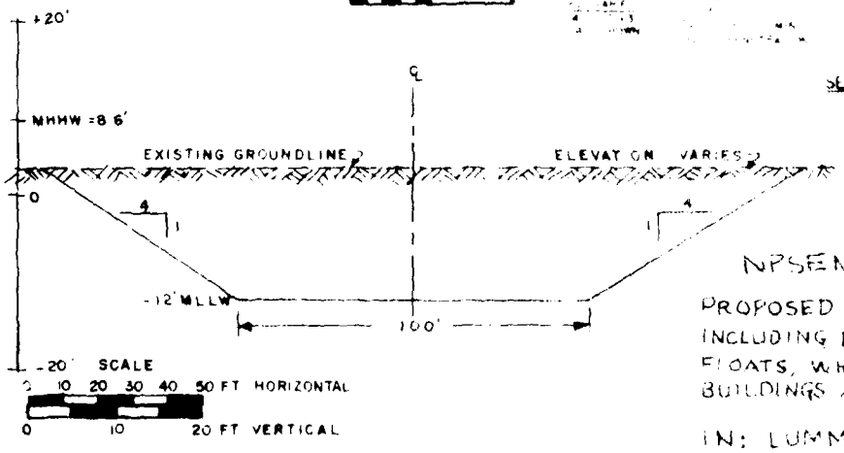


PLAN



SECTION G-G

SECTION H-H



NAVIGATION ENTRANCE CHANNEL (F)
TYPICAL SECTION J-J

NPSEN-PL-NC-814-1

PROPOSED MARINA FACILITIES
INCLUDING DREDGING, FILLING, BERMS, PILES
FLOATS, WHARVES, BOAT LAUNCH, SUPPORT
BUILDINGS AND TIMBER PILE BREAKWATER

IN: LUMMI BAY, BELLINGHAM BAY
NEAR BELLINGHAM

COUNTY OF: WHATCOM
SHEET 5 OF 5 DATE 11/27/83

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504 • (206) 753-2800

5 Jan 84

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Notice of Application for
Water Quality Certification

Notice is hereby given that a request is being filed with the Department of Ecology for certification, that a proposed discharge resulting from the project described in the Corps of Engineers Public Notice No. NPSEN-PL-NC-84-1 will comply with the applicable provisions of State and Federal Water Pollution Laws.

Any person desiring to present views on the project pertaining to water pollution may do so by providing written comments to the Department of Ecology, Inter-Agency Operations Section, Mail Stop PV-11, Olympia, Washington 98504.

Please note, state regulation requires a minimum of 20 days of public notice. The comment period will begin 5 Jan 84 (date of publication) and run until final comments are received from reviewing state agencies and the local government(s).

APPENDIX A, PART 3

PUBLIC AND AGENCY COMMENTS
ON PUBLIC NOTICE
AND CORPS RESPONSES

(To be added following public/agency review of the Public Notice)

APPENDIX B

STUDY COORDINATION AND PUBLIC INVOLVEMENT

PART 1 - COORDINATION AND PUBLIC INVOLVEMENT

PART 2 - COORDINATION LETTERS

PART 3 - U.S. FISH AND WILDLIFE SERVICE REPORT

PART 4 - COMMENTS AND RESPONSES

APPENDIX B, PART 1

COORDINATION AND PUBLIC INVOLVEMENT

1. Coordination and public involvement have been maintained throughout the study and planning process using a public meeting, newsletter, interagency coordination meetings, and Sections 10 and 404 permitting procedures.

Coordination has been maintained with:

- o U.S. Department of Transportation - U.S. Coast Guard
- o U.S. Department of the Interior - Office of the Secretary
- o U.S. Department of the Interior - Fish and Wildlife Service
- o U.S. Environmental Protection Agency - Region X
- o U.S. Department of Agriculture - Soil Conservation Service
- o U.S. Department of Commerce - National Marine Fisheries Service
- o U.S. Department of Commerce - Economic Development Administration
- o Washington State Department of Ecology
- o Washington State Department of Fisheries
- o Washington State Department of Transportation
- o Washington State Department of Natural Resources
- o Washington State Department of Recreation Commission
- o Washington State Office of Archaeology and Historic Preservation
- o Whatcom County Planning Department
- o Friends of the Earth
- o Sierra Club
- o Audubon Society
- o Port of Bellingham
- o Lummi Indian Tribe
- o Nooksack Indian Tribe

2. Comments and Responses. The draft DPR/draft EA was distributed for public and agency review on 27 December 1983. Comments on the draft DPR/draft EA and as a result of the public meeting were requested by 16 March 1984. The initial draft DPR/draft EA mailing list contained ___ organizations or individuals. _____ notices of public meetings were mailed prior to the _____ public meeting. Copies of these mailing lists are on file in the Seattle District office. Reports are sent to Federal, state, and local governmental agencies, public libraries, private organizations, and concerned individuals (to be completed).

3. Late Stage Public Meeting. The Corps of Engineers and Lummi Indian Tribe (project local sponsor) jointly conducted a public meeting on 31 January 1984 to present the District Engineer's findings, tentative recommendations, and to receive public comment. The meeting was held in the _____. Those attending were: (to be completed).

APPENDIX B, PART 2

COORDINATION LETTERS

APPENDIX B, PART 2
PERTINENT CORRESPONDENCE

This portion of the appendix contains copies of project-related correspondence received from agencies and the interested public. The letters contain either specific comments on the Corps of Engineers Detailed Project Report/Environmental Impact Statement or, general comments on the proposed Lummi Bay Marina project. Where appropriate, correspondence relating to the previously considered marina project site at Gooseberry Point on the Lummi Indian Reservation is included. Early in the planning process, the Gooseberry Point site was discarded in favor of the recommended marina site at the northwest portion of the sea pond dike in Lummi Bay. Corps of Engineers responses to comments contained in the agency and public correspondence are contained in part 3 of appendix B. Letters are arranged in the alphabetical order of the commentator. Unless otherwise noted, all correspondence has been written to the Seattle District office of the Corps of Engineers.

TABLE OF CONTENTS

1/Copy of EPA letter to Fish and Wildlife Service (FWS), commenting upon draft Fish and Wildlife Coordination Act report. Date is therefore estimated at June 1983, to correspond with the date of draft FWS report.

TABLE OF CONTENTS (con.)

TABLE OF CONTENTS (con.)

1/Local sponsor letter to National Marine Fisheries Service requesting site change.

2/Local sponsor letter requesting Federal assistance under Section 107 authority.

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release January 14, 1983

FACT SHEET

Indian Policy Statement

SUMMARY

Strong and effective tribal governments are essential in the fight to solve the economic, health, educational, social and other problems of some 735,000 American Indians living on or near reservations. Just as the Federal government deals with States and local governments in meeting the needs of other citizens, so should the Federal government deal with tribal governments in promoting the well-being of American Indians.

The President's Indian Policy Statement emphasizes the Administration's commitment to encourage and strengthen tribal government as called for by President Nixon in 1970 and by Congress in the Indian Self-Determination and Education Assistance Act of 1975. The 1970 policy and 1975 law have not been adequately implemented because the Federal government has inhibited the political and economic development of the tribes. Excessive regulations and self-perpetuating bureaucracy have stifled tribal decisionmaking, thwarted Indian control of reservation resources, and promoted dependency rather than self-sufficiency.

This Administration will reverse this trend by removing obstacles to self-government and by creating a more favorable environment for development of healthy reservation economies. This policy recognizes the diversity of the tribes and the right of each to set its own priorities and goals, and to proceed at its own pace. At the same time, the Federal government will continue to fulfill its traditional responsibility for the physical and financial resources held in trust for the tribes and their members.

Indian tribes are tribal governments because they retain all aspects of their original sovereignty not otherwise given up or taken away by Congress. There are 283 Federally-recognized tribal governments in the United States. In addition, there are 193 Alaska village organizations which are served by the Bureau of Indian Affairs (BIA). According to figures released by the U.S. Census Bureau, there were 1,418,195 American Indians, Eskimos and Aleuts in the United States in 1980.

more

(OVER)

MAJOR POLICY POINTS

-- The Administration will deal with Indian tribes on a government-to-government basis.

-- Tribal governments will be strengthened through these actions:

* Today's signing of H.R. 5470, the Indian Tribal Governmental Tax Status Act. This legislation provides tribes with essentially the same treatment under Federal tax laws as applies to other governments with regard to revenue raising and saving mechanisms.

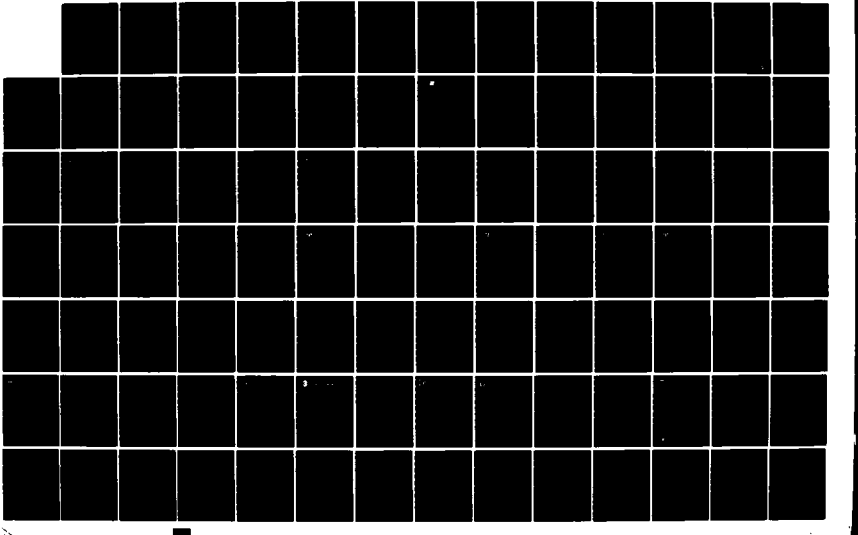
* Encouragement for tribes to assume responsibilities for services such as the enforcement of tribal laws, developing and managing tribal resources, providing health and social services, and education.

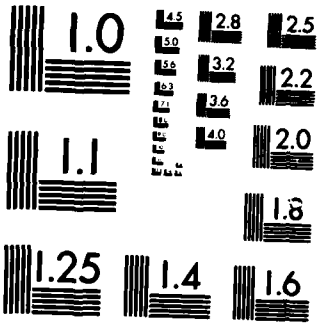
* Designation of the White House Office of Intergovernmental Affairs as liaison for tribes. By moving this function from the White House Office of Public Liaison, the President recognizes that tribal organizations are governments rather than interest groups such as veterans, businessmen and religious leaders.

* A request that Congress expand the authorized membership of the Advisory Commission on Intergovernmental Relations to include a representative of Indian tribal governments.

* Request that Congress repudiate House Concurrent Resolution 108 of the 83rd Congress which called for termination of the Federal-tribal relationship. The Administration wants this lingering threat of termination withdrawn and replaced by a resolution expressing its support of a government-to-government relationship.

* Support for direct funding to Indian tribes under Title XX social services block grants to States. In keeping with the government-to-government relationship, Indian tribes are defined by law as eligible entities and receive direct funding, if they wish, in five block grant programs administered by the Department of Health and Human Services. These and other blocks to the States consolidated dozens of categorical Federal domestic assistance programs to reduce fragmentation and overlap, eliminate excessive Federal regulation, and provide for more local control. This Administration proposes that Indian tribes be eligible for direct funding in the Title XX social services block, the block with the





largest appropriation and the greatest flexibility in service delivery. Grants for social services would be made directly to the tribal governments, at the option of the tribe, and would not be channeled through the States.

-- To solve the severe economic conditions on reservations, the President has:

* Established a Presidential Advisory Committee on Indian Reservation Economies. The Commission is to identify obstacles to economic growth in the public and private sector at all levels; examine and recommend changes in Federal laws, regulations and procedures to remove such obstacles; identify actions State, local and tribal governments could take to rectify identified problems; and recommend ways for the private sector, both Indian and non-Indian, to participate in the development and growth of reservation economies. It will advise the President on actions needed to improve reservation economies.

* Pledged to work with the tribes to implement expeditiously recently passed legislation allowing tribes to enter into joint venture contracts for the development of natural resources on reservations. This is a major step which will enable the tribal governments to become more proficient in business management while increasing employment opportunities for tribal members and adding to tribal revenues.

* Requested funds in the FY 1983 budget to provide seed money to tribes to attract private funding for economic development ventures on reservations.

* Initiated legislation which Congress passed to provide $375 million for building new roads on Indian reservations.

-- This Administration sought suggestions from Indian leaders in developing this policy.

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THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release January 14, 1983

EXECUTIVE ORDER

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PRESIDENTIAL COMMISSION ON INDIAN RESERVATION ECONOMIES

By the authority vested in me as President of the United States of America, and in order to establish, in accordance with the provisions of the Federal Advisory Committee Act, as amended (5 U.S.C. App. I), an advisory commission to promote the development of a strong private sector on Federally recognized Indian reservations, it is hereby ordered as follows:

Section 1. Establishment. (a) There is established a Presidential Commission on Indian Reservation Economies.

(b) The Commission shall be composed of no more than nine members, who shall be appointed by the President from among the private sector, reservation tribal governments, economic academicians, and Federal employees.

(c) The President shall designate a non-Indian representative and an Indian representative to serve as cochairmen of the Commission.

Sec. 2. Functions. (a) The Commission shall advise the President on what actions should be taken to develop a stronger private sector on Federally recognized Indian reservations, lessen tribal dependence on Federal monies and programs and reduce the Federal presence in Indian affairs. The underlying principles of this mission are the government-to-government relationship, the established Federal policy of self-determination and the Federal trust responsibility.

(b) The Commission will focus exclusively on the following items, and not on new Federal financial assistance:

(1) Defining the existing Federal legislative, regulatory, and procedural obstacles to the creation of positive economic environments on Indian reservations.

(2) Identifying and recommending changes or other remedial actions necessary to remove these obstacles.

(3) Defining the obstacles at the State, local and tribal government levels which impede both Indian and non-Indian private sector investments on reservations.

(4) Identifying actions which these levels of government could take to rectify the identified problems.

(5) Recommending ways for the private sector, both Indian and non-Indian, to participate in the development and growth of reservation economies, including capital formation.

(c) The Commission should review studies undertaken in the last decade to obtain pertinent recommendations that are directly related to its mission.

(d) The Commission shall, unless sooner extended, submit a final report to the President and to the Secretary of the Interior within six months after appointment of the last Commissioner, or by September 30, 1983, whichever comes earlier.

Sec. 3. Administration. (a) The heads of Executive agencies shall, to the extent permitted by law, provide the Commission with such information as may be necessary for the effective performance of its functions.

(b) Members of the Commission may receive compensation for their work on the Commission. While engaged in the work of the Commission members may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by law for persons serving intermittently in the government service (5 U.S.C. 5701-5707).

(c) The Secretary of the Interior shall, to the extent permitted by law and subject to the availability of funds, provide the Commission with such administrative services, funds, facilities, staff and other support services as may be necessary for the effective performance of its functions.

(d) The Commission will meet approximately 15 times at the call of the chairmen. All meetings of the Commission and all agenda must have prior approval of the chairmen.

(e) In carrying out its responsibilities, the Commission is authorized to:

(1) Conduct hearings, interviews, and reviews at field sites, or wherever deemed necessary to fulfill its duties.

(2) Confer with Indian tribal government officials and members, private sector business officials and managers, and other parties dealing with matters pertaining to the Commission's mission.

Sec. 4. General Provisions. (a) Notwithstanding the provisions of any other Executive order, the responsibilities of the President under the Federal Advisory Committee Act, as amended, except that of reporting annually to the Congress, which are applicable to the advisory commission established by this Order, shall be performed by the Secretary of the Interior, in accordance with the guidelines and procedures established by the Administrator of General Services.

(b) The Commission shall terminate 60 days after it transmits its final report to the President, or on December 31, 1983, whichever comes earlier.

THE WHITE HOUSE,
January 14, 1983.

RONALD REAGAN

# # # #

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release January 24, 1983

STATEMENT BY THE PRESIDENT

INDIAN POLICY

This Administration believes that responsibilities and resources should be restored to the governments which are closest to the people served. This philosophy applies not only to state and local governments, but also to federally recognized American Indian tribes.

When European colonial powers began to explore and colonize this land, they entered into treaties with sovereign Indian nations. Our new nation continued to make treaties and to deal with Indian tribes on a government-to-government basis. Throughout our history, despite periods of conflict and shifting national policies in Indian affairs, the government-to-government relationship between the United States and Indian tribes has endured. The Constitution, treaties, laws, and court decisions have consistently recognized a unique political relationship between Indian tribes and the United States which this Administration pledges to uphold.

In 1970, President Nixon announced a national policy of self-determination for Indian tribes. At the heart of the new policy was a commitment by the federal government to foster and encourage tribal self-government. That commitment was signed into law in 1975 as the Indian Self-Determination and Education Assistance Act.

The principle of self-government set forth in this Act was a good starting point. However, since 1975, there has been more rhetoric than action. Instead of fostering and encouraging self-government, federal policies have by and large inhibited the political and economic development of the tribes. Excessive regulation and self-perpetuating bureaucracy have stifled local decisionmaking, thwarted Indian control of Indian resources, and promoted dependency rather than self-sufficiency.

This Administration intends to reverse this trend by removing the obstacles to self-government and by creating a more favorable environment for the development of healthy reservation economies. Tribal governments, the federal government, and the private sector will all have a role. This Administration will take a flexible approach which recognizes the diversity among tribes and the right of each tribe to set its own priorities and goals. Change will not happen overnight. Development will be charted by the tribes, not the federal government.

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This Administration honors the commitment this nation made in 1970 and 1975 to strengthen tribal governments and lessen federal control over tribal governmental affairs. This Administration is determined to turn these goals into reality. Our policy is to reaffirm dealing with Indian tribes on a government-to-government basis and to pursue the policy of self-government for Indian tribes without threatening termination.

In support of our policy, we shall continue to fulfill the federal trust responsibility for the physical and financial resources we hold in trust for the tribes and their members. The fulfillment of this unique responsibility will be accomplished in accordance with the highest standards.

Tribal Self-Government

Tribal governments, like state and local governments, are more aware of the needs and desires of their citizens than is the federal government and should, therefore, have the primary responsibility for meeting those needs. The only effective way for Indian reservations to develop is through tribal governments which are responsive and accountable to their members.

Early in this nation's dealings with Indian tribes, federal employees began to perform Indian tribal government functions. Despite the Indian Self-Determination Act, major tribal government functions -- enforcing tribal laws, developing and managing tribal resources, providing health and social services, educating children -- are frequently still carried on by federal employees. The federal government must move away from this surrogate role which undermines the concept of self-government.

It is important to the concept of self-government that tribes reduce their dependence on federal funds by providing a greater percentage of the cost of their self-govern Some tribes are already moving in this direction. This Administration pledges to assist tribes in strengthening their governments by removing the federal impediments to l self-government and tribal resource development. N ary federal funds will continue to be available. This Administration affirms the right of tribes to deter the best way to meet the needs of their members and to blish and run programs which best meet those needs.

For those small tribes which have the greatest need to develop core governmental c ities, this Administration has developed, through the Assi t Secretary of the Interior for Indian Affairs, the Small Tr s Initiative. This program will provide financial suppor necessary to allow these tribes to develop basic tribal administrative and management capabilities.

In keeping with the government-to-government relationship, Indian tribes are defined by law as eligible entities and receive direct funding, if they wish, in five block grant programs administered by the Department of Health and Human Services. These and other blocks to the states consolidated

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dozens of categorical federal domestic assistance programs to reduce fragmentation and overlap, eliminate excessive federal regulation, and provide for more local control. This Administration now proposes that Indian tribes be eligible for direct funding in the Title XX social services block, the block with the largest appropriation and the greatest flexibility in service delivery.

In addition, we are moving the White House liaison for federally-recognized tribes from the Office of Public Liaison to the Office of Intergovernmental Affairs, which maintains liaison with state and local governments. In the past several administrations, tribes have been placed along with vital interest groups, such as veterans, businessmen and religious leaders. In moving the tribal government contact within the White House Intergovernmental Affairs staff, this Administration is underscoring its commitment to recognizing tribal governments on a government-to-government basis.

Further, we are recommending that the Congress expand the authorized membership of the Advisory Commission on Intergovernmental Relations (42 U.S.C. 4273) to include a representative of Indian tribal governments. In the interim before Congressional action, we are requesting that the Assistant Secretary for Indian Affairs join the Commission as an observer. We also supported and signed into law the Indian Tribal Governmental Tax Status Act which provides tribal governments with essentially the same treatment under federal tax laws as applies to other governments with regard to revenue raising and saving mechanisms.

In addition, this Administration calls upon Congress to replace House Concurrent Resolution 108 of the 83rd Congress, the resolution which established the now discredited policy of terminating the federal-tribal relationship. Congress has implicitly rejected the termination policy by enacting the Indian Self-Determination and Education Assistance Act of 1975. However, because the termination policy declared in H. Con. Res. 108 has not been expressly and formally repudiated by a concurrent resolution of Congress, it continues to create among the Indian people an apprehension that the United States may not in the future honor the unique relationship between the Indian people and the federal government. A lingering threat of termination has no place in this Administration's policy of self-government for Indian tribes, and I ask Congress to again express its support of self-government.

These actions are but the first steps in restoring control to tribal governments. Much more needs to be done. Without sound reservation economies, the concept of self-government has little meaning. In the past, despite good intentions, the federal government has been one of the major obstacles to economic progress. This Administration intends to remove the impediments to economic development and to encourage cooperative efforts among the tribes, the federal government and the private sector in developing reservation economies.

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Development of Reservation Economies

The economies of American Indian reservations are extremely depressed with unemployment rates among the highest in the country. Indian leaders have told this Administration that the development of reservation economies is their number one priority. Growing economies provide jobs, promote self-sufficiency, and provide revenue for essential services. Past attempts to stimulate growth have been fragmented and largely ineffective. As a result, involvement of private industry has been limited, with only infrequent success. Developing reservation economies offers a special challenge: devising investment procedures consistent with the trust status; removing legal barriers which restrict the type of contracts tribes can enter into and reducing the numerous and complex regulations which hinder economic growth.

Tribes have had limited opportunities to invest in their own economies because often there has been no established resource base for community investment and development. Many reservations lack a developed physical infrastructure including utilities, transportation and other public services. They also often lack the regulatory, adjudicatory and enforcement mechanisms necessary to interact with the private sector for reservation economic development. Development on the reservation offers potential for tribes and individual entrepreneurs in manufacturing, agribusiness and modern technology, as well as fishing, livestock, arts and crafts and other traditional livelihoods.

Natural resources such as timber, fishing and energy provide an avenue of development for many tribes. Tribal governments have the responsibility to determine the extent and the methods of developing the tribe's natural resources. The federal government's responsibility should not be used to hinder tribes from taking advantage of economic development opportunities.

With regard to energy resources, both the Indian tribes and the nation stand to gain from the prudent development and management of the vast coal, oil, gas, uranium and other resources found on Indian lands. As already demonstrated by a number of tribes, these resources can become the foundation for economic development on many reservations while lessening our nation's dependence on imported oil. The federal role is to encourage the production of energy resources in ways consistent with Indian values and priorities. To that end, we have strongly supported the use of creative agreements such as joint ventures and other non-lease agreements for the development of Indian mineral resources.

It is the free market which will supply the bulk of the capital investments required to develop tribal energy and other resources. A fundamental prerequisite to economic development is capital formation. The establishment of a financial structure that is a part of the Indian reservation community is essential to the development of Indian capital formation.

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Federal support will be made available to tribes to assist them in developing the necessary management capability and in attracting private capital. As a first step in that direction, we provided funds in the FY 1983 budget to provide seed money to tribes to attract private funding for economic development ventures on reservations. As more tribes develop their capital resource base and increase their managerial expertise, they will have an opportunity to realize the maximum return on their investments and will be able to share an increasing portion of the business risk.

It is the policy of this Administration to encourage private involvement, both Indian and non-Indian, in tribal economic development. In some cases, tribes and the private sector have already taken innovative approaches which have overcome the legislative and regulatory impediments to economic progress.

Since tribal governments have the primary responsibility for meeting the basic needs of Indian communities, they must be allowed the chance to succeed. This Administration, therefore, is establishing a Presidential Advisory Commission on Indian Reservation Economies. The Commission, composed of tribal and private sector leaders, is to identify obstacles to economic growth in the public and private sector at all levels; examine and recommend changes in federal law, regulations and procedures to remove such obstacles; identify actions state, local and tribal governments could take to rectify identified problems; and recommend ways for the private sector, both Indian and non-Indian, to participate in the development and growth of reservation economies. It is also to be charged with the responsibility for advising the President on recommended actions required to create a positive environment for the development and growth of reservation economies.

Numerous federal agencies can offer specialized assistance and expertise to the tribes not only in economic development, but also in housing, health, education, job training, and other areas which are an integral part of reservation economies. It is to the advantage of the tribes, and in the interest of the taxpayers, that the federal role be fully reviewed and coordinated. Therefore, this Administration directs the Cabinet Council on Human Resources to act as a mechanism to ensure that federal activities are non-duplicative, cost effective, and consistent with the goal of encouraging self-government with a minimum of federal interference.

Summary

This Administration intends to restore tribal governments to their rightful place among the governments of this nation and to enable tribal governments, along with state and local governments, to resume control over their own affairs.

This Administration has sought suggestions from Indian leaders in forming the policies which we have announced. We intend to continue this dialogue with the tribes as these policies are implemented.

The governmental and economic reforms proposed for the benefit of Indian tribes and their members cannot be achieved in a vacuum.

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This nation's economic health -- and that of the tribes -- depends on adopting this Administration's full Economic Recovery Program. This program calls for eliminating excessive federal spending and taxes, removing burdensome regulations, and establishing a sound monetary policy. A full economic recovery will unleash the potential strength of the private sector and ensure a vigorous economic climate for development which will benefit not only Indian people, but all other Americans as well.

Attachment

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REAGAN ADMINISTRATION INDIAN POLICY INITIATIVES

- Request that Congress repudiate House Concurrent Resolution 108 of the 83rd Congress which called for termination of the federal-tribal relationship. The Administration wants this lingering threat of termination replaced by a resolution expressing its support of a government-to-government relationship.

- Ask Congress to expand the authorized membership of the Advisory Commission on Intergovernmental Relations to include a representative of Indian tribal governments. In the interim, request that the Assistant Secretary of the Interior for Indian Affairs join the ACIR as an observer.

- Move the White House liaison for federally-recognized tribes from the Office of Public Liaison to the Office of Intergovernmental Affairs.

- Establish a Presidential Advisory Commission on Indian Reservation Economies to identify obstacles to economic growth and recommend changes at all levels; recommend ways to encourage private sector involvement, and advise the President what actions are needed to create a positive environment for the development and growth of reservation economies.

- Support direct funding to Indian tribes under the Title XX social services block grant to states.

- Sought and obtained funds for FY 1983 to implement the Small Tribes Initiative to provide financial support needed to allow small tribes to develop basic tribal administrative and management capabilities.

- Sought and obtained funds for FY 1983 to provide seed money for tribes for economic development ventures on reservations.

- Supported and signed into law the Tribal Governmental Tax Status Act which will provide tribal governments with the same revenue raising and saving mechanisms available to other governments.

- Support the use of creative agreements such as joint ventures and other non-lease agreements for the development of Indian mineral resources.

- Direct the Cabinet Council on Human Resources to act as a review and coordination mechanism to ensure that federal activities are non-duplicative, cost effective and consistent with the goal of encouraging tribal self-government with a minimum of federal interference.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E.
BIN C15700
Seattle, Washington 98115

OCT 8 1982

F/NWR5:AG:1503-11-1

Colonel Norman C. Hintz
District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Dear Colonel Hintz:

In response to your letter of September 30, 1982 regarding the proposed access channel and small boat harbor in Lummi Bay, Whatcom County, Washington; enclosed is a list of threatened and endangered species under jurisdiction of the National Marine Fisheries Service (NMFS) that may be present in Lummi Bay.

There are no "Candidate" species presently being considered by NMFS that may be present in the project area.

Sincerely,

for Harvey M. Hutchings
H. A. Larkins
Regional Director

Enclosure

REVIEW OF EASTERN NORTH PACIFIC MARINE ENDANGERED SPECIES

Marine animals which are found in the eastern North Pacific Ocean at some season of the year, which are listed as endangered under the Endangered Species Act of 1973, and which could conceivably enter the Strait of Juan de Fuca and the inside waters of Washington are:

Gray whale	(Eschrichtius robustus)
Blue Whale	(Balaenoptera musculus)
Humpback Whale	(Megaptera novaeangliae)
Right Whale	(Balaena glacialis)
Fin Whale	(Balaenoptera physalus)
Sei Whale	(Balaenoptera borealis)
Sperm Whale	(Physeter macrocephalus)
Leatherback sea turtle	(Dermochelys coriacea)

However, four of these endangered species have never been reported as occurring within the Strait of Juan de Fuca or other inside waters of Washington; they are:

Right Whale

Sei Whale

Sperm Whale

Leatherback sea turtle

The other four endangered species occur only rarely or occasionally within inside waters. The Blue Whale may have been sighted once and the Fin Whale only once or twice. A few individual Gray and Humpback Whales have been sighted almost every year. It is highly unlikely, however, that a significant number of any of these four species would enter and travel within the Strait of Juan de Fuca, the San Juan Islands area, Puget Sound or Hood Canal.

Accounts for each species are as follows. Additional information on the marine mammals of Washington can be found in "Northern Puget Sound Marine Mammals" by Everitt, Fiscus and DeLong (1980).

Gray Whale

The gray whale is primarily a coastal species. A few whales may stray annually into the inside waters of Washington. The eastern North Pacific stock of 16,500 whales passes along the Washington coast in late winter and spring (Mar-May) during its northbound migration and in winter (Nov-Jan) during its southbound migration. A few animals may be seen in coastal Washington waters during any month of the year. A summer population of 50 animals regularly occurs along the West Coast of Vancouver Island where they feed.

We have 17 observations of gray whales from the waters inside of Washington including the eastern Strait of Juan de Fuca, the San Juan Islands, Puget Sound, and Hood Canal in 1978-79. These were all solitary animals with two exceptions: A 6 May 1979 observation of a group in Hood Canal and a 9 May 1979 observation of 1-5 at Port Townsend which may have been the group sighted in Hood Canal 3 days earlier.

Gray whales could occur anywhere in the inside waters of Washington but the chance of more than a few stragglers occurring is slight.

Blue Whale

The blue whale is primarily an offshore species. In the eastern North Pacific it ranges from the Gulf of Alaska to central California during summer and in the eastern tropical Pacific during winter. A recent estimate of the North Pacific population is 1,700.

There are no verified sightings of this species from the Strait of Juan de Fuca or other inside waters of Washington, although there is speculation that the whale (identified as a Fin) which died in a log boom at Shelton, WA in August 1930 may have been a young blue whale..

The blue whale is an offshore species rarely venturing into shallow coastal or protected inside waters of Washington.

Humpback Whale

The humpback whale generally inhabits coastal and offshore waters but does enter protected inside waters on occasion. In the eastern North Pacific Ocean this species ranges from the arctic to southern California in summer and occupies tropical waters in winter. The North Pacific population is estimated to consist of about 1,000 animals.

During the first part of the 20th century this species was one of those most frequently sighted in the inside waters of Washington. Recent sightings of this species in Puget Sound were made off Seattle, WA in May 1976 (2 individuals) and in September 1978 (4 individuals).

Humpback whales could occur anywhere in the inside waters of Washington but the chance of more than a few stragglers occurring is slight.

Right Whale

The right whale occurs in both coastal and offshore waters. In the eastern North Pacific Ocean this species occurs north of Washington waters in summer and ranges from Washington south in winter. The North Pacific population is estimated to be about 220 individuals.

The most recent sighting of this species in Washington waters was made on 17 January 1967 when 3 were observed 15 miles WSW of Cape Flattery. The right whale has never been reported from the Strait of Juan de Fuca or other

Fin Whale

The fin whale is an offshore inhabitant. In the eastern North Pacific Ocean it ranges from the arctic south to California in summer and to tropical waters in winter. In the North Pacific this species is presently estimated to number about 17,000 animals. One fin whale was pursued in Puget Sound in 1915 and another in August 1930, although the 1930 specimen may have been a young blue whale, based on recent examination of photographs. No new sightings have been reported for this species in the Strait of Juan de Fuca or other inside waters of Washington.

Since it is an offshore species, the presence of a fin whale inside waters of Washington would certainly represent an accidental straying away from its normal range.

Sei Whale

The sei whale is an inhabitant of offshore waters. In the eastern North Pacific Ocean it ranges from the Gulf of Alaska south to California in summer and occurs in tropical waters in winter. The population in the North Pacific is presently estimated to be about 7,000 animals.

There are no records of this species from the Strait of Juan de Fuca or other inside waters of Washington.

Sperm Whale

The sperm whale is an inhabitant of offshore waters.

In the eastern North Pacific it ranges north to the Bering Sea in summer, with females and immature animals being found between 40° and 50° north latitude; it ranges south into tropical waters in winter. The current population estimate for the North Pacific is 370,000.

There are no records of this species occurring in the Strait of Juan [illegible] or the inside waters of Washington.

Leatherback Sea Turtle

The leatherback sea turtle is an inhabitant of offshore waters. In the eastern North Pacific it ranges north to the Gulf of Alaska. There are two records from Alaska, one was taken in a salmon seiner's net about 1 September 1962 near Cordova, Prince William Sound, and one was taken near Craig, Southeastern Alaska, also in a seiner's net on 21 August 1978. Its population is unkrown.

None have been reported from the Strait of Juan de Fuca or the inside waters of Washington.

National Marine Mammal Laboratory, NWAFC
7600 Sand Point Way N.E., Building 32
Seattle, Washington 98115

February 19, 1980

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
ENVIRONMENTAL & TECHNICAL SERVICES DIVISION
847 NE 19th AVENUE, SUITE 350
PORTLAND, OREGON 97232
(503) 230-5400

November 4, 1982 F/NWR5:JRB

Mr. Paul Hage
Lummi Indian Tribe
Fisheries Department
2616 Kwina Road
Bellingham, WA 98225

Dear Mr. Hage:

This letter is in regard to the proposal by the Lummi Indian Tribe to develop a commercial fishing complex at the present aquaculture facility, known as the Sea Pond, near Bellingham, Washington. We trust the information provided herein will be helpful in the planning process.

The project as presently proposed would be located in Lummi Bay, would include a marina and adjacent infrastructure, and would provide direct support to the commercial fishing industry of the northern Puget Sound area. The project is very ambitious and is a desirable approach supportive of traditional and developing fisheries.

As proposed, 16 acres of intertidal and subtidal mudflat would be dredged for a navigation channel, 25 acres of the area within the Sea Pond would be dredged for a vessel moorage basin, and 50 to 70 acres of the Sea Pond would be filled to accommodate upland facilities. We believe the magnitude of aquatic habitat that would be either altered or eliminated could have major environmental consequences. Sufficient information is not available to assist us in an evaluation of those consequences. Attached to this letter is a suggested sampling program that would assist us and other resource agencies in making such an evaluation.

If you have questions that concern the attached information, please feel free to contact Jim Bybee of my staff at (503) 230-5427.

Sincerely yours,

Dale R. Evans
Division Chief

Attachment

cc: Corps of Engineers
Environmental Resource Section
Seattle, WA

Recommended Sampling Plan for Evaluating the Impacts of a Proposed Commercial Fishing Complex within the Lummi Indian Tribe's Sea Pond Aquaculture Facility

We believe the sample plan recommended below would be the minimum needed to evaluate the possible environmental impacts of the project. It is recognized that this plan would provide only enough information to make instantaneous assessments and not a complete biological evaluation of the Sea Pond system. Nonetheless, it should be adequate to assess the relative use of the system by aquatic resources at the time of sampling.

The data obtained should provide information on the relative habitat values at control dikes, at shallow water areas, at mid-pond, at the proposed fill site, at the proposed dredge site, and at near-levee areas. Sampling gear and sample sites that are recommended should be adequate to sample benthic, epibenthic, and water column species.

A minimum of eight sample sites are recommended. Three replicate samples should be taken at each indicated site for the following samples: trawl, plankton tow, bottom grab, sediment core, and fish trap.

Fish Trap Various types of fish traps are available. We have experienced good results with traps that have a leader no less than 20 meters in length and have at least 3 fykes. These should be monitored every 24 hours.

Beach Seine A seine at least 50 meters in length with a stretch-mesh size no greater than 3/4 inch is recommended.

Benthic Samples Several types of bottom grabs are available. An Ekman or similar device should be adequate. It may be necessary to use a diver to assure uniform penetration in the shallow areas of the Sea Pond.

Core Sampler Any core sampler would be adequate if it would obtain a core approximately 2 inches in diameter and penetrate to a depth of about 24 inches. Sediment grain size should be recorded for each sample.

Trawl A bottom trawl that would adequately sample epibenthic fish and invertebrates (e.g., flounder, shrimp, crab) is recommended. Five-minute tows are fairly standard.

Plankton Unless plankton samples are taken over an extended period of time, the information could be less than useful. Nonetheless, we believe a few tows during select time periods would provide useful information on the relative abundance of zooplankton. We recommend (1) the use of a standard zooplankton net, (2) that three replicate 5-minute tows be made at each site, and (3) that samples be taken in January, April, July, and October.

Water Quality The following measurements are recommended for the sample sites indicated on the chart that follows: turbidity, salinity, temperature, and dissolved oxygen. Replicate samples are not necessary, but the latter three variables should be sampled at the surface and also near the bottom.

US Department of Transportation
United States Coast Guard

Commander
Thirteenth Coast Guard District

915 Second Avenue
Seattle, WA 98174
Staff Symbol: (oan)
Phone: (206) 442-5864

16500/4
Serial 534
16 November 1982

From: Commander, Thirteenth Coast Guard District
To: District Engineer, Seattle District, Corps of Engineers

Subj: Proposed Lummi Bay Sea Pond Small Boat Harbor Project - Request for Navigation Aids Data

Ref: (a) Your ltr NPSEN-PL-MC dtd 25 Oct '82

1. Reference (a) requested our cost estimate for establishing and maintaining appropriate aids to navigation for subject proposed project.

2. If the project is developed as indicated per reference (a) we would propose to establish and maintain aids as follows (See Enclosure I):

Initial Cost

3 ea 5-pile wood dolphin lights	@ $20,000	= $60,000.00
3 ea 3-pile wood dolphin DB	@ 6,000	= 18,000.00
TOTAL INITIAL COST		$78,000.00

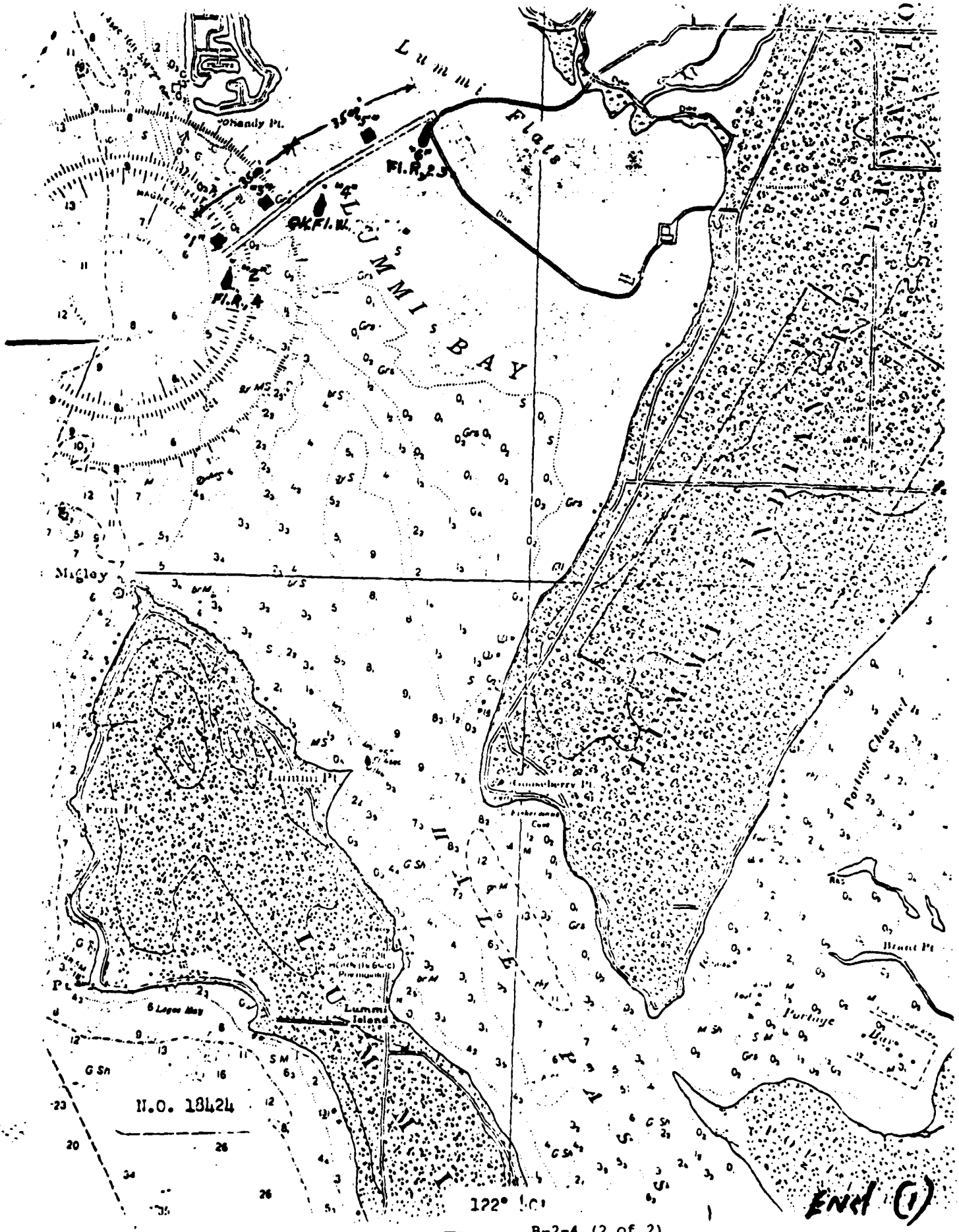
Annual Cost

Batteries for 3 lights	@ $250/yr	= $ 750.00
Struct. amortiz.	@ 8% for 25 yrs	= 7,300.00
TOTAL ANNUAL COST		$ 8,050.00

3. Your consideration is requested in providing adequate response time for our preparation of these cost estimates in the future. A minimum of two months is desired, when possible, to allow for the proper development of our evaluations.

T. M. NUTTING
By direction

Encl: (1) Chartlet of N. O. 18424


Lummi Flats
LUMMI BAY
Migley
Point Pt
Lummi Island
Portage Channel
Portage
Brant Pt
Fl.R.2.5
Fl.R.4
Oak Fl.W.
N.O. 18424
122° 10'
End (1)

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 423

Charles A. Dunn
Field Supervisor
U.S. Department of Interior
Fish and Wildlife Service
2625 Parkmont Lane SW, Bldg. B-3
Olympia, Washington 98502

RE: Draft Coordination Act Report for the Lummi Bay Marina Project

Dear Mr. Dunn:

Thank you for the opportunity to review the draft Coordination Act Report for the Lummi Bay Marina project.

Our review indicates that the report has been well prepared. The environmental impacts of the project are clearly delineated and well thought out.

We generally support the recommendations and conclusions of the report. As such, we intend to use the report as a basis to review the Environmental Impact Statement and Corps permit for this project.

For further coordination on this project, please contact Carl Kassebaum at (206) 442-1447 or FTS 399-1447.

Sincerely,

Carl Kassebaum

for Ronald Lee
Water Resources Assessment Team Leader

Corps of Engineers
NMFS
WDE
WDF
WDG
WDNR

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION X
1200 SIXTH AVENUE
SEATTLE, WASHINGTON 98101

REPLY TO ATTN OF: M/S 423

SEP 20 1982

Mr. Dwain F. Hogan, P.E.
Chief, Planning Branch
Seattle District, C/E
P. O. Box C-3755
Seattle, Washington 98124

RE: Small Boat Harbor and Access Channel, Lummi Indian Reservation

Dear Mr. Hogan:

Thank you for inviting us to participate in the scoping process for the referenced project. Several meetings between Corps and EPA staff have resulted in general agreement on issues to be addressed in the EIS. We would suggest that:

1) Contamination levels of area sediments need to be characterized. Existing data in most cases is sufficient to accomplish this. If existing information identifies a potential problem, additional sampling to adequately characterize the sediment should be undertaken.

2) Flushing characteristics of the proposed marina be estimated using existing literature. Modeling studies do not appear warranted. EIS discussions should compare the flushing characteristics of various marina configurations, including a tear-drop shape, to the proposed rectangular configuration.

3) The resource value of the pond area to be filled be quantified. Some on-site investigations may be necessary to make the determinations.

4) The environmental impacts on water quality and habitat values associated with the initial and maintenance channel dredging activities be identified. Additionally, the frequency, volume, costs, and funding mechanisms for maintenance dredging should be addressed.

5) Mitigation to offset resource losses associated with channel dredging and pond filling be investigated. Breaching of the existing pond walls thereby returning the area to intertidal habitat, should be discussed in detail.

6) If a breakwater in front of the channel entrance is determined necessary, a structure built at the marina entrance to deflect waves is environmentally superior to a rubble mound breakwater, which would have to be located on the mud flats northwest of the channel. The rubble mound breakwater, because of its distance from the entrance, requires extensive fill and would adversely impact a large area of valuable intertidal habitat.

We appreciate the opportunity to review the proposal. If you wish to discuss our comments, Dick Thiel of my staff may be contacted at (206) 442-1728 or (FTS) 399-1728.

Sincerely,

John R. Spencer
Regional Administrator

cc: USFWS - Olympia
NMFS
WDE
WDF
WDG

IN REPLY REFER TO:

Real Property Mgm't

United States Department of the Interior

BUREAU OF INDIAN AFFAIRS
Puget Sound Agency
3006 Colby Avenue-Federal Building
Everett, Washington 98201

October 6, 1982

Colonel Norman C. Hintz
Corps of Engineers
P.O. Box C-3755
Seattle, WA 98124

Dear Mr. Hintz:

Our Natural Resources branch chief, Mr. Steve Roy, has advised that you need to know the status of the land occupied by the Lummi fish ponds.

Our Land Records and Titles Office in the Portland Area Office as well as this office can only check land by being provided with a legal description. However, in general, if the ponds are between the line of ordinary mean high tide and extreme low tide, then they are tidelands held by the United States of America in trust for the Lummi Indian Tribe.

We hope this general statement will be of help.

Sincerely yours,

ACTING Superintendent

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Endangered Species
2625 Parkmont Lane S.W., B-2
Olympia, Washington 98502

April 11, 1983

Colonel Norman C. Hintz,
District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Ref: 1-3-83-I-249
Cross Ref: 1-3-83-SP-21 & 117

Dear Colonel Hintz:

On October 26, 1982, we sent your agency requested information on endangered and threatened species that may be present in the vicinity of the proposed Lummi Bay Small Boat Basin Project, Whatcom County, Washington. Your request for the list and our response were made pursuant to the requirements of Section 7 of the Endangered Species Act of 1973, 16 U.S.C. 1531, et seq. At that time, we listed only the bald eagle as occurring in the project vicinity.

Subsequently, I visited the site as well as the adjacent Sandy Point proposed navigation channel and jetty construction site. On March 1, 1983, we supplied your agency with a list of endangered and threatened species that occur within the vicinity of the Sandy Point site. This list included the bald eagle as well as the peregrine falcon. It was my determination at that time, in concert with members of your staff and the Washington Department of Game, that peregrine falcons could be affected by either project. One study to fulfill the biological assessment requirements outlined in Section 7(c) of the Act would accommodate both projects. This has been discussed with members of your Environmental Resources Staff on several occasions.

To assure that appropriate attention will be given to timing and funding considerations, we request that you include the peregrine falcon in your environmental studies in your Lummi Bay Small Boat Basin project.

We appreciate the opportunity to supply input on your projects and look forward to continuing our coordination with your staff.

Sincerely,

Jim A. Bottorff
Endangered Species Project Leader

cc: RO, AFA-SE
ES, Olympia
Attn: Stout
Mr. Ken Brunner
ERS Section CE
WDG-Non Game Program
WDG-Seattle Regional Office
Attn: Laura Leschner

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Endangered Species
2625 Parkmont Lane S.W., B-2
Olympia, WA 98502

October 26, 1982

Colonel Norman C. Hintz
District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Refer to: 1-3-83-SP-21

Dear Colonel Hintz:

As requested by Gail Arnold of your ERS staff in a letter, dated October 13, 1982, I have attached a list of endangered and threatened species (Attachment A) that may be present in the area of the proposed Lummi Bay Small Boat Basin Project, Whatcom County, Washington. The list fulfills the requirement of the Fish and Wildlife Service under Section 7(c) of the Endangered Species Act of 1973, 16 U.S.C. 1531, et seq. Your Endangered Species Act requirements are outlined in Attachment B.

This service responded on September 21, 1982, to an earlier request from your agency. A correction should be noted in that response. The bald eagle nest site identified near the eastern side of the dike in T.38 N., R 0/E, S 14 is erroneous. No nest site occurs in that area. However, it is a documented feeding area and therefore should be considered in your biological assessment. No candidate species occur in the project area.

Should your biological assessment determine that a listed species is likely to be affected (adversely or beneficially) by the project, your agency should request formal Section 7 consultation through this office.

Even if your biological assessment shows a "no effect" situation, we would appreciate receiving a copy of your assessment for our information. If you have any additional questions regarding your responsibilities under the Act, please contact Mr. Jim Bottorff, Endangered Species Team Leader, (206) 753-9444, FTS 434-9444 at the following address:

U.S Fish and Wildlife Service
Endangered Species Team
2625 Parkmont Lane S.W., Bldg. B-2
Olympia, WA 98502

Your interest in endangered species is appreciated.

Sincerely,

Jim A. Bottorff
Endangered Species Team Leader

Attachments

cc: RO (AFA/SE)
ES, Olympia
WDOG, Non-Game Program
WNHP

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND
CANDIDATE SPECIES THAT MAY OCCUR WITHIN THE AREA OF THE PROPOSED
LUMMI BAY SMALL BOAT BASIN,
WHATCOM COUNTY, WASHINGTON
1-3-83-SP-21

LISTED:

Bald Eagle (Haliaeetus leucocephalus)

Feeding concentration east side of dike in winter and foraging throughout Lummi Bay during nesting season.

PROPOSED:

None

CANDIDATE:

None

Attachment A

FEDERAL AGENCIES' RESPONSIBILITIES UNDER SECTIONS 7(a) and (c)
OF THE ENDANGERED SPECIES ACT

SECTION 7(a) - Consultation/Conference

Requires: 1) Federal agencies to utilize their authorities to carry out programs to conserve endangered and threatened species;

2) Consultation with FWS when a Federal action may affect a listed endangered or threatened species to insure that any action authorized, funded or carried out by a Federal agency is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of Critical Habitat. The process is initiated by the Federal agency after they have determined if their action may affect (adversely or beneficially) a listed species; and

3) Conference with FWS when a Federal action is likely to jeopardize the continued existence of a proposed species or result in destruction or adverse modification of proposed Critical Habitat.

SECTION 7(c) - Biological Assessment for Construction Projects

Requires Federal agencies or their designees to prepare Biological Assessment (BA) for construction projects1/ only. The purpose of the BA is to identify any proposed and/or listed species which are/is likely to be affected by a construction project. The process is initiated by a Federal agency in requesting a list of proposed and listed threatened and endangered species (List attached). The BA should be completed within 180 days after its initiation (or within such a time period as is mutually agreeable). If the BA is not initiated within 90 days of receipt of the species list, please verify the accuracy of the list with our Service. No irreversible commitment of resources is to be made during the BA process which would result in violation of the requirements under Section 7(a) of the Act. Planning, design, and administrative actions may be taken; however, no construction may begin.

To complete the BA, your agency or its designee should: (1) conduct an on-site inspection of the area to be affected by the proposal which may include a detailed survey of the area to determine if the species is present and whether suitable habitat exists for either expanding the existing population for potential reintroduction of the species; (2) review literature and scientific data to determine species distribution, habitat needs, and other biological requirements; (3) interview experts including those within FWS, National Marine Fisheries Service, State conservation departments, universities and others who may have data not yet published in scientific literature; (4) review and analyze the effects of the proposal on the species in terms of individuals and populations, including consideration of cumulative effects of the proposal on the species and its habitat; (5) analyze alternative actions that may provide conservation measures and (6) prepare a report documenting the results, including a discussion of study methods used, any problems encountered, and other relevant information. Upon completion, the report should be forwarded to our Area Manager.

1/ "Construction Project" means any major Federal Action which significantly affects the quality of the human environment (requiring an EIS) designed primarily to result in the building or erection of man-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorization or approval which may result in construction.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
2625 Parkmont Lane, S.W., Bldg. B-3
Olympia, Washington 98502

June 29, 1982

Colonel Norman C. Hintz
District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Dear Colonel Hintz:

This letter provides planning information for the ongoing small boat harbor study near Gooseberry Point. An interagency meeting was held May 25, 1982, and included a site investigation. We were asked at that meeting t summarize the environmental resources at Gooseberry Point and recommend measures to minimize adverse impacts to those resources.

The most important environmental resources associated with this project are the extensive eelgrass at the site and the documented herring spawning which occurs on the eelgrass. The number of herring spawning in Hale Passage has traditionally been quite large. This area has the potential to be one of the most productive herring grounds in Puget Sound.

The project, as originally proposed, would seriously affect at least 25 acres of herring spawning habitat. An analysis of project features, expected impact to resources, and mitigation measures is presented below.

1. Dredging the boat basin.

   The proposed project calls for a 10- to 12-foot-deep harbor. This would totally eliminate 20 or more acres of eelgrass. Partial mitigation could be accomplished by moving the slips to deeper water to avoid dredging the intertidal area. Although most of the herring spawning occurs in the +2 to -4 MLLW range, more detailed analysis would have to be performed to determine how far out the slips would have to be moved to adequately minimize impacts.

2. Filling for upland development.

   The proposed project shows extensive filling of the intertidal zone for parking, shops, and other nonwater-dependent purposes. This fill would permanently eliminate 3 to 5 acres of potential herring spawning habitat. A more environmentally acceptable design would eliminate this fill, would substitute open-pile piers where water access is required, and would relocate other facilities to existing uplands.

3. Solid fill breakwater.

The proposed project calls for a continuous solid-fill breakwater. This structure would directly eliminate a significant amount of herring spawning habitat and would alter littoral drift patterns which may adversely affect existing eelgrass beds. This breakwater may also cause entrapment of juvenile salmonids and make them more vulnerable to predators. Design alternatives which would minimize adverse impacts include use of timber pile or floating breakwaters, where possible, gaps in the breakwater to allow salmonid passage, and moving the structure to deeper water to avoid fill in sensitive areas.

4. Future expansion.

The Tribe has stated that they are interested in expanding the marina to include the entire cove. Therefore, the project would have to be designed to satisfy this need with minimal environmental impact.

Because of the signficant resource values at the originally proposed site, another location is being evaluated. The Tribe now owns a 700+-acre diked seapond in Lummi Bay. It may be possible to construct a large marina inside this dike, creating uplands with spoils from a newly-created entrance channel. We have done a preliminary investigation of this site, including a site visit. We believe that, with careful planning, this site can be developed with far less resource degradation than the Gooseberry Point site. The dredged channel would have to be located along the existing river channel in order to avoid herring spawning habitat. The project would also have to be planned to avoid water quality problems in the boat basin. We are currently investigating this proposal and will provide further comments at a later date.

We look forward to working with your staff to develop a marina plan which satisfies the needs, and protects the natural resources, of the public.

Sincerely,

Lynn P. Childers
Acting Field Supervisor

JOHN SPELLMAN
Governor

DONALD W. MOOS
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6000

October 1, 1982

Ms. Gail Arnold
Seattle District
Corps of Engineers (NPSEN-PL-ER)
P.O. Box C-3755
Seattle, Washington 98124

Dear Gail:

Re: Lummi Indian Tribe - Small Boat Harbor Proposal

Our telephone conversation earlier this month superseded comments I had prepared on the above proposal which we received on 9/1/82. This initial response was directed mainly towards the (in my opinion) false assumption that water quality in the Sea Pond would improve if it were connected to the access channel via the newly constructed boat basin. I understand that this design feature has been deleted now.

Although our review capacity under the state's Shoreline Management Act in this proposal is limited because the project would be constructed entirely on Tribal lands, we are concerned about the impacts on local biota caused by dredging and disposing of bottom sediments well in excess of 1 million cubic yards; about the high project cost in light of the relatively small number of berthing generated for the general public; and spillover effects on the local communities as a result of the construction.

We encourage the Corps to give careful consideration to these points in the environmental analysis.

Sincerely,

Michael

Michael Ruef
Management Section
Shorelands Division

MR:sa

cc: Mike Rundlett

JOHN SPELLMAN
Governor

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia, Washington 98504 • (206) 459-6000

June 10, 1982

Colonel Norman C. Hintz
District Engineer
U.S. Corps of Engineers
P. O. Box C-3755
Seattle, WA 98124

Dear Colonel Hintz:

This letter is in response to your request for comments regarding the small boat harbor proposal near Gooseberry Point in Whatcom County. Our comments also relate to the discussion at the interagency meeting on May 26, 1982 and on the respective information package you furnished us.

We are primarily concerned about the potentially severe impact on marine resources from the proposed facility. The filling of high quality intertidal beaches for upland harbor area facilities and the dredging of approximately 170,000 cubic yards of sediment in the moorage area, would virtually destroy over 20 acres of combined eelgrass, shellfish beds, herring spawning grounds and dungeness crab habitat. In addition there may be spillover impacts on anadromous fish migration and rearing areas into contiguous shorelines. No effective means were demonstrated nor could any proven methods be identified that would compensate for such losses.

There appears to be uncertainty associated with the development of longterm trends and forecasts of the commercial fishing industry. While demands in pleasure boating are expected to remain ahead of facilities for at least the next decade, this situation is likely to be quite different in an industry which is affected by many factors from stock status and catch distribution, to offshore and in-sound regulation trends. A reliable and economically feasible projection of commercial mooring needs predicated on such variables as fleet expansions, transfers from other harbor facilities, ratios of Indian vs. non-Indian moorage needs and distribution of vessel types would be difficult to develop.

We, therefore, encourage efforts to consider a smaller facility and direct the attention toward alternative sites. This would not only tend to lessen environmental impacts but reduce the economic risks associated with the tentatively selected plan for more than 400 vessels. We recognize the constraints dictated by extensive non-Indian upland ownership and the scarcity

of upland areas which would be suitable for siting such a project. However, a marina or any similar facility should be built according to today's resource constraints, that is, it should be compatible with existing site characteristics rather than requiring their extensive modification until they fit the design.

Thank you for the opportunity to become involved at this early planning phase. We hope that our comments will be of assistance.

Sincerely,

D. Rodney Mack
Assistant Director
Office of Land Programs

DRM:kb

JOHN SPELLMAN
Governor

FRANK LOCKARD
Director

STATE OF WASHINGTON

DEPARTMENT OF GAME

Seattle Regional Office—500 Fairview Avenue North Seattle 98109 Telephone 464-7784

September 22, 1982

Ms. Gail Arnold
Environmental Coordinator
Army Corps of Engineers
Post Office Box C-3755
Seattle, Washington 98124

Re: Lummi Tribe 400 commercial boat marina at Sea Pond Site in Lummi Bay, Whatcom County

Dear Ms. Arnold:

Thank you for your scoping letter on the new location for the proposed marina. We appreciate this opportunity to provide comments.

Because the Sea Pond Site proposal would appear to remove less eelgrass, it would appear to have less impact on fish and wildlife than would the Gooseberry site proposal. However, there would still be some adverse impacts that could include loss of intertidal area, loss of some eelgrass, and disturbance to black brandt and eagle feeding. Our comments on the Gooseberry site are still relevant. See copy attached.

The Sea Pond site holds some very real potential for mitigation. Re-allignment of the existing dike could restore an area to intertidal productivity.

If an island-breakwater is seriously being considered, we would recommend a survey of benthic and aquatic resources that could be lost in such a proposal.

We look forward to providing more information at future scoping and planning meetings. If you have any questions, call us at 464-5874.

Sincerely,

Bob Zeigler

Bob Zeigler
Acting Habitat Biologist

BZ:bz

JOHN SPELLMAN
Governor

FRANK LOCKARD
Director

STATE OF WASHINGTON
DEPARTMENT OF GAME
600 North Capitol Way, GJ-11 • Olympia, Washington 98504 • (206) 753-5700

June 16, 1982

Ms. Gail Arnold
Environmental Coordinator
Army Corps of Engineers
Post Office Box C-3755
Seattle, Washington 98124

RE: Lummi Tribe's proposed commercial fishing boat marina for 400 boats in Lummi Flats, Lummi Bay, Sections 14, 15, 16, 21, 22, and 23, Township 38 North, Range 1 East, Whatcom County

Ms. Arnold,

Your request for information was reviewed by our staff; our comments follow.

From a brief site investigation, it would appear a marina sited inside the aquaculture area with a channel to deep water would have less impact on fish and wildlife than the Gooseberry Point site.

The original site southeast of Gooseberry Point supports large amounts of eelgrass and marine algae. A large amount of herring spawning had occurred in the area. Herring are an important food source for many types of animals, including marine mammals, waterfowl, and larger fishes. It is one of the primary sources of protein in Puget Sound. It is a critical wildlife as well as human food source. Eelgrass, upon which the herring had spawned, is an essential element in the diet of black brant. Eelgrass and other algae found in the area are important sources of primary production that initiate the food web for all marine animal life. If a marina was located at this site, we would need assurances there would be no dredging or filling required.

The Lummi Flats site appears to be less of a risk. However, some additional information would be needed. A sampling of benthic invertebrates and an aerial photo at low tide showing eelgrass beds would be important. A dive on the site by resource agency personnel would also be important. Potential impacts at this site could include fish entrapment, degraded water quality, and impacts to fish and wildlife resources from removing intertidal land through

dredging. At this site it would appear impacts may be reduced somewhat if the marina and necessary support facilities were sited inside of the existing aquaculture dike and adjacent uplands and if the channel avoided eelgrass and other marine algae in Lummi Bay. It appeared to be possible to design a channel around existing eelgrass beds and gravel at this site.

Lummi Bay supports an important population of black brant that feeds upon eelgrass and needs gravel each day. Large concentrations of black brant have been reported in Section 16. Game Department records show:

57	brant	were	observed	in	Lummi	Bay	on	December 23, 1980
100	"	"	"	"	"	"	"	February 19, 1981
350	"	"	"	"	"	"	"	March 12, 1981
1,100	"	"	"	"	"	"	"	April 15, 1981
20	"	"	"	"	"	"	"	May 3, 1981
110	"	"	"	"	"	"	"	February 10, 1982
1,000	"	"	"	"	"	"	"	April 6, 1982

The brant populations have been severely depressed since the late 1970's. As many as 4,000 black brant have been observed in Lummi Bay in April. Brant use the bay as a staging area in April as they migrate north from Mexico. They need eelgrass and gravel every day. Any reduction in these resources would impact the brant.

Another important brant staging area was Drayton Harbor to the north of Lummi Bay. Between 4,000 and 7,000 birds used that area. However, after the Drayton Harbor marina went in, use dropped off to not more than 100 birds. In effect, the marina eliminated Drayton Harbor as a brant staging area.

Other critical resources are found in Lummi Bay. Section 8 has an uncommon plant that is of special concern. It is Puccinellia nutkaensis, an atlas alkali grass. A wintering concentration of bald eagle has been reported in Section 14.

Because of the resources at this site, it is essential any channel avoid eelgrass, gravel, and other marine algae.

We look forward to reviewing baseline information you have. If you have any questions, please call us at 753-3318.

Sincerely,

THE DEPARTMENT OF GAME

for Bob Zeigler, Applied Ecologist
Environmental Affairs Program
Habitat Management Division

BZ:cv
cc: Agencies

JOHN SPELLMAN
Governor

ROLLAND A. SCHMITTEN
Director

STATE OF WASHINGTON
DEPARTMENT OF FISHERIES
115 General Administration Building • Olympia, Washington 98504 • (206) 753-6600 • (SCAN) 234-6600

September 24, 1982

Department of the Army
Seattle District
Corps of Engineers
P.O. Box 3755
Seattle, Washington 98124

Attention Mr. Dwain Hogan

Gentlemen:

This letter is in response to your request for comments regarding the proposed marina project at the diked Sea Pond located on the Lummi Indian Reservation. The following comments are based on my staff's initial review of this proposal.

Lummi Bay is important to a number of fish and shellfish species which utilize this area for spawning, rearing, and migrating purposes. Consideration must be given to minimizing project related short and long-term impacts to the fisheries resources of the area. Frequently, short-term impacts can be minimized by selection of proper construction methods and timing restrictions. An evaluation of the long-term impacts resulting from the construction of a marina basin and channel should include studies to address such questions as: 1) what will be the effect on Dungeness crab utilization and distribution within Lummi Bay, 2) will maintenance dredging increase sedimentation of the adjacent eel grass beds, and 3) will the marina basin and channel provide adequate water quality to support the fisheries resources presently found within the project boundary?

Results of WDF sponsored studies have shown that marinas attract and support large populations of salmon and marinefish juveniles. Consequently, water quality is a major issue in our review of marina proposals. A hydraulic model would provide us with the data needed to predict the exchange coefficient at various locations within the marina basin over a series of different tidal ranges. The gross exchange coefficient of the marina for a 1.82 m (6.0 foot) tidal range should average $\geq$ 30 percent and the lower 95 percent confidence limits for all local exchange coefficients should be $\geq$ 15 percent.

A commercial starry flounder trawl fishery and both a sport and commercial Dungeness crab fishery exists at the mouth of Lummi Bay. The proposed channel will direct boat traffic into these fishing areas, posing a conflict with the fishing vessels and their associated gear. We suggest that you contact the representative for the Washington State Inside Draggers Association, Mr. Shaun Waters at (206) 332-8497 and the representative for the Inner Sound Crabbers Association, Mr. Walt Ingram at (206) 671-9776 to discuss this issue in detail.

Thank you for the opportunity to comment. Should you have any questions, please contact Curtis Dahlgren at (206) 753-2908.

Sincerely,

for

Rolland A. Schmitten,
Director

JOHN SPELLMAN
Governor

JACOB THOMAS
Director

STATE OF WASHINGTON
OFFICE OF ARCHAEOLOGY AND HISTORIC PRESERVATION
111 West Twenty-First Avenue, KL-11 • Olympia, Washington 98504 • (206) 753-4011

September 27, 1982

Steven F. Dice, Chief
Environmental Resources Section
Seattle Dist., Corps of Engineers
P.O. Box C-3755
Seattle, WA 98124

Log Reference: 342-F-COE-S-03

Re: Access Channel and Small Boat Basin, Lummi Indian Reservation

Dear Dr. Dice:

We have reviewed the information you provided regarding the proposed access channel and small boat basin at the diked Sea Pond, Lummi Indian Reservation, Whatcom County.

Based upon the information provided for our review, which indicates all project activities will take place within Lummi Bay, we have determined that the proposed project will have no effect on known cultural resources.

Should project elements be considered that would occur landward, we would recommend that prominent consideration be given to cultural resource concerns.

Sincerely,

Robert G. Whitlam, Ph.D.
Archaeologist

dj

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT: Fisheries EXT 228

June 29, 1983

Mr. Charles A. Dunn
Field Supervisor
U.S. Fish & Wildlife Service, Ecological Services
2625 Parkmont Lane SW. BLDG. B-3
Olympia, WA 98502

RE: Comments to USFW Coordination Act Report on the Lummi Bay Marina Project to the Corps of Engineers.

Dear Mr. Dunn:

The Lummi Aquaculture and Natural Resource Offices of the Lummi Tribe have reviewed your Coordination Act Report for the Lummi Bay Marina Project. Your assessment of the environmental impacts were, in our judgement, clearly stated as was the description of the project, given the preliminary nature of the design at present. We have a few additions that may be of importance in the assessment of the project in the future. Our comments are attached.

We hope these comments will be helpful and we appreciate your cooperation and field support during the early phases of this project.

Sincerely,

Jewell P.W. James, Director
Lummi Indian Fisheries

Michael T. MacKay
Fisheries Environmental Biologist

JPWJ/cm

USFW Coordination Act Report Comments for the Lummi Bay Marina
From - Mike MacKay, Enviromental Biologist

Page # Comments/Additions:

4. B. Biological Features, Lummi Bay

1. Salmon

"A large number of juvenile salmoids are expected to rear and migrate through ~~Hale-Passage~~ Lummi Bay.~~area~~. This would include Lummi Seapond releases and steelhead, ~~and~~ coho, chum, pink, and chinook salmon from nearby river systems."

2. Herring

"Spawning in the Bay has been is relatively light and spotty compared to adjacent areas. In the past 3 years, however, spawning has been more frequent. In 1983, 628 tons or approximately 8% of the spawn for the Straits of Georgia herring population was found in Lummi Bay. Most spawning in ~~Lummi~~ the Bay..."

7. Add

6. Waterfowl

Extensive use by scoters, bonaparte gulls, and other diving ducks in April & May which feed on herring eggs following spawn events.

6. Add

9. Water Quality

The marine water quality in Lummi Bay has been designated Class AA (Extraordinary) by the Washington Department of Ecology.[1] This rating is based on several criteria including coliform counts, dissolved oxygen, and concentration of toxic pollutants. Characteristic uses under this designation includes salmonoid rearing and migration; clam, oyster, and mussel rearing, spawning, and harvesting. Harbor areas such as Bellingham Bay generally have a lower rating (eg. Class A) because of their proximity to industrial activities and sewer outfalls.

10. Aquaculture

The aquaculture utilization of Lummi Bay outside of the existing Sea Ponds is limited to a small commercial oyster bed located in the eastern portion of the Bay. At present these mudflats a certifiable by the Department of Social & Health Services, allowing commercial shellfish harvesting throughout the Bay.

The oyster hatchery uses water taken from the northeastern portion of the bay (intake at the 1st tide gate on the dike from the east).

1. WAC 173-201-085 (24)

PAGE #	Comments/Additions
9.	A. Salmon "Marina-related pollutants will probably inhibit productivity ~~to some extent~~. and could have low level toxic effects to juveniles if they remain in the marina for an extended period of time.
15.	Add to Section"D. - Assumptions": 7. Maintenance dredging projections are accurate. (40,000 cubic yards at 5 - year intervals)

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180

DEPARTMENT:_____ EXT_____

April 11, 1983

Colonel Norman C. Hintz
District Engineer
Seattle District, Corps of Engineers
Post Office Box C-3755
Seattle, Washington 98124

Dear Colonel Hintz:

This letter is in reference to our proposed small boat harbor project at the Sea Pond site in Lummi Bay, Whatcom County, Washington. We are pleased with the project layout developed by your staff in close cooperation with the Lummi Tribe. We have reviewed the project construction cost estimate, presently amounting to approximately 4 million dollars, for the Federal, or general navigation features of this project. These involve access channels, turning basin, breaching the existing Sea Pond dike to create the harbor entrance, rock slope protection along the dike, timber pile breakwater adjacent to the harbor entrance, and U.S. Coast Guard navigation aids. We understand that under cost sharing policy the Federal Government will also maintain these same general navigation features.

We are aware that our share of the Federal general navigation features construction cost is currently estimated to be approximately 2 million dollars. We are also aware that it is our responsibility as the project local sponsor to design, construct, and maintain all remaining project features, including all interior dike work, harbor moorage area dredging, mooring facilities, and all necessary shoreside features. In addition to our 2 million dollar share of the Federal general navigation features cost, we expect to invest approximately 2.8 million dollars to complete construction of all remaining non-Federal project development costs. The Tribe is financially capable of raising these funds and expects to use the following financial sources:

a. Bureau of Indian Affairs, Economic Development Grant
b. Bureau of Indian Affairs, Guaranteed Loans

As project local sponsor, we are also aware of, and intend to provide, all applicable items of local cooperation in order to assure construction of the Federal project, including the following:

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

b. Accomplish, without cost to the United States, all alterations and relocations as required of buildings, roads, utilities, and other structures and improvements.

c. Hold and save the United States free from 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.

d. Provide and maintain, without cost to the United States, adequate breathing areas, local access channels with depths commensurate with those in the project improvements, necessary mooring facilities, utilities, a public landing with suitable water supply, essential sanitary facilities, parking areas, and access roads open to all on equal terms.

e. Provide a cash contribution equal to the appropriate non-Federal or local percentage of the final project costs allocated to general navigation.

f. Pay all project costs in excess of Federal cost limitations of 2 million dollars as provided in Public Law 86-645.

The Lummi Indian Tribe further agrees to the following:

a. Comply with Sections 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) that no persons shall be excluded from participation in, denied the benefits of, or be subjected to discrimination in connection with a Federal project on the grounds of race, color, or national origin.

b. Comply with sections 210 and 305 of Public Law 92-646, approved January 2, 1978, and entitled the "Uniform Relocation Assistance and Property Acquisition Policies Act of 1970."

Colonel Norman C. Hintz
District Engineer
Seattle District Corps of Engineers

April 11, 1983

The Lummi Indian Tribe of the State of Washington possesses the authority and capability under the Washington State constitution and other law to furnish non-Federal cooperation required by the Federal legislation that authorizes the project.

Accordingly, the Lummi Indian Tribe requests that you proceed with final design and cost studies leading to completion of the detailed project report.

Sincerely,

Fred F. Lane, Vice-Chairman/
Acting Chairman
Lummi Indian Business Council

cc: David Oreiro, Lummi Tribal Planner

FFL:nb

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT: FISHERIES EXT 216

December 14, 1982

Dale Evans, Division Chief
National Marine Fisheries Service
Environmental & Technical Services
847 NE 19th Avenue, Suite 350
Portland, Oregon 97232

Environmental Resources Section
U.S. Army Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Dear People,

This letter is in response to a letter dated November 4, 1982, from National Marine Fisheries Service to the Lummi Fisheries Office, regarding the marina proposed at the Lummi Sea Pond. We understand this letter to be a suggested sampling program for more biological information to assist the planning process, and agency evaluation of environmental effects of the proposed small boat basin.

We would like to refer NMFS to several documents which we feel contain much of the information suggested in the sampling plan, as well as much more information that has been collected during the years the Sea Pond has been in operation. We respectfully remind NMFS that this site has been under biological study since its construction.

The first document is the "EDA FINAL REPORT" (see reference below), pages 36-53. A copy of this report is at the Corps of Engineers Office in Seattle. This report contains extensive water quality data and information about the benthic community, from some 30 sample sites both for Lummi Bay and the Sea Pond. We suggest that this information is still valuable, and could easily be field checked for any possible significant changes.

The second document is a letter from the Lummi Fisheries Office to Dwain Hogan, Army Corps of Engineers, dated September 24, 1982. This contains a summary of summer field work done by Lummi Fisheries staff to gather data for this environmental impact statement. It includes a discussion of possible environmental effects, as well as data from beach seining performed this summer inside the pond.

In regard to NMFS suggestions about core sampling, Lummi Fisheries feels that the sampling performed by the Corps of Engineers in the last year, and the data in the EDA report, will allow adequate environmental assessment.

Lummi Fisheries would be willing to augment biological information by surveying zooplankton during the winter and spring, and to take water quality data during the same time to check on the continuing relevance of the data in the EDA report. The short time frame for the EIS may make this information useful, but not available for inclusion in the EIS.

In summary, we feel that the data from the EDA survey period, and the data collected in the last year by Lummi Fisheries staff and the Corps, will be adequate for environmental assessment. Further studies of zooplankton and possibly comparative species diversity studies inside and outside the dike would be valuable.

We suggest to NMFS that sufficient information does exist to evaluate the environmental consequences of this project. We further remind NMFS that one of the reasons the Sea Pond site was chosen over another alternative site at Goosebury Point, was that better biological information existed about the Sea Pond and becuase the impact to the biological communities on the Lummi Peninsula would be lessened by the re-siting of the proposed marina project.

We appreciate the efforts of NMFS to monitor propsed environmental impacts in important marine areas. We suggest that, in fact, much more data than the suggested minimum already exists about this project. We welcome comments on this letter, and further suggestions about necessary field data, and we also suggest to NMFS that the environmental information on this project is more than adequate for good impact assessment.

Sincerely,

Paul Hage
Management Biologist

Reference: Heath, W.G., M.C. King, & R.T. Patton, Lummi Aquaculture: Final Report to the Economic Development Administration, Grant No. 07-6-09226-2, September, 1975

Enclosures:

PH:JEC:kb

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT Fisheries Management EXT 236

September 24, 1982

Mr. Dwain F. Hogan, P.E.
Army Corps of Engineers
Post Office Box C-3755
Seattle, Washington 98124

Dear Mr. Hogan:

Enclosed you will find summaries of field work that was outlined in our letter to you dated August 23, 1982. Also attached is a general discussion of possible environmental concerns from the Lummi Bay Marina Project and suggestions for additional field studies to monitor these possible impacts.

Should you have any questions concerning this material please don't hesitate to contact our office.

Sincerely,

FOR -
Jewell P.W. James, Fisheries Director

Michael T. MacKay, Fisheries Biologist

MTK/jb
Enclosures: 5

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT: Fisheries Management EXT 236

TO: Lummi Indian Business Council

FROM: Jewell P.W. James, Fisheries Director
Michael T. MacKay, Fisheries Biologist

DATE: September 24, 1982

RE: Discussion of Possible Environmental Impacts from a Marina in Lummi Bay.

The Lummi Fisheries Department has completed a preiminary investigation of some environmental impacts which could be expected from construction & operation of a small boat harbor in the Aquaculture Dike. It is very difficult to predict these changes without concentrated research. Even then, the complexity of the biological world limits our prediction to little more than an educated guess.

Because of the short time period allowed for these studys(approximately 12 months to the completion of the Draft Environmental Impact Statement), we will have to be content with a very general understanding of changes that will eventually occur as the Marina becomes a reality. The following is a preview of what may eventually be considered as the environmental trade-offs of having a Marina in Lummi Bay. Several impacts may appear to be relatively slight, but when combined they may have visible effects. Cummulative impacts are very difficult to identify and because of this are the most damaging to marine resources in the long run.

Here is a list of the more significant impacts that could occur:

PRELIMENARY SUMMARY of POSSIBLE IMAPACTS from a MARINA IN the AQUACULTURE DIKE

A. Impacts During Construction:

1. Mortalities of an unknown number of benthic organism during the dredging of the access channel and boat basin and filling of the upland area. These resources include:

   juvenile & adult Dungness Crab

   various species of Flounder

   Japanese Little Neck Clams

   Cockles

   Horse Clams

   Bent Nose Clams

   Kelp & Rock Crabs

   Flat worms, Sand Shrimp, Etc.

2. Loss of a limited amount of eelgrass and few other algaes during the dredging of the access channel.

3. Possible avoidance by mobile species that inhabit Lummi Bay due to the lowered water quality during dredging activities. These include:

   adult & juvenile Salmonids

   adult & larval herring

   adult & juvenile Dungess Crab

   Marine Mammals

4. Damage to benthic organisms and avoidance by mobile species at the offshore dump site if one is needed for the dredging material.

B. Impacts After Construction:

1. All of the impacts listed above during periods of "maintenance dredging". (The time interval is unknown at present, it may be needed every 5 years or more often.)

2. Water Quaility Impacts. The lowered water quality from a marina environment (oil,gas,organic wastes,bottom paint, etc.) have effects that range from mortalities to fish and their eggs to avoidance by these species to a more

favorable environment.

3. Increased risk of Red Tide contamination due to organic wastes from the marina environment (human wastes, fish processing wastes, etc.)

4. Localized changes near the dredged channel in beach sand movement, current patterns, water temperatures & salinities etc.

5. Possible damage to eelgrass and other alages as a result of items # 1,2, & 4 above. This could impact herring production to a limited degree as spawning occurs in Lummi Bay on either side of the proposed acess channel.

C. Impacts from Accidents Associated with the Operation of the Marina:

1. Oil spills from difficulties at the fuel pier, collisions between vessels, and discharges of bilge water. The effects of any spill of toxic material is greatly dependant on the wind and tide conditions, the quantity of the spill, the proximity to the resources that may be affected (see items A,1. & A,2.). One additional impact that could develope if the spill is not contained is the contamination of hatchary intake water at the Sea Pond Facility. Damages as a result of contact with these toxic products range from no effect to death and may take on several intermediate forms such as abnormal or slow growth, reduced fecundity (ability to produce eggs), and reduced mobility.

2. Spills of other toxic materials from vessels or processing plants located on the waterfront. The effects are similar to those stated above and vary widely depending on the toxicity and the quantity of the material spilled. The number of toxins transported and used on the waterfront is lengthy. Some of the common types are: detergants, bottom paints, solvants, thinners, paint removers, antifreeze, etc.

Because so many possible impacts exist, there is a need to single out those which are potentially the most damaging. Of all the possibilities, the last two have the greatest impact and are not unusual occurances as more toxic materials are being handled and used as a part of the maritime trades. Fortunately much can be done to prevent spills through the proper design of vessels and their shore facilities. It is suggested that these designs allow for the deployment of oil spill containment booms near the marina site and that adequate gear is available to recover and minimize the impacts of a spill in Lummi Bay, should it occur in the future. Some means should be developed also for non-floating spills that might also be possible in the day to day operation of the marina.

Chronic water quality impacts can best be evaluated by encouraging the following investigations:

1. A monitoring program that periodically samples the important habitats within Lummi Bay for hydrocarbons and other toxic substances which may be damaging to the significant marine resources in the area.

2. Identify areas of particular importance to juvinile salmonids, herring larvae, juvinile and adult Dungenese crab.

3. Monitor changes in water temperature and salinity that may occur after completion of the project. Determine if flushing of the marina is adequate under several combinations of wind and tide.

This concludes our impact review of the Lummi Bay Marina Project. A more detailed report will be made in February, 1983 prior to the Corps of Engineers writing of the Draft Enviromental Impact Statement.

Please contact our office if you have any questions or if your concerns have been overlooked in this preliminary report.

Sincerely,

Jewell P.W. James, Fisheries Director

PRELIMINARY ASSESSMENT OF MARINE RESOURCES IN LUMMI BAY

Beach Seining in Lummi Dike
At the Proposed Marina Site

Four beach seine sets were made along the inside perimeter where dredge and fill activities are proposed during the marina construction. This sampling took place on September 21st and would not indicate the importance to salmonid fry who would be expected to use this estuary-like environment during the spring and early summer months. More intense sampling during this period should be made prior to the final report to assess the impacts to juvenile salmonids from such dredge and fill activities.

The map on page 2 shows the location of each set made. At the time of sampling (0945-1100) the tide was ebbing from 7.1 to 3.7' but this was not evident within the dike due to the tide gates control of the water level. The weather was calm and overcast. The net used was of 1/4 mesh and approximately 13 fathoms long on the lead line.

Results

Sculpins were by far the most abundant. Sticklebacks, although capable of passing through the seine, were also numerous. Next in abundance were shiner perch which averaged approximately 3 cm in length. Starry flounder were also found that ranged from 7.5 to 9.1 cm. Two herring (6.6 and 7.7 cm.) were found at station no. 4.

Kelp, shore, and hermit crabs were discovered in most sets. No Dungenese were found however.

The seaweed which dominated the shoreline is Zostera with some pieces of Ulva intermixed. Several unidentified egg masses were found in 3 of the 4 sets. Tubesnouts and one gunnel were also found in the catch.

The table on page 3 summarizes our data during this limited survey effort inside the dike. We suggest further sampling, especially in the spring, to document the probable presence of salmonid fry inside the Lummi Aqualculture Dike.

BEACH SEINING IN AQUACULTURE DIKE
ON JULY 15, 1982

SPECIES	SET #1	#2	#3	#4
Pacific herring (Clupea pallasii)	-0-	-0-	-0-	2
Shiner Seaperch (Cymatogaster aggregata)	15	1	10	-0-
Starry flounder (Platichthys stellatus)	3	7	3	-0-
Three spine stickleback (Gasterosteus aculeatus)	26	-0-	-0-	4
Staghorn & Misc. sclupins (family Cottidae)	30	31	37	9
Tubesnout (Aulorhynchus flavidus)	3	2	-0-	1
Gunnel (Pholis sp.)	1	-0-	-0-	-0-
Kelp Crab (Pugettia producta)	2	5	1	1
Shoe Crab (Hemigrapsus sp.)	2	-0-	1	3
Hermit Crab ( )	26	P	P	P
Eelgrass (Zostera)	P	P	P	P
Sea lettuce (Ulva)	P	P	P	P

P = Present, uncounted

MM:nb 09/29/82

Lummi Bay Benthic Sampling

On-August 3, 1982, benthic and clam samples were taken at five stations along the proposed access channel to the existing Lummi Aquaculture Dike. Sampling locations are shown on the attached map. In each case a hole 4 square feet was dug with shovels to depths where no more bethic organisms were found, generally 14 to 16 inches. These methods are similar to those used in past years to inventory the shellfish resources on the reservation beaches by the Lummi Fisheries Office.

Weather was overcast and cool and the wind was south easterly 10 to 15 miles per hour. The tide was low (-1.2) at 1045. All sampling was performed between 0950 and 1230. Bouys marking the proposed dredging were repositioned as necessary to locate the center of the channel. At station number 3, a side channel entering from the east was found to have a velocity at low tide of 2.0 feet/sec. This was near sections of b re sand with wave impressions that illustrate the movements of sand that is preventing eelgrass from establishing itself in some areas. The presence of younger eelgrass beds (with narrow blades) are further indications that bed movements near this network of channels is contributing to shifting natches of ellgrass. The thicker blades in other patches indicate year-round growth and a stable sand substrate.

Benthic Sampling in Lummi Bay
3 August 82

(Stations were located along the route of proposed entrance channel).
Sample location = see attached chart of Lummi Bay
Sample area = 4 feet^2
Sample depth = to 14"

Sta. #	Bivalues		Other Benthos	Substrate
	#	Species		
#1	11	Venerupis japonica	1 sand shrimp	coarse sand near 1-1 prap
	6	Tresus capox		
	4	Malcoma na·suta		
#2	3	Tresus capox	1 sand shrimp	fine sand
		Venerupis japonica	2 flat worms	
			eelgrass	
#3		None	13-17 flatworms eelgrass and filimentous algae	fine sand
#4		None	7 worms 1 sand flea	coarse sand
*#5	6	Clinocordum nuttalli	1 cancer productus brittle star many worms*	coarse sand

* sample collected

MM:nb 9/22/82

Lummi Bay EIS References

1 Lummi Fisheries Shellfish Inventory

2 Mike Nelson's M.S. Thesis

Species List

Venerupis japonica (Jap. little-neck)

Clinocardium nuttalli (cockles)

Tresus capox (horse clam)

Malcoma na suta (bent nose clam)

Cancer magister (Dungeness crab)

Cancer productus (red rock crab)

Scuba Survey in Lummi Bay

On July 15, 1982, we conducted a scuba survey near station no. 5 (see attached map) to determine the presence of juvenile dungeness crab along the proposed entrance channel to the Lummi Aquaculture Dike.

The dive was started near the outermost portion of the channel site in 5 to 10 feet of water as the tide was ebbing from 8.5' to 4.6'. Time in the water was approximately 75 minutes (1512 to 1620). The wind was increasing from the southeast 8 to 12 knots. Visibility remained approximately 12' throughout the dive.

A total of 13 small dungenese crabs were found, generally along the margins of the eelgrass beds in the channel where they were easier to spot. Most were one year olds (4.0-4.5) with about equal numbers of males as females. One crab that measured 75 cm may have been 2 years of age. One larger adult was found 17 cm in length. Several smaller juveniles were also found hiding beneath large horse clam shells that littered the 1 - 2' deep channel running through this section of the eelgrass beds. Cockle shells were also present. The outer section of channel surveyed contained many live cockles, evident by their exposed siphons. A few live horse clams were also located in this channel (larger siphons than the cockles).

The presence of flounder in the channel was indicated by several impressions of their outline in the sand. A few darted away before they could be positively identified.

Kelp and hermit crab were also seen along with an unidentified species approximately 10 cms covered with fine hairs but having a shell shape similar to the dungenese. Exposed polychaetes and one blenny were also seen. The dominant algae was Zostria with only small patches of Ulva.

MM:nb 09/22/82

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT: Fisheries EXT 237/236

August 23, 1982

Mr. Dwain F. Hogan, P.E.
Army Corps of Engineers
Post Office Box C-3755
Seattle, Washington 98124

Dear Mr. Hogan:

In regards to your letter dated August 12, 1982, we are capable of providing only limited information by September 24th on the "significant biological components" at the Lummi Bay Project Site. These studies are by no means complete or representative of what should be done prior to the writing of the Draft EIS, but will give some indication of those resources present. Our involvement with other fisheries studies in the next month (Spring Chinook spawn surveys) limits our involvement to performing the following tasks:

1) Quantification of eelgrass beds that would be disturbed by dredging and comparison with all available algaes in Lummi Bay used as spawning substrate by herring (from aerial photos).

2) Field report of one day of clam/benthic sampling along the proposed entrance channel.

3) Field report of beach seining within the dike and outside the channel location. This is only a limited effort of 4 - 6 sets at a period of time when juvenile salmon are not abundant in intertidal areas.

4) Field report of two dives along channel location. Further efforts would be necessary to quantify the relative importance of the channel site to juvenile dungenese crab.

5) Summary of impacts to significant marine resources expected from this project and recommendations for further work prior to completion of the EIS.

Prior to February 1983, we will be able to provide additional information which will asssit you in preparing the Draft EIS. This will include:

Mr. Dwain F. Hogan
Army Corps of Engineers
August 23, 1982

1) Packet of information and references on herring resources in the vicinity of the project.

2) Collection of information on the timing and expected occurrence of juvenile salmonoids in Lummi Bay.

3) Summary of water quality measurements collected by the Tribe in Lummi Bay.

4) Literature review of sources that may provide information n the significant marine resources of Lummi Bay.

Please contact this office if you have any questions concerning our participation in the collection of information for the Lummi Bay Marina EIS.

Sincerely,

Michael T. MacKay, Biologist
Lummi Fisheries Department
Lummi Indian Tribe

Jewell P.W. James, Director
Lummi Fisheries Department
Lummi Indian Tribe

cc: Chairman's Office

MTM:nb

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT: Reservation Attorney EXT. 223

August 23, 1982

Andy Maser
United States Corp of Engineers
Post Office Box C-3755
Seattle, WA 98124

RE: Lummi Boundaries

Dear Mr. Maser:

You have asked for a description of the legal precedents and documents substantiating ownership of the tidelands on the Lummi Indian Reservation in the Lummi Tribe. There is no single document which specifically and explicitly sets up ownership in the Tribe. A number of reported legal cases plus the Executive Order setting the boundaries of the reservation combine to establish ownership of these tidelands in the Tribe.

The Treaty of Point Elliott set aside the island of Cha-choosen between the mouths of the Lummi (now called the Nooksack) River as the northern most reservation described in that treaty. The exact boundaries of the reservation, however, were not set out until 1873 when President Grant signed an Executive Order. A copy of that very brief order is attached. Basically it is a legal description of the reservation.

You will note that the seaward boundary is the "low water mark". I am sure that you are aware that several different definitions of low water exist. The Washington State Supreme Court has construed the term "low water" where a Indian reservation boundary is concerned as meaning extreme low water. State v. Edwards, 188 Wash. 467 (1936). Thus, the seaward boundary of the reservation is at least the extreme low tideline.

In one fairly early case the U.S. Supreme Court rather arbitrarily decided that where a reservation was created for fishing purposes it impliedly included the waters for a quarter

mile around the reservation, even though no mention of the waters was included in the language creating the reservation. Alaska Pacific Fisheries v. U.S. 248 U.S. 78 (1918). Consequently, it is not possible to state with assurance where the outermost limits of the reservation boundaries may be. It is possible to state that the outer most boundary is at least extreme low water mark since that point is mentioned in the Executive Order.

The fact that the reservation boundary extends at least to extreme low water does not necessarily mean that the tidelands are tribally owned. The upland portion of the reservation was divided up among the various tribal members beginning about 1884. Several lawsuits arose over whether this allotment or assignment of the uplands included the tidelands. The federal courts have uniformly answered this question in the negative, holding that the tidelands area belong to the Tribe. See United States v. Romaine, 255 F. 253, U.S. v. Stotts, 49 F. 2d. 619 and United States v. Boynton 53 F. 2d. 297. Boynton is especially important in that it holds that land which was included within an upland allotment but which has subsequently eroded by wave action becomes the property of the tideland owner, in this case the tribe. This case also referred to mean high water as the landward boundary of the tidelands.

If you or your legal council have any questions regarding this situation please contract me either at the reservation 734-8180 or at my office in Bellingham 647-0234.

Sincerely,

Harry L. Johnsen
Reservation Attorney

HLJ/kg

cc: Carl Reichard
Dave Oreiro

middle of the mouth of the Hoh River, Jefferson County, Washington, and running thence up said river in the middle of the channel thereof one mile; thence due south to the south bank of said river; thence due south from said south bank one mile; thence due west to the Pacific Ocean, and thence with the Pacific coast line to the place of beginning, be, and the same are hereby, withdrawn from sale and settlement and set apart as a reservation for the Hoh Indians not now residing upon any Indian reservation: *Provided, however*, That any tract or tracts, if any, the title to which has passed out of the United States, or to which valid legal rights have attached under existing laws of the United States providing for the disposition of the public domain, are hereby excepted and excluded from the reservation hereby created.

GROVER CLEVELAND.

Lummi Reserve.

[In Tulalip Agency, occupied by Dwamish, Ekaimat, Lummi, Snohomish, Sukwamish, and Swinamish; treaty of January 22, 1855.]

EXECUTIVE MANSION, *November 22, 1873.*

It is hereby ordered that the following tract of country in Washington Territory be withdrawn from sale and set apart for the use and occupation of the Dwamish and other allied tribes of Indians, viz: Commencing at the eastern mouth of Lummi River; thence up said river to the point where it is intersected by the line between sections 7 and 8 of township 38 north, range 2 east of the Willamette meridian; thence due north on said section line to the township line between townships 38 and 39; thence west along said township line to the low-water mark on the shore of the Gulf of Georgia; then southerly and easterly along the said shore, with the meanders thereof, across the western mouth of Lummi River, and around Point Francis; thence northeasterly to the place of beginning; so much thereof as lies south of the west fork of the Lummi River being a part of the island already set apart by the second article of the treaty with the Dwamish and other allied tribes of Indians, made and concluded January 22, 1857. (Stats. at Large, vol. 12, p. 928.)

U. S. GRANT.

Makah Reserve.

[In Neah Bay Agency; occupied by Makah and Quillente Area 9 square miles; treaty January 31, 1855.]

EXECUTIVE MANSION, *October 26, 1872.*

In addition to the reservation provided for by the second article of the treaty concluded January 31, 1855, with the Makah Indians of Washington Territory, it is hereby ordered that there be withdrawn from sale and set apart for the use of the said Makah and other Indians a tract of country in the said Territory of Washington, described and bounded as follows, viz: Commencing on the beach at the mouth of a small brook running into Neah Bay next to the site of the old Spanish fort; thence along the shore of said bay in a northeasterly direction to Baadah Point (being a point about 4 miles from the beginning); thence in a direct line south 6 miles; thence in a direct line west to the Pacific shore; thence northwardly along the shore of the Pacific to the mouth of a small stream running into the bay on the south side of Cape Flattery, a little above the Waatch Village; thence following said brook to its source; thence in a straight line to the place of beginning; the boundary line from the mouth of the brook last

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA RD. • BELLINGHAM, WASHINGTON 98226-9298 • (206) 734-8180
DEPARTMENT: Planning EXT. 202

June 23, 1982

Mr. Frank Urubeck
Chief of Navigation and Coastal Planning
Seattle District Corp of Engineers
P.O. Box C-3755
Seattle, Washington 98124

Subject: Lummi Marina

Dear Mr. Urubeck:

As a result of a number of factors including agency review of the environmental considerations of the Gooseberry site, and concerns of nearby upland owners, the Lummi Indian Business Council has elected to examine alternative sites for the proposed marina.

After a reevaluation of the various alternative sites, it has been determined that the Sea Pond site is the only potentially acceptable alternative, and that no further study of the Gooseberry site is warranted by the Corp of Engineers.

As a result of a preliminary cost analysis of the Sea Pond site, it is recognized that the cost would be greater than that of the Gooseberry site, but we are confidant that a financial package can be put together to cover the increased local share of the federal project.

Therefore, we request that the Corp of Engineers continue a study at the Sea Pond site, and pledge our assistance in resolving any project related engineering, environmental, and/or social concerns.

Sincerely,

Edward L. Jones

Edward L. Jones
Vice Chairman and Acting Chairman
LUMMI INDIAN BUSINESS COUNCIL

ELJ:ah
c.c. Planning Department, LIBC

LUMMI INDIAN BUSINESS COUNCIL
2616 KWINA ROAD, BELLINGHAM, WASHINGTON 98225 206/734-8180

June 27, 1980

Colonel John A. Poteat
District Engineer
Seattle District, Corps of Engineers
Post Office Box C - 3755
Seattle, Washington 98124

Dear Colonel Poteat:

The Lummi Indian Business Council hereby requests Federal assistance in the construction of a breakwater at Gooseberry Point site, in Hales Pass, Whatcom County. The breakwater will constitute a portion of the proposed Lummi Marina development.

The Lummi Indian Business Council is aware of and fully intends to provide the appropriate assurances, commensurate with local sponsorship of the breakwater construction project, and therefore requests the Corps of Engineers to pursue the subject project under Section 107 of the 1960 Rivers and Harbors Act, as ammended.

The specific items of local cooperation associated with the Lummi breakwater project will be formalized during the detailed project report phase.

Mr. David Oreiro, Director of Planning, (206-734-8180) will co-ordinate the Lummi Marina Project for the Lummi Indian Business Council, while Mr. Bernie Thomas (206-734-1030) will represent the Lummi Indian Tribal Enterprises.

Sincerely,

William E. Jones

William E. Jones, Chairman
Lummi Indian Business Council

WEJ:et

PORT OF BELLINGHAM

625 Cornwall Avenue
P.O. Box 1737
Bellingham, Washington 98227
Phone (206) 676-2500

June 6, 1983

Department of the Army
Seattle District, Corps of Engineers
P. O. Box C-3755
Seattle, Washington 98124

Attention: Planning Branch
Mr. Duain F. Hogan, P.E.
Chief, Planning Branch

This letter will convey to you the reaction of the Port of Bellingham to your program to develop a boat harbor on Lummi Bay, Washington, in conjunction with the Lummi Indian Tribe.

The Commissioners of the Port of Bellingham discussed this project at their June 3 public meeting and voted unanimously to endorse and support the project.

In addition, our staff has evaluated the proposal and confirms the assessment set forth on Page 2 of 18 May 1983 letter. Other detailed comments are:

A. The boat maneuvering space in front of the fish unloading piers is rather narrow and we suggest widening this space;

B. Would a public boat launch ramp, complete with vehicle/trailer parking, be a desirable feature in this harbor?

C. Will this harbor be open to all on an equal basis, as required of all other boat harbor projects which receive federal funding?

D. Provisions should be made to allow for expansion of the harbor in the future, if that be possible inside the Aquaculture dike,

Finally, we reiterate our position of support for the Lummi Seapond Marina.

Very truly yours,

PORT OF BELLINGHAM

Thomas J. Glenn
General Manager

TJG/gl

B-2-25 (1 of 1)

PORT OF BELLINGHAM

COMMISSIONERS
T B Asmundson
Kenneth McAuley
Peter Zuanich

625 Cornwall Avenue
P.O. Box 1737
Bellingham, Washington 98227
Phone (206) 676-2500

STAFF
Thomas J Glenn — General Manager
Hugh M Wilson — Trade Development and Ocean Terminals Manager
Donald W Elks — Engineer
Marvin E Copeland — Controller
James G Bell — Counsel

September 22, 1982

Department of the Army
Seattle District, Corps of Engineers
P. O. Box C-3755
Seattle, Washington 98124

NPSEN-PL-ER

Gentlemen:

This will reply to your request for comments on the Sea Pond Boat Harbor proposed for construction on the Lummi Indian Reservation.

The Port of Bellingham tenders herewith its firm support of the efforts of the Lummi Tribe to develop a boat harbor on their Reservation property. Our own efforts to provide moorage for Whatcom County boaters in both Blaine Harbor and Squalicum Harbor convince us that the need for expanded boat moorage will continue for the foreseeable future. Development of a boat harbor on Lummi property will serve our northwest community in every way that siting it elsewhere here could accomplish.

We are aware that the Sea Pond Project will necessarily be required to fulfill all environmental regulations and that these matters will be dealt with by regulatory agencies.

Our review of the small boat population figures on Pages 14 and 15 of your 12 May evalatuion for the Gooseberry Point Harbor confirms that these numbers, to the best of our understanding, are accurate.

The location of the Sea Pond Project puts it much closer to both local fishing grounds and cruising areas. Accordingly we believe moorage in the new harbor will be highly attractive to both commercial fishermen and pleasure boaters.

We can also easily visualize extensive shoreside development adjoining the Sea Pond Project. The harbor and its users will need services such as boat haul-out and repair, mechanical maintenance, fish unloading, processing and distribution, and in the future likely cold storage facilities.

We recommend that a long range plan of development for both the waterborne and shoreside facilities be prepared at an early date and include the capability of expansion of the harbor itself in a ten to twenty year time frame.

Again, we affirm our strong support of the Lummi Harbor Project.

Very truly yours,

PORT OF BELLINGHAM

Thomas J. Glenn
General Manager

TJG:mr

cc--Lummi Tribal Office
ATTN: Mr. David Oreiro, Planner

PORT OF BELLINGHAM

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James G. Bell — Counsel

August 27, 1982

Mr. Dwain F. Hogan, P.E.
Chief, Planning Branch
Seattle District, Corps of Engineers
P. O. Box C-3755
Seattle, Washington 98124

NPSEN-PL-ER

Dear Mr. Hogan:

This will reply to your letter dated 26 August requesting comments on the proposed Sea Pond Small Boat Harbor and Navigation Channel on the Lummi Reservation, Whatcom County.

We at the Port of Bellingham, as you in the Seattle District Office well know, have been building projects jointly with the Corps for many years and providing boat harbor facilities for and services to the people of Whatcom County. Looking ahead to continued future growth of small boat population in the Northwest and at the same time realizing that waterfront properties available for continued boat harbor development in Whatcom County are in extremely short supply, we have over the years encouraged the Lummis to develop a boat harbor on their valuable and attractive properties in Western Whatcom County. We have in fact invested a good deal of staff time exploring alternatives with the Lummis and supporting their efforts in every way possible.

We were encouraged by the progress they were making with you on the Gooseberry Point site. In your current letter this site is dismissed with a single short sentence. "...primarily because of environmental and land use concerns."

We would very much like for you to furnish us with a detailed description of those environmental and land use concerns. Following receipt of that information, we shall be pleased to comment on the Sea Pond Harbor proposal.

Very truly yours,

PORT OF BELLINGHAM

Thomas J. Glenn
General Manager

TJG:mr

c/Lummi Tribal Office
ATTN: Mr. David Oreiro

B-2-27 (1 of 1)

WHATCOM COUNTY
COUNCIL OF GOVERNMENTS

401 grand ave. bellingham, wa 98225 • 206-676-6974

DATE: October 7, 1982

TO: Department of the Army
Seattle District. Corps of Engineers
P.O. Box C3755
Seattle, WA 98124

RE: **Lummi Indian Small Boat Harbor/Channel access project**

In accordance with OMB Circular A-95 subject proposal was circulated among local agencies for review and comment. Agencies contacted and their comments if any, are listed below.

Port of Bellingham
WCCOG Executive Board
City of Ferndale
Purseseiners' Association
Gillnetters' Association
Planning Directors
City of Bellingham
Whatcom County

The Whatcom County Council of Governments has determined that this project, in its current form, is consistent with local policies, plans, and programs, and recommends that the requested funding be approved.

Sincerely,

Anne Rose

Anne Rose
Chairman

NOTE: THIS CLEARINGHOUSE REVIEW NOTIFICATION AND ANY ATTACHED COMMENTS SHOULD BE FORWARDED TO YOUR FUNDING AGENCY. IF WE RECEIVE ANY ADDITIONAL LATE COMMENTS, THEY WILL BE FORWARDED TO YOU.

1/82

FISHERIES RESOURCE ACTION GROUP

P. O. Box 702
Mt. Vernon, WA 98273
206-336-3485

Col. Norman C. Hintz
District Engineer
Seattle District Corps of Engineers
P.O. Box C-3755
Seattle, Wa. 98124

Jan. 10,1983

Dear Col. Hintz,

The Executive Council of Fisheries Resource Action Group, after hearing complaints from members about the proposed Corps project - Navigation Channel and Small Boat Harbor, Lummi Sea Pond, Whatcom County, Wa. have intructed me to write to you to protest the expenditure of taxpayers' funds on this project.

We would challenge the conclusions of any studies by the Corps of Engineers, the Lummi Indian Tribe, or other organization which shows benefit over costs for other than a few tribal net fishermen who would likely end up with free moorage for their crafts.

We would call to your attention a moorage facility at Blaine which remains unfilled. We would question any claims that the general public is in need of such a facility, or would use it.

We ask when it will be that agencies of the federal government consider the rights and burdens of taxpayers prior to going ahead with needless, pork barrel projects which are proposed in numbers by persons expert in grantsmanship hired by Indian tribes to perpetuate wasteful welfare programs. Already the federal government has handed out millions to the Lummi Tribe for their Aquaculture experiment. That, so far, has turned out to be a miserable failure with little or no hope of recovering even a fraction of the expense.

The Lummi Sea Pond project proposal should be tabled until such time that an area-wide economic study indicates a need. FRAG members also question the environmental impact of dredging a harbor access channel on herring, salmon, and on their food chain. At least, Colonel Hintz, we ask that the general public be made more aware through the news media of the region, of the scope of the project, the cost, the benefits to the tribe and to the general public, the environmental concerns and the answers to those concerns.

Yours Truly,

John Mitcham, executive secretary

John Mitcham

Washington Environmental Council

107 South Main Street
Seattle, Washington 98104
206-623-1483

RE: SCOPING PROCESS FOR PROPOSED SMALL BOAT HARBOR ETC., LUMMI INDIAN RESERVATION, WHATCOM COUNTY

September 5, 1982

Mr. Erwin F. Hogan, PE
Chief, Planning Branch
Corps of Engineers, Seattle District

Dear Mr. Hogan,

Thank you for receipt of the notice of this proposed action. While the letter and enclosures are not sufficient material with which to judge the entire project we do wish to be informed and to participate. This will require examination of the files and further discussion with staff of the Corps as noted in your letter.

Immediately we have these comments:

1. Heretofore federal projects ostensibly constructed for benefit of the fishing industry have subsequently excluded the fishing industry from use of the projects in favor of recreational boats almost entirely. Shilshole Marina is but one example of this practise.

2. In view of the continuing depression in the Washington state fishing industry, we question the need for additional fishing fleet harborages. We trust that an economic evaluation of the proposal has or will be done. What showing is there of the demand for additional fishing or recreational boat moorages in the vicinity ?

   The number of fishing boats for sale, with no buyers, at Seattle's Fishermen's terminal, must be revealing of the lack of need for additional harborages.

3. We are very concerned that the dredged spoils would be placed within the diked area, termed 'uplands' - which would seem to be an intertidal or wetlands. We object vigorously to the loss of further wetlands or waters for use of dredged spoil disposal.

4. We wish to know how the project will affect the estuary and the flow of the Lummi River. Will the proposed 'upland' result in an increased salinization of the River or the estuarine areas.

5. Sandy Point is included in the Lummi Reservation and seems, by the map (enclosure 1) to have been subject of very large amount of development and fill and dredging sometime in the past.

Washington Environmental Council

107 South Main Street
Seattle, Washington 98104
206-623-1483

What consideration has been given to the use of Sandy Point area for the project as an alternative, to provide facilities without the large cost both in money and resources of proposed project ?

6. The Lummi River is listed in the Washington Environmental Atlas (Corps of Engineers) as an anadromous fish river. It is very possible that the project will have deleterious effects on that river by anadromous fish. The subject must be given significant attention in the EIS.

7. What evidence is there of 'overcrowding of commercial fishing boat moorage" as stated in the cover letter ?

8. Relative to the demand for recreational boat moorage we enclose pages from:

> Recreational Boating in Washington's Coastal Zone: The Market for moorage. R.F. Goodwin, U.W. Institute for Marine Studies, May 1982

This should be available in your office. By Mr. Goodwin's study , "it is difficult to see the market for new moorage remaining firm ", in Whatcom County.

9. Given the climate of animosity between Indian and Non-Indian fishermen, we find it difficult to believe that Non-Indian fishermen would utilize this proposed facility, i.e. lease facilities. We find it equally difficult to believe that the Lummi Tribe will be able to expand their own fishing operations to the point of an additional 370 commercial fishing boats. What is the present fleet size of the Lummi's ?

10. What will be the repercussions in other harborages if any number of boats should be re-sited to the proposed facility ? Are these 370 fishing boats part of a new fleet or existing vessels now located elsewhere ?

CAN THE FISHERIED RESOURCES TOLERATE 370 NEW BOAT LIFTS ??

In summary, there are many adverse potentials for this proposed project, and we have only given the briefest sketch in this letter. We would remind the Corps that the State Shorelines Management Act mandates full utilization of presently degraded areas as an alternative to exploitation of relatively undisturbed areas .

CC - State Depts of:
Fisheries
Natural Resources
Ecology

FWS

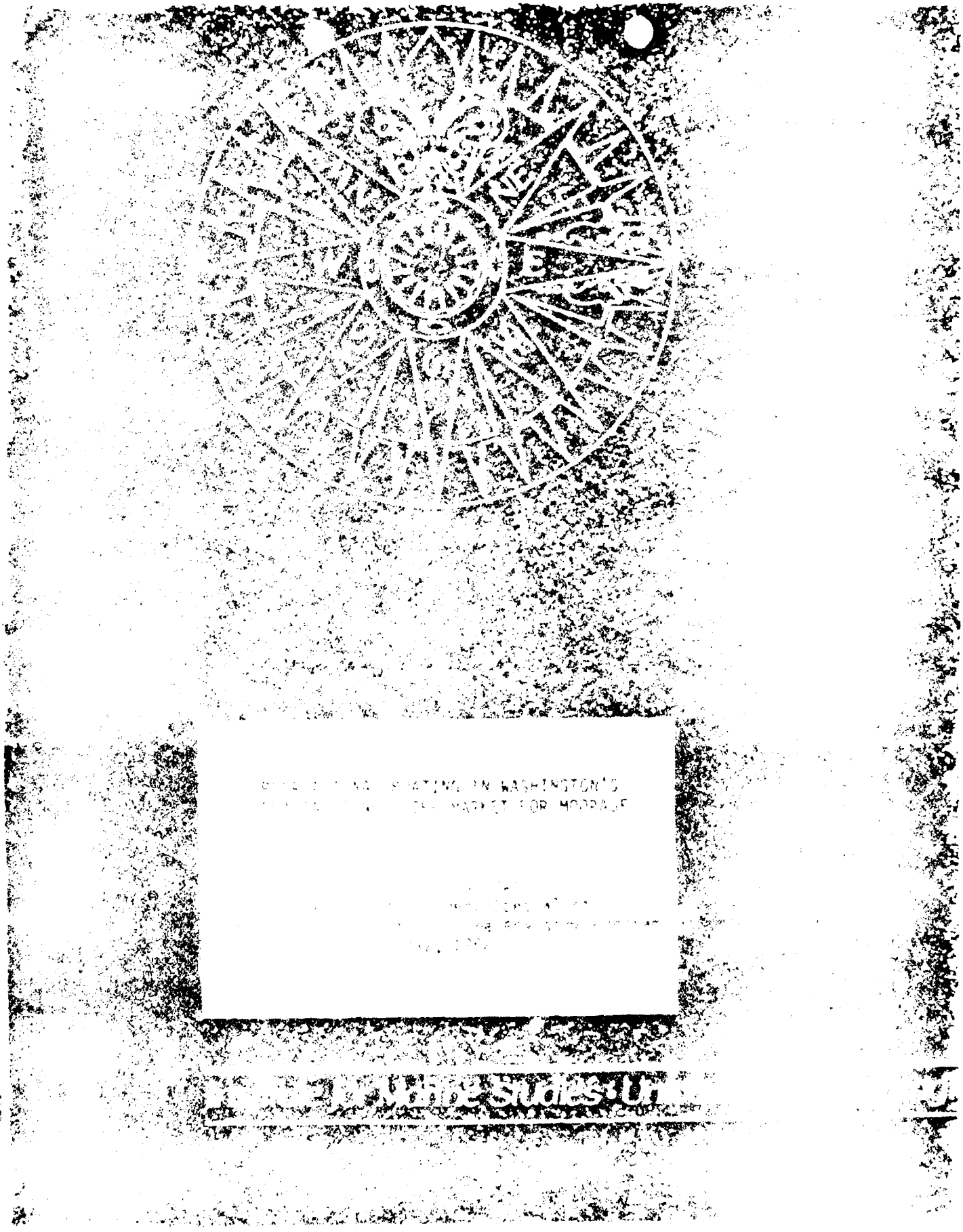
11. What areas of the submerged lands are in state ownership or management by the Dept. of Natural Resources ?

We will be communicating with you again when we have reviewed the file.

Very truly yours,

Benella Caminiti

Benella Caminiti
Shorelines Commi



County are a total of between 2,500 and 5,000 new private wet moorage slips, which would double or triple the 1981 supply. Investors should be extremely cautious, building only to the market as it develops and carefully monitoring prices and occupancy rates in the Anacortes and LaConner area marinas.

E. County-by-county Market Analysis

1. Whatcom County, 1981

Sixty-two and one-half percent of the private moorage in Whatcom County is located in one facility on the Point Roberts peninsula. Its physical location precludes easy access from the United States mainland (one must cross into Canada) but there are good road links to the Vancouver, B.C., metropolitan region. The remaining supply of moorage is dominated by two large public facilities operated by the Port of Bellingham.

The market is year-round--no discernible differences exist between summer and winter occupancy rates.

Under construction are two new private facilities with a first phase construction total of 576 wet slips and a potential build-out of 1,120 slips. An expansion of 450 slips is planned within 12 months for Squalicum Harbor, by the Port of Bellingham. By the fall of 1981 the supply of private marina space will have increased by 54% over that available in June of 1978.

Tenant-origin data for Squalicum Harbor, Bellingham, show a predominantly local market. Canadian demand at Blaine Harbor is unlikely to grow fast given the prevailing unfavorable foreign exchange rates facing the Canadian boater; and the overflow from Bellingham utilizing Blaine Harbor could easily dry up when Squalicum's expansion comes on line. Skagit County, to the south, effectively absorbs metropolitan Seattle boaters seeking "gateway harbors" to the San Juan Archipelago.

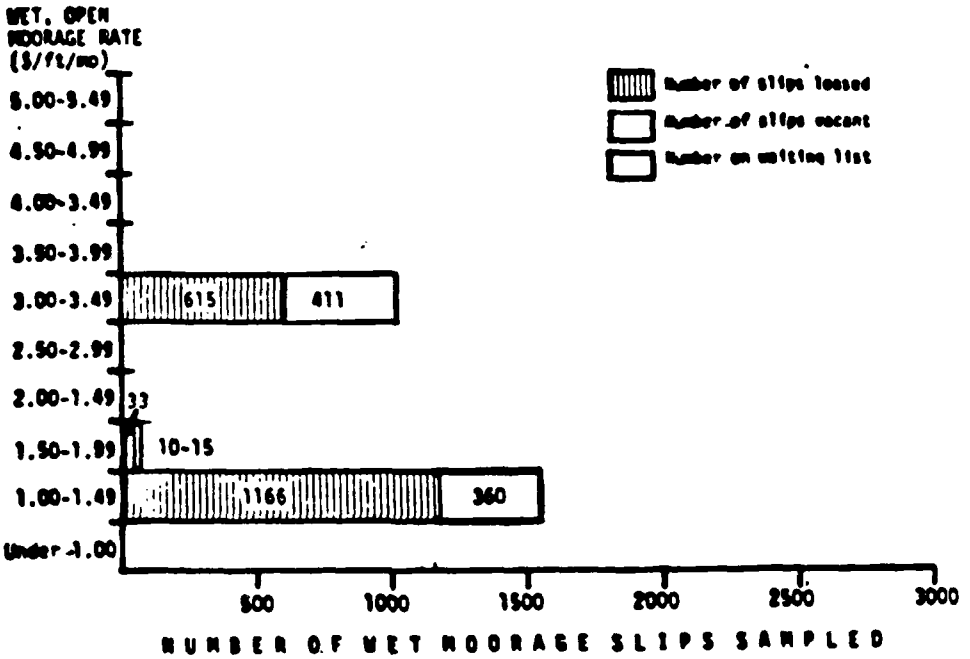
Therefore, when the slips under construction and planned for construction within the next year come on line, it is difficult to see the market for new moorage remaining firm. Investors should proceed with great caution until evidence of waiting lists in these new facilities appears.

2. San Juan County, 1981

All San Juan County's public year-round moorage is provided the Port of Friday Harbor, a 123-slip facility. Almost seven times that amount of moorage is provided by the private sector, whose larger facilities are located on San Juan and Orcas islands. A large number of small facilities operates in a summer market of seasonal, temporary, and transient boaters.

1981 Moorage Market in Washington's Coastal Counties

Whatcom County



SYNOPSIS

1981 market limit rate: $2.50-3.00/ft/mo

Markets served: Whatcom County, S.W. British Columbia (N. Whatcom County marinas only)

	Public	Private	Total
Total number wet moorage slips - 1981	1,166	1,464	2,630
Percent change June 1978-May 1981	~ 0.0	37.2	17.8
Total number marinas and dry storage facilities - 1981	2	12	14
Percent change June 1978-May 1981	0.0	20.0	16.7
Number wet slips under construction - 1981	--	179	179
Number wet slips planned - 1982	450	--	450
1983	--	--	--
1986	--	544	544
Average wet open moorage rate ($/ft/mo)	1.08	2.63	1.94

OUTLOOK:

Market firm, year-round on mainland, but rates low. Market soft, year-round on Pt. Roberts Peninsula. Slips under construction and planned will probably saturate market by 1983.

SAMPLE SIZE:

Facilities: #, (% of total): Public: 2 (100.0)
Private: 4 (33.3)

Slips: #, (% of total) Public: 1166 (100.0)
Private: 1456 (99.5)

WASHINGTON SEA GRANT
Marine Advisory Program
University of Washington
Seattle, WA 98195

Robert F. Goodwin
Coastal Management Specialist
(206) 543-9293

2919 Mayfair Ave, N.
Seattle WA 98109

Mr. Duane Hogan, P.E.
Chief, Planning Branch
Corps of Engineers, Seattle District

Dear Mr. Hogan,

You inquired for the reference in regard to my remarks yesterday are here supplied. I do believe the Corps should have this on hand somewhere in the library even if they do not subscribe to the journal.

Virginia Law Review Vol 63, 504-559, 1977

Garrett Power, Professor of Law, University of Maryland Law School

The Fox in the Chicken Coop: The regulatory program of the U.S. Army Corps of Engineers

Despite the title's derogatory implications, and the documentation of the substantiation of actions that bring the Corps under scrutiny and fire, the paper is very careful in lpointing out the "problems" of the power authorized to the Corps.

The Corps must be aware of this paper. I quoted it very carefully in my EIS reply to the Westhaven Boat Basin Expansion (Westport) in 1978.

Passages on the economic decision making, cost/benefit analysis are on pages 549-550.

He quotes another author and states -- "Haefele seems correct in his charge that District Engineers are required to make social choices unrelated to their expertise and without quantification of the values involved." -- etc.

Over the past few years my criticisms of the Westport Marina project's financial defects have been borne out. The project is an abject failure and the marina patrons have not materialized.

I hope you will be looking at the entire Westport Marina problem in relation to the LUMMI Project in Whatcom County. I deduce that the LUMMI's "boat haven" for 370 boats will not be as presented, a service to commercial fishing boats. I believe that it, like many other recreational marinas, is presented to Congress or the Corps for funding as a fishing vessel project when it is really intended for a recreational marina, for sale or lease to the yacht owners whose acquisition of public funds for their private recreation and pleasure never ceases to amaze me.

The Garrett Power paper was very helpful to me in understanding the function, powers and limitations, etc., of the Corps and I believe that Corps employees would also find that analysis informative.

Very truly yours,

Ms Benella Caminiti

And Sandy Point Project,
Reply by separate mailing to
CC Colonel Hintz

APPENDIX B, PART 3

U.S. FISH AND WILDLIFE SERVICE COORDINATION REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
2625 Parkmont Lane SW, Bldg. B-3
Olympia, Washington 98502

June 3, 1983

Colonel Norman C. Hintz
District Engineer
Seattle District, Corps of Engineers
P.O. Box C-3755
Seattle, Washington 98134

Dear Colonel Hintz:

Enclosed is our draft Fish and Wildlife Coordination Act Report on the effects of the proposed Lummi Bay Marina Project on fish and wildlife resources. This project study is authorized under Section 107 of the 1960 River and Harbor Act, as amended.

This draft report has been prepared under the authority of, and in accordance with, provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It is furnished to assist your agency in the preparation of a final feasibility report for the Lummi Bay Marina Project.

We request that you consider each of our recommendations and notify us in writing of your approval or disapproval. This will ensure that the Service will have a clear understanding of your concerns, and will enable us to incorporate them into our final report. We will also incorporate the comments of the National Marine Fisheries Service and the Washington Departments of Fisheries and Game.

We appreciate the opportunity we have had to provide input to your planning on this project and look forward to continued coordination.

If you have any questions on this draft report, please contact either Lynn Childers or David Stout at FTS 434-9440.

Sincerely,

Charles A. Dunn

Charles A. Dunn
Field Supervisor

Enclosure

cc:

DRAFT
FISH AND WILDLIFE COORDINATION ACT REPORT

U.S. Army Corps of Engineers
Seattle District

LUMMI BAY MARINA PROJECT

Prepared by:

David J. Stout, Fish and Wildlife Biologist

U.S. Fish and Wildlife Service
Division of Ecological Services
Olympia, Washington

June 1983

TABLE OF CONTENTS

Lummi Bay Marina Project

INTRODUCTION

The Lummi Bay Marina Project has been sponsored by the Lummi Indian Tribe to provide moorage for commercial fishing boats. The Lummi Indian Reservation surrounds Lummi Bay, which is located in Whatcom County, Washington at the southern end of the Strait of Georgia (see map). The proposed boat basin would be located in the existing Lummi Aquaculture Seapond. This Seapond was constructed in 1971 and encloses approximately 760 acres (23 percent of Lummi Bay).

The Seapond was originally constructed to provide an area to raise pan-sized salmon for marketing. Due primarily to high summer water temperatures, this operation did not prove to be successful. The Tribe has instead established a very successful net-pen rearing program for chum, coho and chinook. The net pens are full from mid-March until their release in late June. The pens are located at the aquaculture facility in the southeast corner of the Seapond.

The Tribe also has a successful oyster culture program at its aquaculture facility. Eyed larvae are moved into the Seapond from an indoor facility in late winter and are sold as seed in late spring.

Presently, aquacultural operations use about 5 acres of the Seapond. Since most of the Seapond is not being used, the Tribe has for several years considered several alternative development scenarios. These alternatives included a residential/recreational complex, different aquaculture uses, and several marina designs. The Tribe has maintained the position that future development must not endanger the existing aquaculture facility.

DETAILED PROJECT DESCRIPTION

The proposed project would provide moorage for approximately 435 commercial fishing vessels. This fleet includes approximately 60 seiners, 225 gillnetters, and 150 skiffs. Uplands will be created for marina-related facilities and activities.

The principal construction features are as follows:

A. Moorage Basin

The moorage basin will be approximately 26 acres and will require hydraulic dredging of approximately 645,000 cubic yards. The basin will have gently sloping sides (1:4) and will vary from -11 to -13 feet mean lower low water (MLLW). The slopes will not be riprapped. A 21-acre buffer strip of undisturbed tidelands will be maintained 175-200 feet wide around the marina. This buffer strip is necessary because of the unstable bottom sediments. Without the buffer strip, the adjacent fill site could slump into the marina basin.

Zonation moorage will be used at this marina; that is, the innermost end of the marina will be dredged less deep to increase flushing and reduce dredging costs. The shallower draft vessels (skiffs) will be moored at this end.

B. Navigation Channel

The navigation channel from Hale Passage to the Seapond would be roughly 7,300 feet long. Depth would be -14 feet MLLW. The bottom width would be 100 feet with approximately 1:4 side slopes. Maximum width at the shoulder will be about 240 feet. Dredging the channel will be done hydraulically and will require the removal of 645,000 cubic yards of material. Approximately 48 acres of Lummi Bay will be affected by the channel.

C. Breakwater

One timber breakwater will be constructed on each side of the entrance channel to reduce wave action inside the moorage basin. These breakwaters will be approximately 200 feet long.

D. Upland Facilities

Approximately 65 acres of the Seapond will be filled with material from dredging the navigation channel to provide an area for marina-related facilities. These facilities include a shipyard for maintenance and repair work; a seafood processing plant including cold storage; retail stores for fishery supplies, groceries and boat equipment; webhouses and lockers for storage of nets and gear; restrooms; and a restaurant. These upland facilities would use the existing and nearby sewage treatment facility. Stormwater runoff will be controlled through catch basins and oil-grease separators. In addition to marina-support facilities, a barge building opration is presently being considered for the uplands.

E. Entrance Channel and Turning Basin

The interior entrance channel and turning basin provide access to the piers. Approximately 9 acres (180,000 cubic yards) of dredged material will be removed to create a channel depth of -13 feet MLLW. Hydraulic dredging would probably be the selected method.

F. Maintenance Dredging Pond

The Corps of Engineers (CE) has calculated that maintenance dredging would consist of dredging 40,000 cubic yards at 5-year intervals. The proposed project provides a diked area of 25 acres to contain all maintenance dredging materials for the 50-year project life. This area will be open to the estuary until it is completely filled (after 50 years) and so will provide some fish and wildlife habitat. A wetland may be established in the center of the pond to enhance habitat values.

G. Mitigation Area

A 30-acre mitigation area will be diked off from the Seapond and will be reintroduced to the estuary by breaching the existing dike. Biological productivity of this area will be increased by improved flushing and by the establishment of good eelgrass growth in the area. The dike between the marina and the mitigation area will be gently sloped and will be planted to marsh vegetation to increase habitat diversity.

H. Dikes

Approximately 5 acres of dikes will be built inside the Seapond during project construction.

DESCRIPTION OF THE PLANNING AREA

A. Physical Features

Lummi Bay is located adjacent to Hale Passage, a narrow channel of water connecting the Strait of Georgia with Bellingham Bay. Lummi Bay is separated from the Strait by a peninsula called Sandy Point, which was formed by the deposition of littoral drift material. At high tide the average depth of Lummi Bay is four and a half feet. At low tide most of the bay is dewatered.

The major tributary to Lummi Bay is the Lummi River (also known as the Red River). The Lummi River is essentially a high water overflow channel from the Nooksack River. The lower section of the Lummi River is tidal, and when the Nooksack River is not high, the upper stretch of the Lummi River is dry. The Lummi River has been greatly affected by agricultural practices and has little salmon use.

The uplands around Lummi Bay are quite flat. Sandy Point to the west is a highly developed residential community. Diked farmland has replaced the historic wetlands to the north of the Bay, and to the east the land is largely wooded with an interspersion of homes, commercial buildings, and tribal facilities.

Since its construction in 1977, the Aquaculture Seapond has been the most significant feature of Lummi Bay. The dike which encloses the Seapond is approximately 3½ miles long and encloses about 760 acres of former tidelands.

Two major tidegates were created in the Seapond, one in the northwest corner (the proposed project site) and one in the southeast corner (adjacent to the aquaculture facility). These tidegates maintain the Seapond at an average depth of 3-4 feet. Two smaller gates were constructed between each of the larger gates and the shore.

The dike around the Seapond provides protection to the pond from storms. The longest fetch is to the west and southwest. Although the dike is generally well constructed, a severe storm during late 1982 did destroy an 800-foot section of the dike. This breach was quickly repaired.

B. Biological Features

The following biological information is derived from the EDA report on the Lummi Seapond (1975), information supplied by the Lummi Tribal biologists, other reports as noted, and on-site sampling conducted during the winter of 1983. Lummi Bay and the Seapond will be discussed separately.

Lummi Bay

1. Salmon - The only river which drains into Lummi Bay is the Lummi River (also called the Red River). As was stated earlier, the Lummi River is essentially a high water overflow channel from the Nooksack River. During low flow periods of the Nooksack River the upper stretch of the Lummi River is dry. According to the Washington Department of Fisheries (WDF) stream catalog, the Lummi River has been severely impacted by agriculture, resulting in high sedimentation, channelization, debris buildup and low flows (natural and irrigation-related). It is not considered a natural production area although it has received coho plants to take advantage of the available rearing habitat.

   A large number of juvenile salmonids are expected to migrate through the Hale Passage-Lummi Bay area. This would include steelhead and coho, chum, pink and chinook salmon. Lummi Bay is located between several very important watersheds for salmon production, including the Fraser, Nooksack and Skagit Rivers. Juvenile outmigration would generally occur mid-March to mid-June.

2. Herring

   Herring are an extremely important resource due to their value as food for salmonids, the large commercial herring roe fishery, and their use as a bait fish. A tremendous amount of herring spawning takes place along Hale Passage and the Strait north of Sandy Point. Herring spawning in Lummi Bay has been monitored by the WDF and by Lummi tribal biologists. Spawning in the Bay is relatively light and spotty compared to adjacent areas. Most spawning in Lummi Bay occurs south and southeast of Sandy Point and extends approximately halfway across the Bay. Most of the spawning takes place from mid-April through mid-May and is primarily on eelgrass (Zostera) and sea lettuce (Ulva).

3. Flounder

   Starry flounder (Platichthys stellatus) are very common in Lummi Bay, using the bay as a rearing/nursery area. They spawn in shallow water from February through April, and feed on crabs, shrimp, worms, clams and clam siphons, and small fishes.

   A small commercial trawl fishery harvests flounder in the Lummi Bay area from March through May. According to Mark Peterson of the WDF (personal communication), about 8 or 9 boats regularly fish the area and harvest approximately 10,000 pounds of flounder annually. For comparison purposes, the Puget Sound annual catch is about 1,000,000 pounds.

4. Waterfowl

According to the Fish and Wildlife Service (FWS) "Plan for Waterfowl Wintering Habitat Preservation," Lummi Bay has generally low-to-moderate value for waterfowl. The only exception is buffleheads, for which Lummi Bay has high value. The FWS is particularly concerned with protection of habitat for black brant. Brant population distribution has changed dramatically in recent years. Population levels are down and some areas which were historically heavily used by brant are now used very lightly. Brant are completely dependent upon eelgrass for feeding, and so protection of eelgrass beds is extremely important.

Other agencies have also placed high value on protecting brant habitat. According to the Washington Department of Game (WDG) (letter to Seattle Corps, June 16, 1982), Lummi Bay supports an important population of brant. Large populations have been reported, particularly in April, when up to 1100 birds have been reported on one day.

5. Eelgrass/Sea Lettuce

Eelgrass and sea lettuce are very common in Lummi Bay. Corps biologists have calculated that about 2,000 acres of eelgrass exist in the Bay. Shallower parts of the bay (Onion Bay and north Lummi Bay) are typically unvegetated. Eelgrass beds support a diverse benthic community, including several species of crabs, clams, flounder, shrimp and snails. Eelgrass is a critical food for black brant, is utilized as spawning substrate by herring, is a nursery area for many fish and invertebrate species, and is important as a nutrient source to the estuary (detritus production).

6. Dungeness Crabs

Lummi Bay is a productive rearing area for Dungeness crabs (Cancer magister), and supports sport and commercial fisheries. Dungeness crabs are generally found associated with eelgrass beds and feed largely on small clams.

7. Wetlands

The low ground north of Lummi Bay was historically wetlands. In 1889, for example, there were approximately 1430 acres of wetlands associated with the Lummi River Delta (USFWS 1981). Today there are about 80 acres remaining. Most of this loss was due to diking for agriculture. Remnant wetlands exist along the estuary/upland interface and in isolated potholes on both sides of the river. A small wetland also exists inside the Seapond near the northwest tidegate.

As was stated earlier, most of Lummi Bay is intertidal and supports approximately 2,000 acres of aquatic vegetation (largely eelgrass).

8. Endangered Species

The FWS, by letters dated April 11, 1983 and October 26, 1982, notified the Corps that peregrine falcons and bald eagles occur in the project vicinity. Biological assessments are now being prepared by the Corps for these two species.

The National Marine Fisheries Service (NMFS), in a letter dated October 8, 1982 notified the Corps that several endangered species under their jurisdiction occur in the Strait of Juan de Fuca. These species include the gray whale, blue whale, humpback whale, and fin whale. The Corps is also preparing a Biological Assessment for these species.

Seapond

1. Aquaculture

The aquaculture program in the Seapond currently uses approximately 5 acres in the southeast corner. The major operation at this time is net-pen rearing of juvenile salmon. Typical releases from the facility are 1-2 million coho, 1-2 million fall chinook, and 2-4 million chum. Juvenile salmon are normally in the net-pens from mid-April until late June. Trapping of returning adults takes place from late August until the end of December.

The oyster program involves hatching oyster larvae in an indoor facility on the reservation. In late winter, when the oysters reach the spat stage, they are moved to the Seapond. In late spring the oysters reach the seed stage and are sold for planting. A small commercial oyster bed is located in eastern Lummi Bay.

2. Salmon

Use of the Seapond by non-hatchery juvenile salmonids is poorly known. There is some prolonged residency by hatchery-released juveniles, but high summer temperatures probably curtail this use.

3. Flounder

Starry flounder were captured in trap nets and otter trawls during sampling conducted in January 1983. Three trap nets were fished for 24 hours, yielding 16 flounder ranging in size from 12-41 cm.

4. Herring

Some use by herring of the seapond is suspected by Lummi tribal biologists. No spawning activity has been observed and no fish were captured during field sampling. (Note: sampling was done at a time of year when no herring would be expected in nearshore areas.)

5. Other Fish Species

The following species of fish have been observed in the seapond, in addition to those already discussed: staghorn sculpin (many), Pacific tomcod (few), smelt (few), kelp perch (moderate), and sticklebacks (few).

6. Waterfowl

Little information is available on the utilization of the seapond by waterfowl. Up to 300 birds were observed by FWS personnel during January 1983. These birds were scaup, buffleheads, and mergansers. The seapond appears to give some protection from storms and contains water when Lummi Bay is dry at low tide. Food organisms, including eelgrass, are not as abundant as they are in Lummi Bay.

7. Crabs

Dungeness crabs were sampled by both fish traps and otter trawls during January 1983. Ten crabs (8-15 cm) were captured in three traps over a 24-hour period.

8. Eelgrass/Sea Lettuce

Both eelgrass and sea lettuce are found in the seapond. Density is highest near both tidegates, due to better flushing and lower temperatures. As distance from the tidegates increases, eelgrass density decreases rapidly. Overall productivity in the seapond is directly proportional to eelgrass density, as was stated in the Economic Development Administration (EDA) study and confirmed by on-site investigations conducted during January 1983. Eelgrass detritus supports a healthy population of Gammarid amphipods.

9. Benthic Invertebrates

In addition to the above-mentioned Gammarid amphipods, the following benthic invertebrates are commonly found in the seapond:

a. Spio - A 1-cm polychaete, Spio is the most numerous organism in the Seapond. It is a detrital feeder and is ubiquitous

b. Cerithium - Also known as "auger shell," Cerithium is a snail and is the second most abundant organism. Found largely in the center of the pond, it is a scavenger and predator

c. Naminoea - Also known as "bubble shell," Naminoea is a snail and is ubiquitous

d. Prototheca - The "littleneck clam" was found at three stations in moderate to low abundance.

e. Glycera - a "proboscis worm."

f. Acteocina - Another "bubble shell" snail.

g. Venerupis - The "Japanese little clam" is found at low densities throughout the Seapond.

10. Water Quality

The pond was designed to fluctuate three or more inches a day, which would result in an exchange of 8 to 20 percent of its total volume daily. Sediments within the Seapond are generally medium to very fine sand mixed with silt. Salinity varies from 27-33 ppt, and pH varies from 8-9.5. Dissolved oxygen concentrations are generally in the range of 7-13 ppm, although during August and September values of 4.5 to 5 are commonly found. During August and September temperatures sometimes reach 25°C, while in the winter the Seapond occasionally is covered with 6-8 inches of ice.

ALTERNATIVES TO THE PROPOSED PLAN

Alternatives A and B have not been formally proposed by the Corps but are presented here for comparison and information.

A. Proposed Plan with upland or open water disposal – Under this alternative material from maintenance dredging would be disposed of at a location other than in the Seapond. Upland sites may be available north of the Seapond. An open water disposal site is available in Bellingham Bay, approximately 10 miles from Lummi Bay. If one of these options were adopted for maintenance dredging disposal, the proposed 25-acre disposal site would not be filled and would remain available for fish and wildlife habitat.

B. Reduction in scope (less filling) – Under this alternative, upland creation would be limited to provide space for only marina-related facilities. Eliminating the barge building facility would eliminate the need for perhaps 25 acres of fill. In addition, if open water disposal were utilized, total filling for the project would be reduced from 95 acres down to 40-45 acres. Loss of fish and wildlife habitat would be reduced accordingly.

C. Onion Bay – The Lummi Tribe investigated the possibility of constructing a marina at Onion Bay in the northwest corner of Lummi Bay (LIBC 1977). This location would require dredging a very long navigation channel due to its distance from Hale Passage. Wetlands, predatory birds and water quality were considered to be primary concerns. The site is mudflat with some eelgrass beds.

D. East Sandy Point – This site was also considered by the Lummi Tribe (LIBC 1977). The entire site is mudflat and eelgrass. Herring spawning is known to occur in the vicinity of the marina location. Water quality and loss of habitat were considered the main problems with this site.

E. Gooseberry Point — This was the original location chosen for detailed study for a marina. This site was subsequently rejected because of the extensive eelgrass beds which support herring spawning. This herring spawning had been documented by the Lummi Tribe and the U.S. Fish and Wildlife Service and was observed during site visits in late spring 1982.

F. No action — If no commercial marina is constructed, the Tribe would likely continue to pursue other options to increase use of the seapond. These options include increased aquaculture activities (not considered feasible at this time), recreational development, residential development, or another marina plan. The overall productivity of the seapond is expected to maintain current levels, barring future development. The tribal members would continue to raft their vessels at alternate locations some distance from the marina (e.g., Bellingham).

FUTURE WITH THE PROJECT

If constructed as proposed, the seapond marina project would cause a variety of direct and indirect impacts to the Lummi Bay ecosystem. These impacts are summarized below:

A. Salmon — Dredging the navigation channel will cause a loss of benthic food organisms which occur on the mudflats and in the eelgrass beds. Since the channel is quite shallow and sideslopes are fairly gentle, most of this area will probably be recolonized by invertebrates and eelgrass. Boat movement in the channel may inhibit productivity to some extent. Maintenance dredging every five years will remove eelgrass and food organisms but may be necessary only in deeper water adjacent to Hales Passage. In addition, marina-related pollutants (oil and grease, paint, sewage, etc.) may further inhibit productivity in and adjacent to the channel. The presence of the channel is not expected to seriously alter the behavior of either outmigrating juvenile salmonids or returning adults.

Construction-related impacts to salmon can be minimized by proper timing of the dredging. Department of Fisheries' normal restrictions would not allow dredging from March 15 to June 15.

Filling inside the Seapond will eliminate shallow water habitat that is utilized by hatchery-released juveniles. The magnitude and significance of this loss is very difficult to assess.

Following construction, the entire marina area (56 acres) will be available for juvenile salmon. Although juvenile salmon are known to concentrate in marinas, insufficient evidence exists to conclusively determine the benefits which they derive from this association. The tidelands and slopes in the marina basin will be available as feeding areas. Pilings and floats will provide cover and additional food organisms. Marina-related pollutants will probably inhibit productivity to some extent.

The proposed 30-acre mitigation area and portions of the maintenance dredging pond will also be available to juvenile salmonids. The tideflats, marsh, and eelgrass (if established) will provide a feeding and rearing area. It is important that the mitigation area and the spoil disposal area be sloped toward the entrance at least at a 10 percent slope to prevent stranding.

B. Waterfowl – Waterfowl food organisms, including eelgrass, would be lost due to channel dredging. Recolonization would take place over several years, but may be inhibited by boat wakes and marina-related pollutants. Maintenance dredging is expected to be needed mostly where the channel meets Hales Passage, and will periodically remove eelgrass and other waterfowl food.

Boat traffic in the channel will disturb waterfowl populations resting and feeding in Lummi Bay. Vessels will be confined to the channel due to the shallow depths in the bay, and so disturbance will be localized.

Filling within the Seapond will eliminate habitat which is presently used by waterfowl for feeding and resting. This habitat is particularly valuable during winter storms when the Seapond provides protection from waves and wind.

The 56-acre marina will be available to waterfowl, although use will be greatly restricted due to piers, boat traffic, and human activities. The 25-acre disposal site will be available, at diminishing levels, until it is completely filled (after 50 years) with maintenance dredging material. The 30-acre mitigation area is expected to become established with eelgrass/sea lettuce and a small marsh may be created. This will provide a feeding area at high tide and should be more productive for waterfowl than existing conditions.

C. Herring – Herring use of the Seapond is not well documented, but is not considered to be extensive. After construction, the marina and mitigation area will be open to herring. Piers, floats and eelgrass will provide cover, and some herring spawning is possible but not considered likely. Filling within the Seapond will eliminate habitat which is currently available, but probably little used.

The navigation channel has been located to avoid eelgrass as much as possible. The channel follows the unvegetated natural Lummi River channel across the tideflats. Direct impacts on herring spawning should therefore be minimal. Spawning success may be reduced slightly due to marina-related pollutants, since herring eggs have been shown to be susceptible to hydrocarbons.

D. Flounder – Following construction, total acreage of habitat available to flounder in the seapond will be reduced due to filling for dikes, upland creation, and spoil disposal. The entire marine area will be accessible and will provide cover and food organisms. Flounder use is expected to increase in the marina over existing levels. The mitigation area will be enhanced for flounder due to increased productivity which should result from increased flushing.

The navigation channel should cause little adverse impact to flounder. Benthic invertebrates, upon which flounder feed, will be temporarily lost due to dredging. This area is expected to recolonize quickly with both eelgrass and invertebrates. Boats using the navigation channel will pose a potential conflict for the existing flounder trawl fishery. Eight or nine boats currently harvest approximately 10,000 pounds of flounder per year in this area. The fishing season extends from March through May.

E. Eelgrass/sea lettuce community – Most of the productivity in the seapond is associated with eelgrass beds. These areas have value to waterfowl, flounder, salmon, crabs and many other invertebrates. Eelgrass will be lost in the Seapond due to filling for uplands, spoil disposal, dike construction and marina dredging. Some eelgrass will probably reestablish in the marina, especially on the tideflats and sideslopes. Productivity in the marina may be inhibited by marina-related pollutants.

The proposed mitigation area currently has sparse eelgrass growth. Eelgrass density is expected to increase in this area after the dike is breached, due to improved flushing. It may be possible to enhance eelgrass growth in the mitigation area by planting.

The navigation channel has been located to minimize loss of eelgrass. The dredged channel follows the unvegetated Lummi River channel across the tideflats, thereby avoiding all but 13 acres of eelgrass. Due to the gentle sideslopes, it is expected that revegetation will occur rapidly. Disturbance due to boat wakes may inhibit eelgrass growth to some extent.

Maintenance dredging will destroy eelgrass in the channel every five years. It is anticipated that most shoaling will occur where the channel meets Hale Passage.

F. Dungeness crabs – Crab habitat within the seapond will be reduced due to filling for upland creation, dikes and dredged material disposal. The marina will be open to the estuary and will provide usable habitat for crabs. The quality of this habitat may be reduced due to marine-produced pollutants and garbage. The proposed mitigation area would be enhanced for crabs over existing conditions. This area is expected to be vegetated with eelgrass and should be good rearing and foraging habitat.

A year-round sport fishery currently exists for crabs in Lummi Bay. The commercial crab fishery extends from October 1 through April 15, although most fishing pressure takes place during the first two months. Boats using the proposed navigation channel may be in conflict with crab traps from both the sport and commercial fisheries.

Lummi Bay is considered to be an important Dungeness crab rearing and foraging area (Dick Baumgartner, WDF, personal communication). These crabs are associated with the eelgrass beds. Loss of eelgrass will be minimized through careful location of the channel, and eelgrass is expected to quickly revegetate the channel sideslopes. Adverse impacts to the crab population will be minimized by not dredging during the period from March 1 to November 30.

AD-A150 454 LUMMI BAY MARINA WHATCOM COUNTY WASHINGTON DRAFT DETAILED PROJECT REPORT A.. (U) CORPS OF ENGINEERS SEATTLE WA SEATTLE DISTRICT DEC 83 4/4

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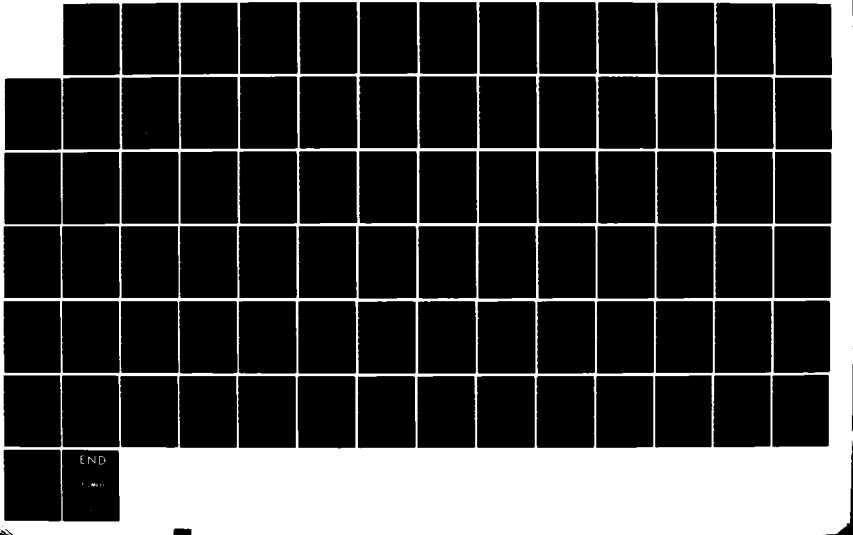

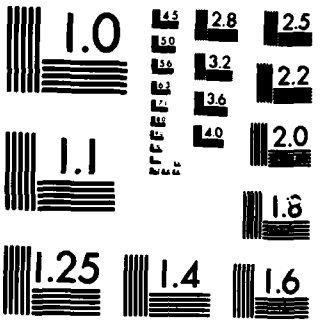

G. Threatened and endangered species – The Corps of Engineers is currently preparing Biological Assessments of the potential effect of this project on peregrine falcons and bald eagles.

H. Water quality – Many different pollutants are known to be associated with marinas. These pollutants include heavy metals, coliform bacteria, hydrocarbons and garbage. The presence of these pollutants in the marina may reduce the habitat value of this area. In addition, these substances may inhibit productivity in and adjacent to the navigation channel. Herring roe are quite vulnerable to hydrocarbons and are probably the resource at most risk from pollution.

MITIGATION OPPORTUNITIES

Many different mitigation techniques to reduce environmental impact have been considered during the planning process for the Lummi Bay Small Boat Basin. Some of these techniques have been incorporated into the proposed plan, some were determined to be infeasible, and some are still under consideration. These mitigation opportunities include:

A. Breach the dike and reintroduce part of the seapond to the estuary.

The EDA report and recent field investigations suggest that productivity in the seapond is limited by high temperatures and restricted flushing. Therefore, habitat losses which result from the project may be partially or completely offset by enhancing productivity in part of the pond by improving flushing. The proposed 30-acre mitigation area will be open to estuarine tidal action and should exhibit habitat value comparable to adjacent undiked tidelands. Eelgrass and sea lettuce are expected to colonize this area and would provide food and cover for many fish and wildlife species.

B. Install culverts through dike to increase flushing to the entire seapond

This mitigation technique is based on the same principle as the previous technique; that is, since productivity in the seapond is highest near the existing tidegates, installing more tidegates/culverts should further increase productivity in the seapond. Benefits would accrue to both fish and wildlife and also the existing aquaculture facility. This idea was dropped after evaluation by the Corps demonstrated that it would be extremely costly (approximately $200,000 per set of culverts).

C. Rehabilitate Lummi River

As was stated previously, the Lummi River has been seriously impacted by agriculture and has limited value for salmonids. Sediment, low flows, and blockages are primary problems. The feasibility of rehabilitating the river for salmon has been discussed. This idea was dropped due to the uncertainty of benefits that could be realized from restoration.

D. Marsh creation/enhancement

Very little marsh remains in the Lummi Bay estuary. Marsh provides a variety of benefits to fish and wildlife, including food, cover, and detritus production. The proposed project includes protection and enhancement of the existing wetland near the northwest tidegate, and creation of small wetlands in the mitigation area and the southwestern corner of the maintenance dredging disposal pond. The particular species of plants to be established has not been determined yet.

E. Establish eelgrass in channel and mitigation area

Eelgrass serves many important functions in the estuarine system. Approximately 13 acres of eelgrass will be removed during channel excavation. Much of the channel is expected to quickly revegetate since the sideslopes are gentle. It would be possible to replant both the new channel as well as several existing unvegetated side channels of the Lummi River where it passes over the tide flats. In addition, eelgrass could be planted on the tideflats surrounding the marina and in the mitigation area. These actions would promote a quick return to productivity to offset impacts to fish and wildlife resources which will result from the project.

F. Reduction in scope of project

One aspect of mitigation involves minimizing the impacts by limiting the degree or magnitude of the action. Therefore, it is appropriate to consider reducing the scope of the project. As was discussed earlier under "Alternatives to the Proposed Plan," less filling would significantly reduce adverse project impacts. A project which involved filling only for marine-related activities and utilized open water disposal for maintenance dredging would reduce the fill from 95 acres to about 45 acres.

MITIGATION ANALYSIS

A. Mitigation Policy

The FWS in 1981 adopted a formal Mitigation Policy to help assure consistent and effective recommendations for the levels of mitigation needed and the various methods for accomplishing mitigation. The policy covers impacts to fish and wildlife populations, their habitat, and the human uses thereof. Four Resource Categories are used to indicate that the level of mitigation recommended will be consistent with the fish and wildlife resource values involved.

The Lummi Bay Small Boat Basin Project was evaluated using the Mitigation Policy. The species used for evaluation were salmonids, waterfowl, Dungeness crabs, flounder, and eelgrass/sea lettuce. Based upon these species, the seapond appears to be covered by Resource Category Four, since the habitat to be impacted is of medium-to-low value for evaluation species. The mitigation goal for this category is to minimize loss of habitat value. According to the policy, the Service will recommend ways

to avoid or minimize losses. If losses are likely to occur, then the Service will recommend ways to immediately rectify them or reduce or eliminate them over time. If losses remain likely to occur, then the Service may make a recommendation for compensation, depending upon the significance of the potential loss. There is no specific requirement that the compensation be "in-kind" replacement of habitat.

B. Habitat Evaluation Procedures

The Habitat Evaluation Procedures (HEP) were developed to be used as a basic tool for evaluating project impacts and as a basis for formulating subsequent recommendations for mitigation. A simplified version of HEP was used to evaluate the existing seapond habitat and to assess the impact of the project on the evaluation species (i.e., flounder, salmonids, crabs, eelgrass/sea lettuce, and waterfowl).

C. Methodology

Four distinct subdivisions of the project site were evaluated for their present and future value for each of the evaluation species. These subdivisions were the 56-acre marina (including 26 acres of basin, 21 acres of tideflats, and 9 acres of turning basin and entrance channel), the uplands (65 acres for marina support facilities and 5 acres of dikes), a 25-acre maintenance dredging disposal area, and a 30-acre mitigation area. The HEP process annualizes the habitat values to accurately depict changes in value over time, such as those changes due to filling the maintenance dredging pond. The evaluation criteria which were used included habitat value, contribution to the estuarine system, and benefits derived from residence. Values assigned to each habitat subdivision for each species were: 0-.3 (low value), .3-.7 (moderate value), and .7-1.0 (high value).

Biologists from the following agencies were contacted individually to obtain their opinions of the values which were appropriate: NMFS, EPA, WDF, WDG, Lummi Tribe, CE and FWS. The project was first reviewed in detail to ensure that each agency had the most current information. An attempt was made to obtain truly independent habitat values from each agency — i.e., values obtained from other agencies were not discussed. The values were averaged to give a figure which represented the best scientific judgment based upon available information. The results were then analyzed using the HEP computer software.

D. Assumptions

A number of assumptions were discussed by the participating agencies. These assumptions were:

1. The mitigation area will be planted to eelgrass, or will revegetate naturally.

2. Habitat conditions in the seapond will become stabilized three years after construction (i.e., the benthos will repopulate, eelgrass will revegetate, etc.).

3. Habitat conditions in the seapond will be stable from three years after construction until the end of the project life.

4. Eelgrass growth in the navigation channel will be monitored, and if necessary, eelgrass will be planted on the side slopes.

5. The project will not affect the habitat value of the rest of the seapond or the existing tribal agriculture facility.

6. Future conditions without the project are expected to remain the same as baseline.

E. Alternatives Evaluated

Two alternative project designs were evaluated using HEP. The first was the proposed project with open water disposal of maintenance dredging material. The second alternative was a project with reduced fill (40 acres) and open water disposal of maintenance dredging material.

F. Results

The HEP software used for this analysis computes average annual habitat units for each species, compares these values to conditions without the project, and then determines the accrued losses that occur over the 50-year project life. Finally, the total amount of mitigation area to offset those losses is calculated. Since the proposed mitigation for this project involves habitat improvement rather than habitat creation, the acreage required to offset habitat losses is considerably larger than the total number of acres directly impacted by the project.

For the proposed project, approximately 186 acres would have to be improved by connecting it to the estuary, to offset project-induced losses. For the proposed project, but with open water disposal of maintenance dredging material, a mitigation area of 168 acres would be required to fully offset project losses. And finally, for a project with less fill (40 acres) and open water disposal, a mitigation area of approximately 114 acres would be required to fully compensate for project-induced losses.

The computer printout forms are included in Appendix A. Form B presents the total Habitat Units available at various years of the project life for each species. Form H presents the size of the mitigation area which would be necessary to fully compensate for project-induced losses.

RECOMMENDATIONS

A. We recommend that maintenance dredging spoils be disposed of at an open water disposal site. A Department of Natural Resources-approved site currently exists in Bellingham Bay. Eliminating the contained disposal site within the Seapond will reduce the total amount of fill required for the project by 25-30 acres, and will reduce adverse impacts to fish and wildlife resources.

B. We recommend that the uplands which will be created be limited in size to that which is necessary for marina support facilities. Restaurants and other non-water-dependent facilities should be eliminated from the filled area. We have not seen evidence of a commitment to construct the barge-building facility, so filling for such an activity must be considered speculative. In addition, alternative locations likely exist which are suitable for such an operation. Eliminating the barge-building facility could reduce the amount of fill required by about 25 acres and would greatly reduce impacts to fish and wildlife resources.

C. We recommend that the Corps attempt to satisfy the HEP analysis mitigation goal and enlarge the presently proposed mitigation area. To fully compensate for project-induced losses, approximately 2 acres of the Seapond should be returned to estuarine flushing for every acre filled. As was stated earlier, the Mitigation Goal for Resource Category Four habitat is to minimize losses and reduce them over time, where possible. Therefore, this Service has some flexibility in mitigation recommendations. We recommend that the Corps provide a mitigation area of at least the same number of acres as the number to be filled, and continue to develop other techniques to reduce adverse project impacts.

D. We recommend that the navigation channel be evaluated two years after construction to see if eelgrass is revegetating the side slopes. If revegetation has not occurred, we recommend that eelgrass be planted on the sideslopes to replace habitat lost during dredging. The state and federal resource agencies should be consulted to determine whether planting is necessary.

E. We recommend that the mitigation area be planted to eelgrass immediately after construction. The full value of this area will only be realized if good eelgrass growth is established. This area is removed from the lush Lummi Bay eelgrass beds and if it is not planted, vegetation may proceed slowly.

F. We recommend that the mitigation area be sloped at at least a 10° angle towards the outlet to prevent stranding of juvenile salmonids and the outlet should be as large as possible.

G. We recommend that the dike between the marina and the mitigation area be gently sloped and planted to marsh vegetation. This will provide cover for nesting and escape and will provide diversity to the mitigation area. State and federal agency biologists should be consulted to determine the proper plant species. We also recommend that the small marsh near the northwest tidegate be preserved and enhanced.

H. We recommend that every effort be made to control stormwater, garbage, oil and gas, paint and other pollutants through proper design of the marina and upland support areas.

I. We recommend that construction timing be limited as follows:

1. No construction outside the Seapond from March 15 to November 30. This will protect out-migrating juvenile salmonids, herring spawning, oyster spat, Dungeness crabs, and juvenile salmon in the net pens, and will avoid conflict with the flounder trawl fishery.

2. Construction inside the Seapond can take place year round provided sedimentation and turbidity are minimized.

J. If contained disposal in the Seapond is selected, we recommend that the maintenance dredging pond and the mitigation area not be separated by a dike. Disposal material should be piled along the sides of the pond to preserve the middle of the pond as wetlands/mudflat.

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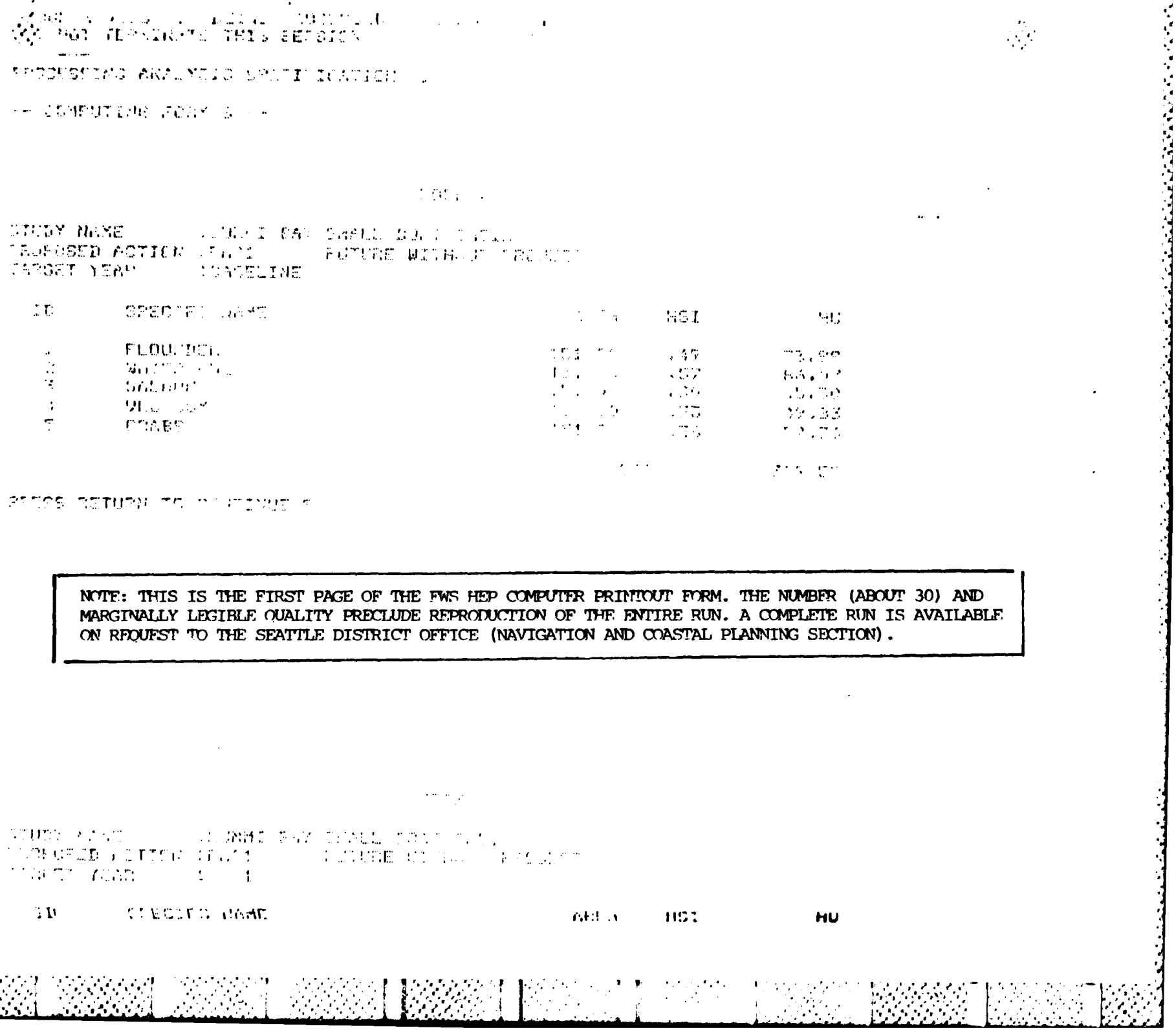


19

NOTE: THIS IS THE FIRST PAGE OF THE FWS HEP COMPUTER PRINTOUT FORM. THE NUMBER (ABOUT 30) AND MARGINALLY LEGIBLE QUALITY PRECLUDE REPRODUCTION OF THE ENTIRE RUN. A COMPLETE RUN IS AVAILABLE ON REQUEST TO THE SEATTLE DISTRICT OFFICE (NAVIGATION AND COASTAL PLANNING SECTION).

APPENDIX B, PART 4

COMMENTS AND RESPONSES

PART 4a - Comments on the Draft Detailed Project Report and Environmental Impact Statement and Corps Responses

PART 4b - Comments on the Lummi Bay Marina Project, in General, and Corps Responses

APPENDIX B, PART 4
COMMENTS AND RESPONSES

Response to Comments Received on the Draft DPR/EIS
(to be completed upon receipt of comments)

APPENDIX C

ENGINEERING, DESIGN, AND COST ESTIMATES

SECTION 1. DESIGN CONSIDERATIONS

1.01 Site Description. Lummi Bay is located on the northwestern side of the Lummi Indian Reservation, between Sandy Point and Gooseberry Point along the eastern side of Hale Passage and Strait of Georgia. The proposed boat basin would be located in the northwest corner of the existing 760-acre Lummi Aquaculture Pond (sea pond). The existing dike system was constructed in 1972 and consists of a gravel core with rock riprap on the seaward face. The proposed navigation channel would follow a natural ebb channel, which provides drainage of the tideflats and for the minor flow of the Lummi River out to deep water. At mean lower low water (MLLW), most of Lummi Bay is exposed tideflats with elevations of -5 to +5 feet MLLW.

1.02 Tides and Currents. Tides in Lummi Bay are typical of the Pacific Coast of North America. Tides are of the mixed type with two unequal highs and lows each day. Tidal data for Lummi Bay, published by the National Ocean Survey, are as follows:

Datum Plane	Elevation in Feet Referred to MLLW Datum
Highest Estimated Tide	12.00 ± 0.5
Mean Higher High Water	8.60
Mean High Water	7.80
Mean (Half) Tide Level	5.15
Mean Low Water	2.50
Mean Lower Low Water	0.00
Lowest Estimated Tide	-4.50 ± 0.5

1.03 The tideflats slope from approximately +3 feet MLLW at the dike surrounding the sea pond to deep water about 1-mile distant to the Strait of Georgia. Mean low water is +2.5 feet and the lowest estimated tide is -4.50 feet MLLW; therefore, Lummi Bay is exposed tideflats at most low tides. The tideflats are generally firm with underlying bottom sediments consisting of mostly sandy silts.

1.04 Currents during the flood phase of the tide occur as sheet flow across the Lummi Flats. Currents during the ebb phase are channelized in existing ebb channels, with discharge partly from the Lummi River discharge, but mainly from drainage off the tideflats. Lummi Bay current velocities and directions are affected by the wind, tide, and riverflow conditions. Generally the current flow is in the east-west direction. Maximum ebb current velocities in the existing ebb channels are estimated at 1.5 feet per second (f.p.s.). Flood currents are less than this velocity.

1.05 The proposed navigation channel will not affect Lummi Bay tideflat currents. Deepening for the channel will result in more pronounced ebb and floodflow in the channel itself. Maximum current velocities will be about 1.5 f.p.s. with the ebb flow the stronger.

1.06 Currents in the Strait of Georgia are generally in a northern direction during the flood phase and in the southern direction during the ebb phase of the tide.

1.07 Winds. During the summer, winds in the Lummi Bay area are light and predominantly from the south and southeastern directions. Wintertime storms, occasionally producing winds in excess of 50 miles per hour (m.p.h.), are from both the north and south but with a westerly component at times. Estimated maximum wind velocities and duration curves are shown on figure C-1; the annual wind rose is shown on figure C-2.

1.08 Waves.

a. Wind Generated Waves. The proposed marina site is exposed to wind waves generated over open fetches from the south, through west, and from the north. Land masses protect the site from all other directions. At low tides the shallow tideflats around the proposed marina site will be dry or provide protection through shoaling and refraction of waves. At extreme high tide conditions, water depths across the tideflats are 8 to 10 feet. Shallow water breaking wave heights were used for the design as they are the most critical condition. Shallow water design wave calculations were calculated by methods described in the "Shore Protection Manual," (SPM) 1977 edition. The following tabulation shows maximum wave characteristics for the principal fetch lengths (see also figure C-3) in the wave generating area at the proposed marina site. Waves transmitted through the entrance of the marina would be less than 1 foot for design wave conditions and would progressively decrease further into the interior basin.

Fetch (Azimuth)	Effective Fetch Length (Stat. Mile)	Wind Velocity (m.p.h.)	Wind Duration (hours)	Wave Period (sec)	Deepwater Wave Length (feet)	Deepwater Wave Height (feet)
190°	3.8	58	1.0	4.1	86	4.1
240°	7.2	53	1.0	4.3	95	4.3
315°	1.2	-	-	2.5	32	1.5

Most of the dike and timber breakwater is located in water depths of less than 20 feet.

b. Vessel Generated Waves. Vessels using the navigation channel and marina will be primarily commercial fishing boats. Waves generated in the channel from these vessels will usually be on the order of 1/2 to 1-1/2 feet with maximums to 2-1/2 feet for the larger vessels transiting the channel at high speed. Prudent vessel speeds within the marina should result in negligible vessel waves in the marina.

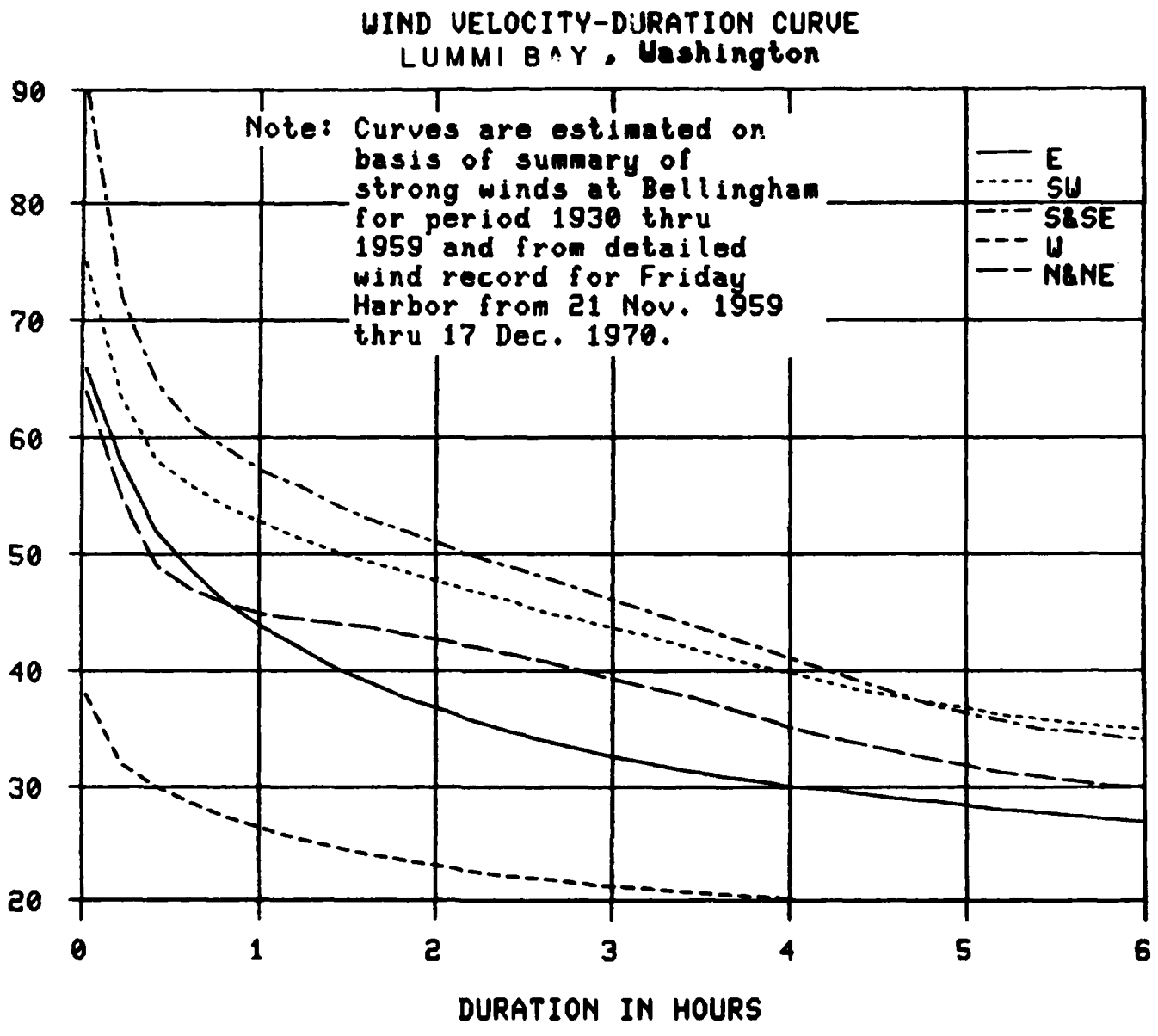
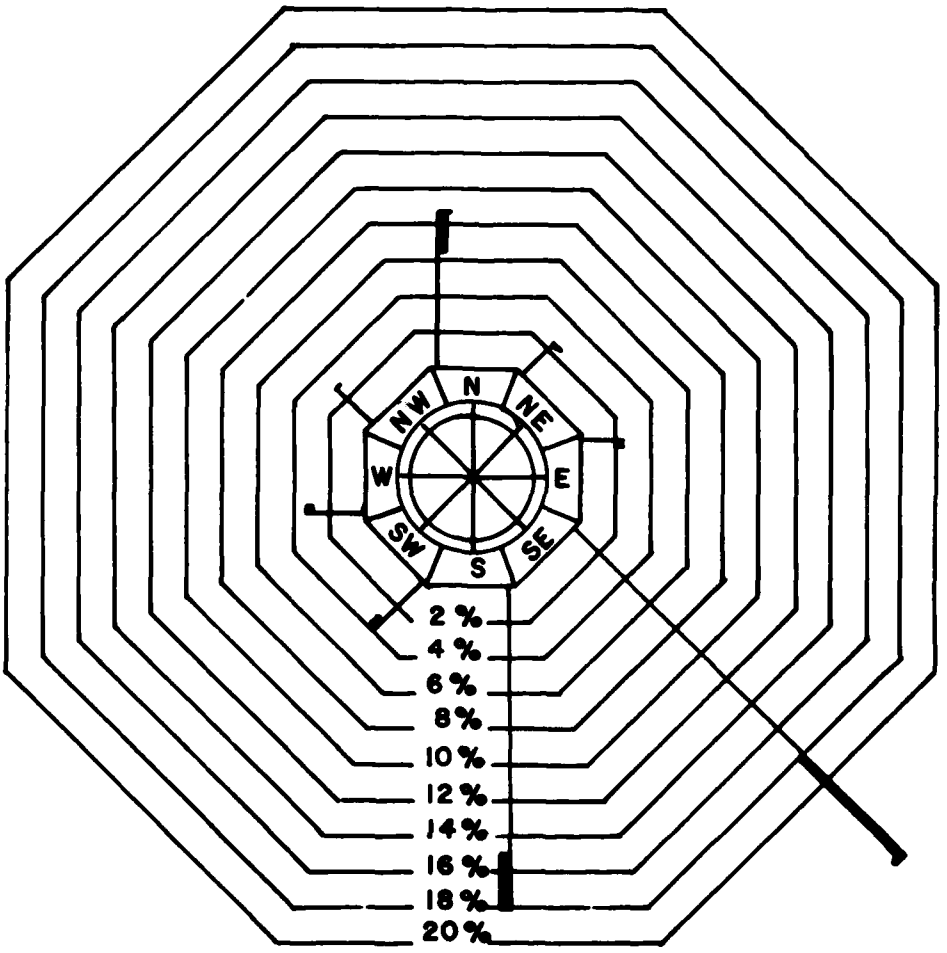

WIND VELOCITY-DURATION CURVE
LUMMI BAY, Washington
Note: Curves are estimated on basis of summary of strong winds at Bellingham for period 1930 thru 1959 and from detailed wind record for Friday Harbor from 21 Nov. 1959 thru 17 Dec. 1970.
E
SW
S&SE
W
N&NE
VELOCITY MPH
90
80
70
60
50
40
30
20
0
1
2
3
4
5
6
DURATION IN HOURS

FIGURE C-1



CALM 33 %

LEGEND

VELOCITY RANGE - M.P.H.

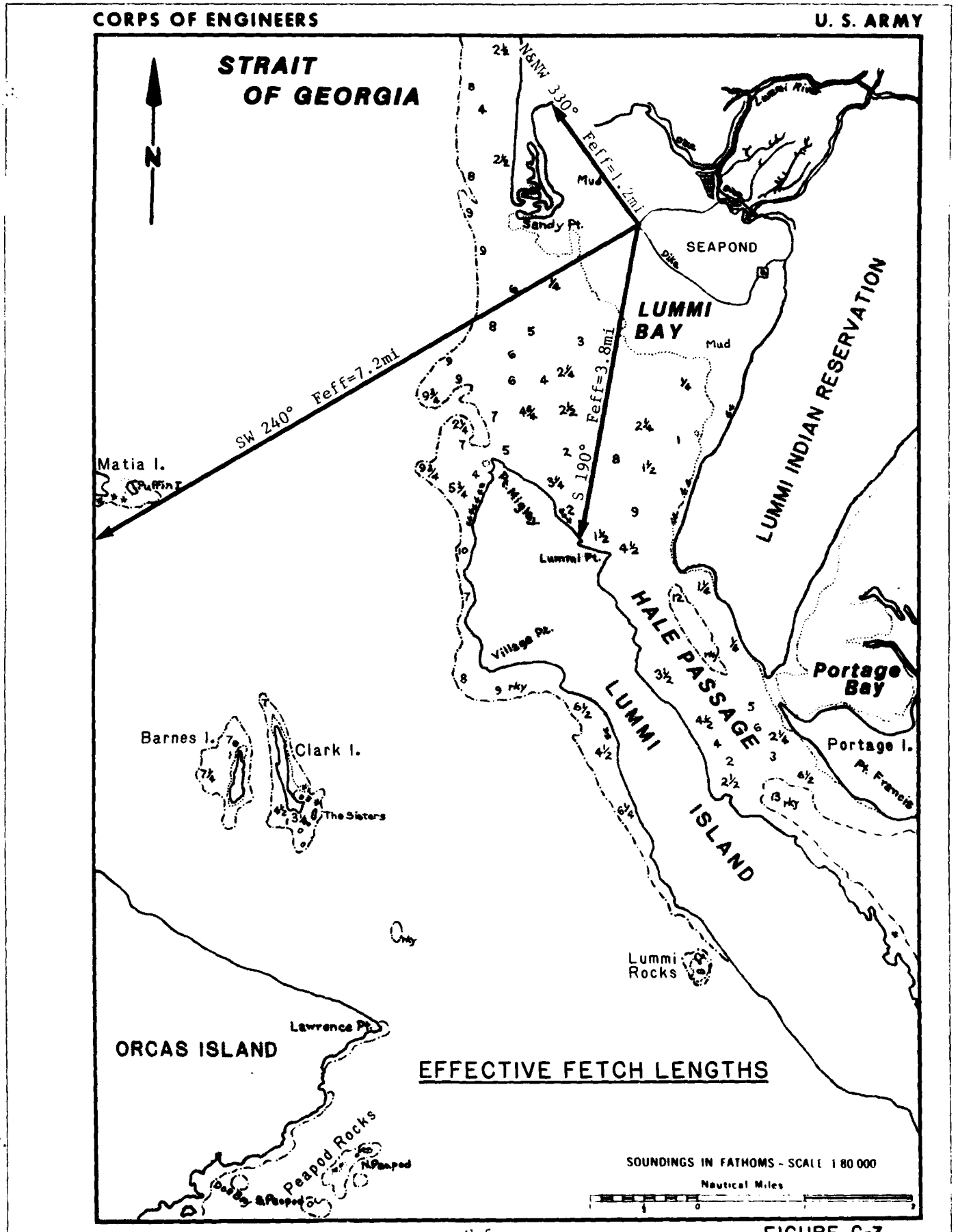
LESS THAN 4 -	CALM
4 TO 12	
13 TO 24	
25 TO 38	
OVER 38	

SOURCE

Climatological Handbook,
Columbia Basin States
Published June 1968

BELLINGHAM WASH.
ANNUAL
WIND ROSE
FROM 1948 TO 1954
U.S. Army Engr. District, Seattle, Wash.
Comp: FLS
Drawn: FLS
Checked: NJM Date: 8/13/71

FIGURE C-2


CORPS OF ENGINEERS
U. S. ARMY
STRAIT OF GEORGIA
N
N&NW 330°
Feff=1.2mi
SW 240°
Feff=7.2mi
S 190°
Feff=3.8mi
Sandy Pt.
SEAPOND
LUMMI BAY
Mud
LUMMI INDIAN RESERVATION
Matia I.
Lummi Pt.
Village Pt.
HALE PASSAGE
LUMMI ISLAND
Portage Bay
Portage I.
Pt. Francis
Barnes I.
Clark I.
The Sisters
Lummi Rocks
ORCAS ISLAND
Lawrence Pt.
Peapod Rocks
EFFECTIVE FETCH LENGTHS
SOUNDINGS IN FATHOMS - SCALE 1 80 000
Nautical Miles

C-5

FIGURE C-3

1.09 Geologic and Foundation Conditions. Prior to the early part of the twentieth century, Lummi Bay was the delta for the Nooksack River which, because of a combination of natural and manmade diversion, now enters Bellingham Bay. The very soft to soft sediments of Lummi Bay consist of silt and fine silty sand with shells and organic debris and largely a mix of Nooksack delta sediments and estuarine bay mud deposits. These materials are on the order of 100 feet thick and have experienced very little consolidation due to their saturated and buoyant condition. They are underlain by medium to stiff sandy clays which probably represent glacio-marine drift.

a. Subsurface Exploration. Twelve 1-inch-diameter wash borings were made to depths up to 23.0 feet using portable hand-carried equipment in the proposed access channel area. Disturbed 1-inch-diameter drive samples (Porter sampler) were obtained from these borings for visual classification and laboratory testing. Nine rotary drill borings were made to depths up to 122.8 feet inside the aquaculture pond using floating plant. Undisturbed 3-inch-diameter tubes were taken using an Osterberg sampler. Disturbed samples with blow counts from standard penetration test (SPT) were also obtained in the rotary drill borings. Boring locations are shown on plates 3 and 4, with detailed drill logs on plate 5.

b. Laboratory Testing. A laboratory test program was undertaken consisting of: gradation and Atterburg limit tests on samples from 1-inch-diameter wash borings and SPT samples; vane shear and triaxial shear, consolidation, and Atterberg and gradation tests on specimens from the 3-inch Osterberg tubes. Gradation curves are shown on plate 6. Other detailed test results are given on figures C-6 through C-26 found at the end of this appendix.

c. Entrance Channel Foundation Conditions. A 7,300-foot-long, 100-foot-wide channel dredged to elevation -12 feet MLLW is required for access from deep water to the boat basin site. Except at the extreme western end the existing ground line along the channel alinement ranges from +3 to -2 feet MLLW in elevation. Along the alinement the surface materials generally consist of a fine sand layer varying in thickness from 3 to 17 feet. The thicker sand depths were found in borings 82-P-11, -13, and -14 at the west end of the channel. The sand layer was absent in boring 82-P-9. Under the surface sand layer the materials vary from silty sands to very soft sandy to clayey silts. The thickness of these soft silty deposits in the entrance channel area was not determined during the exploratory program; however, they probably extend to a depth in excess of 100 feet.

d. Access Channel and Moorage Area Foundation Conditions. Construction of the access channel and boat moorage area will require dredging from the existing ground surface, about elevation +4 feet, to elevations varying from -11 to -13 MLLW. Materials consist of a surface zone of fine sand varying in thickness from about 6 to 10 feet, except that at boring 82-RD-24 this sand layer was not found. Beneath the surface zone the materials encountered were very loose silty fine sands and/or very soft sandy silts grading with depth to very soft silts with some clays. One boring, 82-RD-25, was drilled to a depth of 122.8 feet and encountered a stiff clay underlying the soft silts at elevation -107.5 feet MLLW.

e. Stability Analysis. Conventional static stability studies were made of the existing aquaculture dike, the access channel, and moorage area excavation sections using the modified Swedish slip-circle method. A shear strength defined by an angle of internal friction, $\emptyset$, equal to 35 degrees and a cohesion, c, of zero was assumed for the aquaculture dike material. The original ground surface zone of fine sand was assumed to have a shear strength defined by $\emptyset$ = 32 degrees and c = 0. Based on the torvane shear tests and the unconsolidated-undrained, Q, shear tests, a shear strength of $\emptyset$ = 0 and c = 400 pounds per square foot (p.s.f.) was assigned to the soft silts. Using these shear parameters analyses of the aquaculture dike in its present configuration gave a minimum safety factor of 1.2, indicating that the assigned shear strengths are generally appropriate.

Stability studies of the aquaculture dike-moorage excavation section indicated that the critical design dimension for stability is the width of berm between the dike toe and the top of the access channel or moorage excavation cut slope. Analyses with varying berm widths were made to arrive at the minimum berm width of 175 feet. As shown on figure C-6, stability analysis of the dike-moorage area section (arcs 1 through 4, 8, and 9) gave a minimum safety factor of 1.25.

The results of stability analyses of the channel cut slope (arcs 5, 6, and 7) are also shown on figure C-6. For a 4 horizontal to 1 vertical cut slope the minimum safety factor indicated is 1.75. The channel side slope materials will consist of fine sands and silts which are highly susceptible to wave erosion. This erosion will result in flattening of the cut slopes and require removal of the eroded material from the channel as maintenance dredging.

f. Disposal Site Volume. Construction of the entrance channel and moorage area will require dredging 1,470,000 cubic yards (c.y.) of materials, of which 70 percent, 1,030,000 c.y., are estimated to be fine sand. The sand is assumed to have a "zero" swell factor; i.e., excavation volume equals disposal fill volume. The remainder of the dredging, 440,000 c.y., will be primarily sandy silts and silts which are assumed to swell 50 percent. The total disposal volume required is estimated to be 1,030,000 c.y. plus 1.5 times 440,000 c.y., which equals 1,690,000 c.y.

g. The local sponsor will be required to design and construct a dike system for retention of the dredged material. Preliminary studies indicate that a retention dike/disposal fill system is feasible provided that the berm between the retention dike toe and the top of the moorage area cut slope has adequate width. With a 200-foot-wide berm, a stable dike/disposal fill can be constructed to elevation +12 feet. Additional disposal volume can be obtained by offsetting a second stage dike to elevation +20 feet above MLLW about 200 feet back from the original dike and by mounding dredged material to elevation +25 feet above MLLW inside the second stage dike.

1.10 Breakwater Selection. Existing dikes forming the sea pond will act as a breakwater on the north and west sides of the proposed marina. Existing rock size is greater than the stable rock size of approximately 400 pounds.

Therefore, no additional armor rock protection is necessary, other than the rock relocated from the entrance area dike face scheduled to be breached. The breakwater on both sides of the entrance will be timber pile with rock blanket at the base of the breakwater. A floating breakwater is not practicable because the berm area must be retained for foundation stability; which would result in grounding of the breakwater at low tide. Cost of a floating breakwater is greater than the timber pile structure. The unstable foundation is not suitable for a rubblemound structure.

SECTION 2. DESIGN FEATURES OF THE RECOMMENDED PLAN

2.01 General. The main design features of the project include the navigation channels and turning basin, the entrance and existing sea pond breakwaters, boat basin, upland fill area, future maintenance dredging disposal area, and mitigation area.

2.02 In determining the channel design, major considerations were those related channel dimensions (width and depth) and alinement which would afford safe and efficient vessel operation. The selection of channel depth was dependent upon the loaded draft of expected vessels, squat or sinkage, trim maneuverability, water density, wave action, tides, and type of bottom. Factors considered in determining channel width were: existence of passing situation, vessel controllability, vessel speed relative to channel bottom, current velocity and direction, wave action and direction, and characteristics of channel banks. Factors considered in channel alinement were: alinement and depth of the natural ebb channel (hydrographic data), environmental considerations (eelgrass), vessel maneuverability, aids to navigation requirements, and expected maintenance requirements.

2.03 The breakwater designs consist of two features; the existing section, the sea pond dike, and the timber pile breakwater at the entrance of the proposed boat basin. Design considerations for the dike breakwater section were: design and condition of existing dike, wave action, elevation of surrounding tideflats, tides, currents, foundation conditions, and consequences of a breach in breakwater. The timber pile breakwater design considerations were the same as above, but also included: width of entrance channel, location of moorage facilities inside the boat basin, width of berm between toe of dike and top of cut slope on channel, slope of channel, flushing and circulation characteristics of the boat basin, vessel maneuverability, stability, type of foundation material and fish passage.

2.04 Layout and design of the boat basin and interior channels and turning basin were a combined effort by Federal and local interests. Major design considerations were: number, size and type of vessel to be moored in the marina, location of boat basin relating to the existing natural channel and the deep water of Strait of Georgia, flushing and circulation, compatibility with entrance channel dimensions, upland development, soil stability requirements for dike and cut slopes.

2.05 Alternative Sites Considered. Section 3 of the DPR discusses plan formulation. The south side of Gooseberry Point was initially chosen by the local sponsor as the principal location for the proposed boat basin. DPR studies were initiated for a marina at this location. Due principally to environmental complications associated with a marina at this site, the local sponsor subsequently requested that the Corps of Engineers shift the DPR study focus to a marina situated within the northwest corner of the sea pond in Lummi Bay.

A number of sites were considered within Lummi Bay. The criteria used in selecting the proposed sea pond location, include the following:

a. Impacts on the existing aquaculture operations are minimum.

b. Optimizes use of the existing natural channel through the Lummi Flats to Strait of Georgia to minimize dredging.

c. Minimizes length of the navigation channel from the proposed site to Strait of Georgia.

d. Maximizes wave protection at the entrance of the proposed boat basin.

e. Optimizes use of the existing sea pond for development into uplands.

f. Optimization of flushing and circulation characteristics of the proposed basin.

2.06 Project Description. The recommended plan provides for the following:

o Federal construction and maintenance dredging of the navigation entrance channel from the Strait of Georgia across Lummi Bay to the site of the proposed boat basin in the northwest corner of the existing sea pond.

o Federal construction and maintenance dredging of the turning basin and access channel inside the boat basin.

o Non-Federal construction and maintenance dredging of the boat basin for moorage of commercial fishing boats.

o Federal construction and maintenance of the timber pile breakwaters at the entrance of the proposed boat basin. These breakwaters have been designed to incorporate fish passage.

o Federal reinforcement and maintenance of the existing rock face on the sea pond dike. The rock dike will function as a breakwater for the proposed boat basin.

o Non-Federal development and maintenance of uplands (e.g., containment dikes, fill placement, paving and landscaping) to be used for construction of marina support facilities.

o Non-Federal construction and maintenance of dikes surrounding the proposed mitigation areas and containment dikes for the maintenance dredge pond.

o Non-Federal development of tidelands, as mitigation, inside the sea pond by breaching the existing sea pond dike. Maintenance of the breach entrance and existing rock dike are a non-Federal responsibility.

o Non-Federal construction of three small marshlands at sites in the mitigation area. Monitoring of the marsh areas would occur for the first 5 years following project construction, and would be a shared Federal and non-Federal task under project operation and maintenance.

o Non-Federal construction and maintenance of access roads to the marina.

o Non-Federal construction and maintenance of all facilities such as moorage floats, access ramps and docks, public boat launch ramp, work and fuel docks, wharfs for commercial fishing boats, marina and upland features, and marina and industrial water-related uses, including a harbor master office, restrooms parking areas, web houses, fish processing plant, shipyard and barge construction areas.

2.07 The proposed project dimensions and general details are shown on plates 1 and 2. The public notice in appendix A, part B, contains details of the local sponsor project features, including a general layout for shoreside or upland features. Local sponsor or non-Federal associated marina facility details will be refined by the Lummi Tribe concurrent with Corps of Engineers plans and specifications stage of project design. Additional local sponsor developed marina and support facility details are described in the main report and environmental impact statement. Project acreage and dike requirements are shown on table C-1.

2.08 Marina Layout. The marina layout is located in the northwest corner of the Lummi sea pond, to take advantage of the existing dikes and natural channel. To maintain stability of the sea pond dike, a berm of 175 feet is required between the toe of the dike and the moorage basin cut slope. The entrance is situated with the opening to the north because this is the direction of minimum wave attack and to take advantage of access to the naturally deeper ebb channel at this location. The basin length and width were chosen to assure good flushing characteristics and to maximize float layout efficiency.

2.09 Circulation and Flushing. The boat basin and channel as designed result in a tidal prism ratio (TPR) of 0.33. The TPR is defined as the ratio:

$$\frac{\text{volume of basin water at mean high tide - volume at mean low tide.}}{\text{volume of basin water at mean high tide}}$$

Based on review of existing literature and limited field measurements, the basin should have a single-gyre, counter-clockwise circulation pattern. Stronger current speeds would be anticipated around the outside the perimeter and weaker currents toward the center of the basin. These stronger currents result in good water circulation in the basin. During the early flood tide the surface current and bottom currents at the entrance might be in opposite directions (bottom currents in, surface currents out) as a result of density differences between surface and bottom waters. This phenomena would be accentuated by any stratification in the water column from temperature or salinity differences. Temperature differences in the source water may result from the approximate 4 feet of warm tideflats water at high tide, and the lower channel bottom water from the cool Strait of Georgia water. Salinity

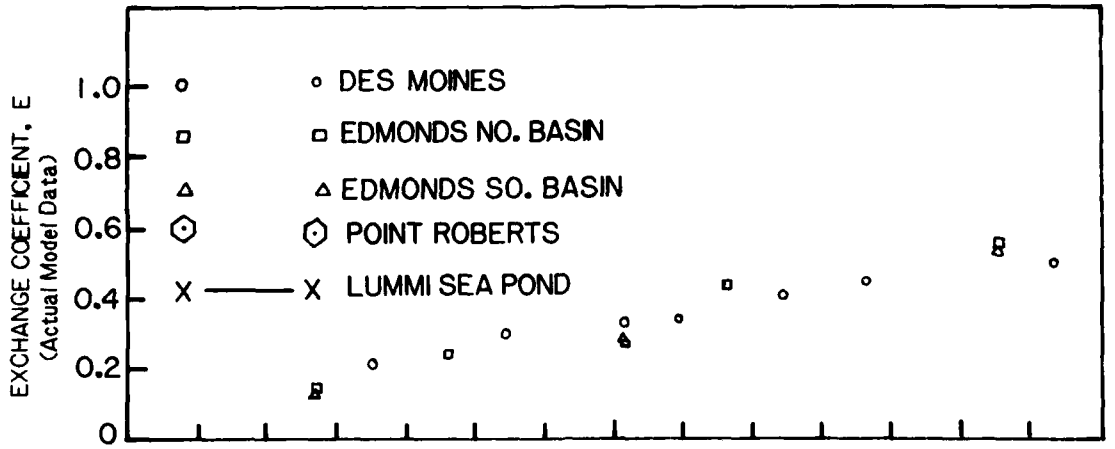
differences may occur due to fresh water from the Lummi River and saltwater from Strait of Georgia. The river water surface current should flow past the entrance of the boat basin on the ebb tide; therefore, the salinity stratification is unlikely in the basin. Stratification in the water would be counteracted most of the time by several mechanisms including wind, waves, tidal currents, circulation in the boat basin, and boat traffic. During ebb flow currents will be directed towards the entrance. Flow off the shallow peripheral berm will locally redirect the ebb currents.

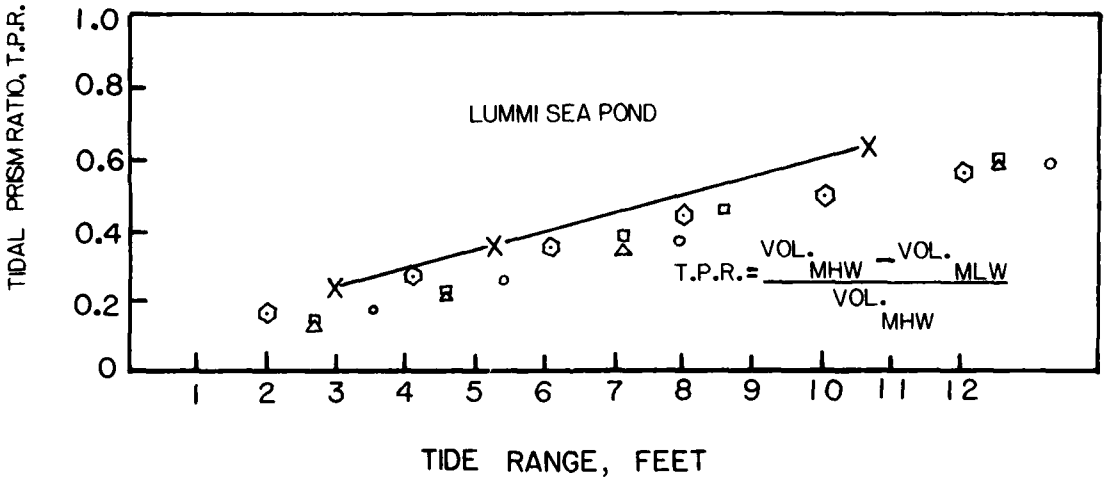
a. Comparisons of the Lummi sea pond boat basin TPR with other boat basins may be made by referring to figure C-4. The tide range used in the TPR calculations was 5.3 feet (7.8 feet to 2.5 feet MLLW (MHW-MLW)) which is an average of neap and spring tides. The TPR at this range tide is 0.33. This is plotted on figure C-4, which indicates the TPR for the proposed boat basin is as high or higher than other marina TPR's. For other tide ranges, the Lummi basin would exhibit the same trend as the other boat basins studied. The shape of the Lummi sea pond boat basin resembles the Des Moines and Edmonds South basin the best. Most all of the marinas tested have flushing efficiencies (exchange coefficient as determined from model tests divided by the TPR x 100) at about 100 percent. Because of similarities in design of the sea pond basin to the tested basins, exchange equal to, or greater than, that predicted by the tidal prism theory should occur at the sea pond small boat basin. The main conclusion from figure C-4, discussed above, is that the TPR is a good indicator of gross flushing for a marina. None of the model tests or the TPR figures account for additional factors which would increase exchange such as density currents, propeller wash, wind, etc.

b. The 0.33 TPR value is an "average" for the entire basin and exchange value for select portions of the basin cannot be determined from simple basin geometry. However, in University of Washington Technical Report No. 62 results of various basin planforms tested are shown that give exchange coefficients throughout the basin (an indication of circulation within the basin). Shown on figure C-5 are the results of local exchange for a basin almost identical in shape and TPR to that proposed at the sea pond site. From the figure it can be seen that exchange coefficients are almost identical throughout the basin; thus, no local "deadspots" should exist. Good basin exchange and mixing design are dependent on the width/length ratio and the entrance width, which has been used to optimize the proposed boat basin layout. Drainage off the shallow peripheral berms will also contribute significantly to eliminating the potential of any circulation "deadspots." A report by the Washington Department of Fisheries, titled "Water Quality and Flushing of 5 Puget Sound Marinas," made the following recommendations in order to avoid violating state standards for water temperature and dissolved oxygen:

(1) Mean exchange coefficient of 25 percent minimum for temperature control.

(2) Mean exchange coefficient of 30 percent minimum for dissolved oxygen purposes.

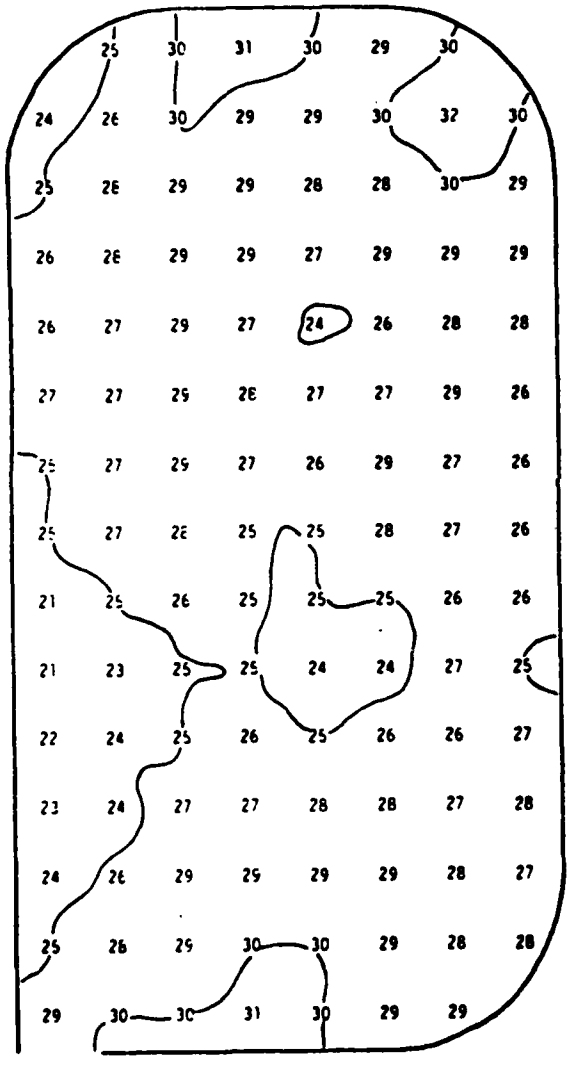




FLUSHING CHARACTERISTICS OF VARIOUS PUGET SOUND MARINAS

SOURCE:
UNIVERSITY of WASHINGTON and
PT. ROBERTS MARINA DRAFT EIS

FIGURE C-4



NOTE:

1. Data shown on this figure are from the source documents listed below. The exchange coefficient data shown are for a representative marina comparable to Lummi Sea Pond.
2. For comparison purposes to the source document tests; Lummi Sea Pond has the following characteristic :

H (MHW - MLW) = 5.0 feet
W (entrance width) = 100 feet
L/B (length/width ratio) = 0.57
E (TPR) = 0.33
$\overline{E}$ = 0.27
S = 0.022

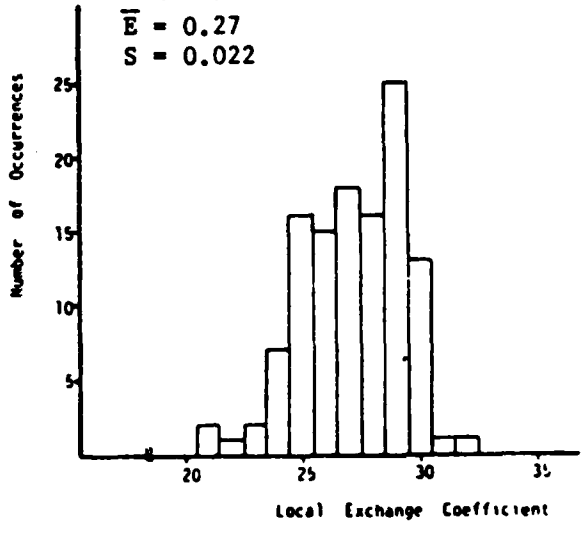


Figure 25. Rounded Corners, Single Entrance, H = 6 feet, w = 125 feet, L/B = 0.53.

SOURCE: Univ. of Wash. Tech. Report #62, Dec 1979.
"Effects of Planform Geometry on Tidal Flushing and Mixing Marinas".
R.E. Nece, E.P. Richey, J. Rhee, H.N. Smith

FIGURE C-5

The exchange coefficient for the Lummi sea pond basin should meet the state recommendations, based on the calculated TPR and the similarity in shape and size to other Puget Sound marinas.

c. Flushing and circulation characteristics of the proposed marina were estimated by review of existing literature. From this review the circulation pattern is estimated to be a single gyre.

2.10 Comparison of mathematical and hydraulic model studies with field studies of a similar boat basin design led to the conclusion that the proposed basin will be well-flushed and circulation will be good.

2.11 Wave Force Analyses. Wave estimates were used to estimate the forces acting on the timber pile breakwater and to check the size of the armor rock protection on the existing dike and size of rock required on the channel slopes at the entrance. A wave estimate was calculated for the dike inside the Lummi sea pond to check the stability of the dike slope and/or requirements for rock protection.

2.12 Application of Design Wave Data. Under design wave conditions, diffracted wave heights through the entrance to the boat basin will be less than 1 foot, which has previously been used in Corps of Engineers projects as an acceptable and realistic standard. Under the most severe wave conditions and design high tides some wave overtopping of the western dike could occur, but other than minor damage to the dike, no wave transmission overtopping problems are anticipated. Design waves used in the analysis are based on the significant wave heights for diffracted wave in the moorage area (northwest wave) and significant wave (breaking) for rock size calculations (southwest wave). Wave forces on the timber pile breakwater are based on a 5 percent wave (of the northwest wave) using the Miche-Rundgren method for nonbreaking waves. The following tabulation shows design wave conditions.

Direction	Hs (FEET)	DESIGN WAVE HEIGHT (FEET)	PERIOD (SECONDS)
South (190°)	4.1	--	4.1
Southwest (240°)	4.3	3.9[1/]	4.3
Northwest	1.5	2.1[2/]	2.5

1/Shallow water breaking condition.
2/Five percent wave height.

2.14 Timber Pile Breakwater Design. Two timber breakwaters, 280 lineal feet each, are to be constructed of class A treated timber piles with rock toe protection. Plan and sections of breakwaters are shown on plate 3 of main report. The breakwaters are similar and each will be comprised of a cantilever and a battered pile section.

2.15 The proposed cantilever section of breakwater will run 212 feet from the existing top of dike to edge of proposed berm. Vertical piles will be driven 3 feet on center to a minimum penetration of 10 feet. One 10-inch by 12-inch treated timber wale will be fastened to the boat basin side of breakwater with galvanized bolts. Piling will be faced with treated timber 3-inch by 12-inch planks on the seaward side.

2.16 The battered pile section of breakwater will run 68 feet from edge of berm to the edge of the navigation channel. Vertical and batter piles will be driven 3 feet 6 inches on center, to a minimum penetration of 15 feet. Two 10-inch by 12-inch treated timber wales will be fastened to the boat basin side with galvanized bolts and steel fittings. Piling will be faced with treated timber, 3-inch by 12-inch planks, to an elevation of -2.0 MLLW, or 2 feet below top of rock toe protection, whichever is highest.

2.17 Existing Rubblemound Breakwater. A minor amount of rock (1,400 tons) will be relocated from the entrance area to selected portions of the existing dike breakwater. Rehabilitation of the structure was done in 1981 and again in 1983 when the dike was partially breached. The repair work in 1983 was based on design input from the Seattle District, Corps of Engineers.

2.18 Federal Navigation Channels and Turning Basin. Project acreages are identified in table C-1. The entrance channel would extend from the northwest corner of the marina in a westerly direction, following the natural channel, to deep water in the Strait of Georgia. The entrance channel would be 7,300 feet long and 100 feet wide with project depth of -12 feet below MLLW. The access channel inside the marina would be 1,400 feet long and 100 feet wide with a project depth of -12 feet MLLW extending the length of the western side of the marina providing access to the moorage area and boat launch ramp. These depths would provide for boat traffic at all tide stages except for the very largest of vessels at extreme low tides. A Federal turning basin, 200 feet by 200 feet, with project depth of -12 feet MLLW would be provided just inside the entrance breakwaters. The seiners are the largest class of vessel used in design of the channel. These vessels have loaded drafts up to 8-10 feet, lengths up to 75 feet and beams of 25 feet. The entrance channel would be alined to follow the natural channel through the mudflats as much as possible, to minimize dredge quantities and impacts on the environment. Dredge volumes for the Federal entrance and access channels and turning basin are estimated at 825,000 cubic yards, which includes 1 foot of overdepth allowance, 1 foot of advance maintenance (except for at the 1,000 foot reaches at the Strait of Georgia end and west from the breakwater entrance which includes 2-foot advance maintenance) plus a 10 percent quantity contingency. Quantities are based on side slopes of 1 vertical to 4 horizontal. Typical sections are shown on plates 7 and 8. Dredging would be by hydraulic dredge with pipeline disposal.

2.19 Moorage Area. The moorage area is about 25 acres would have project depths of -12 and -8 feet below MLLW as shown on plate 2 and the non-Federal portion of the permit application and included in the public notice in appendix A. An estimated 645,000 cubic yards, which includes 1 foot of

overdepth allowance, 1 foot of advance maintenance, and a 10 percent quantity contingency would be dredged from the moorage area. The depths are adequate for moorage of the type of craft expected for all tides.

2.20 Disposal Area. The disposal area of about 65 acres and 3,900 feet of disposal dikes would be provided by local sponsor. The designated area will extend south along the east side of the moorage area and east to the existing tide gate on the existing north dike. A total of approximately 1,470 million cubic yards dredged from the Federal navigation channels, turning basin and moorage basin would be placed in the fill area. The area would be filled to an elevation of about +15 to +25 feet MLLW, providing for marina support facilities. Deep water disposal of the dredge material would be more costly than the proposed disposal method. New dikes, to be provided by the local sponsor would be required along the south and east sides of the fill area and on the south side of the mitigation area and future maintenance dredging disposal area. Dikes would be constructed by trucks hauling gravel to the site and utilizing coarser material from the dredge disposal. The existing dike will be used as a containment dike on the north side. The overflow weir would be placed at the east end of the existing north dike to maximize ponding time and thus reduce the volume of outfall sediment.

2.21 Maintenance Dredging and Disposal. Federal maintenance of the entrance channel, access channel and turning basin is estimated at 40,000 c.y. every 5 years during the 50-year project life. Non-Federal maintenance dredging is expected to be negligible. Disposal of this material would be in the designated 25-acre maintenance dredging pond (plate 2). During initial construction the containment dikes on the south side of the mitigation area and maintenance pond will be constructed. When maintenance dredging is required, expected first at year 5, a 1,200-foot-long cross dike separating the maintenance and tidal mitigation areas will be constructed. The overflow weir constructed in this dike will be reopened to tide action upon completion of each maintenance cycle.

2.22 Maintenance of Breakwaters. Breakwater maintenance is expected to include replacement of the timber pile breakwater and the addition of 7,000 tons of rock on the rubblemound dike breakwater at year 25 of the 50-year project life. Federal breakwater maintenance costs are shown in table C-3.

2.23 Mitigation Area. As part of the mitigation for this project, 65 acres of the sea pond would be converted back to tidelands (see plate 2). This would be accomplished by breaching the existing dike and constructing approximately 1,500 feet of dike separating the mitigation area from the rest of the sea pond. A 300-foot-long breach would include rock slope protection against wave action and tidal current scour. Following initial project construction, approximately 90 acres of the project would be subject to tidal action, 65 acres of mitigation area tidelands and the 25-acre maintenance dredging area).

2.24 Marsh Mitigation Areas. Three marsh areas would be created with the use of dredge material as fill. These marsh areas would be built to a top elevation of approximately +8 feet MLLW. One would be located in the sea pond along the southern dike, one in the mitigation area, and another in the designated maintenance dredge disposal area (see plate 2). An existing marsh in the northwestern corner of the sea pond would remain undisturbed. Material for these marshes is available from the dredged material or from material removed from the dike breach.

2.25 Public Access. A boat launch, constructed by the local sponsor, and open to the public, would be located in the southeastern corner of the boat basin.

2.26 Effects on Adjacent Shorelines. The Lummi Bay project should not have any adverse effects on adjacent shorelines. The predominant longshore movement of littoral drift is in a southerly direction. No substantial blockage of this material should occur along adjacent shorelines. Minor amounts of littoral drift (approximately 8,000 c.y. per year) would be trapped by the proposed channel through the Lummi flats. At low tide, boat wakes would be dissipated on the tideflats causing short-term resuspension of material at water's edge. Sandy Point, approximately 0.5 miles, and the Gooseberry Point mainland, approximately 2 miles away from the channel, should not be adversely affected by the proposed work. Prudent navigation practices and regulations limiting speeds near the entrance would reduce the chance of damage to the channel slopes, timber pile breakwater, rubblemound breakwater, and boats moored in the marina.

SECTION 3. COST ESTIMATE AND SCHEDULE

3.01 Project Cost Estimate. Detailed breakdown of first costs and maintenance costs for the Federal participation items of the project are shown on tables C-2 and C-3. Tables C-4 and C-5 show the estimated non-Federal first costs of construction and maintenance of the self-liquidating associated marina facilities. Detailed project mitigation first costs are shown on table C-6. Equivalent annual costs for items shown on tables C-2 through C-6 are shown on table 4-2 of the main report. Remaining miscellaneous non-Federal project first costs are shown on table C-7. During preparation of the Federal plans and specifications (cost of which is included in Federal engineering and design cost estimate), one additional soils boring will be drilled to obtain undisturbed samples of soft foundation materials under the existing sea pond dike where the entrance channel intersects the dike. The present design shows a substantial length of pile wing-wall on both sides of the channel in this area because of the need for extensive setback from the channel cut slopes due to the soft foundation. Sampling and testing of the existing dike foundation will determine the extent of localized strength increase due to preconsolidation from the existing dike loading, and may result in a shortening of the pile wing-walls. Project costs are based on October 1982 prices.

3.02 Operation and Maintenance. Federal responsibility for breakwater maintenance would include replacement of the timber pile breakwater and repair of the rubblemound breakwater at year 25. Federal dredging of the navigation channel and turning basin is expected every 5 years. The shoaling rate was estimated by reviewing maintenance requirements of other navigation channels with similar designs. Most of the channel should require minor dredging because the outward flow will be predominant. The seaward most portion, say the last 1,000 feet, is where most of the dredging is expected due to greater littoral drift and presence of coarser material. The entrance channel area near the boat basin entrance is also expected to be a relatively high shoaling area. Shoaling in the Federal turning basin, and Federal access channel, and the non-Federal moorage area should be minor. Dredging of an estimated 40,000 cubic yards will be conducted on a 5-year cycle. This estimate includes dredging of 38,000 cubic yards from the entrance channel and 2,000 cubic yards from the turning basin and access channel. The material will be disposed of in the designated 25-acre maintenance dredge pond. A disposal dike with wier will be built separating the disposal area and mitigation area to contain the material in the disposal dredge pond.

3.03 Local interest's responsibility would include maintenance of all marina facilities; moorage, floats, access docks, wharfs, access ramps, and boat launch ramps; access roads; marina parking; shoreside facilities; and other marina support facilities. The estimated local interest's costs for maintenance of marina features are shown on table C-5.

3.04 Design and Construction Schedule. The design and construction schedule of Federal (general navigation facility) project features is shown below. The schedule assumes project authorization and adequate Congressional funding. See plate 9 for a more detailed presentation of the schedule. The dredging schedule which has been coordinated with various agencies to minimize environmental problems, will be confirmed prior to completion of the final report.

Submit Final Detailed Project Report	May 1984
Initiate Plans and Specifications	Jun 1984
Advertise Construction	Feb 1985
Notice to Proceed	Apr 1985
Complete Construction	Sep 1986

3.05 Following initial dredging and disposal operations, the upland disposal area (referred to on plate 2 as Marina Upland Support Area, would be allowed to settle. By late 1987, the local sponsor would complete construction of those marina features identified in table C-3 to achieve project economic benefits and to allow moorage operations to commence. The USCG would install navigation aids before the basin is complete. For purposes of this DPR study, and the project economic analysis, the first year of marina moorage operation would be 1988.

TABLE C-1
ESTIMATED PROJECT ACREAGE

	Project Area	Estimated Acreage 1/
1.	Entrance Channel	35
2.	Turning Basin and Access Channel	6
3.	Moorage Basin (dredged area)	25
4.	Moorage Basin (undisturbed peripheral area)	25
5.	Marina Upland Support Area	65 2/
6.	Maintenance Dredging Disposal Area	25
7.	Tidal Mitigation Area	65
8.	Marina/Mitigation Area Separation Dike	2.9 4/ 5/
9.	Tidal Mitigation Area Dike	1.1 6/
10.	Maintenance Dredging Disposal Area Dike	1.3 7/
11.	Maintenance Dredging/Tidal Mitigation Separation Dike	1.0 8/
	Total	252.3

1/Approximate acreage.
2/Includes adjacent dikes.
3/Maintenance dredge cycle estimated at 40,000 cubic yards every 5 years. The 25-acre site would be subject to tidal action by opening in permanently-installed weir following completion of each maintenance dredge action.
4/Dike acreage is calculated above mean higher high water (+8.6 feet above mean higher high water).
5/The marina/mitigation area separation dike is about 1,300 lineal feet in length.
6/Reflects approximately 1,500 lineal feet of dike.
7/Reflects approximately 1,700 lineal feet of dike.
8/Reflects approximately 1,200 lineal feet of dike.

TABLE C-2
DETAILED FEDERAL FIRST COSTS - GENERAL NAVIGATION FACILITIES
(October 1982 Price Level)

Feature or Item	Unit	Quantity	Unit Price	Amount 1/
1. Dredging and Disposal (Channels and Turning Basin)				
a. Mob and Demob	JOB	1	LS	$200,000
b. Dredge Entrance Channel	CY	645,000	$2.00	1,290,000
c. Dredge Turning Basin and Access Channel	CY	180,000	2.00	360,000
			Subtotal	$1,850,000
2. Breach Sea Pond Dike For Boat Basin Entrance				
a. Remove and Relocate Rock (spalls to 1,500 lbs.)	TON	1,400	$5.00	$7,000
b. Remove Gravel Core	CY	14,000	1.00	14,000
c. Remove Existing Tide Gate	JOB	1	LS	2,000
			Subtotal	$23,000
3. Rock Protection of Boat Basin Entrance (Place Quarry Spalls)	TON	9,000	$16.00	$144,000
			Subtotal	$144,000
4. Timber Pile Breakwaters				
a. Place Treated Piles	LF	7,084	$23.00	$162,932
b. Place Timber and Lumber	BF	27,384	4.00	109,536
c. Place Batter Pile Metal	LBS	16,144	3.00	48,432
d. Place Gravel	CY	670	16.00	10,720
e. Place Rock	TON	820	19.00	15,580
			SUBTOTAL	$347,200
5. Mitigation Features 2/				
a. Construct Tidal Mitigation Area Dikes	LF	960	50.00	$48,000

TABLE C-2 (con.)

b.	Breach Sea Pond Dike for Tidal Mitigation Area Entrance				
	1) Remove and Relocate Rock	TON	768	5.00	$3,840
	2) Remove and Relocate Gravel Core	CY	4,480	1.00	1,300
c.	Marsh Establishment	JOB	1	LS	$3,200
d.	Eelgrass Planting	JOB	1	LS	6,400
				Subtotal	$65,920
Subtotal - Construction Cost				Subtotal	$2,430,120
		Contingencies (±20%)			485,880
				Subtotal	$2,916,000
5. Engineering and Design (±9%)					262,0003/4/
6. Supervision and Administration (±7%)					204,0005/
				Subtotal	$3,382,000
7. Subtotal - Corps of Engineers First Cost					$3,382,000
8. U.S. Coast Guard Navigation Aids					78,000
9. Total Federal First Cost - General Navigation Facilities					$3,460,000

1/Reflects allocation of Federal costs prior to Section 107 cost limitations. See table 4-1 of detailed project report for final distribution of project costs.

2/Reflects Federal portion or 64% of mitigation features, quantities, and costs based upon distribution of project benefits for general navigation facilities (see Table C-6 for back-up).

3/Includes following Corps of Engineers costs during plans and specifications stage of engineering and design required to conduct foundation exploration at location of basin entrance timber breakwater as discussed in paragraph 3.01 of appendix C:

TABLE C-2 (con.)

	Item	Amount
a.	Recon. and Layout - 1 MD @ $250	$250
b.	Mob and Demob Drilling Equipment	2,000
c.	Drill - One 75-foot-deep boring 3 days @ $750	2,250
d.	Inspection - 4 MD @ $300	1,200
e.	Lab testing	2,000
f.	Stability studies - 8 MD @ $250	2,000
g.	Prepare and Review Plans and Specs Input 8 MD @ $250	2,000
h.	S & A (15%)	900
	TOTAL	$12,600

4/Also includes $5,000 to formulate programs for eelgrass planting, marsh establishment, water quality monitoring, and crab entrainment related to dredging activities programs.

5/Includes $3,200 for Federal portion of $5,000 water quality monitoring work during channel and turning basin construction dredging and disposal; supervision of marsh establishment, and crab entrainment monitoring; and $10,000 to supervise non-Federal planting of eelgrass.

TABLE C-3
DETAILED FEDERAL MAINTENANCE COSTS - GENERAL NAVIGATION FACILITIES
(October 1982 Price Level)

Feature or Item	Unit	Quantity	Unit Cost	Total Cost
a. Corps of Engineers Responsibility				
1. Maintenance Dredging and Disposal[1/] (Every 5 Years)				
a. Mobilization and Demobilization	JOB	1	LS	$100,000
b. Entrance Channel	CY	38,000 [2/]	$2.25 [3/]	85,500
c. Access Channel and Turning Basin	CY	2,000 [2/]	2.25 [3/]	4,500
			Subtotal	$190,000
d. Contingencies (20%)				38,000
			Subtotal	$228,000
e. Engineering & Design (9%)				21,000
f. Supervision & Administration (7%)				16,000 [4/]
g. Total Estimated Cost				$265,000
2. Reinforce Sea Pond Dike Breakwater and Moorage Basin Entrance Rip Rap (At Year 25)				
a. Armor Rock	TON	5,000	19.00	$95,000
b. Quarry Spalls	TON	2,000	16.00	32,000
			Subtotal	$127,000
c. Contingencies (20%)				25,000
			Subtotal	$152,000
d. Engineering and Design (9%)				14,000
e. Supervision and Administration (7%)				11,000
f. Total Estimated Cost				$177,000

TABLE C-3 (con.)

Feature or Item	Unit	Quantity	Unit Cost	Total Cost
3. Replace Timber Breakwater at Moorage Basin Entrance (At Year 25)				
a. Treated Piles	LF	7,084	$23.00	$162,932
b. Timber and lumber	BF	27,384	4.00	109,536
c. Batter Pile Metal	OBS	16,144	3.00	48,432
d. Gravel (Quarry Spalls)	CY	670	16.00	10,720
e. Armor Rock	TON	820	19.00	15,580
			Subtotal	$347,200
f. Contingencies (20%)				$ 68,800
			Subtotal	$416,000
g. Engineering and Design (9%)				37,000
h. Supervision and Administration (7%)				29,000
i. Total Estimated Cost				$482,000
4. Monitor Mitigation Features (Annually for First 5 Years)				
a. Monitoring	JOB	1	$2,500	$2,500 5/
			Subtotal	$2,500
b. Contingencies (10%)				300
			Subtotal	$2,800
c. Engineering and Design (5%)				100
d. Supervision and Administration (5%)				100 5/
e. Total Estimated Cost				$3,000

TABLE C-3 (con.)

Feature or Item	Unit	Quantity	Unit Cost	Total Cost
b. U.S. Coast Guard Responsibility				
1. Inspect Navigation Aids and Replace Light Beacon Batteries (Annually)	EA	3	250	$800 6/
			TOTAL	$800
2. Repair and Replace (if necessary) Navigation Aids (At Year 25)	JOB	1	78,000	$78,000 6/
			TOTAL	$78,000

1/Disposal within designated confined upland site, referred to as Maintenance Dredging Disposal Area, on plate 2.

2/Quantity includes 10% contingency.

3/Unit cost includes cost of installing temporary containment dikes and overflow weirs to properly handle disposal of dredged material within disposal site.

4/Includes $1,000 to monitor eelgrass rejuvenation within Federal entrance channel following construction dredging, and replanting of vegetation, if required. Also includes $1,000 to monitor water quality associated with maintenance dredging and disposal. Monitoring will be a shared Federal (Corps) and non-Federal (Lummi Tribe) activity, with input from selected environmental agencies (See EIS for details).

5/Reflects Federal share of estimated $5,000 total mitigation features monitoring cost, based upon distribution of project benefits.

6/U.S. Coast Guard estimate, see their 16 November 1982 letter in Appendix B.

TABLE C-4
DETAILED NON-FEDERAL FIRST COSTS - ASSOCIATED MARINA FACILITIES 1/
(October 1982 Price Level)

	Feature or Item	Unit	Quantity	Unit Price	Amount 2/
1.	Mob and Demob	JOB	1	LS	N/A 3/
2.	Dredging and Disposal (Moorage Basin)	CY	645,000	$2.00	$1,290,000
				Subtotal	$1,290,000
3.	Dikes	LF	7,850	50.00	$392,500
				Subtotal	$392,500
4.	Moorage Facilities				
	a. Access Docks and Wharf	SF	1000	21.00	21,000
	b. Float Ramp	EA	2	3,500.00	7,000
	c. Launch Ramp	EA	1	13,000.00	13,000
	d. Install Moorage Floats	LF	61,500	2.00	123,000
	e. Install Moorage Float Piling	EA	210	300.00	63,000
				Subtotal	$227,000
5.	Mitigation Features				
	a. Construct Tidal Mitigation Area Dikes	LF	540	$50.00	$27,000 5/
	b. Breach Sea Pond Dike for Tidal Mitigation Area Entrance				
	(1) Remove and Relocate Rock	TON	432	5.00	2,160
	(2) Remove and Relocate Gravel Core	CY	2520	1.00	2,520
	c. Marsh Establishment	JOB	1	LS	1,800

TABLE C-4 (con.)

Feature or Item	Unit	Quantity	Unit Price	Amount 2/
d. Eelgrass Planting	JOB	1	LS	3,600
			Subtotal	$35,660
Subtotal - Construction Cost				$1,945,160
6. Contingencies, E & D, S & A and necessary Legal fees (20%)				388,840
			Subtotal	$2,334,000
7. Sunk Costs				
a. Moorage Floats				$492,000
b. Moorage Float Piling				5,000
			Subtotal	$497,000
8. Total Non-Federal First Cost				$2,831,000

1/Reflects non-Federal associated marina facilities self-liquidating project costs required to achieve project benefits.

2/Data developed by local sponsor, numbers rounded.

3/Assumes local sponsor will contract with Federal project dredging contractor. Federal first cost includes mob and demob cost. No need to double-count by identifying mob and demob as an additional non-Federal cost item.

4/Excludes approximately 1,500 linear feet of tidal mitigation area dike and 1,20 linear feet of combination maintenance dredging/tidal mitigation separation dike. See table C-1 for dike lengths.

5/Reflects 36% of mitigation program cost estimate, based upon distribution of project benefits for general navigation facilities (see table C-6 of appendix C for mitigation program).

6/Non-Federal Supervision and Administration (S&A) cost includes $1,800 for non-Federal portion of $5,000 water quality monitoring program during moorage area construction dredging and disposal, reflecting distribution of general navigation supervision of marsh establishment and crab entrainment monitoring.

TABLE C-5

DETAILED NON-FEDERAL MAINTENANCE COSTS - ASSOCIATED MARINA FACILITIES 1/
(October 1982 Price Level)

	Feature or Item	Amount
1.	Replace/Repair Piles (Annually)	$500/year
2.	Replace/Repair Floats (Annually)	$1000/year
3.	Replace/Repair Float Ramps (Annually)	$500/year
4.	Replace/Repair Launch Ramp (Annually)	$400/year
5.	Replace/Repair Access Docks (Annually)	$500/year
6.	Monitor Mitigation Features (Annually for First 5 Years)	$600/year 2/
7.	Construct Maintenance Dredging/Tidal Mitigation Separation Dike (At year 5) 3/	$4,000/year
	TOTAL Non-Federal Annual O&M Cost	$7,500/year

1/Reflects costs for maintaining only those non-Federal items required to achieve project benefits. Cost estimate includes contingencies, E & D, and S & A.

2/Includes replanting of mitigation marsh vegetation, if required. Monitoring will be a shared local sponsor responsibility with Corps of Engineers. Cost estimate reflects $1,800 per year for first 5 years following project construction, and reflects non-Federal share of estimated $5,000 total monitoring cost, based upon distribution of project benefits. Marshes are assumed to be self-sustaining following year 5 and no further Federal and non-Federal maintenance would be necessary.

3/Reflects 1,200 lineal feet of dike at $50.00 per lineal foot for a cost of $72,000. Cost includes wier construction and installation, plus E&D, S&A, and contingencies.

TABLE C-6
MITIGATION FEATURES
(October 1982 Price Level)

	Feature or Item	Unit	Quantity	Unit Price	Amount
1.	Construct Tidal Mitigation Area Dikes 1/	LF	1,500	$50.00	$75,000
2.	Breach Sea Pond Dike for Tidal Mitigation Area Entrance				
	a. Remove and Relocate Rock	TON	1,200	5.00	6,000
	b. Remove and Relocate Gravel Core	CY	7,000	1.00	7,000
3.	Marsh Establishment	JOB	1	LS	5,000
4.	Eelgrass Planting	JOB	1	LS	02/
	Subtotal				$93,000
	Contingency (±20%)				19,000
	Subtotal				$112,000
	Engineering and Design (9%)				10,000
	Supervision and Administration (7%)				8,000
	TOTAL Mitigation Cost				$130,000
	TOTAL Federal Mitigation Cost				$83,0003/
	TOTAL Non-Federal Mitigation Cost				$47,0004/

1/Dike construction includes delivery and placement of sand and gravel, and reshaping into acceptable mitigation area slopes.

2/Assumes local sponsor will plant eelgrass with volunteer labor, but with Corps and environmental agency supervision.

3/Federal share based upon apportionment of general navigation facilities project benefits (see DPR table 4-1), or 64%.

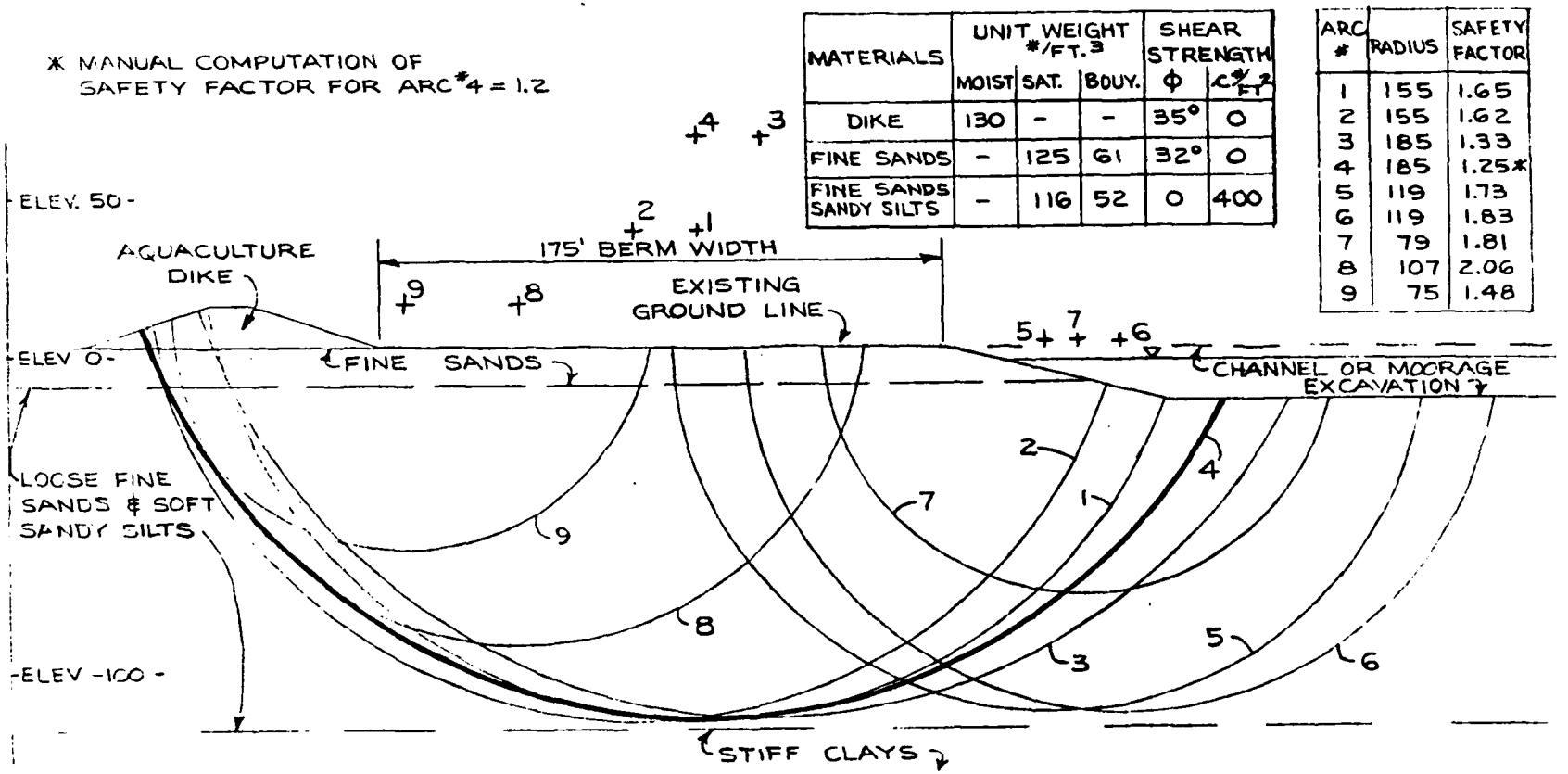
4/Non-Federal share of mitigation cost equal to 36% of general navigation facilities benefits.

TABLE C-7

SUMMARY OF NON-FEDERAL FIRST COSTS - MISCELLANEOUS MARINA FACILITIES 1/
(October 1982 Price Level)

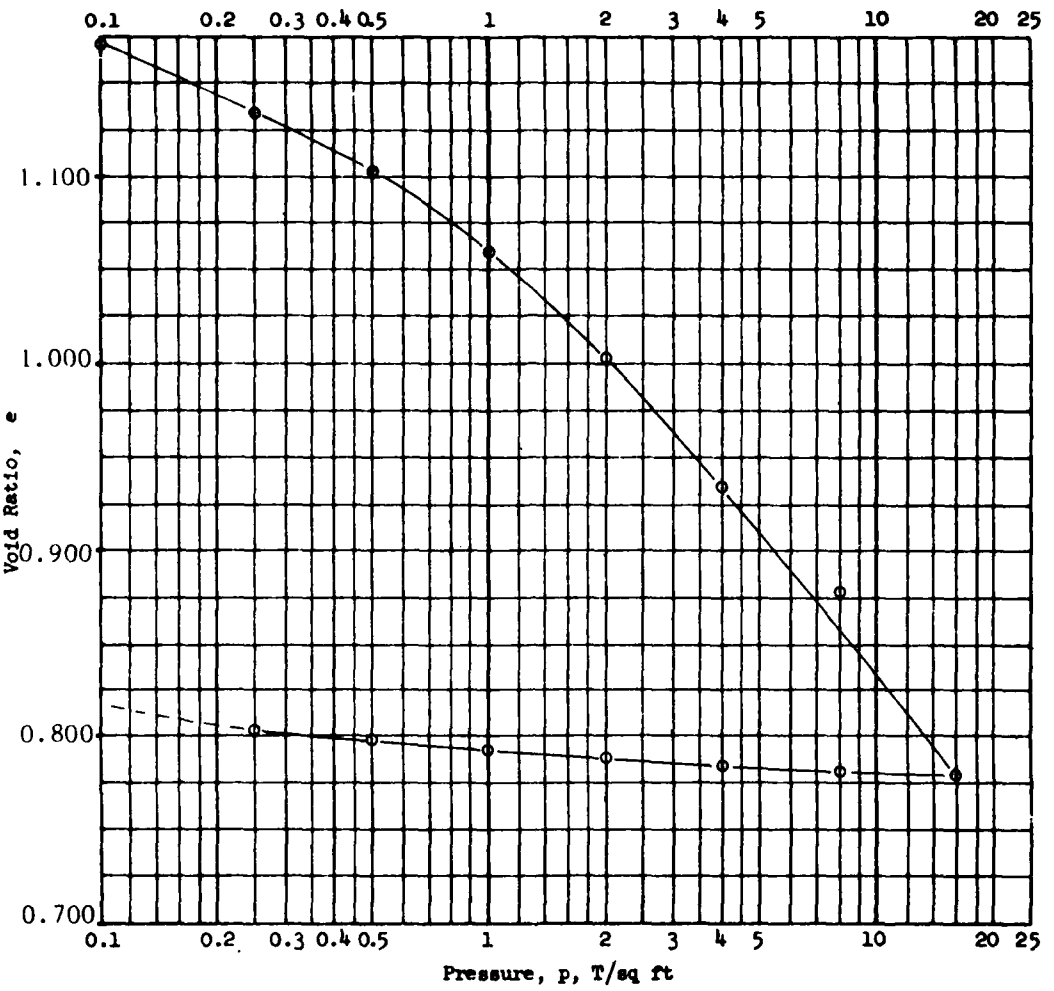
	Item	Amount
1.	Remaining Marina Facilities	$2,400,000
2.	Access and Utilities	800,000
3.	Web Houses	2,300,000
4.	Barge Building Facilities	600,000
5.	Ship Yard Facility	2,100,000
6.	Fish Processing Plant and Wharf	3,600,000
7.	Cold Storage Plant	3,400,000
8.	Marina Commercial Building	2,200,000
		$17,700,000
	Say	$18,000,000

1/ Estimate developed by local sponsor. In addition to the non-Federal associated marina facilities required to achieve project benefits (see table C-3), these additional self-liquidating features would be constructed to complete the marina project. The local sponsor would also maintain these features.



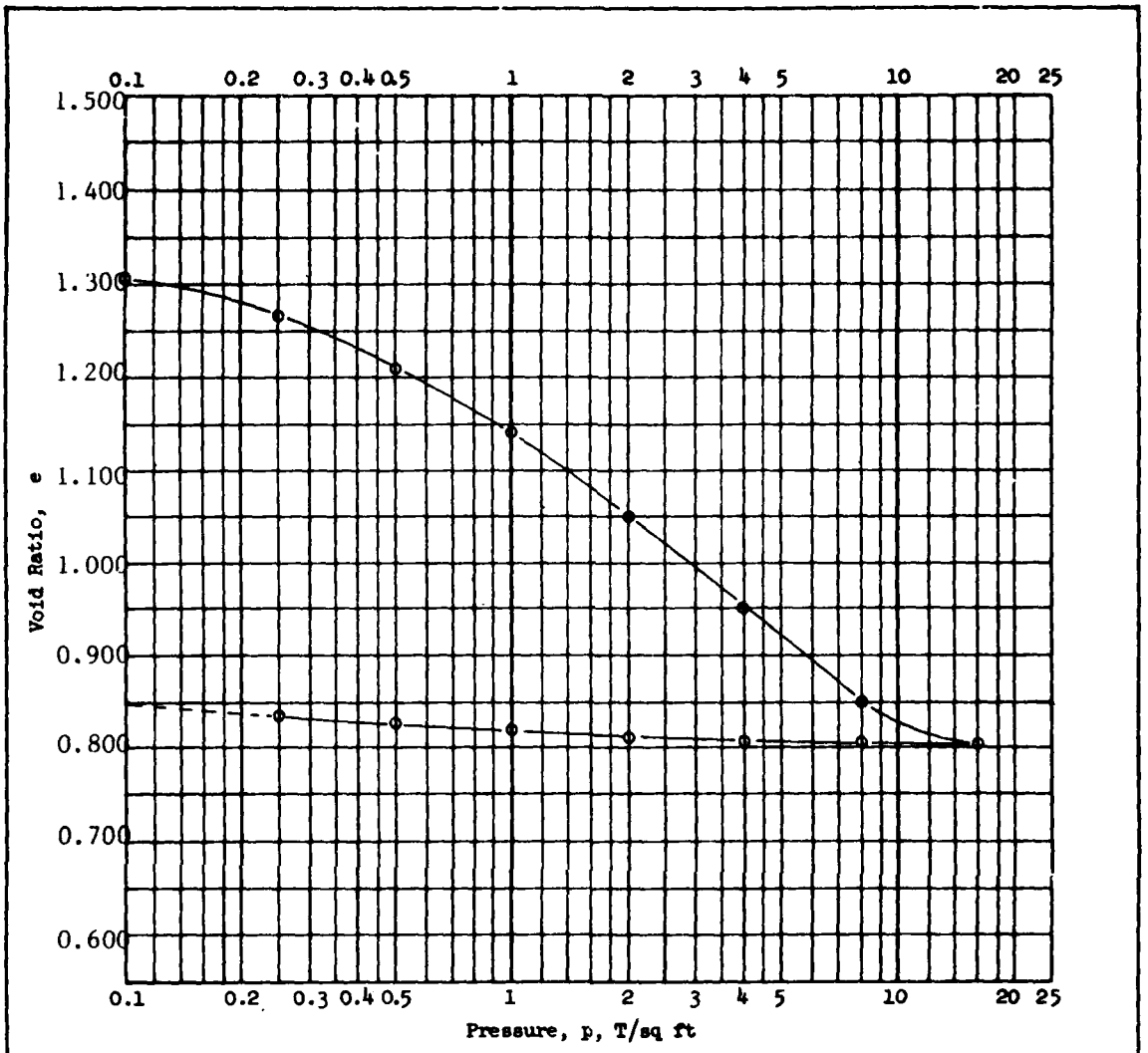
STABILITY ANALYSES SUMMARY

FIGURE C-6



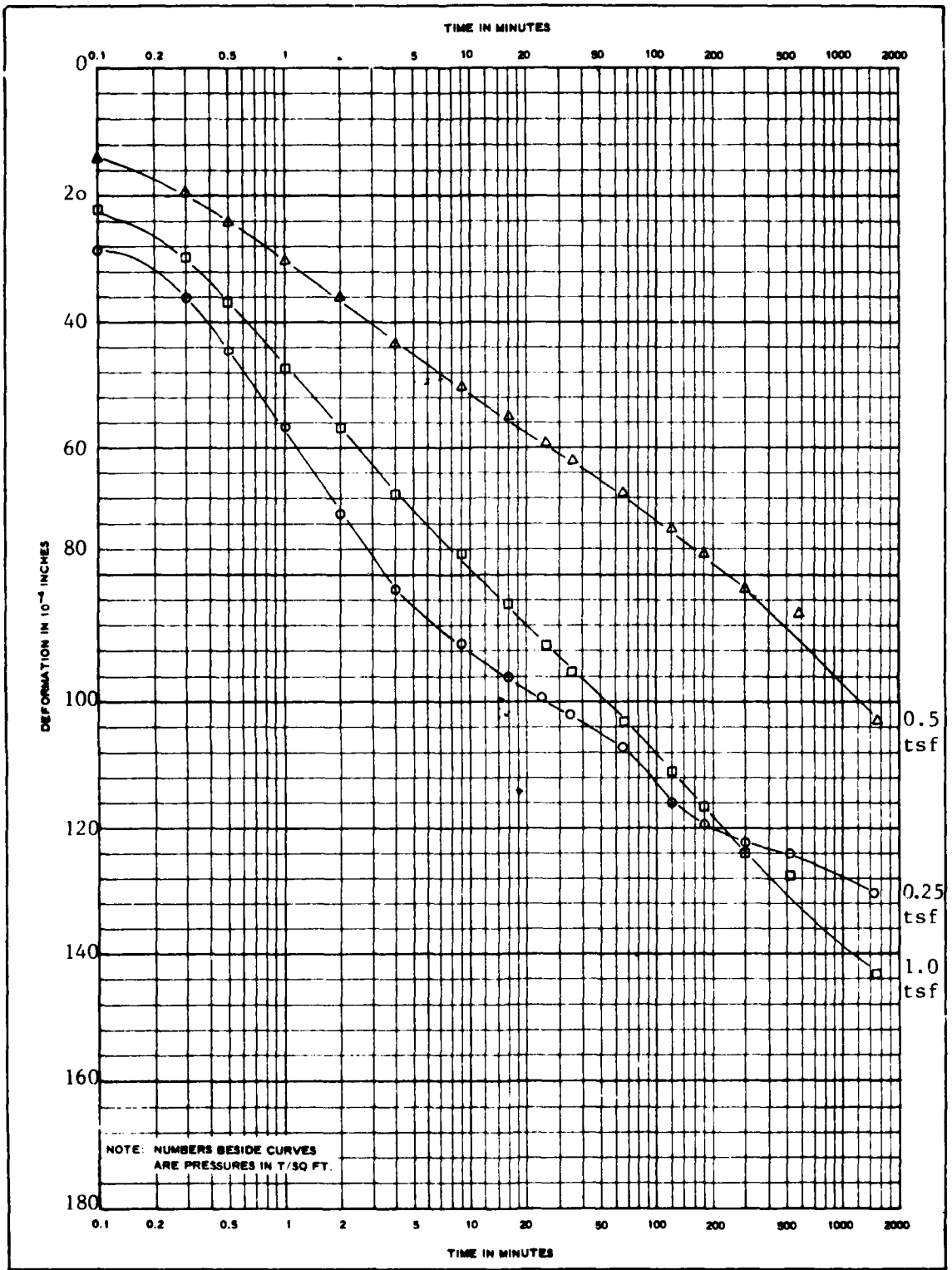
Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.75 in.	Ht 0.765 in.	Water Content, w_o	42.8 %	w_f	30.5 %
Overburden Pressure, p_o - T/sq ft		Void Ratio, e_o	1.173	e_f	0.846
Preconsol. Pressure, p_c 1.2 T/sq ft		Saturation, S_o	99.3 %	S_f	98.0 %
Compression Index, C_c 0.273		Dry Density, γ_d	78.2 lb/ft^3		
Classification -		k_{20} at e_o = -	x 10^{-} cm/sec		
LL -	G_s -	Project	LUMMI SMALL BOAT BASIN		
PL -	D_{10} -		(83-S-302)		
Remarks		Area	Boat Basin		
		Boring No.	82-RD	Sample No.	18 J
		Depth El	37.5-41.2 ft	Date	02 DEC 1982
		NPD	CONSOLIDATION TEST REPORT		

FIGURE C-7



Type of Specimen: Undisturbed			Before Test		After Test
Diam 2.75 in.	Ht 0.765 in.	Water Content, w_o	48.6 %	w_f	31.8 %
Overburden Pressure, p_o - T/sq ft		Void Ratio, e_o	1.325	e_f	0.850
Preconsol. Pressure, p_c 0.6 T/sq ft		Saturation, S_o	99.8 %	S_f	101.9 %
Compression Index, C_c 0.317		Dry Density, γ_d	lb/ft^3		73.1
Classification CL		k_{20} at e_o = - x 10^{-} cm/sec			
LL 44	G_s 2.72	Project LUMMI SMALL BOAT BASIN			
PL 26	D_{10} -	(83-S-302)			
Remarks		Area Boat Basin			
		Boring No. 82-RD-20		Sample No. E	
		Depth El 23.6-26.2 ft		Date 02 DEC 1982	
(83-S-302)		CONSOLIDATION TEST REPORT			

FIGURE C-8

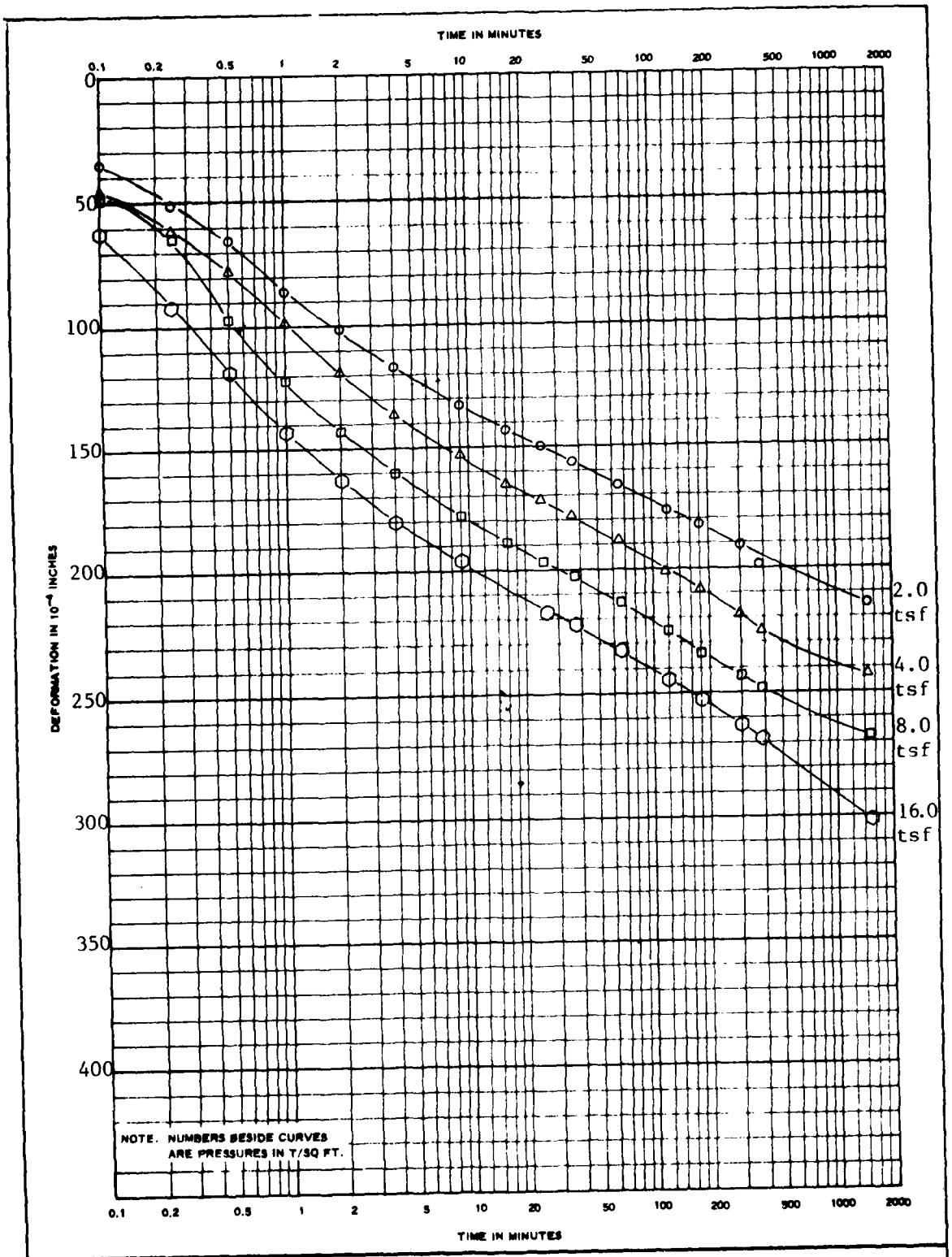


Project	LUMMI SMALL BOAT BASIN		(83-S-302)	
Area	Boat Basin			
Boring No.	82-RD-18	Sample No. J	Depth El 37.5 - 41.2 ft	Date 02 DEC 1982

CONSOLIDATION TEST--TIME CURVES NPD

C 3227

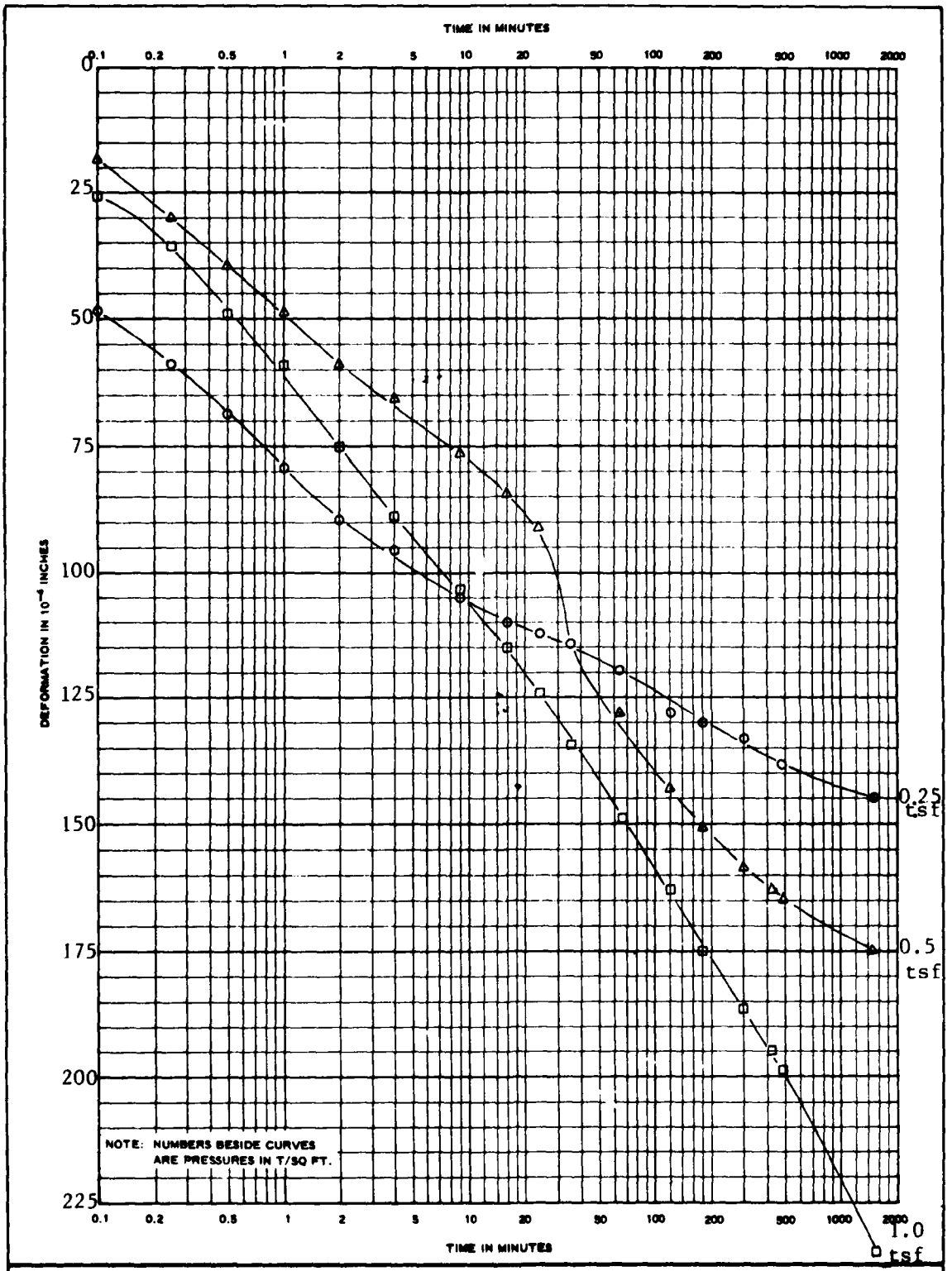
FIGURE C-9



Project: LUMMI SMALL BOAT BASIN (83-S-302)			
Area: Boat Basin			
Boring No. 82-RD-18	Sample No. J	Depth / El 37.5 - 41.2 ft	Date 02 DEC 1982

CONSOLIDATION TEST--TIME CURVES NPD

FIGURE C-10

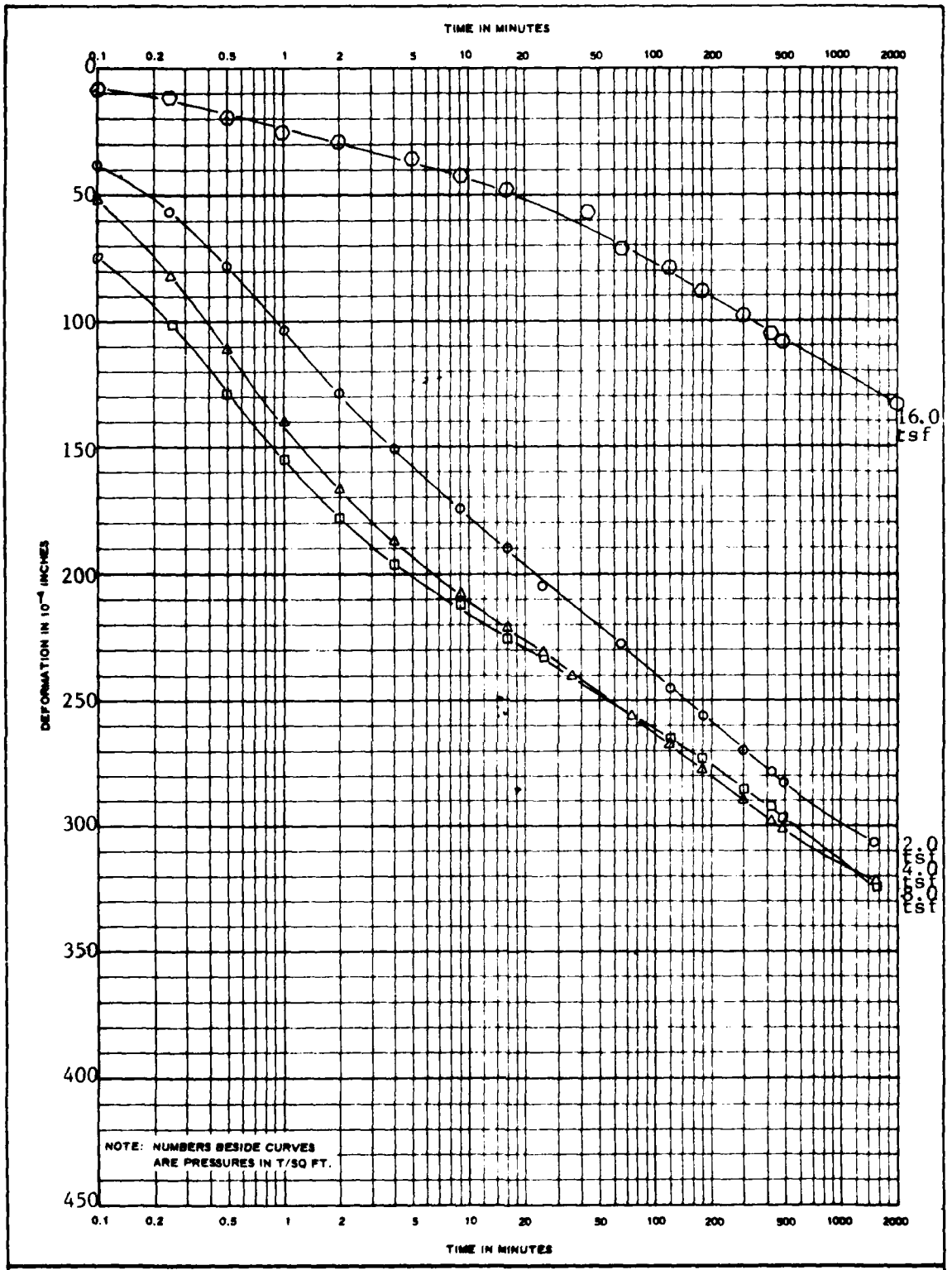


Project	LUMMI SMALL BOAT BASIN		(83-S-302)	
Area	Boat Basin			
Boring No.	82-RD-20	Sample No. E	Depth El 23.6-26.2 ft	Date 02 DEC 1982

CONSOLIDATION TEST--TIME CURVES NPD

C 5227

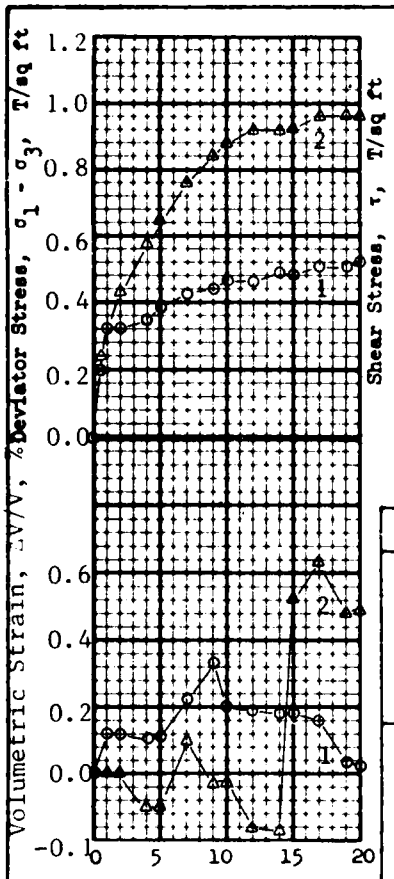
FIGURE C-11

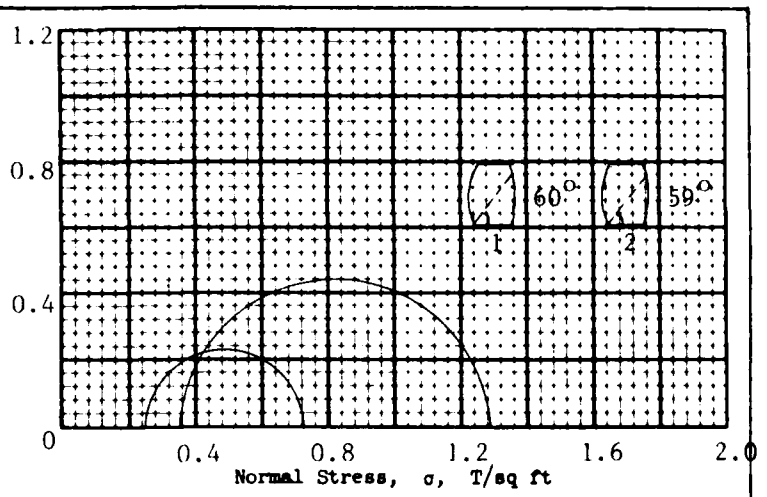


Project	LUMMI SMALL BOAT BASIN (83-S-302)			
Area	Boat Basin			
Boring No.	82-RD-20	Sample No. E	Depth El 23.6 - 26.2 ft	Date 02 DEC 198?

CONSOLIDATION TEST--TIME CURVES NPD

FIGURE C-12





Test No.			1	2		
Initial	Water content	w_o	47.3 %	37.5 %	%	%
	Void ratio	e_o	1.322	1.022		
	Saturation	S_o	97.3 %	99.8 %	%	%
	Dry density, lb/cu ft	γ_d	73.1	83.9		
Before Shear	Water content	w_c	46.2 %	36.4 %	%	%
	Void ratio	e_c	1.279	1.020		
	Saturation	S_c	100 %	100 %	%	%
	Final back pressure, T/sq ft	u_o	1.44	1.44		
Final	Water content	w_f	46.2 %	36.4 %	%	%
	Void ratio	e_f	1.062	0.830		
Minor principal stress, T/sq ft		σ_3	0.25	0.36		
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.48	0.92		
Time to failure, min		t_f	30	30		
Rate of strain, percent/min			0.50	0.50		
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	-	-		
Initial diameter, in.		D_o	1.41	1.41		
Initial height, in.		H_o	3.22	3.21		

Shear Strength Parameters

ϕ = - °

tan ϕ = -

c = - T/sq ft

Method of saturation

Back Pressure

☐ Controlled stress

☒ Controlled strain

Type of test Q-2 **Type of specimen** Undisturbed (Shelby tube)

Classification -

LL	PL	PI		G_s
-	-	-		2.72

Remarks Dark gray, very moist sandy silt with many small shells.

(83-S-302)

Project LUMMI SMALL BOAT BASIN

Area Boat Basin

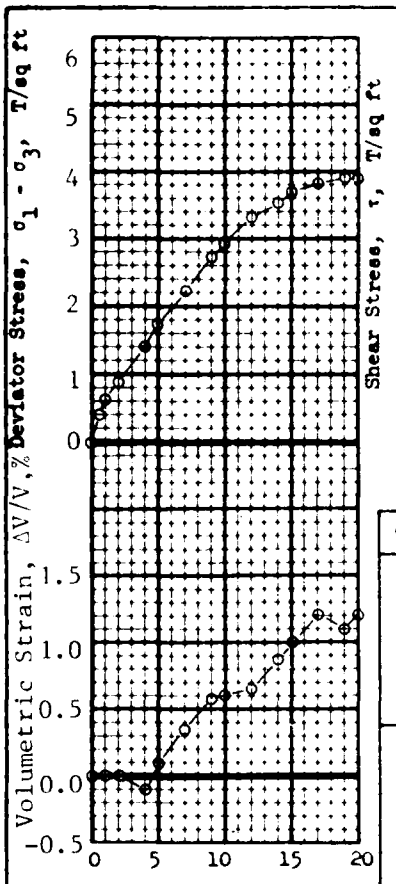
Boring No. 82-RD-21 **Sample No.** C

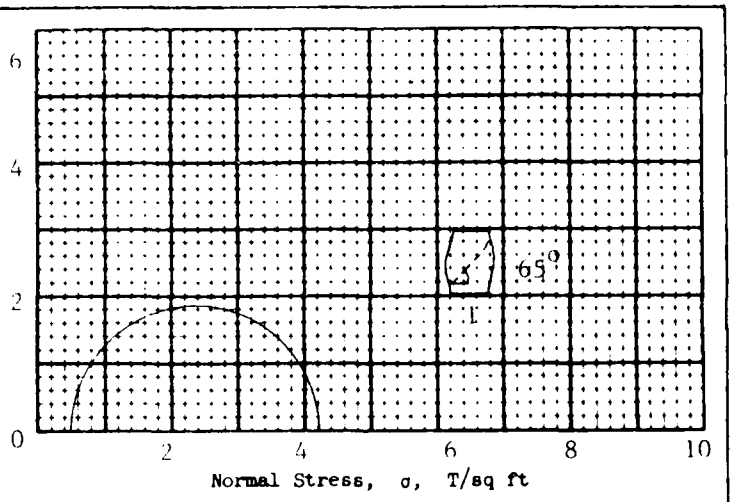
Depth El 13.8-16.5 ft. **Date** JAN 11 1983

NPD

TRIAXIAL COMPRESSION TEST REPORT

FIGURE C-13





Test No.			1				
Initial	Water content	w_o	27.6 %	%	%	%	%
	Void ratio	e_o	0.726				
	Saturation	S_o	98.8 %	%	%	%	%
	Dry density, lb/cu ft	γ_d	98.3				
Before Shear	Water content	w_c	27.5 %	%	%	%	%
	Void ratio	e_c	0.731				
	Saturation	S_c	100 %	%	%	%	%
	Final back pressure, T/sq ft	u_o	0.72				
Final	Water content	w_f	27.5 %	%	%	%	%
	Void ratio	e_f	0.585				
Minor principal stress, T/sq ft		σ_3	0.50				
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	3.69				
Time to failure, min		t_f	30				
Rate of strain, percent/min			0.50				
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	-				
Initial diameter, in.		D_o	1.41				
Initial height, in.		H_o	3.16				

Shear Strength Parameters

ϕ = - °

tan ϕ = -

c = - T/sq ft

Method of saturation Back Pressure

☐ Controlled stress

☒ Controlled strain

Type of test Q-2 **Type of specimen** Undisturbed (Shelby tube)

Classification -

LL	PL	PI		G_s
-	-	-		2.72

Remarks Gray, very wet, silty sand with some shells.

(83-S-302)

Project LUMMI SMALL BOAT BASIN

Area Boat Basin

Boring No. 82-RD-23 **Sample No.** E

Depth El 19.6-22.2 ft. **Date** JAN 11 1983

NPD TRIAXIAL COMPRESSION TEST REPORT

FIGURE C-14

NPDEN-GS-L (83-S-302 A)

JAN 1 1 1983

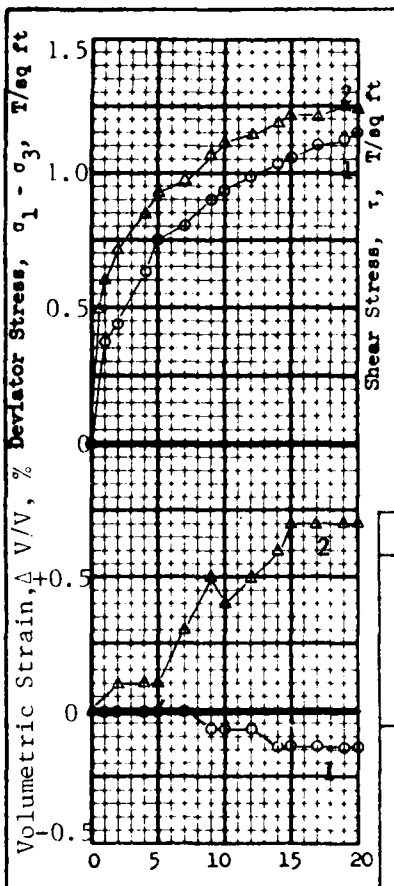
LUMMI SMALL BOAT BASIN

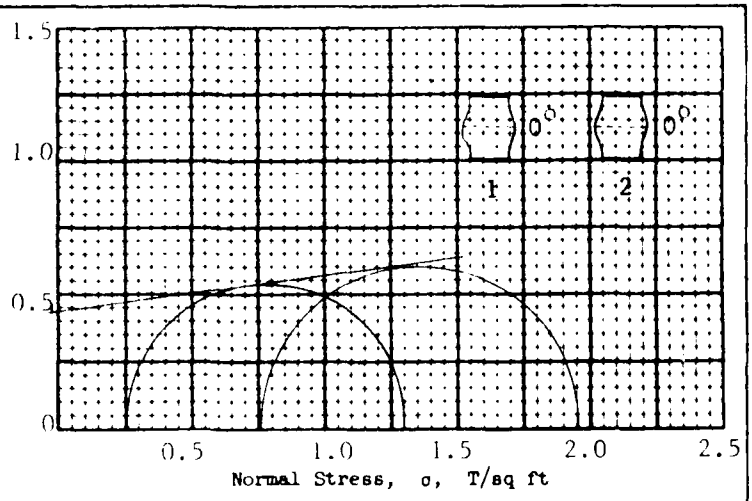
Report of Torvane Shear Tests

Sample No.	Test Location	Torvane Shear Strength, tsf
82-RD-21-C	Above triaxial sample No. 1	0.24
	Below triaxial sample No. 1	0.24
	Above triaxial sample No. 2	0.22
	Below triaxial sample No. 2	0.22
82-RD-23-B	Top of tube	0.15, 0.13
	Middle of tube	0.14, 0.13
	Bottom of tube	0.15, 0.15
82-RD-23-E	Above triaxial sample No. 1	0.16
	Below triaxial sample No. 1	0.17
82-RD-25-D	Top of tube	0.11, 0.08
	Middle of tube	0.20, 0.22
	Bottom of tube	0.21, 0.20
82-RD-25-F	Top tube	0.12, 0.18
	Middle of tube	0.22, 0.21
	Bottom of tube	0.19, 0.20

NOTE: On tubes where triaxial shear tests were not made, two Torvane tests were performed at each location.

FIGURE C-15





Test No.			1	2		
Initial	Water content	w_o	36.3 %	36.9 %	%	%
	Void ratio	e_o	1.027	1.046		
	Saturation	S_o	96.5 %	96.5 %	%	%
	Dry density, lb/cu ft	γ_d	84.0	83.3		
Before Shear	Water content	w_c	35.5 %	35.3 %	%	%
	Void ratio	e_c	1.026	1.014		
	Saturation	S_c	94.5 %	95.0 %	%	%
	Final back pressure, T/sq ft	u_o	1.44	4.32		
Final	Water content	w_f	35.5 %	35.3 %	%	%
	Void ratio	e_f	0.820	0.796		
Minor principal stress, T/sq ft		σ_3	0.25	0.75		
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.05	1.21		
Time to failure, min		t_f	136	146		
Rate of strain, percent/min			0.11	0.10		
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	-	-		
Initial diameter, in.		D_o	1.39	1.41		
Initial height, in.		H_o	3.24	3.23		

Shear Strength Parameters

ϕ = 7.9 °

tan ϕ = 0.139

c = 0.42 T/sq ft

Method of saturation

Back pressure

☐ Controlled stress

☒ Controlled strain

Type of test R **Type of specimen** Undisturbed (Shelby tube)

Classification ML (borderline ML-CL)

LL	PL	PI		G_s
28	23	5		2.73

Remarks

Project LUMMI SMALL BOAT BASIN (83-S-302)

Area Basin

Boring No. 82-KD-18 Sample No. C

Depth El 11.7-15.3 ft Date 02 DEC 1982

NPD TRIAXIAL COMPRESSION TEST REPORT

Page 1 of 2

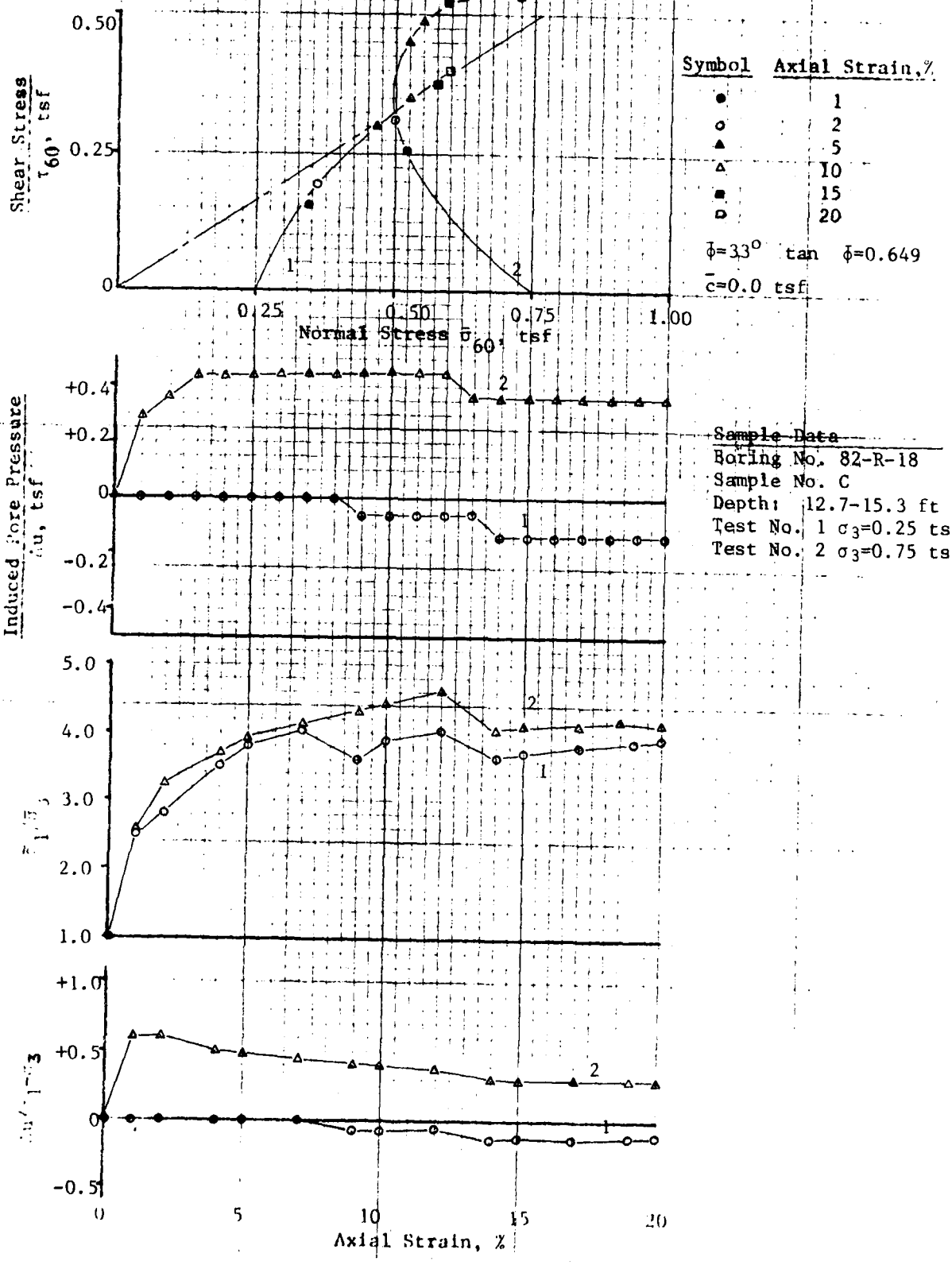
FIGURE C-16

NPDEN-GS-1 (83-S-302)

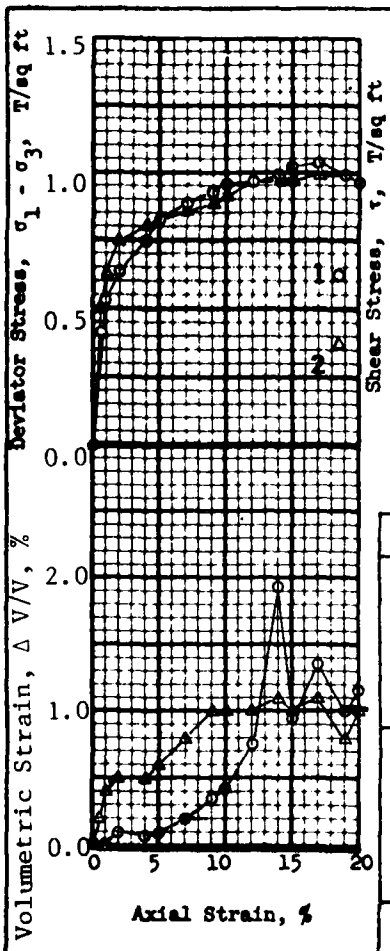
02 DEC 1982

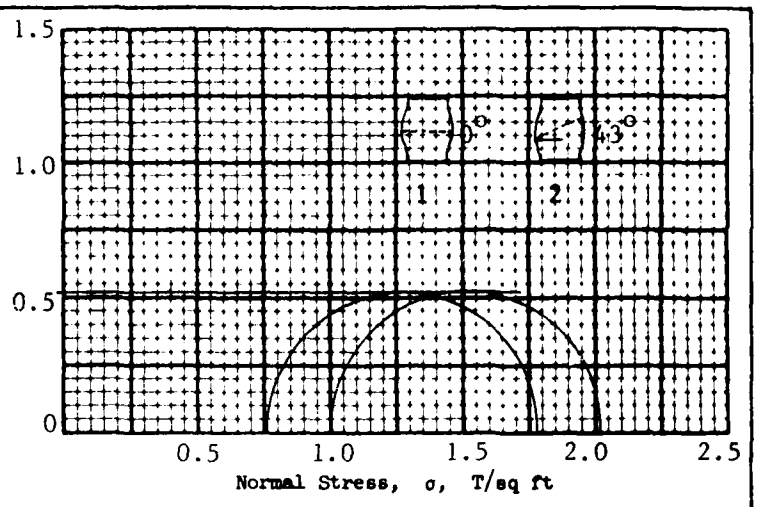
LUMMI SMALL BOAT BASIN

Report of R Triaxial Test Back Pressure/Pore Pressure Data



Page 2 of 2 **FIGURE C-17**





Shear Strength Parameters

ϕ = 0.0 °

tan ϕ = 0.0

c = 0.51 T/sq ft

Method of saturation

Back pressure

☐ Controlled stress

☒ Controlled strain

Test No.			1	2		
Initial	Water content	w_o	43.2 %	41.3 %	%	%
	Void ratio	e_o	1.247	1.192		
	Saturation	S_o	93.9 %	93.9 %	%	%
	Dry density, lb/cu ft	γ_d	75.3	77.1		
Before Shear	Water content	w_c	39.7 %	37.4 %	%	%
	Void ratio	e_c	1.127	1.058		
	Saturation	S_c	95.5 %	95.8 %	%	%
	Final back pressure, T/sq ft	u_o	5.76	3.60		
Final	Water content	w_f	39.7 %	37.4 %	%	%
	Void ratio	e_f	0.937	0.941		
Minor principal stress, T/sq ft		σ_3	0.75	1.00		
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.03	1.01		
Time to failure, min		t_f	159	179		
Rate of strain, percent/min			0.10	0.10		
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	0.98	0.98		
Initial diameter, in.		D_o	1.42	1.40		
Initial height, in.		H_o	3.25	3.23		

Type of test R | Type of specimen Undisturbed (Shelby tube)

Classification CL (borderline ML)

LL 45 | PL 26 | PI 19 | | G_s 2.71

Remarks

Project LUMMI SMALL BOAT BASIN

(83-S-302)

Area Basin

Boring No. 82-RD-18 | Sample No. E

Depth El 18.4-21.0 ft | Date 02 DEC 1982

NPD TRIAXIAL COMPRESSION TEST REPORT

FIGURE C-18

NPDEN-GS-L (83-S-302)

02 DEC 1982

LUMMI SMALL BOAT BASIN

Report of R Triaxial Test Back Pressure/Pore Pressure Data

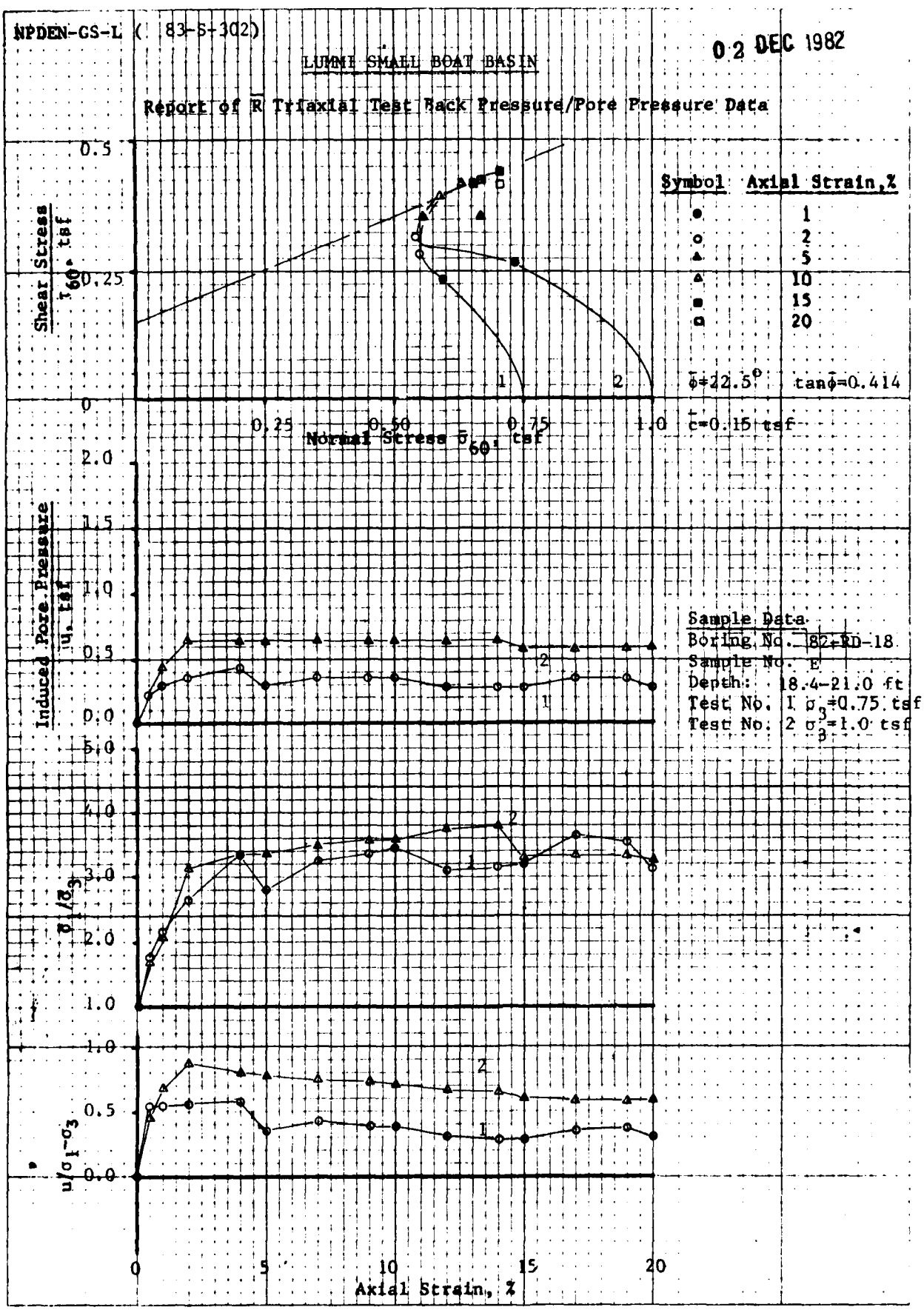
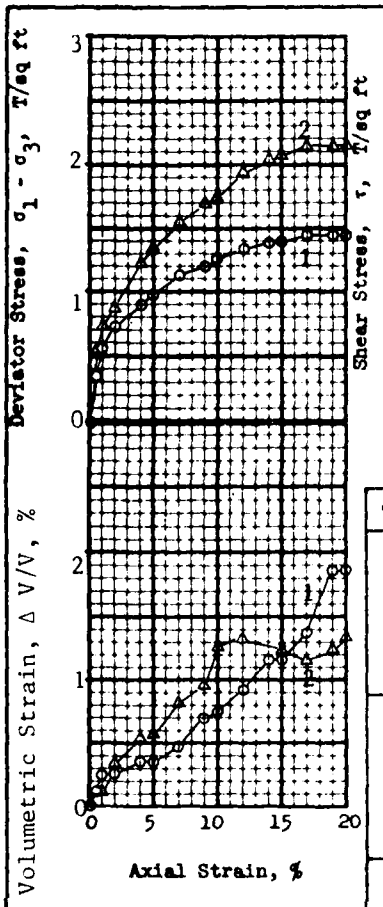
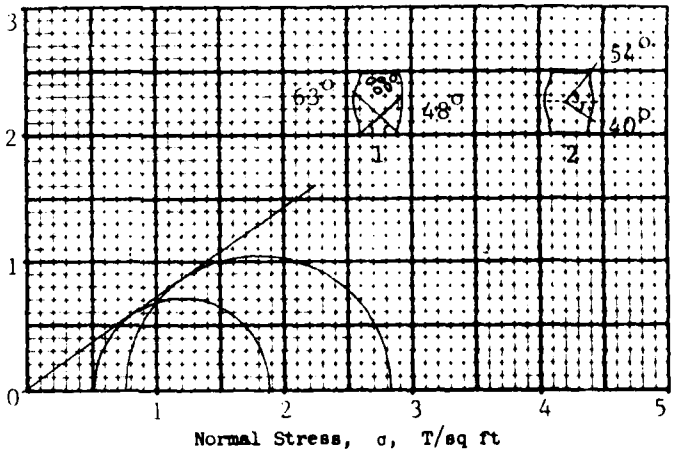


FIGURE C-19





Shear Strength Parameters

ϕ = 35.2 °

tan ϕ = 0.705

c = 0.01 T/sq ft

Method of saturation
Back pressure

[ ] Controlled stress
[X] Controlled strain

Test No.			1	2		
Initial	Water content	w_o	39.5 %	36.2 %	%	%
	Void ratio	e_o	1.044	0.963		
	Saturation	S_o	99.8 %	99.6 %	%	%
	Dry density, lb/cu ft	γ_d	82.7	86.2		
Before Shear	Water content	w_c	36.4 %	33.4 %	%	%
	Void ratio	e_c	1.006	0.956		
	Saturation	S_c	98.1 %	94.7 %	%	%
	Final back pressure, T/sq ft	u_o	5.04	4.32		
Final	Water content	w_f	36.4 %	33.4 %	%	%
	Void ratio	e_f	0.989	0.825		
Minor principal stress, T/sq ft		σ_3	0.50	0.75		
Max deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{max}$		1.39	2.07		
Time to failure, min		t_f	150	148		
Rate of strain, percent/min			0.10	0.10		
Ult deviator stress, T/sq ft	$(\sigma_1-\sigma_3)_{ult}$		-	-		
Initial diameter, in.		D_o	1.42	1.40		
Initial height, in.		H_o	3.11	3.21		

Type of test R | **Type of specimen** Undisturbed (Shelby tube)

Classification Fine Sandy SILT(ML)

LL 28 | PL 23 | PI 5 | | G_s 2.71

Remarks Test No. 1 sample contained about 5 small shells about 0.25 inches in diameter near the top of the specimens.

Project LUMMI SMALL BOAT BASIN
(83-S-302)
Area Basin
Boring No. 82-RD-20 | Sample No. C
Depth El 13.4-15.9 ft | Date 02 DEC 1982
NPD

TRIAXIAL COMPRESSION TEST REPORT

FIGURE C-20

NPDEN-GS-L (83-S-302)

02 DEC 1982

LUMMI SMALL BOAT BASIN

Report of R Triaxial Test Back Pressure/Pore Pressure Data

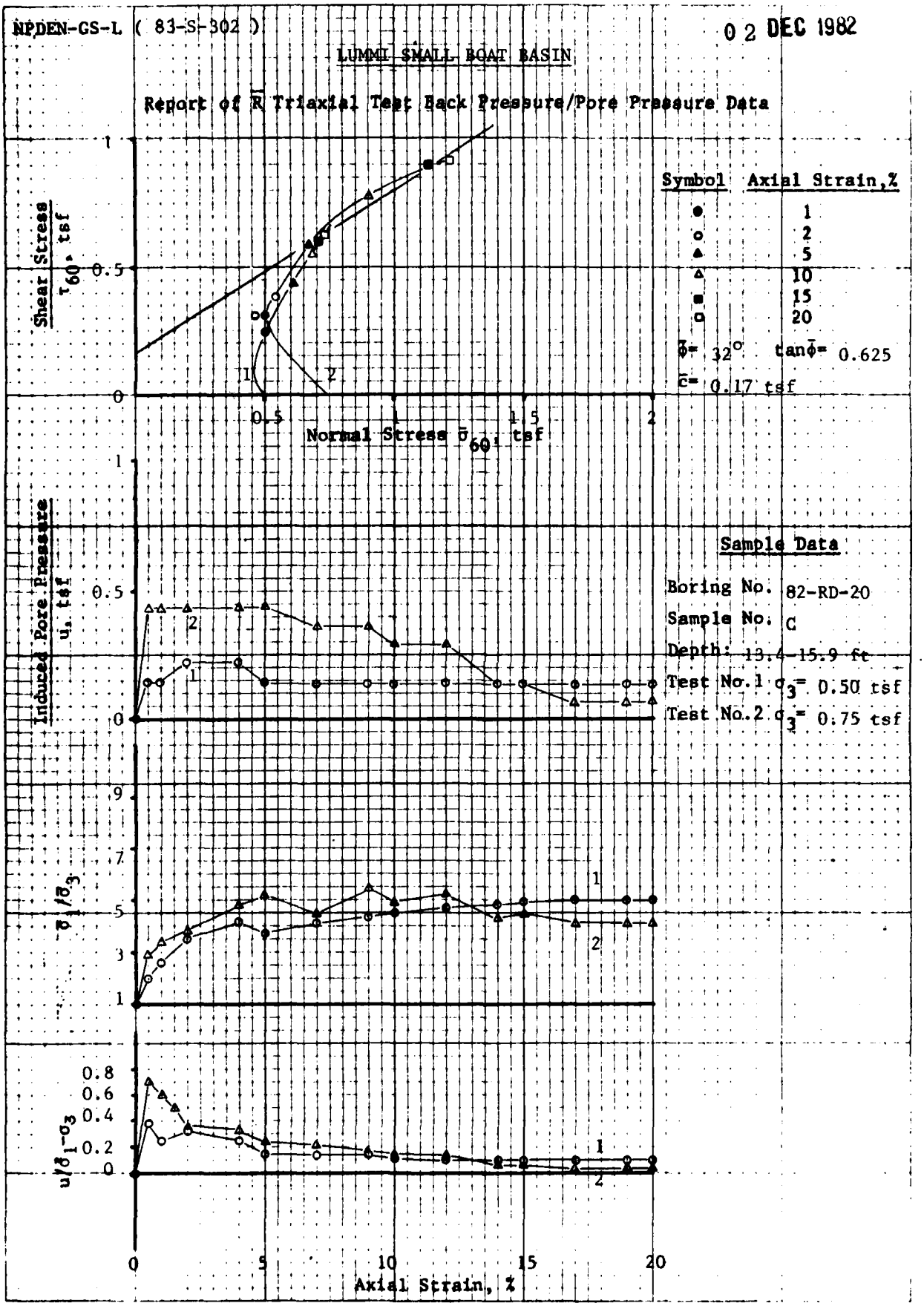
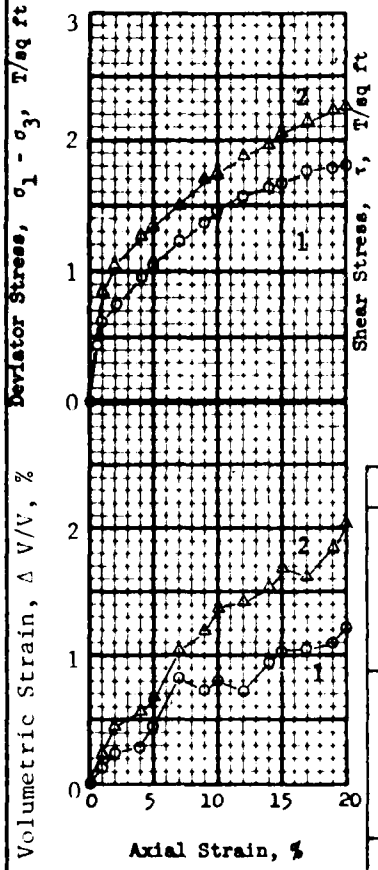
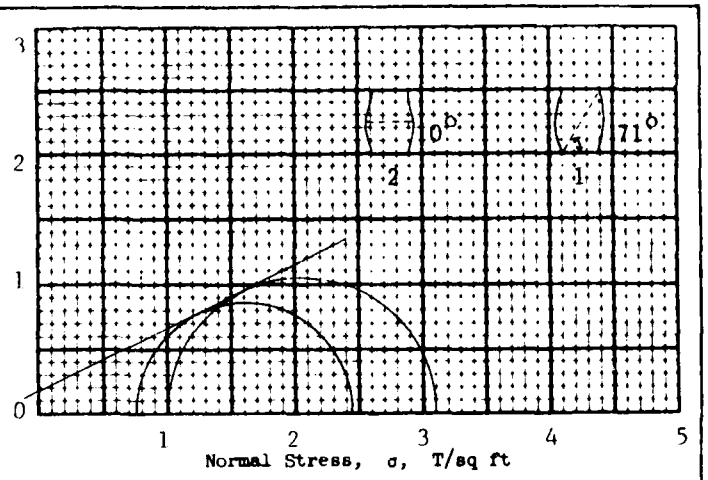


FIGURE C-21





Test No.			1	2		
Initial	Water content	w_o	33.0 %	33.2 %	%	%
	Void ratio	e_o	0.912	0.956		
	Saturation	S_o	98.4 %	94.5 %	%	%
	Dry density, lb/cu ft	γ_d	88.8	86.8		
Before Shear	Water content	w_c	32.3 %	31.3 %	%	%
	Void ratio	e_c	0.889	0.937		
	Saturation	S_c	98.8 %	90.9 %	%	%
	Final back pressure, T/sq ft	u_o	6.48	2.16		
Final	Water content	w_f	32.3 %	31.3 %	%	%
	Void ratio	e_f	0.737	0.740		
Minor principal stress, T/sq ft		σ_3	0.75	1.00		
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	1.67	2.06		
Time to failure, min		t_f	139	110		
Rate of strain, percent/min			0.11	0.13		
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	-	-		
Initial diameter, in.		D_o	1.40	1.41		
Initial height, in.		H_o	3.22	3.23		

Shear Strength Parameters

ϕ = 26.0 °

tan ϕ = 0.488

c = 0.16 T/sq ft

Method of saturation
Back pressure

☐ Controlled stress

☒ Controlled stra

Type of test R **Type of specimen** Undisturbed (Shelby tube)

Classification ML

LL 27 **PL** 23 **PI** 4 **G_s** 2.72

Remarks Test sample No. 1 had several small shells located along the failure plane.

(83-S-302)

Project LUMMI SMALL BOAT BASIN

(83-S-30)

Area Boat Basin

Boring No. 82-RD **Sample No.** 22D

Depth El 22.5-25.2 ft **Date** 02 DEC 1982

NPD

TRIAXIAL COMPRESSION TEST REPORT

FIGURE C-22

NPDEN-GS-L (83-S-302)

02 DEC 1982

LUMMI SMALL BOAT BASIN

Report of $\bar{R}$ Triaxial Test Back Pressure/Pore Pressure Data

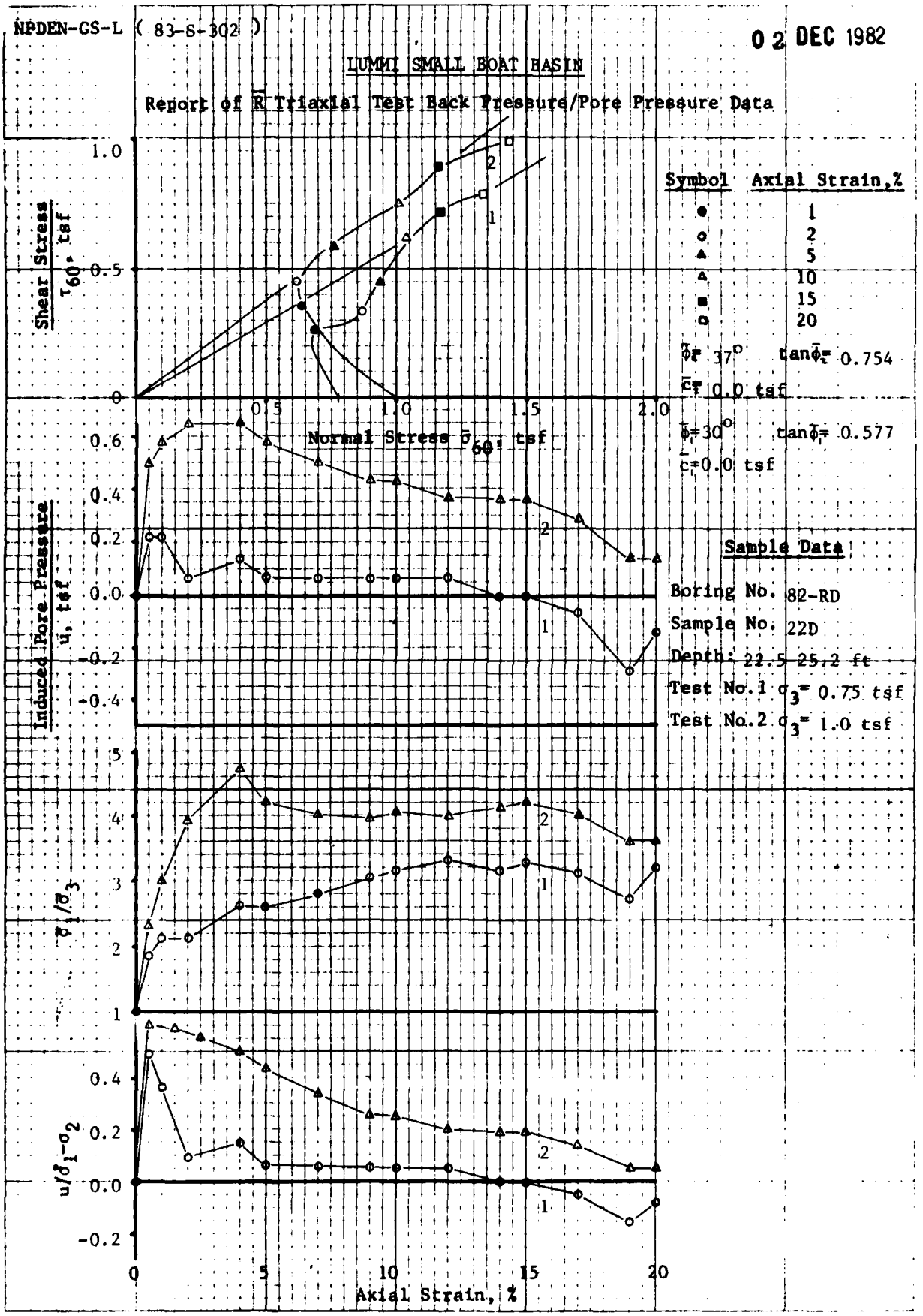
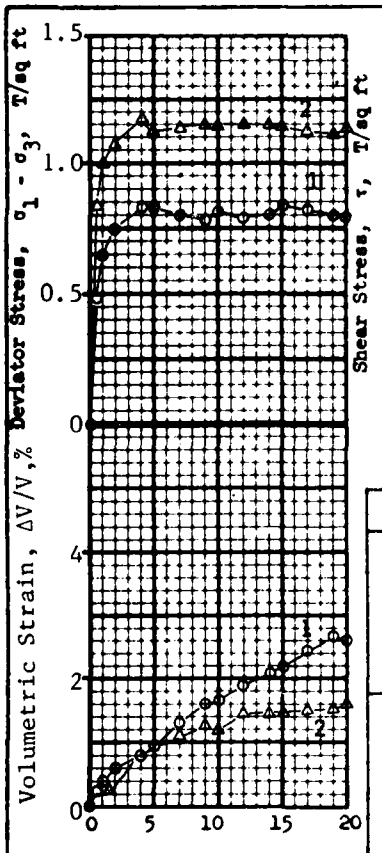
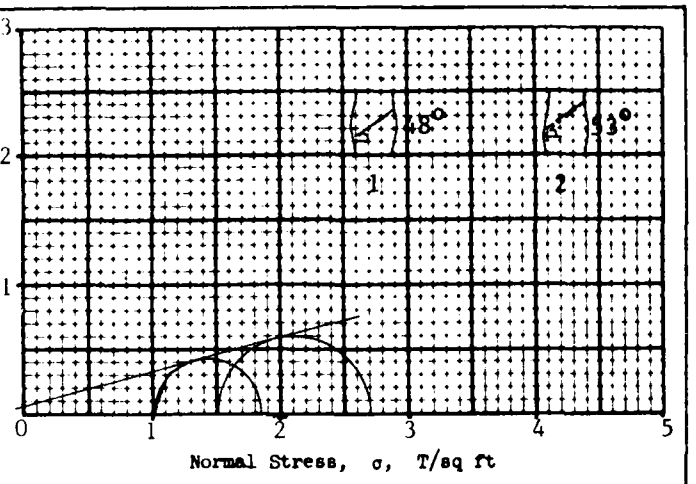


 FIGURE C-23





Test No.			1	2		
Initial	Water content	w_o	49.7 %	44.8 %	%	%
	Void ratio	e_o	1.342	1.201		
	Saturation	S_o	100.0 %	100.0%	%	%
	Dry density, lb/cu ft	γ_d	72.5	77.1		
Before Shear	Water content	w_c	44.5 %	38.3 %	%	%
	Void ratio	e_c	1.256	1.084		
	Saturation	S_c	96.3 %	96.1%	%	%
	Final back pressure, T/sq ft	u_o	7.20	3.60		
Final	Water content	w_f	44.5 %	38.3%	%	%
	Void ratio	e_f	1.012	0.890		
Minor principal stress, T/sq ft		σ_3	1.0	1.5		
Max deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{max}$	0.84	1.20		
Time to failure, min		t_f	151	139		
Rate of strain, percent/min			0.10	0.10		
Ult deviator stress, T/sq ft		$(\sigma_1-\sigma_3)_{ult}$	0.79	—		
Initial diameter, in.		D_o	1.41	1.40		
Initial height, in.		H_o	3.22	3.23		

Shear Strength Parameters

ϕ = 15.3°

tan ϕ = 0.274

c = 0.05 T/sq ft

Method of saturation Back Pressure

☐ Controlled stress

☒ Controlled strain

Type of test R **Type of specimen** Undisturbed (Shelby tube)

Classification CL

LL 44 **PL** 26 **PI** 18 G_s 2.72

Remarks

(82-S-302)

Project LUMMI SMALL BOAT BASIN

(83-S-302)

Area Boat Basin

Boring No. 82-RD-24 **Sample No.** G

Depth El 30.0-32.5 ft **Date** 02 DEC 1982

NPD TRIAXIAL COMPRESSION TEST REPORT

FIGURE C-24

NPDEN-GS-L (83-S-302)

02 DEC 1982

LUMMI SMALL BOAT BASIN

Report of R Triaxial Test Back Pressure/Pore Pressure Data

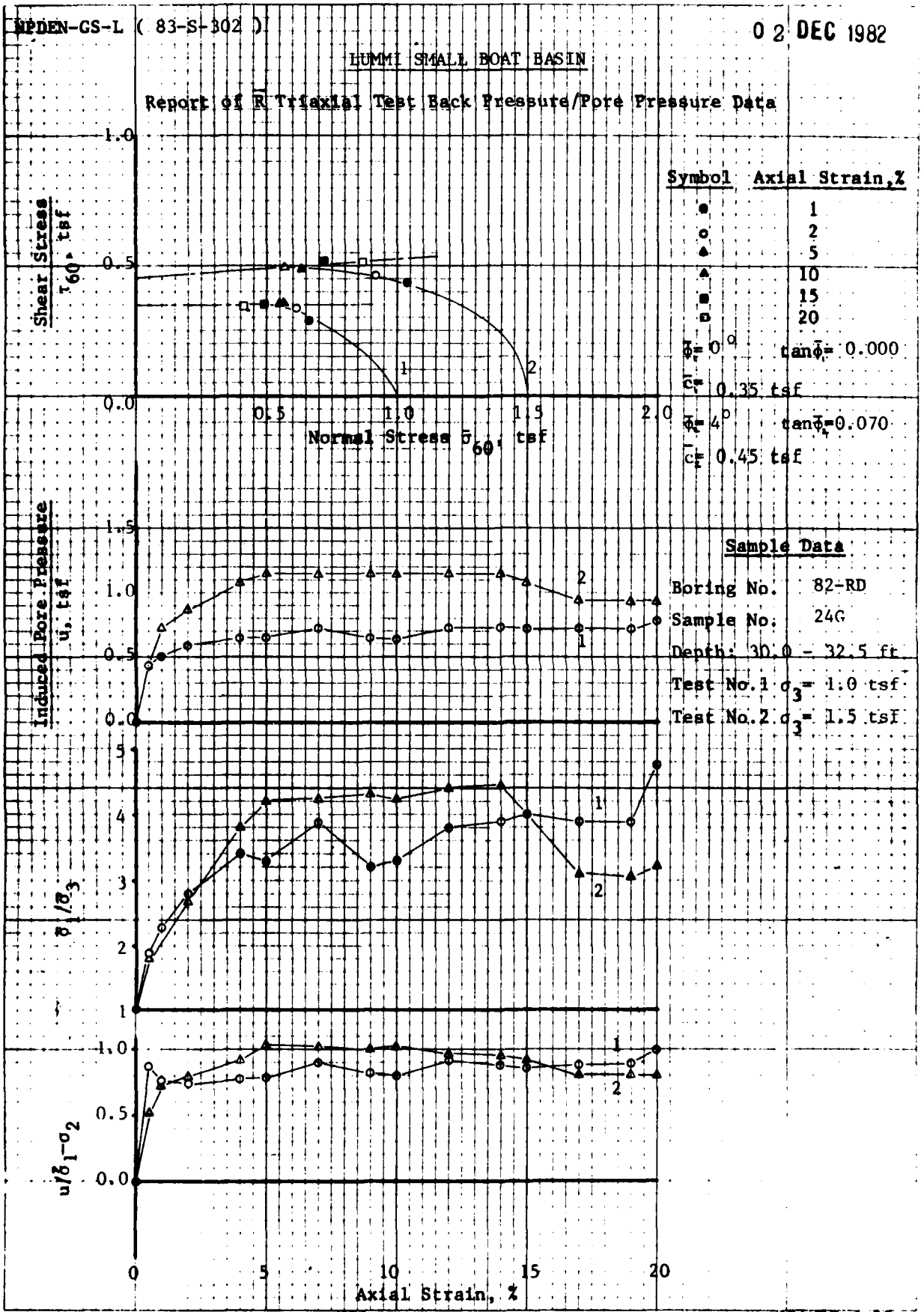


FIGURE C-25

Page 2 of 2

NPDEN-GS-L (83-S-302)

02 DEC 1982

LUMMI SMALL BOAT BASIN

Summary of Atterberg Limits and Moisture Contents

Sample No.	Liquid Limit, %	Plastic Limit, %	Plasticity Index, %	Moisture Content, %
82-P-1-B	31	23	7	-
82-P-2-D	38	26	12	-
82-P-5-C	35	25	10	-
82-P-8-C	31	25	6	-
82-P-10-C	36	23	13	-
82-RD-18-C	28	23	5	-
82-RD-18-E	45	26	19	40.5
82-RD-19-C	-	-	-	39.1
82-RD-19-G	-	-	-	37.2
82-RD-19-I	45	27	18	45.4
82-RD-20-C	28	23	5	-
82-RD-20-E	44	26	18	48.6
82-RD-22-D	27	23	4	-
82-RD-22-G	-	-	-	46.8
82-RD-24-G	44	26	18	46.1

NOTE: Atterberg Limits tests were performed on the minus No. 40 fraction of each sample.

FIGURE C-26

APPENDIX D

ECONOMIC AND SOCIAL INVOLVEMENT

SECTION 1. SOCIOECONOMIC ENVIRONMENT

1.01 Purpose and Scope. Purpose of this study was to identify and describe the socioeconomic study area as well as evaluate economic benefits and economic and social impacts resulting from the proposed Lummi Bay commercial fishing boat marina.

1.02 Economic Study Area. The Lummi Indian Reservation was selected as the study area since most of the economic and social impact of the project will be on the reservation. Where reservation data was not available, county data was used.

1.03 Location and Project Description. The proposed Lummi Bay commercial fishing boat marina is located on the west-central portion of the Lummi Indian Reservation, in southwest Whatcom County, Washington State. The Lummi Reservation is situated approximately 100 miles north of Seattle, Washington; 40 miles south of Vancouver, British Columbia, Canada; and 8 miles northwest of Bellingham, Washington. It is a narrow peninsula consisting of about 5,400 acres of tidelands, 12,600 acres of upland interior basin, and 1,000 acres on Portage Island. This peninsula separates Bellingham Bay, located to the south, and Lummi Bay, located to the north. The upland portion of the reservation contains such public and commercial facilities as a county ferry boat landing for ferries operating between Lummi Island and the mainland, a boat launch hoist, and upland buildings housing boat sales, dry boat storage, and restaurant facilities. The proposed marina is located in rich fishing grounds near the migratory route of salmon and close to the habitats of bottom fish and shellfish, and will provide ideally located moorage for 438 commercial fishing vessels. This marina will be owned and operated by the Lummi Indian Tribe.

1.04 Natural Resources. The Lummi Indian Reservation consists of 19,000 acres which are traversed by the Nooksack River. The Nooksack River drains 80 percent of the 1,000-square-mile Bellingham-Samish Bay drainage basin, and approximately 2,500 acres of reservation are located in the greater Nooksack flood plain. Topography is relatively gentle, rising to 200 feet in the area north of Lummi Bay, 100 feet on the peninsula, and 120 feet on Portage Island. Soils range from silty clay with poor drainage to gravel which provides excellent drainage. Land use is predominantly agriculture and forest.

Waters bordering the west side of the reservation contain a variety of fishery resources. Large numbers of five salmon species pass near the reservation on their annual migrations to freshwater rivers, including the Nooksack. Bottom fish, shellfish, crustaceans, and roe herring also abound in the highly productive waters around the San Juan Islands. These fisheries attract large numbers of commercial as well as recreational fishermen.

The maritime climate of the area is typical of all western Washington; summers are warm, winters are cool and wet. Maximum daily temperatures occur in July and August and average 62° F. Minimum daily temperatures normally occur in January and average 36° F. Temperatures rarely exceed 86° F or fall below 10° F. Area precipitation averages about 33 inches per year, with 76 percent of the precipitation occurring during the wet season (October-April). Winds

are often light and from a southerly direction in the summer. Winter winds are moderate to strong, with average velocities estimated at 9 knots and maximum velocities usually exceeding 50 knots.

1.05 Land Use. The largest managed single-acre activity on the reservation is agriculture and totals approximately 3,500 acres. This use is confined primarily to intensive crop, hay, grass, and native pasture. Other crops include corn, peas, and potatoes. The reservation currently has about 4,000 acres of unmanaged timber, which includes several mixed stands of hardwoods, western redcedar, and smaller amounts of Sitka spruce, Douglas fir, and grand fir. Residential use is divided between Indian and non-Indian. The non-Indian community lies primarily along the shoreline areas of Gooseberry Point and Sandy Point. The Indian population is mostly located in the interior of the reservation and along the eastern shoreline of the peninsula. Commercial enterprises are casually located with no established commercial center on the reservation. Industrial land use consists primarily of a water-based aquaculture facility which was begun in 1969. This fish rearing area consists of a 700-acre impoundment, including a fish rearing pen, located in Lummi Bay. Other land uses consist of rivers, tidelands, beaches, public facilities, roads, meadow, and marsh.

1.06 Human Resources. The Lummi Reservation is comprised of two identifiable communities; Indian and non-Indian. The 1980 population of the reservation totaled 3,471 (3.2 percent of Whatcom County) and consisted of 1,871 Indians and 1,600 non-Indians. An additional 850 Lummi Indians live off the reservation, primarily in the adjacent community of Marietta. As shown in table D-1, the age of the reservation Indian population is young, with 58 percent 24 years or under. After decades of slow growth, the reservation Indian population has been increasing at 3.5 percent per year. This higher rate of population growth is attributed to relative improvements in health care, housing, and associated social services and to increased efforts to identify and enroll tribal members. This rate of growth is higher than Whatcom County, which grew at an average annual rate of 2.2 percent between 1960 and 1980 and the State of Washington which grew at 1.9 percent over the same period. Native Americans represent the largest single racial minority in the county, accounting for 51 percent of the non-White population.

TABLE D-1

PERCENT OF POPULATION BY AGE AND SEX
LUMMI INDIAN

Age	Percent Female	Percent Male
0-4	5.5	5.7
5-14	10.1	10.4
15-24	12.4	13.6
25-34	8.7	7.5
35-44	4.6	4.9
45-64	6.4	6.3
65-over	2.0	1.9
	49.7	50.3

The population of non-Indians on the reservation in significant numbers is a relatively recent and rapid occurrence. In 1960, non-Indians numbered 246, but by 1980 this non-Indian population had increased to 1,600, an increase of 650 percent in just 20 years. Most of these people are recent arrivals and a considerable number are retired or second-home owners who have built on the reservation.

In addition to those living on the reservation, there are transient visitors both on a seasonal and daily basis. The ferry, operating between Lummi Island and the reservation, generates 430 vehicle trips per day through the reservation, and during good weather or when fishing season is open, hundreds of non-Indians utilize the boat launch and restaurant facilities at Fishermans Cove.

Population projections[1/] indicate that the rate of growth of Whatcom County, which from 1975-80 increased from 90,600 to 107,900, an average annual rate of 3.6 percent, will continue to grow at a rapid, though lower, rate of growth. Between 1980 and 2000, Whatcom County population is forecasted to grow at 2 percent per year,[1/] which would result in a population of approximately 160,000 by year 2000. Based on continued improvements in economic and social conditions of the Lummi Indians, a similar growth pattern can be expected on the reservation.

1.07 Economy. The largest single employer on the reservation is the commercial fishing industry. The Lummi Tribe had a fishing fleet in 1982 consisting of 25 purse seiners, 96 gillnets, and 146 skiffs. There are 1,000 registered Lummi Indian fishermen, of which approximately 385 are full-time and 615 part-time. The Indian fishery consists primarily of salmon; however, in recent years other fisheries, such as ground fish, halibut, Dungeness crab, etc., have been playing an increasingly important part of both Indian and non-Indian catches.

As shown in table D-2, the value of the salmon catch appears to be cyclical in nature, ranging from a value of $9.6 million in 1976, up to $21.2 million in 1978, and back to $10.7 million in 1980. This cyclical occurrence is usually caused by the following factors: (1) survival rate of salmon entering Whatcom County waters, especially the higher valued sockeye and chinook species; (2) amount of the higher valued salmon caught in Whatcom County; (3) prices paid per pound for each species; and (4) closure of the pink salmon fishery in even numbered years. As shown in table D-2, other fisheries in Whatcom County include ground fish, Dungeness crab, halibut, tuna, and dogfish. While poundage has remained virtually constant, these fisheries have increased from $4.3 million in value in 1976 to about $5.9 million in 1981, a 38 percent increase in 5 years. Roe herring, which was developed in 1973 in the Straits of Georgia, increased in value from $658,000 in 1976 to a peak of $2.5 million in 1979. Since 1981, however, this fishery has been virtually closed.

1/Source: Economic Forecast for Washington State, Office of Financial Management, December 1979.

TABLE D-2

LANDED VALUE AND POUNDAGE OF
COMMERCIAL FISHING IN WHATCOM COUNTY[1]/
(Value in 1,000 of Dollars - Poundage in 1,000 of Pounds)
($1,000 DOLLARS)

Fishery	1976	1977	1978	1979	1980	1981
Salmon:						
Chinook	$2,658	$3,248	$3,256	$2,144	$3,121	$2,334
Chum	2,142	528	4,944	399	2,513	865
Pink	--	2,879	--	4,270	--	5,347
Coho	1,425	2,232	3,152	2,564	3,354	1,358
Sockeye	3,357	6,997	9,866	8,759	1,758	6,508
Total Salmon Value	$9,582	$15,884	$21,218	$18,137	$10,746	$16,412
Total Salmon Poundage	--	--	14,464	19,204	8,921	19,185
Other Fisheries:						
Ground Fish	$3,085	$2,859	$1,616	$2,383	$2,525	$3,686
Dungeness Crab	623	998	1,318	893	857	893
Halibut	483	284	1,166	151	767	928
Tuna	37	144	17	43	16	115
Dogfish	32	97	195	297	255	263
Total Other Fisheries	$4,260	$4,382	$4,312	$3,767	$4,420	$5,885
Total Other Fisheries Poundage	--	--	26,644	26,498	26,383	26,503
Roe Herring Value	$658	$1,149	$1,901	$2,479	$1,038	$95
Roe Herring Poundage	--	--	4,392	3,557	3,945	929
Total Whatcom County:						
Fishery Value	$14,500	$21,415	$27,431	$24,383	$16,204	$22,392
Fishery Poundage	--	--	45,500	49,259	17,286	46,617

1/Source: Washington State Department of Fisheries, Resource Statistics. Ports include Bellingham, Blaine, Point Roberts, and Marietta.

Additonal economic activity on the reservation includes forest harvesting, small store ownership, construction industry, seafood processing, fish hatchery, community services, and local government. In 1982 these activities employed about 330 persons.

1.08 Employment. Typically, an economy that is primarily reliant on resource-oriented activities which are seasonal in nature will contribute to a fluctuating unemployment rate. With the seasonal fishing industry the largest single employer on the reservation, coupled with other reservation employment opportunities that are seasonal in nature, the unemployment rate is extremely high and persistent. For example, during April of 1980 (an off season fishing month), out of a potential Indian labor force of 1,302, only 584 people were employed and 70 of these were earning less than $5,000 per year.1/ Unemployment rates often range from highs of 75-80 percent during the off season to around 25 percent during the fishing season. In the future the Lummi Indian Tribe hopes to reduce their high unemployment rates by placing a higher emphasis on: (1) higher education of their populace, (2) increased economic development on the reservation, which will (3) provide a greater tax base, and (4) provide greater employment opportunities.

1.09 Government. The Lummi Indian Reservation is governed by an 11-member Lummi Business Council. Under the direction of this council, the Lummi Indian Tribal Enterprise was formed to manage the economic development of the reservation. The tribal council has also provided for, and oversees, such services to the community as education, housing, utilities, natural resources planning and management, economic planning, public safety, recreation, and health.

1.10 Future Development. The economy of the Lummi Reservation will most likely derive an increasing portion of their income from fishing related industries. Future plans are to develop commercial fishing support facilities on the upland portion of the proposed marina. These facilities include such items as a fish processing plant, cold storage plant, webhouse and net repair area, marine repair, barge construction area, boat storage area, commercial marine sales, and miscellaneous small shops and stores. Careful planning by the Indian community will be required to maintain a desirable environment, including land use planning and public services. Commercial fishing facilities, such as the planned development providing 438 commercial fishing slips, and upland development should experience ready acceptance by the reservation community as well as the surrounding non-Indian community. The proposed marina and upland development is in harmony with the long-term development goals of the Lummi Tribe as well as the county.

1/Source: Overall Economic Development Plan, Lummi Indian Tribe, 1980.

SECTION 2. ECONOMIC EVALUATION

2.01 General. The proposed Lummi Bay Marina consists of 438 commercial fishing boat slips designed to accommodate 63 purse seiners, 229 gillnets, and 146 skiffs. Benefits produced by this project consist of increased net income to commercial fishermen resulting from transportation cost savings and reduced vessel damage, land enhancement, and employment. Increase in net income benefits as well as employment benefits were computed in accordance with ER 1105-2-40. Land enhancement benefits were computed in accordance with ER 1165-2-317.

2.02 Need for Additional Commercial Fisherman Moorage. The need for a new commercial fishing boat marina in Whatcom County was based on supply and demand data provided by the Port of Bellingham and Lummi and Nooksack Indian Tribes, as well as discussions with local marina operators.

In Whatcom County, the commercial fishing fleet consists mainly of purse seines, gillnets, and skiffs and is served primarily by the Squalicum and Blaine Marinas. These marinas are owned and operated by the Port of Bellingham. Squalicum Marina is located in south Whatcom County, about 7 nautical miles east of Lummi Bay, at Bellingham, Washington. This marina serves Lummi and Nooksack Indian commercial fishermen as well as non-Indian commercial fishermen and presently has 284 commercial fishing slips. An additional 160 commercial slips will be added by the Port of Bellingham within a year, bringing total commercial slips to 444. The Blaine Marina is located 25 miles north of Bellingham in north Whatcom County, at the town of Blaine, Washington. This marina has 183 commercial fishing slips and also serves both Indian and non-Indian fishermen. While there are instances during the fishing season when vessels must be rafted at the Blaine Marina, overcrowding is not considered a severe problem here nor does the port plan to expand this marina in the foreseeable future. Other marinas in Whatcom County which provide some wet slip moorage for commercial fishermen vessels include Point Roberts Marina, Schotts Birch Bay Marina, and Friday Harbor. All of these marinas are operating at capacity or above during the fishing season.

Determining the demand for commercial fishing slips in a given region is a difficult task at best. This is because most marinas do not maintain a waiting list for commercial fishing vessels, the commercial fishing fleet is transitory by nature, and a regional census of commercial vessels is not maintained. In addition, many commercial fishing vessels that desire wet moorage employ some type of dry moorage option (trailer or blocks). An indication of the need for additional moorage is found though in an overcrowding problem at Squalicum. The commercial fishing boat portion of Squalicum Marina has been experiencing an increasingly severe overcrowding problem which will continue even after marina expansion. The number of commercial fishing vessels moored at Squalicum during the fishing season typically ranges from about 650-700. Commercial vessels at Squalicum obtain a slip on a daily, first-come, first-serve basis. Once slips are filled, excess vessels moor at the protected marina by rafting. This necessitates lashing several vessels together which

often results in vessel damage as well as creating a major congestion problem. In addition to the severe overcrowding at Squalicum, there are other commercial fishermen residing in the Bellingham area who prefer to moor their boats in a wet slip (at least during the fishing season), but due to the lack of wet moorages and resulting congestion at Squalicum, either moor their boats on trailers or on blocks.

2.03 Commercial Fishing Benefits. The following subsections cover the major benefit categories resulting from implementation of the proposed project. These categories are: savings in vessel operating costs from home port to fishing grounds, savings in vehicle operating costs from house to marina, reduced opportunity cost, reduction in vessel damage, land enhancement, and NED employment benefits.

a. Vessel Operating Cost Savings (Home Port to Fishing Grounds). Elements utilized in the computation of vessel operation cost savings were: (1) number of vessels that would accrue an operating cost saving; (2) length of fishing season; (3) number of fishing trips per year per vessel type for Indian and non-Indian fishermen; (4) hours saved per trip per vessel type; and (5) hourly operating costs per vessel type (including real fuel cost escalation in the fuel cost component).

The proposed Lummi Bay Marina will provide 438 commercial fishing slips. Many of these slips are expected to be leased by commercial fishermen who now moor at locations farther from the major fishing grounds. Currently, many commercial fishermen moor at Bellingham and Blaine and will accrue a savings in operating costs as a result of reduced running time between Lummi Bay Marina and the fishing grounds compared to their existing (or without project) moorage facility and the fishing grounds. This savings in vessel operating costs will result in a net income increase to these commercial fishermen. As shown in table D-3, vessels accruing operating cost savings as a result of the project were derived by subtracting from the project year one Lummi Bay marina fleet of 438 vessels, those vessels, which on any given day, incur unscheduled maintenance due to mechanical breakdown (estimated at 7.5 percent, or 32 vessels); vessels already moored near Lummi Bay (estimated at 20 vessels); and vessels which fish only within Bellingham Bay (estimated at 98 vessels). Total number of vessels accruing operating cost savings were estimated at 288 (66 percent of total marina) and consist of 58 purse seiners, 193 gillnets, and 37 skiffs.

Length of the commercial salmon season is 20 weeks and starts in July and extends through November.[1/] Open season days for commercial salmon fishing are established by the Washington State Department of fisheries and are different for Indian and non-Indian fisherman. Based on recent records of open season days, non-Indians typically make two fishing trips per month in July, October, and November and four trips per month during the remaining fishing season. Indian commercial fishermen usually make four fishing trips per month during July, October, and November and eight trips per month during August

1/Washington State Department of Fisheries, Regulations Calendar, 1979 and 1980.

TABLE D-3

VESSELS ACCRUING OPERATING COST SAVINGS

Vessel Owner and Vessel Type	Project Year One Fleet at Lummi Bay	Unscheduled Maintenance	Other Adjustments	Vessels Accruing Transportation Cost Savings
Lummi Fleet: 1/				
Seiner	45	3	0	42
Gillnet	126	19	20 6/	97
Skiff	146	11	98 7/	37
Nooksack Fleet: 2/				
Seiner 3/	8	1	0	7
Gillnet 4/	43	3	0	40
Skiff	0	0	0	0
Non-Indian 5/				
Seiner	10	1	0	9
Gillnet	60	4	0	56
Skiff	0	0	0	0
TOTAL FLEET	438	32	118	288

1/Source: Lummi Planning Council

2/Source: Nooksack Indian Tribe - Includes only those vessels which would move to Lummi Bay.

3/ All vessels are from Squalicum.

4/ 50 percent are from Squalicum and 50 percent from Blaine.

5/ All vessels currently moor in the Bellingham area and will most likely moor at Lummi Bay Marina only during fishing season.

6/ Adjustment reflecting those vessels currently moored/rafted near Lummi Bay.

7/ 75 percent of Lummi Indian skiff fleet fish within Bellingham Bay.

and September. Annual vessel trips per vessel type were determined by multiplying the number of Indian and non-Indian monthly trips by the number of vessels of each vessel type accruing operating cost savings and summing the totals. The number of annual vessel trips by vessel type are shown below:

Vessel Type	Vessel Trips
Seiner	1498
Gillnet	4620
Skiff	1036

Time saved per trip per vessel type is a function of average vessel speed and average miles saved per trip. Shown below in table D-4 are the estimated savings in travel time per trip from Lummi Bay Marina to the fishing grounds.

TABLE D-4

ESTIMATED SAVINGS IN TRAVEL TIME PER TRIP

Vessel Type	Average Miles Saved Per Trip	Vessel Speed (MPH) Range	Vessel Speed (MPH) Average	Hours Saved
Purse Seiner	14	(6-8)	7	2.00
Gillnet	14	(8-30)	19	0.75
Skiff	14	(10-20)	15	1.00

Operating costs are comprised of fuel, maintenance, and engine repair costs. These costs total $32.32/hour of operation for purse seines, $33.20/hour of operation for gillnets, and $12.75/hour of operations for skiffs.1/ Included in the fuel component is an adjustment reflecting real fuel cost escalation. This adjustment is based on Data Resources Incorporated 1982 escalation rates for diesel/distillate fuel between 1983 and 2012 and has been discounted at 7-7/8 percent over the project life. Diesel/distillate fuel escalation rates are shown in table D-5.

TABLE D-5

REAL FUEL COST ESCALATION RATES - DIESEL/DISTILLATE 1/

1983-1985	1985-1990	1990-1995	1995-2000	2000-2012
- .53	+ 4.23	+ 3.71	+ 2.65	+ 3.53

1/Source: Data Resources Incorporated, 1983-2012. Real Fuel Cost Escalation Forecast, August 1982.

1/Nonescalated operating costs total $20.75/hour for seines, $21.10/hour for gillnets, and $8.10/hour for skiffs. Source: Lummi Indian Tribe.

Vessel operating cost savings benefits (marina to fishing grounds) are estimated at $225,000 per year. Computation of these benefits is shown in table D-6.

TABLE D-6

OPERATING COST SAVINGS BENEFITS

(1) Vessel Type	(2) Yearly Trips	(3) Hours Saved Per Trip	(4) Hours Saved Per Year (2x3)	(5) Operating Cost Per Hour	(6) Operating Cost Savings (4x5)
Purse Seines	1,498	2.00	2,996	$32.32	$96,800
Gillnet	4,620	0.75	3,465	33.20	115,000
Skiff	1,036	1.00	1,036	12.75	13,200
Total Vessel Operating Cost Savings Benefit					$225,000

b. Vehicle Operating Cost Savings (Home to Marina). This benefit represents the net savings in vehicle operating costs between the with and without project conditions. For many commercial fishermen the driving distance between home and moorage facilities at Lummi Bay (with project) is shorter than the driving distance between home and their current moorage facilities (without project). As a result of mooring at Lummi Bay Marina, vehicle operating costs are lower and net income higher. Commercial fishermen accruing lower vehicle costs as a result of this project include fishermen living on or near the Lummi reservation and currently mooring at Squalicum Marina and fishermen living in Deming, Washington, and currently mooring at Blaine. Distance traveled from home to moorage by those fishermen living on or near the reservation and mooring their boats at Squalicum is about 12 miles one-way. By mooring at Lummi Bay Marina, these fishermen would only have to travel an average of 2 miles from home to marina, a savings of 10 miles per one-way trip or 20 miles round trip. Fishermen living in Deming, Washington, and mooring at Blaine, travel about 35 miles per one-way trip. By mooring at Lummi Bay Marina, the one-way travel distance decreases to 25 miles, a savings of 10 miles one-way or 20 miles round trip. On the other hand, there are a few commercial fishermen who will travel a greater distance from home to Lummi Bay Marina than they are currently traveling. As a result, they will incur higher vehicle operating costs than their without project distance/cost. These fishermen include those living in Deming and currently mooring at Squalicum, as well as fishermen living in Bellingham and currently mooring at Squalicum. These fishermen will have to drive an estimated 20 additional miles per round trip. Even though these fishermen will incur additional house-to-marina vehicle operating costs as a result of mooring at this project, these extra costs will be more than offset by the locational marina-to-fishing-grounds cost advantages (vessel operating cost savings) achieved by mooring at Lummi Bay Marina.

Vehicle operating cost savings, as well as increased vehicle operating costs, are a function of yearly vehicle trips, mileage saved (or increased mileage) per round trip, and vehicle operating costs per mile. Vehicle trips occur for each fishing trip taken. Seiners consisted of three vehicle trips per fishing trip based on a six-person crew and assuming two persons per vehicle. Gillnets and skiffs consisted of one vehicle trip per fishing trip. In addition, one vehicle trip per vessel was assumed to be taken each week during the fishing season for repairing and maintaining fishing vessels. Based on the above data, annual vehicle trips totaled 4,428 for seiners, 5,836 for gillnets, and 1,996 for skiffs. Vehicle operating costs consist of gasoline, oil, tires, parts, insurance, and maintenance and totaled $.25 per mile. Like vessel operating costs, the fuel portion of vehicle operating costs was adjusted to reflect real fuel costs escalation. Escalation rates were the same as those used with vessel operating costs and are shown in table D-5. Vehicle operating cost savings were estimated at $61,000 per year while vehicle operating cost increases were estimated at $15,000 per year, resulting in a net cost savings benefit of $46,000 per year. Computation of vehicle operating cost savings, vehicle cost increases, and the resulting net operating cost savings benefit are shown in table D-7.

TABLE D-7

SAVINGS AND INCREASES IN VEHICLE OPERATING COSTS

Savings in Vehicle Operating Costs

Vessel Type	Vehicle Trips Per Year 1/	Round Trip Mileage Saved	Total Miles Saved	Operating Cost Per Mile	Savings (increases) in Operating Costs
Seiner	4,428	20	88,560	.25	$22,140
Gillnet	5,836	20	116,720	.25	29,180
Skiff	1,996	20	39,920	.25	9,980
				Subtotal	$61,000
		Increased Vehicle Operating Costs			
Seiner	966	20	19,320	.25	($4,830)
Gillnet	2,000	20	40,000	.25	(10,000)
				Subtotal	($15,000)

Net Savings in Vehicle Operating Costs = $61,000 - $15,000 = $46,000.

1/Source: U.S. Department of Transportation, Federal Highway Administration. Adjusted to include real fuel cost escalation based on Data Resources Incorporated, 1983-2012, Real Fuel Cost Escalation Forecast, August, 1982.

c. Reduced Opportunity Cost of Time. The opportunity cost of any resource, be it capital, labor, or any other, is defined as the value of that resource in its best alternative use.1/ As a result, a simple out-of-pocket accounting of expenditures is not sufficient to reflect total resource costs accurately but most also include the opportunity cost of time. In the case of the proposed project, the economic cost of traveling to and from home and the fishing grounds includes not only vehicle and vessel operating costs, but also the opportunity or alternatives use of that time. A reduction in traveling time to and from home to fishing grounds as a result of the project not only produces a benefit related to reduced vehicle and vessel operating costs, but also a benefit associated with reduced opportunity costs. That is, some of the time that would have been spent traveling under, without project conditions, can now be utilized in other alternative pursuits as a result of the project. The value of this time is reflected in its alternative use(s). While there may be many alternative uses for this time, a conservative estimate or proxy is the Federal minimum wage rate. This rate is currently (October 1983) $3.35 per hour.2/ Table D-8 shows the computation of reduced opportunity cost of time benefits for both vehicle and vessel travel time reduction. Benefits of reduced opportunity cost of time related to reduced vehicle travel were estimated at $30,000 per year and at $90,000 for reduced vessel travel time.

d. Elimination of Vessel Damage Due to Rafting. As previously mentioned, overcrowding at Squalicum Marina requires the rafting of numerous commercial fishing vessels. Each raft is formed by lashing two to five vessels together, which, during storms, subject vessels to damage from their knocking into each other. In addition, access to boats lashed to the outside portion of the raft is normally available only by climbing over the inside boats. This sometimes results in vessel damage as well as injury to fishermen. Based on discussions with port and fishermen representatives, average annual damages attributed to rafting of seiners and gillnets at Squalicum were estimated at $100 per boat. Damages to skiffs were minimal and, therefore, not quantified. Construction of Lummi Bay Marina will provide each rafted seiner and gillnet vessel with its own slip, thereby eliminating vessel damage and associated fishermen injury resulting from rafting. Total fleet mooring at Lummi Bay Marina is 438 vessels. Of this amount, elimination of vessel damages benefits were claimed for 272 vessels. This total includes 63 seiners and 209 gillnets. Elimination of annual rafting damage of $100 per vessel on 272 vessels results in a estimated average annual benefit of $27,000.

e. Land Enhancement. Land enhancement benefits consist of two types: (1) incremental market value of newly created land as a result of the project, and (2) incremental increase in the market value of existing project land. Land enhancement benefits which are the result of newly created land from project dredged material were determined as directed by ER 1165-2-317. This directive states that the value of land created from project dredged material will either be determined using the increased market value of the filled land

1/"Management Economics," S. Charles Maurie and Charles W. Smithson, 1981
2/Source: Department of Labor, Seattle, Washington, October 1983

TABLE D-8

VALUE OF REDUCED OPPORTUNITY COST OF TIME

Vessel Type	Hours Saved	Number of People	Man-Hours of Increased Opportunity	Value per Hour	Value of Reduced Opportunity Cost
Vehicle					
Seiner	1,385[1]	3	4,155	$3.35	$13,900
	346[1]	1	346	$3.35	1,200
Gillnet	1,055[1]	2	2,110	$3.35	7,100
	863[1]	1	863	$3.35	2,900
Skiff	550[1]	2	1,100	$3.35	3,700
	448[1]	1	448	$3.35	1,500
Subtotal					$30,300
Vessel					
Seiner	2,996[2]	6	17,976	$3.35	$60,200
Gillnet	3,465[2]	2	6,930	$3.35	23,200
Skiff	1,036[2]	2	2,072	$3.35	6,900
Subtotal					$90,300
Total					$120,000

1/Net total miles saved (see Table 2-5) divided by average vehicle speed of 40 m.p.h.

2/From Table 2-4.

(based on comparable land sales) or the cost of providing fill by the cheapest alternative means, whichever is less. Land enhancement benefits which reflect a change in the market value of existing project land were determined in accordance with "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies." This directive states that a change in the value of existing land as a result of the project is the market value of comparable land.

Under the proposed plan, 65 acres of land will be filled or created with material dredged during project construction. The 1983 appraised value of these 65 acres before filling was $65,000[1/] and, after filling, was $2,382,000[1/] for an enhanced land value of $2,317,000. Filling this same land area from the nearest upland source would require 1,365,000 cubic yards (c.y.) of material at $8.00 per c.y. for a total cost of $10,920,000. Filling the land with material dredged from the proposed project would require the same 1,365,000 c.y. but an estimted $2.40 per c.y. or $3,276,000 resulting in a net savings of $7,644,000. Accordingly, the least cost method for determining land enhancement benefits associated with the construction part of the project was the appraised value of the filled land or $2,317,000. Average annual land enhancement benefit associated with initial project construction dredge material and based on 7-7/8 percent project interest rate over the 50-year project life, is $187,000.

In addition to the 65 acres created from initial project dredge material, another 2.5 acres of land will be filled every 5 years over the project life, a total of 25 acres, from the disposal of maintenance dredging material. It is probable this future acreage will be developed similarly to the 65 acres. The 1983 nondiscounted appraised value before filling of the 25 acres was $25,000 and after filling was $1,125,000 for an enhanced value of $1,100,000. The enhanced value was based on creating 16 acres of waterfront oriented uplands valued at $49,000/acre ($50,000/acre with project minus $1,000/acre without project)[1/] and 9 acres of backland valued at $34,000/acre ($35,000/acre with project minus $1,000/acre without project)[1/]. Since this land would pobably not be marketable until project year 50, the enhanced value was discounted at 7-7/8 percent over 50 years, resulting in a discounted value of $25,000. Filling each 2.5 acres of area every 5 years from the nearest upland source would require 40,000 c.y. of material at $8 per c.y. for a total discounted cost of $672,000 over the project life. Filling the land with material dredged from project maintenance dredging would require 40,000 c.y. every 5 years at an estimated $2.40 per c.y. for a total discounted cost of $202,000; a net savings of $470,000. The least cost method of determining land enhancement benefits from maintenance dredging of this project was the appraised value of filled land. Average annual land enhancement benefit associated with creating 25 acres of developable land over the 50-year project life through maintenance dredging and discounted at the project interest rate of 7-7/8 percent total $2,000.

1/Source: Appraisal of Lummi Indian Reservation Property, Bellingham, Washington, Edward H. Miller and Company, April 6, 1983.

Finally, the 25-acre tideland area where the boat basin will be located was appraised to determine any change in market value as a result of the proposed project. The with and without project market values were based on sales of comparable land in the area. The without project market value was estimated at $1,000/acre or $25,000 for the entire 25 acres.1/ The with project market value of this land was estimated to be $25,000/acre or $625,0001/ for an enhanced value of $600,000. Average annual land enhancement benefit associated with he 25 acre moorage basin over the 50-year project life at 7-7/8 percent is $48,000.

Land enhancement benefits including the 65 acres created from initial project dredging, 25 acres of land created from operation and maintenance dredging, and 25 acres of moorage basin tidelands totals $237,000 per year.

f. NED Employment Benefits. Criteria developed and formerly used by the Economic Development Administration in designating qualified areas under subsection 1 of Title II of the Public Works and Economic Development Act of 1965 (Public Law 89-136 as amended) was utilized by the Department of Army in designating the Lummi Indian Reservation as an area of "substantial and persistant" unemployment and thus eligible for National Economic Development (NED) employment benefits. NED employment benefits reflect the previously unemployed or underemployed labor resources which are employed as a result of the proposed project. Specifically, alleviation of reservation unemployment constitutes a benefit to the local and national economies. Determination of this benefit included only the Federal cost of major navigation features and non-federal associated costs. Computation of benefits was based on the following study results:

- Federal labor costs were estimated at 15 percent of total Federal construction costs exclusive of nonlabor items. Non-Federal labor costs were estimated at 60 percent of total non-Federal construction costs exclusive of non-labor items.2/

- Skilled and unskilled labor was estimated at 55 and 45 percent, respectively.

- Based on the very high unemployment rate on the reservation (typically, in excess of 25 percent and often 75 to 80 percent) and a Lummi owned and operated construction company located on the reservation, the expected proportion of labor from the local labor force was 75 percent for Federal construction and 100 percent non-Federal construction.

- Based on a reservation local hire rule, the proportion of local unemployed labor employed as a result to this project was 43 percent of the skilled labor and 58 percent of the unskilled labor.

1/Source: Appraisal of Lummi Indian Reservation Property, Bellingham, Washington, Edward H. Miller and Company, April 6, 1983.
2/Source: Lummi Indian consulting engineer.

Table D-9 shows the computation of NED employment benefits of the proposed project. The average annual NED employment benefits levelized over the 50-year project life at 7-7/8 percent is $77,000 (950,000 x .0805703).

TABLE D-9

NED EMPLOYMENT BENEFIT COMPUTATIONS[1/]

	Federal	Non-Federal	Total
Total Construction Cost[2/] Navigation Features	$3,460,000	$2,831,000	$6,291,000
Less: Engineering and Design Supervision and Administration Costs	544,000	194,000	738,000
Subtotal	$2,916,000	$2,637,000	$5,553,000
Amount Assigned to Labor	(15%)	(60%)	--
Labor	$437,000	$1,502,000	$2,019,000

	Federal		Non-Federal		
	Skilled (55%)	Unskilled (45%)	Skilled (55%)	Unskilled (45%)	Total
Labor Categories	$240,000	$197,000	$870,000	$712,000	$2,019,000
Local Contribution	75%	75%	100%	100%	--
Earned by Local Labor	$180,000	$148,000	$870,000	$712,00	
Earned by Local Unemployed[2/]	43%	58%	43%	58%	
Claimed as NED Employment	$77,000	$86,000	$374,000	$413,000	$950,000

1/ Numbers rounded.
2/ Local hire rule in effect.

2.04 Summary of Benefits. A summary of average annual benefits which would accrue to the project is presented in table D-10.

TABLE D-10

SUMMARY OF AVERAGE ANNUAL BENEFITS

Benefit Category	Average Annual Benefit
Transportation Savings	$391,000
Marina to Fishing Grounds	(225,000)
House to Marina	(46,000)
Reduced Opportunity Cost	(120,000)
Damage Reduction	27,000
Land Enhancement	237,000
Employment	77,000
Total Benefits	$732,000

2.05 Project Investment Costs. Project investment costs consist of Federal and associated non-Federal construction costs as well as interest during construction computed at the project interest rate of 7-7/8 percent and are shown in table D-11.

TABLE D-11

SUMMARY OF ESTIMATED FEDERAL
AND ASSOCIATED NONFEDERAL COSTS

Construction First Costs:	
Federal Costs	$3,460,000[1/]
Non-Federal Associated Costs	2,831,000[2/]
Total First Cost	$6,291,000
Interest During Construction	329,000
Total Federal and Non-Federal Investment Cost	$6,620,000

1/Refer to table 4-1 of the DPR for details. Numbers reflect apportionment prior to revised distribution due to Federal cost-sharing limitations under Section 107 authority.

2.06 Justification and Benefit-to-Cost Ratio. Benefits and costs, shown in Table D-12, are based on October 1982 prices and have been annualized at 7-7/8 percent discount rate over the 50-year project life (1988-2038). Benefit-cost ratio is 1.2 to 1 and net benefits total $136,000 per year.

TABLE D-12

SUMMARY OF ECONOMIC ANALYSIS
LUMMI BAY MARINA

Item	Average Annual Amount
Benefits:	
Transportation Savings	$391,000
Damage Reduction	27,000
Land Enhancement	237,000
Employment	77,000
Total Average Annual Benefits	$732,000
Costs:	
Interest and Amortization	$533,000
Operation, Maintenance, and Replacements	63,000
Total Average Annual Costs	$596,000
Benefit-to-Cost Ratio	1.2 to 1
Net Benefits	$136,000

END

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