US Army Corps of Engineers
Alaska District

Vol. I

Interim Integrated Feasibility Report
Environmental Assessment
and Finding of No Significant Impact

Navigation Improvements Valdez, Alaska

May 2011

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
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NAVIGATION IMPROVEMENTS
INTERIM INTEGRATED
FEASIBILITY REPORT
AND ENVIRONMENTAL ASSESSMENT
VALDEZ, ALASKA

May 2011

FINDING OF NO SIGNIFICANT IMPACT

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

Navigation Improvements
Valdez, Alaska

The project will construct a harbor at Valdez, Alaska.

Multiple alternative sites and plans were investigated throughout the course of the feasibility study, with a detailed focus upon five final plans. The East Site Rubblemound 320-Vessel alternative is identified as the National Economic Development plan and the recommended plan in the Valdez Navigation Improvements draft Integrated Interim Feasibility Report and Environmental Assessment and will be constructed as a Federal action.

Harbor Basin. The recommended plan will provide a basin of 5.7 hectares (ha) including the entrance channel and maneuvering basin and will provide moorage for about 320 vessels. The entrance channel depth will be -5.5 meters mean lower low water (MLLW). The mooring basin will be -5.5 to -2.7 meters MLLW.

Breakwater Components. Two of the three breakwaters with crest elevations of +6 meters will be constructed to protect the harbor. The main breakwater will be 473 meters long and protect the south side of the harbor. The eastern-most 70 meters of the south breakwater will angle to the northeast and form the west boundary of the entrance channel. The east breakwater will be approximately 240 meters long and will curve in an arc from the northeast to northwest to form the eastern boundary of the entrance channel and harbor. Side slopes will be 1 vertical: 1.5 horizontal. Both breakwaters will be constructed in 0.0 MLLW to -5 meters MLLW water depths.

Both breakwaters will be breached at the shoreward end to allow fish and other marine biota to move into and out of the harbor near shore. A small stub breakwater will protect the breach in the west breakwater. It will be 30 meters long with a crest elevation of +5 meters.

Material quantities for the three breakwaters are 31,200 cubic meters (m^3) of armor rock, 17,600 m^3 of secondary rock, and 37,570 m^3 of core rock. Materials for the breakwaters will be obtained from existing commercial sources.

Channel and Basin Dredging. All dredging for the East Site will be in the tidal flat south of Hotel Hill and east of the Ship Escort and Response Vessel System (SERVS) dock. Some of the dredged material will be used as fill for construction of a 1.87 ha staging area and the rest will be transported to Two Moon Bay. A total of 186,400 m^3 of material will be dredged for the entrance channel, maneuvering channel, and mooring basin. Dredged material not used in construction will be placed at a formerly used log transfer site at Two Moon Bay to return the bark-covered sea bottom at the site to a more natural and productive state.

Mitigation. Each mitigation measure identified in Section 4.9 of the draft report and environmental assessment is incorporated as an element of the Federal action. Principal features of that plan are as follows: implementation of best management practices to prevent water pollution, design for breaches between the breakwaters and shore to enable near-shore fish passage at most tide stages, design of the harbor for optimal circulation, imposition of seasonal construction/dredging restrictions, and requirements for silt curtains during in-water work when juvenile fish are present.

Construction and operation of the harbor will not substantially affect threatened or endangered species, critical habitat, cultural resources, or other human or biological resources.

The action is consistent with State and local coastal zone management programs to the maximum extent practicable. The accompanying environmental assessment 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 Valdez, Alaska.

Reinhard W. Koenig
Colonel, Corps of Engineers
District Commander

4 Oct 10
Date

EXECUTIVE SUMMARY

This report examines the need for improving navigation facilities in Valdez, Alaska, presents the results of studies conducted to determine the feasibility of Federal participation in potential improvements, and assesses potential environmental effects associated with a range of alternatives. The primary problems addressed in this report are unmet moorage demand and overcrowding in the existing harbor.

This general investigation study is authorized by the U.S. House of Representatives Public Works Committee Resolution for Rivers and Harbors in Alaska, adopted 2 December 1970. The project was authorized by Section 4012 of the Water Resources Development Act of 2007, PL 110-114 at a cost of $20,000,000. Per the WRDA implementation guidance and supporting fact sheet dated 6 June 2008, the total authorized cost of $20,000,000 is for the general navigation features, subject to the 902 limit, and because the project is authorized, the Chief of Engineers report for the project will be replaced by a Director of Civil Works report.

The City of Valdez is approximately 185 kilometers (km) east of Anchorage and is accessible by highway from both Anchorage and the interior City of Fairbanks. The existing mooring basin has capacity for about 500 vessels. During the height of the fishing season, the transient moorage pier can have vessels rafted six deep, dozens of boats using the launch ramp, and all competing with existing users of the marina for the harbor's limited space. Unavailability of moorage has led to harbor congestion, lost income, vessel damages, and lost time.

Multiple alternative sites and plans to provide additional protected moorage capacity were investigated through the course of the feasibility study, with a detailed focus on five final plans. The East Site Rubblemound 320-Vessel plan maximized the net National Economic Development (NED) benefits and was selected as the NED Plan. The NED Plan was supported by the local sponsor and was carried forward as the tentatively recommended plan. The tentatively recommended plan would provide a basin of 5.7 hectares (ha) including the entrance channel and maneuvering basin. The entrance channel depth would be -5.5 meters MLLW and decrease to –2.7 meters at the far end of the basin away from the entrance. The south breakwater would be about 473 meters long. The east breakwater would be constructed in a north-south orientation to the entrance channel and would be approximately 240 meters long, and the stub breakwater would be 30 meters long. The plan also includes beneficial use of dredged material, which would be placed at a formerly used log transfer site at Two Moon Bay to return the bark-covered sea bottom at the site to a more natural and productive state.

The features of the authorized project have a total cost of $24,434,000 which translates to a $19,596,000 Federal cost and a non Federal cost of $4,838,000. In addition, there is an estimated non Federal cost of $31,383,000 for associated local service facilities. The annual NED investment cost of the project, including interest during construction and the cost of operation and maintenance, is $2,968,000 with annual NED benefits of $5,180,000. The project's benefit-to-cost-ratio is 1.75 with net annual benefits of $2,212,000. Construction and operation of the harbor would not substantially affect threatened or endangered species, critical habitat, cultural resources, or other human or biological resources.

The local sponsor, City of Valdez, would pay the non-Federal share of the costs of construction of general navigation features (GNF) and the Beneficial Use of Dredged Material feature. The sponsor would also pay the entire cost of non-GNF, including the float system.

PERTINENT DATA

Recommended Plan

Channel and Basin		Breakwater	
Entrance channel	-5.5 meters MLLW	Design wave	1.4 meters
Mooring basin	Transitions from -5.5 meters to -2.7 meters MLLW	Length, total	743 meters
Maneuvering basin	2.1 ha	Crest elevation	6 meters MLLW
Mooring basin	3.6 ha	Armor rock	31,200 m^3
Total	5.7 ha	Secondary rock	17,600 m^3
Dredging volume	186,400 m^3	Core rock	37,570 m^3

Authorized Project First Cost

Item	Federal ($)	Non-federal ($)	Total ($)
General Navigation Features	20,529,000	2,281,000	22,810,000
Beneficial Use of Dredged Material	512,000	276,000	788,000
Lands, Easements, Rights of Way, and Relocations (LERR)		829,000	829,000
Navigation aids. U.S. Coast Guard	7,000		7,000
Authorized Navigation Project First Cost	21,048,000	3,386,000	24,434,000
Authorized 902(b) Limit			25,692,000

Total Project Cost [a]

Item	Federal ($)	Non-federal ($)	Total ($)
General Navigation Features	21,048,000	3,386,000	24,434,000
Associated costs – Local Service Facilities		31,383,000	31,383,000
Total First Cost	21,048,000	34,769,000	55,817,000
%10 of GNF	-2,281,000	2,281,000	
GNF LERR Credit	829,000	-829,000	
TOTAL PROJECT COST	**19,596,000**	**36,221,000**	**55,817,000**

Annual cost and benefit based on a October 2010 price level, 4 3/8 %, 50-year project life

NED investment cost (includes interest during construction)	$55,707,000
Annualized NED investment	2,651,000
Annual OMRR&R	317,000
Annual NED cost	2,968,000
Annual NED benefits	5,180,000
Net annual NED benefits	2,212,000
Benefit/cost ratio	1.75

[a] Cost sharing reflects provisions of the Water Resources Development Act of 1986 that states the first-cost general navigation feature cost sharing is 90:10 with an additional 10% (minus a GNF LERR credit) paid back over 30 years. Cost sharing for the beneficial use of dredged material is 65:35

All costs are October 2010 price level.

List of Acronyms and Abbreviations

ADOT&PF	Alaska Department of Transportation and Public Facilities
cm	centimeters
dB	decibels
EPA	Environmental Protection Agency
GNF	General Navigation Features
ha	hectares
EC/ICA	Cost Effectiveness and Incremental Cost Analysis
LCRMA	Lower Columbia River Management Area
km	kilometers
LSF	Local Service Features
m^3	cubic meters
MARPOL	Marine Pollution Guidelines
MBA	Marine Benthic Assessment
MLLW	Mean Lower Low Water
Mm	millimeters
NED	National Economic Development
NER	National Ecosystem Restoration
NMFS	National Marine Fisheries Service
PCB	Polychlorinated biphenyls
PDT	Project Delivery Team
PSDDA	Puget Sound Dredged Disposal Analysis
PWS	Prince William Sound
RU	Risk and Uncertainty
spp.	Multiple species
SVOC	Semi-Volatile Organic Compounds

USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service (Service)
VOC	Volatile Organic Compounds

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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 meters	1.308	cubic yards
hectare	2.471	acre
Celsius degrees	*	Fahrenheit degrees
Meters	3.281	Feet
meters per second	3.281	feet per second
centimeters	0.3937	Inches
meters per second	1.944	knots (international)
km	0.6214	miles (U.S. statute)
kilometers	0.5400	miles (nautical)
kilometers per hour	0.6214	miles per hour
kilograms	0.2192	pounds (mass)

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

1.0 INTRODUCTION

1.1 Authority

This general investigation study is authorized by the U.S. House of Representatives Public Works Committee Resolution for Rivers and Harbors in Alaska, adopted 2 December 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 report of the Chief of Engineers on Rivers and Harbors in Alaska, published as House Document Number 414, 83d Congress, 2d 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 project was authorized by Section 4012 of the Water Resources Development Act of 2007, PL 110-114, which contained the following language.

The Secretary shall conduct a study to determine the feasibility of carrying out a project for navigation, Valdez, Alaska, and if the Secretary determines that the project is feasible, shall carry out the project at a total cost of $20,000,000.

Per the WRDA implementation guidance and supporting fact sheet dated 6 June 2008, the total cost of $20,000,000 is for the general navigation features, and because the project is authorized, the Chief of Engineers report for the project will be replaced by a Director of Civil Works report.

1.2 Scope of Study

This study investigates the feasibility of navigation improvements in Valdez, Alaska and assesses potential environmental effects associated with alternatives that could be implemented to address existing navigation problems. The primary focus of this study is to examine the feasibility of improving navigation, with the additional purpose of beneficially using any material dredged during the development of navigation improvements. The study was conducted and this integrated draft Interim Feasibility Report and Environmental Assessment has been prepared in accordance with the study authority. It is consistent with the goals and procedures for water resources planning as stated in Engineer Regulation (ER) 1105-2-100 and Corps regulations for implementing the National Environmental Policy Act (NEPA). Alternatives were examined for their feasibility, considering engineering, economic, environmental, and other criteria. A determination of Federal interest is presented in accordance with present laws and policies.

1.3 Study Participation and Coordination

The Alaska District, U. S. Army Corps of Engineers (Corps) has primary responsibility for this study. The non-Federal sponsor is City of Valdez. This report was prepared with assistance from many individuals, Alaska Department of Transportation and Public

Facilities (ADOT&PF), and resource agencies. The U.S. Fish and Wildlife Service, National Marine Fisheries Service, Alaska Department of Natural Resources, and Alaska Department of Environmental Conservation, and other resource agencies participated in the study process.

1.4 Related Reports and Studies

The following studies and reports have examined navigation improvements in Valdez.

City of Valdez Small Boat Harbor Expansion Permeable Wave Barrier Feasibility Study, January, 2003. This study, prepared by Peratrovich, Nottingham & Drage, Inc. for the City of Valdez, reviewed and analyzed existing conceptual plans for navigation improvements of the small boat harbor. The report expanded on the conceptual plans by developing alternatives using permeable wave barriers in lieu of rubblemound construction. The study produced conceptual designs that appeared to be economically feasible without reducing existing uplands.

Expedited Reconnaissance Study of Boat Harbor Improvements, Valdez, Alaska, July 1998. Tryck Nyman Hayes, Inc. prepared this study for the Alaska District to determine if there was a Federal interest in feasibility studies of navigation improvements in Valdez, Alaska. This study concentrated on Harbor Cove as the preferred site near the existing harbor as it provided the best natural protection. The study developed several sized harbors and provided an economic analysis. The preliminary economic analysis indicated that there was no Federal interest in navigation improvements at Valdez.

Section 905(b) (WRDA 86) Analysis, Valdez Small Boat Harbor, Alaska, October 1998. The Alaska District further developed the information from the July 1998 reconnaissance report and re-evaluated the potential benefits for navigation improvements based on the Harbor Cove alternative site. Upon this further analysis, it was determined there were sufficient benefits to support a Federal interest in proceeding to a feasibility study. Although there were environmentally sensitive areas in and near Harbor Cove, it was believed an environmentally acceptable alternative could be identified.

Review of Hydraulic Performance, Proposed Valdez Harbor Modification, September 1997. Ronald E. Nece, P.E., ScD, prepared this hydraulic analysis of proposed harbor modifications for the Alaska District. The proposed project was presented as a means of improving the circulation of the existing small boat harbor. This review concluded that the proposed modifications would provide a marginal improvement of the existing condition.

Valdez Harbor Modification, May 1997.
This report, prepared by the Alaska District, U.S. Army Corps of Engineers examined a plan for flushing the existing small boat harbor by means of a constructed containment basin in Harbor Cove and two 1.2-meter-diameter culverts placed under South Harbor Drive into the northeast end of the existing boat harbor. The basic concept was to trap water in the containment basin during high tide. Tidal gates on the entrance to the culverts would then be opened at low tide causing water to flow from the impoundment

basin into the existing harbor, increasing circulation and flushing currents. The report concluded that the concept would not substantially improve flushing.

Comparative Analysis Valdez Boat Harbor, February 1996.
Prince William Sound Economic Development Council Inc. prepared this report for the City of Valdez. The report outlines and compares economic issues for a number of Alaskan ports including Valdez, Seward, and Homer. Capital needs, funding sources, revenues, and expenditures were explored. The report concluded that the Valdez port is an important “economic engine” for the community, that portions of the small boat harbor are near the end of their service life, and alternatives to traditional funding are needed to repair or replace the harbor facilities.

Reconnaissance Report for Boat Harbor Improvements, Valdez, Alaska, November 1995.
Raytheon Infrastructure Services Inc. prepared this report for the Alaska District. The report examined several sites for small boat harbor expansion and a protected boat launch facility. The purpose of this report was to identify a Federal interest and assess a need for further study. The study investigated four “potential” sites: Allison Point, Mineral Creek, Old Valdez, and a southern expansion of the existing harbor. Also considered were three “possible” sites: Allison Creek, an eastern expansion of the existing harbor (Harbor Cove), and a southern expansion of the existing harbor east of the Alyeska Ship Escort and Response Vessel System (SERVS) pier. The report concluded that there were insufficient Federal benefits and that further feasibility studies were not warranted.

2.0 PROBLEMS AND OPPORTUNITIES / PURPOSE AND NEED

2.1 Introduction

Valdez (population 3,475) is at the north end of a 22-km-long fjord (Port Valdez) that opens into Valdez Arm of Prince William Sound (PWS; figure 2-1). Valdez is about 193 km due east of Anchorage, but is about 500 km from Anchorage by highway.

Valdez is nationally important because it is at the southern end of the Trans-Alaska oil pipeline. The pipeline terminal adjacent to Valdez (figure 2-2) loads about 20 percent of the crude oil produced in the United States into tankers for transportation to refineries.

Valdez is regionally important because it is one of only five communities on PWS and one of only four ports that connect the interior of Alaska to the Pacific Ocean. Figure 2-1 shows PWS, Valdez, and the other communities on the coast of PWS. Seward is south of PWS at the head of Resurrection Bay, off the Gulf of Alaska.

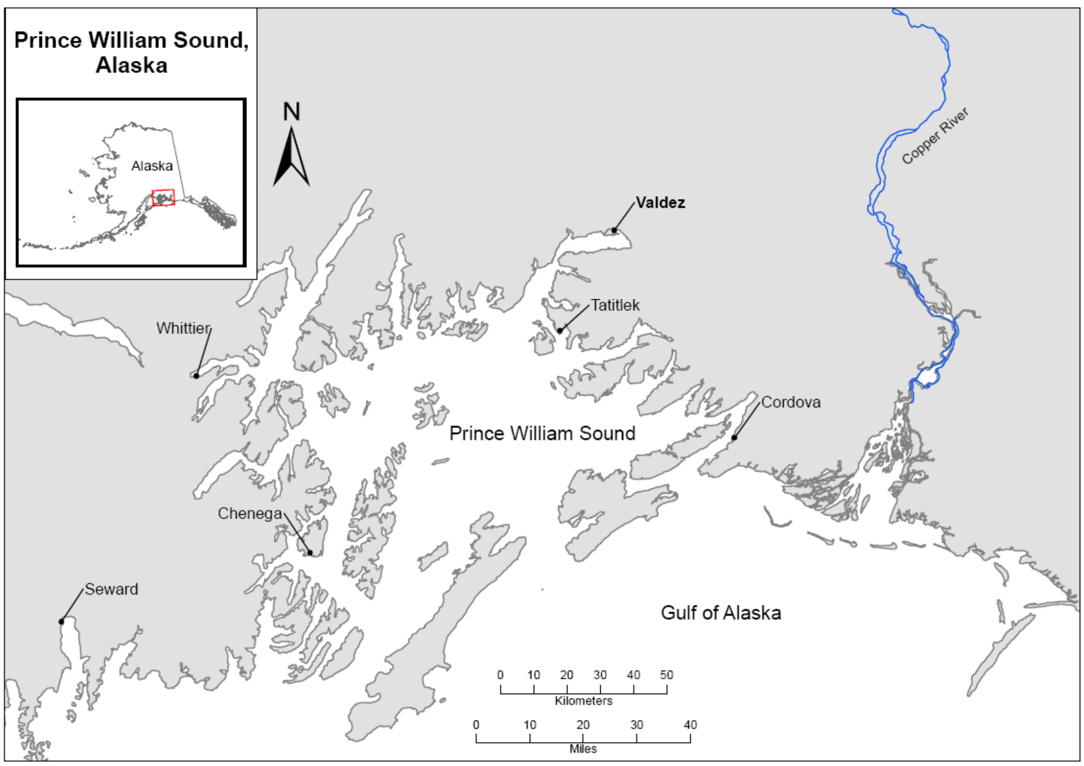

Figure 2- 1. Location and vicinity map

Valdez is at the bottom of a steep-walled canyon that descends into the deep fjord that is Port Valdez. The entire canyon-fjord trench was formed beneath a great ice field that once covered all of PWS. The canyon walls rise to more than 800 meters above the town and the Port Valdez fjord just 500 meters from the entrance to Valdez harbor is 200 meters deep. Figure 2-3 shows Valdez and Valdez Harbor at the base of the Chugach Mountain Range.

Figure 2- 2. Trans-Alaska Pipeline Terminal near Valdez 1998. Photo credit (copyright) from Alaska DCA database

Glaciers have retreated from Valdez, but they still profoundly affect the city and Port Valdez. Active glaciers in the surrounding Chugach Mountains drain into Lowe River, which runs past Valdez to empty into Port Valdez and into other streams in the Port Valdez drainage. Lowe River carries a comparatively large bed load, frequently shifts laterally in its floodplain as the bed is filled, and is very turbid. Most other streams in this watershed have similar characteristics. The breadth of the Lowe River floodplain, threat of erosion, and the wetlands and lakes left behind by glacial recession and deposition all confine development in Valdez to a narrow band in the canyon.

January temperatures range from -6 to -1 degrees C; July temperatures are 8 to 16 degrees C. Average annual precipitation is 160 centimeters. Average snowfall is just over 8 meters, but can be much greater. Figure 2-4 shows snow accumulation near the end of a typical winter in Valdez.

Valdez is one of only two communities on the 40,000 km^2 PWS that can be reached by highway. It is the closest highway access to marine waters from Fairbanks and is a popular destination for people from Fairbanks and elsewhere in eastern interior Alaska. Big returns of hatchery released and wild salmon and the relatively protected boating in Port Valdez add to recreational appeal. Salmon, herring, halibut, and other marine resources of PWS also support substantial commercial fisheries.

Figure 2- 3. The City of Valdez and Valdez Harbor at the base of the Chugach Mountains.

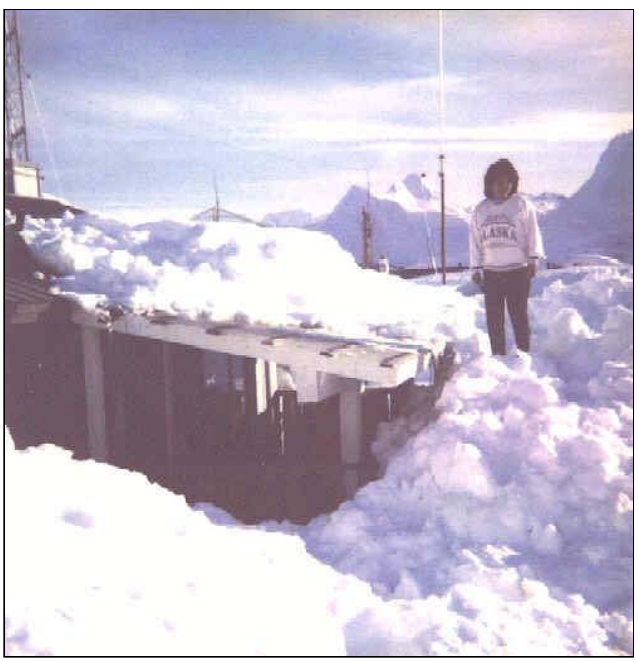

Figure 2- 4. A winter's snow accumulation in Valdez.
Photo credit (copyright) Roy H. Hansen 1997 from Alaska DCA database.

2.2 Problem Description

The small boat harbor in Valdez is overcrowded and congested from insufficient moorage and too much boat traffic.

Use by commercial fishermen, charter boat operators, and recreational boaters has caused demand for year-round moorage to exceed harbor capacity. Boat ramps and transient moorage are in constant use during the commercial fishing and tourist season.

Demand for moorage at the existing small boat harbor in Valdez has steadily increased over the past 20 years. The harbor had only 350 boats in 1979 and no vessels were wait-listed. Currently, the harbor's 500 permanent slips are fully utilized by full-time berth holders, and another 243 boats are wait-listed for permanent moorage. Boaters unable to obtain permanent moorage in Valdez return to their homeport to store their vessels in the off-season. This can be as far away as the Pacific Northwest.

Two harbor management techniques, rafting and hot-berthing, are used to accommodate as many vessels as possible. Rafting is the mooring of several vessels side by side, with only the inner-most vessels attached to the dock. People must cross over several boats to get to the dock to load or unload their vessels. Leaving the raft can be difficult, especially if the owners/operators of the other rafted vessels are not onboard. Hot berthing is the practice of allowing a vessel to use a vacant slip while the slip's designated occupant is out. This can be a problem if the designated occupant returns while the visiting vessel is still using the slip. The harbormaster must then find other accommodations for the visiting vessel and arrange to have it moved if the owner is not available.

There are other inherent delays associated with harbor congestion. If all the commercial fishing vessels leave or return at the same time of day, they are delayed maneuvering and untying when they depart from the rafted moorage and again when they return to be rafted or hot berthed. It is difficult and time-consuming for the harbormaster to keep the commercial fleet; daily arrivals and departures of fishing charters; and day cruisers, recreational boaters, and kayakers, all operating relatively smoothly.

Vessels from Valdez are responsible for preventing and responding to oil spills in PWS, so supporting the SERVS is important. Many commercial and recreational vessels that use Valdez harbor are available to be hired for spill response on short notice in an emergency. The same vessels designated to protect two of the nation's most valuable resources (oil and the seafood that would be impacted by a spill) are moored in a harbor that is so crowded that rapid response cannot be assured.

2.3 Issues and Concerns

Principal issues and concerns were identified by harbor users, residents of Valdez, State and Federal resource agencies, State and Federal petroleum transportation agencies, and major landowners on PWS.

Issues and concerns can be sorted into the following categories:

- Need for efficient moorage and access to resources of PWS
- Need to support efficient oil spill prevention and response
- Concern that harbor development would adversely affect future land uses
- Concern that navigation improvements could directly or indirectly impact important natural resources
- Need to avoid, minimize, and compensate for unavoidable impacts to the maximum extent practicable
- Need to maintain and restore natural resources of PWS

Need for efficient moorage and access to resources of PWS

PWS has been described as a commercial fisher's and sportsman's paradise. Marine resources are abundant, scenery is first class, and although it is accessible by road, it is quite remote from urban areas. During the commercial fishing and busy summer tourist season, boat ramps and transient moorage are highly utilized. Congestion at the harbor occurs from the inherent inefficiencies of rafting and hot-berthing, vessels moored in spaces designed for smaller boats, and the complications of having a high-traffic boat launch within the limited confines of the harbor.

Congestion at the harbor results in problems with delays both entering and exiting the main harbor entrance, travel-related expenses associated with vessels that must travel to distant ports to obtain moorage, damages to vessels, docks and pilings resulting from the abnormally heavy use, and strains on harbor personnel as they attempt to coordinate a smooth-running harbor with multiple user groups. Many operators remove their vessels from the water or seek shelter in distant ports at considerable cost. Slips that are too small for the moored vessels create additional problems as boats must maneuver around obstructions in the fairways.

The long wait-list for permanent moorage at Valdez adds pressure to the lines that form at the launch ramp during the fishing season. Limited access to permanent moorage at the harbor means that users must trailer their boats at the end of the trip. Once in the water, launch ramp users must traverse the length of the harbor to access fishing and recreation opportunities in PWS. These delays impact the income earning capability of commercial fishing and charter boats and impact the recreational experience for charter boat customers and other pleasure craft. Additional details of the various problems at Valdez Harbor are discussed in Economics Appendix B.

Need to support efficient oil spill prevention and response

Alyeska Pipeline's SERVS mission is to prevent oil spills by assisting tankers in safe navigation through PWS. Their goal is to protect the environment by providing effective response services to the Valdez Marine Terminal and Alaska crude oil shippers in accordance with oil spill response agreements and plans. SERVS provides tanker escorts during the 110 km passage through PWS and mobilizes vessels, equipment, and personnel in the event of an oil spill. SERVS is the largest oil spill prevention and response organization in the world.

The PWS Escort System is broken into three zones: Northern PWS, Central PWS, and the Hinchinbrook Entrance. In the Northern PWS zone, two escort vessels must remain within one-quarter of a nautical mile of the tanker, except when one vessel serves as an ice scout. The primary escort, an ocean going tug, must remain tethered to the tanker as it transits Valdez Narrows. The second escort vessel is a specially equipped Escort Response Vessel (ERV). In the Central PWS zone, the primary escort must remain within one-quarter of a nautical mile of the tanker, while the second escort may be stationed underway off Bligh Reef, or east of Naked Island, or off of Montague Point, depending on the tanker's position in the Sound. At Hinchinbrook Entrance, outbound laden tankers must maintain two escorts within one-quarter of a nautical mile of the tanker.

As part of the PWS Tanker Spill Prevention and Response Plan, Alyeska must be able to respond to several spill scenarios, including a large oil spill of 300,000 barrels, within 72 hours. Alyeska provides initial response for a minimum of 72 hours, and then transitions response efforts to the responsible party. Congestion at Valdez Harbor limits timely responses from SERVS vessels during the busy summer season.

Concern that harbor development would adversely affect present and future land uses

Valdez is in the bed of an ancient glacier, walled in by 1,000-meter-high rocky mountain walls, a glacier-fed river system that shifts from side to side in its bed, and the deep waters of Port Valdez. It also is on the seaward face of a mountain range that is inundated with precipitation tracking in from thousands of kilometers across the Pacific Ocean. Valdez gets an average of about 8 meters of snow each winter and can get close to twice that. Just finding places to dump the snow so the city can function is a major problem each winter. Valdez has very little land available for development and no place to grow. The few areas of undeveloped flat land that remain are essential to the city. City representatives and concerned citizens repeatedly said that those remaining lands have value that cannot be adequately defined in monetary terms and that a new harbor should be planned and developed to avoid taking that land.

Concern that navigation improvements could directly or indirectly impact important natural resources

Water Quality - Water quality sufficient to sustain existing diversity and abundance of marine life in habitats surrounding the harbor expansion should be maintained. Primary concerns were dissolved oxygen, turbidity, and fuel spills.

Sea Otters - Sea otters that inhabit Valdez Harbor are part of the PWS population. Disturbance, pollution, and loss of food resources are primary concerns for sea otters recovering from the Exxon Valdez oil spill.

Duck Flats Habitat - The "Duck Flats", sometimes referred to as Island Flats, are expansive tidal flats and marsh at the northeastern head of Valdez Harbor. These tidal flats are home to a diversity of marine invertebrates that seasonally support flocks of migrating shorebirds and waterfowl, and rearing pink, chum and coho salmon. Direct mortality, habitat contamination, and loss of food resources used by migrating birds and juvenile salmon are primary concerns.

Harbor Cove Habitat - Harbor Cove is adjacent to, but separated from, the project site by Hotel Hill. Harbor Cove habitat supports diverse invertebrate species among scattered boulders and patches of eelgrass on a mud-sand substrate. Harbor Cove is a seasonal nursery for juvenile salmon and other marine fish species, and is used seasonally by migrating shorebirds and waterfowl. Harbor Cove is also used for education and recreation. Contamination of habitat and loss of food for important fish, birds, and mammals and potential impacts to recreational resources are primary concerns. In figure 2-5, Harbor Cove is directly beyond the existing Valdez Harbor. Hotel Hill is in the upper right of the figure.

Black-legged Kittiwake - A colony of about 200 black-legged kittiwakes nests on steel beams of the SERVS dock. The number of kittiwakes this colony will support is limited by available nesting space. Disturbance during nesting season and contamination of food resources fed to juveniles are primary concerns.

Marine Vegetation - Patchy eelgrass and marine kelp grow in mud and gravel bottom in areas where a harbor might be constructed. This kelp and vegetation provides support and cover for marine invertebrates that are food resources for juvenile marine fish including salmon, shorebirds, and waterfowl. Potential for loss of this habitat is an important concern.

Marine Invertebrates - Clams, mussels, marine worms, and smaller invertebrates are in the project area. These invertebrates are seasonal food resources for juvenile salmon and other marine fish and for shorebirds and waterfowl. These invertebrates are given a lower priority because they have a relatively low diversity and abundance due to the unfavorable composition of substrate and other environmental factors on the project site. A net loss of invertebrate biomass in the project area is an important concern.

Juvenile Salmon - Juvenile pink, chum, and coho salmon rear seasonally in habitats surrounding the proposed harbor expansion. These salmon are transitory and the amount of time spent in the proposed harbor area is dependant largely on physical environmental conditions and availability of their respective food resources. Juvenile salmon are given a lower priority because they are transitory and will quickly migrate seaward past the proposed harbor expansion site. The harbor design should not impede their seaward migration, and water quality produced by harbor activities should not increase mortality. Maintaining good water quality in the harbor and juvenile salmon migration disruption are important resource concerns.

Adult Salmon - Adult salmon associated with the proposed harbor expansion are large numbers of hatchery raised pink salmon. It is unlikely that wild chum or coho salmon would be affected from the proposed harbor expansion. Adult pink salmon are often

Figure 2- 5. Valdez Harbor, Harbor Cove, and Hotel Hill.

trapped in the existing small boat harbor by the hundreds where they die and degrade water quality as they decompose.

Need to avoid, minimize, and compensate for unavoidable impacts to the maximum extent practicable

This report considers natural resources associated with water resource development at Valdez from two standpoints: mitigation and restoration.

Mitigation can be expressed in three related objectives: avoidance of impact, minimization of impact, and compensation for unavoidable impact. Specific mitigation objectives identified in scoping and consultation for harbor construction and operation in Valdez were:

- Avoid or minimize impacts to high-value habitats, including wetland and estuarine areas of particular importance to waterfowl, rearing salmon, and migratory birds.
- Minimize water quality problems in and near harbors.
- Avoid disturbance of nearby sea bird colonies.
- Minimize effects of the harbor on near-shore fish movement and on dispersal of other near-shore organisms.
- Minimize adverse impact to important sea otter habitat.
- Place project feature so that unavoidable effects are in the least diverse and least productive habitats that are practicable for project needs.
- Compensate for impacts to the maximum extent practicable and focus that type of mitigation on in-kind compensation for impacted resources.
- To the maximum extent practicable, use dredged material beneficially for construction to minimize impacts of extracting and transporting other fill material.

- If possible, use dredged material beneficially so the action avoids impacts to a disposal site.

Need to maintain and restore natural resources of PWS

Restoration objectives in this study focus on bringing affected resources back to or toward pre-impact conditions.

Fewer than 10,000 residents live in the five communities along approximately 5,000 km of PWS shoreline. Commercial fishing and logging are the two principal resource extractive industries in and on the shores of the Sound. Until 1989, runoff from logging, in-water log transfer, fish processing waste, and discharge from the small shoreline communities were the principal, but local, sources of marine habitat impacts. Those effects were limited and were being reduced by tighter permit requirements, better land stewardship, and other institutional controls.

The Exxon Valdez crude oil spill in March 1989 and its effects on PWS habitat vastly overshadowed all other effects. Impacts of the spill linger, although hundreds of millions of dollars were spent to collect spilled oil and restore impacted resources. Scoping and interagency coordination identified only two potential marine habitat restoration opportunities that could be considered in this study.

Logging has been much less important as an industry in PWS than in southeastern Alaska, but some areas of PWS, primarily on Native corporation land, have been logged. The in-water log transfer facilities used to store and load felled timber into vessels have left behind degraded habitat that was identified during scoping as an opportunity for corrective action.

The U.S. Forest Service controls most of the 5,000 km of PWS shoreline and has developed a network of remote cabins for recreational users. Most are accessible only by boat, but many do not have a dock so boats anchor in nearby protected waters while the cabin is in use. Anchor chains of the moored boats damage benthic communities as the boats swing when the tides and winds change. Damaged habitat could be restored and docks or moorings could be installed to avoid further damage.

Scoping also identified habitat degradation in the Valdez watershed that should be considered in water resource development studies. Those impacted resources were considered in an evaluation of watershed needs to determine whether they might be restored as part of a broader water resources project. Potential measures to correct problems in the watershed are considered along with other alternatives in Section 4.

2.4 National Objectives

The objectives of Federal water and land resources planning are to contribute to National Economic Development (NED) in a way that protects the Nation’s environment and increases the net value of goods and services provided to the economy of the United States as a whole and to contribute to National Ecosystem Restoration (NER) in a way to increase the net quantity and/or quality of desired ecosystem resources. Benefits contributing to NED or NER may be claimed for economic justification of a project.

Navigation improvements in Valdez represent a high priority under the current administration guidelines for producing NED benefits. Planning for the Valdez project is consistent with the NED objective and considers economic, social, environmental, and engineering factors.

2.5 Planning Objectives

Planning objectives for this study can be grouped as follows:

- Improve navigation through better moorage capacity and efficiency
- Plan for consistency with land use plans and needs
- Provide additional moorage for as many vessels on the moorage wait list as possible.
- Reduce travel costs incurred by vessels using other home ports.
- Decrease vessel delays and damages caused by rafting and hot berthing activities.
- Reduce delays experienced by commercial vessels and SERVS operations.
- Mitigate unavoidable impacts in accordance with Federal water resource development guidance.
- Identify navigation and beneficial use of dredged material strategies consistent with state, regional, and local land use plans.
- Develop harbor and beneficial use of dredged material plans acceptable to the non-Federal sponsor and other stakeholders.

2.6 Planning Constraints

Evaluation of concerns expressed during coordination and scoping, analysis of lessons learned from previous projects, and historical information led to the following planning constraints:

- Avoid transferring navigation issues to another site.
- Avoid correcting problems for one user group at the expense of another group.
- Avoid impacts to the Alyeska Pipeline Terminal.
- Avoid harbor locations that would bring boaters too close to security areas around the Alyeska terminal.
- Avoid harbor construction in locations with high earthquake risk.
- Avoid harbor locations close to river or stream outlets where they will receive excessive freshwater in the winter and freeze or be blocked with ice.
- Avoid restoration or mitigation strategies that are not self-sustaining or that may create liability for operators.
- Avoid interfering with SERVS facilities, mooring for State ferries, or Coast Guard facilities.
- Avoid harbor or restoration strategies that would reduce available developable lands, particularly those near the Valdez waterfront transportation and industrial complex.

3.0 INVENTORY AND FORECAST CONDITIONS

3.1 Existing Conditions

3.1.1 Project Area Description

The City of Valdez is on the northeast end of Port Valdez, the north-easternmost extension of PWS. Figure 3-1 is a sketch map of the City of Valdez and the layout of Valdez Harbor. Figure 3-2 is an aerial photograph of eastern Port Valdez, the City of Valdez and vicinity. Valdez is separated from interior Alaska by the steep Chugach Mountains. In 1790 Don Salvador Fidalgo named Port Valdez after the celebrated Spanish naval officer Antonio Valdes y Basan. Due to its excellent ice-free port, a town developed in 1898 as a debarkation point for men seeking a route to the Eagle Mining District and the Klondike gold fields. Valdez soon became the supply center of its own gold mining region and incorporated as a city in 1901. Fort Liscum was established in 1900, and the U.S. Army constructed a sled and wagon road to Fort Egbert in Eagle. The Alaska Road Commission further developed the road for automobile travel to Fairbanks; it was completed by the early 1920's. A slide of unstable submerged land during the 1964 earthquake destroyed the original city waterfront, killing several residents. The community was rebuilt on a more stable bedrock foundation approximately 7 km to the west. During the 1970's, construction of the Trans-Alaska oil pipeline terminal and other cargo transportation facilities brought rapid growth to Valdez. In March 1989, it was the center for the massive oil-spill cleanup after the "Exxon Valdez" disaster. In a few short days, the population of the town tripled.

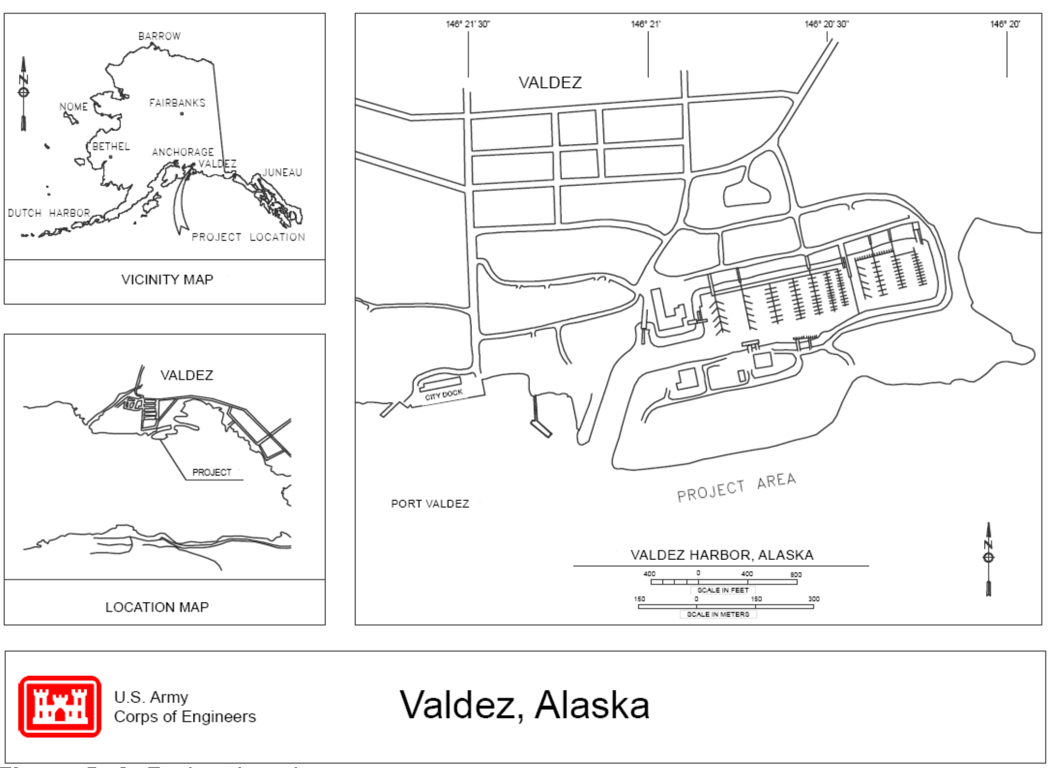

Figure 3- 1. Project location map.

3.1.2 Existing Federal Navigation Project

The original Valdez small boat harbor was constructed in 1939 at the head of Valdez Arm. Breakwaters were added in 1957. The boat harbor along with the community of Valdez was destroyed by a tsunami caused by the March 1964 Alaska earthquake after which the Corps constructed a new basin. Valdez expanded the harbor basin in 1985.

Valdez operates and maintains the harbor. It is approximately 15.4 ha or 585 meters by 264 meters. The harbor slip and float system is designed to accommodate about 500 permanent vessels (depending on the configuration of fish cleaning stations), a boat launch ramp, a tidal repair grid, and a 60-ton Marine Travelift boat haul-out dock. The basin is maintained at -3.7 meters MLLW. The entrance channel is about 37 meters wide and has a maintained depth of -3.7 meters MLLW. Two rock-mound breakwaters of approximately 164 meters and 209 meters in length protect the entrance channel. All slips are under either permanent or transient use lease, with water and electrical services provided to the float system.

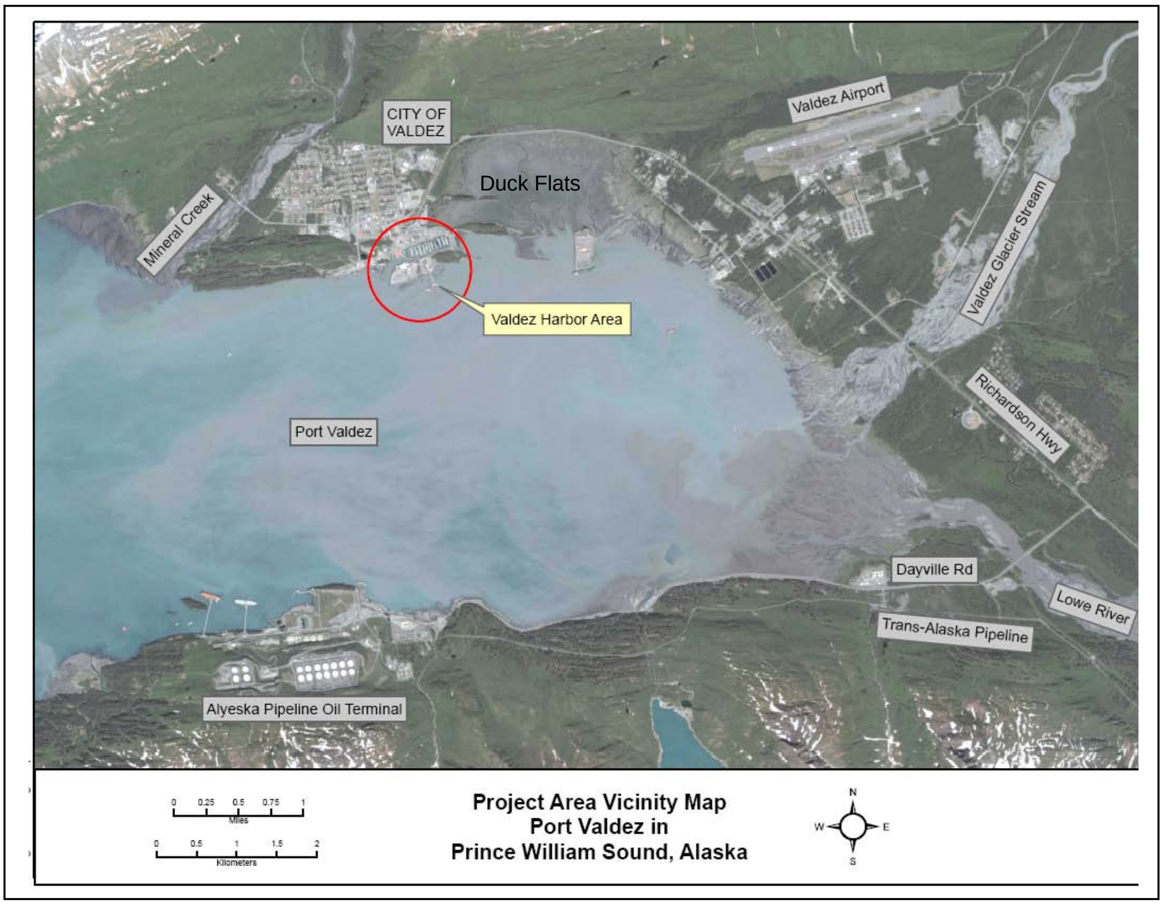

Figure 3- 2. Valdez Harbor Vicinity.

3.1.3 Biological Resources

Much of the upland habitat in and around Valdez is in steep terrain, with upper areas that remain snow covered nearly all year. Most of the area has been glaciated. These factors reduce the value of this habitat for many animals, and these areas generally have low animal population densities. The low-lying deciduous and spruce forests provide a more productive habitat, but are generally limited to small areas along the coastline. Terrestrial species in the Valdez area include mountain goats, wolves, coyotes, red fox, lynx, moose, black bears, brown bears, wolverines, black-tailed deer, river otters, and mink.

The aquatic habitat includes a wide variety of flora and fauna, including more than 200 types of invertebrates and mollusks. Tanner crab and shrimp dominated the catch during trawl sampling done in the 1970's for the nearby Trans-Alaskan Pipeline System. The only commonly occurring ground fish was walleyed pollock. Many other species were also found including Pacific herring, halibut, other species of ground fish, salmon species, and Dungeness, Tanner, and king crab.

The project area supports numerous species of birds. The highest density of winter birds includes goldeneyes, rock sandpipers, common murres, and mallards. Gulls and terns comprise more than 70 percent of the total bird population in the summer. A colony of black-legged Kittiwakes nests underneath the SERVS dock adjacent to the project area.

No listed threatened or endangered species managed by the U.S. Fish and Wildlife Service occurs in any of the proposed alternative sites. Although the Southwest Alaska Distinct Population Segment of sea otters found in marine waters surrounding the Aleutian Islands and Alaska Peninsula are listed as threatened, the sea otter population in PWS, including Port Valdez, is not. Endangered whale species managed by the National Marine Fisheries Service that occur in the project area in deeper waters are humpback, sei, right, blue, and sperm. It is unlikely the whales would come into Valdez Arm. The endangered Steller’s sea lion (western stock) does occur in near-shore waters in Valdez; however, the Corps has determined that this action would not affect listed Steller’s sea lions.

3.1.4 Economic Base

Valdez has one of the highest municipal tax bases in Alaska as the southern terminus and off-loading point of oil extracted from Prudhoe Bay on the North Slope. Four of the top ten employers in Valdez are directly connected to the oil terminus. Alyeska Pipeline Service Co. employs nearly 300 people. Valdez is a major seaport, with a $48 million cargo and container facility. City, State, and Federal agencies combined provide significant employment. Forty-nine residents hold commercial fishing permits. Several fish processing plants operate in Valdez, including Peter Pan and Seahawk Seafoods.

The Richardson Highway connects Valdez to Anchorage, Fairbanks, and Canada. Port Valdez is ice-free year round and is navigated by hundreds of ocean-going oil cargo vessels each year. The State ferry provides transportation to Valdez, Whittier, Cordova, Kodiak, and Homer in summer and only to Cordova in winter. Valdez has the largest floating concrete dock in the world, with a 1,200-foot front and water depths exceeding

80 feet. Valdez also has numerous cargo and container facilities. The State operates the airport, which has a 1,981-meter-long by 46-meter-wide paved runway, instrument landing system, and control tower. A State-owned seaplane base is available at Robe Lake.

The SERVS is an important feature of the Valdez infrastructure and provides escorts for oil tankers through PWS. It was created in the summer of 1989 after the *Exxon Valdez* oil spill. It is administered by the Alyeska Pipeline Service Company and is part of the Trans-Alaska Pipeline System. In addition to tanker escorts, SERVS provides a network of locally based vessels to rapidly respond in the event of another major oil spill. More than a hundred commercial fishing vessels are under contract to act as first responders, many of which are home ported in Valdez, making the efficient and expeditious operation of the port facilities critical.

3.2 Expected Future Conditions

Fairbanks, Alaska and the surrounding North Star Borough is the second most populated area in the State, and Valdez is the closest port for Fairbanks and other Interior Alaska communities on the road system. Over the 50-year period of analysis, the population in this region is expected to grow, which will put further pressure on the Valdez port. Because Valdez is the primary access to PWS for these Interior Alaska communities, it is unlikely delays will decrease.

A lack of moorage space will continue to cause delays to the commercial fishing fleet, recreational users, and emergency response vessels. The Port of Valdez will continue to experience additional costs of operation and maintenance, long lines at boat launches, vessel damages caused by rafting practices of a crowded harbor, and the continued increased safety risk inherent with a facility operating at above capacity. If the disaster of the Exxon Valdez happened again, the overcrowded conditions of the harbor would cause serious delays and slowdowns in the response and cleanup efforts.

Table 3-1 summarizes the damages associated with the expected without-project condition. Total present value of damages for the without project condition are more than $157.2 million with an average annual value of $7.4 million. Categories showing the most damages are the opportunity cost of time, vessel delays, and recreation.

Table 3- 1. Summary of Valdez Harbor Without-Project Conditions

Damages to:	Present Value (FY10$)	Average Annual Value ($)
Harbor Operations		
Harbor personnel time	113,000	5,300
Float and dock repairs	5,664,000	32,700
Commercial Fleet		
Vessel Damage	3,993,000	188,600
Vessel delays	10,407,000	491,600
Harbor of refuge	114,000	5,400
Opportunity Cost of Time	21,848,000	1,032,000
Tender Fleet		
Travel related expenses	2,612,000	123,400
Vessel delays	3,311,000	156,400
Opportunity Cost of Time	644,000	30,400
Charter Fleet		
Vessel Delays	18,238,000	861,500
Opportunity Cost of Time	4,448,000	210,100
Guaranteed space (CV)	1,128,000	53,300
Recreational Fleet		
Recreation experience (UDV)	78,857,000	3,909,500
Subsistence Fleet		
Harvest value	5,819,000	288,500
Total Damages	**$157,196,000**	**$7,388,700**

4.0 FORMULATION AND EVALUATION OF ALTERNATIVES

4.1 Planning Criteria

4.1.1 Plan Formulation

Alternative plans are formulated to meet four study criteria: completeness, efficiency, effectiveness, and acceptability. Completeness is the extent to which alternative plans provide and account for all necessary investments or other actions to ensure planning objectives are met, including actions by other Federal and non-Federal organizations. Effectiveness is the extent to which alternative plans help achieve planning objectives. Efficiency is the extent to which an alternative plan is the most cost-effective means of achieving the objectives. Acceptability is the extent to which alternative plans are acceptable in terms of applicable laws, regulations, and public policies. Mitigation of adverse effects is an integral component of each alternative plan.

The economic evaluation of alternative plans is based on October 2010 prices, a period of analysis of 50 years, and a Federal discount rate of 4-3/8 percent. Beneficial use of dredged material plans are developed with the best available biological information and through incremental cost analysis and in accordance with water resource development policy and guidelines.

4.1.2 Engineering Criteria

Alternative plans should be adequately sized to accommodate user needs and protection against wind-generated waves. Adequate depths and entry should provide for safe navigation. The plans must also be feasible from an engineering standpoint and capable of being economically constructed. Chapter 5 of the Hydraulic Appendix details the engineering criteria, which include:

- Breakwaters are to be positioned so that the waves inside the harbor entrance channel would be minimized to the maximum extent possible. Storm waves should quickly dissipate to less than 0.3 meter before reaching the mooring area.
- Minimum channel width of 5-beam widths for two-way traffic in entrance channels.
- 1.5 times the longest finger pier length factor is the minimum acceptable fairway width.

4.1.3 Economic Criteria

Principles and guidelines for Federal water resources planning require the Corps to identify a plan that produces the greatest contribution to NED. The NED plan is defined as the one that provides the greatest net benefits as determined by subtracting annual costs from annual benefits. Corps policy requires recommendation of the NED plan unless there is adequate justification to do otherwise.

Alternatives considered 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.

4.1.4 Environmental Criteria

Engineering Regulation ER 1105-2-100 establishes mitigation requirements for Corps of Engineer 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.

Mitigation has been defined by the President's Council on Environmental Quality to include (1) avoiding an impact by not taking an action or parts of an action, (2) minimizing impacts by limiting the degree or magnitude of the action, (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment, (4) reducing impact over time by preservation and maintenance operations and (5) compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

This environmental analysis focuses on potential impacts to resources identified as important during the environmental scoping process. It also looks at avoiding, minimizing, and/or mitigating impacts to these resources that could result from implementation of this project.

4.1.5 Social Criteria

Plans considered should minimize adverse social impacts and should seek consistency, to the greatest extent practicable, 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.

4.2 Fleet Size

To determine alternative fleet sizes, logical increments in the number of vessels that could be accommodated were identified in design alternatives. To do this, the study team assessed how Valdez manages harbor demand. The harbormaster fills open slips based on whoever has been on the waitlist the longest without preference for commercial, charter, or recreational vessels. It is first come, first served depending on the size of the boat and the waitlist for which the vessel owner paid the fee.

A characteristic of harbor activities in Valdez is that the interaction of the commercial fleet with other users often causes delays and damages. For example, a mixed raft of transient commercial and recreational vessels would require significant effort by harbor staff to maneuver vessels in and out of the raft at the different times these users wish to depart or arrive. Because both commercial and recreational fleets are most active when the fishing is good, there is a greater opportunity for delay and damage during this time. The recreational fleet, must be accommodated to minimize inter-fleet interference. To maximize the commercial NED benefits, moorage slips for recreation, charter, and subsistence also have to be created. It is impossible to get commercial benefits without other user benefits because harbor expansion benefits all. As each increment of slips is added, commercial, charter, subsistence, and recreation benefits that are incidental to commercial benefits accrue.

To develop the first increment in fleet size, the study team evaluated the existing waitlist for a logical way to group vessels on the list to start the harbor design. It was determined that a cluster of commercial vessels had been on the waitlist since the summer of 2005. This oldest group of waitlisted vessels numbered 125 (table 4-1) and formed the basis for the first increment of harbor configuration. The logic here was that a significant amount of commercial benefits could be gained through meeting the needs of this group of vessels. In addition, an increment of recreational benefits could potentially be gained through freeing up the launch facilities from the load of commercial vessels that still launch from Valdez. There would still be large unmet demands for the remainder of vessels on the waitlist and transient vessels.

Table 4- 1. 125 – Vessel Fleet

Vessel Type	< 6.7 meters	6.7-11 meters	11.3-16.8 meters	>16.8 meters	Total
Recreation	42	52	7	1	101
Commercial Fishers	0	2	13	2	16
Charters	0	6	2	0	8
Total	**42**	**60**	**21**	**4**	**125**

The second increment of fleet size is 200, the maximum transient vessels (table 4-2) the harbor can accommodate on any given peak day. This group is a mix of commercial and recreational vessels that use either open spaces along the piers or moor at the transient pier, where vessels often are forced to raft up to six deep. If the new harbor could accommodate these vessels, then there would be fewer delays in the existing harbor and more efficient handling of the transient vessels. In addition, several vessels from the waiting list could be accommodated because of the transient moorage space that would be opened up. Additional benefits for both commercial and recreational vessels would be realized. There would still be large unmet demands from the remaining vessels on the waitlist.

Table 4- 2. 200 – Vessel Fleet

Vessel Type	< 6.7 meters	6.7-11 meters	11.3-16.8 meters	>16.8 meters	Total
Recreation	69	86	11	2	167
Commercial Fishers	0	3	20	3	26
Charters	0	6	1	0	7
Total	**69**	**94**	**32**	**6**	**200**

The third harbor configuration (table 4-3) accommodates all vessels on the existing waitlist (243 vessels). This fleet size would make a significant contribution toward decreasing vessel delays and other damage categories. It is likely that several of the vessels that could be classified as part of the "transient fleet" would be accommodated because they were already on the waitlist. It should be noted that there are likely many other vessels that would be on the moorage waitlist were it not so long or cost $50 per year to stay on it. If just the vessels on the existing waitlist were accommodated, there still would be significant unmet demand and commercial damages. Transient moorage would remain a problem.

Table 4- 3. 243 – Vessel Fleet

Vessel Type	< 6.7 meters	6.7-11 meters	11.3-16.8 meters	>16.8 meters	Total
Recreation	83	99	13	2	197
Commercial Fishers	0	3	24	4	32
Charters	0	11	3	0	14
Total	**83**	**113**	**41**	**7**	**243**

The fourth and largest configuration (table 4-4) would accommodate half of all transient vessels using Valdez Harbor in 2006 (320 of the estimated 640 transient users). It is assumed that many of the additional customers would seek permanent moorage at Valdez if the waitlist were not already so long. Even at this fleet size, there would still be additional demand, especially during specific periods like salmon derbies or unannounced commercial fishing opportunities, although most of the demand would be met most of the time. The important factor that drives the determination of this fleet size is that a 320-vessel configuration is about the maximum size harbor that could be built at Valdez based upon physical and environmental constraints.

Table 4- 4. 320 – Vessel Fleet

Vessel Type	< 6.7 meters	6.7-11 meters	11.3-16.8 meters	>16.8 meters	Total
Recreation	108	131	18	3	260
Commercial Fishers	0	5	32	6	42
Charters	0	14	3	1	18
Total	**108**	**150**	**53**	**9**	**320**

4.3 Harbor Alternatives Initially Considered

Initial consideration of alternatives looked at a broad range of structural and non-structural approaches. The approaches can be roughly arranged in four sets:

No Action
Non-structural solution
Construct moorage in locations other than Valdez
Construct moorage in or near Valdez

Each alternative in this initial evaluation is briefly considered and then is either eliminated or is carried forward for detailed consideration in Section 4.5.

4.3.1 No Action Alternative

The alternative of no Federal action is considered in each Corps water resources project. This alternative is carried forward for detailed consideration.

4.3.2 Non-Structural Alternative - Redesign the Existing Harbor

One of the first alternatives considered to accommodate increased moorage demand was to redesign the float layout in the existing harbor. Redesign would reduce delay costs for some of the remaining vessels, but displaced vessels would completely lose the use of the harbor. The City of Valdez recently completed a $2.2 million upgrade to the existing float facilities in anticipation of new harbor construction. Reconfiguration of the existing harbor to eliminate delays was found to be ineffective and is not carried forward for further consideration.

4.3.3 Moorage in Locations Other Than Valdez

Water resources guidance encourages planning and development in a regional context. New harbor construction at Whittier, Cordova, or even Seward (figure 2-1) might contribute toward meeting at least some of the objectives identified for Valdez Navigation Improvements in Section 2.5. This alternative would expose vessels to additional travel costs and possible storms in PWS. Additional moorage at Whittier (more than 550 highway km. away), Seward (about 700 highway km. away) or Cordova (no highway access) would do little to reduce crowding at Valdez Harbor to meet spill prevention and response needs, or to meet the needs of the City of Valdez, our non-Federal sponsor.

This alternative is not considered in detail.

4.3.4 Create Additional Upland Boat Storage

Two non-structural alternatives were initially considered. Construction of additional boat launching facilities at the existing harbor would allow faster launching but would be limited by congestion already present on roads, in parking lots, and in the harbor itself, and could displace existing mooring spaces. This option would do nothing to decrease existing delays in the harbor and could even increase congestion with more vessels trying to launch into the already overcrowded harbor. In addition, when a large composite or wood vessel is removed from the water, it is subject to dry-docking damages and could cause owners to incur additional expenses. Boats moved to the dry-dock area are also not available for use in the winter fisheries. Land needed for other purposes would be committed if substantial additional parking was provided for more boat trailers. Larger vessels that make up much of the wait list would not benefit from this approach. This alternative would not meet objectives and was eliminated from detailed consideration. Creation of additional launching and upland boat storage facilities was not considered to be a viable alternative and is not carried forward for further consideration.

4.4. Alternative Harbor Sites Initially Considered

In developing structural alternatives to be considered in detail, the following sites were evaluated first and then alternative harbor plans were developed for promising sites. The location of the Mineral Creek, Old Valdez, Allison Point, and Allison Creek sites evaluated in this initial consideration is shown in figures 4-1 and 4-2. The existing harbor, Harbor Cove site, East site, and West site are shown in figure 4-3

Figure 4-1. Alternative sites initially considered.

Mineral Creek. A 200-boat moorage basin with breakwaters and shore-side facilities could be built entirely on glacial and alluvial deposits near the mouth of Mineral Creek northwest of Valdez. A conceptual illustration is shown in figure 4-2. Construction is not expected to encounter extensive bedrock, large boulders, or other conditions that would substantially raise costs. Larger harbor configurations would be difficult to construct in this location because the site is bounded by deep water seaward and rocky terrain shoreward. The site is not served by roads or utilities, so site development would be more expensive than a similar site on existing roads and utilities. The site would require about 1.7 km of access road and utilities to connect to existing services. The Mineral Creek site is about 3 km from the existing harbor, the central business district and the tourist center, so it would require separate harbor management offices and staffing.

Mineral Creek is one of many streams feeding Port Valdez. It presents two substantial problems for a harbor at this site. Most of Port Valdez becomes more saline in the winter when freshwater inflow drops, so Valdez harbor has relatively little problem with freezing, which periodically closes other harbors at this latitude in Alaska. A new harbor positioned at the mouth of Mineral Creek could accumulate fresh water from the creek and would be much more likely to freeze. Mineral Creek also is an anadromous stream with appreciable runs of Pacific salmon and Dolly Varden. Fish migrating to and from the stream would be exposed to more activity and potential for contamination and interruption to their movements. This site was eliminated from detailed consideration because it would be more expensive to develop and operate than other available sites, would be more likely to adversely affect wild salmon, and because adequate mitigation would be difficult to develop and would further add to the expense of construction and operation at this site.

Old Valdez. The original Valdez townsite was wiped out by the great 1964 earthquake and the tsunamis that followed. The modern town of Valdez was established at its current location and the old site was never redeveloped, in part because the 1965 Seismic Task Force reported that the seismic risk was so great that no Federal funding should be used for construction at the old townsite. Risks were considered unacceptable and the Old Valdez site (figure 4-2) was eliminated from further consideration.

Allison Point/Creek. A harbor could be developed in the comparatively shallow water in an alluvial outwash at the mouth of Allison Creek. A conceptual plan view is shown in figure 4-2. The alluvium is limited in extent, so only a small harbor would be feasible. The rocky shoreline and adjacent deep water would make a larger harbor prohibitively costly. The surrounding uplands rise steeply into the Chugach Mountains. There is very little land that could be developed without extensive and costly blasting. There are no utilities to or near this site. A harbor at this site would be adjacent to a salmon hatchery, and a harbor could impede juvenile salmon movement in the critical weeks that follow release into marine waters. This site also is less than 2 km from the Trans Alaska Pipeline Terminal and much closer to the restricted waters surrounding the terminal, and there is a real concern that boats using the harbor could intrude into that security area or that in an emergency the security area could be enlarged to impair access to this site.

This alternative is eliminated from further consideration because costs and potential risks would be prohibitive.

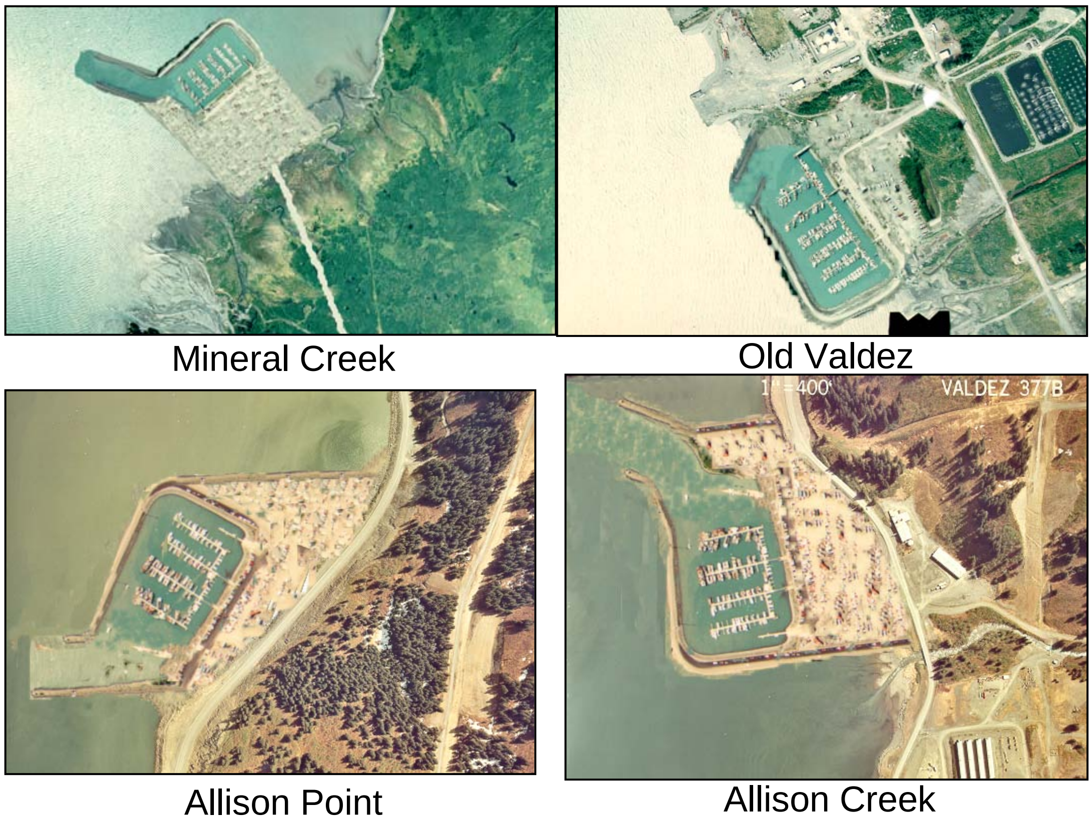

Figure 4-2. Conceptual Alternatives for Sites Eliminated.

Expansion of the Existing Harbor. The existing harbor could be expanded several ways: (1) by dredging shoreward into the existing waterfront, which would be exceptionally disruptive to commercial structures and very costly, (2) dredging seaward into dredged material placed when the harbor was constructed in 1965 and expanded in the 1970's, or (3) by dredging eastward into Harbor Cove, which would make the harbor even longer than it is now. A longer harbor could decrease water circulation and therefore decrease quality within the existing harbor.

Dredging inland would cost substantially more than any benefits that could be realized and is not considered in detail.

Dredging the harbor east into Harbor Cove to make it longer would create a configuration so long and narrow that existing water problem and harbor traffic problems would be greatly exacerbated. Road access to industrial and other facilities on the south side of the harbor would require a bridge that would be prohibitively expensive. Mitigating impacts to the Duck Flats adjacent to Harbor Cove would add further costs and would create controversy that can be avoided. This alternative was eliminated from detailed consideration.

Dredging seaward into lands created when the existing harbor was constructed would eliminate existing moorage on the south side of the present harbor, would eliminate adjacent lands essential for harbor and other water related activities, would disrupt communication lines and other utilities, and could impinge on spill response infrastructure in that area. There also is a very strong likelihood that dredging could encounter contamination and bedrock outcroppings that would make the action economically infeasible. Dredging costs would be high in the congested harbor and disposal would be extremely costly if contamination was encountered. This alternative was eliminated from detailed consideration because it would leave a harbor without lands for essential commercial and industrial activities and because there are unacceptable risks of cost escalation from rock excavation and contamination.

Harbor Cove. This site is just east of the existing harbor, separated only by South Harbor Drive (figure 4-3). It is naturally protected on three sides and has been seen by many local residents as the most logical spot for harbor expansion. Available information indicates that a harbor could be constructed at this site by dredging an entrance channel, turning basin, and mooring space into the intertidal and shallow subtidal flats with relatively little rock excavation.

Harbor Cove is intertidal and very shallow subtidal estuarine habitat that is used by millions of juvenile salmon each year in the critical period when they are adapting to salt water, their mobility is limited, and accessible food sources are essential. The cove also is used heavily by migrating ducks and other migrating birds. Islands at the mouth of the cove are listed sea bird colonies. Sea otters and other animals inhabit the cove or the coastal habitat that would be developed for a harbor at this site.

Harbor Cove is immediately seaward of a broad brackish estuarine wetland complex called the Duck Flats. Its value as habitat for waterfowl and other animals and plants is widely recognized and appreciated. This type of habitat is not common in the mountainous lands around PWS. The Duck Flats is proposed as an area meriting special attention in the Valdez coastal zone management program. Previous permit applications to develop in waters of the United States in the Duck Flats were met with determined resistance by agencies and interested non-government organizations and, as a result, permits were not granted. Development of a harbor in Harbor Cove could adversely affect habitat values in the Duck Flats with petroleum and other contamination, and the noise and activity could displace wildlife.

Developing moorage in Harbor Cove would be controversial and would be perceived as a significant impact by at least some stakeholder agencies. Documenting potentially affected resources, particularly indirect and cumulative effects on those resources, would be difficult and uncertain. Mitigating effects on important resources would be extremely difficult, and probably would be economically infeasible. This alternative was eliminated from detailed consideration because dredging and mitigation costs would be high and because neither the Corps nor the non-Federal sponsor were willing to participate in developing a controversial environmental impact statement with marginal potential for meeting mitigation policy and guidelines.

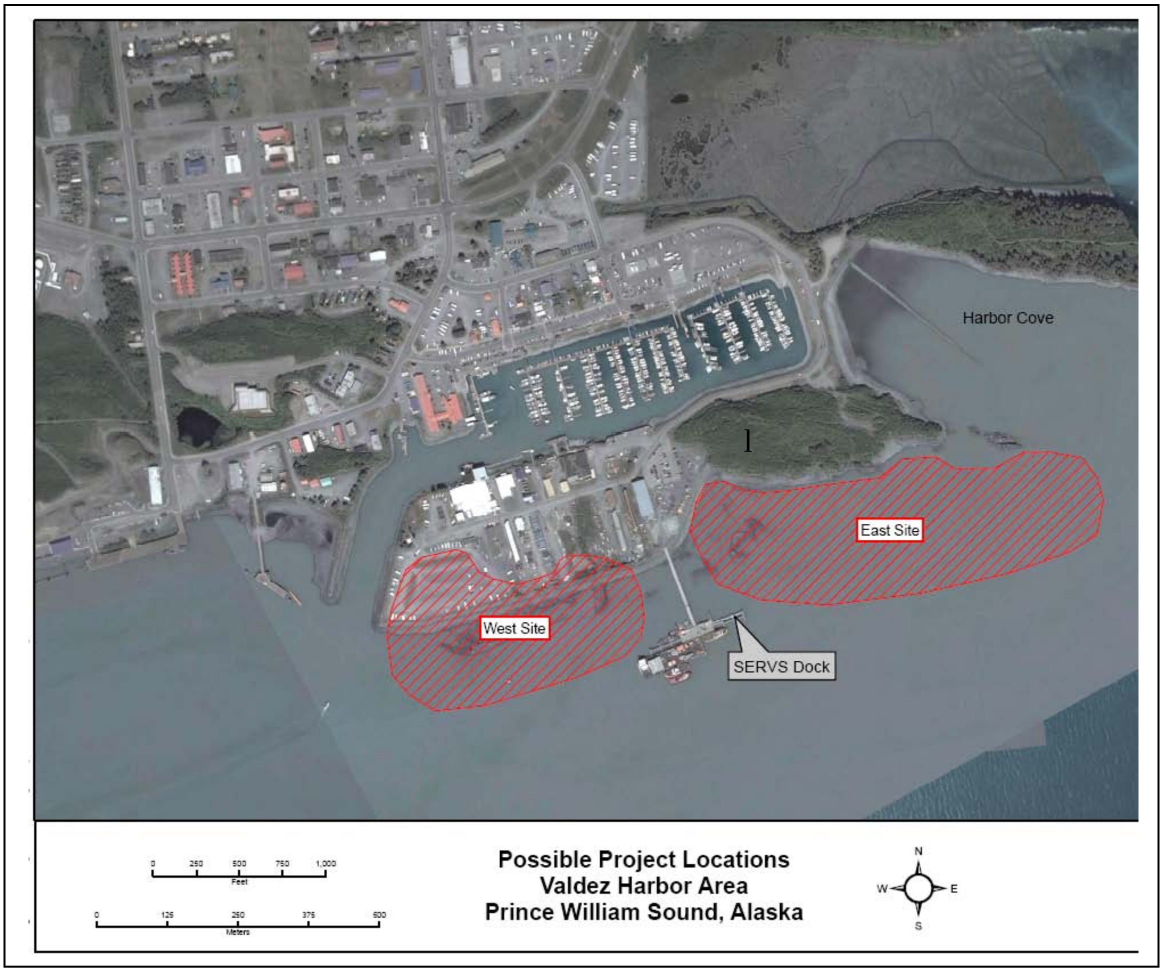

Figure 4-3. Alternative Sites and Harbor Cove.

West Site. This site is west of the SERVS dock and south of the existing harbor on the Port Valdez side of the fill created with the 1982 expansion of the existing harbor. Figure 4-3 shows this site in relation to existing facilities. Because it is near existing harbor facilities and because it has sufficient area for viable alternatives, this site is carried forward for further consideration in Section 4.6.

East Site. This site is east of the SERVS Dock and south of Hotel Hill, a large rock outcropping that was an island before initial harbor construction in 1965. The tidelands and near-shore subtidal zone could be dredged for an entrance channel and moorage for a harbor large enough to moor more than 300 boats. This alternative is considered in detail in Section 4.6.

4.5 Harbor Structural Alternative Measures

Several alternative structural measures were considered for the alternative sites considered in detail study and are described as follows:

Floating Breakwaters. Floating breakwaters are structures that float on the surface of the water, have a shallow draft, and can be anchored with chain systems or piles. The floating structure can be constructed of concrete, logs, tires, or other materials. Floating breakwaters are usually limited to short-fetch water bodies where the design waves are relatively small. Floating breakwaters become exceptionally expensive where waves exceed 1.2 meters or for wave periods greater than 4 seconds. The wave conditions at Valdez would make floating breakwaters more expensive than rubblemound or sheet-pile alternatives, so this option is not considered further.

Rubblemound Breakwaters. These are the most common breakwaters, are often used in shallow water, and are effective against long-period waves. They are typically constructed with three gradations of rock with the outer layer designed to withstand the design waves for the project. They typically require relatively little maintenance. Rubblemound breakwaters are viable structural alternatives and are carried forward for further consideration.

Composite Low Rubble Berm. A composite low rubble berm with vertical sheet-pile wall was considered but was found to have no significant advantage over the rubblemound alternative. The lower weight of the breakwater structure and slightly smaller construction footprint were the only advantages. Cost of materials and constructing a berm from both rock and sheet pile would be more expensive than an all-rock rubblemound breakwater. Maintenance of the sheet pile also would increase costs over the project life. This alternative is not carried forward for further consideration.

Vertical Curtain Wall Wave Barrier. These are walls penetrating a segment of the water column. They can be constructed of steel and have service lives up to 25 years. Use of anodes, thicker steel sections or concrete walls and panels can extend service life. The curtains in this type of wave barrier can be hung from pilings, so this system only places a very narrow footprint on the bottom. This type of wave barrier would be more expensive to construct and maintain in water depths at Valdez and might be less effective in attenuating waves, but might be the most effective measure at sites that could accommodate only a very narrow project footprint. Any alternative harbor design west of the SERVS dock might benefit from this design. The broad base of a rubblemound breakwater at the West site would use so much of the available space that the resulting harbor would not produce enough benefits to be economically feasible. Wave barriers were not found to be viable alternatives at the East site where there is more area of suitable depth for harbor development, and a rubblemound breakwater would produce more net benefits. Vertical wave barriers are considered in detail only for the West site.

4.6 Harbor Alternatives Considered In Detail

The cost of the selected plan in this section is different than the costs in the description of the recommended plan in Section 6. The alternatives were compared utilizing cost estimates prepared in 2006 and inflated to the 2010 price level using the Civil Works Construction Cost Index System for navigation ports and harbors. This cost basis was utilized to ensure all the assumptions and computations used were the same for all the alternatives. When the selected plan was identified, its cost estimate required updates per comments received in Agency Technical Review and have been adjusted to 2010 price levels and resulted in costs for the recommended plan in later sections of the report to be different from those in the alternative analysis.

4.6.1 No-Action Alternative

With no Federal involvement, the no-action alternative would leave the site in its present condition. The identified purpose and need would not be met. The existing Valdez Harbor would continue to be used beyond its design capacity. Damage to vessels and docking facilities from rafting and hot-berthing would continue; economic benefits to the fleet from improved and expanded harbor facilities would not be achieved.

4.6.2 West Site Alternatives

Material dredged during construction of the existing Valdez Harbor was used as fill to construct a broad, flat uplands area seaward of the harbor. This constructed uplands is in shallow water, but is near the seaward limit of the Valdez alluvial fan where the sea bottom plunges to a depth of 200 meters just 500 meters off shore. A harbor constructed seaward at this location would be limited by deep water. A harbor could be dredged into the constructed uplands, but dredging volumes would be high, debris of unknown origin might be encountered, and uplands essential to Valdez's economic existence would be lost. West site harbor alternatives are compromises that would minimize dredging into created uplands, but limit seaward development that would be expensive.

Two harbor configurations were considered initially. Both would use wave barriers rather than rubblemound breakwaters because the narrower wave barrier footprint would make more room for moorage and other harbor functions.

There is no room for future expansion at this location. Two outfalls from the seafood processing plants would be relocated. Dredged material composition is unknown, but would be expected to consist of previous fill that came from expansion of the existing harbor and the underlying in situ ground.

Dredged material would be used beneficially to restore a log transfer site in Two Moon Bay. Access to the new harbor would be by the existing South Harbor Drive.

West Site Wave Barrier 243 -Vessel Alternative. This alternative would accommodate all the vessels from the October 2006 harbormaster’s wait-list. The layout is shown in figure 4-4. This alternative would include breakwaters, wave barrier, dredging, inner harbor floats, bank stabilization, and real estate acquisition for a total project cost of $57.3 million (table 4-5). Operations and maintenance estimates for this alternative are based on 2 percent of the mobilization, demobilization, and wave barrier cost annually to account for annual inspections, cathodic protection, and replacement of worn panels. Operations and maintenance costs for this alternative are estimated at more than $2.2 million annually. That estimate assumes the harbor float system would be completely replaced 30 years after construction and replacement of the wave barrier takes place at 25 years.

Table 4- 5. West Site Wave Barrier 243 -Vessel Alternative Cost Summary

Cost Category	243-slip Wave Barrier
Mob and demobilization	$ 1,880,000
Breakwaters	2,814,000
Wave barrier	14,207,000
Navigation aids	18,000
Dredging	1,410,000
Log transfer mitigation	533,000
Hydro survey	38,000
Inner harbor floats	5,403,000
Bank stabilization	1,274,000
Total Project First Costs	**$ 27,577,000**
Real estate	691,000
Interest During Construction	1,477,000
Preliminary Engineering and Design (PED)	855,000
Supervision and Administration (S&A)	552,000
Contingency (20%)	5,935,000
Total Project Economic Costs	**$ 37,087,000**
Present Value of Operations and Maintenance	**57,267,400**
Average Annual Costs (50 years at 4 3/8%)	**$ 4,677,800**

Source: Alaska District Corps of Engineers Cost Engineering estimate using Tri-Service Automated Cost Engineering System (TRACES) with November 2006 pricing levels updated to August 2010 using the Civil Works Construction Cost Index System for navigation ports and harbors. Present value calculations based on the Federal FY10 discount rate of 4 3/8 percent.

Note: Present value of operations and maintenance costs based on two percent of the wave barrier structure replaced annually. The wave barrier structure is completely replaced at year 25 and the float system is replaced 30 years after construction.

West Site Wave Barrier 320 -Vessel Alternative. This alternative would accommodate half of the transient vessels using the Valdez Harbor in 2006. This alternative would include breakwaters, wave barrier, dredging, inner harbor floats, bank stabilization, and real estate acquisition for a total project cost of $62.5 million (table 4-6). Figure 4-5 shows wave barrier plans. Operations and maintenance for this alternative is based on 2 percent of the mobilization, demobilization, and wave barrier cost annually to account for annual inspections, cathodic protection, and replacement of worn panels. Operations and maintenance costs for this alternative are estimated at more than $2.2 million annually. This estimate assumes the harbor float system would be completely replaced 30 years after construction and the wave barrier is replace at year 25.

Table 4- 6. West Site Wave Barrier 320 -Vessel Alternative Cost

Cost Category	320-slip Wave Barrier
Mob and demobilization	$ 1,880,000
Breakwaters	4,812,000
Wave barrier	18,585,000
Navigation aids	18,000
Dredging	1,441,000
Log transfer mitigation	662,000
Hydro survey	73,000
Inner harbor floats	6,870,000
Bank stabilization	252,000
Total Project First Costs	**$ 34,593,000**
Real estate	691,000
Interest During Construction	1,853,000
Preliminary Engineering and Design (PED)	855,000
Supervision and Administration (S&A)	692,000
Construction contingency (20%)	7,366,000
Total Project Economic Costs	**$ 46,050,000**
Present Value of Operations and Maintenance	**62,482,400**
Average Annual Costs (50 years at 4 3/8%)	**$ 5,380,700**

Source: Alaska District Corps of Engineers Cost Engineering estimate using Tri-Service Automated Cost Engineering System (TRACES) with November 2006 pricing levels updated to August 2010 using the Civil Works Construction Cost Index System for navigation ports and harbors. Present value calculations based on the Federal FY10 discount rate of 4 3/8 percent.

Note: Present value of operations and maintenance costs based on two percent of the wave barrier structure replaced annually. The wave barrier structure is completely replaced at year 25 and the float system is replaced 30 years after construction.

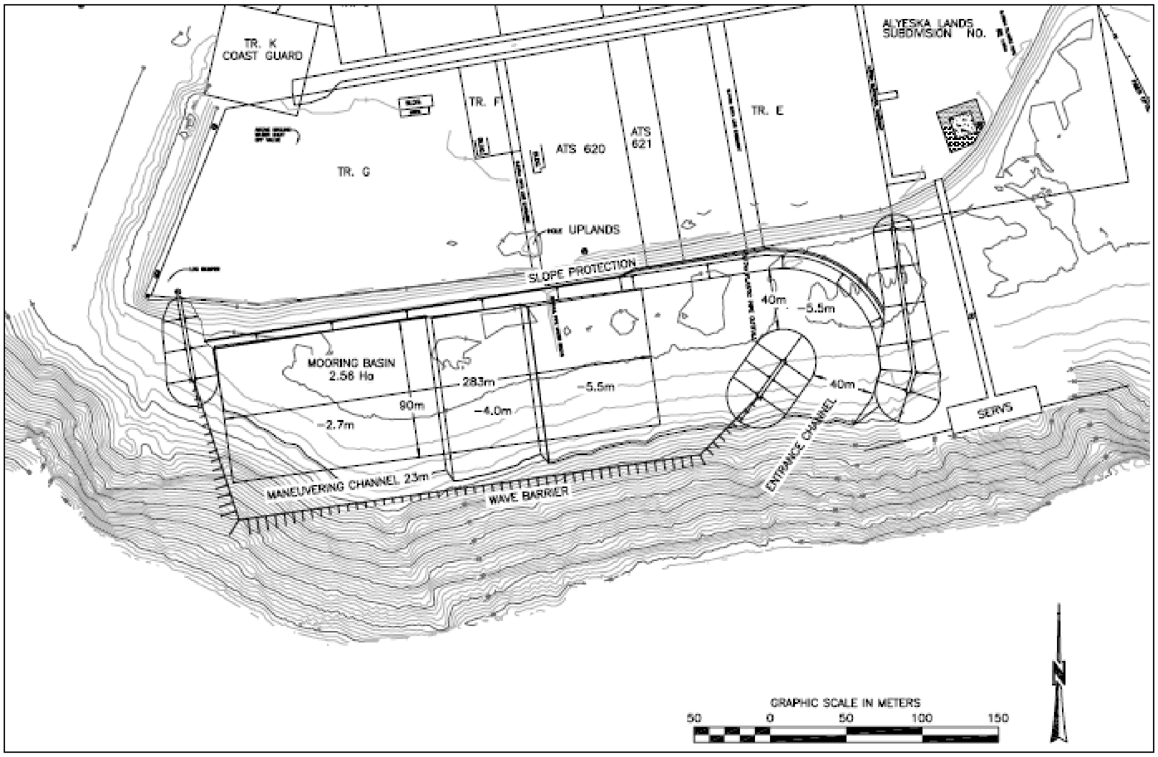

Figure 4- 4. West Site Wave Barrier 243 - Vessel Configuration.

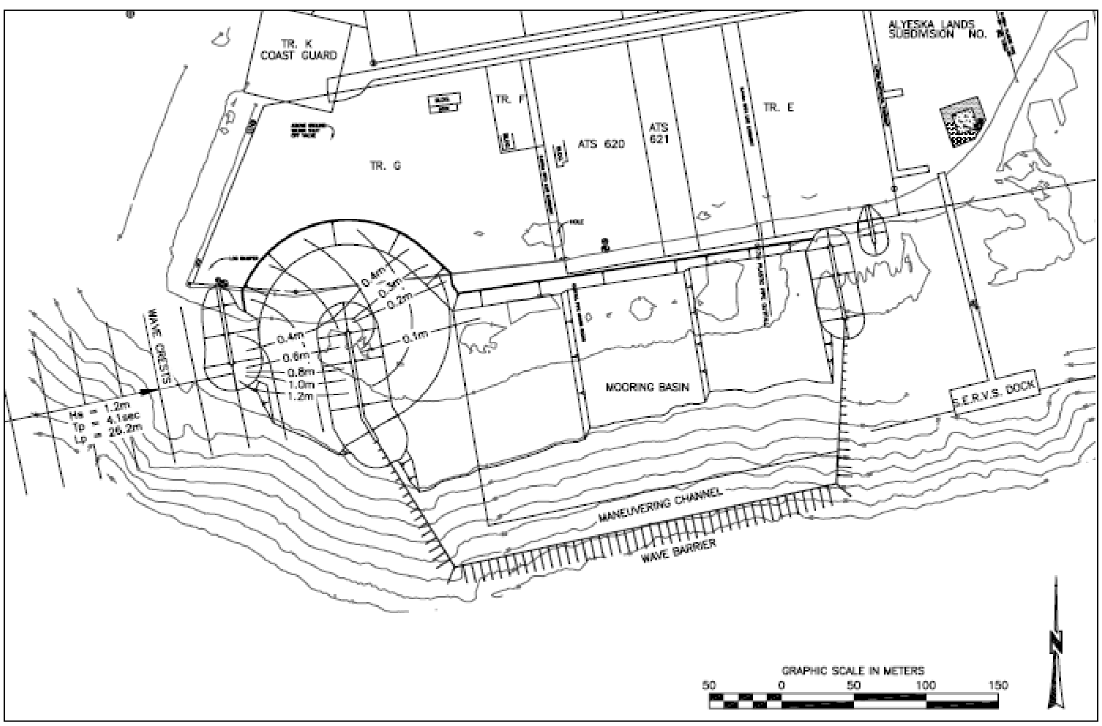

Figure 4- 5. West Site Wave Barrier 320 - Vessel Configuration.

4.6.3 East Site Alternatives

Significantly more area is available for harbor construction east of the SERVS Dock. Water there is shallow enough for economically feasible construction of a rubblemound breakwater considerably farther offshore than at sites west of the SERVS dock. Limited testing indicates bottom material at the East site is primarily sand, gravel, cobbles and boulders, with potential for some large boulders and outcrops. Potential harbor locations are limited by deep water offshore and the SERVS dock to the west. Inshore dredging is limited by Hotel Hill and associated rock terrain. A harbor could be constructed farther east but would impinge on increasingly valuable marine and bird habitat associated with small islands and Harbor Cove. The eastward boundaries of harbor alternatives were limited to avoid potentially significant impacts to those resources.

A major fiber optics communications cable serving much of the population of interior Alaska bisects the East site. The cable would be excavated and relocated before any harbor alternative could be constructed at the East site.

Dredged material would be used to construct the harbor staging area. Remaining material would be placed be at the Two Moon Bay log transfer location.

Rubblemound breakwaters are specified because of wave conditions. Access could be at the west end of Hotel Hill, around the eastern end, or both. A 5-year monitoring plan for the Two Moon Bay disposal site is included in the operations and maintenance for the East site rubblemound alternatives. The alternatives for the East site all have similar configurations, increasing in size from containing 125 vessels up to 320 vessels.

East Site Rubblemound 125-Vessel Alternative. This alternative would provide moorage for vessels that have been on harbormaster's waitlist for many years. Among those waitlisted are several commercial vessels that would realize substantial benefits. This alternative would relocate the communications cable; construct roads, parking areas, breakwaters, and inner harbor floats; stabilize the shoreline, and dredge an entrance channel, turning area, and mooring basin. A 0.2 ha staging and work area would be developed in adjacent uplands and tidelands to allow the harbor to operate efficiently and safely. Material dredged for this alternative would be used to develop the adjacent staging area in a beneficial use action to cap an abandoned log transfer facility in PWS.

Total cost for this alternative is estimated at $20.9 million (table 4-7). Operations and maintenance estimates assume that 2 percent of the breakwater armor rock would be replaced every 5 years at an estimated cost of $31,000 and that harbor floats would be replaced after 30 years.

Table 4- 7. East Site Rubblemound 125 - Vessel Alternative Cost

Cost Category	125-slip Rubblemound
Cable relocation	$ 506,000
Road construction	129,000
Mob and demobilization	426,000
Breakwaters	6,353,000
Navigation aids	18,000
Dredging	1,071,000
Uplands fill	140,000
Log transfer mitigation	393,000
Hydro survey	37,000
Inner harbor floats	5,031,000
Bank stabilization	657,000
Total Project First Costs	**$ 14,761,000**
Real estate	295,000
Interest During Construction	791,000
Preliminary Engineering and Design (PED)	1,283,000
Supervision and Administration (S&A)	443,000
Contingency (20%)	3, 356,000
Total Project Economic Costs	**$ 20,929,000**
Present Value of Operations and	**1,654,800**
Average Annual Costs (50 years at 4 3/8%)	**$ 1,119,600**

Source: Alaska District Corps of Engineers Cost Engineering estimate using Tri-Service Automated Cost Engineering System (TRACES) with November 2006 pricing levels updated to August 2010 using the Civil Works Construction Cost Index System for navigation ports and harbors. Present value calculations based on the Federal FY10 discount rate of 4 3/8 percent.

Note: Present value of operations and maintenance costs based on two percent of the armor rock replaced every five years. Included in the operations and maintenance calculations is a 5-year monitoring plan activity for the Two Moon Bay capping of the log transfer site with dredge material from the East Site alternatives.

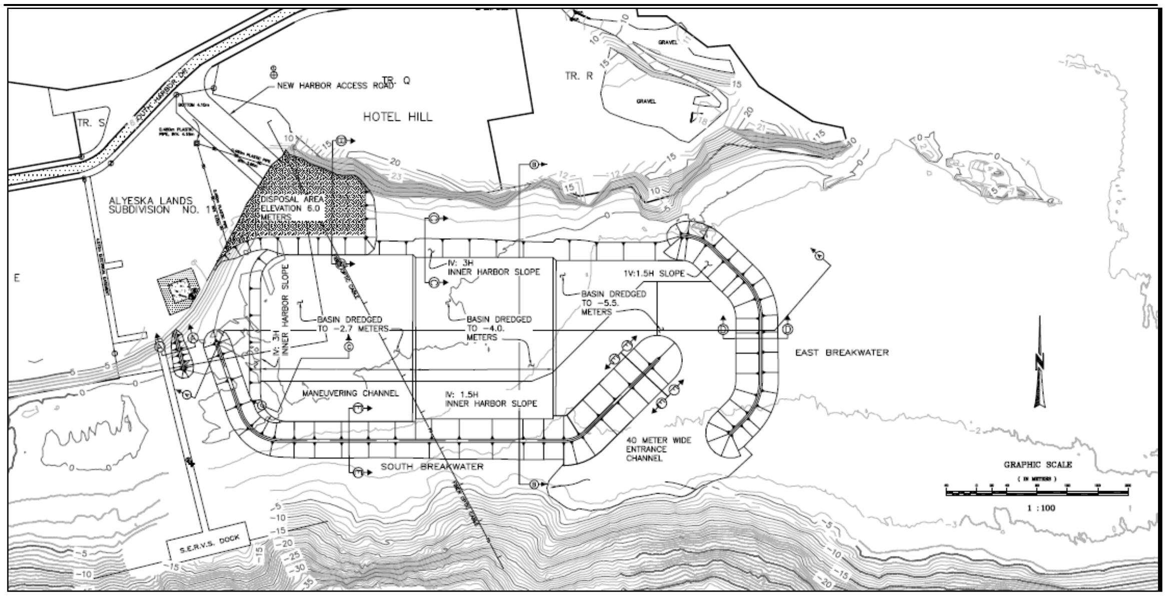

Figure 4-6. Example design for the 200-vessel harbor. The 125-vessel harbor would be proportionally smaller.

East Site Rubblemound 200-Vessel Alternative. This alternative accommodates the maximum number of transient vessels that currently use the existing Valdez Harbor on peak days. This alternative would relocate the communications cable; construct roads, parking areas, breakwaters, and inner harbor floats; stabilize the shoreline, and dredge an entrance channel, turning area, and mooring basin (figure 4-6). A 0.2 ha staging and work area would be developed in adjacent uplands and tidelands to allow the harbor to operate efficiently and safely. Material dredged for this alternative would be used to develop an adjacent staging area.

Total cost for this alternative is estimated at $28.1 million (table 4-8). Operations and maintenance estimates assume that 2 percent of the breakwater armor rock would be replaced every 5 years at an estimated cost of $50,000 and that harbor floats would be replaced after 30 years.

Table 4- 8. East Site Rubblemound 200 - Vessel Alternative Cost

Cost Category	200-slip Rubblemound
Cable relocation	$ 502,000
Road construction	128,000
Mob and demobilization	387,000
Breakwaters	8,644,000
Navigation aids	18,000
Dredging	1,571,000
Uplands fill	128,000
Log transfer mitigation	451,000
Hydro survey	36,000
Inner harbor floats	6,226,000
Bank stabilization	2,222.000
Total Project First Costs	**$ 20,313,000**
Real estate	295,000
Interest During Construction	1,088,000
Preliminary Engineering and Design (PED)	1,283,000
Supervision and Administration (S&A)	609,000
Contingency (20%)	4,500,000
Total Project Economic Costs	**$ 28,088,000**
Present Value of Operations and	**2,054,600**
Average Annual Costs (50 years at 4 3/8%)	**$ 1,494,400**

Source: Alaska District Corps of Engineers Cost Engineering estimate using Tri-Service Automated Cost Engineering System (TRACES) with November 2006 pricing levels updated to August 2010 using the Civil Works Construction Cost Index System for navigation ports and harbors. Present value calculations based on the Federal FY10 discount rate of 4 3/8 percent.

Note: Present value of operations and maintenance costs based on two percent of the armor rock replaced every five years. Included in the operations and maintenance calculations is a 5-year monitoring plan activity for the Two Moon Bay capping of the log transfer site with dredge material from the East Site alternatives.

East Site Rubblemound 243-Vessel Alternative. This alternative is similar to the 320-vessel design in figure 4-7. It would accommodate all the vessels on the harbormaster's October 2006 waitlist. It would relocate the communications cable; construct roads, parking areas, breakwaters, and inner harbor floats; stabilize the shoreline, and dredge an entrance channel, turning area, and mooring basin. A 0.2 ha staging and work area would be developed in adjacent uplands and tidelands to allow the harbor to operate efficiently and safely. Material dredged for this alternative would be used to develop an adjacent staging area and would be used beneficially in Two Moon Bay.

Total cost for this alternative is estimated at $31.4 million (table 4-9). Operations and maintenance estimates assume that 2 percent of the breakwater armor rock would be replaced every 5 years at an estimated cost of $61,000 and that harbor floats would be replaced after 30 years.

Table 4- 9. East Site Rubblemound 243-Vessel Alternative Cost

Cost Category	243-slip Rubblemound
Cable relocation	$ 502,000
Mob and demobilization	394,000
Breakwaters	9,706,000
Navigation aids	18,000
Dredging	1, 815,000
Uplands fill	107,000
Log transfer mitigation	469,000
Hydro survey	36,000
Inner harbor floats	6,712,000
Bank stabilization	3,094,000
Total Project First Costs	**$ 22,853,000**
Real estate	295,000
Interest During Construction	1,224,000
Preliminary Engineering and Design (PED)	1,283,000
Supervision and Administration (S&A)	686,000
Contingency (20%)	5,023,000
Total Project Economic Costs	**$ 31,364,000**
Present Value of Operations and	**2,228,700**
Average Annual Costs (50 years at 4 3/8%)	**$ 1,655,400**

Source: Alaska District Corps of Engineers Cost Engineering estimate using Tri-Service Automated Cost Engineering System (TRACES) with November 2006 pricing levels updated to August 2010 using the Civil Works Construction Cost Index System for navigation ports and harbors. Present value calculations based on the Federal FY10 discount rate of 4 3/8 percent.

Note: Present value of operations and maintenance costs based on two percent of the armor rock replaced every five years. Included in the operations and maintenance calculations is a 5-year monitoring plan activity for the Two Moon Bay capping of the log transfer site with dredge material from the East Site alternatives.

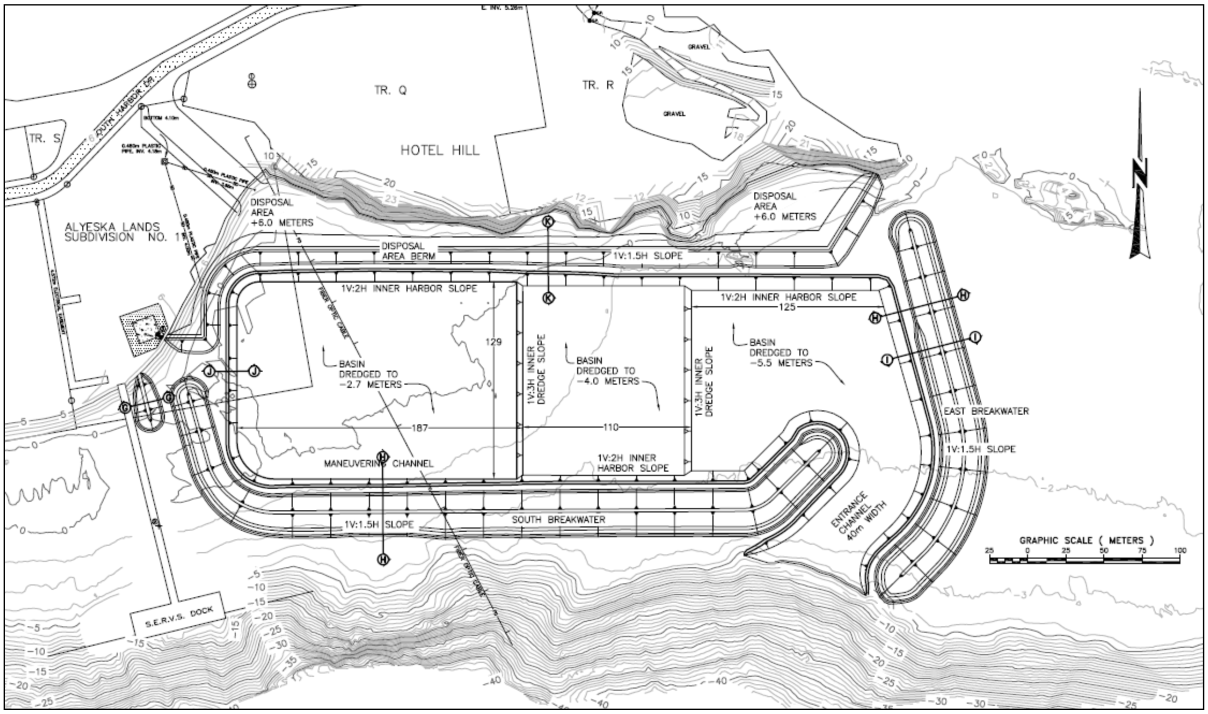

Figure 4-7. East Site Rubblemound 320 - Vessel Alternative

East Site Rubblemound 320-Vessel Alternative. This alternative would accommodate half the transient vessels that used Valdez Harbor in 2006. It would relocate the communications cable; construct roads, parking areas, breakwaters, and inner harbor floats; stabilize the shoreline, and dredge an entrance channel, turning area and mooring basin (figure 4-7). A 0.2 ha. staging and work area would be developed in adjacent uplands and tidelands to allow the harbor to operate efficiently and safely. Material dredged for this alternative would be used to develop an adjacent staging area and in a beneficial use action in Two Moon Bay.

Total cost for this alternative is estimated at $35.1 million (table 4-10). Operations and maintenance estimates assume that 2 percent of the breakwater armor rock would be replaced every 5 years at an estimated cost of $85,000 and that harbor floats would be replaced after 30 years.

Table 4- 10. East Site Rubblemound 320 - Vessel Alternative Cost

Cost Category	**320-slip Rubblemound**
Cable relocation	$ 496,000
Mob and demobilization	331,000
Breakwaters	10,861,000
Navigation Aids	18,000
Dredging	2,107,000
Log transfer mitigation	468,000
Hydro survey	36,000
Inner harbor floats	7,094,000
Bank stabilization	4,354,000
Total Project First Costs	**$ 25,765,000**
Real estate	295,000
Interest During Construction	1,380,000
Preliminary Engineering and Design (PED)	1,283,000
Supervision and Administration (S&A)	773,000
Contingency (20%)	5,623,000
Total Project Economic Costs	**$ 35,119,000**
Present Value of Operations and	**2,423,000**
Average Annual Costs (50 years at 4 3/8%)	**$ 1,861,200**

Source: Alaska District Corps of Engineers Cost Engineering estimate using Tri-Service Automated Cost Engineering System (TRACES) with November 2006 pricing levels updated to August 2010 using the Civil Works Construction Cost Index System for navigation ports and harbors. Present value calculations based on the Federal FY10 discount rate of 4 3/8 percent.

Note: Present value of operations and maintenance costs based on two percent of the armor rock replaced every five years. Included in the operations and maintenance calculations is a 5-year monitoring plan activity for the Two Moon Bay capping of the log transfer site with dredge material from the East Site alternatives.

4.7 Disposition of Dredged Material

Three general alternatives for disposition of dredged material were considered: (1) use dredged material to construct project features or for other construction; (2) discharge dredged material into a cost effective and environmentally acceptable disposal site; and (3) use dredged material beneficially to restore or improve habitat.

4.7.1 Use Dredged Material for Project Features

The West site alternatives would be dredged into existing uplands. No uplands would be created for these alternatives, and none of the material dredged for these alternatives could be used for project construction. No other on-going or proposed projects in the Valdez area could use the material economically, so any material dredged during construction of any West site alternatives would be disposed of as waste or used beneficially for habitat restoration.

Each of the alternatives at the East site would fill intertidal and near-shore lands north of the mooring basin to provide access and parking. Part of the dredged material from each alternative would be used beneficially to develop access and staging areas for the selected harbor project. Using dredged material to construct a staging area would reduce the need for fill material from an upland site and the attendant effects of habitat loss, noise, depletion of resources, and emissions at and on the route from material sites.

4.7.2 Use Dredged Material for Habitat Restoration

State and Federal resource and regulatory agencies participated in scoping and coordination meetings to identify and evaluate potential uses for dredged material. No on-land beneficial use for dredged material (except for construction of project features) could be identified within feasible transportation range of Valdez. Valdez is a small town surrounded by steep mountains, rivers, wetlands, and ocean. Valdez has no use for large quantities of mixed mud, gravel, and larger rock dredged from harbor construction. The closest town of more than 500 people is more than 400 km by road or 150 km by water. No upland uses could be identified even that far away, indicating that there are no upland sites that could benefit from dredged material placement within economic transportation distances. Upland disposal of dredged material for beneficial use or for mitigation was eliminated from further consideration.

Dredged material might be used to raise the existing sea bottom to create new intertidal habitat. Most of PWS drops steeply into sea bottom much too deep for creation of intertidal habitat. Upper subtidal habitat is limited in Valdez Arm and in most other areas of PWS and is valuable to invertebrates, sea otters, salmon, and many other marine resources. Covering that viable and important habitat with dredged material to create intertidal habitat that might not improve habitat value is speculative and is not considered further in this report.

No viable alternatives for beneficial use of excess dredged material were identified on land or in natural, undisturbed in-water sites, so only in-water sites disturbed or contaminated by human use were considered further for beneficial use of dredged material. The only in-water use that could be identified was for capping logging debris. Other in-water habitat restoration measures that were considered for mitigation are discussed in Section 4.9.

The entire population along the shores of PWS, an area about the size of Vermont and New Hampshire together, is less than 10,000 people. The only in-water development or disturbance associated with those populations is from harbors and other marine facilities still in use. Habitat disturbance by those communities offers no beneficial use opportunities for dredged material.

Recreation in PWS is centered on fishing, hunting, boating, and other outdoor activities. Those activities have not disturbed large areas of habitat, but anchor chains from boats moored to buoys at recreational cabins have dragged circular clearings through bottom sea life communities. Those clearings reduce productivity and offer an opportunity for mitigation, but dredged material could not be used to mitigate their effects. No other opportunities to beneficially use dredged material to correct recreation effects could be identified.

Mining, fish processing, transportation, and logging have adversely affected habitat and other resources in PWS. Copper and other mining and transportation related to mining affected shoreline habitat in the late 1800's and early 1900's, but those effects have almost vanished with time. Fish processors in remote locations left a relatively small footprint on the shorelines, but unregulated processing waste fouled the bottoms in some locations. Regulations in the last 30 years and changes in processing have largely ended those impacts, and effects of those earlier practices have almost disappeared. The biggest transportation effect was the 1989 *Exxon Valdez* spill of about 38,000,000 liters of crude oil near the mouth of Valdez Arm. Contamination and its effects were wide spread and required intensive cleanup that cost hundreds of millions of dollars. Effects of the spill remain, but none could be feasibly addressed through the beneficial use of dredged material.

Much of the merchantable timber on non-Federal land adjacent to PWS has been logged. Steep terrain and buffer zone requirements have protected marine habitat from most effects of logging and logging operations. The most notable impacts from logging are at log transfer sites. Steep terrain limits on-shore log yards for timber awaiting transportation to mills, and logs can be loaded efficiently from the water without permanent loading facilities. Most timber logged in coastal Alaska is temporarily stored at in-water log transfer sites. Log transfer sites are regulated by State and Federal permits, which generally limit sites to water 10 or more meters deep and minimize the area affected. Log transfer operations sometimes gouge the sea bottom, and shade from the logs may reduce primary productivity, but bark shed from the stored logs is the biggest problem. The shed bark from coniferous trees soon settles to the bottom where it smothers benthic organisms. Worse, it also degrades into soft, fine material that contains biologically inhibiting chemicals. Biological surveys of former log transfer sites report the bottom is almost void of benthic infauna and epifauna for many years after the site is closed. Recolonization is slow and tends to develop at the margins of the sites and where the deposition is thinnest. Colonization at larger sites tends to be slower. Treatment of the degraded bark would be difficult in remote areas, and it would be difficult to remove degradation compounds that have leached into the sea bottom. Capping is the most effective measure available in most circumstances.

Resource agencies are actively seeking sources of capping material for restoring log transfer sites in PWS. This appears to be the most feasible option for beneficial use of dredged material from harbor construction in Valdez. The Valdez material has been tested and is clean and uncontaminated. It probably contains more fine-grained material, but is otherwise similar to native bottom composition at most log transfer sites.

Formerly used log transfer sites were identified at 17 locations in PWS based on information from permits. The three closest log transfer sites are about 50 km by sea from Valdez. The next two closest sites are about 70 km from Valdez. The major cost for beneficial use of dredged material would be associated with transportation distance, so consideration of capping options focused first on the three closest sites, which are in Port Fidalgo, a fjord south of Valdez (figure 4-8). All three sites were permitted for use by the Tatitlek Corporation.

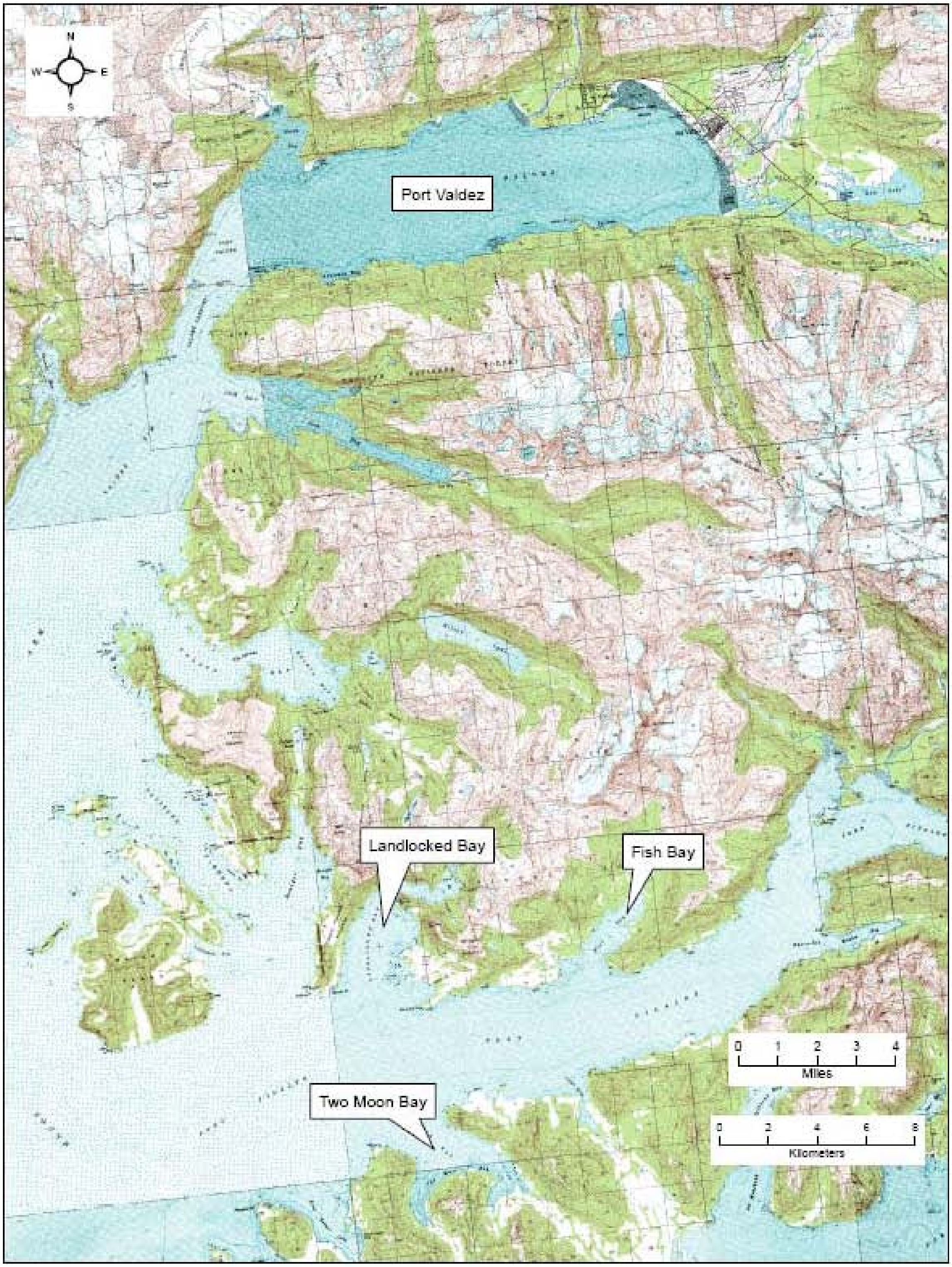

Figure 4-8. Closest former log transfer facilities to Valdez Harbor project site.

The Landlocked Bay log transfer facility is a 4-ha site in water depths greater than 13 meters that was permitted by the State of Alaska in 1995 and closed at the permittee's request in 1999. Available information indicates that the site was only partially used and was not used as intensively as larger sites.

The Fish Bay log transfer site encompasses slightly less than 1 ha of tidal and submerged lands. The State of Alaska permitted the site in 1993, and the permittee relinquished the site back to the State in 1998.

The Two Moon Bay log transfer site is a 10-ha site. The State of Alaska permitted the site in 1986. The facility was closed in 1999 at the permittee's request.

The Two Moon Bay site is by far the largest of the three sites. It was used longer than the others and was used to transfer far more logs than the others. It also has been used more recently. The U.S. Fish and Wildlife Service (Appendix 4) examined log transfer sites in the area. In meetings with the Corps and others, they reported that the other sites were less damaged and are further advanced in natural recovery and recolonization. They reported substantial bottom habitat so degraded that it was not recovering appreciably with natural processes over 81 percent of its area. They recommended Two Moon Bay as the site that would benefit most from any effective restoration effort (Appendix 4). They participated with the Corps in evaluating potential cleanup and restoration options, and they recommend capping for restoration.

In summary, a full range of potential beneficial uses for Valdez Harbor dredged materials was considered. The only feasible and effective use for material not used in harbor construction would be for capping contamination from log bark at a log transfer facility. Two Moon Bay is the most severely impacted and would benefit most of the available sites within reasonable transportation distance from Valdez. The Two Moon Bay log transfer facility is considered in detail for beneficial use of dredged material.

Plan Development for Beneficial Use of Dredged Material at Two Moon Bay Log Transfer Facility

The U.S. Fish and Wildlife Service recommended a depth of at least 30 cm for capping the log transfer site. Some PWS marine species burrow deeper than 30 cm, but the great majority of benthic infaunal species occupy only the upper few centimeters. A 30-cm cap would be expected to allow full site recovery. A thinner cap could be less effective.

If dredged material could be distributed evenly to achieve 30-cm coverage over the 8.3 -ha site, then a total of 30,000 m^3 of dredged material would be sufficient to achieve optimum results. Thin, even distribution of dredged material is not feasible. A scow, barge, or hopper dredges could be used to transport dredged material to the site. Any other transportation would be far more expensive. Scows, barges, and hopper dredges all dump dredged material as a single action. The entire load comes out as a slug of material 2 to 4 meters deep and roughly in the same area as the vessel.
Water depth at the Two Moon Bay log transfer facility is 10 to 20 meters. Dumped

material would disperse a little over that depth, but most of the load would arrive at the bottom in less than 30 seconds and essentially as a single mass. Impact and turbulence would disperse some material, especially finer-grained sands and clays, outward over the surrounding bottom. Most of the material would remain in place in an area not too much larger than the dimensions of the transportation vessel. Slumping, tidal action, waves, and currents would tend to spread the dredged material farther over time, but the bottom of Two Moon Bay is not a dynamic environment, so those mechanisms might not produce much dispersal.

Dispersal can be increased. A load of material discharged at 15 km/hr, for example, can be released over about twice the distance and may be dispersed further by added turbulence and mixing. Calculations for a dredging project in the Chukchi Sea (Corps of Engineers 2004) suggested that this technique could spread dredged material in 20 to 25 meters of water so that maximum accumulated material would be about 2 meters. This would work over a large area, but a tug cannot tow a barge or scow into Two Moon Bay at 15 km/hr, accurately target a specific area of the log transfer facility and turn safely out of the bay. The barge or scow would have to be positioned over a carefully determined location each time it was dumped.

A front-end loader or other earth-moving equipment could be carried on the barge and used to off-load dredged material for thinner, more even bottom coverage. This would add considerable expense for the additional equipment and operator, however, and would greatly expand tug and barge costs. Allowing for error in positioning and variances in quantity, coverage of about 1 meter would be necessary to ensure a minimum of 30 cm over the site. This would indicate a minimum quantity of about 90,000 m^3 of dredged material to achieve full coverage. Barge loads would have to be reduced to carry and operate the loader safely, so more trips would be needed for a given volume. The barge would have to be frequently repositioned to maintain coverage, and overall dredging time would be substantially extended for the project. An additional tug and barge combination might be required. Cursory evaluation indicates that using less material but placing it more precisely would be more costly than simply placing all the excess dredged material at Two Moon Bay.

Placing all the dredged material at Two Moon Bay instead of placing only 90,000 m^3 would not cause unwanted additional effects. Bottom composition would be the same and the minor change in bottom elevation would be biologically meaningless.

4.7.3 Disposal of Dredged Material

Dredged material that could not be used economically for navigation improvements or for beneficial use could be placed in an environmentally acceptable disposal site. Disposal costs would include cost of any required treatment, transportation to the disposal site, construction at the site to retain or otherwise ensure that environmental effects were minimized, and costs for any feasible compensatory mitigation.

Dredged material could not be disposed of at the harbor site. Construction of access and staging facilities would use all room available for dredged material at the harbor site. The search for on-land sites for beneficial use of dredged material did not find any feasible beneficial use sites, and also did not identify any economically feasible on-land disposal sites. Dredged material could be placed in deep water less than 1.6 km from the proposed harbor site. Preliminary analysis suggests that environmental effects would likely be temporary at the site. However, due to lack of data, effects are largely speculative. The affected environment at that site and environmental consequences of using that site were not explored in detail because all the dredged material could be used in construction of navigation facilities for the tentatively recommended harbor and the beneficial use site at Two Moon Bay.

4.7.4 Dredged Material Disposal Alternative Formulation

This section describes the alternatives for dredged material disposal for the Valdez Harbor project. The alternatives utilize dredged material to create fast land at the harbor and for beneficial use to cover wood and bark debris at Two Moon Bay. The beneficial use area at Two Moon Bay is approximately 48 km from Valdez. Approximately 8.3 ha would be covered with dredged material to a minimum depth of 30 cm (the basis for the 30 cm is described later in this analysis). Any material not used at these two sites would be disposed of at a deep water disposal area approximately 1.6 km from the harbor. The amount of material to be dredged is 186,400 m^3. The actual amount dredged may be as much as 3 percent more due to the level of precision to which dredging can be performed. Therefore, for the purposes of the dredged disposal analysis, the quantity of dredged material to be disposed of is up to 192,000 m^3. The local service facility (LSF) quantity of dredged material used in this analysis is 124,400 m^3 while the quantity of general navigation features (GNF) of dredged material is 67,600 m^3.

Dredged Material Disposal Methodologies

Several methods and combinations of placement methods at Two Moon Bay, disposal in deep water, or placement as fill in the new harbor staging area are examined. A summary of the methods are:

(1) Two Moon Bay Scow Dumping: Dredged material placement for this method would use conventional dumping practices for a split-hull scow. These practices incorporate the use of standard GPS equipment to position the scow over the target location within the Two Moon Bay placement area, then opening the scow to release the material and cover the timber debris on the shallow seafloor. By positioning the scow in a gridded method over many placement trips, the dredged material would establish an irregular cover layer over the placement site. This method requires the minimum amount of time for each scow load but lacks the ability to precisely locate each scow load and the ability to control placement thickness on the seafloor. The lack of precision of this method requires that additional material be placed to establish a minimum cover layer of dredged material. With this method there is a small chance that a portion of the less dense bark debris may be suspended with the placement plume generated from the dense dredged material settling to the bottom in a large stream. This possibility can be substantially reduced by limiting the width that the scow can open its hull thus reducing the rate at which the dredged material leaves the scow and the size of the dredged material plume created.

An estimate of the dredged material to establish the minimum cover layer (30 cm) using this method would be 139,200 m^3 to cover the entire 8.3 ha area. The cover layer would vary in thickness from the minimum cover of 30 cm to roughly 2 meters.

(2) Two Moon Bay Scow Dumping with Bed Leveling: This method uses scow dumping to establish windrows along the length of the Two Moon Bay placement site, which can be smoothed out along the bottom using a bed leveler towed by a barge. The bed leveler is a long, heavy blade that can be towed along the length of the windrows, smoothing the dredged material along the bottom in much the same way that a grader blade is used to spread granular soil. Multiple passes would be required by the bed leveler to smooth the windrows and ensure that the minimum cover depth was achieved.

Several difficulties exist for this methodology. Any large boulders or abrupt changes in bathymetry at the site would cause difficulties for the bed leveler. The leveler would easily drag through the timber debris at abrupt edges causing re-suspension of the debris. With this method the bed leveler might inadvertently cut into the timber debris causing re-suspension of the loose material and mixing of the denser debris with dredged material. This method would require several intermediate surveys to determine the progress of the leveling process.

An estimate of the dredged material needed to establish the minimum cover layer (30 cm) using this method would be 75,400 m^3. The cover layer would vary in thickness from the minimum cover of 30 cm to roughly 1.3 meters.

(3) Two Moon Bay Side Casting from Hopper/Scow: The side casting method uses pumps and seawater to suspend the dredged material in the hopper or scow into slurry, which can be pumped out of the hull and side cast or sprayed out over the Two Moon Bay placement area. The side casting method is normally used with hopper dredges that already have the proper equipment installed to suspend the dredged material and pump the material out of the hull. It is likely that a barge or scow would have to have this equipment installed to perform the task of suspending and pumping the dredged material out of the hull.

Once the dredged material was suspended pumps could spray the dredged material over the side in a directed manner. Off loading the dredged material in this manner is a time consuming effort, but establishing the minimum coverage thickness over the timber debris would require the least amount of dredged material. Another advantage to this process is there would be almost no chance of disturbing the timber debris since the rate of placement is much lower and the coverage area of the side casting process would be so large. This alternative would also require an intermediate survey to determine the progress of the side casting process.

A significant concern with this method is turbidity. With the dredged material being suspended in water, the finer grain material would have a greater likelihood of drifting onto surrounding habitat where it could damage healthy benthic communities. The resultant plume of fine grained materials may cause a water quality issue as well.

An estimate of the dredged material to establish the minimum cover layer (30 cm) using this method would be 56,500 m^3. The cover layer would vary in thickness from the minimum cover of 30 cm to roughly 90 cm.

(4) Deep Water Disposal: Disposing of dredged material in deep water assumes the dredged material would be transported by hopper/scow from the construction site to an area of deep water about 1.6 km away. The material would be dumped from the scow/hopper into water 100 to 200 meters deep. This methodology is commonly used for disposal of dredged material. Impacts from this method of disposal are expected to be temporary and minor. However, due to a lack of data, actual impacts to this environment are largely speculative. This option is considered the base dredged material disposal plan.

(5) Fast Land Creation: The fast land site is upland from the dredging site and located between the proposed north harbor berm and Hotel Hill. Dredged material would be moved to the new staging area by front end loaders from intertidal and adjacent upland areas above low tide levels and by barge from areas of greater depth. The staging area would be constructed in a series of lifts to allow for drainage and settling. The seaward side of the staging area would be armored to provide slope stability.

An estimate of the amount of dredged material needed to construct the staging area is 72,280 m^3. Since this is a Local Service Facility (LSF) feature, LSF dredged material would be used for this construction.

Beneficial Use of Dredged Material Disposal Alternatives
These various disposal methodologies have been combined into different dredged disposal alternatives and have been developed with the following parameters:

- Cover the Two Moon Bay site with as much General Navigation Feature (GNF) material as can be incrementally justified, then send the rest to deep water disposal.
- Utilize 72,280 m^3 LSF dredged material to construct the project staging area.
- Send any remaining LSF dredged material to Two Moon Bay per the request of the non Federal sponsor.
- Minimize turbidity released from placement area
- Minimize re-suspension of bark debris

These parameters will allow for the Two Moon Bay site to be restored to a more natural condition. Extra material at Two Moon Bay would likely not provide extra ecosystem restoration benefits but would avoid causing any potential for impact at any other disposal site. The detailed description of the alternatives differentiates between the dredged material related to the GNF features and the LSF features. This distinction is important because any additional cost for disposal of GNF dredged materials above the costs for the base disposal plan has additional requirements for justification and cost sharing.

In addition, two other types of alternatives have been developed to assist in determining the most cost effective and incrementally justified plan. The first type of alternative would be to take only the minimum amount of material to Two Moon Bay as necessary to achieve the desired result. The remaining material would be sent to deep water disposal. Table 4-11 shows the volume of material and the cost associated with each alternative disposal.

Table 4- 11. Alternative Disposal Methods. (2009 Price Level)*

Disposal Plans	Volume of Dredged Material to Establish Fast Land	Volume of Dredged Material to Establish Cover at Two Moon Bay	Volume of Dredged Material to be Disposed of in Deep Water	Cost of Disposal Plans*
No Action Plan	0 m^3	0 m^3	0 m^3	$ 0
Base Disposal Plan	0 m^3	0 m^3	192,000 m^3	$4,169,000
Alternative 1	72,280 m^3	119,720 m^3	0 m^3	$4,369,000
Alternative 2	52,800 m^3	139,200 m^3**	0 m^3	$5,197,000
Alternative 3	72,280 m^3	119,720 m^3	0 m^3	$4,800,000
Alternative 4	72,280 m^3	110,860 m^3	8,860 m^3	$10,253,000

*The costs for the dredge disposal analysis were developed in 2009 and are in the 2009 price level. These costs used in the analysis were not adjusted because the relative change in the costs would not affect the results of the analysis because all alternatives would inflate at the same rate. As stated previously, the cost estimate for the selected alternative (including the BUDM components) has been updated and is reflected in Section 6.
** The amount of dredged material required for full coverage at Two Moon Bay.

The no-action plan would not construct a harbor and thus there would be no need for dredged material disposal.

The base disposal plan sends all 192,000 m^3 of dredged material to deep water disposal. Because none of the dredged material would be used for constructing the harbor staging area, the material needed for constructing the harbor staging area would be imported. The cost is included in the base disposal plan because the disposal alternatives provide the beneficial use of dredged material for this purpose, which provides a cost savings for the project. The cost of the base disposal plan is $4,169,000.

Alternative 1 uses beneficial use of dredged material for habitat enhancement at Two Moon Bay and construction of the harbor staging area. All 67,600 m^3 of GNF dredged material would be sent to Two Moon Bay for the purpose of ecosystem restoration. Of the LSF dredged material, 72,280 m^3 would be used to create the project staging area. The remaining 52,120 m^3 of LSF material would be sent to the Two Moon Bay restoration site to complete the restoration and avoid the potential for adverse impacts related to deep water disposal. The material would be dumped by a scow at Two Moon Bay and would achieve desired coverage of approximately 85 percent of the area available for restoration. This plan has a cost of $4,369,000.

Alternative 2 utilizes beneficial use of dredged material and for ecosystem restoration at Two Moon Bay for constructing the harbor staging area. All 67,600 m^3 of GNF dredged material would be sent to Two Moon Bay for the purpose of ecosystem restoration. Only 52,800 m^3 of the LSF dredged material would be used to create the project staging area. The remaining 19,480 m^3 of material for the harbor staging area would be imported. The remaining 71,600 m^3 of LSF material would be sent to the Two Moon Bay restoration site to complete the restoration and avoid adverse impacts related to deep water disposal. One hundred percent of the restoration area will be covered. This plan has a cost of $5,197,000.

Alternative 3 is very similar to Alternative 1, except that the material at Two Moon Bay would be leveled to create a more even surface. All 67,600 m^3 of GNF dredged material would be sent to Two Moon Bay for the purpose of ecosystem restoration. Of the LSF dredged material, 72,280 m^3 would be used to create the project staging area, with the remaining 52,120 m^3 sent to the Two Moon Bay restoration site to complete the restoration and avoid impacts related to deep water disposal. One hundred percent of the restoration area would be covered. This plan has a cost of $4,800,000.

Alternative 4 uses only 56,500 m^3 of the GNF dredged material to achieve the desired coverage. The material at Two Moon Bay would be side cast, thus requiring less material to achieve the desired depth of material. The remainder of GNF material, 8,860 m^3, would be disposed of in deep water. Of the LSF dredged material, 72,280 m^3 would be used to create the project staging area, with the remaining 54,360 m^3 sent to the Two Moon Bay restoration site. One hundred percent of the restoration area would be covered. This plan has a cost of $10,253,000.

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4.8 Evaluation of Alternatives

As stated in section 4.6 the cost of the selected plan in this section is different than the costs in the description of the recommended plan in Section 6. The alternatives were compared utilizing cost estimates prepared in 2006 and inflated to the 2010 price level using the Civil Works Construction Cost Index for navigation ports and harbors. This cost basis was utilized to ensure all the assumptions and computations used were the same for all the alternatives. When the selected plan was identified, its cost estimate required updates per comments received in Agency Technical Review and have been revised based on technical comments. Therefore, the costs for the recommended plan in later sections of the report are different than as presented in the alternative analysis.

4.8.1 Summary of Alternative Costs

These costs were developed based upon design quantities taken from each of the project alternatives utilizing the Tri-Service Automated Cost Engineering System (TRACES) adjusted to fit the current fleet configurations. Table 4-12 summarizes the information presented in the previous section.

Table 4- 12. Summary of Alternative Costs.

Alternatives	Total Project Economic Costs	Average Annual Costs with OMRR&R
West Site Alternatives		
243 Wave Barrier	$ 37,087,000	$ 4,677,800
320 Wave Barrier	46,050,000	5,380,700
East Site Alternatives		
125 Rubblemound	$ 20,929,000	$ 1,119,600
200 Rubblemound	28,088,000	1,494,400
243 Rubblemound	31,364,000	1,655,400
320 Rubblemound	35,119,000	1,861,200

4.8.2 Alternative Benefits

The alternative benefits demonstrate how well each alternative accrues the available benefits for the variety of accounts. Following is a brief summary of the detailed information found in the Economics Appendix.

East Site Rubblemound 125 -Vessel Alternative. The benefits summary (table 4-13) is based on accommodating a natural break in the waitlist vessels for Valdez Harbor. This benefit summary captures a portion of the total benefits that could be realized for each of the benefit categories based on the waitlisted vessels that would be first offered space at the new harbor facility. Total present value of benefits for the East Site Rubblemound 125-Vessel alternative is $73.3 million with average annual benefits of $3.3 million.

Table 4- 13. East Site Rubblemound 125 - Vessel Alternative Benefits Summary

Benefit Categories	Total Present Value of Benefits	Average Annual Benefits
Harbor Operations		
Harbor personnel time	$ 44,200	$ 2,100
Float and dock repairs	270,400	12,800
Commercial Fleet		
Vessel Damage	1,559,700	73,700
Vessel delays	3,827,600	180,800
Harbor of refuge	44,700	2,200
Opportunity Cost of Time	8,301,000	392,100
Tender Fleet		
Travel related expenses	576,000	27,200
Opportunity Cost of Time	52,900	2,500
Charter Fleet		
Vessel delays	13,341,700	630,200
Opportunity Cost of Time	3,137,500	148,200
Guaranteed space premium	1,037,400	49,000
Subsistence Fleet		
Harvest value	2,273,100	112,700
Recreational Vessels		
Recreational experience	38,815,000	1,633,500
Total Benefits With-Project	**$ 73,281,200**	**$ 3,267,000**

East Site Rubblemound 200 -Vessel Alternative. The East Site Rubblemound 200 -Vessel benefits summary (table 4-14) is based on accommodating the maximum number of transient vessels appearing at the Valdez Harbor on peak days. This benefit summary captures a portion of the total benefits that could be realized for each of the benefit categories based on the waitlisted vessels that would be first offered space at the new harbor facility. Total present value of benefits for the 200-Vessel alternative is $84.7 million with average annual benefits of $4.0 million.

Table 4- 14. East Site Rubblemound 200 - Vessel Alternative Benefits Summary

Benefit Categories	Total Present Value of Benefits	Average Annual Benefits
Harbor Operations		
Harbor personnel time	$ 70,700	$ 3,300
Float and dock repairs	432,700	20,400
Commercial Fleet		
Vessel Damage	2,495,500	117,900
Vessel delays	4,797,300	226,600
Harbor of refuge	71,500	3,500
Opportunity Cost of Time	10,308,000	486,900
Tender Fleet		
Travel related expenses	2,036,300	96,200
Opportunity Cost of Time	160,900	7,600
Charter Fleet		
Vessel delays	13,981,000	660,400
Opportunity Cost of Time	3,152,300	148,900
Guaranteed space premium	1,064,900	50,300
Subsistence Fleet		
Harvest value	3,637,000	180,300
Recreational Vessels		
Recreational experience	42,454,000	2,002,300
Total Benefits With-Project	**$ 84,662,100**	**$ 4,004,600**

West Site Wave Barrier 243 -Vessel and East Site Rubblemound 243 -Vessel Alternatives. The 243-Vessel alternative for both the East and West sites benefits summary (table 4-15) is based on accommodating all the waitlisted vessels at Valdez Harbor. This benefit summary captures a portion of total benefits that could be realized for each of the benefit categories based on the waitlisted vessels that would be first offered space at the new harbor facility. Total present value of benefits for both 243-Vessel alternatives is $92.3 million with average annual benefits of $4.5 million.

Table 4- 15. West Site Wave Barrier 243-Vessel and East Site Rubblemound 243-Vessel Alternatives Benefits Summary

Benefit Categories	Total Present Value of Benefits	Average Annual Benefits
Harbor Operations		
Harbor personnel time	$ 85,900	$ 4,100
Float and dock repairs	525,700	24,800
Commercial Fleet		
Vessel Damage	3,032,000	143,200
Vessel delays	5,351,900	252,800
Harbor of refuge	86,900	4,300
Opportunity Cost of Time	11,459,600	541,300
Tender Fleet		
Travel related expenses	2,612,300	123,400
Opportunity Cost of Time	213,800	10,100
Charter Fleet		
Vessel delays	15,361,400	725,600
Opportunity Cost of Time	3,433,900	162,200
Guaranteed space premium	1,075,500	50,800
Subsistence Fleet		
Harvest value	4,419,000	219,100
Recreational Vessels		
Recreational experience	44,675,000	2,214,800
Total Benefits With-Project	**$ 92,332,900**	**$ 4,476,500**

West Site Wave Barrier 320-Vessel and East Site Rubblemound 320-Vessel Alternatives. The 320-Vessel benefits summary for both the East and West site alternatives (table 4-16 is based on accommodating half of all the transient vessels at Valdez Harbor. This benefit summary captures the portion of total benefits that could be realized for each of the benefit categories based on the transient vessels that would be first offered space at the new harbor facility. Total present value of benefits for both 320-Vessel alternatives is $133.4 million with average annual benefits of $5.2 million.

Table 4- 16. West Site Wave Barrier 320-Vessel and East Site Rubblemound 320-Vessel Alternatives Benefits Summary

Benefit Categories	Total Present Value of Benefits	Average Annual Benefits
Harbor Operations		
Harbor personnel time	$ 113,100	$ 5,300
Float and dock repairs	692,300	32,700
Commercial Fleet		
Vessel Damage	3,992,800	188,600
Vessel delays	6,344,800	299,700
Harbor of refuge	114,400	5,400
Opportunity Cost of Time	13,521,600	638,700
Tender Fleet		
Travel related expenses	2,612,300	123,400
Opportunity Cost of Time	321,800	15,200
Charter Fleet		
Vessel delays	16,367,000	773,100
Opportunity Cost of Time	3,556,700	168,000
Guaranteed space premium	1,088,200	51,400
Subsistence Fleet		
Harvest value	5,819,200	288,500
Recreational Vessels		
Recreational experience	78,857,000	2,590,000
Total Benefits With-Project	**$ 133,401,200**	**$ 5,180,000**

4.9 Mitigation Alternatives

ER 1105-2-100 establishes mitigation requirements for Corps of Engineer 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.

Mitigation has been defined by the President’s Council on Environmental Quality to include (1) avoiding an impact by not taking an action or parts of an action, (2) minimizing impacts by limiting the degree or magnitude of the action, (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment, (4) reducing impact over time by preservation and maintenance operations and (5) compensating for the impact by replacing or providing substitute resources or environments (40 CFR 1508.20).

The following considerations were instrumental in developing mitigation alternatives:

- Analysis of direct project impacts on resources of concern.
- Cumulative and induced impacts on regional resources.
- Relationship of environmental losses to regional resources.
- Regulations and guidance regarding appropriate mitigation for water resources projects.
- Effectiveness and cost of potential mitigation measures.

Mitigation objectives focus on the following resources of concern

- Water quality (primarily concerns about dissolved oxygen, turbidity, and fuel spills)
- Intertidal and subtidal habitat
- Salmonid juveniles and adults
- Benthic invertebrates
- Duck Flats
- Sea otters
- Waterfowl and seabirds

Mitigation Objectives – The mitigation objectives were identified for the resources of concern as follows:

> Water Quality - Minimize adverse impacts to water quality at disposal sites during construction and in the harbor project area during and after construction.
>
> Intertidal and Subtidal Habitat - Minimize project footprint and disturbance during construction. Compensate for unavoidable losses to the extent justifiable.
>
> Salmonid Young and Adults - Avoid/minimize structures that impede juvenile fish movement or force movement into deeper water. Minimize habitat loss.
>
> Benthic Invertebrates - Minimize project footprint. Compensate for unavoidable losses to the extent justifiable.
>
> Marine Mammals - Minimize habitat loss. Avoid harassment during construction.
>
> Waterfowl and Seabirds - Minimize habitat loss and harassment impacts.

Mitigation Measures Considered. The Coordination Act report specifically recommended restoration of an abandoned log transfer site about 50 km from Valdez. The Corps is addressing that recommendation by proposing restoration through beneficial use of dredged material from proposed Valdez Harbor improvements. This proposed beneficial use of dredged material is evaluated in Sections 4.7. The Coordination Act report suggested consideration of two other mitigation alternatives. One alternative would use zoning restrictions, land swaps, and other mechanisms to limit development at Robe Lake outside Valdez. The other would acquire and set aside conservation lands in the Duck Flats to prevent development. These measures are not considered in detail because the resources that would be affected or restored are not similar to those that would be impacted by harbor improvements.

One additional mitigation measure was considered in detail. The existing Valdez harbor is long and narrow, which leads to poor water circulation in the sections most distant from the entrance. This back end of the harbor is separated from Harbor Cove by road fill about 20 meters across. Connecting the boat harbor to Harbor Cove by a short canal or large culvert was evaluated as a measure to improve exchange of water in the harbor. During technical review, Ronald Nece, one of the nation's leading water circulation experts, expressed his opinion that this alternative would be ineffective because there would be no head difference or other force driving water from one system into the other. A decision to drop this alternative from further consideration was based on Nece's review and the Corps in-house confirmatory review.

The Coordination Act report made 14 specific on-site recommendations to mitigate impacts of a harbor at the East site. Mitigation alternatives from the Coordination Act report and from other sources are considered in the following annotated list.

1. The harbor channel entrance should be located as far as possible away from sensitive bird, fish, and marine mammal habitats to reduce vessel disturbances to these resources.

East site harbor configurations considered in detail would place the entrance at the west end of the harbor away from the kittiwake colony on the SERVS dock, but the entrance would be oriented so that boats would approach from the southwest, away from Harbor Cove and the small islands to the west.

2. To reduce fish migration obstructions, the in-water portions of the breakwater and staging area should be contoured with a slope of 2:1. The use of different types of rock should be further investigated to determine what size and type of rock or combinations of rock can be used to maximize juvenile salmon cover along breakwater structure. Additional measures (i.e., breaches) have been incorporated into breakwater design to avoid fish migration impacts. All breaches need to be designed to prevent dewatering: breaches and breakwaters need to be designed to ensure at least 1 foot of sea water remains at all "lowest low water (LLW)" tides to facilitate fish passage. At this time, it is assumed that the breaches will not need maintenance dredging; however, depending on the final elevations and configurations of breaches, dredging needs for breaches will need to be addressed during later design phases.

The critical shoreward slope of the dredged boat basin would be shaped to a ratio of 3 horizontal to 1 vertical. Breakwater slopes would be constructed to a ratio of 1.5 horizontal to 1 vertical. Broadening the breakwater base to achieve a flatter slope would substantially increase costs and would increase the footprint of harbor impacts. Theoretically, a flatter slope may benefit salmon fry, but differences cannot be quantified to justify additional costs. We were not able to conduct research to determine marine biota recolonization rates on different rock types, but would be happy to participate in this type of study in the future as funding allows. The western breach would be dry at tidal stages lower than about +1 meter MLLW, so the breach would be close to shore. If it were moved farther out, water would be much deeper around it during high tides and two separate breakwaters at the harbor west end would be required, with substantial increases in breakwater footprint and construction cost.

3. The harbor will include an approved waste oil disposal site with adequate containment and maintenance measures to ensure proper disposal. The new harbor will contain a new fuel dock designed and equipped with state-of-the-art protection equipment and measures (e.g., fuel collars, clean up equipment and facilities).

Valdez, the project non-Federal sponsor, has agreed to provide and maintain waste oil receptacles. Any fuel facilities the city constructs in the new harbor would be designed with current best fuel management and spill prevention technology.

4. To reduce the potential for accidental fuel spills, heighten vessel operators' awareness of hydrocarbon impacts to species in the marine environment, and provide tips to help boaters prevent and report fuel spills, signs with large and bold text shall be provided by the local sponsors and installed at the Harbormaster's office and at the new and existing

fuel docks; final design will require approval from the US Fish and Wildlife Service (Service). Additional signage is recommended along walkways and other locations. Signs should clearly communicate the need for using provided facilities to ensure safe and legal deposition of litter, oil products, or other chemicals so that marine waters and resources are protected.

The non-Federal sponsor has agreed to provide signs and other information to meet these objectives.

5. Interpretive signs shall be installed in high traffic areas (such as outside the entrance of the Harbormaster's office) to inform harbor users about the hazards of litter and marine debris impacts to fish and wildlife in the marine environment. The sign contractor will work with the Service to develop text for the sign that will meet or exceed the requirements of Marine Pollution Guidelines (MARPOL); final design will require approval from the Service. A clearly identified and easily accessible collection station will be located within the new harbor area (e.g., fuel dock or entrance to the boat launch) to collect discarded marine boating related debris (e.g., fishing nets, packing bands, ropes, buoys, gas cans, etc.).

The non-Federal sponsor has agreed to provide the interpretive signs and adequate waste receptacles in convenient locations.

6. An existing bilge water treatment plant is located 4 miles away from the current harbor. It is highly recommended that a new, state-of-the-art bilge water treatment facility be constructed within the immediate footprint of the existing and proposed new harbor sites. Design, construction, and signs "advertising" the existence of this facility need to be done to meet or exceed MARPOL regulations to ensure this facility is utilized to its maximum potential.

The non-Federal sponsor has agreed to construct and operate a bilge water treatment facility for use by both the existing harbor and any harbor improvements. Its location will be advertised to boat operators.

7. To reduce the biological impacts of dredging generated turbidity and suspended sediments on out-migrating juvenile salmon, dredging or fill activities should not occur from April 15 to May 15 (fry out-migration) and from June 20 to July 20 (adult return harvest period). It may be possible to arrange to continue construction activities during the "closed timing window" periods if activities can be timed to occur during low tide periods when the site is "de-watered." This will require careful consideration of seasonal and daily cycles and flexible work schedules for contractors. Further consultation with the Alaska Department of Natural Resources Office of Habitat Management and Permitting may be necessary to ensure all work is completed within and is consistent with the fish passage timing window for this region (M. Sommerville, pers. comm.).

Dredging or excavation and other harbor construction activities that produce excessive sediment suspension would not be conducted during the April 15 to May 15 out-migration period unless sediments suspended by construction was contained by silt *curtain or other mechanism. Placing clean rock and other coarse material for breakwater construction does not produce excessive sediment suspension and would be allowed if placed from a vessel that was not allowed to ground. Any restrictions imposed by State resource agencies to protect returning adult salmon also would be incorporated into contract requirements. Adult salmon are far more mobile than salmon fry, have been shown to tolerate high levels of suspended sediment, and are a terminal fish stock in Port Valdez. These returning adults will, with few exceptions, die without successfully spawning regardless of measures to protect them. Silt curtains in June and July appear to be an unnecessary cost.*

8. Disposal of dredged materials into selected inter-tidal/sub-tidal areas should include methods to filter or settle out silt-laden water (i.e., the use of silt curtains, where feasible) prior to their discharge at a disposal site. Dredged materials shall be discharged below the water surface to minimize the spreading of suspended particles.

Contractors would be required to employ silt curtains during in-water placement if any dredged material is placed to construct staging/access lands shoreward of the harbor basin. Placing dredged material for beneficial use coverage at Two Moon Bay would require discharge from a moving barge or scow. The size of the Two Moon Bay site, frequency of entry into and out of the disposal site, and need for barge and tug mobility would make silt curtains impractical at that site, but any material placed there would be discharged well below the surface to reduce potential for near-surface turbidity.

9. Valuable "preconditioned" shale and its attached marine infaunal community found along the base of southern and eastern shore of Hotel Hill should be collected prior to harbor construction. This material should be carefully collected and stored in-water so attached fauna does not die. The material would then be placed at the toe of the newly constructed harbor bulwarks or breakwaters as "seed" material to provide some habitat value.

We certainly respect and support the intent to promote redevelopment of diverse and productive benthic communities on project breakwaters as early as possible. We have had poor success in previous attempts to test this concept. Rocks with attached biota are difficult to identify accurately for contractor action, difficult to recover undamaged, difficult to successfully store for the 2 years or more typically required for harbor construction, and difficult to place right-side-up and in optimum locations. We were unable to successfully implement the same measure at another Alaska harbor that is now nearing completion. Most marine biota present on rocks at the East site are highly mobile during some life stage and would readily reach the new breakwater without being "seeded" against or adjacent to it. We will continue to look for ways to improve productivity on breakwaters, but we have seen no convincing evidence that "seeding" as suggested here appreciably increases recolonization rates on structures as extensive as breakwaters. We are not able to recommend this measure for this project.

10. To reduce adverse impacts to nesting kittiwakes and their young located on the SERVS pier and to comply with the Migratory Bird Treaty Act, the Service recommends

construction activities be initiated August 21 (when chicks will have fledged or have left the area) or May 7 (prior to egg laying). Once construction begins it should be able to continue with no date restrictions because it is likely the birds will avoid the area and will relocate to nearby colonies elsewhere within the Valdez Arm region. Following these guidelines will reduce the potential for loss of young of the year. It is unknown whether the birds will continue utilizing or will abandon the site in the presence of harbor related construction activity.

Contractors would be required to observe the stated timing windows.

11. To reduce adverse impacts to sea otters, the Service recommends that Corps Quality Assurance personnel/observers be stationed at the project site during dredging, in advance of when any blasting might be anticipated, and during breakwater rock installation/construction phases of this project. Such construction related activities should be suspended when sea otters are observed within 0.4 km of the project site.

The contractor would be required to prepare a blasting plan before using any in-water explosives. The plan would be consistent with resource agency recommendations and state standards. A monitor would be used as needed and sea otters would be fully protected.

12. As planning and design of the east harbor expansion progresses, the Service will use our Migratory Birds Management annual surveys conducted throughout PWS to ascertain the presence of Kittlitz's murrelets in the Valdez Arm and project areas, subject to funding limitations. The Service will provide any updated information to the Corps for use in harbor planning.

The Corps will re-evaluate plans if needed to protect Kittlitz's murrelets in Port Valdez.

13. Updated studies to determine circulation patterns within eastern Port Valdez would be useful to assess cumulative changes resulting from the potential expanded harbor, SERVS dock, Alyeska Marine Terminal, and the Container Terminal dock. This information would help assess resource impacts associated with water quality issues and potential fuel spills within the proposed harbor and adjacent valuable habitats, such as the Valdez Duck Flats. Information on circulation patterns within eastern PWS could also assist in defining additional mitigation measures to offset new harbor impacts. The Service will work with the City of Valdez and resource agencies to update all local spill prevention plans.

We concur. Circulation studies might be useful for future evaluations. They would not reduce, avoid, or compensate for project effects, so they are not proposed for project mitigation.

14. Preliminary water circulation modeling has been conducted for the proposed harbor designs. However, the Alaska Department of Environmental Conservation has indicated additional modeling and reviews may be necessary and appropriate prior to finalizing the

Corps design and before State of Alaska permits are issued for the proposed project. The Service encourages and supports further review and analysis because continuance of high water quality is necessary for the protection and maintenance of trust resources present in the project area.

We will continue to work with State agencies to ensure that they have the data they require to evaluate project impacts. The project will be constructed only after the State has issued a certificate of reasonable assurance to the Corps.

5.0 COMPARISON AND SELECTION OF PLAN

5.1 Alternative Comparisons

To determine which alternative would net the greatest amount of benefits, a comparison between the costs and benefits for each alternative fleet size was developed (table 5-1). Benefits for each fleet size consists of navigation benefits (time delay prevented, damages prevented, etc.) and incidental recreational benefits. Details of this analysis can be found in the Economics Appendix.

Table 5- 1. Summary of benefits and costs for Valdez Harbor alternatives

Alternatives	Number of Additional Slips	Average Annual Benefits	Average Annual Costs	B/C Ratio	Net Benefits
West Site Alternatives					
Alt 2 Wave Barrier	243	$ 4,476,500	$ 4,677,800	0.96	$ (201,300)
Alt 3 Wave Barrier	320	5,180,000	5,380,700	0.96	(200,700)
East Site Alternatives					
Alt 1 Rubblemound	125	$ 3,267,000	$ 1,119,600	2.92	$ 2,147,400
Alt 2 Rubblemound	200	4,004,600	1,494,400	2.68	2,510,200
Alt 3 Rubblemound	243	4,476,500	1,665,400	2.69	2,811,100
Alt 4 Rubblemound	320	5,180,000	1,861,200	2.78	3,318,800

The alternative with the greatest net NED benefits is the East Site Rubblemound 320-Vessel alternative.

5.2 Alternative Optimization

Alternatives were optimized to maintain design criteria while providing benefits for the given fleet size at the least cost. The harbor shape and breakwater height were designed to standards necessary to provide protected moorage and circulation for water quality, leaving little room for optimization.

The entrance channel was one area where alternative optimization was done (table 5-2). This was briefly analyzed to determine the percent of time the design vessel could transit the entrance channel while remaining within the safety zone as defined by the above criteria related to entrance channel depths and the lowest predicted tide elevation. This analysis shows that the -5.5-meter channel depth provides 98 percent accessibility for a 50-year storm event and lowest predicted tide occurring at the same time.

Table 5- 2. Entrance Channel Optimization

Percent Safe Accessibility	
Channel Depth meters	**Percent Accessibility**
-4.6	89
-4.9	93
-5.2	96
-5.5	**98**
-5.8	99
-6.1	100
-6.4	100

Decreasing the channel depth would lead to a decrease in benefits greater than the decrease in cost. For example, removing 0.3 meter of channel depth (the standard increment for optimization) would yield a present value cost savings of about $15,200. If this decrease in channel depth caused a delay of just 1 hour per year for just four of the larger vessels (in this case the 30-meter tenders), it would create a present value decrease in benefits of about $19,200, showing that the 0.3 meter in channel loss would not be justified. This is an extremely low estimate of potential impacts to the project and does not take into account any of the larger charter vessels, emergency response vessels, large recreational vessels etc.

The 5.5-meter depth is computed as the minimum allowable depth based upon Corps standards for entrance channels. This depth includes factors such as design vessel depth, wave height, and factor of safety. At 98 percent availability, the average delay for any given low tide would be 15 minutes. Not every low tide would demonstrate a delay, and some would be longer than 15 minutes, but the average time computed is 15 minutes. The assumption made for this study is that a 15-minute delay is about the longest amount of time that a vessel operator would be willing to endure without changing their behavior in such a way that an economic benefit would be gained. Therefore, going any deeper than the 98 percent available depth does not appear to be warranted and having a channel shallower than the recommendation of Corps technical guidance would allow does not appear to be justified either.

Optimization of the harbor would follow much the same reasoning as the entrance channel optimization. Certain areas of the harbor are not dredged as deep because not all vessels require the full 5.5-meter depth of the entrance channel. The harbor was designed to accommodate the depth of the 320-vessel fleet. The largest section, 187 meters by 129 meters, would be dredged to -2.7 meters. The next largest section is 110 meters by 129 meters dredged to -4.0 meters. The smallest section is 125 meters by 129 meters, subtracting a substantial portion of the area to accommodate the entrance channel, effectively diminishing the size of this area by a third. Decreasing the size of any of these sections would begin to diminish the benefits gained by vessels in a greater rate than the cost would decrease (see the example illustrated for the entrance channel). Likewise, there would be no economic gain for increasing the depth or size of the areas. Effectively, the basin is optimized by selecting the smallest basin area needed for the three classes of vessels using the harbor.

5.3 Evaluation of Dredge Material Disposal Options

This section evaluates the different disposal options for the disposal of dredged materials including an assessment of the costs, a cost effectiveness analysis, an incremental cost analysis, and identification of the tentatively recommended dredged material disposal plan.

5.3.1 Development of the Cost Effectiveness and Incremental Cost Analysis

The base dredged material disposal plan for Valdez would be to dump the material in the deep water area near the proposed harbor site. Table 2 shows the difference in the GNF dredging costs between the base plan and the various beneficial use of dredged material options.

Table 5- 3. Disposal Alternative Costs

Plan	Cost: ($)	BUDM Cost: ($)
No Action Plan	$ -	$ -
Base Disposal Plan	4,169,000	-
Alternative 1	4,369,000	200,000
Alternative 2	5,197,000	1,028,000
Alternative 3	4,800,000	631,000
Alternative 4	10,253,000	6,084,000

Because the cost of the beneficial use of dredged material plan could exceed $300,000, a Cost Effectiveness and Incremental Cost Analysis (CE/ICA) is needed to justify the plan. To develop a CE/ICA for beneficial use of dredged material plan, an assessment of potential gains and losses to habitat of the base dredging plan and the proposed beneficial use plan was conducted. The decision making criteria is whether the incremental cost is reasonable in relation to the environmental benefits achieved.

There are a number of ways of conducting CE/ICA, thereby determining which plans are cost effective, and from the set of cost effective plans, identifying those plans that are most efficient in production (i.e. "best buys"). These best buy plans are then analyzed to compare the incremental costs and incremental benefits to see what plan has the most reasonable amount of output for an amount of cost. The result of this analysis aids in the identification of the recommended plan.

5.3.2 Development of the Cost Effectiveness and Incremental Cost Analysis

The measure of the habitat's existing condition—gains or losses—is the habitat unit. The habitat unit is the product value of a particular habitat multiplied by some physical dimension. For the analysis of the Valdez Navigation Improvements beneficial use of dredged materials, the value of the habitat was generated using a marine benthic assessment (MBA).

The marine benthic value (MBV) was developed by identifying reference condition to which conditions at other sites can be compared. This reference condition represents an assumption that the habitat is functioning as optimally as can be expected for a given geographic location and environment. This reference condition is assigned a value of 1.0.

Other conditions are given values between zero and one representing the site's MBV compared with the reference site. In the case of the Valdez Navigation Improvements Beneficial Use of Dredge Material plan, MBVs have been developed to represent the without- and with-project conditions at Two Moon Bay and the deep water disposal site. The MBVs were generated using input, judgment, and opinions of knowledgeable experts from the Corps and other agencies familiar with the sites and PWS habitat related issues (see Appendix 6).

The reference condition for this analysis is defined as a properly functioning benthic habitat characterized by a diverse population of locally common species including:

- diatoms and single cell algae
- marine worms
- barnacle, mussel, bivalve, urchin, limpet, snail, and decapod larvae, juveniles, and adults immature and mature kelp
- larvae, juvenile and adult fin fish, sea cucumbers, sea stars, and octopus

A complex set of factors contribute to habitat functionality. This analysis concentrates on the natural conditions, the factors that have been influenced by existing and previous use of the sites, and the factors that would be influenced and have an enduring habitat-related effect as a result of a proposed action.

As part of the site selection and permitting process for the log transfer facility, the Two Moon Bay site and two other nearby sites were surveyed. The Two Moon Bay site was selected because of its lower near-shore productivity, its proximity to deep water, and its longer distances from bald eagle nests and anadromous streams, relative to the other sites that were being considered. The Two Moon Bay site was described as having a gravel shelf extending to about 18 meters offshore from the water's edge where a steep drop off to a depth of about 8 meters to silt/mud occurred. The most important factor that would be influenced by the placement of dredged material is the substrate. Placement of the dredged material at the site would likely improve the chemical and physical nature of the substrate.

The habitat at Two Moon Bay has been altered by the covering of the seafloor with wood and bark debris. The debris, being slow to degrade, smothered the habitat and prevented self recovery. The MBV for the existing condition at Two Moon Bay was determined to be 0.05 because of a lack of attachment potential and the toxic conditions presented by the fine-particle size and water chemistry within the exposed substrate.

To quantify the MBV for the restored Two Moon Bay site, other projects of similar condition were investigated including disposal sites from dredging projects in Portland, Maine, and Long Island Sound (ERDC 2001). The results of these projects show that marine invertebrates only colonize the material to about 30 cm deep and it would make no difference if it were stockpiled as a mound on a disposal site or if used for capping the bark debris at Two Moon Bay. The recommended minimum capping depth is 30 cm because the majority of invertebrates live on the surface or colonizes to about the top 30 cm. Some invertebrates burrow down farther, but substrates generally become increasingly anaerobic with depth.

Colonization is rather rapid (1 to 3 years) in some of these examples. This is probably due to the softer consistency of the dredged materials and the abundance of seed invertebrates occupying the surrounding habitat. The dredged material from Valdez is resorted glacial till ranging from silt to cobble with occasional small boulders that would be expected to show similar results with colonization starting within 1 to 2 years with maximum recovery in about 10 years. Table 5-4 shows how the Two Moon Bay site would be expected to develop over time.

Table 5- 4. Two Moon Bay Expected Habitat Improvement

Successional Stage	Estimated Number of Summers to Reach	Estimated Percent of Community Recovery [1]	Organisms Expected to be Present in the Two Moon Bay Site
Stage I	1 – 2	To 20 %	Diatoms and single cell algae; marine worms, barnacle, mussel, bivalve, urchin, limpet, snail, and decapod larvae
Stage II	2 – 5	20 to 80%	Diatoms and single cell algae; marine worms; barnacle, mussel, bivalve, urchin, limpet, snail, and decapod larvae, juveniles, and adults; immature and mature kelp; larvae, juvenile and adult fin fish
Stage III	5 – 10	80 to 100%	Diatoms and single cell algae; marine worms; barnacle, mussel, bivalve, urchin, limpet, snail, and decapod larvae, juveniles, and adults; immature and mature kelp; larvae, juvenile and adult fin fish; sea cumbers; sea stars; octopus.

1. As compared with ecosystems comparable to the environment found at Two Moon Bay. The diversity of the post-project Stage III (climax) succession at Two Moon Bay is expected to exceed that found at the material source in Valdez because the water quality at Two Moon Bay allows the presence of species that cannot survive in the relatively turbid environment of lower salinity often present at Valdez.

The capping of Two Moon Bay with 30 cm would ensure sufficient coverage for re-colonization and would use all the dredged material. The habitat value after capping is assigned values of 0.5 or 0.7 depending on the methodology of placing dredged material. Table 5-5 is a summary of the assigned marine benthic values.

The capping methodologies (scow dumping, dump and level, side cast) are expected to have different levels of effectiveness. Scow dumping is expected to be the most effective with the least amount of escaping turbidity, loss of fines, and re-suspension of the bark debris, warranting the MBV of 0.7 assigned to capping. The dump and spread methodology has a risk of re-suspending the bark debris with the potential of having bark in the cap or on the cap surface, decreasing the effect of the restoration. To account for this, the MBV for dump and level is decreased to 0.5. The side cast method, due to the remixing of the dredged material with water, would likely cause a plume of fine materials to drift off site, covering existing good habitat, thus decreasing the good habitat production. To account for this effect, the side cast method MBV is decreased to 0.5 as well.

Table 5- 5. Summary of MBA Utilized in the Beneficial Use of Dredged Material CE/ICA

Type of Habitat	MBV
Existing Two Moon Bay	0.05
Two Moon Bay with Scow Dumping	0.7
Two Moon Bay with Dump and Level	0.5
Two Moon Bay with Side Cast	0.5
Existing Deepwater	1.0
Dumped on Deepwater	0.7

Habitat associated with deep water disposal of dredged material was considered the least preferable method. Deep water habitat throughout PWS is generally characterized as undisturbed benthic habitat. The MBV of deep water habitat in this region is generally assumed to be excellent and assigned a value of 1.0. The assumption for the MBA is that dumping material in deep water would likely exceed a 30 cm cap and would likely have short-term adverse impacts. As a result, a value of 0.7 was assigned to the deep water benthic environment to allow for recovery of lost habitat function.

Habitat Units (HUs) for the Two Moon Bay beneficial use of dredged material plan were developed by multiplying the acreage of the various habitat types for each alternative by its corresponding MBV. As more dredged material was placed at a location, proportionally less of the existing condition MBV was utilized as proportionately more of the new habitat was created and the new MBV used. All of the HU's for each alternative were then summed. The following table and graph show the HU and cost for each of the disposal options.

The next step in the CE/ICA is the Cost Effectiveness analysis, which identifies those plans that are inefficient in production. Plans that are inefficient in production are defined as those where the same level of output can be provided at a lesser cost by another plan.

Table 5-6 and Figure 5-1 show that there are three cost effective plans, No Action, Alternative 1 and Alternative 2 that can be carried forward into the incremental analysis. Alternatives 3 and 4 are not considered efficient because greater output can be produced at a lesser cost.

Table 5- 6. Disposal Plans Costs and Outputs (2009 Price Level)*

Plan	Output: (HUs)	Cost: ($)	Cost Per HU: ($)
No Action Plan	10.8	$ 0	$ 0
Base Disposal Plan	7.7	$ 4,169,000	$ 541,000
Disposal Alternative 1	15.5	$ 4,369,000	$ 282,000
Disposal Alternative 2	16.2	$ 5,197,000	$ 321,000
Disposal Alternative 3	14.6	$ 4,800,000	$ 329,000
Disposal Alternative 4	11.3	$ 10,253,000	$ 907,000

**The costs for the dredge disposal analysis were developed in 2009 and are in the 2009 price level. These costs used in the analysis were not adjusted because the relative change in the costs would not affect the results of the analysis because all alternatives would inflate at the same rate. As stated previously, the cost estimate for the selected alternative (including the BUDM components) has been updated and is reflected in Section 6. This comment applies also to all the remaining BUDM analysis in this section.*

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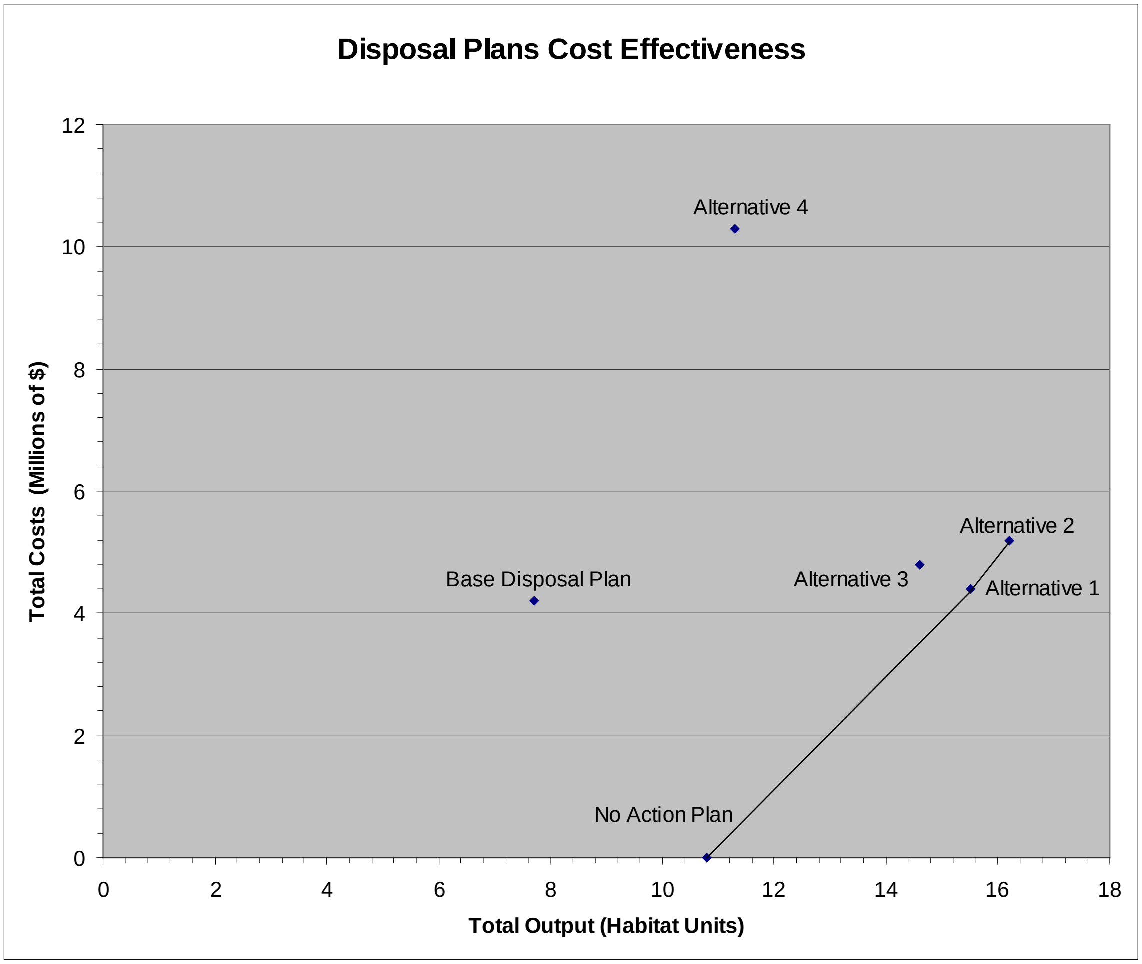

Figure 5- 1. Plan Cost Effectiveness

The next step in the CE/ICA is to perform the incremental cost analysis. The ICA is performed by computing the incremental cost, incremental output, and incremental cost per unit of advancing to each successive cost effective alternative. The Table 5-7 and Figure 5-2 show the result of the incremental cost analysis. Alternative 1 is selected as Alternative 2 adds additional HUs but at a greater cost per unit.

Table 5- 7. Cost Effective Plans with Incremental Costs and Benefits (2009 Price Level)

Plan	Output: (HUs)	Incremental output (HU)	Incremental cost ($)	Incremental cost per unit: ($/HU)
No Action Plan	10.8	0	0	0
Alternative 1	15.5	4.7	$ 4,369,000	$ 930,000
Alternative 2	16.2	0.6	828,000	1,183,000

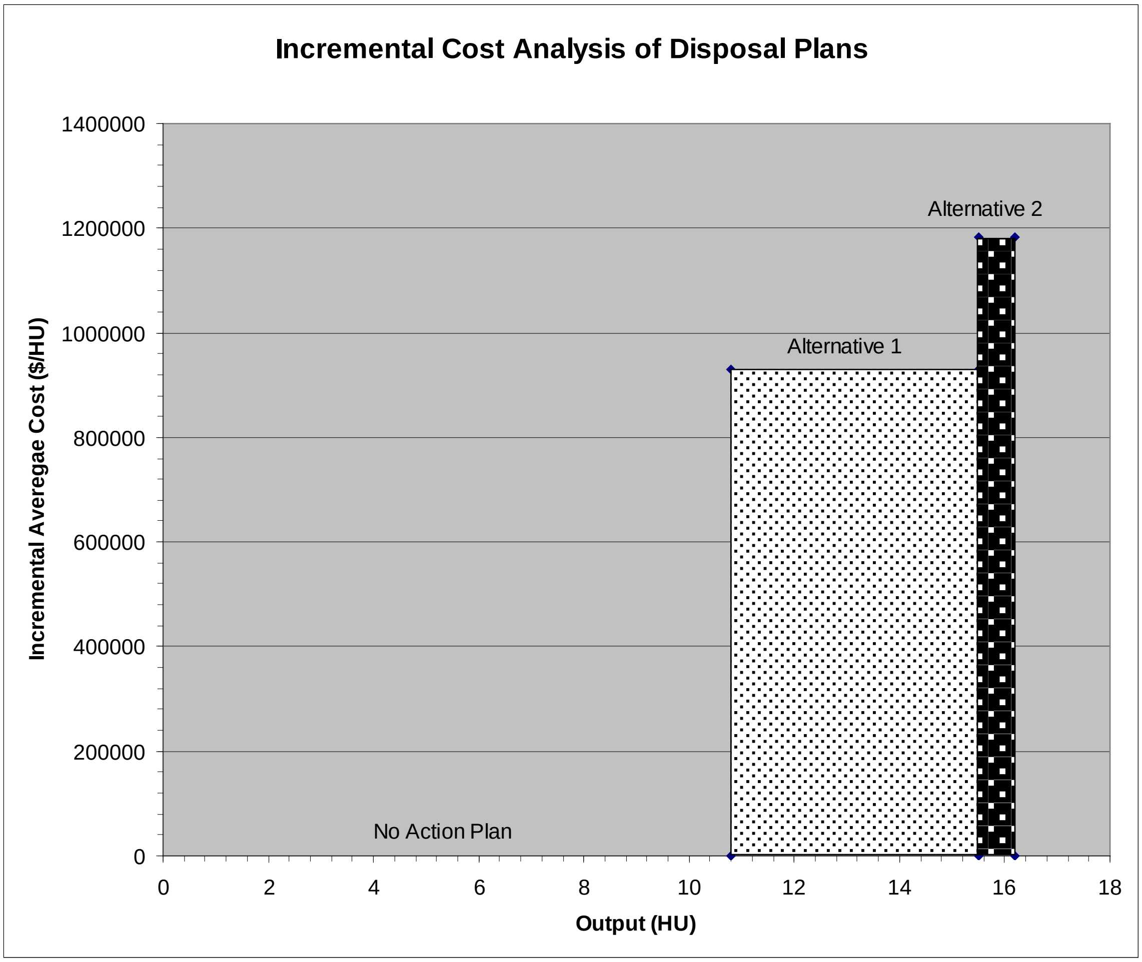

Figure 5- 2. Incremental Cost Analysis for Beneficial Use Plans.

5.4 Plan Selection

5.4.1 Identification of NED Plan

The non-Federal sponsor has identified a constraint to the maximum physical project size, and the District has shown that net benefits are increasing as that constraint is reached and that in accordance with planning regulations the requirement to formulate larger scale plans in an effort to identify the NED plan can be suspended.

The non-Federal sponsor does not want to pursue a project larger than the East Site Rubblemound 320-Vessel alternative. The sponsor deals with water quality and debris issues at the existing Valdez Harbor and wants the new harbor to meet State guidelines that call for an aspect ratio (length divided by width) between 0.3 and 3.0. The aspect ratio of the East Site Rubblemound 320-Vessel alternative is 2.9. Expanding the harbor design would exceed the guidelines unless it could be widened to the north or to the south. Expanding to the north would cut into the steep bedrock of Hotel Hill, which would be prohibitively expensive. Expanding to the south is not practicable because the bathymetry drops off rapidly. A rubblemound breakwater would be unstable and infeasible. The wave environment would not allow a cost-effective floating breakwater.

Beyond water quality, there are other reasons the sponsor prefers not to expand the design to the east or to the west. Expanding the harbor design to the west would interfere with (or require moving) the SERVS dock. Expanding the harbor to the east would be seen as encroaching upon an area recognized as being environmentally important. The USFWS has identified nearby Harbor Cove and adjacent islands as an area with high natural productivity, plant and animal diversity, and essential habitat for biological resources. The USFWS is concerned that expansion farther east would impinge on those resources. Our non-Federal sponsor does not wish to pursue an environmentally controversial project when the environmentally acceptable East Site Rubblemound 320-Vessel alternative resolves many navigation issues at Valdez.

For these two reasons, the local sponsor has identified a constraint to the maximum physical project size.

As demonstrated in table 5-8, net average annual benefits continue to increase as the sponsor-defined constraint is reached.

Table 5- 8. Net average benefits, incremental benefits and justified increment. (2010 Price Level)

Alternative	Net Average Annual Benefits	Incremental Benefits	Increment Justified
East 125	$2,147,400	NA	Yes
East 200	2,510,200	$ 362,800	Yes
East 243	2,811,100	300,900	Yes
East 320	3,318,800	507,700	Yes

5.4.2 Selection of the Beneficial Use of Dredged Material Plan

Before a selection can be made, CE/ICA guidance recommends an “is it worth it” examination be done. This project’s beneficial use of dredged material plan indicates there are multiple factors that demonstrate the worth.

The Valdez Navigation Improvements and associated Two Moon Bay Beneficial Use of Dredged Material plan, agency collaboration, potential for cost savings at the harbor, and need for more data at a deep water site are additional factors that make the plan worthwhile. Significant agency collaboration has been done to determine the best potential use of the dredged materials. The USFWS in particular has stated they wish to get as much material to Two Moon Bay as possible in hopes of not only capping the site, but potentially creating eel grass habitat in areas where water depth was less. Taking more material to Two Moon Bay would be regarded as a positive effect. Disposal plans that utilize dredged material for construction of the harbor staging area provide a cost savings for the overall project. By utilizing dredged material, 72,280 m^3 of fill material is no longer needed for the harbor staging area. This represents a savings for the LSF features.

The factors of agency collaboration, a cost savings for the harbor staging area, and not having to develop a deep water disposal site show a beneficial use of dredged material plan is worth it. Therefore, disposal Alternative 1, the cost effective and incrementally justified plan, is selected as the preferred disposal option.

5.4.3 Identification of the Tentatively Recommended Plan

The locally preferred plan, the East Site Rubblemound 320-Vessel plan, is the tentatively recommended plan. Section 6 describes this plan and its components in detail.

6.0 DESCRIPTION OF TENTATIVELY RECOMMENDED PLAN

As stated previously the cost of the selected plan in this section is different than the costs in the recommended plan in Sections 4 and 5. The alternatives were compared utilizing cost estimates prepared in 2006 and inflated to the 2010 price level. This cost basis was utilized to ensure all the assumptions and computations used to compute the alternative costs were the same for all the alternatives. When the selected plan was identified, its cost estimate required updates per comments received in Agency Technical Review and have been adjusted based on those comments and updated to 2010 price levels. Therefore, the costs for the recommended plan in later sections of the report are different than they are in the alternative analysis.

6.1 Components

The East Site Rubblemound 320-Vessel plan includes three rubblemound breakwaters, dredged entrance channel, maneuvering channel and mooring basin, and a small upland disposal area. The upland disposal site has an area of 1.87 ha located along much of the length of the north edge of the mooring basin. The 5.7-ha mooring basin would provide moorage for 320 vessels ranging in size from 9 meters to 30 meters in length. The entrance channel on the east end of the harbor is 40 meters wide. Vessels enter to the northeast and turn from 135 to 180 degrees to enter the maneuvering channel to access the fairways and floating docks. Breakwater quantities for the south, east, and stub breakwaters are 31,200 m^3 armor rock, 17,600 m^3 secondary rock, and 37,570 m^3 core rock. The side slopes of the break waters are 1V:1.5H. Figures 6-1 and 6-2 show the plan and section views. Figure 6-3 shows which features are GNF or LSF.

6.1.1 Harbor Basin

The basin is approximately 130 meters by 435 meters with depths of -2.7 meters, -4.0 meters, and –5.5 meters. The dredged slopes would be separate from the breakwater footprint. No dredging under the toe berm of the breakwaters or the upland disposal area would occur. The inner harbor slope, within and above the tidal prism, would be dredged to 1V:2H and covered with protection. The slopes that transition between the differing harbor depths would remain unprotected and dredged at a 1V:3H slope.

6.1.2 Breakwaters

Three breakwaters would be constructed to protect the harbor. The main south breakwater is 473 meters long. The eastern most 70 meters of the south breakwater angles to the northeast forming the west side of the entrance channel. The east breakwater, approximately 240 meters long, curves in an arc from the northeast to northwest to form the eastern side of the entrance and harbor. The east breakwater stops short of Hotel Hill forming the eastern breach. Side slopes are 1V:1.5H. Both breakwaters would be constructed in 0.0 MLLW to -5 meters MLLW and have crest elevations of +6 meters. A small stub breakwater protects the western breach. It is 30 meters long with a crest elevation of +5 meters.

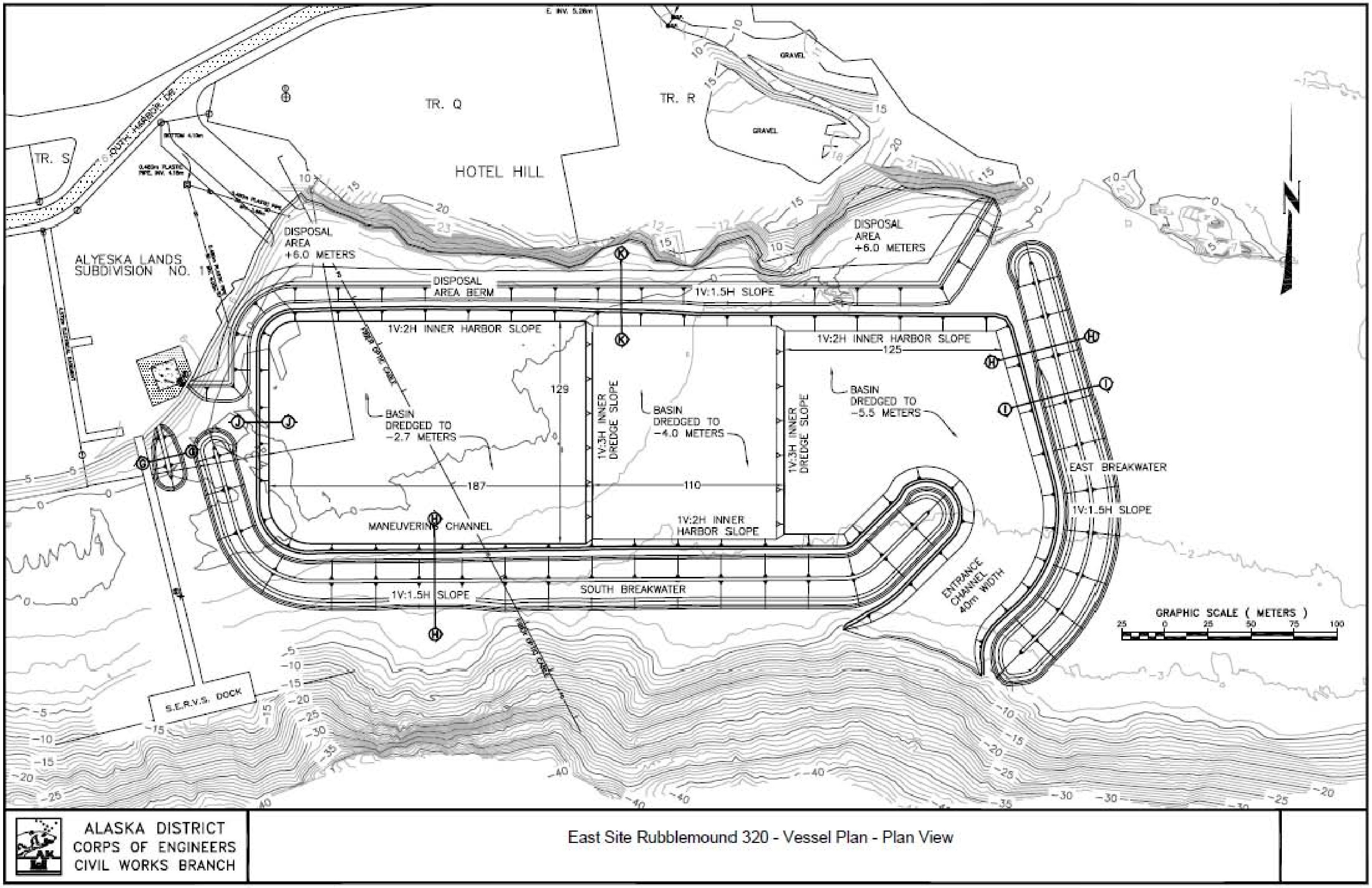

Figure 6- 1. East Site Rubblemound 320–Vessel Plan View

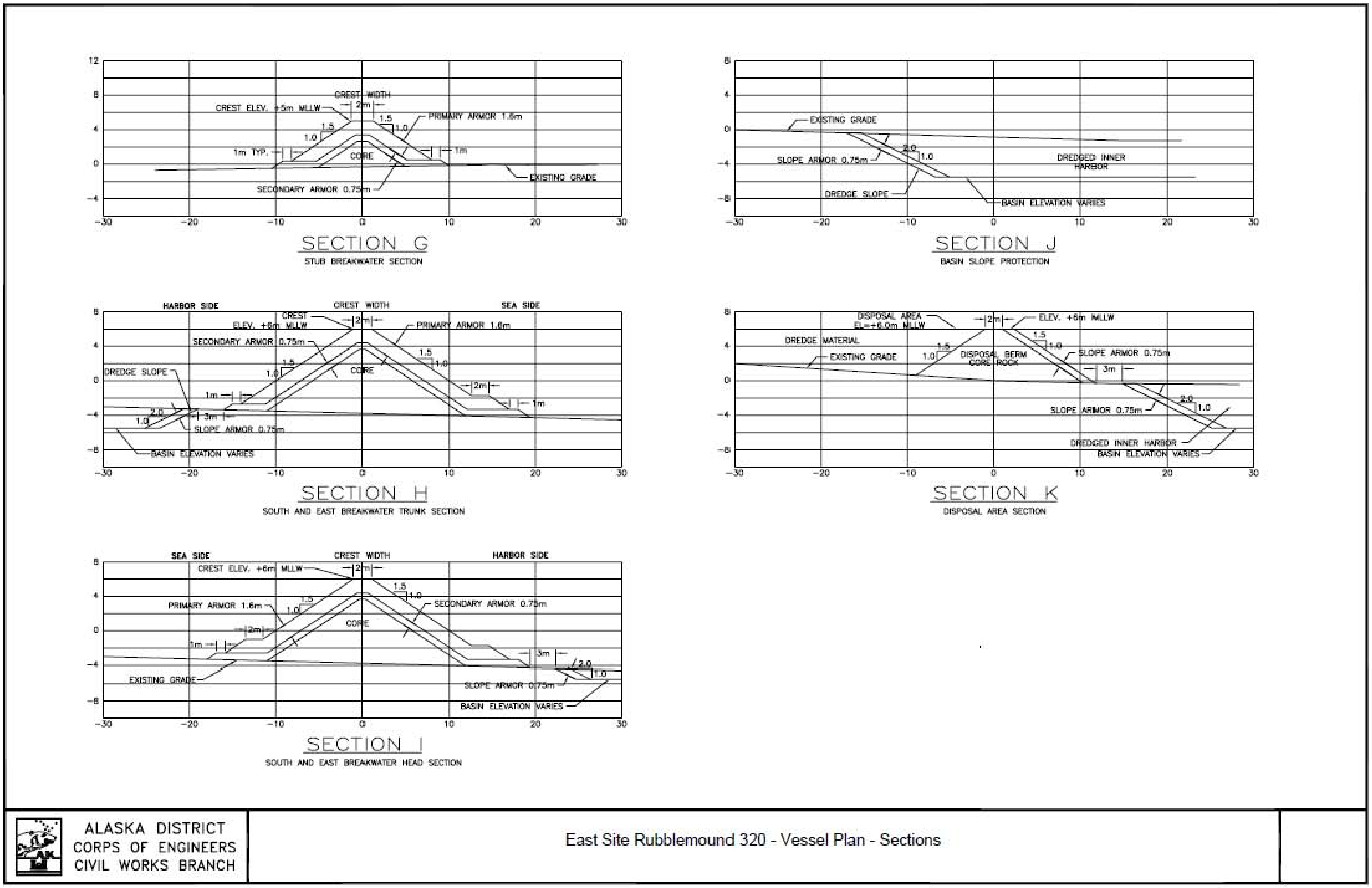

Figure 6- 2. East Site Rubblemound 320–Vessel Sections

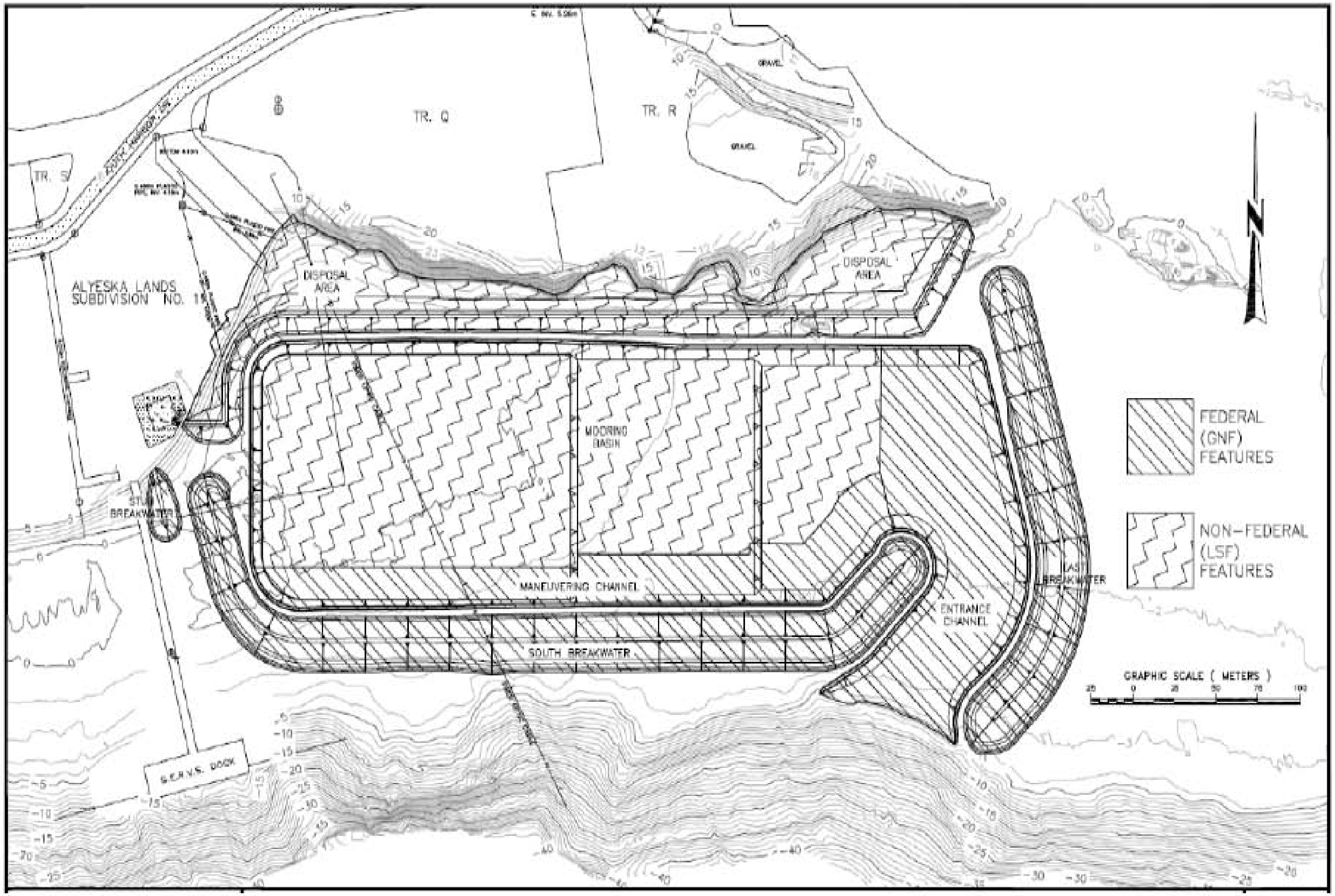

Figure 6- 3. East Site Rubblemound 320–Vessel GNF and LSF Features

6.1.3 Mitigation Plan

The recommended plan would place the entrance at the east end of the harbor away from the kittiwake colony on the SERVS dock, but the entrance would be oriented so that boats would approach from the southwest, away from Harbor Cove and the small islands to the west.

Breaches would be constructed through the east and west breakwaters near shore to minimize potential for fish entrapment, habitat segmentation, and predation losses of juvenile fish. Breaches would be designed to minimize dewatering during low tides. The western breach would be designed to ensure bottom coverage by at least 30 cm of seawater at lowest predicted tides. The eastern breach would be exposed during some low tides.

The non-Federal sponsor will provide and maintain a waste oil disposal site with adequate containment and maintenance measures to ensure proper disposal and to provide a clearly identified and accessible collection station for boating related debris and waste.

If a fueling facility is constructed in the harbor, the non-Federal sponsor will incorporate best available technology for spill prevention, containment, and recovery.

The non-Federal sponsor will post prominent signs at appropriate locations in the tentatively recommended harbor to clearly communicate the need for using provided facilities to ensure safe and legal deposition of litter, oil products, or other chemicals so that marine waters and resources are protected.

The non-Federal sponsor will construct and operate a bilge water treatment facility for use by both the existing harbor and any harbor improvements. Its location will be advertised to boat operators.

Dredging or excavation and other harbor construction activities that produce excessive sediment suspension will not be conducted during the April 15 to May 15 out-migration period unless sediments suspended by construction were contained by a silt curtain or other mechanism. Placing clean rock and other coarse material for breakwater construction does not produce excessive sediment suspension and will be allowed if the native bottom material is not disturbed by equipment used for placement. Any restrictions imposed by State resource agencies to protect returning adult salmon will be incorporated into contract requirements.

Contractors will be required to employ silt curtains or other silt containment measures if dredged material was placed in water to construct harbor support lands or facilities.

Dredged material for beneficial use at the tentatively recommended Two Moon Bay site will be discharged below the surface to reduce potential for near-surface turbidity.

Construction of the tentatively recommended plan will begin before kittiwakes begin egg laying at the adjacent SERVS dock (assumed to be May 7 unless site inspection indicates a later date). Alternatively, construction will begin after August 21, when fledging is assumed to be completed. This measure will ensure compliance with the Migratory Bird Treaty Act.

The contractor will be required to prepare a blasting plan before using any in-water explosives. The plan will be consistent with resource agency recommendations and State standards. A monitor will be used as needed and sea otters would be fully protected.

6.1.4 Dredged Material Disposal Plan

All dredged material would be used beneficially to restore habitat at Two Moon Bay or as fill material to create a harbor staging area.

The non-Federal sponsor would pay the full cost of all LSF dredged material regardless of use. Of the LSF dredged material, 72,280 m^3 would be used to create a project staging area. The remaining 52,120 m^3 of LSF material would be sent to the Two Moon Bay restoration site.

All 67,600 m^3 of GNF dredged material would be sent to Two Moon Bay at a cost of $999,000. The cost of disposing the GNF dredged material is cost shared at the same rate as the GNF features up to the cost of the base disposal plan regardless of use. The cost of the beneficial use of dredged GNF material is the difference in the cost of the GNF disposal between the beneficial use and the base plan. The cost of utilizing the GNF material for beneficial use is shared 65 percent Federal and 35 percent non-Federal.

Table 6- 1. Cost of Beneficial Use of Dredged GNF Material (2010 price level)*

	Base Disposal Plan	Alternative 1	Difference in Costs
GNF Costs	$ 211,000	$ 999,000	$ 788,000

Table 6- 2. Cost Apportionment of the Beneficial Use of Dredged GNF Material

Beneficial Use Cost	Alternative 1
Total GNF Increase	$ 788,000
Federal Share	$ 512,000
Non Federal Share	$ 276,000

*The costs shown in these tables differ from the BUDM CE/ICA analysis because only the recommended plan had its costs updated to current price levels. The total cost of all BUDM including the material from the LSF is $2,129.000. Only the GNF BUDM can be cost shared.

6.2 NED Benefits

The East Site 320-Vessel plan benefits summary (table 6-3) is based on accommodating half of all the transient vessel users at Valdez Harbor in 2006. This assumes some of these vessel owners would be on the waitlist but for the large number already on the list. This benefit summary captures the portion of total benefits that could be realized for each of the benefit categories based on the transient vessels that would be first offered space at the new harbor facility. Total present value of benefits for the 320-vessel alternative is $133.4 million with average annual benefits of about $5.2 million.

Table 6- 3. East Site Rubblemound 320-Vessel Plan Benefits Summary

Benefit Categories	Total Present Value of Benefits	Average Annual Benefits
Harbor Operations		
Harbor personnel time	$ 113,100	$ 5,300
Float and dock repairs	692,300	32,700
Commercial Fleet		
Vessel Damage	3,992,800	188,600
Vessel delays	6,344,800	299,700
Harbor of refuge	114,400	5,400
Opportunity Cost of Time	13,521,600	638,700
Tender Fleet		
Travel related expenses	2,612,300	123,400
Opportunity Cost of Time	321,800	15,200
Charter Fleet		
Vessel delays	16,367,000	773,100
Opportunity Cost of Time	3,556,700	168,000
Guaranteed space premium	1,088,200	51,400
Subsistence Fleet		
Harvest value	5,819,200	288,500
Recreational Vessels		
Recreational experience	78,857,000	2,590,000
Total Benefits With-Project	**$ 133,401,200**	**$ 5,180,000**

6.3 Costs

The cost estimate for the tentatively recommended plan was updated in 2010 and reflects a price level as of June 2010. As mentioned in Chapter 4, the alternative analysis was accomplished utilizing 2006 cost estimates updated to August 2010 using the Civil Works Construction Cost Index. The recommended plan was reworked based on Agency Technical Review comments and current price levels.

The NED first cost is $41,733,000. Cost for beneficial use of dredged material in the amount of $2,212,000 is counted as a NER cost and is therefore removed from the NED analysis.

The cost of the project, which represents that cost of construction including design, real estate, interest during construction, and contingency is $55,707,000, as shown in table 6-4. The price level is August 2010.

Table 6- 4. 320-Vessel East Site Rubblemound Plan Updated NED Cost Summary

Cost Category	**320-slip Rubblemound**
Mobilization/Demobilization	$ 1,983,000
Cable relocation	668,000
Breakwaters	11,739,000
Navigation Aids	6,000
Dredging and ocean disposal	2,775,000
Land disposal	783,000
Hydro survey	143,000
Inner harbor floats	21,460,000
Bank stabilization	2,264,000
Total NED First Costs	**$ 41,821,000**
Real estate	335,000
Contingency (20%)	8,911,000
Preliminary Engineering and Design (PED)	950,000
Supervision and Administration (S&A)	1,450,000
Total NED Costs prior to IDC	**$ 53,467,000**
Interest During Construction	2,240,000
Total NED Costs with IDC	**$ 55,707,000**
Present Value of Operations and Maintenance [2]	**$ 6,398,900**
Average Annual Costs (50 years at 4 3/8%)	**$ 2,968,000**

Note: Costs in this table have been updated to the August 2010 pricing level. Based on Fiscal Year 2010 Federal discount rate of 4 3/8 percent.

1. Placement of material at Two Moon Bay is estimated at $2,212,000 prior to IDC. These costs are NER and therefore not included in the NED total.
2. Operations and maintenance based on two percent of armor rock replacement every five years.

6.4 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. These assumptions are also prone to risk and uncertainty. Therefore, the intent of this analysis is to test the sensitivity of project justification and scoping to changes in the major variables used to compute project benefits. The value of this test is to reveal how the economic analysis results might vary if inputs selected for the benefit evaluation are selected differently or applied differently, thereby providing insight to the amount of confidence one can have in the economic analysis. Issues that deal with variations in data and methods are sometimes referred to as risk and uncertainty (RU) issues, and one of the techniques of revealing their significance is referred to as Sensitivity Analysis.

Methodology used in this analysis is often based on more than one available choice, and selection may be influenced by time and dollar budgets or by the anticipated significance of a variable in the overall study. Even in cases where data is based on a 100 percent sample, the results can be distorted by being out of date or by being inappropriately applied or misinterpreted. There is rarely such a thing as perfect certainty, zero risk, or strictly up-to-date information.

Taken to the extreme one would need to examine and test the risk and uncertainty of every concept, assumption, bit of data, analysis, and conclusion, separately and in combination with each other to satisfy all possible outcomes. This effort would be impractical, so the scope and intent in the RU discussion is oriented toward identification of the degree to which changes in some of the major aspects of this analysis would have a material effect on the outcome.

Major categories of benefits for this evaluation are recreational experience, vessel delays, opportunity cost of time for commercial vessels, and subsistence harvest. Additionally, project costs might increase or decrease in the time from study completion to actual construction. Table 6-5 examines the change to net benefits and the benefit/cost ratio from a 20 percent increase or decrease in the major categories along with a change in total benefits. Changes to total benefits are based on the NED plan for the East Site alternative that will accommodate 320 additional vessels.

Table 6-5 also tests the sensitivity of the major benefits categories and the total benefit category along with the major cost categories and the total cost category to the annual net benefits before and after a 20 percent change for the East Site 320-Vessel alternative.

In the worst case scenario, with a 20 percent increase in costs accompanied by a 20 percent decrease in benefits (highly unlikely), the benefit/cost ratio drops to 1.16 with net benefits of $582,400. In the best case scenario, with a 20 percent increase in benefits accompanied by a 20 percent decrease in costs (also highly unlikely), the benefit/cost ratio rises to 2.62 with net benefits of $3.8 million.

Table 6- 5. Sensitivity Analysis – East Site 320 Additional Slipholders Alternative

Category	Average Annual Claimed	20% Increase	Net Benefits after Increase	BCR	20% Decrease	Net Benefits after Decrease	BCR
Changes to Benefit							
Recreation Experience	$ 2,590,000	$ 3,108,000	$ 2,730,000	1.92	$ 2,072,000	$ 1,694,000	1.57
Charter Fleet Delays	773,100	927,720	2,366,620	1.80	618,480	2,057,380	1.69
Commercial Vessel OCT	638,700	766,440	2,339,740	1.79	510,960	2,084,260	1.70
Subsistence Harvest	288,500	346,200	2,269,700	1.76	230,800	2,154,300	1.73
Total Benefits	$ 5,180,000	$ 6,216,000	$ 3,248,000	2.09	$ 4,144,000	$ 1,176,000	1.40

	Average Annual Claimed	20% Increase	Net Benefits after Increase	BCR	20% Decrease	Net Benefits after Decrease	BCR
Changes to Cost							
Breakwaters	$ 582,000	$ 698,400	$ 2,095,600	1.68	$ 465,600	$ 2,328,400	1.82
Operations and Maintenance	317,200	380,640	2,148,560	1.71	253,760	2,275,440	1.78
Total Costs	$ 2,968,000	$ 3,561,600	$ 1,618,400	1.45	$ 2,374,400	$ 2,805,600	2.18

Worst and Best Case Scenarios	Benefits	Costs	Net Benefits after Change	New BCR
Decrease benefits and increase costs (20% each)	$ 4,144,000	$ 3,561,600	$ 582,400	1.16
Increase benefits and decrease costs (20% each)	$ 6,216,000	$ 2,374,400	$ 3,841,600	2.62

Note: Costs in these tables have been updated to the August 2010 pricing level. Based on 50-year period of analysis and Fiscal Year 2010 Federal discount rate of 4 3/8 percent.

The previous table makes adjustments to the large benefit and cost categories to test the sensitivity to the net benefits for reasonable increases and decreases to particular categories. Were the project to drop to just parity (1:1) for the benefit to cost ratio, the benefits would have to decrease by 43 percent or the costs would have to increase by 75 percent.

The most volatile factor in the costs of the project (fuel prices) would affect benefits in the same direction as the costs. That is, an increase in fuel costs would both increase the costs and the benefits for the project. To demonstrate this effect, the price of fuel in both the cost estimate and the project benefits were increased by 10 percent. The 10 percent increase in fuel costs yielded a 1.6 percent increase in project costs and a 2.5 percent increase in project benefits. Therefore, increases in the cost of fuel would not make the Valdez project less economically justified.

6.5 Accomplishments

The tentatively recommended plan would meet the project objectives in the following ways:

- Provide additional moorage to reduce time delays experienced by the commercial fishing fleet and SERVS operations.
- Provide additional moorage to reduce travel costs incurred from the overcrowded conditions.
- Provide additional moorage for vessels on the moorage waitlist.
- Design and construct breakwaters to minimize adverse impacts to water circulation and environmental resources.
- Provide additional moorage, which would decrease vessel damages caused by rafting activities.
- Provide a plan that is consistent with state, regional, and local land use plans.
- Provide a plan that is acceptable to the non-Federal sponsor.

6.6 Implementation

6.6.1 Construction

Major harbor construction items include the breakwaters, dredging, and disposal area. The breakwater toe trenches would be dredged first, followed by construction of the breakwaters. Basin dredging would then proceed as the breakwaters are constructed or would wait until they are fully completed. Dredging may be limited seasonally to reduce impacts to fish or migratory birds. Construction time is estimated to be 24 months. Construction restrictions would be detailed in plans and specifications.

6.6.2 Operation, Maintenance, Repair, Replacement, & Rehabilitation (OMRR&R)

Operation and maintenance of the local service facilities would be accomplished by the City of Valdez. These include the mooring basin and float system and disposal berms. The Federal Government would be responsible for the breakwaters, entrance channel, and maneuvering channel for the project. The Alaska District would visit the site periodically to inspect the breakwaters and accomplish hydrographic surveys of the harbor at approximately 5-year intervals. Inspections and surveys provide the information to determine if maintenance of the breakwater or dredging of the basin, maneuvering channel or entrance channel is needed. The existing harbor and entrance channel have not required dredging since their completion more than 40 years ago. Based on past experience with the existing harbor, it is assumed that the harbor alternatives would not require maintenance dredging.

The breakwater was designed to be stable in storm conditions that could be expected in Port Valdez. Little, if any, loss of armor rock or other maintenance of the breakwater would be expected over the life of the project (50 years). Historically, breakwaters designed to the conservative criteria used for these new breakwaters for Valdez have experienced no deterioration requiring maintenance for approximately 35 years. However, a value of 2 percent of the armor stone has been assumed for evaluation of the alternatives.

Shoaling has not been a problem at the existing harbor entrance or within the existing harbor. Any littoral drift material will tend to move into deeper waters off the breakwaters. Suspended sediments, most likely from the Lowe River, also have not been a problem in the existing harbor and, therefore, are unlikely to be a problem in the new harbor.

Since there is little expectation that there will be any requirement for maintenance dredging, it has been determined that if any unforeseen maintenance dredging were needed, the current Two Moon Bay restoration site contains more than sufficient capacity to meet the 20-year material capacity requirement.

Monitoring will be required for the Two Moon Bay site. Qualified biologists would conduct biological surveys at the site before construction and in years 2, 3, and 5 after construction to determine baseline conditions and recovery success.

The estimated average annual cost for OMRR&R has been calculated to be about $317,000 based upon a value of 2% loss of armor stone per year.

6.6.3 Dredged Material Maintenance Plan

The District does not expect any maintenance dredging to be required so a dredged material maintenance plan is unnecessary. The existing Valdez Harbor has not required any maintenance dredging due to very little sediment transport in the project area. The same situation is expected for the new harbor at Valdez; therefore, no dredging maintenance plan is required. If the physical conditions of the new harbor were to change in the future in some unforeseen way requiring maintenance dredging, a dredged material maintenance plan would be written then.

6.6.4 Real Property Interest

Following is a brief summary of the real estate interest necessary for the project. Details can be found in the Real Estate Appendix.

Valdez owns the majority of the East site. Only two parcels are needed: one temporary construction easement totaling 0.08 ha and one permanent access easement totaling 0.34 ha. The original mean high water line (MHW) as determined by the State of Alaska places this project below the new MHW line, meaning the sponsor bears the entire burden for acquiring the required real estate for the East Site. There is no crediting for lands provided below MHW.

A fiber optics line identified as crossing through the middle of the project would need to be relocated. No other Public Law 91-646 relocations (relocation of persons) are anticipated nor are any other utility relocations anticipated.

No interest is required for lands below MHW as these areas are subject to the Federal Right of Navigational Servitude. This would include the lands required for the Two Moon Bay disposal site.

6.6.5 Cost Apportionment

Construction costs for the project would be apportioned in accordance with the Water Resources Development Act of 1986. The fully funded cost apportionment for the project features is summarized in Table 6-6.

Table 6- 6. Cost Apportionment for East Site Rubblemound 320–Vessel Plan(Recommended Plan)

	Construction cost contribution (%)	
Portion of project	Federal	Local
General navigation features (includes entrance channel, maneuvering basin, and breakwaters)	80	20[a]
Local Service Facilities (includes floats, mooring basin, beneficial use of LSF dredged material)	0	100
Coast Guard navigation aids	100	0
Benefical Use of GNF dredged material up to cost of base disposal plan	80	20[a]
Benefical Use of GNF dredged material above cost of base disposal plan	65	35

[a]Non-federal interests must provide cash contributions toward the costs for construction of the GNF of the project, paid during construction (PDC) as follows: For project depths of up 6 meters–10%; for project depths over 6 meters and up to 14 meters–25%, and for project depths exceeding 14 meters–50%. For all depths, they must provide an additional cash contribution equal to 10% of GNF costs (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.

Table 6-7 provides a breakdown of the initial Federal and non-Federal project costs of the tentatively recommended plan.

The Federal government would assume 100 percent of the operation and maintenance costs for the breakwaters, entrance channel, maneuvering channel, and turning basin. 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.

The non-Federal sponsor is responsible for its share of the GNF costs and 100 percent of the non-GNF costs. The pertinent data table in the front of this report provides a summary of all shared costs.

Table 6- 7. Cost Allocation for East Site Rubblemound 320–Vessel plan (Recommended Plan) (2010 price level)

	Valdez Small Boat Harbor					
	Federal/Non-Federal Initial Cost Apportionment for Potential East Site 320					
	Items	**Total Project Cost ($000)**	**Implementation Costs ($000)**			
			Federal	**%**	**Non-Federal**	**%**
WBS	**General Navigation Features (GNF):**					
10	BREAKWATERS & SEAWALLS - Mobilization	2,840	2,556		284	
10	BREAKWATERS & SEAWALLS	14,168	12,751		1,417	
12	NAVIGATION PORTS & HARBORS	2,882	2,594		288	
16	BANK STABILIZATION	1,391	1,252		139	
30	PED	669	602		67	
31	S&A	823	741		82	
01	LERR (GNF) - Fed admin cost	37	33		4	
	Subtotal 90/10 GNF	22,810	20,529	90	2,281	10
	Other GNF Features					
	Beneficial Use of GNF Dredged Material	788	512	65	276	35
	LERR (GNF) - Acquisition credit	27		0	27	100
	Relocations	802		0	802	100
	Aids to navigation (Associated Cost)	7	7	100	0	0
	Subtotal Other GNF Items	1,624	519		1,105	
	Subtotal of GNF Related Items	24,434	21,048		3,386	
WBS	**Local Service Facilities (LSF)**					
02	RELOCATIONS - Mobilization	2,396	0		2,396	
10	BREAKWATERS & SEAWALLS	0	0		0	
12	NAVIGATION PORTS & HARBORS	24,518	0		24,518	
16	BANK STABILIZATION	1,340	0		1,340	
30	PED	495	0		495	
31	S&A	917	0		917	
01	LERR (LSF)	376	0		376	
	Subtotal LSF Navigation Features	30,042	0	0	30,042	100
	Other LSF Features					
	Beneficial Use of LSF Dredged Material	1,341	-		1,341	100
	Subtotal of LSF Related Items	31,383	0		31,383	
	TOTAL FIRST COST ALLOCATION					
		55,817	21,048		34,769	
	Additional Local Funding Requirement		**Federal**		**Non-Federal**	
	10% of GNF		-2,281		2,281	
	GNF LERR credit (RE, Admin, Relocation)		829		-829	
	Adjustment for GNF with LERR credit		-1,452		1,452	
	FINAL COST ALLOCATION		**Federal**		**Non-Federal**	
			19,596		36,221	
	All Costs are October 2010 price level					

6.7 Views of Local Sponsor

The local sponsor is very supportive of this project and is eager for the Corps to complete this feasibility study. During development of the feasibility study, the local sponsor had indicated their preferred plan was a harbor that would be constructed to the maximum size possible to the east of the SERVS facility without causing undue environmental consequences, and that they would request that plan be their locally preferred alternative. Further information regarding local sponsor views can be found in Section 9.0 Public Involvement.

6.8 Financial Analysis

The sponsor has completed their self certification of financial capability, which is included in the Correspondence Appendix.

7.0 AFFECTED ENVIRONMENT

This section focuses on the principal issues and concerns identified in Section 2.3 and on conditions that constrain or otherwise affect planning for navigation improvements at Valdez and beneficial use of dredged material at Two Moon Bay.

7.1 Physical Environment

The physical environment includes the landform, topography, bathymetry, soils, rocks, aquatic/marine bottom material (sediments), climate, air, and water. Principal concerns about the physical environment are related to constraints on planning, constructing, and operating a project and about issues and concerns related to potential project impacts.

Principal identified constructing and operating constraints are seismicity, water depth, site topography, foundation material composition, potential for icing, waves, and tides. Principal environmental concerns are linked to water quality, air quality, and contamination in sediments.

Port Valdez and Valdez Arm together form a 46-km northeasterly extension of PWS. Port Valdez is a relatively deep, narrow, east-west oriented, glaciated formation that is properly termed a fjord. It extends about 23 km eastward from Valdez Narrows. Port Valdez is about 5 km wide by 18 km long and is shaped somewhat like a bathtub, bounded by steep sides on the north and south with a flat horizontal bottom at a depth of about 240 meters over three-quarters of its length. In the easternmost quarter of the fjord, the bottom rises to the shore at the former townsite of Valdez.

Two Moon Bay is a divided and comparatively narrow bay near the mouth of Port Fidalgo off Prince William Sound. It slopes rapidly from the rocky shoreline into water more than 20 meters deep. Two Moon Bay is relatively distant from glacial inflows and the natural bottom is generally rocky or mixed substrate.

7.1.1 Geology

The geomorphology of northeastern PWS results from a combination of extensive tectonic forces, including regional uplift and intrusion of igneous rocks and massive glaciation. The tectonic forces at work in the Valdez area are associated with its location in the circum-Pacific Seismic Belt and, more specifically, in a tectonic subduction zone where two tectonic plates collide.

The rocks in northeastern PWS are mainly graywacke, slate, and argillite of the Valdez Group, mildly metamorphosed locally to phyllite or green schist facies. Since the last glaciers that covered the region began to recede, these rocks have been rebounding (rising upward toward pre-glacial elevations). Both the depressing process and the ongoing rebounding have created a complex system of joints (regularly occurring cracks) in the rocks.

Seismic Hazards. PWS, including Valdez, is in a seismically active zone. Earthquakes in this zone can be severe and have caused loss of human life and extensive damage to structures and facilities. Earthquakes present hazards from ground rupture, ground shaking, ground failure, and tsunamis. Ground rupture opens the ground surface as the result of fault displacement or ground failures beneath the surface. Ground shaking is movement induced by the energy released by an earthquake. Ground failure is the loss of ground strength by liquefaction, sliding, and other effects of earthquake shaking. Tsunamis are the seismic sea waves caused by the energy release of an earthquake. Eleven major active fault systems within 390 km of Port Valdez are capable of producing earthquakes strong enough to affect Valdez. The dominant earthquake source for Valdez is the tectonic plate boundary that underlies the region around Valdez at a depth of about 12 km.

Most economic and social damage during the 1964 earthquake was along the shoreline of Port Valdez and was caused by ground failures and seiches (mass water movements that may cause damage like tsunamis) generated by submarine ground failures. Ground shaking led to liquefaction of the unsupported delta deposits and submarine sliding, which in turn generated, or at least amplified, the seiches. Most damage was within 1,500 meters of the pre-quake shoreline. The principal causes of damage to structures away from the waterfront were ground rupture and failure liquefaction of saturated sands and gravels underlying structures. About 40 percent of the homes and most of the commercial buildings in Valdez were destroyed or seriously damaged.

Two Moon Bay is a less confined water body than Port Valdez, but is subject to the same seismic forces and to tsunamis from any seismic activity that would affect PWS.

7.1.2 Soils and Sediments

Soil-forming processes have not progressed much in the area. The dominance of mechanical weathering and the steepness of the slopes have allowed formation of only a thin mantle of soil. Below about the 610-meter elevation, vegetation dominated by alder shrub binds the soils. Above this elevation, soil is removed rapidly by landslides and soil creep, thus retarding or preventing the development of soil-holding vegetation. Without benefit of supporting vegetation, the accumulated debris is drawn down by gravity and precipitation, causing active mass wasting.

Marine Sediments. Most of the Port Valdez shoreline is steep and rocky, except where major streams and rivers have formed deltas where they discharge into the fjord. At the eastern end of Port Valdez, the Lowe and Robe rivers and Valdez Glacier Stream have formed the extensive Valdez outwash delta upon which the town of Valdez was located until the 1964 earthquake. The present site of Valdez is an alluvial fan deposited by Mineral Creek. Both the Valdez outwash delta and the Mineral Creek alluvial fan consist of poorly consolidated alluvial and glacial deposits of silt, sand, and gravel. Finer sediments transported into Port Valdez by the streams and rivers have formed tidal flats at the seaward edge of these deltas.

Intertidal and subtidal bottom material at the East harbor site is pro-grading glacial-fluvial sand and gravel that overlies marine deposits consisting primarily of silt with silty sand interbedded. A deeper unit of sand and gravel underlies this layer at depths of 23 to 30 meters. The depth to bedrock is not known, but is assumed to be 100 meters or more. The near-surface sand and gravel materials were deposited as glacially-derived outwash and alluvium. This subangular to subround material is gray to black, ranges from loose to dense, and is poorly sorted. Boulders were not encountered in limited site evaluations except along the shoreline.

Marine bottom material at the East Site is primarily black, non-plastic silt with interbedded silty fine sand. Traces of gravel and organic material are present. Material from soil borings was 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. Figure 7-1 shows intertidal shoreline at the West site.

The USFWS Coordination Act report (Appendix 4) noted: "There is a high silt load traveling via the slow, predominantly west flowing current, resulting in moderate deposition and high turbidity throughout the project area. Substrate within the subtidal areas includes muddy sands, cobbles and a mixture of shale rock, mud, and sand. Adjacent slopes are composed of muddy rock." USFWS SCUBA dive transects in both the East and West site alternatives (Appendix 4) found extensive fine grey mud near shore, grading to very fine soft mud in deeper water (20 meters below MLLW) at the deep end of the transects. Divers noted scattered gravel and individual rocks out to depths of about 8 meters MLLW, but silt evidently covered any hard substrates at greater depths they examined.

Two Moon Bay is far from glaciers and rivers carrying glacial sediment, so there is almost no discernable accumulation of this material. The natural bottom is mostly rocky with relatively small areas where gravel and silt have collected. At the log transfer site, the bottom is largely covered by fine, soft, loose, organic material from decayed coniferous tree bark and woody debris.

Soil and Marine Contaminants. 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) is used to determine whether sediments should be tested for contaminants before dredging. Nine sediment samples were collected from the East alternative 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 (Chemical Data Report, Materials Section, Alaska District U.S. Army Corps of Engineers, 1997).

Figure 7- 1. Intertidal shoreline at the West Site.

Sampling results indicate that the material at the East Site is suitable for inland water disposal. All sediments in the proposed expansion area meet the strictest State of Washington (SMS) 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 East harbor site. Sample -01SD exceeded the PSDDA screening levels for mercury, silver, indeno (1,2,3,-cd) pyrene, total PCB's, total xylenes, and ethylbenzene. This contamination is believed to be from surface spills in the parking lot and the nearby trash pickup container. This sample was collected outside the area that would be dredged for the East site alternative. Screening levels for contaminants were established in the Pacific Northwest as a basis for deciding whether further, more elaborate chemical or biological testing should be conducted before deciding whether material dredged from a site could be discharged into the open marine environment without harming marine biota.

On May 5 and 6, 2000, sediments samples were collected from test pits at the East and West harbor sites. The sediment samples were analyzed for VOCs, SVOCs, diesel range organics, residual range organics, metals, pesticides, PCBs and total organic carbon, and sulfate. Analytical results were compared with PSDDA, SMS, and Lower Columbia River Management Area (LCRMA) guidance documents. No reported results or method detection limits from this sampling series were above the PSDDA or LCRMA maximum levels or biological trigger values (Chemical Data Report, Materials Section, Alaska District U.S. Army Corps of Engineers, 2000).

The Corps prepared a Final Chemical Report in 2004 for the West harbor alternative site. This effort was performed concurrently with the geotechnical survey of the site. Three auger points were drilled and field screened for volatile contaminants. Selected composite samples were analyzed for fuels, volatile organic compounds, semi-volatile organic compounds, total organic carbon, ammonia, sulfides, organo-tins, total volatile solids, metals, pesticides, and PCB's. This limited effort showed no evidence of soil contamination in the field screening or analytical results.

Chemical sampling on these three separate occasions found contaminants at one sampling site outside the tentatively proposed harbor area, but none were at screening levels in the area where the harbor would be constructed.

The Two Moon Bay log transfer site was permitted by the Alaska Department of Natural Resources to the Tatitlek Corporation between 1986, when the initial letter of entry was issued, and about 1999, when the site lease was relinquished and the State closed the file. During that time it expanded from an initial 0.4 ha lease to a final lease of about 10 ha, making it one of the larger log transfer sites in PWS. Divers surveying the site estimated that about 70 to 80 percent of sea bottom at the site was substantially covered with bark and other debris from the coniferous logs that were yarded and rafted together to be towed to processing facilities or transferred onto barges and ships.

Studies of log transfer sites summarized by The Rivers and Smith Salmon Ecosystems Planning Group (RSSEPS) (2004) define a slow process of bark and debris decomposition that may span decades. Initial decomposition produces hydrogen sulfide, ammonia, terpenes, tropolones, and other toxic compounds that may limit biota in and on the substrate. Ammonia and hydrogen sulfide are produced by the anaerobic breakdown of most organic material. Bottom muck disturbed in even the cleanest marine environments is likely to release the characteristic "rotten egg" odor of hydrogen sulfide. Exchange of seawater and oxygen through the interstitial space between soil particles tends to allow this material to slowly diffuse from bottom mud. Diffusion reportedly is slower from bark and debris beneath log transfer facilities, presumably because the decomposing bark forms tighter substrates with less interstitial space for diffusion and exchange. This property also tends to lessen oxygen transfer, which may prolong anaerobic conditions in that substrate. Cellulose and lignin apparently are the most enduring of the debris components at the end of the biodegradation process and may be present a decade or more after bacteria have broken down almost all other organic constituents of the debris.

Coordination with the Alaska Department of Environmental Conservation during initial evaluation of restoration alternatives determined that this decomposing bark is not suitable for in-water disposal. Earlier evaluations of habitat restoration alternatives found that it would be infeasible to collect this material for remediation on-shore at Two Moon Bay or at an off-site facility.

7.1.3 Climate

Summers typically are cool and winter temperatures usually are relatively mild in Valdez. The mean annual temperature is 3.5 °C; the average summer temperature is 10.3 °C, while winter mean temperature is -4.2 °C. Cold polar air masses often meet warm, moist maritime air masses in this region. These combine to produce average annual precipitation of more than 1.6 meters annually. Winds are generally from the north-northwest between October and March and from the southwest-west between May and August.

Climatic conditions have not been recorded at Two Moon Bay. Temperatures, precipitation, and other conditions there probably are about like those of Valdez, but with less extreme temperatures in the winter and more precipitation because it is closer to large marine water masses.

7.1.4 Freshwater Inflow

Major freshwater inflow sources to Port Valdez include Shoup Glacier Stream, Mineral Creek, Valdez Glacier Stream, and Lowe River. Shoup Glacier Stream discharges into the northeast corner of Port Valdez. Mineral Creek flows along the western edge of Valdez before discharging into Port Valdez. It drains about 119 km^2. Lowe River originates in the mountains approximately 45 km east of Valdez, draining an area of 896 km^2, 35 percent of which is covered by glaciers. Lowe River discharges into the southeast corner of Port Valdez.

Valdez Glacier Stream flows approximately 6 km from the terminus of Valdez Glacier to the northeast corner of Port Valdez. It flows across a wide outwash delta composed primarily of silty sand and gravel. The old Valdez townsite was located on this outwash until it was destroyed by the 1964 earthquake. Valdez Glacier Stream drains an area of 412 km^2, over half of which is covered by glacier.

Both the East and West harbor alternative sites at Valdez are away from direct freshwater inflow from streams that could cause or exacerbate icing in a new harbor.

Two Moon Bay receives fresh water from small, local intermittent, and perennial streams. Freshwater inflow is too minor to substantially affect marine characteristics of Two Moon Bay.

Groundwater at Valdez is limited to glacially formed stream valleys containing deposits of mixed alluvium, colluvium, and glacial outwash deposits. Those deposits serve as aquifers that are recharged by snowmelt, glacier melt, and rainfall from late spring through late fall.

7.1.5 Marine Water Characteristics and Movement

Especially notable are the large amounts of glacial silt and sediment deposited in Port Valdez by Lowe River and Valdez Glacier Stream. Figure 7-2 shows summer turbidity at the project site.

Figure 7- 2. Turbidity at the project site.

Divers noted strong turbidity stratification in the summer, with the highly turbid glacially influenced water in the upper 3 meters and less turbid water beneath.

Barron and Barron (2005) reported that in some parts of Port Valdez, 99 percent of ultraviolet light was attenuated in the first centimeter of surface water, while in outer PWS it penetrated more than 5 meters before the same level of attenuation.

7.1.6 Circulation

The Port Valdez fjord is a "positive" estuary; it receives more fresh water by runoff and precipitation than is lost through evaporation. Each summer, this sets up typical estuarine circulation, with seaward movement of a warmer, brackish upper layer and landward movement of cooler, deeper, more saline ocean waters. The tidal prism (ratio of water that comes in with each high tide) is about 1.6 percent of the total volume of Port Valdez. Recent estimates of freshwater inputs to the fjord during maximum runoff (July) suggest a mean value of about 7 percent of the tidal prism with extreme values of 2 to 15 percent. The major portion of freshwater input is from Lowe River, Valdez Glacier Stream, and Mineral Creek.

Brackish water is confined to the top 15 meters of the water column during the summer, overlaying the heavier, saltier water from PWS (Valdez Coastal Management Program report, 1982). As freshwater inflow declines in the autumn, stratification breaks down and water temperature and salinity become more uniform through the water column.

Tidal and weather-induced flows create a fairly vigorous current structure in Valdez Narrows. Current measurements at the eastern end of Port Valdez have suggested water movement there is sluggish.

Port Valdez tides are mixed (both diurnal and semi-diurnal). Table 7-1 lists the tidal data.

Table 7- 1. Tidal Data, Measured, from Mean Lower Low Water in Meters

Extreme High Tide	5.20
Mean Higher High Water	3.70
Mean High Water	3.42
Mean Tide	1.98
Mean Low Water	0.46
Mean Lower Low Water	0.00
Lowest Observed Water Level	-1.51

7.1.7 Air Quality

Air quality in Valdez is strongly influenced by sources of contaminants and the topographic/meteorological characteristics that affect air movement and the dispersion of pollutants. Contaminants are from combustion of fossil fuels for transportation and power generation and fugitive hydrocarbon compounds from fuel storage and transfer at the Alyeska Terminal complex and associated tanker traffic. Port Valdez is surrounded by steep mountains. Several glacial and river valleys feed into Valdez. These topographic characteristics create a complex "bowl-like" effect that reduces air circulation and mixing. The relatively high frequency of calm surface winds accompanied by early morning surface inversions and stable above-surface layers can allow air pollutants to accumulate. Overall, however, air quality in Port Valdez is good, and Valdez is not in a non-attainment area.

Two Moon Bay is distant from industry, populations, mining, and transportation. Air quality is unimpaired by local or regional sources.

7.2 Biological Environment

Public and agency scoping, field observations, and literature identified principal biological resources of concern at Valdez and in Two Moon Bay. The importance of some biota is defined or implied by statute. The following biota are represented in Port Valdez and/or Two Moon Bay and are specifically protected:

Fish (Magnuson-Stevens Act)
Marine Mammals (Marine Mammal Protection Act)
Birds (Migratory Bird Act)
Threatened and Endangered Species (Endangered Species Act)
Bald Eagles (Bald and Golden Eagle Protection Act)

Department of Interior Coordination Act reports also may identify important biological resources. The Valdez U.S Fish and Wildlife Coordination Act report (Appendix 4) identified important resources in terms of assemblages and habitats. It focused on birds (primarily sea birds, waterfowl, and shorebirds), marine mammals, and salmon. It also briefly identified some of the important habitat at harbor sites considered in detail, but focused more on nearby tidelands and wetlands (Duck Flats and Harbor Cove) that could be affected by coastal development.

Coastal management plans identify important resources and develop policies to protect them. Navigation improvements at Valdez could affect six habitats classified in Coastal Zone Management Act planning and addressed by the Magnuson-Stevens Act. They are as follows:

Essential fish habitats
Estuaries
Wetlands and tide flats
Intertidal and near-shore subtidal communities
Rocky islands and sea cliffs
Deep-water communities (offshore habitats)

Literature reviews, public and agency scoping, and review of the resources protected by statute were synthesized into the following list of resources that are of particular concern for the Port Valdez and Two Moon Bay areas:

Wetlands and tidal flats
Marine algae and eelgrass
Marine invertebrate assemblages important to fish, birds, and sea mammals
Marine and anadromous fish
Birds
Marine mammals

This section of the Valdez report describes those resources and focuses on species, communities, and habitats that are of particular concern. The next section (Section 8) addresses potential effects a new navigation project and dredged material placement could cause to those resources.

7.2.1 Wetlands and Tidal Flats

Wetlands and tidal flats are freshwater and saltwater habitats with and without vegetation. Wetlands are vegetated areas that are partially submerged either continuously or periodically. Saltwater wetlands are coastal areas along sheltered shorelines characterized by halophytic hydrophytes (moisture-tolerant plants growing in a saline soil) and macroalgae extending from extreme low tide to an area above extreme high tide that is influenced by sea spray or tidally influenced water table changes. Freshwater wetlands contain water of less than 0.5 parts per thousand salt content and do not exceed 3 meters in depth. Tidal flats are unvegetated areas that are alternately exposed and inundated by falling and rising tides.

Saltwater wetlands and the associated tidal flats are common in eastern Port Valdez, but less common west of the Alyeska Terminal and Gold Creek. Major saltwater wetlands and tidal flats in Port Valdez extend from the southwest portion of the Duck Flats to the northwest edge of the Duck Flats. Additional significant wetlands and tidal flats in Port Valdez are at Mineral Creek Flats and Gold Creek.

The generally estuarine condition of Port Valdez is evident in the vegetation communities of the saltwater wetlands. They typically contain vegetation and algae common to fresh or brackish water rather than marine vegetation and algae.

The Duck Flats. These are northeast of the harbor sites considered in detail and consist of about 400 ha of highly productive intertidal fish and wildlife habitat. Predominant wetlands in the Duck Flats are intertidal estuarine salt marsh, which depends on daily tidal inundation and freshwater flow from coastal streams. The salt marsh segment of the flats is the largest salt marsh in Valdez Arm. This area has been called the most productive biological community in Port Valdez. Its high natural productivity, plant and animal diversity, and habitat value for biological resources all contribute to its regional importance. The Duck Flats has been nominated as a coastal area meriting special attention in coastal management planning for the Valdez area.

Harbor Cove. This is a 20-ha water body east of the existing Valdez Harbor. It is protected by reefs and reef-like islands to the south, the existing Valdez Harbor to the west and southwest, and bounded by the Duck Flats to the north (figures 3-2 and 4-3). It is shallow, less than 3 meters deep at low tide, and mostly soft bottomed. It contributes to the intertidal characteristics of the Duck Flats and is significant habitat in its own right. It is influenced more by freshwater runoff than the main body of Port Valdez. It tends to be warmer and is less subject to waves and currents than most of Port Valdez.

Tide Pool Habitat. Depressions in the intertidal shoreline retain water and remain immersed during each tidal cycle. Those depressions may be small, a few centimeters across in the space between rocks for example, or may be several meters across. Organisms in tide pools may be separated from the main water body for hours each tidal cycle or for only a few minutes at the lowest tides of the year. Temperatures, dissolved oxygen, salinity, and turbidity in tide pools may be markedly different from the larger water body during the periods when they are isolated. Tide pools can be lush habitats on shorelines where marine waters are clear and may contain biological assemblages that are uncommon elsewhere. Tide pools on the silty shores of Port Valdez typically are shallow and less abundantly populated. They may, however, be a distinct habitat type and may function as habitat for invertebrates and small fish. Those mudflat tide pools also may offer shorebirds feeding opportunities they might not find elsewhere.

Tide pools were mapped at the east and west alternative harbor sites. Their locations are shown in figures 7-5, 7-8, 7-10 and 7-11. Tide pools are not present at or near the proposed dredged material disposal site in Two Moon Bay. Biologists surveying the East and West alternative harbor sites mapped tide pools in the mudflats there but did not note any substantial difference between biota in the tide pools and in the surrounding exposed mudflats. Shorebirds may feed more often or more successfully in the tide pools than in the surrounding habitat, but observations at the project site alternatives were inconclusive. Tide pools are treated as potentially valuable habitat because that function cannot be dismissed with available information.

7.2.2 Marine Algae and Eelgrass

Phytoplankton in PWS peaks in April, then declines in late spring and summer as suspended glacial flour (finely ground rock particles that are easily suspended in water) diffracts and limits sunlight penetration, which limits algal photosynthesis. Barron and Barron (2005) reported that 99 percent of ultraviolet light is attenuated about 2.5 meters deep in outer Valdez Arm and at about twice that depth in the open marine waters of central PWS. The same source reported that the same degree of attenuation was observed in the first few centimeters of surface water at some observation points in Port Valdez.

The clearer waters of outer Valdez Arm support dense beds of eelgrass (*Zostera* sp.), with individual plants more than 2 meters long and highly diverse and productive kelp assemblages on almost all of the abundant rocky bottom habitat down to depths of 20 meters or more. As might be expected, the limited light penetration in Port Valdez profoundly reduces primary productivity by phytoplankton, kelps, and eelgrass (the only vascular marine plant in Port Valdez).

Distribution, abundance, and diversity of kelp, other marine algae, and eelgrass in the alternative sites considered in detail may be largely determined by three abotic factors:

1. Desiccation, temperature, and ice scouring limit community development in the upper intertidal range;

2. Soft or shifting bottom material in most of the habitat provides limited anchoring sites for the larger kelps, and suitable bottom composition for eelgrass is comparatively rare;

3. Restricted light penetration limits photoproduction by attached algae and plants so that they can survive only in intertidal or the very shallow subtidal habitats, where they are exposed to light frequently enough to allow enough productivity for survival. Photosynthesis in this comparatively limited vertical range is further limited by silt that settles on eelgrass and kelp and further reduces available sunlight.

Feder and Keiser (1980) and Feder and Bryson-Schwafel (1988), Lees et al. (1979), USFWS appendix), and Corps biologists have at various times in the last 3 decades identified eelgrass and algae, and their distribution in or near the alternative project sites in Port Valdez. Their general observations can be summarized as follows:

The limited rocky intertidal habitat supports comparatively dense patches of rockweed (*Fucus distichus*) along a band at the -1-meter contour. Green algae *Monostroma* sp.) and other algae also are present. The mud and sand in this intertidal reach support sparse ribbon kelp other scattered (mostly brown) algae. A noteworthy band of kelp (*Laminaria saccharina*) runs along the lower margin of the tide line (deeper than about 0.5 meter MLLW) nearly continuously through the alternative sites. Figure 7-3 shows the laminaria kelp band in the project area. Several small and relatively sparse (4-square-meter) eelgrass patches are in the subtidal regions both west and east of the SERVS pier. Figure 7-4 shows an unusually luxuriant patch of eelgrass in the project area.

East Site. Feder and Keiser (1980) described algae at the East alternative site from their Island Flats (Duck Flats) station as follows:

> "The high intertidal zone at Island Flat is dominated throughout the year by the brown alga kelp *Fucus distichus*; the green alga *Ulothrix flacca* fluctuates seasonally in abundance. Other algae, which also appear in the high intertidal zone during summer and fall, are *Pylaiella littoralis* and *Enteromorpha* spp. *Fucus distichus* extends down into the mid-intertidal zone.
>
> In early spring diatoms form a noticeable brown cover on low intertidal rocks and sediment, and subsequently disappear by early summer. The characteristic low intertidal band of *Monostroma spp*. undergoes a spring-summer proliferation, with subsequent reduction in abundance in the fall and winter. The filamentous red alga, *Pterosiphonia bipinnata*, persists as a low intertidal species throughout most of the year, much the same as the rare yet consistent occurrence of the snail *L. scutulata*.

Figure 7- 3. Laminaria kelp band in the project area.

FFigure 7- 4. Eelgrass patch in the project area.

> *Collisella pelta* reaches its highest densities at the 0.0-meter height at Island Flats, and exhibits seasonal fluctuations. The additional agal species sampled are primarily low intertidal in distribution and early spring-summer ephemerals."

Lees et al. (1979) also investigated intertidal and shallow subtidal habitat in Port Valdez and summarized their findings as infaunal and visually observed species assemblages.

Corps and NMFS biologists' observations matched those of Feder and Keiser (1980); *Fucus distichus* grew abundantly in a narrow band along the higher intertidal zone at the base of Hotel Hill but less abundantly down to about 0 meter MLLW on the tide flat. *Monostroma* and *Ulothrix* were present in low abundance, and *Laminaria* grew in a narrow band starting about the -0.9-meter depth and probably grew in water deeper than -1 meter.

Feder and Keiser (1980) did not mention eelgrass (*Zostera marina*) at the East harbor site during their 1976 to 1978 study. Lee et al. (1979) reported small patches of eelgrass at this site, and biologists reported the same in August 2005. The 2005 report noted that eelgrass at the East harbor site was limited to depressions in the *M. edulis* bed where silt has collected to sufficient depth for the plant to take root.

Figures 7-6 and 7-7 show the distribution of rockweed and laminaria, the two principal kelps in the area and of eelgrass at the East site.

West Site. Figures 7-9 and 7-12 map the distribution of the two principal kelps (rockweed and laminaria) and eelgrass at the West site. That figure indicates the total extent of laminaria habitat is about the same at both sites. The West site had about the same extent of rockweed as the East site, but rockweed was not as dense, and there was no heavy rockweed cover along the shoreline that figures 7-6 and 7-7 show at the East site. Species diversity was judged to be richer at the East site during the 2005 Corps-NMFS surveys, but the differences were not quantified.

7.2.3 Intertidal invertebrates

The intertidal and shallow subtidal habitats of PWS were profoundly altered by the great 1964 Alaska earthquake, which raised the sea floor by 7 meters at some locations. Scouring by tsunamis and seiches set up by that event wiped out major communities, altered bottom composition over wide areas, and produced wide-spread sediment movement that buried other habitats. Much of PWS shoreline is still evolving into a new substrate and biological equilibrium.

Invertebrates in the intertidal and shallow subtidal habitats in Port Valdez range in size from tiny crustaceans less than 1 mm long to much larger sea stars, bivalves, and other mollusks. Harpacticoid copepods are the smallest of the invertebrates specifically reported in the alternative harbor sites. These little crustaceans typically feed on filamentous diatom algae, were abundant throughout both the East and West sites, and are important to several species of juvenile fish, including chum salmon. They typically live on or close to the bottom.

East Site. Amphipods, a group of small crustaceans, were abundant in the heavier rockweed (*Fucus*) community in the upper tidal range at the East alternative site (figures 7-5 and 7-8). Several types of snails, including periwinkles (primarily *Littorina sitkiana)* and whelks *(Nucella lamellose)*, also crawl slowly over the bottom feeding on mussels, clams, and other bottom organisms. They are widely spread over the area but winter in deeper water and are more abundant in the shallows only during the summer (Feder and Keiser 1980).

Barnacles *(Balanus* spp.) are abundant, but typically small. Their spat settle on hard surfaces in mid summer and grow well into autumn, but few survive the rigors of winter. Limpets (*Collisella pelta)* and blue mussels (*Mytilus edulis)* attach to hard surfaces in intertidal and subtidal habitats throughout the area and are moderately abundant. In optimum habitat, mussels may attach to each other and aggregate with rockweed and other kelp to form dense blankets more than 20 cm thick. Mussels at the harbor site alternatives are much more modest in size, typically less than 3 cm long, and are most densely aggregated where the bottom has more gravel and less soft mud. Even in this firmer substrate they were partially smothered in mud. In this habitat, they have not colonized into the thick beds that would be found in less turbid areas of PWS. Mussel beds mapped at the East alternative harbor site are shown in figures 7-5 and 7-8.

Sea stars were absent from the East alternative site during summer field surveys, but have been reported there in the spring. Sea stars typically prefer salinity at close to marine levels, so they may have moved out of the warmer, less saline shallower water and into deeper water during the summer. Isopods, limpets, and shore crabs (*Hemigrapsus oregonensis*) were present, but not abundant, at the upper tidal range during the August 2005 survey, but urchins and predatory snails seen by Feder and Keiser (1980) were not seen in the August survey, possibly because salinity is low along the shoreline during the summer.

Worms and clams are the predominant infauna (biomass below the surface of the sea bottom) in most of the intertidal range at the East site. Lees et al. (1979) defined the infaunal assemblage in the East site and in the Harbor Cove area as the *Polydora-Macoma-Haploscoloplos* complex. *Polydora* and *Haploscoloplos* are genera of polychaetes (segmented worms widely distributed in marine waters and as burrowing animals in marine bottom habitat). *Macoma* is a genus of small clams that are widely distributed along the Alaska coast. Small, *Macoma balthica* clams were abundant at the East alternative site during the 2005 survey. *Mya* (a genus of small clams) a maximum of about 7.5 cm long were also present about 15 cm deep in soft substrate.

Feder and Keiser (1980) did not mention cockles (*Clinocardium spp.*), but small numbers of cockles were also found at the East site during the 2005 survey. This suggests that some bivalves are recolonizing as the intertidal shoreline at Port Valdez continues to recover from the 1964 earthquake. Hard-shelled, littleneck clams (*Prothaca staminea*) were not seen during the August 2005 survey, but they might be present in the lower intertidal or near subtidal zones. A species of soft-shelled clam, *Mya arenaria* was apparently widespread in Port Valdez prior to the 1964 earthquake and its devastating tsunami, but was limited in post earthquake distribution to small sandy areas near Mineral Creek and Island Flats (Feder and Bryson-Schwafel 1988, Lee et al. 1979). They are present, but apparently are not abundant, in the areas shown as sea otter digs in figures 7-5 and 7-8.

The polychaete worm species *Polydora quadrilobata* and *P. panamensis* and the spoonworm species *Echinurus* were more common in the lower intertidal and near-subtidal habitat. They were most abundant in association with *Laminaria* kelp, so they were most abundant in the area shown as *Laminaria* habitat in figures 7-6 and 7-7.

West Site. The August 2005 survey found no apparent significant differences between invertebrate species makeup at the East and West alternative sites. The West site is similar to the East except that mussels cover more of the West site, and they appear to have less silt cover. While mussels and other epifaunal species tended to be more abundant at the West site, there was less muddy habitat and sparser populations of borrowing clams and worms.

Two Moon Bay Site. The intertidal habitat at Two Moon Bay is a narrow band that drops steeply into deeper water. It is well separated from the site proposed for beneficial use of dredged material and was not surveyed for biological resources for this project.

7.2.4 Subtidal Biota

The subtidal habitat in Port Valdez includes areas of subtidal rocks and mud slopes and the deep basin ocean floor (Feder at al 1973). Two Moon Bay has a sloping bottom that drops into deeper water that has been substantially modified by deposited logging debris.

Near-shore subtidal habitats are similar at both the East and West alternative sites. Neither site is inhabited by diverse or highly productive biological assemblages. The areas examined can be divided into shelf and slope habitats on the basis of slope gradient and sediment consolidation. The biological assemblage inhabiting the shelf is basically the same as that described for the lower intertidal zone, but extends out to a depth of about -4 meters MLLW. Laminaria kelp is in a distinctive band.

On the slope, the most important organisms are polychaete worms and clams. As is the case for the intertidal assemblages, the slope and shelf assemblage depends heavily on organic debris, and deposit feeders are dominant fauna. Biomass and productivity of the worms *Nephtys* and *Lumbrineris* and the clam *Axinopsida* appear low. Utilization appears slight with tanner crabs apparently constituting the most important predator. Moderate numbers of very small juvenile tanner crabs inhabit the slope. Animals living on the shelf and on the slope are characteristic of mud bottom biotic assemblages. Slope habitat may be a nursery area for juvenile tanner crabs.

The near-shore shelf that bounds the Port Valdez shoreline drops steeply into water more than 200 meters deep. That deep water habitat is beyond any of the harbor improvement alternatives considered for this action, but it was evaluated as a disposal area for dredged material. More than 200 invertebrate taxa were reported from benthic sampling throughout Port Valdez from 1971 to 1985, (Hood et al., 1973), Feder and Matheke (1980a), (Feder et al 1973), (Feder and Shaw, 1986), (Feder and Jewett, 1988). Those sources reported that annelids were the most diverse invertebrates. Various species were widely distributed throughout Port Valdez. Polychaetes were the most abundant annelids in that habitat.

Clams, snails, and other mollusks were second in importance. Echinoderms (sea stars and sand dollars) were the only other significant group. These worms and other invertebrates that live in bottom material are primarily deposit-feeding organisms that are adapted to soft-bottom environments. The composition, distribution, and abundance of organisms in this habitat appear to be controlled primarily by the deposition of glacially derived sediments. They are less abundant in eastern Port Valdez where sedimentation rates are high. The general diversity, biomass, and abundance are lower in Port Valdez than similar substrates in the Gulf of Alaska.

Feder and Paul (1977) took several trawl samples in Port Valdez in the vicinity of the Trans-Alaska Pipeline System terminal in depths of 38 to 73 meters. Young tanner crab (*Chionoecetes bairdii)* and shrimp (*Pandalus borealis* and *Pandalopsis dispar*) dominated the catches. They also collected small numbers of Dungeness and king crab. There is a recreational fishery for Dungeness crab in the shallow eastern part of Port Valdez. Lower salinity, higher suspended solids, and warmer temperatures may displace some motile species during the summer, as has been observed in other Alaska estuaries.

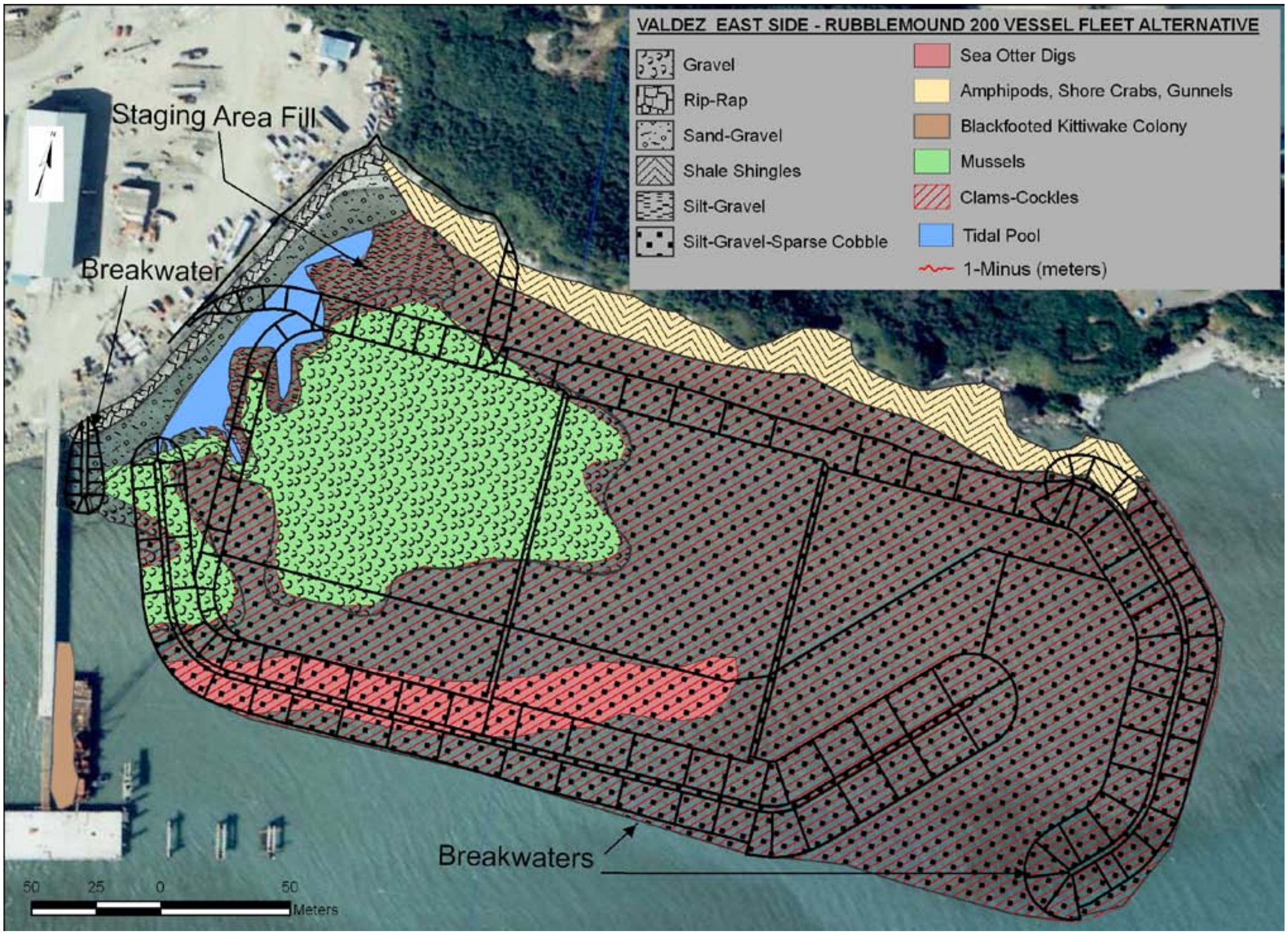

Figure 7- 5. Substrate types and biotic associations of the East Site, 200–Vessel Alternative Plan.

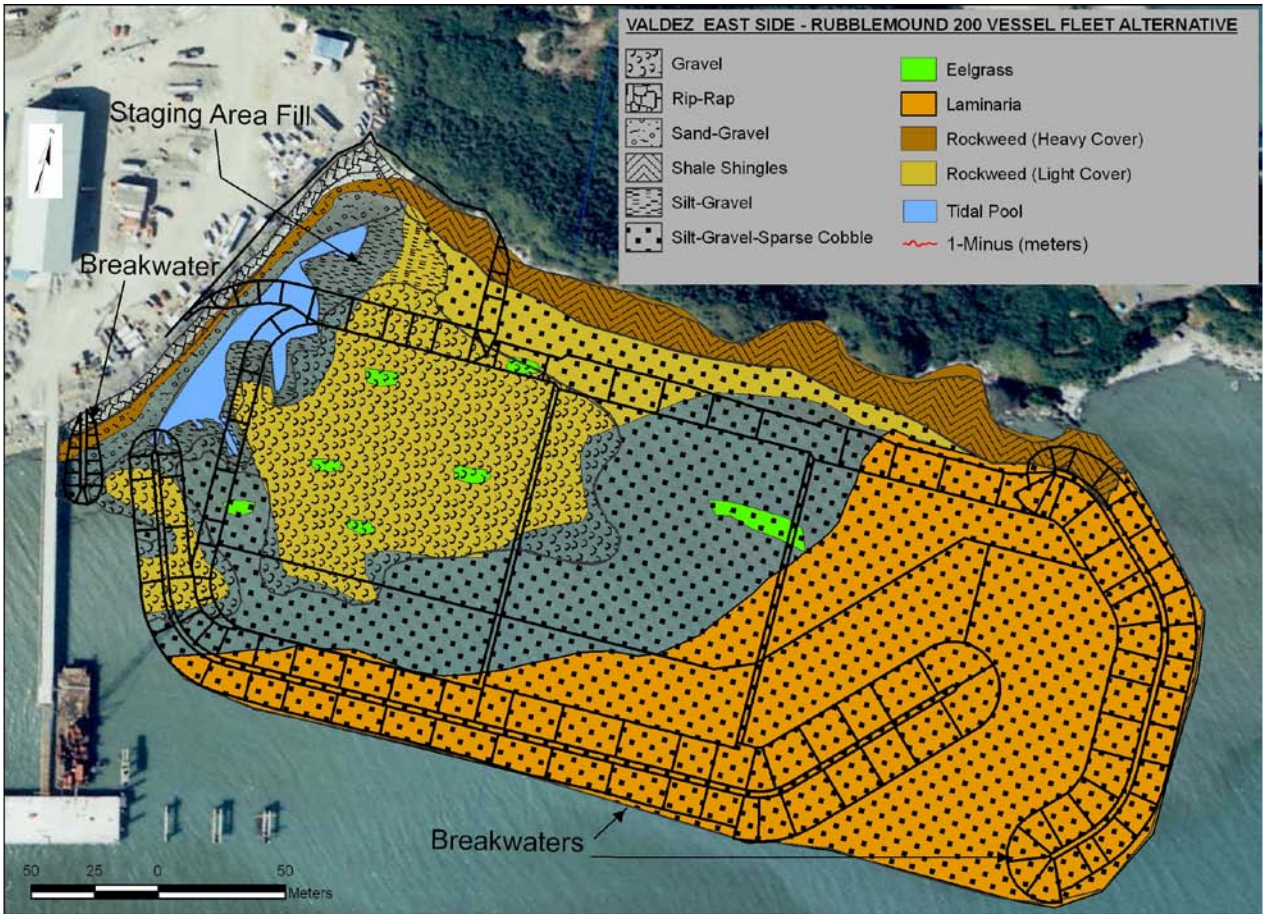

Figure 7- 6. Substrate Types and vegetative associations for the East Site, 200–Vessel Alternative Plan.

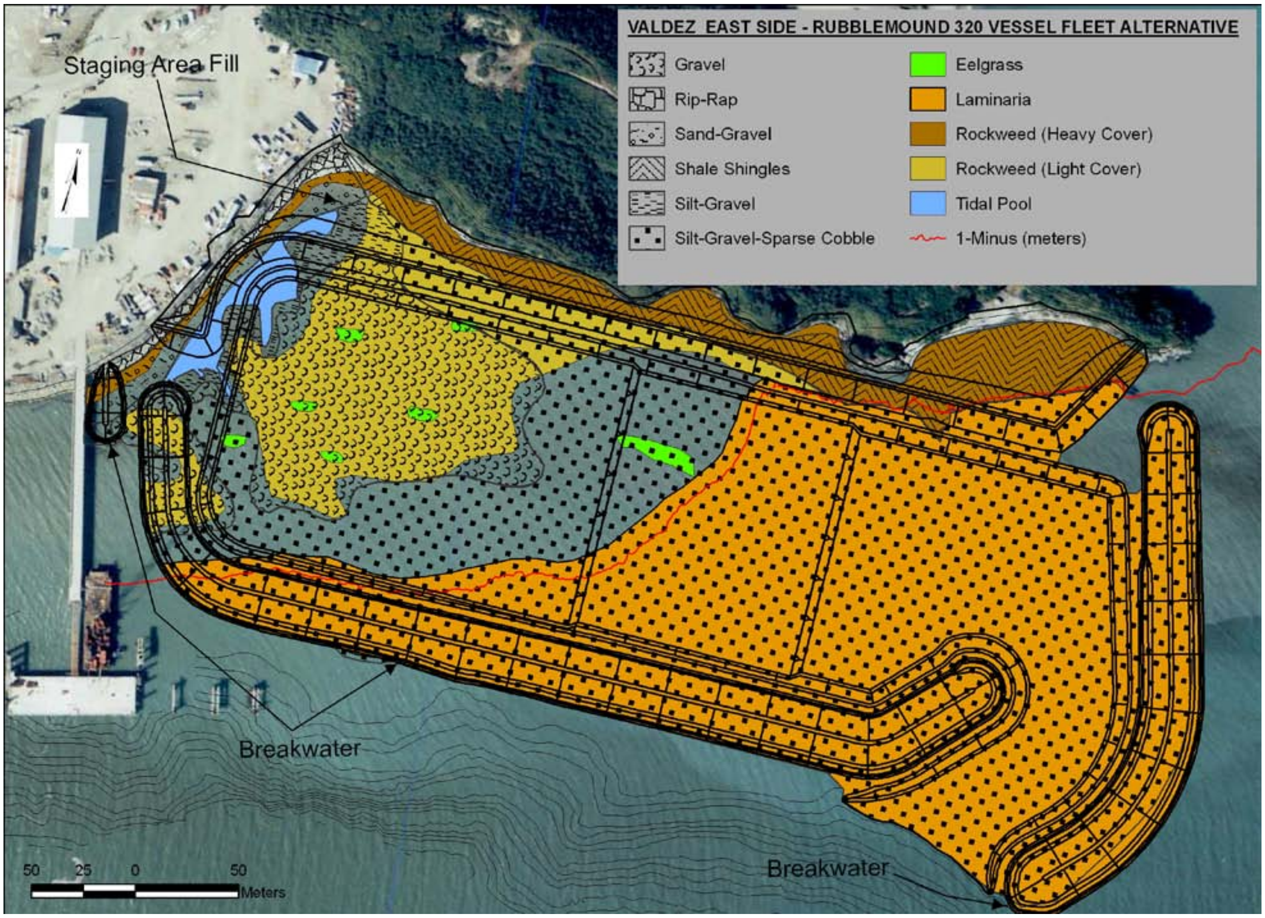

Figure 7- 7. Substrate types and vegetative associations for the East Site, 320–Vessel Alternative Plan.

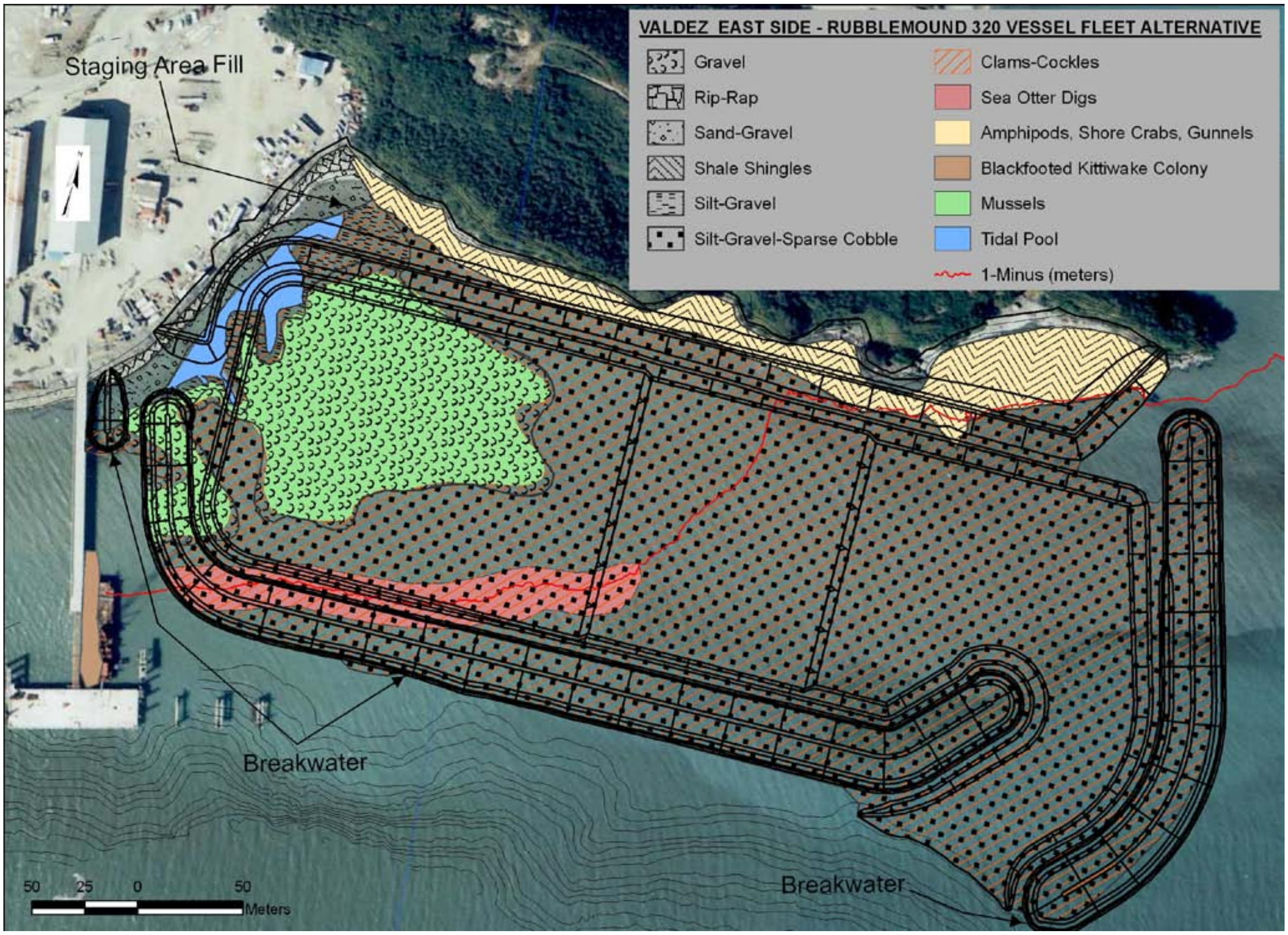

Figure 7- 8. Substrate types and biotic associations for the East Site, 320–Vessel Alternative Plan

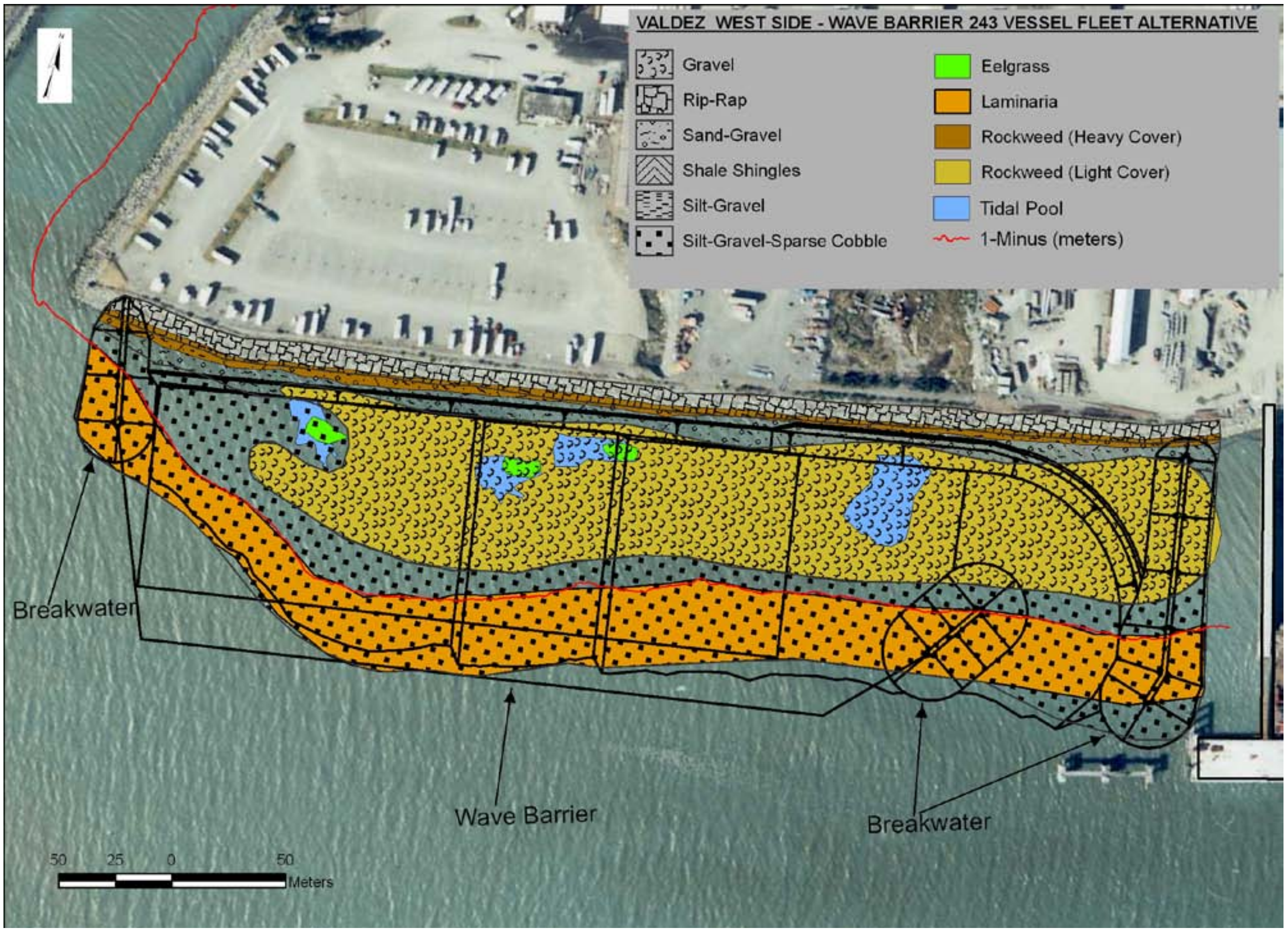

Figure 7- 9. Substrate types and vegetative associations for the West Site, 243–Vessel Alternative Plan.

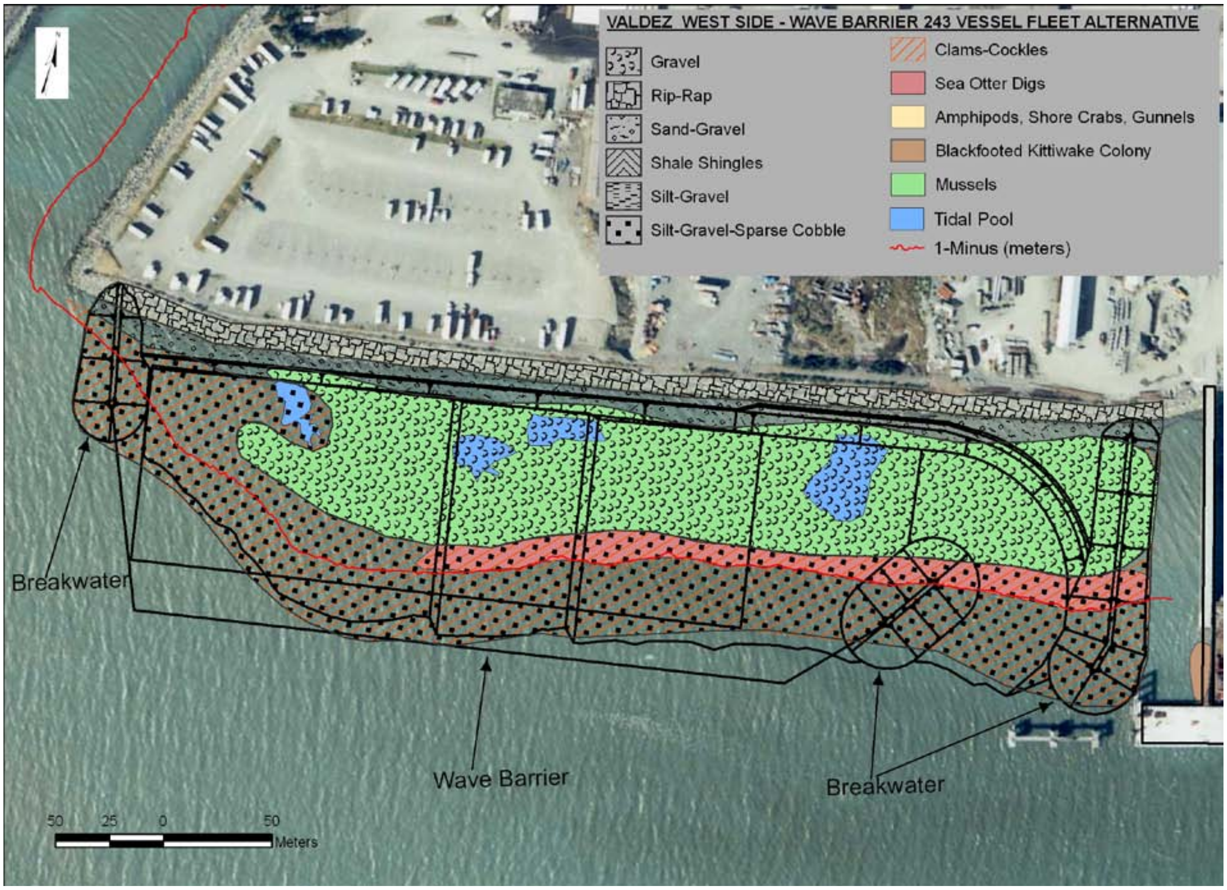

Figure 7- 10. Substrate types and biotic associations for the West Site, 243-Vessel Alternative Plan.

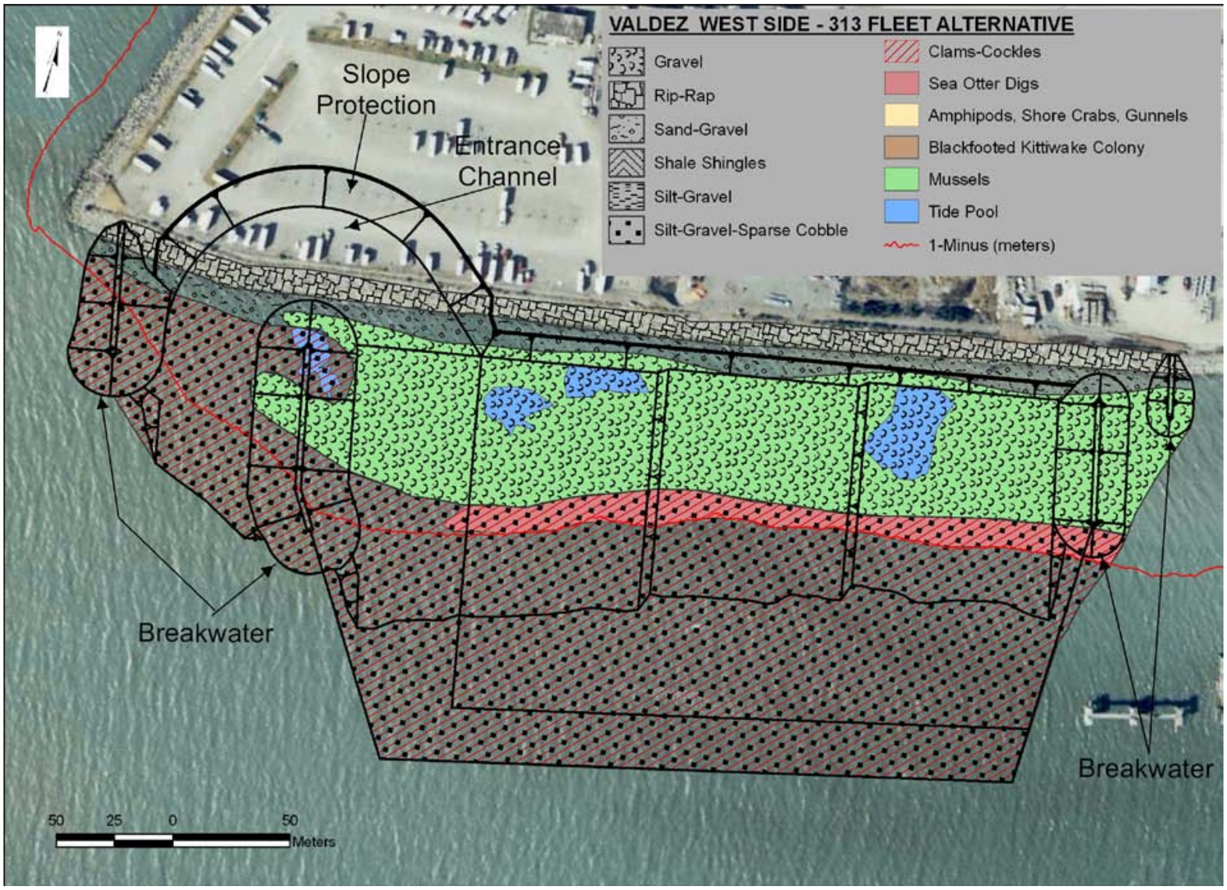

Figure 7- 11. Substrate types and biotic associations for the West Site, 320-Vessel Alternative plan.

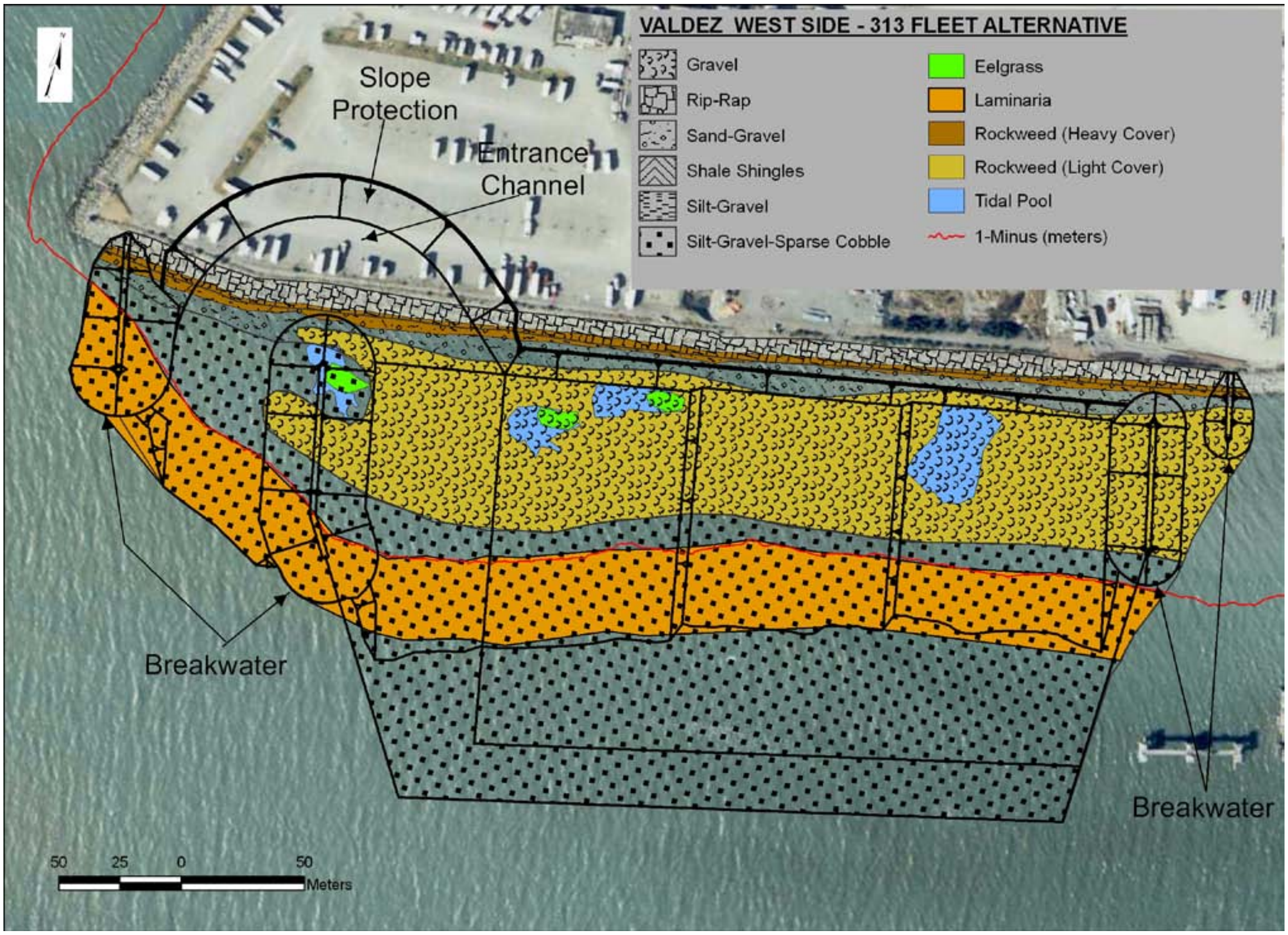

Figure 7- 12. Substrate types and vegetative associations for the West Site. 320–Vessel Alternative Plan.

7.2.5 Marine and Anadromous Fish

Marine Fish. Marine fish species in the deep Port Valdez offshore area are low in abundance but reasonably diverse in species. Twenty-three species including five species of flounder, one species of skate, and members of the cod and sculpin families are found in the offshore waters of Port Valdez. Pacific Ocean perch and yellow-eye rockfish suggest there is some hard bottom in the area. Shallow regions of the offshore area are more diverse, with both rocky and soft subtidal habitats. Herring spawn in the shallow subtidal algal beds of Jack Bay and Valdez Arm, primarily in April and May, but are not known to spawn in Port Valdez.

Anadromous Fish. Four species of Pacific salmon (pink, chum, coho, and sockeye) inhabit eastern Port Valdez during part of their life history and use tributary streams for spawning. During the summer, adult salmon enter Port Valdez and spend a period of up to 6 weeks in Port Valdez prior to entering their spawning streams. City Limits, Ess, Siwash, Mineral, and Sewage Lagoon creeks, Loop Road Streams 1 and 2, and the Robe Lake and Lowe River systems are the largest producers.

Pink and chum salmon fry emerge from the gravels of their home streams in the spring and shortly after proceed down into the estuarine environment. Solomon Gulch Hatchery releases fry directly into the estuarine environment. Chum salmon fry outmigrate from about April 15 until the end of May, with a peak in late April. Pink salmon outmigration peaks around the middle of May.

Chum fry spend at least 2 weeks and perhaps longer in the Island Flat area and in other near-shore habitats while they feed heavily on copepods, other small benthic, and free swimming crustaceans. They often feed within 1 meter of shore and follow the water's edge as the tide goes in and out.

Pink salmon may not remain in the near-shore shallows as long as the chum fry (Dames and Moore 1979). Coho and sockeye salmon live a year or more in freshwater before outmigrating into Port Valdez. These larger and more motile juveniles are less dependant on near-shore habitat than the much younger and smaller pink and chum juveniles.

Essential Fish Habitat. The 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) amendments mandate that Federal agencies assess the effects of Federal projects on essential fish habitat (EFH [commercial fish stocks in all life stages and associated habitats]) and consult with the Department of Commerce (50 CFR 600.905-930). Groundfish Fishery Management Plans (FMP) list four species categories and the forage fish category. The four categories are the target species category (pollock, cod, etc.); the other species category (sculpins, skates, etc.); the prohibited species category (halibut, herring, etc.); and the nonspecified species category (urchin, rattails, etc.). EFH must be described and identified for species listed in the target species and the other species categories. The prohibited species and the nonspecified species categories are not considered EFH for the purposes of sections 303(a)(7) and 305(b) of the MSA.

Habitats of particular concern are areas known to be important to species in need of additional levels of protection from adverse effects. Sensitivity, exposure, rarity, and the importance of the ecological function of the habitats are considered in determining habitat types of particular concern, which include near-shore areas of intertidal and submerged vegetation, rock, and other substrates. Those areas provide food and rearing habitat for juvenile groundfish and spawning areas for some species. All near-shore marine and estuarine habitats used by Pacific salmon, such as eelgrass beds, submerged aquatic vegetation (seaweeds), emergent vegetated wetlands, and certain intertidal zones, are sensitive to natural or human induced environmental degradation, especially in urban areas and in other areas adjacent to intensive human-induced developmental activities.

Essential fish habitat means waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat: "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

Species that could be expected to use the near-shore habitats in the project area during primarily juvenile life stages include four species of Pacific salmon and fish species such as arrowtooth flounder juveniles and adults, rex sole juveniles and adults, flathead sole adults and juveniles, sablefish adults and juveniles, yellowfin sole adults and juveniles, walleye pollock adults and juveniles, Pacific cod adults and juveniles, sculpin spp. adults and juveniles, tanner crab early juveniles, and various forage fish (National Marine Fisheries Service, et al., Habitat Assessment Reports for Essential Fish Habitat, 1998).

Pacific Salmon. They migrate, spawn, and rear in the near-shore area and streams that drain into Port Valdez. Juvenile salmon use near-shore migration corridors and can be expected to be in the project site seasonally.

Arrowtooth Flounder. This species is distributed in North American waters from central California to the eastern Bering Sea on the continental shelf and upper slope. Adults exhibit a benthic lifestyle. From the over-wintering grounds near the shelf margins and upper slope areas, adults begin a migration onto the middle and inner shelf in April or early May each year with the onset of warmer water temperatures. A protracted and variable spawning period may range from as early as September through March. Juveniles are separate from the adult population, remaining in shallow areas until they reach the 10 to15 cm range. The preferred substrate for juvenile and adults is gravel, mud, and sand.

Flathead, Rex, and Yellowfin Sole**.** (General distribution adults and late juveniles) Adults exhibit a benthic lifestyle and occupy separate winter spawning and summertime feeding distributions. Over wintering grounds are near the shelf margins, and the adults migrate to the mid and outer continental shelf in April or May of each year for feeding. Spawning starts as early as January, primarily in deeper waters near the margins of the shelf. Eggs and larvae are planktonic.

Sablefish. Adults occur along the continental slope and shelf gullies at depths generally greater than 200 meters and are generally known to prefer soft bottoms. Adults are assumed to be demersal. Spawning occurs in late winter or early spring along the continental slope. Eggs are released near the bottom where they incubate. Larvae rise to the surface and are oceanic through the spring and late summer. Feeding areas are those containing meopelagic and benthic fishes, benthic invertebrates, and jellyfish. Juveniles have been observed in many inshore areas during their second summer. They may occasionally enter Port Valdez but are unlikely to be present in appreciable numbers.

Walleye Pollock. Walleye pollock spawn in open waters of PWS about mid-March. Egg development is water temperature dependent. The species goes through a larval stage that is distributed in the upper 40 meters of the water column. Early juveniles are found both pelagically and on the bottom. Strong year classes are found from the outer to inner shelf, while weak year classes are found only on the outer continental shelf. Adults occur both pelagically and demersally on the outer and mid-continental shelf. Adults usually are not associated with coastal waters. Walleye pollock juveniles occur on the outer shelf, upper slope, and basin. They are pelagic fish that could occasionally enter Port Valdez but would not be present in appreciable numbers.

Pacific Cod. Pacific cod is a transoceanic species, occurring at depths from shoreline to 500 meters and associated with mud/silt/clay to gravel substrate. Adults are demersal and form aggregations during the peak spawning season, which extends approximately from January through May. Eggs are demersal and adhesive and hatch in about 15 to 20 days. The next life stage is larval, which undergoes metamorphosis at about 25 to 35 mm. Small cod mainly feed on invertebrates while the large adults mainly eat fish. First-year cod feed on copepods, small mollusks, and other invertebrates associated with marine algae and vegetation. Turbidity and silt in the summer may limit populations along the Port Valdez shoreline, but intertidal and near-subtidal communities are suitable habitat for these fish.

Sculpin. This is a large circumboreal family of demersal fishes inhabiting a wide range of habitats in the North Pacific Ocean and Bering Sea. Habitats range from tide pools to water depths of 1,000 meters. Adult and juvenile sculpins are mainly known to be associated with substrates from mud/silt/clay to gravel. Most sculpins spawn in the winter. Eggs are generally laid among rocks and are guarded by the males. The larval stage is found across broad areas of the continental shelf and slope. Sculpins generally eat small invertebrates and fish. Sculpins inhabit near-shore bottom habitat in Port Valdez and are present at harbor site alternatives.

Tanner Crab. Tanner crabs (*C. bairdi* species) prefer soft, muddy bottoms. They migrate inshore to water generally less than 50 meters deep in February where they remain until June to molt and mate. Tanner crab larvae are planktonic and migrate vertically to feed in the water column. After several molts, the larvae settle to the bottom as juvenile crabs. The juvenile crabs begin a seaward migration soon after settling and are found farther offshore by the late juvenile stage. They are present as juveniles, but the project alternative sites are not typical adult crab habitat.

Forage Fish. Eulachon are found pelagically from the middle shelf to over the slope on unconsolidated bottom. They spawn in rivers on coarse sandy bottom. The larvae drift and develop at sea. Capelin is a coastal fish rarely deeper than 200 meters.

They spawn in spring and summer on coarse sand/fine gravel beaches. Sand lance is an inner shelf (1 to 50 meters) and middle shelf (50 to 100 meters) semi-demersal species associated with sand and gravel habitats. All may be seasonally present in Port Valdez and may use the near-shore and intertidal habitat identified as project alternative sites.

7.2.6 Birds

Black-footed kittiwakes have formed a nesting colony on the SERVS dock between the East and West project sites. They nest on the lower outside flanges of the main structural I-beams of the dock (figure 7-13). Black-footed kittiwakes are indigenous to Alaska, Arctic Canada, and Eurasia where they form large breeding colonies on sea cliffs and man-made structures. The world-wide population of black-footed kittiwakes appears to be stable or increasing. They eat small fish and invertebrates snatched from the water surface. In Southcentral Alaska, from 1 to 3 eggs are laid in late May, and the young birds are normally fledged by the end of July. There are several large colonies of black-footed kittiwakes in PWS. The kittiwakes nesting on the SERVS dock are likely an expansion from nearby colonies.

The small islands east of the alternative sites considered in detail are used by about 30 nesting terns and other birds.

A variety of birds are associated with the salt marshes and tidal flats at Port Valdez. They stage, feed, and nest in that habitat. Canada geese and many species of ducks have been observed in the saltmarsh-tidal flat communities around Port Valdez. Because of its size, the Duck Flats marsh in particular has been identified as important habitat for many species. Fifty-three species of birds were reported from the Duck Flats in a 1979 survey.

Sea birds may loiter in the Port Valdez deep water disposal site, but would not feed on the bottom and would not find habitat there that was not abundant elsewhere in Port Valdez.

One bald eagle nesting site is reported to be in a tree near the Two Moon Bay beneficial dredged material disposal site. Incidental observations at the site indicate that sea birds loiter on the surface at least occasionally, but that Two Moon Bay does not offer habitat that is not at least equally productive and abundant in adjacent waters.

Figure 7- 13. Black-footed kittiwakes nesting on the SERVS dock.

7.2.7 Marine Mammals

Marine Mammals. Harbor seals, sea otters, and sea lions at least use Harbor Cove, the Duck Flats and adjacent islands occasionally, and the surrounding marine waters for feeding and resting. Intertidal habitat between the Valdez Duck Flats and Mineral Creek has been identified as an important area for sea otters (NOAA 2000). Sea otters have been observed to make feeding dives along the outer margin of the East alternative site. Feeding sea otters dig to get mussels and other marine invertebrates, leaving bowl-shaped depressions throughout Port Valdez in waters less than 100 meters deep. Figure 7-14 shows a typical sea otter dig at the project site. These depressions are associated with prey species and the communities that support them. Feeding depressions were observed at both project alternative sites, especially at the East site. Quantitative information is not available to compare sea otter usage of the two sites, but the East site has more invertebrates and better feeding habitat than the West site.

Harbor seals have been observed hauling out on the islands approximately 0.8 km east of the East site alternative. Issacs (1992) reported about 27 harbor seals hauled out at the east end of the Mineral Islands. The USFWS (Appendix 4) counted 20 harbor seals in the same area about 1 km east of the East project site alternative.

Figure 7- 14. Sea otter dig at the project site.

Harbor seals follow and prey upon starry flounder and other estuarine fishes as they forage into shallow water with the rising tide. They also prey on adult salmon as the salmon return to Port Valdez to spawn. Their feeding range includes both the East and West project sites. The East site is marginally closer to seal haulouts, but there is no other indication of relative values of the two sites to harbor seals.

Sea lions are only present occasionally in the general area of project alternative sites, but are common seasonally near salmon hatcheries. Figure 7-15 shows a sea lion near the Salmon Gulch hatchery about 3 km south of Valdez. There are no habitats of particular importance at or near alternative project sites.

Sea mammal use of Two Moon Bay and the surrounding waters is not well documented. There are no rookeries or substantial haulouts in Two Moon Bay, but harbor seals, sea lions, and sea otters can be expected to be present at least occasionally. Biological productivity at the log transfer site is poorer than in surrounding habitat, and the site is unlikely to be important to feeding sea mammals.

Figure 7- 15. Sea lion with salmon in general area of project alternative sites.

7.2.8 Biological Resources-Important Communities and Species

Birds. The Duck Flats and Harbor Cove near the East and West harbor alternative sites are important habitat for ducks and other migratory waterfowl. The US Fish and Wildlife Service Coordination Act report listed northern pintail, goldeneye, bufflehead, harlequin, longtail, surf and white-winged scoter, red-breasted merganser, and gadwall, mallard, widgeon ducks, cormorants, marbled murrelets, black-legged kittiwake, black oystercatcher, marbled murrelet, pigeon guillemot, glaucous-winged and herring gulls, and other sea birds.

A full list of birds observed and areas surveyed is in the U.S. Fish and Wildlife Service Coordination Act report (Appendix 4). Their bird counts included the East and West sites in with counts of birds in Harbor Cove and the Duck Flats, which is easily the best waterfowl habitat in all of Port Valdez and possibly in all of Valdez Arm. The habitat at the harbor site alternatives is primarily mud flats, colonized sparsely with algae and invertebrates. This is used by far fewer ducks and other water birds than Harbor Cove and the Duck Flats. Although it is flanked by excellent bird habitat, the alternative harbor site area is not itself particularly important for most species of water birds. The single exception is the nesting colony of about 120 nesting black-legged kittiwakes on the SERVS dock between the East and West sites.

No eagle nests or identified nests of other raptors are near potential harbor sites.

Sea ducks, gulls, and other sea birds use the waters around Two Moon Bay. One eagle nest is reported to be near the shoreline adjacent to the site that could be designated for beneficial use of dredged material. The site would be surveyed before project activities were initiated in the bay.

Endangered, Threatened and Candidate Species. Steller's sea lions in PWS are listed as endangered. They range through Valdez Arm and Port Valdez and are occasionally observed near the project site. No sea lion haulouts or other critical habitats are in the area.

No listed threatened or endangered species managed by the U.S. Fish and Wildlife Service ranges into any of the proposed alternative sites (Fish and Wildlife Coordination Act report, Appendix 4). The southwest Alaska Distinct Population Segment of sea otters found in marine waters surrounding the Aleutian Islands and Alaska Peninsula is listed as threatened (70 FR 46366), but the sea otter population in PWS, including Port Valdez, is not listed.

Whale species that range into deeper waters of PWS and the Gulf of Alaska are humpback, sei, right, blue, and sperm. It is unlikely the whales would come into Valdez Arm. Steller’s sea lions are occasionally reported in the Harbor Cove and Duck Flats areas and can be assumed to range occasionally into the East and West Site project areas.

Marine mammals travel occasionally through the potential deep water disposal site in Port Valdez, but the site is not reported to be important habitat for any marine mammal. Sea lions could feed at that depth (200 meters), but the disposal site is too deep for sea otter feeding.

Two Moon Bay is closer to open waters of PWS than the potential harbor sites. It is more likely to be visited by sea lions than the harbor sites, but is not near any sea lion haulouts or other critical sea lion habitats. The potential beneficial use disposal site would be of no feeding or other habitat value to sea mammals.

Kittlitz's murrelets and yellow billed loons are candidate species for listing and occasionally may be in the general project area. Kittlitz's murrelets would not nest near the harbor site or at elevations like those at the Two Moon Bay site. They might occasionally feed or rest at either site. Yellow billed loons would not be present near any of the project sites during the summer, but may range occasionally into the area during migration.

7.3 Air Quality and Noise

Air quality around Valdez is generally considered good despite the presence of a large crude oil storage and shipping terminal and the super tankers that call to load crude oil for transportation to the lower 48 states. Other potential sources of air pollution in the Valdez area are the fleet of diesel-powered vessels and fishing boats that ply the Port of

Valdez, diesel trucks, generators, gasoline powered automobiles, aircraft, and home heating appliances including wood burning stoves during winter. The Port of Valdez is well outside any non-attainment area, and air quality meets standards.

Atmospheric noise pollution in the Port of Valdez area is generally low, although occasional loud noise may be disruptive to a small and local area. Marine vessels, associated on-shore facilities, trucks, heavy equipment, and vehicles are sources of noise.

Sources of underwater noise include tankers, ferries, tugs, support vessels, and the many smaller commercial and recreational vessels that use Valdez Harbor.

Two Moon Bay is not affected by any substantial human activity. Air quality is typical of PWS conditions. Noise from human activities is rarely introduced and is temporary.

7.4 Cultural Resources

Prehistory. PWS has long been inhabited by humans; archaeological studies suggest that Chugach Eskimos and neighboring groups were present in the region during the early Holocene Period. Separate from the Athabaskan-speaking Eyak and the Ahtna peoples, the Chugachmuit consisted of eight subgroups with an estimated total population of less than 500. The Tatitlek group was the nearest to Valdez. Villages usually occupied protected shoreline sites with unobstructed views of all approaches; closed bays were considered traps and were avoided. It is unlikely that Port Valdez was used for anything more than sporadic foraging and hunting activities.

Nearly all activities revolved around the sea. The Chugachmuit hunted the abundant populations of marine mammals, fish, and shellfish. Trade routes to the Eyak, Ahtna, and Port Graham Eskimos also depended on the sea.

Historic Background. Valdez was a trading settlement during Russian occupancy. Under American administration, the settlement first acquired notoriety in 1898 when thousands of stampeders to the Klondike gold fields departed Valdez from an “All-American” overland route. Valdez later became a vital link to Fairbanks and the mining districts of interior Alaska. In the early years of the 20th century, Valdez was the center of considerable gold and copper mining activity. Until the Alaska Railroad was completed in 1923, Valdez was the only all-season port of entry to the interior. In the winter, freight and passengers were hauled weekly to Fairbanks in horse-drawn sleds over the “Valdez Trail.”

The role of Valdez as a trans-shipment and supply point for the interior was revived twice for brief periods after the town’s eclipse by the ports of Seward and Anchorage. During and shortly after World War II, the town served as a point of entry for military cargo headed to military installations in the interior. During construction of the trans-Alaska pipeline, Valdez was the supply depot for pipe and material used to construct the southern segments of the line. Valdez also became the site of the marine terminal of the pipeline.

Cultural Resources. No resources at any of the alternatives considered for development are listed in the Federal Register of Historic places or recorded by the State Historic Officer. None were identified in a cultural resource survey of those sites.

7.5 Environmental Justice and Protection of Children

Environmental Justice Consideration. On February 11, 1994, President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-income Populations. The order directsFederal agencies to identify and address disproportionately high and adverse human health and environmental effects on minority and low-income populations. For this reason, demographic information on ethnicity, race, and poverty status is provided in Appendix B.

The ratio of minority residents in Valdez is not meaningfully greater than the surrounding area. The number of individuals and families living below the weighted average poverty level in Valdez also is not meaningfully greater than the other communities in the Valdez-Cordova Census Area.

Protection of Children. On April 21, 1997, Executive Order 13045, Protection of Children from Environmental Health and Safety Risks was issued to identify and assess environmental health and safety risks that may disproportionately affect children. There are no large daycare centers, residences, or schools in the immediate area of the project site alternatives.

7.6 Coastal Zone Management

The Valdez Coastal District is a part of the statewide Alaska Coastal Management Program (ACMP). Formation of the district provided local residents a direct role in planning for development of coastal resource policies that affect the Valdez area. Federal, State and local policies must be consistent with policies of the Valdez Coastal Management Program. The goals of the Valdez Coastal Management reflect a wide spectrum of issues pertaining to coastal management and the economic well-being of Valdez. They are:

- To enhance the economic productivity and diversification of the region;
- To provide for public safety and the economic welfare of the community when siting future industrial, commercial, and residential development;
- To protect and enhance all coastal habitats and air and water quality in accordance with Federal and State statutes and in concert with desired industrial expansion;
- To enhance the scenic beauty, uniqueness, and historical significance of the Valdez area;
- To sensibly open up new land for residential and industrial use;

- To strive for compatible use of coastal lands and waters for residential, industrial, commercial, recreation, fish and wildlife needs, and open space activities;
- To seek, through appropriate channels, continued navigational safety and recreational opportunities in PWS; and,
- To expedite and simplify permit procedures and governmental agency project review and implementation of the district program.

The coastal management program supports the development of fish and fisheries related facilities in an environmentally sound manner. To be consistent with the coastal management program, development must avoid or minimize significant adverse effects on the social, historical, or natural environments.

8.0 ENVIRONMENTAL CONSEQUENCES

8.1 Introduction

This section discusses how navigation improvements at Valdez (and the alternative of no action) might affect environmental resources of concern. This section brings together the following:

- Concerns identified during scoping and interagency coordination described in Section 2, Purpose and Need (Problem Identification);
- The no-action and construction alternatives and adverse effects of mitigation alternatives considered in detail in Section 5;
- The resources of concern described in Section 7, Affected Environment.

Material in Section 8 is presented in the same general sequence as in Section 7 to help readers compare information in the two sections. Impact analysis focuses on the resources that are of particular concern and on the alternatives considered in detail in Section 5. The alternatives in Section 8 include integral mitigation measures but do not include features added specifically to compensate for impacts. Direct construction impacts are addressed under each resource heading. Cumulative and other indirect impacts are discussed near the end of this section.

The environmental consequences of the no-action alternative and each of the six action alternatives considered in detail (described in Section 4) are addressed in the sections that follow. For some resources of concern, each of the six action alternatives would cause the same environmental consequences. In those instances, the consequences for all six are addressed together rather than by repeating the same consequences information six times.

Corps biologists and representatives from other agencies recorded site-specific information at both harbor sites considered in detail so potential effects of alternatives can be compared. Information they gathered at both the East and West alternative sites is presented in figures 7-5 through 7-12. The figures are overlaid with project configurations for the following four alternatives: East site 200-vessel, East site 320-vessel, West site 243-vessel, and West site 320-vessel.

This section also discusses two other alternatives that are considered in detail but that are not represented in the figures. Those two configurations are a 125-boat alternative and a 243-boat alternative, both for the East site. Those two alternatives were considered primarily as tools for evaluating relative costs and potential economic benefits among the alternatives. Near-shore areas directly affected by the footprints of those two alternatives would approximate those of the East site 200 and 320-boat alternatives. Indirect and cumulative effects also would be similar to alternatives considered in detail. Environmental effects information was computed and presented for each of the six action alternatives, but the East site 125 and 243-boat information is presented only in the tables.

8.2 Physical Environment

The physical environment at Valdez was important to, and was carefully considered in, development of project features for each of the alternatives considered in detail. Each of the action alternatives would, in turn, affect the soils and sediments, marine water quality and characteristics, water quality, and air quality. Beneficial use of dredged material also would beneficially affect existing sediment contamination at Two Moon Bay.

8.2.1 Water Quality

Breakwaters and moorage facilities at each alternative site would cause minor localized impacts to the predominantly wind-driven, near-shore currents along the western coast of Port Valdez. Construction and operation of any of the harbor alternatives would not impact existing area-wide currents and circulation patterns.

Circulation and flushing in any harbor at Valdez would be greatly influenced by the 3.7-meter tidal exchange with a mean tide height of 1.98 meters. Circulation in the proposed alternatives was estimated using the methods outlined in *Effects of Planform Geometry on Tidal Flushing and Mixing in Marinas*, (Nece, et al, 1979). Tides in the Nece study area of Puget Sound, WA ranged from 0.6 to 2 meters, so the larger Valdez tides should provide better mixing. Each harbor configuration considered in detail meets informal guidelines to ensure that water in it would be adequately exchanged.

The parameters that most affect circulation and water quality are (1) tidal prism ratio (TPR), (2) planform aspect ratio of the basin (AR), (3) ratio of the basin area to the channel cross-section (A/a), and (4) the relative roundness of the basin.

The TPR is governed by both the local tide conditions and the basin depth required for the design fleet. A shallow basin has a larger TPR and, therefore, a greater exchange of ambient water. The TPR is equivalent to an exchange coefficient in which all the water in the harbor at low tide is thoroughly mixed with ambient water entering on the flood tide.

The ratio of basin area to channel area A/a is governed strongly by the requirement for moorage and navigation. The size of the fleet and mooring density will determine the basin size (A) and the vessel draft, beam, wave conditions, and tides will determine the channel cross-section (a). A large A/a value is preferred to achieve the momentum necessary for driving circulation cells. This can be improved by reducing the channel width or depth; however, this can restrict navigation. The A/a parameter can also be improved by increasing the basin area.

The aspect ratio (AR) should normally be no greater than 3 to 1 and preferably less than 2 to 1; however, like the other design parameters, this is determined primarily by site specific constraints. The existing harbor in Valdez is a good example of inefficient circulation caused by planform geometry. This harbor is too long and narrow, about double the recommended length to width ratio.

The exchange coefficient is the average per-cycle exchange of water in a harbor that is flushed out and replaced with ambient water during each tide cycle. Exchange efficiency for a harbor is defined as the ratio of average exchange coefficient over the tidal prism ratio. It is recommended that at least 95 percent of the basin exceed an exchange value of 0.15 (Cardwell and Koons, 1981). Lower values indicate potential for stagnation zones. Rounding basin corners may reduce local stagnation zones and help mixing.

Improved safety, operational controls, and related efficiencies in a new harbor could improve long-term marine water quality in the Valdez area. Fewer vessels would be subjected to overcrowded conditions that currently increase the risk of petroleum spills. However, water quality in the immediate vicinity of any new harbor would be degraded by harbor construction and operation. Dredging, dredged material disposal, and placement of breakwaters may cause short-term impacts to localized water quality. Chronic petroleum spills, inadvertent waste disposal, and fish cleaning in a harbor may cause longer-term water quality impacts.

West Site Alternatives. Tidal flushing calculations developed by Nece cannot be used for unconfined basins. The partial depth vertical wave barrier section would not block water from flowing under the wave barrier panels. Either alternative considered in detail would have tidal flushing conditions near those of the undisturbed site. Floating debris and surface contamination such as oil and other petroleum products would not leave under the wave barrier and could still be trapped in the harbor.

East Site Alternatives. The TPR's for the East site plans are influenced by the shallow tideland area at the base of Hotel Hill. The TPR for the alternatives at this site are approximately the same: about .53 to .58. The smaller alternatives are slightly better than the 320-vessel alternative. All the East site alternatives are much better than Nece's recommended minimum value of 0.3. The TPR indicates that roughly half the harbor volume would be exchanged with each tide cycle. The harbor alternatives are rectangular with an aspect ratio of 2.5 to 1 to 2.9 to 1.0. The estimated average exchange coefficient based on Nece's calculations would be about 0.43. The harbor has three tidal openings into the basin (entrance and two breaches) so the ‘a’ value would be more; however, because of the added tidelands the ‘A’ would also increase; therefore, the resulting A/a for these alternatives ranges from 136 to 138. Based on these calculations, the harbor plan’s circulation and flushing should be adequate.

From the results of the four important circulation parameters, this harbor would have acceptable circulation and flushing.

Impacts Related to Construction Activities. Each of the action alternatives considered in detail would require dredging for access and mooring and for breakwater construction. Dredging and placement of dredged materials would temporarily increase turbidity levels and suspended solids in adjacent waters. The time it takes suspended material to precipitate and the current velocities within the impacted water body determine the size and migration characteristics of construction-related turbidity/suspended solids plumes. Precipitation times are highly dependent on, and are inversely related to, particle size. Dissolved oxygen levels in aquatic habitats are usually reduced by organic material suspended by dredging operations. This would not be meaningful in Port Valdez, where organic material is sparse in bottom material and where dissolved oxygen levels are high. Effects would be temporary and associated turbidity would not significantly affect water quality.

Impacts Related to Harbor Operation. Water quality in harbors typically is impacted to some degree by lighter parts of spilled fuel floating on the surface and heavier petroleum constituents accumulated on the bottom. Sampling in water columns in Alaska harbors indicates that comparatively little of spilled hydrocarbons is usually held in the water column. Specific appropriate measures would be adopted to minimize harbor operation effects on water quality. Those measures are listed in Section 6, Description of Tentatively Recommended Plan. Data collected at other harbors in Alaska indicate that chronic water quality effects of operations are confined generally to the harbor itself and sometimes to a small area just outside the entrance.

8.2.2 Air Quality and Noise

Air quality in the immediate project area would be affected by emissions from harbor construction and operational activities. The proposed dredging and construction activities would involve primarily the use of diesel-powered dredging equipment and land-based heavy construction equipment and haul trucks. Fugitive dust emissions during construction are minimized generally by the wet working conditions associated with dredging operations and the natural meteorological conditions that predominate. Collectively, construction-related emissions would be temporary and intermittent, and would stop at the end of the construction period. Vessels using the mooring basins would be the primary source of continuing air emissions during harbor operations. Pollutants of primary concern at harbors are nitrogen oxides, sulfur dioxide, and particulate matter less than 10 microns in diameter from diesel fuel combustion and carbon monoxide from gasoline combustion. Air quality in the Valdez area is not expected to be impacted significantly by new harbor construction or operational activities. No new emission sources are anticipated, and because of the strong meteorological influences in the area, National Ambient Air Quality Standards are not likely to be exceeded.

The harbor alternative sites are adjacent to the existing harbor and therefore harbor related noise is part of the existing condition and accepted in the community. The addition of vessels in the new harbor may increase the noise levels in a general way although not significantly.

Noise during construction would be elevated above normal levels from diesel engine powered equipment and rock placement. Driving sheet pile for the wave barrier alternatives would be a very strong and continuing sound that would reverberate in the water column. The water column noise reverberations could affect fish and marine mammals. Threshold noise levels and buffer zones are common mitigation measures to minimize affects. National Marine Fisheries Service has established a threshold noise level for behavioral and physical effect to marine mammals at 160 dB and 190 dB (re:1 micoPascals at 10 meters), respectively. Bubble curtains can attenuate the sound impacts as well as including a conservation measure whereby the pile driving activity would cease if an animal is present within a certain distance threshold. Threshold levels should not exceed 220 dB or 180 dB during juvenile and adult salmon migration periods.

People from the nearby hotel and recreational vehicles may be disturbed temporarily by construction noise, but sounds of operation would be similar to on-going, nearby harbor and industrial noise. No residential homes would be affected by the noise.

Blasting is unlikely but could be required to break up large boulders in the moorage basin area. Advance notification of any blasting to the community and a notice to mariners is standard procedure. Coordination would be conducted with responsible resource agencies to ensure effects to fish, birds, and marine mammals were mitigated appropriately.

8.2.3 Contamination at Two Moon Bay

Discharging dredged material to cover decayed logging debris at Two Moon Bay is expected to disperse briefly small amounts of the decayed material into the water column. This would increase briefly dissolved oxygen demand in the surrounding waters. Marine waters at Two Moon Bay are well oxygenated, so biochemical oxygen demand effects would be short-lived. Most of the debris would be capped, which would prevent any further release.

Effects of dredged material placement in Two Moon Bay have been evaluated as required by Section 404(b)(1) of the Clean Water Act. The evaluation is in Appendix 2.

8.3 Biological Environment

Public and agency scoping, field observations, and literature identified principal biological resources of concern in Valdez and in Two Moon Bay. The importance of some biota is defined or implied by statute. The following biota and habitats were identified as resources of particular concern:

- Wetlands and tidal flats
- Marine algae and eelgrass
- Marine invertebrate assemblages important to fish, birds, and sea mammals
- Marine and anadromous fish
- Marine mammals
- Birds
- Threatened and endangered species

This section of the Valdez report focuses on species, communities, and habitats that are of particular concern and addresses potential effects that a new navigation project in Valdez and the placement of dredged material from that project would cause to those resources.

8.3.1 Wetlands and Tidal flats

The no-action alternative would have no effect on wetlands and tidal flats.

None of the action alternatives considered in detail would adversely affect freshwater wetlands. Both the East and West sites contain intertidal habitat that includes rocky substrates in the upper intertidal and mudflats in the lower intertidal zone. Shallow, muddy tide pools are in the tide flats at both sites. Figures 7-5 through 7-12 show tidal flats and rocky intertidal extent for four of the alternatives considered in detail. The rockweed (heavy cover) in those figures is rocky intertidal habitat. Land seaward of the rockweed (heavy cover), out to the red 1-meter minus line can be classified as tidal flats. Shallow tide pools are identified at each site. There are no saltwater wetlands in the areas that would be directly affected by any of the alternatives considered in detail, but there are important saltwater wetlands in the vicinity. Potential project effects to biota in those offsite wetlands are addressed later in Section 8.3.

Computed areas that would be directly impacted by the six action alternatives considered in detail are in table 8-1.

Table 8- 1. Areas directly impacted by alternatives considered in detail.

	Area Affected (Hectares)		
Alternative	Tidal Flats	Tide Pools *	Rocky Intertidal
East Site 125 Vessels	5.5	0.3	1.0
East Site 200 Vessels	6.0	0.3	1.2
East Site 243 Vessels	6.2	0.3	1.4
East Site 320 Vessels	6.5	0.3	1.6
West Site 243 Vessels	3.6	0.3	0.2
West Site 320 Vessels	3.9	0.3	0.2

*Tide pool area is within tidal flats area

The East site alternatives would directly impact about 80 percent more tidal flats, about the same area of tide pool habitat, and about 6 times as much rocky habitat as alternatives for similar numbers of vessels at the West site. There are two principal reasons for the difference: (1) the West site would use a wave barrier, which would have a much smaller footprint to protect the harbor, and (2) a greater percentage of the West site would be in water deeper than the intertidal zone.

Tidal Flats. The tidal flats at Valdez were described in Section 7.2..
This habitat within the project footprint would be destroyed or extensively modified by harbor construction. Tidal flats habitat within the harbor footprint would be covered by breakwaters and converted to rocky intertidal and subtidal habitat or dredged to produce deeper subtidal habitat. Tidal flat functions would be lost.

Tide Pools. Tide pools would drain into the deeper harbor basin or would be covered by project features. They would lose this function as habitat. Tide pools appear to sometimes form where energy from water movement scours shallow depressions. Some of the tide pools mapped at Valdez were close to the rocky shoreline where wave action may have scoured the bottom. Tide pools might develop in tide flats near breakwaters constructed for the action alternative, but probability cannot be estimated.

Rocky Intertidal Habitat. Most of this habitat in Port Valdez is at the upper tidal limit and hosts a rockweed assemblage that is dense by comparison with local conditions but is unremarkable by comparison with rockweed in the marine waters of PWS proper. This habitat is fully exposed by diurnal tides and is inhabited by barnacles, amphipods, shore crabs, gunnels and other small fish, and by other intertidal species. They, in turn, are prey to birds, larger fish, and other marine predators.

Most of this habitat in the project footprint would be covered by staging and access features for the project or would be directly affected by changes in circulation, sedimentation, or water quality.

Regional Intertidal and Wetland Habitats. Project alternatives were placed to avoid wetlands and tidal flats of regional importance. None of the alternatives would directly affect tide flats or wetland habitat in Harbor Cove or the Duck Flats.

Created Habitat. None of the harbor alternatives can be expected to produce new tidal flats, tide pools, or eelgrass habitat. Most of those habitat types would be lost irreplaceably in the harbor footprint. The rubblemound breakwater features could be excellent substitutes for lost rocky intertidal habitat. Breakwater rock would provide good attachment surface for typical intertidal species, would be cleaned of sediment by the waves, and would be an inter-connected band that would encourage colonization. Within the 6.7-meter tidal range at Valdez, each linear meter of breakwater would produce up to about 10 square meters of rocky intertidal habitat on each face (inner and outer harbor faces) of the breakwater. Habitat area produced per linear meter would be less in shallower water.

The wave barrier at the West site would do little to replace lost habitat. The steel wave barrier would be a poor substitute for intertidal rocky habitat.

Allowing for water depth variation, total rocky intertidal habitat produced by breakwater construction for each alternative would be approximately as shown in table 8-2.

Table 8- 2. Total rocky intertidal habitat produced by breakwater construction for each alternative

Alternative	(hectares)
East Site 125 Vessels	0.9
East Site 200 Vessels	1.0
East Site 243 Vessels	1.1
East Site 320 Vessels	1.2
West Site 243 Vessels	0.3
West Site 320 Vessels	0.3

This is roughly equivalent to the area of rocky intertidal habitat that would be lost at each of the alternatives considered in detail. The natural rocky habitat consists of rock partially buried in silt and interspaced with silty material. The breakwater would present considerably more rock surface per square meter for colonization.

Summary of Effects. Any action alternative at the East site would replace existing rocky intertidal habitat with constructed rocky habitat. Tide flat and tide pool habitat would be lost and would not be replaced. About 5.5 ha of tide flats for the 125-vessel alternative to about 6.5 ha for the 320-vessel alternative would be lost. At the West site, about 3.6 to 3.9 ha of tide flats and about 0.2 ha of rocky intertidal habitat would be lost.

8.3.2 Marine Algae and Eelgrass

Eelgrass. Bottom material (substrate) and water quality in the project area are far from ideal for eelgrass, but there are sparse assemblages of small plants in limited areas in the mid to upper intertidal range. National Marine Fisheries Service noted (Letter: Robert Mecum 2007): *"Eelgrass is present; however, density is extremely sparse with only a scattering of single rooted plants."* Eelgrass would be substantially lost as habitat within the footprint of any action alternative. Section 7.2.2 noted the presence of small (up to 4 square meters) sparse eelgrass patches. A total of less than 0.1 ha of sparse eelgrass habitat scattered over the project alternative footprints would be lost with any of the action alternatives.

Marine Algae. Section 7.2.2 noted that rockweed (*Fucus distichus*), a species of green algae (*Ulothrix*), and other algae species, form a distinct but not especially dense band of marine algae at the upper tidal range and that rockweed extends down into the mid tidal elevations. These and other marine algae also are present in scattered clumps across the tidal flats. Rockweed is an extremely hardy kelp that survives high wave energy, wide ranges of salinity, icing, and considerable siltation, but it needs to anchor onto clean, hard substrates. There is not much rock or other hard substrate suitable for holdfast attachment in either the East or West sites. National Marine Fisheries Service noted (Letter: Robert Mecum 2007) *"These gravel, cobble, and mud substrates are not colonized with marine algae or vegetation, except for a few high-tidal, boulders extensively covered with rockweed."* Another distinct band of laminaria, a brown kelp, is at and below the lowest tidal range (about -1 meter below MLLW). Marine algae do not grow much deeper in the silty waters of Port Valdez.

Algae would be destroyed in the footprint of any action alternative by breakwater placement, dredging, and other project features. Section 8.3.1 identified the area of intertidal habitat that would be affected by the action alternatives. It also noted that the intertidal habitat created by breakwaters at the East site would replace upper intertidal habitat lost to construction with an equal or greater area of rock surface. This indicates that rockweed and other intertidal algae colonization at the East site alternatives would replace marine algae lost to construction for those alternatives. At the West site, there would be little marine algae colonization.

Dredging and breakwater construction also would affect laminaria and other marine algae in a band at the lower limits of the tide range. Laminaria is less hardy in wave environments than rockweed, but like rockweed, needs to attach to hard surfaces, which are not abundant in the lower intertidal zone at the East or West sites. Dredging and breakwater construction for any of the East site alternatives would destroy about 0.3 ha of laminaria kelp and its habitat. Construction of either West site alternatives would destroy about 0.2 ha of laminaria and its habitat.

Breakwaters at the East site would create rocky substrate in the lower intertidal and upper subtidal zone that could be used for anchoring substrate for laminaria and other marine algae that occupy those zones. The East site breakwaters would create about 0.1 to 0.2 ha of clean rocky substrate at depths suitable for laminaria colonization.

The small stub breakwaters required for the West site alternatives would create a small area (less than 0.05 ha) of lower intertidal/upper subtidal rocky substrate at depths suitable for laminaria and other marine algae.

Summary of Effects. Construction of any action alternative would destroy less than 0.1 ha of sparse, patchy eelgrass in the upper and middle intertidal zone.

Construction of an East site alternative would destroy about 0.9 to about 1.2 ha of rocky habitat in the upper tidal zone and would largely replace it with an approximately equal area of new rocky habitat that could be colonized by the same algae. Construction would destroy about 0.3 ha of laminaria and associated algae in the lower tidal range and would replace it with 0.1 to 0.2 ha of clean rocky substrate that is expected to support the same species assemblage.

Construction of any alternative in the West site would destroy or substantially modify about 0.2 ha of rocky intertidal habitat and about 0.2 ha of habitat in the lower tidal range used by laminaria and associated algae species. Little of that would be replaced by colonization on project structures.

8.3.3 Intertidal Invertebrates

Marine invertebrates in the upper intertidal zone at both the East and West sites are predominantly animals that live on the surface or in the sparse marine algae. Small crustaceans, including isopods, shore crabs and barnacles; and mollusks, including mussels, limpets, and snails are associated with the rockweed in that zone and occupy about the same habitat and area of this zone in both the East and West alternative sites. Construction at the East site that affected rockweed algae also would equally affect the invertebrates associated with it, so construction would eliminate 1.0 to 1.6 ha of invertebrate habitat in the upper intertidal zone.

In the middle and lower tidal zones, small mussels are scattered over the surface, so invertebrates that live in the bottom material, including polychaete worms, small clams, and cockles are more important. Spoon worms and polychaete worms are more common lower in the intertidal zone. Isopods, amphipods, and other very small invertebrates also live in lower densities across the barren flats that make up most of the middle and lower intertidal zone. East site alternatives would eliminate 3.5 to 5 ha of that habitat, including about 1.5 ha of the low-density mussel habitat in that zone (figures 7-5 and 7-8). West site alternatives would eliminate about 3 ha of that middle and lower intertidal habitat, including about 2 ha of sparse mussel populations in the areas shown in figures 7-10 and 7-11.

8.3.4 Subtidal Invertebrates

Section 7.2.4 describes shelf and slope subtidal habitat in Port Valdez. The deeper sections of each action alternative would be constructed on the subtidal shelf seaward of the intertidal zone. This upper subtidal zone is similar to the lower intertidal with similar invertebrates and other biota, except that laminaria do not grow very far into this zone. Additional species of worms may be present and small tanner crabs occasionally may be present. About 1.2 to 4.3 ha of the East site alternatives and about 1.7 to 4.5 ha of the West site alternatives would be in this near-shore subtidal habitat. Those areas would be substantially modified by harbor construction. Soft-bottom biota would be largely eliminated by dredging and by breakwater or wave barrier placement.

The near-shore subtidal shelf drops steeply into about 200 meters of water. The deeper, more saline water of the lower slope and the bottom of the fjord at least seasonally hosts tanner crabs, sea stars, shrimp, and other invertebrates. This area would not be affected by any of the harbor alternatives considered in detail. The least cost alternative for disposal of dredged material would discharge that material into up to 11.4 ha of this deep water habitat. The bottom-living invertebrates in the disposal site would be buried under several meters of mixed material ranging in particle size from fine silt to boulder. Up to about 11.4 ha of sessile invertebrates on the substrate of the existing bottom and most of the worms and clams in that habitat would be killed. The disposal site would likely recolonize with similar organisms, but rates of successional change cannot be estimated with available information. Some of the more motile organisms, including crabs, shrimp, and other crustaceans could escape from the site, but escape rates cannot be estimated.

The Two Moon Bay dredged material placement site is all well below the intertidal zone. This subtidal habitat is heavily impacted by decaying bark and wood debris from log holding and transfer operations. Divers reported a diverse and productive assemblage of sea stars, nudibranchs, tanner crabs, and sea anemone where there was no bark but few invertebrates in the impacted log transfer site (Sargent, 2000). Divers noted dead tanner crabs in the bark covered area but not in areas away from the wood debris.

Dredged material would cover the limited subtidal invertebrate community at the log transfer site. Small areas of more productive communities also would be impacted because the wood debris areas are not precisely defined and because there are scattered areas free of bark within the transfer site. Altogether, about 5 ha of largely depaupate benthic invertebrate community would be displaced or destroyed by dredged material placement. That core degraded area is surrounded by bottom that is covered less completely or where the wood debris is patchier. Smaller amounts of silt and fine sand would disperse outside the core target area of the log transfer site and could cover habitat that was not substantially degraded by logging debris. Modern navigation and positioning instruments should minimize placement outside the intended placement area, but there would be some dispersal of dredged material onto less damaged invertebrate communities.

The placed dredged material would be largely silt, sand, and other material that is smaller in grain size than the predominant bottom material in Two Moon Bay. Invertebrates would be expected to begin colonizing it soon after placement was completed and to produce a strong infaunal and epifaunal invertebrate community that would include clams, shrimp, tanner crabs, snails, and other invertebrates typical of both hard-bottom and soft-bottom communities in PWS.

8.3.5 Marine and Anadromous Fish

The no-action alternative would leave the environment as it is for the foreseeable future and would have little effect on fish. The harbor projects considered in detail are at the north end of Port Valdez in an area that lacks water conditions or habitat that is attractive to most marine fish. The National Marine Fisheries Service (letter in Appendix 3) Robert D. Mecum 23 April 2007) stated:

> *Marine fish habitat within the project area appears to have low value. This rating is based on low density and diversity of fish, and a minimal amount of suitable habitat utilized by fish, as documented by both historical studies and recent on-site investigations by my staff. The substrates within the project area are heavily silt-laden from the nearby Lowe River.*

A few gunnels and other small fish that hide in kelp are in the rockweed habitat in the upper intertidal zone. They would be likely to escape habitat disruption and might find similar habitat later in rockweed on the new breakwaters of any action alternative. Larger marine fish are not reported in the project area. Habitat in the project area is not regularly used by or important habitat for rock bass, cod, ling cod, herring, sole, or any other marine species of commercial or recreational importance. The bottom is not sandy enough to serve as spawning habitat for capelin, sand lance, or eulachon. It may serve as general feeding/resting habitat for sculpins, pricklebacks, and other small marine fish. Loss of a maximum of 10.8 ha of this relatively low value marine fish habitat would have no discernable effect on local or regional populations of any marine fish species.

Marine fish in the alternative project sites considered in detail are relatively unimportant in regional ecological systems and economic value. Anadromous salmon, however, are abundant in the alternative project sites and are ecologically and economically important. Tens of thousands of mature salmon, including coho, pink, chum, and sockeye return to Port Valdez each year where they stage to spawn. Port Valdez, therefore, including the alternative harbor sites, is important pre-spawning habitat for mature Pacific salmon. Mature salmon move through the alternative project sites as they often school and move along the shoreline relatively close to shore.

Project alternatives considered in detail would, however, have little direct effect on those mature fish. Mature salmon are strong swimmers and can easily swim a little farther off shore to avoid any of the harbor alternatives considered in detail or to avoid boat traffic or other activity or noise. Pacific salmon cease feeding as they approach their spawning phase, so harbor effects on food organisms would have little effect on adult salmon feeding. All harbor configurations considered in detail would be relatively open structures that would allow salmon into and out of each harbor alternative at both the east and west ends, as well as through the entrance channel.

Salmon juveniles out-migrate from natal streams into Port Valdez beginning in April. They are much less mobile than adults and may be more affected by changes in their environment. The young of two species, coho and sockeye, live a year or more in freshwater streams, lakes, or hatchery ponds. They enter Port Valdez as strong-swimming juveniles that are likely to acclimate close to shore for relatively short periods and then migrate out into marine waters of Valdez Arm and PWS where plankton and smaller fish are more abundant.

Chum and pink salmon both enter Port Valdez in April and May or early June in their first year of life. They are small, weak swimmers that may be present in the shallower waters of Port Valdez longer than coho or sockeye juveniles. They also are much more abundant.

Several concerns about potential harbor effects on juvenile salmonids have been raised for harbor projects in Alaska. Those concerns can be grouped as follows:

1) Loss of feeding habitat. This is generally a relatively minor concern, but may be important where feeding habitat is limited.

2) Juveniles may enter a harbor and be trapped when they cannot find their way back out.

3) Harbor breakwaters or other structures may force juveniles into deep water where they may be prey for other salmonids or marine fish.

4) Juveniles may be exposed to contaminants in harbors.

Feeding habitat loss would have little effect on coho and sockeye juveniles, which do not preferentially feed in muddy tidal flats and soon migrate into more marine waters. Pink and chum juveniles do feed on tidal flats. The intertidal habitat in the harbor footprint, which ranges from 3.6 to 6.5 ha in alternatives considered in detail (table 8-1), would be potentially lost to those juveniles.

Large aggregations of salmon young, usually pink salmon, may be seen every summer in many Alaska harbors. Some biologists interpret this to mean that those fish cannot find their way out of the harbors or that they are unwilling to go into deeper water. This interpretation has not been proven or disproven. This should not be a meaningful adverse effect at any of the Valdez Harbor alternatives considered in detail. All the alternative layouts would open into shallow water at each end of the harbor during at least part of each tidal cycle.

Small fish forced to migrate around breakwaters and other natural and man-made obstructions may go into deeper water where they are prey for Dolly Varden, other salmonids, cod, rock bass, other fish, and predatory invertebrates. Active and perhaps substantial predation has been observed at some harbors and around natural rocky points of land. Young of the year pink and chum salmon tend to swim in the upper part of the water column, so the most successful predators tend to be those that feed effectively near the surface. Starry flounder and sculpins probably are the two predatory fishes most likely to hold near breakwater structures in Port Valdez. Both species, and most others that would be encountered at a harbor there, are typically bottom-feeding fish. They would be unlikely to find and prey on fish in the upper water column of deeper water, but could be effective predators of salmon juveniles in shallow water. A harbor would be unlikely to substantially increase predation on young salmon in the turbid, estuarine waters of Port Valdez where predators are relatively sparse.

Contaminants generally are related to heavy hydrocarbons, other organic chemicals, and heavy metals that accumulate in sediments on the bottom or are lighter hydrocarbon fuels floating on the surface. Bottom-feeding fish are generally sparse in harbors, but marine species tolerant to lower salinity conditions could occasionally be present and would be exposed to bottom contaminants. Most marine and anadromous species are unlikely to feed in the surface film and become exposed to substantial amounts of floating fuel. Detectable fuel contamination in the water column of harbors we have tested in Alaska is rare. When present, it would most likely be from benzene, which is highly soluble, but breaks down or dissipates quickly in natural conditions. Short-term exposure from substantial fuel spills could occasionally threaten salmon young and other fish in the water column. Adult salmon preparing for spawning also could be exposed, but adult fish generally are less likely to be harmed by comparable levels of exposure, and adult salmon in Port Valdez have only a short life span left, so long-term or chronic effects are less important concerns.

Two Moon Bay. Placement of dredged material to cover wood debris in Two Moon Bay would displace the marine fish in that habitat. Rock bass, flounder, Pacific cod, and other species are likely to be present in that degraded habitat, but that habitat has no specific attributes that would make it especially attractive to any marine or anadromous species. Most fish are mobile enough to escape from beneath discharged dredged material. So, adverse effects from dredged material discharge would be related primarily to temporary site avoidance. In the longer term, the restored habitat in Two Moon Bay should become better habitat for most fish species.

Deep Water Disposal Site. If the deep water disposal site in Port Valdez was selected, the dredged material would be discharged into about 200 meters of water. Boulders, cobbles, and other larger rocks would fall rapidly to the bottom, followed by the main mass of dredged material. Fish would be displaced by the first material to arrive, so there would be little chance of substantial adverse effect. Marine bottomfish might avoid the site after disposal, but the site would begin recolonizing almost immediately. Adverse effects would be relatively short term and would not be meaningful in the much larger area of Port Valdez. Salmon and other fish in the middle and upper water column would not be affected substantially.

8.3.6 Birds

Birds would be displaced from the immediate project vicinity during construction. Without construction timing windows, black-legged kittiwake success might be expected to decline at the adjacent SERVS dock nesting colony. There is no other known nesting habitat in the immediate harbor project area, so additional effects to nesting birds are not expected. Ducks, other water birds, and shorebirds would lose 5.3 to 10.7 ha of general purpose resting and feeding habitat.

Perhaps the greatest concern about a harbor project at the sites considered in detail was that it might impact birds and other resources in Harbor Cove or on the Duck Flats. The U.S. Fish and Wildlife Service may have favored the West Site based in large part on that concern. The West Site is farther from Harbor Cove, which would create a larger buffer for fuel spills, and between bird habitat at the Duck Flats and the noise and activity from a harbor.

Harbor Cove is less than 50 meters from the east end of the existing Valdez Harbor, within 100 meters of the very busy boat launching ramp in the harbor, and immediately adjacent to the road around the existing harbor. Seafood processors and other industrial users also are between the East alternative site and Harbor Cove. The East Site would be screened from Harbor Cove by the mass of Hotel Hill (figure 4-3) and Mineral Creek Islands, but boat traffic to and from the East Site would be closer to Harbor Cove than from the existing harbor or from the West Site.

8.3.7 Marine Mammals

Harbor seals, sea lions, and sea otters are the principal marine mammal species of concern in Port Valdez. None of the harbor alternatives would directly affect harbor seal or sea lion feeding, haulout, or other important habitat, but boats traveling to any harbor at the East or West sites might go closer to the more heavily used habitat of Harbor Cove and the islands off the entrance to the cove. The East Site harbor alternatives would be closer to that habitat and would be more likely to have an indirect effect on those resources from boat traffic. Relative differences between the alternatives cannot be quantified. Boat traffic can displace seals and sea lions, so this could cause an observable effect on behavior. Reefs and shallow water would tend to discourage boat traffic, but there could be some level of unquantifiable effect. There is relatively abundant shallow habitat that would serve as a refuge for any seals or sea lions that were disturbed.

Sea otters may be present almost anywhere in Port Valdez and appear to be relatively undisturbed by boat traffic that is not close enough to be a direct threat. The only habitat type specifically identified as important to them is feeding habitat. In the project area they dig for clams and mussels in a narrow band near the lower tidal limits. Figures 7-5, 7-8, 7-10, and 7-11 show this band of feeding habitat in both the East and West alternative sites. This habitat amounts to about 0.5 ha in each alternative site. Bivalves in that band are sparse and are at the lower end of the sizes used by sea otters, but the habitat has at least some value. The bivalves and the substrate they inhabit would be destroyed by any of the action alternatives, so about 0.5 ha of sea otter feeding habitat would be lost to any of the alternatives considered in detail. Blue mussels, the apparent principal bivalve in the feeding habitat, would likely colonize the rocky breakwater, which would provide substantially more holdfast substrate than the existing feeding band. Replacement habitat from alternatives in the East Site could be substantially better than existing sea otter habitat. Alternatives at the West Site would not be expected to provide appreciable amounts of replacement feeding habitat.

8.3.8 Endangered, Threatened, and Candidate Species

Endangered whale species that may be in Gulf of Alaska waters—humpback, sei, right, blue, and sperm—are all deeper water species and would not be affected by any of the harbor, disposal, or beneficial use of dredged material alternatives.

Steller's sea lions are occasionally reported in the Harbor Cove and Duck Flats areas and can be assumed to range occasionally through the waters of East and West site project areas. No sea lion haulouts or sea lion critical habitat occur near any of the harbor, disposal, or beneficial use of dredged material alternative sites. The Corps has determined that this action would not affect listed Steller's sea lions. National Marine Fisheries Service concurrence is expected.

Candidate species for listing, yellow billed loon and Kittlitz's murrelets, may visit project areas occasionally, but none of the project features would affect any known nesting or other important habitat of these species. The action would not adversely affect either candidate species.

None of the listed species within the jurisdiction of the U.S Fish and Wildlife Service would be adversely affected by this action. The Service concurred with this determination during informal consultation for this report.

8.4 Cultural Resources

The project area was examined and records were researched by a qualified archeologist who also coordinated with the State Historic Preservation Officer. None of the alternatives considered in detail would adversely affect any historic or other cultural resource site.

Harbor construction would affect aesthetics of the immediate area. The alternatives considered in detail are all in a commercial waterfront setting. Any of the alternatives considered in detail would be similar to and consistent with the appearance of surrounding structures, facilities, and activities. Aesthetics would not be significantly affected.

8.5 Environmental Justice and Protection of Children

All the alternatives considered in detail are in a developed commercial or light-industrial area away from homes, schools, and playgrounds. No racial, ethnic, age, or other population group would be affected disproportionately. Children would not be put at risk by any project alternative.

8.6 Coastal Zone Management Resources

The goals of the Valdez Coastal Management Plan are listed in Section 7.6. Those goals are similar to many of the project objectives identified in Section 2. The no action alternative would not produce substantial positive or negative results. The relative success of the action alternative in meeting those goals would be as follows:

- To enhance the economic productivity and diversification of the region;
  Fully consistent

- To provide for public safety and the economic welfare of the community when siting future industrial, commercial, and residential development;
  Fully consistent

- To protect and enhance all coastal habitats and air and water quality in accordance with Federal and State statutes and in concert with desired industrial expansion;
  Impacts minimized. Consistent to the maximum extent practicable.

- To enhance the scenic beauty, uniqueness, and historical significance of the Valdez area;
  Impacts minimized. Consistent to the maximum extent practicable.

- To sensibly open up new land for residential and industrial use;
  Fully consistent

- To strive for compatible use of coastal lands and waters for residential, industrial, commercial, recreation, fish and wildlife needs, and open space activities;
  Fully consistent

- To seek, through appropriate channels, continued navigational safety and recreational opportunities in PWS; and,
  Fully consistent

- To expedite and simplify permit procedures and governmental agency project review and implementation of the district program.
  Fully consistent

The coastal management program supports the development of fish and fisheries related facilities in an environmentally sound manner. To be consistent with the coastal management program, development must avoid or minimize significant adverse effects on the social, historical, or natural environments.

A full analysis of consistency with enforceable standards is presented in Appendix 5.

8.7 Cumulative Impacts

The Council on Environmental Quality defines cumulative impacts as follows:

> "Cumulative impacts" is the impact on the environment that results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individual minor but collectively significant actions taking place over a period of time (40 CFR 1508.7). Cumulative impacts can be added to those of existing, past, and predicted future effects."

Previous coastal development in Port Valdez has been related primarily to transportation. The Alyeska Pipeline Terminal has developed about 2 km of shoreline for receiving, storing, and transshipping crude petroleum from the Alaska Pipeline from the North Slope of Alaska. About a half-kilometer of shoreline was developed in the mid 1960's to create the existing Valdez Harbor and to create new shoreline seaward of the harbor. Container transshipment facilities, docking for the State ferry and other large commercial vessels, shore facilities for the tugs and cleanup vessels that support crude petroleum shipping, and other shoreline development account for another 0.5 km of industrial shoreline development. Coastal resources of Port Valdez also are affected by development of hydropower and fish hatchery facilities. Valdez Arm was historically logged, mined, and fished but little remains of that earlier development except for a few scattered shoreline buildings.

Future development in Port Valdez is limited by terrain, which is very steep along most of the shoreline; security restrictions that protect the oil pipeline and terminal facilities and the supertankers that haul the crude oil out for refining; conservation designations that protect lands from further development; and protected wildlife habitat and other resources that make development unlikely (e.g. the 400-ha Duck Flats just outside Valdez).

The remainder of Valdez Arm is even more protected from development. Almost the entire shoreline is too steep for more than an occasional cabin site. Almost all of it is in State or Federal conservation status or was reserved from development by purchase of rights with *Exxon Valdez* oil spill settlement funds. Almost none of the Valdez Arm shoreline outside the City of Valdez is likely to be developed in the foreseeable future.

Harbor construction and use of a new harbor would cause additional increments of use and of effects to infrastructure and natural resources. Principal concerns related to that type of cumulative effects on resources at Valdez and in the broader area of eastern PWS might be summarized as follows:

- Additional traffic and demand for goods and services in Valdez
- Adverse effects on air and water quality
- Additional demand for and pressure on fish and other consumable resources
- Additional recreational access to and use of wilderness areas in eastern PWS

Valdez is a small town with lots of summer visitors. The existing harbor is close to the main business district. Traffic is congested and parking is limited near the waterfront. Boat launching may be difficult and time consuming, and boat trailer parking is extremely limited near the boat launch. A new harbor could increase the numbers of visitors, traffic coming into Valdez, and pressure on local camping and other support facilities. A new harbor would be expected to increase highway traffic into town. A new harbor at the alternative sites considered in detail, however, would pull traffic away from the congested area around the existing harbor. There is ample parking and area to stage near the harbor site alternatives considered in detail, so downtown congestion would not be expected to increase and could be lessened.

Summer air quality is generally good. Additional small watercraft and automobiles are not likely to appreciably contribute to long-term air quality degradation. Additional harbor usage would add an increment of fuel leakage and other water quality effects to these from existing harbors and from industrial uses. This would affect water quality inside the harbor and would add an increment to Port Valdez. Existing water quality is good, and the minor contaminant contribution from a relatively small harbor employing best management practices would not lead to significant water quality impacts. Future contaminant sources could be managed to prevent significant impacts.

This project, along with other development in Valdez, is part of a recent history of increased commerce and recreation in PWS. There is a growing demand in Alaska for tourism destinations and development of additional recreational outlets, particularly sport and personal use fishing. Salmon stocked from local hatcheries has supported more independent recreation and small boat charter fishing as well as commercial fishing. Tour boat operation, particularly to Columbia Glacier, also has increased. Additional harbor space and launching capacity would allow more boaters to fish and participate in other recreational activities. There would be greater pressure on marine fisheries and recreational use sites within range of Valdez. Fish stocks are maintained by regulation, so additional pressure would not affect viability of regional stocks, but could lead to tighter limits on harvest. Those effects would be social rather than biological.

The Valdez Fisheries Development Association at Solomon Gulch stocks pink and coho salmon. The returning adults attract many anglers with trailer-hauled pleasure craft, many from Fairbanks. Transient boats operators can reach 200 per day on peak-use months. It is expected that moorage demand by recreational vessels is well represented by those currently using the harbor facilities and would be accommodated in the new harbor. There are 77 permanent charter boat berth holders in the harbor at this time. Economics analysis predicts 10 more charter vessels in the future (Appendix B). Commercial fishing is limited by available permits and is fully utilized, but a new harbor would allow more permanent moorage. In 2005 there were 1,244 PWS permits, 48 belonging to local residents. The commercial vessels would not be likely to increase but may become more efficient.

Recreational boating is relatively light in eastern PWS outside Valdez Arm. There are protected anchorages, but few good campsites and public use cabins. Boaters who stay out for several days may be able to find little or no traffic at beautiful anchorages. A new harbor at Valdez would be expected to increase recreational boating in eastern PWS. This could add an increment of additional boaters to eastern PWS outside Port Valdez. There are no landowner plans to increase numbers of public cabins or improved campsites. Cabins are fully used now, so cabin occupancy would not increase. There might be small increases in on-shore camping, but most additional users would sleep aboard if they remained out overnight. This could add additional users to remote, lightly used sites and could diminish the value of the experience for some. This could be important to individual boaters but would not be a significant regional impact.

9.0 PUBLIC INVOLVMENT AND AGENCY COORDINATION

U.S. Fish and Wildlife Service (USFWS) participation in this study under the Coordination Act started in 2000. A Planning Aid report was received in March 2000. In this report the USFWS recommended an environmentally preferred site on the west side of the Alyeska Service dock or on the East site with appropriate mitigation. Harbor Cove was considered significant habitat because it borders the Duck Flats. A draft Coordination Act report was received in May 2001. Several scoping meetings and a design charrett were held (March 4, 1999, January 26-27, 2000, October 22, 2001, March 2002, and July 22, 2002) with resource agencies and City of Valdez representatives to discuss issues and formulate appropriate mitigation. Some of the meeting minutes are contained in Appendix 3, Correspondence. A site survey of a log transfer facility at Two Moon Bay was conducted in November 2001. A final Coordination Act Report was submitted informally in April 2002 with the USFWS recommending the East Site and extensive mitigation.

Coordination under the Coordination Act was re-initiated with a meeting in May 2005. An agency meeting was held on July 19, 2005, to discuss harbor and mitigation alternatives. A multi-agency meeting was held on October 4, 2005, to present the Corps planning process, evaluate designs, and discuss mitigation options. Agencies in attendance were the USFWS, National Marine Fisheries Service, Environmental Protection Agency, State Departments of Natural Resources, Fish and Game and Environmental Conservation. The city manager of Valdez spoke to the group about the existing and future harbor's importance to the city's economy. The agencies agreed that a new harbor was needed and agreed to work toward common goals to develop effective mitigation and to use dredged material beneficially.

A facilitated meeting was held on November 4, 2005, to sort through the mitigation alternatives. Avoidance and minimization measures were an agreed part of the design to the extent practical. A fuel facility was determined to be necessary for efficient operation of a new harbor and would include best management practices. On November 21, 2005, the Corps met with the Valdez city council to present the harbor alternatives, including beneficial use and mitigation alternatives. The council agreed to support the beneficial use of dredged material at Two Moon Bay; to construct a bilge disposal facility; and to a number of design, construction, and operation measures for a harbor at the East Site. At the December 4, 2005, agency meeting, the recommended plan, including mitigation and beneficial use, was presented and accepted, with some reservations, by the participating agencies. Another meeting was held with USFWS on January 29, 2009 to again discuss the project and make sure mitigation and methodologies were agreeable. After the ongoing public and agency coordination effort, the Alaska District received the Final Coordination Act Report from USFWS in September 2006.

The City of Valdez has conducted public meetings throughout the planning process. In February 2007, a city survey on capital project was mailed to Valdez citizens. Three out of four respondents favored a new harbor and said a harbor was a top priority.

This feasibility report and environmental assessment were distributed for the public and agency review as part of the NEPA process in February 1, 2010. In addition, a public meeting was held on February 17, 2010, in Valdez during the review period, to discuss the project alternatives and solicit public views and opinions. Comments received were mostly supportive. Collaboration with the public and agencies will be ongoing throughout the life cycle of the project.

10.0 PERMITS AND AUTHORIZATIONS

The Corps or project sponsor (Valdez) would likely need the following permits from various State of Alaska agencies:

1. Alaska Department of Natural Resources
   a. ACMP Consistency Determination. This consistency review and determination is described in Section 7.6.

2. Alaska Department of Environmental Conservation
   a. 401 Water Quality Certification. This certification is issued after the State of Alaska ACMP review and final consistency determination. The certification states that the there is reasonable assurance that Alaska Water Quality standards will be met and maintained.

A checklist of project compliance with relevant Federal, state, and local statutes and regulations is shown in table 10-1.

Table 10- 1. Environmental Compliance Checklist

FEDERAL	Compliance
Archeological & Historical Preservation Act of 1974	FC
Clean Air Act	FC
Clean Water Act	PC
Coastal Zone Management Act of 1972 *	PC
Endangered Species Act of 1973	FC
Estuary Protection Act	FC
Federal Water Project Recreation Act	FC
Fish and Wildlife Coordination Act	FC
National Environmental Policy Act *	PC
Land and Water Conservation Fund Act	FC
Marine Protection, Research & Sanctuaries Act of 1972	FC
National Historic Preservation Act of 1972	FC
River and Harbors Act of 1899	FC
Magnuson-Stevens Fishery Conservation & Management Act *	FC
Marine Mammal Protection Act	FC
Bald Eagle Protection Act	FC
Watershed Protection and Flood Preservation Act	FC
Wild & Scenic Rivers Act	N/A
Executive Order 11593, Protection of Cultural Environment	FC
Executive Order 11988, Flood Plain Management	FC
Executive Order 11990, Protection of Wetlands	FC
Executive Order 12898, Environmental Justice	FC
Executive Order 13045, Protection of Children	FC
STATE AND LOCAL	
State Water Quality Certification *	PC
Alaska Coastal Management Program *	PC

PC = Partial compliance, FC = Full compliance

*Full compliance will be attained upon completion of the permitting process which is dependent upon completion of plans and specifications

11.0 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

The studies documented in this report indicate that Federal construction of navigation improvements with rubblemound breakwaters, as described in the recommended plan, is technically possible, economically justified, and environmentally and socially acceptable. Of the alternatives evaluated in this study, the East Site Rubblemound 320-Vessel alternative was chosen by the local sponsor as the locally preferred plan due to physical limitations at the project site. The NED benefits for this alternative are found to be increasing in size over the next smaller alternative thus indicating that the NED plan is larger than the locally preferred plan. Valdez is willing to act as the non-Federal sponsor for the project and fulfill all the necessary local cooperation requirements. Thus, it is concluded that the navigation improvements described herein should be pursued by the Federal government in cooperation with the city.

11.2 Consistency with the Chief of Engineers Actions for Change for Applying Lessons Learned during Hurricanes Katrina and Rita

This section explains how the selected plan for the Navigation Improvements, Valdez, Alaska is consistent with each of the Chief of Engineers Action for Change for Applying Lessons Learned during Hurricanes Katrina and Rita.

11.2.1 Effectively Implement a Comprehensive Systems Approach

This item of change describes how the Corps will comprehensively design, construct, maintain and update engineered systems to be more robust, with full stakeholder participation.

11.2.1.1 Item of Change 1 - Employ Integrated, Comprehensive and Systems-based Approach

In planning for this project the study examined the system of commercial and recreational vessel usage in the PWS region. We considered how the system of Valdez Harbor was utilized for various purposes, where the system inefficiencies were, and what measures could be implemented to improve those inefficiencies.

11.2.1.2 Item of Change 2 - Employ Risk-based Concepts in Planning, Design, Construction, Operations, and Major Maintenance

The analysis of this study investigated what would happen if the costs or benefits of the project would increase or decrease and how that may affect project justification. We also examined the impact of hydraulic conditions on the breakwater to determine the most appropriate dimension and gradations of this structure. We also examined how the tidal cycle would affect the performance of the project to determine what the appropriate depth of dredging would be in order to achieve the desired project benefits. However, when taken into the greater context of projects that provide physical protection from damages, this is a very low risk project in terms of likelihood of physical damages and the magnitude of potential damages.

11.2.1.3 Item of Change 3 - Continuously Reassess and Update Policy for Program Development, Planning Guidance, Design and Construction Standards

This Item of Change is not directly applicable to the navigation improvements project for Valdez, Alaska.

11.2.1.4 Item of Change 4 - Employ Dynamic Independent Review

This project was one of the first District projects to have an ATR performed not only by a different District, but by an entirely different Division as well. Just performing required reviews was not considered sufficient. At several times throughout project formulation, the PDT called upon national experts in the formulation of small boat harbors to identify key policy issues and how best to ensure the project was in compliance with current policy and practice.

11.2.1.5 Item of Change 5 - Employ Adaptive Planning and Engineering Systems

The District employed a project charrett meeting and many other collaborative meetings as part of the planning process to identify the needs and concerns of the community, project stakeholders, and environmental resource agencies to develop a plan that met the many needs of the community, the environment, and the harbor users.

11.2.1.6 Item of Change 6 - Focus on Sustainability

As part of the project, an agreement was reached with the USFWS to dispose of dredged materials in an area that was damaged by its former use as a log boom holding facility. By depositing the dredged materials at this site, a more suitable material for the aquatic environment would be recreated. In addition, the new project examined the ability of the harbor to naturally provide the appropriate circulation and flushing needed for maintaining water quality.

11.2.1.7 Item of Change 7 - Review and Inspect Completed Works

As part of the planning and design of this project, the PDT used a variety of lessons learned from historical projects and ones that have recently gone through formulation and approval processes. We also examined the existing harbor and associated revetment projects to ensure that anything we would incorporate into our designs would not propagate inefficiencies or shortcomings of previous projects.

11.2.1.8. Item of Change 8 - Assess and Modify Organizational Behavior

This Item of Change is not directly applicable to the navigation improvements project for Valdez, Alaska.

11.2.2 Communication

This Item of Change discusses the effective and transparent communication with the public, and within the Corps, about risk and reliability.

11.2.2.1 Item of Change 8 - Effectively Communicate Risk

The PDT met with stakeholders, the local sponsor, and resource agencies to discuss the planning process, plan selection methodology, and the recommended plan and its expected performance. As mentioned previously, this is a low risk project.

11.2.2.2 Item of Change 9 - Establish Public Involvement Risk Reduction Strategies

The public will be able to review the project and public meetings will be held to discuss the findings and recommendations of this report. As mentioned previously, this is a low risk project.

11.2.3 Reliable Public Service Professionalism

Improve the state-of-the-art and the Corps' dedication to a competent, capable workforce on a continuing basis. Make the commitment to being a "learning organization" a reality.

11.2.3.1 Item of Change 11 - Manage and Enhance Technical Expertise and Professionalism.

This Item of Change is not directly applicable to the navigation improvements project for Valdez, Alaska.

11.2.3.2 Item of Change 12. - Invest in Research

This Item of Change is not directly applicable to the navigation improvements project for Valdez, Alaska.

11.3 Consistency with the Environmental Operating Principles

The recommended plan maximizes the balance of human need and impacts to the environment. The community and harbor users were involved in the planning process and endorse the recommended plan. Mitigation of impacts to the environment was incorporated to place dredged material in a location in need of such material to help generate a more natural aquatic environment. The breakwater layout maximizes circulation within the harbor to provide sustainable water quality. The environmental operating principles were addressed in the project as follows:

Environmental Sustainability

- Self-flushing harbor – ensures adequate water quality
- Breakwater design – minimal O&M

Interdependence of Life and the Physical Environment

- Minimized impacts to the marine environment
  - Putting dredged material into an impacted area to generate aquatic habitat
  - Provided near-shore gaps for fish passage

Seek Balance and Synergy between Human and Natural Systems

- Coordinated alternative development with the community members, harbor users, and State and Federal agencies

Continue to Accept Corporate Responsibility and Accountability

- Addressed agency and public concerns
- Identified and mitigated all project impacts

Assess and Mitigate Cumulative Impacts to Environment

- Project designed to minimize impacts
  - Minimize project footprint
- Unavoidable impacts mitigated
- Construction windows to avoid salmon migration
- Isolate in-water construction as necessary to minimize turbidity

Build and Share Knowledge

- Multi-partner effort to obtain study information to arrive at a recommended plan
- Utilized local knowledge of wind and wave conditions
- Utilized local and regional knowledge of vessel practices

Respect the Views of Individuals and Groups

- Listened to and incorporated views of others through public and team meetings

11.4 Recommendations

I recommend that the navigational improvements in Valdez, Alaska, be constructed generally in accordance with the plan herein, and with such modifications thereof as at the discretion of the Chief of Engineers may be advisable at an estimated Federal cost of $19,596,000 and non Federal cost of $36,221,000 provided that prior to construction the local sponsor agrees to the following:

a. Provide, during the period of design, 25 percent of design costs allocated by the Government to commercial navigation in accordance with the terms of a design agreement entered into prior to commencement of design work for the project; and provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs allocated by the Government to commercial navigation in accordance with the cost sharing as set out in paragraph b. below;

b. Provide, during construction, 10 percent of the total cost of construction of the general navigation features attributable to dredging to a depth not in excess of 20 feet; plus 25 percent of the total cost of construction of the general navigation features attributable to dredging to a depth in excess of 20 feet but not in excess of 45 feet; plus 50 percent of the total cost of construction of the general navigation features attributable to dredging to a depth in excess of 45 feet;

c. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of the general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the non-Federal sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the 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, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;

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

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

f. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities consisting of the existing float system and additional floats added to accommodate the fleet designed for the recommended project 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;

g. Shall not use funds from other Federal programs, including any non-Federal contribution required as a matching share thereof, to meet any of the non-Federal obligations for the project unless the Federal agency providing the Federal portion of such funds verifies in writing that expenditure of such funds for such purpose is authorized;

h. Shall prepare and implement a harbor management plan that incorporates best management practices to control water pollution at the project site and to coordinate such plan with local interests;

i. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way required for construction or operation and maintenance of the general navigation features and the local service facilities, including those necessary for relocations, the borrowing of materials, or the disposal of dredged or excavated material and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act;

j. 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 project for the purpose of operating and maintaining the general navigation features;

k. Hold and save the United States free from all damages arising from the construction or 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;

l. Keep and maintain books, records, documents, or other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, or other evidence are required, to the extent and in such detail as will properly reflect total costs 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 Code of Federal Regulations (CFR) Section 33.20;

m. Comply with all applicable Federal and State laws and regulations, including, but not limited to: Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d) and Department of Defense Directive 5500.11 issued pursuant thereto; Army Regulation 600-7, entitled “Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army”; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c *et seq.*);

n. Perform, or ensure performance of, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for construction or operation and maintenance of the general navigation features. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal 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;

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

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

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and Section 101(e) of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2211), which provides that the Secretary of the Army shall not commence the construction of any water resources project, or separable element thereof, until each non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

r. Ensure that lands created for the proposed project are retained in public ownership for uses compatible with the authorized purposes of the project. The non-Federal sponsor shall regulate the use, growth and development on such lands for the industries whose activities are dependent upon water transportation.

The recommendations for implementation of navigation improvements in Valdez, 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.

Reinhard W. Koenig   4 Oct 10

Reinhard W. Koenig
Colonel, Corps of Engineers
District Commander

Date

12.0 DOCUMENT PREPARERS

The persons listed in this table contributed to the preparation of this study through planning, research, data collection, writing, editing, and reviewing the feasibility report and environmental assessment.

Merlin Peterson, PE, Coastal Engineer, Alaska District, U.S. Army Corps of Engineers. Mr. Peterson prepared the Hydraulics Design appendix.

Bruce Sexauer PE, Senior Plan Formulator, Alaska District Corps of Engineers. Mr. Sexauer is the current plan formulator for this project and a principal preparer of the planning report.

Dave Martinson, Project Manager, Alaska District, U.S. Army Corps of Engineers. Mr. Martinson was the previous plan formulator for the study. He is currently the Project Manager.

Lorraine Cordova, Economist, Alaska District Corps of Engineers. Ms. Cordova prepared the economic appendix.

Guy McConnell, Biologist, Alaska District Corps of Engineers. Mr. McConnell is the current lead biologist for this project and a principal preparer of the planning document and the principal preparer of the environmental assessment.

Chris Hoffman, Biologist, Alaska District Corps of Engineers. Mr. Hoffman prepared the marine benthic assessment for the beneficial use of dredged material analysis

Diane Walters, writer-editor Alaska District, Corps of Engineers. Ms. Walters edited and organized this document.

Neil Rodriguez, Economist, formerly with the Alaska District Corps of Engineers. Mr. Rodriquez assisted in the preparation the economic appendix.

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Tryck, Nyman, and Hayes. Architect and Engineering Consultant assisted in designing alternatives.

Jon Brown, Economist with the Buffalo District, U.S, Army Corps of Engineers contributed to the economic analysis for the study.

Estrella Campellone, Biologist, Alaska District Corps of Engineers. Ms. Campellone prepared figures used in the environmental assessment.

John Burns. Mr. Burns (retired) worked as a biologist in Alaska for 30 years including 26 years with the Alaska District Corps of Engineers. Mr. Burns did the early environmental analysis for the study.

Larry Bartlett, Biologist (deceased), Alaska District Corps of Engineers biologist for 10 years and retired as a fisheries biologist from the Alaska Department of Fish and Game. Mr. Bartlett conducted field analysis, mapped habitat, contributed photographs, and wrote sections of the document.

Lizette Boyer, Biologist (retired), Alaska District Corps of Engineers. Ms. Boyer compiled data, worked with and was the principal preparer of initial versions of the Environmental Assessment.

Margan Grover, Archeologist, formerly with the Alaska District Corps of Engineers. Ms. Grover contributed to the cultural resources, existing environment and consequences sections of the environmental assessment.

Marcia Heer, Biologist, formerly with the USFWS wrote the Fish and Wildlife draft Coordination Act Report.

Dana Seagars, Ann Rappoport and Mary Lynn Nation of USFWS contributed to the final (revised) Coordination Act Report.

Jon Hozey and Nancy Peterson, City of Valdez project sponsor, contributed significant time and energy to seeing this project completed.

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APPENDIX 1

Evaluation under Section 404 (b)(1) of the Clean Water Act

EVALUATION UNDER
SECTION 404(b)(1) CLEAN WATER ACT 40 CFR PART 230
VALDEZ NAVIGATION IMPROVMENTS

EAST SITE RUBBLEMOUND 320-VESSEL ALTERNATIVE

I. Project Description

The proposed recommended harbor plan (East Site 320-Vessel Plan) would construct an approximately 5.7 hectare harbor at Valdez, Alaska. The harbor would accommodate approximately 320 commercial fishing and recreational vessels. Harbor construction includes a 473-meter-long south breakwater, 240-meter-long east breakwater and a 30-meter-long stub breakwater. The rubblemound breakwaters would require approximately 86,450 cubic meters (m^3) of rock discharged at the site. The mooring basin and the entrance and maneuvering channels would require 186,400 m^3 of dredging. The footprint of the harbor, including the basin and breakwaters, would be approximately 10 ha. The harbor improvements would benefit local economic development and provide for transient and permanent moorage. The proposed action description and alternatives are contained in the accompanying integrated feasibility report/environmental assessment.

II. Factual Determinations

A. Physical Substrate Determinations

The beach surface at the harbor site has a fairly flat sandy profile that consists primarily of coarse sand and cobble, scattered boulders, and some silt. At the outer extent of the harbor the profile slopes to deep water. Bedrock next to the shoreline may extend into the subsurface requiring blasting to create the moorage basin.

B. Water Circulation, Fluctuations, and Salinity Determinations

Tidal action and swift currents influence water circulation patterns in the project area. Circulation within the proposed harbor would be influenced by the tidal prism, water depth, and flow through the detached breakwaters and the entrance channel. Lower wave energy, increased water depths, and altered current patterns behind the breakwater could result in minor salinity and temperature fluctuations. Since the discharge of the dredged material would occur in open water that is approximately 10 fathoms deep, it would not be expected to have more than a negligible effect on area circulation patterns.

C. Suspended Particulate/Turbidity Determinations

An increase in suspended sediment load and turbidity would be expected during and immediately following periods of work. Due to the size and type of sediment to be dredged and discharged, significant plumes would not be expected to occur. Should small plumes occur, they would be localized and short-lived. Based upon an analysis of the forces acting on the disposal of the dredged material as it is dumped below the water surface, most material would be directly deposited over approximately or 5 hectares on the seabottom. The discharge would purposely cap the decomposing bark debris covering the sea bottom. Fines would be displaced over a larger area. Concentrations would not be expected to approach lethal dosages for aquatic species known to occur in the area.

D. Contaminant Determinations

The proposed construction project would not be associated with any contaminant materials. Marine sediments along the beach at the harbor site were collected and classified by the U.S. Army Corps of Engineers Geotechnical Branch. Sediment samples were tested and considered suitable for water disposal. There are no known sources of contamination at the site; the material is considered to be in a relatively high current/wave energy area, and sediment is composed predominantly of sand, gravel, and other bottom material with particle sizes larger than silt.

E. Aquatic Ecosystems and Organism Determinations

The proposed work would destroy or displace organisms at the harbor site (approximately 10 hectares). Organisms would be expected to colonize the harbor area after construction is completed; however, species composition and density would not be expected to mirror pre-construction conditions since substrate type and water depth would be altered. At the disposal site, non-motile and most slow moving organisms (e.g. crab, shrimp, and other invertebrates) could be smothered by the dredged material. However, given the low habitat value of the bark debris, organisms are not abundant. 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 restored bottom habitat. Further discussion of the aquatic resources and anticipated impacts is contained in the environmental assessment (Sections 7 and 8).

F. Proposed Disposal Site Determinations

The proposed action would comply with applicable water quality standards and would have no appreciable detrimental effects on any of the following:

- Municipal and private water supplies;

- Recreational and commercial fisheries;

- Water-related recreation; or

- Aesthetics.

The dredge and fill operations would have only a temporary effect on the water column. The breakwater would create rock-reef habitat suitable for colonization. The majority of the dredged materials would be discharged at the restoration site at Two Moon Bay. Mitigation measures are: (a) breakwaters would be constructed prior to dredging. The breakwaters with the use of silt curtains would contain as much as possible of the turbid water; and (b) breakwaters would be detached from the shoreline to facilitate near shore migration of fish. Seasonal avoidance windows to protect fish and wildlife would be incorporated in the construction plan.

G. Determination of Cumulative and Secondary Effects on the Aquatic Ecosystem

A minor amount of boat traffic would increase in the Valdez area as a result of harbor construction. Increased vessel activity and incidental release of pollutants such as paints, fuel, grease, oils from boats, and from discarded debris would degrade water quality within the proposed harbor. The degree of degradation would depend upon water exchange behind the breakwater and the proper handling of sewage, refuse, wastes, and other pollutants. A harbor management plan is recommended to include best management practices. A bilge water pump-out facility is planned at the harbor which would benefit the best management practices.

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge

A. Adaptation of the Section 404 (b)(1) Guidelines to this Evaluation

The proposed project complies with the requirements set forth in the Environmental Protection Agency's Guidelines for Specification of Disposal Sites for Dredged or Fill Material.

B. Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem

A number of alternative sites and designs have been rejected as being impracticable and/or not fulfilling the project purpose and need. The alternative discussion is contained in Section 4. The action, as proposed, including the water disposal of the majority of the dredged materials, is the least damaging practicable alternative after taking into consideration cost, existing technology, and logistics in light of the overall project purpose.

C. Compliance with Applicable State Water Quality Standards

The proposed project would not be expected to have an appreciable adverse effect on water supplies, recreation, growth and propagation of fish, shellfish and other aquatic life, or wildlife. It would not be expected to introduce petroleum hydrocarbons, radioactive materials, residues, or other pollutants into the waters of Valdez. A temporary increase in turbidity would result from construction activities. The project would comply with State water quality standards. Adherence to water quality standards would be monitored.

D. Compliance with Applicable Toxic Effluent Standards or Prohibition Under Section 307 of the Clean Water Act

No toxic effluents that would affect water quality parameters are associated with the proposed project. Therefore, the project complies with toxic effluent standards of Section 307 of the Clean Water Act.

E. Compliance with Endangered Species Act of 1973

The proposed project would not have an adverse effect on Steller sea lions or whale species that are listed as threatened or endangered or their critical habitat. This determination has been coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, agencies responsible for management of protected species.

F. Evaluation of Extent of Degradation of the Waters of the United States

There are no municipal or private water supplies in the area that could be negatively affected by the proposed project. Commercial interests would benefit from harbor improvements. There would be no significant adverse impacts to plankton, fish, shellfish, wildlife, and/or special aquatic sites.

APPENDIX 2

Evaluation under Section 404 (b)(1) of the Clean Water Act Two Moon Bay

EVALUATION UNDER SECTION 404**(b)**(1)
OF THE CLEAN WATER ACT
FOR
TWO MOON BAY DISPOSAL AREA
VALDEZ, ALASKA

I. PROPOSED PROJECT DESCRIPTION

The proposed recommended harbor plan (East Site 320-Vessel Plan) would construct an approximately 5.7 hectare harbor at Valdez, Alaska. The harbor would accommodate approximately 320 commercial fishing and recreational vessels. Harbor construction includes a 473-meter-long south breakwater, 240-meter-long east breakwater and a 30-meter-long stub breakwater. The rubblemound breakwaters would require approximately 86,450 cubic meters (m^3) of rock discharged at the site. The mooring basin and the entrance and maneuvering channels would require 186,400 m^3 of dredging. The footprint of the harbor, including the basin and breakwaters, would be approximately 10 ha. The harbor improvements would benefit local economic development and provide for transient and permanent moorage. Approximately 72,280 m^3 of the dredged material would be used in creating a staging area in the intertidal zone. A 404(b)(1) analysis was undertaken for the harbor site construction and is included as a separate appendix to the accompanying integrated feasibility report/environmental assessment.

The excess dredged material, estimated at 119,720 m^3, would be disposed of in 40 to 60 feet of water at Two Moon Bay as part of a beneficial use of dredged material disposal plan. This site is approximately 50 km from Valdez. The footprint of the Two Moon Bay disposal site would be approximately 5 to 8 hectares. This 404(b)(1) analysis is specific to the Two Moon Bay beneficial use disposal site. A more detailed description of the proposed action and alternatives is in the integrated feasibility report/environmental assessment.

II. SUBPART B—COMPLIANCE WITH THE GUIDELINES

Sec 230.10 Restrictions on discharge.

(a) Alternatives Test:

Alternative disposal sites have been rejected as being impracticable and/or not fulfilling USACE Environmental Operating Principles. A disposal alternatives discussion is contained in Section 4 of the environmental assessment. The beneficial use of dredged material in Two Moon Bay is the least damaging practicable alternative after taking into consideration cost, environmental considerations, existing technology, and logistics in light of the overall project purpose.

1. Based on the discussions in subparts D & E, there are no available, practicable alternatives having less adverse impacts on the aquatic ecosystem and without other significant adverse environmental consequences that do not involve discharges into "waters of the U.S." or at other locations within these waters.

2. Based on subpart E, the proposed disposal site is not located within a special aquatic site.

(b) Special Restrictions.

1. The proposed discharge would not violate state water quality standards**.**

The proposed project would not be expected to have a long-term adverse effect on water quality or recreation. The proposed disposal action is not expected to introduce substantial petroleum hydrocarbons, radioactive materials, residues, or other pollutants into wetlands and other waters of the United States. The proposed dredge area was tested in May 2000 and no contaminations were found. The material was deemed suitable for beneficial use disposal (USACE, 2000). The sediments associated with this project are suitable for in water disposal and are natural sediments that would be taken from an area east of Valdez Harbor and transported to Two Moon Bay. There would be no net loss or gain of sediments in Valdez Arm as a result of this disposal action.

2. The proposed discharge would not violate toxic effluent standards [under Section 307] of the Clean Water Act**.**

The proposed project is not expected to increase levels of contaminants to the aquatic ecosystem in Valdez Arm. The proposed dredge site was tested in May 2008 and was found to have no contamination (USACE, 2008). Best management practices on the vessels are also taken to prevent spills and contaminant release into the environment from equipment associated with the disposal action.

3. The proposed discharge would not jeopardize endangered or threatened species or their critical habitat**.**

The proposed project would not have an adverse effect on Steller sea lions or whale species that are listed as threatened or endangered or their critical habitat. This determination has been coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, agencies responsible for management of protected species.

4. The proposed discharge would not violate standards set by the Department of Commerce to protect marine sanctuaries, as there are no marine sanctuaries in the project area.

(c) Other restrictions:

1. The discharge would not contribute to significant degradation of "waters of the U.S." through adverse impacts to human health or welfare, through pollution of municipal water supplies, fish, shellfish, wildlife and/or special aquatic sites.

There are no municipal water supplies in the area that could be negatively affected by the proposed project. This disposal action would result in taking sediment suitable for in water disposal from one place in Valdez Arm and placing it in another. There would be no net loss or gain of sediment in Valdez Arm. Although there would initially be increases in sediment and turbidity, no substantial impacts are expected to occur to plankton, fish, shellfish, and/or wildlife. There are no special aquatic sites within the proposed disposal site

2. The discharge would not contribute to significant degradation of "waters of the U.S." through adverse impacts to life stages of aquatic life and/or wildlife.

The disposal would not substantially impact various life stages of aquatic life and/or wildlife. For further discussion see Subparts C and D below.

3. The discharge would not contribute to significant degradation of "waters of the U.S." through adverse impacts to diversity, productivity, and stability of the aquatic life and other wildlife or its habitats, nor to the loss of the capacity of wetlands to assimilate nutrients, purify water or reduce wave energy.

The disposal of these materials would occur in Two Moon Bay. Disposal Methodology would ensure that target parameters are met in order to successfully cap the log transfer site at Two Moon Bay. The actual discharge would likely take place below the water surface from the hull of a hopper dredge, so surface feeders are minimally affected. The disposal has no impact on wetlands ability to assimilate nutrients, purify water or reduce wave energy.

4. The discharge would not contribute to significant degradation of "waters of the U.S." through adverse impacts to recreational, aesthetic, and/or economic values.

Conversely, if dredging does not occur to accommodate the Port's needs, recreational and economic values will be impacted, as both commercial and recreational vessels will have delays and/or the inability to dock at the port.

(d) Actions to minimize potential adverse impacts [mitigation].
All appropriate and practicable steps [40 CFR 230.70-77] would be taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem. Disposal is in an area where the sediments would be used to cap an existing log transfer facility and provide an improvement in the overall benthic environment.

Sec 230.11 Factual Determinations (Short/Long term effects on physical, chemical, & biological components of aquatic environment)

(a) Physical substrate determinations. See Subpart C below.

(b) Water Circulation, Fluctuation, and salinity determinations. See Subpart C below.

(c) Suspended particulate/turbidity determinations. See Subpart C below.

(d) Contaminant determinations.

As further discussed in Subpart G below, there are no contaminants in levels of concern to be found in the materials that are to be disposed.

(e) Aquatic ecosystem and organism determinations.

At the disposal site, non-motile and most slow moving organisms (e.g. crab, shrimp, and other invertebrates) could be smothered by the dredged material. However, given the low habitat value of the bark debris, organisms are not abundant. 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 restored bottom habitat. Further discussion of the aquatic resources and anticipated impacts is contained in the environmental assessment (Sections 7 and 8 of the integrated feasibility report and environmental assessment).

(f) Proposed disposal site determinations.

1. The disposal site was chosen because of the existence of the log transfer facility and the desire of stakeholders to cap the debris field. The Two Moon Bay disposal site could also serve as a location for future disposal if needed.

2. The following factors were considered in determining the acceptability of a proposed site:

> (i) Depth of water at the disposal site: Not applicable;
> (ii) Current velocity, direction, and variability at the disposal site: Velocities and direction are variable due to the tides; however, they are conducive to placing material in a manner that would improve the benthic habitat at the site;
> (iii) Degree of turbulence: turbidity levels would likely be minimal in Two Moon Bay as Port Fidlago is somewhat sheltered from the rest of Valdez Arm; Some increases in turbidity would be noticed within the water column during initial disposal but would likely return to normal conditions within the water column quickly following the disposal activity;

(iv) Stratification attributable to causes such as obstructions, salinity or density profiles at the disposal site: Not applicable;
(v) Discharge vessel speed and direction if appropriate; Care will be taken to place the material in a manner that will maximize the area of coverage at specified depths to maximize the capping of the existing debris field;
(vi) Rate of discharge. Discharge rate is relative to density and composition of dredged material;
(vii) Ambient concentration of constituents of interest.
(viii) Dredged material characteristics, particularly concentrations of constituents, amount of material, type of material (sand, silt, clay etc.) and settling velocities: The beach surface at the harbor site has a fairly flat sandy profile that consists primarily of coarse sand and cobble, scattered boulders, and some silt. At the outer extent of the harbor the profile slopes to deep water. Bedrock next to the shoreline may extend into the subsurface requiring blasting to create the moorage basin.;
(ix) Number of discharge actions per unit of time.
(x) Other factors of the disposal site that affect the rates and patterns of mixing.

(g) Determination of cumulative effects on the aquatic ecosystem.

The designated disposal site could also serve as a disposal site for future maintenance dredging associated with Valdez Harbor and potentially other future dredging or construction projects. Given the extent of the bark debris and water depths in Two Moon Bay, disposal at this site would provide benefit to benthic organisms within Port Fidalgo. Futhermore, support exists for future disposal in an effort to further raise the bottom elevation in order to support eel grass within the photosynthetic layer of the water column. No substantial negative cumulative effects are expected to occur as a result of this project. Further and future analysis of effects will be generated from monitoring the site after project construction.

(h) Determination of secondary effects on the aquatic ecosystem.

Secondary effects of this project would include:

- temporary increases in noise and vessel traffic during operation. Based upon noise readings from ERDC, any expected noises from the proposed work would remain below thresholds known as harmful to marine mammals.
- increased frequency of temporary disturbance to wildlife using Two Moon Bay. The physical presence of tugs and barges would temporarily displace most sea birds and marine mammals from the immediate disposal area during dumping operations. Juvenile salmon and other fishes are mostly surface oriented due to the high sediment bed-loads in strongly mixed tidal estuaries like Upper Cook Inlet. These fishes would tend to avoid temporary increases in surface turbidity and would temporarily be displaced from the area. This temporary displacement from a relatively small part of Two Moon Bay is not expected to have more than a minimal impact on the growth rates or overall survival of juvenile salmonids or

other fishes in Port Fidalgo. There could be mortality of bottom-dwelling fish and less mobile aquatic organisms such as smolts;
- potential for marine mammal strikes from vessels. This is not likely.
- the potential for fuel to be introduced into the water column from dredge and boat equipment. These potentials are minimized by using best management practices;

Secondary effects resulting from the proposed project would not be substantial.

III. SUBPART C – POTENTIAL IMPACTS ON PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM.

Sec. 230.20 Substrate.

Prior to the site being used as a log transfer facility, a pre-project assessment of the site for the log transfer facility was conducted by U.S. Fish and Wildlife Service and the Alaska Department of Game and Fish (ADFG) in 1985. The area was originally characterized as a shallow gravel shelf that was approximately 60 feet in length. The report documented that the gravel shelf ended approximately 90 feet offshore with a steep 25 foot drop off where the substrate flattened to a silt/mud bottom. A bark accumulation monitoring study conducted in 1992 divided the project site into transects and reported on each transect. The study found sections along each transect with "fairly deep" depositional areas of bark accumulation (>15cm). The heaviest bark accumulation occurred at the base of the slope adjacent to the LTF face and generally tapered off as distance form the LTF increased.

This disposal of dredge material at this location is intended to cap the existing woody debris and change substrate composition to benefit the benthic environment.

Sec 230.21 Suspended particulates/turbidity.

An increase in suspended sediment load and turbidity would be expected during and immediately following periods of work. Due to the size and type of sediment to be dredged and discharged, significant plumes would not be expected to occur. Plumes would be localized and short-lived. Based upon an analysis of the forces acting on the disposal of the dredged material as it is dumped below the water surface, most material would be directly deposited over approximately 5 hectares on the seabottom. The discharge would purposely cap the decomposing bark debris covering the sea bottom. Fines would be displaced over a larger area. Concentrations would not be expected to approach lethal dosages for aquatic species known to occur in the area.

Sec 230.22 Water.

The discharge of dredged material in association with this project will not change the chemistry and the physical characteristics of the receiving water at the disposal site through the introduction of any chemical constituents in suspended or dissolved form.

Sec 230.23 Current patterns and water circulation.

Water circulation within Two Moon Bay is influenced by the tidal prism and water depths within the bay. Two Moon Bay probably experiences less wave energy as a result of being protected waters from Port Fidalgo or Valdez Arm. As with any coastal bay, salinities likely fluctuate seasonally and may stratify within the water column depending on weather, tides, and other environmental conditions. The reason for choosing the LTF at Two Moon Bay for dredge material disposal is to cap the existing bark accumulation that has created a dead zone within the benthic layer. As a result, the discharge of the dredged material would occur in open water using methodologies that would ensure that the existing bark layer would be capped. The disposal of the dredge material would be expected to have a positive effect on the area and will not likely impact circulation patterns within the project area.

The proposed disposal is not expected to have a measurable effect on current patterns or water circulation.

Sec 230.24 Normal water fluctuations.

This disposal project will not affect water fluctuations in Two Moon Bay.

Sec. 230.25 Salinity gradients.

This disposal project has no affect on salinity gradients in Two Moon Bay.

IV. SUBPART D – POTENTIAL IMPACTS ON BIOLOGICAL CHARACTERISTICS OF THE AQUATIC ECOSYSTEM

Sec 230.30 Threatened and endangered species.

The proposed project would not have an adverse effect on Steller sea lions or whale species that are listed as threatened or endangered or their critical habitat. This determination has been coordinated with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, agencies responsible for management of protected species.

Sec. 230.31 Fish, crustaceans, mollusks, and other aquatic organisms in the food web.

A complete list of species can be found in the Environmental Assessment to which this evaluation is appended. Several of these species are important for commercial, recreational, subsistence, and personal uses. Species include five species of Pacific salmon of the genus *Oncorhynchus*, Pacific herring, arrowtooth flounder, rex soul, flathead sole, yellowfin sole, Pacific cod, Walleye Pollock, and tanner crab.

Of major importance are the juveniles of the five Pacific salmon species. These juvenile salmonids migrate and feed throughout Valdez Arm. Depending on the species, they can spend up to about 4 months feeding on zooplankton, shrimp-like invertebrates, small fish, and even terrestrial insects throughout the Valdez Arm area.

This disposal action would not adversely impact essential fish habitat (EFH) including salmon, groundfish, and forage fish populations or their habitats. It will result in temporary turbidity that juvenile and adult Pacific salmon will avoid, but it will not interfere with the homing instinct of migration timing of adults and will have only minor effects, if any on juvenile salmon. However, there is potential for some impact to smolt not strong enough to navigate the tides and currents well enough to avoid more turbid areas, and/or to groundfish who are not visual navigators. Any potential impacts are expected to be minor and limited to a small area in the vicinity of the dredge hull.

This determination has been coordinated with the National Marine Fisheries Service, which is responsible for managing EFH under the Magnuson-Stevens Fishery Conservation and Management Act.

Invertebrates are scarce at the Two Moon Bay log transfer facility as a result of the woody debris. Thus invertebrate habitat improvement is the primary objective of capping the log transfer facility at this point in time.

Sec 230.32 Other wildlife.

Wildlife on the disposal site consists of marine mammals, fish, invertebrates, and marine birds. Marine mammals in the project area consist primarily of harbor seal, sea otter, and sea lions that use Two Moon Bay and the surrounding marine waters for feeding and resting.

V. SUBPART E – POTENTIAL IMPACTS ON SPECIAL AQUATIC SITES.

The definition of special aquatic sites is found in Sec. 230.3 (q-1).

None of this Subpart E is applicable to this project.

Sec. 230.40 Sanctuaries and refuges.

None are in the project area.

Sec. 230.41 Wetlands.

None are in the project area.

Sec. 230.42 Mud flats.

None are in the project area.

Sec. 230.43 Vegetated shallows.

None are in the project area.

Sec. 230.44 Coral reefs.

None are in the project area.

Sec 230.45 Riffle and pool complexes.

None are in the project area.

VI. SUBPART F – POTENTIAL EFFECTS ON HUMAN USE CHARACTERISTICS

Sec. 230.50 Municipal and private water supplies.

There are no water supply sources or uses associated with this project.

Sec. 230.51 Recreational and commercial fisheries.

Commercial fisheries

Commercial Fisheries in Valdez Arm are managed by the Alaska Department of Fish and Game with Prince William Sound Eastern Subdistrict Management Plan and Strategies defined by the Alaska Board of Fisheries. The commercial fisheries regulated by these plans and strategies are conservatively managed. Commercial fishing takes place throughout Valdez Arm and adjoining bays.

Sport Fishing

Sport fishing takes place throughout Valdez Arm and adjoining bays.

Sec 230.52. Water-related recreation.

Water-related recreation may occur in Two Moon Bay; however, due to the remote is likely to be infrequent at the Two Moon Bay disposal site.

Sec. 230.53 Aesthetics.

The act of disposing dredged material into Two Moon Bay at the designated site would have the effect of seeing and hearing the dredged and transport barge in operation during the dredging periods listed in Table 2. Port Fidalgo experiences some recreational and subsistence use but is not a heavily traveled area. The temporary addition of a dredge barge, hopper barge, and tugs would have only minor effects on the aesthetics of the Port Fidalgo area for the occasional users.

Sec. 230.54 Parks, national and historic monuments, national seashores, wilderness areas, research sites, and similar preserves.

There are no parks or preserves associated with this project. However, the project area is located seaward of the Chugach National Forest.

VII. SUBPART G – EVALUATION AND TESTING

Sec. 230.60 General evaluation of dredged or fill material.

Sediment from the Port of Valdez was last tested for contamination in 2006(USACE, 2007). No petroleum hydrocarbons, pesticides or PCBs were detected. All heavy metal concentrations were well below management levels and the sediment is suitable for in water disposal. Sediment dredged from the Port of Valdez would be taken from the vicinity of port construction and placed in the beneficial use disposal site. Heavier materials would sink to the bottom of the disposal area and the finer sediments that would remain in suspension for a longer time would be spread thinly in many areas of Two Moon Bay. The concentration of heavier sediments on the bottom and the thin layer of finer sediment that settles out within the old log transfer facility are expected to have positive effects on the aquatic ecosystem of Two Moon Bay. Post construction monitoring of the site will evaluate the success or failure of the beneficial use of the dredge material.

VIII. SUBPART H – ACTIONS TO MINIMIZE ADVERSE EFFECTS

Note: There are many actions which can be undertaken in response to Sec. 230.10(d) to minimize the adverse effects of discharges of dredged or fill material. Some of these, grouped by type of activity, are listed in this subpart.

Sec. 230.70 Actions concerning the location of the discharged material.

The location for disposal of materials associated with construction at the Port of Valdez has been identified as a beneficial use site. The disposal site is an old log transfer facility. The material for disposal is similar in content to substrate in the disposal area prior to the accumulation of woody debris at the site.

Sec. 230.71 Actions concerning the material to be discharged.

Based upon testing results, the proposed dredge material is free of contaminants in levels of any concern. Therefore, all of the material is suitable for disposal at the Two Moon Bay disposal site.

Sec. 230.72 Actions controlling the material after discharge.

The disposal methodology will ensure maximum coverage of the beneficial use site for the purpose of capping the existing woody debris presently smothering the benthic layer. However, based upon testing results, there is no need to contain or control the material after discharge. The idea is to cap the existing log debris facility as efficiently as possible and allow the benthic layer to naturally recolonize. Currents within Two Moon Bay are relatively slow and should allow for maximum coverage of the site for the purpose of capping.

Sec. 230.73 Actions affecting the method of dispersion.

The Corps is proposing to use the footprint of the old log transfer facility to orient the material that will maximize the area to be capped. The Corps will make the best use of currents and circulation patterns to cap the existing woody debris within the footprint of the old log transfer facility.

Sec. 230.74 Actions related to technology.

The intent of this section is to address technologies that would reduce the impact to wetlands or waters of the U.S. In this type of operation, the only way to remove the materials and then dispose of them is via dredge equipment. Both clam shell and hydraulic suction dredges are used at Port of Valdez; however, the disposal method is the same. The material in each operation ends up on a barge that discharges the material approximately 10 feet below the water surface via a split hull.

Sec. 230.75 Actions affecting plant and animal populations.

Use of a split hull for disposal would disperse sediments beginning approximately 10 feet below the water surface. This would reduce potential impacts to smolt which are found at the water's surface.

Sec. 230.76 Actions affecting human use.

The discharges do not appear near public water supplies or affecting aesthetic features of the system.

Sec. 230.77 Other actions.

There are no items under this section that apply to this action.

Sec. 230.12 Findings of Compliance or Non-compliance with the restrictions on discharge:

The discharge complies with the guidelines.

REFERENCES

Chemical Data Report, Valdez Harbor Expansion study for Valdez Harbor Expansion, NPDL WO#08-060 Materials Section, Engineering Services Branch, March 2009

APPENDIX 3

Environmental Coordination Correspondence

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

August 31, 2010

Colonel Reinhard W. Koenig
U.S. Army Corps of Engineers, Alaska District
P.O. Box 6898
Elmendorf AFB, AK 99506-0898

Re: Navigation Improvements
Draft Interim Integrated Feasibility
Report and Environmental Assessment
Valdez, Alaska

Attn: Michael Salyer

Dear Colonel Koenig:

The National Marine Fisheries Service (NMFS) has reviewed the above referenced report in conjunction with the Public Notice from the U.S. Army Corps of Engineers, Alaska District Civil Works Branch (Corps), regarding proposed navigation improvements in Valdez, Alaska.

The Corps proposes to construct a new small boat harbor. The Corps has identified the East Site Rubblemound, 320-Vessel alterative in their National Economic Development Plan as the preferred alternative. This alternative would provide moorage for about 320 vessels and a basin of 5.7 hectares (ha) including the entrance channel and maneuvering basin. The entrance channel depth would be -5.5 meters (m) mean lower low water (MLLW) and the mooring basin would range from -5.5 to -2.7 m MLLW. The Corps noted that the creation of the proposed harbor area is expected to greatly increase safety in the existing harbor by alleviating the current overcrowding of vessels in this area. However, the Corps does not expect an increase in overall usage of the harbor areas after the navigation improvements.

In order to protect the harbor, two breakwaters with crest elevations of +6 m would be constructed. To protect the south side of the harbor, the main south breakwater would be 473 m long. The eastern-most 70 m of the breakwater would angle to the northeast and form the west boundary of the entrance channel. The eastern boundary of the entrance channel and harbor would be formed by the east breakwater which would be approximately 240 m long, and curve from the northeast to northwest.

To allow fish and other marine biota to move into and out of the harbor near shore, both of the breakwaters would be breached at the shoreward end. The breach in the west end of the south breakwater would be protected by a small stub breakwater which would be approximately 30 m long. This alternative requires a total of 186,400 m^3 of material to be dredged for the entrance channel, maneuvering channel, and mooring basin. Some of this dredged material would be placed at Two Moon Bay, a former log transfer facility (LTF), as mitigation. The intention is to

return the bark-strewn sea bottom at Two Moon Bay to a more natural and productive site. The remaining dredged material would be used as fill to construct a 1.87 ha staging area.
NMFS offers the following comments under the Endangered Species Act (ESA) and the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Threatened and Endangered Species / Marine Mammals

NMFS has management responsibility for all marine mammals in Alaska except sea otter, walrus, and polar bear, including several species listed as threatened or endangered under the Endangered Species Act. Section 7(a)(2) of the ESA directs federal interagency cooperation "to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species" or result in the destruction or adverse modification of critical habitat. Please visit our web sites http://www.nmfs.noaa.gov/pr/species/esaspecies.htm, http://www.fakr.noaa.gov/ for additional information.

The Draft Interim Integrated Feasibility Report Environmental Assessment and Finding of No Significant Impact Navigation Improvements Valdez, Alaska, Vol. 1, January 2010 states that the Corps has determined that "this action would not affect listed Steller sea lions." NMFS has met with the Corps to discuss this and offer suggestions.

The current harbor contains extremely functional fish cleaning stations. These stations allow fish waste to be contained and then emptied outside of the harbor. NMFS recommends having such stations present in the proposed harbor area to reduce and/or avoid concerns about Steller sea lions becoming a nuisance.

NMFS spoke with the Valdez harbor master who confirmed that there have been no issues of Steller sea lions hauling out onto floats within the existing harbor. NMFS suggests that the Corps evaluate whether utilizing float and pier designs similar to those in the current harbor for the new harbor area will also be adequate to avoid any such potential issues. If the Corps determines that additional methods may be needed to prevent Steller sea lions from hauling out onto floats and piers, NMFS would be willing to provide further information on specific designs for deterrence that have been tested in other harbors.

Essential Fish Habitat

Section 305(b)(2) of the Magnuson-Stevens Act requires federal agencies to consult on all actions or proposed actions authorized, funded, or undertaken by the agency that may adversely affect EFH. If a federal action agency determines that an action will not adversely affect EFH, no consultation is required, and the federal action agency is not required to contact NMFS about their determination. Please see our website for more information: http://www.fakr.noaa.gov/habitat/efh.htm .

In 2005, NMFS worked with the Corps to survey the project's intertidal area. We also provided input on living marine resources including preliminary EFH Conservation Recommendations and proposed mitigation concepts. In 2007, NMFS provided additional ESA and EFH information to the Corps. NMFS staff has also coordinated informally with the Corps staff throughout this project. As a result of these early coordination efforts, the project incorporates several design modifications, including unattached and specially designed breakwaters, timing windows, and minimizing to the extent practicable marine intertidal fill. As a result impacts to EFH have been avoided and minimized such that NMFS does not have any further EFH recommendations at this time.

Mitigation Options

In a letter (enclosed) to the Corps dated April 23, 2007, NMFS disagreed with the selection of the Two Moon Bay mitigation project as it is unknown whether any benefits will result from its implementation. NMFS concluded that the mitigative designs within the preferred alternative, minus the Two Moon Bay LTF fill project, are sufficient to mitigate for the effects on EFH. In contrast, NMFS recommended that should the Corps determine the need to further compensate for effects, the Corps should re-evaluate on-site mitigation to construct a free span breach of the existing harbor's eastern breakwater. Such an additional mitigation option would allow tidal exchange through the current harbor, thus improving the existing poor water quality. This option would also compensate for adverse impacts to EFH resulting from the expansion of the existing Valdez Small Boat Harbor several years ago. In fact the Corps' Draft Project Modification Report and Environmental Assessment, April 1997, Habitat Improvement Project, Valdez Harbor Modification, Valdez, Alaska Section 1135 noted that "water located in the back end (away from the entrance channel) of the harbor may not be exchanged with outside waters for several days. This would allow the accumulation of pollutants, cause an increase in water temperature through solar radiation, reduce dissolved oxygen concentrations, and cause formation of thermoclines." The report also notes that "the poor water quality will continue to degrade the potentially excellent habitat for juvenile salmon and Pacific herring." In contrast to the uncertain benefits of the Two Moon Bay option, any level of improvement to water circulation in the existing harbor would be a worthy onsite mitigation effort.

If the Two Moon Bay LTF fill mitigation option is selected by the Corps, NMFS would like to reiterate the importance of site monitoring. NMFS would appreciate the opportunity to work with the Corps' environmental department as discussed previously to conduct a pre-assessment survey and some post project monitoring of the area.

We look forward to receiving future updates on the project and to offering additional comments.

Should you have any questions, please contact LT Amy Cox by email at amy.b.cox@noaa.gov, or by telephone at (907) 271-6620.

Sincerely,

Robert D. Mecum

for James W. Balsiger, Ph.D
Administrator, Alaska Region

cc: brad.smith@noaa.gov
jeanne.hanson@noaa.gov
matthew.eagleton@noaa.gov
Michael.9.salyer@usace.army.mil

References

USACOE-CW Project Modification Report and Environmental Assessment, April 1997 Habitat Improvement Project, Valdez Harbor Modification Valdez, Alaska Section 1135 (Draft).

G:Coe Valdez Navigation Improvments comments ac 8-31-10

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

April 23, 2007

Guy McConnell
Chief, Environmental Resources Section
Civil Works (CW)
U.S. Army Engineer District, Alaska
P.O. Box 898
Anchorage, Alaska 99506-0898

ATTN: Lizette Boyer

Dear Mr. McConnell:

The National Marine Fisheries Service (NMFS) offers the following information on the presence of threatened or endangered species and their designated critical habitat, which may occur within or near the proposed small boat harbor project in Valdez, Alaska. Additionally, NMFS offers comment regarding Essential Fish Habitat (EFH) under the Magnuson Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Endangered Species
Section 7(a)(2) of the Endangered Species Act (ESA) directs federal interagency cooperation "to insure that any action authorized, funded or carried out by such an agency is not likely to jeopardize the continued existence of any endangered or threatened species" or result in the destruction or adverse modification of critical habitat.

The following species listed under the ESA for which National Marine Fisheries Service (NMFS) bears responsibility are found in this area:

Steller (Northern) Sea Lion, Western population (*Eumetopias jubatus*)......Endangered

No designated critical habitat occurs near this area. As the action agency, the Corps of Engineers (Corps) should now determine whether this action may affect the Steller sea lion. Your evaluation of potential effects should include consideration of secondary effects, including vessel traffic. Should the Corps determine that this work may affect the Steller sea lion, the Corps would then enter informal consultation, during which NMFS staff would work with the Corps' staff to consider means to avoid any adverse effects.

Essential Fish Habitat
Under Section 305(b)(2) of the Magnuson-Stevens Act, federal agencies are required to consult with the Secretary of Commerce on any action that may adversely affect EFH. The Corps has

provided information that includes a list of marine fish species present in the project area. Additional information exists for these species, and their habitat associations, within Appendix F of the EFH FEIS April 2005, available online at http://www.fakr.noaa.gov/habitat/seis/final/Volume_II/Appendix_F.2.pdf.

Marine fish habitat within the project area appears to have low value. This rating is based on low density and diversity of fish, and a minimal amount of suitable habitat utilized by fish, as documented by both historical studies and recent on-site investigations by my staff. The substrates within the project area are heavily silt laden from the nearby Lowe River. These gravel, cobble, and mud substrates are not colonized with marine algae or vegetation, except for a few high-tidal, boulders extensively covered with rockweed. Eelgrass is present; however, density is extremely sparse with only a scattering of single rooted plants.

The existing Valdez Small Boat Harbor was expanded several years ago. A direct result is a long and narrow harbor that does not circulate or flush well. This created a circulation "dead-zone" for almost half of the entire harbor area. Thus, marine resources, such as juvenile salmon and forage fish, are entrained in this area and subjected to continuous exposure of marine-related contaminants. Juvenile salmonids suffer long term reproductive, and often lethal, effects from exposure to such contaminants, even when measured in the smallest amounts (parts per billion). Additionally, the eastern breakwater is paved and has allowed access and development of a group of small islets directly adjacent to the existing harbor. The islets were at one time stand alone with intertidal areas.

Mitigation

NMFS has coordinated with your office and provided comments throughout the project, including mitigation components. As a result of early coordination efforts the project incorporates several design modifications, which avoid and minimize impacts, such as unattached and specially designed breakwaters, re-utilization of large rockweed covered boulders, timing windows, and minimizing, to the extent practicable, marine inter-tidal fill. Also, meetings were held to discuss additional needs for mitigation, and options available to mitigate for the remaining impacts that could not be avoided or minimized.

Using this step-wise approach, options to mitigate for the existing detrimental water quality (likely to be exacerbated) in the harbor were discussed. Several options were discussed and identified, including a breach of the eastern man-made breakwater to allow tidal exchange through the harbor. This option would be commensurate for associated habitat impact and loss of fish habitat.

This idea has been investigated by the ACOE-CW[1]. NMFS has reviewed the harbor breach investigation report and noted it concludes: 1) only slight water quality improvements would result and 2) water quality conditions would not be restored to their original state. NMFS does not agree with these statements. Further, context for these conclusions was limited to a culvert-type breach versus a free-span design breach. NMFS considerers any flow as beneficial and likely will result in exponential benefits to the existing condition. NMFS also finds it

[1] USACOE-CW Project Modification Report and Environmental Assessment Habitat Improvement Projects Section 1135. Valdez Harbor Modification. Valdez, Alaska. April 1997.

unnecessary to compare mitigation to the natural condition. No mitigation will fully amend the environment to the natural condition. Mitigation minimizes and compensates for human effects and is *not* meant to return the area to the natural baseline. Thus, we find the report's conclusions unrealistic and applied out of context.

The mitigation option under current consideration is out-of-kind, offsite, and not commensurate with the level of effect. The alternative includes the transportation and deposition of the new dredge spoils to fill and cover an older log transfer facility (LTF) in Two Moon Bay approximately 40 nautical miles from the project site. Several important issues surround this mitigation concept. Foremost, it is unknown whether any benefits will result. In fact, the fill even may impede current on-going recovery rates.

Discussion specific to the LTF site stated that this fill would eventually create a substrate plateau for a future eelgrass bed. The LTF site is fairly exposed to wind wave energy and these environments are not normally as conducive as to eelgrass growth in more sheltered areas. Also, the dredge spoils are mostly gravels and cobbles, which are not suitable for eelgrass colonization. Further, the LTF is fairly deep and the spoils are of insufficient amount to cover the site and far from creating the photic depth needed for eelgrass to colonize. Thus, NMFS suspects that over time the area would become a depositional "mitigation bank" for future projects. This would occur with a limited understanding as to whether or not any benefit will result to the marine environment. Thus, NMFS disagrees with the selection of the Two Moon Bay mitigation project. If restoration of the site is warranted, that would be the responsibility of the parties who took the original action; not necessarily ACOE-CW.

Conclusion

Mitigative designs within the preferred alternative, minus the Two Moon Bay LTF fill project, are sufficient and commensurate for the effects on EFH. Should the COE seek further need to compensate for effects, then NMFS recommends the ACOE-CW re-evaluate on-site mitigation to construct a free-span breach of the existing harbor's eastern breakwater.

We hope this information will be useful in fulfilling your requirements under the ESA and Magnuson-Stevens Act. Please direct any endangered marine mammal questions to Brad Smith in our Anchorage office, (907) 271-3023. Any EFH questions should be directed to Matthew Eagleton, also in our Anchorage office, (907) 271-6354.

Sincerely,

Robert D. Mecum
for Acting Administrator, Alaska Region

cc: NMFS/PRD - kaja.brix@noaa.gov
NMFS/PRD - brad.smith@noaa.gov

USFWS - phil_brna@fws.gov
OHMP –ed.weiss@dnr.state.ak.us
Records

Navigation Improvements, Valdez, Alaska

Meeting Notes
(Revised)

Feasibility Study Rescoping Workshop
July 22, 2002
Valdez, Alaska

Introduction

The rescoping workshop was organized for the purpose of discussing the locally preferred plan features, the environmental concerns and level of effort and schedule for continuing studies. The meeting was attended by Corps and City representatives (see separate attendance list) and held at the Convention Center in Valdez from 9:30 AM to 4:00 PM on Monday July 22, 2002.

Ken Turner, Corps PM, outlined the following considerations:

a. Technical constraints, including costs
b. Needs of others, including Environmental Resource agencies
c. Corps of Engineers guidelines, Federal laws and regulations.

Dave Dengel, Valdez City Manager, expressed the following concerns:

a. The city wants and needs additional harbor space
b. A new harbor is very important to the city,
c. The city is committed to providing the necessary support to get the project completed,
d. The schedule cannot be slipped further

Workshop Notes

The existing project to date was briefly reviewed, covering the west site alternatives and east site alternatives. As the day progressed, various topics as they related to the locally preferred plan (LLP), along with the already completed alternatives, were discussed. The notes summarize the main points mentioned.

The city definitely wants the east site, east of the SERVS Dock as the locally preferred harbor location. Details about the project features were touched on during the workshop.

City concerns expressed were:

a. The city needs to resolve a strategy for meeting with the Corps HQ and Congressional delegation. When, how often, etc.
b. The city believes that moving from considering Harbor Cove should be much more strongly presented as a "mitigation" measure.

c. They are concerned about the functionality of the presently selected NED plan on the west site. The NED plan in not functional with little adjacent uplands along the north side of the harbor. The cannot service the harbor properly as related to local traffic, snow removal and other tasks.
d. The west site is constrained on all four sides. There is some room for potential expansion on the east "preferred" site. A phased approach could be utilized.
e. There is a need to relook at the west site plans to insure that there is adequate uplands and access for a fully functional and serviceable harbor.
f. The cost sharing needs to be reconsidered for all plans.
g. It is desirable from the city's perspective to have at least a 14 to 16 acre harbor capable of handling 350 to 400 vessels.
h. The environmental aspects need to be taken care of. If mitigation is required, determine what it is and incorporate into the project.

Guy McConnell reviewed the environmental requirements, especially as they would be anticipated by the resource agencies. The items included:

a. Why is project needed
b. Alternatives considered
c. Environmental consequences and impacts
d. Economic evaluation
e. Design aspects and costs
f. Environmental compliance evaluation
g. Public participation and comments
h. Answers to comments

The requirements and desirability for either an EA or EIS were discussed. Aspects such as costs for each, amount of effort required and costs, relative risk of agency acceptance and time to obtain necessary data and information was discussed. Sometimes additional alternatives with the associated time and cost impacts can be added during the process. The agencies viewpoint is to get the "best deal" for the resources. While the conclusion of the discussions/debates remains unclear, it seemed to be that the best approach would be to initiate an EIS, especially if the project is leading toward a larger basin on the east side of SERVS and/or Harbor Cove is added as a potential harbor site. It was noted that if a larger east site harbor was included, additional data would be necessary and that would add at least a year, since the data could not be obtained before next summer (2003). The agencies would need specific plan details too, ones that avoid or minimize impacts.

Regulatory representatives reviewed their requirements, which involve the local portion of the project. Section 10 covers work in on over the water as related to the mean high water line, such as floats and dredging. Section 404 work covers things such as fills in waters below the high tide line. Permits are issued primarily for "the least damaging practical alternative that meets the objectives of the project." Regulatory would be coordinating with Civil Works Branch related to this project.

Tasks
A list of tasks was developed for work over the next 3 weeks prior to the next meeting of the study team. These tasks included:

1. Make a "quick review" for suitability for further study in the feasibility study of items outlined above. (COE)

2. Consider means to "increase the NED cost" for west side alternatives. (COE)

3. Review PND and old CoE studies for harbor flushing in the existing harbor. (COE)

4. Look for obstructed fish passage locations. (VAL)

5. Pass along PND harbor flushing video and report to Corps for review. (VAL)

6. Look at education and preservation mitigation ideas. (VAL)

The above items would be discussed at the next meeting.

Schedule

The next meeting/workshop will take place about August 8th or 9th. The meeting will cover the items noted above in the "Tasks" paragraph and "solidify" the alternatives that would be included in the feasibility report.

A meeting on about August 23rd would be called to go over the scope of work and budgets for continuing work on the feasibility study.

Carl S Observations

1. While there was significant discussion, the environmental issues remain still somewhat "elusive." A list of criteria and objectives could be developed to keep us on track from an environmental perspective. We all "sort of" know what they are, but I'm not sure they have been defined specifically.

2. The west site is NOT ACCEPTABLE to the sponsor. The sponsor is committed to the east site as their locally preferred plan.

3. Sponsor wants the maximum size harbor possible and will phase construction as necessary.

4. Sponsor will accept a "reasonable" local environmental mitigation.

DRAFT

Valdez Harbor Improvements Feasibility Study
Phase II Design Meeting

January 26 & 27, 2000
Valdez, Alaska

Introduction

The feasibility study team, environmental resource agency representatives and the harbor staff from the City of Valdez met to initiate Phase II of the harbor expansion project. The format for the meeting was a design charrette, which provides a systematic approach to meet the following goals:

- Provide the study team functional information from the sponsor, users and agencies at the beginning of the project to provide focus and understanding.
- Provide a partnering environment.
- Enhance study, design and construction schedules.
- Reduce study costs by avoiding re-evaluation and re-design due to "lost" information.
- Gain buy-in by all participants at an early stage of the study/project development.
- Gain sponsor and user satisfaction with the final product.
- Identify show stoppers early and resolve or determine what needs to be done to resolve them.

As part of the design charrette process a Partnering Agreement is developed and signed by those present. Its purpose is to identify the key requirements discussed and decisions reached during the charrette process, such that continuing work can proceed in an orderly fashion through the remaining Feasibility Study period.

An agenda and attendance list are shown as Attachments 1 and 2. The agenda shows the general process for conducting the design charrette. Initially, a brief overview of the current status and results of the study are presented. This is followed by all present voicing their goals and objectives for the study as a whole and for the meeting. The process is facilitated by an experienced facilitator, who guides the discussion, keeping it on track and writing down key points under various category headings. Next the group identifies any issues and concerns, sensitive items and items that need resolution. All constraints are identified and key design assumptions specific to the project outlined. At this point the analysis phase begins. The function of the project and its features are then identified and critically reviewed in light of the overall goals, objectives and constraints; sifting through and modifying the currently conceived plan(s) to accomplish their functions in the most cost effective manner. At the conclusion of the meeting, a well defined direction should be established, with a good idea of the design considerations and issues known. The study team can then confidently proceed knowing what the direction, approaches and critical issues are.

Background

The need for expanded harbor facilities at Valdez has been known for many years While there have been other earlier studies, this effort bagan with the preparation of a Reconnaissance Study, prepared by Tryck Nyman Hayes, Inc, dated July 1998. It recommended proceeding to the feasibility study phase with a new harbor at Harbor Cove. Two areas of concern were raised: the economic evaluation and the presence of sensitive environmental areas. Early feasibility work should focus on these areas.

The Alaska District Corps of Engineers then prepared the Section 905(b), (WRDA 86) Analysis also recommending proceeding with the feasibility study. Following Corps review, authority to proceed with the feasibility study was given. A Feasibility Cost Sharing Agreement with accompanying Project Study Plan was prepared and signed by the Corps and the Sponsor, the City of Valdez. Once funding was in place, the study was started.

Prior to the start of the feasibility study, during the development of the FCSA/PSP, a scoping meeting was held on March 4, 1999 to discuss the project. All potential sites were discussed and the three sites at Harbor Cove, West of the SERVS dock and East of the SERVS dock sites were selected for continuing study. The Mineral Creek site, Old Valdez town site, Allison Creek/Allison Point site and Existing Harbor Expansion were dropped from further detailed consideration. The economic issues were again recognized and the decision made to initiate the economic studies promptly. The environmental issues were also recognized and some work was initiated to resolve them. This meeting set the basis for the feasibility study scope.

The PSP specifically identified the above three alternative harbor sites. These alternatives were to be studied in a three-phase process. Phase I – All three sites were to receive a preliminary screening with emphasis on the economic evaluation. Phase II – Assuming two alternatives were identified in Phase I, the detailed analysis and evaluation would be completed, resulting in a draft feasibility report recommending a specific project. Phase III – This phase will finalize the feasibility study completing the Corps and public review process.

Phase I was initiated in August 1999. The engineering firm of Tryck Nyman Hayes, Inc was contracted to assist the Alaska District with the feasibility study. The design team included representatives from the Corps, the City, the ADOT and TNH. Concept designs with cost estimates were developed for each site. The economic analysis started earlier, developed a higher level of detail to insure that sufficient benefits were identified early on. This provided sufficient information to make a justifiable decision to proceed with the study or not based on the Federal NED economic procedures. The results were very promising. Annual net benefits were over $400,000 for all projects and a Federal interest in proceeding was assured. A draft Checkpoint I report was completed in November 1999 and the Checkpoint I meeting held on December 2, 1999. The Checkpoint I report was finalized shortly after the meeting. As noted, there was a Federal interest and the decision was made to continue with the project as promptly as possible. The initial design meeting was scheduled for January 2000. The results of the Checkpoint I report document the basis for this decision. Several concerns still remained. 1) History proves as studies continue, costs usually increase and benefits usually decrease. 2) The environmental issues, and especially the costs, were still not identified and would require additional effort. 3) Costs for real estate, especially for the West SERVS alternative, were unknown.

It was also recognized during Phase I, that additional hydrographic and geophysical data would be necessary to complete the feasibility study. Again TNH was contracted to provide this information. Due to a late start in the fall and deteriorating weather conditions, the decision was made to delay the field work from early November 1999 to the spring 2000. This data is critical to the technical design effort and resulting project cost, due to the high risk of encountering rock near the surface, especially in the East SERVS dock alternative. It is anticipated the data will be available by early June 2000.

Briefly, the harbor sites dropped from further consideration and reasoning follows:

Mineral Creek – The site is to be used for a different development project. Sedimentation and seismic risk were also considered negative aspects.

Old Valdez Town – A 1965 Seismic Task Force recommended no Federal monies be spent in this area. The site is also too far for the new town site and existing infrastructure. There is the possibility for impacting the Valdez Duck Flats.

Allison Creek/Allison Point – The area is heavily used for recreational sport fishing and adjacent to salmon streams. It is too far from the existing new town site and has no existing utilities or facilities and has no available uplands.

Expand Existing Harbor – Due to the existing development, the only direction the existing harbor could be expanded is toward Harbor Cove. Harbor Cove is already an alternative site.

No further work is contemplated at these sites, however, they do remain as available alternatives throughout the feasibility study process until the final NED plan is recommended.

Goals and Objectives

Goals and objectives were developed by the participants and are shown in Attachment 3. These included both for the meeting and for the project. They are shown in no specific order or priority and are all valid.

Issues and Concerns

Next the group identified the issues and concerns, again in no specific order or priority. They are shown in Attachment 4. They do indicate that the same concerns and issues that had surface previously still were needing resolution. Some will require further study and data acquisition as would normally be part of the feasibility study.

The environmental issues were repeatedly brought up. The USF&WS and ADF&G representatives could not quantify the impacts to the alternative harbor sites at this time. Additional review of existing information and data, determining needed additional data and completing the field studies still needs to be done. Field studies are currently scheduled for the spring 2000 and are expected to include a dive survey and uplands bird surveys. Generally, it was indicated that the impacts decreased from east to west. Harbor Cove and Dock Point with the adjacent Duck Flats are considered extremely sensitive environmentally. The East SERVS dock site follows the same trend, with impacts decreasing east to west. The West SERVS dock site is the preferred site from and environmental perspective. As noted elsewhere in the attachments, an EIS would be required if Harbor Cove is considered as a harbor site. This would add 2 to 4 years to the total feasibility study schedule for a total schedule time of 3 to 5 years. Needless to say, the cost would also significantly increase for the feasibility study. An estimate of approximately $200,000 additional study cost was mentioned. The EIS would be elevated to the agency level in Washington D.C. for the final decision.

Without additional data it is unknown whether an EIS will be required for the East SERVS site. However, it was indicated that the harbor should be located as close to the GCI cable and SERVS dock as possible. Doing this would reduce the potential for an EIS, allowing for a shorter EA route. Habitat values in the West SERVS site appear to be such that only an EA would be necessary.

The environmental data and analysis is also critical to the construction of the project. Very often construction is restricted to times that will eliminate or minimize disturbance to fish and wildlife. At this location there are juvenile and adult fish migrating and rearing in the area. Birds use the area for feeding and nesting. Seals and sea otter frequent these waters. Fortunately there appears to be no endangered species. With the abundance of wildlife, construction "windows" will be very limited.

Mitigation measures were discussed also. However there was no indication of what mitigation measures would be required and no approximate cost could be attached. Mitigation would be the highest for the Harbor Cove site and would probably require at least a 2 to 1 ratio of enhanced or replaced habitat to that destroyed. These costs would become project costs and would almost certainly result in an uneconomic project from a Federal stand point. Some mitigation and/or environmental enhancements are potentially possible for the East SERVS alternative site.

Real estate costs were discussed as they related to the West SERVS site. While the City of Valdez owns some of the land adjacent to the proposed harbor, some is leased and several tracts are privately owned. Acquiring the leases or title to the property necessary to provide adequate uplands will be costly. No estimate of the dollar value was mentioned. The East SERVS and Harbor Cove sites are far less complicated from a real estate perspective. The City of Valdez owns the tidelands and Hotel Hill already and real estate costs should be minimal.

The GCI fiber optic communications cable was recently placed adjacent to the east side of the SERVS dock. This single cable provides the sole communications link for GCI servicing the entire interior of Alaska. Significant study, effort and time were necessary to secure the permits and complete the construction. Earlier discussion with GCI representatives indicated that the harbor project could fill over the existing cable as long as it was adequately protected and several additional conduits, such as old drill stem, were placed in the fill to provide GCI with a ready capability to string a repair or expansion cable from off shore to their cable vault on shore. Discussions regarding the cable opened the concept of relocating the cable. The GCI representative at the meeting provided information that relocating the cable would be an extremely expensive operation. It would require re-mobilizing the cable laying ship and re-routing all communications while new cable was placed and tested. The studies and logistics of accomplishing the relocation quickly revealed that the costs would be so prohibitive that the project would be uneconomical. The costs would be in the many millions of dollars. Therefore, the cable will define the western boundary of the dredged basin.

The geotechnical issue was another that repeatedly surfaced. As noted above the contract for obtaining geophysical data in the East and West SERVS dock sites is scheduled to be accomplished in the spring of 2000. The scope of work includes sub-bottom profiling and hydrographic surveying of both areas. This information will indicate the character of the subsurface and the presence of rock. It is known that the east end of the SERVS dock encountered rock when piling was being driven. There is significant risk that rock will be found in the East SERVS site area, especially near Hotel Hill. There is some latitude in locating the dredged basin footprint and defining the basin depths to avoid the rock and minimize dredging and pile driving costs. While cost estimates for the Checkpoint I report included consideration for this, a more accurate evaluation is required in the feasibility study. Future geotechnical work also includes test pits in conjunction with the geophysical surveys. The information will also be used to provide guidance on seismic stability and usability of dredged material. No geotechnical surveys are scheduled for Harbor Cove at this time, but it is known that about the top five feet of dredged material is unusable and a disposal area would need to be identified. Some rock is also expected in Harbor Cove project area.

Design Considerations and Assumptions

At this point during the meeting the designs identified in the Checkpoint I report were presented and the design considerations enumerated. Additional constraints, considerations and assumptions were generated from the group. These are shown in Attachment 5. Copies of the three plans with the cost estimates and pertinent data were distributed to those present. A copy is included here as Attachment 6. Many of the issues and concerns overlap into the design considerations and constraints. The evaluation matrix factor descriptions also provide a source of design considerations and are shown as Attachment 7.

Pro and Con Development

Once the plans were described, the group looked at each plan individually and listed the good (Pro) and bad (Con) aspects of that plan. The listing of the "Pro's" and "Con's" for each site plan is shown in Attachments 8.

Analysis Phase

The "Con's" for each site were looked at to stimulate thought on methods or means to eliminate or minimize them or turn them into a "Pro".

The East SERVS dock alternative appeared to be the most acceptable. Therefore, it was analyzed first. A summary of the discussion of the "Con's" follows:

- Requires access road: The access road is necessary, however, since Hotel Hill is owned by the City, any work necessary could be done to make the shortest and least expensive route. It is anticipated Hotel Hill will eventually be developed in some manner. The access road is very likely to be a Corps haul road for project construction. Corps haul road safety standards are quite high and little additional work is likely to improve it for public use. While the east approach is preferred, it is also possible to come on the west side of Hotel Hill, but with more involvement with the SERVS facility and their snow removal plan. Adding a western approach would provide two access routes.

- Requires utilities extensions: Similar to above. The utilities could be brought to the harbor from the west with or without road access resulting in reduced length.

- Potential for encountering rock: Environmental concern resulted in moving the dredged basin as far as possible to the west. The potential for encountering rock is at least equal if not greater than if the location was further east and had more flexibility to adjust to the rock locations.

- Possible pile socketing in rock: Same as previous.

- GCI cable is constraint: The cable can not be moved, but can be filled over.

- More sensitive high value habitat & environmental concerns: As noted earlier, the further west the basin is located, the less the environmental impact. Therefore the harbor will be located as far west as the GCI cable and rock will allow. Water quality can be improved by providing rounded corners in the basin and stepping the bottom of the basin toward the shore opposite the entrance channel.

- Possible EIS requirement: Moving the harbor to the west will minimize the environmental impact and reduce the potential for an EIS requirement.

- Potential environmental cost (mitigation or enhancements): Some mitigation can be expected. The cost is unknown and can not be determined until additional studies regarding harbor siting and environmental field studies can better quantify impacts. Mitigation should be less with a westerly shift of the harbor.

- Requires inter-tidal fill for uplands: The site requires upland and filling tidelands is the only alternative other than leveling Hotel Hill. The fill does provide a nearby least cost alternative for placing basin dredged material in a beneficial manner, a significant plus. The SERVS representative indicated the fill could come over to the dock causeway and even extend under it, if necessary. The only requirement would be security, snow storage and uninterrupted operations.

- Haul road concern if local rock source: Armor rock will be needed and the two closest sources are via the road system. Local roads have been used in this manner previously and no significant concerns are known.

- Spreads environmental concerns / impacts over a larger area than West SERVS alternative.: The West SERVS area is already impacted by the two out-falls and the fact it is a filled area. The westerly shift of the harbor location is anticipated to minimize the impacts.

- Most exposed location / least natural protection: The westerly shift of the harbor will help some. Breakwaters and slope protection on the fill will be required. The use of energy absorbing beaches, which could serve as recreational sites could be an advantage.

- Potential decrease in future expansion capability due to environmental concerns: Expanding this harbor to the east is possible, but with the known environmental concerns this could be a significant future challenge.

As a side note, the SERVS representative indicated during the discussions, that an impending small boat float project on the east shore side of the SERVS dock could be stopped, if the harbor were to move forward. Their small boat would use the new harbor, since it was located adjacent to the SERVS dock, rather than the proposed new float.

Similar analyses were completed for the remaining two sites. It was evident that the East SERVS site alternative was the preferred harbor site.

As part of the analysis process, revised harbor plans were sketched and are included as Attachment 9. Two plans are shown for the West SERVS site and one for the East SERVS site.

Conclusions

The design charrette format provided a good opportunity for the major stakeholders in the project to have a forum to express their thoughts and concerns and to help in determining the direction of the project.

Harbor Cove – The Harbor Cove alternative is subject to major environmental concerns and some technical issues that substantially detract form its implementation. An EIS will be required if it is considered as the primary alternative. This will increase the time and cost for the feasibility study considerably, up to 4 years and $200,000 or more. Approval would still not be assured. Federal funding could be in jeopardy. Mitigation remains a huge unknown. Mitigation is a project cost. We know that for each acre of lost habitat, two acres would need to be replaced. The cost would be considerable and the success of the habitat replacement characteristically is often poor. These costs would easily cause the project to lose positive net benefits and a Federal interest. This alternative would then become an expensive locally preferred plan. Technically, the location is great, but there are unusable sediments that will need to be disposed of, which the old sewer out fall may have effected. There is the real potential for rock dredging, especially in the entrance channel, and pile socketing in the basin. Maintenance dredging could be higher due to littoral transport. Future harbor expansion would be limited. The one recreational beach in the City of Valdez would be less usable.

The environmental reasons, their excessive cost and the long battle to gain approval appear to make this alternative one that should be dropped from further detailed consideration.

West SERVS Dock – This alternative also has many negative factors attached. Environmentally, it is the preferred site and only an EA appears to be necessary, because it has the least environmental impact. Technically and socially, however, there are major detractors. Primary among these is the fact there is no available uplands and obtaining uplands to support the new harbor would be very expensive and potentially time consuming to acquire. It will add much more congestion to an already busy crowded area. Harbor size and plan form are restricted by surrounding features, the steep off shore drop off, the SERVS dock and upland development. Future expansion is nil. Implementation of this alternative will be a major disruption to the existing development. Costs, while not too well defined, will be heavily weighted toward the local share.

The West SERVS harbor site is not the best alternative, but it does merit continued study to the next level to better define the costs for implementation.

East SERVS Alternative – This alternative appears to have the most technical merits plus, if shifted as far west toward the GCI cable and SERVS dock as possible, acceptable environmental impacts. Some environmental consideration and mitigation is likely, however, there is a reasonably good chance that an EA will suffice rather than an EIS. The jury is still out on this issue, but the risk is worth taking to continue to work to implement this alternative. If an EIS is required, it is proposed that the study include the preparation of the EIS and add Harbor Cove as an alternative harbor site. A major concern is the high likelihood of encountering shallow rock in the basin area. There is room to adjust the basin plan form some and limit depths to avoid the rock. Additional geophysical information is needed, which should be available in the spring 2000. Uplands can be created by disposing of the dredged material adjacent to the harbor. Fill can also extend to the SERVS dock causeway and where appropriate, beaches can be created for environmental and recreational uses. The GCI cable can be under the fill, but can not be moved or disturbed. This limits the dredged basin location. Utilities and access needs to be extended, either east or west of Hotel Hill

The East SERVS alternative has problems. It appears, however, to be the best, most workable alternative of the three under consideration.

Conclusion - Both the East and West SERVS dock alternative harbor locations should continue to be studied to the next level of detail

Action Items

During the course of the meeting a list was maintained for items that needed to be done for the feasibility study. This list along with task assignments is shown in Attachment 10. The list was earlier transmitted to those assigned tasks to permit their starting as soon as possible.

Partnering Agreement

The partnering agreement was developed at the conclusion of the meeting. An unsigned copy is included as Attachment 11. Not all participants signed the agreement, because they had left early or felt they did not have the authority to commit their agency.

Notes from Valdez Harbor Improvements Scoping meeting held March 4, 1999

The scoping meeting was held at the Alaska District Corps of Engineers building. Representatives from the City of Valdez could not attend the meeting due to weather conditions effecting air transportation. This was the second time weather had effected their attendance at the meeting so it was decided to utilize our conference call abilities to continue with the meeting as scheduled.

The meeting began at approximately 10:30 a.m. and included various Corps members and environmental agency members (See attached Phone list). A presentation was given describing the basic outline to be used for producing the Feasibility report for this study. The last half of the presentation served to aid in the discussion to establish potential sites to be investigated for the study. During the discussion issues were noted for the various previously suggested and additional sites and options. The following is a summary of the sites and the issues discussed.

Mineral Creek site: Raytheon listed this site in the 1995 Reconnaissance report produced. This site is not available for consideration for the development of a harbor. The land is to be used by others for a different project. There are also concerns about seismic risk and sedimentation from the adjacent stream. It was determined by all members at the meeting not to use this as a potential site to be studied during Feasibility.

West of SERVS dock: This site was suggested by the Dennis Gnath of USFG. The area has fewer clam beds than others considered sites and is farther away from a highly sensitive natural habitat area. It has less chance of encountering bedrock but could require extensive dredging caused by excavation of adjacent uplands. It is located close to existing harbor and to an area that could be used to facilitate parking and other harbor support facilities. This site has some limitation because of the SERVS dock and existing depths immediately south of the proposed site. It was decided to include this site for further study and gather existing geotechnical and survey information and provide for the acquisition of additional necessary information to develop alternative designs.

East of SERVS dock: This site compares with the West site and has more clam beds, is closer to highly sensitive natural habitat area, and rock is more likely to be encountered dredging here. It is in an area of high intertidal and subtidal biological value. Diving ducks use this area. It does offer more area for the development of a Harbor without interfering with the SERVS dock. It was decided to include this site for further study and gather existing geotechnical and survey information and provide for the acquisition of additional necessary information to develop alternative designs.

Harbor Cove: This site offers the least construction effort solution because of its natural harbor configuration. It is also close to the existing harbor, easily expandable, and has the most local sponsors support. The site is also the most environmentally sensitive of the proposed sites with greatest impact on fish wildlife and waterfowl. The site is cited as an Aquatic Resource of National Importance. The site is used by locals for recreation. Construction here would require a physical circulation model. It was decided to include this site for the study but not to expend effort to refine an alternative design here unless investigation of the other sites could not provide a feasible project. At that point we would renegotiate the study and costs involved with the City of Valdez if they wanted to pursue construction at this site. John Burns will pursue acquiring a written statement existing that would remove Harbor Cove from consideration.

Old Valdez site: A 1965 Seismic Task Force recommended no federal money be used for construction in this area due to seismic risk. There is high possibility of contamination/ debris from the 1964 earthquake. Too far from town or existing harbor requiring two harbor staffings. Potential for impact to duck flats area. This site was generally not preferred for study. Chuck Wilson will be tasked with providing information stating a clear rationale, policy, or law for removing the Old Town site from consideration for the development of a harbor.

Allison Creek and Allison Point: Too far away from town, no existing utilities/facilities, and no adjacent uplands available. The area is used for sport fishing and recreation. Two harbor staffs would be required. Possible fish migration impacts. Although no positive elements were expressed for this location it was agreed upon to provide a limited study using existing data, of what it would cost to construct a harbor in this vicinity.

Expanding the Existing Harbor: this option was suggested but after closer review of the existing conditions this option was withdrawn because of the unavailability of space for expansion.

It was also discussed at the meeting that we need to incorporate the SERVS vessels into the design of the new harbor and to focus on creating the harbor to meet the needs of the larger commercial vessels.

I also suggested that we incorporate a Design Meeting to be held at the City Valdez to develop design alternatives. The participants would include members from the community that would use the facility, environmental agency team members, the State coastal engineer, and key members of the study team from the Corps. The meeting would probably occur for 2 days around the end of August.

After the meeting I contacted the City of Valdez to discuss some more issues regarding the timing for completing the study. The City would like to have the study completed in time to be included in the Water Resources Development Act for FY2000. I expressed this would require a very concentrated and event free investigation. If we can avoid developing in the Harbor Cove area this may be possible. I have requested the Economics Section of the Corps begin conducting the without project analysis immediately.

I have enclosed a copy of the study team phone numbers along with a draft schedule for the study. If there is any information that is incorrect please notify me and I will make the corrections.

VALDEZ HARBOR IMPROVEMENTS STUDY TEAM

AGENCY	PARTICIPANT	PHONE NO.	
COE. PLAN FORMULATION	DAVID MARTINSON	753-2668	david.a.martinson@poa02.usace.army.mil
COE. PLAN FORMULATION	CARL BORASH	753-2609	
COE HYDRAULICS & HYDROLOGY	KEN EISSES	753-2742	
COE HYDRAULICS & HYDROLOGY	ED SORENSON	753-2671	
COE ECONOMICS	JANIS KARA	753-2631	
COE ECONOMICS	ANDREW MILLER	753-2615	
COE ENVIRONMENTAL RESOURCES	JOHN BURNS	753-2641	
COE COST ESTIMATING	AL ARRUDA	753-5679	
COE SOILS & GEOLOGY	CHUCK WILSON	753-2687	
COE MATERIALS & INSTRUMENTS	RICHARD RAGLE	753-2683	richard.a.ragle@poa02.usace.army.mil
COE SURVEY	JERRY ZUSPAN	753-2660	
COE REAL ESTATE	GUY HOPSON	753-2858	
COE REAL ESTATE APPRAISER	ANN HARDINGE	753-2858	
COE PROJECT MANAGEMENT	BO WIERZBICKI	753-5778	
STATE DOT COASTAL ENGINEER	HARVEY SMITH	269-6239	
VALDEZ CITY MANAGER	DAVID DENGEL	835-4313	ddengel@ci.valdez.ak.us
VALDEZ HARBOR MASTER	MAC MacDONALD	835-4981	
VALDEZ PORT DIRECTOR	TIM LOPEZ	835-4564	
VALDEZ CITY ENGINEER	FLOYD SHEESLEY	835-3404	fsheesley@ci.valdez.ak.us
US FISH & WILDLIFE	MARCIA HEER	271-2440	
NATIONAL MARINE FISHERIES SERVICE	DAN VOSS	271-5006	
DEPT. OF GOVERNMENTAL COORD.	JENNIFER WING	269-7475	jennifer_wing@gov.state.ak.us
AK DEPT. OF FISH & GAME	DENNIS GNATH	267-2278	dennisgn@fishgame.state.ak.us
AK DEPT. OF FISH & GAME	TOM RUTZ	267-2164	
ENVIRONMENTAL PROTECTION AGENCY	MARK JEN	271-3411	jen.mark@epamail.epa.gov

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-6898

REPLY TO
ATTENTION OF:

Environmental Resources Section

Mr. Stewart Seaberg
Area Manager
Office of Habitat Management and Permitting
Department of Natural Resources
550 West 7th Ave., Suite 1420
Anchorage, Alaska 99501

Dear Mr. Seaberg:

Please find enclosed the current alternative harbor designs and quantities table for the Valdez Navigation Improvements project. In addition, we have drafted up a conceptual drawing of the Two Moon Bay capping mitigation plan. We would like to keep you up to date on the Valdez Harbor project and are requesting your comments, especially on construction timing windows for fish for inclusion in the environmental assessment. We appreciate your involvement in the project.

For more information, please contact Ms. Lizette Boyer at 753-2637 or by e-mail at Lizette.P.Boyer@poa02.usace.army.mil.

Sincerely,

Guy R. McConnell
Chief, Environmental Resources Section

Enclosures

LBoyer/G/ER/Lizette/ValdezHarbor/ltrtoDNRwithaltplans06
12 May 06 Concur: Walters
marks No: 1105-2-10b

Boyer, Lizette P POA

From: Mark A. Somerville [mark_somerville@dnr.state.ak.us]
Sent: Tuesday, May 23, 2006 11:57 AM
To: Boyer, Lizette P POA
Subject: RE: Valdez Harbor

Thanks Lizette. Those were the answers I expected, so no surprises. The pink salmon outmigration from Port Valdez is the source of a multimillion dollar fishery. Avoiding the smolt outmigration will be extremely important. The adult pink return has been huge in recent years (20 + million pinks), but averages about half that. I believe the project site is outside the main fishing activity, but those pinks go all over and will be a nuisance to in-water work. Secondly I'd expect a larger number of sea lions and seals in the Port capitalizing on the concentrated fish.

I believe the plan was to construct the rubble mound walls first (after relocating the fiber optic line) and then dredging/blasting inside that contained area. This seems like a good plan. Adding fill to exposed ground at low tide would work, from our standpoint, anytime as long as it doesn't created pools that will strand fish. In-water placement of fill would need to avoid the pink outmigration period. For work within the rubble mounds during adult return period, I would suggest barrier nets at all entry points to exclude adult pinks from moving into the area during high tides. I believe blasting would be limited to the winter months and will be restricted more by NOAA and USFWS requirements for marine mammals than by OHMP and the ACMP.

I don't envision any timing restrictions for dredge disposal in Two Moon Bay. I'd have to see a preliminary dumping schedule to be sure. Pinks spawn in several streams in Two Moon Bay and their timing is similar to that of the Valdez return timing. If the dump schedule is only 1 -3 barges per day or could be timed, as best possible, during outgoing tides then there should be minimal impact on the returning adults.

Take care and free feel to contact me with further questions or requests.

MAS

Mark A. Somerville
Habitat Biologist
Alaska Department of Natural Resources
Office of Habitat Management and Permitting
550 W. 7th Ave., Suite 1420
Anchorage, AK 99501
Phone: (907) 269-6969
Fax: (907) 269-5673

From: Boyer, Lizette P POA [mailto:Lizette.P.Boyer@poa02.usace.army.mil]
Sent: Tuesday, May 23, 2006 10:05 AM
To: Mark A. Somerville
Cc: Martinson, David A POA; Peterson, Merlin D POA
Subject: RE: Valdez Harbor

Answers to questions: 1. The west side design in an effort to satisfy the boat demands needed to use vertical sheet piles to extend out to the edge of the submarine trench. Going further would make the structure unstable. A rubblemound structure requires a lot more footprint reducing moorage space. The east site is much shallower. 2. Some of the dredged material is going to fill for a staging area, the rest out to Two Moon Bay. 3. The available dredged material would be placed in barge dump loads and therefore have an imprecise placement for a wide range of cover depths on an irregular bottom profile. We would expect wave action to smooth it out. The slope cover would be thicker fill. One of FWS goals was to have this area filled to an elevation so that eelgrass could be planted. The additional fill would come from other projects like mitigation banking. This project's mitigation is only to cap. Some real estate easement to set aside this area for mitigation is required. 4. The dredged material is composed of some silts, but predominantly coarse sand and large rock that would be blasted into smaller pieces.

The timing window hopefully could be refined so more work in the middle of summer could be done. Typically we can sequence the work so that the breakwaters are built first so that we can use silt curtains. This would also help because we are predicting blasting is necessary to get to moorage and entrance channel depths. Winter work is certainly doable in Valdez. I hope this helps.

From: Mark A. Somerville [mailto:mark_somerville@dnr.state.ak.us]
Sent: Monday, May 22, 2006 12:08 PM
To: Boyer, Lizette P POA
Subject: Valdez Harbor

Hi Lizette,

I have a couple of questions on the Valdez Harbor project.

1. Why does the West Side Alternative have a wave barrier rather than a rubble mound like the East Alternatives?
2. Is all the projected dredge material destined for Two Moon Bay or will some of it be used for the projected upland fill in the project?
3. Is the plan for the harbor project to achieve all the fill requirements for the Two Moon Bay capping as shown in the drawing? Why is there a minimum and maximum depth of cover?
4. Are there different fill types designed for the capping?

As for a timing window on the project, pink and coho smolt are in the area during all of May and into the first week of June. Adult pinks start showing up the first week of July and the fishery extends through that month and into the first part of August. I would say you'd have 3 - 4 weeks of opportunity for in-water work in June and then again late August/September or during the winter before April 15. Winter work would be preferable from a fisheries standpoint.

I look forward to hearing back from you.

MAS

Mark A. Somerville
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Alaska Department of Natural Resources
Office of Habitat Management and Permitting
550 W. 7th Ave., Suite 1420
Anchorage, AK 99501
Phone: (907) 269-6969
Fax: (907) 269-5673

Date: August 19, 2005

Field Summary: Valdez Small Boat Harbor Expansion (Area East of SERVS)

NOAA Field Personnel: Matthew P. Eagleton, Dennis Carlson

Tide Stage: -2.8 MLLW @ ~8:00 am

0700 Met with Larry Bartlet, COE-CW Environmental, and Mark, COE-CW Engineering.

Dennis and I surveyed the project's intertidal area; turned over rocks, dug clams, identified fish and vegetation, if present. We also assisted Larry. We worked back and forth between the high and low tide edges and continued east around the point and back towards the existing harbor.

Habitat

Intertidal Habitat Rating: Low

Silt covers the benthos, both physical and biological; nearby glacier rivers load the area. Water turbidity was extremely high. Continuous laminaria kelp bed at lower edge of tide stretched north towards the other mud flat and south towards SERVS terminal.

Substrate: hard; thin layer of silt over muddy sand; cobble; or mixture of sand, mud, and cobble (up to with 6").

Living substrate: At 0 to -1 MLLW, a small. Circular, mussel bed exists and centered within the planned harbor site. Area was about 50' in diameter. Mussels were smaller. Mussels also scattered throughout rest of site. Brown and green algae present.

Species

Fish: Gunnels, hermit crabs, small rock crabs, juvenile cancer crabs (~ 4 dead), snake prickleback(s), macoma clams, little neck clams, butter clams, 2 small anemone, small periwinkles (scattered), small acorn barnacles (coverage sporadic), welks (more near out point), amphipods, larger isopods, smaller blue mussels, and spawn phase and dead pink salmon.

- No species persisted throughout the area.
- Benthic invertebrates patchy.
- Gunnel fish were under several rocks, however not under every rock turned over.
- Silted mussel bed consists of smaller mussels.

Vegetation: laminaria, eelgrass, fucus

- A continuous laminaria bed surfaced at the low tide line (> -2' MLLW) and extended along this elevation from north to south.
- Eelgrass scattered sparsely in mud throughout the site.
- Fucus covered upper tidal boulders and rock edges along the tide line. Concentrations denser near the northern point and small island group.

Preliminary EFH Conservation Recommendations:

- **Avoid** impacts to/near northernmost point intertidal habitat areas. NMFS recommends road access maintain existing grade and continue through the hill area; as not to extend along the coastline and around the rocky northern point.

- **Avoid** disturbance (dredge spoil placement) to continuous laminaria bed habitat. NMFS recommends upland and/or other beneficial spoil use and disposal locations.

- **Mitigate** impact(s) through:

  1. Breach existing northern harbor wall

     Previous harbor circulation studies note extremely poor water quality and dissolved oxygen concentration lethal to fish. Further, discussion includes water quality improvement through a breach at the harbor's end. A UAF study offers the water quality condition improve; however, only marginally, at best.

     Although scientific, the approach lacks realistic value to improve lethal conditions for fish. Whether or not costs outweigh the benefits are likely not measurable in dollars. Quite simply stated, any water movement improves conditions.

     Improvements through breach design include: 1) increase water exchange versus stagnant conditions and 2) allow fish passage, both juvenile and adult.

     NMFS recommends mitigation focus on a breach in existing harbor wall. Waiting for an ideal design acerbates the lack of passage and lack of circulation; fish exposed to lethal dissolved oxygen concentrations.

  2. Breach breakwaters (offshore breakwater design)

     Preliminary design incorporates breached breakwaters. NMFS recommends harbor designs maintain breaches; facilitates fish passage and water movement.

  3. Contour breakwater slopes.

     Similar harbor designs incorporate contour or stepped breakwater slopes to provide shelf habitat for nearshore migratory fish. NMFS recommends use of this design.

  4. Seed breakwaters using on-site, mussel and rockweed covered boulders.

     Seeded boulders assist the growth of newly placed rip rap. NMFS recommends seeded boulders remain in place, if possible, or scattered along the newly developed breakwaters and project site edges.

Eliminated Mitigation Concepts

- Our considerations eliminated artificial reef ball creation because: 1) mitigation needs to focus on harbor associated impacts, 2) habitat lost is not reef habitat, 3) silt-laden water conditions likely produce silt-covered reef balls, and 4) rock seeding will provide similar habitat structure.

END

Matthew Eagleton, Habitat Conservation Division, Anchorage, Alaska 907.271.6354, mattthew.eagleton@noaa.gov

VAL A7

3130-1R COE/Envirn

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-6898

REPLY TO
ATTENTION OF:

APR -3 2006

RECEIVED
APR 04 2006
OHA

Environmental Resources Section

Ms. Judith Bittner
State Historic Preservation Officer
Office of History and Archaeology
550 West 7th Avenue, Suite 1310
Anchorage, AK 99501-3565

No Historic Properties Affected
Alaska State Historic Preservation Officer
Date. 5-4-2006
File No.: 3130-1R COE/Envirn. SL

Dear Ms. Bittner:

The U.S. Army Corps of Engineers, Alaska District (Corps) has been studying proposed alternatives for improving the boat harbor in Valdez, Alaska (SW1/4 Section 32, USGS Valdez (A-7) Quadrangle; enclosure 1) by adding additional moorage space for 30 to 120-foot vessels south of the exiting harbor. The preliminary reconnaissance study was completed in January 2000 and recommended a federal interest in navigation improvements at Valdez. Your office was notified of this federal undertaking with the potential to cause effects on historic properties in 2001. The purpose of this letter is to update your office on the selected alternative and to seek your concurrence on the assessment of effects.

The area of the current harbor has been modified considerably by construction associated with the relocation of Valdez after the 1964 Earthquake. Eighty percent of the original town of Valdez was destroyed after a series of tidal waves caused by a submarine slide hit the shore during the earthquake. The current town site is east of Mineral Creek, approximately 4 miles northwest of the former town site. The existing harbor was completed in September 1965, and expanded in 1966. A series of bedrock islands extended into the tidal flats and fill was placed between them and the mainland to construct a protective barrier between the boat harbor and the waves. The current small boat harbor is completely surrounded by artificial fill with the exception of one bedrock island on the southeast side of the harbor. This bedrock island is called "Hotel Hill."

The locally preferred alternative for the new Valdez boat harbor is designed to provide space for 244 additional vessels (enclosure 2). Known as the East Alternative, it is situated on the east side of the SERVS dock on the tidal flats south of Hotel Hill. Two rubble mound breakwaters will protect the basin, one on the south side and one on the east side. This will create a basin of 13.8 acres. Approximately 166,000 cubic yards of material will be dredged from the basin and entrance channel and will be deposited at Two Moon Bay (discussed below). Large rocks and slabs may be removed beside Hotel Hill. The south breakwater will be 1559 feet long and the east breakwater will be 752 feet long. The small "stub" breakwater on the west end of the harbor will be 95 feet long. Constructed breaches will be provided on the east and west sides of the basin.

The Alaska Heritage Resource Survey documents were consulted and two sites are recorded in the new Valdez town site. VAL-205 is the Ahrens-Fox Continental Steamer #131 being exhibited in the Valdez City Museum and VAL-208 is the Meals-Whalen Cabin, a two-story log cabin built before 1903 in the old Valdez town site. VAL-208 was moved to the new town site and is now sitting at the edge of the modern town. Neither of these sites is within the area of potential effect, nor would they be affected by the harbor construction.

Underwater surveys of subtidal and intertidal flora and fauna were conducted using SCUBA equipment. The intertidal areas are rocky and mud/sand flats. The subtidal area is rock and mud slopes. At 30 to 65 feet below the mean high tide the substrate was a very fine soft mud, which dropped off steeply to the south. Although the vertical shoreline did not shift as a result of the 1964 earthquake (Coulter and Migliaccio 1966:C-18), the shoreline of the area of potential effect is artificial fill with the exception of the south shore of Hotel Hill. Hotel Hill has steep, almost vertical shoreline nearly 60 feet high. Because of the disturbance from construction in 1965-66, the steep shoreline of Hotel Hill, and the absence of reported sites within the area of potential effect, it is our judgment that there is a low probability that cultural resources are present in the area of the proposed construction.

In addition, the Corps has introduced to the project new environmental mitigation efforts, which are required by various regulations. Engineering Regulation (ER) 1105-2-100 and Council on Environmental Quality regulations require federal agencies to consider environmental mitigation opportunities, including opportunities for compensatory mitigation, in the environmental assessment or environmental impact statement process for each project.

The Corps considered several different mitigation opportunities, but ultimately a compensatory project proved to be the best option for both the restoration of benthic habitat and beneficial use of dredged harbor material. The site chosen for restoration is Two Moon Bay in Port Fidalgo, in eastern Prince William Sound (NW1/4, Section 7, T13S, R07W, USGS Cordova (D-7) Quadrangle, Copper River Meridian; enclosure 3). Two Moon Bay is 26 miles south-southeast of Valdez, and the nearest community is Tatitlek, 9 miles to the north. The city of Cordova is 30 miles southwest of the bay. Dredged material from the Valdez harbor will be barged to the bay where it will be deposited over an 11.4-acre area just offshore below the mean low low water line (enclosure 4). Mitigation at Two Moon Bay is intended to restore marine habitat impacted by accumulated bark debris from a former log transfer facility within the bay. Use of the dredged material to cover bark debris will restore nearshore habitat by using fill suitable for eelgrass colonization.

Permitted for operation in 1987 and abandoned in 1997, the logging camp at Two Moon Bay consisted of a log transfer facility, mechanical building, fueling station, maintenance building, electrical generator building and fuel tank, bunkhouse/mess hall and fuel tank, and a mobile home area. The area designated for mitigation lies to the southwest of the log transfer facility, as this is where a majority of the bark has accumulated.

mobile home area. The area designated for mitigation lies to the southwest of the log transfer facility, as this is where a majority of the bark has accumulated.

In 1985 a team of biologists/divers from the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Alaska Department of Fish and Game (ADF&G) conducted subtidal investigations in response to a request from the Tatitlek Native Corporation. These divers surveyed three locations in Two Moon Bay, one of which was subsequently chosen for the location of the log transfer facility. This location is now the setting for the proposed project mitigation. This underwater area was again surveyed in 1990 by the USFWS, Tatitlek Native Corporation, and ADF&G as part of a bark accumulation survey. Although the goal of these investigations was to determine the ecological impacts of the log transfer station in Two Moon Bay, the survey does provide an underwater view of the deposit area. The reports generated by the divers make no mention of cultural resources (Ferrell 1985). Thus, there is a low probability that cultural resources exist within the disposal area.

Due to the low probability of encountering cultural resources at either the preferred harbor area or the Two Moon Bay dredged material disposal area, it is the Corps' determination that there will be **no historic properties affected** by this undertaking. If you have any questions, please call Margan Grover (753-5670) or Aaron Wilson (753-2631).

Sincerely,

Guy R. McConnell
Chief, Environmental Resources Section

6 enclosures

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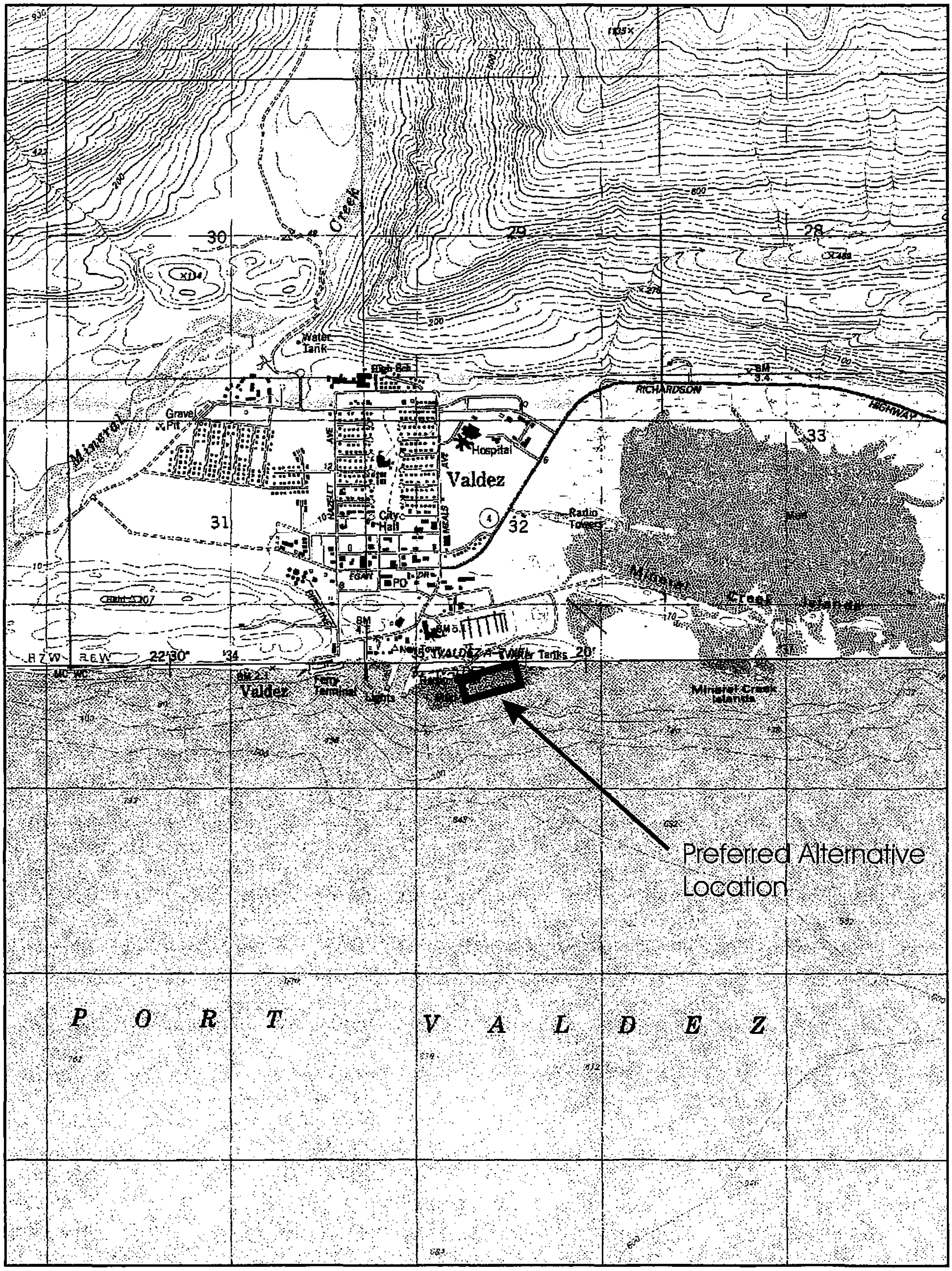
cf w/ encl:

Mr. Bert Cottle, Mayor, City of Valdez
Gary Kompkoff, President, Native Village of Tatitlek
Benna Hughey, President, Valdez Native Tribe
Tim Joyce, Mayor, City of Cordova
Helmer Olson, President, Valdez Native Association
Barry Uhart, President & CEO, Chugach Alaska Corporation



Enclosure 1. Valdez Small Boat Harbor Preferred Alternative Location

APPENDIX 4

U.S. Fish and Wildlife Coordination Act Report

FINAL REVISED

Fish and Wildlife Coordination Act Report

For the

Navigation Improvements Project

Valdez, Alaska

Prepared by:

Project Planning Staff
Anchorage Fish & Wildlife Field Office

U. S. Fish and Wildlife Service
Alaska Region 7
Anchorage, Alaska

September 2006

This report constitutes the U. S. Fish and Wildlife Service's Final Fish and Wildlife Coordination Act Report on the U. S. Army Corps of Engineers (Corps) proposed Small Boat Harbor Improvement project in Valdez, Alaska as revised, based upon updated information and coordination meetings in late 2005. The purpose of this report is to: (1) provide the Corps with planning information concerning the presence of significant fish and wildlife resources likely to be affected by the various design concepts and their alternatives of the proposed Valdez Small Boat Harbor Improvement Project; (2) define fish and wildlife resource problems and opportunities that should be addressed by further study; (3) define potentially significant impacts that could result from the project's objectives and alternatives; and (4) identify and prioritize potential mitigative design changes, alternatives and projects.

This report has been prepared in accordance with the Fiscal Year 2006 Scope of Work (using work completed in previous Fiscal Years and in consideration of prior project iterations) 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 Lizette Boyer and Project Manager Dave Martinson, previous input from John Burns (Corps, retired), a review of pertinent literature conducted by Marcia Heer (formerly USFWS, AFWFO), consultation with state and federal biologists, staff from the City of Valdez, an assessment of potential impacts to known fish and wildlife resources, site evaluations conducted in 2000, 2001 and 2005, and facilitated brainstorming and mitigation development meetings held in late 2005.

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List of Tables and Figures

Introduction

The Alaska District of the U.S. Army Corps of Engineers (Corps) proposes to improve harbor facilities in Valdez, Alaska (Figure 1) by adding additional mooring space for vessels to meet the demand from growth in commercial fishing, recreational vessels, charter boat, excursion, oil monitoring and response, and marine freight sectors. Over the last decade, the Corps has considered two primary approaches for the harbor improvements, each having minor variations in design proposed as alternatives.

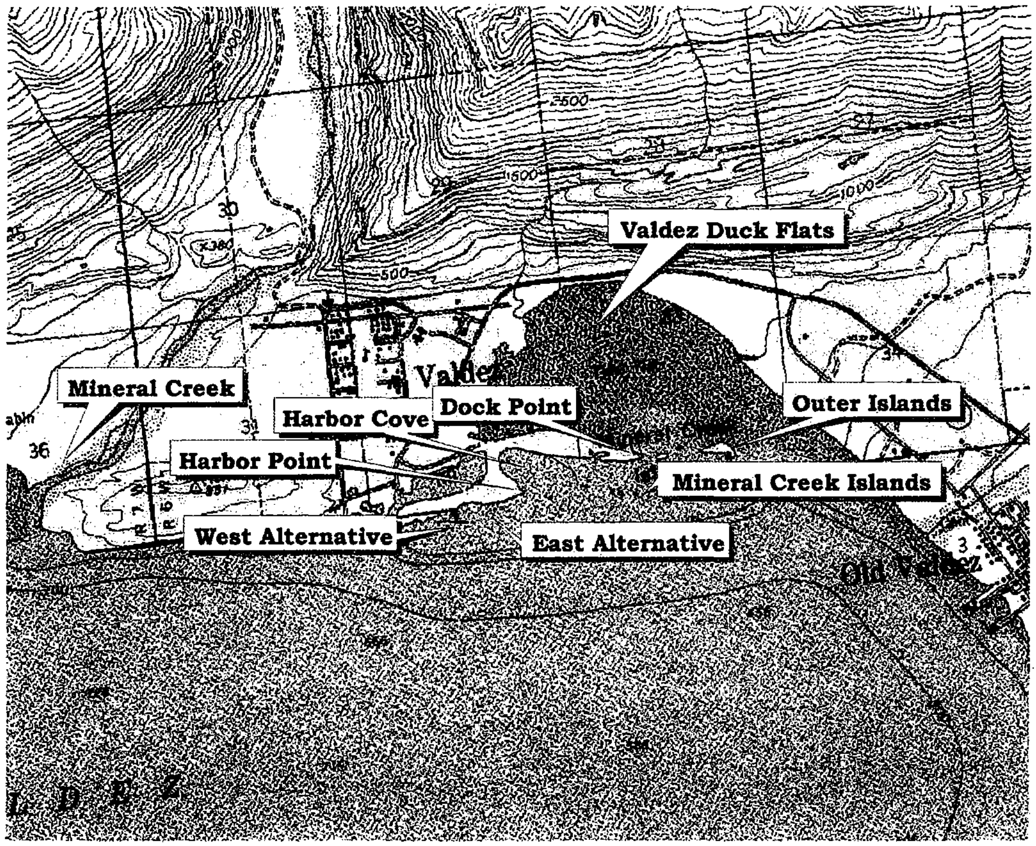
Formal coordination between the U. S. Fish and Wildlife Service (Service) and the Corps on this project was initiated in October 1998. Biological investigations were conducted in March and June of 2000. Several iterations of project design were developed during this period with a final design presented in early 2002. A scope of work to conduct a Coordination Act Report to assess impacts from this initial design and set of alternatives was completed in FY2000/2001; the resulting Final CAR was completed in April 2002 (Heer 2002). Subsequently, the Corps did not receive funding and the local sponsor, the City of Valdez, continued to reassess the proposed design to better address local needs. In late 2005, the City and the Corps approached the Service with a new design concept relocating the initially preferred alternative from west of the SERVES pier to a region east of this facility. This new approach was recognized to pose increased impacts to Service trust resources from the revised design concept. The three key partners (Corps, City, and Service) agreed to work together to develop appropriate and adequate mitigation measures for these impacts. A series of small and large meetings, one facilitated, were held over the next few months to identify, explore, develop, and establish consensus on measures to avoid, minimize, mitigate and compensate for impacts to fish and wildlife resources in such a way that the proposed harbor expansion could proceed without having to commit limited and precious financial resources to development of a full Environmental Impact Statement. A number of local, State, and Federal agencies were involved in these discussions.

This Fish and Wildlife Coordination Report represents the Service's biological investigation and impact assessment of the initial and current design concepts and alternatives for harbor improvements in Valdez. This report will discuss fish and wildlife resources in the project area, describe in detail the potential adverse impacts of project alternatives, and recommend measures for mitigating those impacts.

Study Area

The proposed alternatives for harbor improvements are located south of the existing harbor facilities in Valdez, Alaska (Figure 1). Valdez is located approximately 115 miles (185 km) from Anchorage at the northeastern end of Valdez Arm in Port Valdez. Winter temperatures range from 21 to 30 degrees Fahrenheit. Summer temperatures range from 46 to 61 degrees Fahrenheit. Annual precipitation is 59.3 inches. The average snowfall is 25 feet annually.

Port Valdez, a deep-water fjord, is approximately 3 miles (5 km) wide by 14 miles (23 km) long. Port Valdez tides are mixed, semi-diurnal, and range from an extreme high of 16.5 feet to an extreme low water of -5.8 feet (Dames and Moore 1978). The mean tidal range is 9.4 feet with a



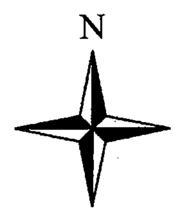


Figure 1. Vicinity map for proposed harbor improvements in Valdez, Alaska.

diurnal range of 11.8 feet. Extreme tidal fluctuations occur in the spring. Tidal circulation in and adjacent to the Valdez Duck Flats has been described as irregular and complex (USFWS 1981). Current measurements at the eastern end of Port Valdez have been characterized as stagnant much of the time (City of Valdez 1986). Information on circulation patterns within eastern Prince William Sound (PWS) is limited.

The oceanographic regime of Port Valdez is strongly stratified both in temperature and salinity during the summer and is typically unstratified in the winter. Port Valdez is classified as a positive estuary with the circulation of the deeper layers of saline water towards land and a seaward movement of brackish waters. Freezing air temperatures and minimal fresh water runoff in the winter result in renewal of the entire water structure (Feder et al. 1976).

Detailed Plan Description

The purpose of the proposed Valdez boat harbor improvements is to increase moorage space and parking facilities and improve areas of congestion such as launch facilities. Additional justification for the project's purpose and need is provided by the ACOE (Boyer/Peterson e-mail to Seagars March 27, 2006 - in Service, AFWFO files).

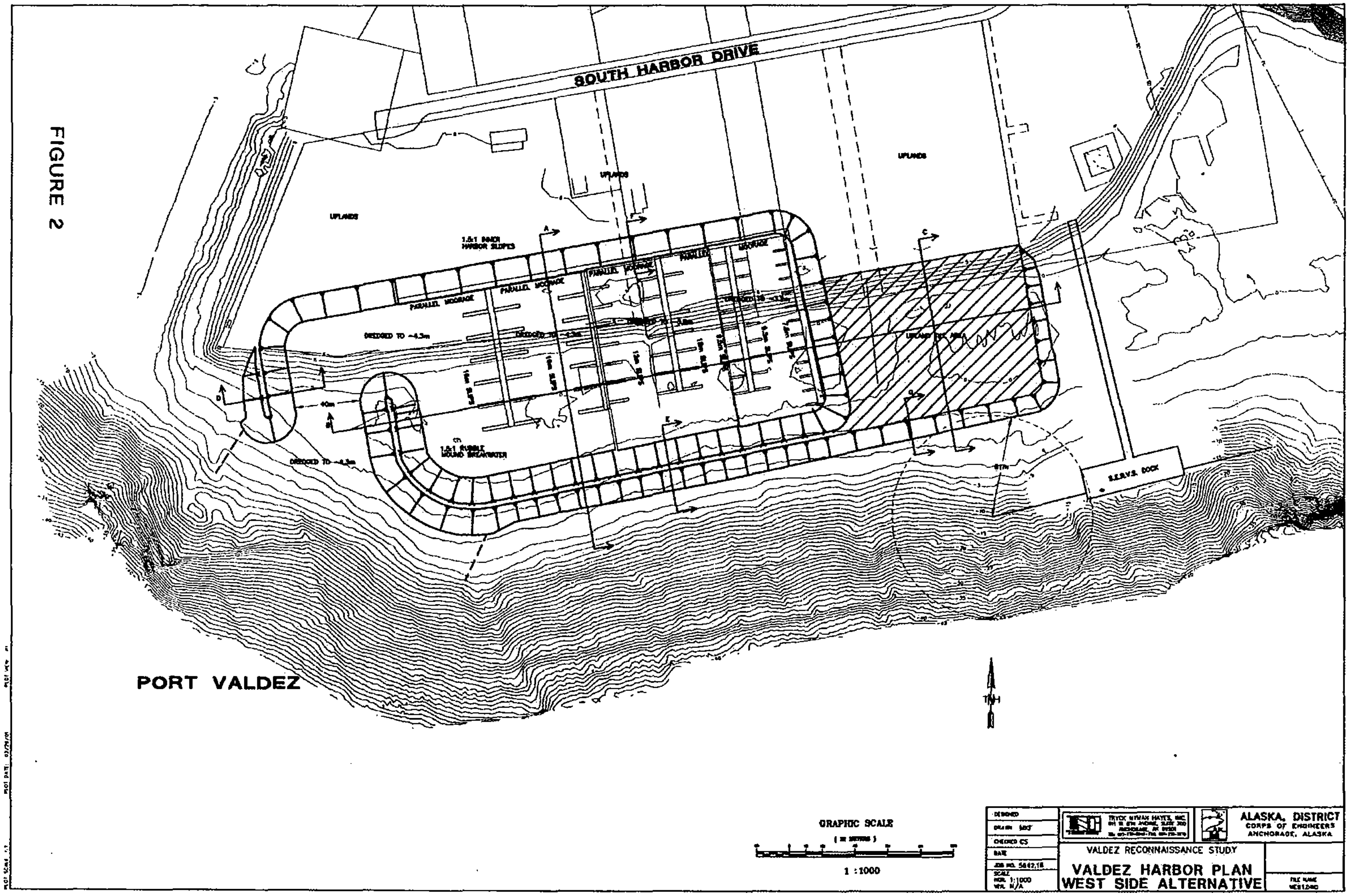
Harbor Design Concept: The initial design proposed accommodating vessels in an area south of the existing harbor facilities or in Harbor Cove to the east of the harbor. Design concepts considered to date south of the existing harbor have generally included two alternatives, one to the west and another to the east of the Alyeska Ship Escort Response Vessel System (SERVS) dock.

West Side Alternatives

In both the 2002 and 2005 west side alternatives, one of two outfalls from existing fish processing plants passes through the harbor site and would require relocation to the east around the dredged basin. Both the relocated and other existing outfall would have been positioned under the eastern disposal area/staging area fill. The 2002 West Alternative was the environmentally preferred option addressed by the initial CAR (Heer 2002).

2002 (Initial) West Side Design. As described by Tryck Nyman Hayes, Inc. (pers. comm. to Heer, 2002), the initially considered approach was designed to create a 3.7 ha (9.14 acres) basin by excavating the "uplands," extending the facility (previously deposited fill) area and an additional, newly dredged, subtidal area to be protected by two rubble mound breakwaters (Figure 2). The mooring area was designed to accommodate a fleet of 153 vessels ranging in size from 9 m to 30 m. The 40 m wide entrance channel would be sufficient for two way traffic for all except the largest vessels. The entrance channel depth was anticipated to be – 4.3 m MLLW. Basin depths would have varied from – 4.3 MLLW at the entrance to – 3.2 m MLLW at the far end of the basin. Dredged material would include primarily sands and gravels in the "off shore" areas and "fill" from the upland areas. Some trash was expected in the old fill material. Approximately 265,000 m^3 of material was anticipated to be dredged from the basin with an unspecified portion planned to be disposed of in an adjacent upland fill to the east of the new

FIGURE 2



SOUTH HARBOR DRIVE
UPLANDS
UPLANDS
UPLANDS
1.5:1 INNER HARBOR SLOPES
PARALLEL MOORAGE
DREDGED TO -4.5m
1.5:1 RUBBLE MOUND BREAKWATER
S.E.R.V.S. DOCK
PORT VALDEZ
GRAPHIC SCALE
1 :1000
ALASKA DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA
VALDEZ RECONNAISSANCE STUDY
VALDEZ HARBOR PLAN
WEST SIDE ALTERNATIVE

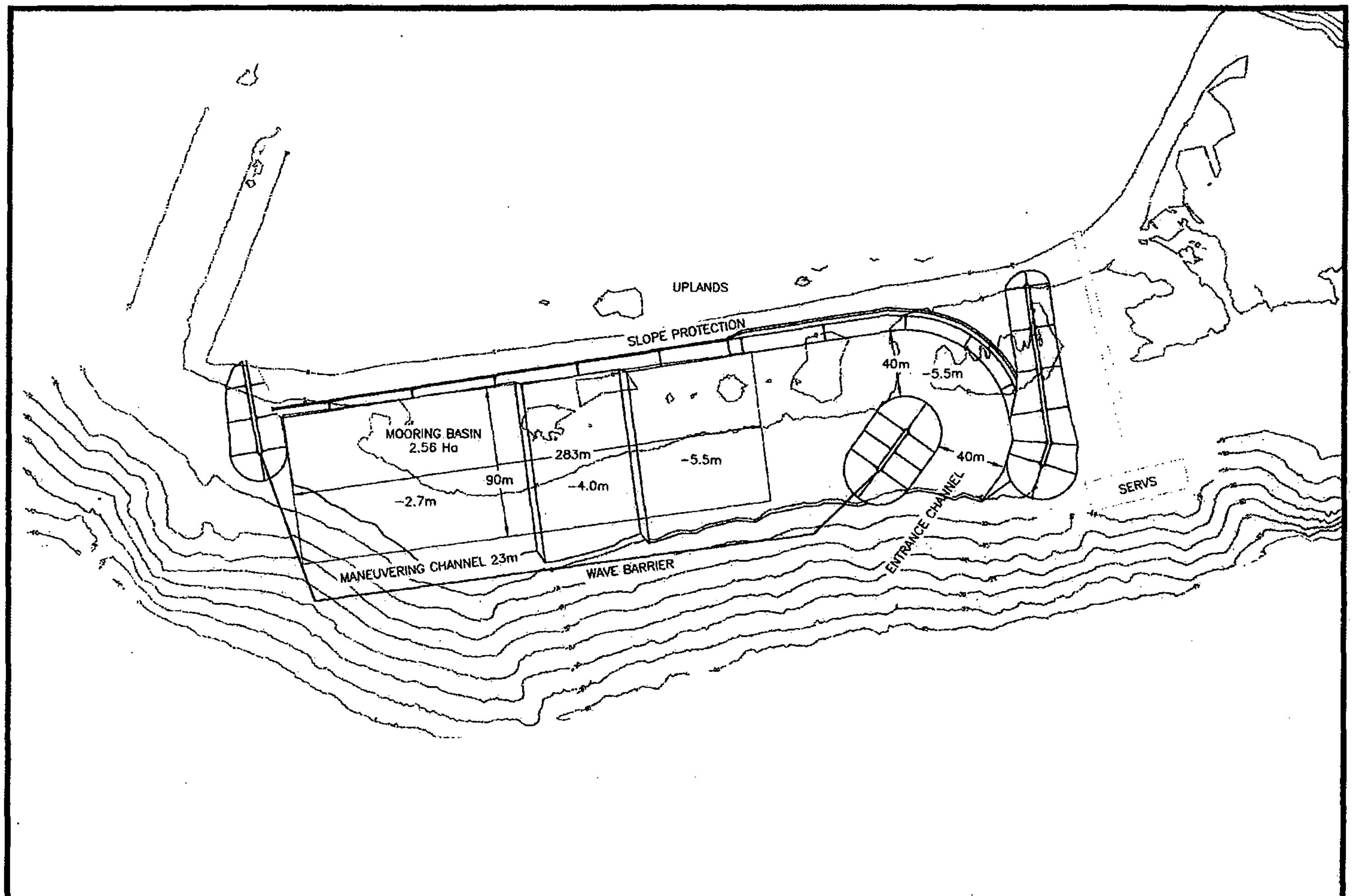
harbor. The remainder was likely to have been disposed of off shore at an undetermined location. Rock quantities for the early breakwater design included the following type and amount of rock: armor (23,300 yd^3), secondary (14,300 yd^3), core (26,200 yd^3).

The south breakwater was to be approximately 460 m long, including the south side of the upland fill area and on the westerly end turned to the north to form the east side of the entrance channel. The west breakwater was only 45 m long and was to form the western side of the entrance channel. The breakwaters were designed to protect the basin from waves in the southern quadrant from west to east. The largest anticipated wave, 1.4 m high and 4.3-second period, would be from the westerly direction. Natural depths of about 0 to –2 m MLLW would have formed the foundation to the breakwaters. Subsurface materials were sands and gravels with surface fines. The breakwater crest elevation was to be + 6 MLLW with a crest width of 4 m. The previous Coordination Act Report addressing this west alternative did not recommend compensatory mitigation.

2005 (Current) Alternatives for West Side. The west alternative was revised in mid-2005 at the request of the City of Valdez. The City re-evaluated the use of the filled "upland" area forming the southern margin of the existing harbor. A number of tenants had established facilities on this site, providing income to the City. Furthermore, the City had been approached by additional clients (camper park, facilities related to fish processing plants, etc.) and foresaw a future expansion need for commercial/industrial space on this land adjacent to the waterfront. Expansion of boat facilities at the loss of this upland space was not considered to be an economically desirable approach. Recent designs include addressing west side expansion through either a rubble mound breakwater system or a Wave Barrier Design. However, the steeply declining bathymetry on the southern margin of this site limits the available developable area for mooring facilities and necessitates implementing an innovative approach to providing "breakwater" protection. Hence the ACOE selected the Wave Barrier Design for further design analysis; this approach is what is evaluated further here (Figure 3).

Under this plan, approximately 451.2 meters of partial penetration wave barrier would be constructed as 8 pre-cast, pre-stressed concrete panels, and lowered into slots between 82 steel pipe pile frames placed at 6 meters on center. The top of the wave barrier would be at 6.5 m above MLLW, to prevent over-topping, and the bottom would be approximately –5 m MLLW to limit transmitted waves to less than 1 foot. (Actual depth will vary based on predominant wave direction and depth of water at wall location). Approximately 270 m of the wall would be placed at the –35 m contour line. Pipe piles would be 36-inch diameter by 5/8-inch thick and driven to a depth of 12 m below the mud line. Batter piles would be sloped at 4 on 12, and placed on the outside of the harbor. All steel would be galvanized, and protected with underwater anodes. The east breakwater would be 182.1 m, the west stub breakwater 91.9 m and the east breakwater 360.9 m. The harbor basin would be 4.4 ha. The dredging volume is 175,600 m^3. (Description provided by ACOE by email, Boyer to Seagars, March 27, 2006).

Shoaling in the entrance under any of the west side alternatives discussed above is expected to be minimal. Long shore sediment movement would be very small. The existing entrance just to the west of the new entrance has experienced only very minor shoaling. Maintenance dredging in the



ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

WEST SITE ALTERNATIVE 3 – 228 BOAT HARBOR
SERVS DOCK ENTRANCE
VALDEZ HARBOR EXPANSION, VALDEZ, ALASKA

Figure 3

entrance and in the basin is anticipated to be infrequent, if necessary at all.

East Side Alternatives

This site and its related alternatives (Figure 4) are situated on the east side of the SERVS dock on the tidal flats south of Hotel Hill. Plans for the east site have typically described a harbor bounded by two rubble mound breakwaters; one on the south side and one on the east side to protect this basin. The basin is physically constrained on all sides except the east; however, strong environmental constraints prevent further easterly expansion. Originally the East Side alternative was not the preferred alternative because it was believed to pose a greater risk and impacts to sensitive wildlife and other Service trust resources. Subsequent review in 2005 and 2006 by the City of Valdez and the ACOE identified the need to design a larger harbor that could accommodate more vessels than could be reasonably placed in any of the western harbor designs. There is the potential for blasting in the moorage basin; a geophysical survey will be conducted to determine the need for additional space and material. Recognizing the greater resource sensitivity of the eastern side, the City, the ACOE, the Service, and other partners worked together to incorporate design considerations and a detailed, expanded approach for mitigating for resource impacts from the East Side project design.

For both the initial and current East Side designs the following holds true: there is little movement of surface sediments in this area due to wave or current action. Therefore little or no maintenance dredging is expected to be necessary. A fiber optic communications cable is shallowly buried at the west end of the basin. This cable serves the interior of Alaska with telephone and data service. Relocating the cable would be costly. A pair of open conduits would be buried in the upland fill to serve as emergency repair or expansion ports into the onshore communications manhole. Constructed beaches will be provided on the east and west sides of the basin to provide a more natural curved, environmentally sympathetic plan.

2002 (Initial) East Side Design. The proposed harbor was to include a basin of 4 ha (9.88 acres), including the entrance and maneuvering channels (Figure 4). The mooring basin was to accommodate 153 vessels ranging in size from 9 m to 30 m. The entrance channel would be 40 m wide, sufficient for two way traffic, except for the largest vessels. The entrance channel depth would be – 4.25 m MLLW and decrease to – 3.2 m at the far end of the basin away from the entrance. Basin dredging would have totaled 105,700 m^3, including the entrance and maneuvering channels. Disposal was originally planned for adjacent disposal areas forming the staging area. No offshore disposal was anticipated. The dredge material was expected to consist of sands and gravels; however, large rock slabs and boulders will be present closer to Hotel Hill.

The south breakwater was designed to be approximately 390 m long, including the part by the upland fill area. The east end curved slightly to the north at the entrance channel. The east breakwater curved in a north-south direction from Hotel Hill to the entrance and was approximately 294 m long. The seaside slope of the east breakwater had a 1 vertical (V):2 horizontal (H) slope to simulate a more natural condition. The foundation materials were sands and gravels with a thin muddy layer on the surface. Foundation and stability aspects were considered good by the ACOE. The elevation of the foundation of the breakwaters varied from

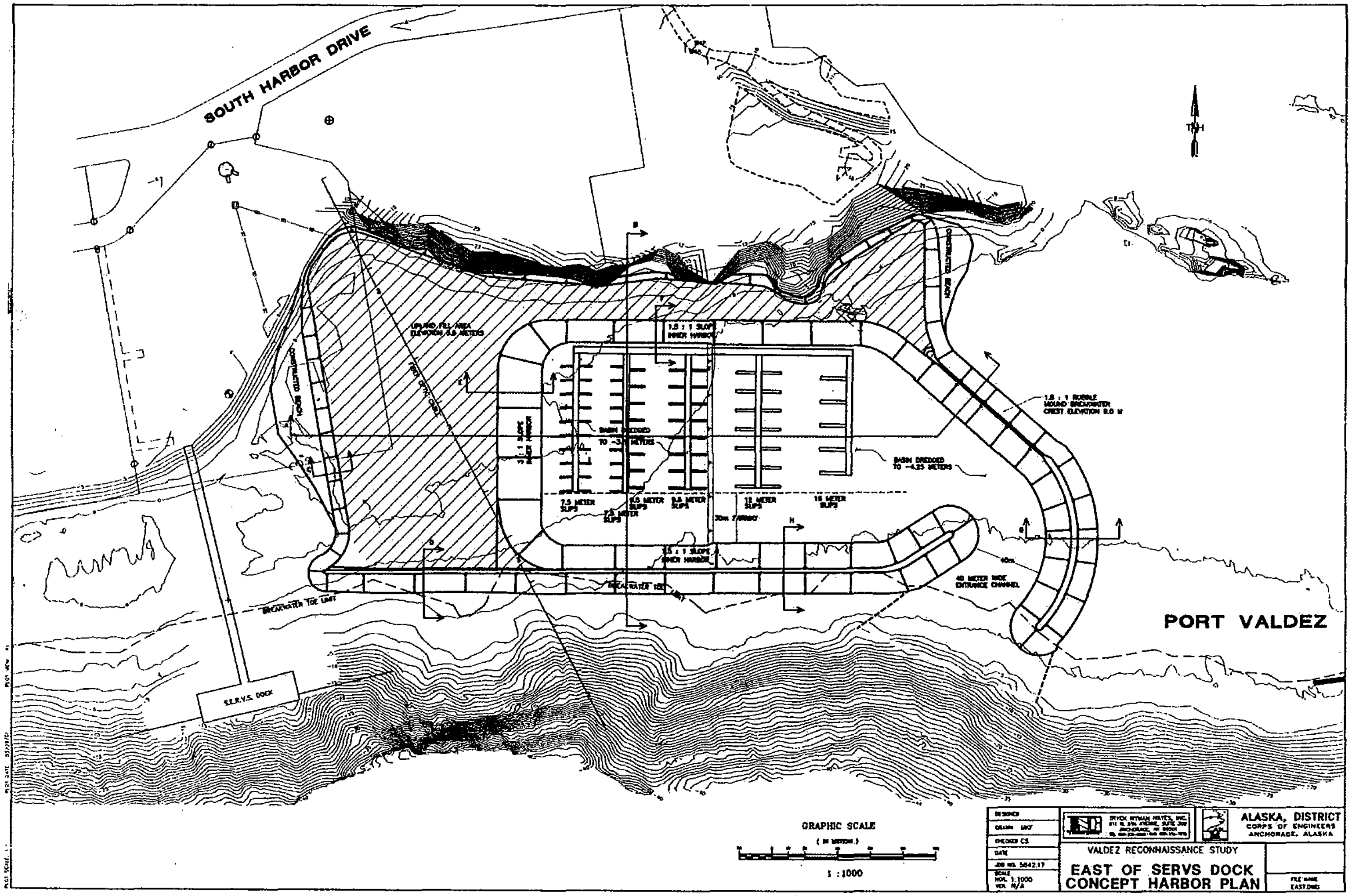

SOUTH HARBOR DRIVE
PORT VALDEZ
S.E.R.V.S. DOCK
BREAKWATER TOE LIMIT
40 METER WIDE ENTRANCE CHANNEL
1.5 : 1 SLOPE INNER HARBOR
GRAPHIC SCALE
(IN METERS)
1 : 1000
ALASKA, DISTRICT
CORPS OF ENGINEERS
ANCHORAGE, ALASKA
VALDEZ RECONNAISSANCE STUDY
EAST OF SERVS DOCK
CONCEPT HARBOR PLAN

Figure 4

about 0 to – 2 m MLLW. The crest elevation was + 6 m MLLW and the crest width was 4 m at the entrance and decreased to 2.3 m away from the entrance. Rock quantities anticipated for the breakwater included: armor (23,300 yd^3), secondary (14,300 yd^3), and core (26,200 yd^3).

2005 (Current) Alternatives for East Side (Preferred Alternative). The East Site is located east of the SERVS Dock and to the south of Hotel Hill on the existing tidal flats. There are two harbor plans for the east site; the smaller plan is potentially the National Economic Development (NED) Plan that maximizes project benefits with costs (Figure 5). The larger, locally preferred plan (Figure 6) accommodates more vessels matching the local demand for boats. Both designs would have near shore breaches for fish passage and intertidal staging areas created by dredged material. Disposal of dredged material would be in Two Moon Bay for habitat restoration. No maintenance dredging is anticipated for either plan. Table 1 summarizes the harbor features and quantities in both metric and English for all of the current design alternatives.

National Economic Design (NED) Plan. The 4.5 ha basin would accommodate 186 vessels. The south breakwater is 396.2 m, the east breakwater is 183.2 m, and the stub breakwater is 29.1 m in length. Dredge depths would vary from –5.5 m to –4 m to –2.7 m as the draft of the vessels dictated

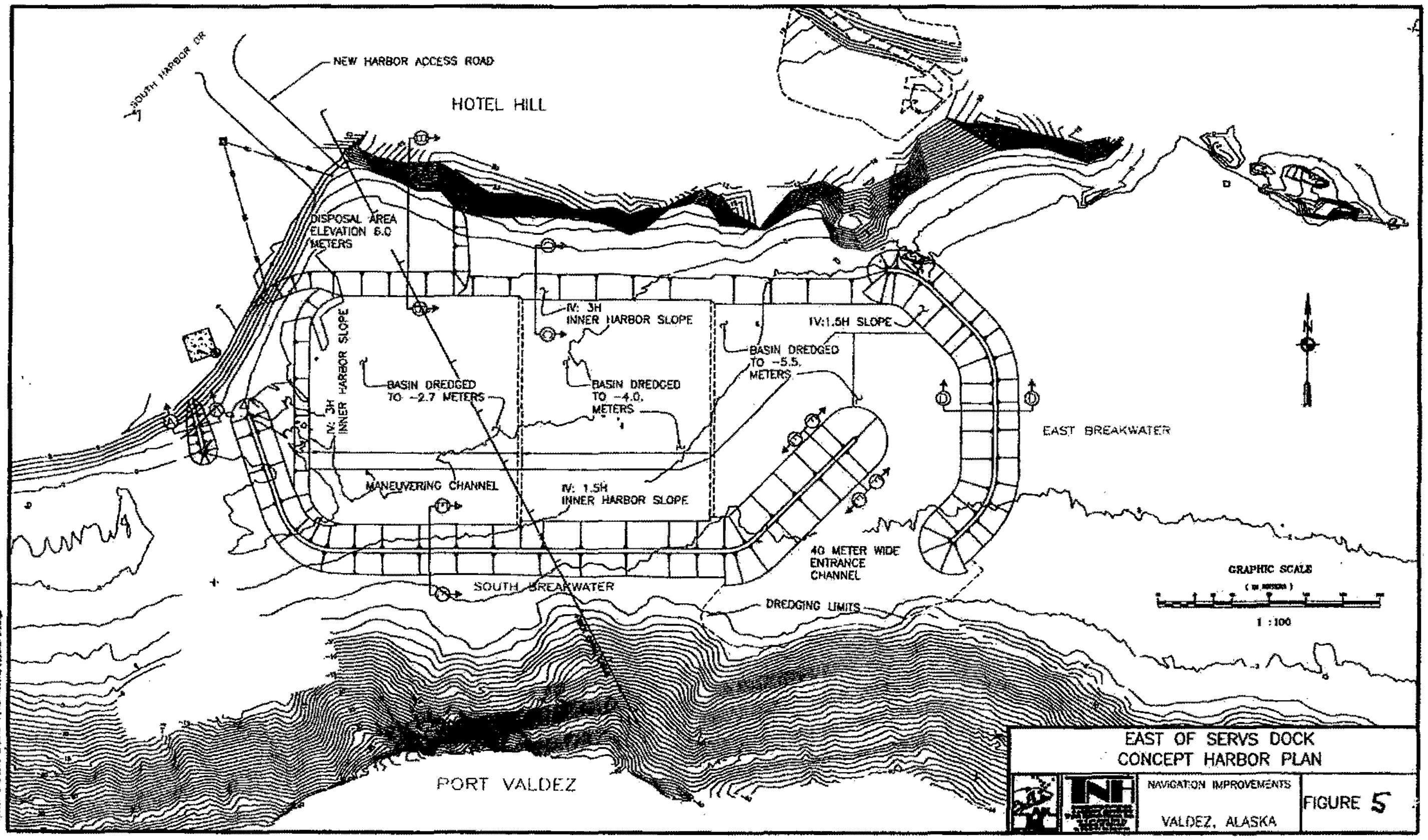
The western edge of the basin would be established as close to the SERVS Dock as possible. This location would require the relocation (i.e., deepening the burial depth below the harbor bottom) of the cable. Hotel Hill to the north and the steep drop off into Port Valdez would establish the north and south harbor feature limits. The only practical potential for harbor expansion would be in the eastern direction.

The entrance to the harbor is to be located on the eastern end of the harbor, away from potentially conflicting navigation at the SERVS Dock. Vessels would normally arrive from the west and enter in a northeasterly direction turning 90 degrees to 180 degrees to enter the maneuvering channel and floating docks in the inner harbor.

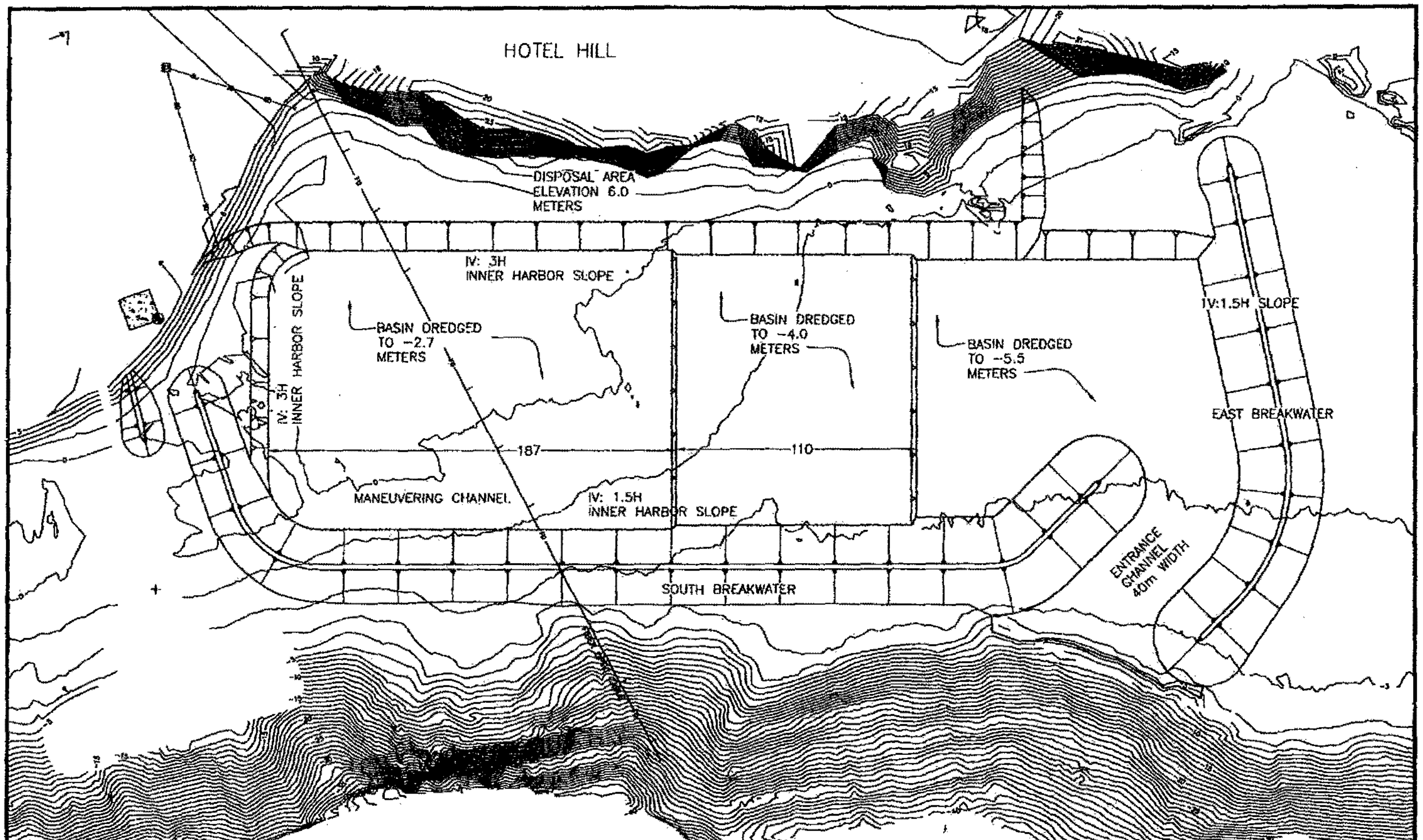
All dredging for the East Site would be in the tidal flat to the south of Hotel Hill and east of the SERVS Dock. Most materials are expected to be similar to the West Site with the exception that closer to Hotel Hill on the north, larger rock slabs would be encountered. The blasting of rock may still be needed in this alternative; a geophysical survey will be done to determine the need for blasting and additional material. A total of 175,600 m^3 of dredging would be required for the entrance channel, maneuvering channel and mooring basin. Slope protection for the basin would be afforded by 1,975 m^3 of material.

A fiber optic communications cable is buried at the west end of the basin. This cable serves the interior of Alaska with telephone and data service. Relocating the cable is very costly; therefore, a pair of open conduits would be buried in the upland fill to serve as emergency repair or expansion ports into the on-shore communications manhole.

Existing uplands in this area are limited. A small dredge material disposal area is planned at the



SOUTH HARBOR DR
NEW HARBOR ACCESS ROAD
HOTEL HILL
DISPOSAL AREA ELEVATION 6.0 METERS
IV: 3H INNER HARBOR SLOPE
IV: 3H INNER HARBOR SLOPE
1V:1.5H SLOPE
BASIN DREDGED TO -2.7 METERS
BASIN DREDGED TO -4.0 METERS
BASIN DREDGED TO -5.5 METERS
EAST BREAKWATER
MANEUVERING CHANNEL
IV: 1.5H INNER HARBOR SLOPE
40 METER WIDE ENTRANCE CHANNEL
SOUTH BREAKWATER
DREDGING LIMITS
GRAPHIC SCALE
1 :100
PORT VALDEZ
EAST OF SERVS DOCK
CONCEPT HARBOR PLAN
NAVIGATION IMPROVEMENTS
VALDEZ, ALASKA
FIGURE 5



ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

EAST SITE LOCALLY PREFFERED PLAN
RUBBLEMOUND BREAKWATER ALTERNATIVE WITH 3:1 ASPECT RATIO
VALDEZ HARBOR EXPANSION

Figure 6

northwest corner of the basin to provide minimum access requirements for construction and during operation of the harbor. Areas on Hotel Hill would be used for access and associated harbor development in the future.

Wave heights of up to 1.1 m would also be expected in the East Site entrance channel during the design storm event. These waves would again dissipate as they enter the inner entrance channel and basin area, quickly reducing to 0.3 m or less. The entrance channel alignment would provide a good circulation pattern to develop in the basin. Currents would be low and should not effect navigation. Shoaling has not been a problem at the existing harbor entrance or within the existing harbor and is also unlikely to be a problem at the East Site.

The 1V:1.5H harbor side slope would follow down to the basin depth, except for the western basin side, which has a 1V:3H slope. A toe trench would be excavated adjacent to the breakwater at a 1V:3H slope down to the basin depth. Then the breakwater core and secondary rock would be placed in the trench at the 1V:1.5H slope as the breakwaters are fully constructed. This approach would maximize the basin width in the north-south direction.

Locally Preferred Plan for the East Side. The proposed harbor has a basin of about 5.6 ha. The breakwater would be placed as far east as possible for maximum moorage basin capacity and to maintain plan form geometry ratios for good circulation. The mooring basin would accommodate 244 vessels ranging from 9 m to 30 m.

The basin dredging would total 202,700 m^3 including the entrance and maneuvering channels. Dredged material would be used to form the staging area. The majority of the material to be dredged is sand and gravel with large rock and boulders close to Hotel Hill. Blasting would be avoided by placing fill into the near shore as a 1.93 ha staging area. Large boulders would be removed and placed near the east breakwater. The south breakwater would be 475.2 m long. The east breakwater would curve in a north-south direction from Hotel Hill to the entrance channel and would be approximately 229.2 m long. The seaside slope of the east breakwater would have a 1V:2H slope to simulate a more natural condition. The crest elevation would be 6 m MLLW and the crest width would be 4 m at the entrance and decrease to 2.3 m from the entrance.

The local sponsor has the option to select the locally preferred alternative if they pay any increased costs over the NED plan and the alternative is environmentally acceptable.

Biological Resources

The existence of several sources of biological data precluded the need for the Service to conduct additional SCUBA-based sampling dives or detailed benthic sampling within the project region. These sources include biological data from a 1993 SCUBA dive (Feder 1993) and benthic sampling conducted in 1994 (Feder 1995) to establish an environmental baseline for the proposed SERVS dock. Initial site visits to observe biological conditions and resources were conducted in March and June of 2000 by Service staff. These field investigations focused on documenting bird and marine mammal use in the vicinity of the proposed alternatives. As a result of the revised design concept and a revitalized interest in advancing new project alternatives, the ACOE and the National Marine Fisheries Service conducted additional on-site habitat observations during a low tide period in August 2005 (see "trip reports/memoranda" detailing these observations, included in Bartlett (2005) and Eagleton (2005). Information on the variety of substrates, plants, invertebrates, fish, birds, and marine mammals within eastern Port Valdez also is available from numerous sources and is included or referenced in this report.

Topography, Sediment, Marine Plants, and Invertebrates

Substrate within the intertidal areas of both the west and east alternative regions includes both rocky and mud/sand flats (USFWS 1981). There is a high silt load traveling via the slow, predominantly west flowing current, resulting in moderate deposition and high turbidity throughout the project area. Substrate within the subtidal areas includes muddy sands, cobbles and a mixture of shale rock, mud, and sand. Adjacent slopes are composed of muddy rock (USFWS 1981, Eagleton 2005).

The rocky intertidal habitat supports dense patches of rockweed (*Fucus distichus*) along a band at the -1 m contour, green algae (*Monostroma sp.*), blue mussels (*Mytilus edulis*), and various barnacles and snails. Mussels observed were predominately small in size, indicating either marginal growth conditions or overgrazing by sea otters. The intertidal mud and sand flats support ribbon kelp, brown algae, polychaetes, various crustaceans, and gastropod and bivalve mollusks (e.g., Myidae). During the August 2005 site visit, it was noted that a large quantity of shale had exfoliated from the side of "Hotel Hill" and had settled into the high intertidal zone. These large (in some cases, "car-sized") slabs appear to be well conditioned to the marine environment and have been colonized densely by marine algae and an associated invertebrate faunal assemblage (Bartlett 2005). Subsequent comments by NMFS and ACOE staff biologists noted that it would be highly desirable to ensure these materials are not covered by harbor construction (e.g., new rock bulwarks, dredge spoil) or otherwise destroyed. It would be best to remove them prior to harbor development for subsequent replacement as "seed material" on top of new harbor rock (e.g., breakwaters), or to be transferred for use at mitigation sites away from the new harbor.

The rocky subtidal habitat supports sea anemones, bryozoans, hermit crabs, small rock crabs, juvenile cancer crabs, macoma, butter, and littleneck clams, and marine fish that include greenling, Pacific tomcod, sculpins, and gunnels. Small circular mussel beds occur throughout the eastern project site; the western site also has small, patchy mussel beds. The subtidal mud slopes support bivalve mollusks and polychaetes, Subtidal mud slope habitat is used by Tanner crabs for foraging, mating, and rearing. Depending on the season, kelp cover can range from 15 to 55 percent (Issacs 1990). A noteworthy band of laminaria (*Laminaria saccharina*) kelp runs along the lower margin of the tide line (deeper than 2 feet MLLW) nearly continuously through the project region. Several small (4 meter^2) eelgrass (*Zostera* sp.) patches are present in the subtidal regions both west and east of the SERVs pier.

Sediment and invertebrate samples were collected at three different transects near the SERVS dock during a SCUBA dive conducted in 1993 (Feder 1993). Transect #1 located 25 feet to the west of the SERVS dock extended from 10 to 65 feet in depth. Transect #2 ran along the western edge of the SERVS dock. The sediment at 10 feet was fine gray mud with scattered gravel. From 10- to approximately 25-foot patches of brown algal detritus covered the sediment and barnacles, hermit crab, brown algae (kelp) attached to gravel or rocks, and clam and polychaete worm holes were observed. A number of larger holes were also observed in this zone and were presumed to be the result of sea otter foraging. (Several sea otters were observed in the vicinity of transect #1 during the FWS site visit in 2002.) At 30-65 feet, a very fine soft mud was observed. The bottom dropped off steeply towards the end of the transect line. The sediments and species documented at transect #2 were very similar to transect #1. Transect #3 ran parallel to and was approximately 25 feet east of transect #2; extending 18 to 70 feet in depth. Sediments, plants, and invertebrates were similar to the other two transects. Many small worm and clam holes were observed. Transect #3 paralleled shore east of the pier running to approximately 70 feet in depth. Soft gray sediment was observed throughout this region. Large clam holes were common; more common than at transects occurring in shallower areas. Active polychaete worms were also observed along this transect. Feder's transect summary describes a healthy, undisturbed bottom with many worm and clam holes present and signs of otter digging activities.

Benthic surveys were conducted in 1994 near the SERVS dock (Feder 1995). Taxa observed in the 1994 survey and a ranking of their abundance is included in Appendix 1 of this report. Sampling stations occurred east, west, and south of the SERVS dock. Some of the more abundant species documented during the surveys include *Capitellidae*, *Cirratulidae*, *Melinna cristata*, *Pista cristata*, *Polydora spp.*, *Sternaspis scutata*, *Nuculana fossa*, *Axinopsida spp.*, and *Macoma spp.*

The East Alternative encompasses a larger area of shallow intertidal habitat than the West Alternative. Relatively speaking, the East Alternative intertidal and subtidal regions are broader and more topographically variable than the West Alternative area; species diversity and abundance is similar throughout the project area, although the shallow eastern intertidal areas appear to be somewhat more biologically productive for commercially important species.

Fish

Marine waters within the area of the proposed harbor alternatives provide rearing and migration habitat for Dolly Varden, and sockeye, coho, chum, and pink salmon. The estuarine waters of the Valdez Duck Flats, and the nearshore coastlines of Dock Point and Mineral Creek Islands provide important habitat components for the early stages of fry development and feeding for chum and pink salmon (Issacs 1992). Outmigrating salmon fry feed on benthic and planktonic crustaceans within the intertidal habitat of Port Valdez.

Visual surveys conducted in nearshore habitats of eastern Port Valdez indicate that chum salmon fry outmigration was the greatest in late April and tapered off over a period of five to six weeks. In the surveys conducted along Inner Point, Southwest Cove, Dock Point, Mineral Creek Islands, Ammunition Island, Harbor Cove, and Harbor Point, salmon fry were observed in schools ranging from 10 to 500 fish, and were usually observed within 3 feet of the shore. The greatest numbers of fry were continually observed along the south shore of Dock Point, followed by Harbor Point/Harbor Cove, and the Mineral Creek Islands (Morsell and Perkins 1979).

The Valdez Duck Flats contain large areas of intertidal mudflats cut by six freshwater streams that drain into the mudflats. All six streams that flow into the Duck Flats are anadromous and are classified by Alaska Department of Fish and Game as sensitive habitat. During spring, salmon fry from Siwash Creek, Ess Creek, Sewage Lagoon Creek, and the Loop Road Creek system forage on insect larvae in the mudflats (USEPA 1980).

Upon release from the Solomon Gulch fish hatchery across the bay from the Valdez Duck Flats, millions of juvenile pink, chum, and coho salmon are carried toward the Duck Flats and proposed harbor areas by the counter-clockwise currents in Port Valdez. Annually, 10 million fry are released from the hatchery; however, the precise number of juveniles that utilize the Duck Flats as a nursery is unknown (Valdez Aquaculture Association 1993).

Siwash Creek is the most important pink salmon producer in Port Valdez (Dames and Moore 1977). From 1971-1978, roughly twice the number of adult pink salmon returned to Siwash Creek (173,175) than to the nearby Lowe River system (86,852). The Duck Flats streams provide a high percentage of the pink salmon taken in the Valdez Arm commercial fishery during odd-year runs. In 1973 and 1975, Siwash Creek had the largest escapement of any stream in the eastern management district of Port Valdez. The Duck Flats also contribute about one percent of the chum salmon to this fishery.

Harbor Cove is an important estuary for juvenile pink and coho salmon (Gnath, 1999, pers. comm.) Substrate within the subtidal areas includes subtidal rock and mud slopes (USFWS 1981). The rocky subtidal habitat supports marine fish including greenling, Pacific cod, sculpins, and ronquils (Issacs 1990). The marine waters of Port Valdez also support arrowtooth flounder; flathead, rock, and yellow fin sole; sablefish; sculpin; walleye pollock, and Pacific herring (NOAA 2000). Eulachon also occur in Port Valdez and are reported to enter Siwash Creek in early spring (City of Valdez 1986).

Birds

The eastern portion of Port Valdez, including locations within the proposed harbor alternatives, has been identified as a sensitive biological resource area for birds (NOAA 2000). Marine birds are relatively abundant in Port Valdez, especially during the winter. A total of 26 species of birds, of which 22 species were marine birds, was observed in Port Valdez during winter shoreline surveys conducted in 1979 (Hogan and Colgate 1980). The four highest densities of winter birds documented during these shorelines surveys were goldeneyes (*Bucephala sp.*), rock sandpipers (*Calidris ptilocnemis*), common murres (*Uria aalge*), and mallards (*Anas platyrhynchos*).

Diving ducks are the most abundant group of birds that utilize Port Valdez during the winter (Sangster 1978). Diving ducks such as Barrow's (*B. islandica*) and common goldeneye (*B. clangula*), bufflehead, harlequin duck (*Histrionicus histrionicus*), and white-winged scoter

(*Melanitta fusca*) feed on pink shelled clams (*Macoma balthica*) that occur within and adjacent to the proposed harbor alternatives.

A total of 45 species of marine birds was recorded during the summer in Port Valdez (Hogan and Colgate 1980). Gulls and terns comprised over 70 percent of the total bird population in the summer. Glaucous-winged gulls (*Larus glaucescens*) and black-legged kittiwakes (*Rissa tridactyla*) were the two most abundant species. Arctic terns (*Sterna paradisaea*) were the third most abundant species.

Inventories conducted by the Service in 1993 and 2000 (North 1993, Stackhouse 1993, Heer and Connor 2000), documented birds within or adjacent to the proposed harbor alternatives in three different transects (Figure 7). Transect locations occurred within marine waters seaward of the mudflats to 300 feet in depth. Transect 1 was located west of the existing harbor, extending up to (but not including) the mouth of Mineral Creek. Transect 2 was located within the existing Valdez Harbor and entrance channel. Transect 3 was located east of the existing harbor entrance up to the Old Valdez town site. A summary of this bird data is included in Table 2.

Based on this limited data, transect 3 shows greater bird diversity and abundance than transects 1 and 2 combined. However, transect 3 covers a larger area than transects 1 and 2 and the inventories did not allow for statistical analysis. Therefore, no conclusions backed by statistics can be made that Transect 3 supports higher diversity and abundance on a per unit basis than Transects 1 and 2. Transect 3 does have more diverse habitat features such as shallower intertidal zones, islands, and protected areas so it is likely to attract a higher abundance and greater species diversity than the other transects. The low bird diversity and abundance in Transect 2 is likely caused by low habitat values that occur within the Valdez Harbor.

Bird species observed (Heer and Connor 2000) within or adjacent to the proposed alternatives during the Service's February 29-March 2, 2000, site visit include northern pintail, Barrow's goldeneye, bufflehead, harlequin duck, common eider, long-tailed duck, surf and white-winged scoter, red-breasted merganser, gadwall, pelagic cormorant, and marbled murrelet. During the Service's June 23, 2000, site visit, birds observed within or adjacent to the proposed alternatives included black-legged kittiwake, herring and glaucous-winged gull, marbled murrelet, arctic tern, harlequin duck, long-tailed duck, mallard, American wigeon, black oystercatcher, and pigeon guillemot.

A seabird colony occurs within approximately 0.75 miles of the proposed East Alternative (Figure 8). This colony of approximately 195 arctic terns and 5 glaucous-winged gulls was documented July 20, 2000, on one of the Outer Islands just south of the Mineral Creek Islands (Stephensen 2001, pers. comm.).

The East alternative is located adjacent to Harbor Cove. Harbor Cove is within one of the two primary sea duck feeding areas identified in Port Valdez and has been identified as a sensitive habitat area for feeding sea and diving ducks (Hemming and Erikson 1979).

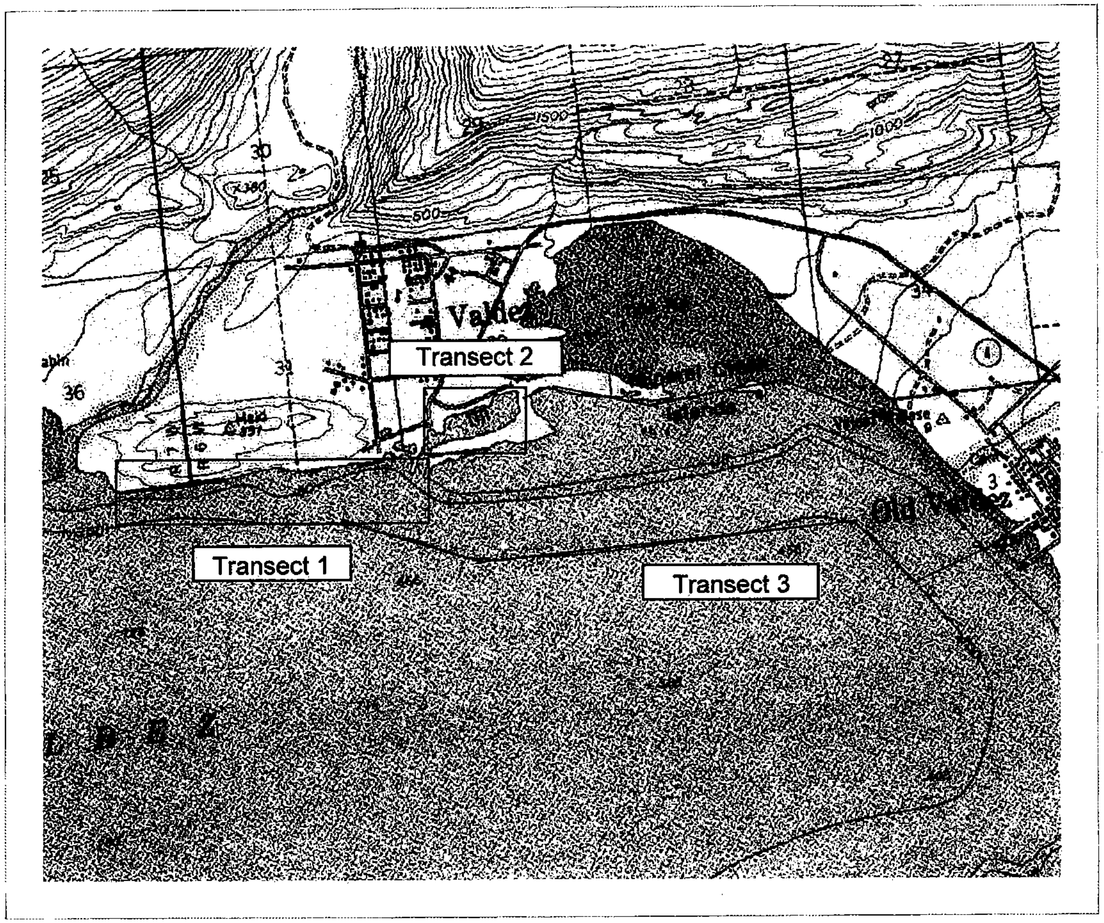


Figure 7. Transect areas 1-3 for 1993 and 2000 bird surveys conducted in Port Valdez.

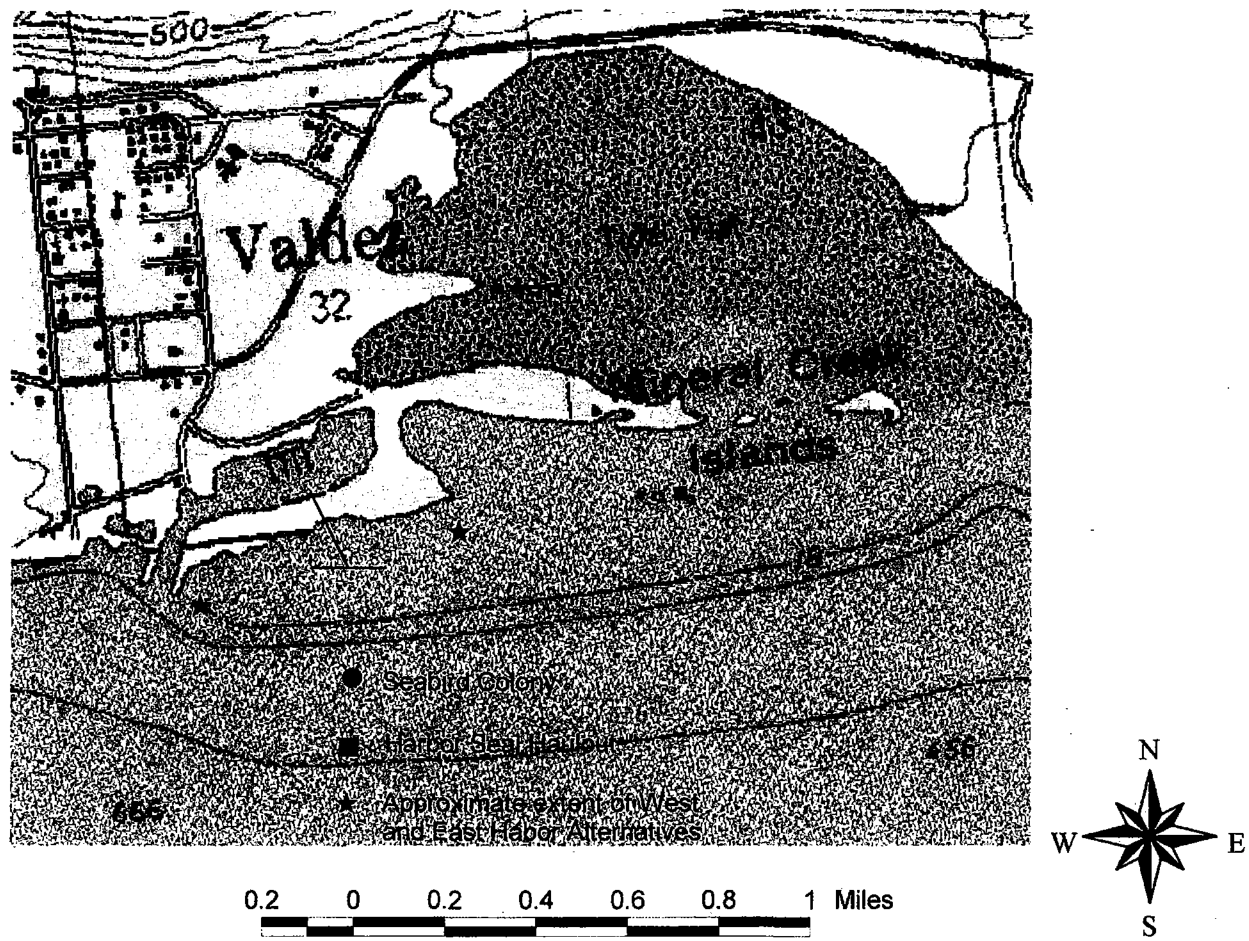


Figure 8. Seabird Colony and Harbor Seal Haulout.

Table 2. U.S. Fish and Wildlife Service Bird Surveys conducted in 1993 and 2000 within 3 transect areas of Port Valdez within and adjacent to the Valdez Harbor. Transect areas are indicated in Figure 7.

	Transect 1			Transect 2			Transect 3		
Survey Dates	02/93	05/93	02/00	02/93	05/93	02/01	02/93	05/93	02/00
Pelagic cormorant	2	------	3		------				3
Mallard		------			------		8		
Gadwall		------			------			4	
American widgeon		------			------			4	
Greater scaup		------			------		4	11	
Long-tailed duck		------			------		26		45
Common eider		------			------				4
Bufflehead		------			------		12	2	32
Pintail		------			------				1
Harlequin Duck		------			------				3
Common merganser	3	------		1	------				
Common murre	498	------		542	------		814		
Common goldeneye		------		1	------		35		
Barrow's goldeneye		------	57		------	5	1	33	184
Surf scoter		------			------			48	33
White-winged scoter		------			------	1			7
Red-breasted merganser		------	6		------				9
Artic Terns		------			------			37	
Mew Gull		------			------			28	
Larus sp.		------			------			248	
Sea Otter	1	------	1	12	------	5	25		2
Harbor Seal		------	1	28	------		39		1

------Indicates survey was not conducted in these transects. Due to ice and adverse weather conditions inventories were only partially completed in survey areas 1 and 3 in 2000.

The Duck Flats, located southeast of the proposed harbor improvements, consist of 1000 acres of extremely productive intertidal fish and wildlife habitat providing high levels of nutrient availability. The predominant wetlands type within the Duck Flats is intertidal estuarine salt marsh, which depends on daily tidal inundation and fresh water input from streams. The salt marsh within the Duck Flats is the largest salt marsh in Valdez Arm and one of the larger marshes in PWS. The Duck Flats are noteworthy for their size not only in PWS but in Alaska (Crow 1977). Salt marshes are relatively rare in Alaska.

Since the early 1970s, this area has been regarded by federal and state resource agencies and the scientific community as the most productive ecosystem in Port Valdez, containing unique habitat with high natural productivity, plant and animal diversity, and essential habitat for biological resources. The Valdez Duck Flats have been recognized as an Aquatic Resource of National Importance by the U.S. Army Corps of Engineers.

The Valdez Duck Flats provide significant waterfowl production, including important nesting and brood rearing habitat for a variety of birds, notably ducks, geese, gulls, and terns (Hogan and Colgate 1980). The Duck Flats also provide important feeding, nesting, molting, and staging habitat for numerous species of marine birds, waterfowl, shorebirds, passerines, and raptors.

In previous breeding bird surveys (Hogan and Colgate 1980), mallards were the most abundant waterfowl species counted at the Duck Flats, followed by green-winged teal (*Anas crecca*). Mallards (*Anas platyrhynchos*), green-winged teal, pintail (*Anas acuta*), and American wigeon (*Anas americana*) nest on the Duck Flats and use the numerous channels and pools for feeding and brood rearing.

The August 2005 site visit by the ACOE and the NMFS noted both sides of the Alyeska service dock serve as nesting sites for a colony of blacklegged kittiwakes. One hundred twenty birds were estimated to utilize the east side of the SERVs pier . Nests were built on the lower, outside web of the main steel girder (see photos in Bartlett 2005).

Marine Mammals

Marine mammals, primarily harbor seal (*Phoca vitulina*) and sea otter (*Enhydra lutris*), use Harbor Cove, the Duck Flats, adjacent islands, and the surrounding marine waters for feeding and resting. Intertidal habitat located between the Valdez Duck Flats and Mineral Creek has been identified as a high concentration area for sea otters (NOAA 2000). Sea otters have been observed to make feeding dives along the outer margin of the east site. Sea otters forage on clams and mussels in this area. A recent sea otter dig into the substrate was observed during the low tide site inspection on August 19, 2005 (Bartlett 2005). The proposed project is expected to eliminate or reduce these feeding habitat areas for sea otters. The western population of sea otter (*Ehydra lutris kenyoni*) has been listed as threatened under the Endangered Species Act; however, that stock does not occur east of western Cook Inlet. Sea otters in Valdez Arm were not protected under the Endangered Species Act at the time this CAR was being prepared. Under the Marine Mammal Protection Act, sea otters are afforded protection from harassment.

Harbor seals in the project area are likely to feed on starry flounder, salmon, and shellfish located along the barrier islands and the Valdez Duck Flats during high tides (Issacs 1990). As many as 27 harbor seals have been observed hauled out at the east end of the Mineral Islands (Issacs 1992). On the Service's February 29, 2000, site visit, 20 harbor seals were observed hauled out in this same area which is located approximately one-half mile from the proposed East Alternative. Harbor seals move in over the subtidal shelf and mudflats to feed on starry flounder and seasonally when spawning salmon are available (Lees et al. 1979).

Threatened and Endangered Species

The Kittlitz's murrelet (Brachyramphus brevirostris) throughout its range was designated a candidate species for threatened status under the Endangered Species Act (ESA) on March 4, 2004. This is a small diving seabird that lives in Alaskan coastal water from Point Lay to southeast Alaska. It is a secretive breeder, laying a single egg in a depression on bare, often alpine ground. Only about two dozen nests have ever been found (Day et al. 1999). They tend to forage around tidewater glaciers among icebergs and brash ice, but avoid areas that contain heavy ice. They also feed along coasts where waters are influenced by glacial outwash. Kittlitz's murrelets are known to occur in Valdez Arm, potentially in the project area. Surveys should be undertaken to determine if this species uses the area for feeding, or as a transitioning corridor between feeding, nesting and brood rearing areas, or as a travel route during migration between winter and spring-summer habitats.

Steller's eiders (*Polysticta stelleri*), listed as threatened under the ESA, are sighted only very rarely during the winter in the Valdez Arm. This project is not expected to have any effect upon the species.

Our records indicate that there are no other listed threatened or endangered species for which the Service has authority known to occur within any of the proposed alternatives. Based on the Corps project description, we concur with their assessment that the proposed action is not likely to adversely affect species listed as threatened or endangered under the Endangered Species Act of 1973 (Act), as amended. This constitutes informal consultation under the Act; for reference note this is consultation number 2006-086. Further consultation regarding this project is not necessary at this time. Consultation should be reinitiated by the Corps if: 1) project plans change; 2) new information becomes available that would indicate listed or proposed species may be affected by the project in ways not previously addressed; 3) new species are listed or proposed for listing that may be affected by the project; or 4) listed or proposed species are observed on the project site.

The NMFS has responsibility for all other threatened and endangered marine mammals. The Corps should contact NMFS to determine if future consultation regarding marine mammals is required for this project.

Future Resource Conditions Without the Project

Without the project, we would expect resource conditions to remain largely as they are today. Consequently, the habitat is likely to remain in its current condition for the most part.

Future Resource Conditions With the Project

Impacts Related to the Breakwater and Staging Area

The dredging and structures associated with the Valdez Small Boat Harbor Improvement project will cause shallow intertidal habitat losses in both of the newly proposed alternatives. However, these losses are much greater in the East Alternatives, which encompass a larger area of shallow intertidal habitat, 7.33 – 10.56 ha (18.12 – 26.08 ac) respectively for the NED and locally preferred plans, than for the West alternative which would involve 5.14 ha (12.71 ac), see Table 1. These shallow intertidal areas provide an important habitat zone for plants, invertebrate, fish, seabirds, and marine mammals that does not occur in adjacent subtidal areas.

Bird surveys conducted by the Service in 1993 and 2000, documented numerous birds using these areas for feeding. They also use the nearshore habitats for protection from harsher wind and wave conditions that occur in deeper waters. In addition, nearshore habitat losses will reduce available sea otter foraging areas and nearshore anadromous fish migration and feeding habitat. The breakwater and other structures associated with the harbor improvements would displace fish and wildlife from foraging in these areas.

A solid fill breakwater extending from shore to deep water can interrupt nearshore anadromous fish migration (Starr et al. 1981). Sloped topography, unconsolidated rocks and sediments, vegetation, fresh water seeps, and shallower habitat along the shoreline provide juvenile fish with important rearing and migration habitat. This nearshore habitat provides food, and escape cover that helps protect salmon fry from predation by larger fish. The placement of inwater structures, such as the breakwater and staging area, adjacent to the shore will force juvenile fish that migrate along the shore further seaward. Juvenile fish in deeper waters will be more susceptible to predation, where predatory fish are more abundant than in shallower nearshore waters. The steeper slopes associated with breakwater structures may also increase predation on juvenile salmon because no habitat is available for them to hide from predators. In addition, fish forced to go around the breakwater structures, are susceptible to increased wave action and turbulence. During project construction, juvenile fish could also be more susceptible to predation if they are forced out into deeper water to avoid construction impacts such as increased turbidity or blasting.

Some juvenile fish, salmon in particular, either prefer or become trapped within some harbor configurations (Cardwell and Koons 1981). Juvenile salmon may seek the protective cover of the floating breakwaters, finger floats, and vessel hulls. This behavior would bring them into close proximity to sources of petroleum compounds and other contamination from vessels in the harbor, where concentrations of toxic materials would be greatest. These effects are related directly to the harbor design and its proximity to salmon migration routes.

Both of the proposed harbor alternatives support benthic invertebrate food resources that attract birds and marine mammals. Some of the more important food resources for sea otters and sea ducks include mollusks and crustaceans. The East Alternative supports a greater abundance of invertebrates than the West Alternative because the shallow intertidal habitat encompasses a larger area. Therefore, impacts to invertebrates would be greater in the East Alternative. The additional invertebrate losses associated with development of the East Alternative would also have greater impacts than the West Alternative on birds and marine mammals, since invertebrates are an important part of their diet.

Structures from the proposed breakwater and staging areas will bury and smother invertebrates causing direct mortality (see Table 1 for acreage to be lost due to each facet of each alternative). Invertebrate mortality can also be expected to result from increased hydrocarbons and other contaminants that are associated with marine vessels. The structures will also cause invertebrate habitat losses and alterations, resulting in reduced diversity and abundance which will diminish food supplies for birds and marine mammals. Construction activities such as dredging will bury benthic organisms and interfere with filter feeding activity of invertebrates.

Although some breakwaters could be re-colonized by marine organisms, there is little evidence to document to what degree it would occur and how long it could take. The constructed breakwater may, over time, support some marine habitat, but at a much reduced level compared to pre-existing habitat conditions.

Dredging Impacts

Dredging will result in unavoidable suspension of large quantities of sediment into the water column, degradation of water quality for a short period of time, and physically altered benthic habitat. Excessive sedimentation and turbidity can clog fish gills, interfere with along-shore fish movements, lower dissolved oxygen concentrations, bury benthic organisms, and interfere with filter feeding activity of invertebrates. Juvenile outmigrating salmon are highly sensitive to turbid water conditions. Consequently, if dredging were to occur during the juvenile outmigration, thousands of salmon smolts may be injured.

Environmental Contaminants/Water Quality Impacts

Leaching of trace contaminants from marine vessels can contribute to contamination of coastal waters. For example mercury and tin have been used extensively as toxicants in antifouling paints, while chromium, lead, and zinc are used in bottom primers.

Since the proposed harbor will increase vessel use in eastern PWS, the potential for fuel spill incidences will also increase. Chronic residual oil and petroleum products that enter marine waters from daily vessel operation will also increase. Although not currently proposed, the construction of a new fuel facility associated with any new harbor will increase the potential for the number of acute and chronic fuel spills which could have devastating impacts on fish and wildlife.

Chronic discharges may be less noticeable than large spills; however, they could be introducing more hydrocarbon by-products into the marine environment and causing longer term damages (Breuel 1981). Seabird mortality caused by large spills from tankers or barges usually attracts public attention and official investigation, but the cumulative mortality of seabirds from small, unreported spills may often be higher (Burger and Fry 1993). Beached bird surveys have demonstrated that small-volume, chronic oil pollution is an ongoing source of mortality in coastal regions (Burger and Fry 1993). Small volumes of fuel may be released from leaking tanks and valves, accidents during loading and off-loading, flushing of tanks and bilges, accidental tank overflow during vessel refueling, etc.

Petroleum can be ingested by birds and mammals through feather preening, grooming, drinking, consumption of contaminated food, and inhalation of fumes from evaporating oil. Ingestion of oil is seldom lethal, but it can cause many debilitating sublethal effects that promote mortality from other causes, including starvation, disease and predation. Effects include inflammation and hemorrhaging of the digestive tract, pneumonia, organ damage, red blood cell damage, hormonal imbalance, intoxication, inhibited reproduction, retarded growth in young, and abnormal parental behavior (Albers 1991).

Fish are exposed to spilled oil through contact with dissolved petroleum compounds or particles of oil dispersed in the water column, ingestion of contaminated food or water, and through contact with surface oil. Juvenile fish are more sensitive to contamination. Sublethal effects of oil on fish include changes in heart and respiratory rates, enlarged livers, reduced growth, fin erosion, a variety of biochemical and cellular changes, and behavioral responses (Albers 1991).

The East Alternative is closer to sensitive fish and wildlife habitats of Valdez Duck Flats, Harbor Cove, and adjacent islands, than is the West Alternative. Therefore this alternative may result in an increased exposure of trust resources inhabiting those sensitive adjacent regions to hydrocarbons and other harbor induced contaminants. Since information on circulation patterns for east Port Valdez is not available, it is hard to project surface water movement patterns. Fish and wildlife using Harbor Cove could be the most vulnerable to fuel spills within or near the proposed East Alternative because fuel may be more concentrated and less dispersed.

Mortality and sublethal effects on invertebrates are caused by smothering, contact with dissolved oil or suspended oil particles, ingestion of oil or contaminated food and water, and possibly changes in the water, including oxygen depletion and pH change (Albers 1991). Kasymov and Gasanov (1987) determined that a 0.001 mg/L gasoline concentration tends to reduce the survival rate of crustaceans except crab. A gasoline concentration increased to 0.1 mg/L caused the mass elimination of shrimp and amphipods. A concentration of 20 mg/L gasoline was lethal for crabs (Kasymov and Gasanov 1987).

<u>Vessel Disturbance Impacts</u>

The proposed Boat Harbor Improvement project will increase marine vessel use in areas adjacent to the project and throughout PWS. Increases in boat traffic, human access, and developments within PWS are a cause of major concern within a biologically rich, sensitive, and fragile environment containing many species that have not yet recovered from the1989 Exxon Valdez oil spill. Potential impacts resulting from the increased vessel use include:

1. Noise, boat traffic, and other human disturbances (i.e., onshore trampling in previously disturbed areas) may cause birds and marine mammals to abandon habitats and abort/abandon young. Increased numbers of large fishing boats using a harbor constructed in certain areas could result in disturbance to those species that are sensitive to the presence of humans or vessels, forcing them to other areas where food or shelter could be less optimal. Of particular concern is vessel disturbances to the harbor seal haulout located approximately ½ mile from the East Alternative.

2. Increased boat landings and access into protected non-rocky shallow shores that support sensitive habitat such as eelgrass beds and black oystercatcher nesting areas.

3. Increase in chronic spills and residual hydrocarbons from vessels.

4. Increased potential for larger fuel spills which could have devastating effects on invertebrate, fish, birds, and marine mammals.

5. Increase of other pollutants such as bilge and grey water into marine waters.

6. Increased litter in the marine environment.

7. Loss and alteration of terrestrial and aquatic vegetation caused by anchoring, hiking, trampling, camping, firewood use, etc.

8. Increased transport of non-native aquatic species. Although not currently documented in Alaska waters, but expanding north along the Pacific Northwest coast, species like the green crab compete for prey food sources such as small clams. They have been known to totally take over habitats used by other crabs.

9. Increased fishing pressure on fresh and salt water fish and other aquatic species (i.e, clams) could deplete or reduce local populations, further impacting species that prey on them.

Recommendations

Under the Fish and Wildlife Coordination Act (48 Stat. 401, as amended: 16 U.S.C. 661 et seq.), the Service is responsible for identifying potential project impacts and recommending actions which would mitigate negative project effects on fish, wildlife, and their habitats.

Habitat impacted by the proposed harbor within the East Alternative is of high to moderate value and is relatively abundant in the region (Resource Category 3). Shallows closer or adjacent to the Duck Flats have increased biological productivity. Based on the Service's Mitigation Policy (FR Vol. 46, No. 15, January 23, 1981) our mitigation goal for projects within Resource Category 3 habitat is no net loss of habitat value while minimizing loss of in-kind habitat value. Habitat impacted by the proposed harbor within the West Alternative is of medium to low value (Category 4). The mitigation goal for Resource Category 4 is to minimize loss of habitat value.

In order to meet these goals, 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. Should subsequent design changes result in either more or less significant impacts than predicted for the current proposed alternatives, then the Service will need to review these recommendations for potential changes needed.

Alternatives and Recommended Mitigation Actions:

The West Alternative is recognized as being the least environmentally damaging alternative due primarily to its distance from Harbor Cove and the Duck Flats. It will cause less intertidal habitat loss, such as highly productive food sources for birds and marine mammals. A West Alternative harbor would result in a lessened level of boat disturbance impacts to species within these habitats and less direct exposure to hydrocarbons and other contaminants originating from the harbor. However, it is also recognized that pursuing the West alternative alone will not adequately address either the short term, or long term, need for expanded boat moorage in the greater Valdez Arm region.

Consequently, at meetings held in late 2005, the ACOE, the NOAA Fisheries, a variety of state and local agencies including the City of Valdez, and the Service, "brainstormed," evaluated, and collaborated in the design of a variety of mitigation measures. These focused on reducing impacts to, or otherwise compensating for, loss of trust resources from development of either of the two East harbor alternatives (locally preferred or NED). The following recommendations are divided into two categories: (1) measures to avoid and minimize adverse impacts, and (2) measures to compensate for remaining adverse impacts.

Synopsis of Recommendations for Additional Information and Steps to be Taken to Avoid and Minimize Impacts - Applicable to Development of the Eastern Harbor Expansion (both alternatives).

1 The harbor channel entrance should be located as far as possible away from sensitive bird, fish, and marine mammal habitats to reduce vessel disturbances to these resources.

2. To reduce fish migration obstructions, the in-water portions of the breakwater and staging area should be contoured with a slope of 2:1. The use of different types of rock should be further investigated to determine what size and type of rock or combinations of rock can be used to maximize juvenile salmon cover along breakwater structure. Additional measures (i.e., breaches) have been incorporated into breakwater design to avoid fish migration impacts. All breaches need to be designed to prevent dewatering: breaches and breakwaters need to be designed to ensure at least 1 foot of sea water remains at all "lowest low water (LLW)" tides to facilitate fish passage. At this time, it is assumed that the breaches will not need maintenance dredging; however, depending on the final elevations and configurations of breaches, dredging needs for breaches will need to be addressed during later design phases.

3. The harbor will include an approved waste oil disposal site with adequate containment and maintenance measures to ensure proper disposal. The new harbor will contain a new fuel dock designed and equipped with state-of-the-art protection equipment and measures (e.g., fuel collars, clean up equipment and facilities).

4. To reduce the potential for accidental fuel spills, heighten vessel operators' awareness of hydrocarbon impacts to species in the marine environment, and provide tips to help boaters prevent and report fuel spills, signs with large and bold text shall be provided by the local sponsors and installed at the Harbor Master's office and at the new and existing fuel docks; final design will require approval from the Service. Additional signage is recommended along walkways and other locations. Signs should clearly communicate the need for using provided facilities to ensure safe and legal deposition of litter, oil products, or other chemicals so that marine waters and resources are protected.

5. Interpretive signs shall be installed in high traffic areas (such as outside the entrance of the Harbor Master's office) to inform harbor users about the hazards of litter and marine debris impacts to fish and wildlife in the marine environment. The sign contractor will work with the Service to develop text for the sign that will meet or exceed the requirements of MARPOL; final design will require approval from the Service. A clearly identified and easily accessible collection station will be located within the new harbor area (e.g., fuel dock or entrance to the boat launch) to collect discarded marine boating related debris (e.g., fishing nets, packing bands, ropes, buoys, gas cans, etc.).

6. An existing bilge water treatment plant is located 4 miles away from the current harbor. It is highly recommended that a new, state-of-the-art bilge water treatment facility be constructed within the immediate footprint of the existing and proposed new harbor sites. Design, construction, and signs "advertising" the existence of this facility need to done to meet or exceed MARPOL regulations to ensure this facility is utilized to its maximum potential.

7. To reduce the biological impacts of dredging generated turbidity and suspended sediments on out-migrating juvenile salmon, dredging or fill activities should not occur from April 15 – May 15 (fry out-migration) and from June 20 – July 20 (adult return harvest period). It may be possible to arrange to continue construction activities during the "closed timing window" periods if activities can be timed to occur during low tide periods when the site is "de-watered." This will require careful consideration of seasonal and daily cycles and flexible work schedules for contractors. Further consultation with the Alaska Department of Natural Resources – Office of Habitat Management and Permitting may be necessary to ensure all work is completed within and is consistent with the fish passage timing window for this region (M. Sommerville, pers. comm.).

8. Disposal of dredged materials into selected (see below) intertidal/subtidal areas should include methods to filter or settle out silt-laden water (i.e., the use of silt curtains, where feasible) prior to their discharge at a disposal site. Dredged materials shall be discharged below the water surface to minimize the spreading of suspended particles.

9. Valuable "preconditioned" shale and its attached marine infaunal community found along the base of southern and eastern shore of Hotel Hill should be collected prior to harbor construction. This material should be carefully collected and stored in-water so attached fauna does not die. The material would then be placed at the toe of the newly constructed harbor bulwarks or breakwaters as "seed" material to provide some habitat value.

10. To reduce adverse impacts to nesting kittiwakes and their young located on the SERVs pier and to comply with the Migratory Bird Treaty Act, the Service recommends construction activities be initiated *after* August 21 (when chicks will have fledged or have left the area) or *before* May 7 (prior to egg laying). Once construction begins it should be able to continue with no date restrictions because it is likely the birds will avoid the area and will relocate to nearby colonies elsewhere within the Valdez Arm region. Following these guidelines will reduce the potential for loss of young of the year. It is unknown whether the birds will continue utilizing or will abandon the site in the presence of harbor related construction activity.

11. To reduce adverse impacts to sea otters, the Service recommends that Corps Quality Assurance personnel/observers be stationed at the project site during dredging, in advance of when any blasting might be anticipated, and during breakwater rock installation/construction phases of this project. Such construction related activities should be suspended when sea otters are observed within 0.25 mi of the project site.

12. As planning and design of the east harbor expansion progresses, the Service will use our Migratory Birds Management annual surveys conducted throughout Prince William Sound to ascertain the presence of Kittlitz's murrelets in the Valdez Arm and project areas, subject to funding limitations. The Service will provide any updated information to the Corps for use in harbor planning.

13. Updated studies to determine circulation patterns within eastern Port Valdez would be useful to assess cumulative changes resulting from the potential expanded harbor, SERVS dock, Alyeska Marine Terminal, and the Container Terminal dock. This information would help assess resource impacts associated with water quality issues and potential fuel spills within the proposed harbor and adjacent valuable habitats, such as the Valdez Duck Flats. Information on circulation patterns within Eastern PWS could also assist in defining additional mitigation measures to offset new harbor impacts. The Service will work with the City of Valdez and resource agencies to update all local spill prevention plans.

14. Preliminary water circulation modeling has been conducted for the proposed harbor designs. However, the Alaska Department of Environmental Conservation has indicated additional modeling and reviews may be necessary and appropriate prior to finalizing the ACOE design and before State of Alaska permits are issued for the proposed project. The Service encourages and supports further review and analysis because continuance of high water quality is necessary for the protection and maintenance of trust resources present in the project area.

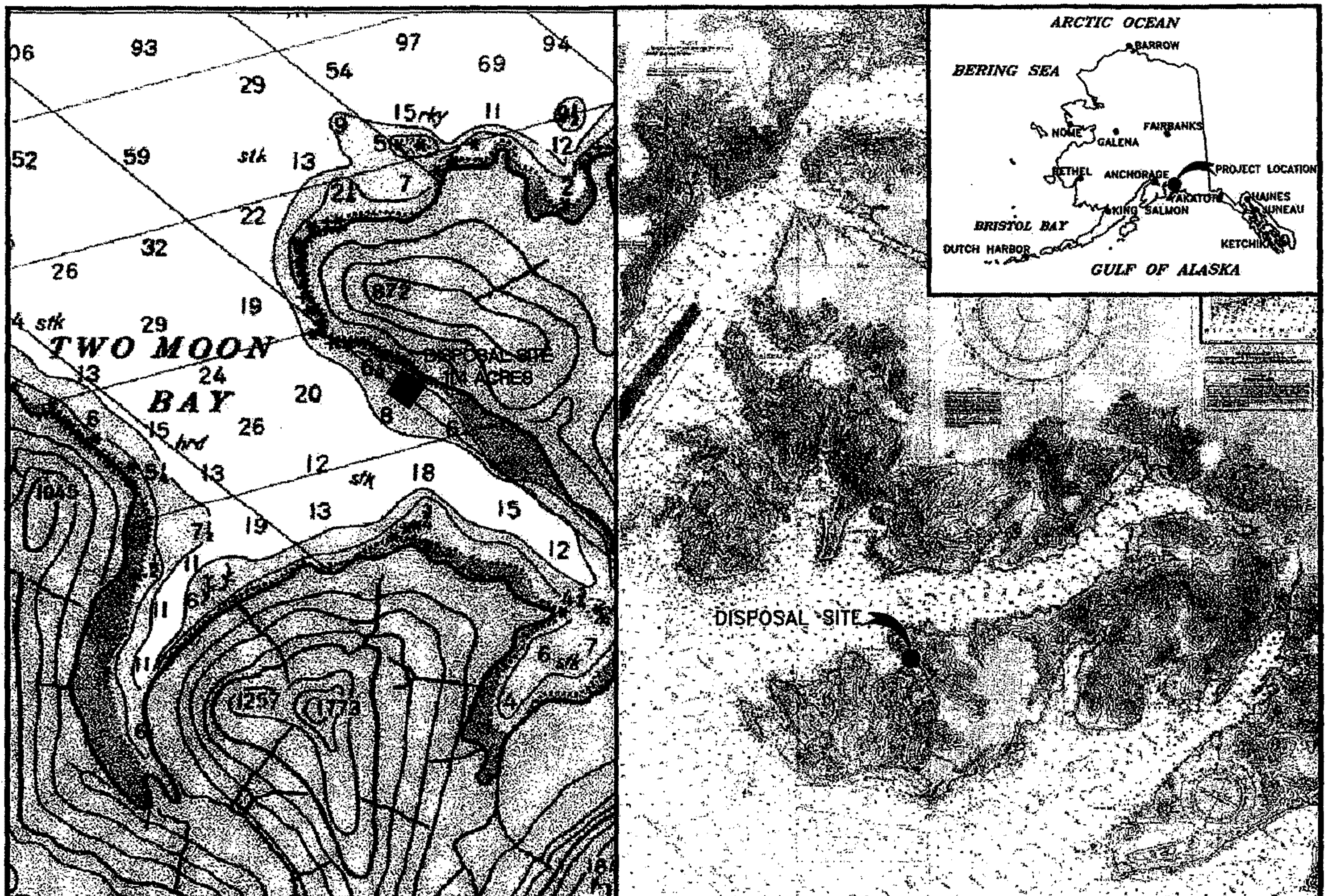
Recommended Compensatory Mitigation for Unavoidable Habitat Losses - Applicable to both East Harbor Alternatives.

The Fish and Wildlife Service, in collaboration with the ACOE, the City of Valdez, the National Marine Fisheries Service, the Alaska Department of Fish and Game, and the Alaska Department of Natural Resources – Office of Habitat Management and Permitting developed a "Mitigation Options Discussion Paper" for this project. In this paper, a wide range of mitigation concepts and alternatives were reviewed as potential compensation for unavoidable losses to fish and wildlife resources and their habitats due to implementation of the proposed action. This review is attached as Appendix 1 and is incorporated into this CAR by reference. A number of options were considered and evaluated at the November and December, 2005 meetings. Some of these options were set aside as not desirable or appropriate at this time by one or more of the participants at the meeting. The following synopsis is a list of remaining options recommended for further consideration as compensatory mitigation. Additional details and discussion can be found in Appendix 1.

1. ***Restore habitat impacted by bark debris accumulated from previous log transfer facilities located within Two Moon Bay***. The Service recommends a phased restoration project be developed and implemented over time as fill and project funds become available. The ultimate restoration goal for this site will be to restore the area to high quality habitat including eelgrass beds. There would be four phases to this restoration project: site surveying and design, capping, vegetative restoration, and monitoring to determine "success."

The initial phase would involve conducting bathymetric and biological surveys of Two Moon Bay (Figure 9) to determine the precise extent of the debris field, assess current and tidal patterns, and the location of existing important subtidal marine resources adjacent to the debris field (such as eelgrass beds, rocky outcropping, etc.). Secondly, as much of the existing bark field at Two Moon Bay as possible would be capped using dredge spoil from the proposed Valdez harbor expansion (Figure 10). While there may not be enough fill from harbor dredging to fully bring the debris field up to grade, the Service recommends that the restoration plan developed as part of harbor development account for this final goal. Subsequent projects in eastern PWS could provide additional fill for Two Moon Bay. Additionally, any large slabs of colonized substrate harvested from the harbor development site and not used as seed material on top of new harbor rock should be considered for moving to Two Moon Bay as part of the habitat restoration there.

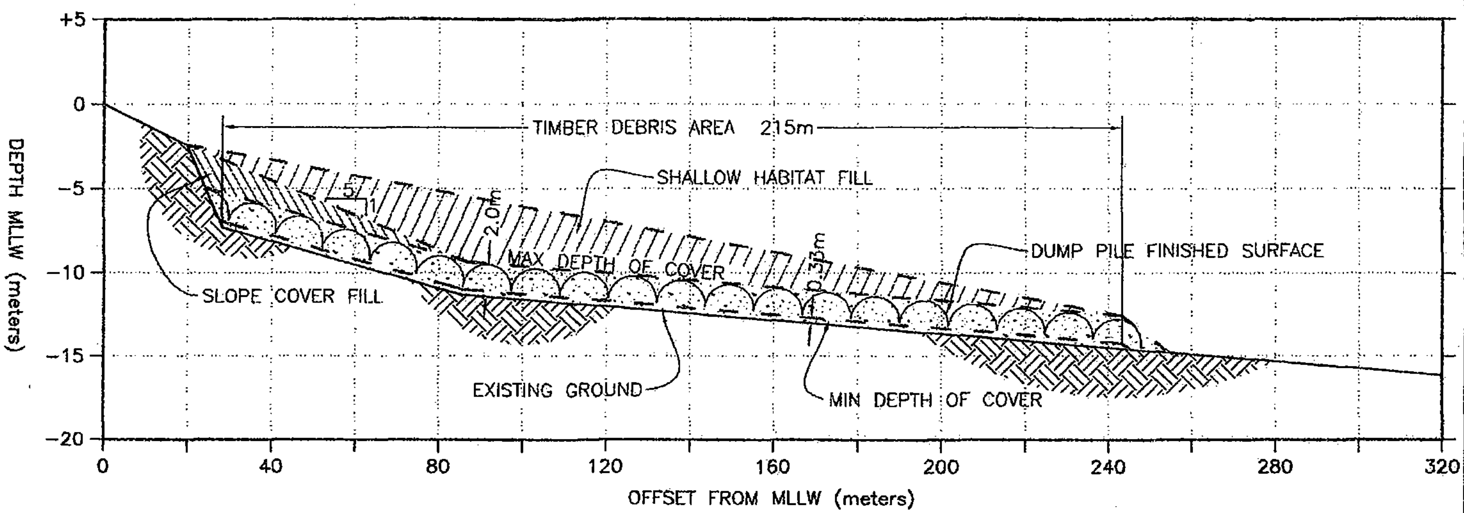
Once the filled substrate is an adequate depth for eelgrass, the third phase of restoration would involve harvesting eelgrass shoots from existing eelgrass beds in Two Moon Bay and adjacent coves for transplanting on the fill. Additional habitat value and stabilization of the fill slopes might be achieved by the placement of "reef balls" in a double row around the perimeter of the project site (Figure 11). "Reef balls" are cement structures which provide habitat complexity and substrate for colonizing mussels, oysters, and marine algae. They have been effectively used as mitigation in many locations around the world and were installed near Whittier, Alaska, in



ALASKA DISTRICT
CORPS OF ENGINEERS
CIVIL WORKS BRANCH

TWO MOON BAY DISPOSAL SITE
VALDEZ HARBOR EXPANSION, VALDEZ, ALASKA

Figure 9



DISPOSAL VOLUMES:

MINIMUM DEPTH OF COVER	15,700 CM
MAXIMUM DEPTH OF COVER	97,000 CM
SLOPE COVER FILL	15,000 CM
SHALLOW HABITAT FILL	93,300 CM

NOTES:

1. DREDGE MATERIAL SHALL BE USED TO CAP TIMBER DEBRIS. DREDGE MATERIAL SHALL BE DUMPED FROM THE BARGE IN SUCH A MANNER TO ACHIEVE AN ACCEPTABLE CAP THICKNESS OVER THE ENITIRE SITE.
2. DUMP PILE COVER SHALL NOT BE SMOOTHED OR LEVELED. FINISHED COVER SURFACE SHALL BE BUMPY AND IRREGULAR.
3. TIMBER DEBRIS AREA ASSUMED TO BE 215m SQUARE (11.4 ACRES).
4. BATHYMETRY TAKEN FROM TRANSECT 3 – TWO MOON BAY.

ALASKA DISTRICT
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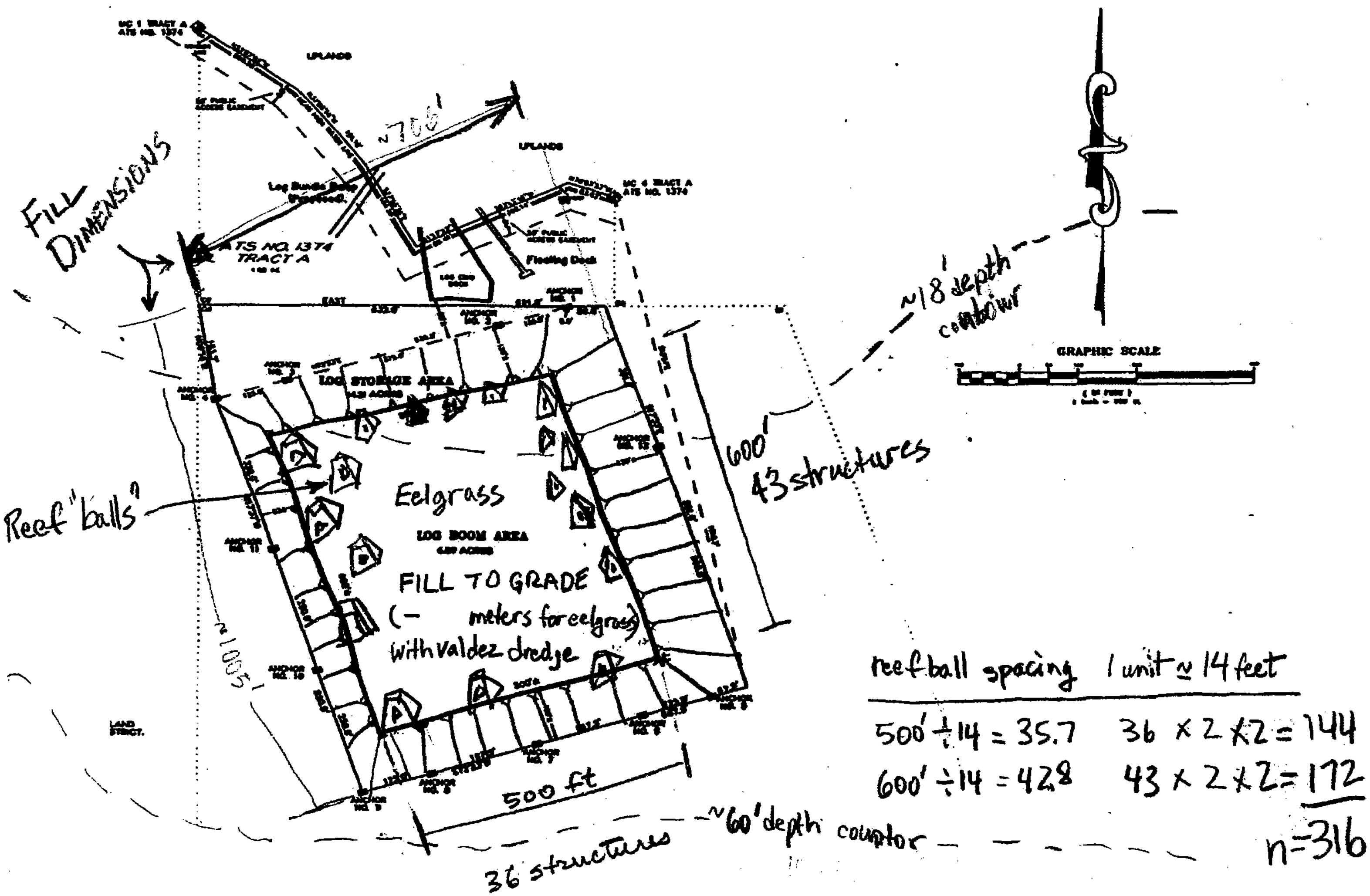
TIMBER DEBRIS CAPPING – TWO MOON BAY

VALDEZ HARBOR EXPANSION, VALDEZ, ALASKA

Figure 10

Figure 11



FILL DIMENSIONS
~700'
UPLANDS
ATS NO. 1374
TRACT A
Floating Deck
LOG STORAGE AREA
Reef "balls"
Eelgrass
LOG BOOM AREA
FILL TO GRADE
(– meters for eelgrass)
with valdez dredge
~18' depth contour
GRAPHIC SCALE
600'
43 structures
~1005'
500 ft
36 structures
~60' depth countor
reef ball spacing 1 unit ≃ 14 feet
500' ÷ 14 = 35.7   36 × 2 × 2 = 144
600' ÷ 14 = 42.8   43 × 2 × 2 = 172
n = 316

spring, 2006. A monitoring study of those reef balls is currently ongoing. Because the Valdez Harbor expansion is not anticipated to occur until 2007 or later, some data will likely be available for evaluating the utility of reef balls as a mitigation tool (B. Lance, NMFS, pers. comm.).

Monitoring, the fourth phase of the restoration project, should include evaluation by Remotely Operated Vehicles (ROVs), SCUBA diving transects and videography. Bottom sampling should also be conducted in advance of, and throughout each stage of the Two Moon Bay restoration project.

Each component of this restoration project (e.g., capping bark debris, reef balls, eelgrass transplants) has been successfully used in other areas. However because this combination of restoration techniques has not been implemented in the south central Alaska habitats, this project can be considered an experimental approach. An adequate and carefully designed scientific evaluation should be conducted to determine whether and what tweaking of the restoration design is needed to make it more effective at Two Moon Bay and to document the project's value as an appropriate mitigation tool for a wide variety of future anticipated projects.

The Service recognizes that full implementation of the Two Moon Bay Restoration Project will depend on the availability of funds and staff resources. At the minimum, we recommend the ACOE adopt the appropriate portions of phases 1, 2, and 4 to cap between 6-8 acres of the debris field with between 1-3 meters of dredge spoil from the Valdez Harbor Expansion. Plans to conduct pre-restoration surveys and for continued monitoring and assessment throughout the project will need to be jointly developed and implemented with input from the Service and other stakeholders. These assessments should be considered an essential component of the mitigation plan and any FOSNI to be adopted for the project.

Other compensatory mitigation sites - Two other options which were "set aside" in the Mitigation Options Paper as not being timely may need to be reconsidered in the future if implementation of the harbor expansion does not occur within the current anticipated schedule (e.g., funding and construction ca FY2007-08). The Valdez City Council has not endorsed either of these options. Additional coordination with the ACOE will be necessary as both of these options focus on "out of kind" resources which might not qualify for inclusion into ACOE Civil Works Projects mitigation activities:

2. ***Limit development at Robe Lake through land swaps, transfers and zoning restrictions to provide protection of natural resources.*** (see "Options" document for details).

3. ***Set aside city lands on the western side of the Duck Flats as a Conservation Zone.*** The City of Valdez has indicated they may consider purchase of "Area 6" (20 acres on the west side of the Duck Flats as a "set aside" conservation zone. The City may consider constructing a "Potter's Marsh-like" interpretative boardwalk to provide educational opportunities to the public concerning the wildlife and habitat value of the Duck Flats region.

The Service concurs that either of these options could provide compensation for the proposed harbor. However because they involve "out-of-kind" habitats and conservation not restoration, a formulae or process is needed to relate the relative value of habitat lost to habitat "protected."

This relationship would need to be developed in cooperation with the Service and the ACOE and agreed upon before either of these options could be further explored as acceptable compensatory mitigation.

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Table 1. Specifications for 2006 revised alternatives, Valdez Harbor Expansion project. Data provided to the US Fish & Wildlife Service by the Army Corps of Engineers (email from Boyer to Seagars, March 27, 2006).

Project: Valdez Harbor Expansion
Description: Estimated areas and quantities for current alternatives
Prepared: MDP reviesd 27 MAR 2006

ALTERNATIVE ITEM	LENGTH		VOLUME		AREA*		ESTIMATED DISTURBED AREA: Above MHHW		Intertidal		Below MLLW		Total	
	M	FT	M^3	YD^3	hectares	acres	hectares	acres	hectares	acres	hectares	acres	hectares	acres
East Site NED Plan (186 boats)							**0.05**	**0.12**	**2.31**	**5.70**	**4.98**	**12.30**	**7.33**	**18.12**
South Breakwater	396.2	1300	49,600	64,877	1.21	2.99								
East Breakwater	183.2	601	28,500	37,278	0.62	1.53								
Stub Breakwater	29.1	95	1,100	1,439	0.04	0.10								
Dredging			175,600	229,685	5.99	14.80								
Upland Fill			25,400	33,223	0.70	1.73								
East Site Locally Prefered (244 boats)							**0.12**	**0.29**	**3.00**	**7.40**	**7.44**	**18.38**	**10.56**	**26.08**
South Breakwater	475.2	1559	79,400	103,855	1.80	4.45								
East Breakwater	229.2	752	40,600	53,105	1.00	2.47								
Stub Breakwater	29.1	95	1,500	1,962	0.06	0.15								
Dredging			202,700	265,132	7.39	18.25								
Upland Fill			75,600	98,885	1.93	4.77								
West Site Wave Barrier (228 boats)							**0.01**	**0.01**	**1.95**	**4.81**	**3.19**	**7.89**	**5.14**	**12.71**
Wave Barrier	451.2	1480												
West Breakwater	182.1	597	5,900	7,717	0.23	0.57								
Entr West Breakwater	91.9	302	8,700	11,380	0.26	0.64								
Entr East Breakwater	360.9	1184	14,600	19,097	0.42	1.04								
Dredging			154,500	202,086	4.92	12.15								
Two Moon Bay Disposal							**0.08**	**0.19**	**1.22**	**3.00**	**1.52**	**3.74**	**2.81**	**6.93**
Max Depth of Cover			97,000	126,876	0.90	2.22								
Slope Cover Fill			15,000	19,620	0.40	0.99								
Shallow Habitat Fill			93,300	122,036	1.98	4.89								

* The areas of individual plan items partially overlap one another

APPENDIX 5

Alaska Coastal Management Program Enforceable Policies Evaluation

Valdez Coastal Management Program
Enforceable Policies

Effective Date: February 4, 1987

The following evaluation compares the enforceable policies against the anticipated effects of the Valdez Navigation Improvements project. The project features and environmental impacts are discussed in the Feasibility Report and Integrated Environmental Assessment.

A. Coastal Development

1. Water-Related and Water-Dependent Uses

In planning for and approving development in shoreline areas, priorities shall be in the following order:

(a) water-dependent uses and activities;

The Valdez proposed harbor is water-dependent.

(b) water-related uses and activities; and
(c) uses and activities which are neither water-dependent nor water-related for which there is no feasible and prudent inland alternative to meet the public need for the use or activity.

2. Habitat Protection

To the extent feasible and prudent, all land and water uses and activities shall avoid potentially adverse impacts on fish and wildlife and their habitats. Where adverse impacts cannot be avoided, mitigation shall be required. **The harbor would impact 26 acres of intertidal/subtidal moderately productive habitat. Adjacent habitats are similar and abundant. Avoidance and minimization measures have been employed in the design. Compensatory mitigation proposed is to cap decaying bark at the Two Moon Bay Log Transfer Site to restore the bottom habitat and thereby replacing lost habitat at the harbor.**

3. Development In and Over Water

To the extent feasible and prudent, development in or over water, such as piers, docks and protective structures shall avoid adverse impacts on water quality, fish and wildlife, vegetation and physical processes. **The harbor would construct breakwaters and create an upland staging area using dredged material. Construction would be timed to avoid sensitive fish migration periods, allow for near shore fish migration by providing near shore breaches, and maintain water quality by configuring the harbor for maximum circulation. Best management practices would be instituted into a harbor management plan to include trash and waste oil disposal, a bilge water pump-out station, and fuel spill prevention and containment.**

4. Buffer Zones

Where industrial uses and activities may cause significant adverse visual or noise impacts on adjacent uses and activities, the developer shall be required to provide adequate screening or open space buffers to reduce the nuisance to acceptable levels. Where prudent and feasible a 100 foot buffer of natural vegetation will be maintained. **Not Applicable**

5. Alteration of Bodies of Water

The placement of structures and the discharge of dredge or fill material into water bodies, floodways, backshores or wetlands must, at a minimum, comply with the standards contained in parts 320-330, Title 33, Code of Federal Regulations. **The project will be in compliance.**

6. Sewage Systems

Every building in which plumbing fixtures are installed and every premise with drainage piping thereon shall have a connection to a public sewer or an approved on-site sewage disposal system. **Not Applicable**

7. Hazardous Lands

Residential development shall not occur in areas designated as hazardous areas (including those shown in figures 4.1 and 4.2) such as avalanche run out zones, active floodways and high water channels and unstable slopes and shorelines. **Not Applicable**

8. Cooperative Uses of Facilities

Cooperative use of piers, cargo handling, storage, parking or other water-front facilities is strongly encouraged. (Administrative Policy). **The harbor would be a public harbor open to everyone.**

9. Coordination [Administrative Policy]

The City of Valdez shall use zoning, subdivision and floodplain ordinances and building codes as well as implementation procedures set forth in this plan to implement the district plan. Local regulation shall allow flexibility in the techniques used to achieve the desired goals and objectives of the local government, as expressed in the District Coastal Management Program. **Not Applicable**

10. Optimum Location [Administrative Policy]

The City of Valdez shall assist with the identification of suitable sites for industrial development which satisfy industrial requirements, meet safety standards, protect fish and wildlife resources and maintain environmental quality. **The city of Valdez participated in the identification of the harbor location.**

11. Dredge and Excavation Material [Administrative Policy]

Dredge and site excavation material should be disposed of in sites which will be approved by the Community Development Department. Dredge spoils may also be disposed of by deep water method with the appropriate local, state and federal permitting. **The Valdez Planning Department has approved of the Two Moon Bay disposal/restoration plan for the harbor's dredged material**. **Permits must be obtained from the State of Alaska.**

B. Industrial and Commercial Facilities

1. Facility Expansion

To the extent feasible and prudent, industrial commercial uses and activities must have enough space for reasonable expansion of facilities without preempting lands suitable for other development. **The harbor alternative selected is the expanded plan.**

2. Consolidation

To the extent feasible and prudent, the activities associated with construction and operation of industrial and commercial uses and activities shall consolidate use of facilities such as staging and storage areas, right-of-ways and dock and other transportation facilities. **The harbor alternative is adjacent to the existing harbor and the Alyeska SERVS Dock.**

3. Habitat Protection

Projects which require dredging, clearing or construction in productive habitats shall be designed to keep these activities to a minimum area necessary for the project. **The harbor plan has been maximized to accommodate the vessel moorage demand. The harbor configuration is constrained by topography and also to meet circulation and flushing standards.**

4. Accidental Spills

To the extent feasible and prudent, industrial and commercial uses and activities must be designed and sited where waste water effluents and oil, fuel and other potentially harmful or toxic spills can be controlled or contained effectively by utilizing the most effective technology and natural features, such as topography. **The harbor will have a state of the art fuel dock with a spill prevention and containment plan. The breakwater would contain spills with the aid of sorbent booms.**

5. Air Quality

To the extent feasible and prudent, industrial and commercial uses and activities with airborne emissions must be located where winds and air currents can disperse emissions which cannot be captured before escape into the atmosphere. The shore-term emissions and cumulative impacts of facilities shall not violate state and federal air quality standards. **The proposed harbor is in a windy area and would be expected to adhere to air quality standards.**

6. Water Quality

The shore term effluents and cumulative impacts of facilities shall not violate state and federal water quality standards. To the extent feasible and prudent, industrial and commercial uses and activities must be located in areas of least biological productivity, diversity and vulnerability and where effluents can be controlled (including areas where currents can disperse effluents) or contained. **The harbor is located in a moderately productive habitat but is also sited near the existing harbor. The combined facility will improve water quality in the existing harbor by reducing overcrowded conditions and upgrading the fuel facility. A harbor management plan will include fuel spill containment and prevention plans and equipment, trash and waste oil containers, and a bilge water pump out station. Sediment control measures would be in place during dredging.**

7. Impact Avoidance

To the extent feasible and prudent, industrial and commercial uses and activities will be sited to minimize adverse impact on environmental and cultural values on adjacent lands and waters. **The new harbor is adjacent to the existing harbor so the commercial and industrial uses are concentrated in one area.**

8. Pipeline and Utility Corridors

To the extent feasible and prudent, existing pipeline utility corridors shall be used for new facilities or expansion of existing facilities, rather than developing new corridors. **Not Applicable**

9. Site Selection

The siting and approval of major energy facilities shall be based on the standards of the Alaska Coastal Management Program (RCMP). Sites suitable for the development of major onshore, near shore, and offshore energy facilities must be identified by the state in cooperation with the district. **Not Applicable**

C. Recreation, Tourism, and Natural Setting

1. Scenic Views

Recreational and access developments shall, wherever appropriate, blend into the surroundings, and preserve or enhance scenic views and vistas. **Not Applicable**

2. Development of Recreation and Tourism [Administrative Policy]

The City of Valdez shall encourage recreational and tourism development and improvement of the aesthetics of the city. Recreational developments shall provide the local population a wide range of recreations opportunities in appropriate locations. **The proposed harbor would provide increased recreational and charter boat tourist opportunities.**

3. Public Recreation [Administrative Policy]

The City of Valdez shall support local, state, and federal efforts to develop marine parks, roadside pullouts and other recreation facilities on public lands within the adjacent to the Valdez coastal district boundaries. **Not Applicable**

D. Transportation and Utility Routes

1. Location

Wherever there is a feasible inland alternative, transportation and utility routes shall be located away from the shorelines. If shoreline routes are constructed, they shall provide reasonable means of public access to the water. All state projects within the City limits shall be reviewed by the City as required in AS 35.30.010. **Not Applicable**

2. Facility Design, Construction, and Maintenance

Design, construction and maintenance of highways, airports, ports, and utilities shall not alter water courses, wetlands, and intertidal marshes unless there is a significant public need for the use or activity and no other feasible alternate site is available. If construction is approved all feasible and prudent steps to maximize conformance with the RCMP standards and the policies in this plan will be taken. **The proposed harbor will alter the near shore zone by the construction of breakwaters and dredging. There will be no impact to water courses, wetlands or intertidal marshes. There is a significant public demand for additional moorage slips.**

3. Stream Crossings

To the extent feasible and prudent, roads shall avoid crossings of anadromous fish streams. Bridges and culverts shall be designed, scheduled, and constructed in accordance with good fisheries conservation practices which minimize habitat disturbance and allow the free passage of fish. **Not Applicable**

4. Underground Utilities

To the extent feasible and prudent, underground installation of utilities shall be required. Overhead installation will only be approved if it is not feasible and prudent to place the utilities underground. **Not Applicable**

5. State-Highway Construction and Maintenance [Administrative Policy]

The City of Valdez shall support highway construction and maintenance efforts to improve the transportation link to Interior Alaska. **Not Applicable**

E. Geophysical Hazards

1. Avalanches and Mass Wasting

Proposed industrial and commercial development within mass wasting areas and avalanche run out zones shall be prohibited unless appropriate siting, design, and construction measures for minimizing property damage and protection against loss of life have been provided. **Not Applicable**

2. Riverine and Glacier-Dammed Lake Outburst Flooding

To the extent prudent and feasible, structures (including bridges and flood diversion structures such as dikes) shall not be located in the floodway. Bridges and fills that cross the floodway shall be designed and maintained to permit flow through the structure at flood levels and to avoid retaining and spreading flood waters behind them. Applicants for structures within the floodway and floodway fringe shall be aware that the Valdez Flood Plain Ordinance also addresses such uses and activities. **Not Applicable**

3. Coastal, Seiche, and Tsunami Flooding

New development within 10.5 feet elevation above mean sea level (100-year recurrence or 1 percent probability event) shall be limited to water-related or water-dependent uses. Water-related and water-dependent development within 10.5 feet above sea level shall be subject to siting, design, and construction measures to safeguard against potential hazards. **The harbor is water-dependent.**

4. Seismic Events

All development in seismic hazard and liquefaction areas shall be prohibited unless appropriate siting, design, and construction measures for minimizing property damage and protecting against loss of life have been provided. (Refer to Figure 4.1). **Not Applicable**

5. Coordination [Administrative Policy]

The City of Valdez shall work with state and federal governments and private interests to gather geophysical information, analyze the extent of hazards, and recommend proper siting, design, and construction measures in order to maximize safe utilization of hazardous lands. **The city of Valdez as project sponsor has cooperated in siting and design of the harbor.**

6. Glacier Stream Flood Plain Plan [Administrative Policy]

The City of Valdez shall prepare a Glacier Stream Gravel Management Plan to direct gravel mining within the Glacier Stream flood plain. **Not Applicable**

F. Coastal Access

1. Public Access

To the extent feasible and prudent, new development adjacent to the shoreline shall incorporate public access to the shoreline. **The harbor would be public and have boat launch facilities.**

2. Recreation Facilities [Administrative Policy]

The City of Valdez shall continue to provide access to the shoreline through trails, bike paths, and development of state public interest lands under its management.

G. Fisheries and Seafood Processing

1. Optimum Resource Use

Maintenance and enhancement of fisheries habitat and migratory routes shall be given high priority when evaluating shoreline uses. **The harbor would incorporate near shore fish passage breaches into the breakwaters**.

2. Development

To the extent feasible and prudent, development which may have an adverse impact on recreational or commercial fishing activities or fisheries enhancement projects shall be designed and sited to avoid these impacts. Where adverse impacts cannot be avoided, mitigation shall be required. **The harbor will benefit commercial and recreational fishing activities by providing additional moorage space.**

3. Fisheries Enhancement [Administrative Policy]

Fisheries programs will strive to maintain, restore, develop or enhance the natural biological productivity of Port Valdez, anadromous fish streams and lakes in the coastal zone. **The harbor project would not significantly affect the biological productivity of the area.**

H. Mineral Extraction and Processing **Not Applicable**

1. Site Preference

To the extent feasible and prudent, sources of sand and gravel shall be authorized in the following sequence:

- (a) existing gravel pits;
- (b) reuse of gravel from abandoned development areas;
- (c) new upland sites;
- (d) rivers, streams, and lakes that do not support fish;
- (e) shoreline and offshore gravel sources; and
- (f) floodplain gravel sources in fish-bearing streams.

2. Gravel Mining

If mining in floodways and floodway fringes cannot be avoided, the following policies apply to all types of rivers and streams:

- (a) to the extent feasible and prudent, changes to channel hydraulics shall be avoided; and

(b) gravel pits shall be located to minimize the probability of channel diversion through the site.

In addition, the following policies shall apply to anadromous fish bearing waters and tributaries to anadromous fish bearing waters:

The affects of gravel removal shall be minimized by maintaining buffers between active channels and the work area and by avoiding: 1) instream work, 2) unnecessary clearing of riparian vegetation and 3) disturbance to natural banks.

To the extent feasible and prudent, site configurations shall avoid the use of long straight lines and shall be shaped to blend with physical features and surroundings to provide for diverse riparian and aquatic habitat.

(c) If the site is likely to be inundated during operation, temporary dikes shall be constructed around the site to minimize disturbance to low flow channels and avoid entrapment of fish.

(d) When gravel washing operations occur on the floodplain, settling ponds are required and shall be diked or set back to avoid breaching by the 10year flood. The wash water shall be recycled; effluent discharge shall comply with state and federal water quality regulations.

3. Mineral Extraction and Processing **Not Applicable**

Mining and mineral processing in the coastal district shall be regulated, designed, constructed and maintained so as to be compatible with the RCMP, adjacent uses and activities, state and federal laws and this plan.

4. Material Sources [Administrative Policy]

Applicants proposing activities that require development of new gravel or other material resources will coordinate with the City of Valdez in the identification of material sites. **Agreed**

I. Archaeological and Historic Resources

1. State and Federal Regulations

The Valdez Coastal Management Plan adopts 6 AAC 80.150 dealing with historic, prehistoric and archaeological resources. This standard requires districts and appropriate state agencies to identify coastal areas important to the study, understanding or illustration of national, state, or local history or prehistory. **Coordination with the State Historic Preservation Officer has determined that the harbor project would have no affects to cultural resources.**

2. Resource Identification [Administrative Policy]

Because prehistoric and archaeological sites are important assets, the City of Valdez shall institute programs designed to identify and protect all significant sites not already protected by federal and state programs.

Air and Water Quality

1. State and Federal Regulations

All uses and activities shall comply with state and federal regulations for air and water quality. **The harbor would be in compliance with air and water quality standards.**

2. Wastewater Discharge

To the extent feasible and prudent, the site of discharge of wastewater and other effluents must be located in areas of least biological productivity, diversity and vulnerability and where effluents can be controlled (including areas where currents can disperse effluents) or contained. All uses and activities shall avoid violations of federal and state water quality standards, including those for maintaining fish and wildlife populations and their habitats, commercial fishing activities and recreation activities. **Not Applicable**

3. Harbor

Harbor, small boat harbor and marina designs shall incorporate facilities for proper handling of sewage and refuse in accordance with state and federal regulations. **The proposed harbor would have a harbor management plan to insure proper pollution controls are in place. A new bilge water pump out facility will be constructed in association with the harbor.**

K. Resource Enhancement and Protection

1. Conservation Areas

Important habitat areas identified below are designated as conservation areas whose primary use is for the enhancement and protection of fish and wildlife habitats. These areas shall be maintained in an undisturbed and natural state. Weirs and other structures necessary for the study or enhancement of habitats are permitted. Access roads, trails, vehicle pullouts and parking, and interpretive signs may be allowed after a coastal consistency review determines such uses to be consistent with other RCMP and Valdez Coastal Management Program (CMP) provisions.

Conservation areas include all public lands and waters in the Duck Flats; Robe Lake and associated wetlands; and all anadromous fish streams and lakes, including appropriate setbacks (see policy K-4). **The harbor is not within these areas.**

2. Habitats

The City of Valdez adopts the standards set forth in 6 AAC 80.130, which apply to habitats within the coastal area. **The harbor project adheres to the below standards.**

3. Upland Habitats

Upland habitats shall be managed to prevent excessive runoff and erosion and to retain natural drainage patterns, surface water quality and natural groundwater recharge areas.

4. Anadromous Fish Streams and Lakes

No development or land clearing with the exception of hydroelectric, transportation or utility routes, and uses and activities involving the study, protection, or enhancement of anadromous fish shall take place within a minimum of 25 feet within residential subdivisions and within 40 feet outside residential subdivisions from the ordinary high water mark of anadromous fish streams and lakes. In consultation with the Alaska Department of Fish and Game setback distances of up to 100 feet may be required based on a site-specific analysis utilizing the following evaluation criteria:

(a) Sensitivity of anadromous fish using the proposed site (i.e., species and life stage).
(b) Nature of the proposed activity, including construction and operation, and size and configuration of the lot with respect to the stream.
(c) Characteristics of riparian vegetation.
(d) Slope and soil type at proposed activity site.
(e) Social and economic impacts.

5. Eagle Nest Sites

Bald eagles and their nests are protected under the Bald Eagle Protection Act (16 U.S.C. 668-668c). To minimize the potential of violating this federal act through induced nest abandonment, an undisturbed buffer of 330 feet in radius around each bald eagle nest tree will be established where feasible and prudent. The exact dimensions of the undisturbed buffer may be modified based upon the local topography, timber type, wind firmness, and other factors. The undisturbed buffers will be established in consultation with the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game. **The harbor is not near eagle nest sites.**

6. Buffer Zones

Where industrial and commercial activities may cause significant adverse impacts on fish and wildlife populations and habitat, the development shall be required to provide a minimum 25 foot buffer. Where prudent and feasible, additional buffers of up to 100 feet will be required to avoid significant adverse impacts. **Buffers are not necessary for the harbor.**

1. Subsistence

> The City of Valdez adopts the standards set forth in 6 AAC 80.120, which apply to subsistence activities within the Valdez Coastal Management District. This standard requires the recognition and assurance of opportunities for subsistence usage of coastal areas and resources; requires the identification of areas where subsistence is the dominant use of the coastal resource; allows subsistence zones, giving those uses and activities priority, to be designated and protected from proposals with possible adverse impacts; and requires that districts that share migratory fish and game resources submit compatible plans for management. **The harbor project would provide more moorage space that would benefit subsistence activities.**

M. Timber

1. Timber Harvest and Processing **Not Applicable**

APPENDIX 6

Marine Benthic Assessment for Beneficial Use of Dredged Material at Two Moon Bay

Appendix 6
Marine Benthic Assessment for Beneficial Use of Dredged Material at Two Moon Bay

1. Introduction

The goal of this paper is to establish a framework to identify important criteria needed to assess marine benthic habitat located at an abandoned Log Transfer Facility (LTF) at Two Moon Bay, Alaska. Existing habitat evaluation tools that apply to coldwater marine benthic environments are largely deemed inadequate for Alaska coastal waters. As a result, existing scientific literature and best professional judgment form the overall basis for this assessment.

Traditionally, Habitat Suitability Indices (HSIs) have been used to evaluate various habitats nationwide. For the Two Moon Bay marine benthic environment, a conclusion was made by Corps analysts that there was no existing HSI that would be applicable. The existing HSI models often do not apply to specific Alaska species, life stages, or habitats. This problem is especially acute for marine habitats, particularly when dredged material placement for beneficial use does not focus on improving habitat for a single species. Over time, the discipline of improving habitat has evolved into improving overall habitat function rather than a single species approach. An illustration of this issue could be an HSI for salmon in Alaska. The HSI for salmon is focused on freshwater life requirements and therefore does not provide a tool for evaluating the marine benthic environment and also takes a single species approach to the evaluation process. Of all the indices that have been developed, analysts concluded that the HSI for the littleneck clam (*Protothaca staminea*) is the closest to being applicable for restoration at Two Moon Bay. However, littleneck clams were not documented at Two Moon Bay during the 1985 pre-LTF site survey and have not been documented at reference sites in Two Moon Bay during the dive surveys in 2000. Furthermore, the goal of the placement of dredged material for beneficial use is to improve the marine habitat to a habitat condition that supports the same species composition and habitat functions that existed prior to 1985 when the site was used as an LTF. This goal is a divergence from the approach of improving habitat for a particular life requirement for a single species such as the littleneck clam.

In an effort to establish criteria necessary to assess the marine benthic environment at Two Moon Bay, scientific literature was researched, dive surveys were consulted, species composition was documented, and a marine benthic value was assigned to the Two Moon Bay LTF, as it existed prior to use in 1985. The same effort was undertaken to establish values for the marine benthic environment after being used as an LTF, as well as predicting future values associated with site improvement as a result of strategically placing dredged material. Typical conditions at existing and abandoned LTFs, such as those in Two Moon Bay, are described in the text that follows. The marine benthic habitat assessment values that resulted from this effort were then compared for each alternative to determine the alternative that provided the greatest chance of improving the LTF habitat to a condition that existed prior to 1985.

The approach for assigning marine benthic habitat values is herein termed the Marine Benthic Assessment (MBA). As previously mentioned the MBA uses the 1985 pre-LTF conditions as the goal and considers those attributes to be the optimum habitat condition for this assessment and was assigned a value of 1.0.

2. LTF Site Conditions

a. Typical LTF Conditions

Bark debris can accumulate in the marine environment when logs are transferred or temporarily stored in the water before they are transported to pulp and sawmills or shipping export facilities. Accumulated wood debris smothers the bottom and usually leads to less diverse infauna, and the sediment is generally anoxic. A number of studies document that bark accumulations at LTF sites have negatively impacted anadromous fish, shellfish, marine invertebrates, aquatic plants, and water quality. Freese and O'Clair (1987) and Jackson (1986) documented that polychaetes, bivalves *(Protothaca staminea* and *Mytilus edulis)* are significantly diminished under bark deposits. Freese and O'Clair also found that bark debris 6 cm in depth reduced the survival and condition of bivalves and Jackson reported that bark debris of at least 2.5 cm in depth significantly affected the structure of the benthic community. Other studies have documented that the decomposed bark and wood products could adversely affect interstitial water quality because of low concentrations of pore water dissolved oxygen, increased elevations of interstitial reducing conditions, elevated concentrations of hydrogen sulfide, production of ammonia and alkaline products, and altered infaunal communities dominated by opportunistic species (Pease 1974, Duff 1981, Conlan and Ellis 1979, and Jackson 1986).

Large benthic predators, such as crabs and sea stars, tend to avoid wood-dominated benthic habitat, most likely due to a reduced abundance of infaunal prey species. Wood dominated sites favor planktivorous species due to the dearth of infaunal prey. Where large sunken logs are numerous, some anemones (Metridium spp.) may benefit from attachment sites. Also, sea cucumbers (Parastichopus spp.) may abound due to abundant microbe populations that provide an abundant food source (Picard et al. 2003).

High egg mortality observed in Dungeness crab at LTF sites in southeast Alaska have been attributed to elevated levels of hydrogen sulfide and ammonia from pore water of bark deposits (Freese and O'Clair 1988). The study also concluded that ammonia concentrations were acutely toxic to some crustacea. Histopathological studies of idiopathic legions of Dungeness crab in Southeast Alaska concluded that crabs at LTF sites also exhibited greater egg mortality and harbored more nemertean predators (Morado et al. 1988). Other studies concluded that bark log extracts (leachates) from Sitka spruce and western hemlock are toxic to adult and larval pink salmon *(Oncorynchus gorbuscha)* fry (Buchanan et al.I976). Lastly, the accumulation of bark and wood debris reduces benthic infauna and eradicates aquatic plants and marine animals (Pease 1974, Ellis 1973).

b. Two Moon Bay Conditions

Dive surveys were conducted by the U.S. Fish and Wildlife Service in Two Moon Bay in 2000 to document conditions at the former LTF. A summary of transect conditions follows, and species encountered in each transect are presented in table 1. Figure 1 shows the dive transects.

Transect A: Most (70%) of this 100-meter transect was covered in bark, and many of the species found in this area were either at the beginning of the transect where bark was not present or were found on non-bark structures such as debris and cables. Marine vegetation was absent except for a small patch of rockweed.

Transect B: The lowest diversity of species was documented in Transect B, which was 100 percent covered in bark debris. Transect B began at the 50-meter mark on transect A and extended east for 100 meters roughly parallel to shore. Marine vegetation was completely absent.

Transect C: This transect was approximately 225 meters west of Transect A and perpendicular to the shore. No bark debris was documented the first 100 meters. Accumulated bark debris was only documented between the 150 and 170-meter distances.

Transect D: Bark was not visible within Transect D during the dive survey. Transect D is approximately 250 meters east of Transect A.

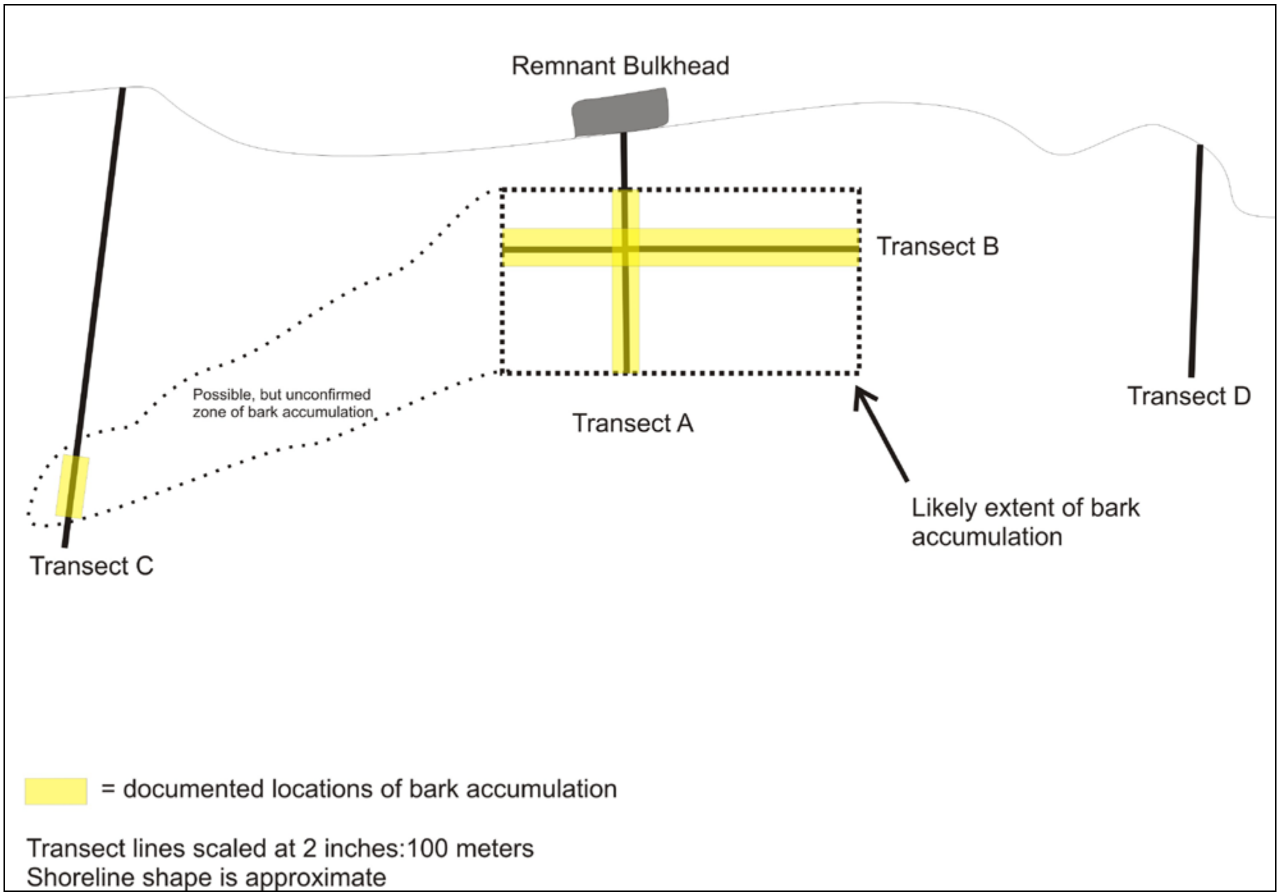

Figure 1. Dive Transects.

Table 1. Species documented in transects A-E during October 31-November 1, 2000, dive surveys conducted at abandoned Two Moon Bay LTF and adjacent areas.

	A	B	C	D
% of transect with bark accumulation	**70**	**90**	**10**	**0**
Fucus furcatus (rockweed)	X		X	X
Zostera marina (eelgrass)			X	X
Desmarestia viridis (acid kelp)			X	
Desmarestia spp. (witches hair)				
Laminaria bongardiana (Elephant-ear kelp)			X	
Laminaria saccharina (sugar kelp)			X	X
Mesophyllum spp. (coralline algae)				
Lithothamnium spp. (red rock crust)			X	
Cerianthus (burrowing anemone)			X	X
Metridium senile (Plumose anemone)			X	
Tubulanus sexlineatus (ribbon worm)			X	
Nereis brandti (sand worm)			X	
Pectinaria californiensis (cone worm)				X
Serpula vermicularis (calcareous tubeworm)			X	X
Littorina sitkana (sitka periwinkle)			X	
Fusitriton oregonensis (hairy triton)		X		
Hinnites multirugosus (rock scallop)			X	
Chlamys spp. (small scallop)		X	X	
Saxidomus giganteus (butter clam)			X	
Mytilus edulis (blue mussel)	X			
Tresus capax (horse clam)				
Onchidoris bilamellata	X			
Melibe leonine (lion nudibranch)	X		X	X
Balanus glandula (acorn barnacle)			X	X
Onchidoris bilamellata (brown barnacle nudibranch)	X			
Pododesmus cepio (rock jingle)	X		X	X
Elassochirus spp. (hermit crab)	X		X	X
Oregonia gracilis (decorator crab)	X		X	
Telmessus cheiragonus (helmet crab)	X			
Oregonia gracilis (decorator crab)	X			
Lophopanopeus bellus (black-clawed crab)				X
Pandalus spp. (shrimp)			X	X
Parastichopus californicus (regular sea cucumber)	X			X
Dermasterias imbricata (leather star)	X		X	X
Evasterias troschelii (mottled star)	X		X	X
Pycnopodia helanthoides (sunflower star)	X		X	X
Crossaster papposus (rose star)			X	
Henricia leviuscula (blood star)				X
Anarrhichthys ocellatus (wolf eel)		X		
Hexagrammos stelleri (white-spotted greenling)	X	X		
Hexawammos decagrammus (kelp greenling)				
Myoxocephalus polyacanthocephalus (great sculpin)				
Lepidopsetta bilineata (rock sole)		X		
Sebastes maliger (quillback rockfish)				
Sebastes caurinus (Copper rockfish)				

* Identified from shell only.

3. Pre-LTF Conditions in Two Moon Bay

In 1985, the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game conducted a pre-project assessment of log transfer facility sites at Two Moon Bay. The area where the LTF was eventually placed was characterized as a shallow gravel shelf sparsely inhabited by rockweed, eelgrass, and barnacles that extended 60 feet shoreline from the waters edge, where a steep 25-foot drop off flattened to a silt/mud bottom. The silt/mud bottom began approximately 90 feet offshore and was vegetated with scattered brown algae. Invertebrate species documented in the silt/mud substrate included sunflower star, leather star, Nuttall's cockles, rock oysters, sea colander, and butter clams. An annotated list of species found at the proposed LTF site is available in Table 2. Other species documented at Two Moon Bay include hermit crab, littleneck clam, limpet, nudibranch, leather star, halibut, Pacific herring, pink salmon, Dolly Varden, steelhead trout, seabirds, ducks, geese, bald eagles, and sea otters (Ferrell et al. 1985, U.S. Fish and Wildlife Service 1992).

Table 2. LTF Annotated species list from 1985 surveys conducted at Two Moon Bay.

Common Name	Scientific Name
Rockweed	Fucus distich us
Eelgrass	Zostera marina
Sea colander	Agarum cribrosum
Red rock crust	Lithothamnium sp.
Coralline algae	Corallina sp.
White-plumed anemone	Metridium senile
Tube worm	Spirorbis sp.
Blue mussel	Mytilus edulis
Rock oyster	Posodesmus macroschisma
Butter clam	Saxidomus giganteus *
Soft-shelled clam	Mya arenaria *
Nuttall's cockle	Clinocardium nuttallii *
Horse clam	Tresus capax *
Scallop	Chlamys Sf!.
Barnacle	Balanus sp.
Dungeness crab	Cancer magister
Dock shrimp	Pandalus danae
Sunflower star	Pycnopodia helianthoides
Starry flounder	Platichthys stellatus
Red Irish lord	Hemilepidotus hemilepidodus

* Identified from shell only.

4. Comparison of Alternatives

A range of alternatives for disposing of dredged material is considered below and the rationale for assigned values is discussed. The values of the alternatives are displayed graphically in figure 2.

a. Pre-LTF Conditions in the 1985 Dive Survey

This condition is assessed a value of 1.0, which is the highest score possible. This value is warranted because it represents natural conditions before the construction of the LTF and is 4 years prior to the effects of the Exxon Valdez Oil Spill of 1989.

b. Existing Conditions at the LTF in Two Moon Bay

This condition is assessed a value of 0.05. Data from table 1 indicates that native vegetation is essentially absent where bark coverage ranges from 70 to 90 percent (transects A and B). Invertebrate species present in these two transects are primarily those that are attached to debris such as cable and submerged metal structures that are either planktivorous or microbial feeders. While a few fish were observed passing through, the area does not have vegetation that provides cover for juvenile and forage fish or natural attachment sites for epifaunal invertebrates that are prey for some waterfowl. It should be recognized that marine benthic habitat need not be vegetated to be productive, but if it is unvegetated, it should at least have chemical conditions that support life. Notably, the site should not be hypoxic or anoxic and there should not be elevated concentrations of hydrogen sulfide, ammonia, and alkaline products, which can lead to altered infaunal communities dominated by opportunistic species. The value of the existing LTF site as marine habitat might only be lessened if it were filled and converted to upland habitat.

c. Dump and Level or Side Cast at LTF in Two Moon Bay

This condition is assessed a value of 0.5. The new substrate would provide improved attachment sources for marine vegetation and invertebrates and the depth of the new substrate would probably be sufficient to cover the low dissolved oxygen/reducing environment of the bark thus leading to a new benthic layer that would likely support infaunal invertebrates. However, the benefits from either of these disposal methods is tempered by the likelihood that disturbance and incidental habitat damage may occur during leveling and that side casting might result in a turbidity plume and imprecise deposition that could negatively impact adjacent habitat beyond the current zone of bark accumulation. A fair improvement in habitat would be made, but excessive disturbance within the LTF site and dumping beyond the area of bark accumulation would limit the effectiveness of this disposal method.

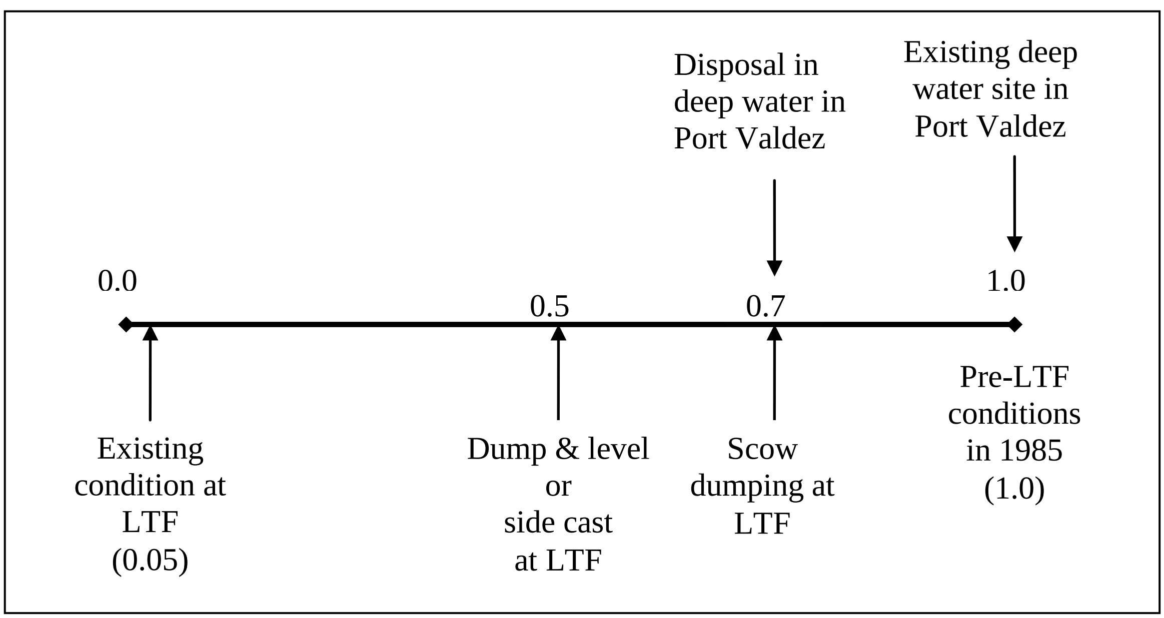

Figure 2. Values of disposal and beneficial use alternatives.

d. Scow Dumping at LTF in Two Moon Bay

This condition is assessed a value of 0.7. The new substrate would provide improved attachment sources for marine vegetation and invertebrates, and the depth of the new substrate would probably be sufficient to cover the low dissolved oxygen/reducing environment of the bark, thus leading to a new benthic layer that would likely support infaunal invertebrates. The irregularity of substrate depth/height through this method of disposal would lead to diversity and limit negative effects of mechanical leveling. Though some localized increase in turbidity is likely, it would likely be less than side casting, and the disposal could be targeted to a specific area that could be marked with buoys. A value of 0.7 would not be realized immediately, but algae and invertebrate assemblages should resemble surrounding habitat within a few years. The value is limited to 0.7 since some of the deeper water habitat that is now covered by bark used to be silt bottom. Reestablishing a silt bottom is not practical, so it is not possible to achieve a value of 1.0 after disposal. However, the new substrate would be of sufficient depth to provide the chemical and physical prerequisites for plant and animal life. Establishment of vegetation, infaunal, and epifaunal species is not the only benefit; the habitat benefits of disposal would likely extend to fish, seabirds, waterfowl, and marine mammals.

e. Existing Deep Water Habitat in Port Valdez

This condition is assessed a value of 1.0, which is the highest score possible. This value is warranted because it represents natural conditions.

f. Deep Water Disposal in Port Valdez

This condition is assessed a value of 0.7. The disposal would cover existing deep water (~600 feet) habitat with a mound of cobble, sand, and gravel. It is likely that the disposed material would be colonized, albeit with a different species assemblage. While the negative effects of this disposal method are probably minimal, it represents a departure from the existing natural environment and with existing data can only be viewed as a decrease in habitat value.

5. Conclusion

Scow dumping the dredged material at the former LTF site in Two Moon Bay represents the greatest increase in marine benthic habitat value. It will likely raise the value of the habitat from 0.05 to 0.7 and establish the physical and chemical conditions necessary for marine life similar to those before the establishment of the LTF.

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