US Army Corps
of Engineers ®
Alaska District

General Reevaluation Report
Saint Paul Small Boat Harbor

Saint Paul, Alaska

October 2005

GENERAL REEVALUATION REPORT
SAINT PAUL SMALL BOAT HARBOR
SAINT PAUL, ALASKA

ADDENDUM

This addendum adds item T. to section 6.2 Recommendations, replaces section 5.1.4 Dredged Material Disposal, and adds a new paragraph to section 5.3.2 Operations & Maintenance.

Section 6.2 Recommendations
Add new item.

T. Where confined disposal facilities are located on port property, the disposal facility operations, maintenance, and management are to be accomplished at full non-Federal cost without reimbursement. Specifically, the sponsor would operate, maintain, and manage the disposal facilities in exchange for the opportunity to beneficially use the dredged material.

Section 5.1.4 Dredged Material Disposal
Replace entire section.

A confined dredged material disposal area will be constructed in the intertidal area adjacent to the boat basin shown as the "Services Area" in Figure 6. About 115,000 yd^3 of dredged material from the entrance channel, maneuvering basin, and tidal pool and 41,000yd^3 from the boat basin will be disposed of in the disposal area. After harbor construction, the non-Federal sponsor will develop the stockpile area as the services area for harbor operations. Dredged material in excess of needs to develop the services area will be used for sponsor public projects or relocated to stockpiles on non-Federal sponsor property.

Dredge maintenance material will be dewatered onshore and then stockpiled on non-Federal sponsor provided stockpile areas. The non-Federal sponsor will use the stockpiled material for public projects such as fill material for the city-owned Ataqan subdivision or other public lands. About 28,000yd^3 of dredged material (14,000 yd^3 at a 10-year interval) will be disposed of during the 20-year period. This volume of material will not exceed the needed fill material during that period.

Section 5.3.2 Operations & Maintenance
Add new paragraph.

The non-Federal sponsor may use dredged material for approved fill activities or other public uses. The non-Federal sponsor will maintain the stockpiled dredged material and capture, contain, and treat runoff from the dredged material as necessary. When dredged material is used or relocated to other stockpiles, the non-Federal sponsor may use the stockpile area for the services area, see Figure 6. Material from future maintenance dredging operations will be stockpiled on non-Federal sponsor property and used for public purposes.

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-6898

GENERAL REEVALUATION REPORT
SAINT PAUL SMALL BOAT HARBOR
SAINT PAUL, ALASKA

October 2005

EXECUTIVE SUMMARY

This report reevaluates the authorized federal project at Saint Paul, Alaska. The authorized project was a result of the findings from the Feasibility Report of navigation improvements at Saint Paul, dated August 1996. WRDA 1999 authorized the modification of the authorized project to include a small boat harbor. This General Reevaluation Report (GRR) was prepared to serve as a decision document to support amendment of the existing project cooperation agreement and to demonstrate that with the addition of the small boat harbor, the authorized projects remains technically sound, and economically and environmentally acceptable.

Initial harbor construction at Saint Paul was completed in 1990. The design vessel length was 100 feet in length with an unladen draft of 12 feet. The Corps of Engineers and the city of Saint Paul completed a feasibility study of needed harbor improvements in 1996. The recommended plan provided an entrance channel depth of –30 feet MLLW, a maneuvering basin at –29 feet MLLW, a spending beach on the lee side of the detached breakwater, three offshore reefs parallel to the main breakwater, each 1,300 feet long with a crest elevation of –12 feet MLLW, and a environmental restoration measure to restore water circulation and biological productivity to Salt Lagoon. This plan was authorized by Section 101(b)(3) of the Water Resources Development Act (WRDA) of 1996, and is currently under construction.

The small boat harbor recommended herein would reduce local problems including: inadequate moorage, harbor congestion, vessel launch and retrieval delays, and safety hazards. The plan would also reduce operating costs of commercial fishing, existing damages to vessels, existing delays associated with use of the deep draft harbor, existing dock maintenance costs, vessel repair costs and improve the subsistence fishery and the safety of vessels operating in the harbor.

The recommended plan is located at the South Village Cove and is designed to accommodate a 60-vessel fleet, with a footprint of approximately 12 acres. General navigation features include an entrance channel at –16 feet MLLW, a maneuvering basin at –12 feet MLLW, a rubblemound breakwater, erosion protection, and a circulation berm. Local service facilities (LSF) include a mooring basin and floats, docks, boat launch ramp, boat lift trailer, and walkway ramps.

The national economic development (NED) plan is the recommended plan. The features of the recommended plan that contribute to the Nation have a construction cost of $11,742,000 (October 2005 price level), excluding $12,000 for navigation aids. This provided an annual NED investment cost of $849,000 including an annual operation and maintenance cost of $159,000. Average annual NED benefits are $2,082,000. The project's benefit to cost ratio is 2.5 with annual net benefits of $1,233,000. The fully funded cost of the recommended plan escalated to the mid-point of construction is estimated as $13,261,000.

As local sponsor, the city of Saint Paul would be required to pay the non-Federal share of the cost of construction of the general navigation features as specified by Section 101 of the Water Resources Development Act of 1986. This amount is estimated at $698,000. The city must also pay the entire cost of the LSF, which is estimated at $8,227,000. The non-Federal share of all costs of the project is $8,929,000. The Federal share of the project is $2,825,000,

which includes $12,000 for navigational aids. The U.S. Coast Guard would provide these navigation aids.

The recommended plan is compatible with the existing project. The overall project with the added small boat harbor remains economically justified, technically feasible, and environmentally acceptable.

PERTINENT DATA

Recommended Plan

Dredging	Area (ac)	Bottom Elevation (ft)	Dredging Vol. (yd^3)	**Breakwater**	
Maneuvering Basin	1.1	-12 MLLW	22,000	Length, total	445 ft
Mooring Area	3.3	-12 MLLW	41,000	Crest elevation	10 ft, MLLW
Entrance Channel A	2.3	-16 MLLW	48,000	Crest width	10 ft
Entrance Channel B	1.4	-12 MLLW	29,000	Reconfigure splitter breakwater	
Tidal Pool	2.5	0 MLLW	16,000	Length, total	150 ft
TOTAl	8.1		156,000	Crest elevation	10 ft, MLLW
				Crest width	8 ft

Project Costs and Benefits

Item:	Federal ($)	Non-Federal ($)	Total
General Navigation Features [a]	2,813,000	698,000	3,511,000
Local NED-Associated Costs	0	8,227,000	8,227,000
LERR (GNF) – Acquisition credit	0	4,000	4,000
Aids to Navigation	12,000	0	12,000
TOTAL NED Costs	2,825,000	8,929,000	$11,754,000
NED investment cost (w/ interest during construction)			$12,355,000
Interest and Amortization of NED investment cost			$690,000
Average annual NED maintenance cost			$159,000
Total average annual cost:			$849,000
October 2005 price level, 5 1/8 %, 50-year project life			
Average annual NED benefits			$2,082,000
Net annual NED benefits			$1,233,000
Benefit/cost ratio			2.5 : 1

[a] Cost sharing reflects provisions of WRDA 1986 – non-Federal initial share 10% of GNF plus reimbursement of 10% GNF minus LERR credit

CONTENTS

TABLES

FIGURES

ENVIRONMENTAL SECTION

Finding of No Significant Impact (FONSI)
Environmental Assessment

APPENDICES

1.0 INTRODUCTION

1.1 Study Authority

This study is a general reevaluation of a previously authorized project at Saint Paul Island, Alaska. The reevaluation was authorized by the United States Congress in the Water Resources Development Act (WRDA) of 1999. Specifically, Section 303 of that Act states

> *The project for navigation, Saint Paul Harbor, Saint Paul, Alaska, authorized by Section 101(b)(3) of the WRDA of 1996 (110 Stat. 3667), is modified to include the construction of additional features for a small boat harbor with an entrance channel and maneuvering area dredged to a 20-foot depth and appropriate wave protection features at an additional estimated total cost of $12,700,000, with an estimated Federal cost of $5,000,000 and estimated non-Federal cost of $7,700,000.*

1.2 Scope of Study

The purpose of this general reevaluation study was to conduct analyses of project feasibility and prepare a decision document (this report) to serve as a basis to amend the existing Project Cooperation Agreement (PCA) for the previously authorized project. The scope of this study was to evaluate the viability and federal interest in development of a small boat harbor consistent with other ongoing or completed harbor developments. The study focused on conducting and documenting sufficient analyses to demonstrate:

1. that the authorized work added by Section 303 of the 1999 WRDA is compatible with the existing project,
2. that the overall project with the added work is economically justified,
3. that the project with the added work remains technically feasible,
4. that the project with the added work remains environmentally acceptable.

The Fiscal Year (FY) 2000 and 2001 Energy and Water Development Appropriations Acts provided funds for continuation of construction of the previously authorized Saint Paul Harbor project. Existing harbor features and features currently under construction are described in Section 1.6. This funding supported the analyses documented in this General Reevaluation Report (GRR).

1.3 Study Participants

The city of Saint Paul and the U.S. Army Corps of Engineers (Corps), Alaska District, have conducted this general reevaluation study as a partnership. The study management team includes representatives of both the city of Saint Paul and the Alaska District. Many other agencies and organizations contributed to this study, including:

Study Participants

U.S. Fish and Wildlife Service	Tanadgusix Corporation (local native corporation)
U.S. Environmental Protection Agency (EPA)	Central Bering Sea Fisherman's Association
National Marine Fisheries Service	Pribilof Islands Joint Management Board
Alaska Department of Transportation and Public Facilities	Saint Paul Interagency Working Group
Alaska State Historic Preservation Officer	Pribilof Bering Seafood
Alaska Department of Governmental Coordination	Bering Sea Ecotech
Alaska Department of Natural Resources	North Pacific Fisheries Management Council
Alaska Department of Fish and Game	International Pacific Halibut Commission
Tribal Government of Saint Paul Island	

1.4 Study Area

Saint Paul is located on a narrow peninsula on the southern tip of Saint Paul Island, the largest of five islands in the Pribilofs, in the eastern Bering Sea of Alaska. It lies 47 miles north of Saint George Island, 240 miles north of the Aleutian Islands, 300 miles west of the Alaska mainland, and 750 air miles west of Anchorage. It lies at approximately 57°07' N. Latitude, 170°16' W. Longitude (Sec. 25, T035S, R132W, Seward Meridian). The community is located in the Aleutian Islands Recording District.

Because the community is tied to the resources of the Bering Sea, the extended study area includes Bering Sea resources available to harvesters operating from Saint Paul and those delivering to processors based at Saint Paul. Also included is the area encompassing alternative harbors. These aspects of the extended study area are further discussed in Section 3.1 title "Problems and Opportunities". The study area is shown in Figure 1. The existing harbor layout is shown on Figure 2.

1.5 Previous Studies

Numerous studies of Saint Paul Harbor have been conducted by Federal, state, and local government agencies. Many of these studies are described in the following sections.

1.5.1 Investigations by the Corps of Engineers

Alaska District. 1996 (Dec.) "Information Report – Proposed Small Boat Harbor, Saint Paul Island, Alaska. The South Village Cove site was shown as the most acceptable with regard to planning criteria and objectives. The report recommended that (1) model studies be initiated for a harbor at the South Village Cove location, and studies should address practicality of incremental development; (2) the fully expanded harbor should include temporary moorage for 100-foot vessels; (3) because cost estimates are very sensitive to assumptions regarding materials to be excavated, exploration should be conducted prior to development of detailed estimates; and (4) upon completion of model studies, an Implementation Report should be prepared as a Post Authorization Change.

Alaska District. 1996 (Aug.) "Harbor Improvements Feasibility Report and Environmental Assessment," Anchorage. The study report recommends a plan for Salt Lagoon restoration and harbor improvements to accommodate increased boat and ship traffic, including refrigerated cargo vessels in excess of 300 feet in length. Improvements also aim to reduce damage to facilities and vessels from storm waves that overtop the breakwater. The

restoration of Salt Lagoon includes increasing water circulation and restoring biological productivity.

Alaska District. 1996 (Aug.) "Harbor Improvements Feasibility Report and Environmental Assessment - APPENDICES," Anchorage. This document includes the documentation of technical studies for the feasibility study.

Alaska District. 1995 (Jul). "Reconnaissance Report for Harbor Expansion," Anchorage.

Alaska District. 1995. "Saint Paul Salt Lagoon Project, Section 1135," Anchorage. This study was directed at opening a new channel on Boulder Spit outside the Saint Paul Harbor and enlarging the entrance channel to Salt Lagoon.

Alaska District. 1988 (May). "General Design Memorandum, Saint Paul Island Harbor, Saint Paul Island, Alaska," Anchorage. The harbor was authorized as a project for navigation in Section 202 of the Water Resources Development Act of 1986.

Waterways Experiment Station, Coastal Engineering Research Center (WES-CERC). 1998 (Sep). "Saint Paul Harbor Breakwater Stability Study," TR CERC-88-10, Vicksburg, MS.

WES-CERC. 1998 (Sep). "Saint Paul Harbor Design for Wave and Shoaling Protection, Saint Paul Island, Alaska," TR CERC 88-13, Vicksburg, MS.

Alaska District. 1998 (Feb). "Environmental Assessment, Saint Paul Island Harbor, Saint Paul Island, Alaska."

Alaska District. 1982 (Dec). "Final Harbor Feasibility Report and Environmental Impact Statement, Saint Paul Island, Alaska." This report describes the plan authorized by the Water Resources Development Act of 1986, Public Law (PL) 99-662. Modified by the Chief of Engineers' Report dated August 10, 1983.

1.5.2 Studies by Others

DHI Consulting Engineers, Dames & Moore, Inc. and Coastline Engineering. 1994 (May 5). "Report of Findings, Technical Addendum to U.S. Army Corps of Engineers Permit No. 870522, Marine Fill, Harbor Hydrodynamics and Salt Lagoon Impacts, Saint Paul Island Harbor Expansion," prepared for the Tanadgusix Corporation.

Tetra Tech, Inc. 1987 (Feb). "Alaska Saint Paul Harbor and Breakwater Technical Design Report," prepared for the city of Saint Paul.

Woodward-Clyde Consultants. 1983 (Nov). "Saint Paul Harbor Geotechnical Investigation," prepared for Norgaard Consultants.

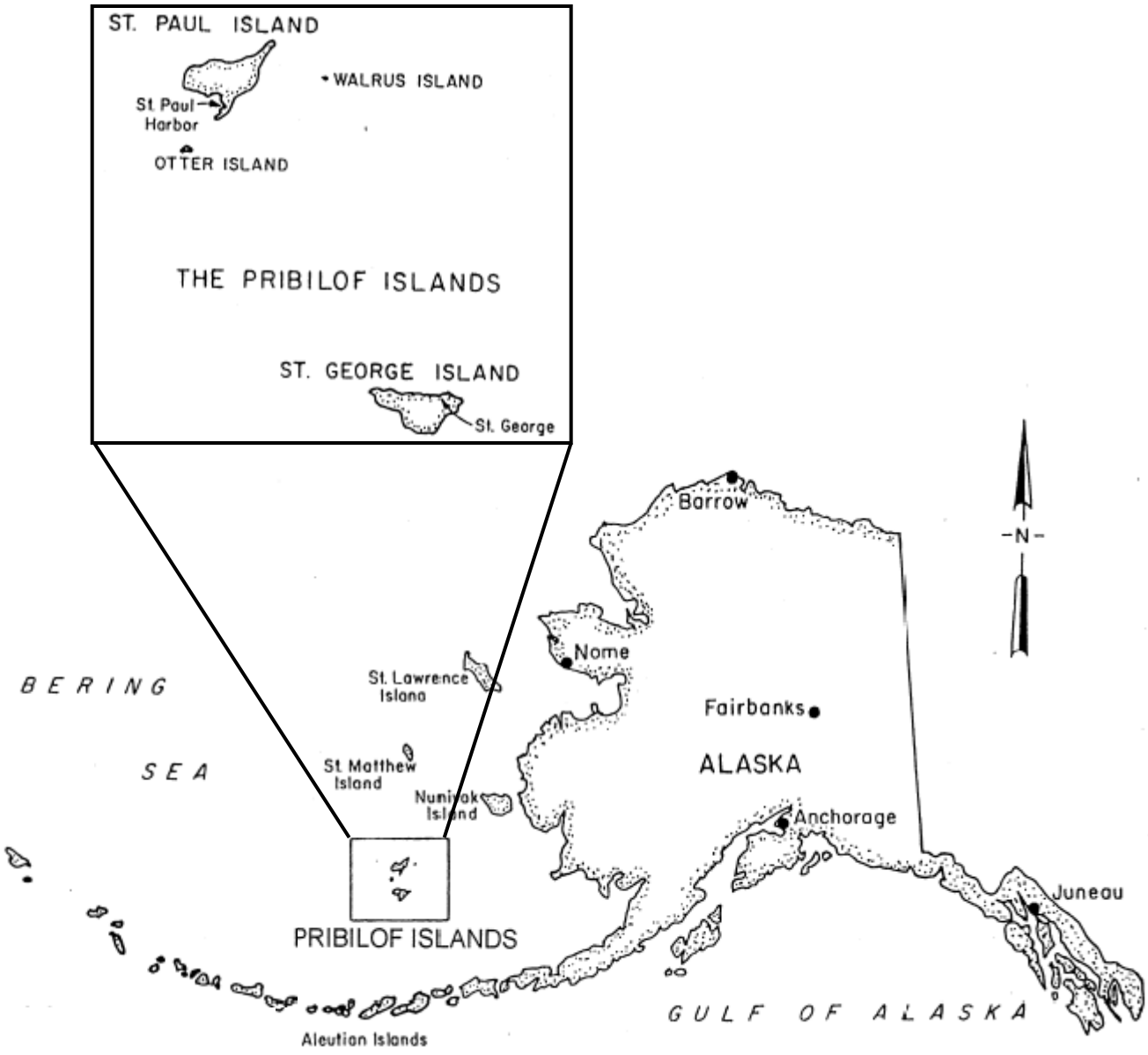

Figure 1. Location and vicinity Map

1.6 Completed and Ongoing Harbor Improvements

Saint Paul Harbor has been under development since the early 1980s. Development has occurred in three general phases. The three phases of harbor development are described in the following paragraphs and are displayed on Figures 2 through 4.

Phase 1: Harbor Development (complete) - A feasibility study and environmental impact statement to investigate navigational problems and opportunities in relation to Saint Paul Island and the eastern Bering Sea were completed in 1982. This report presented a harbor designed to accommodate vessels up to 120 feet and had a design fleet of 36 crabbing and bottomfish vessels. The project was based upon a design wave of 16.5 feet and 9.7 seconds for a fifty-year storm. Project features included a 1,800-foot breakwater, and an entrance channel and maneuvering area.

In 1983, a Chief of Engineers Report on the project was transmitted to the Secretary of the Army for review. This report and the plan it recommended were authorized in WRDA 1986. Also authorized in WRDA 1986, was the law (Section 204(e)) that permitted non-federal sponsors to undertake navigation improvements in harbors of the United States, subject to certain limitations. In December 1986, the city of Saint Paul requested permission to construct the authorized harbor under the authority of Section 204(e).

In 1988, the Corps completed the GDM for the harbor project, which the project design to include a main breakwater 1,050 feet long, 37 feet high; an inner breakwater 1,000 feet long, 18 feet high; a turning basin of 2 acres at a depth of 18 feet; a 700-foot dock; and a six-acre mooring basin. By 1990, construction of the general navigation features was completed. The phase 1 harbor features are shown on Figure 2.

Phase 2: Harbor Improvements (on-going) - Following completion of harbor construction in 1990, unanticipated demand for harbor services was experienced in Saint Paul Harbor. Harbor modifications were required to accommodate the increased boat and ship traffic, including refrigerated cargo vessels in excess of 300 feet in length. In addition, the constructed breakwater continued to experience problems with overtopping by storm waves causing damage to vessels and facilities.

A feasibility study of needed harbor improvements was completed in 1996. The recommended plan increased the depth of the entrance channel to –30 feet MLLW, a maneuvering basin at –29 feet MLLW, a spending beach on the lee side of the detached breakwater, and three offshore reefs parallel to the main breakwater, each 1,300 feet long at a depth of –12 feet MLLW. As an environmental restoration measure to restore water circulation and biological productivity to Salt Lagoon, the natural entrance channel to the lagoon will be realigned. The project, recommended in the 1996 feasibility report, was authorized by Section 101(b)(3) of the WRDA 1996 (110 Stat. 3667), and is currently under construction. The phase 2 harbor features are shown in Figure 3.

Phase 3: Small Boat Harbor Development (on-going study effort) - The report presents the findings of a study of the feasibility of adding a small boat harbor to the project authorized in 1996 and currently under construction. As presented herein, the study found the project to be engineering sound, economically justified as a last added increment to the existing project, politically acceptable, and implementable. These features are shown in Figure 4.

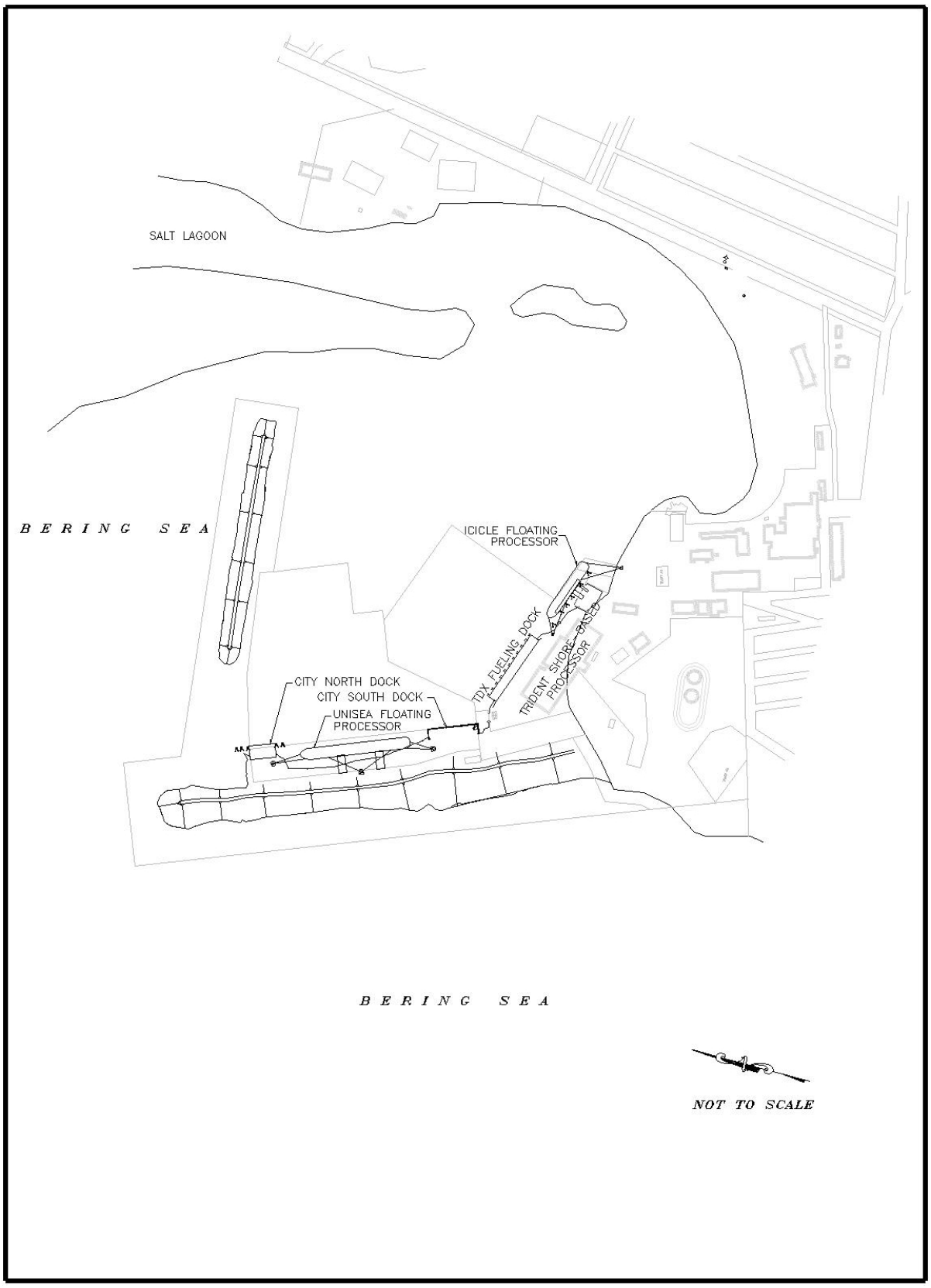

Figure 2. Harbor Development Prior to 1996 (Phase I)

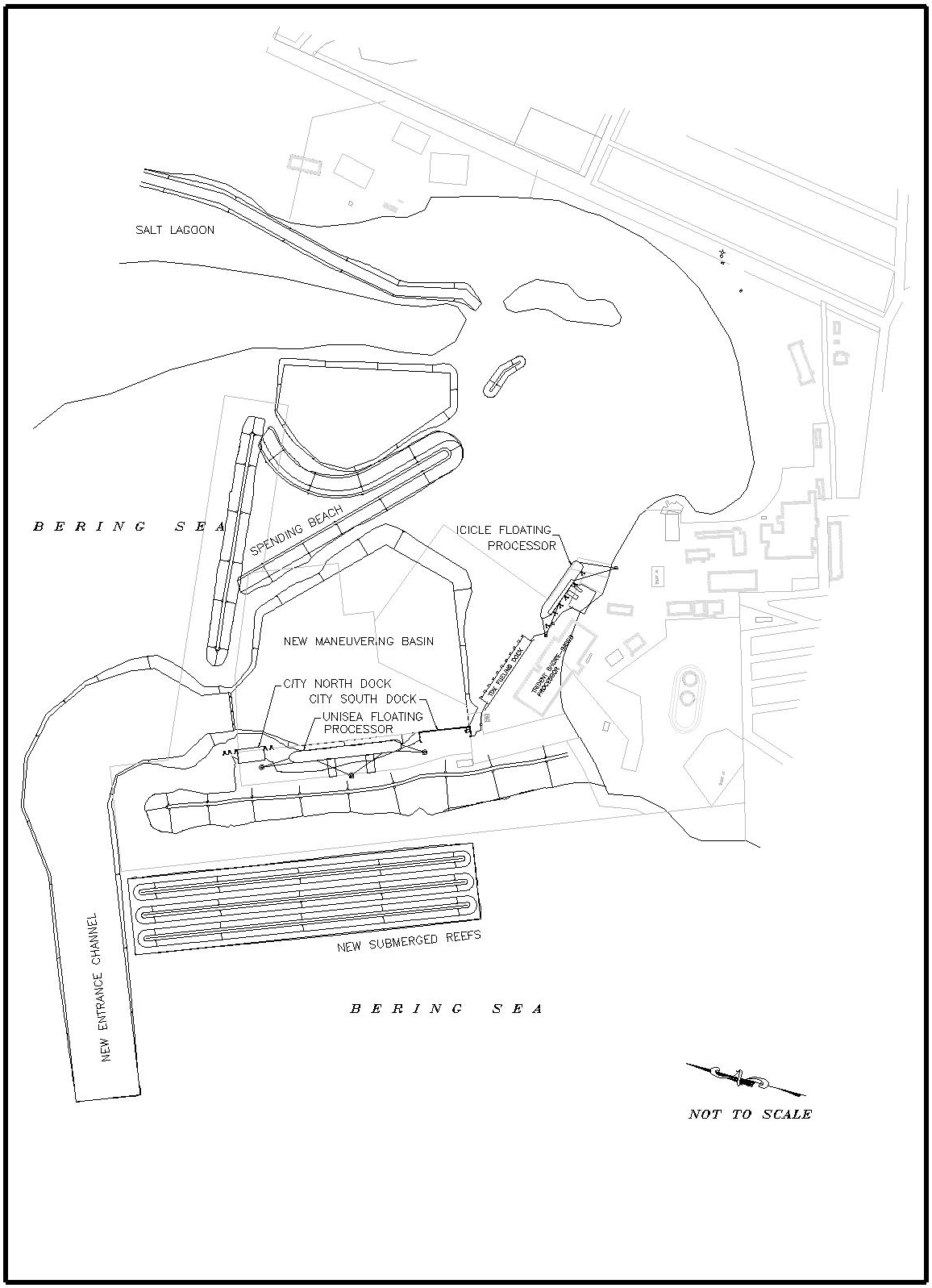

Figure 3. Phase 2 Harbor Development

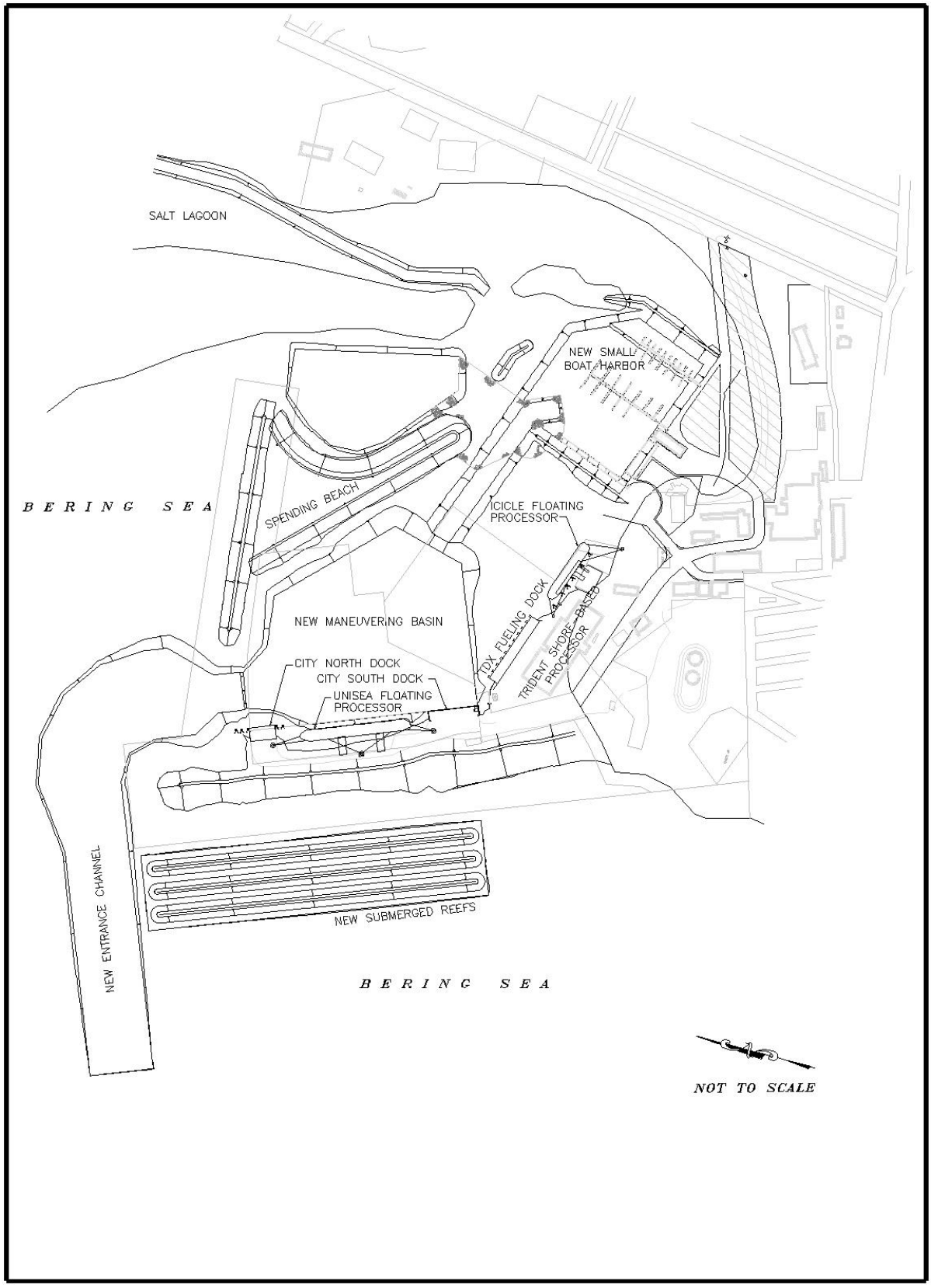

Figure 4. Phase 3 Harbor Development

2.0 STUDY AREA CONDITIONS

2.1 Socioeconomics

Saint Paul Island is the largest and northernmost of the Pribilof Islands in the eastern Bering Sea of Alaska with a land area of 44 mi^2. Only two of the Pribilof Islands are populated, Saint Paul with 585 people and Saint George with 290 people. Two-thirds of the Saint Paul population is Alaska Native. Saint Paul Harbor provides the only facility for boat moorage and service in the region except for a small harbor on Saint George Island.

Economic conditions on the Pribilof Islands are unique. Before October 1983, Saint Paul was classified as a Federal Government installation. The island was the center of fur sealing activities under the administration of the National Marine Fisheries Service (NMFS). Since the NMFS withdrew from the island in 1983, the community has had to find other sources of employment. The cessation of Government-supported sealing was a setback for the community: NMFS accounted for more than 60 percent of the total labor force employment and operated the island's basic services.

The City now provides basic services and has developed a new economic base related to fisheries by constructing a 750-foot breakwater and a 200-foot dock in 1986. The City of Saint Paul constructed the existing project in 1990, extending the main breakwater. The City also dredged the harbor to –23 feet MLLW, substantially deeper than the authorized elevation of –18 feet MLLW.

Prior to initial harbor development on the island, supply ships had to anchor offshore and be unloaded to open skiffs that took the cargo to the beach where it was carried ashore. Completion of the harbor has not only revolutionized the delivery of supplies to the island, it has also placed Saint Paul as a key transshipment point and processing center in one of the world's most productive fisheries.

Development of the harbor together with rapid changes in the fishing industry have placed major demands on Saint Paul Harbor to better accommodate the new mix of commercial fishing vessels, onshore and floating processors, and cargo vessels and barges. Use of the harbor over the last 10 years has surpassed all economic forecasts. Vessels in the 160-foot class routinely call on the harbor, which was originally intended as a refueling and water supply port for seven 110-foot vessels. Currently, three shore-based processors are located in the harbor, and vessels as large as 275 feet with 21-foot draft have called there. These demands resulted in the authorization of the deep draft harbor improvements currently under way.

Economic Base. Following the NMFS pullout, the City has had to build a new economic base, based largely on fishing. Many current fishing related jobs are seasonal, and local managers import workers to staff the food processing factories during peak harvest season. The developing local economy is the result of City development of a harbor to accommodate large fish catching and processing vessels. About 79% of adult residents have income from some form of employment (approximately 36% by local government). The most recent data available shows average household earned income among the island permanent residents was $40,900 in 1994, and per capita income was $13,100. Average earned income per employed person was approximately $18,000.

Employment in local government is large because the government role is woven into almost every aspect of the local economy, which is based on the fishing industry. The island economy is closely tied to a basically transient fishing fleet as a transshipment point and processing station. Management of this industry support role is a focal point for local government. Major sectors of employment of island residents in the local economy are summarized in Table 1.

Table 1. Saint Paul Employment By Sector

Sector	% Employed
Local Government	36%
Education	19%
Services	14%
Trade	12%
Fishing	18%

Even with the City's success in developing a fleet-service and processing-based economy, unemployment in the adult population remains at approximately 21%. After the harbor was constructed, the protected area was far too rough to accommodate smaller boats that island residents were interested in owning, and able to afford for subsistence fishing. Existing opportunity for subsistence fishing by the local fleet is limited by the lack of moorage and lengthy queuing periods for loading vessels during favorable weather windows. Today, island residents look forward to participation in the fishing industry as owners of modern harvesting vessels that would be made possible by implementation of a small boat harbor.

2.2 Fishery Resource Management

Responsibility for management and development of the fishery resources in the study area is shared between Federal, State, and quasi-governmental agencies. These agencies include the National Marine Fisheries Service (NMFS), the North Pacific Fishery Management Council (NPFMC), the Alaska Department of Fish and Game (ADF&G), and the International Pacific Halibut Commission (IPHC). The Magnuson Fishery Conservation and Management Act of 1976 (Public Law 94-265, as amended), often referred to as the Magnuson Act, provides for the conservation and exclusive management of all fishery resources within the U.S. Exclusive Economic Zone (EEZ). The U.S. EEZ extends from the seaward boundaries of the territorial sea (3 nautical miles from shore) to 200 nautical miles offshore around the coast of the United States.

2.3 Hydrologic and Hydraulic Environment

2.3.1 Location and Climate

Saint Paul is the northernmost and largest of the Pribilof Islands. The climate is maritime, resulting in considerable cloudiness, heavy fog, high humidity, and daily temperature fluctuations. Maritime influence in the Pribilofs keeps seasonal temperatures mild and daily variations to a minimum. Summertime temperatures are low with the highest recorded temperature being 64 °F. Precipitation on Saint Paul Island is minimal with an average annual rainfall of about 24 inches. The island area has periods of high wind throughout the year. Frequent storms occur from October to April, often accompanied by gale-force winds to produce blizzard conditions.

2.3.2 Tides and Water Levels

Tide levels at Village Cove on Saint Paul Island, referenced to MLLW, are shown in Table 2. Extreme high tide levels result from the combination of astronomic tides and rises in local water levels due to atmospheric and wave conditions.

Table 2. Saint Paul Tide Levels (ft)

Highest Tide (estimated)	+6.0
Mean Higher High Water (MHHW)	+3.2
Mean High Water (MHW)	+3.0
Mean Sea Level (MSL)	+2.0
Mean Low Water (MLW)	+1.0
Mean Lower Low Water (MLLW)	0.0
Lowest Tide (estimated)	-2.5

(Source: NOAA Tide Tables, 1980)

2.3.3 Currents

Currents near Village Cove are primarily tidal and are typically one to two knots, occasionally increasing to three knots when augmented by strong winds. The strongest nearby currents (to three knots) are encountered southeast of Village Cove between Reef Point and Otter Island. Currents within the localized area of the harbor, however, are dominated by storm surge and wave setup. Model studies of the harbor indicate currents of up to 8 feet per second (fps) are more than double the magnitude of currents associated with tides.

2.3.4 Ice Conditions

The icepack in the northern Bering Sea occasionally moves south and surrounds the island during periods of prolonged north and northeast winds between January and May. Mariners are warned by NOAA charts against the possibility of entrapment in Village Cove. Ice conditions could possibly preclude the use of the proposed day fishery mooring facilities during the months of January through May, and could require vessel removal for short periods in some years.

2.3.5 Waves

The existing harbor in Village Cove is in direct alignment with deep-water waves approaching between the west-northwest and southwest sectors. Deep-water waves approaching from the south and southeast sectors are partially sheltered by Saint George Island and Otter Island, and would diffract around Reef Point before impinging on the project site. Southerly and southeasterly deep-water waves therefore undergo considerable energy reduction before affecting the project site. Village Cove is in the lee of Saint Paul Island for waves approaching from northwest clockwise through southeast. Waves in the Bering Sea are extremely large, and around the shallower waters of Saint Paul Island, their heights are depth limited during numerous events each year. Maximum wave height to be expected near the entrance to the present harbor is 27 feet.

Wave heights in the present harbor are greatly modified by the breakwaters and spending beaches. Waves are expected to be attenuated to less than three feet by existing protection. Wave energy enters through both the east and west entrances with the dominant energy entering through the west entrance (the navigation channel).

2.3.6 Harbor Water Quality

Harbor water quality is dominated by the exchange of tide-generated flow through the harbor on its way to and from Salt Lagoon and by wave driven currents. The Salt Lagoon surface area is more than three times that of the harbor and more than double the tidal prism. This is very fortunate for the harbor because the harbor waters are mostly exchanged in one tidal cycle by just tidal flows. This characteristic does, however, put a great deal of pressure on the harbor users to maintain a clean harbor and to maintain as much flood flow as possible through the east entrance of the harbor to avoid contaminating or negatively impacting water quality in the Salt Lagoon. Harbor water is also exchanged by wave-generated setup even under minor storm conditions. The pocket where the eddy forms under storm conditions does not benefit to as great an extent as other portions of the harbor and care needs to be taken to insure against water quality problems in that region.

2.3.7 Lagoon Water Quality

Salt Lagoon water quality appears to be dominated by tidal exchange. Because of the small range in tidal elevation and length of basin, several tide cycles may be required before all the water is exchanged. Mixing of water in the tidal lagoon is thought to be good because waters are shallow, and winds are frequent and strong enough to stir from top to bottom. Storm surge water elevations of up to three or four feet above normal tidal elevations cause supplemental exchange in the lagoon and periodically improves water quality. Maintaining water quality in the Salt Lagoon is imperative to the local community.

2.3.8 Sedimentation

Sediments in the harbor area consist of sands and well-rounded boulders. The dominant transport mechanism for both is the current generated by the storm surges. Wave generated currents under more minor storm conditions are probably also capable of moving sands along the shoreline. Currents in the pocket where the harbor resides are generally in a clockwise direction and prior to harbor construction probably resulted in the harbor area fluctuating between being a sediment sink and a sediment source for down flow beaches. The position of the Salt Lagoon entrance has shifted several hundreds of feet over brief periods of time, indicating insufficient boulders in the material being transported to armor and hold its position beyond its present northerly position. The Salt Lagoon entrance is being stabilized in the deep-draft project currently under construction.

Prior to phase 1 harbor construction, sediment accumulation in the area was limited, and most accumulations were transported after brief periods of storage in the lagoon entrance. Since construction of the breakwaters, the currents have been modified, and the sediments reaching the harbor are retained in the area south of the east entrance in the general area from the entrance to the historic Salt Lagoon channel. Storm surges and the current driving mechanisms, however, are still similar to pre-construction. Construction sediment accumulation within the harbor appears to be less than 2,000 yd^3 per year: However, precise measurements of infill have not been made, and the 2,000 yd^3 could be exceeded. The observed accumulation is in the eastern segment of the harbor and was not expected to encroach on Federal facilities for five years.

Much of the sediment approaching the harbor is diverted westward along the detached breakwater and recirculated to the ocean about 1,000 feet offshore of its previous to existing

project circulation path. This likely results in some deficit of sediments along the headlands to the west and may extend into Zolotoi Bay.

2.4 Environmental

This section describes baseline environmental conditions in the study area. The documentation includes a summary of threatened and endangered species and other environmental resources of concern, including the salt lagoon, sea birds, and fur seals.

2.4.1 Threatened and Endangered Species

Two species of birds, six species of whales, and one sea mammal listed in the "United States List of Endangered and Threatened Wildlife and Plants" have been reported on or in the vicinity of the Pribilof Islands. The short-tailed albatross is reported as accidental in the Pribilofs, while a confirmed sighting of the Eskimo curlew has not occurred since the late 1880s. The six whales are the blue, finback, sei, humpback, right, and sperm. The sea mammal is the stellar sea lion, which occurs at two locations on Saint Paul Island but not in the vicinity of the harbor.

2.4.2 Environmental Resources of Concern

In addition to the threatened and endangered species listed above, the study area includes other resources of concern. Of the most significant concern for this study are the Salt Lagoon, sea birds, and fur seals, which are descried in the following sections. Other land mammals inhabiting Saint Paul Island include reindeer, house mouse, Pribilof shrew, and arctic fox. Reindeer were transplanted to Saint Paul Island in 1911 to provide subsistence meat for the Native population. Reindeer now roam freely on the island and are managed by the Saint Paul tribal government. Foxes are relatively abundant, particularly near bird colonies and on the main breakwater.

Salt Lagoon. The salt lagoon and its associated intertidal areas is the only salt lagoon on the island and in the central Bering Sea. It is an extremely productive body of water and supports large numbers of shorebirds, waterfowl, and other avian species from spring through fall. The heavy invertebrate populations also support juvenile fishes and water-oriented birds in Village Cove. Migrating waterfowl and many species of shorebirds use Salt Lagoon during the summer months. Unacceptable impacts to Salt Lagoon associated with the original harbor and breakwater development require water circulation restoration to protect the sensitive resource. Environmental restoration is a component of the harbor improvements project currently underway. The local community stresses the importance of avoiding any new impacts the Salt Lagoon when designing new projects.

Sea Birds. An estimated 250,000 sea birds of 11 species use Saint Paul Island annually for nesting and rearing young. The most abundant species are thick-billed murre, common murre, black-legged kittiwake, parakeet auklet, and least auklet. A large least auklet colony exists on Village Cove beach. The majority of the world's population of red-legged kittiwake nest in the Pribilofs. Lesser numbers of waterfowl, shore birds, and songbirds are found on the island either as migrants or residents. Salt Lagoon, the only salt estuary in the Bering Sea, is an important resource for migrating sandpipers and turnstones as well as migratory Eurasian species. Waterfowl occasionally use the freshwater ponds on Saint Paul Island.

Fur Seals. Seventy-five percent of the world's population of northern fur seals establish harems and pup on the Pribilofs at established rookeries scattered around the islands. Seals come to the Pribilofs for breeding and pupping from early May to October, feeding within a 200-mile radius of the islands. Fur seals begin migrating toward Southern California and Northern Japan during October and remain at sea until returning to the Pribilofs in May. They feed on anchovy, hake, herring, Alaska pollock, and other fish and squid. Other marine mammals, principally whales and porpoises, frequently are observed offshore at Saint Paul. Several fur seal rookeries are near the harbor but appear to be far enough away so that no direct harbor activities would impact them. Fur seals have been seen inside the harbor and in the entrance to Salt Lagoon.

2.4.3 Environmental Assessment

The environmental assessment is located in the environmental documents sections (colored pages) of this report. The assessment concluded that the Saint Paul small boat harbor could be constructed with no significant effect on the quality of the environment. The finding of no significant impact was signed September 9, 2002. The majority of the impacts would be minor and of short duration. The proposed action is consistent with state and local coastal management programs to the maximum extent practical.

2.5 Geology

The Pribilof Islands were formed through volcanic activity. Saint Paul Island is made up predominately of lava flows and sills of basaltic habit, with minor amounts of pyroclastic tuffaceous material and glacial sediments. No trace of glaciation is seen on the surface of the island, but evidence of glacial striation exists on Saint George Island, and Pleistocene sediments of apparent glacial origin are exposed in vertical sections along some of the steep sea cliffs near the city of Saint Paul.

Surface material in the proposed project area is generally sandy with scattered cobbles and boulders. Data from test borings, as well as from pile driving logs and dredging logs, indicates that subsurface material in the project area is black/gray with red poorly graded sand. Seismic profiles indicate that sediment deposits in the basin are underlain by very dense material (previously interpreted as bedrock).

3.0 PLAN FORMULATION

3.1 Period of Analysis

The primary period of study and analysis for this report was based on an October 2001 price level. Preliminary and detailed cost estimates and economic analyses, screening of alternatives, and subsequent selection of the NED plan were based on this price level.

During the review phase of this report the economic analysis and cost estimate of the recommended plan were updated to an October 2005 price level. An assessment of the alternative plans was also performed based on this update. This assessment confirmed the selection of the recommended plan. The recommended plan's project costs, cost apportionment, and NED benefits are presented in an October 2005 price level.

3.2 Problems and Opportunities

Residents of Saint Paul Island depended on marine mammal programs of the NMFS for employment. When NMFS withdrew in 1983, the community had to find other means of employment. Because of the Island's remote location in the eastern Bering Sea of Alaska, employment opportunities were limited and tied to the surrounding ocean's fishery resources. To take advantage of these opportunities, the community constructed a deep draft harbor consisting of a breakwater, channel, and dock in 1986. The Corps of Engineers (Corps) modified the project and completed construction in 1990. Until the 1980's, only a few skiffs and traditional skin boats were in service on the island. These vessels were used primarily for lightering freight to the island from ocean going vessels. Following completion of the harbor in 1990, the local fleet has grown to 26 vessels in the 20 to 30-foot class, primarily used in a day fishery for halibut within sight of the island.

Lack of protected moorage in the harbor for the small boat fleet has constrained opportunities to effectively participate in the region's commercial fisheries. Poor facilities for loading and offloading vessels cause significant time delays as local fishing vessels try to take advantage of fair weather windows. While the island has a strategic location advantage for efficiently participating in the fisheries, adequate infrastructure is not in place to realize the benefits. Local concerns were identified and documented in public meetings at the community. Major categories of problems identified by the public included inadequate moorage, harbor congestion, launching and haulout of vessels, inadequate upland support facilities, safety concerns, problems with theft and vandalism, and environmental concerns. Some specific local comments related to these problem areas are provided below.

3.2.1 Inadequate Moorage / Harbor Congestion

- The existing temporary dock, launch ramp, and haulout machinery have a practical limit of 32-foot vessels. Resources next to the island are plentiful, but the small boats are unsuited to the Bering Sea conditions. Upgrading of the fleet will require a protected moorage and an improved haulout facility. The Central Bering Sea Fishermen's Association (CBSFA) has determined local moorage needs to be for 30–60 or possibly more vessels up to 58 feet.
- The temporary floating dock does not have adequate space for all of the local vessels involved in commercial fishing, or aspiring to be involved. A concern of the Aleut Tribal Community is that members needing to launch or tie up skiffs for purposes of

subsistence harvest have no room. There is no direct economic consequence to the commercial harvest, but there is a consequence in the form of family subsistence hardship. The tribe needs a facility that will support subsistence use.

- The temporary docks and launch facilities are essentially limited to vessels no larger than 32 feet. This limitation of vessel size causes severe limits to be placed on the harvest. Larger vessels would be able to venture further out to sea and would be used in a wider range of weather conditions. They would also be more effective in targeting more distant stocks and would have higher production rates.
- The smaller vessels use the deep draft dock to unload their catch. When they arrive, they must wait for larger vessels to clear the area. Frequently they find themselves working while vessels in the 100- to 200-foot class are docking next to them. This can lead to extensive waiting periods, crowding, and safety concerns. There is a need to minimize congestion caused by small boats using the deep draft facility.
- Dock space is inadequate and rafting is sometimes required. Since there is no wave and wind protection, the vessels get banged together, and damages occur. Damages to vessels and docks cause the cost of harvest to increase. A new harbor would eliminate the damages, which the vessel owners consider to be part of their operating budget. Some of these costs appear as lost time since the vessels and docks are removed when there is a threat of storm damages.
- Currently large vessels enter the harbor for crew changes and for re-provisioning. The large number of service calls adds to congestion outside the harbor, in the approach channel, and at the harbor. Because the harbor is very busy, vessels often wait outside for dock space to become available. Future users of a small boat harbor have explored the possibility of tending waiting vessels with a water taxi service that would operate out of a new small boat harbor. It would move people and supplies to and from waiting vessels, at their option and would reduce the number of vessel hours spent waiting for service.
- The fleet is moored at unprotected temporary docks. When threatened by wave conditions the vessels and the docks must be removed from the water. It is a costly and time consuming operation, and it brings an end to all harvesting. The fleet needs all weather protection for as much of the year as possible.
- The temporary dock is impractical for managing heavy gear. With a protected moorage, a breakwater could be modified to provide for loading and off-loading. It could also serve to moor vessels too large to fit into the small boat harbor as well as for temporary moorage of disabled.

3.2.2 Launch and Haulout

- There is an existing launch ramp, but the surface is broken and sheets of concrete have been displaced causing an uneven traction surface. The ramp is too narrow to accommodate launch trailers sized to handle the larger vessels. Its use is further discouraged by the fact the ramp terminates at the water's edge causing vehicles to be stuck and damaged as they roll off the edge. The launch ramp is not protected from wave action and is frequently unusable for that reason.
- The vessels and docks must be removed by use of a rented crane owned by a local contractor. Protected harbor is needed to save the cost of crane service.

- Congestion in the launch process, limited crane services, and ramp limitations stretches out the amount of time it takes to launch the entire fleet. At times, the launch process can be so challenging as to eat away the fair weather window to the point that fishing trips are canceled.
- High haulout cost results from the need to hire a crane. The use of a crane requires an operator and a spotter. An additional cause of high cost is limited uplands, which cause a bottleneck during the haulout thus stretching out the time that the crane is needed. Future users argue that a small boat harbor must provide a means to remove vessels and docks efficiently at low cost.

3.2.3 Inadequate Upland Facilities

- The existing temporary dock has practically no dedicated staging area. The shore side area is not dedicated to providing support for the harbor operation so parking of trucks, trailers, vessels, and gear is neither guaranteed nor secure. This creates a situation where juggling of equipment causes a great deal of lost time. All of the potential users of a small boat harbor stated that adequate uplands be necessary as part of the moorage facility.
- The island lacks a convenient boat repair facility. Vessel repair, maintenance, and improvements require repair crews to be flown to Saint Paul or require vessels to be taken elsewhere sometimes under tow or aboard a freighter.
- An ongoing vessel repair and maintenance project sponsored by CBSFA has been one of the most important undertakings for the local fleet. Currently, the vessel work done during these clinics takes place in the open or in a temporary shop. Future users of a small boat harbor have urged that the harbor be planned such that community development of a boat repair facility can be integrated into the overall harbor plan.

3.2.4 Safety

There are reefs near the existing temporary docks. The approach is so limited by the reefs that several captains familiar with the approach have damaged their vessels. An adequate and safe approach channel is needed in connection with a new moorage facility.

3.2.5 Theft and Vandalism

Vessel security is a concern due to theft and vandalism problems related to the large number of short-term visitors. The island is host to several hundred temporary workers when local processing facilities are in full swing.

3.2.6 Environmental Concerns

Salt Lagoon is a sensitive environmental area southeast of the temporary dock and moorage. Small boat traffic congestion and reefs near the dock could potentially cause of accidents resulting in pollution spills.

3.3 Planning Objectives

The Federal objective of water and related land resources planning is to contribute to National Economic Development (NED) in a way consistent with protecting the Nation's environment. NED features are those that increase the net value of goods and services

provided to the economy of the United States as a whole. Only benefits contributing to NED may be claimed for economic justification of the project.

The specific planning objectives of this study relate to addressing study area problems and opportunities consistent with achieving the NED goal of improving the value of goods and services to the Nation. The following are the specific planning objectives of this study:

- Reduce operating (harvest) costs of U.S. commercial fishing
- Reduce damages to fishing vessels caused by storm waves within the existing harbor
- Reduce damages to fishing vessels associated with current loading/offloading
- Reduce and prevent costs associated with vandalism and theft
- Reduce current delays in use of deep draft harbor
- Reduce current vessel repair costs
- Reduce costs of dock maintenance
- Enable effective and efficient subsistence fishery
- Improve safety of vessels operating in the harbor
- Protect environmentally sensitive areas, especially Salt Lagoon

3.4 Plan Evaluation Criteria

Planning policy provides four general plan evaluation criteria for the evaluation of alternatives. These criteria are: completeness, effectiveness, efficiency, and acceptability. For the purpose of this study, these general criteria were further specified in the categories of economic criteria, engineering criteria, environmental criteria, and social criteria. These specific criteria are as follows.

3.4.1 Economic Criteria

The economic evaluation of alternative plans is based on an October 2001 price level with a 50-year project life. Presentation of the NED/recommended plan is based on an October 2005 price level. Plan development must be such that benefits exceed project costs to the maximum extent possible. The benefits must be capable of being expressed in terms of constant time and value of money and must exceed the equivalent economic costs of the project.

3.4.2 Engineering Criteria

The selected plan should be adequately sized to accommodate user needs. Adequate depths and size are needed in the entrance channel and the maneuvering basin to accommodate the vessels required to meet NED goals. Wave energy within the small boat harbor must be reduced to a level that does not restrict harbor activities (either in the water or on shore) and does not compromise human safety. The plan must be feasible from an engineering standpoint. Specific engineering criteria include:

Physical Criteria for Harbor Development – Develop a harbor facility for a day fishing fleet within the general confines of the existing Saint Paul Harbor without conflicting in a significant manner with other land use and development plans. Minimize adverse impacts to the environment and the existing deep draft harbor operations.

Waves – Waves in the day facility harbor are to be reduced to 1.5 feet or less under the most adverse storm conditions.

Currents – Currents in the day facility harbor should either be reduced to less than three fps under maximum storm surge conditions and post storm surge emptying of the Salt Lagoon, or moorages established that would prevent residual vessel damage under more adverse currents. Engineering should maximize opportunities to develop circulation gyres (that will enhance flushing) under normal tidal exchange.

Sedimentation – Sediments are to be managed so their interference with the day fishery harbor and main harbor facilities is minimized. Maximum effort should be extended to develop beneficial uses for dredged material.

3.4.3 Environmental Criteria

Environmental criteria include identification of aquatic life and wildlife that might be impacted by implementation of the plan, minimizing the disruption of the area's natural resources, documenting all threatened and endangered species in the project vicinity and avoiding any adverse impact thereon, maintaining consistency with the Alaska Coastal Management Plan, and protecting or enhancing existing environmental values, including water quality in the salt lagoon. Specific environmental criteria include:

Harbor Water Quality – The objective is for the day fishery and main harbor water to be exchanged within three tidal cycles. Steps need to be taken to ensure trash, sewage, and oil and greases are collected. Normal ebb tide flows from the Salt Lagoon need to be directed through the harbor to the same or greater extent than they now are.

Salt Lagoon Water Quality – Tidal flushing is not to be impaired by the day fishery harbor, and the flood flow path for exchange is given east channel preference**.**

3.4.4 Social Criteria

Plans considered must minimize adverse social impacts and maintain consistency with State, regional, and local land use plans, both public and private. The plan must be reasonably acceptable to the local sponsor. Specific social criteria of the local community include:

Protection – The project would need to provide all-weather, year-round protection. (excluding occasional freezing of sea ice and winter time haulout)

Location – The harbor should be in a secure location and out of the way of larger vessels.

Size – The harbor should allow for 40 or more boats up to 58 feet in length.

Benefits – Benefits would need to exceed costs.

Environmental Impacts – Design must be beneficial or non-harmful to Salt Lagoon.

Uplands – Beneficial use of the IRA Tribal Operation area is welcome as part of the project. Respect for existing property rights and land use plans is required.

3.5 Determination of Small Boat Harbor Fleet

To determine the design criteria for the small boat harbor, fleet sizes that would use the harbor were estimated. The fleet projection was derived by determining the gross harvest income that would be captured by a Saint Paul based fleet and then by calculating the number

of vessels that income would support. The gross harvest income was based upon a fishery resource assessment conducted for the study and vessel operating cost data. The resource assessment and the development of the with-project fleet are summarized below and are discussed in greater detail in the Appendix B (Economic Analysis).

3.5.1 Resource Assessment and Valuation

The fishery resource assessment for this study focused on eastern Bering Sea species that would be targeted by small vessels operating out of a new harbor at Saint Paul. These species are crab, cod, and halibut. Generally, the stocks near the island were inventoried in terms of allowable catch. The assessment depicts harvests by Saint Paul based vessels as they are anticipated with the project and includes an estimate of the value of harvest. The derivation of harvest values is summarized in the following sections.

Crab Harvest. In order to incorporate the cyclical nature of annual crab harvest data, an average of harvest data over the last ten years was used as an estimate of future harvest activity. The ten-year average used in the analysis includes boom years and bust years. It also is recent enough to capture productivity effects of present day capital and technology. The data show an average annual harvest of tanner, Pribilof red/blue king, and Saint Matthew red/blue king of 185.4, 0.94, and 2.75 million pounds, respectively.

Although Saint Paul is practically at the center of the crab fishery, the fleet currently operates out of other ports. Most crab harvesters are too large to find moorage at Saint Paul in both the with-project and without-project condition. There are typically between 10 and 40 vessels under 60 feet that operate successfully in the Bering Sea crab fishery.[1] Currently these vessels must do so from other ports. In harvest years before the huge specialized crabbers were introduced (early 1980s), vessels under 60 feet could compete and were in the fishery in greater numbers. It is vessels in this under 60-foot size class (if based at Saint Paul under the with-project condition) that will realize lower operating cost due to the harbor's significant location advantage.

According to data of the Commercial Fisheries Entry Commission, vessels under 60 feet make up approximately 2% of the total crab harvest.[2] For this study, the harvest of these smaller vessels was allocated to the with-project Saint Paul-based fleet on the strength of the economic advantage of operating from there. Harvest data indicates these vessels historically account for about 1,340,000 lbs per year, valued at $1,430,000. Adding Saint Paul Island's CDQ[3] harvest allocation, valued at $1,100,000, the estimated annual crab harvest by a Saint Paul-based fleet is valued at **$2,530,000**.

Cod Harvest. The majority of the Pacific cod harvest occurs in the spring and early summer. The entire fishery is active for 90 to 120 days each year in the eastern Bering Sea and Aleutian Islands. Pacific cod are not allocated between shore-based and at-sea fisheries. Long-line fishermen concentrate their efforts in the vicinity of Saint Paul Island during much of the year.

---

[1] Generally, the higher the harvest limit in a given year, the more smaller vessels that are likely to participate.

[2] In year 2000, crab fishers under 60 ft made up 215 of the 1,035 active crab harvesters statewide.

[3] CDQ stands for Community Development Quota. It is an exclusive harvest share allocated to residents of Saint Paul.

The total allowable catch for Pacific cod in the eastern Bering Sea and Aleutian Islands has varied between 164,500 and 250,000 metric tons in the 1990s. The harvest of Pacific cod varied from 206,000 to 167,000 metric tons during the decade. The Pribilof area contains 76% of the cod population of the entire eastern Bering Sea. Development of a small boat harbor would allow the local fleet to fully participate in the cod fishery.

A December 1999 stock assessment prepared by Natural Resources Consultants of Seattle, Washington, indicated allowable biological catch for eastern Bering Sea cod over the past 20 years has been 140,000–240,000 metric tons. The applicable Commercial Fisheries Entry Commission (CFEC) database for year 2000 shows 1,717 longline, jig, and pot permits, for vessels under 60 feet. With a harbor at Saint Paul providing year around moorage for 60 vessels, about 3.5% of the total fleet under 60 feet would likely be based there. It was estimated that with the project, 3.5% of the harvest of Pacific cod would be by vessels from St Paul, an annual harvest of 7,000 metric tons. Under the without-project condition, the harvest will be by vessels operating out of Dutch Harbor. At an ex-vessel value of $.45/lb (average price in the 1999 and 2000 west coast market), the total annual value of harvest taken by the Saint Paul fleet is estimated at **$6,930,000**.

Halibut Harvest. The total year 2001 IFQ[4] halibut quota for Area 4C[5] was 1,015,000 pounds, but that quota is distributed among permit holders home ported outside of Saint Paul. In 2001, the Saint Paul fleet's halibut quota included 1,015,000 pounds of CDQ, which gave Saint Paul exclusive rights to these stocks. The annual average halibut landings at Saint Paul during the last three years have been 100% of the 3-year average CDQ. Activity by the local fleet accounted for all of the CDQ halibut landings.

With the project, it is anticipated that the economic advantage of the location of St Paul will result in half the Area 4C IFQ being harvested by vessels home ported at Saint Paul with over half of the Area 4C halibut fleet based out of the new harbor. These vessels will arrive with IFQ. In addition, the Central Bering Sea Fisherman's Association is actively seeking IFQ for the local fleet. With reliance on IFQ, there will be an increase in average annual landings at St Paul, of at least 508,000 pounds. At ex-vessel prices of $2.00 per pound, this will yield an estimated increased gross long-term average annual income of the local fleet of **$1,016,000**. Without the project, the balance of the area harvest would be by vessels continuing to operate out of Dutch Harbor with some incidental participation by vessels possibly from King Cove, Sandpoint, and False Pass.

Subsistence Harvest. Under current Alaska and Federal law, subsistence is defined as customary and traditional, non-commercial uses of wild resources for a variety of purposes. The uses include harvest and processing of wild resources for food, clothing, fuel, transportation, construction, arts, crafts, sharing, and customary trade. As such, subsistence cuts across Native cultures and is significant to survival well beyond basic food needs.

Alaska has a subsistence law because subsistence supports a major part of the State's economy and culture. Alaska is unique in this regard. Traditional cultures and economies co-exist with the industrial-capitalism of Alaska's urban centers. The intent of the Federal

[4] IFQ is individual fishing quota, which is a marketable quota for a specified level of harvest of managed species.

[5] Halibut fishing grounds within the study area fall in the managed zone called Area 4C.

and State subsistence laws was to provide the opportunity for the traditional cultures and economies to co-exist.

Statewide, non-commercial fishing and hunting provided about 35–44 million pounds of food annually to rural areas during the 1980s. This is about 318–400 pounds per person a year or a pound per person per day for the 110,000 subsistence users.

For the Aleutian Island area, data gathered by ADF&G in 1994, reveals average per person subsistence harvest is 378 pounds per year. Current subsistence data for Saint Paul indicates per capita harvest of 267 pounds. Alaska's highest per capita subsistence harvest is at Hughs where it is 1,498 pounds. A 1989 study by ADF&G entitled *Alaskan's Per Capita Harvest of Wild Foods*, summarized the following as factors accounting for some communities having extraordinarily high per capita consumption rates:

- The subsistence harvest is high because it is used as a substitute for milk products (the single largest item in the American diet), fruits, vegetables, and grains.
- In the U.S., average meat and poultry consumption is 255 pounds per year, but in Saint Paul the subsistence harvest also provides clothing, home goods, trade, ceremony, arts and crafts, and other uses.
- Native communities harvest more wild foods than communities with higher non-native populations.
- Generally, harvests increase as the distance from road systems increase.
- Because of the high cost of transportation and storage, store bought foods in remote areas can be expensive, and often the choices are very limited.

A survey of the community by ADF&G revealed that 89% of the people are involved in subsistence harvests, but 99% use subsistence resources. Pressure on harvesters is indicated by 1994 ADF&G statistics that reveal over 14,000 pounds of halibut were removed from the commercial harvest to be used for subsistence purposes. This is an indication that fish, which the islanders harvested for commercial purposes, were more valuable to the islanders for subsistence use. There is an obvious unmet need for subsistence harvest.

For purposes of this analysis, discussion with residents support the assumption that the community would harvest at least enough halibut to bring the community subsistence harvest up to that of other Aleutian villages. Subsistence harvests by residents of Akutan, Atka, False Pass, King Cove, Nelson Lagoon, Nikolski, Sand Point, and Unalaska were used to establish an average harvest level. Based on this baseline, the Saint Paul harvest would be an increase from 267 to 378 pounds per year for the 492 subsistence harvesters on the island to equal the average for the Aleutian area. The result is an increase of 99,900 pounds for all Saint Paul permanent residents. Studies by ADF&G use replacement food values for subsistence harvest in the $3–$5 range. Using $4.00 per pound, the value of the increased subsistence harvest is **$399,600** annually.

3.5.2 Projected Fleet with Project

A fleet for the proposed small boat harbor was projected by determining the number of vessels that the harvest values determined in the resource assessment would support. These values are summarized in Table 3.

Table 3. Fleet Harvest Value Estimates by Fishery

Crab	Cod	Halibut	Subsistence	Total Harvest
$2,530,000	$6,930,000	$1,016,000	$399,600	$10,875,600

The table presents the total value of the potential harvest for a day fishery fleet based out of Saint Paul to be **$10,900,000**. To determine the number of vessels that would be supported by the projected harvest, vessel operating cost data, and income threshold levels were analyzed.

Vessel Operating Costs. The most applicable data on vessel operating costs for use in this study was identified as the database maintained by the University of Alaska. This data shows ex-vessel values for a multiple fishery fleet of vessels under 50 feet as follows:

- Operating Expense = 24%, including fuel, gear, bait, food, and special payments to hired captains and vessel owners.
- Crew Share = 49%, including crew payments net of expenses shared by the crew.
- Operator's Share = 27%, including fixed cost such as license, insurance, moorage, maintenance, and vessel payments.
- Net Operator's Share = 12%, excluding deductions for fixed costs estimated at 15%.

Using the net operator's share of 12% as a basis for estimating operator's income, the fleet based at Saint Paul would provide a total net operators share of $1,305,048.

Income Threshold Levels. Income threshold levels were estimated to provide an adequate incentive to induce development of a local fleet. These threshold levels were set at 120% and 140% of the average income in Saint Paul of $18,100 or at $21,720 and $25,340, respectively. These levels place entry into fishing among the better employment opportunities on the island.

Projected Fleet Size Distribution. Based on an increase in landings by the Saint Paul fleet of $10,875,600, a net operators share of 12% ($1,305,048), and threshold income levels of $21,720 and $25,340, the number of vessels that will be added to the local fleet will be a low of 50 and a high of 60. Given that a with-project condition could support a fleet of up to 60 vessels, a fleet configuration was needed.

Typically the Bering Sea resources are harvested by vessels in the 90–230-foot class. These huge vessels stay on the fishing grounds for a longer time and are able to withstand the sea conditions in which they must operate for long periods. A harbor at Saint Paul offers a harbor of refuge in proximity to the fishing grounds to allow local vessels under 60 feet to maximize harvest on a daily basis and return to port nightly.

For the analysis, it was assumed that the Saint Paul fleet would mirror the distribution of vessel sizes in the pre-IFQ halibut fleet.[6] This assumption is supported if the Saint Paul fleet becomes a multi species harvester. The pre-1995 halibut fleet had the characteristic of being multi-species, and 80% of the halibut fleet was made up vessels under 60 feet. There is no other Bering Sea fleet with comparable characteristics. Table 4 presents the fleet size distribution for a 60-vessel small boat fleet based out of Saint Paul.

Table 4. Distribution Of Harvest By Vessel Size Class

Class	Crab ($)	Cod ($)	Halibut ($)	Subsistence ($)	Harvest Total ($)	Number of Vessels
0–26	0	970,000	142,200	399,600[7]	1,511,800	28[8]
26–39	0	2,772,000	406,400	0	3,178,400	14–17
40–55	0	2,079,000	304,800	0	2,383,800	11–13
55+	2,530,000	1,108,800	162,600	0	3,801,400	17–22
Total	2,530,000	6,930,000	1,016,000	399,600	10,875,400	70–80
Moorage Demand without Trailerable Vessels						50–60

The 60-vessel harbor economic analysis was based upon the vessel sizes presented in Table 5. The 20 trailered vessels anticipated to be users of the launch ramp. Other harbor sizes were evaluated based upon a similar ratio of vessel sizes.

Table 5. Design Fleet

Class (ft)	No. Vessels
0–26 (trailered)	20
0–26 (moored)	8
26–39	17
40–55	13
55–60	22
Total	80

3.5.3 Design Vessel

The design vessel length was estimated at 60 feet. The average beam was estimated to be in excess of 30% of the length, and 22 feet was used. The loaded draft used for the major part of the harbor was 8 feet.

3.6 Preliminary Alternative Harbor Plans Considered

There was an early consensus among all project stakeholders that the most appropriate course of action to address study area problems and opportunities and accomplish planning objectives was through the development of a small boat harbor on Saint Paul Island,

[6] The pre-1995 halibut fleet was used with one modification. The modification was dictated by the nature of the crab harvest because in order to handle the necessary equipment, and operate at a scale that is profitable, minimum crab vessel size is at the upper limit of the Saint Paul fleet. Therefore, crab harvest was allocated to the class above 55 ft for the Saint Paul Fleet.

[7] Evaluated at an equivalent market price based on substitute values. Includes only the project related harvest increase.

[8] The allocated harvest justifies 8 additional vessels based on the income threshold. An estimated 20 local skiffs were included in this class. All are trailered or carried and are anticipated to be users of the launch ramp.

consistent with the study authorization. The general harbor location was relatively fixed due to the existing and ongoing harbor development at the existing deep-draft harbor. The locations of these alternatives are shown in Figure 5. The initial plans are described below:

3.6.1 Hammerhead

This plan, located near the vicinity of the existing maneuvering basin, consists of a rubble-filled foundation with a timber trestle. The trestle would allow access to the head that could be utilized as wharf space for the transshipment of goods. The plan was discarded because it did not meet the engineering criteria: It concentrated storm generated current in the mooring area and would not have reduced wave activity to an acceptable level.

3.6.2 Floating Breakwater

An anchored structure located adjacent to the TDX docks at the south end of Village Cove would work to dampen wave activity. Wave attenuation of such a structure in the long period wave climate would be primarily by reflection. The added wave activity in the reflected wave path would adversely affect other harbor operations. Currents in the harbor under design storm conditions would make mooring the structure very difficult. This alternative was rejected from this study based on its failure to meet engineering criteria, primarily due to its adverse effects on harbor waves.

3.6.3 TDX Plan 4A and TDX Plan 2A

TDX conceptual plans 4A and 2A are variations of a two-dock concept that incorporate moorings for vessels which are larger than anticipated for the day use harbor. These plans also include a major dock facility. Both of the plans were eliminated from further consideration because they failed to meet environmental criteria. Both plans were configured to require the major proportion of flood flow water entering Salt Lagoon to pass through the harbor complex before entering the lagoon. This is an ideal situation for the harbor, but it places a higher potential for Salt Lagoon contamination than environmentally acceptable. Also, both plans were expected cause unacceptable increases in velocities during and immediately after storm events.

3.6.4 Salt Lagoon

Also suggested as TDX plan 1A is a harbor located in the entrance to Salt Lagoon. It would be well protected from waves but would suffer from exposure to high velocity flows when storm surge water volumes are purged from the Salt Lagoon. A harbor in this location would also eliminate bird-feeding habitat and expose Salt Lagoon to a higher potential for contamination than is desirable. This alternative was eliminated from further consider due to its failure to meet environmental criteria.

3.6.5 Westerly Harbor

A harbor site to the east of the Icicle Barge was examined. Water depths were favorable in that location. The wave climate and currents during storm conditions require both a wave barrier and the current barrier extending out from the south shoreline to provide protected moorage on the south shoreline. Most of the existing depth advantage would be eliminated by the breakwater's footprint. Placement of the harbor in this location constrains other potential harbor uses and violates engineering plan criteria. There is no major cost advantage

to a harbor at this site, and there would be major losses in benefits to other users. The site was not studied in further detail.

3.6.6 South Village Cove

The plan (referred to as TDX plan 3A) considered for the same location as the floating breakwater plan, initially consisted of a short north breakwater and a west breakwater near the public access area. The day use harbor would consist of two docks and would occupy about twelve acres. Of all plans examined this plan has the most potential for meeting planning and engineering goals. With modest future excavation, it could also meet late surfacing goals of a tribal dock and temporary moorage of 100-foot plus vessels. This plan and variations thereof are pursued more fully in the remainder of the analysis.

3.7 Preliminary Alternative Plan Section - South Village Cove

Based upon the evaluation of alternative sites by the study team in coordination with the local sponsor, the South Village Cove site was identified as the only site meeting the planning criteria. Subsequent analysis in this study focused on refining specific elements of the small boat harbor at this site and the costs and benefits associated with each feature. Section 4 provides details of further study efforts for development at this site.

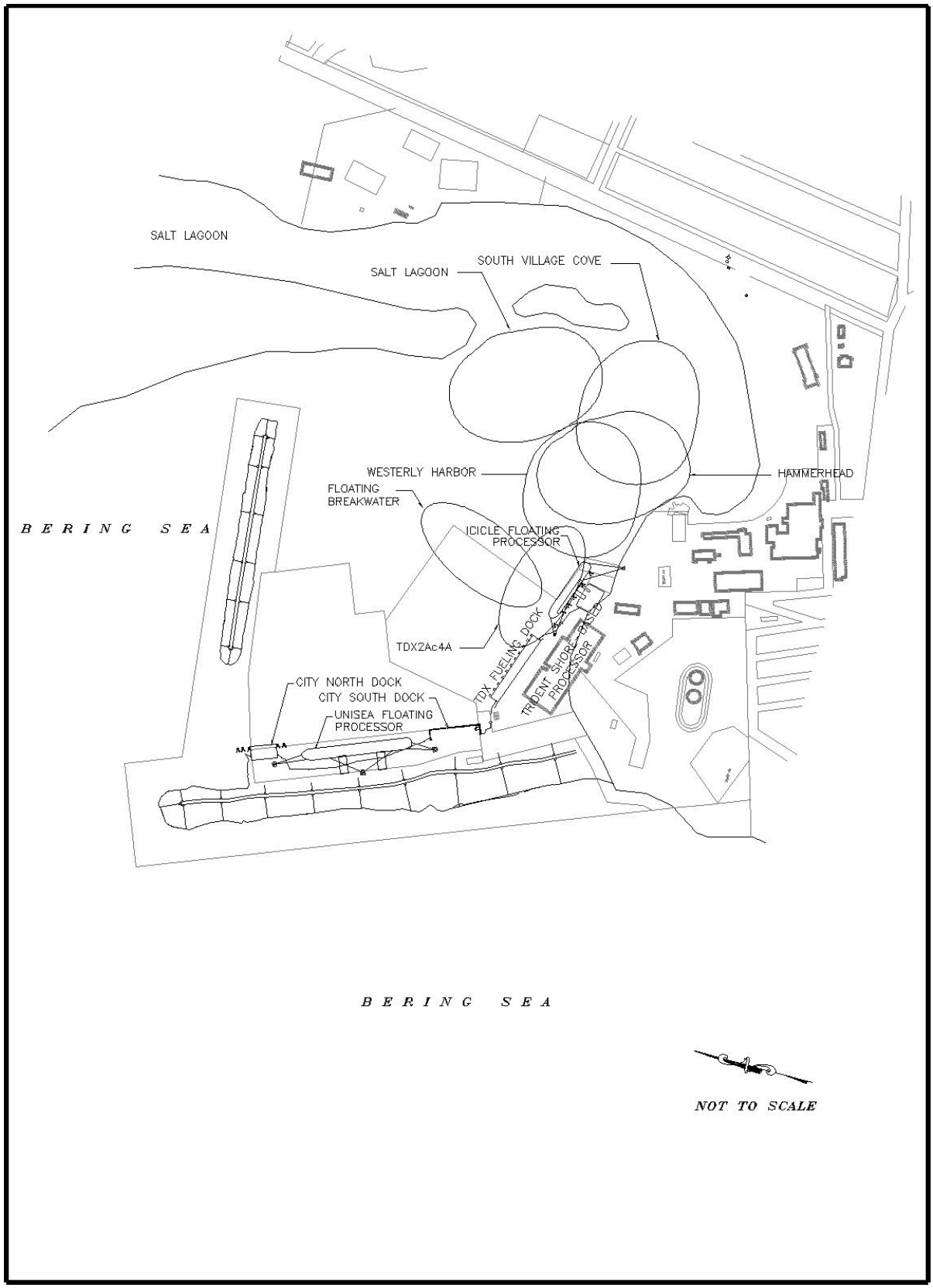

Figure 5. Preliminary Harbor Plan Locations

4.0 ALTERNATIVE PLANS AND NED PLAN SELECTION

4.1 Physical Model Study

A three-dimensional physical model of Saint Paul Harbor was developed for previous deep-draft harbor studies. The model was first used to evaluate the relative differences in harbor wave action, currents, and sedimentation in support of the design in the August 1996 Harbor Improvements Feasibility Report. The model was used for a second study to evaluate wave induced currents and flushing within Salt Lagoon in August 1997. For this small boat harbor feasibility study, the model was applied a third time to:

- Define the potential for harbor surge
- Define small boat harbor wave activity
- Ensure Salt Lagoon flushing with the proposed harbor in place
- Maximize the exchange of water in the small boat harbor
- Test ultimate development in other areas of the embayment
- Test ice circulation patterns
- Locate the interior detached breakwater to best enhance circulation in the small boat harbor and Salt Lagoon
- Ensure that the decrease in elevation of the spending beach did not have major impact on waves or circulation

The three-dimensional model reproduced approximately 2,865 meters (9,400 feet) of the Saint Paul Island shoreline. This produces an extent from Tolsti Point easterly and then southerly to a point south of the existing breakwater trunk. It also reproduces the existing harbor and underwater topography in the Bering Sea to an offshore depth of 12.2 meters (40 feet) with a sloping transition to the wave generation pit elevation of –30.5 meters (–100 feet), MLLW. A small connecting channel to the Salt Lagoon (located east of the harbor) also was included in the model as well as the tidal prism of the Salt Lagoon. Vertical control for model construction was based on MLLW, and horizontal control was referenced to a local prototype grid system. Details and conclusions from the model study are provided in Appendix A. Relative merits of the various plans were evaluated by:

- Comparison of short-period wave heights and long-period wave heights (seiches) at selected locations in the model
- Comparison of wave-induced current patterns and magnitudes
- Comparison of tidal flows
- Visual observations

4.2 Harbor Design Criteria

Input parameters for harbor design were based on the existing and ongoing harbor development and input from public meetings, model studies, climatological data, and professional judgment of the study team. Public meetings provided local requirements for harbor layout and basic criteria for dock facilities to maintain a given size and composition fleet. The physical controls for design were extracted from model studies, climatological

data, and common practice for harbor depths and channel dimensions. The following sections describe key harbor design criteria:

4.2.1 Harbor and Channel Depth

The harbor was designed to provide ingress and egress for vessels for all reasonable conditions. The entrance channel depth was established based upon vessel draft; pitch, roll, and heave; flotation; squat; and safety. Consideration of these factors resulted in an entrance and maneuvering channel initial design depth of –12 feet MLLW (see Section 4.2.4 for a description of the modified entrance channel depth). The design tide selected would allow entrance and exit under all but the most extreme conditions of offshore winds and would be approximately a 99% use condition. The design harbor depth was based on having flotation under the estimated lowest tide of –2.5 feet MLLW.

4.2.2 Harbor Flushing

Using the physical model, the harbor was tested for its flushing characteristics using both a 3.2-foot tide and a 7-foot tide with the navigation channel at –12 feet MLLW. This was combined with the smallest persistent wave that would normally be encountered during the non-storm periods. Circulation within the harbor was developed under these conditions but the multiple gyre system was weaker than under without-project conditions. To improve gyre strength, the hydraulic efficiency of the small boat basin entrance was improved by deepening the first segment of the entrance channel (~750 ft x 76 ft) by 4 feet to an elevation of –16 feet MLLW. The gyres were strengthened to the point that the mass transfer of water by this mechanism was similar to the without project conditions. Wind and wave setup in the harbor are other major mechanisms for mass transfer and mixing. These remain unchanged under with- and without-project conditions. The entrance channel depth required for water quality levels similar to existing conditions in the southeastern harbor is –16 feet MLLW for the initial channel segment.

4.2.3 Entrance Channel and Maneuvering Basin Width

The entrance channel of 100 feet was designed for two-way traffic where vessel speeds are not constrained under most conditions. One-way traffic is possible under the more adverse wind and current conditions. The width of the maneuvering channel was determined to be 120 feet to account for the wind and current drift associated with constrained vessel speeds and congestion associated with arrivals and departures from the docks.

4.2.4 Wave Height in Moorage Area

Guidance on long-period waves (seiches) indicates that considerable seiche sizes can be accommodated if vessels and docks are properly oriented and moorings account for the forces imposed by the seiche activity. Based on model studies, short-period wave heights of less than one foot prevailed in the harbor under all test conditions. Long-period waves in the 110-second to 140-second range will, however, be present in the harbor. The southeastern corner of the harbor has the maximum vertical response in a seiche mode under these conditions. The seiche is oriented in an east to west direction and therefore boat moorages must be oriented in that direction to allow a vessel to ride with the seiche when moored. Harbor oscillation horizontal velocities are quite low, and mooring stresses should be easily accommodated.

4.2.5 Erosion Protection

The project areas that have high velocities are in the vicinity of the breakwater nose and the high ground that supplies natural harbor wave protection. The high ground is that area between the spending beach and the interior detached breakwater. The –2 feet MLLW grade must be maintained at that location for wave protection and also retained for flushing control for the harbor. The area will be excavated so that erosion protection can be placed to the –2 feet MLLW elevation. The protection will consist of 50-pound minus riprap with a two-foot layer thickness. The added thickness was selected in lieu of a gravel filter. A plus or minus tolerance of six inches is to be allowed over an area not exceeding 200 feet^2 to allow ease in placement. In-situ boulders need not be removed if they lie within this tolerance, and erosion protection can be continuous without sand pockets.

4.2.6 Interior Harbor Layout

The orientation of moorings is critical to the harbor functioning satisfactorily during periods of seiching and were included in this study and design phase. All mooring configurations were designed to minimize adverse impacts of seiching.

4.2.7 Sensitivity to Future Deep-Draft Harbor Modifications

Deepening of the deep-draft portions of the harbor is always a future possibility. The harbor lying west of the small boat harbor was examined to see the potential impacts of expansion on the small boat harbor, other portions of the harbor, and water quality. The area was modeled, and the differences between conditions with existing topography and with deepening to –22 feet MLLW were examined and found to be minor. Harbor circulation is adequate to allow development and there does not appear to be obvious technical reasons to constrain future development. There are technical items that must be considered. The harbor seiche manifests itself in this segment of the harbor. The surge is a gain oscillating on an east to west axis making mooring perpendicular to this direction difficult. Local desire to place a fixed dock parallel to the small boat harbor breakwater will need to take the seiche conditions under consideration.

4.3 Alternative Plans

The existing and ongoing harbor development at the South Village Cove site and design criteria dictated by the physical model study limited the array of alternatives. To ensure that the NED plan was identified the costs and benefits of five alternatives of the harbor design were evaluated and compared. Design features that varied across the alternatives included harbor size (number of vessels accommodated) and harbor depth. The array of alternatives is presented in Table 6. Different fleet sized harbors are characterized as follows:

30-Vessel Harbor – primarily a halibut fleet in the under 32-foot class with most of them in the 20–30-foot class. Vessels under 26 feet are considered trailerable and are primarily subsistence fishers.

60-Vessel Harbor – includes the day use halibut fleet plus a larger fleet of primarily 40–58 feet multi-use vessels. During most of the year, these larger vessels would be capable of targeting all species available to the island. They would be the primary wintertime crab harvesters.

90-Vessel Harbor – includes the 60-vessel resident fleet with transient moorage for 30 more.

4.3.1 Alternative Plan Costs

Engineering design studies showed that the space required for a harbor that can be protected from waves and currents, generate good flushing qualities, and protect the flushing characteristics of Salt Lagoon is about 12 acres. This basin would require a breakwater, dredged entrance channel with erosion protection, dredged maneuvering basin within the harbor, circulation berm, and other local service facilities.

Cost estimates were developed for the three harbor sizes identified: a 30-vessel harbor, a 60-vessel harbor, and a 90-vessel harbor. Cost estimates were also developed for the 60-vessel harbor at three depths: 8 feet, 10 feet, and 12 feet. The cost estimates, includes all project implementation costs and economic opportunity costs (including interest during construction) for the various basin sizes and are summarized in Table 6. Detailed cost estimate information is provided in Appendix C.

Table 6. Comparison of NED Costs

	Alternative 1 60 vessels, 12-ft depth	Alternative 2 60 vessels, 10-ft depth	Alternative 3 60 vessels, 8-ft depth	Alternative 4 30 vessels, 12-ft depth	Alternative 5 90 vessels, 12-ft depth
Mob and Demob	1,454,000	1,400,000	1,346,000	1,414,000	1,568,000
Breakwaters	863,000	863,000	863,000	863,000	863,000
Dredging	1,052,000	912,000	770,000	998,000	1,335,000
Inner Harbor Development	3,557,000	3,557,000	3,557,000	3,299,000	3,932,000
Subtotal	6,926,000	6,732,000	6,536,000	6,574,000	7,698,000
Contingency	1,345,000	1,306,000	1,267,000	1,275,000	1,500,000
Subtotal	8,271,000	8,038,000	7,803,000	7,849,000	9,198,000
Engineering and Design	808,000	784,000	760,000	765,000	899,000
Subtotal	9,079,000	8,822,000	8,563,000	8,614,000	10,097,000
Construction Management	710,000	690,000	669,000	673,000	792,000
Construction Cost	9,789,000	9,512,000	9,232,000	9,287,000	10,889,000

4.3.2 Economic Benefits for Alternative Plans

The evaluation of economic benefits started with the resource assessment and income analysis presented in Section 3.4. This was central to forecasting the type of fleet that would operate out of Saint Paul. The resource assessment provided the basis for estimating potential gross income. Given the makeup of the fleet, the cost of operations, and the harvest income, a comparison was made of operating out of Saint Paul and out of alternative ports. In addition, alleviation of the problems incurred by the limited fleet operating at Saint Paul, under the without-project condition, were also identified and quantified as benefits.

Corps' planning is conducted in a with-project and without-project context. By comparing forecasts of future conditions in a study area without a project to forecasts of conditions with a project, the differences in costs incurred by, and benefits accruing to the study area as a result of the project, are more readily identified. In order to ensure that plan alternatives are economically efficient, it is necessary to impose the condition of economic rational behavior on individuals and firms in both the with- and without-project condition. The result of the evaluation is identification of a theoretical willingness to pay for the project outputs and is used to express the NED benefit regardless of who will actually pay. In this analysis four techniques had a role in estimating willingness to pay:

- Actual market prices (used to determine ex-vessel harvest values)

- Changes in net income (used to estimate fleet development)
- Cost of the most likely alternative (used to estimate benefits due to project caused improvements in harbor efficiency, travel cost, and subsistence harvest)
- Administratively established values (used to estimate opportunity cost of time)

The NED benefits are summarized in Table 7. The benefit analysis for each category is summarized in the following sections. Details of the economic benefits are provided in Appendix B.

Table 7. NED Benefit Summary

NED Benefit Category	30-Vessel Fleet	60-Vessel Fleet (12-ft depth)	90-Vessel Fleet
Harvest travel cost reduction	168,800	360,300	360,300
Prevention of damage to vessels	12,300	127,900	188,700
Prevention of theft loss	5,000	52,000	76,700
Prevention of vandal Loss	2,000	21,000	30,900
Congestion delay prevented by water taxi	80,000	80,000	80,000
Reduced cost of vessel repair	0	540,400	540,400
Port land opportunity cost	260,000	20,000	(943,000)
Vessel launch and haulout	69,800	69,800	69,800
Transportation savings for disabled vessels	0	198,300	198,300
Reduced harbor dock maintenance cost	48,100	48,100	48,400
Improved subsistence fishery	399,600	399,600	399,600
TOTAL	$1,045,600	$1,917,400	$1,050,000

Harvest Travel Cost Reduction. Without a project, a relatively small portion of the harvest is landed by the existing 28-vessel fleet (0–25 feet) currently operating out of Saint Paul. The significant harvest of the resources around the island is by 58-foot plus vessels operating out of Dutch Harbor and delivering there. A run of between 215 and 340 miles is necessary to reach the main eastern Bering Sea fishing grounds from Dutch Harbor. This open water trip is made with vessels heavily loaded and under frequent adverse weather conditions. The typical trip from Dutch Harbor used in this analysis was a three-day trip out of which about 30 hours are spent fishing.

With a project, a mixed fleet of 58 ft x 23 ft vessels operating out of Dutch Harbor and 58 ft x 17 ft vessels operating out of Saint Paul was assumed. This allows both fleets to harvest to the maximum potential of vessel capacity and is the most economical mode of operation.

The three-day trip from Dutch Harbor with 30 hours fishing was compared to the reduced travel time and six-hour fishing periods for day trips out of Saint Paul. The operating scenario for the two fleets would also differ in that the Dutch Harbor vessels are anticipated to be actively involved in the fishery every day when the weather is suitable. This gives the Dutch Harbor vessels an advantage in terms of catch per harvest day and fewer vessels are needed to conduct the harvest. This advantage is somewhat offset by the increased travel time to and from Dutch Harbor. When compared to the with-project condition travel cost of $596,500, the annual saving provided by the small boat harbor will be **$168,800** for the 30-vessel fleet, **$360,300** for both the 60- and 90-vessel fleets.

Prevention of Damage Loss. Based on discussions with fifteen local fishermen, existing damages to vessels and equipment is related to:

- Wind, tidal currents, and wave action that pushes vessels into one another as they wait to be hauled out
- Wind, tidal currents, and wave action that sets vessels onto shoals near the launching area
- Larger vessels which take the right of way and squeeze the local fleet away from tie up locations

Existing average annual damages to the existing 26-vessel fleet are estimated at $12,300. The fleet, under the with-project condition, is expected to expand to 50–60 vessels as early as the year 2002, and no later than 2005. The vessels that will be added are larger than the local fleet and will be relocated from other ports where they experience similar damage. For example, average annual damage per vessel at Dutch Harbor was reportedly estimated at $5,000 in 1999. Annual prevented damages with the project are estimated to be **$12,300** for the 30-vessel fleet, **$127,900** for the 60-vessel fleet, and **$188,700** for the 90-vessel fleet.

Prevention of Theft Loss. Presently the vessels are stored wherever there is usable space available. This finds them scattered throughout the industrial area and around the island. Little of the outside area of the island is illuminated at night, and there are no fences to allow vessel security. In addition, the community is host to hundreds of vessel stops each year, and there are frequently large numbers of outsiders coming in to work at the processors or waiting to be picked up as crew replacements. When vessels are left unattended for short periods just before or just after a fishing trip, theft is common. The most common items taken are electronic navigation equipment, safety equipment, survival suits, gas cans, and fuel. All of the theft would be preventable in a secure harbor with controlled access, a 24-hour security service, and fenced area.

There is no statistical data available to estimate the losses associated with theft. The issue was discussed at a local meeting with a group of fishermen, where average losses were estimated at $1,000 per year for each theft event. Preventable theft loss is estimated at **$5,000** per year for the present fleet. With fleet value increases associated with the 60- and 90-vessel fleets, preventable theft losses are estimated at **$52,000** and **$76,700**, respectively.

Prevention of Vandalism. Vandalism is a continual problem for vessel owners and happens in any open moorage. There is some overlap of complaints of vandalism problems with theft problems. The vandalism however differs in that the stolen items are usually discovered damaged, broken, or discarded. Recent complaints included anecdotes involving slashed survival suites, gas cans recovered empty, VHF radios recovered with the cases smashed or removed, skiffs that had been used and abandoned, and broken windows in stored vessels. All of the vandalism could be prevented if vessels were in a secure moorage. Preventable damages are estimated at **$2,000** annually for the current fleet and are adjusted by estimated fleet value factors to arrive at **$21,000** and **$30,900** for the 60- and 90-vessel fleets, respectively.

Congestion Delays Prevented by Water Taxi. Large trawlers and crabbers over 90 feet regularly call at Saint Paul for crew change, supplies, and medical assistance. During a 1999 sample period of port records for a 300-day period, harbor records show 1,680 tie-ups at dockside by these deep draft commercial vessels. Because the harbor is so busy, many of

these vessels were frequently required to wait outside for a clear channel and a place to tie-up. Vessels occasionally waited eight or more hours, but the normal waiting period was generally two hours or less. If they wanted to use the harbor when it was full, they had no choice but to wait because the nearest alternative port is 275 miles away.

With the small boat harbor, a water taxi could service vessels waiting outside and deliver people and supplies. With a call-ahead strategy in place, a water taxi service based at the small boat harbor could be on the scene with supplies, parts, and personnel as the customer arrived, thus reducing waiting time. Since a water taxi should be able to service vessels waiting outside in a wide range of weather conditions, the operating cost of the taxi was based on a 58-foot vessel.

Without the project, vessels waiting cost was estimated to be $180,000 based upon operating expenses. Wave activity outside the harbor will make it impractical to provide water taxi service 35% of the time so the preventable waiting cost is $117,000. Under the with-project condition, benefits associated with water taxi service made possible by the project are **$80,000** for the three fleet sizes (30-, 60-, and 90-vessel fleets).

Reduced Cost of Vessel Repair. The new small boat harbor will supply moorage needed to make a vessel repair operation viable. The repair yard will exist only under the with-project condition and will be located on existing uplands near the harbor. The boatyard analysis included evaluation of the regional demand for vessel repair services, the economic viability of a yard at Saint Paul, and the capital and operating costs of the yard.

Benefits are based on reduced operating cost for vessels at large because the location of Saint Paul will save the cost of travel to other locations for repair work. Reduction in variable operating cost was used to estimate willingness to pay for reduced travel to alternate facilities. NED benefits are earned for reduction in trips to use yard facilities elsewhere.

There are 14 locations in Alaska, which were considered as alternative haulout for vessels up to 58 feet and which offer hull, machinery, electronic, and hydraulic, repair facilities. They are Anchorage, Seward, Valdez, Kenai, Homer, Sitka, Petersburg, Ketchikan, Juneau, Kodiak, King Cove, King Salmon, Dutch Harbor, and Sand Point. All of the harbors are wait listed. These locations vary in distance from Saint Paul, ranging from 300 to 1,300 miles. Under the with-project condition, the annual travel saving of using a repair facility at Saint Paul was estimated as **$0** for the 30-vessel fleet[9] and **$540,400** for both the 60- and 90-vessel fleets.

Port Land Opportunity Cost. The City's land use plan shows that potential development is restricted. Most of the developable area has already been improved. Some valuable port lands are tied up because the local fleet is required to be stored out of the water. After a harbor is built the fleet will be accommodated in the water most of the year, and formerly used port lands will become available for other income producing activities. To a certain extent this results in a net economic gain. Presently vessels are stored on cradles or trailers tying up land needed for highly valued marine services. The with-project condition enables the storage to be on lower valued lands.

[9] The 30-vessel harbor layout provides inadequate moorage to accommodate the transient customers necessary to support a break-even boat repair yard operation.

The difference in annual land lease cost for storage of the existing fleet with the project, compared to without it, is estimated at **$260,000** for the 30-vessel harbor. Alternative plans that consider expansion beyond 30 vessels require navigation servitude lands having a high opportunity cost. The value of these lands is not recognized elsewhere in the study so is treated as a non-monetary economic cost in this aspect of the economic analysis. This non-monetary opportunity cost effectively cancels out much of the economic gain of using less valuable lands for storage. At the scale of a 60-vessel harbor, the economic cost of the navigation servitude lands is so high as to reduce the overall gain in terms of port land use opportunity cost to **$20,000** annually. For the 90-vessel harbor, the benefit becomes a net opportunity cost with an annual economic loss of **$943,000** annually.

Vessel Launch and Haulout. Launching is currently done with a crane and on occasion with a large wheeled loader. Cost of using the equipment is $100 per hour for the loader and an operator, and $240 per hour for the crane, including an operator and volunteer spotter. Fishermen ordinarily avoid use of the loader because the channel at the put-in point is narrow with rock shoals that are difficult to avoid even when the tide is not running and winds are light. Each year several outdrives are damaged and at least one vessel has been sunk. The launching and retrieval often demand the attention of six people for a single vessel. Skippers must use valuable weather windows for launching and retrieval. Fishing for subsistence and for commercial purposes are interrupted, and to a great extent limited.

Because of the need to wait on availability of a crane or loader, and the fact everyone rushes to launch and retrieve within a limited weather window, each launch can take 2 hours and 45 minutes of crane time for the first vessel and 45 minutes for each additional vessel, for a total crane time of 22 hours to service the 26-vessel fleet. Similar queuing occurs when vessels wait for haulout to avoid adverse weather. The study assumed seven annual launch and retrieval windows, under the without project condition, based upon weather history.

With the project, a hydraulic trailer will be used instead of a crane. Only one haulout each year will be required taking a half hour per vessel. Annual savings are estimated to be **$69,800** for all three fleet sizes (30-, 60-, and 90-vessel fleets).

Transportation Savings For Disabled Vessels. Presently vessels over 32 feet, which are in need of repair, must be towed to Dutch Harbor. Saint Paul does not have adequate haulout facilities, crane capacity, or dockside work area for repair crews to fix larger vessels. Each year there are 5–10 vessels that must risk the open water trip from Saint Paul to Dutch Harbor for repairs, and frequently, the vessels must be taken in tow for the entire trip. Sometimes the owners elect to return vessels to Seattle where they contract with the manufacturer for repair. Vessels have sunk on the way to Dutch Harbor because it was not possible for them to be repaired at Saint Paul.

Since there is not an ocean going tug stationed at Saint Paul, one must make the trip from Dutch Harbor to take the disabled vessel in tow. It takes time to arrange for a tow thus adding lost income to the financial damages. The Ocean Challenger was in the harbor 3 months, Smokey Point 2 months, and the High Seas 6 months. An average of five tow trips from Saint Paul to Dutch Harbor were reported during the last three years. Benefits related

to transportation savings for disabled vessels are **$0**[10] for the 30-vessel fleet and **$198,300** for both the 60- and 90-vessel fleets.

Reduced Harbor Dock Maintenance Cost. When storm conditions cause wave activity inside the harbor, floating docks that are used for temporary tie-ups for the small boat fleet are required to be removed. The crane lifts the three approximately 60-foot units from the water and stores them alongside the waterfront at a cost per event of $30,000, not including the opportunity cost associated with storage of the dock units on valuable industrial land and damage to the docks. During an assumed "normal year" this removal activity will take place one time. Annual savings from eliminating the need to remove the docks is estimated at **$48,100** annually for all three fleet sizes (30-, 60-, and 90-vessel fleets).

Improved Subsistence Fishery. Weather conditions limit the time the local fleet fishes, and each hour saved in the launch and retrieval process is an hour of additional harvest time for the subsistence fisheries. There is considerable room for expansion of local fleet activities, and local fishermen have stated a small boat harbor is needed so they can increase their subsistence harvest. The value of the increased subsistence harvest is **$399,600** annually. See Subsistence Harvest in Section 3.5.1 for details.

4.4 Plan Comparison and NED Plan Selection

Section 4.3 described the costs and benefits of associated with the final array of alternative harbor development plans at the South Village Cove site. The annual costs and benefits of these plans are summarized in Table 8. Alternative 1 maximized the net NED benefits and was selected as the NED and Recommended Plan.

Table 8. Alternative Plan Comparison

(October 2001 Price Level)

	Alternative 1 60 vessels, 12-ft depth	Alternative 2 60 vessels, 10-ft depth	Alternative 3 60 vessels, 8-ft depth	Alternative 4 30 vessels, 12-ft depth	Alternative 5 90 vessels, 12-ft depth
Construction Cost	9,789,000	9,512,000	9,232,000	9,287,000	10,889,000
Interest During Construction	562,454	546,516	530,410	533,579	625,662
NED Investment Cost	10,351,454	10,058,516	9,762,410	9,820,579	11,514,662
Annual NED Cost (50 yrs at 6 1/8%)	672,000	653,000	633,000	637,000	747,000
Annual OMRRR	159,000	159,000	159,000	151,000	172,000
Total Annual NED Cost	831,000	812,000	792,000	788,000	919,000
Average Annual Benefits	1,917,000	1,829,000	797,000	1,046,000	1,050,000
Benefits to Cost Ratio	2.3	2.3	1.0	1.3	1.1
Net Annual Benefits	1,086,000	1,017,000	5,000	258,000	131,000

[10] Transportation benefits would not exist because the small boat harbor would not accommodate fishing vessels significantly larger than the existing fleet (it would accommodate one water taxi of approximately 58 ft). Boats larger than 32 ft would still be towed to Dutch Harbor for repair.

4.4.1 Basin Size Optimization

The harbor configurations were relatively the same for the three alternatives with changes limited to the north breakwater and inner-harbor facilities to accommodate changes in the basin area and different design fleets. Therefore, selection of the optimum harbor size was done as part of the selection of the NED plan.

4.4.2 Project Depth Optimization

Some economic studies of NED depth trade off fleet delay cost against the cost of deepening the project. In some cases, it has been shown that waits will be so infrequent and by so few vessels that provision of an increment of depth is not justifiable. In the case of Saint Paul, waiting was not considered to be an option.

The harbor is designed to act as a day-use harbor. The fleet must be able to seek shelter without delay due to the sudden arrival of treacherous sea conditions. In addition, the blow-down of water surface was considered to be unpredictable and random. A reasonable database was not available to do the analysis, and an error could jeopardize human life. This was considered to be an unacceptable and unnecessary risk.

Concerning the depth of the entrance channel, it was necessary to provide a depth of 16 feet for Entrance Channel Segment A. This was a specified hydraulic design constraint on all alternatives. Lesser depths at the entrance could not provide the tidal cycle water exchange existing in the without-project condition. Greater depths were not evaluated in the economic analysis because the entire fleet would be able to pass unhindered with a 16 feet depth, and there would be no incremental benefits to be achieved.

The comparison of benefits and costs for the various depths indicates 12 feet to be supportable as the NED depth for Entrance Channel Segment B, the maneuvering basin, and the mooring area. It was not bracketed by a deeper project. It was the maximum depth evaluated because it accommodates the entire fleet being planned by the local community, and the incremental benefit from added depth would be zero. There is no residual delay.

4.4.3 Reconciliation of Fleet Cost and Income

Reconciliation is necessary to demonstrate that the claimed difference between the with-project and without-project conditions is actually achievable. Estimated cost reductions cannot be so great as to reduce costs below reasonable operating levels. Nor can without-project costs be so high as to remove the prospect of profitability. Reasonableness was verified by tallying all of the benefits related to fleet operating cost and added them to the vessel operating budgets to determine if the fishers could actually operate and show profitability in both the with-project and without-project conditions. It was concluded that the fishers will be profitable in both cases, and the estimated savings are reasonable.

4.5 Hazardous, Toxic, and Radioactive Waste Investigation

HTRW investigation for the small boat harbor was limited to a literature review of existing sampling data. This review indicated that the proposed dredge material is compatible with its intended use.

4.6 Evaluation of Risk and Uncertainty

Details of the risk and uncertainty analysis are presented in Appendix B. A summary of this analysis is presented below:

The summary R&U analysis classified each of the NED benefit categories as *Uncertain*, *Reasonably Certain*, or *Reliable and Supported*. The category of **Uncertain** consisted of: prevention of damages to vessels, prevention of theft loss, and prevention of vandalism loss. The benefit estimated from these three *uncertain* benefit categories totaled $200,900 for the NED plan. Even if these benefits were excluded entirely, the NED plan would still have a benefit to cost ratio of 2.2 to 1.

Two NED benefit category estimates used were classified as **Reasonably Certain**: harvest travel cost reduction and reduced cost of vessel repair. The estimated benefits from this category totaled $900,700. Even if these benefits were excluded entirely, the NED plan would still have a benefit to cost ratio of 1.3 to 1.

The remaining NED benefit categories were classified as **Reliable and Supported**: congestion delays prevented by water taxi, port land opportunity cost, vessel launch and haulout, transportation savings for disabled vessels, reduced harbor dock maintenance cost, and improved subsistence fishery. Theses benefits totaled $815,800.

In the economic analysis, multiple benefit estimates were derived by alternate methodologies for the following benefit categories: harvest travel cost reduction, congestion delays prevented by water taxi, reduced cost of vessel repair, transportation savings for disabled vessels, and improved subsistence fishery. In these cases, the benefit estimate adopted was the lower, more conservative estimate. If the high-side benefit estimates for these categories were used in the analysis, the total benefits of the NED plan would be $2,715,800, resulting in net benefits of $1,922,000 with a benefit to cost ratio of 3.4 to 1.

To incorporate the uncertainty in engineering cost estimates, a 20% cost contingency was applied to the estimate of total direct costs for each alternative and included in the cost estimate for each. If this contingency were increased to 200%, the NED plan would have a benefit to cost ratio of 1.1 to 1.

5.0 RECOMMENDED PLAN

5.1 Plan Components

The recommended plan provides a protected small boat harbor at the Village Cove Site at the southeastern corner of Saint Paul Harbor. The plan will provide moorage for up to 60 vessels up to 60 feet in length. The design fleet is presented in Table 5. The recommended harbor layout is shown in Figure 6. General navigation features of the recommended plan consist of the dredged entrance channel and maneuvering basin, channel erosion protection, breakwater, and circulation berm. Local service facilities consist of the dredged mooring basin, floats, docks, boat launch ramp, and boat lift trailer.

5.1.1 Entrance Channel

Due to physical constraints of the harbor site, the entrance channel is presented in two sections, differentiated by depth. Approximately 77,000 yd^3 would be dredged to form the entrance channel. The first section, entrance channel A (EC_A), starts in the middle of the eastern end of the existing harbor's maneuvering basin and continues eastward for approximately 750 feet at a depth of –16 feet MLLW. This depth is required to provide flushing characteristics similar to the existing conditions. The channel is 100 feet wide. An area, extending from the eastern 350 feet of EC_A north and northeast towards the previously authorized new sediment management area and new spending beach, will be protected from erosion by placement of a 2-foot thick layer of riprap.

The second entrance channel section, entrance channel B (EC_B), extends from the eastern terminus of EC_A approximately 250 feet east and then 300 feet southeast and serves as a main channel that connects EC_A with local facilities areas at the east end of the harbor. EC_B is –12 feet MLLW. The depth will provide flotation under the estimated lowest tide of –2.5 feet MLLW. The channel as designed will allow two-way traffic for the design vessel where vessel speeds are not constrained under most conditions. This vessel is 60 feet long, 22 feet wide, and drafts 8 feet fully loaded.

5.1.2 Maneuvering Area

Approximately 22,000 yd^3 of dredged material would be excavated to create a 1.1 ac maneuvering basin dredged to a depth of –12 feet MLLW. The –12 feet MLLW depth would allow the design vessel to remain in the harbor regardless of the tide level. Also, the maneuvering area could be used for the temporary mooring of vessels displaced from the dock that provides a temporary moorage for disabled vessels.

5.1.3 Mooring Area

The recommended plan includes a 3.3-ac mooring area dredged to –12 feet MLLW. Excavation of approximately 41,000 yd^3 of dredge material will be required.

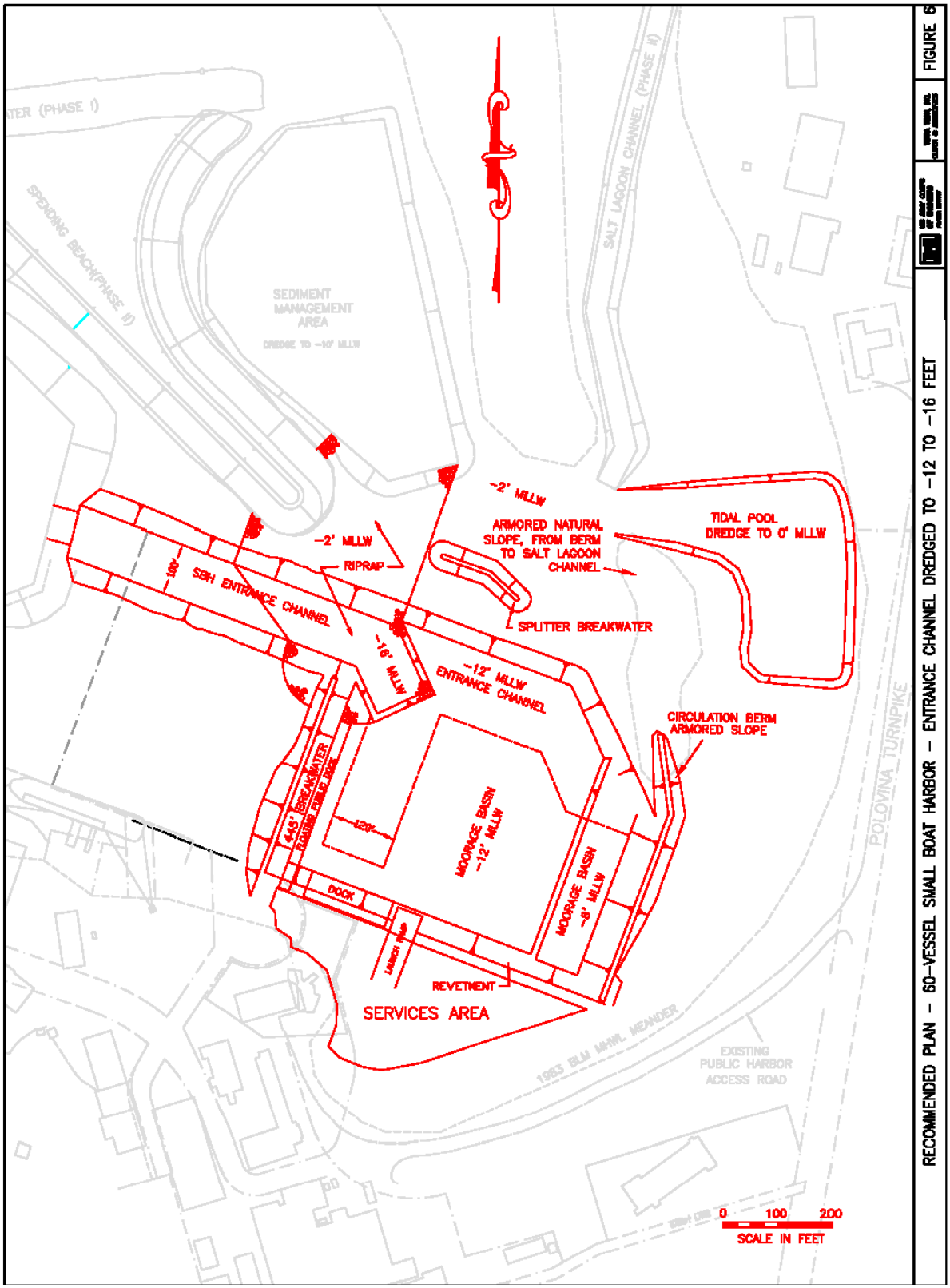

Figure 6. Recommended Plan

5.1.4 Dredged Material Disposal

About 115,000 yd^3 of dredged material from the entrance channel, maneuvering basin, and tidal pool and 41,000 yd^3 from the boat basin will be disposed of in the intertidal area adjacent to the boat basin.

Dredged maintenance material will be used as fill material at the city-owned Ataqan subdivision or other public lands to be identified by the local sponsor. About 28,000 yd^3 of dredged material (14,000 yd^3 at a 10-year interval) will be disposed of during the 20-year period. This volume of material will not exceed the needed fill material during that period.

5.1.5 Breakwater

A 445-foot breakwater would be constructed at +10 feet MLLW parallel to, and approximately 50 feet to the west of, the maneuvering basin. The breakwater would run perpendicular to entrance channel A. The eastern toe of the breakwater would be at –20 feet MLLW. The breakwater would reduce all waves within the small boat harbor mooring area to less than 1.5 feet.

5.1.6 Circulation Berm

A circulation berm would extend from the southeastern corner of the proposed harbor 520 feet to the north, terminating into an armored natural sloped area from the north end of the berm to the Salt Lagoon entrance channel being constructed as part of the deep draft improvement. The berm is required to maintain circulation constraints imposed due to the project's proximity to the sensitive Salt Lagoon.

5.1.7 Floats

Within the mooring area, two systems of pile stabilized floating docks were designed. The eastern float system is located in the far southeastern corner of the harbor and includes seven 44 ft x 6 ft finger piers on its western side and ten 25 ft x 6 ft finger piers on its eastern side. The western float system is located between the eastern float system and the boat launch ramp and includes seven 60 ft x 6 ft finger piers on its east side and five 60 ft x 6 ft finger piers on its west side. The two float systems are separated by a 100-foot harbor fairway.

5.1.8 Boat Launch Ramp

The harbor plan includes a 50 ft x 140 ft boat launch ramp at a 15% slope. The ramp is located immediately to the east of the South Dock and immediately to the west of the harbor's western float system. The recommended design proposes use of a 12 in. structural precast concrete boat ramp.

5.1.9 Docks

Two docks are included in the recommended plan. These docks are referred to in this report as the west floating dock and the south dock based upon their orientation within the harbor. The west floating dock is located immediately to the east of the breakwater and is approximately 20 ft x 275 ft. It is a floating dock that is connected to shore by a 20 ft x 115 ft ramp. The south dock (50 ft x 160 ft) is located approximately 30 feet east of the east dock and approximately 10 feet west of the boat launch ramp.

5.1.10 Boat Lift Trailer

A 60-ton capacity mobile boat lift trailer is proposed for launch and retrieval of larger vessels in service during extreme winter weather conditions.

5.1.11 Mitigation

Mitigation for project impacts would consist of the following.

- Splitter breakwater realignment – The rubblemound splitter breakwater is currently being constructed as part of the Phase II construction project. For mitigation of the small boat harbor, the breakwater will be realigned to provide adequate flushing of the harbor during ebb tides.
- Use oil booms and absorbents during dredging to collect any hydrocarbons in the water column.
- Construct in early summer to avoid conflict with fur seals.
- Use of dredged material for beneficial public use – Initial dredged material will be disposed of at the intertidal area adjacent to the boat basin. Maintenance dredged material will be disposed of at the city-owned Ataqan subdivision or other public lands to be identified by the local sponsor for development of uplands.
- Salt Lagoon entrance channel tidal pool – A 2.5-acre tidal pool with a bottom elevation of 0 feet, MLLW will be dredged adjacent to the Salt Lagoon entrance channel and within the tidelands. The pool will recreate intertidal habitat, which has shoaled in over the years.

5.2 National Economic Development Benefits

The recommended plan would provide average annual NED benefits of $2,082,000 for the 60-vessel fleet. Net annual NED benefits are $1,233,000 and the benefit to cost ratio is 2.5 based on an October 2005 price level.

5.3 Plan Implementation

5.3.1 Construction Phasing

The time needed for construction is estimated at less than six months but will represent two construction seasons because mobilization, demobilization, and entrance dredging must be scheduled around seasons conducive to their accomplishment and environmental resource construction windows. Moorings and docks would be constructed during the second season. Construction scheduling would facilitate the continued use of the harbor by local fishermen, fish processing facilities, and cargo vessels during construction.

The Corps would be responsible for construction of the breakwaters, entrance channel, and intertidal dredge material disposal area. The USCG would be responsible for installing aids to navigation. The sponsor would be responsible for providing all lands, easements, and rights-of-way and relocations necessary for the project. The sponsor would also be responsible for utility service to the harbor and for funding its share of the general navigational features. The sponsor is also responsible for the cost of all local service facility features.

5.3.2 Operations & Maintenance

Table 9 provides a description of the O&M requirements for each of these features as well as an annual O&M cost estimate for each. The total annual O&M costs of the project are estimated to be $159,000. Federal O&M responsibilities would be for entrance channel dredging and breakwater, totaling $38,000 annually. Non-Federal O&M responsibilities would be for mooring area dredging, boat launch ramp, floats and walkway ramps, west floating dock, south dock, and the boat lift trailer, totaling $121,000 (rounded) annually.

Table 9. O&M Requirements and Annual Costs

		Equivalent Annual Cost ($)		
	Interval (yr)	Corps	Local Sponsor	Total
Federal channel dredging	10	6,500		
Mooring area dredging	10		2,600	2,600
Breakwater	20	31,500		31,500
Boat launch ramp	20		2,300	2,300
Floats and walkway ramps	1		34,700	34,700
West floating dock	1		31,200	31,200
South dock	1		49,600	49,600
Boat lift trailer	1		1,000	1,000
TOTAL OMRRR COSTS		38,000	121,400	159,400

5.3.3 Real Property Interests

The project is located within Village Cove at Saint Paul, Alaska. The non-federal sponsor, the City of Saint Paul, will be required to provide all Lands, Easements, and Rights-of-Way (LER) necessary for access, construction, operation, and maintenance of the project. The Government's dominant right of navigation servitude will be exercised for tidelands below the mean high water (MHW) line, which covers a majority of the Federal general navigation features (GNF) for the proposed small boat harbor. The City will provide local service facilities (LSF) for the project and will provide perpetual and temporary easements for the GNF berm tie-in on a small island within the cove. An informal value estimate for lands and related administrative costs is shown below. The detailed Real Estate Plan is provided in Appendix D, with a detailed map, and sponsor assessment as attachments to the plan.

	Federal ($)	Non-Federal ($)
Lands – GNF		4,000
Administrative Costs	16,000	16,000
TOTAL Real Estate Costs	16,000	20,000

5.4 Project Costs

Table 10 presents the detailed cost estimate for the recommended plan to develop a small boat harbor at Saint Paul Island. The estimate includes project implementation costs and excludes economic opportunity costs, operation and maintenance costs, and LERR.

Table 10. Summary Cost Estimate for Recommended Plan

(October 2005 price level)

Item	Cost Share	Unit	Quantity	Unit Cost ($)	Total Direct Costs ($)	Contingency ($) 20%	PED ($) 10%	S&A ($) 8%	Total Cost ($)
Mob/Demob (1st season)	GNF	ls	1	628,216	628,216	125,643	75,386	66,340	895,584
Mob/Demob (2nd season)	LSF	ls	1	1,122,003	1,122,003	224,401	134,640	118,483	1,599,527
Dredging: EC_A (-16 ft)	GNF	cy	47,630	8.50	404,867	80,973	48,584	42,754	577,179
EC_B (-12 ft)	GNF	cy	28,950	8.50	246,082	49,216	29,530	25,986	350,815
Maneuvering Basin (-12 ft)	GNF	cy	22,420	8.50	190,576	38,115	22,869	20,125	271,685
Mooring Area (-12 ft)	LSF	cy	41,000	8.50	348,510	69,702	41,821	36,803	496,837
Entrance Channel Armor	GNF	cy	6,500	46.08	299,545	59,909	35,945	31,632	427,031
Dredge Disposal Armor	GNF	cy	2,625	54.81	143,867	28,773	17,264	15,192	205,096
Breakwater	GNF	cy	12,653	47.66	602,981	120,596	72,358	63,675	859,610
Circulation Berm	GNF	cy	27,300	2.92	79,582	15,916	9,550	8,404	113,453
Pile Stabilized Floats	LSF	sf	13,438	84.98	1,141,982	228,396	137,038	120,593	1,628,009
Float Walkway Ramps	LSF	sf	960	99.80	95,809	19,162	11,497	10,117	136,585
Boat Launch Ramp	LSF	sf	7,000	24.67	172,693	34,539	20,723	18,236	246,192
South Dock	LSF	sf	8,000	223.09	1,784,735	356,947	214,168	188,468	2,544,319
West Floating Dock & Ramp	LSF	sf	7,800	99.80	778,448	155,690	93,414	82,204	1,109,756
Boat Lift Trailer	LSF	ls	1	245,967	245,967	-	-	-	245,967
LERR – Federal Admin Cost	GNF	ls	1	15,750	15,750	-	-	-	15,750
LERR (GNF) – Acquisition Cost	LSF	ls	1	4,200	4,200	-	-	-	4,200
LERR – Non-fed Admin Cost	LSF	ls	1	15,750	15,750	-	-	-	15,750
Nav. Aids – USCG (not cost shared)		ls	1	12,000	12,000				12,000
TOTAL COST						1,608,000	965,000	849,000	11,754,000

5.4.1 Cost Apportionment

Construction costs for the project would be apportioned in accordance with the Water Resources Development Act of 1986 and is shown in Table 11.

Table 11. Apportionment Of Construction Costs

	Construction cost contribution (%)	
Portion of project	Federal	Local
General navigation features (includes entrance channel, maneuvering basin, and breakwaters)	80	20[a]
Local features (includes floats and mooring basin)	0	100
Coast Guard navigation aids	100	0

[a]Non-federal interests must provide cash contributions toward the costs for construction of the general navigation features (GNF) of the project, paid during construction (PDC) as follows: For project depths of up to 20 ft–10%; for project depths over 20 ft and up to 45 ft–25%, and for project depths exceeding 45 ft–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 LERR (except utilities) shall be credited. *Note:* Costs for general navigation features include associated costs, such as mobilization.

The sponsor is also responsible for 100 percent of the construction cost of the local service facilities. Table 12 provides a breakdown of the initial Federal and non-federal costs of the project of the recommended plan. The fully funded cost is $13,261,000.

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

In addition to the sponsor's share of costs for general navigation features, the sponsor is responsible for costs associated with other NED and non-NED features. The pertinent data table in the front of this report provides a summary of all shared costs.

Table 12. Cost Apportionment for Recommended Plan

(October 2005 Price Level)

Items	Total Project Cost ($000)	Implementation Costs ($000)			
		Federal	%	Non-Federal	%
General Navigation Features (GNF):					
Mob/demob – 1st season	754	679		75	
Breakwaters and circulation berm	819	737		82	
Entrance channel and maneuvering basin	1,369	1,232		137	
Preconstruction, engineering, & design	294	265		29	
Construction management (S&A)	259	233		26	
LERR (GNF) - Administrative costs	16	14		2	
Subtotal GNF	3,511	3,160	90	351	10
Additional Funding Requirement					
10% of GNF		-351		351	
GNF LERR credit		4		-4	
Adjustment for GNF LERR credit		-347		347	
Subtotal of GNF Related Items	3,511	2,813		698	
LERR (GNF) - Acquisition credit	4	0	0	4	100
Aids to navigation	12	12	100	0	0
Local Service Facilities					
Mob/demob – 2nd season	1,346	0		1,346	
Mooring basin, floats, walkways, & ramps	5,604	0		5,604	
Preconstruction, engineering, & design	671	0		671	
Construction management (S&A)	590	0		590	
LERR (LSF)	16	0		16	
TOTAL LOCAL SERVICE FACILITIES	8,228	0	0	8,227	100
ULTIMATE FIRST COST REQUIREMENTS	**11,754**	**2,825**		**8,929**	

The initial construction cost of the general navigation features is 90 percent for the initial Federal investment and 10 percent for the initial local share because all dredging is less than 6.1 meters (20 ft). The non-federal sponsor must also contribute an additional 10 percent, plus interest, during a period not to exceed 30 years after completion of the General Navigation Features. The sponsor would be credited toward this 10-percent cost with the value of LERR necessary for construction, operation, and maintenance of the general navigation features. This post construction contribution is currently estimated at $347,000 as shown in Table 13.

Table 13. Post-Construction Contribution

Total GNF	10 % of GNF	LERR Credit	Non-federal post construction contribution
3,511	351	4	347

5.4.2 Assessment of Sponsor's Financial Capability

As the local sponsor, the city of Saint Paul will require the leaseholder to develop local service facilities. The State of Alaska has obtained appropriations from legislature for the balance of the local share of the project. The sponsor's letter of intent is provided in appendix E.

5.5 Local Economic Impacts

Development of a local boat harbor will enhance prospects for development of an economic base that will be able to create jobs and bring money into the community. An analysis of local economic impacts of the recommended plan estimates creation of 51–91 new jobs. Saint Paul's 2000 population is approximately 580 residents. These new job opportunities would employ approximately 9% to 16% of the local population. Four primary categories of new jobs were identified and described in the sections to follow.

5.5.1 Seafood Harvest Jobs

The recommended plan will produce a minimum of 42 full time equivalent (FTE) harvest jobs. Under present conditions, the local fleet spends a few weeks fishing during the summer. Among the 26 vessels there are probably less than 10 FTE jobs even though there are a large number of fishers employed for a short period. A net gain in harvest FTE in excess of 32 jobs was estimated.

5.5.2 Seafood Processing Jobs

Harbor development is essential to achieving the local communities plan for development of multi-species processing on the island. Near term impacts are creation of from 10–50 jobs directly in processing including 5–10 in management product development, packaging, and marketing. Including a multiplier effect, assumed to be a factor of two based on the isolated nature of the island, indicates total related employment would range from 20–100 jobs.

5.5.3 Hospitality and Tourism

The community plans to promote tourist visits to the community and the framework plan includes development of bed and breakfasts and restaurant operations for regularly scheduled tours. Community cultural resources, bird watching, and nature walks will entertain visitors

who may also be attracted to future development of local sport fishing opportunities. The small boat harbor provides the community with the opportunity to develop a sport charter fishing operation like no other. A charter operation would add stability to the fleet by diversifying dependence on commercial harvest. A secondary effect of a growing charter business would be an invigorated hospitality industry. Shore side support for tours and service to vessels making refueling stops will create four additional jobs.

5.5.4 Marine Services Jobs

Management, operation, and maintenance of the harbor will require a harbormaster. Also, the development of a boat repair yard will employ a full time manager and four marine repair specialists.

5.6 Social Impacts

The recommended plan is consistent with local values that emphasize development of an economic base, maintaining focus on stewardship of the island, and preservation of unique aspects of the Aleut community. The plan is consistent with community guidelines related to expansion of the harbor, development of a day boat facility, preservation of adequate harbor space for three processors, and minimization of environmental impact.

Development of a boat harbor will expand opportunities for subsistence gathering and will also create the opportunity for a stable economic base. The economic expansion is not expected to stimulate growth in the population because a local labor pool exists and unemployment is a problem. The most likely future is one of expanded job opportunities for the residents, increased family incomes, and decreases in the number of persons at or below the poverty level.

5.7 Environmental Impacts

Environmental impacts associated with the construction and operation of a small boat harbor at the south end of Village Cove will be minor. The intertidal and subtidal environs are of minor habitat value. There are no threatened or endangered species at the site, and the area does not support fish or shellfish species of commercial or subsistence value. A Clean Water Act Department of the Army permit public review was completed in 1999 for a proposed small boat harbor at the exact location. The permit was issued with no letters of objection.

5.7.1 Consultation Requirements

Extensive coordination with resource agencies concerning the navigation improvements on Saint Paul Island has occurred. This coordination is documented in the 1982 feasibility study and environmental impact statement, the 1987 environmental assessment, the 1988 general design memorandum and environmental assessment, and the 1996 environmental assessment. The most recent NEPA document is the 2002 environmental assessment, which covers the small boat harbor.

The NMFS and USFWS were consulted for species included in the Endangered Species Act. There are no listed threatened or endangered species that would be affected in the project area. NMFS has also been consulted concerning the northern fur seal. Construction timing criteria has been established to assure no impact on fur seals. The USFWS concluded that no further coordination is required under the Fish and Wildlife Coordination Act for the

proposed small boat harbor. Completion dates for NEPA documents are provided below. These documents are located in the Environmental Assessment.

Environmental Compliance	Date Completed	Discussion
FONSI Signed	September 9, 2002	
EIS Filed	N/A	
ROD Signed	N/A	
Endangered Species Act, Section 7, US Fish and Wildlife Service	September 9, 2002	No effect determination in the EA
Coastal Zone Management Consistency Determination	September 13, 2002	
Clean Water Act Certification, Section 401	March 15, 2002	
Clean Water Act, Section 404(r)	N/A	
Clean Water Act, Section 404(b)(1)	September 9, 2002	Evaluated in EA
Section 103, Marine Mammal Protection Act Evaluation	March 2002	Reviewed as part of the EA
Section 106, National Historic Preservation Act	February 17, 2005	Coordinated during permit review – no affected properties
Seal Island National Historic Landmark	February 23, 2005	Coordinated with the National Park Service – no affect to landmark
USFWS Coordination Act Report	N/A	No need for additional USFWS CAR – coordinated during permit and EA review and mitigation planning
Clean Air Act	September 9, 2002	

5.7.2 Alaska Coastal Management Program Consistency Determinations

The city of Saint Paul applied for and received a Coastal Consistency Determination for a small boat harbor in a Department of the Army permit action in the same location and of almost the same configuration as the proposed alternative. The Alaska Department of Governmental Coordination determined the only part of the proposed action that required additional coastal consistency review was the proposed intertidal fill. A consistency determination has been issued.

5.8 Views of the Local Sponsor

The city of Saint Paul worked closely with the Corps study team during this study. Cooperation between the Corps and city resulted in the selection of the NED Plan, which became the Recommended Plan. The city has stated its preference for the Recommended Plan and agrees that the project will meet the planning objectives.

5.9 Hazardous, Toxic, and Radioactive Waste Cleanup

Section 3(a) of Public Law 104-91 states that "The Secretary of Commerce shall, subject to the availability of appropriations provided for the purposes of this section, clean up landfills, wastes, dumps, debris, storage tanks, property, hazardous or unsafe conditions, and contaminants, including petroleum products and their derivatives, left by the National Oceanic and Atmospheric Administration on lands which it and its predecessor agencies abandoned, quitclaimed, or otherwise transferred or are obligated to transfer, to local entities or residents of the Pribilof Islands, Alaska, pursuant to the Fur Seal Act of 1966 (16 U.S.C. 1151 et seq.), as amended, or other applicable law."

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The studies documented in this report indicate that Federal construction of a small boat harbor at Saint Paul, Alaska, as described in the recommended plan in this report, is technically possible, economically justified, and environmentally and socially acceptable. It has been demonstrated that the modification of the previously authorized harbor improvements project at Saint Paul currently under construction will not be adversely impacted by the addition of the small boat harbor. With the addition of the small boat harbor as a last added increment, the previous project remains economically justified.

The recommended plan includes general navigation features that include an entrance channel in two segments, one at –16 feet MLLW and the second at –12 feet MLLW; a vessel maneuvering area at –12 feet MLLW, a breakwater to +10 feet MLLW, and a circulation berm to +10 feet MLLW. Local service facilities recommended include a mooring area at –12 feet MLLW with revetment; two pile stabilized float systems with walkway ramps; a boat launch ramp; two docks; and a boat lift trailer.

The recommended plan alleviates problems and realizes opportunities in the study area by reducing the travel cost of harvest, preventing vessel damages, relieving harbor congestion and delays, reducing the cost of vessel repair, providing transportation savings for disabled vessels, reducing dock maintenance costs, and improving the local subsistence fishery. Based on an October 2005 price level the annual NED benefits were estimated as $2,082,000 with an annual cost, including operation and maintenance, for the recommended plan of $831,000. The recommended plan has a net benefit of $1,233,000 and a benefit to cost ratio of 2.5.

The city of Saint Paul is willing and able to act as the local sponsor for the project and fulfill all the necessary local cooperation requirements. Thus it is concluded that the recommended plan should be pursued by the United States in cooperation with the city of Saint Paul and the State of Alaska.

6.2 Recommendations

I recommend that the navigational improvements at Saint Paul, Alaska be constructed generally in accordance with the plan herein and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable at an estimated total Federal cost of $2,825,000 and $38,000 annually for Federal maintenance provided that prior to construction the local sponsor agrees to the following:

A. Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of the design costs;

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

C. The estimated non-federal initial costs for the general navigation features of the project is $698,000 plus $4,000 for GNF LERR and $8,227000 for local service facilities;

D. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities consisting of the new mooring basin and moorage facilities 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;

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

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

1. 10 % of the costs attributable to dredging to a depth not in excess of 6.1 m (20 ft)
2. 25 % of the cost attributable to dredging to a depth in excess of 6.1 m (20 ft) but not in excess of 13.7 m (45 ft)
3. 50 % of the costs attributable to dredging to a depth in excess of 13.7 m (45 ft)

G. 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 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;

H. For so long as the project remains authorized, operate and maintain the local service facilities and provide lands, easements, and rights-of-way for any dredged or excavated material disposal areas, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and state laws and regulations and any specific directions prescribed by the Federal Government;

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

J. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any

betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

K. Keep, and maintain books, records, documents, and 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, and other evidence is required, to the extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

L. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation 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, subject to Section 3(a) of Public Law 104-91 states that "The Secretary of Commerce shall, subject to the availability of appropriations provided for the purposes of this section, clean up landfills, wastes, dumps, debris, storage tanks, property, hazardous or unsafe conditions, and contaminants, including petroleum products and their derivatives, left by the National Oceanic and Atmospheric Administration on lands which it and its predecessor agencies abandoned, quitclaimed, or otherwise transferred or are obligated to transfer, to local entities or residents of the Pribilof Islands, Alaska, pursuant to the Fur Seal Act of 1966 (16 U.S.C. 1151 et seq.), as amended, or other applicable law."

M. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, subject to Section 3(a) of Public Law 104-91 states that "The Secretary of Commerce shall, subject to the availability of appropriations provided for the purposes of this section, clean up landfills, wastes, dumps, debris, storage tanks, property, hazardous or unsafe conditions, and contaminants, including petroleum products and their derivatives, left by the National Oceanic and Atmospheric Administration on lands which it and its predecessor agencies abandoned, quitclaimed, or otherwise transferred or are obligated to transfer, to local entities or residents of the Pribilof Islands, Alaska, pursuant to the Fur Seal Act of 1966 (16 U.S.C. 1151 et seq.), as amended, or other applicable law."

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

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

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

Q. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

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

S. Do not use Federal funds to meet the non-federal sponsor's share of total project costs unless the Federal-granting agency verifies in writing that the expenditure of such funds is authorized.

The recommendations for implementation of navigation improvements at Saint Paul, 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.

TIMOTHY J. GALLAGHER
Colonel, Corps of Engineers
District Engineer

7.0 REFERENCES

1. Bottin, R. R., Jr., and Acuff, H. F. 1997. "Study for Flushing of Salt Lagoon and Small Boat Harbor Improvements at Saint Paul Harbor, Saint Paul Island, Alaska: Coastal Model Investigation," Miscellaneous Paper CHL-97-7, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
2. Bottin, R. R., Jr., and Eisses, K. J. 1997. "Monitoring of Harbor Improvements at Saint Paul Harbor, Saint Paul Island, Alaska," Technical Report CHL-97-13, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
3. Bottin, R. R., Jr., and Mize, M. G. 1988. "Saint Paul Harbor, Saint Paul Island, Alaska, Design for Wave and Shoaling Protection; Hydraulic Model Investigation," Technical Report CERC-88-13, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
4. Danish Hydraulic Institute . 1983b. "Saint George Harbor, Pribilof Islands, Alaska, Hydraulic Model Investigation" (July).
5. Danish Hydraulic Institute. 1982. Pribilof Islands Wave Study, Alaska, U.S.A., Final Report, Vol. I (June).
6. Danish Hydraulic Institute. 1983a. Pribilof Islands Wave Study, Alaska, U.S.A., Final Report Addendum (September).
7. Tetra Tech, Inc. 1987. "Saint Paul Harbor and Breakwater Technical Design Report," TC-3263-07, Pasadena, CA. Prepared for the city of Saint Paul, Alaska.
8. U.S. Department of Interior, Bureau of Land Management. 1977. Climatic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska, Volume II, Bering Sea.
9. USACE, CERC. 1988a. "Saint Paul Harbor Breakwater Stability Study," Ward.
10. USACE, CERC. 1988b. "Saint Paul Harbor, Saint Paul Island, Alaska. Design for Wave and Shoaling Protection," Bottin and Mize.
11. USACE, Coastal Engineering Research Center (CERC). 1987. "Ten-Year Hindcast, Saint Paul," Corson.
12. USACE, Waterways Experiment Station, Coastal Engineering Research Center (WES-CERC). 1998 (Sep). "Saint Paul Harbor Breakwater Stability Study," TR CERC-88-10, Vicksburg, MS.
13. USACE, WES-CERC. 1998 (Sep). Saint Paul Harbor Design for Wave and Shoaling Protection, Saint Paul Island, Alaska," TR CERC 88-13, Vicksburg, MS.
14. USACE, WRSC-IWR. Evaluation of Saint Paul Island Harbor, Alaska (Section 204 (e) Project). IWR Report 96-PS-2, June 1996.
15. Ward, D. L. 1996. "Runup and Overtopping Studies for Saint Paul Harbor Breakwater, Saint Paul, Alaska," (unpublished), U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

8.0 ABBREVIATIONS

ABC	Allowable biological catch
ADFG	Alaska Department of Fish & Game
ADOT	Alaska Department of Transportation
BSAI	Bering Sea Aleutian Islands
CBSFA	Central Bering Sea Fishermen's Association
CDQ	Community development quota
CFEC	Commercial Fisheries Entry Commission
EBS/AI	Eastern Bering Sea/Aleutian Islands
EEZ	Exclusive economic zone
F/V	Fishing vessel
FTE	Full time equivalent
GHL	Guideline harvest level
HP	Horsepower
IFQ	Individual fishing quota
I-O	Inboard-outboard
IPHC	International Pacific Halibut Commission
IRA	Indian Reorganization Act
KW	Kilowatt
LLP	Limited license program
LOA	Length overall
LRIC	Long run incremental cost
MHHW	Mean higher high water
MHW	Mean high water
MLLW	Mean lower low water
MLW	Mean low water
MSL	Mean sea level
NED	National economic development
NMFS	National Marine Fisheries Service
NRC	Natural Resource Consultants
PNW	Pacific northwest
TAC	Total allowable catch
TDX	Tanadgusix Corporation
USACE	United States Army Corps of Engineers
WRDA	Water Resources Development Act