US Army Corps of Engineers
Alaska District

Harbor Improvements
Final Interim Feasibility Report
and Environmental Assessment

Seward, Alaska

Volume 1

SEPTEMBER 1998

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
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HARBOR IMPROVEMENTS
FINAL INTERIM FEASIBILITY REPORT
AND ENVIRONMENTAL ASSESSMENT

SEWARD, ALASKA

Volume 1

September 1998

SUMMARY

This report examines the need for additional protected harbor space at Seward, Alaska, and determines the feasibility of Federal participation in potential improvements. The community of Seward, 125 miles south of Anchorage, occupies the northern head of mountainous Resurrection Bay, a fiord extending southward 15 nautical miles to the Gulf of Alaska. The town is accessible by rail, highway, air, and sea, and is regularly visited by Anchorage residents for boating and other recreational purposes. The Seward waterfront includes commercial port terminals, seafood processors, and a ship repair facility. Seward is a routine stop for ferry vessels of the Alaska Marine Highway System and a port of call for commercial cruise ships. It is home port to a diverse fleet of commercial and recreational fishing vessels.

The existing harbor was constructed after the original harbor was destroyed by the 1964 earthquake. The harbor has a berthing capacity of 656 commercial fishing, tourism and recreational vessels, with adjacent dry storage. The harbor includes two double launch ramps, a shallow-draft cargo dock, a 300-ton ship lift and marine ways, a seaplane float, and a fuel float. The harbormaster has a paid waiting list for an additional 339 slips.

Harbor designs were considered for four locations around Resurrection Bay. Only the eastward expansion of the existing harbor was retained for detailed analyses. Four design alternatives were evaluated for the eastward expansion. Alternatives 2 and 2a (same plan except that alternative 2 uses upland disposal and 2a has deep-water disposal) were found to be best for maximizing net benefits and were designated the recommended and NED plans, respectively. The city of Seward is willing to act as local sponsor for the project and fulfill all the necessary local cooperation requirements. We recommend alternative 2 be constructed with Federal participation.

A 1,700-foot rubblemound breakwater would be constructed approximately 400 feet east of the existing harbor in a north-south alignment for a length of 1,070 feet, then turn to a southwest alignment to form the eastern side of the new entrance channel. The entrance channel would be moved to the east side of the remaining east breakwater. The 330-foot existing entrance gap would be filled with a rubblemound structure. The plan would add 11.7 acres of moorage basin and accommodate 346 additional vessels of sizes appropriate for the present and anticipated fleet. Uplands south of the harbor would be enlarged for access to the new south basin area. The new basin would be dredged at two design depths to optimize the requirements of the fleet. The existing harbor's mooring configuration would remain unchanged. The recommended plan has tidal disposal areas of 5.2 acres at the south beach and 0.8 acres at the north basin area (6 acres total), which the non-federal sponsor plans to grade for badly needed parking area. These areas can be easily filled from basin dredging. Basin dredging and upland disposal are local costs.

The features of the project that contribute to the National Economic Development (NED) have a project cost of $11,930,000 (April 1998 price level), an annual NED investment cost of $940,000, and annual benefits of $1,553,000. The project's benefit-to-cost ratio is 1.7, with annual net benefits of $613,000. The fully funded cost estimate is $13,101,000.

As non-federal sponsor, the city of Seward would be required to pay the non-federal share of the NED plan costs of general navigation features (GNF) as specified by Section 101 of the Water Resources Development Act of 1986 (Public Law 99-662). This amount is currently estimated at $940,600. The city must also pay the entire cost of some local NED features (including basin dredging, hydrographic survey, and the float system) and other local features discussed in this report. For the recommended plan, alternative 2, which differs from the NED plan only in the disposal area, the non-federal cost for features contributing to the Federal project would be $6,082,000. Thus, the total non-federal cost would be $8,147,600.

The Federal share of General Navigation Features is $3,782,400. It is recommended that this harbor be constructed with Federal participation.

PERTINENT DATA

Harbor Improvements
Seward, Alaska
Recommended Plan (Alternative 2)

Basin

Area	11.7 acres
Depth	-15 and –12.5 ft MLLW
Entrance channel depth	-15 ft MLLW
Dredging volume:	
Entrance channel	86,900 yd^3
Maneuvering basin	0
Mooring basin	200,000 yd^3
Total	286,900 yd^3
Upland disposal	162,000 yd^3
Shoal disposal	86,900 yd^3
Gap breakwater dredged fill	38,000 yd^3

Breakwater

Design wave	6.2 ft
New construction length	1,700 ft
Length to be removed	1,575 ft
Crest elevation	+20 ft MLLW
Crest width	8.5 ft
Rock volume:	
Primary armor	23,300 yd^3
Secondary rock	14,300 yd^3
Core	26,200 yd^3
Entrance channel slope armor	6,100 yd^3

PROJECT COSTS[a]

Item	Federal	Non-federal	Total
General Navigation Features[b,c]	$3,762,400	$ 940,600	$4,703,000
Other NED local costs	---	7,207,000	7,207,000
Move Coast Guard navigation aids	20,000	---	20,000
NED project costs	~~$3,782,400~~ 3,544,800	$~~8,147,600~~ 8,385,200	$11,930,000
TOTAL			**$11,930,000**

NED investment cost (includes interest during construction)	$12,341,000
Interest and amortization of NED investment cost	$908,000
Ave. annual NED maintenance cost	32,000
Total average annual NED cost	$940,000
Average annual NED benefits	$1,553,000
Net annual NED benefits	$613,000
Benefit/cost ratio (7-1/8% interest)	1.7

[a] Basic assumptions:
(1) April 1998 price levels.
(2) 50-year project life.

[b] Cost sharing reflects provisions of the Water Resources Development Act of 1986.
[c] NED = National Economic Development.

Note: The numbers above reflect today's costs. Fully funded costs, projections for FY 2001, when construction is anticipated, are shown in table 5-3.

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CONVERSION TABLE FOR SI (METRIC) UNITS

Units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To obtain
cubic yards	0.7646	cubic meters
Fahrenheit degrees	*	Celsius degrees
feet	0.3048	meters
inches	2.54	centimeters
miles (U.S. statute)	1.6093	kilometers
miles (nautical)	1.8520	kilometers
miles per hour	1.6093	kilometers per hour
pounds (mass)	0.4536	kilograms
yards	0.9144	meters

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$.

GLOSSARY
Abbreviations, Acronyms, and Technical Terms

ADF&G = Alaska Department of Fish and Game
ADOT&PF = Alaska Department of Transportation and Public Facilities
BCR = benefit/cost ratio
CERC = Coastal Engineering Research Center; part of WES
Continuing Authority = A program that permits the Corps to study, construct, and maintain projects for certain purposes without specific congressional authorization. Federal cost limits apply.
DPR = Detailed Project Report
EA = Environmental Assessment
ER = Engineer Regulation
GI = General Investigations. This is the type of Corps study specifically authorized by Congress. (See Continuing Authority.)
ft = foot, feet
General Navigation Features = Features of a project which can be paid for in part by the Federal Government through the Corps of Engineers. A breakwater is a general navigation feature.
H = horizontal
h = hour(s)
IDC = interest during construction
lb = pound(s)
LERRD = lands, easements, rights-of-way, relocation, and disposal areas
LF = linear feet
LS = lump sum
MLLW = mean lower low water
mi/h = miles per hour
mo = month(s)
n/a = not applicable
NED = National Economic Development. NED features of a project are those that increase the net value of goods and services provided to the economy of the United States as a whole.
NEPA = National Environmental Policy Act
NMFS = National Marine Fisheries Service
NOAA = National Oceanic and Atmospheric Administration
NPFMC = North Pacific Fishery Management Council
O&M = operation and maintenance
OM&R = operation, maintenance, and replacement
PL = Public Law
s = second(s) (time)
SPM = *Shore Protection Manual*
TPR = Tidal prism ratio
USACE = U.S. Army Corps of Engineers
USCG = U.S. Coast Guard
USFWS = U.S. Fish and Wildlife Service
V = vertical
WES = Waterways Experiment Station (of the U.S. Army Corps of Engineers)
yd^3 = cubic yard(s)
yr = year(s)

ACKNOWLEDGMENTS

This report was prepared by the staff of the Alaska District, U.S. Army Corps of Engineers, in Anchorage, Alaska. The study manager was Mr. Morgan Ruther of the Project Formulation Section in the Civil Works Branch, Engineering Division.

Mr. David Martinson and Mr. Ken Eisses of the Hydraulics and Hydrology Section, Civil Works Branch, did the hydraulic analysis. Ms. Janis Kara and Mr. Andrew Miller of the Economics Section performed economic analyses. Mr. William Abadie and Mr. Guy McConnell of the Environmental Resources Section performed environmental analyses. In the Cost Engineering Branch, Mr. Al Arruda and Mr. Frank Antolin estimated the project cost. In the Real Estate Branch, Mr. Guy Hopson and Mr. Doug Trosper analyzed the real estate requirements. The geotechnical investigation was performed by Golder Associates. Mr. Richard Ragle prepared the chemical data report.

Mrs. Carolyn Rinehart of the Civil Works Branch edited the report, and Mr. Bart Lane and Mr. Jim Fuhrer of the Civil Works Branch prepared the figures.

These investigations were conducted under the direction of Mr. Kenneth E. Hitch, Acting Chief, Engineering Division; Mr. Carl E. Borash, Acting Chief, Civil Works Branch and Chief, Project Formulation Section; Mr. Ken Eisses, Chief, Hydraulics and Hydrology Section; Mr. Andrew W. Miller, Chief, Economics Section; Mr. Guy R. McConnell, Chief, Environmental Resources Section; Mr. Delwyn F. Thomas, Chief, Geotechnical Branch; Mr. Jerry Raychel, Chief, Soils and Geology Section; and Mr. James W. Pekar, Chief, Materials and Instrumentation Section.

Additional assistance was provided by Ms. Ruth Carter and Mr. Harvey Smith from the coastal engineering section of the Alaska Department of Transportation and Public Facilities.

Commander and District Engineer of the Alaska District during this study was Colonel Sheldon L. Jahn, Corps of Engineers.

Harbor Improvements
Final Interim Feasibility Report
Seward, Alaska

1. INTRODUCTION

1.1 Study Authority

This study is in partial response to the Rivers and Harbors in Alaska study resolution, adopted by the U.S. House of Representatives Committee on Public Works on December 2, 1970. The resolution states in part:

> *Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the reports of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Numbered 414, 83rd Congress, 2nd Session;...and other pertinent reports, with a view to determine whether any modifications of the recommendations contained therein are advisable at the present time.*

The study was requested by the city of Seward to investigate navigation improvements at Seward, Alaska.

1.2 Scope of Study

This study investigates the feasibility of navigation improvements at Seward, Alaska (figure 1), a fishing, fish processing, and tourism center on the Kenai Peninsula, about 125 miles south of Anchorage by road. The investigation was limited to means of satisfying immediate and future needs for vessel refuge within the study area. The study was conducted and the report prepared in accordance with goals and procedures for water resources planning as contained in Engineer Regulation (ER) 1105-2-100. Alternatives are examined for their feasibility, considering engineering, economic, environmental, and other criteria. A determination of Federal interest in accordance with present laws and policies is also included.

1.3 Study Participation

The Alaska District, Corps of Engineers, has primary responsibility for this study. The report was prepared with assistance from many individuals and agencies, especially the city of Seward, the Alaska Department of Transportation and Public Facilities (ADOT&PF), the U.S. Fish and Wildlife Service (USFWS), and the Alaska Department of Fish & Game (ADF&G).

1.4 Related Reports and Studies

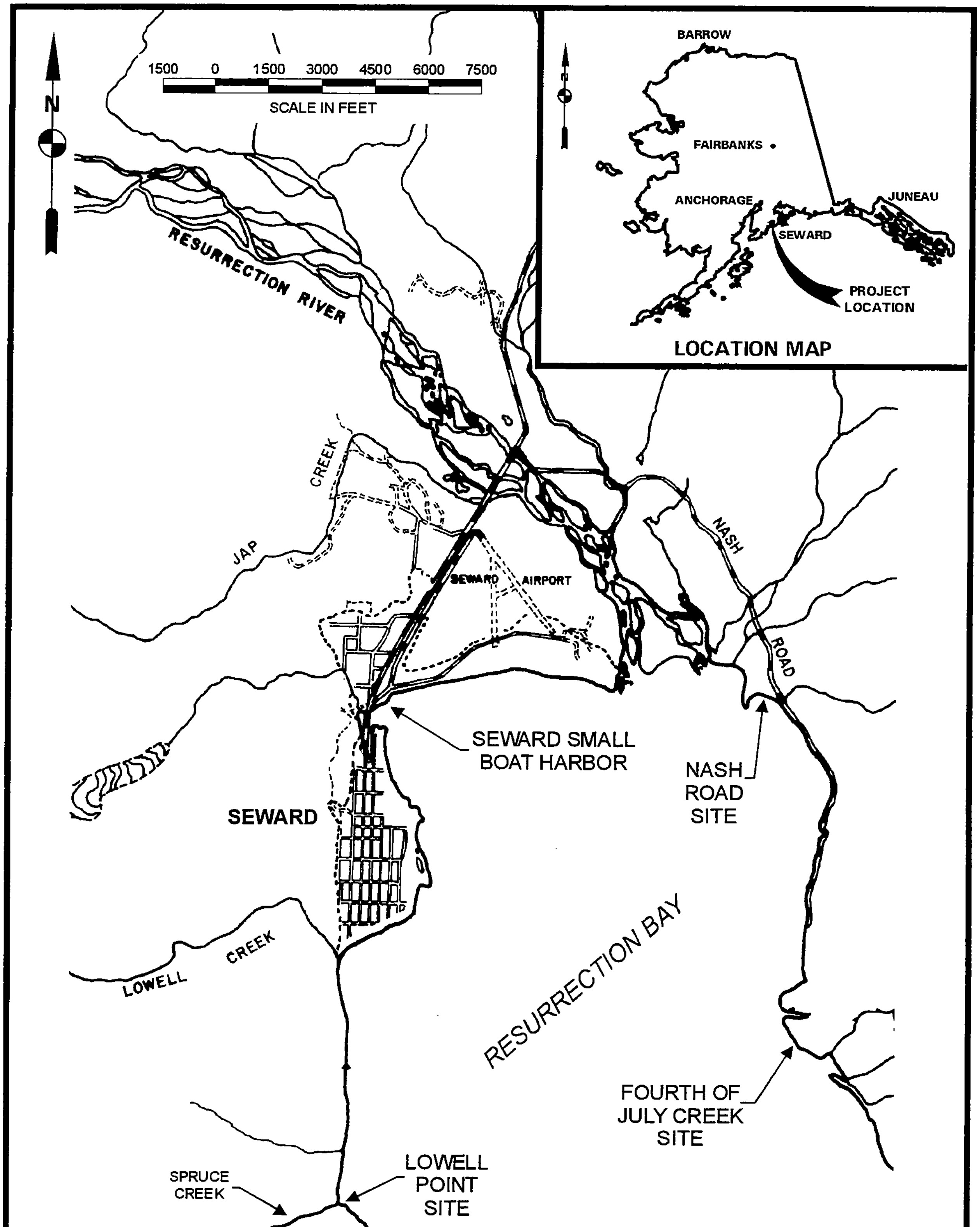
The following studies have examined navigation improvements at Seward.

The Corps' Alaska District published the "Seward, Alaska, Detailed Project Report and Final Environmental Impact Statement for Proposed Small Boat Harbor Navigational Improvements" in April 1982, recommending construction of a new 30-acre harbor to accommodate 1,100 to 1,400 vessels. The site chosen for this report lies east from the city across Resurrection Bay, adjacent to Nash Road. The locations of all sites evaluated in this study, including the Nash Road site, are shown in figure 1. Construction plans and specifications were nearly completed for the harbor at Nash Road, but no construction took place because a local cost-sharing agreement could not be finalized.

The Seward City Council, by resolution 90-001 dated January 8, 1990, asked the Corps to again investigate the feasibility of harbor improvements. A Preliminary Reconnaissance Report under Section 107 of the River and Harbor Act of 1960, as amended, was completed on September 7, 1990, and recommended further studies. The ensuing Reconnaissance Report, published in February 1992, recommended a cost-shared feasibility phase study based on a Federal interest in expanding the existing harbor to the east, as well as the possible potential feasibility of a redesigned harbor at the Nash Road site recommended 10 years earlier.

At the same time, a wave barrier development study was conducted by Peratrovich, Nottingham & Drage, Inc., for the Alaska Science and Technology Foundation. This study was funded by the city of Seward and other entities. The study included two- and three-dimensional modeling for the configuration of the small boat harbor's eastward expansion at Seward. Although specific cost data was not presented, the February 1992 report indicated the wave barrier concept would compare favorably with a rubblemound breakwater, and thus was a viable option for the city's harbor expansion.

The Corps study, after being converted to the General Investigations (GI) program in November 1993, was put on "hold" in June 1994 when the city opted to pursue construction of a Nash Road harbor with a private developer. The city's agreement with



ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

LOCATION & VICINITY MAP

SEWARD HARBOR IMPROVEMENTS

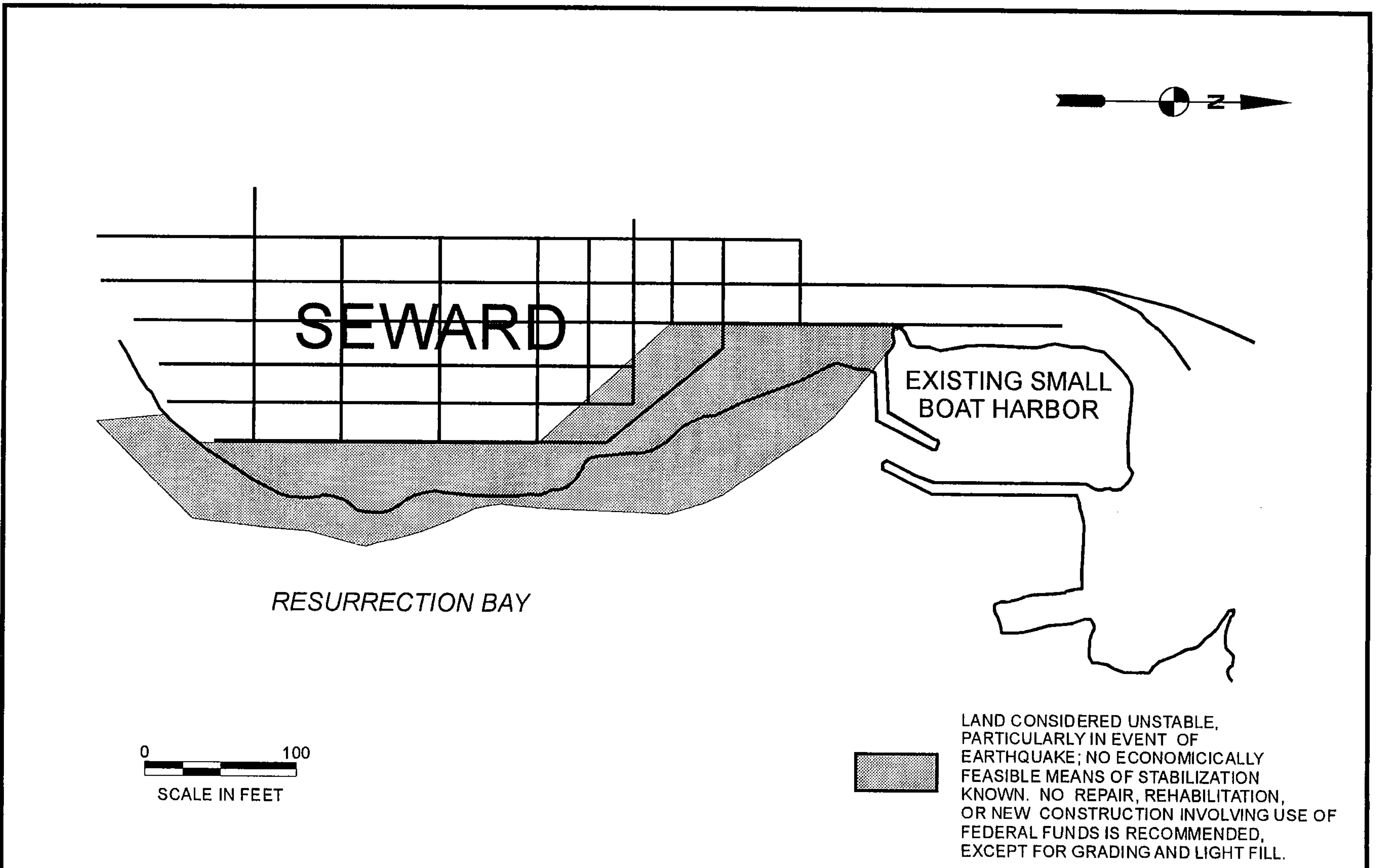
1

the developer expired in January 1995 without a successful development plan. Subsequently, the city asked the Corps to reactivate the "harbor eastward expansion" study in a letter to the Corps dated February 7, 1995, and a Seward City Council resolution dated June 26, 1995. The study was reactivated, and a Reconnaissance Report was finalized in July 1996.

The Alaska District did a related study on potential navigation improvements at the Seward Marine Industrial Center and at the Alaska Railroad dock. In a February 1996 reconnaissance report, these improvements were found infeasible from an economic standpoint. At the railroad dock, the railroad planned to build a groin to trap sediments, preventing them from entering the approach channel. This would allow continued deep-draft navigation at Seward. This report and the 1992 harbor reconnaissance report both drew from a 1991 economic study for the Corps by BST Associates.

1.5 Existing Project

The U.S. Army Corps of Engineers first constructed a small boat harbor at Seward in 1932. The city and that harbor were constructed on an old alluvial fan from Lowell Creek. A submarine seismic landslide occurred during the 1964 Good Friday earthquake, destroying that harbor, which was located south of the existing harbor site. Based on subsequent evaluation, a nearby area considered to consist of unstable lands was designated a high-risk earthquake area. A technical paper, "The Great Alaska Earthquake of 1964," is attached at the end of the geotechnical appendix, C. The use of Federal funds in this area is restricted to grading and light fill. This area is shown on figure 2. The Corps completed construction of the present harbor in 1965. The harbor has a berthing capacity of 656. The harbor includes two double launch ramps, a shallow-draft cargo dock, a 300-ton ship lift and marine ways, a seaplane float, and a fuel float. A plan drawing of the existing harbor is shown in figure 3.



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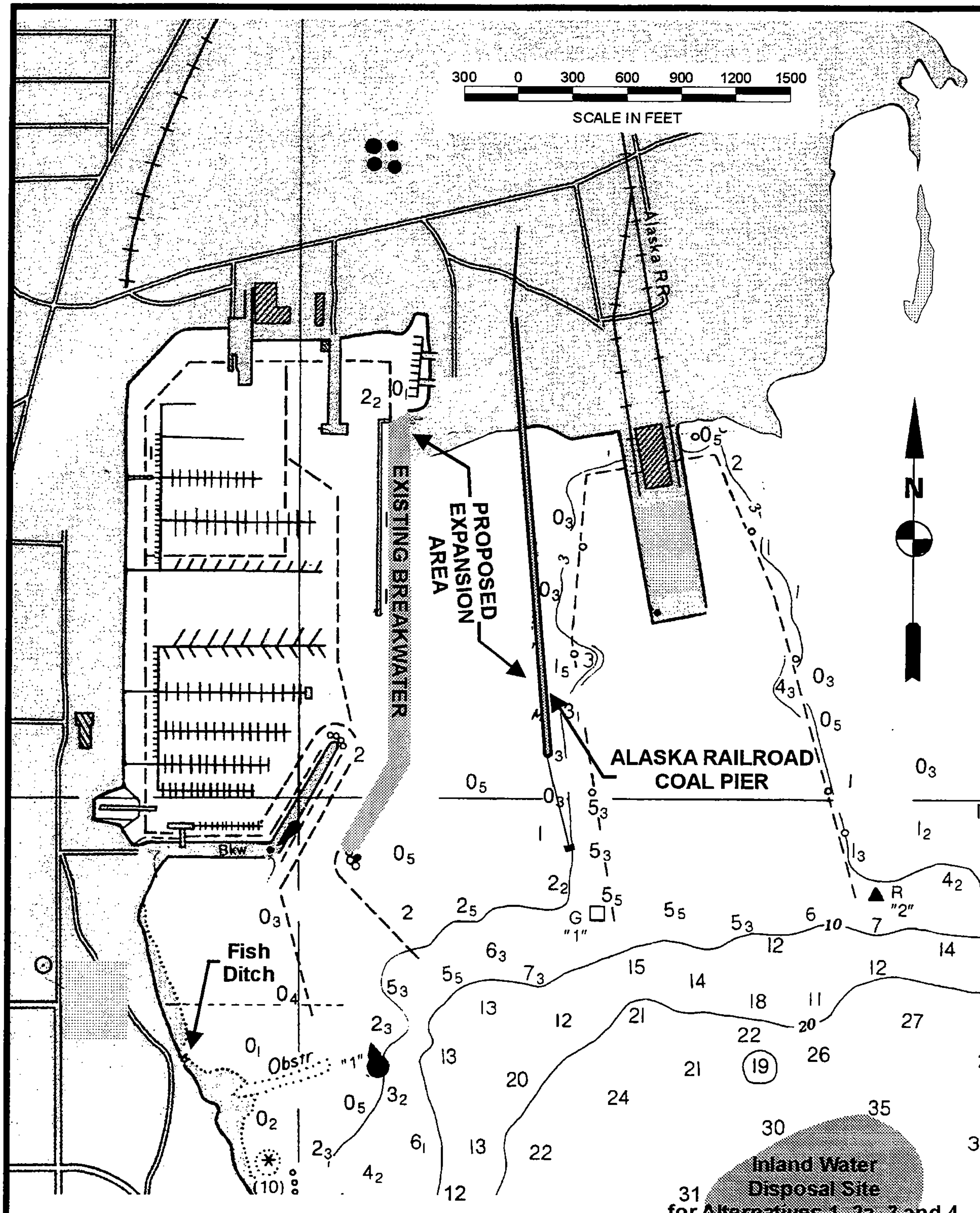
HIGH-RISK EARTHQUAKE AREA

SEWARD HARBOR IMPROVEMENTS

2



NOTE: Soundings are in fathoms.

ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	EXISTING HARBOR SEWARD HARBOR IMPROVEMENTS	3

2. REGIONAL DESCRIPTION

2.1 Physical Setting

Seward is located at the northern end of Resurrection Bay, a north-south fiord 19 miles long and 3 miles wide opening to the Gulf of Alaska. Depths along Resurrection Bay exceed 120 fathoms, and the mountains on either side rise to elevations more than 4,000 feet above sea level. The city is the ocean terminus of the railroad and highway connecting Seward to Anchorage and Fairbanks. The city is 125 highway miles south of Anchorage and is the gateway to the Kenai Fjords National Park. The harbor lies within the Kenai Peninsula Borough Coastal Management Zone.

In September 1995, the harbor received flood runoff from the Resurrection River about 1 mile to the north. Sedimentation of the river in the area of the Seward Highway bridge and Alaska Railroad bridge crossings has constricted the openings. During severe rainfall events, the river can back up, overtop the highway, flood the industrial area north of town, and eventually flow into the harbor. About 20,000 cubic yards of sediments were deposited in the northeast corner of the harbor during the 1995 flood. The city has since installed several drainage ditches to intercept storm water runoff as interim protection from potential flooding. In addition, the city is currently participating in a flood prevention task force which includes the Federal Emergency Management Agency (FEMA), the Alaska Department of Transportation and Public Facilities (ADOT&PF), the Kenai Peninsula Borough, the Alaska Division of Emergency Services, and the Alaska Railroad. ADOT&PF and the Alaska Railroad both plan to double the length of their existing bridge spans, which will minimize future flooding potential.

2.2 Hydrology and Hydraulics

2.2.1 Climate.

Relatively mild winters, cool summers, and a mean annual precipitation of 68 inches characterize the subarctic maritime climate at Seward. The bay remains ice-free all year, with the occasional exception of thin ice near the mouths of freshwater streams during the coldest winter days. The average temperature is 25 °F in winter and 62 °F in summer.

2.2.2 Tides and Water Levels.

Tides at Seward have a mean range of 8.3 feet and a diurnal range of 10.6 feet, causing tidal currents of 1 to 2 knots. Tide levels, referenced to mean lower low water (MLLW), are shown in table 2-1. Extreme high tide levels result from the combination of astronomic tides and rises in local water levels due to atmospheric and wave conditions.

TABLE 2-1.—*Tidal data, Seward, Alaska*

Tide	**Elevation (ft MLLW)**
Observed Extreme High Water*	+15.09
Mean Higher High Water	+10.58
Mean High Water	+9.67
Mean Tide	+5.52
Mean Low Water	+1.36
Mean Lower Low Water	0.0 (datum)
Observed Extreme Low Water**	-4.15

* November 11, 1981.
** December 20, 1968.
Source: NOAA National Ocean Service (1984).

2.2.3 Currents.

Alaska coastlines fronting the north Pacific Ocean are subject to two diurnal tides of relatively great range, resulting in extreme currents among the islands and inlets. Tidal currents at Seward, as reported in the 1982 Detailed Project Report, are as follows:

Flood		**Ebb**	
Direction	**Ave. maximum velocity (knots)**	**Direction**	**Ave. maximum velocity (knots)**
180°	1.0	355°	1.7

In Resurrection Bay, the velocity of ebb currents exceeds that of flood currents except when influenced by strong onshore winds, and then only at the surface.

2.3 Biological Resources

Resurrection Bay is a very productive marine habitat, supporting many species of fish, mammals, birds, and other organisms. The bay supports a large marine sport fishery for coho salmon, with incidental catches of pink and chinook salmon. Sockeye and chum salmon are also found in the area but do not contribute significantly to the fishery. Other sport fish include rockfish, lingcod, and Pacific halibut. Charter vessel operators based at Seward offer excursions to tour the Kenai Fjords National Park, which stretches along the south shore of the Kenai Peninsula west of Resurrection Bay. This park includes many wilderness fjords similar to Resurrection Bay, with an abundance of sea birds, marine mammals, and glaciers.

More than 200 bird species migrate through or reside in the Resurrection Bay area. Major groups of birds in the Seward vicinity include upland forest birds, raptors, waterfowl, shorebirds, and both shallow-water and ocean going sea birds. Resurrection Bay provides wintering habitat for many species of waterfowl and sea birds. Substantial waterfowl nesting and feeding area exists along the shoreline at the head of the bay. Steller's eider, a proposed threatened species, winters in small numbers in Resurrection Bay. The bald eagle is the most abundant raptor resident and breeder in the Seward area.

Terrestrial mammals found in the Seward area are similar to those found throughout the Kenai Peninsula and include black bear, brown bear, moose, mountain goat, and wolf.

Marine mammals such as harbor porpoise, harbor seal, sea lion, and sea otter inhabit Resurrection Bay. Whales seen in Resurrection Bay include orca, humpback, and gray.

2.4 Economic Base

Seward is an important supply center to interior Alaska, being linked by both highway and rail. The current population approaches 3,000. The economy has expanded with tourism, ship services and repairs, fish processing, a coal export facility, a state prison, and the University of Alaska's Institute of Marine Sciences. Construction of a SeaLife Center has recently been completed. More than 100 residents hold commercial fishing permits. Seward hosted tourists from more than 110 cruise ships in 1997. Over 200,000 travelers toured the Kenai Fjords National Park visitor center in Seward in 1996. Daily air services and charters are available at the State-owned airport. Cargo barges and ocean freighters arrive from Seattle and overseas. The city is also a port for the Alaska Marine Highway, the State ferry system that provides vehicle and passenger transportation.

2.5 Problem Description

Both commercial and recreational vessels incur significant annual expenses at Seward due to the shortage of moorage facilities. Many operators remove their vessels from the water or seek shelter in distant ports at considerable cost. Dry storage damages vessels and causes their owners to incur expense. Thus, boat access becomes more difficult for winter use in crab, bottom-fish, herring, and other fisheries. Leaving the Seward area is not a desirable alternative. The costs of traveling are high, and vessels cannot always be readily available throughout the year. The local economy suffers as a result. The majority of the permanent moorage slips in the Seward small boat harbor are 42 feet long or less. Permanent moorage is allocated by slip size. The existing size distribution is indicated in table 2-2.

TABLE 2-2.—*Existing permanent moorage at Seward*

Length (ft)	**Number of slips**
Up to 21	132
22-26	58
27-36	162
37-45	120
46-54	46
55-90	19
Total assigned moorage	537
Transient slips	119
Total designed mooring capacity	**656**

The harbormaster maintains a waiting list of vessels desiring slips. Owners of the vessels on this list pay a yearly fee to maintain their position on the list. These vessels are representative of the design fleet for the expanded harbor. The number and lengths of vessels anticipated to use the new moorage area are shown in table 2-3. As the table shows, 339 additional vessels are anticipated. Lengths, beams, and drafts for the fleet were developed in conjunction with the harbormaster and various harbor users. One 115-foot-long vessel routinely uses the harbor. The design vessel for this study is 90 feet in length, with a beam of 23 feet and a draft of 9 feet.

TABLE 2-3.—*Design fleet*

Length (ft)	**No. of vessels**
12-21	2
22-26	36
27-36	164
37-45	84
46-54	32
55-90	21
Total additional vessels	**339**

3. PLAN FORMULATION

3.1 Planning Criteria

3.1.1 National Economic Development Objective.

The Federal objective of water and land resources planning is to contribute to the National Economic Development (NED) in a way consistent with protecting the Nation's environment. NED features are those that increase the net value of goods and services provided to the economy of the United States as a whole. Only benefits contributing to the NED may be claimed for economic justification of the project. For the Seward harbor, NED features include the breakwater, channels, basins, and float system.

Resource planning must be consistent with the NED objective and considers economic, social, and environmental as well as engineering factors. The following criteria are guidelines for developing alternative plans and are used to evaluate those plans.

3.1.2 Engineering Criteria.

The plans should be adequately sized to accommodate user needs and provide for development of harbor-related facilities. They should protect against wind-generated waves and boat wakes. Adequate depths and entry are required for safe navigation. The plan must also be feasible from an engineering standpoint and capable of being economically constructed. At the existing harbor, most of the uplands are developed and there is a shortage of parking. The State of Alaska's recommended guidelines include:

a. The ratio of upland area to mooring basin area should be at least 0.2 for basic parking and minimal support facilities. If there will be dry storage for boats, boat ramps, and/or public green areas, this could be increased to about 1.0.

b. The maximum distance from nearest parking to farthest berth should be no more than 600 feet.

c. The maximum distance from farthest parking to farthest berth should be no more than 1,000 feet.

3.1.3 Economic Criteria.

Principles and guidelines for Federal water resources planning require a plan to be identified that produces the greatest contribution to the NED. This plan, called the NED plan, is defined as the plan providing the greatest net benefits as determined by subtracting annual costs from annual benefits. Corps of Engineers policy requires recommendation of the NED plan unless there is adequate justification to do otherwise.

All alternatives considered to meet project needs should be presented in quantitative terms where possible. Benefits attributed to a plan must be expressed in terms of a time value of money, and must exceed equivalent economic costs for the project. To be economically feasible, each separate portion or purpose of the plan must provide benefits at least equal to the cost of that unit. The scope of development must be such that benefits exceed project costs to the maximum extent possible. The economic evaluation of alternative plans is on a common basis of April 1998 prices, a project life of 50 years, and an interest rate of 7-1/8 percent.

3.1.4 Environmental Criteria.

Environmental considerations include identifying forms of aquatic life and wildlife that might be impacted by a plan's implementation, minimizing disruption of the area's natural resources, maintaining consistency with the Alaska Coastal Management Plan, and using measures to protect or enhance existing environmental values.

An Environmental Assessment (EA) was prepared and printed for public and agency review. It is included with this report.

3.1.5 Social Criteria.

Plans considered must minimize adverse social impacts and be consistent with State, regional and local land use and development plans, both public and private. The selected plan must be acceptable to the non-federal sponsor.

3.2 Description of Alternative Plans

3.2.1 No Action.

If no Federal action were taken, both commercial and recreational vessels would continue to incur significant annual expenses associated with delays getting in and out of the harbor during peak season. Rafting damages would continue to be excessive. In

March 1995, float system 'X' had catastrophic piling failure due to overloading (rafting) and high winds. There is a significant shortage of moorage for vessels over 22 feet in length. Most of the proposed moorage would be for vessels over 30 feet in length. Transient vessels, which also incur damages, are typically rafted four (or more) deep during the peak season. Due to the lack of moorage facilities, many transient operators avoid Seward at considerable cost.

3.2.2 Nonstructural Alternatives.

There are two main alternatives for operators of fishing vessels unable to secure moorage space:

a. Remove the vessel from the water, or

b. Seek shelter in distant ports.

Dry storage can potentially damage vessels and is a costly annual expense for owners. In addition, boats are not available for winter use in the crab, bottom-fish, herring and other fisheries.

Likewise, leaving the Seward area is not a desirable alternative. This practice is already occurring. The costs of traveling are high, and vessels cannot always be readily available throughout the year. The local economy suffers as a result.

3.2.3 Structural Alternatives.

The reconnaissance report evaluated three sites: the eastward expansion of the existing harbor, the Nash Road site, and the North City Waterfront Plan (southward expansion of the existing harbor). This last plan was not carried forward because the area south of the existing harbor is considered an area of high seismic risk. For this study, two other sites were added for evaluation: Lowell Point and Fourth of July Creek. Three of the alternative locations are away from the downtown area. The fourth alternative was the eastward expansion of the existing harbor. At the beginning of the feasibility study, the criteria for evaluating potential harbor sites to satisfy the additional harbor demand were identified and compiled into a matrix with the cooperation of coastal engineering at ADOT&PF. The matrix was composed of three main categories--physical characteristics, harbor uplands, and environmental compatibility--with relative weights assigned to the elements under each category. The four sites considered for Seward harbor improvements are described in the following paragraphs, and the matrix is included as table 3-1. Locations of the four sites were indicated in figure 1.

TABLE 3-1.--*Site selection criteria for Seward Harbor*

Ranking Very good (5), Good (4), Fair (3), Poor (2), Very poor (1)
Weight: 1 to 10
Alternative:

		Eastward expansion		Nash Road		Lowell Point		Fourth of July Creek	
		Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score
Physical characteristics:	**Weight**								
Basin area	9	5	45	5	45	3	27	1	9
Basin depth	8	3	24	3	24	1	8	2	16
Entrance channel (access) dredging	7	5	35	2	14	5	35	5	35
Ease of navigation (reefs, hazards, obstructions,etc.)	7	5	35	4	28	5	35	5	35
Expandability	8	1	8	5	40	1	8	2	16
Swell and surge (open ocean, gulf, etc.)	8	3	24	1	8	3	24	1	8
Local waves (at moored site)	8	3	24	4	32	1	8	1	8
Wind protection	4	1	4	2	8	3	12	1	4
Bottom suitable for piles	6	5	30	5	30	2	12	2	12
Foundation material	8	5	40	4	32	3	24	4	32
Usability of dredged material	4	4	16	3	12	5	20	4	16
Seismic risk	8	4	32	2	16	1	8	1	8
Ice/fresh water	3	5	15	2	6	1	3	2	6
Sedimentation (littoral processes)	5	4	20	1	5	2	10	3	15
Subtotal			**352**		**300**		**234**		**220**
Harbor uplands:									
Ease of development (topography, etc.)	10	4	40	2	20	1	10	5	50
Ped. access - boat owners, tourists, trans. vesl.	9	5	45	2	18	2	18	1	9
Vehicle access - ATV's, emergency response, etc.	10	5	50	4	40	2	20	3	30
Vessel security (vsls. visible from harbormaster's)	2	5	10	1	2	1	2	1	2
Subtotal			**145**		**80**		**50**		**91**
Environmental Compatibility									
Existing habitat									
Anadromous fish streams	5	5	25	2	10	2	10	4	20
Intertidal marine habitat (incl. eelgrass beds)	9	5	45	3	27	4	36	4	36
Ambient water quality (circulation and flushing)	9	4	36	4	36	5	45	5	45
Coal dust	6	1	6	5	30	5	30	5	30
Subtotal			**112**		**103**		**121**		**131**
TOTALS			**609**		**483**		**405**		**442**

- **Lowell Point.** This site is about 2.5 miles south of town on the west side of Resurrection Bay. The location would be near the mouth of a creek in the alluvial fan near the city's sewage treatment plant. It would require extensive dredging due to the steep natural drop of the bay floor. The site currently has no utilities, but electricity and sewer are nearby. The site is served by a single-lane gravel road which would require upgrades to provide two-way traffic. An estimated 440,000 cubic yards (yd^3) of material would require dredging at this site. This material would be used to create an upland area for the proposed harbor and for widening the road. However, due to higher quantities for dredging, the need to develop infrastructure near the site and improve the road to town, and higher costs to construct, this site was eliminated from further consideration.

- **Fourth of July Creek.** This site is about 9 miles from town by road on the east side of Resurrection Bay. The location would be in the alluvial fan near the mouth of Spring Creek and would require extensive dredging due to the steep natural dropoff of the bay floor. The amount of material to be dredged at this site would be about 370,000 yd^3. The site is north of the existing Seward Marine Industrial Center, which has all utilities necessary to support a nearby harbor. The site was rejected primarily because of the presence of a bald eagle nest tree, the need for filling wetlands, and impacts to Spring Creek, which supports anadromous fish. Furthermore, there is a lack of consensus from the community on locating a small boat harbor on the east shore of Resurrection Bay, far removed from the main part of town.

- **Nash Road.** This site is in the northeast corner of Resurrection Bay, about 4 miles from town by road. The site is in the alluvial delta of the Resurrection River and was examined by Corps studies in 1982 and 1996. This site was also studied by the city of Seward with a private developer in 1992. An estimated 316,000 yd^3 of material would require dredging at this site. This area could be dredged easily, with the excess material being used to create the uplands necessary for the support of the harbor. However, cooperation of two adjacent upland property owners is critical to success of the project. Consent agreements could never be obtained from the two parties, and the city terminated its agreement with the developer in 1994 (see Resolution 94-205 in Appendix F, Correspondence). To date, these two property owners have been unwilling to cooperate with the city regarding a harbor proposal at the Nash Road site. Thus, the city has expressed a total lack of interest in this site. Due to the lack of support from the local sponsor and landowners at the proposed site, the Nash Road site was eliminated from further consideration.

- **Eastward Harbor Expansion.** The existing harbor lies in the northwest corner of Resurrection Bay at the north end of town. This alternative consists of developing the area between the existing harbor and the Alaska Railroad coal trestle to the east. The existing north-south 1,300-foot breakwater would be moved eastward about 550 feet to facilitate construction of a new 2,200-foot breakwater that would take advantage of the existing entrance channel. The new mooring area would be dredged to –12 to –15 ft MLLW, the same as most of the existing mooring area, generating 250,000 yd^3 of material. This solution satisfies the current demand for mooring spaces and maintains the present concentration of harbor-related activities. Tourists from the cruise ships would be able to walk to the day cruise boats and use the present office and ticket booth locations. The commercial fishing fleet will likely expand to better supply the planned cannery expansion. Road access and utilities are present, and uplands are now city-owned. Local support is strong, and the city administration is totally committed to this project's completion.

3.3 Site Considered in Detail – Eastward Expansion

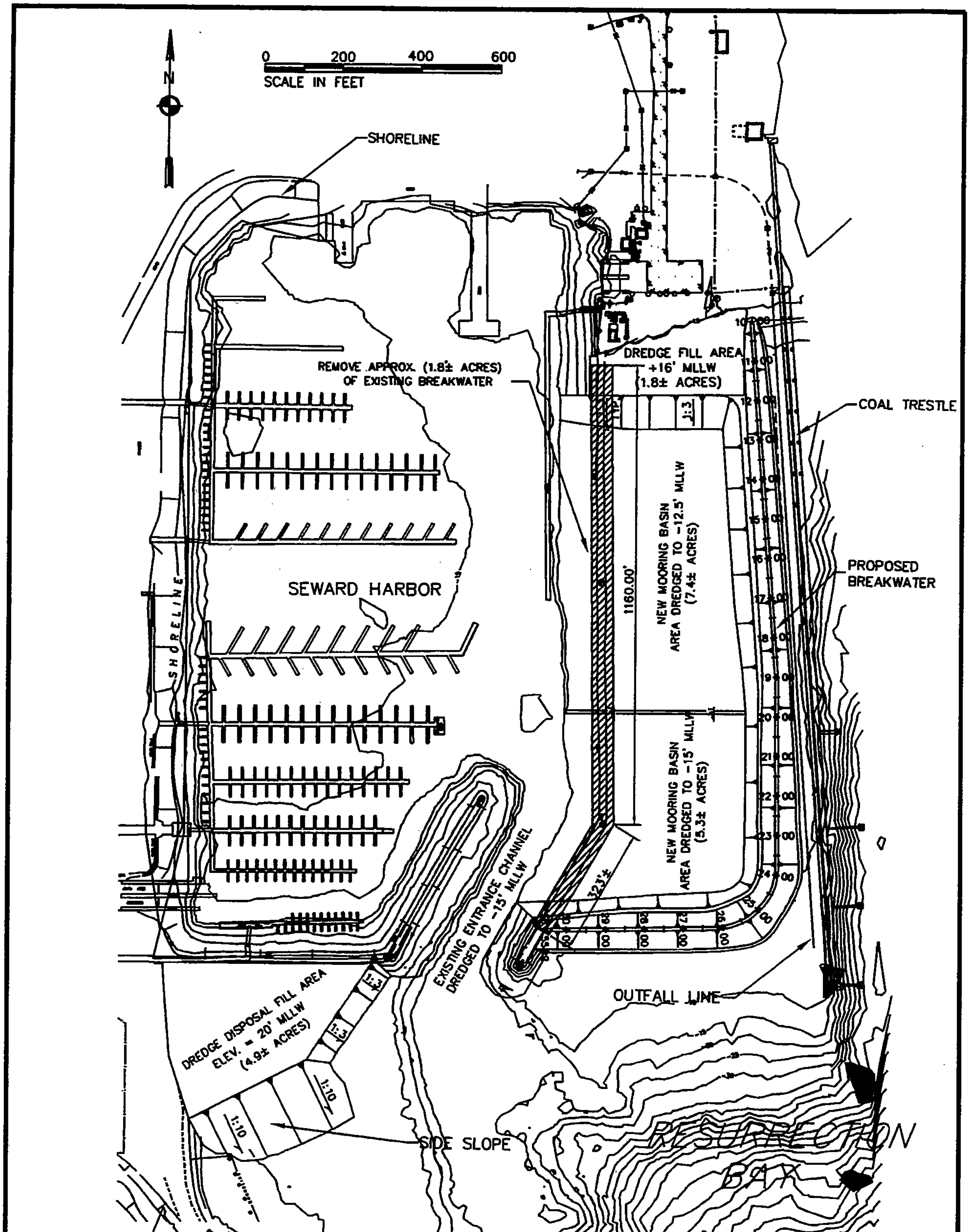
Physical modeling of the Seward small boat harbor was previously performed by others to measure the effectiveness and provide data for the design of wave barrier systems. This information, contained in the 1992 Final Report completed by Peratrovich, Nottingham & Drage, Inc., was used to aid in the development of the alternatives. A physical model was conducted to evaluate the water quality for the Nash Road alternative that was developed in the 1982 Detailed Project Report. This information was also used to help predict the water quality anticipated for improvements to the existing harbor. The alternatives were then evaluated using established design guidance given in the appropriate Engineer Manuals (EM's) and the *Shore Protection Manual.* Alternatives considered must also be suitable for construction and have no negative effects on the adjacent coal trestle to the east. A geotechnical investigation was performed for the eastward expansion to evaluate the effects of the proposed breakwater on the coal trestle and to evaluate the quality of the dredged materials for reuse. The borings indicate that floodplain deposits in the area to be dredged generally consist of 50 percent fine to coarse sand and 45 percent fine to coarse gravel up to about 1.5 inches. The remaining +/- 5% is silt. No chemical contamination was found in these sediments. The geotechnical engineering analyses evaluated the effects of the proposed breakwater on the stability of the dredged slope east of the coal trestle and downdrag on the coal trestle piles. The analyses conclude the toe of the breakwater should be a minimum of 30 feet from the nearest piles supporting the coal trestle to minimize downdrag effects. The geotechnical report is included as appendix C to this report, and the chemical data report is included as appendix 4 to the Environmental Assessment. With these constraints in mind, five alternatives were developed and evaluated for the eastward harbor expansion.

These five options have several similar features and would not change the existing moorage area configurations. All include removing the existing easternmost breakwater and installing a breakwater about 450 feet farther east, as close to the coal trestle as possible. This breakwater would also proceed as far to the south as possible and wrap around to the west to the entrance channel at the southern end of the basin to maximize the size of the mooring basin. Three alternatives include disposal areas to create uplands immediately south of the existing east-west breakwater and a smaller area immediately north of the new basin area. For alternatives 1, 3, and 4, excess dredged material not used to create uplands would be disposed at a location over ¼ mile into the bay, at an area the railroad previously used for dredge disposal. For alternative 2a, all dredged material not used to fill the old entrance channel would be disposed at this deep-water site. This area was shown on figure 3. For alternative 2, all dredged material would be used to build uplands and fill the old entrance channel. Filling the old (existing) entrance channel to an elevation of 0 feet MLLW creates clam/mussel habitat to replace the existing beds that would be destroyed during inner harbor dredging.

Most of the razed breakwater can be reused in the new construction. The gradation of the material in the core is not known. A sampling of the armor rock revealed weights ranging from 1,000 lb to 10,000 lb, with the average weight at 3,300 lb. Work inside the harbor could be accomplished with a hydraulic cutterhead and suction pipeline or an excavator. Dredging equipment and methods would be left as an option for the contractor. Side slopes for the basin would be dredged to 1V:3H and would not require armoring. A comparison of values for design quantities and areas is included as table 3-2 at the end of this section. The five alternatives are described in the following paragraphs.

3.3.1 Alternative 1.

The existing harbor would be expanded to the east by removing most of the east breakwater and constructing a new breakwater, as shown in figure 4. The existing entrance channel would not be altered and would be used to provide access to the new moorage area. This alternative would accommodate the additional moorage demand

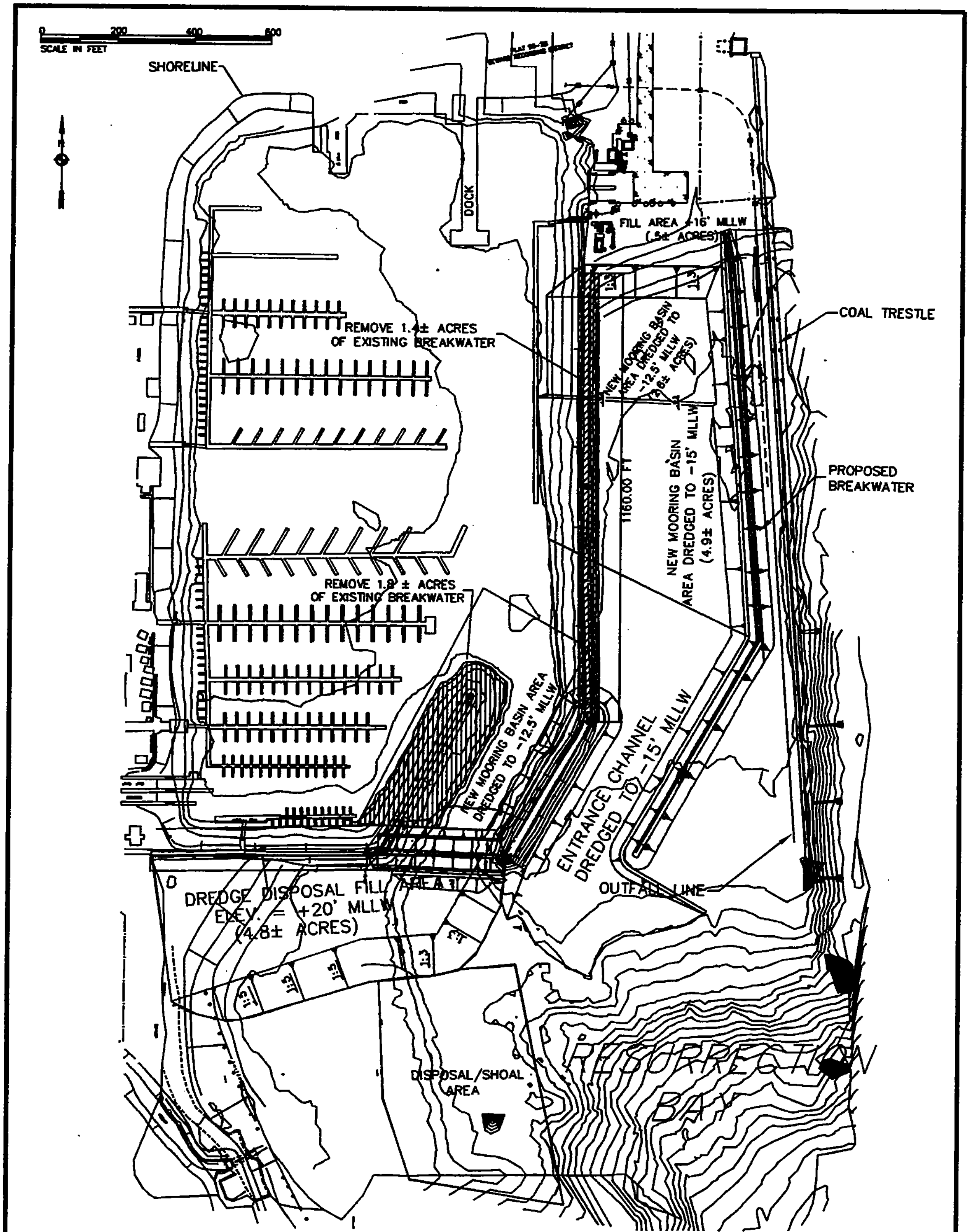


ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	ALTERNATIVE 1 SEWARD HARBOR IMPROVEMENTS	4

by providing 10 acres of additional basin. The new harbor basin would be dredged at two design depths to optimize the requirements of the fleet based on drafts of the vessels. Approximately 4.5 acres would be dredged to -15 ft MLLW to accommodate vessels drafting 9 feet. The remainder of the harbor would be dredged to -12.5 ft MLLW for the fleet with drafts less than 6.5 feet. Both depths of dredging allow for 2 feet safety clearance and a minimum low-tide elevation of –4 feet MLLW. Dredged materials would be placed to the south to create 2.2 acres of uplands for parking and harbor operations. North of the new basin, a 1.8-acre area would be filled to minimize the walking distance to the south end of the basin. About 1,470 feet of the existing breakwaters would be removed and 2,055 feet of new breakwater and revetment constructed. This option has a slightly larger north fill area than other alternatives, but would still require a very long walk of about ¼ mile to reach the southern end of the basin.

3.3.2 Alternative 2.

This alternative, shown in figure 5, was developed to minimize the walking distance by splitting the new mooring basin length, utilizing a new entrance channel, and developing larger south uplands for access to the new south basin area. The existing entrance channel would be relocated to the east side of the remaining east breakwater, maintaining the same alignment, width, and depth. About 475 feet of the existing south breakwater that forms the west side of the entrance channel would be removed to provide additional moorage basin area within the existing harbor. The 330-foot existing entrance gap would be filled with a rubblemound structure. Approximately 5.2 acres of upland area would be created south of the existing harbor to allow access to the new basin in this area. An additional 0.8 acres of uplands would be filled north of the new eastward expansion basin. All remaining dredge disposal would be to elevation 0 feet MLLW in the existing entrance channel as mitigation for destruction of existing clam/mussel beds in the harbor expansion area. This alternative would provide an additional 11.7 acres of moorage basin. The repositioning of the entrance channel reduces the haul distance from vehicle access areas to the farthest moorage stalls while providing a larger additional moorage area. A 120-foot-wide channel allows two-way traffic for vessels with beams up to 27 feet. Side slopes of 1V:3H would be armored in the entrance channel in areas exposed to wave action. The new harbor basin would be dredged at two design depths to optimize the requirements of the fleet based on drafts of the vessels. Approximately 4.5 acres would be dredged to -15 ft MLLW to accommodate vessels drafting 9 feet. The remainder of the harbor would be dredged to –12.5 ft MLLW for those vessels with drafts less than 6.5 feet. Both depths of dredging allow for 2 feet safety clearance and a minimum low-tide



ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	ALTERNATIVE 2 SEWARD HARBOR IMPROVEMENTS	5

elevation of –4 ft MLLW. Alternative 2 requires the removal of 1,575 feet of the existing breakwaters and 1,700 feet of new breakwater construction. This is the locally preferred alternative.

3.3.3 *Alternative 2a.*

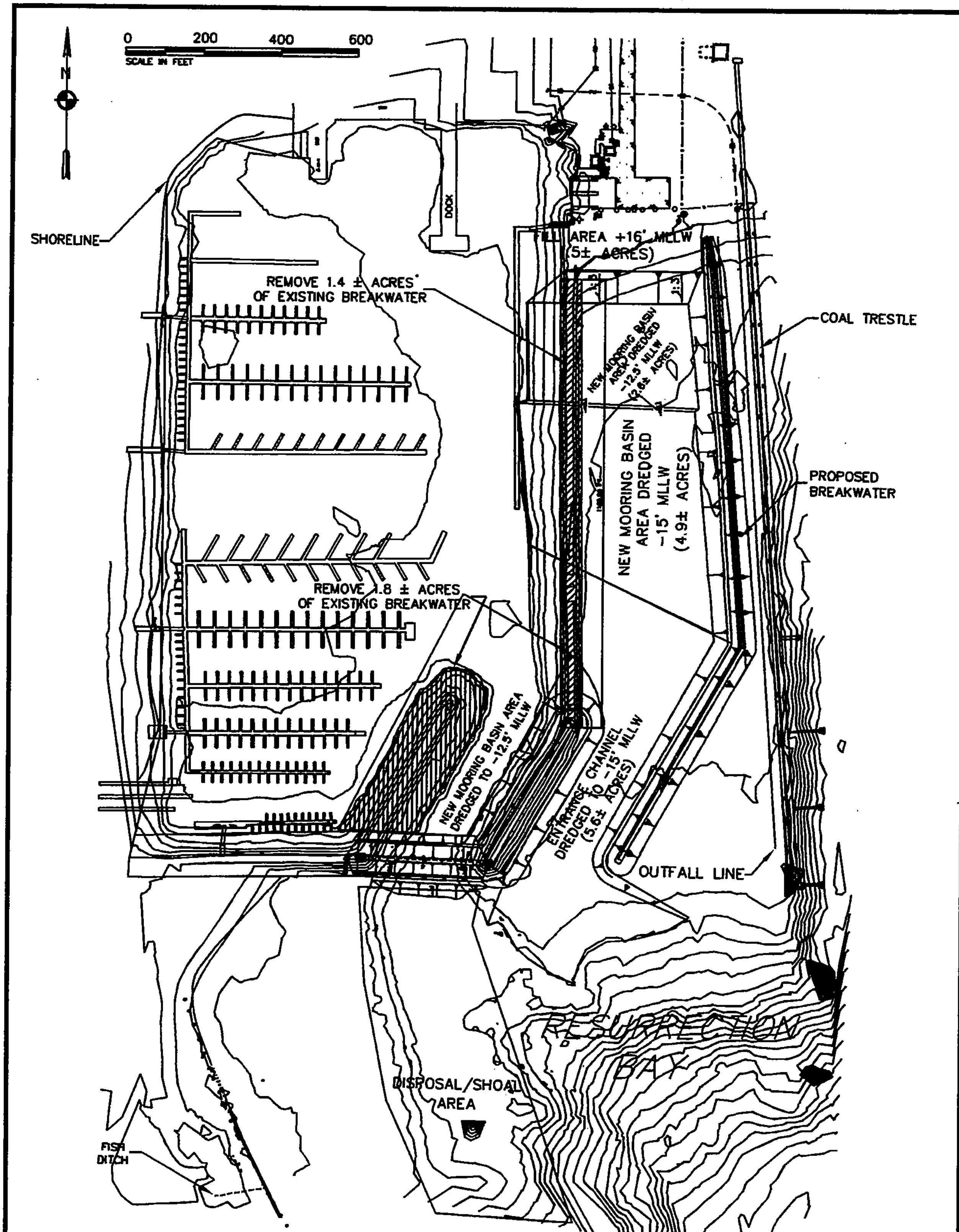
This plan, shown in figure 6, is identical to alternative 2 except that no dredged material would be used for upland disposal immediately south of the harbor. The existing entrance channel would be filled, and the remaining material would be disposed at the deep-water disposal area previously used by the railroad about 1,500 feet farther south.

3.3.4 *Alternative 3.*

This alternative, shown in figure 7, was developed to minimize walking distance to the south end of the basin by installing a causeway on the breakwater. The causeway size was minimized to maintain moorage area, and no permanent parking would be available The existing harbor would be expanded to the east by removing 1,470 feet of the east breakwater and constructing about 2,000 feet of new breakwater. The existing mooring basin would not require any alterations to the entrance channel, layout, or fairways. The demolition required would be the same as for alternative 1. This alternative would accommodate the additional moorage demand by providing 10.4 acres of additional basin. The structure is designed for no overtopping due to the road access designed on the crest of the structure; therefore, no primary armor is needed inside the basin. The new harbor basin would be dredged at three design depths to optimize the requirements of the fleet based on drafts of the vessels. Approximately 3.4 acres would be dredged to -15 ft MLLW to accommodate vessels drafting 9 feet. The next third of the harbor would be dredged to –12.5 ft MLLW for the fleet with drafts less than 6.5 feet. The last third would be dredged to –10 ft MLLW to accommodate small vessels drafting 4 feet or less. All depths of dredging allow for 2 feet safety clearance and a minimum low-tide elevation of –4 ft MLLW. About 2.2 acres of uplands for parking and harbor operations to the south and 0.8 acres to the north of the new basin would be created.

3.3.5 *Alternative 4.*

With this plan, shown in figure 8, the existing harbor would be expanded to the east by removing 1,470 feet of the east breakwater. The existing entrance channel, basin layout, and fairways would not be altered and would be used to provide access to the new moorage area. The demolition would be the same as for alternative 1. This alternative would accommodate the additional moorage demand by providing



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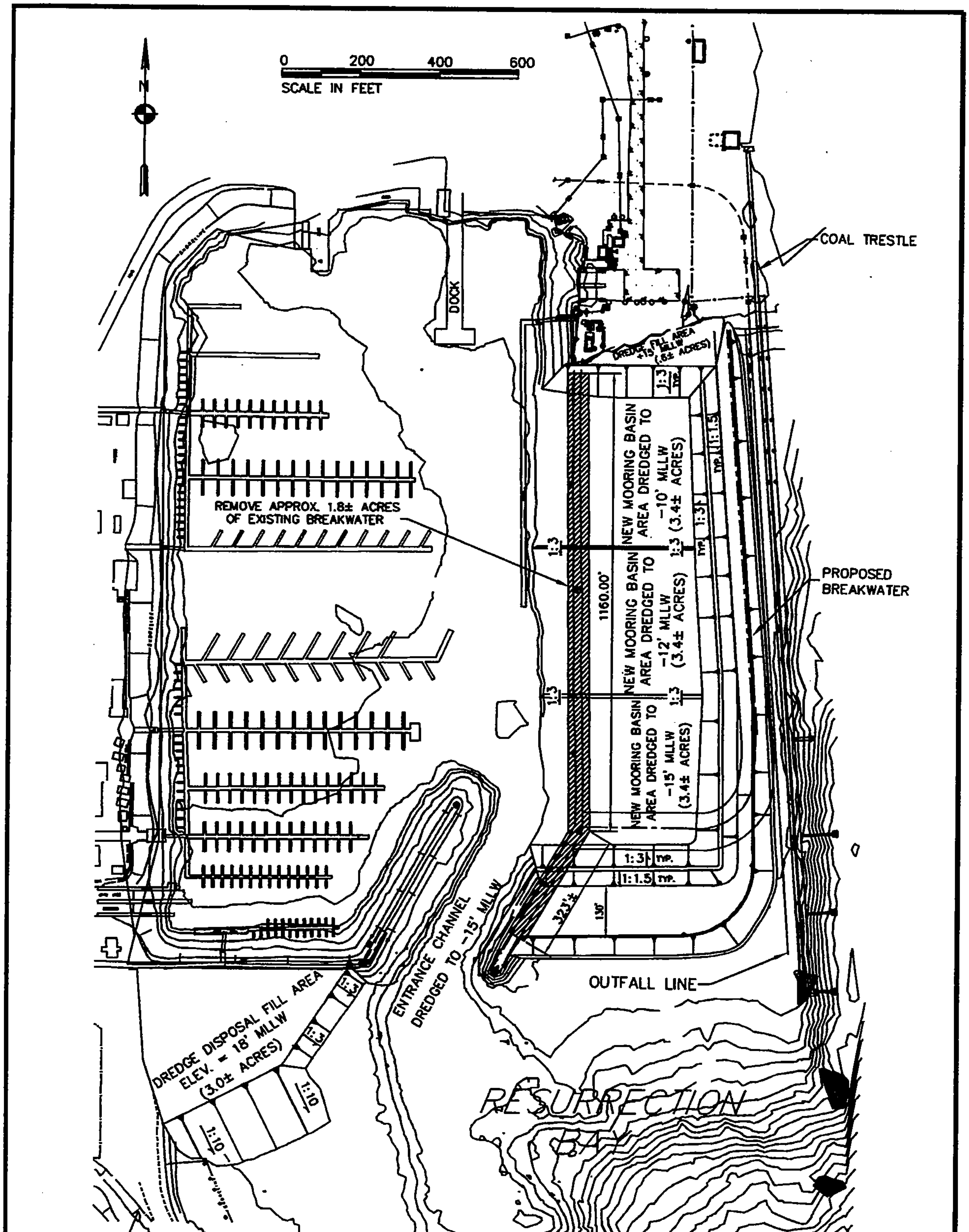

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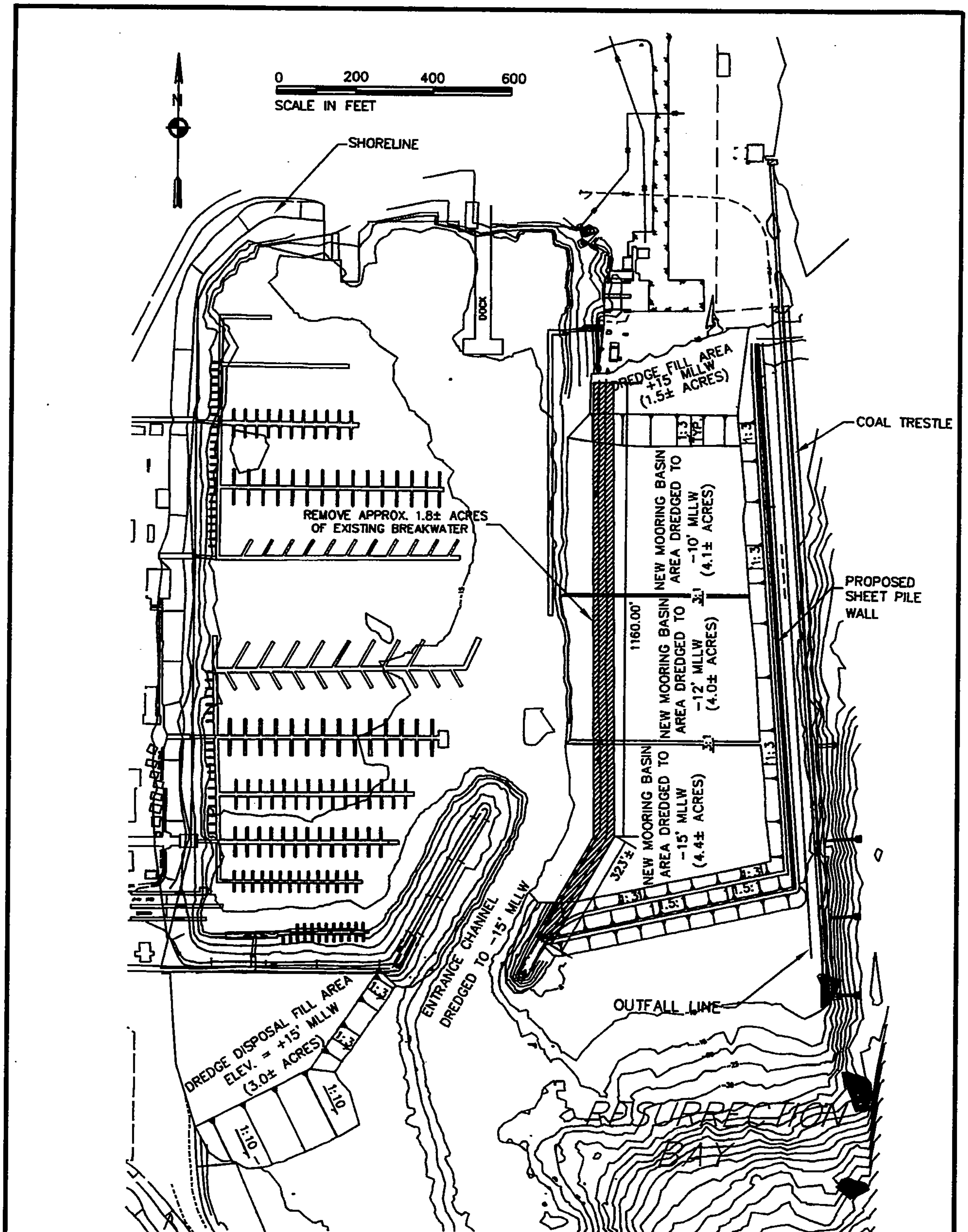

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11.4 acres of additional basin. The layout of the new breakwater and sheet-pile wall wave barrier is approximately the same as in alternative 1. A sheet-pile wall with a scour rock toe extending 1,350 feet from shore to the south would be constructed. A 650-foot-long rubblemound structure would connect the sheet-pile wall to the remaining end of the breakwater at the entrance to the harbor. The new harbor basin would be dredged at three design depths to optimize the requirements of the fleet based on drafts of the vessels. Approximately 3.8 acres would be dredged to -15 ft MLLW to accommodate vessels drafting 9 feet. The next third of the harbor would be dredged to –12.5 ft MLLW for the fleet with drafts less than 6.5 feet. The last third would be dredged to –10 ft MLLW to accommodate vessels drafting 4 feet or less. All depths of dredging allow for 2 feet safety clearance and a minimum low-tide elevation of –4 feet MLLW. A total of 255,000 cubic yards (yd^3) of dredging would be required for the mooring area. Dredged materials would be placed along the shore south of the existing basin to create 2.2 acres of uplands for parking and harbor operations and 1.8 acres north of the new basin area.

3.3.6 Conclusions.

Alternative 4 has two distinct disadvantages compared to the other three alternatives. Environmentally, a sheet-pile wall does not provide a habitat where the smaller fish can seek shelter from larger predators, as do the rubblemound breakwaters of the other three alternatives. Secondly, the cost of this alternative is excessive, ranging from $5.3 million to $9.3 million higher than the other alternatives. A comparison of preliminary costs is in table 3-3. For these two reasons, alternative 4 is not evaluated further. Alternative 2 has the lowest cost per acre of basin area. Alternatives 1, 2, 2a, and 3 are further evaluated and optimized in the following section.

TABLE 3-2.—*Physical comparison of alternatives*

	ALT. 1	ALT. 2	ALT. 2a	ALT. 3	ALT. 4
Entrance channel (-15 ft MLLW)					
Dredged area (acres)	0	5.6	5.6	-	-
Dredged quantities (yd^3)	0	86,900	86,900	-	-
Mooring basin (-15 & -12.5 ft MLLW)					
Total area (acres)	10.5	11.7	11.7	10.4	12.1
Dredged area (acres)	12.7	10.1	10.1	12.4	14
Dredged quantities (yd^3)	250,000	200,000	200,000	230,000	255,000
Entrance channel slope armoring					
Armor rock size (lb)	N/A	-	-	-	-
Armor quantities (yd^3)	0	-	-	-	-
Filter layer rock size (lb)	N/A	150	150	-	-
Filter layer quantities (yd^3)	0	3,500	3,500	-	-
Adjacent upland fill area/dredged material disposal					
Fill finish elevation (ft MLLW)	15	16	16	15	15
Fill area (acres)*	(2.2) **4** (1.8)	(5.2) **6** (0.8)	**0.8**	(2.2) **3** (0.8)	(2.2) **4** (1.8)
Dredged fill quantity (yd^3)	79,800	162,000	4,600	67,800	79,800
Core quantities (yd^3)	2,600	20,000	-	2,600	2,600
Secondary quantities (yd^3)	-	8,000	-	-	-
Armor quantities (yd^3), 1,500-lb	2,900	-	-	2,900	2,900
Shoal dredged fill quantity (yd^3)	-	86,900	147,500	-	-
Deep-water disposal (yd^3)	170,200	-	123,900	162,200	175,200
Gap breakwater (330 feet)					
Fill finish elevation (ft MLLW)		20	20		
Dredged fill quantity (yd^3)		38,400	11,000		
Core quantities (yd^3)		10,000	9,600		
Secondary quantities (yd^3)		1,100	3,100		
Armor quantities (yd^3), 1,500-lb		6,100	-		
Armor quantities (yd^3), 3,000-lb=W50		-	5,400		
Basin circulation values (existing TPR = 0.53)					
Tidal prism ratio	0.44	0.42	0.42	0.44	0.4
Basin aspect ratio	1.3	1.3	1.3	1.3	1
Breakwaters removed (ave. rock size = 3,300 lb)					
Total length (ft)	1,470	1,575	1,575	1,470	1,470
Armor quantities (yd^3)	8,300	10,700	10,700	8,300	8,300
Core quantities (yd^3)	28,000	30,000	30,000	28,000	28,000
Breakwaters					
Footprint area (acres)	4.2	3.3	3.3	5.2	1.25
Total length (ft)	2,055	1,700	1,700	2,000	650
Height (ft MLLW)	20	20	20	21	20
Armor rock					
Max - min rock size (lb)	4,200-2,500	4,200-2,500	4,200-2,500	4,200-2,500	4,200-2,500
Armor quantities (yd^3)	28,600	23,300	23,300	17,000	9,600
Secondary rock					
Max - min rock size (lb)	1,000-250	1,000-250	1,000-250	1,000-250	1,000-250
Secondary quantities (yd^3)	17,300	14,300	14,300	28,800	6,600
Core material					
Max - min rock size (lb)	250-1	250-1	250-1	250-1	250-1
Core quantities (yd^3)	33,350	26,200	26,200	123,400 (98K dredge fill)	13,100
Wave barrier construction (ft)					1,350
Scour rock (yd^3) (secondary rock)					1,200

*Bold number is total fill area. South fill area on left, north on right. Alt. 2a has no south fill area.

TABLE 3-3.--*Preliminary cost comparison of alternatives*

	Preliminary estimates ($000)				
	Alt. 1	**Alt. 2**	**Alt. 2a**	**Alt. 3**	**Alt. 4**
Mobilization & demobilization	485	490	490	473	492
Breakwater and seawalls	2,879	2,009	2,009	6,581	10,710
Dredging and harbor facilities	6,498	8,986	8,452	6,422	7,075
Total construction costs	**9,862**	**11,485**	**10,951**	**13,476**	**18,277**
Lands and damages	50	50	50	50	50
Planning, engineering & design	511	560	560	731	995
Construction management	490	541	541	689	929
Total project costs	**10,913**	**12,636**	**12,102**	**14,946**	**20,251**
Mooring basin area (acres)	10.5	11.7	11.7	10.4	12.1
Cost /acre of basin area	1,039	1,080	***1,034***	1,437	1,674

4. COMPARISON OF ALTERNATIVES AND SELECTION

Four alternatives for the eastward expansion were evaluated based on environmental, economic, and design considerations. Table 4-1 is a condensed comparison of the plans.

TABLE 4-1.—*Comparison of alternatives*

	Alt. 1	Alt. 2	Alt. 2a	Alt. 3
Estimated NED construction cost	$10,796,000	$11,910,000	$11,377,000	$14,787,000
NED investment cost (includes IDC)	**$11,178,000**	**$12,341,000**	**$11,790,000**	**$15,312,000**
Annual investment cost (7-1/8%, 50 yr)	$831,000	$908,000	$868,000	$1,139,000
Average annual maintenance cost	30,700	32,000	32,000	35,000
Total average annual cost	**$861,700**	**$940,000**	**$900,000**	**$1,174,000**
Average annual benefits*	$1,137,000	$1,553,000	$1,553,000	$1,197,000
Benefit/cost ratio	1.32	1.65	1.73	1.02
Net annual benefits	**$275,300**	**$613,000**	**$653,000**	**$23,000**
Estimate of vessels accommodated	**288**	**346**	**346**	**302**
Mooring basin size (acres)	**10.5**	**11.7**	**11.7**	**10.4**
Harbor features				
Dredged area (acres)	12.7	10.1	10.1	12.4
Upland fill area created (acres)	4.0	6.0	0.8	3.0
Breakwater footprint (acres)	4.2	3.3	3.3	5.2
Breakwaters removed (LF)**	1,470	1,575	1,575	1,470
Breakwaters constructed (LF)	2,055	1,700	1,700	2,000
Basin dredge quantities (yd^3)	250,000	200,000	200,000	230,000
Entrance channel dredge quantities (yd^3)	n/a	86,900	86,900	n/a

* Variance in annual benefits is due to different mix of vessels being accommodated.
** LF = linear feet.

4.1 Environmental Considerations

The Environmental Assessment is located in the Environmental Documents section of this report. The assessment concluded that the Seward small boat harbor expansion could be built and operated with minimal effects on the quality of the human environment. The majority of impacts would be minor and of short duration. The proposed action is consistent with State and local coastal zone management programs to the maximum extent practical.

Construction will not affect any sites eligible for inclusion in the National Register of Historic Places. The project also will not affect any threatened or endangered species or their critical habitat. The Alaska Department of Fish and Game has recommended that all in-water work be limited to August 1 through March 31 to minimize the impact to wild salmon and hatchery-released salmon smolt. However, it may be possible to install breakwaters during this time, since larger, silt-free materials are used in this process. Adverse environmental effects will include direct impacts to about 30.7 acres of marine habitat, the loss of mussel beds within the project footprint, minor increases in turbidity levels during periods of work, and a reduction in the net productivity of the site. A plan is being developed by the city which consists of a net recycling/disposal program, educational signs detailing local wildlife along the boardwalk/waterfront, and revegetation/habitat enhancement on Rudolph Creek. Mitigation was required for the loss of mussel/clam beds in the proposed mooring basin area. This consists of filling the old entrance channel to elevation 0 feet MLLW to create a shoal for new mussel/clam beds. This plan meets the requirements of the USFWS Coordination Act Report. A finding of no significant impact has been prepared.

Harbor operations may contribute to water quality degradation because of incidental discharges of pollutants such as sewage, fuel, and fish wastes. Adoption and enforcement of ordinances to prevent these practices can minimize impacts. Water quality would be expected to remain high because of good circulation and flushing characteristics, which would prevent the accumulation of pollutants.

4.2 Economic Considerations

Economic considerations in the selection process included a comparison of the costs of the alternatives as seen in table 4-1. Detailed cost estimates for alternatives 1, 2, 2a, and 3 are provided in Tables 4-2, 4-3, 4-3a, and 4-4, respectively. Cost components include the costs of construction, engineering and design, supervision and administration, and interest during construction, based on a discount rate of 7-1/8 percent and a 12-month construction period. The project cost was reduced to an equivalent annual cost based on a project life of 50 years. To this was added the annual operation, maintenance, repair, replacement, and rehabilitation (OMRRR) cost to arrive at a total annual cost. In table 4-1, these annual costs were subtracted from the annual National Economic Development (NED) benefits to arrive at net NED benefits. Because it maximizes net benefits, alternative 2a is designated the NED plan.

TABLE 4-2.--*Detailed cost estimate, alternative 1 (August 1998)*

Item	Quantity	Unit	Unit price ($)	Shared NED costs ($000) Federal	Local	TOTAL
Mobilization & demobilization	1	LS	422,000	338	84	422
Breakwater removal						
Armor rock removal	8,300	yd^3	4.8	32	8	40
Core rock removal	28,000	yd^3	4.44	99	25	124
Breakwater construction						
Core rock placement	33,350	yd^3	14.54	388	97	485
Secondary rock placement	17,300	yd^3	46.86	649	162	811
Armor rock placement	28,600	yd^3	31.86	729	182	911
Causeway construction		n/a		0	0	0
Road access on causeway		n/a		0	0	0
Navigation foundation		n/a		0	0	0
Hydrographic survey	3	ea	15,330	37	9	46
Entrance channel installation						
Mechanical dredging		n/a		0	0	0
Offshore disposal		n/a		0	0	0
Filter layer rock placement		n/a		0	0	0
Dredging and disposal, mooring basin						
Mechanical dredging	250,000	yd^3	4.164		1,041	1,041
Disposal berm core placement	2,600	yd^3			0	0
Upland disposal	79,800	yd^3	5.865		468	468
Offshore disposal	170,200	yd^3	1.645		280	280
Disposal berm protection	2,900	yd^3			0	0
Inner harbor development						
Float system	1	LS	3,267,588		3,268	3,268
Power, lights and water	1	LS	268,630		269	269
Hydrographic surveys	2	ea	9,581		19	19
SUBTOTAL				2,271	5,912	8,183
Contingency				437	1,124	1,562
CONSTRUCTION CONTRACT				**2,708**	**7,037**	**9,745**
Lands and damages				10	40	50
Planning, engineering and design				152	359	511
Supervision and administration				135	355	490
TOTAL PROJECT COST				**3,005**	**7,791**	**10,796**
Total NED construction cost						10,796
NED interest during construction (7-1/8%, 12 mo)						382
NED investment cost						**11,178**
Annual NED cost						**831**
Annual O& M cost						**31**
TOTAL ANNUAL NED COST						**862**

TABLE 4-3.--*Detailed cost estimate, alternative 2, Locally Preferred Plan (August 1998)*

Item	Quantity	Unit	Unit price ($)	Shared NED costs ($000) Federal	Local	TOTAL
Mobilization & demobilization	1	LS	465,635	373	93	466
Breakwater removal						
Armor rock removal	10,700	yd^3	2.6	22	6	28
Core rock removal	30,000	yd^3	2.6	62	16	78
Breakwater construction						
Core rock placement (new)	26,200	yd^3	28.73	602	151	753
Secondary rock plcmt. (new)	14,300	yd^3	44.97	514	129	643
Armor rock plcmt. (45% new)	23,300	yd^3	24.91	464	116	580
Navigation foundation	2	ea	5,024	8	2	10
Hydrographic survey	3	ea	15,071	36	9	45
Entrance channel installation						
Mechanical dredging	86,900	yd^3	4.19	291	73	364
Shoal disposal	86,900	yd^3				
Filter layer rock plcmt. (reused)	3,650	yd^3	2.70	8	2	10
Gap breakwater						
Dredged fill quantity	38,400	yd^3				
Core rock (reused)	10,000	yd^3	2.41	19	5	24
Secondary rock (new)	1,100	yd^3	44.15	39	10	49
AB armor rock (new)	6,100	yd^3	48.65	237	59	297
Dredging and disposal, mooring basin						
Mechanical dredging	200,000	yd^3	4.1		820	820
Disposal berm core (reused)	20,000	yd^3	1.42		28	28
Upland disposal	162,000	yd^3				
(No offshore disposal)						
Secondary rock fill prot. (new)	8,000	yd^3	43		342	342
Inner harbor development						
Float system	1	LS	3,839,203		3,839	3,839
Power, lights and water	1	LS	317,008		317	317
Hydrographic surveys	2	ea	9,420		19	19
SUBTOTAL				2,677	6,034	8,711
Contingency				517	1,202	1,719
CONSTRUCTION CONTRACT				**3,194**	**7,237**	**10,430**
Lands and damages					50	50
Planning, engineering and design				240	375	615
Supervision and administration				400	415	815
TOTAL PROJECT COST				**3,834**	**8,077**	**11,910**
Total NED construction cost						11,910
NED interest during construction (7-1/8%, 12 mo)						431
NED investment cost						**12,341**
Annual NED cost						**908**
Annual O& M cost						**32**
TOTAL ANNUAL NED COST						**940**

TABLE 4-3a.--*Detailed cost estimate, alternative 2a (August 1998)*

Item	Quantity	Unit	Unit price ($)	Shared NED costs ($000) Federal	Local	TOTAL
Mobilization & demobilization	1	LS	465,527	372	93	466
Breakwater removal						
Armor rock removal	10,700	yd^3	2.6	22	6	28
Core rock removal	30,000	yd^3	2.6	62	16	78
Breakwater construction						
Core rock placement (new)	26,200	yd^3	28.74	602	151	753
Secondary rock plcmt. (new)	14,300	yd^3	44.98	515	129	643
Armor rock plcmt. (45% new)	23,300	yd^3	24.92	465	116	581
Navigation foundation	2	ea	5,025	8	2	10
Hydrographic survey	3	ea	15,075	36	9	45
Entrance channel installation						
Mechanical dredging	86,900	yd^3	4.19	291	73	364
Shoal disposal	147,500	yd^3				
Filter layer rock (reused)	3,650	yd^3	2.70	8	2	10
Gap breakwater						
Dredged fill quantity	11,000	yd^3				
Core rock (reused)	9,600	yd^3	2.41	19	5	23
Secondary quantity (new)	3,100	yd^3	44.16	110	27	137
Armor quantities (45% new)	5,400	yd^3	24.92	108	27	135
Dredging and disposal, mooring basin						
Mechanical dredging	200,000	yd^3	4.1		820	820
(No disposal berm core)						
(No upland disposal)						
Offshore disposal	123,900	yd^3				
(No secondary rock fill prot.)						
Inner harbor development						
Float system	1	LS	3,389,203		3,839	3,839
Power, lights and water	1	LS	317,008		317	317
Hydrographic surveys	2	ea	9,421		19	19
SUBTOTAL				2,618	5,649	8,267
Contingency				505	1,125	1,630
CONSTRUCTION CONTRACT				**3,123**	**6,775**	**9,897**
Lands and damages					50	50
Planning, engineering and design				240	375	615
Supervision and administration				400	415	815
TOTAL PROJECT COST				**3,763**	**7,615**	**11,377**
Total NED construction cost						11,377
NED interest during construction (7-1/8%, 12 mo)						413
NED investment cost						**11,790**
Annual NED cost						**868**
Annual O& M cost						**32**
TOTAL ANNUAL NED COST						**900**

TABLE 4-4.--*Detailed cost estimate, alternative 3 (August 1998)*

Item	Quantity	Unit	Unit price ($)	Shared NED costs ($000) Federal	Local	TOTAL
Mobilization & demobilization	1	LS	411,000	329	82	411
Breakwater removal						
Armor rock removal	8,300	yd^3	4.67	31	8	39
Core rock removal	28,000	yd^3	4.32	97	24	121
Breakwater construction						
Core rock placement	123,400	yd^3	25.33	2,501	625	3,126
Secondary rock placement	28,800	yd^3	45.71	1,053	263	1,316
Armor rock placement	17,000	yd^3	18.14	247	62	308
Causeway construction	1	LS	428,328	343	86	428
Road access on causeway	1	LS	118,469	95	24	118
Navigation foundation		n/a		0	0	0
Hydrographic survey	3	ea	14,901	36	9	45
Entrance channel installation						
Mechanical dredging		n/a		0	0	0
Offshore disposal		n/a		0	0	0
Filter layer rock placement		n/a		0	0	0
Dredging and disposal, mooring basin						
Mechanical dredging	230,000	yd^3	4.078		938	938
Disposal berm core placement	2,600	yd^3			0	0
Upland disposal	67,800	yd^3	5.325		361	361
Offshore disposal	162,200	yd^3	1.607		261	261
Disposal berm protection	2,900	yd^3			0	0
Inner harbor development						
Float system	1	LS	3,416,090		3,416	3,416
Power, lights and water	1	LS	281,815		282	282
Hydrographic surveys	2	ea	9,313		19	19
SUBTOTAL				4,730	6,459	11,189
Contingency				930	1,197	2,127
CONSTRUCTION CONTRACT				**5,660**	**7,656**	**13,316**
Lands and damages				10	40	50
Planning, engineering and design				318	414	732
Supervision and administration				283	406	689
TOTAL PROJECT COST				**6,271**	**8,516**	**14,787**
Total NED construction cost						14,787
NED interest during construction (7-1/8%, 12 mo)						525
NED investment cost						**15,312**
Annual NED cost						**1,139**
Annual O& M cost						**35**
TOTAL ANNUAL NED COST						**1,174**

4.3 Selection of Optimum Harbor Size

Annual benefits for three alternatives were analyzed to identify the most cost-effective configuration. Alternatives 2 and 2a, accommodating a fleet of 346 vessels, have the highest net benefits based on this analysis. Incremental benefits are earned as protection is provided for additional vessels and delay times are minimized. These incremental benefits are used to determine the value of adding more slips in order to establish the NED plan.

The benefits for harbors accommodating varying numbers of vessels are compared in table 4-5. As can be seen in the table, Scenario 2 has the highest net benefits. Although Scenario 3 has more slips, at 385, those stalls were sized for the vessels under 18 feet, where annual benefits are minimal.

TABLE 4-5.—*Harbor size optimization*

	Scenario 1	Scenario 2	Scenario 3
No. of slips	**288**	**346**	**385**
Investment cost	$11,293,000	$12,526,000	$15,470,000
Annual cost	$831,000	$922,000	$1,139,000
Annual benefits	$821,000	$1,293,000	$877,000
Net annual benefits	($10,000)	$371,000	($262,000)

4.4 Optimization of Entrance Channel and Moorage Basin Depth

The alternative identified as the National Economic Development plan must, by Federal policy, have the greatest net benefits. Costs and benefits of an excavated channel vary with its depth, so increases in cost for added channel depth must be incrementally compared to the corresponding increases in benefits. This section describes the analyses undertaken to identify the NED plan. The existing entrance channel at Seward has been used without a damage incident for more than 23 years. This entrance channel configuration is being shifted by only 300 feet. The users do not desire any different entrance channel configuration, as indicated in public meetings throughout the design process. There is no basis for ship simulator studies, as this is not a deep-draft channel where low horsepower-to-mass ratios make turning and stopping a critical factor. In addition, Engineer Regulation (ER) 1110-2-1461, dated October 31, 1989, has been superseded by ER 1110-2-1403, dated January 1,

1998. Paragraph 7c of the new ER reads in part, "This policy does not pertain to the design of commercial small-craft harbor channels."

Channel depth was optimized by comparison of the life-cycle costs for increments of increasing depth from –13 to –17 ft MLLW. This comparison is seen in table 4-6. Annual benefits were derived based on percentage of vessel access to the harbor at various entrance channel depths. Annual costs are subtracted from corresponding total annual benefits for each level of access to the harbor by commercial fishing vessels. The net benefits presented in table 4-6 demonstrate the NED channel depth as –15 ft MLLW, in terms of maximum net benefits. An analysis to predict the percentage of access availability during low tides/extreme waves was performed in appendix A (section 5.5), and indicates that under extreme conditions, access may be hampered 12 percent of the time. The existing entrance channel is at elevation -15 ft MLLW, and no problems have been reported in the 30-year life of the harbor.

TABLE 4-6.--*Comparison of costs and benefits for various channel depths*

Channel depth (ft MLLW)	NED investment cost	Annual cost	Annual benefit	Net benefits
-13	$12,159,000	$924,000	$1,319,000	$395,000
-14	$12,255,000	$931,000	$1,494,000	$563,000
-15	$12,341,000	$940,000	$1,553,000	$613,000
-16	$12,457,000	$948,000	$1,553,000	$605,000
-17	$12,720,000	$998,000	$1,553,000	$555,000

Design criteria for the entrance depth was determined based on:

a. Draft of design vessel, 9 ft; beam, 34 ft; length, 90 ft.

b. Pitch, roll and heave of 3.3 ft, based on two-thirds of the significant wave height in the channel.

c. Safety clearance, 2 ft (based on sandy bottom).

d. Squat = 0.6 ft.

These criteria also result in an entrance channel bottom elevation of –15 ft MLLW.

The proposed moorage basin depth was determined based on:

a. Unloaded draft of design vessel, 9 ft; beam, 34 ft.

b. Typical draft of smaller vessels, 6.5 ft.

c. Safety clearance, 2 ft.

d. Extreme low tide, -4 ft MLLW.

These criteria result in a moorage basin bottom elevation of –15 ft MLLW for deeper-draft vessels and –12.5 ft MLLW for the remainder. The minimum tide level was used due to the requirement that vessels remain and maneuver in the harbor regardless of tide level.

5. DESCRIPTION OF RECOMMENDED PLAN

5.1 Plan Components

The NED plan, based on the previous analyses, is alternative 2a. However, the recommended plan is the locally preferred plan, alternative 2. A cost estimate for this plan is presented in table 4-3, and the cost estimate summary in M-CACES format is in appendix D. Specific construction details and features of the recommended plan are presented in this section. The plan is illustrated in figure 9.

Major construction items include breakwaters, dredging, existing breakwater removal, existing entrance channel fill, and upland fill. The core of the new east breakwater would be constructed first. It would be armored on the seaward side using new stone or armor stone removed from the existing breakwater, leaving the existing breakwater's core berm intact. After the new breakwater is completed, work on dredging the new entrance channel and fairway may be started concurrently with the upland fill construction. Once the new entrance channel is completed allowing access to the existing harbor, the existing entrance channel gap could be filled concurrently with the removal of the 415 feet of breakwater. Construction scheduling would facilitate the continued use of the existing harbor by local fishermen and by fish processing and cargo vessels during construction. Project specifications would outline requirements for the contractor to conduct certain activities during specified time periods to allow continued harbor use and ensure environmental protection.

5.1.1 Rubblemound Breakwater.

A 1,700-foot-long rubblemound breakwater would be constructed approximately 400 feet east of the existing harbor in a north-south alignment for a length of 1,070 feet. The seaward toe of the breakwater would maintain a minimum distance of 30 feet from the existing piles supporting the coal trestle. The remainder of the new breakwater would then change to a southwest alignment to form the eastern side of the new entrance channel. Maximum depth of water is –7 ft MLLW along the alignment of the breakwater. Foundation materials are silty sand and gravel, serving as a suitable base for the rubblemound structure. A plan view of the structure is shown in figure 9.

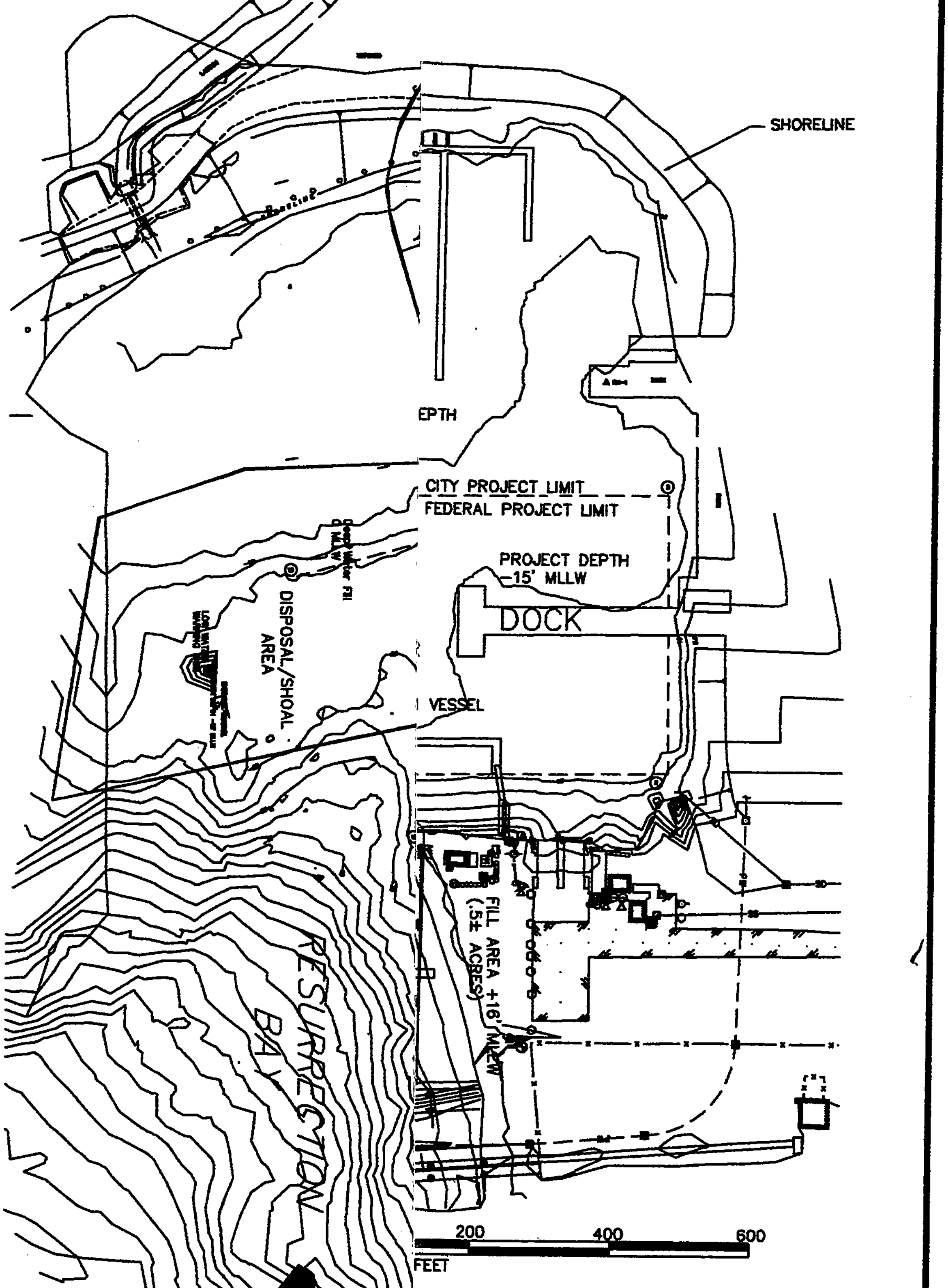
Armor stone with a range of sizes from 2,500 lb minimum to 4,200 lb maximum would be used on the sea-side face. Secondary stone would range from 250 lb minimum to 1,000 lb maximum. Core material would be 1 lb minimum to 250 lb maximum. Armor stone thickness would be 5.5 feet, and secondary rock thickness would be 2.5 feet. Considering the past performance and the calculated values, a crest height of + 20 feet MLLW with an 8.5-foot crest width would be used for new construction. The increase in height to +20 ft would minimize the effects of overtopping, provide an adequate core crest width at MHW to facilitate construction of the breakwater, and allow for potential long-term settlement.

The 330-foot gap of the existing entrance would be closed by the construction of a rubblemound structure armored on both sides. Dredged material or material removed from the existing breakwaters would be used to fill in the area between the armoring. This would create a causeway for access to the new moorage area created by removal of approximately 475 feet of breakwater that lined the existing entrance channel. Additional uplands would be created south of the harbor using dredged materials. The revetment of this structure would require 6,100 cubic yards of armor stone (average weight 1,500 lb), 1,100 cubic yards of secondary stone, 10,000 cubic yards of core material, and 38,400 cubic yards of dredged fill.

5.1.2 Channels and Basin.

Repositioning the entrance channel reduces the haul distance from vehicle access areas to the farthest moorage stalls while providing a larger additional moorage area. Relocating the entrance channel to an area with greater natural depths also reduces the footprint of the entrance channel, further reducing the potential for maintenance dredging. This alternative would accommodate the additional moorage demand by providing 11.7 acres of additional basin. The 120-foot-wide channel allows two-way traffic for vessels with beams up to 27 feet. A cross section of the entrance channel is shown in figure 10.

Side slopes of 1V:3H would be armored in the entrance channel in areas exposed to wave action. The entrance channel width would be about 4.5 times the beam width of the design vessel. The depth of –15 ft MLLW accommodates vessels drafting 9 feet. The new harbor basin would be dredged at two design depths to optimize the requirements of the fleet based on drafts of the vessels. Approximately 4.5 acres would be dredged to -15 ft MLLW to accommodate vessels drafting 9 feet. The remainder of the harbor would be dredged to –12.5 ft MLLW for the vessels with drafts less than 6.5 feet. Both depths of dredging allow 2 feet safety clearance.



OMMENDED PLAN
HARBOR IMPROVEMENTS

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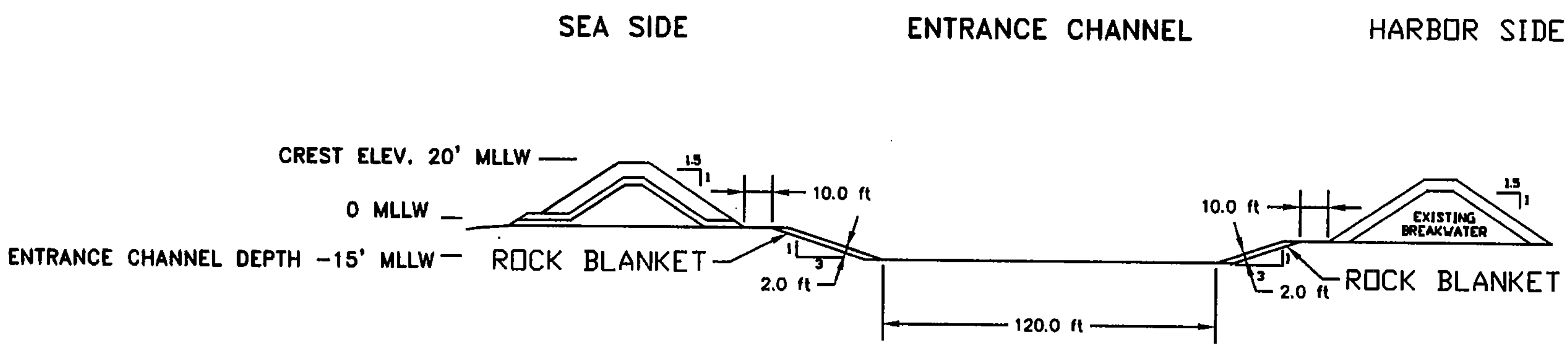

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CIVIL WORKS BRANCH

ENTRANCE CHANNEL CROSS SECTION
SEWARD HARBOR IMPROVEMENTS

10

5.1.3 Staging Area and Disposal of Dredgings.

A total of 200,000 cubic yards (yd^3) of dredging would be required for the mooring area, and 86,900 yd^3 would be dredged for the new entrance channel. Dredged materials would be disposed along the shore, south of the existing basin, to create 5.2 acres of uplands for possible parking and harbor operations. The existing harbor lacks adequate parking, and the area around the harbor is completely developed. The fill is being placed in a high seismic risk zone, suitable only for light fill activities such as parking for the harbor. Thus the land created has negligible value and requires no special cost sharing. Dredged material would also be disposed of north of the new basin area to create 0.8 acres and enhance the limited uplands available there. Additional disposal of at least 86,900 yd^3 would occur in the existing entrance channel to establish clam/mussel beds, as mitigation for destroying the same in the harbor expansion area. Any excess material from the first two disposal sites would also be applied to the existing channel area, and no disposal would occur in the project site previously used by the railroad. The plan requires the removal of 1,575 feet of existing breakwaters. An estimated 23,000 yd^3 of core material would need to be removed. This material could be used for portions of the new construction. The gradation of the material is not known. An estimated 10,700 cubic yards of armor rock would also be removed from the existing breakwaters. This material could be reused for the new breakwater and revetment construction. A sampling of the rock revealed weights ranging from 1,000 lb to 10,000 lb, with the average weight at 3,300 lb. Work inside the harbor could be accomplished with a hydraulic cutterhead and suction pipeline or an excavator. Dredging equipment and methods would be left as an option for the contractor.

5.2 Plan Benefits

Benefits of the NED plan (alternative 2a) and the recommended plan (alternative 2) are the same and are presented in table 5-1. As seen in the table, annual benefits of the recommended plan are estimated to be $1,553,000. Its annual costs are estimated at $940,000. Thus, the net annual benefits are estimated to be $613,000, and the benefit/cost ratio is 1.7.

TABLE 5-1.—*Benefit summary*

Benefit category	Annual expenses: Without project	Annual expenses: With project
Vessel damage	$420,000	$109,000
Dock/pilings	131,000	34,000
Commercial fishers	1,004,000	324,000
Charter fishers	672,000	216,000
Harbor personnel	12,000	3,000
TOTAL	$2,239,000	$686,000
Project annual benefits		**$1,553,000**

5.3 Plan Costs

Interest during construction (IDC) is added to the first cost to account for the opportunity cost incurred during the time after the funds have been spent, but before the benefits begin to accrue. IDC is calculated by matching the construction expenditure flow with the interest the funds would have accumulated had they been deposited in an interest-bearing account. Planning, engineering and design is assumed to take a minimum of 6 months. Construction is expected to last for 12 months. For this analysis, level monthly expenditures are assumed.

First cost of the recommended plan, including the cost of plans and specifications (P&S), is $11,910,000. Interest on the P&S cost for 6 months at 7.125 percent is calculated and added to the first cost before calculating IDC. The IDC for the first cost is $398,000. The first cost plus IDC equals $12,341,000. The annual cost equals $908,000. With the annual operation and maintenance cost of $32,000, the total annual NED cost is $940,000.

5.4 Risk and Uncertainty

As in any planning process, some of the assumptions made in this report are subject to complex social, economic, and natural variables that themselves have no absolute value typical of all cases. Other uncertainty is inherent in imperfect data and in analytical procedures designed to reasonably estimate rather than calculate with certainty and precision. One of the best examples would be calculation of benefits for the Seward harbor based on expert opinion, interviews, and experience with other harbors. The results are subject to considerable interpretation. The operating costs and the number of vessels are the factors most subject to uncertainty. These elements are discussed in the pertinent portion of the report and in Appendix B, Economic Analysis. At Seward, an additional risk is that of an earthquake comparable to the Alaska earthquake of 1964, described in Appendix C, Geotechnical Report.

5.5 Plan Accomplishment

The recommended plan would meet the planning objectives for Seward in the following ways:

a. Provide year-round, convenient moorage for about 346 additional vessels.

b. Reduce the considerable costs for fuel, vessel maintenance, and standby time associated with delays due to overcrowding.

c. Provide a harbor of refuge for additional transient vessels.

d. Minimize damages/costs associated with rafting.

e. Provide employment during harbor construction in the Seward area.

5.6 Plan Implementation

5.6.1 Construction.

Federal. The Corps of Engineers would be responsible for construction of the breakwater and entrance channel. The U.S. Coast Guard would be responsible for moving the navigation aids.

Local. The local sponsor would be responsible for excavating the mooring basin, constructing the float system, and providing all lands, easements, and rights-of-way necessary for the project. The local sponsor would also be responsible for utility service to the harbor and for funding its share of the Federal major navigational items (general navigation features).

5.6.2 Operation, Maintenance, and Replacement (OM&R).

Federal. The Corps of Engineers would maintain the breakwater and channels as needed and would conduct periodic hydrographic surveys to determine if or when maintenance dredging is required. The U.S. Coast Guard would maintain navigational aids. Dredged material could be deposited in upland disposal areas for use as fill material or in the ocean at sites discussed in the EA. (The Federal Government must be held free from responsibility or cost in connection with the upland disposal site.) Table 5-2 indicates OM&R intervals and costs.

Local. The local sponsor would perform maintenance dredging of the mooring boat basin if necessary, maintain the floats, utilities, etc., and operate the completed project. The local sponsor may use dredged material for approved fill activities or other construction activities.

TABLE 5-2.--*Annual NED costs of operation, maintenance and replacement (OM&R), Recommended Plan*

		Equivalent annual costs ($)			
	Interval	**Corps**	**Other Fed**	**Local**	**Total**
Maintenance dredging, 1 event	25 yr			2,600	2,600
Replace 5% armor on breakwater	15 yr	6,900			6,900
Hydrographic surveys	4 yr	2,400			2,400
Maintain navigation aids	5 yr		600		600
Maintain floats, stalls and piles	1 yr			9,000	9,000
Replace floats, stalls and piles	40 yr			10,500	10,500
TOTAL OM&R COSTS		**9,300**	**600**	**22,100**	**32,000**

5.6.3 Real Property Interests.

The sponsor would provide all lands necessary for the project. The only land requirements anticipated for the Federal portion of the project are a temporary staging area of 0.4 acre for a 2-year period. The breakwater would be attached and would therefore require uplands. Public access is currently available to the project site. No relocations of public utilities are anticipated. The project's real estate costs for the Federal and the non-federal portions are estimated at $33,000 and $17,000, respectively. The details of land interests required, the real estate costs, and the sponsor's ability to acquire the necessary real estate are assessed in appendix E.

5.6.4 Cost Apportionment.

Construction costs for the project would be apportioned in accordance with the Water Resources Development Act of 1986. The apportionment of the fully funded cost for project features, assuming 10 percent is paid by the non-federal sponsor at the time of construction, is summarized in table 5-3.

The construction cost of the General Navigation Features is to be shared, 80 percent Federal and 20 percent local. The initial Federal share is 90 percent of the cost of this portion and the initial local share is 10 percent. The non-federal sponsor contributes the additional 10 percent, plus interest, during a period not to exceed 30 years after completion of the General Navigation Features. The sponsor would be credited toward this 10-percent cost with the value of lands, easements, rights-of-way, utility relocations, and dredge spoil disposal areas (LERRD) necessary for construction, operation, and maintenance of the general navigation features. The sponsor is also responsible for 100 percent of the construction cost of the inner harbor facilities, which includes dredging the mooring area.

TABLE 5-3.—*Apportionment of construction costs ($000)*

Portion of project	Fully funded construction cost: Federal (90%)	Local (10%)
General Navigation Features (initial cost)	4,658 - 297	518[a]
Local features (includes utilities, uplands, LERRD)	0	7,926 + 297
Coast Guard navigation aids	20	0
Construction subtotal (initial cost)	4,678	8,444
Final 10% payment	(482)	482
TOTAL COST	~~4,196~~ 3,998	~~8,926~~ 9,223

[a] Non-federal interests must provide cash contributions toward the cost for construction of the general navigation features (GNF) of the project, paid during construction as follows: for project depths of up to 20 ft - 10%. For all depths, they must provide an additional cash contribution equal to 10% of GNF cost (which may be financed over a period not exceeding 30 years), against which the sponsor's costs for LERRD (except utilities) shall be credited.

Note: Costs for General Navigation Features include associated costs, such as mobilization.

The Federal Government would assume 100 percent of the operation and maintenance costs for the breakwater and entrance channel. The non-federal sponsor would assume all other operation and maintenance costs. The sponsor would be responsible for providing LERRD for construction and future maintenance of the inner harbor facilities.

In addition to the sponsor's share of costs for General Navigation Features, the sponsor is responsible for costs associated with other NED and non-NED features. Table 5-4 provides a detailed summary of all shared construction costs as well as other local construction costs.

TABLE 5-4.—*Seward Harbor cost sharing—first cost, Recommended Plan estimate (August 1998)*

CONSTRUCTION BREAKDOWN

Work item[a]	Item description	Qty.	Unit	Unit price ($)	Amount	GNF[b] costs	Final Federal GNF costs	100% local costs & final local GNF costs	100% local costs & initial local share of Fed. GNF costs	Initial Fed. share of Fed. GNF costs
	NED FEATURES:						**80% of GNF**	**20% of GNF**	**10% of GNF**	**90% of GNF**
C-10-01	Mobilization & demobilization	1	LS	536,000	$536,000	$536,000	$428,800	$107,200	$53,600	$482,400
C-10-06	Breakwaters & seawalls	1	LS	2,918,000	2,918,000	2,918,000	2,334,400	583,600	291,800	2,626,200
C-12-01	Entrance channel	1	LS	449,000	449,000	449,000	359,200	89,800	44,900	404,100
P-30-02	Engineering & design (GNF)[c]	1	EA	300,000	300,000	300,000	240,000	60,000	30,000	270,000
P-31-02	S&A (const. mgt., GNF)[c]	1	EA	500,000	500,000	500,000	400,000	100,000	50,000	450,000
	Move Coast Guard navigation aids	1	LS	20,000	20,000		20,000			20,000
C-12-05	Dredge mooring basin	1	LS	983,000	983,000			983,000	983,000	
C-12-08	Inner harbor	1	LS	4,606,000	4,606,000			4,606,000	4,606,000	
C-12-04	Hydrographic survey	1	LS	23,000	23,000			23,000	23,000	
	Subtotal of NED Plan features				$10,335,000	$4,703,000	$3,782,400	$6,552,600	$6,082,300	$4,252,700
	OTHER LOCAL COSTS:									
C-12-09	Power, light, & water	1	LS	380,000	$380,000			$380,000	$380,000	
C-12-02	Adjacent uplands	1	LS	534,000	534,000			534,000	534,000	
P-01	Lands & damages (GNF LERRD)	1	EA	34,000	34,000			34,000	34,000	
P-01	Lands & damages (local services)	1	EA	17,000	17,000			17,000	17,000	
P-30-02	Engineering & design (local features)	1	EA	315,000	315,000			315,000	315,000	
P-31-02	S&A (const. mgt., local features)	1	EA	315,000	315,000			315,000	315,000	
	Total other local costs				$1,595,000	0	0	$1,595,000	$1,595,000	
	TOTAL GNF and LOCAL COSTS				**$11,930,000**	**$4,703,000**	**$3,782,400**	**$8,147,600**	~~**$7,677,300**~~ 7,944,600	~~**$4,252,700**~~ 3,785,400
		Sponsor's financing amount:			*If sponsor pays 10% down, 10% financed for 30 years*				*$470,300*	
								Less credit for LERRD (GNF portion only)	*(34,000)*	
								Total amount financed for 30 years	*$436,300*	

[a] As numbered in M-CACES (see appendix D).

[b] GNF = General Navigation Features, initially cost-shared at 90% Federal and 10% sponsor cost (90/10).

[c] These items are initially cost shared at 90%/10%.

5.6.5 *Financial Analysis.*

The city of Seward is considering a combination of General Obligation bonds and revenue bonds to finance the local share of project costs. The borough is able to issue debt because of its Permanent Fund, in which 15 percent of fish tax revenues are deposited each year. City Manager Scott Janke explains the city's financial capability in a letter dated June 9, 1998, included in appendix F.

5.6.6 *Public Involvement.*

At a series of public meetings, residents of Seward responded in favor of the construction of additional harbor space for this community. Since initiation of this feasibility study, the city manager and harbormaster have worked closely with the study team, and local concerns have been addressed. Cooperation between the staffs of the Corps of Engineers and ADOT&PF, together with input from the city of Seward, resulted in the recommended plan. The city of Seward and local residents have stated their preference for the locally preferred alternative recommended in this report.

5.6.7 *Consultation Requirements.*

This study has been coordinated with all relevant Federal and State agencies, including the U.S. Fish and Wildlife Service. Information on this coordination is provided in the draft EA. Pertinent correspondence is presented in appendix 2 to the EA and in appendix F. The harbor plans will be in full compliance with each requirement when the final EA is accepted.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The studies documented in this report indicate that Federal construction of navigation improvements with a rubblemound breakwater, as described in the recommended plan, alternative 2, is technically possible, economically justified, and environmentally and socially acceptable. The city of Seward has endorsed this plan and is willing to act as local sponsor for the project and fulfill all the necessary local cooperation requirements. Thus it is concluded that the recommended plan should be pursued by the United States in cooperation with the city of Seward.

6.2 Recommendations

I hereby recommend that the navigational improvements at Seward, Alaska, be constructed as described in the recommended plan in this report with the Federal Government contributing a first cost of $4,233,000 and $9,300 annually for Federal maintenance. I also recommend the deauthorization of the existing breakwaters, which must be removed and replaced to facilitate the eastward expansion of the harbor, and the existing entrance channel, which will be filled as mitigation for the harbor. It is recommended this project move to the Preconstruction Engineering and Design (PED) stage and be value-engineered so that any improvements or suggestions can be incorporated into the Plans and Specifications.

Prior to construction, the local sponsor agrees to:

a. Provide and maintain, at its own expense, the local service facilities, consisting of the mooring basin and the mooring facilities.

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

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

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet;

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

(3) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet.

d. Repay with interest, over a period not to exceed 30 years following completion of the period of construction of the Project, an additional 0 to 10 percent of the total cost of construction of general navigation features depending upon the amount of credit given for the value of lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas provided by the Non-Federal Sponsor for the general navigation features. If the amount of credit exceeds 10% of the total cost of construction of the general navigation features, the Non-federal Sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, right-of-way, relocations, and dredged or excavated material disposal areas, in excess of 10% of the total cost of construction of the general navigation features.

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

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

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

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

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

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

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

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

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

n. Provide a cash contribution equal to the following percentages of total historic preservation mitigation and data recovery costs attributable to commercial navigation that are in excess of one percent of the total amount authorized to be appropriated for commercial navigation:

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet;

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet;

(3) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet.

o. Enter into an agreement which provides, prior to construction, 25 percent of preconstruction engineering and design (PED) costs;

p. Provide, during construction, any additional funds needed to cover the non-federal share of PED costs;

q. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government.

The recommendations for implementation of harbor improvements at Seward, Alaska, reflect the policies governing formulation of individual projects and the information available at this time. They do not necessarily reflect the program and budgeting priorities inherent in the local and State programs or the formulation of a national civil works water resources program. Consequently, the recommendations may be changed at higher review levels of the executive branch outside Alaska before they are used to support funding.

Date: 23 Sept 90

SHELDON L. JAHN
Colonel, Corps of Engineers
District Engineer

REFERENCES

U.S. Army Corps of Engineers (USACE). 1984. *Shore Protection Manual.*

Other pertinent reports are described in section 1.4, Related Reports and Studies.

ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

SEWARD HARBOR
NAVIGATION IMPROVEMENTS
SEWARD, ALASKA

September 1998

FINDING OF NO SIGNIFICANT IMPACT

In accordance with the National Environmental Policy Act of 1969, as amended, the U.S. Army Engineer District, Alaska, has assessed the environmental effects of the following action:

Seward Harbor
Navigation Improvements
Seward, Alaska

The Seward Harbor will be expanded to satisfy additional moorage needs. The harbor improvements, referred to as alternative 2 and described in the September 1998 environmental assessment, will provide approximately 11.7 acres of additional moorage space. Work will entail removing approximately 1,100 feet of the existing east breakwater and re-locating the entrance channel to the east. The southern 470 feet or so of the east breakwater will remain in place and be incorporated into the south breakwater. The end of the existing south breakwater that now forms the west side of the entrance channel (about 475 linear feet) will be removed and the existing entrance channel will be filled in. A total of 1,575 feet of breakwater will be removed (about 40,700 cubic yards [yd^3]). The new east rubblemound breakwater will be about 1,700 feet long and will be constructed just west of the existing coal trestle. Approximately 63,800 yd^3 of armor rock, secondary rock, and core material will be placed to construct the new east breakwater, which will have a footprint of about 3.3 acres. Materials from the existing breakwaters will be re-used where possible. The new breakwater will be constructed with a 1 vertical(V):1.5 horizontal (H) slope. Work will also include the replacement of the existing navigation aids to define the new entrance channel and the installation of navigation lights.

Approximately 304,500 yd^3 will be dredged from 17.7 acres to construct the entrance channel and the expanded mooring basin and maneuvering area. The area will be dredged to a depth ranging from –12.5 feet mean lower low water (MLLW) to –15 feet MLLW. Side slopes for the basin will be dredged to 1V:3H. Approximately 3,500 yd^3 of filter layer rock will be discharged to protect the side slopes of the entrance channel. Approximately 162,000 yd^3 of the dredged material will be placed in two separate intertidal/subtidal areas adjacent to the harbor. One will be at the north end of the harbor with a footprint of about 0.8 acre. The other will be south of the existing south breakwater with a 7.1-acre footprint. An additional 28,000 yd^3 of armor rock and core material will be placed to aid in construction of the fill areas and to protect them from erosion. Construction of the breakwaters, mooring basin, and staging/access areas would have direct impacts on 29 acres of intertidal and shallow subtidal habitat.

Approximately 38,400 yd^3 of the dredged material, along with approximately 17,100 yd^3 of core material, secondary rock, and armor rock will be discharged to close off the existing entrance channel. The remainder of the dredged material, approximately 104,100 yd^3, will be used to create a shoal south of the harbor as a mitigation measure to provide suitable habitat for invertebrates that would be fed upon by sea otters and ducks. The shoal will have a footprint of about 5.15 acres and have a surface elevation of approximately 0 feet MLLW. The side slopes of the shoal will be as gradual as possible, approaching a 1V:50H slope where possible. The shoal will be graded such that it drains properly and does not trap fish in depressions or pools. Additional mitigation measures include:

1. Disposal of the dredged materials for construction of the north and south staging/access areas will include methods to filter or settle out silt laden water (e.g., the use of berms and/or silt fences) prior to its discharge into any natural body of water.

2. To the extent practicable, dredged materials will be discharged below the water surface to minimize the spreading of suspended materials.

3. Construction of the harbor will be coordinated with the city of Seward and the Kenai Peninsula Borough to avoid conflicts with subsistence and recreational activities.

4. No in-water construction activities related to dredging and the subsequent disposal of the dredged material will occur between April 1 and September 15 to minimize potential impacts to salmonids and recreational fishing activities.

5. No in-water construction activities related to breakwater removal and construction shall occur between July 31 and September 15.

6. The slope of the southern staging/access area will be steepened from a 1V:10H to a 1V:5 H to reduce the project footprint.

7. If the expansion of the harbor affects circulation at Icicle Seafood's outfall line near the coal trestle in such a manner as to cause processing wastes to enter the harbor or to be washed up on the new breakwaters or adjacent shoreline, the Alaska District and/or the city of Seward will take measures to mitigate such conditions. Mitigative measures may include the relocation or the extension of the outfall line. Determination for the need for mitigative measures will be done in consultation with the Alaska Department of Environmental Conservation.

The Federal portion of the project will include removal of the existing breakwater and construction of the new breakwaters, and construction of the entrance channel and maneuvering area. Basin construction and installation of inner harbor facilities will be the responsibility of the city of Seward, the local sponsor. Inner harbor facilities will initially consist of finger floats and walkways.

The action is consistent with State and local coastal zone management programs to the maximum extent practicable. The action also complies with Section 404 (b)(1) Guidelines for the disposal of dredged or fill materials in waters of the United States. The environmental assessment for the project supports the conclusion that the project does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an environmental impact statement is not necessary to construct the navigation improvements in Seward, Alaska.

Sheldon L. Jahn
Colonel, Corps of Engineers
District Engineer

23 Sept 98
Date

Environmental Assessment
Navigation Improvements
Seward, Alaska

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September 23, 1998

ENVIRONMENTAL ASSESSMENT
NAVIGATION IMPROVEMENTS
SEWARD, ALASKA

1. PURPOSE AND NEED OF THE PROPOSED ACTION

The purpose of the proposed action is to provide additional moorage space for vessels in Seward, Alaska, which is on the east coast of the Kenai Peninsula in southcentral Alaska (figure EA-1). Because Seward is accessible by road and is fairly close to Anchorage (about 125 miles), the harbor is used heavily by recreational and charter vessels. The harbor is also used by commercial fishing vessels to obtain provisions, for crew rotations, for moorage during closed fishing periods, and for protection during adverse weather conditions.

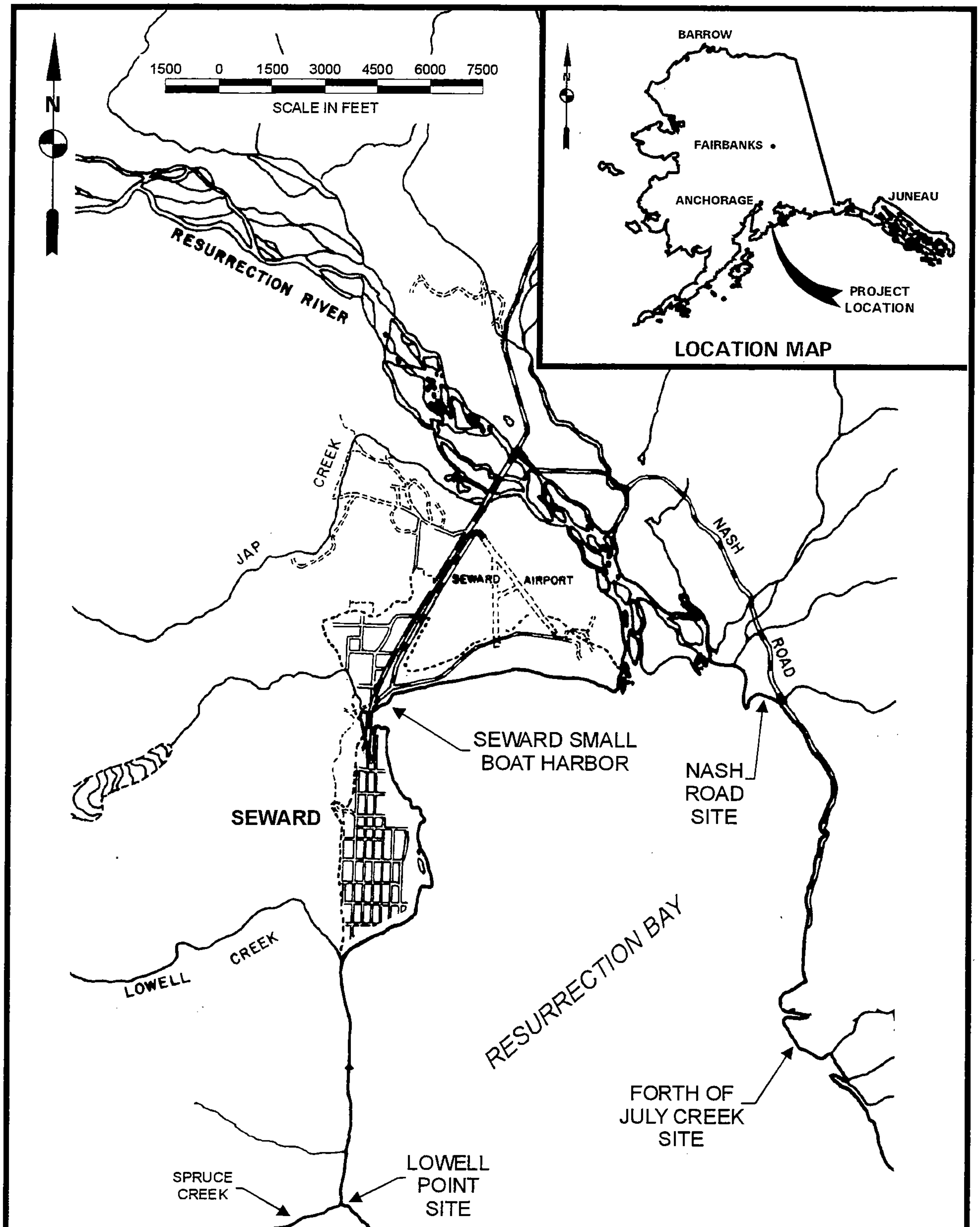
The demand for moorage greatly exceeds the current availability for much of the year. Excess demand for harbor services and facilities, especially for transient vessels, occurs during peak fishing periods. Overcrowded harbors increase the likelihood of vessel damage, personal injury, and fire. Commercial enterprises that depend on harbor facilities and services experience inefficiencies and, ultimately, loss of income when a harbor does not run smoothly because of overcrowding. An analysis of the existing and projected moorage demand at Seward determined a need for additional moorage space for 465 vessels, including 339 seeking permanent stalls and 126 seeking transient space.

This study of proposed harbor improvements is in partial response to the Rivers and Harbors in Alaska study resolution adopted by the U.S. House of Representatives Committee on Public Works on December 2, 1970. This General Investigation study was requested by the city of Seward.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 No-Action Alternative

The no-action alternative would leave the site in its present condition. The identified purpose and need would not be met. The harbor would continue to be used beyond its designed capacity. Damage to vessels and docking facilities from overcrowded conditions would continue; economic benefits to the fleet from improved and expanded harbor facilities would not be achieved; and vessels unable to secure moorage in the existing harbor would continue seeking refuge at other ports.



ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

LOCATION & VICINITY MAP

SEWARD HARBOR IMPROVEMENTS

EA-1

2.2 Alternative Sites Eliminated From Further Study

Alternatives considered to fulfill the project purpose and need included constructing another harbor at Lowell Point, Nash Road, or near Fourth of July Creek. These alternatives were rejected as being impracticable, having a benefit-cost ratio less than one, not fulfilling the project purpose and need, and/or having unacceptable environmental impacts.

2.2.1 Lowell Point.

Lowell Point, about 2.5 miles south of the existing harbor, is at the mouth of Spruce Creek on the west shore of Resurrection Bay, as shown in figure EA-1. The harbor would be constructed in the alluvial fan of the creek where it empties into Resurrection Bay. Due to the shallow water at the site, over 400,000 yd^3 of material would need to be dredged and disposed of for a harbor that could accommodate the design fleet. This alternative was rejected because of (1) excessive amount of dredging required; (2) lack of existing utilities except electricity; (3) the need for widening and upgrading the existing roadway to accommodate increased traffic flows; (4) property acquisition concerns; and (5) environmental concerns with relocating and channelizing the mouth of Spruce Creek. The site was considered and rejected for development in the Corps' 1980 Draft Feasibility Report and Draft Environmental Impact Statement (USACE, 1980).

2.2.2 Nash Road

The Nash Road site is approximately 4 miles by road east of the existing harbor in the northeast corner of Resurrection Bay (figure EA-1). Several studies have investigated the feasibility and environmental effects of constructing a harbor at this location (USACE, 1982 and 1983). In these studies, a harbor was designed to accommodate over 1,000 boats with a basin area of over 30 acres. A smaller harbor could be built at this location with a basin area that would accommodate the current design fleet. This site was also studied by the city of Seward with private developers in 1992. However, written consent from adjacent property owners could not be obtained. The city terminated its agreement with the developers in 1994 (see letter from the city of Seward dated February 24, 1998, in appendix 2). Land acquisition problems and environmental concerns eliminated this site from further consideration.

2.2.3 Fourth of July Creek

The Fourth of July Creek site is on the east side of Resurrection Bay, approximately 9 road miles from the existing harbor (figure EA-1). The harbor would actually be sited at the mouth of Spring Creek, just north of the Seward Marine Industrial Center (SMIC). The SMIC was constructed in the early 1980's to serve as an industrial center and shipyard for fishing and other commercial vessels. Facilities at the SMIC include several large deep-draft docks and a Syncrolift. The site was rejected primarily because of the presence of a bald eagle nest tree, the need for filling wetlands, and impacts to Spring Creek, which supports anadromous fish. Furthermore, there is a lack of consensus from the community on locating a small boat harbor on the east shore of Resurrection Bay, far removed from the main part of town.

2.3 Preferred Site (Eastward Expansion of Existing Harbor)

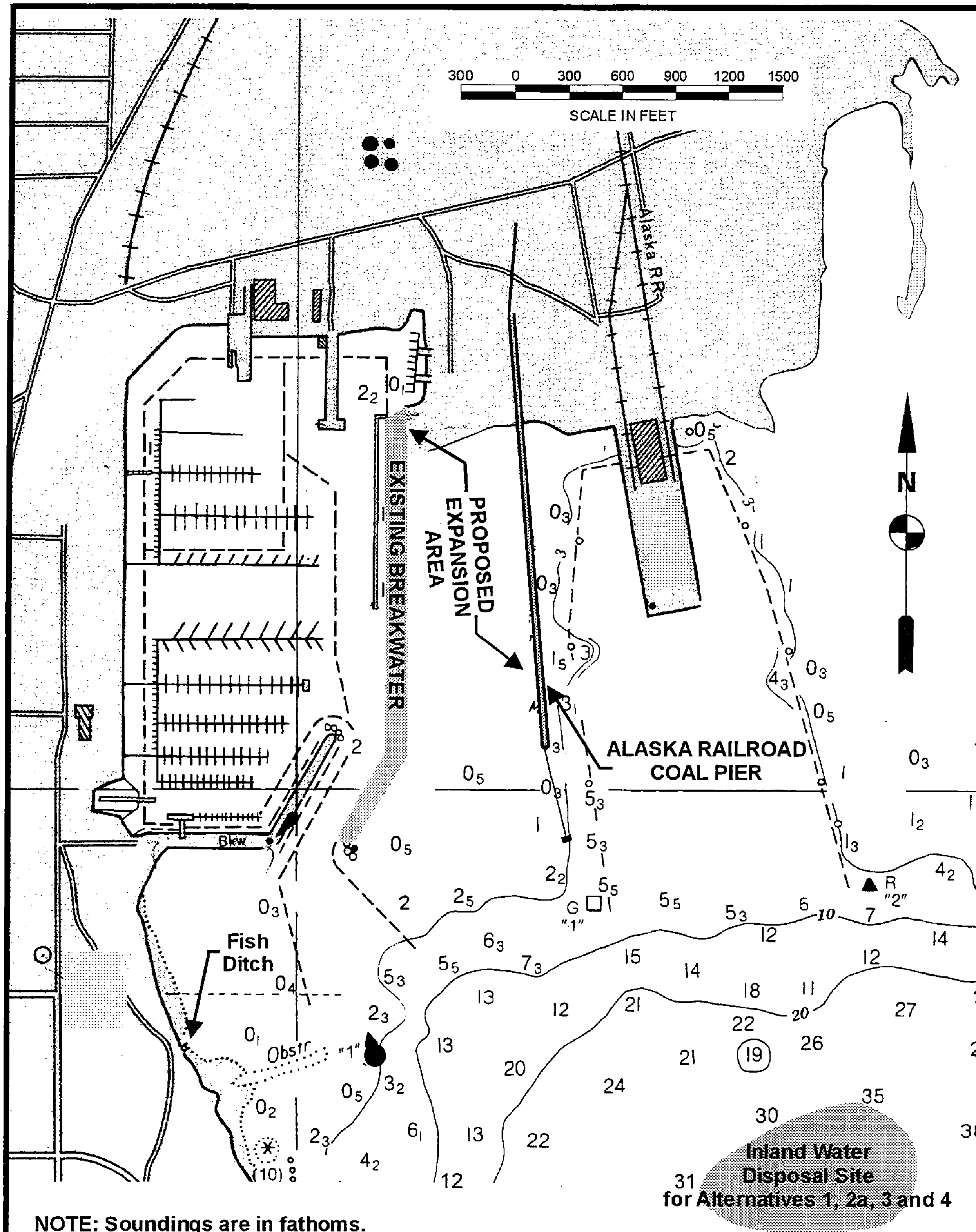
The preferred site is eastward expansion of the existing harbor (figures EA-1 and EA-2). A number of alternative designs were considered to expand the existing harbor, and these preliminary designs were narrowed down to five. Information on the area of impact and the quantity of materials to be dredged and discharged for each alternative is in Table EA-1. Alternative 2, as discussed below, is the preferred alternative/proposed action. The eastward expansion site best satisfies site selection objectives. The Federal portion of the project would include removal and construction of the breakwater and construction of a basin and maneuvering area. Construction and installation of inner harbor facilities would be the responsibility of the city of Seward, the local sponsor. Inner harbor facilities would initially consist of finger floats and walkways.

2.3.1 Alternative 1

With alternative 1, approximately 1,470 feet (36,300 yd^3) of the existing east breakwater would be removed and a new breakwater would be constructed about 450 feet to the east (figure EA-3). This would provide an additional 10 acres of basin and maneuvering area. The last 100 feet or so of the existing breakwater would remain in place and be incorporated into the new breakwater. The new rubblemound breakwater would be about 2,055 feet long and would be constructed southward from the shoreline parallel to the existing coal trestle. It would then change to an east-west alignment near the end of the coal trestle. Approximately 80,000 yd^3 of armor rock, secondary rock, and core material would be placed for the breakwaters construction. Armor stone and core material from the original breakwater would be re-used where possible. The new breakwater would have a footprint of about 4.2 acres and would be constructed with a 1 vertical (V):1.5 horizontal (H) slope. The eastward toe of the breakwater would maintain a minimum distance of 30 feet from the coal trestle.

To construct the expanded mooring basin and maneuvering area, approximately 266,500 yd^3 of material would be dredged from about 12.7 acres. The area would be dredged to depths ranging from –12.5 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods most likely would be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.

Approximately 80,000 yd^3 of the dredged material would be discharged in two separate intertidal/subtidal areas adjacent to the harbor. An additional 5,500 yd^3 of armor rock and core material would be placed to aid in construction of the fill areas (berms) and to protect the areas from erosion. One fill area would be at the north end of the harbor and have a footprint of about 1.8 acres. The other would be south of the existing south breakwater and have a 4.9-acre footprint. The city of Seward, who is the local sponsor, would be responsible for grading and compacting the two disposal areas for use as staging/access areas.



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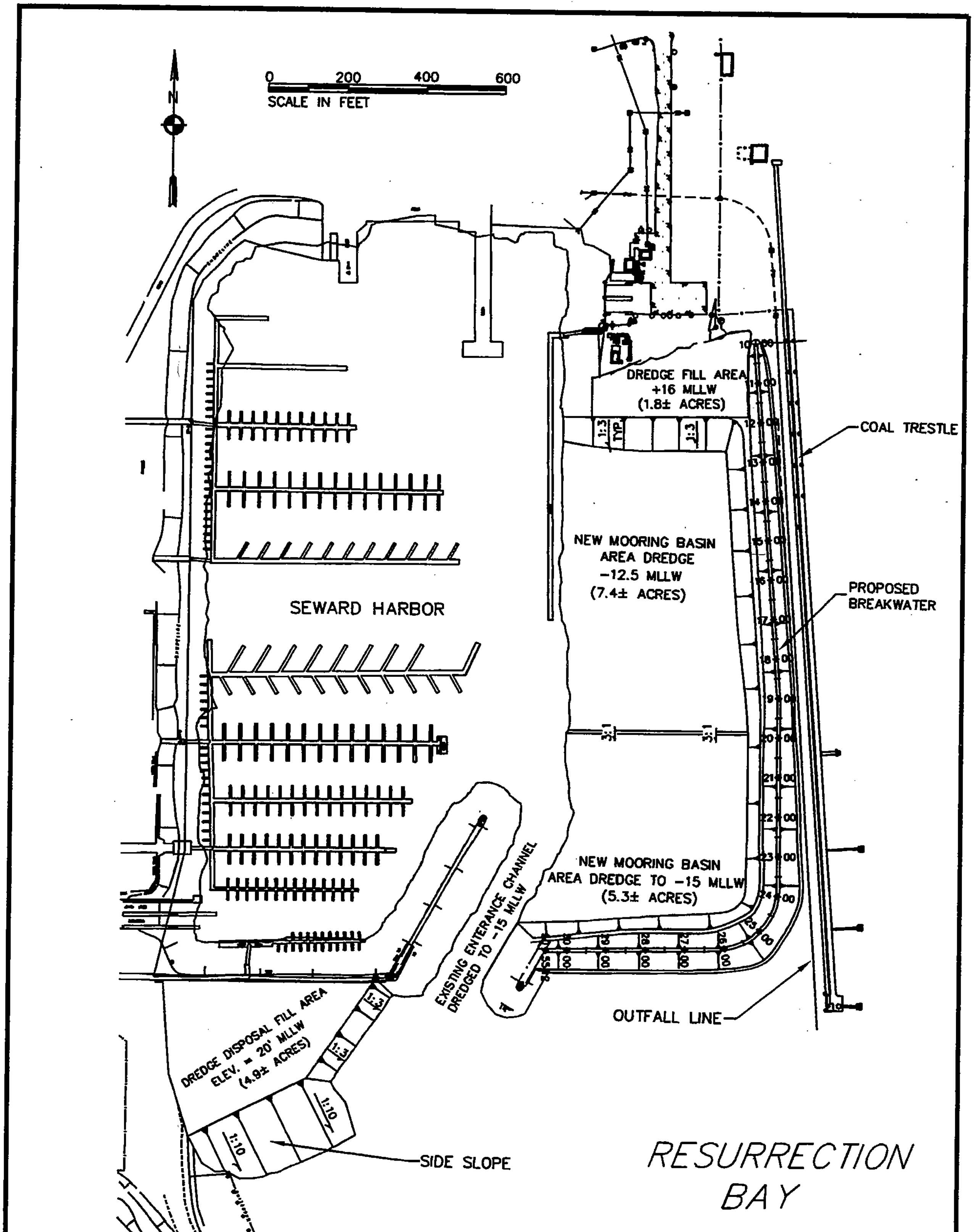
EXISTING HARBOR
SEWARD HARBOR IMPROVEMENTS

EA-2



ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	ALTERNATIVE 1 SEWARD HARBOR IMPROVEMENTS	EA-3

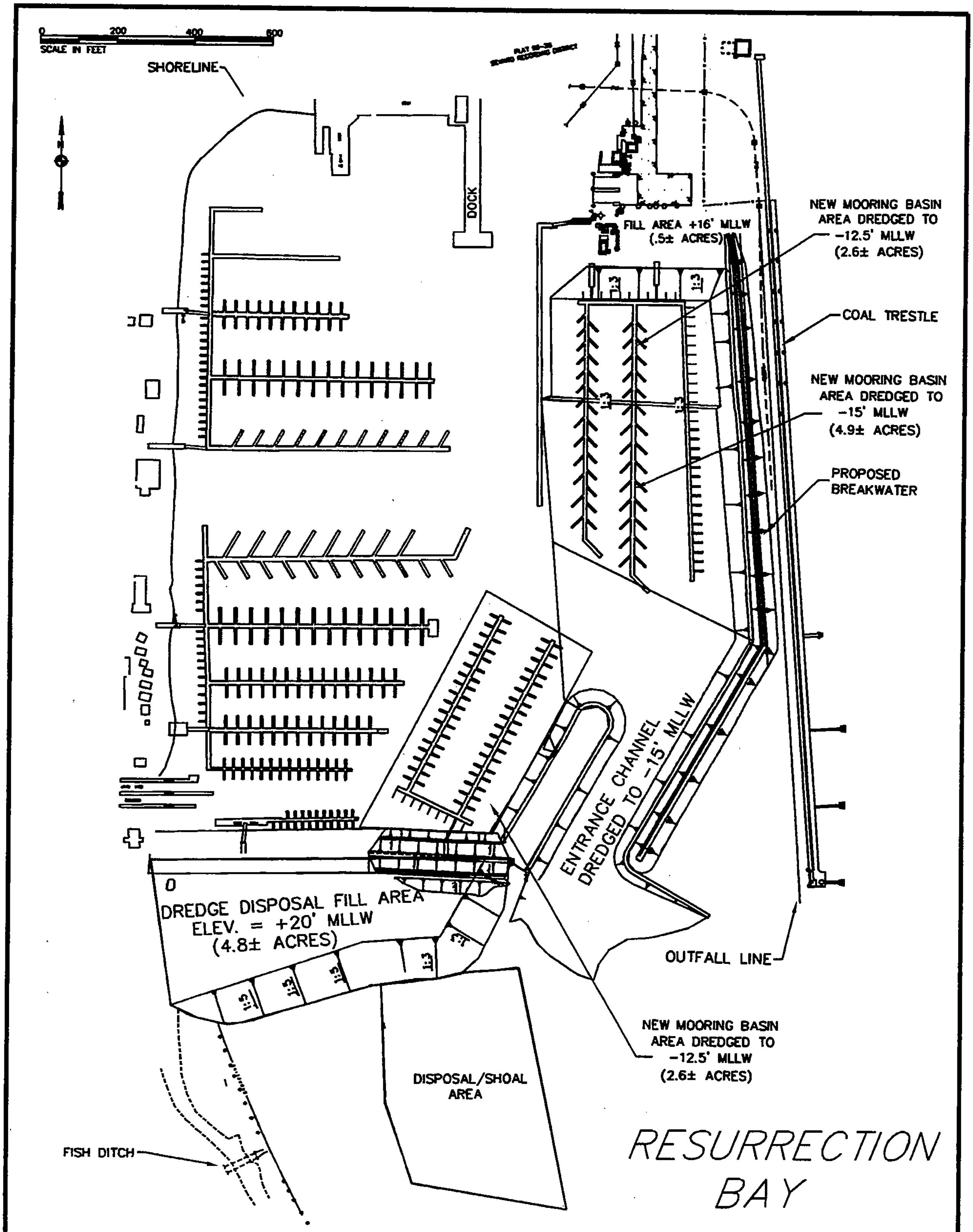
Staging/access areas are an integral part of the harbor design and should be located as close to the harbor as possible for efficient use. Most of the land surrounding the harbor is developed or is owned by the Alaska Railroad Corporation. Existing staging/access/parking areas near the harbor are highly congested during peak periods. Use of the land northeast of the harbor is limited since it is owned and used by the railroad. The city does own some of the land north and southeast of the harbor. Use of these areas does not satisfy current demand during peak periods. The proposed intertidal/subtidal fill areas would expand existing staging/access areas and would help alleviate existing and anticipated congestion. No additional upland areas near the harbor exist that could be used for staging/access areas. The two fill areas (north and south) would provide approximately 4 acres of usable area, the minimum necessary to accommodate the anticipated demand.

The rest of the dredged material would be stockpiled at an upland site north of the existing harbor for local fill projects and/or disposed of in inland waters approximately 1,500 feet south of the harbor in water depths greater than 30 fathoms. The inland water disposal site, as shown in figure EA-2, has been used by the Alaska Railroad Corporation (See Corps of Engineers, Regulatory Branch file number R-650034, Resurrection Bay 26).

2.3.2 Alternative 2 (Preferred Alternative/Proposed Action)

Alternative 2 is similar to alternative 1; however, the entrance channel would be relocated to the east and the southern staging/access area would be larger (figure EA-4). An additional 11.7 acres of basin and maneuvering area would be created with this alternative. The harbor would be expanded by removing about 1,100 feet of the existing east breakwater and constructing a new breakwater about 450 feet to the east. The new east rubblemound breakwater would be about 1,700 feet long and would be constructed primarily in a north/south alignment. The last remaining 470 feet or so of the existing east breakwater would be attached to the south breakwater. The end of the existing south breakwater that now forms the west side of the entrance channel (about 475 linear feet) would be removed and the existing entrance channel would be filled in. A total of 1,575 feet of breakwater would be removed (about 40,700 yd^3). Approximately 63,800 yd^3 of armor rock, secondary rock and core material would be placed to construct the new east breakwater, which would have a footprint of about 3.3 acres. Materials from the existing breakwaters would be re-used where possible. The new breakwater would be constructed with a 1 V:1.5 H side slope.

Approximately 304,500 yd^3 of material would be dredged from 17.7 acres to construct the entrance channel, mooring basin, and maneuvering area. The area would be dredged to depths ranging from –12.5 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods most likely would be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H. An additional 3,500 yd^3 of filter layer rock would be discharged to protect the side slopes of the entrance channel.



ALASKA DISTRICT
CORPS OF ENGINEERS
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ALTERNATIVE 2
SEWARD HARBOR IMPROVEMENTS

EA-4

Approximately 162,000 yd^3 of the dredged material would be discharged at two intertidal/subtidal areas adjacent to the harbor. An additional 28,000 yd^3 of armor rock and core material would be discharged to aid in construction of the fill areas and to protect them from erosion. One fill area would be at the north end of the harbor with a footprint of about 0.8 acre. The other would be south of the existing south breakwater with a 7.1-acre footprint. The city of Seward, the local sponsor, would be responsible for grading and compacting the two disposal areas so they can be used as staging/access areas. These two fill areas would provide about 6 acres of usable area and provide improved access. The larger southern access/staging area would provide improved access to the center of the harbor, compared with alternative 1, and would close off the existing entrance channel. As recommended by State and Federal resources agencies, the face of the southern fill area would have a slope of approximately 1V:5H to minimize the project footprint.

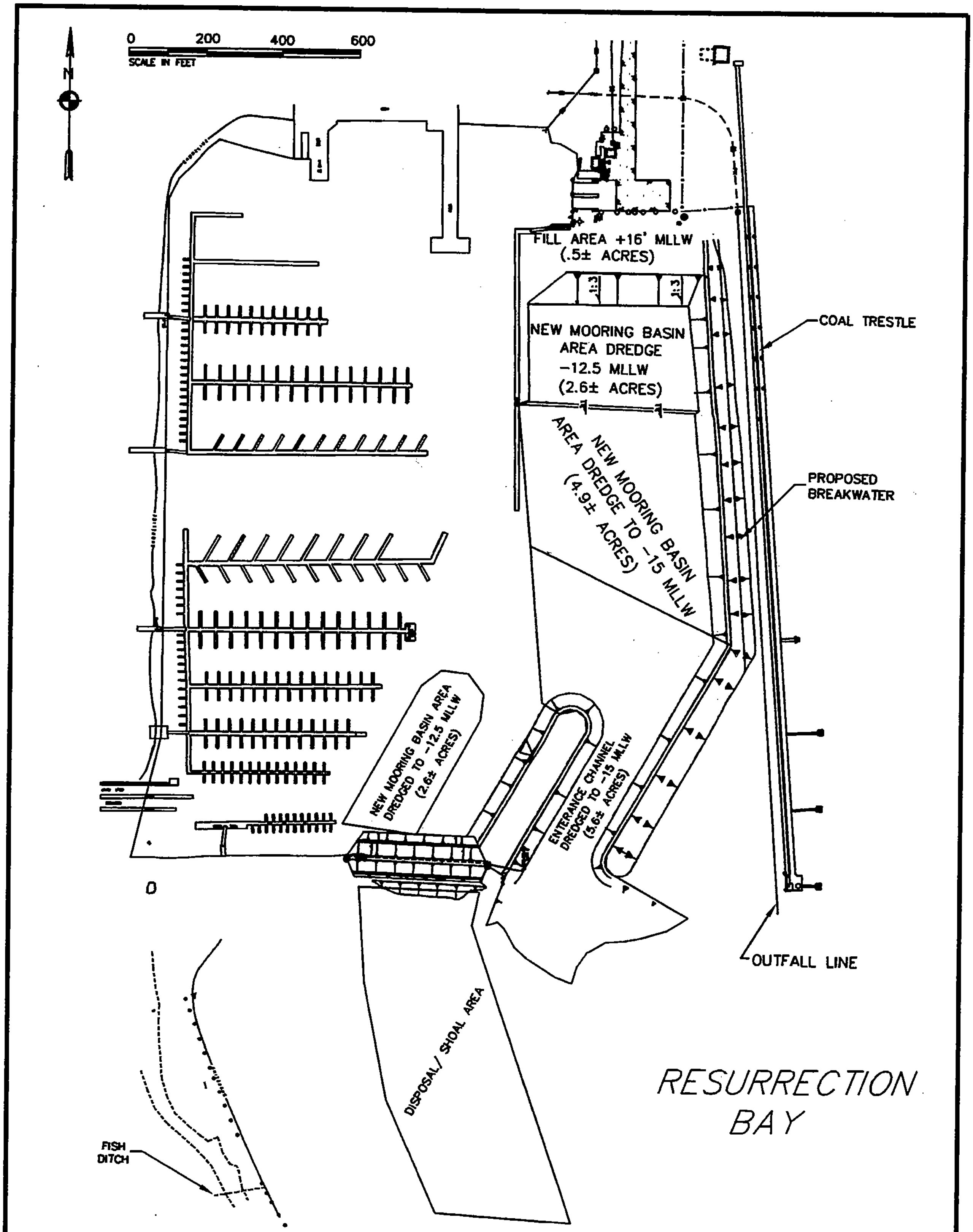
Approximately 38,400 yd^3 of the dredged material, along with approximately 17,100 yd^3 of core material, secondary rock, and armor rock would be discharged to close off the existing entrance channel. The remainder of the dredged material, approximately 104,100 yd^3, would be used to create a shoal south of the harbor as a mitigation measure (see section 5.0 for a discussion of mitigation measures considered). The shoal would have a footprint of about 5.15 acres and have a surface elevation of approximately 0 feet MLLW.

2.3.3 Alternative 2a

Alternative 2a is identical to alternative 2, except the dredged material to be used for the southern staging/access area would be discharged at the inland water disposal site about 1,500 feet south of the harbor (figures EA-2 and EA-5). This design is the National Economic Development (NED) plan; however, it is not the locally preferred plan. The NED plan is the alternative that optimizes the benefit to cost ratio based upon Federal criteria. However, this plan (without the southern staging/access area) does not meet State criteria for having sufficient staging/access areas in the immediate project vicinity. The functional use of the harbor would be greatly diminished with this design. There would not be sufficient space for vehicle and boat trailer parking, dry storage of vessels, and similar activities. Traffic and parking problems near the harbor would be exacerbated. The city and State have requested the additional staging/access area under alternative 2, to meet anticipated needs.

2.3.4 Alternative 3

Alternative 3, as shown in figure EA-6, would be almost identical to alternative 1, except the new east breakwater would be wide enough to allow vehicles to drive on it, and it would have a smaller northern fill area. The wider breakwater would allow for improved access to the southern end of the expanded harbor. This alternative would create approximately 10.4 acres of additional basin and maneuvering area. Approximately 1,470 (36,300 yd^3) feet of the existing east breakwater would be relocated. The last 100 feet or so of the breakwater would not be removed and would be incorporated into the new relocated breakwater. The new rubblemound breakwater would be about 2,000



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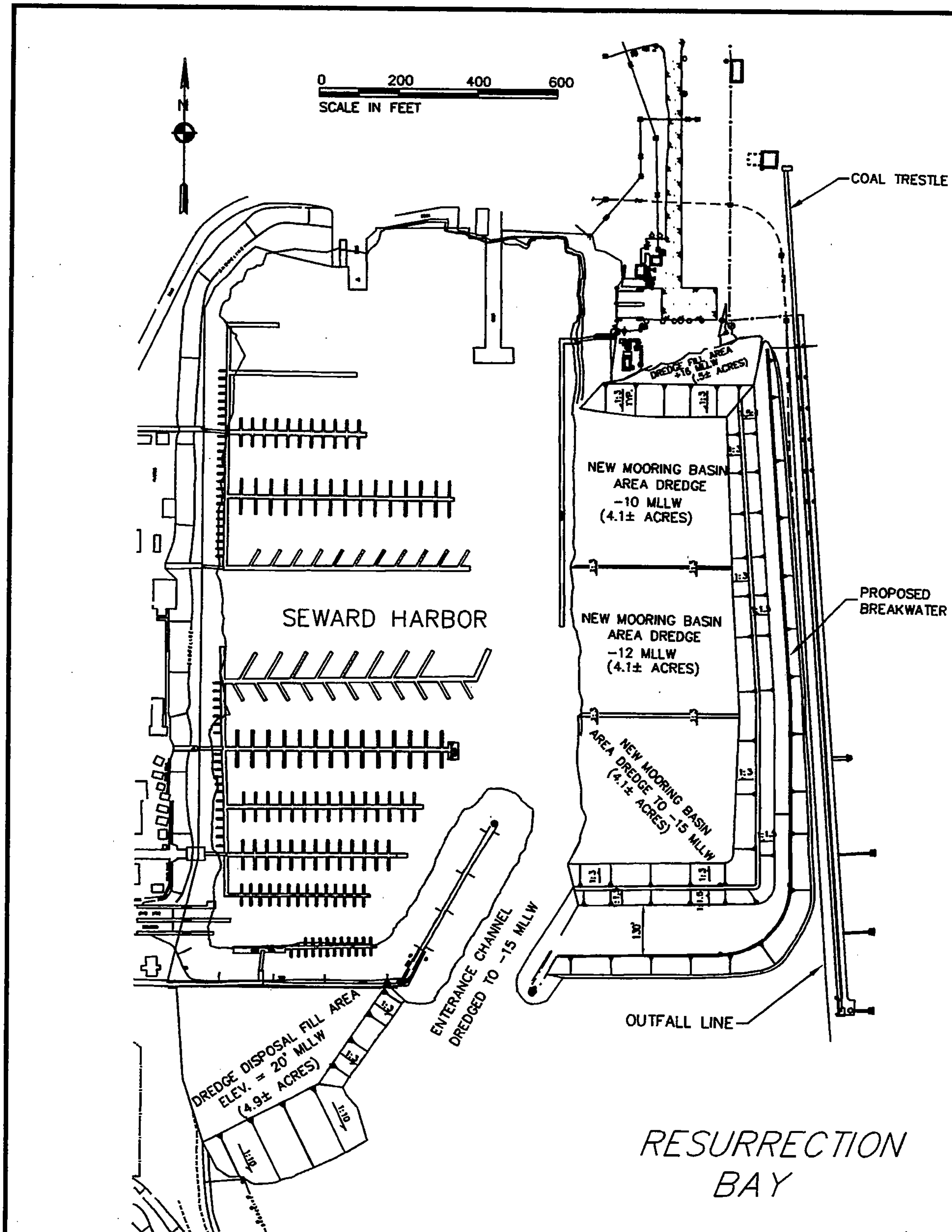
ALTERNATIVE 2A
SEWARD HARBOR IMPROVEMENTS

EA−5



ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	ALTERNATIVE 3 SEWARD HARBOR IMPROVEMENTS	EA-6

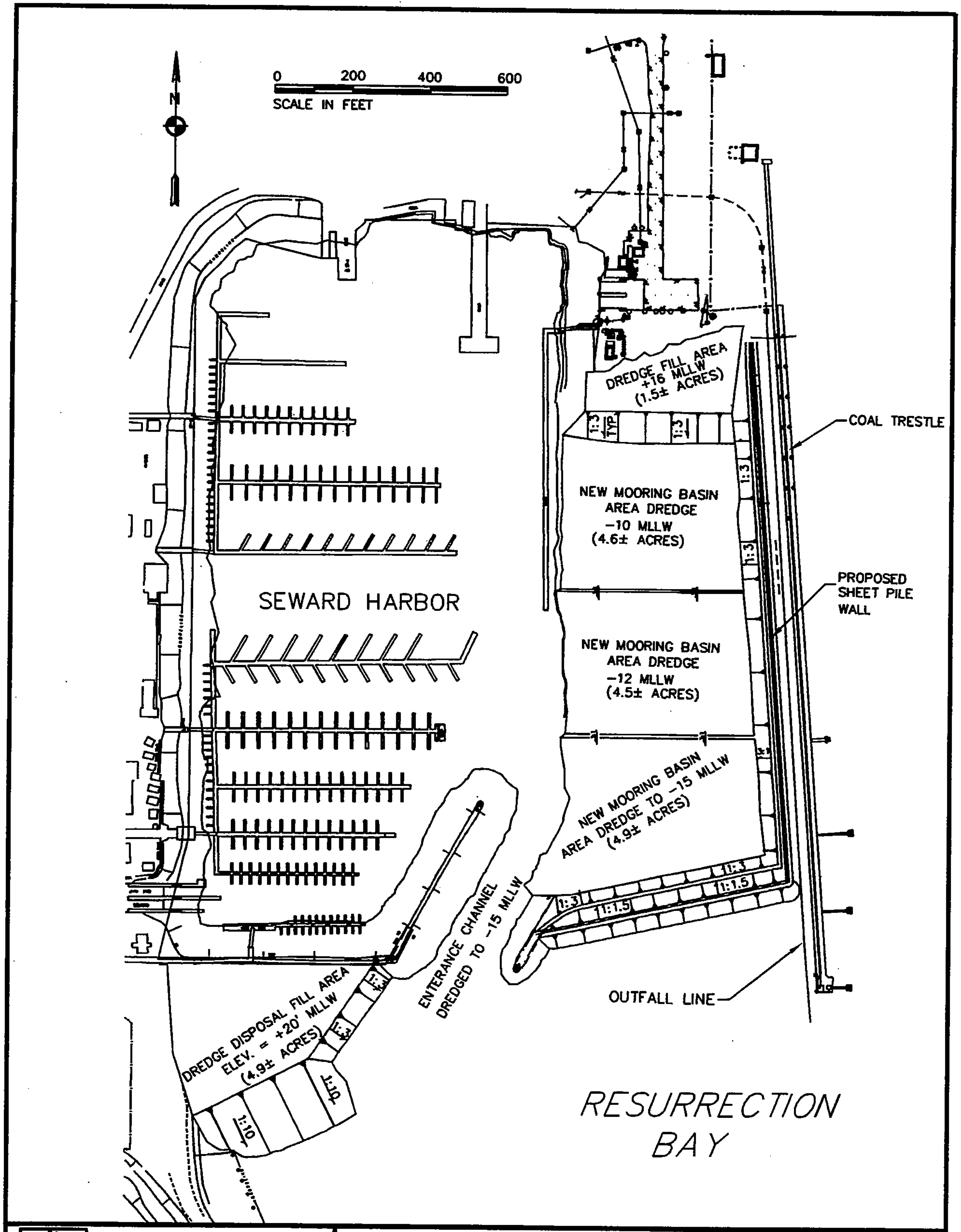
feet long and would be constructed southward from the shoreline parallel to the existing coal trestle. It would then change to an east-west alignment near the end of the coal trestle. Approximately 169,200 yd^3 of armor rock, secondary rock, and core material would be placed for its construction. Armor stone and core material removed from the original breakwater would be re-used where possible. The new breakwater would have a footprint of about 5.2 acres and would be constructed with a 1 V:1.5 H slope. The eastward toe of the breakwater would maintain a minimum distance of 30 feet from the coal trestle.

Approximately 247,160 yd^3 of material would be dredged from about 12.4 acres to construct the expanded mooring basin and maneuvering area. The area would be dredged to a depth ranging from –10 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods would most likely be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.

Approximately 67,800 yd^3 of the dredged material would be discharged in two intertidal/subtidal areas adjacent to the harbor. An additional 5,500 yd^3 of armor rock and core material would be placed to aid in construction of the fill areas and to protect them from erosion. One fill area would be at the north end of the harbor with a footprint of about 0.8 acre. The other would be south of the existing south breakwater with a 4.9-acre footprint. The city of Seward, the local sponsor, would be responsible for grading and compacting the two disposal areas so they can be used as staging/access areas. These two fill areas would create only about 3 acres of usable area. This is slightly less than the estimated area needed to meet the anticipated demand (approximately 4 acres). The remainder of the dredged material (179,360 yd^3) would be stockpiled at an upland site near the existing harbor for local fill projects and/or disposed of in inland waters approximately 1,500 feet south of the harbor as shown in figure EA-2.

2.3.5 Alternative 4

Alternative 4, is also similar to alternative 1, but sheetpile would be used in the construction of a portion of the new east breakwater (figures EA-7 and EA-8). This design would provide an additional 12.1 acres of basin and maneuvering area. Approximately 1,470 feet (36,300 yd^3) of the existing east breakwater would be removed. The southern 100 feet or so of the east breakwater would remain in place. Approximately 1,350 linear feet of sheetpile wall wave barrier with scour toe would be constructed in a north-south alignment. About 1,200 yd^3 of scour rock would be placed at the base of the wall. Near the southern end of the coal trestle, 650 feet of rubblemound breakwater would be constructed in an east-west alignment and would connect with the portion of the existing east breakwater that was not removed. Approximately 29,300 yd^3 of armor rock, secondary rock, and core material would need to be placed for construction of the 650 feet of breakwater, which would have a footprint of 1.25 acres. Armor stone and core material removed from the original breakwater would be re-used where possible.



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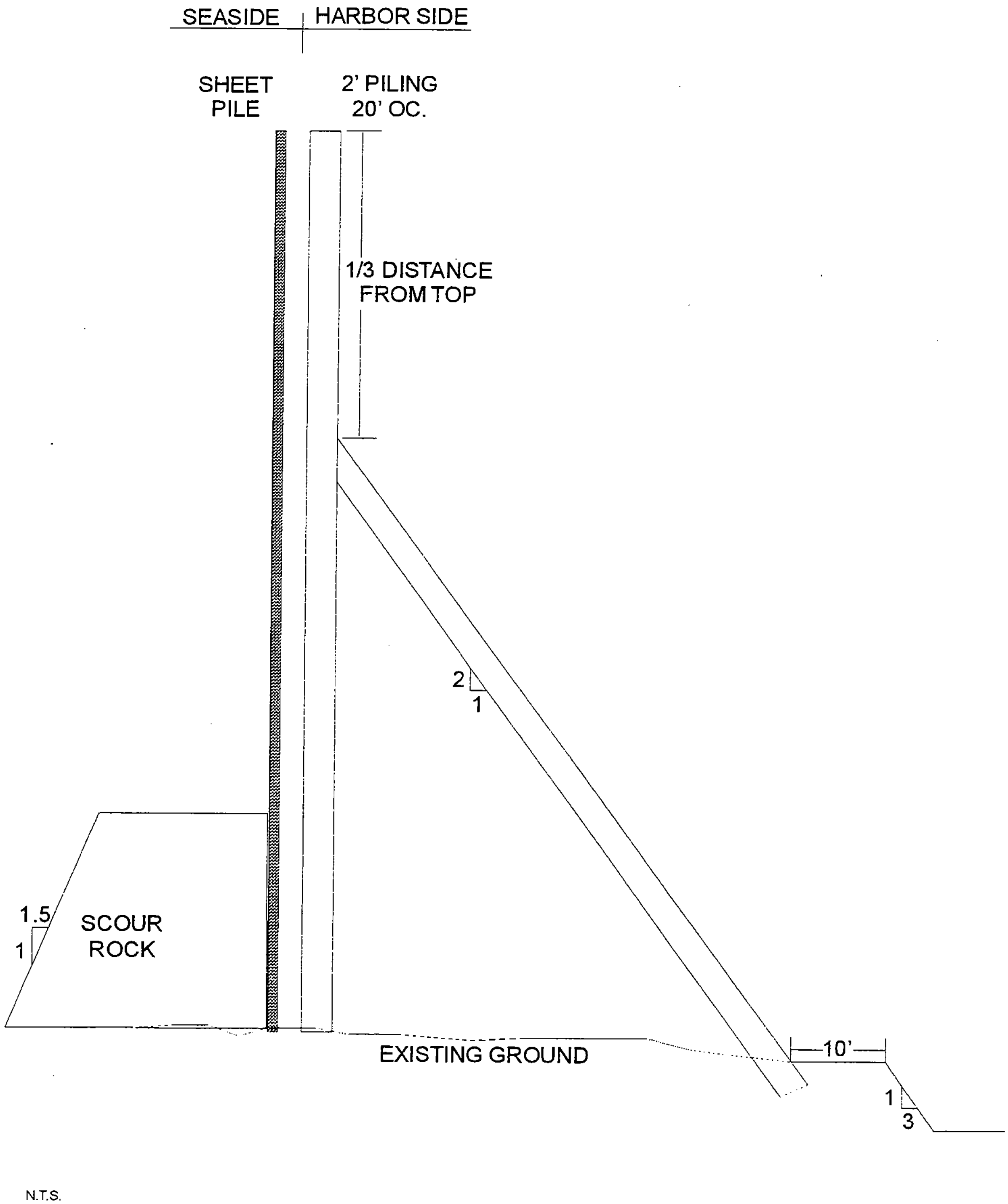
ALTERNATIVE 4
SEWARD SMALL BOAT HARBOR

EA-7



ALASKA DISTRICT
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ALTERNATIVE 4 CROSS SECTION

SEWARD HARBOR IMPROVEMENTS

EA-8

Approximately 273,100 yd^3 of material would be dredged from about 14 acres to construct the expanded mooring basin and maneuvering area. It would be dredged to depths ranging from –10 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods most likely would be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.

Approximately 79,800 yd^3 of the dredged material would be discharged in two intertidal/subtidal areas adjacent to the harbor. One would be at the north end of the harbor with a footprint of about 1.8 acres. The other would be south of the existing south breakwater with a 4.9 acre footprint. An additional 5,500 yd^3 of armor rock and core material would be placed to aid in construction of the fill areas and to protect the areas from erosion. The city of Seward, the local sponsor, would be responsible for grading and compacting the two disposal areas for use as staging/access areas. The remainder of the dredged material (193,300 yd^3) would be stockpiled at an upland site near the existing harbor for local fill projects and/or disposed of in inland waters approximately 1,500 feet south of the harbor as shown in figure EA-2.

Table EA-1. Values For Design Alternatives

	ALT-1	ALT-2	ALT-2a	ALT-3	ALT-4
Entrance Channel (-15 MLLW)					
Dredged Area (acres)	0	7.6	5.6	0	0
Dredged Quantities (yd^3)	0	86,900	86,900	0	0
1' Overdredge Quantities (yd^3)	0	6,700	6,700	0	0
Mooring Basin (-15 & -12.5 MLLW)					
Total Area (acres)	10	11.7	11.7	10.4	12.1
Dredged Area Footprint (acres)	12.7	10.1	10.1	12.4	14
Dredged Quantities (yd^3)	250,000	200,000	200,000	230,000	255,000
1' Overdredge Quantities (yd^3)	16,500	10,900	10,900	17,160	18,100
Entrance Channel Slope Armoring					
Armor Rock Size (lbs)	0	0	0	0	0
Armor Quantities (yd^3)	0	0	0	0	0
Filter Layer Rock Size (lbs)	0	150	150	0	0
Filter Layer Quantities (yd^3)	0	3,500	3,500	0	0
Adjacent Intertidal Fill Areas					
Fill Area Footprint (acres)	(4.9) 6.7 (1.8)	(7.1) 7.9 (.8)	0.8	(4.9) 5.7 (.8)	(4.9) 6.7 (1.8)
Dredged Fill Quantity (yd^3)	79,800	162,000	4,600	67,800	79,800
Core Quantities (yd^3)	2,600	20,000	0	2,600	2,600
Secondary Quantities (yd^3)	0	8,000	0	0	0
Armor Quantities (yd^3), 1500 lb.	2,900	0		2,900	2,900
Gap Breakwater					
Dredged Fill Quantity (yd^3)	0	38,400	11,000	0	0
Core Quantities (yd^3)	0	10,000	9,600	0	0
Secondary Quantities (yd^3)	0	1,100	3,100	0	0
Armor Quantities(yd^3)	0	6,100	5,400	0	0
Breakwaters Removed (avg. rock size = 3,300 lbs)					
Total Length (ft)	1,470	1,575	1,575	1,470	1,470
Armor Quantities (yd^3)	8,300	10,700	10,700	8,300	8,300
Core Quantities (yd^3)	28,000	30,000	30,000	28,000	28,000
Breakwaters					
Footprint Area (acres)	4.2	3.3	3.3	5.2	1.25
Total Length (ft)	2055	1,700	1,700	2,000	650
Height (Ft MLLW)	20	20	20	21	20
Armor Rock Max - Min Rock Size (lbs)	4200-2500	4200-2500	4200-2500	4200-2500	4200-2500
Armor Quantities (yd^3)	28,600	23,300	23,300	17,000	9,600
Secondary Rock Max - Min Rock size (lbs)	1000-250	1000-250	1000-250	1000-250	1000-250
Secondary Quantities (yd^3)	17,300	14,300	14,300	28,800	6,600
Core Material Max - Min Rock Size (lbs)	250-1	250-1	250-1	250-1	250-1
Core Quantities (yd^3)	33,350	26,200	16,200	123,400	13,100
Wave Barrier Construction (ft)	0	0	0	0	1,350
Scour rock (yd^3) (secondary rock)	0	0	0	0	1,200
Maximum Cubic Yardage To Be Discharged At Disposal Site 1,500 Feet South Of Harbor	186,700	0	124,000	179,360	193,300
Cubic Yardage To Be Discharged For Shoal Just South Of Harbor	0	104,100	147,500	0	0

2.3.6 Maintenance Dredging

Based on conditions at the existing harbor and an evaluation of the littoral transport processes in the area, maintenance dredging at the eastward expansion site is expected to be minor. Since the harbor was rebuilt following the March 1964 earthquake, it has only been maintenance dredged once. In April 1995, the Resurrection River flooded its banks and carried almost 23,000 yd^3 of material into the harbor. In January 1996, this material was removed from the upper basin area.

An estimated 4,000 yd^3 of material would be removed from the expanded moorage area every 25 years. Dredged material would likely be disposed of in inland waters approximately 1,500 feet south of the harbor in water depths greater than 30 fathoms. The inland water disposal site has been used by the Alaska Railroad Corporation (see Corps of Engineers, Regulatory Branch file number R-650034, Resurrection Bay 26). Evaluation for compliance with applicable environmental laws and regulations, along with testing the material for contamination, would be conducted at the time of dredging.

2.4 Breakwater Material Source

The breakwater material source would not be designated by the Corps of Engineers. The contractor would be responsible for selecting a quarry site and providing rock to meet design specifications. Pre-project planning, including National Environmental Policy Act investigations and documentation, assumes that the construction contractor would use only an existing quarry as a rock source. A rock quarry is considered to be existing if there has ever been mining at the site, and it has not been restored. An existing quarry may be "operating" or "non-operating" (abandoned, idle, not currently used). Borrow materials (gravel, sand, classified material, etc.) would continue to come from sites designated by the government or from a permitted borrow source.

Upon quarry selection, the contractor would submit a quarry development plan for that site to the Corps of Engineers. A coordinated agency review of the plan would be conducted to determine whether further documentation and review would be required to meet National Environmental Policy Act and Coastal Zone Consistency requirements. The development plan would define limits of construction, disposal of quarry waste, necessary access roads and traffic routes, quarry rock stockpile area(s) and other stockpile areas for material to be used for quarry restoration. The plan would also present a blasting plan, an outline of excavation methods, and a restoration plan.

2.5 Aids to Navigation

A self-contained signal lantern has been installed at the head of the existing breakwaters as an aid to navigation. Alternatives 1, 3, and 4 would not require altering the existing signal lantern. Alternative 2 would require replacing the existing navigation aids to define the new entrance channel. The existing navigation lights would be incorporated into the breakwaters at the new entrance to the harbor. Coordination with the U.S. Coast Guard would continue.

3. AFFECTED ENVIRONMENT

3.1 Community Profile

Seward is at the north end of Resurrection Bay, 125 miles southeast of Anchorage. Seward is primarily a non-Native community, with a population of 2,914. The town was founded in 1902 by surveyors for the Alaska Railroad and was named after U.S. Secretary of State William Seward, who was instrumental in the purchase of Alaska (Alaska Department of Community & Regional Affairs Database, 1998). Seward is a Home Rule City under Title 29 of the Alaska State Statutes, with a council-manager form of government, including an elected mayor and an appointed city manager. Seward is within the Kenai Peninsula Borough (KPB), which also includes the communities of Kenai, Soldotna, and Homer.

Seward is an important transportation center for the State because it is at the southern terminus of the Alaska Railroad and linked to Anchorage by road. It is the only ice-free deep-draft port with all-weather air, road, and rail access to the major population centers of southcentral and interior Alaska. The local economy is diverse and dependent upon tourism, ship services and repairs, fish processing, a coal export facility, and a State prison. The economy of Seward is becoming more dependent upon the tourism industry. During the summer months, large cruise ships dock in Seward, and the Alaska Sealife Center opened in May 1998. Another ice-free port near Anchorage is Whittier. Whittier is about halfway between Seward and Anchorage at the head of Passage Canal. Currently there is no road access to the community. Access is gained by rail, boat, or plane. A road to Whittier is under construction and is scheduled to be completed around the year 2000. The demand for moorage space in Whittier currently exceeds availability, and additional demand is expected to occur following completion of the road. Improved access and the potential for new harbor facilities in Whittier were considered during the planning of the Seward harbor improvements.

3.2 Seward Harbor

The original harbor was constructed in 1934 and was destroyed in the March 1964 earthquake. Reconstruction of the harbor was completed in 1965. The current harbor provides moorage space for about 656 vessels and consists of a 1,060-foot-long south breakwater, a 1,750-foot-long east breakwater, and a 26.3-acre mooring basin. A controlling depth of –14.0 feet MLLW was recorded in the outer portion of the entrance channel (USACE, 1997).

A coal dock with a conveyor belt system to load coal onto freighters is east of the harbor. The coal dock consists of a 1,730-foot trestle, a ship loader platform, fender dolphins, and a mooring basin with a depth of –58 feet MLLW. The Alaska Railroad Corporation dock is east of the coal dock. The dock consists of a 200-foot by 735-foot concrete deck on a steel-piling finger pier with a warehouse/office building on the north end. The dock serves many different types of vessels, including fish processors, fishing vessels, U.S. Coast Guard ships, Alaska State ferries, and cruise ships (USACE, 1996).

3.3 Physical Environment

3.3.1 Geology

The Resurrection Bay area is characterized by steep mountains with peaks rising to elevations of over 4,000 feet. The Harding Icefield is to the west, and the Sargent Icefield is to the northeast. Resurrection Bay is a typical U-shaped fjord, 17 miles long and 3 to 5 miles wide, with a maximum recorded depth of 978 feet near Thumb Cove, 5 miles south of Seward.

Alternating units of graywacke and phyllite constitute most all the bedrock in the immediate vicinity of Seward (USACE, 1994). The area is underlain by sedimentary rocks of the Valdez Group, principally of Jurassic and the late Cretaceous age (Golder Associates, 1998). The town is constructed upon the alluvial fan of Lowell Creek. The fan is approximately 1.25 miles long and 0.5 mile wide (U.S. Department of the Interior [DOI], 1994).

Seward and Resurrection Bay are within known geophysical hazard areas. Of primary concern is potential damage from earthquakes and flooding (KPB, 1990). The area south of the existing breakwater is a high-risk seismic area, classified as having a high-risk of future landslides (Eckel and Schaem, 1970).

3.3.2 Area Watersheds

Watersheds in the upper Resurrection Bay include Spruce Creek, Lowell Creek, Scheffiler Creek, Jap Creek, Resurrection River, Salmon Creek, Sawmill Creek, and Fourth of July Creek. Information on area watersheds is from the Corps of Engineers Report, *Seward Area Rivers, Flood Damage Prevention Interim Reconnaissance Report* (USACE, 1994).

The Lowell Point site is at the mouth of Spruce Creek (not Lowell Creek). Spruce Creek originates at a small glacier and flows for about 5 miles before emptying into Resurrection Bay. The creek drains a 9.26-square-mile area. The first half of the creek flows at an approximate slope of 12 percent through a steep-walled canyon. The next 2 miles of creek flow at a more gradual slope of 2.5 percent. The last half mile of the stream has a braided channel with a slope of about 2 percent and flows through an alluvial fan. The fan deposits are comprised primarily of silt, sand, and gravel.

Lowell Creek is north of Lowell Point, near the main part of town. Lowell Creek is about 3 miles long with a 4-square-mile watershed. The creek flows at a slope of 5 to 10 percent, terminating at a diversion dam and tunnel. The creek is diverted through a tunnel system originating in Lowell Creek Canyon and discharging directly into Resurrection Bay. The tunnel has been repaired many times since its original construction and has been the subject of numerous studies (USACE, 1992b).

Just to the west of the existing harbor is the Scheffiler Creek (also known as Rudolph Creek) watershed. Scheffiler Creek originates on the east side of Marathon Mountain in an ice-cored moraine. The creek has been altered and flows into a lagoon just west of Third Avenue. Drainage from the lagoon flows under Third Avenue, beside an apartment building before emptying into Resurrection Bay through several large culverts. This drainage is locally referred to as the "fish ditch."

Jap Creek, a small tributary of the Resurrection River, is at the far north end of Seward. The creek originates in an alpine moraine. The watershed has an area of about 3.5 square miles. The upper portion of the creek flows through a steep canyon with a slope of about 19 percent, before entering a broad fan. The creek flattens out to a slope of about 2 percent at its mouth. Residential development occupies part of the fan.

The Resurrection River, at the head of Resurrection Bay, has a mean annual flow rate of 1,300 cubic feet per second (ft^3/s). Its drainage area covers 169 square miles (not including Jap Creek and Salmon Creek watersheds). The river's main channel is braided, with low, densely vegetated banks. It migrates across a wide floodplain consisting mainly of sand and fine-to-medium gravel. In its lower reaches, the average slope is 0.4 percent. Numerous named and unnamed-tributaries contribute to the main channel's flow. These tributaries drain steep, glaciated mountain basins. They deposit large quantities of coarse bed material at their mouths, forming large alluvial fans and contributing high sediment loads to the river.

Box Canyon Creek is directly north of Seward and is one of the tributaries of the Resurrection River. Its watershed area is about 12 square miles. The creek originates at an alpine lake, flowing for about a mile through a narrow, steep-walled canyon before widening. The creek flows for another 5.5 miles into the Resurrection River. The slope of the creek averages about 4 percent.

Salmon Creek watershed has an area of 36 square miles and contains Clear, Lost, Grouse, Bear, and Glacier Creeks. Salmon Creek originates in the Kenai Mountains north of Seward and flows southwesterly into Resurrection Bay. The lower portions of the creek are braided with a gentle slope of 1.5 percent. The creek bed consists mainly of medium-to-coarse sand and fine gravel.

Just south of the Nash Road site is Sawmill Creek. The watershed has an area of about 7.85 square miles. At least four tributaries contribute water from glaciated basins at slopes greater than 18 percent. The lower portions of the creek are braided with a slope of about 3.2 percent.

The Fourth of July Creek site is at the mouth of Spring Creek, which is just to the north of Fourth of July Creek and the SMIC. Spring Creek is a small stream that drains the north valley wall of the Fourth of July Creek alluvial fan. It has a drainage area of about 3 square miles. The Fourth of July Creek watershed, which includes Spring Creek and

Goodwin Creek, is roughly 25-square miles. Goodwin Creek originates at Goodwin Glacier and flows for about a mile before emptying into Fourth of July Creek.

3.3.3 Climate

Seward has a maritime coastal climate and is greatly affected by cyclonic storms that cross the Gulf of Alaska. Overcast and cool days are frequent. Average winter temperatures range from 17 °F to 38 °F. Average summer temperatures range from 49 °F to 63 °F. Annual precipitation includes 66 inches of rain and 80 inches of snowfall (Alaska Department of Community & Regional Affairs Database, 1998). Due to heavy rainfall, rivers surrounding the city of Seward have a history of damaging floods. The area receives about 40 percent of its total annual precipitation during September, October, and November (USACE, 1994). Resurrection Bay and the Port of Seward are ice-free all year. Minimal icing occurs along the shoreline and at the mouths of freshwater streams during periods of extreme cold weather.

Prevailing winds are generally from the north in winter and the south in summer. Winds shift slightly east or west in the spring and fall. Mountains block winds from the southwest, while southeast winds blow directly into Seward (DOI, 1994).

3.3.4 Air Quality

Air quality in Seward is considered to be good. Seward is not in a non-attainment area. Main sources of emissions include vehicles, dust from gravel roads, wood fires, ocean-going vessels, and railroad related activities.

3.3.5 Tides and Circulation

Tides. Tides at Seward have a mean range of 8.3 feet and a diurnal range of 10.5 feet (USACE, 1992a). The maximum tidal current at the mouth of the bay is about 4 knots, and the maximum at the head of the bay is around 1 knot (DOI, 1994). Table EA-2 presents tidal data for Seward.

Table EA-2. Seward, Alaska, Tidal Data

Observed Extreme High Water*	15.1 feet MLLW
Mean Higher High Water	10.6 feet MLLW
Mean High Water	9.7 feet MLLW
Mean Tide Level	5.5 feet MLLW
Mean Low Water	1.4 feet MLLW
Mean Lower Low Water	0.0 feet MLLW
Extreme Lower Low Water**	-4.2 feet MLLW

* November 11, 1981.
** December 20, 1968.
Source: National Oceanic and Atmospheric Administration 1984.

Circulation. Circulation in the harbor is dependant on tidal action, which is the dominant mechanism in producing currents and flow. The planform geometry of a harbor has a significant effect on these circulation patterns. Several studies in the Pacific Northwest have been performed to determine boat harbor configuration with optimal circulation and flushing (Cardwell and Koons,1981; Neece *et al.* 1979). The studies derived an optimum quantity for the exchange coefficient and harbor aspect ratio. The exchange coefficient measures the relative exchange of water within a harbor basin with ambient water due to tidal flushing. The coefficient indicates the fraction of water in a basin or segment of the basin that is removed (flushed out) and replaced with ambient water during each tidal cycle. Ideally, for adequate flushing, a gross exchange coefficient should be greater than 0.30. The exchange coefficient can be reliably estimated by the tidal prism ratio when a physical model is not used. The tidal prism ratio is calculated by subtracting the basin volume at MLLW from the basin volume at mean higher high water (MHHW) and then dividing the difference by the basin volume at MHHW.

The harbor aspect ratio is the relationship between the length of the basin and its width. The ratio is calculated by dividing the basin length by its width. The aspect ratio affects the angular momentum, which allows the in-flowing ambient water to sweep past a major portion of the basin's interior boundaries without losing its identity by diffusion. Factors contributing to increased angular momentum improve the overall flushing. Ideally, this ratio should be between 0.5 and 2.0 for adequate flushing.

The water column of Resurrection Bay is stratified during the summer due to the influx of freshwater. During the winter, stratification is reduced as freshwater runoff lessens. Surface waters of Resurrection Bay flow primarily seaward year round, driven by the influx of freshwater and by north winds during the winter months (DOI, 1994).

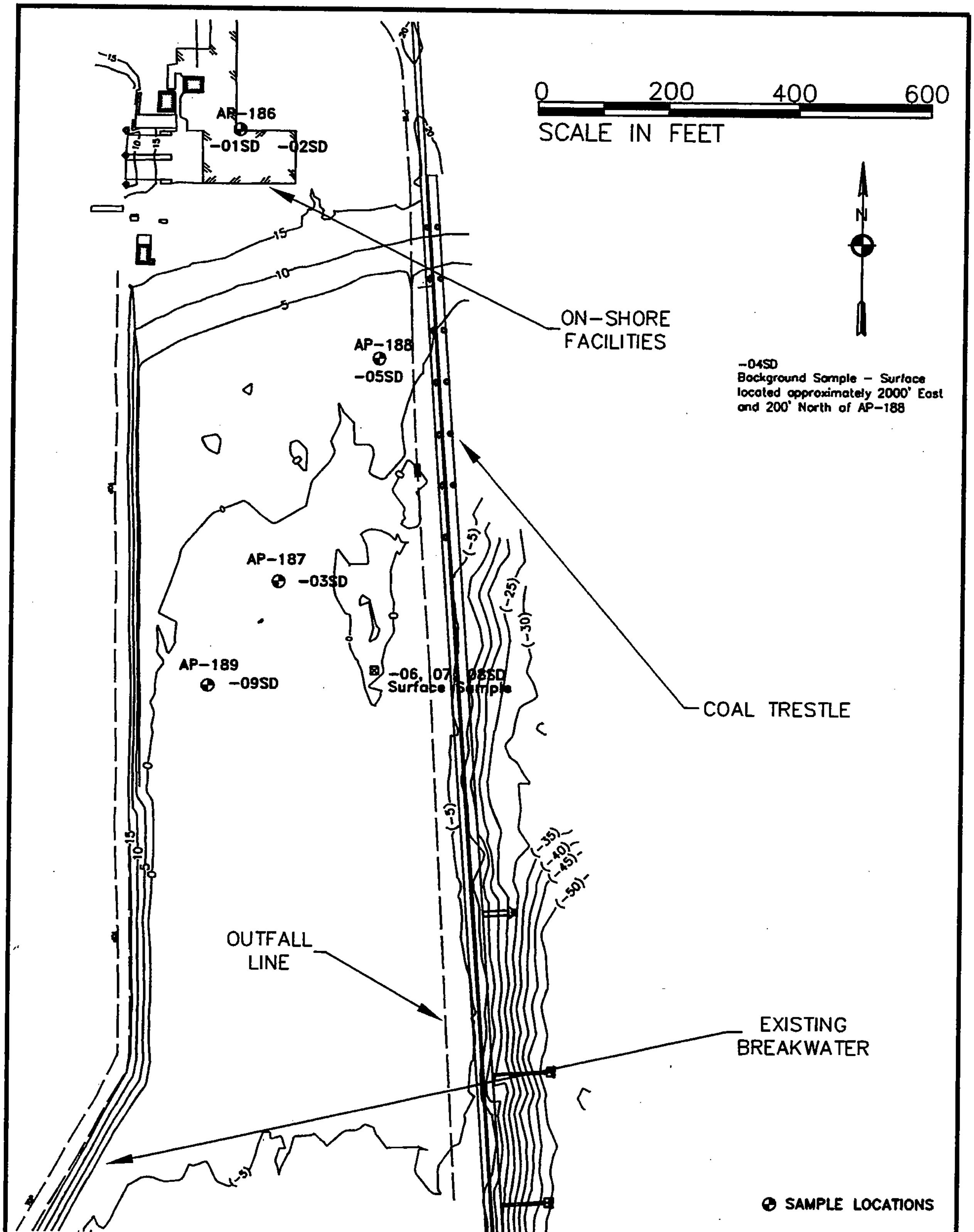
3.3.6 Sediment Characterization

Based upon information in the *Geotechnical Investigation Report – Proposed Small Boat Harbor Expansion, Seward, Alaska* (Golden Associates, 1998), the subsurface at the eastward expansion site (preferred site), is characterized by pro-grading glacial-fluvial sand and gravel that overlies marine deposits consisting primarily of silt with silty sand interbeds. A lower unit of sand and gravel underlies the marine sediments at depths ranging from 75 to 100 feet. The depth to bedrock is not known, but is assumed to be several hundred feet. The near-surface sand and gravel deposits were deposited as glacially-derived outwash and alluvium. These materials are gray to black, range from loose to dense, are poorly sorted, and are subangular to subround. Boulders were not encountered or detected. The marine deposits consist mainly of black, non-plastic silt with silty fine sand interbeds. Traces of gravel and organic material is typically present. Borings were classified as poorly graded sand with gravel, poorly graded sand with silt and gravel, poorly graded sand with silt, and silty sand. The percent fines (amount of material passing through a No. 200 screen) ranged from 2 to 20 percent.

Whether the material to be dredged needs to be tested is based on guidance in the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual* (U.S. Environmental Protection Agency [EPA] and USACE, 1998). Nine sediment samples were collected from the eastward expansion site in October 1997 and were tested for total organic carbon, nitrate and nitrite, sulfate, volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, zinc, eight polychlorinated biphenyls (PCB's), and pesticides.

Sampling results indicate that the material to be dredged is suitable for inland water disposal. All of the sediments within the proposed expansion area meet the strictest State of Washington and Puget Sound Dredged Disposal Analysis (PSDDA) sediment management levels. The only chemical contamination of concern was found in the surface sample, -01SD, collected in the parking lot north of the excavation area. Sample –01SD exceeded the PSDDA screening limits for mercury, silver, indeno(1,2,3,-cd)xylene, total PCB's, total xylenes and ethylbenzene. The contamination at this site is most likely due to surface spills in the parking lot and the nearby garbage dumpster. This sample was collected outside the proposed dredging limits.

Sample results for silver, total xylenes, and ethylbenzene are listed as "non-detect" in Table EA-3 below. For these three analytes, the method reporting limits (MRL's) exceeded the PSDAA screening levels. However, the method detection limits (MDL's) were all below the PSDAA screening levels. The MRL's reported in association with the "non-detect" results represent the contaminant concentrations that could be both detected and accurately quantified. The MDL's, on the other hand, represent the contaminant concentration that could be detected but not quantified with acceptable precision. Though the reported MRL's are above associated screening levels, all MDL's are below those screening levels. Contaminant concentrations are frequently reported at levels between the MDL and MRL. Normally, such results are qualified as estimated but are generally still reliable for project purposes. Table EA-3 below contains information on



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the analytes where the sampling result exceeded the screening level (sample –01SD) and where MRL's exceeded screening levels. Detailed sampling information can be found in the final Chemical Data Report (Appendix 4).

Table EA-3. Chemical Data Results

			PSDDA	
Analyte	**Sample #**	**Result**	**SL**	**ML1**
Mercury (ppm)	-01SD	0.21	0.21	0.41
Silver (ppm)	All	ND (1.9-2.2)	1.2	1.2
Indeno (1,2,3,-cd)pyrene (ppb)	-01SD	150	69	600
Total PCB's (ppb)	-01SD	299.1	130	130
Total Xylenes (ppb)	All	ND (31-35)	12	100
Ethylbenzene (ppb)	All	ND (10-12)	3.7	33

Puget Sound Dredge Disposal Analysis (PSDDA) - SL is Screening Limits
- ML1 is the Lowest Apparent Effects Threshold Value

ND – non detect, values in parenthesis are the method reporting limits

ppm – parts per million
ppb – parts per billion

Geotechnical investigations and sampling for contaminants were not conducted at the other three alternative sites considered (Lowell Point, Nash Road, and Fourth of July Creek) because these sites were eliminated from further study (see section 2.2 above).

3.3.7 Water Quality

Water quality in the Seward area is generally good. Resurrection Bay was not listed on the State's proposed 1998 Clean Water Act Section 303(d) water quality-limited water body list (Alaska Department of Environmental Conservation, 1998). Based upon water quality samples taken from the bay in the fall of 1993, water quality in the vicinity of the Alaska Sealife Center (southern part of town) was generally good to above average for typical nearshore coastal conditions (DOI, 1994).

The flushing rate influences a harbor's water quality by affecting such factors as temperature, dissolved oxygen levels, and light penetration. These conditions directly affect local biological communities. Tidal exchange is the principal factor attributed to flushing the harbor and maintaining good water quality. Activities that can result in heavy metal deposits include copper from anti-fouling paints, sacrificial anodes on recreational and commercial vessels and other protectively coated marine hardware, lead from boat batteries, engine exhaust products, and fuel spills. Certain organisms tend to be more tolerant of trace metals than others. Generally, the early life stages of aquatic organisms are the most susceptible to heavy metals and pollutants in general, but many chemical, physical and seasonal factors influence this toxicity.

3.4 Biological Environment

3.4.1 Vegetation

Seward is in the coastal forest zone where the predominant tree species are Sitka spruce, western hemlock, balsam poplar, paper birch, and black cottonwood. Common understory species include alder, willow, devil's club, elderberry, and rose. Wetter areas are dominated by grasses, sedges and heath-type plants such as blueberry, Labrador tea, and low-bush cranberry. Alpine tundra is found in the mountainous areas. Vegetation near the existing harbor is minimal. The site is developed with parking lots and buildings. Dominant plant species in the area include fireweed, yarrow, blue joint grass, red fescue, dandelions, and alder.

3.4.2 Birds and Terrestrial Mammals

Resurrection Bay supports a variety of seabirds, waterfowl, passerines, and raptors. The bay provides winter habitat for waterfowl and seabirds due to its mild winters. Waterfowl common to the area include goldeneyes, scoters, mergansers, and harlequin ducks. Other species found in the area include sandpipers, puffins, cormorants, murres, murrelets, magpies, ravens, and bald eagles. Shorebirds, gulls and ducks are routinely seen feeding in the intertidal areas in and around Seward. Bald eagles frequently use larger trees along the coastline for roosting. A bald eagle nest is known to exist near the Fourth of July Creek site.

Mammals typical to southcentral Alaska are found in and around Seward. Black bear and moose are found in the lowlands and mountain goats range in the mountains surrounding Seward. Other mammals found in the area include fox, beaver, lynx, coyote, hare, squirrel, weasel, and land otter.

3.4.3 Marine Habitat

Detailed information on the marine resources of the area may be found in the U.S. Fish and Wildlife Service's (USFWS) Fish and Wildlife Coordination Act Report in appendix 3. The following discussion is a summary from that report and other sources.

The intertidal and subtidal zone of the area supports a wide variety of invertebrates and algaes. Mussels beds are common in the intertidal area surrounding the existing harbor. Scattered patches of eelgrass can be found throughout the area. Rockweed, barnacles, and limpets can be found on rocks in the intertidal area. Polychaete worms and various types of mussels inhabit silty/muddy substrates.

Resurrection Bay supports important commercial and sport fisheries (Alaska Department of Fish and Game [ADF&G], 1998a). The bay and area streams support five species of Pacific salmon - coho, chum, chinook, pink, and sockeye. In the fall, large numbers of coho salmon can be found in northern Resurrection Bay, especially along the shoreline between Lowell Point and the existing boat harbor. Pacific herring spawn in the intertidal and subtidal waters of northern Resurrection Bay in the spring.

ADF&G stocks the waters of Resurrection Bay with both coho and chinook salmon. The saltwater smolt release of chinook and coho salmon generally begins in the third week of May and continues through the middle of June. Resurrection River juvenile salmon out-migration generally begins in early April for pink and chum salmon and continues through mid July for chinook and coho salmon. The juvenile wild stocks and hatchery salmon utilize the estuarine and near shore areas of Resurrection Bay from April through July. These juvenile salmon are susceptible to disturbance during this critical time (Alaska Division of Governmental Coordination, 1994).

Sport fisherman harvest thousands of coho salmon every summer; about 67,000 were harvested in Resurrection Bay in 1996. The largest number of anglers are present during the annual Seward Silver Salmon Derby, which is held in early August. During the derby, which typically lasts about a week, about half of the bay's annual coho catch is harvested (ADF&G, 1998b).

Chinook salmon use area streams including Box Canyon, Jap Creek, and Resurrection River. The early run of chinooks return to Lowell Creek and Seward Lagoon areas from late May through June and peak around June 10. The late run of chinook return in late July through August. Bear Lake and Grouse Lake have been stocked with sockeye salmon smolts. Sockeyes return to Bear Lake in early June, and continue through mid-July. Sockeyes also return to Dairy, Railroad, Pasture and Grouse Creeks in mid-July and continue through mid-August. The culverts that drains Seward Lagoon and Scheffiler Creek have seen a small but growing fishery for sockeye in June (ADF&G, 1998b).

The offshore waters of the area support a variety of marine fish resources. Dominant fish species encountered by weight from the National Maine Fisheries Service (NMFS) 1996 triennial bottom trawl survey from the Gulf of Alaska near Resurrection Bay were arrowtooth flounder, walleye pollock, skates, sharks, flathead and Dover sole, Pacific halibut and rockfish (NMFS, 1997).

Near shore marine mammals that frequent upper Resurrection Bay include the Steller sea lion, harbor seal, northern elephant seal, harbor porpoise and Dall's porpoise. Offshore marine mammals that are found primarily in the waters of southern Resurrection Bay include humpback, gray, killer, minke, and fin whales.

3.4.4 Special Aquatic Sites

Scattered eelgrass, a special aquatic site as defined by 40 CFR Part 230.43, can be found in the northern end of Resurrection Bay. Small amounts were observed within the footprint of the eastward expansion site. Wetlands, a special aquatic site as defined by 40 CFR part 230.41, dominate the Fourth of July Creek site. The presence of wetlands at the Fourth of July Creek site was one factor in its elimination as a feasible alternative.

3.4.5 Endangered, Threatened, and Candidate Species

The Alaska District has coordinated with the USFWS and the NMFS to determine if any threatened, endangered, or candidate species inhabit the area. The project is within the historic range of the Steller sea lion (endangered), Steller's eider (threatened), and humpback whale (endangered). The biological assessment to identify impacts on these species, as required by Section 7(c) of the Endangered Species Act is included in this section and in the Endangered, Threatened, and Candidate Species section in the Environmental Consequences section of this report.

The Alaska breeding population of Steller's eiders were listed as a threatened species on July 11, 1997. There has not been a designation of critical habitat for this species. Steller's eiders are sea ducks that spend the majority of the year in shallow, near-shore marine waters where they feed on mollusks, polychaete worms, and crustaceans. Nesting occurs adjacent to shallow ponds or within drained lake basins. The breeding distribution encompasses the arctic coastal regions of northern Alaska and parts of eastern Russia. Most of the world's population of Steller's eiders winter along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet (Federal Register, 1997). Steller's eiders occur in small numbers in Resurrection Bay near Seward during the winter (October to April). From zero to eleven birds were counted in Seward each year during the Audubon Christmas bird counts in 1988, 1991, 1992, 1993, 1994, and 1995.

Steller sea lions (waters west of 144 degrees latitude) were placed on the endangered species list in April 1997 due to recent declines in populations in the western Gulf of Alaska. The 1997 populations in the area from Prince William Sound to the Aleutian Islands are estimated to be around 44,300. Recent declines are believed to be primarily the result of juvenile mortality. Steller sea lions frequent upper Resurrection Bay during the peak salmon returns. The northern sea lion is distinctive in its use of a few specific locations along the coast as breeding and pupping rookeries and hauling-out grounds. There are no haul-out or breeding rookeries in the north end of Resurrection Bay. The nearest mapped rookeries are near the mouth of Resurrection Bay, about 10 miles south of the proposed harbor expansion.

Humpback and fin whales mostly occur in Alaskan waters during the spring and fall months and are rarely observed in the upper Resurrection Bay area. Humpbacks feed primarily on krill and small fish. Fin whales feed on a variety of species including squid, krill and other zoo plankton, and schooling fishes. The worldwide population of fin whales is estimated between 105,000 to 122,000, and humpback whale populations are estimated between 1,000 to 1,200 (ADF&G, 1996).

3.5 Cultural Resources

The Kenai Peninsula, including the Seward area, is rich in archeological and cultural resources. The city of Seward was designated as a Certified Local Government for Historic Preservation. A Phase I Historic Preservation Plan was developed that includes a history of Seward, historical site inventory summaries, and recommendations for action (City of Seward, 1993). This report lists over 175 historical sites in and around Seward.

Based upon consultation with the State Historic Preservation Officer (SHPO), the potential for cultural resources to be encountered at the eastward expansion site is minimal. Most of the work would occur below the high tide line or in previously disturbed areas. However, there is a high potential for the Lowell Point, Nash Road, and Fourth of July Creek sites to contain undiscovered archeological sites; therefore, an archeological survey would be necessary along with additional consultation with the SHPO if these sites are developed.

3.6 Subsistence Activities

Many Seward residents, both Native and non-Native, depend upon subsistence resources. The distinction between subsistence and sport/recreational harvest is often difficult to define. Resources harvested/collected in the immediate Seward area include shell fish, salmon, bottomfish, waterfowl, ptarmigan, grouse, berries, moose, and small mammals such as beaver, hare, and marten.

3.7 Coastal Zone Management

Seward is within the KPB Coastal Management Program (CMP) boundaries. The KPB program was developed to provide local information and policies that carry out the objectives of the Alaska CMP. Issues, goals, objectives, and enforceable policies were developed for the following13 categories: coastal development, geophysical hazards, recreation and public access, energy and industrial development, transportation and utilities, fish and seafood processing, mariculture, timber harvest and processing, mining and mineral processing, subsistence, fish and wildlife habitat, air, land, and water quality, and archeological and historic resources.

Upper Resurrection Bay has been designated as an Area Meriting Special Attention (AMSA). AMSA designation is a means of focusing management attention on a chosen area that is considered critical to borough needs and where conflicts exist or are likely to occur as the area develops. Upper Resurrection Bay was designated as an AMSA because of its recreational, scenic, and heritage characteristics, its coastal resources, and because it is Alaska's only year-round, ice-free, deep-water port with rail, road, and air access to the State's interior.

4. ENVIRONMENTAL CONSEQUENCES

4.1 No-Action Alternative

With the no-action alternative, the project purpose and need would not be fulfilled. Both beneficial and adverse effects from construction and use of the harbor would not occur. Overcrowded conditions would continue to cause shortages of mooring space and damage to vessels and inner harbor facilities. Vessels seeking safe refuge would have to use other ports or weather-out storms. The community would not experience beneficial socio-economic effects from the development, such as increased employment opportunities during construction. However, adverse environmental effects associated with construction and use of the proposed harbor would not occur.

4.2 Alternative Sites Considered

Use of the Lowell Point, Nash Road, and Fourth of July Creek sites were eliminated as discussed in section 2.2. Therefore, the environmental affects associated with the use of these sites is not discussed.

4.3 Preferred Site (Eastward Expansion of Existing Harbor)

Environmental effects associated with expansion of the existing harbor are discussed below. Unless otherwise noted, the environmental effects would be similar for the five alternatives. Alternative 3 and 4 were not chosen as the preferred alternative, primarily due to higher costs. Alternative 2 is the preferred plan/proposed action.

4.3.1 Area Watersheds

The proposed harbor improvements would be constructed within the waters of Resurrection Bay adjacent to the Scheffiler Creek and Resurrection River watersheds. The work would have little if any affect on the watersheds themselves since most all of the proposed work would occur in Resurrection Bay. Flooding damage from the Resurrection River has caused damage to the existing harbor and associated facilities, most recently in the fall of 1995. Almost 23,000 yd^3 of material was washed into the harbor during that flood. There was also damage to harbor facilities, including the eastern boatramp. Flooding by the Resurrection River will always be of concern. The Alaska Department of Transportation and Public Facilities, and the city of Seward have been investigating possible solutions to the problem. Expansion of the harbor would not be expected to exacerbate the problem.

4.3.2 Noise and Air Quality

Minor increases in noise levels would be expected to occur. Wildlife sensitive to increased noise levels would be expected to avoid the project site. Emissions from heavy equipment would occur during construction. Also, the harbor would provide increased moorage space for up to 346 vessels. Emissions from vessels would be expected to occur throughout the life of the project. These minor increases in emissions, both from construction and with the continued use of the facility, would not be expected to have an appreciable affect on the air quality in the Seward area. Winds would be expected to quickly dissipate pollutants.

4.3.3 Currents

Construction of the proposed harbor would be expected to cause minor changes in current patterns in the immediate project area. Alternative 4 has the greatest potential for causing erosion problems at the north end of the harbor. Sheetpile walls tend to reflect wave energy to a much greater extent than rubblemound breakwaters. Further evaluation would need to be conducted to determine if additional shoreline protection would be necessary near the base of the coal trestle for alternative 4.

The transport of sediments in the area is minimal, as indicated by a lack of accretion of sediments within the existing harbor and entrance channel. Maintenance dredging of the proposed harbor would be expected to be minimal, as discussed above in section 2.3.4.

Flushing and circulation patterns are expected to be good for all four alternatives. A clockwise gyre driven by tidal currents would flush the harbor through the entrance channel. The aspect ratio is 1.0 for alternative 4 and 1.3 for the other three alternatives, all of which are within the ideal range of 0.5 and 2.0. Having an aspect ratio of 1.0 is best. The tidal prism ratio for all the alternatives range from 0.40 to 0.44, which is above the minimally preferred value of 0.30. These values can be compared to the existing harbor, which has an aspect ratio of 1.9 and a tidal prism ratio of 0.53 (see table EA-4).

Table EA-4. Basin Circulation Values

	Existing Harbor	ALT-1	ALT-2 and 2a	ALT-3	ALT-4
Tidal Prism Ratio	0.53	0.44	0.42	0.44	0.4
Basin Aspect Ratio	1.9	1.3	1.3	1.3	1

The ratio of the entrance channel cross-sectional area to the basin planform area can also affect water exchange, and thus water quality. Expansion of the basin area, while keeping the cross-sectional area of the entrance channel the same, would decrease the amount of water being exchanged during each tidal cycle. However, these effects are typically minimal when the aspect ratio approaches a value of one, provided the entrance channel is not excessively long and narrow. The ratio of the entrance cross-sectional area to the basin planform area would have minimal affects on the exchange of water in the harbor, since the aspect ratios of the five alternatives being considered is near the value of one and the entrance channels are not excessively long and narrow.

4.3.4 Water Quality

Dredging the harbor and the associated discharges would temporarily increase water turbidity at the project site. Tidal current and action would cause any loosened fine-grained material to form a sediment plume. Considering the minimal amount of fines in the material to be dredged, as discussed in section 3.3.6, plumes are expected to be localized and short-lived. Suspended sediments would be expected to temporarily decrease light penetration, primary productivity, and dissolved oxygen levels. Sediment constituents would be released into the water column, where they are more readily available to organisms. Mixing and dilution in the overlying water would be expected to decrease turbidity levels.

Of concern is the impact of increased turbidity levels and their impact on fishery resources. Work would initially consist of removing the existing breakwater and constructing the new breakwaters concurrently. This would likely occur in the spring and summer months. Most all of the material to be removed from the existing breakwater and discharged for the new breakwaters would consist of rocks greater than 1 pound in size. Increases in turbidity levels would be expected to be negligible to minimal during this phase of work. After the breakwaters are constructed, dredging of the basin and maneuvering area would occur. Dredging of the basin and the subsequent disposal of the dredged material would not occur between April 1 and September 15 to minimize potential impacts to juvenile salmonids and recreational fishing activities. In addition, no in-water construction activities related to breakwater removal and construction would occur between July 31 and September 15 to avoid the height of the sport fishing season. The disposal of the dredged materials for construction of the northern and southern staging/access areas would include methods to filter or settle out silt laden water (i.e., the use of berms and/or silt fences) prior to its discharge.

The disposal of dredged materials in open water (construction of the shoal for alternative 2, or at the inland water disposal site for alternatives 1, 3, and 4) would increase turbidity and suspended particulate levels at the discharge site during periods of work. To the extent practicable, dredged materials would be discharged below the water surface to minimize the spreading of suspended materials. As with the dredging operations, the suspended plume associated with the disposal of the dredged material would be short-lived and localized due to sediment size. Most materials would travel horizontally minimal distances prior to reaching the ocean floor (less than 20 feet). Fines would travel a greater distance.

A seafood processing plant outfall line runs parallel to the coal trestle. The outfall line was extended slightly past the end of the coal trestle during the summer of 1998. The outfall line discharges into water at a depth of –25 feet MLLW. Expansion of the harbor and the re-location of the entrance channel is not expected to affect circulation at the end of the outfall line; however, the potential does exist due to the line's proximity to the harbor. If the expansion of the harbor affects circulation at the outfall line in such a manner as to cause processing wastes to enter the harbor or to be washed up on the new breakwaters or adjacent shoreline, the Alaska District and/or the city of Seward would take measures to mitigate such conditions. Mitigative measures may include the relocation or the extension of the outfall line. Determination for the need for mitigative measures would be done in consultation with the Alaska Department of Environmental Conservation.

Also of concern in the seafood processing plant's saltwater intake line. The intake is located at the north end of the harbor near the T-dock. Increases in turbidity levels during periods of work could adversely affect the plant's use of the water. Dredging and other work in the harbor would be coordinated with the processing plant to minimize potential adverse affects.

Harbor operation and harbor-related activities historically degrade water quality. Incidental discharges of pollutants such as paints, fuel, oil, human refuse, fish wastes, and discarded debris contribute to poor water quality. The city of Seward would continue to provide facilities such as trash receptacles and used oil disposal containers. Harbors with good circulation and flushing characteristics quickly disperse pollutants and prevent them from accumulating. As discussed above in section 4.3.3, circulation is expected to be good, minimizing water quality concerns.

4.3.5 Marine Biota

Impacts associated with dredging can be placed in three categories: near-field effects, far-field effects, and ecosystem effects.

Near-field effects are considered to be those associated with immediate injury to fish brought into contact with suspended sediment plumes. Juvenile salmon have exhibited histological, immunological, physiological, and behavioral responses to suspended sediments (Servizi, 1988). Studies have shown that exposure to suspended sediments damages gill tissue and reduces the fish's tolerance to bacterial infection. Fish also exhibit behavioral responses to increased turbidity levels. In the case of juvenile Pacific salmon, observations indicate that chum and chinook fry tend to move into shallow waters along the shoreline; juvenile pinks occupy surface waters and may venture further out in channels during low light periods. Adult salmon do not appear to have clear migratory behavior; their movement is highly variable. Although delays in timing of adults impair reproductive success in some stocks, there is no evidence to indicate that turbidity will induce such a delay. The literature tends to agree that juvenile salmon migration is more vulnerable to disruption than adult migration.

Far-field effects caused by dredged material disposal include behavioral effects that impact certain fishes by reducing foraging success and increasing vulnerability to predation. These impacts are highly dependent upon the duration of exposure to the turbidity plume. As with near-field effects, the primary determinant would probably be the spatial and temporal overlap between the distribution of elevated turbidity and the fish. Dredging operations, where the turbidity plume encompasses a small portion of the center of a channel or is in open water and the highest concentrations are at depth, are not considered to pose significant effects compared to operations that produce highly turbid plumes from bank to bank and for long distances along a channel.

Ecosystem effects are assumed to include the loss or change in critical habitat, reduction of primary and secondary production (food web effects), or changes in hydrology and sedimentology. Excessive sediment accretion of productive habitats likely poses the greatest potential impact. Areas to avoid would be active, cross-current, shallow channels and near or on hard substrates such as rock or known unique habitats.

One of the more appreciable impacts associated with the disposal of dredged material is the smothering and/or burying of aquatic organisms. The Alaska District tries to identify disposal sites in water over 100 feet deep, which is typically out of the photic zone and avoids impacts to most aquatic vegetation. Most mobile or epifaunal invertebrates at a dredged material disposal site would likely be destroyed. Infaunal organisms are destroyed if the dredged material disposal is over 1 foot thick. In depositions of less than 1 foot, the organisms are generally able to dig up through the material. A trade-off must be made between the size (footprint) of the disposal area and its thickness.

The smothering and destruction of organisms does not necessarily mean there would be a permanent loss of habitat. As with the terrestrial habitats, the marine sediments may go through a successional process, with the more resilient organisms acting as the pioneer species. Most studies demonstrate a reduction in epi- and infaunal populations, and that, in most cases, the recovery occurs over time (ranging from months to years).

Loss of small areas of critical habitat can be significant to important species and can be population limiting. This is not a concern at the Seward harbor site. No critical habitats that would limit existing fish, bird, or mammal or other resources of the region would be affected. Evaluation of the area affected by the project and by other development in the region shows that those effects would not limit populations or diversity.

Dredging the harbor at Seward and construction of the breakwaters and storage/access areas would have direct impacts on up to 29 acres of marine habitat, depending on the alternative. See table EA-1 for specific information on dredge and fill quantities for each alternative. Benthic and non-motile organisms inhabiting the project site would be destroyed. Fish and marine mammals would be expected to avoid the project site during periods of work. After construction is complete, organisms would be expected to re-colonize the basin and the perimeter of the breakwater within a few growing seasons. Species composition and density would not be expected to mirror pre-construction conditions since the water depth and substrate composition would be altered.

Harbor construction is not expected to require blasting. If, however, explosives are required to remove bedrock, a blasting plan would be developed and coordinated with the NMFS, USFWS, and ADF&G to minimize potential adverse effects to marine mammals and other aquatic resources.

The sea otter is one of the more common marine mammals in the area. Sea otter populations in Alaska are estimated at a minimum of 100,000, and are expected to continue to grow (USFWS, 1997). Sea-otters have been observed feeding on mollusks and other organisms at the proposed project site. Some of the mussel beds they are known to feed on would be destroyed. Otters would be expected to continue to use undisturbed food sources in the area during and after construction. The loss of habitat is not expected to have an appreciable adverse affect on otter populations due to the presence of higher value/more productive habitats in the area. The proposed harbor site is not known to be a critical habitat for sustaining sea otter populations.

One of the principal drawbacks of alternative 4 is the adverse impacts sheetpile walls have on fishery resources. Sheetpile walls provide minimal if any hiding places for juvenile fish. Furthermore, migrating fish are forced to swim in deep water when traveling around the perimeter of a sheetpile wave barrier. The combination of these two factors greatly increase juvenile fish's susceptibility to predation.

With alternative 2, the preferred alternative, a shoal would be constructed out of the dredged material just south of the harbor and east of the fish ditch to help compensate for the loss of habitat (see section 5.0, Mitigation Plan, below). With alternatives 1, 3, and 4, a shoal could not be created south of the harbor and east of the fish ditch. Construction of a shoal at this location would interfere with navigation because the entrance channel would remain in its current location. Under these three alternatives (1, 3, and 4), a portion of the dredged materials would be discharged at the inland water disposal site used by the Alaska Railroad Corporation, approximately 1,500 feet south of the harbor.

The water depth at the disposal site, 1,500 feet south of the harbor, approaches 30 fathoms, which would exceed the maximum depth of the photic zone, minimizing primary productivity. Data to determine species composition and density was not collected because the area has been previously used as a disposal site. In 1995 and in 1997, the Alaska Railroad Corporation discharged over 190,000 yd^3 of dredged material at this location. The material the railroad discharged probably had a fairly high percentage of fines since the material likely originated from the Resurrection River. Non-motile and most slow moving organisms (e.g. crab, shrimp, and other invertebrates) would be smothered by the dredged material. Most groundfish and other highly motile organisms would be expected to avoid the area until turbidity levels returned to near normal conditions. Benthic organisms, crustaceans, groundfish, and other life forms would be expected to colonize the disposal site over time.

4.3.6 Birds

The project would be expected to have negligible effects on species such as eagles, gulls, ravens, and crows, which are opportunistic feeders. The project would likely have the greatest effect on shorebirds and ducks that feed on benthic organisms in the intertidal and shallow subtidal habitats, since the productivity of these habitats within the project footprint would be either eliminated or greatly reduced. These taxonomic groups of birds would be expected to continue to use undisturbed food sources in the area during and after construction. The project would have direct adverse affects on general feeding habitat, but would not affect nesting sites, rookeries, or other critical habitats.

4.3.7 Threatened and Endangered Species

The nearest Steller sea lion haul-out/rookery to Seward is at the mouth of Resurrection Bay, approximately 10 miles to the south. Steller sea lions visit the project area; however, the Seward area is not known to be a critical feeding area. Humpback and fin whales can be found in Prince William Sound and infrequently visit upper Resurrection Bay. The proposed project would impact a relatively small portion of general feeding habitat used by Steller's eiders, although eiders are generally only seen during the winter and in small numbers. Given these facts, the proposed harbor improvements would have no adverse affect on any threatened or endangered species. This determination has been coordinated with the USFWS and NMFS (see appendix EA-2).

4.3.8 Special Aquatic Sites

None of the habitats or biota affected by the harbor are regionally scarce, although several are nationally recognized as deserving special consideration in planning. Most notably, eelgrass is given special recognition because it may be particularly important as habitat, food, and as a nutrient accumulation mechanism. In much of the United States, eelgrass stocks are threatened by development and pollution. In response, resource and regulating agencies have restricted activities that would affect eelgrass and have done all that was possible to restore it . This is not the case in most of Alaska. At this time, eelgrass habitats are not substantially affected by development, pollution, or other adverse effects in southcentral and western Alaska.

A minimal amount (approximately 200 square feet) of eelgrass is within the footprint of the entire project. Eelgrass within the project footprint would be eliminated and would not be expected to become re-established. The environmental values these vegetated shallows provide, such as nursery cover and forage areas, would be eliminated. However, the loss of these habitats would not be expected to have an appreciable adverse affect on the aquatic resources of the area due to the minimal amount of eelgrass at the project site and the relative abundance of similar or higher value habitats in the area. Higher value sites such as the one near Fourth of July Creek have been avoided. Since impacts cannot be completely avoided (i.e. no practicable alternative), all practicable measures to minimize harm to the habitat would be incorporated into the project, to include the mitigation measures proposed in section 5.0 below. The proposed discharges comply with the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (see appendix 1).

4.3.9 Cultural Resources

Coordination with the SHPO (see appendix 2) determined that no resources listed on or eligible for inclusion in the National Register of Historic Places are known to exist in the vicinity of the eastward expansion site. In addition, the potential for unknown cultural resources to be encountered at the site is minimal. If archeological resources are discovered, work that could affect such resources would be stopped until consultation with the SHPO is completed.

4.3.10 Subsistence Activities

No appreciable adverse effects are expected to occur to subsistence activities or resources. Construction of the harbor would be coordinated with the city of Seward and the KPB to avoid conflicts with subsistence activities.

4.3.11 Socio-economic Impacts

The proposed project would provide up to 465 additional moorage spaces. Overcrowded conditions at the existing harbor would be greatly reduced, minimizing vessel damage, personal injuries, risk of fire, and operational inefficiencies. The proposed harbor facilities would contribute to the future growth of Seward by providing increased employment opportunities during construction and by accommodating a larger fleet. Expansion of the existing harbor would be consistent with local zoning and is supported by the city.

The harbor is vital to Seward's economy. About 70 percent of slip holders are from out of town, tens of thousands of people come for tours, and thousands more come for fishing charters. With just these industries, more slips would create an opportunity for more commercial operators, which in turn would create permanent jobs in the community. However, the proposed harbor improvements would not open significant new employment or other opportunities that would appreciably alter population, industrial, or employment trends, and thereby cause additional impacts. The population of Seward has been fairly constant since 1990, with a population ranging from 2,699 in 1990 to 2,914 in 1996 (Alaska Department of Labor, 1997).

Commercial sockeye fishing occurs at both the Fourth of July Creek and Nash Road Harbor locations. Fish targeted by anglers include all species of salmon, halibut, lingcod, rockfish, and Dolly Varden. The coho salmon sport fishery is dispersed throughout Resurrection Bay early in the season. Later in the season, the majority of the fishing effort shifts to the north end of the bay, including areas near Lowell Point and Fourth of July Creek. The area just south of the existing harbor is also heavily fished in the fall when coho salmon are present. Timing of construction of the harbor would be coordinated with the city of Seward to minimize affects on fishermen and the annual silver salmon derby.

On February 11,1994, Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations was issued. The purpose of the order is to avoid the disproportionate placement of federal actions and policies having adverse environmental, economic, social, or health effects on minority and low-income populations. Based upon an analysis of 1990 U.S. Census data, the make-up of the minority and low-income population of Seward is slightly higher than similarly sized communities in the borough (see table EA-5).

Construction of the proposed harbor would have both beneficial and detrimental effects on the entire population of Seward, not just on one demographic or economic group. The harbor would not be sited in a low income or minority area of town. It would be in an industrial area, near few residences. Contrary to resulting in a disproportionate placement of adverse environmental, economic, social or health effects on minority and low-income populations, the proposed action would result in economic and social benefits to the local community as a whole.

Table EA-5. Demographic and Economic Data

Community	Total Population	Percent Native	Median Household Income	Percent Below Poverty
Kenai Peninsula Borough	40,802	7.2	$42,403	7.7
Seward	2,699	15.2	$37,049	10.7
Kenai	6,327	8.5	$42,889	7.3
Soldotna	3,482	4.5	$38,004	5.7
Homer	3,660	3.6	$36,652	5.0
Based upon 1990 U.S. Census Data (Alaska Department of Community & Regional Affairs Community Database, 1998).				

On April 21,1997, Executive Order 13045, Protection of Children From Environmental Health Risks and Safety Risks was issued to identify and assess environmental health and safety risks that may disproportionately affect children. The proposed action would affect the community as a whole. There would be no environmental health or safety risks associated with the action that would disproportionately affect children.

4.3.12 Coastal Zone Management

The proposed project is water-dependent and would provide improved water-related transportation. The proposed facilities would not create a hazard or obstruction to commercial fishing operations. Rather, they would improve fishing operations and allow for a larger fleet. Adverse impacts to the aquatic environment have been avoided, minimized, and compensated to the extent appropriate and justified. Geophysical hazards in the area, primarily earthquake and flooding hazards, have been taken into consideration during the design and siting of the proposed facilities. The proposed facilities would improve the public's access to marine waters. Construction activities would be coordinated with the city and borough to minimize potential adverse affects on recreational and subsistence activities. Siting and design of the harbor has been and will continue to be coordinated with State and local agencies. The proposed project complies with the KPB and the State of Alaska coastal zone standards to the extent practicable.

4.3.13 Required Permits and Authorizations

Construction of the preferred alternative would require the following permits and authorizations:

- Certificate of Reasonable Assurance (Section 401 of the Clean Water Act) from the Alaska Department of Environmental Conservation.

- Conclusive Coastal Zone Consistency Determination from the Alaska Division of Governmental Coordination.

5.0 MITIGATION PLAN

The mitigation strategy for Seward Harbor was developed based on the following considerations:

1. Analysis of direct project impacts on resources of concern.
2. Cumulative and induced impacts on regional resources.
3. Mitigation incorporated in project siting and design.
4. Relationship of environmental losses to regional resources.
5. Regulations regarding compensatory mitigation.
6. Feasibility of compensatory mitigation.

Engineering Regulation (ER) 1105-2-100 establishes mitigation requirements for Corps of Engineers projects. Other regulations, including section 404 of the Clean Water Act, also apply. ER 1105-2-100 states: "District commanders shall ensure that project-caused adverse impacts to fish and wildlife resources have been avoided or minimized to the extent practicable, and that remaining, unavoidable impacts have been compensated to the extent justified."

Both the ER and Council on Environmental Quality regulations require Federal agencies to consider mitigation opportunities, including opportunities for compensatory mitigation, in the environmental assessment or environmental impact statement process for each project. Neither regulation requires that compensatory mitigation be implemented to fully mitigate project impacts, and both regulations have the implementing agency consider the cost and effectiveness of the mitigation alternatives along with the impact potential.

Alternative 2 as discussed above is the preferred alternative for accomplishing the project purpose and need. Construction of the breakwaters, mooring basin, and staging/access areas would have direct impacts on 29 acres of intertidal and shallow subtidal habitat. Evaluation of the need for mitigation also considered regional growth and the likelihood that habitat losses and other project effects from the harbor project would be added to those from other development to cumulatively affect important resources of the region.

A discussion of both direct and indirect project impacts can be found in the Environmental Consequences section of this document (section 4.0).

The project, as proposed, contains all appropriate and practicable mitigation measures to minimize potential adverse environmental effects. Expansion of the existing harbor avoids higher value sites such as the one near Fourth of July Creek. No less damaging practicable alternative site exists that would accomplish the project purpose and need. Mitigation measures to minimize potential adverse impacts include:

1. Disposal of the dredged materials for construction of the north and south staging/access areas would include methods to filter or settle out silt laden water (e.g., the use of berms and/or silt fences) prior to its discharge into any natural body of water.

2. To the extent practicable, dredged materials would be discharged below the water surface to minimize the spreading of suspended materials.

3. Construction of the harbor would be coordinated with the city of Seward and the Kenai Peninsula Borough to avoid conflicts with subsistence and recreational activities.

4. No in-water construction activities related to dredging and the subsequent disposal of the dredged material would occur between April 1 and September 15 to minimize potential impacts to salmonids and recreational fishing activities.

5. No in-water construction activities related to breakwater removal and construction would occur between July 31 and September 15.

6. The slope of the southern staging/access area would be steepened from a 1V:10H to a 1V:5 H to reduce the project footprint.

7. If the expansion of the harbor affects circulation at Icicle Seafood's outfall line near the coal trestle in such a manner as to cause processing wastes to enter the harbor or to be washed up on the new breakwaters or adjacent shoreline, the Alaska District and/or the city of Seward would take measures to mitigate such conditions. Mitigative measures may include the relocation or the extension of the outfall line. Determination for the need for mitigative measures would be done in consultation with the Alaska Department of Environmental Conservation.

Most of these mitigation measures were recommended by the USFWS in their Fish and Wildlife Coordination Act Report (see page 25 in appendix 3) and all would minimize the loss of in-kind habitat to the extent appropriate and practicable. However, the project would result in the loss of marine habitat and a reduction in the site's net productivity, and thus contribute to the cumulative loss of aquatic habitat in the area. As a result, the need for compensatory mitigation was evaluated.

Establishing new eelgrass habitat to replace minor losses of eelgrass plants is not considered feasible or warranted. The proposed project would impact negligible amounts of eelgrass (about 200 square feet). In most situations in the Seward area, eelgrass is growing where habitat allows. Techniques for planting eel grass in Alaskan waters are not proven and results are uncertain. Planting of eelgrass was, therefore, eliminated from further consideration.

The city currently provides containers to collect used oil at the existing harbor and intends to continue the practice. The disposal of old nets at sea is of concern because improperly discarded nets continue to catch fish and marine animals. The disposal of large nets in Seward is minimal due to the type of vessels using the port. The city harbormaster does not believe that the establishment of specific net disposal/recycling facilities is needed or warranted at this time. However, the harbormaster's office will increase their efforts to inform port users that they are available to assist them in the proper disposal of their nets and other debris.

At the request of Federal and State resource agencies, a shoal would be constructed south of the harbor and east of the fish ditch to mitigate for the loss of mussel and clam beds. The shoal would be constructed in the existing entrance channel by discharging approximately 104,100 yd^3 of dredged material. The shoal would have a footprint of about 5.15 acres, as shown in figure 4. To encourage the colonization of the area by mussels, clams and other intertidal invertebrates, the surface elevation would be approximately 0 feet MLLW. The side slopes of the shoal would be as gradual as possible. As recommended by the USFWS, a slope of 1V:50H would be attempted to the west and south; however, this is not possible to the east where water depths drop off drastically and the new entrance channel would be located. The shoal would be graded such that it drains properly and does not trap fish in depressions or pools. The intent of creating the shoal is to provide suitable habitat for invertebrates that would be fed upon by sea otters and ducks. The area would also be accessible to fisherman at low tides.

Construction of the shoal south of the harbor and just east of the fish ditch is only practicable under the scenario for alternative 2 (the preferred alternative). With alternatives 1, 3 and 4, a shoal could not be created at this location. The shoal would interfere with navigation since the entrance channel would remain in its current location. Additional mitigation measures would need to be developed in consultation with the USFWS, NMFS, ADF&G and other resource agencies if one of these three alternatives is pursued as the preferred alternative.

In conclusion, the following mitigation measures would be implemented for alternative 2:

1. Incorporating methods to filter or settle out silt-laden water when constructing the north and south staging/access areas.

2. To the extent practicable, discharging the dredged materials below the water surface.

3. Coordinating construction of the harbor with the city of Seward and the Kenai Peninsula Borough to avoid conflicts with subsistence and recreational activities.

4. Not dredging the basin and not disposing of the dredged material between April 1 and September 15.

5. Not removing or constructing the breakwaters between July 31 and September 15.

6. Steepening the slope of the southern staging/access area to a 1V:5H.

7. Using the dredged materials to create a shoal south of the harbor to compensate for the loss of mussel and clam beds.

8. Taking mitigative measures, such as relocating or extending the seafood processing plant outfall line, if the harbor expansion adversely affects water circulation causing processing wastes to enter the harbor or to be washed up on the breakwaters.

9. Having the harbormaster's office increase their efforts to inform port users that they are available to assist in the proper disposal of nets and other debris.

6.0 CONCLUSION

Construction of alternative 2 as discussed in this document, would not cause significant impacts to the environment. The proposed action is consistent with the State of Alaska and KPB Coastal Management Programs to the maximum extent practicable. This assessment supports the conclusion that the proposed project does not constitute a major Federal action significantly affecting the quality of the human environment; therefore, a finding of no significant impact will be prepared.

7.0 AGENCIES AND PERSONS CONTACTED

Richard Albright, Alaska Operations Office, Environmental Protection Agency
Florence Carroll, Environmental Protection Agency, Region 10
Matthew Eagleton, National Marine Fisheries Service
Gary Wheeler, U.S. Fish and Wildlife Service
Gary Prokosch, Alaska Department of Natural Resources, Division of Water
Richard Thompson, Alaska Department of Natural Resources, Division of Land
Maureen McCrea, Office of Management and Budget, Division of Governmental Coordination
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8.0 PREPARER OF THIS DOCUMENT

This environmental assessment was prepared by Mr. William D. Abadie, biologist, of the Environmental Resources Section, Alaska District, Corps of Engineers. Mr. Guy McConnell, biologist, Mr. John Burns, fisheries biologist, and Ms. Diane Walters, writer-editor, contributed to the content and editing of the document. The study manager is Mr. Morgan Ruther, Plan Formulation Section, Alaska District, Corps of Engineers.

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APPENDIX 1

SECTION 404(b)(1) GUIDELINES EVALUATION

Section 404(b)(1) Guidelines for the Specification of Disposal Sites for Dredged or Fill Material 40 CFR Part 230

SUBPART A - GENERAL

Dredged or fill material should not be discharged into the aquatic ecosystem unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact, either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern.

The Guidelines were developed by the Administrator for the Environmental Protection Agency (EPA) in conjunction with the Secretary of the Army acting through the Chief of Engineers under Section 404(b)(1) of the Clean Water Act (33 U.S.C. 1344). The Guidelines are applicable to the specification of disposal sites for discharges of dredged or fill material into waters of the United States (U.S.).

In evaluating whether a particular discharge site may be specified, the following steps should generally be followed: (a) review the restriction on discharge, the measures to minimize adverse impacts, and the required factual determinations; (b) examine practicable alternatives to the proposed discharge; (c) delineate the candidate disposal site; (d) evaluate the various physical and chemical components; (e) identify and evaluate any special or critical characteristics of the candidate disposal site and surrounding areas; (f) review factual determinations to determine whether the information is sufficient to provide the required documentation or to perform pre-testing evaluation; (g) evaluate the material to be discharged to determine the possibility of chemical contamination or physical incompatibility; (h) conduct the appropriate tests if there is a reasonable probability of chemical contamination; (i) identify appropriate and practicable changes in the project plan to minimize the impact; and (j) make and document factual determinations and findings of compliance.

SUBPART B - COMPLIANCE WITH THE GUIDELINES

The proposed navigation improvements at Seward (Eastward Expansion, Alternative 2) would involve discharges of fill material into a special aquatic site and other waters of the U.S. to provide additional moorage space. A description of the proposed action and alternatives considered can be found in section 2 of the attached environmental assessment (EA). There are no practicable alternatives to the proposed discharge (preferred alternative) that would accomplish the project's purpose and need and not result in a discharge into a water of the U.S. or have a less adverse impact on the aquatic ecosystem. Therefore, the proposed action is considered the least damaging practicable alternative.

As determined in Subparts C through G of this evaluation and as discussed in the EA, the proposed project would not contribute to significant degradation of the waters of the U.S., including adverse effects on human health or welfare, life stages of aquatic life and other wildlife dependent on aquatic ecosystems, aquatic ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values. In addition, the discharge of fill materials associated with the proposed action complies with the requirements of the guidelines with the inclusion of appropriate and practicable discharge conditions (see Subpart H below) to minimize pollution and adverse effects to the affected aquatic ecosystems.

SUBPART C - POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Applicable information about direct, indirect, and cumulative environmental impacts of the proposed action and alternatives related to substrate, suspended particulates/turbidity, water, current patterns and water circulation, and normal water fluctuations is contained in sections 3.3 and 4.3 of the EA. Adverse impacts to these characteristics are expected to be relatively minor. Work would result in minor increases in turbidity levels during periods of work, and minor changes to existing current patterns in the immediate project area. No appreciable adverse effects are anticipated to occur.

SUBPART D - POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Pertinent information about direct, indirect, and cumulative impacts of the proposed action and alternatives related to threatened and endangered species, fish, aquatic organisms, and other wildlife is contained in sections 3.4 and 4.3 of the EA. Adverse impacts resulting from the discharge of dredged and/or fill materials are expected to be relatively minor. Construction of the breakwaters, mooring basin, and staging/access areas would have direct impacts on 29 acres of intertidal and shallow subtidal habitat. Adverse effects to threatened and endangered species would not occur.

SUBPART E - POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES

The proposed action would adversely affect minimal amounts of eelgrass. Discussions about impacts on functions and values associated with the proposed work are found in sections 3.4.4 and 4.3.8 of the EA. Eelgrass within the project footprint would be eliminated and would not be expected to become re-established.

SUBPART F - POTENTIAL EFFECTS ON HUMAN USE CHARACTERISTICS

Human use characteristics affected by the proposed project include fisheries, aesthetics, and recreation areas. Pertinent information about potential impacts of the proposed work on human use characteristics can be found in sections 3.1, 3.6, 4.3.10, and 4.3.11 of the EA. The proposed harbor facilities would contribute to the future growth of Seward, although minimally, by providing increased employment opportunities during construction and by accommodating a larger fleet, while having minimal adverse affects on human use characteristics.

SUBPART G - EVALUATION AND TESTING

The potential for encountering hazardous wastes is discussed in section 3.3.6 of the EA. Sediment sample results indicate that the sediment proposed for dredging is not contaminated and is suitable for beneficial use, upland disposal, or open water disposal.

SUBPART H - ACTIONS TO MINIMIZE ADVERSE EFFECTS

The project as proposed, contains all appropriate and practicable mitigation measures to minimize adverse environmental effects. Actions proposed to minimize potential adverse effects for the proposed action are listed below and are discussed in the EA.

- Incorporating methods to filter or settle out silt-laden water when constructing the north and south staging/access areas.

- To the extent practicable, discharging the dredged materials below the water surface.

- Coordinating construction of the harbor with the city of Seward and the Kenai Peninsula Borough to avoid conflicts with subsistence and recreational activities.

- Not dredging the basin and not disposing of the dredged material between April 1 and September 15.

- Not constructing or removing the breakwaters between July 31 and September 15.

- Steepening the slope of the southern staging/access area to a 1V:5H.

- Implementing mitigative measures if the expansion of the harbor affects circulation at the seafood processor's outfall line near the coal trestle in such a manner as to cause processing wastes to enter the harbor or to be washed up on the new breakwaters or adjacent shoreline.

- Using the dredged materials to create a shoal south of the harbor to compensate for the loss of mussel and clam beds.

APPENDIX 2

CORRESPONDENCE

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September 18, 1998

Bill Abadie
U.S. Army Corps of Engineers, Alaska District
P.O. Box 898
Anchorage, Alaska 99506-0898

VIA FAX

Dear Mr. Abadie:

SUBJECT: PROPOSED CONSISTENCY DETERMINATION
Seward Small Boat Harbor Expansion
STATE I.D. NO. AK 9808-02AA

The Division of Governmental Coordination (DGC) is currently coordinating the State's review of your project for consistency with the Alaska Coastal Management Program (ACMP) and has developed this proposed consistency finding based on reviewers' comments.

The project is the expansion of the small boat harbor in Seward, Alaska. Expansion of the small boat harbor would involve removing approximately 1,100 feet of the existing east breakwater. The end of the existing south breakwater would be removed and the existing entrance channel fill in. The new east rubblemound breakwater would be constructed just west of the existing coal trestle. The east breakwater would be approximately 1,700-feet long, require 63,800 cubic yards of material, and have a footprint of about 3.3 acres. Approximately 304,500 CY would be dredged from 17.7 acres for the entrance channel and mooring basin. Approximately 3,500 CY would be placed as fill: 0.8 acres at the north end and 7.1 acres south of the existing south breakwater. Work would have direct impacts on 29 acres of intertidal and shall subtidal habitat. Approximately 104,100 CY of the dredged material would be used to create a 5.15-acre shoal south of the harbor as suitable habitat for invertebrates that would be food for sea otters and ducks.

This proposed consistency determination, developed under 6 AAC 50, applies to the following State and federal authorizations:

Alaska Department of Environmental Conservation (DEC)
Section 401
Certificate of Reasonable Assurance

Based on the review of your project by the Alaska Departments of Environmental Conservation, Fish and Game, and Natural Resources, and the Kenai Peninsula Borough Coastal District, the State concurs with your certification that the project is consistent with the ACMP with the following modifications which will appear as stipulations on the State permit noted:

1. The proposed staging area disposal sites shall be constructed in such a manner as to insure that silt laden disposal water is not discharged into marine waters during the dredge spoils disposal operation. This may necessitate the use of a diking system and silt curtains, to enclose the discharge water until the silts settle.

2. If mechanical dredging is used and the dredge spoils are to be discharged from the barge, the dredge spoils shall be discharged from the barge through a cylinder or similar device which extends 15' downward or within 5' of the ocean bottom, whichever is shorter, and at a 90 degree angle to the water surface, unless the applicant can demonstrate to this department that the state of the fresh water lens, character of the dredged material slurry, slurry discharge rate, and current velocities (wind and tidal), are such that the spoils could be discharged to a higher elevation without adversely effecting water quality. If the dredge spoils are discharged from a grounded barge, methods shall still be used to inhibit siltation of the adjacent marine waters.

3. If a barge is used to discharge dredge spoils, upon reaching the disposal site, the tug pulling the barge shall stop its propellers just prior to, during, and for a few minutes after dredge material discharge, to insure that prop wash does not agitate the slurry while it is in the upper water column.

4. If the mitigation shoal is constructed using hydraulic dredging discharge, the discharge area shall be enclosed within a silt curtain to minimize the spread of silt laden water into adjacent marine waters.

5. The applicant shall insure that the enlargement of the harbor does not effect the circulation at the seafood processors outfall line in such a manner as to cause a building up of processing waste at the end or along the line or cause processing wastes to enter the harbor or wash up onto the new breakwaters or adjacent shoreline.

6. All in-water construction activities related to dredging and disposal of dredged material shall be conducted during the period from September 15 through March 31.

7. All in-water construction activities related to breakwater removal and reconstruction shall be conducted during the period from September 15 through July 31.

Stipulations 1 through 5 are necessary to ensure water quality is not degraded during construction activities and as a consequence of the construction. These stipulations ensure consistency with the statewide standard for Air, Land, and Water Quality (6 AAC 80.140) and district policies for Dredging and Filling (KPBCMP 2.4) and for Disposal of Dredged Material (KPBCMP 2.5). Stipulation 6 is necessary to protect outmigrating salmon smolt and prevent conflicts with sport and commercial fishing within Resurrection Bay and ensures consistency with the statewide standards for Habitats (6 AAC 80.130) and Recreation (6 AAC 80.060) and the district policy for Commercial Fishing (KPBCMP 2.3.a). Stipulation 7 is necessary to prevent conflicts with the coho salmon sport fishery in Resurrection Bay and ensures consistency with the statewide standard for Recreation.

Copies of the relevant ACMP statewide standards and district policies are enclosed.

You must respond within five calendar days of your receipt of this proposed determination to indicate whether or not you concur with this determination. If you are not prepared to concur within the five-day period, you may either:

(a) request an extension of the review schedule, if you need more time to consider this determination, or

(b) request that the State reconsider this determination, by submitting a written statement requesting "elevation" of the determination, describing your concerns, and proposing an alternative consistency determination. This alternative determination must demonstrate how your project is consistent with the referenced standards of the ACMP and district policies <u>without</u> the stipulations included in this proposed determination.

If I do not receive your request for extension or an elevation statement from you, or any other reviewing party with elevation rights as per 6 AAC 50.070(j), within five calendar days of receipt of this letter, this proposed determination will be issued as a final consistency determination.

Other Concerns/Advisories

Please be advised that although the State has found the project consistent with the ACMP, based on your project description and any modifications that appear as stipulations contained herein, you are still required to meet all applicable State and federal laws and regulations. Your consistency determination may include reference to specific laws and regulations, but this in no way precludes your responsibility to comply with other applicable laws and regulations.

If changes to the approved project are proposed prior to or during its siting, construction, or operation, you are required to contact this office immediately to determine if further review and approval of the revised project is necessary. If the actual use differs from the approved use contained in the project description, the State may amend the State approvals listed in this consistency determination.

Should cultural or paleontological resources be discovered as a result of this activity, we request that work which would disturb such resources be stopped, and that the State Historic Preservation Office (269-8720) and the U.S. Army Corps of Engineers (COE) (753-2712) be contacted immediately so that consultation per section 106 of the National Historic Preservation Act may proceed.

This consistency determination does not obligate DNR to issue authorization under AS 38.05, nor does it supersede the statutory obligations thereunder. You may not proceed with any specific land use activity on the subject State lands until authorized by DNR/Division of Land. Authorities outside the ACMP may result in additional permit/lease conditions not contained in the consistency decision.

By copy of this letter we are informing the COE of our proposed determination.

If you have any questions regarding this process, please contact me at 269-7473 or Email maureen_mccrea@gov.state.ak.us.

Sincerely,

Maureen McCrea

Maureen McCrea
Senior Project Review Coordinator

Enclosure

cc: COE Regulatory, Alaska District
Tim Smith, DNR/SHPO, Anchorage
Linda Medeiros, , ACMP Coordinator, DNR, Anchorage
Don McKay, DFG/DHR, Anchorage
Gary Liepitz, DFG/DHR, Soldotna
Tim Rumfelt, DEC, Anchorage
Glenda Landua, KPBCMP Coordinator, KPB, Soldotna
Phil North, EPA, Kenai
Suzanne Fisler, DNR/SP, Soldotna

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

Habitat and Restoration Division

333 Raspberry Road
Anchorage, AK 99518-1599
PHONE: (907) 267-2285
FAX: (907) 267-2464

MEMORANDUM

TO: Maureen McCrea
Project Review Coordinator
Division of Governmental Coordination
Office of Management and Budget

FROM: Stewart Seaberg SJS
Habitat Biologist
Region II

DATE: September 17, 1998

SUBJECT: Seward Harbor Expansion; U.S. Army Corps of Engineers
SID AK9808-02AA

Regarding our recent discussions on the subject proposal, the Alaska Department of Fish and Game (ADF&G) proposes to amend the stipulation recommended in our previous comments. These comments, dated September 10, 1998, recommended that the project be found consistent with the Alaska Coastal Management Program (ACMP) subject to the following stipulation:

1. All inwater construction activities within Resurrection Bay shall be conducted during the period from September 1 through March 31.

After discussing this stipulation with the U.S. Army Corps of Engineers, the ADF&G proposes to modify this stipulation to permit inwater construction activities related to breakwater removal and reconstruction, during the period from September 15 through July 31. It is expected that the breakwater removal and reconstruction will not adversely impact water quality due to the large rock that will be removed and replaced to accomplish this work. However, the ADF&G continues to recommend that inwater construction activities related to dredging, and disposal of dredged material, be conducted within the September 15 through March 31 time period. The ADF&G recommends this proposal be found consistent with the Alaska Coastal Management Program (ACMP) subject to the following stipulations:

1. All inwater construction activities related to dredging and disposal of dredged material shall be conducted during the period from September 15 through March 31.

2. All inwater construction activities related to breakwater removal and reconstruction shall be conducted during the period from September 15 through July 31.

Stipulation 1 is necessary to protect outmigrating salmon smolt and to prevent conflicts with sport and commercial fishing activities within Resurrection Bay in accordance with the Habitats standards (6 AAC 80.130) and the Recreation standards (6 AAC 80.060) of the ACMP. Stipulation 2 is necessary to prevent conflicts with the coho salmon sport fishery in Resurrection Bay in accordance with the Recreation standards (6 AAC 80.060) of the ACMP.

We appreciate the opportunity to comment on this proposal. Please call if you have any questions.

cc: T. Rumfelt, DEC
L. Medeiros, DNR
G. Landua, KPB
B. Stratton, ADF&G
W. Bucher, ADF&G
P. North, EPA
G. Wheeler, FWS
D. Vos, NMFS
W. Abadie, COE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
222 W. 7th Avenue, #43
Anchorage, Alaska 99513-7577

August 19, 1998

Colonel Sheldon L. Jahn
U.S. Army Corps of Engineers
Alaska District
CEPOA-EN-CW-ER (Abadie)
P.O. Box 898
Anchorage, Alaska 99506-0898

Re: Seward, Alaska
Navigation Improvements
Environmental Assessment

ATTN: Mr. William D. Abadie

Dear Mr. Jackson,

The National Marine Fisheries Service has reviewed the above referenced Environmental Assessment and Finding of No Significant Impact (ER 98-26) which includes practicable mitigation measures. We concur with your Preferred Alternative 2 and the mitigation findings of your EA (pages EA-41&42). Therefore, we offer no further recommendations at this time.

Please contact Mr. Matthew P. Eagleton at (907) 271-6354 if there are any questions or additional information is needed.

Sincerely,

for Jeanne L. Hanson
Acting Supervisor
Western Alaska Field Office
Habitat Conservation Division

cc: ADFG, ADEC, ADGC, EPA, USFWS - Anchorage
City of Seward Harbor Master Office (Beckham)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
222 W. 7th Avenue, #43
Anchorage, Alaska 99513-7577

June 26, 1998

Guy McConnell
Chief, Environmental Resources Section
U.S. Army Corps of Engineers
CEPOA-EN-CW-ER
P.O. Box 898
Anchorage, Alaska 99506-0898

Re: Seward Harbor Improvements

ATTN: Mr. William D. Abadie

Dear Mr. McConnell,

Thank you for your letter requesting concurrence on your determination regarding threatened and endangered species under the National Marine Fisheries Service (NMFS) jurisdiction. The NMFS concurs with your finding of no adverse effect will be placed on endangered or threatened marine mammals and offers the following information.

Near shore marine mammals that frequent upper Resurrection Bay include the Stellar sea lion, harbor seal, northern elephant seal, harbor porpoise and Dall's porpoise. Offshore marine mammals that are found primarily in the waters of southern Resurrection Bay include the humpback, grey, killer, minke, and fin whales. Of these marine mammals, the Steller sea lion (waters west of 144 degrees latitude), fin whale, and humpback whale are listed as endangered species. Steller sea lions frequent the area during the peak salmon returns at the "fish ditch". Also, sea lions are known to gather near the cannery outfall. However, the NMFS feels your project will not adversely affect sea lions. Endangered humpback and fin whales mostly occur during the spring to fall months and are rarely observed in the upper bay. Therefore, these whales would not be expected to occur at the project site. No critical habitat for any of these listed species has been identified within your project area.

We hope this information is useful in finalizing your determination. Please contact Mr. Matthew P. Eagleton at (907) 271-6354 if there are any questions or additional information is needed.

Sincerely,

for Jeanne L. Hanson
Acting Field Office Supervisor
Habitat Conservation Division

RECEIVED
JUL 1 199
REGULATORY BRANCH
Alaska District, Corps of

cc: ADFG, ADEC, ADGC, USEPA, USFWS - Anchorage

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services Anchorage
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

IN REPLY REFER TO:

WAES

Mr. Guy R. McConnell
Chief, Environmental Resources Section
Department of the Army
U.S. Army Engineer District, Alaska
P.O. Box 898
Anchorage, AK 99506

June 25, 1998

Re: Seward Boat Harbor Improvements

Dear Mr. McConnel:

This letter is in response to your request for informal consultation pursuant to the Endangered Species Act of 1973 (as amended) regarding proposed harbor improvements in Seward, Alaska. The Service understands that a 17 acre area will be dredged, with dredged material discharged into 0.5 acre and 7.1 acre area at the north and south end of the harbor, respectively. The Service also understands that rock and core material would be discharged to aid in construction of the fill areas and to protect them from erosion. A projected 28 acres of intertidal and shallow subtidal habitat will be affected. As stated in your letter, the threatened Steller's eider (*Polysticta stelleri*) occurs in small numbers in Resurrection Bay during the winter months.

Bald eagles also occur in the area of proposed activity but are not on the list of endangered or threatened species in Alaska. They are, however, protected by the Bald and Golden Eagle Protection Act.

Based on the project description provided, the Service concurs with your agency's assessment that this project is not likely to adversely affect listed species. Preparation of a Biological Assessment or further consultation under Section 7 of the Act regarding this project is not necessary at this time. If project plans change, additional information on listed or proposed species becomes available, or new species are listed that may be affected by the project, consultation should be reinitiated.

This letter relates only to endangered species under our jurisdiction. It does not address species under the jurisdiction of National Marine Fisheries Service, or other legislation or responsibilities under the Fish and Wildlife Coordination Act, Clean Water Act, or National Environmental Policy

Act.

Thank you for your cooperation in meeting our joint responsibilities under the Act. If I can be of further assistance, please contact me at (907) 271-2778.

Sincerely,

Gregory R Balogh

Gregory R. Balogh
Endangered Species Biologist

L:\S7REPLY\SEWHARBR.S7

KENAI PENINSULA BOROUGH
144 N. BINKLEY • SOLDOTNA, ALASKA • 99669-7599
BUSINESS (907) 262-4441 FAX (907)262-1892

MIKE NAVARRE
MAYOR

March 10, 1998

Guy McConnell
Chief, Environmental Resources Section
U.S. Army Corps of Engineers
P.O. Box 898
Anchorage, AK 99506-0898

Dear Mr. McConnell:

Thank you for providing the opportunity to comment on proposed harbor improvements for Resurrection Bay in Seward, Alaska. After briefly reviewing the four alternatives, the Eastward Expansion location appears it would have the least environmental impact.

The Lowell Point, Fourth of July Creek and Nash Road alternatives have the potential to conflict with the commercial and sport fisheries in Resurrection Bay. In addition, salmon smolt migration could be directly impeded with the Nash Road and Fourth of July Creek alternatives. The Nash Road alternative is in a mapped FEMA Coastal Velocity Zone. Although not in an officially mapped floodplain, the Lowell Creek and Fourth of July Creek alternatives are adjacent to streams known for dynamic flood flows.

Again, thank you for the opportunity to comment. The Borough may also submit Coastal Management Program comments as part of a review for this project.

Sincerely,

Mike Navarre

Mike Navarre
Borough Mayor

MN/LMP/rc

cc: Lisa Parker, Planning Director
John Alcantra, Office of Emergency Management
Bob Satin, Mayor, City of Seward
Pat O'Brien, Kenai Peninsula Borough Assembly

CITY OF SEWARD

P.O. BOX 167
SEWARD, ALASKA 99664

• Main Office (907) 224-3331
• Police (907) 224-3338
• Harbor (907) 224-3138
• Fire (907) 224-3445
• Fax (907) 224-3248

February 24, 1998

Guy R. McConnell
Chief, Environmental Resources Section
Department of the Army
U.S. Army Engineer District, Alaska
PO Box 898
Anchorage, AK 99506-0898

Dear Mr. McConnell:

Thank you for the opportunity to make a few comments, regarding the harbor improvement sites in Seward. Increasing moorage space has always been a priority for Seward and recognized as needed by the Corps of Engineers. The possible need for increased moorage was recognized in 1970, and a resolution was adopted by the United States Senate, "with a view to determining whether any modification of the existing project at Seward, Alaska, is advisable at the present time."

From this beginning, a Draft Feasibility Report and Draft Environmental Impact Statement was researched and written by the Corps of Engineers in 1980. This is an excellent research document and includes sites being presently considered. The 1992 Reconnaissance Report and the 1996 Reconnaissance Report for Boat Harbor Improvements only considered the Eastward Expansion and Nash Road. One important observation and conclusion from all of these documents is that the Eastward Expansion consistently received very positive evaluations.

Since the 1980s, the Eastward Expansion has become the most viable Corps/City of Seward project. Lowell Point, Nash Road, and Fourth of July have interesting possibilities; however, as Seward has developed it has become my opinion these sites are more suited for private development as (for lack of a better term) "special use harbors or docks."

Lowell Point

> This proposal is within shallow areas at the mouth of a stream or within an area dredged into the alluvial fan extending into the bay. An artificially dredged mooring basin 1,800 feet in length, 700 feet wide, served by a 200-foot wide -15 feet MLLW entrance and maneuvering channel, all protected by 2, 000 feet of rockfill breakwater, could provide an interim answer to local needs. Property acquisition, parking, utilities, and an access road are requisites for site development.
>
> This site has engineering potential. However, it is 2.5 miles from the townsite, has no utilities, except electricity, and is accessible only over a narrow cliff-roadway. Property at the site is predominantly privately owned and not available for public development except at high cost. A project providing inner harbor facilities for present needs for the recreation fleet only is costed, since commercial craft need access to townsite facilities. The cliff-like shore area approach largely precludes necessary shore development. Consequently, not being in keeping with local needs, it is not considered further.[1]

The Lowell Point site was considered and eliminated in the 1980 Reconnaissance study. The factors which eliminated it in 1980 have not changed since 1980; adequate road access, uplands, and utilities will continue to be major barriers. Attempts by private developers, one located at the southern corner of Lowell Point and one in the Spruce Creek area, all ran into difficulties and were abandoned. Also, this site was not even considered by the Corps during the 1992 and 1996 Reconnaissance Reports.

Fourth of July Creek

> This site lies within shallow areas at the mouth of Fourth of July Creek or within an area dredged into the alluvial fan which extends into the bay.
>
> This site has engineering potential, however, it is on the opposite side of Resurrection Bay (4 miles by water from Seward) and no roadway exists to the area. Access could be developed by reconstruction and upgrading of 8 miles of existing public road, acquisition and construction of two new miles

---

[1] "Draft Feasibility Report And Draft Environmental Impact Statement," US Army, Corps of Engineers, February 29, 1980, p. 22.

of roadway along the cliff face, eventually leading into the Fourth of July Creek valley.[2]

This site was explored in 1980 and eliminated because there was no road access or utilities. Although the road was built to the industrial area, there are still utility costs; the Fourth of July site was not considered in the 1992 and 1996 Reconnaissance Reports. Fourth of July Creek was relocated subsequent to the 1980 report, the old location is now Spring Creek and North Dock. The site is presently on or adjacent to private land. The project would cover Spring Creek which has pink and chum salmon in it. Further, the adjacent private property has active eagles nests.

Nash Road

This site lies within shallow waters at the northeast corner of the bay, approximately 2 miles by water east of the existing harbor and townsite which is shown on Figure 1. Alluvial channels and delta of the Resurrection River bound west limits of the site. To the east, rocky cliffs reach to the waters edge, allowing only room for a four wheel drive trail to an abandoned dock site to the south. Uplands north of the site are privately owned.[3]

This alternative was studied thoroughly before the Corps recommended its construction in 1982. The plan was considered to be economically feasible at that time. The environmental impacts were found to be acceptable, as documented by an Environmental Impact Statement and supplementary Environmental Assessment. Mooring space in the 1982 design exceeds the current documented demand, and the costs exceed achievable NED benefits by today's policies and guidelines. A modification of this design to reduce the harbor size and capacity to match the current demand may prove economically feasible, particularly since there is reason to believe the actual demand exceeds the number of boats on the waiting list.[4]

In 1982 the Corps proposed another harbor on the east side of Resurrection Bay (figure 6), about 10 minutes by road from the city center, after a study of potential Seward harbor improvements.

---

[2] Ibid., p. 22.

[3] Ibid., p. 23.

[4] "Reconnaissance Report for Boat Harbor Improvements," US Army Corp of Engineers, February 1992, pp. 24-25.

> This alternative was studied thoroughly before the Corps recommended its construction in 1982. The plan was considered economically feasible at that time. Mooring space in the 1982 design exceeds the current documented demand, and the costs exceed achievable NED benefits by today's policies and guidelines. A modification of this design to reduce the harbor size and capacity may prove economically feasible.[5]

This site was examined in 1980, 1992, and 1996. Private development was proceeding; however, private property acquisition and sewer and water development halted progress. A future project will encounter the same obstacles. The Agenda Statement (Attachment A-1) and the passage of Resolution No. 94-205 (Attachment A-2) states the obstacles that were encountered with this location.

Eastward Expansion of the Existing Harbor

> This alternative is within the area confined by the present harbor on the west and the Alaska Railroad dredging on the east, extending north-south to take advantage of the existing entrance channel, (i.e., move existing north-south breakwater laterally 550 feet east). For approximate location, see Figure 4.
>
> This area has favorable aspects for harbor expansion comparable to the harbor expansion south.[6]
>
> Expanding the existing boat harbor eastward was considered in the Corps' 1982 Seward harbor study but discarded because of conflicts with a commercial lease of adjacent property. This lease is no longer in effect, and the city-owned land up to the coal trestle is available for harbor expansion, according to city officials.
>
> A modified version of these previous proposals for eastward expansion could accommodate approximately 472 vessels, with vessel size and moorage density about the same as in the existing harbor. The mooring area could be protected from waves by removing the inner 1,300 feet of the existing eastern rubblemound breakwater and building a new 2,200-foot breakwater attached at an angle to the outer portion, as indicated in figure 5.

---

[5] "Reconnaissance Report for Boat Harbor Improvements," US Army Corps of Engineers, July 1996, pp. 16, 27.

[6] February 29, 1980, p. 20.

> This solution satisfies most of the current demand for small boat mooring space and maintains the current concentration of harbor - related development in the northwest corner of Resurrection Bay.[7]
>
> Expanding the existing boat harbor eastward was considered in the Corps' 1982 Seward harbor study but discarded because of conflicts with a commercial lease of adjacent property. This lease is no longer in effect, and the city-owned land up to the coal trestle is available for harbor expansion, according to city officials. The north city waterfront plan discussed in subsection 4.1 includes a second phase that would expand the existing harbor eastward to the coal dock.
>
> A modified version of these previous proposals for eastward expansion could accommodate approximately 472 more vessels than in the existing harbor, with vessel size and moorage density about the same. The new mooring area would be dredged to -15 ft. MLLW, the same depth as most of the existing mooring area. This area would be protected from waves by removing the inner 1,300 feet of the existing eastern rubblemound breakwater and building a new 2,200-foot breakwater attached at an angle to the outer portion, as indicated in figure 5.
>
> This solution satisfies most of the current demand for small boat mooring space and maintains the current concentration of harbor-related development in the northwest corner of Resurrection Bay.[8]

As I've mentioned, since 1980 this site continued to be extremely viable. Although modified, due to the construction of the coal dock, the smaller expansion will show a positive benefit/cost ratio. All road access and utilities are present and uplands are now city owned.

Another positive development that should be considered is the steady growth of Seward's tourist industry. Last year there were 101 cruise ship landings and a rapidly growing day cruise/charter fishing industry. Commercial fishing in Seward continues to grow; a state of the art cannery expansion and a growing fleet of vessels supplying the new operation, demonstrate the need for expansion. Proximity to the existing waterfront and small boat harbor is an important consideration for any harbor expansion. Tourists enjoy walking, sightseeing, and photographing the sites in our harbor and along the waterfront;

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[7] February 1992, pp. 16, 22.

[8] July 1996, pp. 15, 23.

presently, plans for boardwalk expansion are being considered. The Eastward Expansion is the ideal spot to incorporate this growing market. Tourists from the railroad dock's cruise ships, would be able to walk to the day cruise boats, located in the new harbor. The day cruise industry would be able to expand and still maintain present office and ticket booth locations; new, day cruise and charter boats would be able to get a stall and begin operating. The present harbor is so crowded, it is making future growth in this industry practically impossible.

Local support is strong and City Administration is totally committed to this project's completion. This remains the city's largest priority. The Eastward Expansion, is the site with the most positive assessment and most worthy of further Corps of Engineers study.

Sincerely,

CITY OF SEWARD, ALASKA

James B. Beckham
Harbormaster

JBB/rkg
Enc

Ordinance No. 94-54, repealing SCC §7.05.125, approval as to form by city attorney, was introduced and public hearing was set for December 12, 1994;

Ordinance No. 94-55, amending SCC §8.20.010, vehicles for hire, was introduced and public hearing was set for December 12, 1994;

Resolution No. 94-204, appropriating funds from retained earnings for construction of the Nash Road 12.5 KV Distribution Feeder, was approved;

Resolution No. 94-205, terminating the Nash Road Small Boat Harbor Development Agreement, was approved;

Resolution No. 94-206, approving the purchase of materials for construction of exterior floats for the northeast harbor launch ramp, was approved; and

Resolution No. 94-208, approving a settlement agreement between the city and J. W. T. Anderson, was approved.

BOROUGH ASSEMBLY REPORT

Kenai Peninsula Borough Assembly Member Michael Wiley gave a verbal report of the last three assembly meetings. He noted that the assembly was considering sales tax exemptions for air taxi businesses, child care centers and long term leases.

SPECIAL ORDERS AND PUBLIC HEARINGS

Ordinance No. 94-41, amending SCC §15.10.415.D regarding remands of appeals to the board of adjustment that allege new evidence

Carol Giles explained that this would streamline the procedure on appeals by allowing administrative remand of a matter that included new evidence to the Planning and Zoning Commission rather than bringing it before Council as the Board of Adjustment.

Notice of public hearing as posted and published as required by law was noted, and the public hearing was opened. No one appeared in order to be heard, and the public hearing was closed.

MOTION (Sieminski/Deeter) **Enact Ordinance No. 94-41.**

Motion Passed. **Unanimous**

Ordinance No. 94-42, amending SCC §3.15.060, overtime

Attachment A-1

Agenda Statement

Meeting Date: Nov. 28. 1994

From: City Manager Tyler Jones TJ

Agenda Item: Resolution 94-205
Termination of Nash Road Small Boat Harbor Development Agreement

---

BACKGROUND & JUSTIFICATION:
A development agreement for the Nash Road Small Boat Harbor was approved by the City Council Feb. 14. 1994. The agreement authorized Al Schafer and Afognak Logging to pursue development of the long-sought boat harbor with conditions and with commitments from the City of Seward.

As Council knows very well, Mr. Schafer developed his project Master Plan and worked to respond to Council comments on it. The primary obstacle impeding further progress of the project and Mr. Schafer's plan was a requirement in the development agreement that Mr. Schafer obtain written consent from adjacent property holders. The absence of such consent from the adjacent and most significantly impacted property holder causes termination of the agreement under Section 2.4(B).

Council has been willing to be flexible concerning timing requirements. However. since an agreement was not reached by Mr. Schafer and the impacted adjacent property holder. and since both have indicated a reluctance to initiate or pursue further any mutually agreeable resolution(s). formal termination of the Nash Road Boat Harbor DevelopmentAgreement is in order.

The administration worked closely with all parties and their respective consultants to bring the adjacent property holders to a meeting of the minds. We enjoyed considerable community interest and support in this endeavor and we are confident that future Nash Road boat harbor proposals will come forth due in part to the work done recently.

While it is regrettable that the parties were unable to arrive at an accommodation. much has been gained by this exercise. We now have in the public domain a well-reviewed project Master Plan. We have received comments from engineers. architects and planners concerning the plan and we have preliminary engineering information on project utilities.

RECOMMENDATION: Council approval of Resolution 94-205 terminating the Nash Road Small Boat Harbor Development Agreement.

TONY KNOWLES, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF LAND
SOUTHCENTRAL REGION

3601 C STREET, SUITE 1080
ANCHORAGE, ALASKA 99503-5937

February 23, 1998

Guy R. McConnell
Dept. Of the Army
U.S. Corp of Engineers
P.O. Box 898
Anchorage, AK 99506-0898

Re: Seward Harbor Improvements

Dear Mr. McConnell:

Thank you for your recent letter outlining potential harbor expansion assessments at four sites near Seward. The following "site control" comments are offered to assist you and the City of Seward in selecting a workable site.

Expanding the existing harbor by moving the breakwater to the east or constructing a new facility near Nash Road would not require a land use authorization from the State Division of Lands. Both sites are on tide and submerged lands owned and managed by the City of Seward. Presently, the 4th of July Creek site is in state ownership. However, the City has recently applied for ownership of the lands encompassed by the proposed 4th of July Creek project.

The Lowell Point site appears to be located on state owned tide and submerged lands. If so, the City of Seward could apply for either a tideland lease or for conveyance of the tide and submerged lands.

For your information, the Division of Lands received a tideland lease application for a private marina at Lowell Point in the mid 1980's. The applicant withdrew his application after severe rains flooded and inundated the area depositing rocks and gravel across the site proposed for parking and a portion of the adjacent marina basin. It sounds from your plans that you are aware of Spruce Creek and mention plans to relocate it.

Thank you for the opportunity to comment. If you have any questions please feel free to give me a call at 269-8564.

Sincerely,

Kim Kruse

Kim Kruse
Natural Resource Manager

c:sewardhrb.prj

cc: Rick Gifford, Acting City Manager, City of Seward, P.O. Box 167, Seward, AK 99664

TONY KNOWLES, GOVERNOR

DEPARTMENT OF FISH AND GAME

HABITAT AND RESTORATION DIVISION

333 RASPBERRY ROAD
ANCHORAGE, ALASKA 99518-1599
PHONE: (907) 344-0541

February 24, 1998

Mr. William Abadie
U.S. Army Corps of Engineers
Environmental Resources Section
P.O. Box 898
Anchorage, AK 99506-0898

Dear Mr. Abadie:

Re: Comments on Seward Harbor Improvement Alternatives
Resurrection Bay

The Alaska Department of Fish and Game (ADF&G) has reviewed your request for comments on the proposed harbor improvement alternatives for the north end of Resurrection Bay, near Seward. These alternatives consist of constructing a new harbor at one of the following locations: the Lowell Point alternative, at the mouth of Spruce Creek; the Nash Road alternative, in the Northwest corner of Resurrection Bay; and the Fourth of July Creek alternative, adjacent to the mouth of Spring Creek. The eastward expansion of the existing small boat harbor is also being considered. The proposed harbor improvements are to be approximately 13 acres in size and are expected to accommodate approximately 385 vessels.

Resurrection Bay supports important commercial and sport fisheries that may be impacted by the proposed alternatives. Both the sport and commercial fisheries will be directly effected by boat harbor construction at the proposed Lowell Point, Fourth of July Creek, and Nash Road locations. Commercial sockeye fishing activities are presently conducted at both the Fourth of July Creek and the Nash Road harbor locations. The coho salmon sport fishery is dispersed throughout Resurrection Bay early in the season and the majority of the fishing effort shifts to the north end of the bay, including areas near Lowell Point and Fourth of July Creek, as the season progresses.

The Nash Road alternative is proposed in a location that will likely be utilized by salmon smolt outmigrating from the Resurrection River and other salmon streams that flow into the north end of Resurrection Bay. Harbor construction in the Nash Road location would require a single large breach, or several smaller breaches, to allow free movement of juvenile fishes and water into and out of the proposed harbor. All inwater activities related to harbor construction in this area should only be conducted from August 1 through March 31 to protect wild stock and hatchery released salmon smolts in the vicinity of this proposal.

The Lowell Point alternative will not only impact the sport fishing in the area it will be located adjacent to Spruce Creek, a flood prone stream that flows into Resurrection Bay immediately south of the proposed harbor. Although Spruce Creek has not been documented as supporting salmon, the likelihood of continuous maintenance dredging to maintain this channel makes this alternative undesirable.

The Fourth of July Creek alternative may conflict with possible salmon enhancement work that has recently been considered for the mouth of Spring Creek. This enhancement work will likely consist of smolt releases and cost recovery activities within this area. Harbor construction in this area may not be compatible with future enhancement activities.

The eastward expansion of the existing harbor will not interfere with commercial or sport fishing activities but construction activities may impact salmon smolt that inhabit that area. To mitigate the impacts to these resources, breakwater construction, dredging and all other inwater activities should only be conducted from August 1 through March 31 to protect wild stock and hatchery released salmon smolts. The ADF&G considers this proposal to present minimal impacts to the fish and wildlife resources or the existing fisheries within Resurrection Bay.

We appreciate the opportunity to respond to this proposal. Please call me at 267-2285 if you have any questions.

Sincerely,

Stewart Seaberg
Habitat Biologist
Region II

cc: B. Stratton, ADF&G
W. Bucher, ADF&G
J. Durr, DGC
G. Fandrei, CIAA
G. Landua, KPB
R. Satin, City of Seward

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
222 W. 7th Avenue, #43
Anchorage, Alaska 99513-7577
February 20, 1998

Guy R. McConnell, Chief
U.S. Army Engineer District, Alaska
Environmental Resources Section
P.O. Box 898
Anchorage, Alaska 99506-0898

Attn: Mr. Bill Abadie

Dear Mr. McConnell,

The National Marine Fisheries Service (NMFS) offers the following comment for consideration to your feasibility report and Environmental Assessment (EA) for harbor improvements in Seward, Alaska. NMFS has been a partnering agency since the first proposals for an additional small boat harbor were introduced. NMFS feels that the eastward expansion alternative would offer the least impact to the marine resources of the project area. This area has been previously disturbed and would compliment the current small boat harbor. NMFS believes the activity could have an impact on marine mammals, anadromous fishery resources, and marine habitat of the project area.

The marine waters near the site may support returning adult migrations and juvenile life stages of chinook, coho, pink and chum salmon, as well as Dolly Varden. Also, the area may provide habitat for benthic organisms and juvenile forms of crab species. These habitats need to be identified, located, and described in the EA.

The proposed dredging needs to be described in detail within the EA. NMFS assumes this would be accomplished with a dragline or barge mounted clamshell rather than by agitation or suction dredging, which would require special provisions to avoid water quality impacts.

Under Federal statutes, the NMFS, under the Department of Commerce (DOC), has responsibility for managing and protecting all cetaceans and pinnipeds, except walruses. Also the DOC, through NMFS, is responsible for the administration of the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA) as it applies to certain cetaceans and pinnipeds in Alaska. These include seven species of whale: fin, right, humpback, blue, sperm, sei, and bowhead. While these whales would not occur near the project area, humpback whales may be present seasonally within Resurrection Bay. Additionally, Steller sea lions have been sighted in the existing harbor, and are currently listed as an Endangered Species. The protection of these marine mammals will need to be discussed including population densities, frequency, dependance and/or use of habitat, timing restrictions and use of explosives during construction, if applicable. NMFS will coordinate with your section and the U.S. Fish and Wildlife Service regarding these issues.

NMFS hopes this information is useful to you in fulfilling your requirements under Section 7 of the Endangered Species Act. Also, the NMFS is willing to discuss the specifics of your plan and meet with your staff. If there are any questions regarding our comment, please contact Mr. Matthew P. Eagleton at (907) 271-6354.

Sincerely,

Jeanne Hanson
Acting Supervisor
Habitat Conservation Division
Anchorage Field Office

STATE OF ALASKA

TONY KNOWLES, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION
OFFICE OF HISTORY AND ARCHAEOLOGY

3601 C STREET, SUITE 1278
ANCHORAGE, ALASKA 99503-5921
PHONE: (907) 269-8721
FAX: (907) 269-8908

February 17, 1998

File No.: 3130-1R COE

Subject: Seward Harbor Improvements

Guy R. McConnell, Chief
Environmental Resources Section
U.S. Army Engineer District, Alaska
ATTN: CENPA-EN-PL-ER (Abadie)
P.O. Box 898
Anchorage, AK 99506-0898

Dear Mr. McConnell;

Thank you for your letter on the referenced project. The Eastward Expansion alternative involves no landward work. Therefore, we concur with your finding that there are no historic properties in the area of potential effect.

The Lowell Point, Nash Road, and Fourth of July Creek alternatives all have high potential to contain presently undiscovered archaeological sites. We recommend that an archaeological survey take place in the unlikely event that one of these alternatives is chosen.

Please contact Tim Smith at 269-8722 if there are any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner
State Historic Preservation Officer

JEB:tas

APPENDIX 3

U.S. FISH AND WILDLIFE SERVICE COORDINATION ACT REPORT

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services Anchorage
605 West 4th Avenue, Room 62
Anchorage, Alaska 99501

IN REPLY REFER TO:
WAES

JUN 25 1998

Colonel Sheldon L. Jahn
District Engineer, Alaska District
U.S. Army Corps of Engineers
Post Office Box 898
Anchorage, Alaska 99506-0898

Attention: Mr. William Abadie

Re: Final Fish and Wildlife
Coordination Act Report:
Seward Harbor Navigation
Improvements Seward, Alaska

Dear Colonel Jahn:

The enclosed Fish and Wildlife Coordination Act (FWCA) report constitutes the U.S. Fish and Wildlife Service's final report on the U.S. Army Corps of Engineers' (Corps) proposed Seward Harbor Navigation Improvements at Seward, Alaska. The document was prepared in accordance with the fiscal year 1997 and 1998 scope of work and the Fish and Wildlife Coordination Act [PL 85-624 Section 2 (b)]. The contents of this report are provided for equal consideration of fish and wildlife resources with other project purposes as planning proceeds. The document also contains information on threatened and endangered species, pursuant to Section 7 of the Endangered Species Act of 1973, as amended.

Findings herein are based on project information provided by the your staff and a site investigation. A copy of this report will be forwarded to the National Marine Fisheries Service and the Alaska Department of Fish and Game as well.

If you have questions or need more information, please contact project biologist Gary Wheeler at 271-2780.

Sincerely,

Ann G. Rappoport
Field Supervisor

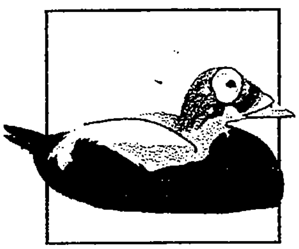
U.S. Fish & Wildlife Service

Ecological Services
Anchorage Field Office

Coordination Act Report WAES-CAR-98-03

Habitat Conservation

Boat Harbor Improvements Seward, Alaska



Endangered Species

by:
Gary P. Wheeler

Environmental Contaminants

June 1998

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INTRODUCTION

This report constitutes the U. S. Fish and Wildlife Service's Fish and Wildlife Coordination Act Report on the U. S. Army Corps of Engineers' (Corps) Boat Harbor Improvements Study at Seward, Alaska. The purpose of this Report is to provide the Corps with planning information to discuss the presence of significant fish and wildlife resources likely to be affected by improvements to the Seward Small Boat Harbor; define the fish and wildlife resource problems and opportunities that should be addressed by the study; define the potentially significant impacts that could result from meeting other study purposes and objectives; and highlight potentially significant fish and wildlife issues or concerns.

This report is prepared in accordance with the Fiscal Year 1997 and 1998 Scope of Work and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended: 16 U.S.C. 661 et seq.). This document constitutes the final report of the Secretary of the Interior as required by Section 2(b) of the Fish and Wildlife Coordination Act.

The following report is based on information provided by Corps' project biologist William Abadie, a review of pertinent literature, an assessment of potential impacts to known fish and wildlife resources, and site evaluations on August 19-20, 1997, and March 5 and March 30, 1998.

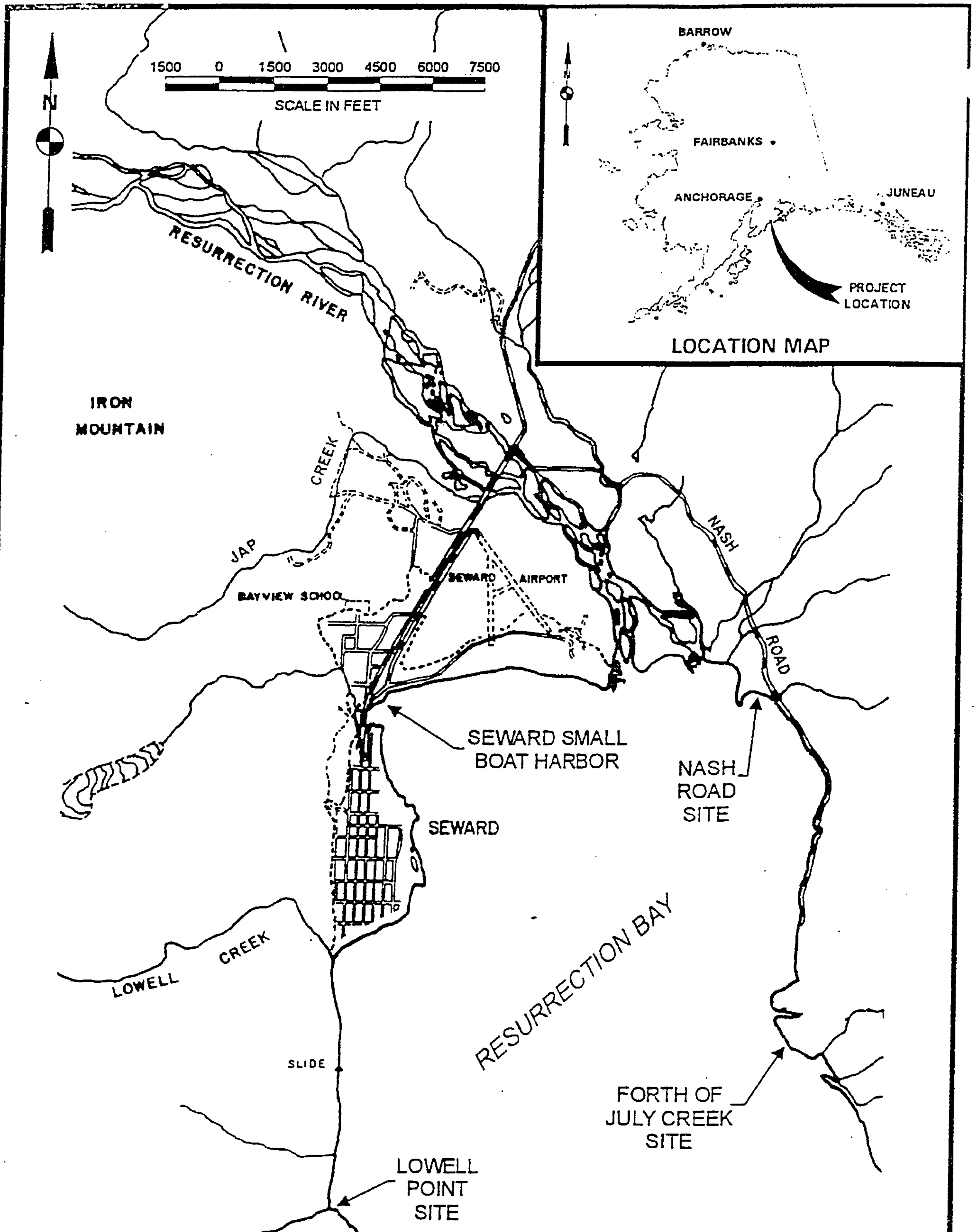
STUDY AREA

The Seward Boat Harbor is located in the northwest corner of Resurrection Bay, approximately 125 miles south of Anchorage, Alaska (Figure EA-1). Resurrection Bay is a typical U-shaped fiord, 20 miles long and 3 to 5 miles wide, with a maximum recorded depth of 978 feet near Thumb Cove, 8 miles south of Seward.

The original boat harbor was constructed in the 1930s and was destroyed in the March 1964 earthquake. The current harbor was constructed in 1964-65. In moving the harbor north of the high risk earthquake area, nearly 50 percent of a nearby brackish water lagoon was filled to provide fast land for shoreside facilities. The lagoon historically provided habitat for more than 600 coho salmon and several hundred pink and sockeye salmon (Rietze 1964). The lagoon is still utilized by salmon, but only that portion west of the Seward Highway remains. The outlet of the lagoon was diverted through a ditch and enters the Bay south of the harbor.

The current harbor provides moorage space for about 640 vessels and consists of a 1060-foot south breakwater, a 1750-foot east breakwater, and a 26.3-acre mooring basin (Figure EA-2). A controlling depth of -14.0 feet MLLW was recorded in the outer portion of the entrance channel (USACE 1997).

East of the harbor is a coal dock with a conveyor belt system to load coal onto freighters. The coal dock consists of a 1730-foot trestle, a ship loader platform, fender dolphins, and a mooring basin at -58 feet MLLW. East of the coal dock is the Alaska Railroad Corporation dock. The

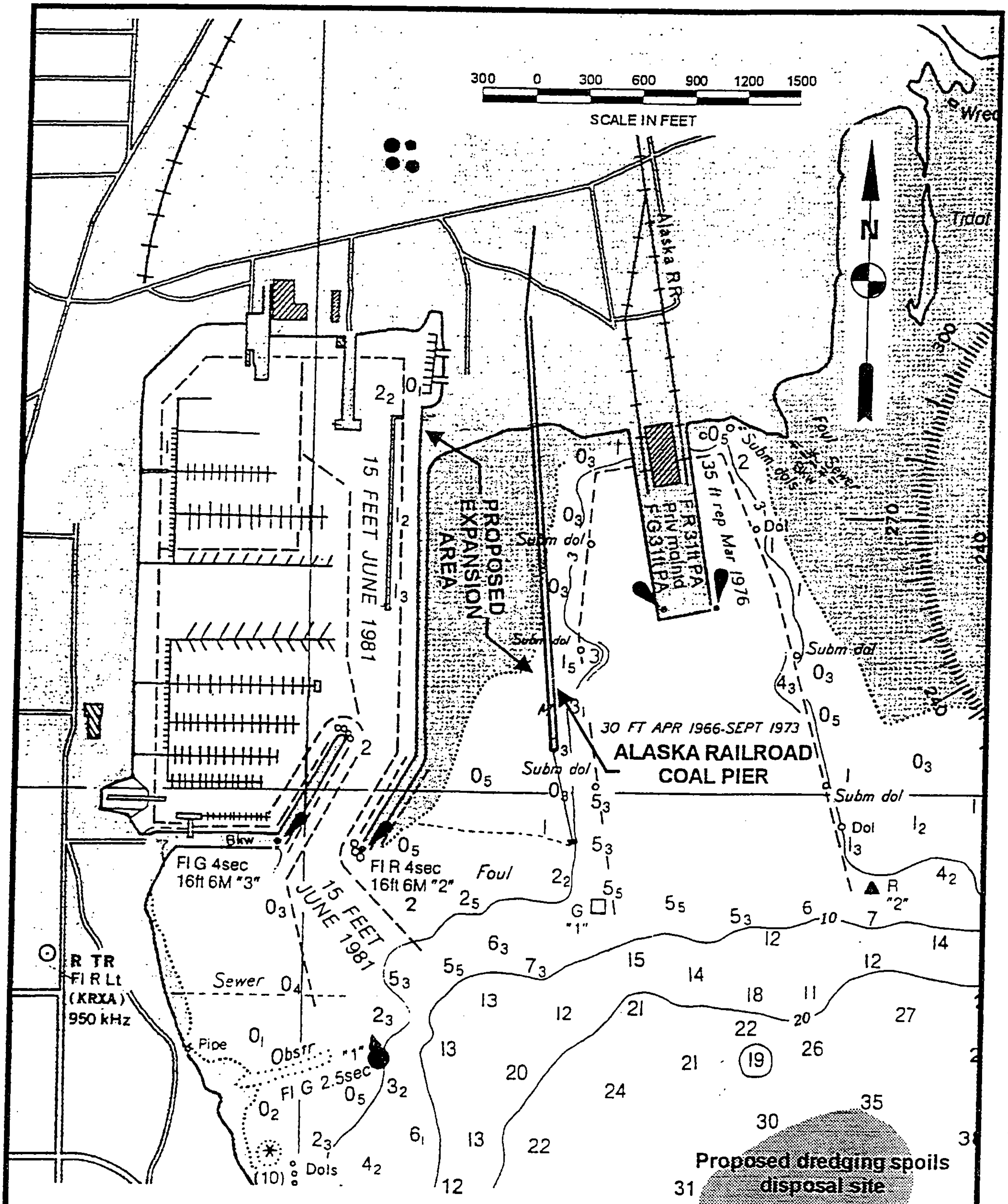


ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

LOCATION & VICINITY MAP

SEWARD HARBOR IMPROVEMENTS

EA-1



NOTE: Soundings are in fathoms.

ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	**EXISTING HARBOR** SEWARD HARBOR IMPROVEMENTS	**EA-2**

dock consists of a 200-foot by 735-foot concrete deck on a steel piling finger pier with a warehouse/office building on the north end. The dock serves fish processors, fishing vessels, Coast Guard ships, Alaska State ferries, and cruise ships (USACE 1996).

FISH AND WILDLIFE RESOURCES

Marine Resources

The intertidal and subtidal zone of the area supports a wide variety of invertebrates and algaes. Mussels beds are common in the intertidal area surrounding the existing harbor. Scattered patches of eelgrass can be found throughout the area. Rockweed, barnacles and limpets can be found on rocks in the intertidal area. Polychaete worms and various types of mussels inhabit silty/muddy substrates.

Resurrection Bay supports important commercial and sport fisheries (Alaska Department of Fish and Game 1998a). The bay and area streams support five species of Pacific salmon - coho, chum, chinook, pink and sockeye. In the fall, large numbers of coho salmon can be found in northern Resurrection Bay, especially along the shoreline between Lowell Point and the existing boat harbor. Pacific hearing spawn in the intertidal and subtidal waters of northern Resurrection Bay in the spring.

ADF&G stocks the waters of Resurrection Bay with both coho and chinook salmon. The saltwater smolt release of chinook and coho salmon generally begins in the third week of May and continues through the middle of June. Resurrection River juvenile salmon out-migration generally begins in early April for pink and chum salmon and continues through mid July for chinook and coho salmon. The juvenile wild stocks and hatchery salmon utilize the estuarine and near shore areas of Resurrection Bay from April through July. These juvenile salmon are susceptible to disturbance during this critical time (Alaska Division of Governmental Coordination 1994).

Sport fisherman harvest thousands of coho salmon every summer; about 67,000 were harvested in Resurrection Bay in 1996. The largest number of anglers are present during the annual Seward Silver Salmon Tournament, which is held in early August. During the Tournament, which typically lasts about a week, about half of the bay's annual coho catch is harvested (ADF&G 1998b). Adult coho return to Resurrection Bay streams from July into October.

Chinook salmon utilize area streams including Box Canyon, Jap Creek, and Resurrection River. The early run of chinooks return to Lowell Creek and Seward Lagoon areas from late May through June and peak around June 10. The late run of chinook return in late July through August. Bear Lake and Grouse Lake have been stocked with sockeye salmon smolts. Sockeye return to Bear Lake in early June, and continue through mid-July. Sockeyes also return to Dairy, Railroad, Pasture and Grouse Creeks in mid-July and continue through mid-August. The culverts that drain Seward Lagoon and Rudolph Creek have seen a small but growing fishery for sockeye in June (ADF&G 1998b).

The offshore waters of the area support a variety of marine fish resources. Twenty-one fish species were collected by beach seining in northern Resurrection Bay during 1986-87. Of the species collected, the most numerous were herring, sand lance, starry flounder, sockeye salmon smolts, and eulachon (Faurot et al. 1989).

Dominant fish species encountered by weight from the National Marine Fisheries Service 1996 triennial bottom trawl survey from the Gulf of Alaska near Resurrection Bay were arrowtooth flounder, walleye pollock, skates, sharks, flathead and Dover sole, Pacific halibut and rockfish (NMFS 1997).

The most common marine mammals in the Seward/Resurrection Bay area are sea otter, harbor seal, and Steller sea lion. More infrequently observed species include harbor porpoise, Dall porpoise, killer whales, humpback whales, minke whales, gray whales and fin whales.

Eastward Expansion Area

A site visit was conducted on August 19, 1997, at a -2.9 foot MLLW low tide. Observations were made to characterize the area. The intertidal area could be divided into several zones based upon the elevation of the area.

The uppermost, northern portion of the site was composed of a steep unvegetated gravel beach. Productivity in this area appeared to be low.

Moving seaward, the next zone extended about 43 yards seaward from the base of the steep gravel beach. This area was gently sloping with a gravel substrate with some fines interspersed. This zone was mostly unvegetated with sparse patches of rockweed and some thatched barnacles, *Semibalanus cariosus*, on the gravel and an occasional amphipod.

The next zone extended seaward about 70 yards. Its substrate was composed of about 2 inches of fine silt over gravel. There were sparse patches of rockweed on the larger rocks and a moderate number of blue mussels, *Mytilus edulis*. Benthic samples were randomly taken in this area, and the Baltic macoma clam, *Macoma balthica,* was found to be present at a mean density of 677 individuals per m^2 (n=3). This area encompasses about 2 acres.

The next zone extended seaward about 100 yards. Its substrate was again fine silt over gravel. This zone supported a dense blue mussel bed. There were also small, widely scattered patches of eelgrass and some shells of Nuttall's cockle, *Clinocardium nuttalli*, present in this zone. Benthic sampling revealed a mean of 1714 blue mussels and 1895 Baltic macoma per m^2 (n=3) in this zone. This area covers about 2.8 acres.

The last zone sampled extended 56 yards to the water's edge. This area was characterized by about 2 inches of very soft silts covering a gravelly substrate. There were many small (0.25-0.5 inch) blue mussels attached to exposed gravel. Benthic infauna was not sampled in this area, but based upon the similarity of the soft bottom habitat with adjacent areas, we would expect that Baltic macoma clams would be abundant in this area as well. This area covered about 1.5 acres.

The rock face of the eastern harbor breakwater was densely covered with thatched barnacles and blue mussels. There was also an abundant growth of rockweed on the breakwater. As rocks low in the intertidal area were turned over, an anoxic odor was released. We assume this is the result of the abundance of organic matter in the area being discharged by the seafood processing outfall line located near the coal terminal.

Birds present at the site at high tide included 20 northwestern crows, 150 herring gulls, and about 500 black-legged kittiwakes feeding at the seafood processing outfall line.

On March 5, 1998, cursory observations of wildlife utilizing the eastward expansion area were made. A total of 10 common goldeneyes and 7 buffleheads were observed feeding in the area. On March 30, 1998, 75 common mergansers, 11 common goldeneye, 5 buffleheads, and 52 northwestern crows were observed in the area. In addition, one sea otter and one harbor seal were observed. The mergansers, goldeneyes, and buffleheads were actively diving and feeding.

On March 30, 1998, observations were also made of the area proposed for fill south of the existing harbor. Wildlife observed in or near the existing harbor entrance channel included 11 murres, 5 mallards, 3 sea otters, and 4 harbor seals.

The substrate south of the harbor is comprised of gravels in the higher intertidal areas and a mixture of silts, gravels, and cobbles in the lower areas. There are sparse patches of eelgrass in the lower intertidal zone. There are two blue mussel beds totaling about 0.36 acres between the south harbor breakwater and Rudolf Creek which runs from Seward Lagoon to the Bay. Sea otter digs were present in this area and the sunflower star, *Pycnopodia helianthoides,* was observed in one of the mussel beds.

<u>Nash Road Site</u>

The Nash Road site comprises a complex of habitat types. Descending from the beach wrack line, there is a steep cobble beach that extends for about 30 feet. There is a sparse amount of rockweed in this area.

Seaward is a cobble and large gravel zone that extends for about 115 feet. The slope is gentle and there are sparse amounts of rockweed and some Link confetti, *Enteromorpha intestinalis,* in the area. There are also sparse numbers of thatched barnacle and some amphipods.

The next zone, extending for about 150 feet is dominated by gravel with some cobbles and fines. Rockweed is abundant, link confetti is abundant in areas of flowing water (presumed fresh water from a nearby unnamed stream or from springs), and there is an occasional sea sack, *Halosaccion* *glandiforme.* Amphipods were relatively abundant in this zone; a mean of 1,531 individuals per m^2 were collected (n=3). Thatched barnacles and Baltic macoma clams were common, and some blue mussels were present.

A tidal/creek channel about 30 feet wide with flowing water approximately 2 inches deep was present. The bottom was comprised of a thin layer of silt overlaying gravel. Link confetti was common, clam siphon or marine worm holes were occasional, and a sculpin was seen. Low numbers of Baltic macoma clams were present in the substrate.

Sand/mud bars extend for hundreds of feet seaward. These bars are interspersed and interlaced with creek/tidal channels. Link confetti is common on the bars. There are numerous sea otter digs present. Baltic macoma clams are abundant, a mean of 3017 per m^2 were observed. Small cockle shells were found and clam or marine worm siphon holes are fairly numerous.

Adult pink and chum salmon were observed in the unnamed creek near the site. Bald eagles were common, 24 were observed perched on the mud flats. Herring gulls were also common on the mudflats and in the unnamed creek. Other birds observed at the site included least sandpiper, solitary sandpiper, double-crested cormorant, white-winged crossbills, magpie, pine siskin, and savannah sparrow. A harbor seal was also observed near the unnamed creek.

Fourth of July Creek Site (Mouth of Spring Creek)

The gravel beach berm forms a lagoon at the mouth of Spring Creek. This lagoon supports a rather extensive wetland in the area. A bald eagle nest in a cottonwood tree is adjacent to this wetland.

The beach is a fairly steep gravel beach. Sparse algal vegetation such as crisp color changer, *Desmarestia aculeata*, and sea girdle, *Laminaria platymeris*, was present. A sparse number of amphipods were observed. A single fish, a silverspotted sculpin, *Blepsias cirrhosus*, was taken during a total of three beach seine hauls. Birds observed at the site included double crested cormorant, marbled murrelet, and herring gull in the marine environment and magpie, belted kingfisher, bald eagle, green-winged teal, white-winged crossbill, orange-crowned warbler, fox sparrow, and savannah sparrow associated with the wetlands and uplands area.

Lowell Point Site

Several zones characterized by different substrates and biotic communities were identified at Lowell Point. The upper zone extended for about 90 feet from the beach wrack line. The substrate was large gravel. There were sparse clumps of rockweed and a sparse number of thatched barnacles in this area. No invertebrates were observed in three benthic samples.

Seaward was a zone extending about 48 feet with a substrate of smaller gravels averaging about 1.5 inches in diameter. Rockweed was moderately abundant. Blue mussels were present at a mean density of 810 individuals per m^2 and amphipods were also observed.

The next zone, extending for about 30 feet, was a gravel area supporting a dense population of rockweed and blue mussels. The blue mussel population averaged 5270 individuals per m^2.

The last zone sampled extended about 39 feet to the water's edge. The substrate was mostly cobble. This zone also supported an abundance of rockweed and blue mussels. The algae *Ulva* sp. was common in this zone. Blue mussels averaged 3698 individuals per m^2. The clam worm, *Nereis virens,* and Vosnesenky's isopod, *Idotea Wosnesenskii,* were common in this area, and also observed was the mask limpet, *Notoacmaea persona.*

Endangered, Threatened, and Candidate Species

The project is within the historic range of the Steller sea lion (endangered), Steller's eider (threatened), humpback whale (endangered), and American peregrine falcon (endangered).

The Alaska breeding population of Steller's eiders was listed as a threatened species on July 11, 1997. There has been no designation of critical habitat for this species. Steller's eiders are sea ducks that spend the majority of the year in shallow, near-shore marine waters where they feed on mollusks, polychaete worms, and crustaceans. Nesting occurs adjacent to shallow ponds or within drained lake basins. The breeding distribution encompasses the arctic coastal regions of northern Alaska and parts of eastern Russia. Most of the world's population of Steller's eiders winters along the Alaska Peninsula from the eastern Aleutian Islands to southern Cook Inlet (Federal Register 1997). Steller's eiders occur in small numbers in Resurrection Bay near Seward during the winter (October to April). As many as 11 birds have been counted in Seward each year during the Audubon Christmas bird counts in 1988, 1991, 1992, 1993, 1994 and 1995.

Endangered American peregrine falcons, *Falco peregrinus anatum*, may be present in the project vicinity during migration; however, their occurrence in the area is probably irregular and transitory.

Steller sea lion (northern) was upgraded to endangered status in April 1997 due to recent declines in populations in the western Gulf of Alaska. The 1997 population in the area from Prince William Sound to the Aleutian Islands was estimated to be around 44,300. Recent declines are believed to be primarily the result of juvenile mortality. Steller sea lions frequent the area near the mouth of Scheffiler Creek during the peak of the salmon run. They are also known to gather near the cannery outfall. The northern sea lion is distinctive in its use of a few specific locations along the coast as rookeries and haulouts. There are no haulouts or rookeries in the north end of Resurrection Bay. The nearest mapped rookeries are near the mouth of Resurrection Bay, about 10 miles south of the proposed project.

Humpback whales are occasionally present in Resurrection Bay. During the summer, they inhabit coastal waters from southern California through the Gulf of Alaska to the Southern Chukchi Sea. In Alaska, they feed primarily on krill and small fish. Populations are estimated to be between 1000 and 1200 (ADF&G 1996).

SIGNIFICANT RESOURCES LIKELY TO BE AFFECTED BY THE PROJECT

The most significant impacts of this project will likely occur to benthic invertebrates and the fish and wildlife resources that prey upon them. An estimated 17 acres would be dredged for the new harbor entrance channel and mooring basins and an estimated 10.8 acres would be filled for the new breakwater and new access/staging areas. The eastward expansion area supports a dense population of blue mussels and Baltic macoma clams which provide food resources for sea otters and sea ducks such as goldeneyes and buffleheads. The harbor expansion project would eliminate most of their shallow feeding area in the vicinity of the harbor and would force them to forage elsewhere. If other areas are already at carrying capacity, that is, supporting the maximum number of animals that the prey base can sustain over the long term, then it would result in a reduction in the sea otter and sea duck populations.

FUTURE RESOURCE CONDITIONS WITHOUT THE PROJECT

Without the project, we would expect resource conditions to remain largely as they are today until another harbor project is proposed. The Seward Sea Life Center has recently opened, and it is likely to draw more visitors to Seward or it may encourage visitors to stay longer in Seward. Many of these visitors will take wildlife cruises or fishing charters from the Seward Harbor. As a result, there will likely be an increasing demand for excursion vessels and charter fishing vessels. However, without another harbor expansion proposal, we are unaware of any proposals to develop the areas proposed by this project. Consequently, the habitat is likely to remain in its current condition for the most part.

RESOURCE PROBLEMS, OPPORTUNITIES, AND PLANNING OBJECTIVES

Problems: Construction of the harbor expansion would present the potential problem of introducing increased levels of petroleum hydrocarbons into the marine ecosystem through an increased number of vessels and increased opportunities for fuel spills. Increased numbers of visitors and tour boat operations could result in disturbance to those species that are sensitive to the presence of humans. However, adherence to viewing guidelines published by the National Marine Fisheries Service could mitigate the potential for additional disturbance.

Opportunities: There may be opportunities to enhance visitor enjoyment of fish and wildlife with this project. More visitors to Seward would be taking wildlife cruises and charter fishing excursions. This would enhance their appreciation of the fish and wildlife of Alaska and Resurrection Bay in particular. We also propose that an underwater shoal be constructed south of the boat harbor. This would provide a sheltered area for juvenile salmon acclimation to marine waters, and good habitat for sea duck and sea otter feeding.

Planning Objective: Our planning objective for this project is to conserve the habitat values associated with the Resurrection Bay marine ecosystem and the fish and wildlife that are a part of the ecosystem. Specifically, for this project, our mitigation goal is no net loss of habitat value while minimizing loss of in-kind habitat value.

DESCRIPTION OF PROJECT

The purpose of the proposed action is to provide additional moorage space for vessels in Seward, Alaska. The Seward Harbor is used heavily by recreational and charter vessels. The harbor is also used by commercial fishing vessels to obtain provisions, for crew rotations, for moorage during closed fishing periods, and for protection during adverse weather conditions.

The demand for moorage greatly exceeds availability for much of the year. Excess demand for harbor services and facilities, especially for transient vessels occurs during peak fishing periods. Overcrowded harbors increase the likelihood of vessel damage, personal injury, and fire; and commercial enterprises that depend on harbor facilities and services experience inefficiencies. An analysis of existing and projected moorage demand determined a need for additional moorage space for 465 vessels, 339 seeking permanent stalls and 126 seeking transient space.

PROJECT ALTERNATIVES

No-Action Alternative

The no-action alternative would leave the site in its present condition. The identified purpose and need would not be met. The harbor would continue to be used beyond its designed capacity. Damage to vessels and docking facilities from overcrowding would continue; economic benefits to the fleet from improved and expanded harbor facilities would not be achieved; and vessels unable to secure moorage in the existing harbor would continue seeking refuge at other ports.

Alternative Sites Eliminated From Further Study

Alternatives considered to fulfill the project purpose and need included constructing another harbor at Lowell Point, Nash Road, or Spring Creek. These alternatives were rejected as being impracticable, having a benefit-cost ratio less than one, not fulfilling the project purpose and need, and/or having unacceptable environmental impacts.

Lowell Point

Lowell Point, about 2.5 miles south of the existing harbor, is at the mouth of Spruce Creek on the west shore of Resurrection Bay as shown in figure EA-1. The harbor would be constructed in the alluvial fan of the creek where it empties into Resurrection Bay. Due to the shallow water at the site, over 400,000 yd^3 of material would need to be dredged and subsequently disposed of for a harbor that could accommodate the design fleet. This alternative was rejected because of (1) excessive amount of dredging required; (2) lack of existing utilities except electricity; (3) the need for widening and upgrading the existing roadway to accommodate increased traffic flows; (4) property acquisition concerns; and (5) environmental concerns with relocating and channelizing the mouth of Spruce Creek. The site was considered and rejected for development in the Corps' 1980 Draft Feasibility Report and Draft Environmental Impact Statement (USACE 1980).

Nash Road

The Nash Road site is approximately 4 miles by road east of the existing harbor in the northeast corner of Resurrection Bay (figure EA-1). Several studies have investigated the feasibility and environmental effects of constructing a harbor at this location (USACE 1982 and 1983). In these studies, the harbor was designed to accommodate over 1000 boats with a basin area of over 30 acres. A smaller harbor could be built at this location with a basin area that would accommodate the current design fleet. This site was also studied by the City of Seward with private developers in 1992. However, written consent from adjacent property owners could never be obtained. The city terminated its agreement with the developers in 1994 (see letter from the City of Seward dated February 24, 1998, Appendix 2). Land acquisition problems and environmental concerns eliminated this site from further consideration.

Fourth of July Creek

Fourth of July Creek site is on the east side of Resurrection Bay, approximately 9 road miles from the existing harbor (figure EA-1). The harbor would actually be sited at the mouth of Spring Creek, just north of the Seward Marine Industrial Center. The SMIC was constructed in the early 1980's to serve as an industrial center and shipyard for commercial and fishing vessels. Facilities at the SMIC include several large deep-draft docks and a Syncrolift facility. The site was rejected primarily because of the presence of a bald eagle nest tree, the need for filling wetlands, and the need for re-locating Spring Creek which supports anadromous fish. Furthermore, there is a lack of consensus from the community on locating a small boat harbor on the east shore of Resurrection Bay, far removed from the main part of town.

Preferred Site (Eastward Expansion of Existing Harbor)

The preferred site is to expand the existing harbor (Figure EA-2). A number of alternative designs were considered that would entail the expansion of the existing harbor. Preliminary alternatives were narrowed down to four designs. Alternative 2, as discussed below is the preferred alternative. The eastward expansion site best satisfied site selection objectives. The Federal portion of the project would include removal and construction of the breakwater, and construction of a basin and maneuvering area. Construction and installation of inner harbor facilities would be the responsibility of the City of Seward, the local sponsor. Inner harbor facilities would initially consist of finger floats and walkways.

Alternative 1

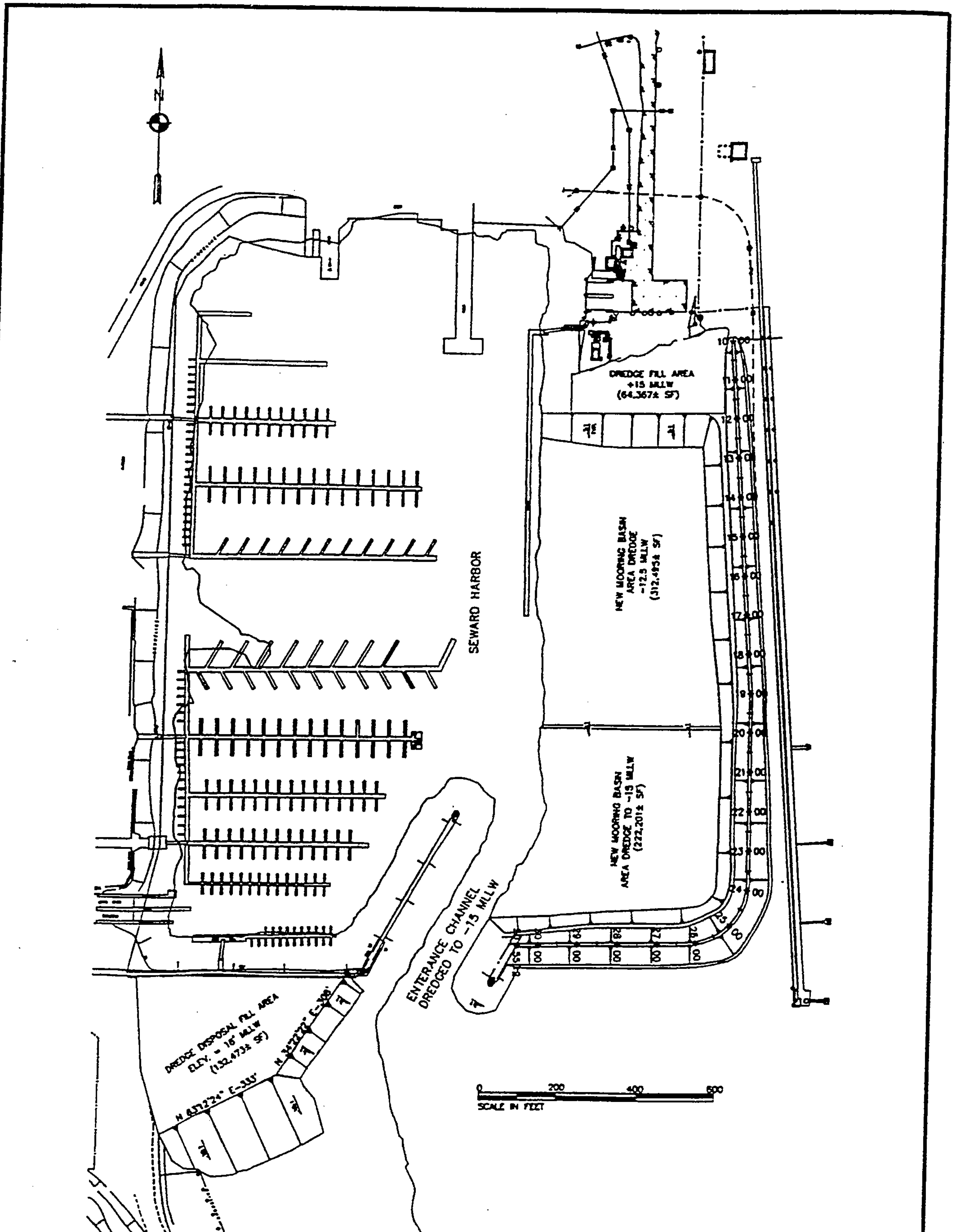
With alternative 1 the harbor would be expanded by relocating the eastern breakwater about 450 feet to the east (Figure EA-3). This would provide an additional 10 acres of basin and maneuvering area. Approximately 1470 feet of the existing east breakwater would be removed (32,000 yd^3). The last 100 feet or so of the breakwater would remain in place and be incorporated into the new relocated breakwater. The new breakwater (rubble-mound) would be about 2055 feet long and would be constructed southward from the shoreline parallel to the existing coal trestle and then would change to an east-west alignment near the end of the coal trestle. Approximately 80,000 yd^3 of armor rock, secondary rock and core material would need to be discharged for its construction. Armor stone and core material removed from the original breakwater would most likely be re-used. The new breakwater would have a footprint of about 4.2 acres and would be constructed with a 1 vertical:1.5 horizontal slope (V:H). The eastward toe of the breakwater would maintain a minimum distance of 30 feet from the coal trestle.

Approximately 250,000 yd^3 would be dredged from about 14.7 acres to construct the expanded mooring basin and maneuvering area. It would be dredged to a depth ranging from –12.5 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods would most likely be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.

Approximately 80,000 yd^3 of the dredged material would be discharged in two separate intertidal/subtidal areas adjacent to the harbor. An additional 5,500 yd^3 of armor rock and core material would be discharged to aid in construction of the fill areas (berms) and to protect the areas from erosion. One fill area would be at the north end of the harbor with a footprint of about 1.8 acres. The other would be south of the existing south breakwater with a 4.9 acre footprint. The two fill areas would provide approximately 4 acres of useable area, the minimum necessary to accommodate the anticipated demand.

Staging/access areas are an integral part of the harbor design and should be located as close to the harbor as possible to be efficiently utilized. Most of the land surrounding the harbor is currently developed or is owned by the Alaska Railroad Corporation. Existing staging/access/parking areas near the harbor are highly congested during peak periods. Use of the land to the northeast of the harbor is limited since it is owned and used by the railroad. The city does own some of the land north and southeast of the harbor. Use of these areas does not satisfy current demand during peak periods. The proposed intertidal/subtidal fill areas would expand existing staging/access areas and would help alleviate existing and anticipated congestion. Additional upland areas near the harbor that could be used for staging/access areas do not exist.

The remainder of the dredged material would be stockpiled at an upland site near the existing harbor for local fill projects and/or disposed of in inland waters approximately 1500 feet south of the harbor in water depths greater than 30 fathoms (180 feet). The inland water disposal site, as shown in figure EA-2, has been used by the Alaska Railroad Corporation (See Corps of Engineers, Regulatory Branch file number R-6500034, Resurrection Bay 26).



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ALTERNATIVE 1
SEWARD HARBOR IMPROVEMENTS

EA-3

Alternative 2 (Preferred Alternative)

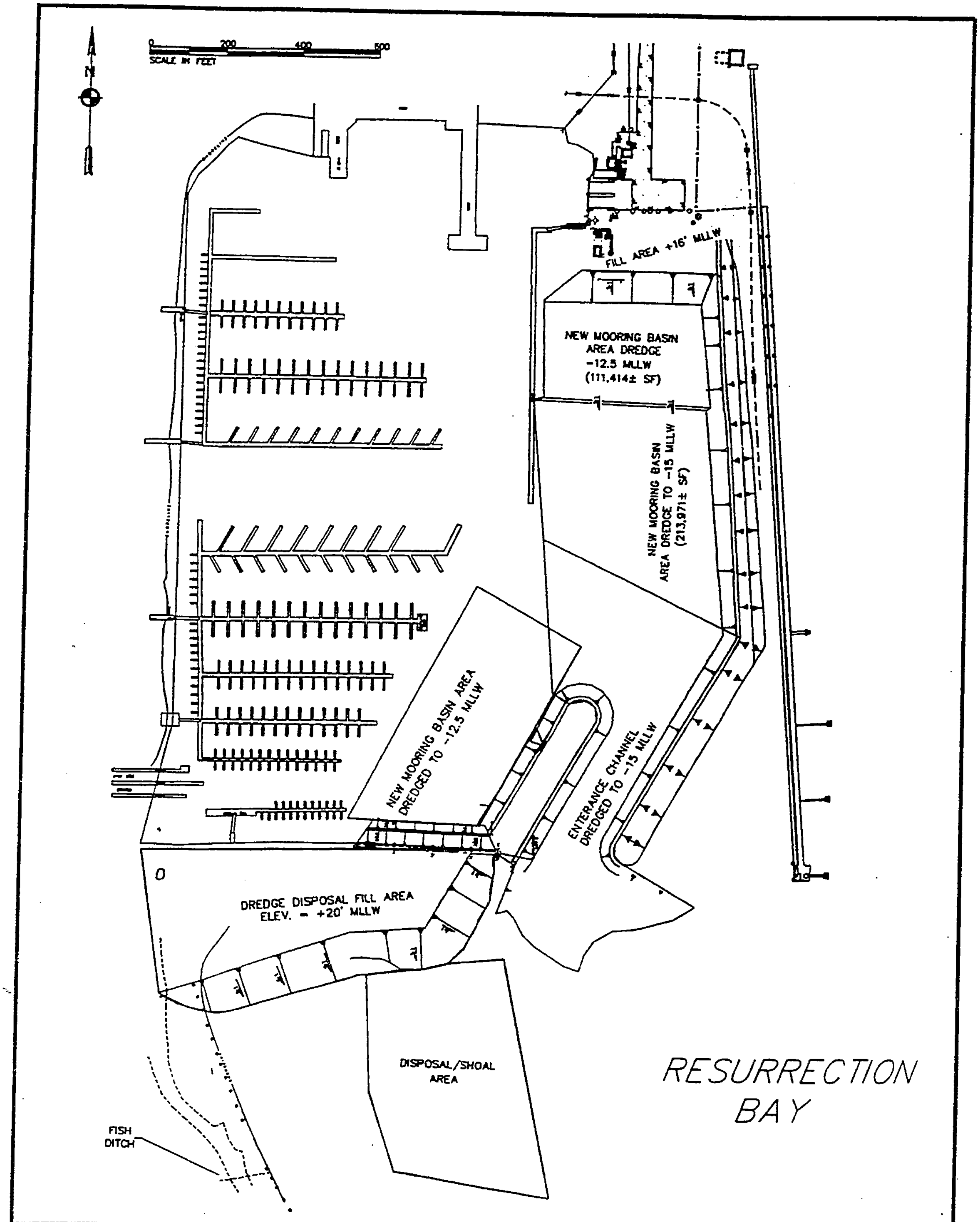
Alternative 2 is similar to alternative 1; however, the entrance channel would be relocated to the east and the southern staging/access area would be larger (Figure EA-4). An additional 11.7 acres of basin and maneuvering area would be created with this alternative. The harbor would be expanded by removing about 1100 feet of the existing east breakwater and constructing a new breakwater about 450 feet to the east. The last 470 feet or so of the east breakwater would not be removed and would be incorporated into the south breakwater. The end of the existing south breakwater that now forms the west side of the entrance channel (about 475 linear feet) would be removed and the existing entrance channel would be filled in. A total of 1,575 feet of breakwater would be removed (about 36,000 yd^3). The new east breakwater (rubble-mound) would be about 1,700 feet long and primarily be constructed in a north/south alignment. Approximately 64,000 yd^3 of armor rock, secondary rock and core material would be discharged to construct the new east breakwater, which would have a footprint of about 3.3 acres. Materials from the existing breakwaters would be re-used where possible. The new breakwater would be constructed with a 1 V:1.5 H slope.

Approximately 295,000 yd^3 would be dredged from 17 acres to construct the entrance channel and expanded mooring basin and maneuvering area. It would be dredged to a depth ranging from −12.5 feet MLLW to −15 feet MLLW. A combination of both hydraulic and mechanical dredging methods would most likely be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.

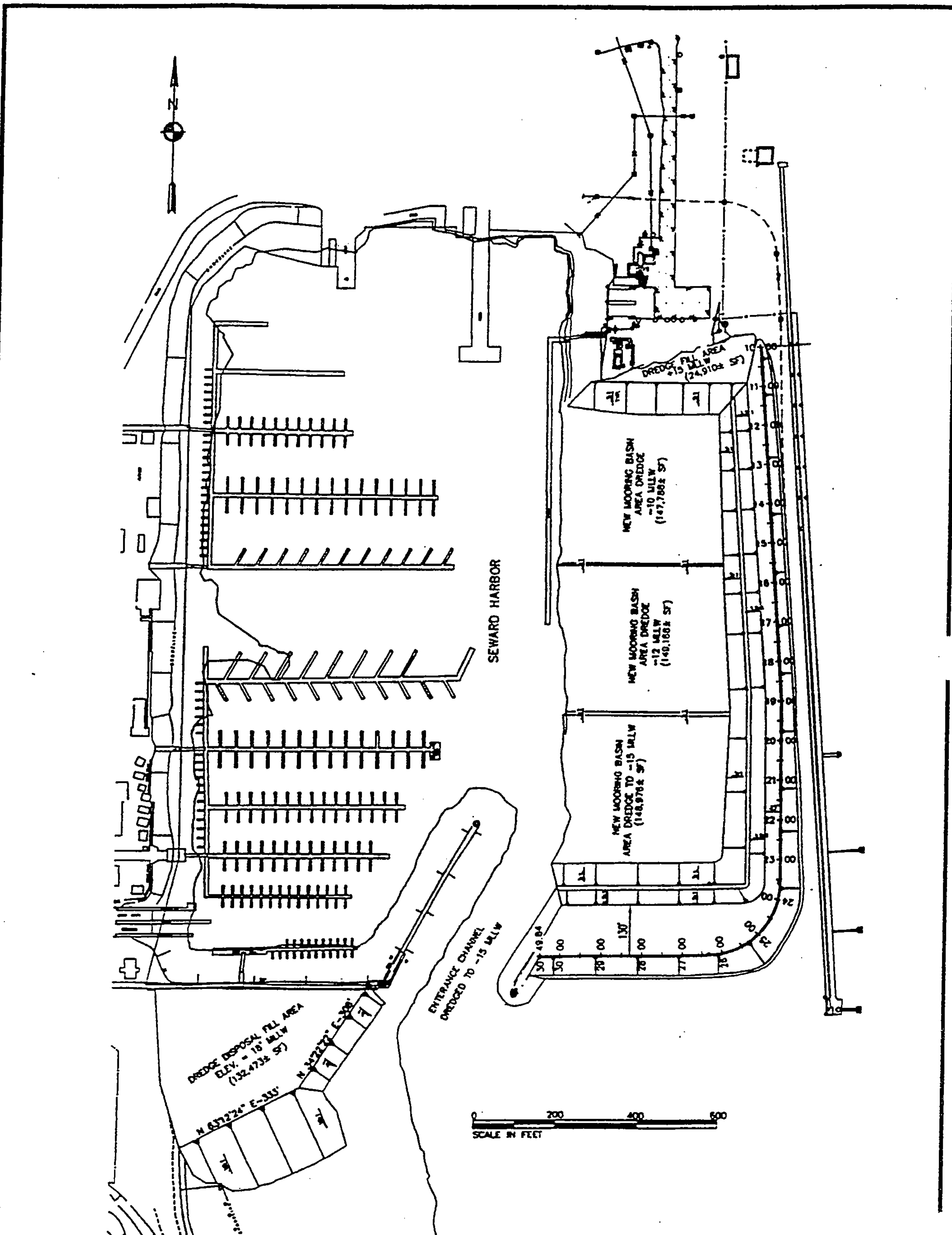
Approximately 185,000 yd^3 of the dredged material would be discharged in two separate intertidal/subtidal areas adjacent to the harbor. An additional 22,400 yd^3 of armor rock and core material would be discharged to aid in construction of the fill areas and to protect them from erosion. One fill area would be at the north end of the harbor with a footprint of about 0.5 acres. The other would be south of the existing south breakwater with a 7-acre footprint. These two fill areas would be used to provide improved access. The reason for the larger southern access/staging area as compared to alternative 1 is to provide improved access to the center of the harbor and to close off the existing entrance channel. The remainder of the dredged material, approximately 110,000 yd^3 would be used to create a shoal just east of the "fish ditch."

Alternative 3

Alternative 3, as shown in Figure EA-5, would almost be identical to alternative 1 except the new east breakwater would be wide enough to allow vehicles to drive on it and it would have a smaller northern fill area. The wider breakwater would allow for improved access to the southern end of the expanded harbor. This alternative would create approximately 10.4 acres of additional basin and maneuvering area. Approximately 1470 feet of the existing east breakwater would be removed (32,000 yd^3). The last 100 feet or so of the breakwater would not be removed and would be incorporated into the new relocated breakwater. The new breakwater (rubble-mound) would be about 2000 feet long and would be constructed southward from the shoreline parallel to



ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	ALTERNATIVE 2 SEWARD HARBOR IMPROVEMENTS	EA-4



ALASKA DISTRICT
CORPS OF ENGINEERS
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ALTERNATIVE 3
SEWARD HARBOR IMPROVEMENTS

EA-5

the existing coal trestle and then would change to an east-west alignment near the end of the coal trestle. Approximately 169,200 yd^3 of armor rock, secondary rock and core material would be discharged for its construction. Armor stone and core material removed from the original breakwater would most likely be re-used. The new breakwater would have a footprint of about 6.5 acres and would be constructed with a 1 V:1.5 H. The eastward toe of the breakwater would maintain a minimum distance of 30 feet from the coal trestle.

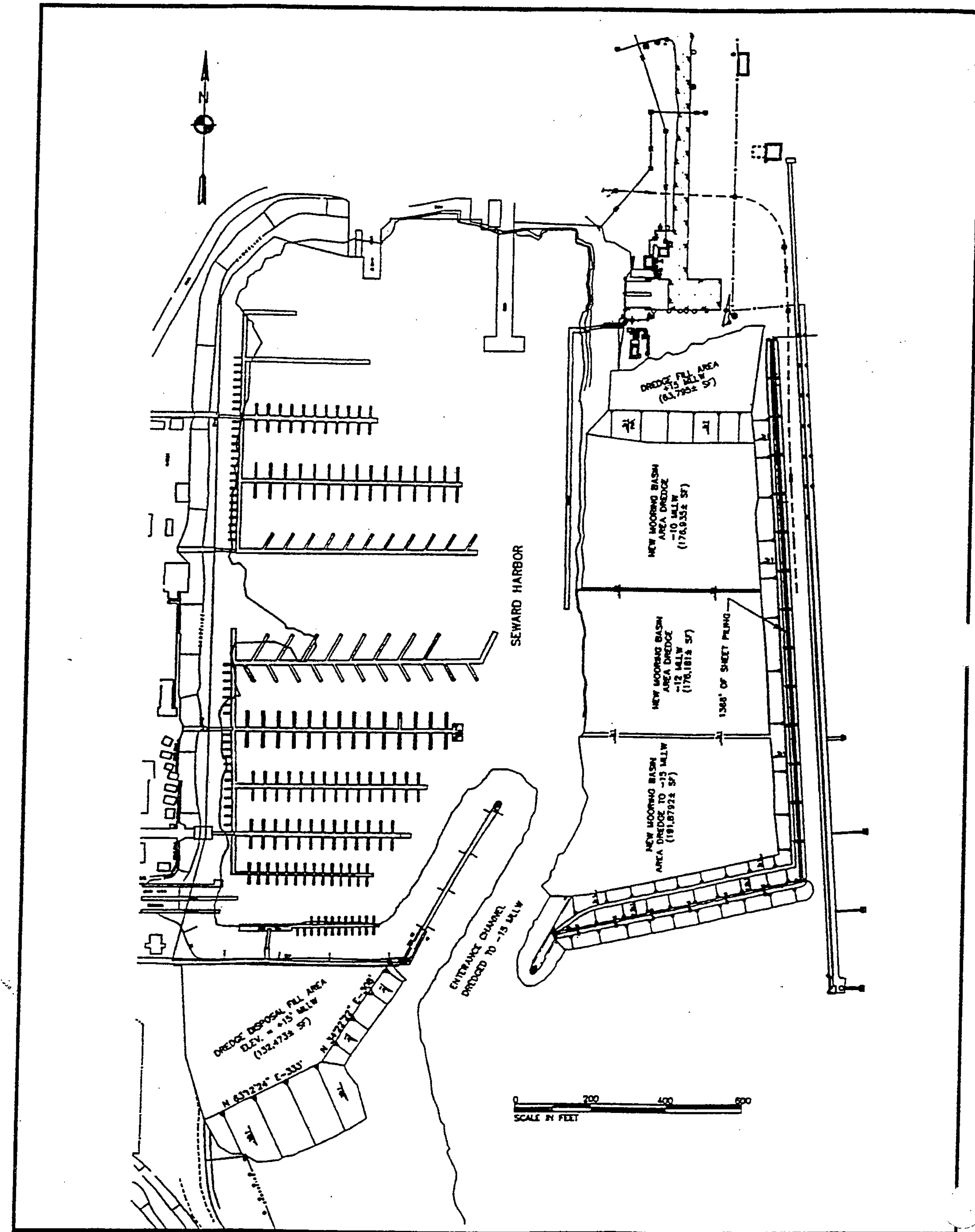
Approximately 230,000 yd^3 would be dredged from about 13.2 acres to construct the expanded mooring basin and maneuvering area. It would be dredged to a depth ranging from –10 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods would most likely be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.

Approximately 68,000 yd^3 of the dredged material would be discharged in two separate intertidal/subtidal areas adjacent to the harbor. An additional 5,500 yd^3 of armor rock and core material would be discharged to aid in construction of the fill areas and to protect them from erosion. One fill area would be at the north end of the harbor with a footprint of about 0.5 acres. The other would be south of the existing south breakwater with a 4.9-acre footprint. These two fill areas would create only about 3 acres of useable area. This is less than the estimated area needed to meet the anticipated demand, which is estimated to be 4?? acres. The remainder of the dredged material would be stockpiled at an upland site near the existing harbor for local fill projects and/or disposed of in inland waters approximately 1500 feet south of the harbor in water depths greater than 30 fathoms, as shown in figure EA-2.

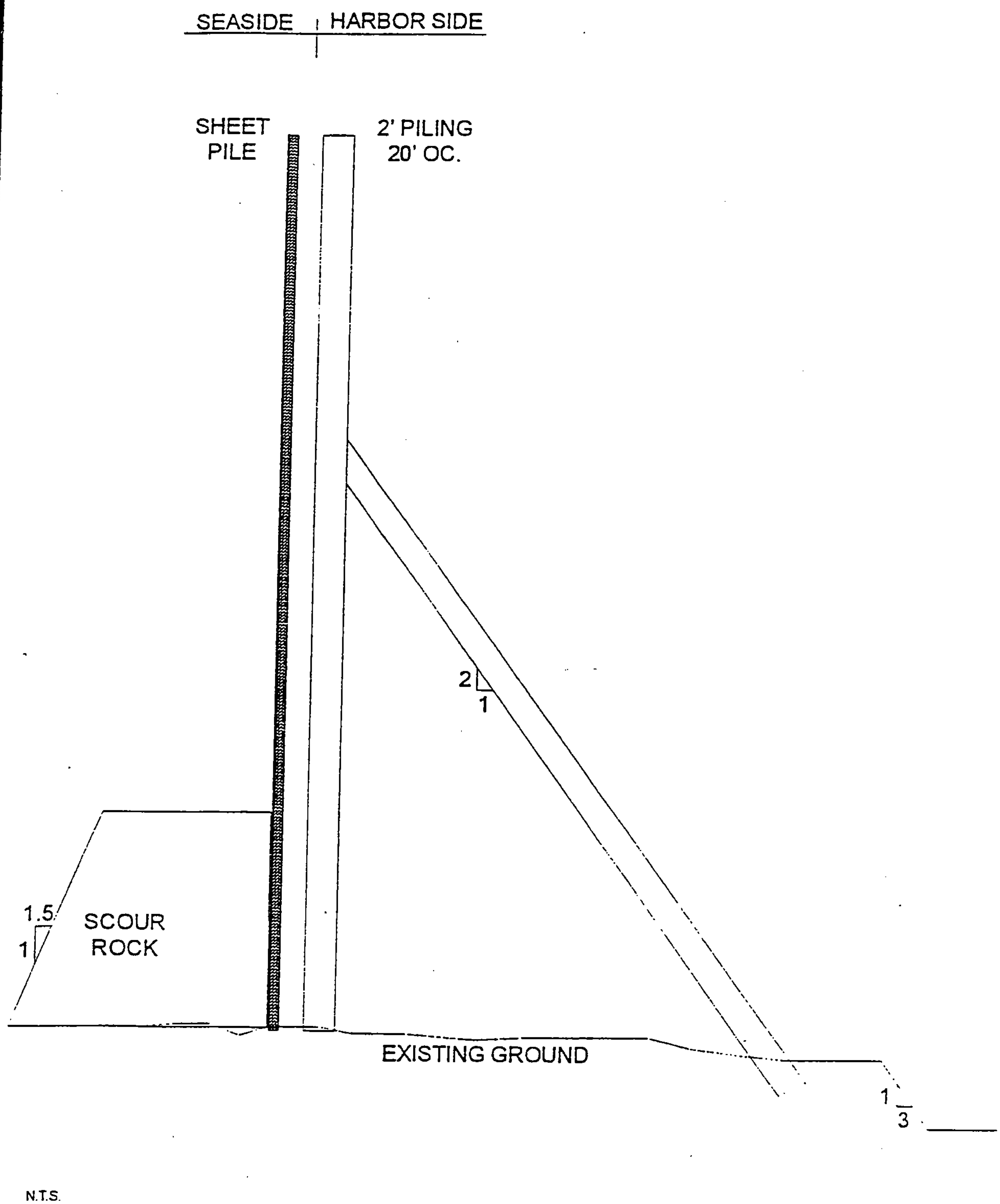
Alternative 4

Alternative 4, is also similar to alternative 1, but sheetpile would be used in the construction of a portion of the new east breakwater (Figures EA-6 and EA-7). This design would provide an additional 11.4 acres of basin and maneuvering area. Approximately 1470 feet of the existing east breakwater would be removed (32,000 yd^3). The southern 100 feet or so of the east breakwater would remain in place. Approximately 1350 linear feet of sheetpile wall wave barrier with scour toe would be constructed in a north-south alignment. About 1200 yd^3 of scour rock would be placed at the base of the wall. Near the southern end of the coal trestle, 650 feet of rubble mound breakwater would be constructed in an east-west alignment and would connect with the portion of the existing east breakwater that was not removed. Approximately 29,300 yd^3 of armor rock, secondary rock and core material would need to be discharged for construction of the 650 feet of breakwater and it would have a footprint of 2.5 acres. Armor stone and core material removed from the original breakwater would most likely be re-used.

Approximately 255,000 yd^3 would be dredged from about 14.9 acres to construct the expanded mooring basin and maneuvering area. It would be dredged to a depth ranging from –10 feet MLLW to –15 feet MLLW. A combination of both hydraulic and mechanical dredging methods would most likely be used; however, the actual method of dredging would be left up to the contractor. Side slopes for the basin would be dredged to 1V:3H.



ALASKA DISTRICT CORPS OF ENGINEERS CIVIL WORKS BRANCH	ALTERNATIVE 4 SEWARD SMALL BOAT HARBOR	EA-6



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ALTERNATIVE 4 CROSS SECTION

SEWARD HARBOR IMPROVEMENTS

EA-7

Approximately 80,000 yd^3 of the dredged material would be discharged in two separate intertidal/subtidal areas adjacent to the harbor. One would be at the north end of the harbor with a footprint of about 1.5 acres. The other would be south of the existing south breakwater with a 4.9 acre footprint. An additional 5,500 yd^3 of armor rock and core material would be discharged to aid in construction of the fill areas and to protect the areas from erosion. These two fill areas would be used for staging and access. The remainder of the dredged material would be stockpiled at an upland site near the existing harbor for local fill projects and/or disposed of in inland waters approximately 1500 feet south of the harbor, as shown in figure EA-2.

Maintenance Dredging

Based on conditions at the existing harbor and an evaluation of the littoral transport process in the area, maintenance dredging at the eastward expansion site is expected to be minor. Since the harbor was rebuilt following the March 1964 earthquake, maintenance dredging has only been conducted once. In April of 1995, the Resurrection River flooded its banks and carried almost 23,000 yd^3 of material into the harbor. In January 1996, this material was removed from the upper basin area.

Depending on the alternative, an estimated 3,500 to 4,200 yd^3 of material would be removed from the expanded moorage area every 25 years. Dredged material would be disposed of at the inland water disposal site about 1500 feet south of the harbor.

DESCRIPTION OF POTENTIAL IMPACTS

No-Action Alternative

There would likely be negligible impacts on fish and wildlife resources under this alternative. No new harbor would be developed and no habitat purposefully altered or destroyed. However, there is some potential for vessel collisions to occur as a result of overcrowded conditions resulting in spills of fuel or other toxic substances.

Alternative 1

Expansion of the boat harbor would result in the presence of additional vessels and thereby additional contaminants entering the marine environment. Sources that can result in environmental contamination include copper from anti-fouling paints, sacrificial anodes on recreational and commercial vessels and other protectively coated marine hardware, lead from boat batteries, engine exhaust products, and fuel spills. Certain organisms tend to be more tolerant of trace metals than others. Generally, the early life stages of aquatic organisms are the most susceptible to heavy metals and pollutants in general but many chemical, physical and seasonal factors influence this toxicity. Although there may be an increase in the local contaminant load, as long as proper storage, handling, and disposal procedures are maintained for toxic substances and good circulation is maintained in the harbor, it is unlikely that contaminant concentrations will be lethal to or will significantly affect fish and wildlife resources.

Dredging the harbor and the associated discharges would temporarily increase water turbidity at the project site. Tidal current and action would cause any loosened fine-grained material to form a sediment plume. Considering the minimal amount of fines in the material to be dredged, plumes are expected to be localized and short-lived. Suspended sediments would be expected to temporarily decrease light penetration, primary productivity, and dissolved oxygen levels.

The principal potential near-field injury is to fish gills when fishes are present in high suspended sediment concentrations. This is also common to juvenile salmon migrating in naturally turbid estuaries (Servizi 1988). Experiments have revealed obvious evidence of stress in fish at sustained levels of suspended concentrations (>500 mg l^{-1}), but what is unknown is the actual extent and duration of exposure in the natural environment. The natural behavior of fish in estuaries, much less their avoidance of dredging plumes, is poorly understood. In the case of juvenile Pacific salmon, observations indicate that chum and chinook fry tend to move in shallow waters along the shoreline, juvenile pinks occupy surface waters and may venture further out in channels during low light periods, and larger fish (sockeye, coho and chinook salmon and steelhead) occur in deeper water and throughout channels. Adult salmon do not appear to have clear migratory behavior; their movement is highly variable. Although delays in timing of adults may impair reproductive success in some stocks, there is no evidence to indicate that turbidity will induce such a delay. The literature tends to agree that juvenile salmon migration is more vulnerable to disruption than adult migration. Should harbor dredging or shoreline disposal of dredged material occur during the period of salmon smolt outmigration (April-June), it is conceivable that smolts migrating from the Resurrection River or Rudolf Creek could be impacted. In addition, use of dredged material to construct access/staging areas could cause turbidity which may cause adult salmon to avoid the area south of the harbor. Adequate retention basins which would allow only clean return flows to Resurrection Bay and/or silt curtains or equivalent technology must be used to control turbidity and reduce or eliminate salmon avoidance.

The most apparent impact associated with dredged material disposal is the smothering and/or burying of aquatic organisms. Most mobile or epifaunal invertebrates at a dredged material disposal site would likely be destroyed. Infaunal organisms are destroyed if the dredged material disposal is over 1 foot thick. In depositions of less than 1 foot, the organisms are generally able to dig up through the material. A trade-off must be made between the size of the disposal area and its thickness. For the proposed action at Seward, the area of impact would be over 30 acres per 50,000 yd^3 if the disposal of the dredged material was kept under 1 foot thick

Salmon have an extraordinary ability to detect and distinguish turbidity and other water quality gradients. When dredged material is disposed of in open water, most of the turbidity and/or suspended solids are at or near the bottom of the water column. Juvenile pink and chum salmon are not expected to be affected by dredged material disposal in open water because of their shallow water, nearshore behavior. It appears that adult salmon would detect the turbidity caused by dredged material disposal, and since the disposal site is in open water, they could avoid the turbidity plume, if they so choose.

Data to determine species composition and density at the inland water disposal site 1500 feet south of the harbor was not collected because the area has been previously used as a dredged material disposal site. In 1995 and in 1997, the Alaska Railroad Corporation discharged dredged material at this location (a total of over 190,000 yd^3). The material the railroad discharged probably had a fairly high percentage of fines because the material likely originated from the Resurrection River. Materials to be discharged at the disposal site by the Corps would primarily be poorly graded sand with silt and/or gravel.

After disposal of the dredged material, the disposal site would go through a successional process, with the more resilient organisms acting as the pioneer species. Most studies demonstrate a reduction in epi- and infaunal populations, and that, in most cases the recovery occurs over time (ranging from months to years).

Dredging the harbor at Seward and construction of the breakwaters and storage/access areas would have direct impacts on 23.8 to 30.7 acres of marine habitat, depending on the alternative selected. An additional 2.9 to 3.5 acres would be impacted by disposal of dredged material. About 10 to 15 acres of mud flats in the eastern expansion area and south of the harbor impacted by dredging and filling would be considered a "special aquatic site" under the 404 (b)(1) Guidelines definition. Benthic and non-motile organisms inhabiting the project site would be destroyed. Fish and marine mammals would be expected to avoid the project site during periods of work. After construction is completed, benthic and non-motile marine organisms would be expected to re-colonize the basin and the perimeter of the breakwater within a few growing seasons. Species composition and density would not mirror pre-construction conditions since the water depth and substrate composition would be altered. The face of the southern intertidal/subtidal fill area would have a gradual slope (approximately a 1V:10H) in an effort to minimize potential adverse impacts on fishery resources. Young fish will be able to migrate through the area in relatively shallow water, minimizing their susceptibility to predation.

Harbor construction is not expected to require blasting. If, however, explosives are required to remove bedrock, a blasting plan will need to be developed and coordinated with the NMFS, USFWS, and ADF&G to minimize potential adverse effects to marine mammals and other aquatic resources.

Sea otters and sea ducks have been observed feeding on mollusks and other organisms at the proposed project site. Some of the mussel and clam beds on which they are known to feed would be destroyed; consequently, otters and sea ducks would be forced to utilize other undisturbed food sources in the area during and after construction. The combination of deepening 14.7 acres and filling 10.9 acres would result in an overall reduction in foraging area and habitat quality for these animals. Fortunately, the project area comprises only a small portion of the available foraging habitat in northern Resurrection Bay. Nevertheless, it does represent a reduction in available habitat and continued losses will ultimately lead to reductions in populations of species dependent on this foraging habitat.

The amount of material to be disposed of at that inland water disposal site ranges from 145,000 to 175,200 yd^3 depending on the alternative. Dredged material would be discharged to a height of about 10 feet and would have direct impacts on approximately 5 acres of habitat per 50,000 yd^3. Based on projected dredged material volumes, an estimated 2.9 to 3.5 acres would be impacted by dredged material disposal.

The water depth at the disposal area approaches 30 fathoms. Non-motile and most slow moving organisms (e.g. crab, shrimp, and other invertebrates) would be smothered by the dredged material. Most groundfish and other highly motile organisms would be expected to avoid the area until turbidity levels return to near normal conditions. Benthic organisms, crustaceans, groundfish, and other life forms would be expected to colonize the disposal site over time.

The area just south of the existing harbor is heavily fished by sport anglers in the late summer when coho salmon are present. The harbor expansion project has the potential to interfere with this fishery if consideration is not given to avoiding construction in this area during the better portions of the coho run and during the Seward Silver Salmon Derby.

Impacts to Threatened and Endangered Species

Steller's eiders are not known to nest in the project area. They can be found in the Seward area in small numbers during the winter months. Given the fact that the project would impact a relatively small proportion of Steller's eider feeding habitat, and the fact that so few birds are present in Resurrection Bay, the Service concurs that the project is not likely to affect Steller's eider. Further consultation under Section 7 of the Endangered Species Act is not needed unless there are significant changes to the proposed project, a new species is listed which may be affected by the project, or greater numbers of Steller's eider are found to be present in the project area during project construction.

The nearest Steller sea lion haul-out and rookery area to Seward is at the mouth of Resurrection Bay, approximately 10 miles to the south. Steller sea lions have been sighted in the project area, especially during the peak of the coho salmon run. Humpback whales occasionally are present near the mouth of Resurrection Bay but would not be expected near the project site. Direct impacts on Steller sea lions are likely to be low. The area around the boat harbor is not a high use area for sea lions so it is unlikely that more than a few individual animals would occasionally be in the vicinity of the harbor construction. However, should blasting be required to remove rock during harbor dredging, the NMFS should be consulted to discuss potential impacts on sea lions and the need for additional consultation under the Endangered Species Act of 1973, as amended.

The project has the potential for secondary impacts on Steller sea lions and humpback whales in that it would provide the facilities for expanding the fleet of excursion vessels for fishing and wildlife viewing. Increased vessel traffic could cause harassment of these species if adequate controls on viewing and vessel operations are not exercised. The NMFS has published guidelines for viewing and boat operations in the presence of marine mammals. Adherence to these guidelines would likely mitigate the potential for increased disturbance to marine wildlife. The Corps should contact the NMFS regarding the need for further consultation on impacts to listed marine mammals under Section 7 of the Endangered Species Act of 1973, as amended.

Alternative 2 (Preferred Alternative)

The project footprint for this alternative is the largest of the four alternatives at 29.6 acres. This is due to the need to dredge a new harbor entrance channel and the incorporation of a larger south access/staging area fill. Qualitatively, this alternative would have the same impacts as discussed under alternative 1. The footprint for this alternative is 16 percent larger than alternative 1. Consequently, quantitatively, impacts to fish and wildlife habitat would be correspondingly greater than alternative 1. Some sea duck and sea otter foraging habitat (about 2-3 acres) would be avoided just east of the southern tip of the coal trestle; however, this benefit would be offset by a larger fill for the access/staging area south of the harbor. In general, impacts of this alternative on fish and wildlife would be slightly greater, but of the same general overall magnitude as alternative 1. A 5.15-acre shallow water shoal area is proposed to be constructed to the south of the south staging/access area. This shoal would help to replace mussel and clam beds lost to dredging and is expected to provide a new feeding area for sea otters and sea ducks. It is expected that it would take at least a couple of years for clams and mussels to become established in the area and grow to a size utilized by foraging otters and ducks.

Alternative 3

The project footprint for this alternative at 25.2 acres is almost identical with alternative 1. About 1 additional acre of fill is proposed for this alternative as compared with alternative 1 due to the wider east breakwater. Impacts of this alternative would be qualitatively similar to those described for alternative 1. Quantitatively impacts to fish and wildlife habitat would be slightly greater than alternative 1 due to the greater amount of fill; however, the magnitude of impacts would not be significantly different.

Alternative 4

The project footprint for this alternative, 23.8 acres, is about 2 acres smaller than alternative 1. The major difference is that sheetpile would be used in the construction of a portion of the new east breakwater. One of the principal environmental drawbacks of alternative 4 is the adverse impacts sheetpile walls have on fishery resources. Sheetpile walls provide minimal if any hiding places for juvenile fish. Furthermore, migrating fish are forced to swim in deep water when traveling around the perimeter of a sheetpile wave barrier. The combination of these two factors greatly increases juvenile fish susceptibility to predation. Consequently, we believe that alternative 4 would have greater impacts on fish than any of the other alternatives. Because the other impacts of alternative 4 would be similar to the other alternatives; the greater fishery impacts would make this alternative have the greatest overall impacts on fish and wildlife resources.

POTENTIAL FISH AND WILDLIFE CONSERVATION MEASURES

Because the habitat which will be impacted by the proposed project is of high to moderate value for sea otter and sea duck feeding and is relatively abundant in the region, our mitigation goal is no net loss of habitat value while minimizing loss of in-kind habitat value. In order to meet this goal, we have the following recommendations to mitigate the potential adverse impacts of the project on fish and wildlife resources and the habitats on which they depend. In addition, we believe these measures would satisfy the 404(b)(1) Guidelines requirement that appropriate and practicable steps be taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem.

We recommend that:

1. Disposal of dredged materials in the intertidal/subtidal areas and in any upland area include methods to filter or settle out silt-laden water (i.e., the use of berms and/or silt fences) prior to its discharge into any natural body of water.

2. To the extent practicable, dredged materials be discharged below the water surface to minimize the spreading of suspended particles.

3. Construction of the harbor be coordinated with the City of Seward and the Kenai Peninsula Borough to avoid conflicts with subsistence and recreational activities.

4. Dredging of the basin and the subsequent disposal of the dredged material not occur between April 1 and September 15, to minimize potential impacts to juvenile and returning adult salmonids and to the sport fishery which occurs immediately south of the harbor.

5. The south harbor access/staging area be constructed as proposed in alternative 2 with the southern and eastern slope at a 1V:5H ratio.

6. If alternative 2 is selected for construction, to mitigate for the loss of mussel and clam beds used by sea otters and sea ducks, and to enhance habitat for juvenile salmon and provide enhanced opportunities for sport fishing and wildlife viewing, a shallow water shoal with a footprint of about 5.15 acres and a maximum elevation of 0 MLLW be created by disposing of dredged material from the harbor expansion in the location of the current harbor entrance channel. The surface of the shoal should be very gradually sloping (about 1V:50H or less) to the east, west, and south to provide positive drainage so that fish are not trapped in pools on the surface of the shoal.

7. If an alternative other than alternative 2 is selected for construction, the Corps, Fish and Wildlife Service, National Marine Fisheries Service, and Alaska Department of Fish and Game will need to develop a plan to be incorporated into the project to mitigate losses to fish and wildlife resources and the habitats on which they depend.

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APPENDIX 4

FINAL CHEMICAL DATA REPORT

FINAL CHEMICAL DATA REPORT

Eastward Expansion
Small Boat Harbor
Revised

October 1997 Investigation
Seward, Alaska

PREPARED BY THE

ALASKA DISTRICT ARMY CORPS OF ENGINEERS

GEOTECHNICAL BRANCH

MATERIALS AND INSTRUMENTATION SECTION

September 17, 1998

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Abbreviations

BTEX	Benzene, Toluene, Ethylbenzene, Xylene
COE	Corps of Engineers
EPA	Environmental Protection Agency
ML1	Lowest Apparent Effects Threshold Value
ML2	Highest Apparent Effects Threshold Value
ND	Non Detect
PCBs	Polychlorinated Biphenyl's
ppb	part per billion
ppm	part per million
PSDDA	Puget Sound Dredge Disposal Analysis
QA	Quality Assurance
QC	Quality Control
RBC	Risk Based Concentration
SL	Screening Level
SVOC	Semi Volatile Organic Compounds
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
VOC	Volatile Organic Compounds

Executive Summary

This chemical data report prepared by the Materials and Instrumentation Section of the U.S. Army Corps of Engineers, Alaska District (CEPOA-EN-G-MI), presents the results of a sediment investigation east of the current small boat harbor in Seward, Alaska. The investigation was performed on behalf of the U.S. Army Corps of Engineers, Alaska District, Engineering Division, Civil Works Branch, Project Formulation Section (CEPOA-EN-CW-PF).

Nine sediment samples were collected for chemical analysis. Chemical samples were analyzed for Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), PCBs and Pesticides, Total Organic Carbon (TOC), 8 RCRA Metals plus Copper and Zinc, Sulfate, and Nitrate + Nitrite.

The only sample with levels of contamination of concern is sample –01SD, located in the extreme northern limits of possible excavation. (See Table 3, page 6 of the report for the chemical results of sample 01SD.) This contamination is most likely due to surface spills from the parking lot and nearby garbage dumpster. The area near sample –01SD is outside of proposed dredging limits. All other samples have no detectable contamination or contamination levels that are well below State of Washington Sediment Management Standards or PSDDA regulatory limits.

1. Site Background Information

1.1 Location

The project site is located directly to the east of the current Seward Small Boat Harbor and directly to the west of the coal trestle, see (Appendix A, Figures 1 & 2).

1.2 Site History

The original Seward Small Boat Harbor (SBH) was constructed between 1931 and 1937 and was destroyed during the March 1964 Good Friday Earthquake. Reconstruction was completed June of 1965, to the north of the destroyed harbor, and in its present location. In 1966 the Alaska Railroad completed construction of a railroad dock 800' to the east of the SBH. Dredged fill from this project was deposited in the intertidal area between the SBH and the Alaska Railroad dock. A coal trestle was constructed adjacent, to the west, of the Alaska Railroad dock in 1984. Subsequently, a sewer outfall for a local fish processing facility was constructed to the west of the trestle. The sewer outfall is exposed and rests on the ocean floor.

2. Field Sampling

2.1 Sampling Objectives

Testing, handling and disposal of proposed dredged material is mandated by the Clean Water Act and the Ocean Dumping Act. Tier I and II investigations are mandated by the jointly authored Inland Testing Manual, United States Army Corps (USACOE)/United States Environmental Protection Agency (EPA) Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. Testing Manual (Draft). Tiered procedures will determine, by means of mechanical analysis and analytical chemistry, the possible toxicity and the potential impacts of the proposed dredged material. The objectives of this sampling event are:

-- the collection of sediment samples from within the proposed project boundary for the SBH Eastward Expansion. The sampling included quality assurance (QA) and quality control (QC) samples collected from locations chosen by the chemist using his best professional judgement after examining site conditions.

-- resulting data methods to be compliant with state and federal agencies and of such quality that the findings can be used to determine disposal options of the proposed dredge material.

2.2 Summary of Field Work

Appendix A, Figures 1 and 2, contain project location and vicinity maps with sampling locations plotted with survey data provided by drilling contractor. Chemical data summary tables for each sampling location and analyses, are provided in Appendix B. Drill logs are included in Appendix B, provided by the geotechnical firm that oversaw the drilling contractor. Appendix B contains worksheets comparing TOC normalized chemical data with State of Washington and PSDDA regulatory limits and the Data Validation Report is included in Appendix D.

Sampling activities began on 14 October 1997 and ended on 17 October 1997. Field crew consisted of Richard Ragle, Chemist, CEPOA-EN-G-MI, Discovery Drill Crew and a geotechnical engineer from Golder Associates. Four grab samples were collected using a Nodwell mounted CME-75 drill rig utilizing a 3.25" I.D. hollow stem auger with bullet tooth bit. Five surface grab samples were collected, including one background sample and a QA/QC triplicate. A total of nine samples were analyzed for 8 RCRA Metals, Copper, Zinc, Nitrate + Nitrite, Sulfate, Volatile Organic Compounds, Semivolatile Organic Compounds, Total Organic Carbon, PCBs and Pesticides. Mechanical samples were collected by the Golder geotechnical engineer and analyzed by Dowl Engineering.

Table 1

Number of Samples	Method
9	8 RCRA Metals + Copper & Zinc
9	Semivolatile Organic Compounds (Method 8270B)
9	Volatile Organic Compounds (Method 8260A)
9	Nitrate + Nitrite (Method 353.2)
9	Total Organic Carbon (Method 9060)
9	Sulfate (Method 375.4)
9	PCBs + Pesticides (Method 8081)

2.3 Laboratory Assignments

The primary samples and quality control (QC) duplicates were analyzed by Sound Analytical Services Inc., Tacoma, Washington. The quality assurance (QA) samples were analyzed by Columbia Analytical Services in Anchorage, Alaska, both under contract to the Alaska District.

3. Results of Chemical Analysis

The results of the chemical analyses are discussed in detail below.

3.1 Sediment Sampling

Surface samples were collected with a decontaminated shovel and a dedicated stainless steel spoon. While wearing disposable Nitrile gloves, the shovel was used to dig a 6" to 10" deep hole. Then using the spoon, sufficient material was placed in a dedicated ziplock bag. The material collected in the bag was homogenized and then placed in sample containers. The volatile organic samples (Method 8260A) were collected directly into the sample containers to minimize the loss of volatile constituents. The shovel was deconned prior to use with the same procedure as the split spoon, see procedure below.

Subsurface sediment samples were collected using a 3' long 2.5" I.D. split spoon. Once the auger had advanced to the sampling interval, the split spoon was placed on the end of the rod string and driven into the sediment with a 300-pound hammer. The split spoon was deconned prior to sampling with the following steps:

1. Soapy water rinse and scrub with brush to remove all visible sediment.
2. Water rinse and scrub to remove any more material.
3. Rinse with methanol. Then wiped with paper towel.
4. Rinse with hexane. Then wiped with paper towel.
5. Rinse with deionized water. Then wiped with paper towel.

All handling of the split spoon was done while wearing disposable Nitrile glove. After the drive depth was reached, the sampler was retrieved and opened. Samples for volatile organic analysis were immediately placed into sampling containers, using a dedicated stainless steel spoon. The rest of the sample was composited in a ziplock bag and then placed into sample containers, for sample container sizes see below.

Analytical Method	Sample Container
Method 8260 VOCs	2 x 2 ounce Septa Lidded Jars
Method 8270 SVOCs	4 ounce Hard Top Jar
Method 8081 PCB's and Pest	4 ounce Hard Top Jar
Method 9060 TOC	4 ounce Hard Top Jar
Nitrogen as Nitrate + Nitrite	8 ounce Hard Top Jar
Sulfate	4 ounce Hard Top Jar
8 RCRA Metals + Cu & Zn	8 ounce Hard Top Jar

Upon completion of sampling the samples were immediately transferred to a cooler maintained at 4 ± 2 C° with commercially available ice. The samples were maintained at this temperature to maintain sample integrity, limit biological activity and meet EPA regulations. Sample coolers were maintained within control of the sampler for the entire time period of the sampling event. When the coolers were not within the samplers immediate control they were locked within a vehicle or hotel room.

3.1.1 Biological Parameters

Samples were analyzed for a variety of organic parameters, see Table 1 for Nitrate + Nitrite and Sulfate results and Table 3 for Total organic carbon (TOC) results in Appendix B. TOC was used to normalize chemical constituents for comparison to State of Washington Chemical Criteria Tables and Minimum Cleanup Levels. TOC levels ranged from a high of 6,600 ppm to a low of 2,800 ppm, and can be found in Table 3 of Appendix B. These values are within normal ranges for sediments. TOC is not a regulated material but provides site information.

Levels of Sulfate ranged from 11 ppm – 540 ppm. These values are within normal ranges for sediments and were collected for site characterization and possible future Tier III studies.

Nitrogen as Nitrate + Nitrite levels were all below detection limits, except for sample –01SD which had 11 ppm. Method reporting limits ranged from 2 ppm – 0.67 ppm. These values are within normal ranges for sediments and were collected for site characterization and possible future Tier III studies. EPA has not set restrictive criteria on this parameter due to the fact that levels that would exhibit toxic effects on marine organisms rarely occur in nature.

3.1.2 Method 8260A Volatile Organic Compounds

Nine samples were analyzed by method 8260A, Volatile Organic Compounds (VOCs), see Table 2, Appendix B. Methylene Chloride was detected in two of the nine samples and acetone was detected in one sample. These constituents are common laboratory contaminates. There were no compounds detected that were over regulatory limits that would limit disposal.

3.1.3 Method 8270B Semivolatile Organic Compounds

Nine samples were analyzed by method 8270B, Semivolatile Organic Compounds (SVOCs), complete data tables can be found in Table 3 Appendix B. The only compounds that was detected over State of Washington or PSDDA regulatory limits was a single high molecular weight polyaromatic hydrocarbon. Sample –01SD had Indeno (1,2,3-c,d) pyrene levels, 150 ppb, that exceeded the PSDDA screening level of 69 ppb.

The PSDDA screening level, "is a guideline used to define the concentration of a chemical in dredged material below which there is no reason to believe unacceptable adverse impacts would result from unconfined, open-water disposal." Materials that exceed screening levels must be subjected to the PSDDA Tier III biological testing requirements before open-water disposal is possible. All other samples had concentrations that were well below the most stringent screening levels. Chemical results are compared against State of Washington and PSDDA regulator limits in Appendix C.

3.1.4 Method 8081 PCBs and Organochlorine Pesticides

Nine samples were collected and analyzed for PCBs and Organochlorine pesticides by method 8081, Table 5 Appendix B. Aroclor 1260 and 1254 were detected, surface sample –01SD, at 120 ppb and 150 ppb respectively. Both hits were second column confirmed. None of the positive detection's was over EPA Region III RBCs residential scenario. However, the total PCBs value exceeds the PSDDA maximum chemical level (ML). The ML is defined as the maximum concentration of an analyte that would have unacceptable effects on biological indicators. All other samples were ND for PCBs and organochlorine pesticides.

3.1.5 Metals

Nine samples were analyzed for 8 RCRA Metals plus copper and zinc. Selenium was the only metal analyzed for that was not detected. All other analytes were detected in at least one sample. All metals were under the most stringent regulatory limits set forth by State of Washington and PSDDA, except for mercury in sample –01SD and silver in all nine samples. Mercury was reported at the PSDDA screening limit of 0.21 ppm. The reporting limits for silver from both laboratories ranged from 1.9 to 2.2 ppm, which is higher than the PSDDA screening limit of 1.2 ppm. Method detection limits for silver ranged from 0.69 – 0.81 ppm which is well below PSDDA screening limits.

3.1.6 Mechanical Analysis

Full results of mechanical analysis can be found in the drill logs which are located in Appendix B.

TABLE 2
Results of Mechanical Analysis

Sample Location	Sample Depth	Soil Classification
AP-186	10'	Poorly graded Sand with silt and gravel
AP-187	10'	Poorly graded Sand with gravel
AP-188	15'	Poorly graded Sand with gravel
AP-189	15'	Poorly graded Sand with gravel

4. Conclusion:

The quality of the sediment within the proposed eastward expansion area of the Seward SBH is very good. All of the sediment in the intertidal zone meets the strictest State of Washington and PSDDA sediment management levels. There is no chemical reason that the material can not be disposed of via ocean water disposal. No compounds are present that exceeds RCRA or EPA Region 3 Risk Based Concentration values. The only chemical contamination of concern was found in the surface sample (-01SD) collected at the extreme northern limits of excavation, these sediments should be segregated if the material is disposed of via ocean disposal. Sample –01SD exceeded the PSDDA Screening Limits (see Table 3 below) for mercury, silver, indeno(1,2,3,-cd)xylene, total PCBs, total xylenes and ethylbenzene. The method reporting limits used by the laboratories were too high to determine if there were reportable concentrations of silver, total xylenes and ethylbenzene to exceed the PSDDA SL. However these compounds were detected at levels much below regulatory numbers or not detected at all.

Table 3

			State of Washington		PSDDA	
Analyte	Sample #	Result	Minimum	Maximum	SL	ML1
Mercury	-01SD	0.21	0.41	0.59	0.21	0.41
Silver	All	ND (1.9-2.2)	6.1	6.1	1.2	1.2
Indeno(1,2,3-cd)pyrene	-01SD	150	34,000	88,000	69	600
Total PCBs	-01SD	299.1	12,000	65,000	130	130
Total Xylenes	All	ND (31-35)	NR	NR	12	100
Ethylbenzene	All	ND (10-12)	NR	NR	3.7	33

All numbers in parts per billion (ppb), except metals (ppm)

State of Washington – Minimum is the Marine Sediment Quality Standard Chemical Criteria

- Maximum is the Sediment Impact Zones Maximum Chemical Criteria

PSDDA – SL is Screening Limits

- ML1 is the Lowest Apparent Effects Threshold Value

Exceeds Regulatory Limit

5. Data Quality Review

The complete chemical data package, including the laboratories internal quality control reports, is on file at CENPA-EN-G-MI. The data and associated materials were reviewed by chemists at the Corps of Engineers Alaska

District and evaluated under contract by Kismet Scientific Services as evaluated in their Chemical Quality Assurance Report. Laboratory data are summarized in Appendix B, and a copy of the Chemical Quality Assurance Report is provided in Appendix D.

Kismet performed an extensive set of procedures to assess the quality of the data. The initial inspection of the data screened for errors and inconsistencies. The chemist checked the instrument and analysis identification, sample description and identification, time and date of analysis, weight or volume of sample, units employed, dilution feeds, sample clean-up, and detection limits. The chemist then verified that the data were checked by the laboratory manager or quality assurance officer. Sample holding times, preservation, and storage were checked and noted.

The second step of the data verification process was an assessment of the laboratory instrumentation procedures. The precise process varied depending on the method of analysis, but may have included inspection of instrument tuning, example calculations, standard solution preparation methods, and identification criteria including quantification and confirmation of ions. Surrogate recoveries were scrutinized to ensure they fell within an acceptable range. Adequate surrogate recoveries indicate that sample extraction procedures were effective, and that overall instrument procedures were acceptable. The next phase of data quality assessment was an involved examination of the actual data. This phase of the data quality assessment is by far the most time-intensive, requiring the chemist to examine all the data produced by the laboratory. By examining data from laboratory duplicates, blind duplicates, trip blanks, laboratory blanks, matrix spike and matrix spike duplicate samples, and field samples, the chemist determined whether the data are of high quality.

The precision of the data was quantified by the relative percent difference (RPD) between two results obtained for the same sample. Laboratory duplicates and matrix spike duplicates were assessed by their RPD values. High RPD values indicate a lack of reproducibility, and such data were rejected. Any such results were reported in the Data Validation Report.

Data from blank samples were examined to determine if sample contamination occurred after the sample was collected in the field. Method blanks are blank samples prepared in the laboratory and analyzed along with project samples. If analytes are detected in a method blank, it is a strong indication of laboratory contamination. This would raise the possibility that project samples were contaminated in the laboratory as well.

The accuracy of the data was monitored by analysis of matrix spike and matrix spike duplicate sample analyses. A matrix spike sample is prepared by adding a known quantity of a certain analyte to an actual sample. The matrix spike duplicate is prepared in an identical manner. Matrix spike and matrix spike duplicates must be run at least once per every twenty samples. Recovery of the matrix spike indicates the level of accuracy of the data. Comparison of the matrix spike and matrix spike duplicate results provides another indication of data precision. Chemists at Kismet examined all matrix spike and matrix spike duplicate data. Low or high spike recoveries or a high RPD for duplicates are evidence of poor accuracy or low precision; all such results are reported in the Data Validation Report.

Blind duplicate quality control (QC) samples were submitted to the project laboratory, which analyzed the majority of the samples. Analysis of QC duplicate samples provides a measure of intra-laboratory variations. Additional replicate samples were provided to an independent quality assurance (QA) laboratory, to provide a test of inter-laboratory accuracy. Approximately 20% of the samples were QA or QC replicates that effectively provide triplicate analysis on approximately 10% of the samples. QC and QA duplicates are so noted in the data tables.

Data from all replicate samples were analyzed by Kismet as part of development of the Data Validation Report. Of each triplicate set, two samples were analyzed at the project laboratory, and the third was analyzed at the QA laboratory. If two of three data sets agreed, each laboratory internal QA/QC data were reassessed to determine which set of data is the most accurate. Data from related analyses may have been inspected to determine which set of data was more accurate.

Primary Laboratory Data: Sample shipment received was within EPA temperature requirements. There were problems with blank contamination in the VOC and SVOC samples. Phthalates, acetone and methylene chloride are due to laboratory cross contamination. Reporting limits for xylenes, ethylbenzene, and silver exceeded regulatory criteria. Data do not meet DQOs. The laboratory did not provide the MS/MSD, LC/LCD or RPD for the PCB data. Therefore it is not possible to determine accuracy and precision of the data, beyond the blind duplicate agreements, Data are usable for project needs, with these exceptions.

Referee Laboratory Data: The sample cooler was received within the EPA temperature guidelines. Due to poor laboratory sample management, however, intra-laboratory sample transfer was performed without custody seals. Sample data are open to tampering. Laboratory did not meet project DQOs for the SVOC analysis. Data are not usable, since the reporting limit was two orders of magnitude greater than project specified DQOs. The MSD for lead exceeded the EPA QC limits, data are estimated. Data are usable for project needs, except for the referee laboratory SVOC analysis.

6. References

a. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Test Methods for Evaluating Solid Wastes, SW-846, Third Edition, August 1993.

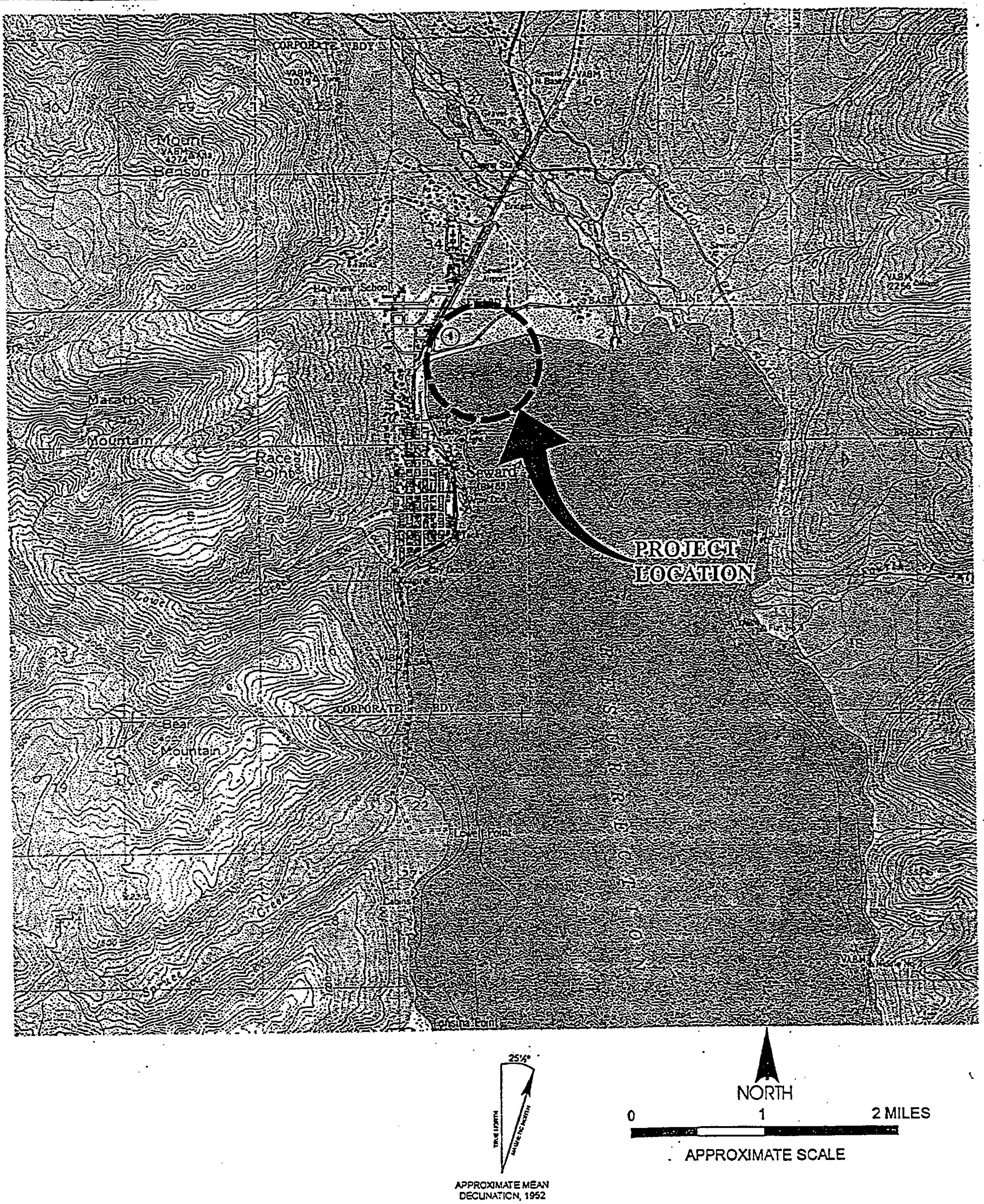
b. U.S. Army Corps of Engineers, ER 1110-1-263, Chemical Data Quality Management for Hazardous Waste Remedial Activities, April 1996.

c. U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, State of Washington Department of Ecology, Puget Sound Dredged Disposal Analysis, June 1988.

d. State of Washington, Chapter 173-204 WAC Sediment Management Standards, December 1995

APPENDIX A

Figures



REFERENCE:
U.S.G.S. TOPOGRAPHIC MAP "SEWARD (A-7), ALASKA",
1:63,000, 1950.

Figure 1

PROJECT LOCATION MAP

COE / SEWARD HARBOR / AK

CORPS OF ENGINEERS

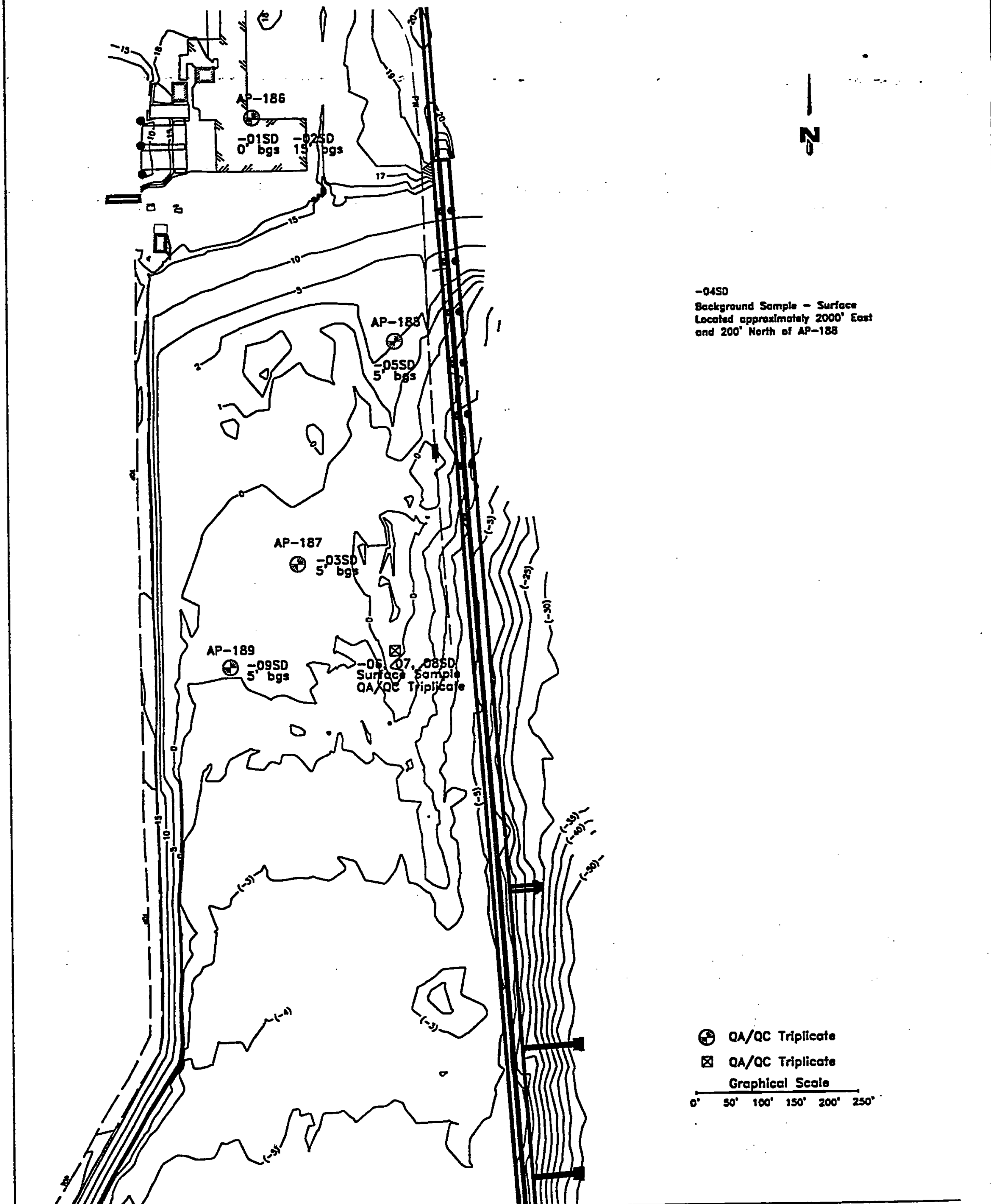


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Figure 2 – Sample Locations
SBH Eastward Expansion
Seward, Alaska

SCALE: Graphical
DATE: 3 Feb. 1998
DWG/RVW: Richard Ragle
C:\ACAD12C2\DWGLIB\SEW013.dwg

APPENDIX B

Chemical Data

Table 1
Small Boat Harbor (Eastward Expansion), Seward, AK
Parameters
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
DEPTH (FT):	Surface	15'	5'	Surface
TESTING LABORATORY:	SAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	11/5/97	11/5/97	11/5/97	11/5/97
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Nitrogen, Nitrate-Nitrite	0.34	ND (0.65)	ND (0.67)	ND (0.63)
Sulfate	11	32	290	167

SAS: Sound Analytical Services, Inc., Tacoma, WA.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 1
Small Boat Harbor (Eastward Expansion), Seward, AK
Parameters
October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
DEPTH (FT):	5'	Surface	Surface	Surface	5'
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-05	A9700977-01	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	11/5/97	10/27 - 12/2/97	11/5/97	11/5/97	11/5/97
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Nitrogen, Nitrate-Nitrite	ND (0.6)	ND (2)	ND (0.64)	ND (0.6)	ND (0.58)
Sulfate	340	102	540	420	280

SAS: Sound Analytical Services, Inc., Tacoma, WA.
CAS: Columbia Analytical Services, Inc., Kelso, WA.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 2
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8260
Volatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
DEPTH (FT):	Surface	15'	5'	Surface
TESTING LABORATORY:	SAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/29/97	10/29/97	10/29/97	10/29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
1,1,1,2-Tetrachloroethane	ND (10)	ND (11)	ND (11)	ND (11)
1,1,1-Trichloroethane	ND (10)	ND (11)	ND (11)	ND (11)
1,1,2,2-Tetrachloroethane	ND (10)	ND (11)	ND (11)	ND (11)
1,1,2-Trichloroethane	ND (10)	ND (11)	ND (11)	ND (11)
1,1-Dichloroethane	ND (10)	ND (11)	ND (11)	ND (11)
1,1-Dichloroethene	ND (10)	ND (11)	ND (11)	ND (11)
1,1-Dichloropropene	ND (10)	ND (11)	ND (11)	ND (11)
1,2,3-Trichlorobenzene	ND (10)	ND (11)	ND (11)	ND (11)
1,2,3-Trichloropropane	ND (10)	ND (11)	ND (11)	ND (11)
1,2,4-Trichlorobenzene	ND (10)	ND (11)	ND (11)	ND (11)
1,2,4-Trimethylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
1,2-Dibromo-3-chloropropane	ND (10)	ND (11)	ND (11)	ND (11)
1,2-Dibromoethane	ND (10)	ND (11)	ND (11)	ND (11)
1,2-Dichlorobenzene	ND (10)	ND (11)	ND (11)	ND (11)
1,2-Dichloroethane	ND (10)	ND (11)	ND (11)	ND (11)
1,2-Dichloropropane	ND (10)	ND (11)	ND (11)	ND (11)
1,3,5-Trimethylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
1,3-Dichlorobenzene	ND (10)	ND (11)	ND (11)	ND (11)
1,3-Dichloropropane	ND (10)	ND (11)	ND (11)	ND (11)
1,4-Dichlorobenzene	ND (10)	ND (11)	ND (11)	ND (11)
2,2-Dichloropropane	ND (10)	ND (11)	ND (11)	ND (11)
2-Butanone	ND (10)	ND (11)	ND (11)	ND (11)
2-Chlorotoluene	ND (10)	ND (11)	ND (11)	ND (11)
2-Hexanone	ND (10)	ND (11)	ND (11)	ND (11)
4-Chlorotoluene	ND (10)	ND (11)	ND (11)	ND (11)
4-Isopropyltoluene	ND (10)	ND (11)	ND (11)	ND (11)
4-Methyl-2-pentanone	ND (10)	ND (11)	ND (11)	ND (11)

Table 2
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8260
Volatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
DEPTH (FT):	Surface	15'	5'	Surface
TESTING LABORATORY:	SAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/29/97	10/29/97	10/29/97	10/29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Acetone	ND (10)	ND (11)	33	ND (11)
Benzene	ND (10)	ND (11)	ND (11)	ND (11)
Bromobenzene	ND (10)	ND (11)	ND (11)	ND (11)
Bromochloromethane	ND (10)	ND (11)	ND (11)	ND (11)
Bromodichloromethane	ND (10)	ND (11)	ND (11)	ND (11)
Bromoform	ND (10)	ND (11)	ND (11)	ND (11)
Bromomethane	ND (10)	ND (11)	ND (11)	ND (11)
Carbon disulfide	ND (10)	ND (11)	ND (11)	ND (11)
Carbon tetrachloride	ND (10)	ND (11)	ND (11)	ND (11)
Chlorobenzene	ND (10)	ND (11)	ND (11)	ND (11)
Chloroethane	ND (10)	ND (11)	ND (11)	ND (11)
Chloroform	ND (10)	ND (11)	ND (11)	ND (11)
Chloromethane	ND (10)	ND (11)	ND (11)	ND (11)
cis-1,2-Dichloroethene	ND (10)	ND (11)	ND (11)	ND (11)
cis-1,3-Dichloropropene	ND (10)	ND (11)	ND (11)	ND (11)
Dibromochloromethane	ND (10)	ND (11)	ND (11)	ND (11)
Dibromomethane	ND (10)	ND (11)	ND (11)	ND (11)
Dichlorodifluoromethane	ND (10)	ND (11)	ND (11)	ND (11)
Ethylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
Hexachlorobutadiene	ND (10)	ND (11)	ND (11)	ND (11)
Isopropylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
m,p-Xylene (Sum of Isomers)	ND (21)	ND (22)	ND (23)	ND (23)
Methylene chloride	3 J	ND (11)	ND (11)	ND (11)
Naphthalene	ND (10)	ND (11)	ND (11)	ND (11)
n-Butylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
n-Propylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
o-Xylene	ND (10)	ND (11)	ND (11)	ND (11)
sec-Butylbenzene	ND (10)	ND (11)	ND (11)	ND (11)

Table 2
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8260
Volatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
TESTING LABORATORY:	SAS	SAS	SAS	SAS
DEPTH (FT):	Surface	15'	5'	Surface
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/29/97	10/29/97	10/29/97	10/29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Styrene	ND (10)	ND (11)	ND (11)	ND (11)
tert-Butylbenzene	ND (10)	ND (11)	ND (11)	ND (11)
Tetrachloroethene	ND (10)	ND (11)	ND (11)	ND (11)
Toluene	ND (10)	ND (11)	ND (11)	ND (11)
trans-1,2-Dichloroethene	ND (10)	ND (11)	ND (11)	ND (11)
trans-1,3-Dichloropropene	ND (10)	ND (11)	ND (11)	ND (11)
Trichloroethene	ND (10)	ND (11)	ND (11)	ND (11)
Trichlorofluoromethane	ND (10)	ND (11)	ND (11)	ND (11)
Vinyl chloride	ND (10)	ND (11)	ND (11)	ND (11)
Xylenes, Total	NT	NT	NT	NT
TIC's:	0	10	0	0
Total TIC Concentration:	0	545 J	0	0

SAS: Sound Analytical Services, Inc., Tacoma, WA.
CAS: Columbia Analytical Services, Inc., Kelso, WA.
TIC: Tentatively Identified Compounds.
J: Estimated Value.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 2
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8260
Volatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
DEPTH (FT):	5'	Surface	Surface	Surface	5'
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-05	K9707802-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/29/97	10/27 - 28/97	10/29/97	10/29/97	10/29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
1,1,1,2-Tetrachloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,1,1-Trichloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,1,2,2-Tetrachloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,1,2-Trichloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,1-Dichloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,1-Dichloroethene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,1-Dichloropropene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,2,3-Trichlorobenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
1,2,3-Trichloropropane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,2,4-Trichlorobenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
1,2,4-Trimethylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
1,2-Dibromo-3-chloropropane	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
1,2-Dibromoethane	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
1,2-Dichlorobenzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,2-Dichloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,2-Dichloropropane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,3,5-Trimethylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
1,3-Dichlorobenzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,3-Dichloropropane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
1,4-Dichlorobenzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
2,2-Dichloropropane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
2-Butanone	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
2-Chlorotoluene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
2-Hexanone	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
4-Chlorotoluene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
4-Isopropyltoluene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
4-Methyl-2-pentanone	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)

Table 2

Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8260
Volatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
DEPTH (FT):	5'	Surface	Surface	Surface	5'
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-05	K9707802-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/29/97	10/27 - 28/97	10/29/97	10/29/97	10/29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Acetone	ND (12)	ND (50)	ND (11)	ND (11)	ND (11)
Benzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Bromobenzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Bromochloromethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Bromodichloromethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Bromoform	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Bromomethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Carbon disulfide	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Carbon tetrachloride	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Chlorobenzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Chloroethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Chloroform	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Chloromethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
cis-1,2-Dichloroethene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
cis-1,3-Dichloropropene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Dibromochloromethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Dibromomethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Dichlorodifluoromethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Ethylbenzene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Hexachlorobutadiene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
Isopropylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
m,p-Xylene (Sum of Isomers)	ND (23)	NT	ND (22)	ND (22)	ND (22)
Methylene chloride	ND (12)	210	ND (11)	ND (11)	ND (11)
Naphthalene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
n-Butylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
n-Propylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
o-Xylene	ND (12)	NT	ND (11)	ND (11)	ND (11)
sec-Butylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)

Table 2

Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8260
Volatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
DEPTH (FT):	5'	Surface	Surface	Surface	5'
LABORATORY SAMPLE ID:	68308-05	K9707802-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/29/97	10/27 - 28/97	10/29/97	10/29/97	10/29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Styrene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
tert-Butylbenzene	ND (12)	ND (20)	ND (11)	ND (11)	ND (11)
Tetrachloroethene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Toluene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
trans-1,2-Dichloroethene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
trans-1,3-Dichloropropene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Trichloroethene	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Trichlorofluoromethane	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Vinyl chloride	ND (12)	ND (5)	ND (11)	ND (11)	ND (11)
Xylenes, Total	NT	ND (5)	NT	NT	NT
TIC's:	0	1	0	0	0
Total TIC Concentration:	0	8 J	0	0	0

SAS: Sound Analytical Services, Inc., Tacoma, WA.
CAS: Columbia Analytical Services, Inc., Kelso, WA.
TIC: Tentatively Identified Compounds.
J: Estimated Value.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 3
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8270B
SemiVolatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
DEPTH (FT):	Surface	15'	5'	Surface
TESTING LABORATORY:	SAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Total Organic Carbon (TOC)	3600000	2800000	3600000	3600000
1,2,4-Trichlorobenzene	ND (2.9)	ND (3.1)	ND (3.2)	ND (3.2)
1,2-Dichlorobenzene	ND (3.4)	ND (3.6)	ND (3.7)	ND (3.7)
1,3-Dichlorobenzene	ND (2.2)	ND (2.3)	ND (2.4)	ND (2.4)
1,4-Dichlorobenzene	ND (3.4)	ND (3.7)	ND (3.7)	ND (3.8)
2,4,5-Trichlorophenol	ND (1.4)	ND (1.5)	ND (1.5)	ND (1.5)
2,4,6-Trichlorophenol	ND (2.3)	ND (2.5)	ND (2.5)	ND (2.5)
2,4-Dichlorophenol	ND (2.2)	ND (2.4)	ND (2.4)	ND (2.4)
2,4-Dimethylphenol	ND (3.1)	ND (3.4)	ND (3.4)	ND (3.4)
2,4-Dinitrophenol	ND (3.7)	ND (3.9)	ND (4)	ND (4)
2,4-Dinitrotoluene	ND (2.1)	ND (2.3)	ND (2.3)	ND (2.3)
2,6-Dinitrotoluene	ND (3)	ND (3.2)	8	7.7
2-Chloronaphthalene	ND (2)	ND (2.1)	ND (2.1)	ND (2.2)
2-Chlorophenol	ND (3.2)	ND (3.4)	ND (3.4)	ND (3.5)
2-Methyl-4,6-dinitrophenol	ND (3.4)	ND (3.6)	ND (3.7)	ND (3.7)
2-Methylnaphthalene	ND (3.3)	ND (3.6)	ND (3.6)	ND (3.6)
2-Methylphenol (o-cresol)	ND (2.9)	ND (3.1)	ND (3.1)	ND (3.2)
2-Nitroaniline	ND (3)	ND (3.3)	ND (3.3)	ND (3.3)
2-Nitrophenol	ND (3.5)	ND (3.8)	ND (3.8)	ND (3.9)
3,3'-Dichlorobenzidine	ND (1.3)	ND (1.4)	ND (1.4)	ND (1.4)
3- & 4- Methylphenol coelution	2.3	ND (2.3)	70	ND (2.3)
3-Nitroaniline	ND (3.5)	ND (3.8)	ND (3.8)	ND (3.9)
4-Bromophenyl phenyl ether	ND (2.6)	ND (2.8)	ND (2.8)	ND (2.8)
4-Chloro-3-methyl phenol	ND (2.9)	ND (3.1)	ND (3.5)	ND (3.5)
4-Chloroaniline	ND (1.6)	ND (1.7)	ND (1.7)	ND (1.7)
4-Chlorophenyl phenyl ether	NT	NT	NT	NT
4-Methylphenol (p-cresol)	NT	NT	NT	NT

Table 3
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8270B
SemiVolatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
DEPTH (FT):	Surface	15'	5'	Surface
TESTING LABORATORY:	SAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
4-Nitroaniline	ND (2.6)	ND (2.8)	ND (2.8)	ND (2.9)
4-Nitrophenol	ND (4.6)	ND (5)	ND (5)	ND (5.1)
Acenaphthene	ND (3.5)	ND (3.7)	ND (3.8)	ND (3.8)
Acenaphthylene	23	ND (2.7)	ND (2.8)	ND (2.8)
Aniline	NT	NT	NT	NT
Anthracene	55	ND (2.9)	ND (2.9)	ND (3)
Benzo(a)anthracene	49	ND (1.7)	ND (1.7)	ND (1.7)
Benzo(a)pyrene	70	ND (1.9)	ND (1.9)	ND (2)
Benzo(b)fluoranthene	120	ND (3.5)	ND (3.5)	ND (3.5)
Benzo(g,h,i)perylene	81	ND (0.74)	ND (0.74)	ND (0.75)
Benzo(k)fluoranthene	73	ND (1.7)	ND (1.7)	ND (1.8)
Benzoic acid	21	ND (4.3)	3 J	ND (4.4)
Benzyl alcohol	ND (3.1)	ND (3.4)	ND (3.4)	ND (3.4)
Benzyl butyl phthalate	8.8 B1	5.3 B1	10 B1	5.7 B1
bis-(2-chloroethoxy)methane	ND (3.8)	ND (4.1)	ND (4.2)	ND (4.2)
bis-(2-chloroethyl)ether	ND (10)	ND (11)	ND (11)	ND (11)
Bis(2-chloroisopropyl)ether	ND (3.3)	ND (3.5)	ND (3.5)	ND (3.6)
bis-(2-ethylhexyl)phthalate	52 B1	33 B1	37 B1	28 B1
Chrysene	78	ND (3.4)	ND (3.5)	ND (3.5)
Dibenzo(a,h)anthracene	9.8	ND (1.8)	ND (1.8)	ND (1.8)
Dibenzofuran	3.8	ND (1.9)	ND (1.9)	ND (2)
Diethyl phthalate	4.3 B1	5.6 B1	6.6 B1	6 B1
Dimethyl phthalate	56	ND (5.1)	ND (5.2)	ND (5.2)
Di-n-butyl phthalate	23 B1	23 B1	27 B1	15 B1
Di-n-octyl phthalate	ND (1.7)	3.6	1.9	ND (1.9)
Fluoranthene	190	ND (1.8)	3	ND (1.9)
Fluorene	5.2	ND (2.4)	ND (2.4)	ND (2.4)
Hexachlorobenzene	ND (0.93)	ND (1)	ND (1)	ND (1)

Table 3
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8270B
SemiVolatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
TESTING LABORATORY:	SAS	SAS	SAS	SAS
DEPTH (FT):	Surface	15'	5'	Surface
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Hexachlorobutadiene	ND (2.9)	ND (3.1)	ND (3.2)	ND (3.2)
Hexachlorocyclopentadiene	ND (2.6)	ND (2.8)	ND (2.8)	ND (2.8)
Hexachloroethane	ND (1.8)	ND (1.9)	ND (2)	ND (2)
Indeno(1,2,3-cd)pyrene	150	ND (1.8)	ND (1.8)	ND (1.8)
Isophorone	ND (2.4)	ND (2.6)	ND (2.6)	ND (2.7)
Naphthalene	2.3 J	9.5	ND (2.5)	ND (2.6)
Nitrobenzene	ND (5.4)	ND (5.8)	51	ND (6)
n-Nitrosodimethylamine	NT	NT	NT	NT
n-Nitrosodi-n-propylamine	ND (3.3)	ND (3.5)	ND (3.6)	ND (3.6)
n-Nitrosodiphenylamine	ND (1.3)	2.2	ND (1.5)	ND (1.5)
Pentachlorophenol	7.3	ND (4.4)	ND (4.4)	ND (4.5)
Phenanthrene	33	ND (3.1)	ND (3.2)	ND (3.2)
Phenol	ND (3.9)	ND (4.2)	ND (4.3)	ND (4.3)
Pyrene	110	ND (2.8)	ND (2.8)	ND (2.8)
TIC's:	0	0	0	0
Total TIC Concentration:	0	0	0	0

SAS: Sound Analytical Services, Inc., Tacoma, WA.
TIC: Tentatively Identified Compounds.
B1: Analyte was detected in the associated method blank.
J: Estimated Value.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 3

Small Boat Harbor (Eastward Expansion), Seward, AK

Method 8270B

SemiVolatile Organic Compounds

October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
DEPTH (FT):	5'	Surface	Surface	Surface	5'
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-05	K9707802-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27 - 29/97	10/28/97	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Total Organic Carbon (TOC)	2800000	6600000	4100000	3600000	2800000
1,2,4-Trichlorobenzene	ND (3.2)	ND (300.0)	ND (3.2)	ND (3.2)	ND (3)
1,2-Dichlorobenzene	ND (3.7)	ND (300.0)	ND (3.7)	ND (3.7)	ND (3.5)
1,3-Dichlorobenzene	ND (2.4)	ND (300.0)	ND (2.4)	ND (2.4)	ND (2.3)
1,4-Dichlorobenzene	ND (3.8)	ND (300.0)	ND (3.8)	ND (3.8)	ND (3.6)
2,4,5-Trichlorophenol	ND (1.5)	ND (300.0)	ND (1.5)	ND (1.5)	ND (1.4)
2,4,6-Trichlorophenol	ND (2.5)	ND (300.0)	ND (2.5)	ND (2.5)	ND (2.4)
2,4-Dichlorophenol	ND (2.4)	ND (300.0)	ND (2.4)	ND (2.4)	ND (2.3)
2,4-Dimethylphenol	ND (3.4)	ND (300.0)	ND (3.4)	ND (3.4)	ND (3.3)
2,4-Dinitrophenol	ND (4)	ND (2000.0)	ND (4)	ND (4)	ND (3.8)
2,4-Dinitrotoluene	ND (2.3)	ND (300.0)	ND (2.3)	ND (2.3)	ND (2.2)
2,6-Dinitrotoluene	10	ND (300.0)	11	9.2	ND (3.1)
2-Chloronaphthalene	ND (2.2)	ND (300.0)	ND (2.1)	ND (2.2)	ND (2)
2-Chlorophenol	ND (3.5)	ND (300.0)	ND (3.5)	ND (3.5)	ND (3.3)
2-Methyl-4,6-dinitrophenol	ND (3.7)	ND (2000.0)	ND (3.7)	ND (3.7)	ND (3.5)
2-Methylnaphthalene	ND (3.6)	ND (300.0)	ND (3.6)	ND (3.6)	ND (3.4)
2-Methylphenol (o-cresol)	ND (3.2)	ND (300.0)	ND (3.2)	ND (3.2)	ND (3)
2-Nitroaniline	ND (3.3)	ND (2000.0)	ND (3.3)	ND (3.3)	ND (3.1)
2-Nitrophenol	ND (3.9)	ND (300.0)	ND (3.9)	ND (3.9)	ND (3.7)
3,3'-Dichlorobenzidine	ND (1.4)	ND (2000.0)	ND (1.4)	ND (1.4)	ND (1.3)
3- & 4- Methylphenol coelution	ND (2.3)	NT	5.5	4.7	ND (2.2)
3-Nitroaniline	ND (3.9)	ND (2000.0)	ND (3.8)	ND (3.9)	ND (3.7)
4-Bromophenyl phenyl ether	ND (2.8)	ND (300.0)	ND (2.8)	ND (2.8)	ND (2.7)
4-Chloro-3-methyl phenol	ND (3.5)	ND (300.0)	ND (3.5)	ND (3.5)	ND (3.3)
4-Chloroaniline	ND (1.7)	ND (300.0)	ND (1.7)	ND (1.7)	ND (1.6)
4-Chlorophenyl phenyl ether	NT	ND (300.0)	NT	NT	NT
4-Methylphenol (p-cresol)	NT	ND (300.0)	NT	NT	NT

Table 3

Small Boat Harbor (Eastward Expansion), Seward, AK

Method 8270B

SemiVolatile Organic Compounds

October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
DEPTH (FT):	5'	Surface	Surface	Surface	5'
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-05	K9707802-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27 - 29/97	10/28/97	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
4-Nitroaniline	ND (2.8)	ND (2000.0)	ND (2.8)	ND (2.8)	ND (2.7)
4-Nitrophenol	ND (5.1)	ND (2000.0)	ND (5.1)	ND (5.1)	ND (4.8)
Acenaphthene	ND (3.8)	ND (300.0)	ND (3.8)	ND (3.8)	ND (3.6)
Acenaphthylene	ND (2.8)	ND (300.0)	ND (2.8)	ND (2.8)	ND (2.7)
Aniline	NT	ND (1000.0)	NT	NT	NT
Anthracene	ND (2.9)	ND (300.0)	ND (2.9)	ND (2.9)	ND (2.8)
Benzo(a)anthracene	2.7	ND (300.0)	ND (1.7)	ND (1.7)	ND (1.6)
Benzo(a)pyrene	ND (2)	ND (300.0)	ND (2)	ND (2)	ND (1.9)
Benzo(b)fluoranthene	5.3	ND (300.0)	3.4 J	ND (3.5)	ND (3.4)
Benzo(g,h,i)perylene	ND (0.75)	ND (300.0)	ND (0.75)	ND (0.75)	ND (0.71)
Benzo(k)fluoranthene	2.5	ND (300.0)	ND (1.7)	ND (1.7)	ND (1.7)
Benzoic acid	ND (4.4)	ND (2000.0)	ND (4.3)	ND (4.4)	ND (4.1)
Benzyl alcohol	ND (3.4)	ND (300.0)	2.8 J	ND (3.4)	ND (3.2)
Benzyl butyl phthalate	6.1 B1	ND (300.0)	5.3 B1	4.6 B1	6.3 B1
bis-(2-chloroethoxy)methane	ND (4.2)	ND (300.0)	ND (4.2)	ND (4.2)	ND (4)
bis-(2-chloroethyl)ether	ND (11)	ND (300.0)	ND (11)	ND (11)	ND (11)
Bis(2-chloroisopropyl)ether	ND (3.6)	ND (300.0)	ND (3.6)	ND (3.6)	ND (3.4)
bis-(2-ethylhexyl)phthalate	34 B1	ND (300.0)	31 B1	27 B1	29 B1
Chrysene	ND (3.5)	ND (300.0)	5.8	ND (3.5)	ND (3.3)
Dibenzo(a,h)anthracene	ND (1.8)	ND (300.0)	ND (1.8)	ND (1.8)	ND (1.7)
Dibenzofuran	ND (2)	ND (300.0)	ND (1.9)	ND (2)	ND (1.9)
Diethyl phthalate	6.4 B1	ND (300.0)	8 B1	5.7 B1	5.7 B1
Dimethyl phthalate	ND (5.2)	ND (300.0)	ND (5.2)	ND (5.2)	ND (5)
Di-n-butyl phthalate	19 B1	ND (300.0)	19 B1	13 B1	13 B1
Di-n-octyl phthalate	ND (1.8)	ND (300.0)	ND (1.8)	ND (1.8)	ND (1.7)
Fluoranthene	6.7	ND (300.0)	8.4	4.2	ND (1.8)
Fluorene	ND (2.4)	ND (300.0)	ND (2.4)	ND (2.4)	ND (2.3)
Hexachlorobenzene	ND (1)	ND (300.0)	ND (1)	ND (1)	ND (0.96)

Table 3
Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8270B
SemiVolatile Organic Compounds
October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
DEPTH (FT):	5'	Surface	Surface	Surface	5'
LABORATORY SAMPLE ID:	68308-05	K9707802-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27 - 29/97	10/28/97	10/27 - 29/97	10/27 - 29/97	10/27 - 29/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
Hexachlorobutadiene	ND (3.2)	ND (300.0)	ND (3.2)	ND (3.2)	ND (3)
Hexachlorocyclopentadiene	ND (2.8)	ND (300.0)	ND (2.8)	ND (2.8)	ND (2.7)
Hexachloroethane	ND (2)	ND (300.0)	ND (2)	ND (2)	ND (1.9)
Indeno(1,2,3-cd)pyrene	2	ND (300.0)	ND (1.8)	ND (1.8)	ND (1.7)
Isophorone	ND (2.7)	ND (300.0)	ND (2.7)	ND (2.7)	ND (2.5)
Naphthalene	ND (2.6)	ND (300.0)	ND (2.5)	ND (2.5)	ND (2.4)
Nitrobenzene	ND (5.9)	ND (300.0)	ND (5.9)	ND (5.9)	ND (5.6)
n-Nitrosodimethylamine	NT	ND (2000.0)	NT	NT	NT
n-Nitrosodi-n-propylamine	ND (3.6)	ND (300.0)	ND (3.6)	ND (3.6)	ND (3.4)
n-Nitrosodiphenylamine	ND (1.5)	ND (300.0)	ND (1.5)	ND (1.5)	ND (1.4)
Pentachlorophenol	ND (4.5)	ND (2000.0)	4.3 J	ND (4.5)	ND (4.2)
Phenanthrene	5.1	ND (300.0)	4.5	ND (3.2)	ND (3)
Phenol	ND (4.3)	ND (300.0)	ND (4.3)	5.7	ND (4.1)
Pyrene	5	ND (300.0)	2.8	ND (2.8)	ND (2.7)
TIC's:	0	1	0	0	0
Total TIC Concentration:	0	0.3	0	0	0

SAS: Sound Analytical Services, Inc., Tacoma, WA.
CAS: Columbia Analytical Services, Inc., Kelso, WA.
TIC: Tentatively Identified Compounds.
B1: Analyte was detected in the associated method blank.
J: Estimated Value.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 4
Small Boat Harbor (Eastward Expansion), Seward, AK
8RCRA Metals + Copper & Zinc
Metals, Total
October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
DEPTH (FT):	Surface	15'	5'	Surface
TESTING LABORATORY:	SAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27/97	10/27/97	10/27/97	10/27/97
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic	5.6	3.6	5.6	11
Barium	28	14	8.7	13
Cadmium	ND (0.49)	ND (0.54)	ND (0.5)	ND (0.5)
Chromium	30	31	18	27
Copper	72	17	26	28
Lead	46	6	7.9	9.3
Mercury	0.21	0.096	0.14	0.12
Selenium	ND (2)	ND (2.2)	ND (2)	ND (2)
Silver	ND (2)	ND (2.2)	ND (2)	ND (2)
Zinc	63	65	40	67

SAS: Sound Analytical Services, Inc., Tacoma, WA.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 4

Small Boat Harbor (Eastward Expansion), Seward, AK
8RCRA Metals, Copper & Zinc
Metals, Total
October, 1997

LOCATION OF SAMPLE:	AP-188	QA Dup	QC Dup	Primary	AP-189
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
DEPTH (FT):	5'	Surface	Surface	Surface	5'
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
LABORATORY SAMPLE ID:	68308-05	A9700977-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	10/27/97	11/3 - 18/97	10/27/97	10/27/97	10/27/97
CONCENTRATION UNITS:	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
Arsenic	5.9	10	7.3	7.1	5.1
Barium	9.9	28	12	11	13
Cadmium	ND (0.52)	0.8 J	ND (0.54)	ND (0.55)	ND (0.46)
Chromium	19	35	23	20	25
Copper	18	28	23	23	21
Lead	6.2	10	7.3	7.4	6.8
Mercury	0.16	ND (0.2)	0.11	0.13	0.12
Selenium	ND (2.1)	ND (1)	ND (2.2)	ND (2.2)	ND (1.9)
Silver	ND (2.1)	2	ND (2.2)	ND (2.2)	ND (1.9)
Zinc	44	72	54	52	55

SAS: Sound Analytical Services, Inc., Tacoma, WA.
CAS: Columbia Analytical Services, Inc., Kelso, WA.
J: Estimated Value.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 5

Small Boat Harbor (Eastward Expansion), Seward, AK

Method 8080

Organochlorine Pesticides and Polychlorinated Biphenyls (PCB's)

October, 1997

LOCATION OF SAMPLE:	AP-186	AP-186	AP-187	Background
DATE OF SAMPLE:	10/17/97	10/15/97	10/15/97	10/16/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	01SD	02SD	03SD	04SD
TESTING LABORATORY:	SAS	SAS	SAS	SAS
DEPTH (FT):	Surface	15'	5'	Surface
LABORATORY SAMPLE ID:	68308-01	68308-02	68308-03	68308-04
DATE RECEIVED:	10/23/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	11/5/97	11/5/97	11/5/97	11/5/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg
4,4'-DDD	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
4,4'-DDE	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
4,4'-DDT	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
Aldrin	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
alpha-BHC	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
beta-BHC	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
Chlordane	ND (9.6)	ND (11)	ND (10)	ND (11)
delta-BHC	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
Dieldrin	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
Endosulfan I	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
Endosulfan II	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
Endosulfan sulfate	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
Endrin	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
Endrin aldehyde	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
Endrin ketone	ND (1.9)	ND (2.2)	ND (2.1)	ND (2.3)
gamma-BHC (Lindane)	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
Heptachlor	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
Heptachlor epoxide	ND (0.96)	ND (1.1)	ND (1)	ND (1.1)
Methoxychlor	ND (9.6)	ND (11)	ND (10)	ND (11)
PCB-1016 (Aroclor 1016)	ND (0.1)	ND (0.1)	ND (0.1)	ND (0.1)
PCB-1221 (Aroclor 1221)	ND (0.2)	ND (0.2)	ND (0.2)	ND (0.2)
PCB-1232 (Aroclor 1232)	ND (9.6)	ND (11)	ND (10)	ND (11)
PCB-1242 (Aroclor 1242)	ND (9.6)	ND (11)	ND (10)	ND (11)
PCB-1248 (Aroclor 1248)	ND (9.6)	ND (11)	ND (10)	ND (11)
PCB-1254 (Aroclor 1254)	150 C	ND (11)	ND (10)	ND (11)
PCB-1260 (Aroclor 1260)	120 C	ND (11)	ND (10)	ND (11)
Toxaphene	ND (96)	ND (110)	ND (100)	ND (110)

SAS: Sound Analytical Services, Inc., Tacoma, WA.

C: Additional confirmation performed.

ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

Table 5

Small Boat Harbor (Eastward Expansion), Seward, AK
Method 8080
Organochlorine Pesticides and Polychlorinated Biphenyls (PCB's)
October, 1997

LOCATION OF SAMPLE:	AP-185	QA Dup	QC Dup	Primary	AP-189
DATE OF SAMPLE:	10/17/97	10/17/97	10/17/97	10/17/97	10/17/97
TYPE OF SAMPLE:	Sediment	Sediment	Sediment	Sediment	Sediment
FIELD SAMPLE ID #: 97SSEW-	05SD	06SD	07SD	08SD	09SD
TESTING LABORATORY:	SAS	CAS	SAS	SAS	SAS
DEPTH (FT):	5'	Surface	Surface	Surface	5'
LABORATORY SAMPLE ID:	68308-05	A9700977-001	68308-06	68308-07	68308-08
DATE RECEIVED:	10/23/97	10/20/97	10/23/97	10/23/97	10/23/97
DATE ANALYZED:	11/5/97	11/17/97	11/5/97	11/5/97	11/5/97
CONCENTRATION UNITS:	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg
4,4'-DDD	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
4,4'-DDE	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
4,4'-DDT	14 C	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
Aldrin	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
alpha-BHC	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
beta-BHC	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
Chlordane	ND (11)	ND (400.0)	ND (10)	ND (11)	ND (10)
delta-BHC	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
Dieldrin	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
Endosulfan I	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
Endosulfan II	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
Endosulfan sulfate	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
Endrin	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
Endrin aldehyde	ND (2.1)	ND (10.0)	ND (2.1)	ND (2.2)	ND (2)
Endrin ketone	ND (2.1)	NT	ND (2.1)	ND (2.2)	ND (2)
gamma-BHC (Lindane)	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
Heptachlor	ND (1.1)	2.0 J	ND (1)	ND (1.1)	ND (1)
Heptachlor epoxide	ND (1.1)	ND (10.0)	ND (1)	ND (1.1)	ND (1)
Methoxychlor	ND (11)	ND (10.0)	ND (10)	ND (11)	ND (10)
PCB-1016 (Aroclor 1016)	ND (0.1)	ND (100.0)	ND (0.1)	ND (0.1)	ND (0.1)
PCB-1221 (Aroclor 1221)	ND (0.2)	ND (100.0)	ND (0.2)	ND (0.2)	ND (0.2)
PCB-1232 (Aroclor 1232)	ND (11)	ND (100.0)	ND (10)	ND (11)	ND (10)
PCB-1242 (Aroclor 1242)	ND (11)	ND (100.0)	ND (10)	ND (11)	ND (10)
PCB-1248 (Aroclor 1248)	ND (11)	ND (100.0)	ND (10)	ND (11)	ND (10)
PCB-1254 (Aroclor 1254)	ND (11)	ND (100.0)	ND (10)	ND (11)	ND (10)
PCB-1260 (Aroclor 1260)	ND (11)	ND (100.0)	ND (10)	ND (11)	ND (10)
Toxaphene	ND (110)	ND (100.0)	ND (100)	ND (110)	ND (100)

J: Estimated Value
C: Additional confirmation performed.
NT: Not Tested.
ND: Not Detected. (The number in parentheses is the Method Reporting Limit (MRL)).

PROJECT: COE / Seward Small Boat Harbor / AK

PROJECT LOCATION: Seward, Alaska

PROJECT NUMBER: 973-5287x007

RECORD OF BOREHOLE AP186

BORING DATE: October 15, 1997

BORING LOCATION: N 2236560.18, E 603969.02

DATUM: MLLW

SOIL PROFILE

Boring method: 3.25-In. I.D. Hollow Stem Auger

ELEV / DEPTH (ft)	DESCRIPTION
17.3 / 0.0	Compact, moist, dark gray, poorly graded SAND with silt and gravel, 25-40% fine to coarse subrounded gravel up to 1-in., 45-55% fine to coarse sand, 10-15% non-plastic silt (SP-SM) (FILL) Sample 1 (4.5 ft - 5.7 ft) FIELD CLASSIFICATION: Compact, moist, dark gray, silty SAND with gravel, 15-20% fine to coarse subrounded gravel up to 1 in., 50-55% medium to coarse sand, 15-20% non-plastic silt (SM) Sample 2 (9.5 ft - 10.7 ft) LAB CLASSIFICATION: Poorly graded SAND with silt and gravel, 38% fine to coarse gravel up to 1 in., 51% fine to coarse sand, 11% fines (SP-SM)
4.3 / 13.0	Compact, wet, dark gray to black, poorly graded SAND with silt, 10-15% fine angular gravel up to 3/8 in., 45-55% fine to coarse sand, 5-10% non-plastic silt (SP-SM) COE representative took Sample 3 for environmental testing
-0.7 / 18.0	Very soft, wet, gray, lean CLAY (CL)
-8.7 / 26.0	Intermittant 4-in. to 3-ft thick layers of very loose to loose, wet, dark gray to black, poorly graded SAND with silt, 5-10% fine subrounded to angular gravel up to 1/2 in., 65-75% fine to coarse sand, 5-10% non-plastic silt, and gray, non-plastic SILT (SP-SM and ML)
-14.7 / 32.0	CONTINUED ON NEXT PAGE

SAMPLES

NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT
1	HD	7/5/5	10	14/18
2	HD	4/10/8	18	14/18
3	HD	2/4/6/5	10	12/24
4	HD	1/1/1	2	9/18
5	HD	1/4/1	5	14/18

PENETRATION RESISTANCE BLOWS/FT ■ (20, 40, 60, 80)

WATER CONTENT, PERCENT Wp —O^W— Wl (20, 40, 60, 80)

PIEZOMETER OR STANDPIPE INSTALLATION: 13 ft ▽ 10/15/97

DRILL RIG: CME-75 on Nodwell

DRILLING CONTRACTOR: Discovery Drilling

DRILLER: Scott Clinkerbeard

Figure A-1

Golder Associates

LOGGED: Steve L Anderson

CHECKED: RGD

DATE: 12/22/97

PROJECT: COE / Seward Small Boat Harbor / AK

PROJECT LOCATION: Seward, Alaska

PROJECT NUMBER: 973-5287x007

RECORD OF BOREHOLE AP186

BORING DATE: October 15, 1997

BORING LOCATION: N 2236560.18, E 603969.02

DATUM: MLLW

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	ICE BOND	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ 20 40 60 80 / WATER CONTENT, PERCENT Wp —O W— Wl 20 40 60 80	PIEZOMETER STANDPIPE INSTALLATION
		CONTINUED FROM PREVIOUS PAGE										
32–38	3.25-in. I.D. Hollow Stem Auger	Intermittent layers 4-in. to 4-ft thick of very loose to loose, wet, dark gray to black, poorly graded SAND with silt, 5-10% fine subrounded to angular gravel up to 1/2 in., 65-75% fine to coarse sand, 5-10% non-plastic silt, and gray, non-plastic SILT (SP-SM and ML)										
39		About 2 ft of heave in auger when sampling at 39.5 ft										
40–41		Sample 6 FIELD DESCRIPTION: Soils recovered appeared to be unrepresentative heave materials that were discarded. Blow counts are not representative of the true relative density.				6	HD	8/8/18		18/18		
43		About 15 ft of heave in auger when attaching auger flight to drill deeper.			-26.7							
44		Bottom of hole at about 44 ft			44.0							

NOTES:

1. Groundwater encountered at about 13 ft.
2. Samples collected with 2.5-in. I.D. split-spoon sampler (HD) driven with 340-lb hammer.
3. Major soil description same as sample field classification when field classification is not noted.
4. Hole terminated at 44 ft due to excessive heave inside augers.

DRILL RIG: CME-75 on Nodwell

DRILLING CONTRACTOR: Discovery Drilling

DRILLER: Scott Clinkerbeard

Figure A-1

Golder Associates

LOGGED: Steve L. Anderson

CHECKED: RGD

DATE: 12/22/97

RECORD OF BOREHOLE AP187

PROJECT: COE / Seward Small Boat Harbor / AK
PROJECT LOCATION: Seward, Alaska
PROJECT NUMBER: 973-5287x007

BORING DATE: October 15, 1997
BORING LOCATION: N 2235872.63, E 604035.24

SHEET: 1 OF 1
DATUM: MLLW

BORING METHOD: 3.25-In. I.D. Hollow Stem Auger

DEPTH SCALE FEET	SOIL PROFILE – DESCRIPTION	ELEV / DEPTH	SAMPLE NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT
0	Soft intertidal zone with mussel shells.	-0.2 / 0.0					
0–18	Compact, wet, gray-black, poorly graded SAND with silt and sand, 45-50% fine to coarse subrounded, flat gravel up to 1 in., 45-55% fine to coarse sand, 5-10% non-plastic silt (SP-SM)						
5	Sample 1 (4.5 ft - 5.2 ft) FIELD CLASSIFICATION: Compact, wet, gray-black, poorly graded GRAVEL with silt and sand, 45-50% fine to coarse subrounded, flat gravel up to 1.25 in., 25-30% medium to coarse sand, 10-15% non-plastc silt (GP-GM) (COE representative took sample for environmenmtal testing)		1	HD	10/6/10/10	16	20/24
10	Sample 2 (9.5 ft - 10.3 ft) LAB CLASSIFICATION: Poorly graded SAND with gravel, 46% fine to coarse gravel up to 1 in., 52% fine to coarse sand, 2% fines (SP)		2	HD	6/8/10	18	10/18
14	About 5 ft of heave in auger when sampling at 14.5 ft						
15	Sample 3 (14.5 ft - 15.3 ft) FIELD CLASSIFICATION: Compact, wet, black-gray, poorly graded GRAVEL with silt and sand, 45-50% fine to coarse subrounded gravel up to 1 in., 30-35% fine to coarse sand, 10-15% non-plastic silt (GP-GM) (QUESTIONABLE REPRESENTATION)		3	HD	3/6/10	16	10/18
18	Compact, wet, black-gray, poorly graded SAND with silt and gravel, 15-20% fine subangular gravel up to 3/8 in., 55-65% fine to coarse sand, 10-15% non-plastic silt, occasional lenses of non-plastic SILT up to 3-in. thick (SP-SM)	-18.2 / 18.0					
20			4	HD	4/7/7	14	18/18
22	Compact, wet, black, poorly graded SAND with silt, 90-95% fine sand, 5-10% non-plastic silt (SP-SM)	-22.2 / 22.0					
25			5	HD	9/8/8	16	12/18
26	Bottom of hole at about 26 ft	-26.2 / 26.0					

PENETRATION RESISTANCE BLOWS/FT ■ (20, 40, 60, 80); WATER CONTENT, PERCENT Wp —○W— Wl (20, 40, 60, 80)

PIEZOMETER OR STANDPIPE INSTALLATION

NOTES:

1. Samples taken with 2.5-in. I.D. split-spoon sampler (HD) driven with 340-lb hammer.
2. Major soil description same as sample field classification when field classification is not noted.
3. Hole terminated at 26 ft due to nearness of incoming tide.

DRILL RIG: CME-75 on Nodwell
DRILLING CONTRACTOR: Discovery Drilling
DRILLER: Scott Clinkerbeard

Figure A2

Golder Associates

LOGGED: Steve L. Anderson
CHECKED: RGD
DATE: 12/22/97

PROJECT: COE / Seward Small Boat Harbor / AK

PROJECT LOCATION: Seward, Alaska

PROJECT NUMBER: 973-5287x007

RECORD OF BOREHOLE AP188

BORING DATE: October 16, 1997

BORING LOCATION: N 2236213.35, E 604186.92

SHEET: 1 OF 1

DATUM: MLLW

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE: DESCRIPTION	ICE BOND	GRAPHIC LOG	ELEV / DEPTH	SAMPLES: NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT (20 40 60 80); WATER CONTENT, PERCENT Wp W Wl (20 40 60 80)	PIEZOMETER STANDPIPE INSTALLATION
		Flat gravelly surface in intertidal zone.			1.9 / 0.0							
0–13	3.25-in. I.D. Hollow Stem Auger	Compact, wet, dark gray to black, poorly graded GRAVEL with silt and sand, 45-55% fine to coarse, subrounded to subangular gravel up to 1.25 in., 45-50% medium to coarse sand, 5-10% non-plastic silt (GP-GM)										
5		Sample 1 (4.5 ft - 5.5 ft) FIELD CLASSIFICATION: Compact, wet, dark gray, poorly graded GRAVEL with silt and sand, 45-55% fine to coarse, subrounded to subangular gravel up to 1.25 in., 30-35% medium to coarse sand, 5-10% non-plastic silt (GP-GM)				1	HD	14/12/17	29	12/18		
10		Sample 2 (9.5 ft - 10.4 ft) FIELD CLASSIFICATION: Compact, wet, dark gray to black, poorly graded GRAVEL with silt and sand, 45-55% fine subrounded to subangular gravel up to 3/4 in., 30-35% medium to coarse sand, 5-10% non-plastic silt (GP-GM)				2	HD	18/13/14	27	11/18		
13		Compact, wet, black to dark gray, poorly graded SAND with silt and gravel, 25-30% fine subrounded gravel up to 1/2 in., 55-60% medium to coarse sand, 0-10% non-plastic silt, occasional lenses of non-plastic SILT at least 3-in. thick, drilling indicates occasional lenses about 2 ft thick with higher gravel content (SP-SM)			-11.1 / 13.0							
15		Sample 3 (14.5 ft - 15.3 ft) LAB CLASSIFICATION: Poorly graded SAND with gravel, 24% fine gravel, up to 3/4 in., 73% fine to coarse sand, 3% fines (SP)				3	HD	20/12/9	21	15/18		
19		About 3 ft of heave in auger when sampling at 19.5 ft										
20		Sample 4 (19.5 ft - 20.3 ft) FIELD CLASSIFICATION: Compact, wet, black to dark gray, poorly graded SAND with silt and gravel, 25-30% fine subrounded gravel up to 1/2 in., 55-60% medium to coarse sand, 5-10% non-plastic silt, lense of non-plastic SILT at least 3-in. thick (SP-SM)				4	HD	6/10/8	18	8/18		
29		About 8 ft of heave in auger when sampling at 29.5 ft			-27.6 / 29.5							
29.5		Bottom of hole at about 29.5 ft										

NOTES:

1. Samples taken with 2.5-in. I.D. split-spoon sampler (HD) driven with 340-lb hammer.
2. Hole terminated at 29.5 ft due to excessive heave in auger and nearness of incoming tide.

DRILL RIG: CME-75 on Nodwell

DRILLING CONTRACTOR: Discovery Drilling

DRILLER: Scott Clinkerbeard

Figure A3

Golder Associates

LOGGED: Steve L. Anderson

CHECKED: RGO

DATE: 12/22/97

PROJECT: COE / Seward Small Boat Harbor / AK

PROJECT LOCATION: Seward, Alaska

PROJECT NUMBER: 973-5287x007

RECORD OF BOREHOLE AP189

BORING DATE: October 17, 1997

BORING LOCATION: N 2235713.98, E 603928.68

DATUM: MLLW

DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE DESCRIPTION	ICE BOND	GRAPHIC LOG	ELEV / DEPTH	SAMPLES NUMBER	TYPE	BLOWS / 6 in	N	REC/ATT	PENETRATION RESISTANCE BLOWS/FT ■ (20 40 60 80); WATER CONTENT, PERCENT Wp —O^W— Wl (20 40 60 80)	PIEZOMETER OR STANDPIPE INSTALLATION
		Soft intertidal zone with mussel shells.			-0.5							
0	3.25-in. I.D. Hollow Stem Auger	Compact, wet, dark gray to black, poorly graded GRAVEL with silt and sand, 45-65% fine to coarse, subrounded to subangular gravel up to 1 in., 30-45% medium to coarse sand, 0-10% non-plastic silt (GP-GM)			0.0							
5		Sample 1 (4.5 ft - 5.4 ft) FIELD CLASSIFICATION: Compact, wet, dark gray to black, poorly graded GRAVEL with silt and sand, 45-55% fine to coarse, subrounded to subangular gravel up to 1 in., 30-35% medium to coarse sand, 5-10% non-plastic silt (GP-GM) (COE representative took sample for environmental testing)				1	HD	5/6/11	17	11/18	■ (17)	
9		About 2 ft of heave in auger when sampling at 9.5 ft										
10		Sample 2 (9.5 ft - 10.0 ft) FIELD CLASSIFICATION: Compact, wet, black, poorly graded GRAVEL with sand, 55-65% fine, subrounded to subangular gravel up to 3/4 in., 35-40% fine to coarse sand, 0-5% non-plastic silt (GP)				2	HD	6/7/6	13	6/18	■ (13)	
13		Loose to dense, wet, black to gray, poorly graded SAND with gravel, 10-20% fine subangular gravel up to 3/8 in., 80-95% fine to medium angular sand, 0-5% non-plastic silt, occasional lense of gray, non-plastic SILT at least 2-in. thick (SP)			-13.5 / 13.0							
15		Sample 3 (14.5 ft - 15.7 ft) LAB CLASSIFICATION: poorly graded SAND with gravel, 18% fine gravel up to 3/8 in., 80% fine to coarse sand, 2% fines (SP)				3	HD	10/5/3	8	14/18	■ (8)	
19		About 3 ft of heave in auger when sampling at 19.5 ft										
20		Sample 4 (19.5 ft - 20.2 ft) FIELD CLASSIFICATION: Compact to dense, wet, gray-black, poorly graded SAND with silt, 85-95% fine to medium angular sand, 5-10% non-plastic silt (SP-SM) (QUESTIONABLE SAMPLE AND BLOW COUNT REPRESENTATION)				4	HD	22/28/20	48	8/18	■ (48)	
28		About 6 ft of heave in auger when sampling at 29.5 ft										
29					-30.0 / 29.5							
30		Bottom of hole at about 29.5 ft										

NOTES:

1. Samples taken with 2.5-in. I.D. split-spoon sampler (HD) driven with 340-lb hammer.
2. Boring terminated at 29.5 ft due to excessive heave in auger and nearness of incoming tide.

DRILL RIG: CME-75 on Nodwell

DRILLING CONTRACTOR: Discovery Drilling

DRILLER: Scott Clinkerbeard

Figure A4

Golder Associates

LOGGED: Steve L Anderson

CHECKED: RGO

DATE: 12/22/97

APPENDIX C

State of Washington
Marine Sediment Quality Standard
&
PSDDA

Worksheets

Sample Number: 01SD

TOC (ppm) 3600 = 0.36

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards: Table 1 Marine Sed. Quality Stand. Chem Criteria	State of Washington Sediment Management Standards: Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized: SL	PSDDA Not TOC Normalized: ML1
				Metals Not TOC Normalized		ppm dry	
Ar	5.6		Not Normalized to TOC	57	93	70	85
Cd	0.49	nd		5.1	6.7	0.96	5.8
Cr	30			260	270		
Cu	72			390	390	80	310
Pb	46			450	530	70	300
Hg	0.21			0.41	0.59	0.21	0.41
Ag	2	nd		6.1	6.1	1.2	1.2
Zn	63			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	153.5		426	370,000	780,000	610	5200
Naphthalene	2.3		6	99,000	170,000	210	2100
Acenaphthylene	23		64	66,000	66,000	64	560
Acenaphthene	35	nd	97	16,000	57,000	63	500
Fluorene	5.2		14	23,000	79,000	64	540
Phenanthrene	33		92	100,000	480,000	320	1500
Anthracene	55		153	220,000	1,200,000	130	960
2-Methylnaphthalene	33	nd	92	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	930.8		2586	960,000	5,300,000	1800	12000
Fluoranthene	190		528	160,000	1,200,000	630	1700
Pyrene	110		306	1,000,000	1,400,000	430	2600
Benz(a) anthracene	49		136	110,000	270,000	450	1300
Chrysene	78		217	110,000	460,000	670	1400
Total Benzofluoranthenes	193		536	230,000	450,000	800	3200
Benzo(a) pyrene	70		194	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	150		417	34,000	88,000	69	600
Dibenzo(a,h) anthracene	9.8		27	12,000	33,000	120	230
Benzo(g,h,i) Perylene	81		225	31,000	78,000	540	670
1,2-Dichlorobenzene	3.1	nd	9	2,300	2,300	19	35
1,4-Dichlorobenzene	3.4	nd	9	3,100	9,000	26	110
1,2,4-Trichlorobenzene	2.9	nd	8	810	1,800	6.4	31
Hexachlorobenzene	0.93	nd	3	380	2,300	23	70
Dimethyl Phthalate	56		156	53,000	53,000	160	--
Diethyl Phthalate	4.3	b	12	61,000	110,000	97	--
Di-n-butyl Phthalate	23	b	64	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	8.8	b	24	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	52	b	144	47,000	78,000	1900	--
Di-n-Octyl phthalate	1.7	nd	5	58,000	4,500,000	68000	--
Dibenzofuran	3.8		11	15,000	58,000	--	--
Hexachlorobutadiene	2.9	nd	8	3,900	6,200	29	120
N-nitrosodiphenylamine	1.3	nd	4	11,000	11,000	22	40
Total PCBs	299.1		831	12,000	65,000	130	130
Phenol	3.9	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	2.9	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.1	nd		29	29	10	29
Pentachlorophenol	7.3			360	690	140	
Benzyl alcohol	3.1	nd		57	73	10	57
Benzoic Acid	21			650	650	216	650
Trichloroethene	10	nd		--	--	160	1600
Tetrachloroethene	10	nd		--	--	14	140
Ethylbenzene	10	nd		--	--	3.7	33
Total Xylenes	31	nd		--	--	12	100

Sample Number: 2SD							
TOC (ppm)	2800	=	0.28	State of Washington Sediment Management Standards		PSDDA Not TOC Normalized	
	Analytical Results (ppm)	Qualifiers	Normalized Results	Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	3.6		Not Normalized to TOC	57	93	70	85
Cd	0.54	nd		5.1	6.7	0.96	5.8
Cr	31			260	270	--	--
Cu	17			390	390	80	310
Pb	6			450	530	70	300
Hg	0.096			0.41	0.59	0.21	0.41
Ag	2.2	nd		6.1	6.1	1.2	1.2
Zn	65			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	24.3		87	370,000	780,000	610	5200
Naphthalene	9.5		34	99,000	170,000	210	2100
Acenaphthylene	2.7	nd	10	66,000	66,000	64	560
Acenaphthene	3.7	nd	13	16,000	57,000	63	500
Fluorene	2.4	nd	9	23,000	79,000	64	540
Phenanthrene	3.1	nd	11	100,000	480,000	320	1500
Anthracene	2.9	nd	10	220,000	1,200,000	130	960
2-Methylnaphthalene	3.6	nd	13	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	21.14		76	960,000	5,300,000	1800	12000
Fluoranthene	1.8	nd	6	160,000	1,200,000	630	1700
Pyrene	2.8	nd	10	1,000,000	1,400,000	430	2600
Benz(a) anthracene	1.7	nd	6	110,000	270,000	450	1300
Chrysene	3.4	nd	12	110,000	460,000	670	1400
Total Benzofluoranthenes	5.2	nd	19	230,000	450,000	800	3200
Benzo(a) pyrene	1.9	nd	7	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	1.8	nd	6	34,000	88,000	69	600
Dibenzo(a,h) anthracene	1.8	nd	6	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.74	nd	3	31,000	78,000	540	670
1,2-Dichlorobenzene	3.6	nd	13	2,300	2,300	19	35
1,4-Dichlorobenzene	3.7	nd	13	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3.1	nd	11	810	1,800	6.4	31
Hexachlorobenzene	1	nd	4	380	2,300	23	70
Dimethyl Phthalate	5.1	nd	18	53,000	53,000	160	--
Diethyl Phthalate	5.6	b1	20	61,000	110,000	97	--
Di-n-butyl Phthalate	23	b1	82	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	5.3	b1	19	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	33	b1	118	47,000	78,000	1900	--
Di-n-Octyl phthalate	3.6		13	58,000	4,500,000	68000	--
Dibenzofuran	1.9	nd	7	15,000	58,000	--	--
Hexachlorobutadiene	3.1	nd	11	3,900	6,200	29	120
N-nitrosodiphenylamine	2.2		8	11,000	11,000	22	40
Total PCBs	55.3	nd	198	12,000	65,000	130	130
Phenol	4.2	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3.1	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.4	nd		29	29	10	29
Pentachlorophenol	4.4	nd		360	690	140	
Benzyl alcohol	3.4	nd		57	73	10	57
Benzoic Acid	4.3	nd		650	650	216	650
Trichloroethene	11	nd		--	--	160	1600
Tetrachloroethene	11	nd		--	--	14	140
Ethylbenzene	11	nd		--	--	3.7	33
Total Xylenes	33	nd		--	--	12	100

Sample Number: 03SD

TOC (ppm) 3600 = 0.36

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	5.6		Not Normalized to TOC	57	93	70	85
Cd	0.54	nd		5.1	6.7	0.96	5.8
Cr	31			260	270		
Cu	17			390	390	80	310
Pb	6			450	530	70	300
Hg	0.096			0.41	0.59	0.21	0.41
Ag	2.2	nd		6.1	6.1	1.2	1.2
Zn	65			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	17.6		49	370,000	780,000	610	5200
Naphthalene	2.5	nd	7	99,000	170,000	210	2100
Acenaphthylene	2.8	nd	8	66,000	66,000	64	560
Acenaphthene	3.8	nd	11	16,000	57,000	63	500
Fluorene	2.4	nd	7	23,000	79,000	64	540
Phenanthrene	3.2	nd	9	100,000	480,000	320	1500
Anthracene	2.9	nd	8	220,000	1,200,000	130	960
2-Methylnaphthalene	3.6	nd	10	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	22.44		62	960,000	5,300,000	1800	12000
Fluoranthene	3		8	160,000	1,200,000	630	1700
Pyrene	2.8	nd	8	1,000,000	1,400,000	430	2600
Benz(a) anthracene	1.7	nd	5	110,000	270,000	450	1300
Chrysene	3.5	nd	10	110,000	460,000	670	1400
Total Benzofluoranthenes	5.2	nd	14	230,000	450,000	800	3200
Benzo(a) pyrene	1.9	nd	5	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	1.8	nd	5	34,000	88,000	69	600
Dibenzo(a.h) anthracene	1.8	nd	5	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.74	nd	2	31,000	78,000	540	670
1,2-Dichlorobenzene	3.7	nd	10	2,300	2,300	19	35
1,4-Dichlorobenzene	3.7	nd	10	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3.2	nd	9	810	1,800	6.4	31
Hexachlorobenzene	1	nd	3	380	2,300	23	70
Dimethyl Phthalate	5.2	nd	14	53,000	53,000	160	--
Diethyl Phthalate	6.6	b1	18	61,000	110,000	97	--
Di-n-butyl Phthalate	27	b1	75	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	10	b1	28	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	37	b1	103	47,000	78,000	1900	--
Di-n-Octyl phthalate	1.9		5	58,000	4,500,000	68000	--
Dibenzofuran	1.9	nd	5	15,000	58,000	--	--
Hexachlorobutadiene	3.2	nd	9	3,900	6,200	29	120
N-nitrosodiphenylamine	1.5	nd	4	11,000	11,000	22	40
Total PCBs	50.3	nd	140	12,000	65,000	130	130
Phenol	4.3	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3.1	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.4	nd		29	29	10	29
Pentachlorophenol	4.4	nd		360	690	140	
Benzyl alcohol	3.4	nd		57	73	10	57
Benzoic Acid	3	j		650	650	216	650
Trichloroethene	11	nd		--	--	160	1600
Tetrachloroethene	11	nd		--	--	14	140
Ethylbenzene	11	nd		--	--	3.7	33
Total Xylenes	34	nd		--	--	12	100

Sample Number: 04SD

TOC (ppm) 3600 = 0.36

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	11		Not Normalized to TOC	57	93	70	85
Cd	0.5	nd		5.1	6.7	0.96	5.8
Cr	27			260	270		
Cu	28			390	390	80	310
Pb	9.3			450	530	70	300
Hg	0.12			0.41	0.59	0.21	0.41
Ag	2	nd		6.1	6.1	1.2	1.2
Zn	67			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	21.1		59	370,000	780,000	610	5200
Naphthalene	2.3	nd	6	99,000	170,000	210	2100
Acenaphthylene	2.8	nd	8	66,000	66,000	64	560
Acenaphthene	3.8	nd	11	16,000	57,000	63	500
Fluorene	2.4	nd	7	23,000	79,000	64	540
Phenanthrene	3.2	nd	9	100,000	480,000	320	1500
Anthracene	3	nd	8	220,000	1,200,000	130	960
2-Methylnaphthalene	3.6	nd	10	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	21.55		60	960,000	5,300,000	1800	12000
Fluoranthene	1.9	nd	5	160,000	1,200,000	630	1700
Pyrene	2.8	nd	8	1,000,000	1,400,000	430	2600
Benz(a) anthracene	1.7	nd	5	110,000	270,000	450	1300
Chrysene	3.5	nd	10	110,000	460,000	670	1400
Total Benzofluoranthenes	5.3	nd	15	230,000	450,000	800	3200
Benzo(a) pyrene	2	nd	6	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	1.8	nd	5	34,000	88,000	69	600
Dibenzo(a,h) anthracene	1.8	nd	5	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.75	nd	2	31,000	78,000	540	670
1,2-Dichlorobenzene	3.7	nd	10	2,300	2,300	19	35
1,4-Dichlorobenzene	3.8	nd	11	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3.2	nd	9	810	1,800	6.4	31
Hexachlorobenzene	1	nd	3	380	2,300	23	70
Dimethyl Phthalate	5.2	nd	14	53,000	53,000	160	--
Diethyl Phthalate	6	b1	17	61,000	110,000	97	--
Di-n-butyl Phthalate	15	b1	42	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	5.7	b1	16	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	28	b1	78	47,000	78,000	1900	--
Di-n-Octyl phthalate	1.9	nd	5	58,000	4,500,000	68000	--
Dibenzofuran	2	nd	6	15,000	58,000	--	--
Hexachlorobutadiene	3.2	nd	9	3,900	6,200	29	120
N-nitrosodiphenylamine	1.5	nd	4	11,000	11,000	22	40
Total PCBs	55.3	nd	154	12,000	65,000	130	130
Phenol	4.3	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3.2	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.4	nd		29	29	10	29
Pentachlorophenol	4.5	nd		360	690	140	
Benzyl alcohol	3.4	nd		57	73	10	57
Benzoic Acid	4.4	nd		650	650	216	650
Trichloroethene	11	nd		--	--	160	1600
Tetrachloroethene	11	nd		--	--	14	140
Ethylbenzene	11	nd		--	--	3.7	33
Total Xylenes	34	nd		--	--	12	100

Sample Number: 05SD

TOC (ppm) 2800 = 0.28

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	5.9		Not Normalized to TOC	57	93	70	85
Cd	0.52	nd		5.1	6.7	0.96	5.8
Cr	19			260	270		
Cu	18			390	390	80	310
Pb	6.2			450	530	70	300
Hg	0.16			0.41	0.59	0.21	0.41
Ag	2.1	nd		6.1	6.1	1.2	1.2
Zn	44			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	23.2		83	370,000	780,000	610	5200
Naphthalene	2.6	nd	9	99,000	170,000	210	2100
Acenaphthylene	2.8	nd	10	66,000	66,000	64	560
Acenaphthene	3.8	nd	14	16,000	57,000	63	500
Fluorene	2.4	nd	9	23,000	79,000	64	540
Phenanthrene	5.1		18	100,000	480,000	320	1500
Anthracene	2.9	nd	10	220,000	1,200,000	130	960
2-Methylnaphthalene	3.6	nd	13	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	32.25		115	960,000	5,300,000	1800	12000
Fluoranthene	6.7		24	160,000	1,200,000	630	1700
Pyrene	5		18	1,000,000	1,400,000	430	2600
Benz(a) anthracene	2.7		10	110,000	270,000	450	1300
Chrysene	3.5	nd	13	110,000	460,000	670	1400
Total Benzofluoranthenes	7.8		28	230,000	450,000	800	3200
Benzo(a) pyrene	2	nd	7	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	2		7	34,000	88,000	69	600
Dibenzo(a,h) anthracene	1.8	nd	6	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.75	nd	3	31,000	78,000	540	670
1,2-Dichlorobenzene	3.7	nd	13	2,300	2,300	19	35
1,4-Dichlorobenzene	3.8	nd	14	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3.2	nd	11	810	1,800	6.4	31
Hexachlorobenzene	1	nd	4	380	2,300	23	70
Dimethyl Phthalate	5.2	nd	19	53,000	53,000	160	--
Diethyl Phthalate	6.4	b1	23	61,000	110,000	97	--
Di-n-butyl Phthalate	19	b1	68	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	6.1	b1	22	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	34	b1	121	47,000	78,000	1900	--
Di-n-Octyl phthalate	1.8	nd	6	58,000	4,500,000	68000	--
Dibenzofuran	2	nd	7	15,000	58,000	--	--
Hexachlorobutadiene	3.2	nd	11	3,900	6,200	29	120
N-nitrosodiphenylamine	1.5	nd	5	11,000	11,000	22	40
Total PCBs	55.3	nd	198	12,000	65,000	130	130
Phenol	4.3	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3.2	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.4	nd		29	29	10	29
Pentachlorophenol	4.5	nd		360	690	140	
Benzyl alcohol	3.4	nd		57	73	10	57
Benzoic Acid	4.4	nd		650	650	216	650
Trichloroethene	12	nd		--	--	160	1600
Tetrachloroethene	12	nd		--	--	14	140
Ethylbenzene	12	nd		--	--	3.7	33
Total Xylenes	35	nd		--	--	12	100

Sample Number: 06SD

TOC (ppm) 6600 = 0.66

QA Lab did not run requesed 8270 SIM analysis. Detection limits 2 orders of magnitude greater than primary sample.

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	10		Not Normalized to TOC	57	93	70	85
Cd	0.52	nd		5.1	6.7	0.96	5.8
Cr	19			260	270		
Cu	18			390	390	80	310
Pb	6.2			450	530	70	300
Hg	0.16			0.41	0.59	0.21	0.41
Ag	2.1	nd		6.1	6.1	1.2	1.2
Zn	44			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	0		0	370,000	780,000	610	5200
Naphthalene			0	99,000	170,000	210	2100
Acenaphthylene			0	66,000	66,000	64	560
Acenaphthene			0	16,000	57,000	63	500
Fluorene			0	23,000	79,000	64	540
Phenanthrene			0	100,000	480,000	320	1500
Anthracene			0	220,000	1,200,000	130	960
2-Methylnaphthalene			0	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	0		0	960,000	5,300,000	1800	12000
Fluoranthene			0	160,000	1,200,000	630	1700
Pyrene			0	1,000,000	1,400,000	430	2600
Benz(a) anthracene			0	110,000	270,000	450	1300
Chrysene			0	110,000	460,000	670	1400
Total Benzofluoranthenes			0	230,000	450,000	800	3200
Benzo(a) pyrene			0	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene			0	34,000	88,000	69	600
Dibenzo(a,h) anthracene			0	12,000	33,000	120	230
Benzo(g,h,i) Perylene			0	31,000	78,000	540	670
1,2-Dichlorobenzene			0	2,300	2,300	19	35
1,4-Dichlorobenzene			0	3,100	9,000	26	110
1,2,4-Trichlorobenzene			0	810	1,800	6.4	31
Hexachlorobenzene			0	380	2,300	23	70
Dimethyl Phthalate			0	53,000	53,000	160	--
Diethyl Phthalate			0	61,000	110,000	97	--
Di-n-butyl Phthalate			0	220,000	1,700,000	1400	--
Butyl Benzyl phthalate			0	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate			0	47,000	78,000	1900	--
Di-n-Octyl phthalate			0	58,000	4,500,000	68000	--
Dibenzofuran			0	15,000	58,000	--	--
Hexachlorobutadiene			0	3,900	6,200	29	120
N-nitrosodiphenylamine			0	11,000	11,000	22	40
Total PCBs			0	12,000	65,000	130	130
Phenol			Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol				63	63	6.3	63
4-methylphenol				670	670	120	670
2,4-dimethyl phenol				29	29	10	29
Pentachlorophenol				360	690	140	
Benzyl alcohol				57	73	10	57
Benzoic Acid				650	650	216	650
Trichloroethene				--	--	160	1600
Tetrachloroethene				--	--	14	140
Ethylbenzene				--	--	3.7	33
Total Xylenes				--	--	12	100

Sample Number: 07SD

TOC (ppm) 4100 = 0.41

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	7.3		Not Normalized to TOC	57	93	70	85
Cd	0.54	nd		5.1	6.7	0.96	5.8
Cr	23			260	270		
Cu	23			390	390	80	310
Pb	7.3			450	530	70	300
Hg	0.11			0.41	0.59	0.21	0.41
Ag	2.2	nd		6.1	6.1	1.2	1.2
Zn	54			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	22.5		55	370,000	780,000	610	5200
Naphthalene	2.5	nd	6	99,000	170,000	210	2100
Acenaphthylene	2.8	nd	7	66,000	66,000	64	560
Acenaphthene	3.8	nd	9	16,000	57,000	63	500
Fluorene	2.4	nd	6	23,000	79,000	64	540
Phenanthrene	4.5		11	100,000	480,000	320	1500
Anthracene	2.9	nd	7	220,000	1,200,000	130	960
2-Methylnaphthalene	3.6	nd	9	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	30.25		74	960,000	5,300,000	1800	12000
Fluoranthene	8.4		20	160,000	1,200,000	630	1700
Pyrene	2.8		7	1,000,000	1,400,000	430	2600
Benz(a) anthracene	1.7	nd	4	110,000	270,000	450	1300
Chrysene	5.8		14	110,000	460,000	670	1400
Total Benzofluoranthenes	5.2		13	230,000	450,000	800	3200
Benzo(a) pyrene	2	nd	5	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	1.8	nd	4	34,000	88,000	69	600
Dibenzo(a,h) anthracene	1.8	nd	4	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.75	nd	2	31,000	78,000	540	670
1,2-Dichlorobenzene	3.7	nd	9	2,300	2,300	19	35
1,4-Dichlorobenzene	3.8	nd	9	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3.2	nd	8	810	1,800	6.4	31
Hexachlorobenzene	1	nd	2	380	2,300	23	70
Dimethyl Phthalate	5.2	nd	13	53,000	53,000	160	--
Diethyl Phthalate	8	b1	20	61,000	110,000	97	--
Di-n-butyl Phthalate	19	b1	46	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	5.3	b1	13	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	31	b1	76	47,000	78,000	1900	--
Di-n-Octyl phthalate	1.8	nd	4	58,000	4,500,000	68000	--
Dibenzofuran	1.9	nd	5	15,000	58,000	--	--
Hexachlorobutadiene	3.2	nd	8	3,900	6,200	29	120
N-nitrosodiphenylamine	1.5	nd	4	11,000	11,000	22	40
Total PCBs	50.3	nd	123	12,000	65,000	130	130
Phenol	4.3	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3.2	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.4	nd		29	29	10	29
Pentachlorophenol	4.3	j		360	690	140	
Benzyl alcohol	2.8	j		57	73	10	57
Benzoic Acid	4.3	nd		650	650	216	650
Trichloroethene	11	nd		--	--	160	1600
Tetrachloroethene	11	nd		--	--	14	140
Ethylbenzene	11	nd		--	--	3.7	33
Total Xylenes	22	nd		--	--	12	100

Sample Number: 08SD

TOC (ppm) 3600 = 0.36

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	ML1
				Metals Not TOC Normalized		ppm dry	
Ar	7.1		Not Normalized to TOC	57	93	70	85
Cd	0.55	nd		5.1	6.7	0.96	5.8
Cr	20			260	270		
Cu	23			390	390	80	310
Pb	7.4			450	530	70	300
Hg	0.13			0.41	0.59	0.21	0.41
Ag	2.2	nd		6.1	6.1	1.2	1.2
Zn	52			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	21.2		59	370,000	780,000	610	5200
Naphthalene	2.5	nd	7	99,000	170,000	210	2100
Acenaphthylene	2.8	nd	8	66,000	66,000	64	560
Acenaphthene	3.8	nd	11	16,000	57,000	63	500
Fluorene	2.4	nd	7	23,000	79,000	64	540
Phenanthrene	3.2	nd	9	100,000	480,000	320	1500
Anthracene	2.9	nd	8	220,000	1,200,000	130	960
2-Methylnaphthalene	3.6	nd	10	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	23.75		66	960,000	5,300,000	1800	12000
Fluoranthene	4.2		12	160,000	1,200,000	630	1700
Pyrene	2.8	nd	8	1,000,000	1,400,000	430	2600
Benz(a) anthracene	1.7	nd	5	110,000	270,000	450	1300
Chrysene	3.5	nd	10	110,000	460,000	670	1400
Total Benzofluoranthenes	5.2	nd	14	230,000	450,000	800	3200
Benzo(a) pyrene	2	nd	6	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	1.8	nd	5	34,000	88,000	69	600
Dibenzo(a,h) anthracene	1.8	nd	5	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.75	nd	2	31,000	78,000	540	670
1,2-Dichlorobenzene	3.7	nd	10	2,300	2,300	19	35
1,4-Dichlorobenzene	3.8	nd	11	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3.2	nd	9	810	1,800	6.4	31
Hexachlorobenzene	1	nd	3	380	2,300	23	70
Dimethyl Phthalate	5.2	nd	14	53,000	53,000	160	–
Diethyl Phthalate	5.7	b1	16	61,000	110,000	97	–
Di-n-butyl Phthalate	13	b1	36	220,000	1,700,000	1400	–
Butyl Benzyl phthalate	4.6	b1	13	4,900	64,000	470	–
Bis (2-ethylhexyl) phthalate	31	b1	86	47,000	78,000	1900	–
Di-n-Octyl phthalate	1.8	nd	5	58,000	4,500,000	68000	–
Dibenzofuran	2	nd	6	15,000	58,000	–	–
Hexachlorobutadiene	3.2	nd	9	3,900	6,200	29	120
N-nitrosodiphenylamine	1.5	nd	4	11,000	11,000	22	40
Total PCBs	55.3	nd	154	12,000	65,000	130	130
Phenol	5.7		Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3.2	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.4	nd		29	29	10	29
Pentachlorophenol	4.5	nd		360	690	140	
Benzyl alcohol	3.4	nd		57	73	10	57
Benzoic Acid	4.4	nd		650	650	216	650
Trichloroethene	11	nd		–	–	160	1600
Tetrachloroethene	11	nd		–	–	14	140
Ethylbenzene	11	nd		–	–	3.7	33
Total Xylenes	33	nd		–	–	12	100

Sample Number: 09SD

TOC (ppm) 2800 = 0.28

	Analytical Results (ppm)	Qualifiers	Normalized Results	State of Washington Sediment Management Standards Table 1 Marine Sed. Quality Stand. Chem Criteria	State of Washington Sediment Management Standards Table 3 Sed. Impact Zones Maximum Chemical Criteria	PSDDA Not TOC Normalized SL	PSDDA Not TOC Normalized ML1
				Metals Not TOC Normalized		ppm dry	
Ar	5.1		Not Normalized to TOC	57	93	70	85
Cd	0.46	nd		5.1	6.7	0.96	5.8
Cr	25			260	270		
Cu	21			390	390	80	310
Pb	6.8			450	530	70	300
Hg	0.12			0.41	0.59	0.21	0.41
Ag	1.9	nd		6.1	6.1	1.2	1.2
Zn	55			410	960	160	260
	(ppb)			TOC Normalized		ppb dry	
LPAH (sum of next 6 analytes)	20.2		72	370,000	780,000	610	5200
Naphthalene	2.4	nd	9	99,000	170,000	210	2100
Acenaphthylene	2.7	nd	10	66,000	66,000	64	560
Acenaphthene	3.6	nd	13	16,000	57,000	63	500
Fluorene	2.3	nd	8	23,000	79,000	64	540
Phenanthrene	3	nd	11	100,000	480,000	320	1500
Anthracene	2.8	nd	10	220,000	1,200,000	130	960
2-Methylnaphthalene	3.4	nd	12	38,000	64,000	67	670
HPAH (sum of next 9 analytes)	20.51		73	960,000	5,300,000	1800	12000
Fluoranthene	1.8	nd	6	160,000	1,200,000	630	1700
Pyrene	2.7	nd	10	1,000,000	1,400,000	430	2600
Benz(a) anthracene	1.6	nd	6	110,000	270,000	450	1300
Chrysene	3.3	nd	12	110,000	460,000	670	1400
Total Benzofluoranthenes	5.1	nd	18	230,000	450,000	800	3200
Benzo(a) pyrene	1.9	nd	7	99,000	210,000	680	1600
Indeno (1,2,3-c,d) pyrene	1.7	nd	6	34,000	88,000	69	600
Dibenzo(a,h) anthracene	1.7	nd	6	12,000	33,000	120	230
Benzo(g,h,i) Perylene	0.71	nd	3	31,000	78,000	540	670
1,2-Dichlorobenzene	3.5	nd	13	2,300	2,300	19	35
1,4-Dichlorobenzene	3.6	nd	13	3,100	9,000	26	110
1,2,4-Trichlorobenzene	3	nd	11	810	1,800	6.4	31
Hexachlorobenzene	0.96	nd	3	380	2,300	23	70
Dimethyl Phthalate	5	nd	18	53,000	53,000	160	--
Diethyl Phthalate	5.7	b1	20	61,000	110,000	97	--
Di-n-butyl Phthalate	13	b1	46	220,000	1,700,000	1400	--
Butyl Benzyl phthalate	6.3	b1	23	4,900	64,000	470	--
Bis (2-ethylhexyl) phthalate	29	b1	104	47,000	78,000	1900	--
Di-n-Octyl phthalate	1.7	nd	6	58,000	4,500,000	68000	--
Dibenzofuran	1.9	nd	7	15,000	58,000	--	--
Hexachlorobutadiene	3	nd	11	3,900	6,200	29	120
N-nitrosodiphenylamine	1.4	nd	5	11,000	11,000	22	40
Total PCBs	50.3	nd	180	12,000	65,000	130	130
Phenol	4.1	nd	Dry Weight Not TOC Normalized (ppb)	420	1200	120	420
2-methyphenol	3	nd		63	63	6.3	63
4-methylphenol	NT			670	670	120	670
2,4-dimethyl phenol	3.3	nd		29	29	10	29
Pentachlorophenol	4.2	nd		360	690	140	
Benzyl alcohol	3.2	nd		57	73	10	57
Benzoic Acid	4.1	nd		650	650	216	650
Trichloroethene	11	nd		--	--	160	1600
Tetrachloroethene	11	nd		--	--	14	140
Ethylbenzene	11	nd		--	--	3.7	33
Total Xylenes	33	nd		--	--	12	100

APPENDIX D

Data Validation Report

Kismet Scientific Services

Chemical Quality Assurance Report

Seward SBH Eastward Expansion

Work Order NO: 97-A052

Prepared For: US Army Corps of Engineer, Alaska District

Approved By: Ajmal M. Ilias
Dr. Ajmal M. Ilias
President

1. SUMMARY:

1.1 Positive results of the primary laboratory are summarized in table IA through IE. The majority of the data from the primary laboratory meets method required internal quality control (QC) standards and blind duplicate agreement with the following exception: The presence of four semi-volatile analytes (Phthalates) in the blank and associated samples are due to laboratory cross contamination. Precision and accuracy of the PCB data could not be completely determined because of some missing internal QC data.

1.2 Primary and Quality Assurance (QA) laboratories' data comparisons are shown in table II. Methylenechloride, semi-volatile organics (BNA), pesticide (heptachlor) and one of the two project sulfate data did not agree. For details about this data disparity refer to section 9.

2. BACKGROUND:

The project samples were collected from Seward Small Boat Harbor (SBH) Eastward Expansion from October 15 through October 17, 1997. The Quality Assurance (QA) sample was hand delivered to local analytical laboratory on October 20, 1997. The project samples were shipped to Sound Analytical Services Inc. (SAS) of Tacoma, WA on the same date.

3. OBJECTIVES:

3.1 Eight sediment samples were collected to determine the extent of chemical contamination on the Seward SBH Eastward Expansion site.

3.2 One QA sample was collected to evaluate the primary laboratory's data.

4. PROJECT ORGANIZATION:

4.1 The project samples were collected by the staff of the U.S. Army Corps of Engineers (USACE), Pacific Ocean Division, Alaska District.

4.2 The primary samples were analyzed by Sound Analytical Services, Inc. (SAS) of Tacoma, Washington.

4.3 The QA sample was analyzed by Columbia Analytical Services (CAS) of Anchorage, Alaska and CAS of Kelso, Washington.

5. PROJECT FINDINGS:

5.1 All detected analytes are summarized in tables IA through IE.

TABLE IA. Semi-Volatile Organics (BNA) reported by SAS

Prefix: 97SSEW-
Units : µg/kg

Matrix : Sediment	Samples							
Analyte Detected	-01SD	-02SD	-03SD	-04SD	-05SD	-07SD	-08SD	-09SD
Diethylphthalate	4.3B	5.6B	6.6B	6.0B	6.4B	8.0B	5.7B	5.7B
Di-n-butylphthalate	23B	23B	27B	15B	19B	19B	13B	13B
Butylbenzyl	8.8B	5.3B	10B	5.7B	6.1B	5.3B	4.6B	6.3B
bis(2-ethylhexylphthalete)	52B	33B	37B	28B	34B	31B	27B	29B
Dimethylphthalate	56	--	--	--	--	--	--	--
Di-n-octylphthalate	--	3.6	1.9	--	--	--	--	--
3&4-methylphenol	2.3	--	70	--	--	5.5	4.7	--
Benzoic Acid	21	--	3J	--	--	--	--	--
Naphthalene	2.3	9.5	--	--	--	--	--	--
Acenaphthylene	23	--	--	--	--	--	--	--
Dibenzofuran	3.8	--	--	--	--	--	--	--
Fluorene	5.2	--	--	--	--	--	--	--
Pentachlorophenol	7.3	--	--	--	--	4.3J	--	--
Phenanthlene	33	--	--	--	5.1	4.5	--	--
Anthracene	55	--	--	--	--	--	--	--
Fluoranthene	190	--	3	--	6.7	8.4	4.2	--
Pyrene	110	--	--	--	5	2.8	--	--
Benzo(a)anthracene	49	--	--	--	2.7	--	--	--
Chrysene	78	--	--	--	--	5.8	--	--
Benzo(a)fluoranthene	120	--	--	--	--	--	--	--
Benzo(k)fluoranthene	73	--	--	--	2.5	--	--	--
Benzo(a)pyrene	70	--	--	--	--	--	--	--
Indino(1,2,3-cd)pyrene	150	--	--	--	2	--	--	--
Dibenzo(a,h)anthracene	9.8	--	--	--	--	--	--	--
Benzo (g,h,i)pyrene	81	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	2.2	--	--	--	--	--	--
Nitrobenzene	--	--	51	--	--	--	--	--
2,6 Dinitrotoluene	--	--	8	7.7	10	11	9.2	--
Benzo(b)fluoranthene	--	--	--	--	5.3	3.4J	--	--
Benzylalcohol	--	--	--	--	--	2.8J	--	--
Phenol	--	--	--	--	--	--	5.7	--

-- = Not detected at Method Detection Limit
J = Detected between Method Detection Limit and Method Reporting Limit
B = Detected in method blank as well as in the associated samples

TABLE IB. Volatile Organic Compounds reported by SAS

Matrix : Sediment		Samples (Prefix: 97SSEW-)							
Analyte Detected	Units	-01SD	* -02SD	-03SD	-04SD	-05SD	-07SD	-08SD	-09SD
Methylenechloride	µg/kg	3J	--	--	--	--	--	--	--
Acetone	µg/kg	--	--	33	--	--	--	--	--

TABLE IC. Chlorinated Pesticides/PCBs reported by SAS

Matrix : Sediment		Samples (Prefix: 97SSEW-)							
Analyte Detected	Units	-01SD	-02SD	-03SD	-04SD	-05SD	-07SD	-08SD	-09SD
4,4'-DDT	µg/kg	--	--	--	--	14	--	--	--
Aroclor 1254	µg/kg	150	--	--	--	--	--	--	--
Aroclor 1260	µg/kg	120	--	--	--	--	--	--	--

TABLE ID. Metals reported by SAS

Prefix: 97SSEW-
Units : mg/kg

Matrix : Sediment		Samples							
Metals	Methods	-01SD	-02SD	-03SD	-04SD	-05SD	-07SD	-08SD	-09SD
Arsenic	EPA 6020	5.6	3.6	5.6	11	5.9	7.3	7.1	5.1
Barium	EPA 6010	28	14	8.7	13	9.9	12	11	13
Cadmium	EPA 6020	--	--	--	--	--	--	--	--
Chromium	EPA 6010	30	31	18	27	19	23	20	25
Copper	EPA 6010	72	17	26	28	18	23	23	21
Lead	EPA 6020	46	6	7.9	9.3	6.2	7.3	7.4	6.8
Mercury	EPA 7471	0.21	0.096	0.14	0.12	0.16	0.11	0.13	0.12
Selenium	EPA 6020	--	--	--	--	--	--	--	--
Silver	EPA 6010	--	--	--	--	--	--	--	--
Zinc	EPA 6010	63	65	40	67	44	54	52	55

-- = Not detected at Method Detection Limit
J = Detected between Method Detection Limit and Method Reporting Limit
* = About 10 tentatively identified compound of hydrocarbons and naphthalene derivatives were approximated.

TABLE IE. Total Organic Carbons (TOCs), Nitrate/Nitrite and Sulfate reported by SAS

Prefix: 97SSEW-
Units : mg/kg

Matrix : Sediment		Samples							
Parameters	Methods	-01SD	-02SD	-03SD	-04SD	-05SD	-07SD	-08SD	-09SD
TOC	EPA 9060	3600	2800	3600	3600	2800	4100	3600	2800
Nitrate/Nitrite	EPA 300	0.34	--	--	--	--	--	--	--
Sulfate	EPA 300	11	32	290	167	340	540	420	280

5.1.1 Semi-volatile Organics (BNA): BNAs' data are shown in table IA. 20 BNAs ranging from 2 to 150 ppb were found in BNA samples excluding four phthalates detected due to laboratory's cross contaminations. Tentatively identified compounds (TICs) were not reported in any of the eight BNA samples.

5.1.2 Volatile Organics (VOC): Data are shown in table IB. 3 ppb of methylenechloride was detected in sample 97SSEW01SD and 33 ppb of acetone was detected in sample 97SSEW03SD. Reported methylenechloride was below the laboratory's method reporting limits. 10 TICs of naphthalene and hydrocarbon derivatives, ranging from concentrations of 13.7 through 21.6 ppb were found in sample 97SSEW02SD. VOC or VOC TICs were not detected in the other five remaining project samples.

5.1.3 Chlorinated Pesticides/PCBs (Pest/PCB): Pest/PCB data are shown in table IC. 150 ppb of PCB 1254 and 120 ppb of PCB 1260 were detected in sample 97SSEW01SD. 14 ppb of 4, 4'-DDT was detected in sample 97SSEW05SD. Targated analytes of Pest/PCBs were not detected in the remaining six samples.

5.1.4 Metals: Metals data are shown in table ID. Metal concentrations range from 0.11 to 72 ppm. Cadmium, Selenium and Silver were not detected in any of the eight samples.

5.1.5 Total Organic Carbons(TOCs), Nitrate/Nitrite and Sulfate: TOCs, nitrate/nitrite and sulfate data are shown in table IE. 2800 to 4100 ppm of TOCs and 11 to 540 ppm of sulfate were found in all eight sediment samples. 0.34 ppm of nitrate/nitrite was found only in sample 97SSEW01SD.

-- = Not detected at Method Detection Limit

6. ANALYTICAL REFERENCES:

Number	Title	Date
SW-846, Third Edition	Test Methods for Evaluating Solid Waste	12/96

7. EVALUATION OF PRIMARY LABORATORY'S DATA:

7.1 Primary Laboratory Methods: The following is a listing of preparations and analytical methods as reported in laboratory's data deliverable.

Primary Laboratory	Parameter	Preparation Method	Analytical Method
SAS, Tacoma, WA	VOC	--	EPA 8260A
	BNA	--	EPA 8270B
	Pest/PCBs	--	EPA 8081
	Metals: As,Cd, Pb and Se Ba, Cr, Cu, Ag and Zn Hg	-- -- --	EPA 6020 EPA 6010 EPA 7471
	Nitrate/Nitrite	EPA 300 method preparation	EPA 300
	Sulfate	EPA 300 method preparation	EPA 300
	Total Organic Carbons (TOC)	EPA 9060 preparation	EPA 9060

7.1.1 Missing Methods and Method Deviations: The laboratory did not report sample preparation, extraction and digestion for most of the analytical methods. The method that was requested for analysis of nitrate/nitrite was EPA 353.3 and for sulfate was 375.3, but the laboratory used EPA method 300 series for both of these parameters.

7.2 Chain of Custody Records and Sample Cooler Receipt Forms: All chain of custody (COC) records, sample shipping and preservation conditions, as documented on the sample cooler receipt (SCR) form, were evaluated according to the EPA, and USACE ER1110-1-263 regulations. The following notations were made:

SAS Report: 68308 — The sample cooler temperature was 4°C and the sample blank temperature was at 3°C. Both temperatures were within the EPA recommended temperature range of 4 ± 2 °C.

7.3 Sample Holding Times (HT), Method Detection Limits (MDL)/Method Reporting Limits(MRL), Calibration, Laboratory Method Blanks, Extraction Efficiency, Accuracy and Precision: Sample HT and MDL/MRL, initial calibration verification (ICV), continuing calibration verification (CCV), tuning and mass calibration (where applicable) were evaluated with the EPA criteria. The laboratory blanks were evaluated for the absence of targeted analytes. The extraction efficiencies (EE), accuracy and precision of the data were represented by surrogates recovery, matrix spike (MS), matrix spikes duplicates (MSD), laboratory control (LC) and laboratory control duplicate (LCD) recoveries, blind duplicate agreements (table II) and relative percent difference (RPD) results. The laboratory's reported surrogate, MS/MSD, LC/LCD recoveries and RPD's were compared to the EPA and/or laboratory established quality control (LEQC) acceptance limits for out of control results.

7.3.1 Volatile Organic Compounds (VOCs): All method related internal QC met EPA method or LEQC limits.

7.3.2 Semi-Volatile Organics (BNAs): All method related internal QC met EPA method or LEQC limits except for the laboratory blank. Four phthalate ranging from 3.2 through 22 ppb were detected in the laboratory blank. Data of these phthalates in the associated samples are due to the laboratory cross contamination.

7.3.3 Chlorinated Pesticides and Polychlorinated Biphenyls (Pest/PCB's): Except for the following, all internal QC including confirmation on secondary column found to be within the EPA method and LEQC limits.

7.3.3.1 Surrogate Recovery: One (decachlorobiphenyl) of the two surrogate recoveries in MS/MSD sample extract was above LEQC limits. EE was within the method acceptance criteria of one valid surrogate recovery.

7.3.3.2 MS/MSD, LC/LCD, RPD: No MS/MSD, LC/LCD or RPD was reported for PCBs. Precision and accuracy for the PCB's data could not be completely determined except for the precision demonstrated by the blind duplicate agreements.

7.3.4. Metals, TOC, Nitrate/Nitrite and Sulfate: All method related internal QC met EPA method and LEQC limits except for the duplicate analysis RPD of mercury and sulfate. Both exceeded the method required RPD of 20 but met LEQC limits. The data precision is also accepted based on blind duplicate agreements (table II).

7.4 Overall Project Laboratory's Data: All data are acceptable except for the four phthalates found in the laboratory blank and samples. The precision and accuracy of the PCBs' data could not be completely evaluated partially because of missing PCB analysis data that were related to precision and accuracy.

8. EVALUATION OF THE QA LABORATORIES' DATA:

8.1 QA Laboratory Methods: The following is a listing of preparations and analytical methods used by the laboratories as reported in their deliverable data.

QA Laboratory	Parameter	Preparation Method	Analytical Method
CAS Kelso, WA Report: K9707802	VOC	EPA 5030A	EPA 8260 A
	BNA	EPA 3550	EPA 8270 B
	TOC	ASTMD4129-82M prep	ASTMD4129-82M
CAS Anchorage, AK Report: A9700977	Pest/PCB	EPA 3540	EPA 8081
	Metals: Ba,Cd,Cr,Cu,Ag, Zn As Pb Hg Se	 EPA 3050 A EPA 3050 A EPA 3050A EPA 7471 Prep. EPA 3050 A	 EPA 6010 A EPA 7060 EPA 7421 EPA 7471 EPA 7740
	Nitrate/Nitrite	EPA 353.2 prep	EPA 353.2
	Sulfate	EPA 375.4 Prep.	EPA 375.4

8.2 COC and SCR Forms: All COC records, sample preservation, and sample shipping condition, as documented on SCR forms, were evaluated according to EPA, and USACE ER1110-1-263 regulations. The following notations were made:

CAS Anchorage, AK. Report: A9700977 — Samples were received at the CAS, Anchorage facility within the EPA recommended temperature range of 4 ± 2 °C.

CAS-Kelso, WA Report: 9707802	The VOC, BNA and TOC samples were received at the CAS Kelso, WA facility on October 22, 1997 within the EPA recommended cooler temperature range of 4 ± 2 °C. The custody seal was missing on the sample cooler. This is considered a COC record violation

8.3 <u>Sample Holding Times (HT), Method Detection Limits (MDL)/Method Reporting Limits(MRL), Calibration, Laboratory Method Blanks, Extraction Efficiency, Accuracy and Precision:</u> Sample HT and MDL/MRL, initial calibration verification (ICV), continuing calibration verification (CCV), tuning and mass calibration (where applicable) were evaluated with the EPA method criteria. The laboratory blanks were evaluated for the absence of targeted analytes. The extraction efficiencies (EE), accuracy and precision of the data were represented by surrogates recovery, matrix spike (MS), matrix spikes duplicates (MSD), laboratory control (LC) and laboratory control duplicate (LCD) recoveries and relative percent difference (RPD) results. The laboratories reported surrogate, MS/MSD, LC/LCD recoveries and RPD's were compared to the EPA , and/or laboratory established quality control (LEQC) acceptance limits for out of control results.

8.3.1 <u>VOCs:</u> All internal QC data met EPA method and LEQC limits. QA sample was reanalyzed with dilution, but no internal QC data of reanalysis was submitted except for the laboratory's blank data.

8.3.2 <u>BNAs:</u>

8.3.2.1 <u>MDL and MRL:</u> 50 to 300 ppb of MDL and 300 to 2000 ppb of MRL were used in the BNA analysis. This high level reporting of MDL and MRL did not meet project requirement.

8.3.2.2 <u>Surrogate Recoveries:</u> Out of the six surrogate recoveries, two surrogates (Nitrobenzene d^5 and 2-fluorobiphenyl) recoveries were below the LEQC limits in the laboratory blank. If low levels of laboratory contamination occured, it may not have been detected.

8.3.2.3 <u>MS/MSD, LC/LCD and RPDs:</u> Batched (K97078-08-02MS) MS/MSD and RPD data were submitted which met method and LEQC limits. Laboratory control recovery was also within the method and LEQC limits.

8.3.3 Pest/PCBs:

8.3.3.1 MDL and MRL: Elevated 1 to 200 ppb of MDL and 10 to 400 ppb of MRL were used in Pest/PCB analysis.

8.3.3.2 Surrogate Recovery: Out of two surrogate recoveries in LCS_2, one (Tetrachlorometaxylene) was above the LEQC limits. Extraction efficiency data are accepted based on one surrogate within the LEQC limits per EPA method 8081.

8.3.3.3 Confirmation of the positive results: Heptachlor was detected at the MDL, but no reconfirmation data was submitted. Data of this analyte should be considered tentative.

8.3.4 Metals:

8.3.4.1 MS/MSD and RPD: Selenium MS/MSD recoveries were below LEQC and EPA method QC limits. If low level of Selenium is present, it may not have been detected. Lead MSD recovery was above EPA QC limits and therefore RPD was also above the EPA method and LEQC limits. QA Lead data should be considered an estimate. Mercury RPD of 22 was marginally above the EPA QC limits (RPD = 20) but met LEQC limits.

8.3.5 Nitrate/Nitrite, Sulfate and TOC:

8.3.5.1 MDL/MRL: Elevated MDL/MRL was used for nitrate/nitrite (MDL/MRL of 1 and 2 ppm), sulfate (MDL/MRL of 5 ppm) and TOC (MDL/MRL of 0.05 percent = 500 ppm).

8.3.5.2 MS/MSD and RPD: Sulfate's RPD was 28, which is within the LEQC limits but did not meet EPA method QC limits of 20.

9. COMPARISON OF PRIMARY AND QA LABORATORY'S DATA:

The primary blind duplicate and QA data comparisons are presented in Table II. The analytical results in table II were reviewed for agreement with each other, their respective MDL/MRL and for comparability. The intra and inter laboratory data for a sample must be within a factor of five (for sediment) for them to be considered in agreement. The primary and QA laboratories' MDL/MRL must be within a factor of 10 to be considered comparable. Estimated data (results which have been quantitated below the method reporting limits and qualified with a "J" flag) should not be considered significant for the purpose of data agreement. All data comparisons agree with each other and are comparable with the following exceptions.

9.1 VOC: Methylene Chloride data in Table II did not agree. High levels, 210 ppb of methylene chloride was found in the QA sample but was not detected at MDL 0.9 and 0.97 ppb in the primary blind duplicate samples. This data disparity could not be explained by the internal QC data alone.

9.2 BNA: Primary blind duplicate and QA data could not be compared due to unproportionally high detection limits used by the QA laboratory.

9.3 Pest/PCB: Primary blind duplicate and QA heptochlor data did not agree. Heptachlor reported by the QA laboratory at the MDL (2J ppb) was not detected in the primary blind duplicate sample at 0.11 ppb. The QA laboratory's heptachlor datum is not confirmed by another analytical technique or column and should be considered tentative.

9.4 Sulfate: One of the blind duplicate data did not agree within the factor of five of QA data. QA data are questionable since the precision (RPD=28) datum was out of the method QC limits.

TABLE II. Comparison of Primary and QA Data

Matrix : Soil		Field Identification:	Primary Samples 97SSEW -08SD	Primary Samples 97SSEW -07SD	QA Sample 97SSEW 06SD
Parameter	**Units**	**Analytes Detected**			
VOC	µg/kg	Methylenechloride	< 0.94	< 0.96	210
BNA	µg/kg	Benzyl Alcohol	< 2.2	2.8J	< 100
		3 and 4-Methylphenol	4.7	5.5	< 90
		2,6 Dinitrotoluene	9.2	11	< 50
		Diethylphthalate	5.7B	8B	< 100
		Pentachlorophenol	< 3.2	4.3J	< 50
		Phenanthrene	< 2.7	4.5	< 80
		Di-n-butylphthalate	13B	19B	< 70
		Fluoranthene	4.2	8.4	<80
		Pyrene	< 1.7	2.8	< 60
		Butylbenzylphthalate	4.6B	5.3B	< 70
		Chrysene	< 2.3	5.8	< 70
		bis(2-Ethylhexylphthalate)	27B	31B	< 100
Pest & PCB	µg/kg	Heptachloro	< 0.11	< 0.11	2J
RCRA, Cu &Zn Metals	mg/kg	As	7.1	7.3	10
		Ba	11	12	28
		Cd	< 0.22	< 0.22	0.8J
		Cr	20	23	35
		Cu	23	23	28
		Pb	7.4	7.3	10
		Hg	0.13	0.11	< 0.1
		Se	< 1.6	< 1.6	< 0.4
		Ag	< 0.8	< 0.8	2
		Zn	52	54	72
TOC	mg/kg	Total Organic Carbons	3600	4100	6600
NO_3/NO_2	mg/kg	Nitrate/Nitrite	< 0.60	< 0.64	< 1
Sulfate	mg/Kg	Sulfate	420	540	102

Comments: All data agree except for the methylenechloride data in VOC, all BNA and one of the two sulfate data. Refer to section 9 for details.

<= Not detected at Method Detection limit.
J = Detected between Method Detection limit and Method Reporting limit.
B = Detected in the method blank as well as in the associated samples